DRAFT
ENVIRONMENTAL ASSESSMENT (EA)
FOR
INVASIVE SPECIES MANAGEMENT
ON
TRAVIS AIR FORCE BASE AND GEOGRAPHICALLY SEPARATED UNITS, CALIFORNIA

PREPARED BY:

Department of the Air Force, Travis Air Force Base

Letters or other written comments provided may be published in the Final EA. As required by law, substantive comments will be addressed in the Final EA and made available to the public. Any personal information provided will be kept confidential. Private addresses will be compiled to develop a mailing list for those requesting copies of the Final EA. However, only the names of the individuals making comments and their specific comments will be disclosed. Personal home addresses and phone numbers will not be published in the Final EA.

Suggested Citation: TAFB (2023) Draft Environmental Assessment (EA) for Invasive Species Management on Travis AFB and its Geographically Separated Units (GSUs). 21 September. 190 pp.

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1.0 PURPOSE OF AND NEED FOR ACTION

This Environmental Assessment (EA) has been prepared by Travis Air Force Base (AFB) and Marty Ecological Consulting, Inc. (MEC) to evaluate potential environmental impacts associated with the implementation of invasive species management actions on Travis AFB properties. These activities may include chemical and mechanical control as well as the use of grazing and fire.

1.1 INTRODUCTION

This EA has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 as amended (42 United States Code [USC] 4321-4347), §102(2)(C); the President's Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA, 40 Code of Federal Regulations (CFR) Parts 1500-1508; 32 CFR Part 989, Environmental Impact Analysis Process; Department of Defense Instruction (DoDI) 4715.9, *Environmental Planning and Analysis* (DoD 1996a); Air Force Instruction (AFI) 32-7061, *The Environmental Impact Analysis Process (EIAP)*, and AFM 32-7003, *Environmental Conservation* (TAFB 2016). In addition, this document is intended to comply with the requirements of the California Environmental Quality Act (CEQA) (California Public Resources Code 21000-21177) and the Guidelines for CEQA (Sections 15000-15387, California Code of Regulations, Title 14, Chapter 3) for the purposes of fulfilling state permitting requirements.

Federal agencies are required under NEPA to consider the environmental consequences of Proposed Actions in the decision-making process. Environmental analysis under NEPA is not required to implement the education, prevention (i.e. best management practices like cleaning seeds off of mowers before moving into new areas), inventory, and monitoring aspects of this Proposed Action, but is required to implement the containment/control and habitat enhancement elements. This EA evaluates the environmental impacts of the Proposed Actions, considers alternatives and mitigation measures, and allows for agency and public participation.

While invasive species management programs at Travis AFB have been ongoing since at least 1977, development and initial implementation of various activities focused on managing invasive species made clear the limits of invasive species management activities that could occur due to the prevalence of federally listed species in Travis's annual grasslands but also the need to pesticides and herbicides in Waters of the United States (WoTUS). The lack of sufficient environmental analysis under NEPA has been evident. Specifically, the activities that are being evaluated in this EA come from the following documents:

- Invasive Species Management Plan (ISMP; HT Harvey 2014);
- Updated Invasive Plant Species Management Plan (IPSMP; ManTech 2017);
- Grazing Management Plan (GMP; Hopkinson 2017);
- Aquatic Pesticide Application Plan (APAP, Auxilio 2013, 2018, OTIE 2020); and
- Wildland Fire Management Plan (Chloeta 2019)

On Travis AFB, a suite of invasive species threatens the accomplishment of military objectives, sensitive resources and other environmental and human values. In this EA, the term "invasive species" is intended to be inclusive of both native and non-native invasive plants and animals and also includes naturalized species. While not common, some native plant species on Travis AFB

are considered invasive and control measures have been implemented to reduce their populations in specific circumstances (e.g., cattails and tules in recreational ponds). Naturalized species are species that are ubiquitous across the landscape and somewhat integrated into the native ecosystem though may still pose threats to specific sensitive resources in certain areas and thus require management. In this EA, the term "invasive aquatic species" refers to invasive species that primarily grow in aquatic environments like wetlands, vernal pools, ponds and streams that are having negative impacts on the environment.

Approximately 30 species that occur on Travis AFB or its GSUs have been identified as problematic. In addition, an extensive watch list of invasive plant species that have not yet been found but could spread to the base has been developed and can be found in Appendix A and the IPSMP (ManTech 2017). These lists are based on lists of California noxious plant weeds maintained by the California Department of Food and Agriculture (CDFA) and invasive species maintained by the California Invasive Plant Council (Cal-IPC) (https://www.cal-ipc.org/plants/inventory/). Of particular concern in grasslands, vernal pools and isolated ponds are the invasive plant species barb goatgrass (*Aegilops triuncialis*), medusahead (*Elymus caput-medusae*), treasure flower (*Gazania linearis*), stinkwort (*Dittrichia graveolens*), perennial pepperweed (*Lepidium latifolium*), yellow starthistle (*Centaurea solstitialis*), and purple starthistle (*C. calcitrapa*). The primary invasive animal species of concern on Travis AFB is the American bullfrog (*Lithobates catesbeianus*) along with occurrences of non-native fish, turtles and other predators.

Invasive species management activities include a varied toolkit of available methods to allow for a nuanced approach to selecting and eliminating only the target species, making each activity as efficient as possible. General methods include manual/mechanical removal, grazing, prescribed burning, habitat modification, trapping and use of herbicides. With so many available tools and the numerous invasive species present on Travis AFB properties, a coherent and updated strategy is needed to achieve many of the goals in the Travis INRMP.

1.1.1 Location

Travis AFB is located seven miles north of the city of Fairfield, Solano County, California. Travis AFB occupies approximately 5,137 acres (Figure 1) five miles southeast of Interstate 80. The base is approximately 50 miles northeast of San Francisco and 40 miles southwest of Sacramento, approximately midway between the coastal zone and the interior valley of California. The base has lesser interests in the form of easements surrounding the base. Travis AFB is densely constructed with only limited areas set aside for outdoor recreation and natural resources. Travis AFB is bordered on the east, north, and south by agricultural lands and open space. Some of these agricultural lands are protected by conservation easements including the Muzzy Ranch Mitigation Bank and the Wilcox Ranch. These protected areas contain vernal pools with numerous large playa pools. On the west, the base is bordered by mixed urban uses, including commercial uses adjacent to the main entrance north of Travis Boulevard.

Travis AFB includes seven geographically separated units (GSUs; Figure 2) that are managed by the Air Force and where invasive species management activities may occur. Most of these properties are located fairly close to the main base (Figure 2):

1. Defense Fuel Supply Point Ozol is a 51.4-acre fuel facility within the Carquinez Strait in neighboring Contra Costa County.

2. Potrero Hills Annex is a 24.81-acre former Nike missile site in Potrero Hills, Solano County.

Figure 1. Location of Travis AFB

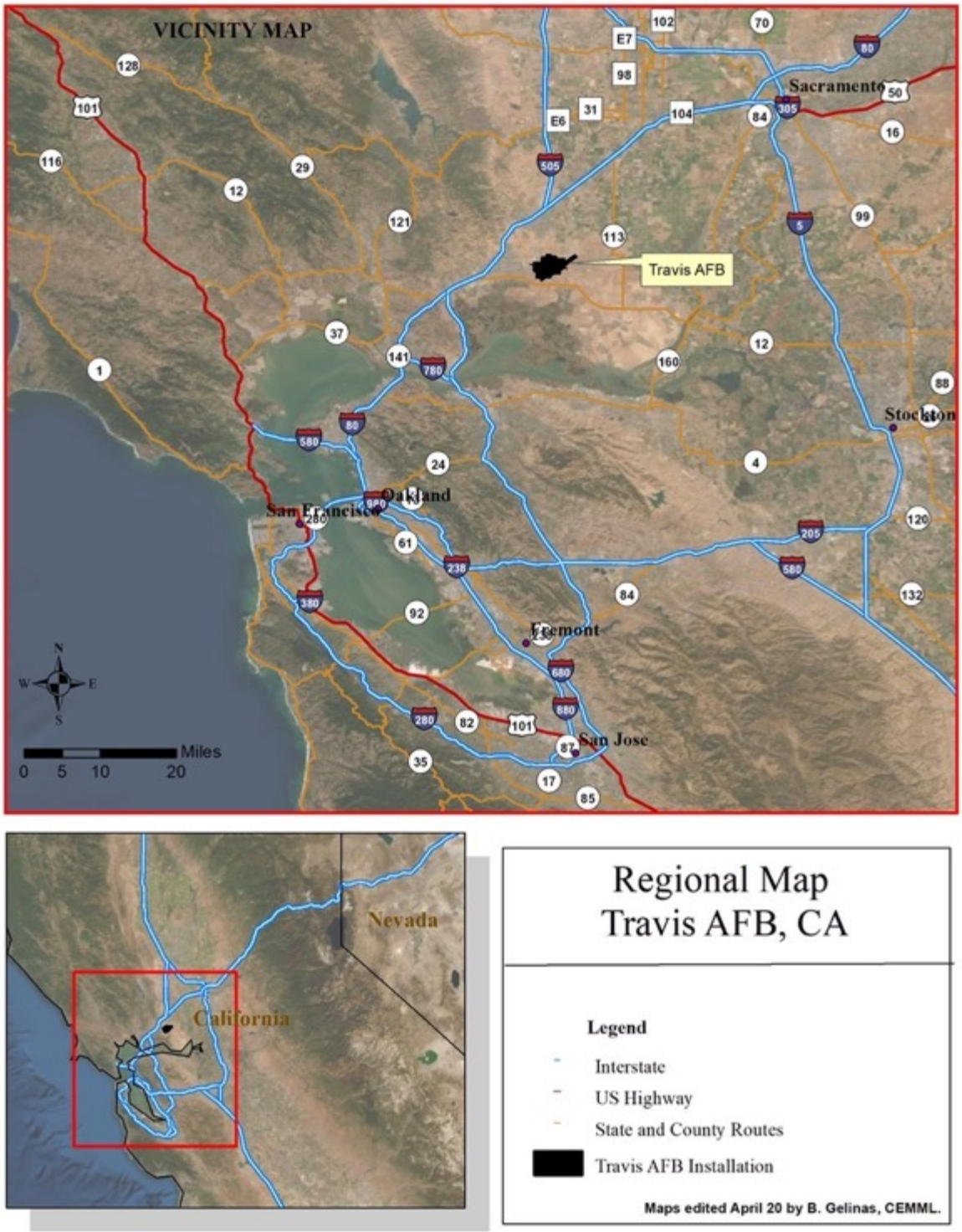
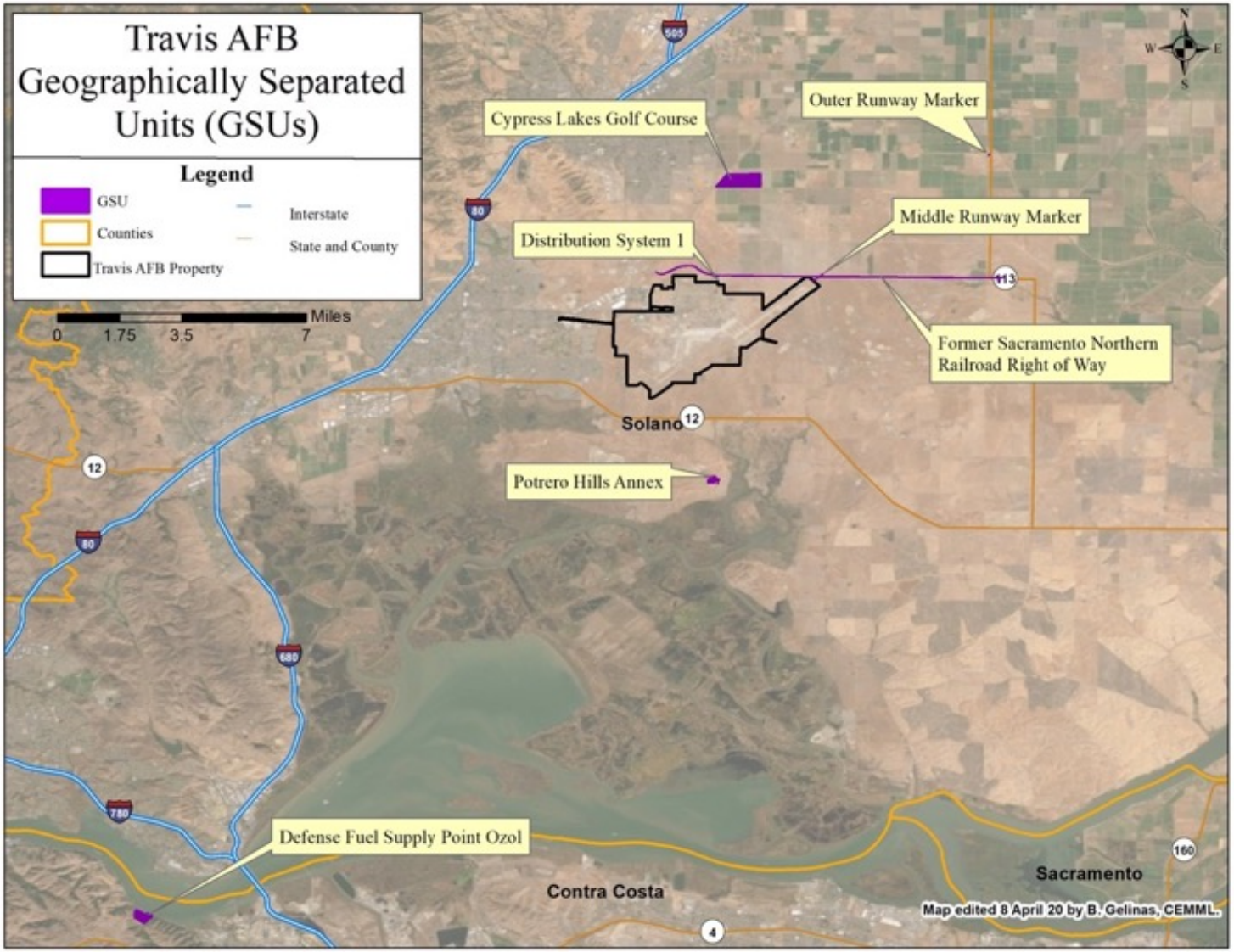


Figure 2. Location of Travis AFB GSUs



3. Outer Runway Marker is a 0.23-acre parcel just northwest of the base that contains airfield infrastructure.
4. Middle Runway Marker is a 1.86-acre parcel adjacent to the base that supports airfield infrastructure.
5. Distribution System 1 is a 1.75-acre well facility in Solano County.
6. Cypress Lakes Golf Course is a 207.52-acre golf course facility located just north of the base in Solano County.
7. Former Sacramento Northern Railroad Right of Way is a 70-acre linear parcel that supports a former railroad that runs just north of the base in Solano County.

Travis AFB is situated in an inland area with ocean or cold air influence (Baldwin et al. 2012). This region has a Mediterranean climate characterized by mild, wet winters and warm, dry summers. The rainy season typically begins in November and continues into March. During this period, approximately 83 percent of the annual rainfall occurs. The rainfall for the area averages approximately 23 inches per year. The hot summer weather (characteristic of the interior valleys of California) is tempered by cool, moist winds blowing inland from the ocean and bay (TAFB 2016).

1.1.2 Mission

Travis AFB is under the operational control of the Air Force's (USAF) Air Mobility Command (AMC) and hosts the 60th and 349th Air Mobility Wings (AMW). The 60th AMW is responsible for strategic airlift and air refueling missions circling the globe. The 60th AMW is the largest air mobility organization within the USAF (in terms of personnel) and supports the C-5 Galaxy cargo aircraft, the KC-10 Extender refueling aircraft, and the C-17 Globemaster III cargo aircraft. 60th Medical Group, a unit of the 60th AMW, is the West Coast terminal for aeromedical evacuation aircraft and returning injured or sick airmen from the Pacific.

In partnership with the 60th AMW, the largest reserve wing, the 349th AMW, also makes its home at Travis AFB with its four flying squadrons, three Aerial Port Squadrons and three Aircraft Maintenance Squadrons. The missions of the wing's aircrews include airlifting personnel and material worldwide as well as aerial refueling a wide variety of aircraft. The 60 AMW – 349th AMW partnership allows the base to handle more cargo and passengers than any other military air terminal in the United States, earning it the title "The Gateway to the Pacific".

Several other large tenants on Travis AFB include:

- The 621st Contingency Response Wing, a specialized wing that provides a multifunctional rapidly deployable capability designed to set up air bases, establish theater-wide command and control, conduct airfield operations, perform aircraft maintenance and provide security and communications assets anywhere in the world within 12 hours of notification.
- The AMW Band of the Golden West is the only active-duty USAF band west of the Rockies and is composed of 60 talented and versatile airmen-musicians.
- Tactical Airborne Communication and Maritime Operation (TACAMO) is a Navy organization that maintains survivable communications in the threat of nuclear warfare.

1.2 PURPOSE OF THE ACTION

The purpose of the Proposed Action is to implement management activities to control invasive species on Travis AFB and its GSUs to reduce the prevalence of invasive flora and fauna in order to protect and preserve the military mission, ecosystem function and, valued resources and programs.

1.3 NEED FOR THE ACTION

The need for the Proposed Action is to address the threats of numerous invasive plant species on Travis AFB. There is a need to eliminate or control known priority infestations and prevent the establishment of new infestations of invasive plants and animals. If allowed to spread unchecked, invasive plant species would degrade the remaining native habitat; interfere with management of sensitive resources, economic activities, and quality of life; and impede the military mission. Invasive animal species threaten the persistence of native fauna.

Threats associated with invasive species on Travis AFB and its GSUs include:

- Increased fire risk, which can impede the military mission.
- Increased fuel load, which would contribute to a higher burn severity and increased damage to natural and cultural resources.
- Added habitat for birds and other undesirable wildlife near the airfield, increasing bird/wildlife aircraft strike hazard (BASH) potential.
- Deteriorated native vegetative communities, restricting desired wildlife habitat and biodiversity.
- Altered vernal pool hydrology, water quality, and biomass levels, threatening the vernal pool ecosystem and associated listed species.
- Degraded aquatic and riparian habitats (e.g., changes in streamflow, bed and bank levels) threatening the associated ecosystems, native and listed species, and recreational fishing.
- Diminished livestock forage quality and quantity through reduced palatable forage species, threatening the existing grazing program and associated fuels reduction.
- Toxic effects on humans and pets, degrading outdoor activity and quality of life.
- Growth on roads, sidewalks, trails, and parking areas reducing visibility, increasing erosion and flooding potential, degrading aesthetics and recreational opportunities, and contributing to the spread of undesirable species.
- Reduced open space, degrading quality of life and recreational opportunities.
- Invasion of decorative landscaping.
- Allowed to spread unchecked, habitat degradation escalates and costs to control balloon.

AFI 32-7003, Environmental Conservation, (USAF 2020, Section 3.10.4), provides for the following instruction regarding invasive species: “The INRMP must identify any existing programs and strategies to control and/or eradicate those species when practical and consistent with the military mission.” The current Travis AFB INRMP five-year plan (TAFB 2016) includes goals, objectives, and projects to guide the management of invasive species on the installation. This EA addresses the implementation of these strategies.

1.4 DECISION TO BE MADE

The decision to be made is the selection of an alternative for Headquarters Air Mobility Command (HQ AMC) to support implementation of comprehensive invasive species management. The decision options are:

1. To continue with current operations (the No Action Alternative);
2. Selecting an alternative and preparing a Finding of No Significant Impact (FONSI); or
3. Preparing an Environmental Impact Statement (EIS) of the alternatives would result in significant environmental impacts.

CEQ regulations (40 CFR Parts 1500−1508) ensure compliance with NEPA. These regulations dictate that an EA be prepared to provide evidence for determination of a FONSI and a Finding of No Practicable Alternative (FONPA), or if an EIS is needed. The EIAP (32 CFR Part 989, as amended) outlines the process for implementing NEPA. AFI 32-7064, *Integrated Natural Resources Management,* outlines the policy and procedure for implementation of a FONSI or FONPA. If the selected alternative must be located in a wetland or floodplain, and no practicable alternative exists, then a FONPA must be prepared that discusses why no other practicable alternative exists to avoid impact to the wetland or floodplain. The FONPA is a statement included in the FONSI that states there is no practicable alternative to that which is selected. The analysis in the EA must support this finding.

The lead agency conducts an EA to assess the environmental effects of a proposed project. Depending on the potential effects, a further and more substantial review may be conducted in the form of an Environmental Impact Statement. A project may not be approved if there is another alternative that meets the Purpose and Need and has less significant environmental effects. In addition, a project could be approved if mitigation is proposed to lessen the environmental effects to an insignificant level.

Per NEPA, upon completion of the EA review and consultation process, the project sponsor (USAF) will determine whether the Proposed Action would result in significant impacts to environmental or other resources. If it is found that no significant impacts would occur as a result of the Proposed Action, the USAF can move forward with the Proposed Action as such once it publishes a FONSI/FONPA.

1.5 AGENCY AND INTERGOVERNMENTAL COORDINATION/ CONSULTATIONS

1.5.1 Interagency and Intergovernmental Coordination and Consultations

Federal, state, and local agencies with jurisdiction that could be affected by the alternative actions were notified and consulted during the development of this EA. Appendix B contains the list of agencies consulted during this analysis and copies of correspondence(s).

1.5.2 Government to Government Consultations

The National Historic Preservation Act and its implementing regulations at 36 CFR Part 800 require federal agencies to consult with Native American tribal governments that attach religious and cultural importance to properties eligible for the National Register of Historic Places. To comply with legal mandates, federally recognized tribes that are affiliated historically with the Travis AFB geographic region will be invited to consult on all proposed undertakings that have a potential to affect properties of cultural, historical, or religious significance to the tribes. The tribal consultation process is distinct from NEPA consultation or the Interagency/Intergovernmental

Coordination for Environmental Planning (IICEP) processes and requires separate notification of all relevant tribes.

Travis AFB routinely consults with four federally recognized Native American tribes with ethnographic ties to the region including: the Yocha DeHe Wintun Nation of California, the Cachil DeHe Band of Wintun Indians of the Colusa Indian Community of the Colusa Rancheria, the Guideville Rancheria of California, and the Kletsel Dehe Band of Wintun Indians. The base initiated consultation with the tribes on March 15, 2021, inclusive of a fifth tribe, the United Auburn Rancheria. On March 16, 2021 United Auburn Rancheria replied that the project is outside of their traditional ethnographic territory. On April 2, 2021 the Yocha DeHe Wintun tribe responded with the recommendation that cultural monitors be included due to the location of the project within their aboriginal territory (see Appendix B). No other comments have been received.

The Native American tribal governments that were coordinated with regarding this action are listed in Appendix B.

1.6 PUBLIC AND AGENCY REVIEW OF EA

A Notice of Intent (NOI) to prepare an EA for Proposed Actions that would occur in floodplains and may affect wetlands was published in the newspapers of record (listed below), soliciting public comments on 10 February 2021. The NOI invited the public to provide comments on the proposal and any practicable alternatives that may reduce impacts. The public comment period ended on 10 March 2021. The NOI is provided in Appendix C. There were no comments received from the public.

A Notice of Availability (NOA) of the Draft Final EA and FONSI/FONPA was published in the newspapers of record (listed below), announcing the availability of the EA for review for 30 days from the NOA publication. The NOA invited the public to review and comment on the Draft Final EA during the 30-day review period. Public and agency comments are provided in Appendix B. The NOA was published in the following newspapers:

- The Daily Record, Fairfield-Suisun, CA;
- The Reporter, Vacaville, CA; and
- The Tailwind, Travis AFB, CA.

Copies of the Draft EA and FONSI were also made available for review at the following locations:

Fairfield Civic Center Library **1150 Kentucky Street** **Fairfield, CA 94533**	**Suisun County Library** **601 Pintail Drive** **Suisun County, CA 94585**
Vacaville Public Library Cultural Center **1020 Ulatis Drive** **Vacaville, CA 95688**	**Mitchell Memorial Library** **510 Travis Boulevard** **Travis AFB, CA 94535**
Online: https://www.travis.af.mil/Environment/Compliance/	

1.7 KEY DOCUMENTS

Key documents are sources of information incorporated into this EA. Documents are considered to be key because of similar actions, analyses or impacts that may apply to this Proposed Action.

CEQ guidance encourages incorporating documents by reference. Documents incorporated by reference in part or in whole include:

- *Travis Air Force Base Integrated Natural Resources Management Plan* (TAFB 2016, 2019a). The Travis INRMP documents and recommends natural resources management activities. Its implementation helps ensure that Travis AFB lands continue to support present and future mission requirements while preserving, enhancing, and restoring ecosystem integrity.

- *Final Invasive Species Management Plan for Travis Air Force Base, Solano County, California* (HT Harvey 2014). This plan characterizes the distribution and abundance of weed and pest species at Travis AFB (TAFB), describes appropriate methods to manage populations of target species, describes strategies to avoid adversely affecting special-status species as a result of weed and pest control, and proposes best management practices (BMPs) and other measures to achieve these objectives. The invasive plant species content of this plan is superseded by the IPSMP (ManTech 2017); however, the invasive fauna (pest) portion of this plan is applicable.

- *Travis Air Force Base Updated Invasive Plant Species Management Plan* (ManTech 2017). This document replaces the vegetation sections of the ISMP (HT Harvey 2014). The IPSMP presents a long-term strategy for managing the vegetation at Travis AFB to maximize the opportunities for stewardship of sensitive species and resources and reduce the prevalence of undesirable non-native plants. This plan includes protocols for preventing the spread and introduction of weeds, a framework for weed control decision making, control methods for specific weeds and management strategies for the habitats and sensitive species of TAFB.

- *Grazing Management Plan, Travis Air Force Base, California* (Hopkinson 2017). This plan prescribes livestock grazing management activities on Travis AFB to meet INRMP goals. The plan addresses goals and mission support functions of the grazing program, grazing conditions, leases, land use rules, management recommendations, stocking rates, monitoring procedures, and adaptive management.

- *Aquatic Pesticide Application Plan Environmental, Travis Air Force Base, CA* (OTIE 2020). This plan was prepared to satisfy a requirement for coverage under the Statewide General National Pollutant Discharge Elimination System (NPDES) Permit for Residual Aquatic Pesticide Discharges to WoTUS from Algae and Aquatic Weed Control Applications, Water Quality Order 2013-0002-DWQ from the California State Water Resources Control Board. The APAP describes planned aquatic herbicide applications for the control of aquatic invasive, non-native, and native plants on TAFB.

- *Travis Air Force Base TIER 1 Wildland Fire Management Plan* (Chloeta 2019). The WFMP supports a coordinated approach to wildfire response and risk mitigation. This plan addresses the specific fire-related supporting goals and objectives for wildfire response. This WFMP provides guidance for the suppression and prevention of wildfires on TAFB lands and implementation of ecosystem management and fuels reduction goals using mechanical fuels treatments and prescribed fire in support of the INRMP (TAFB 2016).

- *Programmatic Formal and Informal Consultation on the Proposed Effects of Activities Conducted at Travis Air Force Base on Six Federally Threatened and Endangered Species, Solano County, California* (PBO, USFWS 2018a). The PBO covers proposed

federal actions that include typical activities conducted at Travis AFB and its seven GSUs. The PBO provides a framework for Section 7 ESA consultation for typical activities, authorizes take at levels to be determined by individual Project Analyses (PAs), and includes reasonable and prudent measures to minimize impacts to listed species.

- *Travis AFB Non-Native and Invasive Species List including Surveillance Species*, 2020. This list (see Appendix A) contains information on all non-native and invasive species known or likely to invade TAFB or its GSUs in the future. The list is based on several past surveys of the base and a CalWeed Mapper list for the region.

2.0 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

This chapter describes the Proposed Action and reasonable alternatives for implementation. The Proposed Action was developed in accordance with the objectives listed in Chapter 1, *Purpose and Need for Action*. The purpose and need sets forth a rational context in which to analyze the viability of potential alternatives.

2.1 PROPOSED ACTION

Travis AFB proposes to manage invasive species on the installation and at the GSUs in order to satisfy resource management goals outlined in the installation INRMP (TAFB 2016) and other installation management plans. Implementation of a procedural approach incorporating an integrated management process will reduce the negative effects under a manageable annual scope of work. Treatments could include but are not limited to broad-scale actions such as grazing and prescribed fire, targeted treatments including manual/mechanical and chemical applications, habitat enhancement activities, humane trapping and culling of invasive fauna, habitat modification, and actions to prevent introduction and spread. The annual scope of work presented for each alternative and associated BMPs (Appendix D) allow for predictable reduction of invasive species, improvement of federally listed species habitat and inform the associated effects analyses presented in Chapter 4, Environmental Consequences.

The currently signed Travis INRMP (TAFB 2016) includes several goals, objectives and projects that provide explicit drivers for invasive species management, framed in terms of conserving and benefiting sensitive, threatened and endangered species and their habitats; reducing fire hazard; reducing the potential for BASH incidents; and maintaining a sustainable rangeland ecosystem. Over the past several years, new invasive species management science and recommended methodologies have become available; invasive species mapping surveys have been performed; and local sensitive and invasive species data have been collected and analyzed. Travis AFB proposes to satisfy invasive species and resource management goals as outlined in the INRMP and other installation management plans in accordance with current available data and information, in the safest, most cost effective, efficient and effectual way possible.

2.2 SELECTION STANDARDS

NEPA and CEQ regulations mandate the consideration of reasonable alternatives for the Proposed Action. “Reasonable alternatives” are those that also could be utilized to meet the purpose of and need for the Proposed Action. Per the requirements of 32 CFR Part 989, the USAF EIAP regulations, selection standards are used to identify alternatives for meeting the purpose and need for the USAF action.

The Proposed Action alternatives must meet the following selection standards:

- Satisfy resource and management goals as defined in the current installation INRMP and associated management plans
- Minimize collateral effects to the environment
- Align with accepted BMPs
- Utilize the most current available information and science on invasive species management and resource protection

- Optimize costs, efficacy and efficiency

2.3 SCREENING OF ALTERNATIVES

The following potential alternatives that might meet the purpose and need for invasive species management were considered:

- **Alternative 1 (No Action)** – Under the No Action Alternative, the current management activities would continue as is, which include limited and small-scale manual/mechanical control and chemical applications outside of federally listed species habitat; grazing without the ability to expand operations into new areas; maintenance of mowed firebreaks without the ability to use mineral or graveled firebreaks; and limited prescribed burn activities. Current management activities lack a programmatic, cohesive approach and long-term strategy; don't utilize the most effective treatment methods; don't consider the most current science, data and analyses, and management recommendations; and don't fully address current INRMP (TAFB 2016) and associated program management goals.

- **Alternative 2 (Comprehensive Management)** – Manage invasive species in order to reduce their prevalence using an efficient, sustainable and long-term strategy that incorporates a programmatic, adaptive approach, maximizes opportunities for stewardship of sensitive resources and utilizes a varied scientifically-based toolkit of control methods including manual/mechanical activities, chemical applications, grazing, burning and fire management activities such as firebreak installation and maintenance. The ISMP, IPSMP, GMP, APAP, WFMP and INRMP provide the basis for this alternative.

- **Alternative 3 (Limited Control Methods)** – The same as Alternative 2, excluding the use of chemical applications.

- **Alternative 4 (Limited Control Locations)** – The same as Alternative 2 except it excludes all activities in locations within 25 feet of federally listed species habitat and known listed species records. As a result of this restriction, mineral or gravel firebreaks would not occur under this Alternative as they would necessarily occur in High Risk CTS upland habitat.

The selection standards described in Section 2.2 were applied to these alternatives to determine which alternative(s) could be effective in managing invasive species and would fulfill the purpose and need for the action (Table 1).

2.4 ALTERNATIVES ELIMINATED FROM FURTHER CONSIDERATION

Alternative 3 (Limited Control Methods – Same as Alternative 2, Excluding Chemical Treatments)

This alternative would not meet the purpose and need because many invasive species cannot be controlled without chemical treatments. Manual and mechanical treatments can be too costly for large infestations or ineffective on some hard-to-control species. Other control methods are also not always effective on certain species. This alternative does not satisfy current INRMP and other management goals and does not optimize cost, efficacy and efficiency. This alternative is not carried forward for analysis in this EA.

Table 1. Screening of Alternatives

Alternative Description	Selection Standards				
	Satisfies INRMP and Other Management Plan Goals	Minimizes Collateral Environmental Effects	Aligns with BMPs	Utilizes Current Science and Information	Optimizes Cost, Efficacy, and Efficiency
Alternative 1 – No Action – Maintain Current Management	No	No	Yes	No	No
Alternative 2 – Preferred Alternative – Proposed Action	Yes	Yes	Yes	Yes	Yes
Alternative 3 – Limited Control Methods – Same as Alternative 2 excluding chemical treatments	Partly	No	Yes	No	No
Alternative 4 – Limited Control Locations – Same as Alternative 2 excluding locations within 25 feet of federally listed species & habitats	No	No	Yes	No	No
	Green – meets selection standard Red – does not meet selection standard Yellow – partially meets selection standard				

Alternative 4 (Limited Control Locations – Same as Alternative 2, Excluding Certain Locations)

This alternative limits invasive species control in all locations within 25 feet of federally listed species habitat and known records of those species. This alternative would not meet the purpose and need because many invasive species control projects are undertaken for the sole purpose of protecting and benefiting federally listed species. Treatments that exclude proximity to listed species would have none of the positive impacts to the species that planned invasive species control projects are meant to have. This alternative does not satisfy current INRMP and other management goals and does not optimize cost, efficacy and efficiency. This alternative is not carried forward for analysis in this EA.

2.5 DETAILED DESCRIPTION OF THE ALTERNATIVE(S)

Two alternatives: Alternative 1 (No Action), and Alternative 2 (Comprehensive Management), are fully analyzed. Table 2 shows a proposed annual scope of work indicating maximum potential activity under Alternatives 1 and 2. Actual scopes of work would be developed on a seasonal basis in accordance with changing needs and conditions.

Table 2. Proposed Annual Scope of Work at Travis AFB and its GSUs

Activity	Alternative 1 No Action*	Alternative 2 Comprehensive Management
Livestock Grazing	457 acres long-term, 70 short-term. 90 acres non-AF grazing outside perimeter fence or on GSUs	654 acres up to 1,024 acres short and long-term
Grazing capacities and stocking rates	Existing ceiling	Ceiling adjustable to meet resource objectives
Grazing management strategies	Limited by ceiling	Adjustable
Prescribed Burns (including hand torching/flaming methods)	No prescribed burns prior to 2019; 17.6 acres in July 2019; 6.8 acres in 2020. Future fires limited to 50 acres annually as approved under Categorial Exclusion under EIAP.	164 - 493 acres burned annually to achieve fuels treatment goals outlined in the WFMP. Includes torch/flaming methodology.
Fuel/Fire Breaks	2,000 feet mineral fire breaks (20' wide) in 2019 12.5 miles mowed non-mineral fire breaks (20' wide)	A total of 5.6 miles of 30' wide mineral firebreaks (20.55 acres). A total of 8.6 miles of 20' wide mowed or burned firebreaks (20.9 acres). Avoids wetlands. Impacts CTS upland habitat.
Herbicide Use^	0.5 acre in 2015 2 acres in 2016 7 acres in 2017 16 acres in 2018 40 acres in 2019	200 acres
Aquatic Weed Control w/ Herbicide^	0 acres/year	2 acres
Aquatic Weed Control w/ Manual/Mechanical	<1 acre/year	2 acres
Manual/Mechanical Control^^	14 acres in 2015 14 acres in 2016 10 acres in 2017 10 acres in 2018 44 acres in 2019	200 acres
Habitat Restoration	None	10 acres
Invasive Fauna Control	None	10 acres

*No invasive species control work using any method except grazing is currently ongoing on any GSU under Alternative 1 (except the livestock grazing), thus Alternative 1 - No Action only reflects current work on Travis AFB within the perimeter fence. Alternative 2 – Comprehensive Management includes acre estimates for both Travis AFB proper (fenced and unfenced) and its GSUs combined.
^ Excludes Pest Management Shop and Grounds Maintenance activities
^^ Excludes mowing activities by Grounds Maintenance

2.5.1 Alternative 1 (No Action)

The No Action Alternative is required by law to be analyzed fully and serves as a baseline for comparison with the action alternatives. Under the No Action Alternative, current management activities would be maintained, including manual/mechanical activities, chemical applications to terrestrial habitats, chemical aquatic application to the North Gate Pond, grazing, and limited prescribed fire and firebreak installation (Table 2). All methods proposed under this Alternative are outlined in Table 2 and Section 2.5.2 under Alternative 2. The differences between Alternative 1 and 2 are discussed here.

While measures under Alternative 1 may help slow the spread of invasive plant species and may protect a select few assets, they won't be implemented at a large enough scale to prevent the expansion of infestations or provide the types of conservation benefits listed species need on Travis AFB. Current management activities (Table 2) typically address fewer than 100 acres a year (excluding grazing operations), which is less than 2% of the base and less than 6% of the wildlife management areas (grasslands and vernal pool habitat primarily) on Travis AFB and its GSUs, and therefore achieves little, if any, net gain in control, conservation benefit, or mission support since invasive vegetation continually re-invades when seed sources are not adequately controlled. Specifically, as shown by an analysis completed for the Beale AFB Invasive Species Environmental Assessment (USAF 2021) inadequate management allows *Containment Stage* species to expand base-wide reaching the *Asset-Based Protection Stage* and gives *Eradication Stage* species the opportunity to reach *Containment Stage* within 15 years (see Section 2.5.2 for explanations of the invasion stages). Finally, environmental impacts for current management activities are analyzed on an inefficient project-by-project basis using the USAF EIAP.

Table 3. Alternative 1 Past Use of Herbicides on Travis AFB

Includes only herbicide use for Natural Resources Management projects only; exludes Pest Management Shop application to North Gate Pond and terrestrial habitats. Oz = ounces. Ac = Acres

Year	Metric	Glyphosate	Imazapyr	Triclopyr	Chlorosulfuron	Aminopyralid	Total Acres Treated	Total Oz
2015	Total Oz	74		4				78
	Acres*	0.4		0.1			0.5	
2016	Total Oz	82	12	10		11		115
	Acres	0.38	0.13	0.1		1.2	1.58	
2017	Total Oz	26	1.25	297.5		31.5		356
	Acres	0.05	0.05	6.87		6.72	6.92	
2018	Total Oz	7.5	7.5	597.5	2.5	72		687
	Acres	0.29	0.29	13.37	2.05	13.22	15.71	
2019	Total Oz	1		448	2	233.65		685
	Acres	0		10.14	1.02	37.455	40.16	
All Years	Total Oz	190.5	20.75	1357	4.5	348.15		1921
	Total Ac	1.12	0.47	30.58	3.07	58.595		

*Some herbicides are applied to the same locations so the sum of acres across herbicides overestimates the total acreage where herbicides are applied. See Total Acres Treated column for this information.
Sources: SRCD 2016, 2017, 2019a, 2020

Alternative 1 does not include grazing expansion, use of aquatic herbicides base-wide, use of herbicides in jurisdictional vernal pools, and invasive species control near federally listed species. These actions, together with limited fire management activities that do not allow the use of mineral or graveled fuel breaks, ensure that Alternative 1 will negatively impact wildlands, which are highly invaded, and perpetuate current problems such as the high cover of medusahead.

Alternative 1 is limited to terrestrial habitat control and chemical control of aquatic weeds only at the North Gate Pond and terrestrial habitat control and emergent vegetation control via manual/mechanical methods in Union Creek for BASH control. However, Travis AFB also needs to reduce BASH habitat concerns in and around its water conveyances such as Union Creek by controlling the growth of aquatic and riparian vegetation through the use of herbicides.

Finally, this Alternative does not include installation of mineral firebreaks on the base in a configuration that adequately protects Air Force assets. This hampers the bases' response to rapidly approaching wildfire that may threaten human health, life and property.

As discussed in Section 2.3, Alternative 1, No Action Alternative does not meet the purpose and need of the Proposed Action.

2.5.2 Alternative 2 (Comprehensive Management)

Alternative 2, Comprehensive Management, would manage invasive species to reduce their prevalence using an efficient, sustainable and long-term strategy that incorporates a programmatic, adaptive approach, maximizes opportunities for stewardship of sensitive resources and utilizes a varied toolkit of control methods including manual/mechanical activities, chemical applications, grazing and burning. The current INRMP (TAFB 2016) and other Key Documents (Section 1.7) contains several goals, objectives and projects that provide explicit drivers for invasive species management.

Environmental analysis will focus on mowing, grazing, hand removal, mechanical removal, prescribed fire, chemical control and habitat restoration (e.g., native species planting) everywhere on Travis AFB and its GSUs though primarily focused within Natural Resource Management Units (NRMUs) which encompass undeveloped lands or those areas where federally listed species habitat or records occur on base. Analysis will focus on known invasive species (Table 11), species that may arrive in the future or have otherwise not become a problem yet (Appendix A). Some known weed populations have been mapped but they are not all inclusive, base-wide or complete for any one species.

To increase the likelihood of successful long-term control, invasive species management experts recommend combining several management methods, tailored to situation-specific goals, constraints, and opportunities. The following methods and activities for invasive species containment/control are considered under Alternative 2:

1. Continue and expand Livestock Grazing (Section 2.5.2.1, Figures 3 & 4, see also GMP)(cattle, sheep, goats, and horses), including prescribed grazing management strategies and techniques (e.g., continuous grazing, seasonal grazing, variable stocking rates, short duration high-intensity grazing methods), new grazing locations, and new infrastructure (e.g., permanent barbed wire fence, temporary or permanent electric fence, water troughs, solar wells including groundwater well and solar power and trough infrastructure, water tanks, trenched waterlines, and maintenance of all infrastructure).
2. Pest Animal Control (Section 2.5.2.2, see also ISMP) via indirect and direct methods including hand capture, trapping, netting, gigging, shooting, fencing, sediment excavation,

chemical control, and manipulating the habitat to prevent the reproductive success or long-term survival of bullfrogs (e.g. dewatering of aquatic habitat).

3. Prescribed Burns (Section 2.5.2.3, Figure 5, see also the WFMP) (prescribed fires, torching/flaming, fire control lines, installation and/or maintenance of various kinds of firebreaks including targeted grazing, mowed, blacklined, temporary mineral via blading/ scraping or disking the soil, and/or permanent mineral via gravel).
4. Chemical Treatments (Section 2.5.2.4, Figures 6 & 12, see also the IPSMP and APAP) including herbicide application via broadcast, spot-spray, or cut-stump treatments to terrestrial habitats; aquatic application applied directly to foliage growing at or above the water's surface in non-flowing waters, ephemeral vernal pools, swales and wetlands during the dry season.
5. Manual and Mechanical Treatments (Section 2.5.2.5, Figure 12, see also the IPSMP) including mowing, hand-pulling, weed-whacking, and digging.
6. Habitat Enhancement Treatments (Section 2.5.2.76, see also the IPSMP) including soil preparation, digging, planting, drill or broadcast seeding, hydroseeding, tilling, and watering.
7. Monitoring, Tracking, and Surveying (see IPSMP) including measuring treatment efficacy, recording effects of invasive species, documenting weed spread, mapping and detecting new species, recording and tracking phenology over time.
8. Prevention Measures (see IPSMP) including education, equipment cleaning, and using weed-free mulch and fill.

IPSMP, Invasive Plants: The IPSMP includes protocols for preventing the spread of existing invasive plant species and the introduction of new species, methods for controlling specific invasive species, and general management strategies for the sensitive species and habitats on the installation. While the IPSMP does not explicitly include the GSUs, the habitat and species present on the GSUS are similar to those on Travis and thus all management prescriptions and recommendations are applicable.

Specific information on the framework for invasive species control decision making, details of all control techniques, and future desired conditions are incorporated by reference from the IPSMP document and are not fully replicated. Briefly, invasive species are prioritized into stages as a means of deciding which ones to control and how much effort to expend. These stages include:

- Prevention: prevent invasive species from establishing any population on the base;
- Eradication: Control of small populations that have not had the opportunity to establish substantial widespread seedbanks or alter ecosystems;
- Containment: As a given species establishes viable populations and begins to spread outward, containment becomes the most cost-effective strategy and the focus should be on monitoring the original introduction site, if known, curtailing the spread outward from that site and targeting any newly established populations for immediate control; and
- Asset-Management: The final stage is for wide-spread, ubiquitous species control. At this stage, management shifts from a focus on the weed species itself to focusing on landscape-scale decision making. Management at this stage typically focuses on large-scale control measures such as grazing, timed mowing or restoration planting rather than techniques such as spot-spraying or hand pulling and/or targets only specific areas like important habitat for federally listed species.

While Alternative 2 is designed to reduce overall invasive species cover or occurrence, it also simultaneously aims to improve forage quality for grazing animals, as grazing is a primary tool for controlling invasive species biomass. Improving forage quality equates to maintaining or increasing certain desirable non-native species, often referred to as naturalized species (normally annual grasses and forbs) that have been on the landscape for decades or centuries (i.e., *Erodium* sp.). Such species are too ubiquitous to warrant control, do not threaten the ecosystem like non-natives targeted for control, provide suitable forage for livestock, and provide an ecosystem benefit (i.e. supporting cattle grazing operations which controls other invasive species).

ISMP, Invasive Animals: The ISMP provides information and management for the invasive fauna control component of this alternative. Management activities in support of these goals include preparing and implementing a plan to reduce the number of bullfrogs, fish and other predators of CTS in breeding ponds in the Castle Terrace Housing NRMU (Figure 13). The ISMP also focuses on using management practices to prevent the introduction and/or spread of the American bullfrog, which could threaten natural habitats and native species on TAFB.

This Alternative is meant to capture all iterations of adaptive management for invasive fauna species under the ISMP thought it will mostly target American bullfrog, non-native fishes, red-eared sliders (*Trachemys scripta*), Louisiana red-swamp crayfish (*Procambarus clarkii*), and other predators of CTS or Western Pond Turtle (*Actinemys marmorata*).

APAP, Aquatic Species Management: Invasive perennial pepperweed and arundo (*Arundo donax*) invade wetlands and vernal pools, rapidly forming large, dense stands that displace desirable vegetation. Invasive stinkwort is also invading vernal pools and wet areas along with upland grassland areas. At Travis AFB, the federally endangered CCG occurs in vernal pools and is directly threatened by existing populations of perennial pepperweed; stinkwort occurs nearby. Other federally listed species potentially affected include VPFS, VPTS and CTS all of which occur in vernal pool habitat at Travis AFB near habitat invaded by these three aquatic invasive species. Control is required to meet conservation recovery goals for these species at Travis AFB per the INRMP (TAFB 2016).

2.5.2.1 Livestock Grazing

Grazing by domestic livestock, including cattle, sheep, goats, and horses, can be implemented as a method for controlling invasive plant species. Grazing reduces biomass and wildland fire fuels and contributes to the local agricultural and food economy. Grazing is a low-cost landscape-level tool for achieving conservation goals. While grazing alone does not eradicate invasive plant species, it can be effective in reducing infestations, slowing the spread of some undesirable species, and can make some plants more susceptible to herbicide application.

Under Alternative 2, the grazing program at Travis AFB and its GSUs will be maintained in accordance with the Travis AFB GMP, which helps guide livestock grazing management activities to meet INRMP goals. While the GMP does not currently include the GSUs, all management prescriptions, goals, objectives, and BMPs in it apply to the GSUs. The existing grazing program is described in Chapter 3 Affected Environment, Section 3.3, *General Land Use*.

Areas proposed for grazing expansion are ecologically identical to currently grazed lands (Figures 3 & 4). The areas are predominantly California annual grassland, interspersed with vernal pool complexes and seasonal swales habitat. Most of these areas do not currently have infrastructure to support livestock grazing, so improving and installing fencing and developing water sources will be required for grazing to be initiated. Up to 258,000 feet of linear fencing would be needed to enclose all additional grazing areas at Travis AFB and its GSUs. This will involve modifying

existing fencing and installing new, permanent barbed wire fencing, and temporary electric fencing. No new access roads will be installed within the proposed grazing units, but existing access roads will be maintained. Each pasture will need at least one water trough and access gates as well as mineral supplements to help with animal distribution across the pasture.

Expansion of the grazing program will follow the strategy outlined in the GMP to expand grazing into areas of Travis AFB and the GSUs that have not been grazed in recent years. The strategy identifies approximately 596 acres on Travis AFB and 124 acres on its GSUs of land that could potentially be utilized for grazing (Figures 3 & 4). An analysis of the most likely areas where grazing would be expanded (Castle Terrace NRMU, Three Tanks Pastures, and Cordelia Rd Pastures, the latter two being contiguous with current grazing pastures) show that 197 acres would be added to the grazing program which would support an additional 43 cows. For comparison, current grazing practices under Alternative 1 supports 80 cows on 383 acres for 8 months, 26 horses on 74 acres for 12 months, and approximately 300 sheep on 70 acres for about 6 weeks.

Further details on methods and prescriptions are provided in the GMP and incorporated into this EA by reference.

2.5.2.2 Invasive Animal Control Methods

Methods to control bullfrog populations generally fall into two categories: direct removal and indirect removal (Adams and Pearl 2007). Methods of direct removal include hand capture, trapping, netting, gigging, shooting, fencing and sediment excavation, and chemical control. These methods are typically labor intensive and may not reduce bullfrogs to desired numbers (Miera 1999). Indirect removal strategies involve manipulating the habitat to prevent the reproductive success or survival of bullfrogs. The most common method is the dewatering of aquatic habitat (Snow and Witmer 2010). All methods require repetition every one to four years. Additional details on these methods are available in the ISMP and are incorporated into this EA by reference.

2.5.2.3 Wildland Fire Management

Wildland fire management uses prescribed fire to manage invasive plant species and can achieve the following:

- Control certain invasive species, particularly those present over large areas;
- Improve wildlife habitat by decreasing thatch, destroying seeds, reducing invasive plant cover, and increasing native species cover and diversity;
- Remove competing vegetation;
- Minimize the negative effects and severity of wildfires; and
- Maintain open grasslands and vernal pools.

Prescribed burns require careful planning, coordination, and implementation to be successful. All prescribed burns are managed in accordance with the IPSMP, in addition to the WFMP (Chloeta 2019). The WFMP lays out responsibilities and procedures for prescribed fire management in a manner that is safe, efficient, and effective.

Travis AFB NRM, after detailed study of locations and proposed fire activities, may approve all prescribed fires in support of goals and objectives described in the INRMP. The NRM alone will set prescribed fire priorities on the installation for the purpose of meeting natural resources goals and will be consulted on all planned prescribed fire actions conducted for fuels reduction

purposes. A prescribed fire plan (PFP; also known as a 21-Element Plan) will be developed that includes relevant information for each planned burn unit. In addition, an Incident Action Plan (IAP) will be developed for each unit to guide implementation of the burn once the date, time and available resources are known. Burn Units have been identified for Travis AFB (Figure 5).

According to the WFMP, the historic mean fire return interval (MFRI) for the grassland areas on Travis AFB is about four years. Prescribed fire application on the installation, with a recommended MFRI of four years (between two and six years is acceptable) will need to average 164 - 493 acres annually (Table 2). As with other invasive plant control methods, timing of treatment is critical (Table 4).

Table 4. Travis AFB Prescribed Fire Recommendations for Control of Select Invasive Species

Species Controlled	Prescribed Burn Recommendation
Barb goatgrass (*Aegilops triuncialis*)	Early summer or late spring prescribed fire.
Yellow starthistle (*Centaurea solstitialis*)	Early summer or late spring prescribed fire in 3 consecutive years. Repeat treatments may be necessary every 2-4 years.
Medusahead (*Elymus caput-medusae*)	Late spring (after seed head dispersal but before the seed moisture drops below 30%) prescribed fire. Repeat treatments may be necessary every 2-4 years.

Source: Beale AFB WFMP Table 3.2 (Beale AFB 2018).

In addition to prescribed fire, installation and maintenance of firebreaks is a primary task under wildland fire management. Specific methods include the following:

1. Permanent mineral firebreak (with or without gravel covering soil)
2. Temporary mineral firebreak (soil-disturbing via disking or blading)
3. Blackline
4. Mow
5. Targeted grazing

While firebreaks currently exist on Travis AFB under the No Action Alternative, they are mostly maintained by mowing to keep vegetation as short as possible (Figure 5). Disked firebreaks have been maintained in the past, avoiding wetlands, but were discontinued in most areas in favor of mowing. In August 2020, mineral firebreaks were installed by blading the ground using heavy equipment in two of the conservation areas on base in response to emergency conditions associated with the LNU Lightning Fire Complex (Marty 2020). The emergency action included blading, with a dozer, mineral firebreaks in the Castle Terrace Conservation Area and the Aero Club Conservation Areas.

These mineral firebreaks, totaling 5.67 acres, were installed along the perimeter fence in two locations in areas where grazed or mowed grasslands abutted both sides of the perimeter security fence. The firebreak, running along the northern edge of the Aero Club Conservation Area was an existing firebreak that had been maintained historically with disking, most recently in 2019.

Figure 3. Current and Proposed Cattle Pastures on Travis AFB

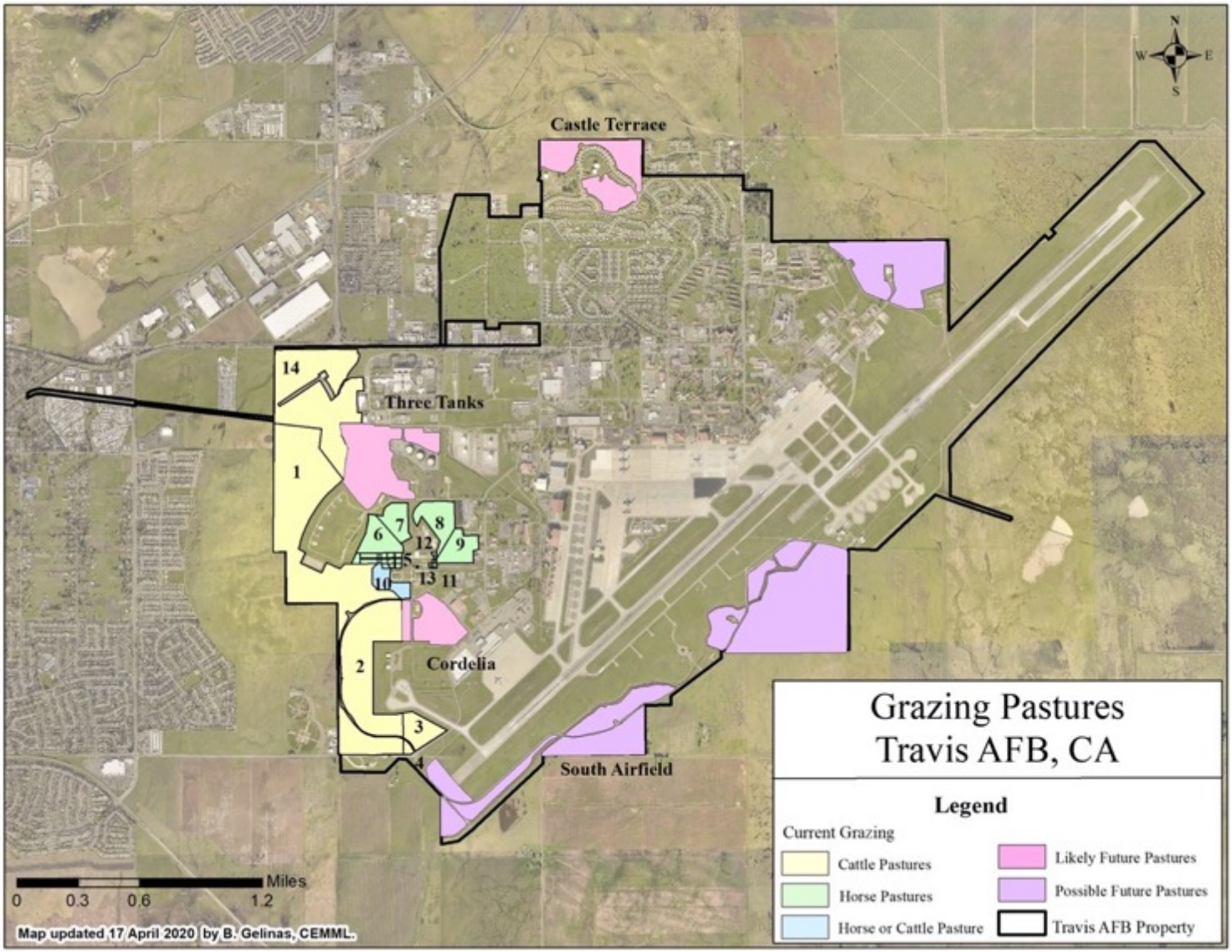
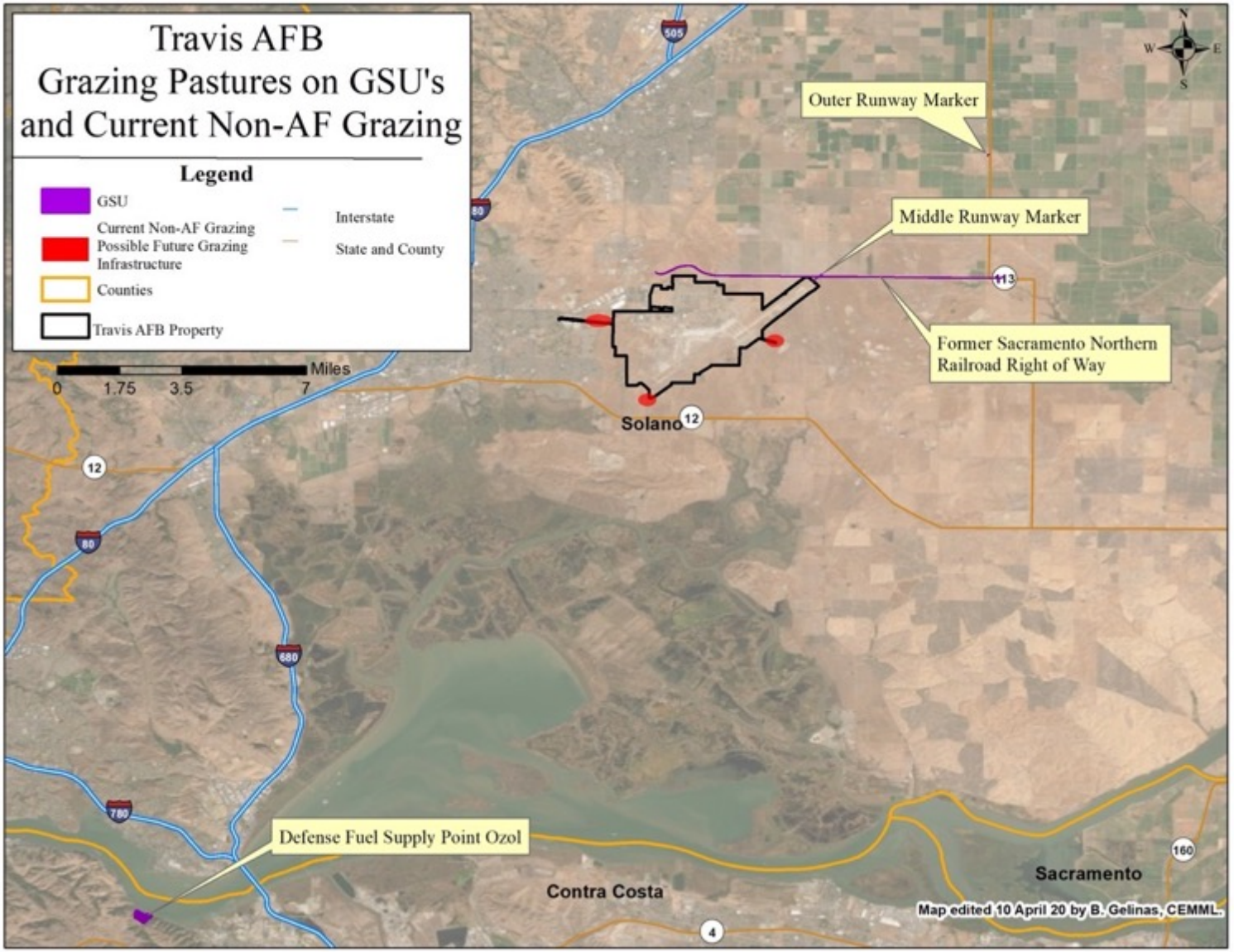
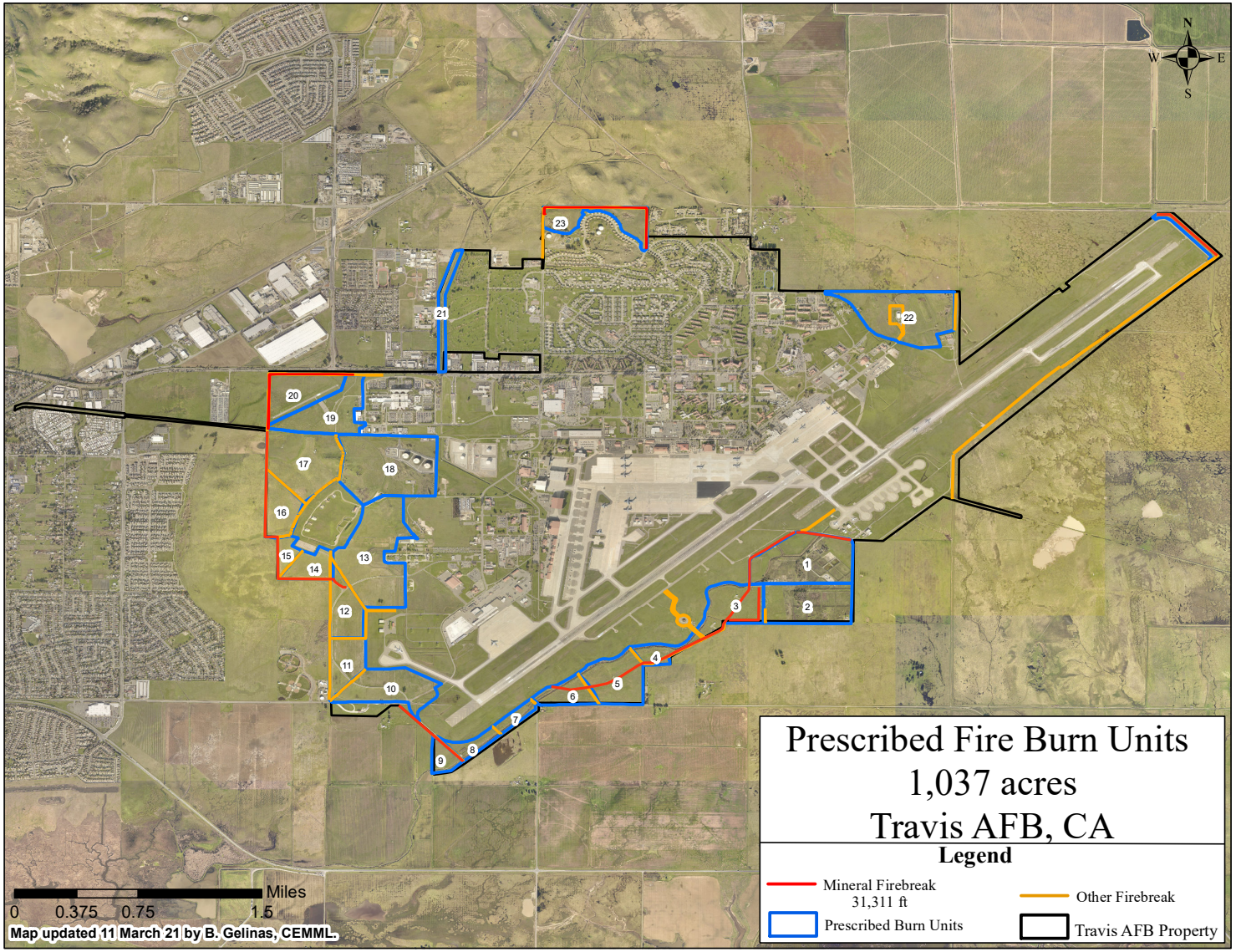


Figure 4. Proposed Cattle Pasture at Travis AFB GSUs



1 **Figure 5. Travis AFB Burn Units (1,037 acres)**



2

Alternative 2 includes use of various methods to maintain existing firebreaks and the ability to create new ones. New methods include use of mineral firebreaks which require disking or blading to remove/bury vegetation and to expose the soils. Mineral firebreaks provide a true fuel break whereas mowed firebreaks can only slow the pace of a fire. The WFMP requires disking and blading to avoid wetlands and allows mowing within the wetland basin when needed. Vegetation is typically sparse within vernal pools and seasonal wetlands, so avoiding these features with allows for a continuous fuel break and meets all fire management objectives. Mowing may be used inside vernal pools and their buffers using hand tools to cut the vegetation to ¼'' to 1'' tall to reduce fuels. A leaf blower is then used to remove all cut material to expose as much soil and reduce the amount of flammable material within the firebreak.

Black lines are narrow strips of burned vegetation along the perimeter of a planned prescribed fire project and/or along a pre-identified firebreak. They reduce the chances of slop-over and/or fire advancements outside of the desired burn perimeter. Black lines can be used in conjunction with larger prescribed burns or used as stand-alone firebreaks in areas where soil disturbance could harm sensitive resources. Black lines are a non-destructive alternative to traditional firebreaks in areas where ground disturbance is restricted.

Mineral firebreaks with gravel applied on top are used to cover vegetation and create a true fuel break. This is primarily being considered to reduce impacts to federally listed species caused by repeated, annual mineral firebreak installation methods.

2.5.2.4 Chemical Treatments

Under Alternative 2, chemical treatments in the form of herbicide applications will be utilized to control certain invasive terrestrial and aquatic plants at Travis AFB and the GSUs. Herbicides are most often used when other methods are not effective or feasible. Herbicides may be used to manage dense or large infestations or specific species that cannot be successfully controlled through other management actions. In a successful management program, the amount of herbicide used on a particular site will decrease over time as the invasive plant population declines.

Selection of the herbicide to be used in any given situation is critical, with attention to label instructions, toxicity, use restrictions and timing of the application. In areas where aquatic resources are present, requirements of the General NPDES Permit for Residual Aquatic Pesticide Discharges and/or other required permits will be followed, which limit the types of herbicides that can be used.

Herbicides would always be applied in accordance with the IPSMP; the Travis AFB Integrated Pest Management Plan (IPMP) (IPMC 2017); AFMAN 32-1053 Integrated Pest Management Program; the General NPDES Permit for Residual Aquatic Pesticide Discharges; the APAP (OTIE 2020) required by the NPDES permit and approved by the State Water Resources Control Board; all applicable federal, DoD, USAF, State of California, and local directives and regulations; and label instructions. The IPMC is in charge of approving and tracking use of chemical pesticides (herbicides) on the installation. The IPMP maintains a list of all pesticides approved for use on Travis AFB and its GSUs. If new pesticides are required, approval can be acquired through a separate request from the Travis IPMC.

All individuals who apply herbicide must have either a DoD applicator's license or a California Qualified Applicator License or Certificate (QAL/C). The Pest Management Shop tracks and reports all pesticide use on the installation, and maintains a record of QAL/Cs, active ingredients

(AI) and DoD Applicator's Licenses if applicable. All herbicide use on the installation is reported to the Pest Management Shop, which reports up to the Air Force Civil Engineer Center.

Up to 10 primary herbicides are proposed for use on Travis and its GSUs for invasive plant species control (Table 5). An additional 11 are allowed for use on aquatic plants per the APAP though are not reviewed as part of this EA. Additional herbicides may also be used as new species are detected, new research suggests more effective chemicals, and new herbicides come to market. The herbicide and application method used will depend on the target plant species and is always based on current science. Only herbicides approved for use in California and on DoD lands will be applied. Application methods that may be used include:

- **Broadcast Spray (Boom):** Spraying herbicide onto an entire infested area, rather than targeting individual plants using a regulated nozzle. This method uses a truck- or ATV-mounted boom sprayer.
- **Targeted Spray:** Spraying herbicide onto the foliage of individual target plants. This is done using a regulated nozzle, which helps to concentrate application toward target plants. This method uses a backpack-mounted wand sprayer or a truck- or ATV-mounted hose sprayer.
- **Pre-emergent Spray:** Herbicide is applied directly to the soil in areas with known infestations to prevent seed germination or to otherwise inhibit development. Herbicide may be applied using backpack-mounted wand sprayer or a truck- or ATV-mounted hose sprayer.
- **Basal Bark:** Basal bark herbicides are mixed with an oil carrier to penetrate the bark of the target plant. Herbicide is sprayed around the circumference of the base of the stem. This is used to control thin-barked plants less than 6 inches in basal diameter.
- **Selective Application:** Touching individual target plants with applicators containing herbicide. Because these methods involve direct application, there is a very low likelihood of drift, run-off, or accidental nontarget exposure. Specific methods include hack-and-squirt, cut-stump, and wicking or wiping. Applies to application of herbicides in upland grasslands as well as in dry jurisdictional wetlands and vernal pools.
  Aquatic Applications: Herbicide is either applied directly to foliage growing at or above the water's surface. Most, if not all aquatic application will occur to dry, seasonal wetlands during the dry season. Only herbicides approved for aquatic use may be applied using these methods.

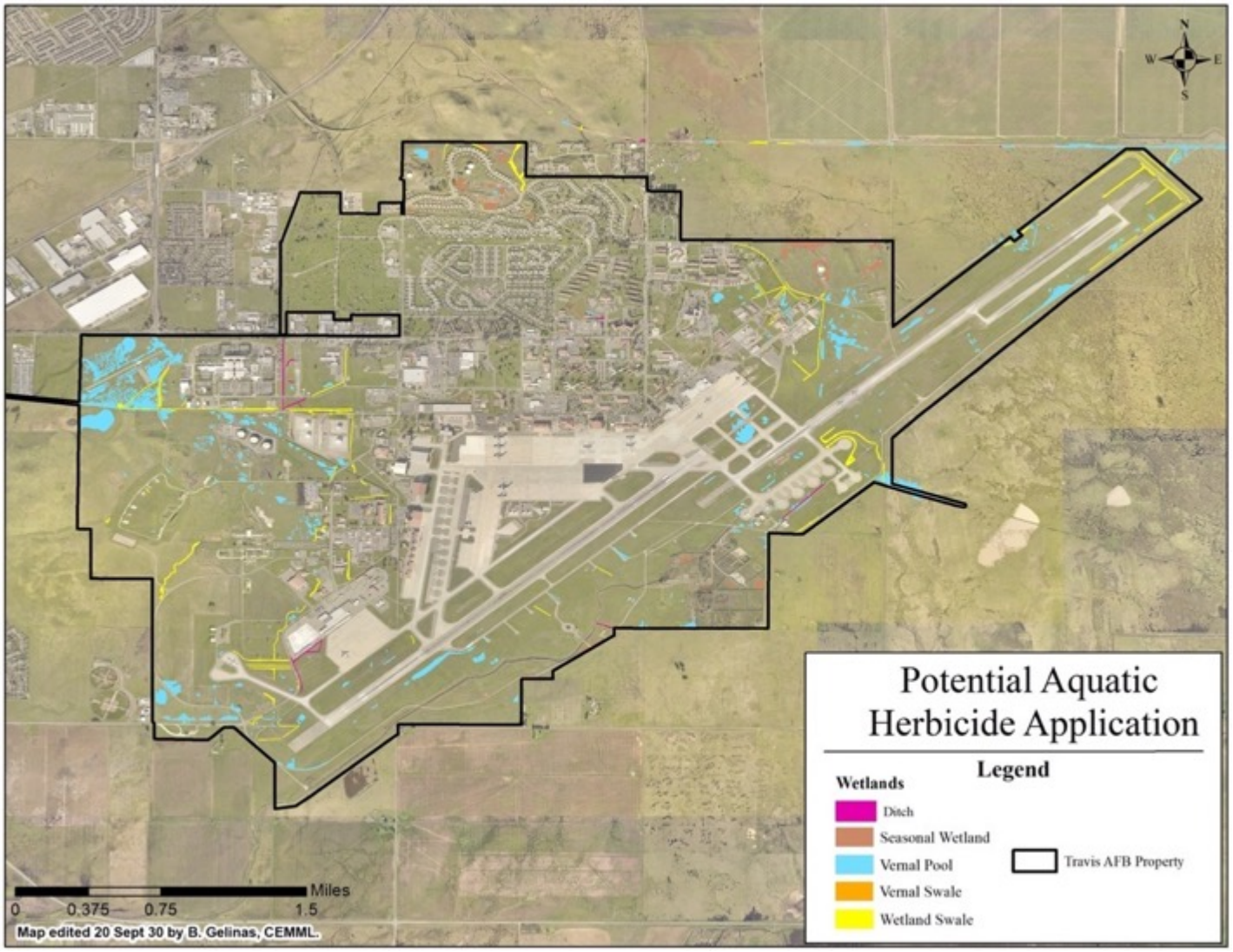
Table 5. Herbicides Most Likely to be Used Under Alternative 2

Active Ingredient	Example Product Name (EPA Reg No.)	Type
Triisopropanolammonium salt of aminopyralid	Milestone (62719-519)	Liquid concentrate
Chlorsulfuron	Telar XP (432-1561)	Dry flowable
Isopropylamine salt of glyphosate	Roundup Custom* (524-475) Rodeo (62719-324) Roundup Pro Roundup Pro Concentrate	Liquid concentrate
Isopropylamine salt of imazapyr	Habitat* (241-426)	Liquid concentrate

Active Ingredient	Example Product Name (EPA Reg No.)	Type
Triclopyr: 2-[(3,5,6-trichloro-2-pyridinyl) oxy], acetic acid, triethylamine salt	Garlon 3A* (62719-37); Renovate 3 (62719-37-67690)	Suspension; emulsifiable concentrate
Clethodim	Volunteer (59639-3-55467)	Emulsifiable concentration
Sulfometuron Methyl	Oust XP* (432-1552	Emulsifiable concentration; Water soluble granule
Mono(N,N-dimethylalkylamine) salt of endothall	Hydrothol 191 (4581-174-82695)	Liquid concentrate
Diquat dibromide	Reward (100-1091)	Liquid concentrate
imazamox	Clearcast (241-437)*	Emulsifiable concentration

* aquatic approved formulation

Figure 6. Locations for Potential Aquatic Herbicide Application under Alternative 2



2.5.2.5 Manual and Mechanical Treatments

Under Alternative 2, manual and mechanical treatments including mowing, hand-pulling, digging up with hand tools, and weed-whacking may be utilized to control certain invasive plant species at Travis AFB and the GSUs. Heavy equipment including flail mowers may be used to control infestations of yellow starthistle and barb goatgrass typically (Table 6).

Standard mowers such as ride-on mowers and multi-terrain loaders with a front-mounted mowing deck may be used to control or suppress certain invasive species, particularly annual species. For treatments of invasive species, mowing will be carefully timed to coincide with target species' phenology. Mowing may also be used in conjunction with prescribed fire in order to prepare the site for wet fire lines. It reduces vegetation height which allows for installation of hose lays and wet lines in order to secure the prescribed burn perimeter, instead of using ground disturbing equipment. This is ideal for locations where ground disturbance is restricted (e.g. vernal pools).

Manual removal methods or use of small hand-powered or hand-held equipment (Table 6) are often the first methods considered for removing small or new invasive plant infestations. For perennial species, especially trees, hand removal can take the form of girdling if the species is incapable of resprouting below the girdling cut. Depending on the target species and environmental constraints, manual and mechanical removal will be used independently or in concert with herbicide application.

2.5.2.6 Other Treatments

Torching, also known as flaming is the use of handheld propane torches to treat seedlings. Torching can reduce the seed bank in the soil by killing germinated seeds and preventing invasive plant reproduction that would lead to additional seed production during that year. Torching requires a relatively low level of effort and is a precise treatment.

2.5.2.7 Habitat Restoration

Under Alternative 2, habitat restoration may be utilized to control invasive plant species at Travis AFB and the GSUs. Habitat enhancement may be accomplished by replanting or reseeding with desirable, often native species. Revegetating may be accomplished using a mixture of native grasses and forbs and may include trees and shrubs if appropriate. Methods and steps required for habitat enhancement or restoration treatments include soil preparation, digging, planting, drill or broadcast seeding, hydroseeding, tilling and watering. Habitat restoration guidance is provided in the IPSMP and ISMP.

Site preparation for habitat restoration is not likely to include disking but could, depending on overall project goals and location, and would occur just prior to herbicide treatment. The most common restoration methods that may be used at Travis AFB include:

Table 6. Manual and Mechanical Control Method Descriptions and Impacts

Type	Tool/Method	Description of Technique	Benefit	Cons	BRC[1]	PGD[2]	LSI[3]	ID[4]	TS[5]	DoA[6]	T[7]
Manual (Conducted by hand or with non-mechanized hand tools)	Cut Stump with Hand Saws	Used to kill tree or shrub species unlikely to resprout or in conjunction with herbicide application	No herbicides, species specific	Limited to few a species, generates biomass that may need to be removed	Low	Low	Small	Diffuse	High	High	Flat to mod
	Trim with Hand Sheers, Loppers, or Similar Tools	Used to remove portions of trees and shrubs without killing them	No herbicides, species specific	No kill, generates biomass that may need to be removed	Low	None	Small	Diffuse	High	High	Flat to mod
	Pull by Hand or Weed Wrenches	Used to remove small trees/shrubs and small or intermixed infestations of plants	No herbicides, species specific	Limited to a few species, generates biomass that needs to be removed, very labor/time intensive	Low	Low	Small	Diffuse	High	Mod	Flat to mod
	Excavate with Shovels or similar Tools	Used to dig up small patches of plants that are too difficult to pull by hand	No herbicides, species specific	Limited to a few species, minor soil disturbances, generates biomass that may need to be removed, very labor/time intensive	Low	Mod	Small	Diffuse	High	Mod	Flat to mod
	Mulch	Organic material (wood chips) used to suppress germination of invasive species	No herbicides, can be used in conjunction with restoration activities	Non-selective, only useful against seedlings, physically disruptive, labor intensive	None	None	Mod	Diffuse	Low	High	Flat
Mechanical	Cut Stump with Chain Saw or Similar Tool	Used to kill tree or shrub species unlikely to resprout	No herbicides, species specific	No kill, generates biomass that may need to be removed	Low	Low	Large	Dense	High	High	Flat to mod
	Trim with Chain Saws, Brush-cutters, or Similar Tools	Used to remove portions of trees and shrubs without killing them or in conjunction with herbicide application	No herbicides, species specific	Limited to few a species, generates biomass that may need to be removed	Low	None	Large	Dense	Mod	High	Flat to mod
	Remove Using Excavator or Back Hoe	Used to remove large rhizomatous species like Arundo	No herbicides, species specific	Limited to a few species, highly disruptive to soil	Low	High	Mod	Diffuse	High	High	Flat
Mowing	Mow using weed-whackers, riding mowers, multi-terrain loader with a front-mounted mowing deck or similar equipment	Used to mow small to large infestations of annual invasive species or reduce biomass of perennial species	No herbicides, can cover significant areas	Limited to few species, non-selective, equipment must be cleaned to prevent spread of invasive species	Mod	Low	Large	Dense	Low	High	Flat

[1] BRC=Biomass Reduction Capability, [2] PGD= Potential for Ground Disturbance, [3] LSI= Landscape Scale of Infestation, [4] ID= Infestation Density, [5] TS= Target Specificity, [6] DoA= Detection of Application, [7] T= Terrain.

- **Hand Seeding:** In small upland areas, hand seeding with a base-approved native seed mix may be used to encourage native vegetation.
- **Drill Seeding:** A drill seeder with a row of small disks mounted on the front is used to plant seeds. The seeder digs a 0.75 to 1-inch groove in which the seed is planted, and then the grove is closed behind the machine. This is also known as no-till drilling.
- **Plug Planting:** A dibble tool is used to poke a hole in the ground to a depth of about two to three inches. A small container plant is placed in the hole and the top of the soil is closed around it to seal it in. Typically, these plugs will be planted every one to three feet.
- **Container Planting:** Hand tools are used to dig holes in the ground for the installation of regionally native plants of larger sizes.

2.5.2.8 Other Treatment Methods and Activities

Monitoring, invasive plant surveys, tracking of invasive plant populations and phenology and education are additional activities that may be utilized in the management of invasive plant species under Alternative 2. These activities, addressed in the IPSMP, are an important part of the adaptive, programmatic management process in guiding treatment plans, but do not themselves affect the environment.

2.5.3 Conservation Measures

Impact avoidance and minimization measures (AMMs), best management practices (BMPs) and Conservation Measures (CMs) define a set of conditions or requirements that an activity must meet to avoid or minimize potential effects on sensitive resources and to ensure consistency with the INRMP and compliance with inter-agency consultations. AMMs involving herbicides are an added layer of caution to the already regulated and approved use of these chemicals. AMMs are typically not optional and application of these measures is the basis for the environmental analysis. Some of them are required by ESA Section 7 documents. In limited cases, AMMs may not be implemented due to project requirements and ESA Section 7 consultations would be updated and coordinated accordingly. BMPs and CMs will be followed whenever possible. In all cases where the project is part of the INRMP, a long-term, population-level beneficial effect is expected to any impacted federally listed species. All AMMS, BMPS and CMs can be found in Appendix D and are part of Alternative 2.

3.0 AFFECTED ENVIRONMENT

The Region of Influence (ROI) for the Proposed Action is Travis AFB (Figure 1) and its GSUs (Figure 2), unless otherwise specified below for a particular resource area where a resource would have a different ROI.

3.1 SCOPE OF THE ANALYSIS

This chapter describes the current conditions of the environmental resources, either man-made or natural, that would be affected by implementing Alternative 1 or Alternative 2.

3.1.1 Resource Areas Eliminated from Detailed Analysis

Based on the scope of the Proposed Action, issues with minimal or no impacts were identified through a preliminary screening process. The following describes those resource areas not carried forward for a detailed analysis, along with the rationale for their elimination.

Regardless of the alternative selected, the following resources would not be affected by the Proposed Action and are not discussed in detail in this EA: Socioeconomics, Environmental Justice, Aesthetics, Agricultural and Forest Resources, Recreation, Cultural and Tribal Cultural Resources.

3.1.1.1 Socioeconomic Resources and Growth-Inducing Impacts

Socioeconomics is typically defined as the relationship between economies and social elements, such as population and economic activity. Factors that describe the socioeconomic resources represent a composite of several attributes. There are several factors that can be used as indicators of economic conditions for a geographic area, such as demographics, income, unemployment, poverty level and employment. Socioeconomic resources include consideration of housing and population growth and growth-induced impacts.

An evaluation of the growth-inducing impacts of the Proposed Action is required. A growth-inducing impact is defined as: “[T]he ways in which the proposed project could foster economic or population growth, or the construction of additional housing, either directly or indirectly, in the surrounding environment. Included in this are projects which would remove obstacles to population growth. It must not be assumed that growth in any area is necessarily beneficial, detrimental, or of little significance to the environment.”

Grazing expansion under the Proposed Action would increase the number of acres available to be leased for grazing. This will have a direct, permanent beneficial effect for both the USAF, in the form of increased revenue, and local grazing operators, in the form of available land. Leases are awarded in a competitive bid process that is open to any interested parties. Grazing leases do not affect properties outside of the base.

Implementation of invasive species control activities could also beneficially effect employment availability, possibly resulting in a negligible occasional increase in environmental jobs. No additional personnel would be relocated to Travis AFB as a result of the Proposed Action.

The Proposed Action would not contribute to changes in other socioeconomic resources, such as impacts on housing availability, community resources or local population. Therefore, there would be no adverse impact to socioeconomic as a result of the Proposed Action.

3.1.1.2 Environmental Justice

The U.S. Environmental Protection Agency (EPA) defines environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, sex, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies."

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (1994)*, requires federal agencies to consider disproportionately high adverse effects on the human or environmental health to minority and low-income populations resulting from implementation of a proposed action. Consideration of environmental justice concerns includes race, ethnicity and the poverty status of populations in the vicinity of a Proposed Action.

The Proposed Action would not disproportionately and adversely impact low-income and minority populations. The Proposed Action would occur completely within Travis AFB boundaries and across the base in natural areas. Natural areas are adjacent to base housing, medical facilities, the airfield and various buildings supporting military operations. Per U.S Census Bureau (2020), Fairfield City, CA had 31% White non-Hispanic, 30% Hispanic/Latino, 8% two or more races, 1.5% native Hawaiian or other pacific islander, 17.5% Asian, 0.5% American Indian, 14.5% Black or African American, thus all races would be considered minority populations in Fairfield City, CA. While minority populations exist on Travis, the Proposed Action would not target any specific location on Base and all places of business and work are expected to be diverse, on average, preventing any adverse effect on specific populations of interest. Additionally, per the US Census Bureau, 7.3% of Solano County and 6% of Fairfield, CA residents are below the poverty line based on the 2018 American Community Survey.

EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, states that each federal agency "(a) shall make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children; and (b) shall ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks." Implementation of the Proposed Action would not result in increased exposure of children to environmental health or safety risks such as those associated with the generation, use or storage of pesticides. The only location on Travis which is expected to have children would be the housing area, which is adjacent to the Castle Terrace NRMU where limited and low levels of herbicide are already in use (Alternative 1). As all safety precautions are taken, label directions are followed and all weather conditions for safe application are complied with, no disproportionate adverse health or safety risks are expected from the Proposed Action to children specifically.

In conclusion, no impacts to environmental justice would be anticipated, and this resource is not further evaluated in this EA.

3.1.1.3 Aesthetics

NEPA establishes that the federal government use all practicable means to ensure all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings (42 United States Code [USC] 4331[b][2]). It is the policy of the state to take all action necessary to provide the people of the state "with…enjoyment of *aesthetic*, natural, scenic and historic environmental qualities" (California Public Resources Code §21001[b]).

While vegetation removal would occur under the Proposed Action, those species removed would be invasive species that currently impede the visual character of the landscape. The project would

not change rural and undeveloped landscapes to an urban appearance. Invasive species removal efforts would be expected to be seen as positive by the public given that invasive species, especially those most likely to form monocultures that destroy the scenic beauty of native landscapes, would be removed. Many projects would not be within public view. While the proposed project would include prescribed burns, which would not change the visual character of a vista from brown grasses to black soil, the change would not be considered adverse given that prescribed burns would help prevent more catastrophic wildfires, visual impacts would be temporary as grasses and forbs germinate in the early fall upon the first rains, and because of the resulting improvement of the visual character and quality of the view after fire. Fires provide one or more years of invasive species control primarily of invasive annual grasses which obscure native flowering forbs. The presence of flowering forbs after fire can dramatically improve scenic vistas.

The Proposed Action would not have adverse effects on scenic vistas, would not damage scenic resources including trees, rock outcroppings, or historic buildings and would not degrade the existing visual character or quality of public views. Finally, the project would not create a new source of substantial light or glare that would affect day or nighttime views in the area. Therefore, this resource area is not further analyzed under this EA.

3.1.1.4 Agricultural and Forest Resources

NEPA and the Farmland Protection Policy Act (FPPA, 7 United States Code [USC] 4201-4209; and its regulations, (7 CFR Part 658) require federal agencies to coordinate with the Natural Resources Conservation Service (NRCS) if their activities may irreversibly convert farmland (directly or indirectly) to nonagricultural use. For purposes of the FPPA, farmland includes prime farmland, unique farmland, and land of statewide or local importance. Farmland subject to the act's requirements does not have to be currently used for cropland. It can be forest land, pastureland, cropland, or other land, but not water or urban built-up land (NRCS 2018).

A review is required of projects that would convert Williamson Act contract land to non-agricultural uses. The main purposes of the Williamson Act are to preserve agricultural land and to encourage open space preservation and efficient urban growth. The Williamson Act provides incentives to landowners through reduced property taxes to discourage the early conversion of agricultural and open space lands to other uses. Impacts to timberland are analyzed as required by the California Timberland Productivity Act of 1982 (CA Government Code §51100 et seq.), which was enacted to preserve forest resources. Similar to the Williamson Act, this program gives landowners tax incentives to keep their land in timber production.

As the objective of the Proposed Action would be to improve native landscapes, grazing lands and forested landscapes would be maintained. Grazing would provide numerous conservation benefits and the aim of the Proposed Action would be to expand grazing, not reduce it. The Proposed Action would, therefore, not convert farmland to another use, would not conflict with existing zoning for agricultural use, and would not conflict with existing zoning for or cause rezoning for forest lands or timberlands. While unplanned and uncontrolled wildfires could result in the conversion of oak woodlands to non-forested grasslands, prescribed burns proposed under the Proposed Action would help prevent such wildfires. Prescribed burns would be conducted in such a way that protects oaks if woodlands are targeted for burning, which they typically are not. Therefore, this resource area is not further analyzed under this EA.

3.1.1.5 Recreation

Recreation resources at Travis AFB include a recreation facility (the Fitness Center), paved and unpaved walking trails, designated fishing areas, and other open spaces. The Proposed Action would not involve construction or expansion of recreational areas or facilities. The Proposed Action could improve but would not negatively impact existing recreation facilities. Invasive plant removal at restoration sites, natural areas, and hiking trails would improve recreation opportunities. Any impacts to access or use of outdoor recreation from prescribed burns would be temporary. Recreation at Travis AFB would not be negatively impacted by the Proposed Action and therefore is not analyzed in detail.

3.1.1.6 Air Installation Compatible Use Zone

The Air Installation Compatible Use Zone (AICUZ) program is designed to assist local, regional, state, and federal officials in protecting and promoting public health, safety, and welfare by promoting compatible development within the AICUZ area of influence. It is also designed to protect USAF operational capabilities from effects of land uses that are incompatible with aircraft operations (USAF 1999). The AICUZ footprint defines the minimum recommended area within which land use controls are needed to enhance the health, safety, and welfare of those living or working near a military airfield, and to preserve the flying mission.

Per AFI 32-7063, *Air Installations Compatible Use Zones Program* (USAF 2015a), land uses that release any substance into the air that would impair visibility or otherwise interfere with operating aircraft, such as, but not limited to, steam, dust, and smoke are prohibited within the “Clear Zones” (the area closest to the runway end with the greatest accident potential). For this reason, prescribed burns would not be conducted within the Clear Zone. Prescribed burns in other locations would still have the potential to interfere with flying operations. Impacts to flying operations would be avoided by coordinating the timing of prescribed burns with the Beale AFB Flight Safety Office. Any effects on visibility resulting from smoke would be temporary. The No Action alternative would result in no changes to current AICUZ conditions. This includes the continuation of cattle grazing in Clear Zones and other Accident Potential Zones, which, Per AFI 32-7063, would be considered a compatible land use. There would be no impacts to the AICUZ from grazing expansion, chemical, or manual/mechanical invasive plant control measures under Alternative 2. Therefore, there would be no adverse impact to the AICUZ as a result of the Proposed Action.

3.1.1.7 Noise

Noise is an unwanted, disturbing or annoying sound that interferes with normal activities and/or diminishes quality of life. Continuous, extended exposure to high noise levels can cause hearing loss but, the principal human response to noise is annoyance. Noise levels are measured in decibels (dB). 65 dB through 80 dB are average sound levels using the Community Noise Equivalent Level (CNEL). CNEL is a time-weighted 24-hour average noise level based on the A-weighted decibel. A-weighting is a frequency correction that correlates sound pressure levels with the frequency response of the human ear (EPA 1971).

The principal source of noise at Travis AFB is aircraft operations, which results in direct and indirect effects on the surrounding community. Maximum CNELs exceed 80 dB during flight operations. These noise levels are intermittent and localized to the flightline. Most of the Base experiences CNELs ranging from 60 to 75 dB. Some activities at the Base produce noise levels higher than the CNELs produced by flight operations.

Only minimal, short-term changes to ambient noise levels would occur as a result of implementing the Proposed Action. Heavy equipment utilized during grazing infrastructure development, and cattle loading and unloading could cause occasional, temporary, increases in noise levels. Prescribed burns could result in a temporary increase in vehicle traffic. ATVs would be used on an intermittent, short-term basis, for off-road large-scale herbicide application, causing minimal increases in noise levels. Hand-held gasoline-powered equipment, such as weed-whackers and chain saws, and larger equipment such as ride-on mowers would be used for some manual/mechanical control and restoration treatments and could result in temporary increases in noise levels. All activities would be conducted during business hours in areas where there is existing aircraft, traffic, and construction noise. Therefore, there would be no adverse impacts to ambient noise levels as a result of the Proposed Action.

3.1.1.8 Cultural Resources

Cultural resources include prehistoric and historical archaeological sites, buildings, structures, objects, and traditional cultural properties. Cultural resources are determined to be significant when they have demonstrated association with one of four criteria including:

a. important events in American history

b. important individuals in American history,

c. represent unique architectural or engineering merit

d. retain data potential to answer important research questions.

When cultural resources are determined eligible for listing in the National Register of Historic Places (NRHP), they become “historic properties” to be protected and managed by the federal agency. To become historic properties, cultural resources must also retain sufficient integrity of those features necessary to convey historic significance.

A total of 48 cultural resources studies have been conducted between 1965 and 2020 on or within the vicinity of TAFB and the GSUs (TAFB 2021). These studies include archaeological and historical architectural surveys and documentation, archaeological testing, and data recovery investigations. .

TAFB defined the Area of Potential Effect (APE) in accordance with 36 CFR 800.16 (y) as the geographic area in which historic properties may be affected by the proposed undertaking. A Phase I cultural resources study of the APE was conducted (Paleowest 2021), which focused on proposed actions in the EA with ground disturbance. The study included a records search of previously identified cultural resources and associated studies within or adjacent to the APE, a review of the Native American Heritage Commission (NAHC) Sacred Lands File, an archaeological survey, and consultation with federally recognized Indian tribes.

Based on the results of the study, no prehistoric archaeological resources or sacred lands were identified within the APE and initial results from the installation’s geoarchaeological model indicate low potential to encounter intact subsurface deposits (Meyer 2017). Two historic period archaeological sites (homesteads) were identified in the APE (CA-SOL-420H and CA-SOL-448H); however, the base has previously received SHPO concurrence that neither are eligible for listing in the NRHP. Portions of two historic districts (ADC Alert and Readiness Area and Special Q) were identified in the APE. Subsequent to completing the SHPO consultation for this undertaking, both historic districts were determined to no longer retain sufficient integrity to be

considered historic properties. On April 13, 2021, TAFB received SHPO concurrence on the determination of *No Adverse Effect* in accordance with 36 CFR 800.5 (b) for the undertaking.

TAFB also consulted with federally recognized tribes identified by the California Native American Heritage Commission (NAHC) as having ethnographic ties to the area. TAFB initiated consultation on March 15, 2021 with the Yocha DeHe Wintun Nation of California, the Cachil DeHe Band of Wintun Indians of the Colusa Indian Community of the Colusa Rancheria, the Guidville Rancheria of California, the Kletsel Dehe Band of Wintun Indians, and the Auburn Rancheria. While no known sacred sites or tribal resources have been previously identified within the APE or the installation, the Yocha De He Wintun Nation recommended cultural monitors due to the location of the APE within their aboriginal territory. The Auburn Rancheria advised the installation is not located within their traditional territory. No additional responses have been received.

Consultation was conducted as required by Section 106 of the National Historic Preservation Act (1966 as amended) and its implementing regulations (36 CFR Part 800). On 13 April 2022 the base received concurrence from the California State Historic Preservation Office (SHPO) on the determination of *No Adverse Effect* in accordance with 36 CFR 800.5(b).

In conclusion, no impacts to Cultural Resources would be anticipated for any activities within this EA and this resource is not further evaluated in this EA.

3.2 LAND USE

3.2.1 Affected Environment

Land use refers to Real Property classifications – either natural conditions or the types of human activity occurring on a parcel. Two main objectives of land use planning are to ensure orderly growth and compatible uses among adjacent property parcels or areas. Land use planning can also be used to protect environmentally sensitive or other specially designated areas. There is no nationally recognized convention or uniform terminology for describing land use categories. Descriptive terms often used include residential, commercial, industrial, agricultural, institutional and recreational.

Travis AFB has a variety of land uses that are typical of military installations. The four largest land uses at Travis AFB (Table 7) are the airfield, open space, industrial and outdoor recreation (Jacobs 2016). Travis AFB's main development area is clustered on the west side of the airfield. The north side of the airfield is primarily occupied by airfield operations and maintenance uses, with some industrial and outdoor recreation uses mixed in. The heart of Travis AFB is a mixture of administrative, community, open space, recreation, industrial and airfield operations and maintenance uses (Jacobs 2016).

Industrial land uses are scattered across the base but are concentrated in the southwest. The perimeter of the installation is mostly characterized by open space except in the north, where accompanied housing is clustered closely together. Medical land uses are concentrated at the David Grant Medical Center along Air Base Parkway (Jacobs 2016). The most current land use documents at Travis AFB are the IDP (Jacobs 2016) and the INRMP (TAFB 2016).

Land uses for two of the larger GSUs are presented (Figure 7); however, land uses for the smaller GSUs are not mapped. These GSUs are comprised of open space, aircraft ops. /maintenance, industrial and/or administrative uses.

Land on Travis AFB is classified as improved, semi-improved and unimproved land areas based on definitions in AFI 32-7064. Improved and semi-improved grounds receive regularly scheduled maintenance such as weekly mowing and irrigation. Unimproved grounds receive scheduled grounds maintenance twice per year. Typical grounds maintenance activities on improved and semi-improved areas consist of lawn mowing, mulching, tree planting and pruning, airfield management and pest management. Typical grounds maintenance activities on unimproved grounds includes only mowing (TAFB 2019a).

All grazing occurs in the unimproved areas. Unimproved grounds also include the majority of areas related to specific natural resource conservation and management activities though not all of them.

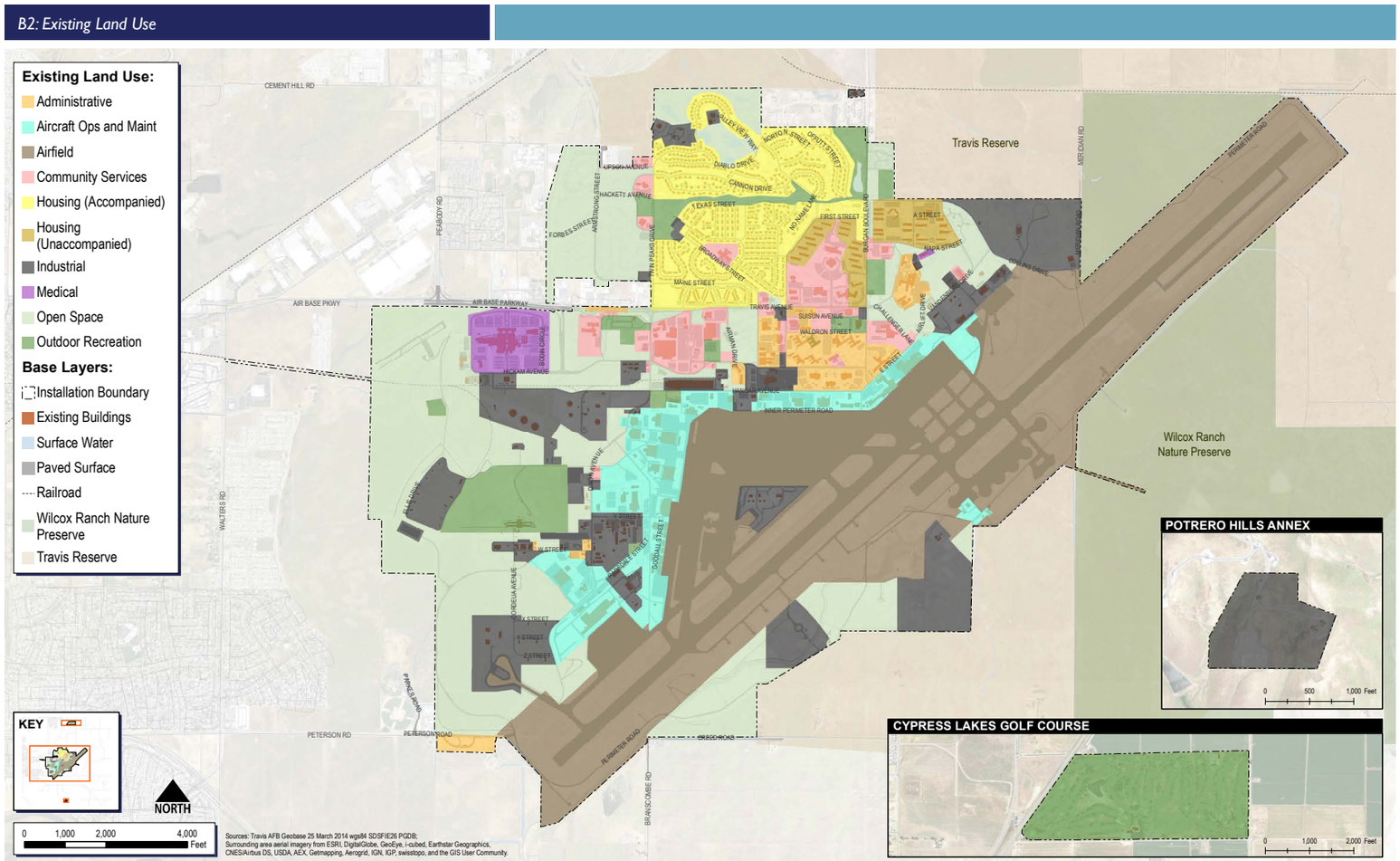
Table 7. Acreage and Typical Facilities/Features of Land Uses on Travis AFB

Color	Land Use	Typical Facilities/Features	Existing Size (acres)	Future Size (acres)	Difference (acres)
	Administrative	Headquarters, Security Operations, Office	134.9	219.1	+84.2
	Aircraft Ops./Maintenance	Hangars, Aircraft Maintenance Units (AMUs), Squad Operations, Air Traffic Control Tower, Fire Station	310.2	463.8	+153.6
	Airfield	Runways, Taxiways, Aprons, Overruns	1,794.0	1,791.4	-2.6
	Community (Commercial)	Commissary, Exchange, Clubs, Dining Facilities, Restaurants	0.0	141.8	+141.8
	Community (Service)	Gym/Recreation Center, Arts and Crafts, Theater, Post Office, Youth Center, Child Development Center	184.9	107.4	-77.5
	Housing (Accompanied)	Family Housing	371.1	320.4	-50.7
	Housing (Unaccompanied)	Airman Housing, Visitor Housing – Visiting Quarters, Temporary Lodging Facilities	91.3	108.9	+17.6
	Industrial	Civil Engineering, Maintenance Shops, Warehousing, Logistics	651.9	439.0	-212.9
	Medical	Hospital, Clinic, Pharmacy, Dental	70.8	102.6	+31.8
	Open Space	Conservation Area, Buffer Space, Undeveloped Land	1,243.6	1,080.6	-163
	Outdoor Recreation	Outdoor Courts, Athletic Fields, Golf Course	411.6	489.1	77.5
	Total		5,264	5,264	

*Source: AFPAM 32-1010; Travis Geobase; * = Existing Land Use does not differentiate between Community Commercial and Community Service*

Source: 2016 Installation Development Plan (Jacobs 2016)

Figure 7. Travis AFB Land Use



Travis AFB lands are managed to permit multiple uses of natural resources, including grazing domestic livestock. The grazing component of this multiple-use policy is based on the recognition that grazing is a way to maintain sound stewardship of federal lands. Grazing livestock reduces fuel loads, controls invasive plants, and improves wildlife habitat. Agricultural outleasing is also an economically self-sustaining program as lessees are required to pay for grazing rights.

Travis AFB has operated a livestock grazing program since 1977 (TAFB 2016). Grazing currently occupies 430 acres, 276 acres grazed by cattle in 4 pastures, 84 acres occupied by horses in 9 pastures/turnouts, and 70 acres grazed short-term by sheep and/or goats. Most if not all this space is classified as "open space" (Table 7, Figure 7) and perhaps half of the pastures on the Western edge of the base are within Explosive Safety Quantity-Distance (ESQD) arcs which restrict development of these lands for health and safety reasons (Jacobs 2016). Travis' cattle and horse grazing area infrastructure comprises the usual cattle guards, fencing (in varying degrees of repair), gates, mineral supplements and water troughs (Figure 4).

For most of Travis's grazing program, the grazing season is November 1–June 30, targeting invasive weed control and high forage production windows. Horse pasture are allowed year-round grazing rights as those pastures are operated by an on-base Travis Equestrian Center (TEC), comprised of military families. TEC operates through Force Support Services Outdoor Recreation.

Grazing leases, executed by 60 CES Real Property and signed by the Commander, are effective for one year with four years of annual renewals thereafter. In compliance with AFI 32-7064, Travis's grazing leases include land use rules. Grazing land use rules ensure sustainable rangeland management practices by lessees or license holders, compliance with the base INRMP, and federal laws like the ESA. Grazing land use rules and the extensive provisions they outline to protect the land can be found in current leases, the GMP (2016 version; Appendix E of the GMP), and or the INRMP (TAFB 2019a). Monitoring is conducted annually to ensure sustainable grazing practices are maintained.

3.3 AIR QUALITY

3.3.1 Definitions

Air quality is determined by the concentration of pollutants in the atmosphere and can be influenced by many factors including:

- the type and amount of pollutants emitted into the atmosphere;
- the size and topography of the air basin;
- transformation of pollutants into other chemical substances such as acid rain;
- and the prevailing meteorological conditions such as wind and precipitation patterns affecting the distribution, dilution, and removal of pollutant emissions.

Most air pollutants are anthropogenic in origin and include mobile sources (e.g., cars, trucks, buses) and stationary sources (e.g., factories, refineries, power plants). They can also include indoor sources (e.g., some building materials and cleaning solvents) and pollutants released from natural sources such as wildfires. According to Section 39655 of the California Health and Safety Code, a toxic air contaminant is "an air pollutant which may cause or contribute to an increase in mortality or an increase in serious illness, or which may pose a present or potential hazard to human health."

Greenhouse gas (GHG) emissions are gaseous emissions that trap heat in the atmosphere. These emissions occur from natural processes and human activities but are primarily produced

by the burning of fossil fuels and through industrial and biological processes. The most common GHGs emitted include carbon dioxide, methane and nitrous oxide.

3.3.2 Regulatory Setting

The Clean Air Act (CAA; 42 USC §7401) provides comprehensive federal legislation designed to establish nationwide air quality standards and control air pollution throughout the United States. Initially passed in 1963 and last amended in 1990, the CAA identifies two types of ambient air quality standards. Primary standards provide public health protection including sensitive populations such as asthmatics, children, and the elderly. Secondary standards provide public welfare protection such as decreased visibility and damage to animals, crops, vegetation, and buildings (US EPA 2018a).

The EPA is responsible for enforcing the CAA and establishing standards. As per the CAA, the EPA has set National Ambient Air Quality Standards (40 CFR Part 50) (NAAQS) for six principal pollutants considered harmful to the public and environment including: ozone, particle pollution (respirable particulate matter and fine particulate matter), carbon monoxide, nitrogen dioxide, sulfur dioxide, and lead (US EPA 2018a) (Table 8). Areas historically in compliance with the NAAQS are designated as attainment areas, and areas that violate federal air quality standards are designated as nonattainment areas. Areas transitioning from nonattainment to attainment are designated as maintenance areas and are required to adhere to maintenance plans to ensure continued attainment. Unclassified attainment status means no monitoring data are available. By default, these areas are considered to be in attainment (Table 8).

The CAA gives states authority to establish their own air quality standards, and California has developed their own California Ambient Air Quality Standards (CAAQS) that are more restrictive than the NAAQS. Federal Actions are not subject to State standards for air quality; however, and therefore the CAAQS and attainment statuses designated by the State are not relevant and not discussed. Travis AFB and its GSUs are under the Bay Area (BAAQMD) and/or Yola-Solano Air Quality Management Districts (YSAQMD) thus attainment status is listed for these districts.

Federal Prevention of Significant Deterioration (PSD) regulations apply in attainment areas to a major stationary source, (i.e., source with the potential to emit 250 tons per year of any criteria pollutant), and a significant modification to a major stationary source (i.e., change that adds 15−40 tons per year to the facility's potential to emit depending on the pollutant). Additional PSD major source and significant modification thresholds apply for GHGs. PSD regulations can also apply to stationary sources if: (1) a proposed project is within 10 kilometers of national parks or wilderness areas (i.e., Class I Areas), and (2) regulated stationary source pollutant emissions would cause an increase in the 24-hour average concentration of any regulated pollutant in the Class I area of 1 microgram per cubic meter or more (40 CFR 52.21(b)(23)(iii)). A Class I area includes national parks larger than 6,000 acres, national wilderness areas and national memorial parks larger than 5,000 acres, and international parks. PSD regulations also define ambient air increments, limiting the allowable increases to any area's baseline air contaminant concentrations, based on the area's Class designation (40 CFR 52.21(c)).

Table 8. Federal Ambient Air Quality Standards & State Air District Attainment Status.

		NAAQS	BAAQMD	YSAQMD
Pollutant	**Averaging Time**	**Federal Standard**	**Attainment Status**	**Attainment Status**
CO	1-hour	35 ppm	Attainment	Attainment
	8-hour	9 ppm	Attainment	Attainment
NO2	1-hour	100 ppb	Unclassified/ Attainment	Attainment
	Annual	53 ppb	Attainment	Attainment
O3	8-hour	0.07 ppm	Non-Attainment	Non-Attainment
PM2.5	24-hour	35 ug/m3	Non-Attainment	Non-Attainment
	Annual	12 ug/m3	Unclassified/ Attainment	Attainment
PM10	24-hour	150 ug/m3	Unclassified/ Attainment	Unclassified
SO2	1-hour	75 ppb	Attainment	Attainment
	24-hour	0.14 ppm	Attainment	Attainment
Lead (Pb)	Calendar quarter	1.5 ug/m3	Attainment	Attainment

BAAQMD = Bay Area Air Quality Management District. YSAQMD = Yola-Solano Air Quality Management District.

Federal Standards NAAQS: https://www.epa.gov/criteria-air-pollutants/naaqs-table

BAAQMD: https://www.baaqmd.gov/about-air-quality/research-and-data/air-quality-standards-and-attainment-status.

YSAQMD: https://www.ysaqmd.org/plans-data/attainment/

On 22 September 2009, EPA issued a final rule for mandatory GHG reporting from large GHG emissions sources in the United States. The purpose of the rule is to collect comprehensive and accurate data on carbon dioxide and other GHG emissions that can be used to inform future policy decisions. In general, the threshold for reporting is 25,000 metric tons or more of carbon dioxide equivalent emissions per year but excludes mobile source emissions.

AFI 32-7040, *Air Quality Compliance and Resource Management*, implements AFPD 32-70, *Environmental Quality*. The instruction provides details of the USAF Air Quality Compliance and Resource Management Program and explains how to assess, attain, and sustain compliance with the CAA; other federal, state, and local environmental regulations; Final Governing Standards or the Overseas Environmental Baseline Guidance Document; applicable international agreements; and related DoD and USAF directives.

Smoke management in California is governed by the California Air Resources Board, which implements the guidelines found in Title 17 of the California Code of Regulations (CCR), Subchapter 2. Guidelines provide direction for air pollution control and air quality management districts (air district) in the regulation and control of agricultural burning, including prescribed fire, in California. All prescribed fires require prior permission from the local air district. Permission is

obtained by completing the following planning steps: (1) register the prescribed fire with the local air district, (2) obtain an air district and/or fire agency burn permit, (3) submit a Smoke Management Plan (SMP) to the air district, and (4) obtain air district approval of the SMP. Each air district has developed specific requirements for SMPs based upon 17 CCR §80160 Subchapter 2.

There are local air quality air district regulations that also apply to burn activities conducted on Travis AFB. Travis AFB, Middle Runway Marker GSU, Potrero Hills Annex GSU, Water Well 1 GSU, and the western portion of Sacramento Northern Railroad Right of Way GSU are within the BAAQMD, who implements the guidelines found in BAAQMD Regulation 5 *Open Burning*. Cypress Lakes Golf Course GSU, Outer Runway Marker GSU, and the eastern portion of Sacramento Northern Railroad Right of Way GSU are within the YSAQMD, who implements the guidelines found in YSAQMD Rule 2.8 *Open Burning* and YSAQMD Rule 6.1 Agricultural Burning. The purpose of these guidelines is to provide direction to air pollution control and air districts in the regulation and control of agricultural burning, including prescribed fire, in California. These guidelines are intended to provide for the continuation of agricultural burning, including prescribed fire, as a resource management tool, and provide increased opportunities for prescribed fire and agricultural burning, while minimizing smoke impacts on the public. The regulatory actions called for are intended to assure that each air district has a program that meets air district and regional needs (Chloeta 2019).

The General Conformity Rule requires that any federal action meet the requirements of a state or federal implementation plan. More specifically, CAA conformity is ensured when a federal action does not cause a new violation of the NAAQS, contribute to an increase in the frequency or severity of violations of NAAQS, or delay the timely attainment of any NAAQS, interim progress milestones, or other milestones toward achieving compliance with the NAAQS.

The General Conformity Rule applies only to actions in nonattainment or maintenance areas and considers both direct and indirect emissions. If a federal action does not meet or exceed the de minimis thresholds and is not considered regionally significant, then a full Conformity Determination is not required.

3.3.3 Affected Environment

Travis AFB, Middle Runway Marker GSU, Potrero Hills Annex GSU, Water Well 1 GSU, and the western portion of Sacramento Northern Railroad Right of Way GSU are governed by the Bay Area Air Quality Management District (BAAQMD) (Chloeta 2019). Cypress Lakes Golf Course GSU, Outer Runway Marker GSU, and the eastern portion of Sacramento Northern Railroad Right of Way GSU are within the Yolo-Solano AQMD (YSAQMD) (Chloeta 2019).

The BAAQMD regulates stationary air emission sources and regularly inspects these sources. Permits to operate have been issued for a total of 173 point sources on the base, 106 permitted air sources, and 67 exempt sources. Additionally, 188 units of tactical support equipment are registered with the Air Resources Board. No air sources are known to negatively affect the natural resources on the base or surrounding area. The Travis AFB IDP (Jacobs 2016) contains information about the air quality conformance within the BAAQMD (TAFB 2016, 2019a). All air permits are obtained through BAAQMD or YSAQMD and updated/renewed annually.

The BAAQMD is currently designated as non-attainment relative to air quality standards for Ozone (O3) and PM2.5. The YSAQMD is currently designated as non-attainment relative to air quality standards for O3 and PM2.5. For all other pollutants, the BAAQMD and YSAQMD are considered to be in attainment with national air quality standards.

In addition to EPA standards, the Air Force also measures total emissions of hazardous air pollutants (HAPs). HAPs are 187 chemicals known by the EPA to cause or possibly cause cancer or other serious health effects, or adverse environmental and ecological effects. On Travis AFB, HAPs are associated with the emissions identified in the Travis AFB Synthetic Minor Operating Permit (SMOP). The SMOP for Travis AFB includes a total of 90 permitted air sources and 46 exempt sources. Like most Air Force installations, Travis AFB's primary air emissions are from mobile sources such as vehicles; planes are not included in air emissions for synthetic minor operating permits as they are not considered single source emissions. Stationary sources include air conditioning and heating units and emergency generators. Currently the base meets all emissions regulations. The base currently operates under a minor emissions source permit from the state and the base is classified as "not a major source of HAPs" (Jacobs 2016).

Baseline Air Emissions

The current level of air emissions within a region represent the Baseline emissions. For Solano County and the BAAQMD, the most recent available baseline emissions levels were obtained from the NEI for 2014, which represent the most recent published data available for this area (Table 9). Note that O_3 is not shown in these tables since it generally is not emitted directly into the atmosphere. Instead, it is formed in the lower atmosphere by chemical reactions between precursor pollutants in the presence of sunlight. NO_x and volatile organic compounds (VOCs) are the main precursors of O_3. Control of these precursor pollutants is the primary method of reducing O_3 concentrations in the atmosphere.

Table 9. Local and Regional Baseline Emissions

Location	Emissions (tons/year)						
	CO	NOx	PM10	PM2.5	SO2	VOC	GHGs I
Solano County (A)	31,315	7,521	3,781	1,608	225	17,110	3,104,100
Bay Area AQMD (B)	421,624	94,954	42,624	19,784	9,142	199,100	39,033,396
(A) County level emission totals reported in tons per year from the 2014 NEI. (B) Regional emission totals reported in tons per year from the 2014 NEI. I GHG emissions reported as CO2 equivalent.							

Within the BAAQMD, the baseline emissions occur from a variety of stationary and mobile emission source categories, including:

- Fuel Combustion – electrical generation, industrial, food processing, residential;
- Industrial Process;
- Mobile Sources – automobiles, buses, trucks, locomotives, boats, aircraft, off-road vehicles
- Petroleum Refining, Storage, and Marketing;
- Surface Coating and Cleaning;
- Waste Disposal; and
- Other Miscellaneous Sources – farming, fires, fugitive dust, etc.

Although the emissions data shown in Table 9 are for 2014, these values are relatively constant from year to year and are sufficient to represent current baseline emissions. Solano County contributes approximately 8% of the total BAAQMD emissions.

3.4 WATER RESOURCES

3.4.1 Definitions

This discussion of water resources includes groundwater, surface water, wetlands, and floodplains:

- Groundwater is the water present beneath the earth's surface, used for drinking, irrigation and industrial purposes. Groundwater properties are often described in terms of depth from the surface, aquifer or well capacity, water quality, recharge rate, and surrounding geologic formations.
- Surface water resources generally consist of wetlands, lakes, rivers and streams, and are important for their contribution to the economic, ecological, recreational and human health of a community.
- Wetlands are jointly defined by the EPA (2019b) and the U.S. Army Corps of Engineers (USACE) as "those areas that are inundated or saturated by water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Wetlands on Travis AFB generally include marshes and vernal pools.
- Floodplains are areas of low-level ground present along rivers, stream channels, large wetlands, or coastal waters. Floodplains provide flood storage and conveyance, recharge groundwater, and cycle nutrients. Floodplains also help to maintain water quality and are often home to a diverse array of plants and animals. In their natural vegetated state, floodplains slow the rate at which overland flow reaches a water body. Floodplain boundaries are most often defined in terms of frequency of inundation, such as the 100-year and 500-year flood.

3.4.2 Regulatory Setting

The Clean Water Act (CWA) of 1977 (33 USC §1251 et, seq.) is an amendment to the Federal Water Pollution Control Act of 1972, administered by the EPA, sets the basic structure for regulating discharges of pollutants into Waters of the United States (WoTUS). The CWA requires the EPA to establish water quality standards for specified contaminants in surface waters and forbids the discharge of pollutants from a point source into navigable waters without a NPDES permit. NPDES permits are issued by the EPA or the appropriate state if it has assumed responsibility. Section 404 of the CWA establishes a federal program to regulate the discharge of dredge and fill material into WoTUS. Section 404 permits are issued by the USACE. WoTUS include interstate and intrastate lakes, rivers, streams, and wetlands that are used for commerce, recreation, industry, sources of fish, and other purposes. The objective of the CWA is to restore and maintain the chemical, physical, and biological integrity of the nation's waters.

Section 303(d) of the CWA requires states and the EPA to identify waters not meeting state water-quality standards and to develop Total Maximum Daily Loads (TMDLs). A TMDL is the maximum amount of a pollutant that a water body can receive and still follow state water-quality standards. After determining TMDLs for impaired waters, states are required to identify all point and nonpoint sources of pollution in a watershed that are contributing to the impairment and to develop an implementation plan that will allocate reductions to each source to meet the state standards. The TMDL program is currently the nation's most comprehensive attempt to restore and improve water quality. The TMDL program does not explicitly require the protection of riparian areas. However, implementation of the TMDL plans typically calls for restoration of riparian areas as one of the required management measures for achieving reductions in nonpoint source pollutant loadings.

The Safe Drinking Water Act (42 USC §7401) is the federal law protecting drinking water throughout the United States as applicable to public water systems. Passed in 1974 and amended in 1986 and 1996, it focuses on all waters with the potential to be used as drinking water by public water systems, including surface and groundwater sources. Under the Safe Drinking Water Act, the EPA is responsible for setting drinking water standards and overseeing states and any other water suppliers who implement those standards.

EO 11990, Protection of Wetlands, dated May 24, 1977, requires all federal agencies to provide leadership in wetland protection when acquiring, managing, and disposing of federal lands. The EO recommends avoiding adverse impacts associated with destruction and modification of wetlands, if possible, as well as avoiding new construction when there are alternatives. Under Executive Order 11990, a FONPA must be prepared by the installation and signed by the Commander, before any action in wetlands can proceed. In support of EO 11990, DoDI 4715.3, Environmental Conservation Program (DoD 1996b), was issued, which sets a goal of no net loss of wetlands on DoD lands.

EO 11988, Floodplain Management, also dated May 24, 1977, provides guidance and direction regarding actions of federal agencies in floodplains. It requires federal agencies to avoid long and short-term adverse impacts associated with occupancy and modification of floodplains when possible, to avoid direct and indirect support of floodplain development when there are practicable alternatives, and to avoid risks to human health and safety. As with EO 11990, DoDI 4715.3 supports EO 11988 by recommending avoidance of adverse impacts on floodplains when possible.

EO 13690, Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input, dated January 30, 2015 amends EO 11988 by establishing the Federal Flood Risk Management Standard to increase the nation's resilience to current and future flood risks, which are anticipated to increase over time due to the effects of climate change and other threats.

Within California, the California Porter-Cologne Water Quality Act (California Water Code § 13000 et seq.) provides a framework for protecting water quality and beneficial uses of water. Created in 1969, the Act applies to both surface and groundwater and uses the NPDES permit program, authorized by the CWA, and/or Waste Discharge Requirements to regulate discharges and protect water quality.

California enacted the Sustainable Groundwater Management Act (SGMA) in 2014 in order to halt overdraft and bring groundwater basins into balanced levels of pumping and recharge. SGMA requires local agencies to adopt sustainability plans for high- and medium-priority groundwater basins. Under SGMA, basins must reach sustainability within 20 years of implementing their plans. SGMA requires the State Water Board to protect basins that are not managed sustainably through a process called State Intervention.

The California State Water Resources Control Board adopted the Statewide General National Pollutant Discharge Elimination System (NPDES) Permit for Residual Aquatic Pesticide Discharges to Waters of the United States from Algae and Aquatic Weed Control Applications, Water Quality Order 2013-0002-DWQ, for the reissuance of General NPDES Permit CAG990005 in June 2013. Order 2013-0002-DWQ became effective on December 1, 2013. This general permit covers the point source discharge to WoTUS of residues resulting from pesticide applications using products containing 2,4-D, acrolein, copper, diquat, endothall, flumioxazin, fluoridone, glyphosate, hydrogen peroxide, imazamox, imazapyr, penoxsulam, peroxyacetic acid, sodium carbonate peroxyhydrate, and triclopyr-based algaecides and aquatic herbicides, and

adjuvants containing ingredients represented by the surrogate nonylphenol. This General Permit covers only discharges of algaecides, and aquatic herbicides that are currently registered for use in California, or that become registered for use and contain the above-listed active ingredients and ingredients represented by the surrogate of nonylphenol (California State Water Resources Control Board 2019). No other chemicals are allowed to be applied to wetlands with or without the permit.

3.4.3 Affected Environment

3.4.3.1 Hydrology

Hydrology and water management on Travis AFB is complex due to both natural and man-made influences. Travis AFB is located in the northeastern portion of the Fairfield-Suisun Hydrologic Basin. Within this basin, water generally flows south to southeast toward Suisun Marsh, an 85,000-acre tidal marsh that is both the largest contiguous estuarine marsh and the largest wetland in the continental United States (CH2MHILL 2001). Suisun Marsh drains into Grizzly and Suisun Bays. Water from these bays flows through the Carquinez Strait to San Pablo Bay and San Francisco Bay, and ultimately discharges into the Pacific Ocean near the city of San Francisco. Hydrology on the base has been significantly altered by the creation of impoundments, channelization of Union Creek and groundwater pumping. Impoundments have been created historically for recreation areas and aesthetics (North Gate Pond).

3.4.3.2 Groundwater

The Suisun–Fairfield Valley Basin is the second largest groundwater basin in Solano County. It lies southwest of English Hills beneath the cities of Fairfield and Suisun and Travis AFB. Intensive extraction of groundwater does not occur at Travis AFB for domestic supply because of poor water-bearing subsurface geology, mainly limited alluvial deposits, low yields, and poor water quality (brackish water). The depth to unconfined groundwater aquifers on Travis AFB varies seasonally from approximately 15 to 70 feet below the ground surface (TAFB 2019a). The Solano Subbasin, which underlies the northeastern portion of Solano County, is the largest groundwater basin in Solano County. As such, more intensive groundwater extraction occurs within the Solano Subbasin.

Wells operated by the City of Vacaville and those wells at the Cypress Lakes Golf Course GSU draw from the Tehama Formation in the Solano Subbasin for groundwater supplies because of the higher water-bearing capacities resulting from greater abundance of coarse-grained sediments and alluvium. The existing Cypress Lakes Golf Course GSU groundwater extraction wells are capable of providing between 700 and 1,100 gallons per minute (gpm) with a total production volume of approximately 3.8 million gallons per day (Weston Solutions 2011). With the exception of the City of Vacaville's groundwater wells and those at the Cypress Lakes Golf Course GSU, wells in the areas east of Travis AFB are limited to private domestic, stock-watering, and irrigation wells with typical screened depths within 100 feet below ground surface (CH2MHILL 2001).

Domestic wells, several of which are downgradient from Travis AFB, are typically used to provide water to households for domestic use (CH2MHILL 2001).

The amount of groundwater in storage has not been determined; as such, a determination of overdraft is also not available. A search of available data from local, state and federal agencies did not return reportable information. According to the California Department of Water Resources, there has been no groundwater storage calculation for the Solano Subbasin as it is described by

Bulletin 118. The USGS; however, has determined specific yield averages and groundwater storage calculations for some areas within and around the Solano Subbasin (Thomasson et al. 1960).

Recharge to the shallow groundwater table is from the foothills of Cement Hill to the north, in channel infiltration from the draining area of nearby creeks (Union Creek, Denverton Creek, and smaller unnamed creeks northwest of the base), and through direct precipitation.

Each month, over four million gallons of groundwater are extracted from contaminated groundwater plumes under Travis AFB, treated and discharged to Union Creek pursuant to two interim Groundwater Records of Decision with the EPA, the California Department of Toxic Substances Control and the San Francisco Bay Regional Water Quality Control Board. This treated groundwater supplements the flow of the eastern branch of Union Creek, which could dry up seasonally without it.

3.4.3.3 Surface Water

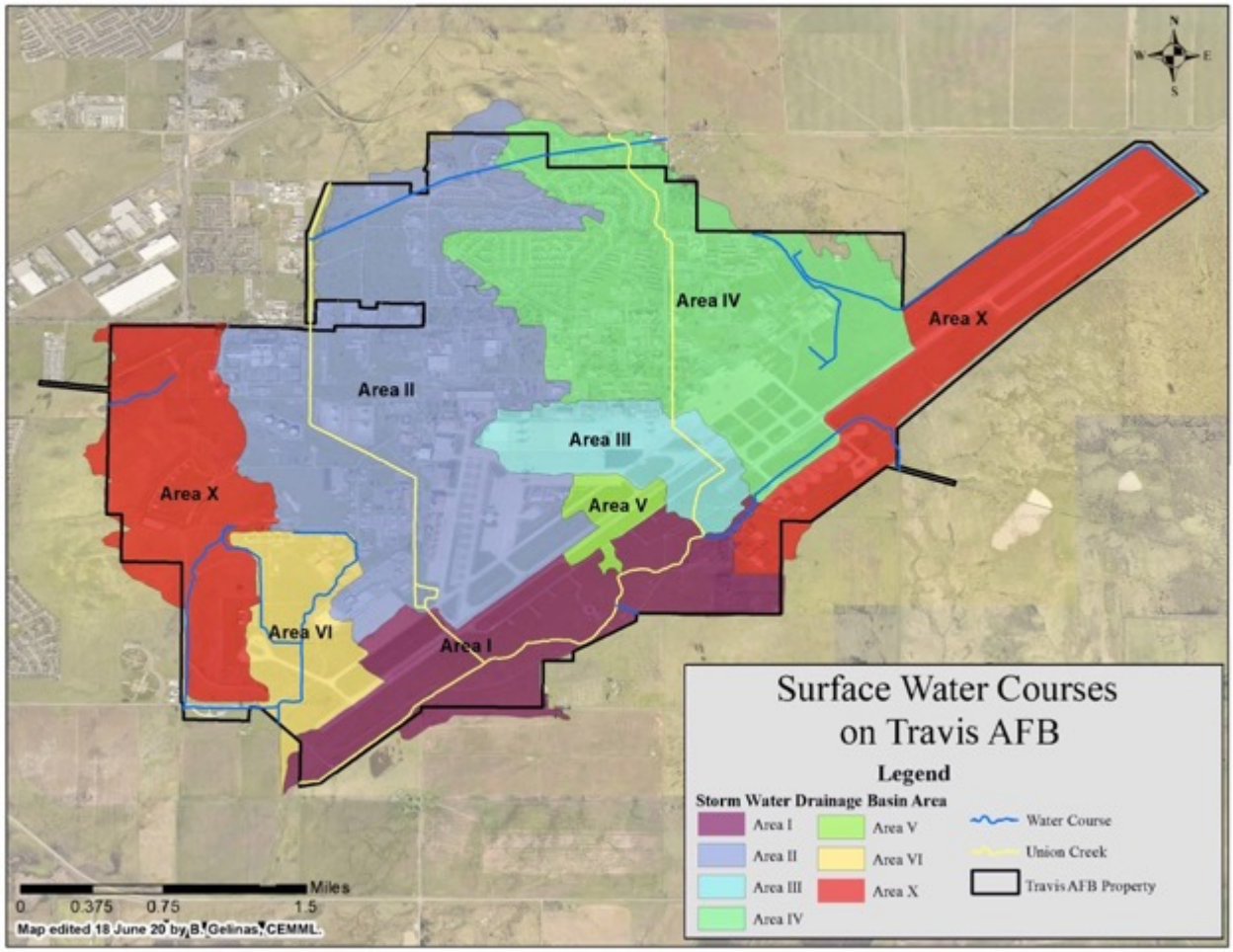
Surface water flow onto Travis AFB is mainly comprised of the western and eastern branches of Union Creek (Figure 8) and little to no sheetflow from off-base.

Travis AFB lies in the southern portion of the Union Creek watershed. The headwaters of Union Creek are located approximately 1 mile north of Travis AFB, near the Vaca Mountains. Union Creek splits into two branches north of Travis AFB. On base, the main eastern branch (25 acres total) is impounded to create a recreational pond designated as the North Gate Pond (2.2-acre surface area, 5 feet deep). The Western branch (8.6 acres in total) runs south along the western boundary in a ditch (Figure 8).

Union Creek is the primary surface water drainage for runoff at Travis AFB. Stormwater runoff flows into Union Creek through a network of pipes, culverts, and open drainage ditches. Local drainage patterns have been substantially altered by the rerouting of Union Creek, the construction of Travis AFB, the aircraft runway and apron, the installation of storm sewers and ditches, and general development (e.g., construction of buildings, roads and parking lots). Impervious areas total approximately 38 percent of the installation property and account for the majority of storm water collected and discharged from these basins. Travis AFB's storm drain capacity is designed to handle a 10-year, 24-hour storm, and only minor temporary flooding occurs during extreme rain events in areas where storm drain piping is undersized or infiltrated by roots. Routine maintenance minimizes flooding in these small areas and no damage occurs to structures (TAFB 2017a).

Travis AFB is divided into eight distinct drainage basins (Figure 8) according to topography and drainage patterns. Six of these basins discharge through a series of underground piping and open ditches to storm water outfalls along Union Creek, Hill Slough and ultimately Suisun and San Francisco Bays. Outfall locations are designated similarly to the drainage basin from which the storm water is collected. The other basins, designated as XE and XW, sheet flow storm water from around the Aero Club Conservation Area and east portion of Runway 21L to adjacent property outside the base (TAFB 2019a).

Figure 8. Surface Water Courses on Travis AFB



3.4.3.4 Wetlands

Wetlands are an important natural system and habitat because of the diverse biologic and hydrologic functions they perform. These functions include water quality improvement, groundwater recharge and discharge, pollution mitigation, nutrient cycling, wildlife habitat provision, unique flora and fauna niche provision, storm water attenuation and storage, sediment detention, and erosion protection. Wetlands generally include swamps, marshes, bogs, and similar areas" (33 CFR 328). On Travis, they include wet meadows, riparian habitat, lacustrine marsh, wetlands including vernal pools and vernal swales, and manmade waters (ponds), primarily for recreation. (TAFB 2019a).

Several wetland delineations of the Main Base (Auxilio 2015, Marty 2019) and several GSUs including Cypress Lakes Golf Course, the Sacramento Northern Railroad Right-of-Way, and the Middle Runway Marker (Marty 2019) were conducted in the Spring of 2014, Winter of 2015, Spring of 2017 and Spring of 2018. A preliminary jurisdictional determination was first received from the USACE on 19 July 2016. The 2016 and 2018 delineations show 122 acres of wetlands on Travis AFB and its GSUs that are potential WoTUS regulated under Section 404 of the CWA (Figures 10A & 10B). A study measuring the hydrological functioning of vernal pools on the Main Base was conducted in the spring of 2014 (TAFB 2019a).

Vernal Pools and Swales. Vernal pools and swales are found within the grasslands. Vernal pools are shallow depressions or small, shallow ponds that fill with water during the winter rainy season, then dry out during the spring, becoming completely dry by late spring or early summer. The vernal pools on Travis AFB are classified as northern claypan vernal pools (Marty 2016, 2019). These pools occur on deep alluvial soils where the restricting layer is comprised of a surface clay layer rather than a hardpan (Marty 2019).

Vernal swales are ecologically and floristically related to vernal pools. Vernal swales are drainage ways or poorly defined depressions that are wet during the rainy season but hold standing water for only relatively short periods.

This hydrologic regime supports the unique plant and animal community's characteristic of vernal pools. These pools provide unique habitat for plants that germinate as aquatic or semiaquatic plants but must survive a terrestrial life and a drought environment

These wetlands are scattered throughout the installation but are generally absent in the highly developed central and northern areas. Over 600 sites on Travis AFB have been identified that support vernal pool indicator species (TAFB 2019a).

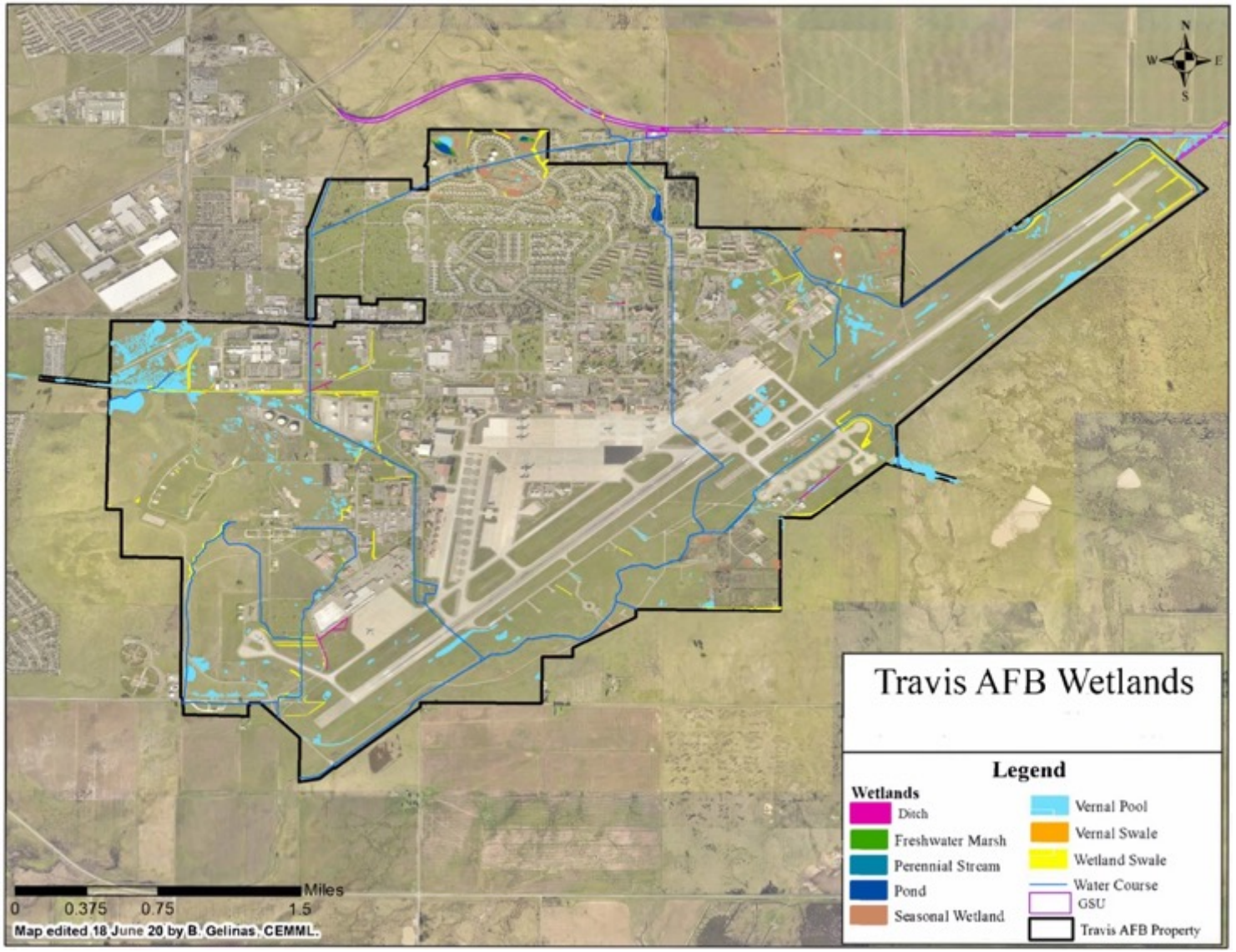
Riparian Vegetation. The riparian community is a component of the in-stream habitat and the exposed banks of Union Creek. The streambed is channelized, and, for the most part, the flow is sluggish. This habitat type does not extend more than a few meters from the banks of these aquatic environments. The dominant vegetative species found along Union Creek include creeping wild-rye (*Elymus triticoides*), perennial pepperweed (*Lepidium latifolia*), Harding grass (*Phalaris aquatica*), saltgrass (*Distichlis spicata*), and areas of dense twig/leaf litter. Red willows, arroyo willow, coyote bush (*Baccharis pilularis*), and small patches of scrub/shrub vegetation are found scattered along the creek. The habitat north of North Gate Pond is characterized by small stands of cattails and willow along the creek edge (TAFB 2019a).

Lacustrine Marsh. A small man-made, open-water habitat associated with North Gate Park was created by the impoundment of Union Creek as discussed in Section 3.4.2.3. Some rooted, aquatic, submerged, and floating macrophytes such as duckweed, Eurasian water-milfoil, and leafy pondweed are located in the pond, as well as some emergent vegetation such as cattails (*Typha latifolia*), which offer cover to fish (Weston, Inc. 1995). This pond supports recreational fishing. A number of small ponds in the southeast portion of the base and Valley View Pond in the Castle Terrace Conservation Area also exhibit this lacustrine, open water environment. The edges of these ponds support vegetation dominated by grass species (Poaceae) and some species of dock (*Rumex* spp.) (TAFB 2019a).

3.4.3.5 Floodplains

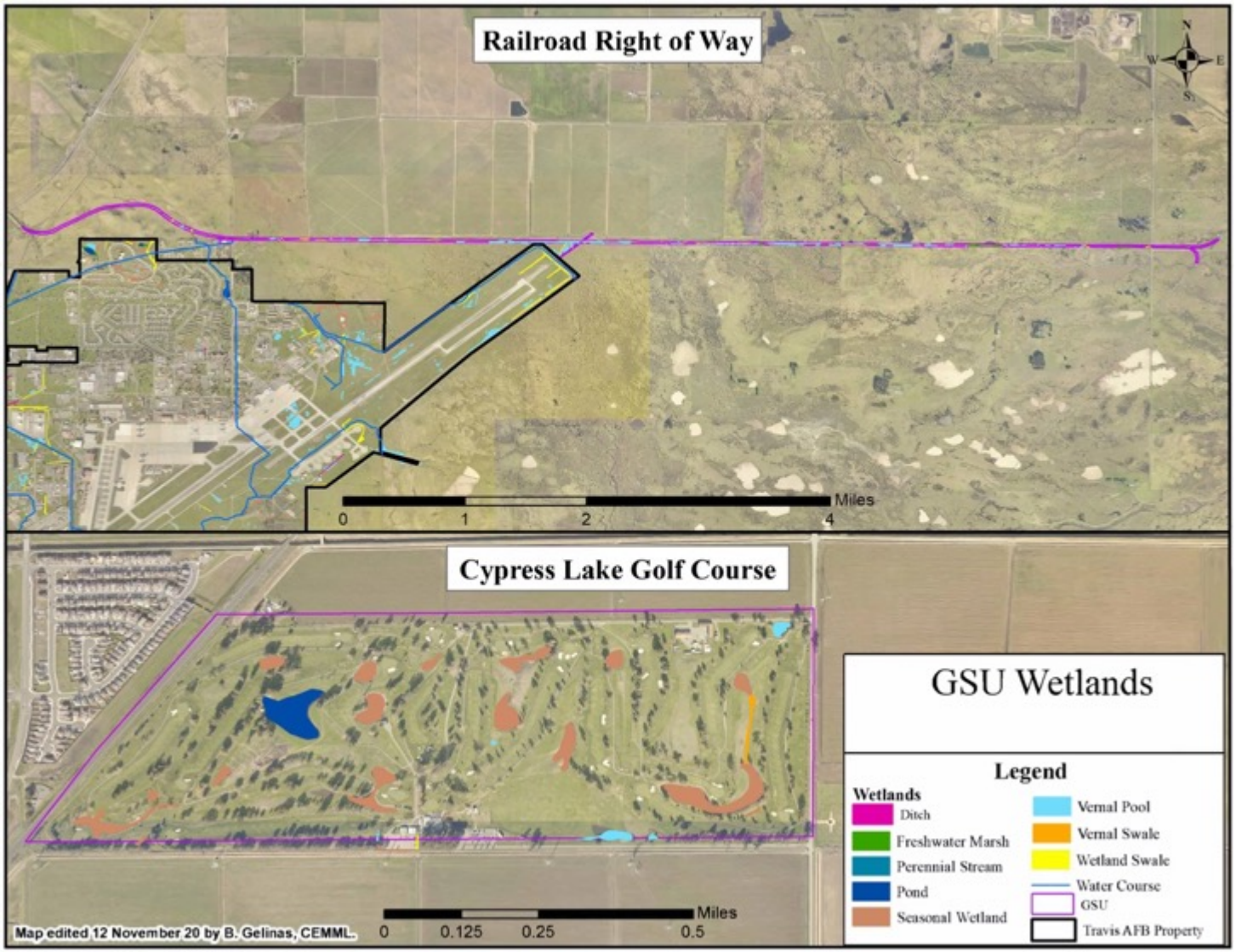
The Federal Emergency Management Agency (FEMA) develops floodplain maps to ensure compliance with regulatory statues and not necessarily from an ecosystem value standpoint. Travis AFB has not been mapped for floodplains, however, by FEMA or others. Areas just off the base near the Main Gate and northern parts of the western boundary as far south as the Old Aero Club are within the 500-year floodplain associated, presumably, with the western branch of Union Creek (FEMA 2020). Other sources provide contradictory information. The Suisun City General Plan (Suisun City 2010) states there are no existing 100- and 500-year floodplains adjacent to Travis AFB. In the southwest corner where Union Creek leaves Travis AFB and the elevation is

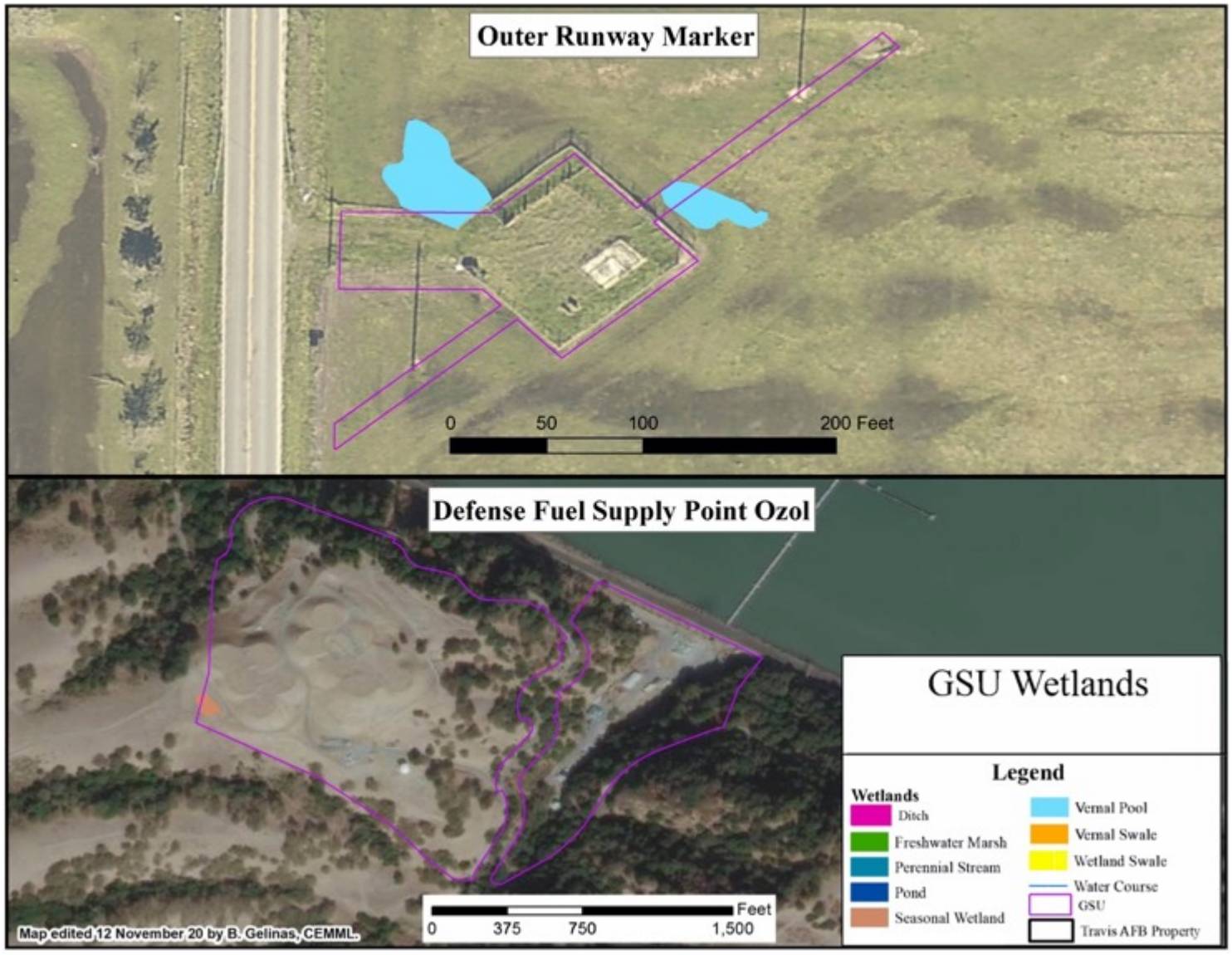
1 **Figure 9. Travis AFB Wetlands**



2

Figure 10A and B. GSU Wetlands




Outer Runway Marker
0
50
100
200 Feet
Defense Fuel Supply Point Ozol
0
375
750
1,500
Feet
Map edited 12 November 20 by B. Gelinas, CEMML.
GSU Wetlands
Legend
Wetlands
Ditch
Freshwater Marsh
Perennial Stream
Pond
Seasonal Wetland
Vernal Pool
Vernal Swale
Wetland Swale
Water Course
GSU
Travis AFB Property

1

low, Union Creek has crested its banks during heavy rains. Major storm events have little effect on the storm water infrastructure's ability to drain the base and natural and manmade barriers such as elevation changes and roads prevent flood waters from Union Creek from reaching developed areas of the base (TAFB 2019a).

3.5 SAFETY AND OCCUPATIONAL HEALTH

This discussion of safety and occupation health covers any activities, occurrences, or operations having the potential to affect the safety, well-being, or health of members of the public. A safe environment is one in which there is no, or optimally reduced, potential for death, serious bodily injury or illness, or property damage. The primary goal is to identify and prevent potential accidents or impacts to the general public. A public health and safety discussion can pertain to community emergency services, construction activities, and environmental health and safety risks to children.

3.5.1 Regulatory Setting

The Occupational Safety and Health Act of 1970 (OSHA; PL 91-596) assures safe and healthy working conditions by setting and enforcing safe workplace standards. As a result, Congress created the Occupational Safety and Health Administration to enforce standards as well as to provide training, outreach, education, and assistance (OSHA 2018).

Federal worker protection standards for pesticide use (40 CFR Part 170), are designed to reduce the risks of illness or injury resulting from workers' and handlers' occupational exposures to pesticides used in the production of agricultural plants on farms or in nurseries, greenhouses, and forests and also from the accidental exposure of workers and other persons to such pesticides. It requires workplace practices designed to reduce or eliminate exposure to pesticides and establishes procedures for responding to exposure-related emergencies.

The State of California administers its own occupational safety and health program (Cal/OSHA) to protect and improve the health and safety through setting and enforcing standards; providing outreach, education, and assistance; and issuing permits, licenses, certifications, registrations, and approvals (DOSH 2018).

California regulations for Pesticide Worker Safety for Pest Control Operations (3 CCR § 6700) applies to workers who mix, load, apply, store, transport, or otherwise handle pesticides for any use, except for manufacturing, formulating or repackaging of pesticides; and for workers who are exposed to residues of pesticides after application to fields. The regulations are designed to reduce risk of exposure and to ensure availability of medical services for employees who handle pesticides, and to provide safe working conditions for field and other workers.

EO 13045, Protection of Children from Environmental Health Risks and Safety Risks, requires federal agencies to "make it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children and shall ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks."

AFI 91-301, Air Force Occupational and Environmental Safety, Fire Protection, and Health (AFOSH) Program (USAF 1996), implements AFPD 91-2, Safety Programs (USAF 2019), by outlining the purpose of the AFOSH program to minimize loss of USAF resources and to protect USAF personnel from occupational deaths, injuries, or illnesses by managing risks.

AFI 32-1053, Integrated Pest Management Program (USAF 2014b), provides guidance for pest management programs at USAF installations. It implements AFPD 32-10, Installations and Facilities (USAF 2010), and DoDI 4150.07, DoD Pest Management Program (DoD 2008b). It includes worker protection measures that must be followed when applying pesticides on USAF property. These are further specified in individual IPMPs.

3.5.2 Affected Environment

Safety and occupational health are managed by the BioEnvironmental Flight. Any work conducted on base by contractors is subject to contracts that generally require standard terms and conditions that include safety as a priority.

Per the WFMP, firefighter and public safety are the top priorities for every fire management activity on Travis AFB or its GSUs. Several national requirements, including the PMS 310-1, *National Incident Management System (NIMS): Wildland Fire Qualification System Guide*, October 2017 (PMS 310-1), are in place to aid the conduct of safe operations. It is of the highest importance that all firefighters have the training and experience for their positions and equipment they operate. Personnel must use the appropriate PPE in conjunction with their assigned task. Constant reminders of the "*10 Standard Fire Orders and the 18 Situations That Shout Watch Out*" help keep the individual's attention on safety. In compliance with the NWCG standards, annual safety refresher training is a requirement (Chloeta 2019).

The WFMP ensures that installation-specific safety and emergency operations protocols are identified to mutual aid crews and in prescribed fire plans. Additionally, 60 CES/CEIE will brief the Environment, Safety, and Occupational Health Council (ESOHC) of upcoming prescribed fire operations. A safety officer will be designated on the day of any planned prescribed fire (Chloeta 2019).

Finally, any fire-related aviation operations will follow applicable guidelines of AFI 32-7064 and to the National Fire Equipment System (NFES) 2724, *Interagency Standards for Fire and Aviation Operations*, January 2018 (Red Book), which establishes uniform safety, communications, and organizational standards for firefighting operations across organizations (Chloeta 2019).

The Integrated Pest Management Plan (IPMP) (IPMC 2017) requires industrial hygiene surveys maintained by the Pest Management Office and requires all personnel applying pesticides including government or contractor personnel to wear personnel protective equipment (PPE) in accordance with the Safety Data Sheet and product use instructions (IPMC 2017). In addition, pest application requires a triennial certification. The IPMP requires contractors to comply with all federal, state, local, DoD, and Air Force regulations. AFI 32-1053 outlines numerous safety requirements and is incorporated here by reference.

3.6 HAZARDOUS MATERIALS / WASTE

Hazardous materials are defined by 49 CFR §171.8 as "*hazardous substances, hazardous wastes, marine pollutants, elevated temperature materials, materials designated as hazardous in the Hazardous Material Table (49 CFR §172.101), and materials that meet the defining criteria for hazard classes and divisions in 49 CFR Part 173*." Transportation of hazardous materials is regulated by the U.S. Department of Transportation regulations within 49 CFR Parts 105–108.

Hazardous wastes are defined by the Resource Conservation and Recovery Act (RCRA) at 42 USC §6903(5), as amended by the Hazardous and Solid Waste Amendments, as "*a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical,*

or infectious characteristics may (a) cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or (b) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed." Certain types of hazardous wastes are subject to special management provisions intended to ease the management burden and facilitate the recycling of such materials. These materials are called universal wastes and their associated regulatory requirements are specified in 40 CFR Part 273. Four types of waste are currently covered under the universal waste regulations: hazardous waste batteries, hazardous waste pesticides that are either recalled or collected in waste pesticide collection programs, hazardous waste thermostats, and hazardous waste lamps such as fluorescent bulbs. Travis Pest Management Shop, the sole location for pesticide storage on base, uses pesticides in order to prevent waste thus does not contribute any pesticides to the waste stream. Contracts applying herbicides on base may.

3.6.1 Regulatory Setting

Pollution Prevention Act of 1990 (42 USC §13101(b)) established a national policy that pollution should be prevented or reduced at the source whenever feasible; pollution that cannot be prevented should be recycled in an environmentally safe manner, whenever feasible; pollution that cannot be prevented or recycled should be treated in an environmentally safe manner whenever feasible; and disposal or other release into the environment should be employed only as a last resort and should be conducted in an environmentally safe manner.

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (42 USC §9601 et seq.) authorizes the EPA to respond to spills and other releases of hazardous substances to the environment and authorizes the National Oil and Hazardous Substances Pollution Contingency Plan. CERCLA also provides a federal "Superfund" to respond to emergencies immediately. Although the "Superfund" provides funds for clean-up of sites where potentially responsible parties cannot be identified, the EPA is authorized to recover funds through damages collected from responsible parties. This funding process places the economic burden for clean-up on polluters.

The RCRA of 1976 (42 USC §6901 et seq.) is an amendment to the Solid Waste Disposal Act. RCRA authorizes the EPA to provide for "cradle-to-grave" management of hazardous waste and sets a framework for the management of nonhazardous municipal solid waste. Under RCRA, hazardous waste is controlled from generation to disposal through tracking and permitting systems and restrictions and controls on the placement of waste on or into the land. Under RCRA, a waste is defined as hazardous if it is ignitable, corrosive, reactive, toxic, or listed by the EPA as being hazardous. The Hazardous and Solid Waste Amendments of 1984 strengthen control of both hazardous and nonhazardous waste and emphasize the prevention of pollution of groundwater.

The Toxic Substance Control Act (TSCA) of 1976 (40 CFR §700 et seq.) consists of four titles. Title I established requirements and authorities to identify and control toxic chemical hazards to human health and the environment. TSCA authorized the EPA to gather information on chemical risks, require companies to test chemicals for toxic effects, and regulate chemicals with unreasonable risk. TSCA also singled out polychlorinated biphenyls (PCBs) for regulation. PCBs are persistent when released into the environment and accumulate in the tissues of living organisms. TSCA and its regulations govern the manufacture, processing, distribution, use, marking, storage, disposal, clean-up, and release reporting requirements for numerous chemicals like PCBs. TSCA Title II provides statutory framework for "Asbestos Hazard Emergency

Response," which applies only to schools. TSCA Title III, "Indoor Radon Abatement," states indoor air in buildings of the United States should be as free of radon as the outside ambient air. Federal agencies are required to conduct studies on the extent of radon contamination in buildings they own. TSCA Title IV, "Lead Exposure Reduction," directs federal agencies to "conduct a comprehensive program to promote safe, effective, and affordable monitoring, detection, and abatement of lead-based paint and other lead exposure hazards." Further, any federal agency having jurisdiction over a property or facility must comply with all federal, state, interstate, and local requirements concerning lead-based paint.

The DoD developed the Defense Environmental Restoration Program (ERP) to facilitate thorough investigation and clean-up of contaminated sites on military installations (i.e., active installations, installations subject to Base Realignment and Closure, and formerly used defense sites). The Environmental Restoration Program (ERP) and the Military Munitions Response Program (MMRP) are components of the ERP. The ERP requires installations to identify, investigate, and clean up hazardous waste disposal or release sites. The MMRP addresses nonoperational rangelands that are suspected or known to contain UXO, discarded military munitions, or munitions constituent contamination (USAF ACC 2014).

The Travis AFB Hazardous Waste Management Plan (HWMP) establishes procedures, training requirements, inspections, and record management for hazardous waste (TAFB 2019b). The plan complies with requirements for the base-permitted treatment, storage and disposal facility in accordance with the U.S. Environmental Protection Agency (USEPA) and California regulations. The HWMP and the IDP contain detailed information about the generation and management of hazardous waste (TAFB 2019b).

3.6.2 Affected Environment

Issues regarding hazardous materials include the ongoing use, storage and disposal of hazardous materials on Travis AFB. Each process involving the use of hazardous materials and generation of waste streams is evaluated and authorized through the installation's Hazardous Material Management Program (HMMP) using the Enterprise Environmental, Safety, and Occupational Health Management Information System (EESOH-MIS), which provides centralized management of the procurement, handling, storage, and issuing of hazardous materials, and turn-in, recovery, reuse, or recycling of hazardous materials (TAFB 2020).

The Travis AFB ERP is administered by Air Force Civil Engineer Center (AFCEC). The goal of the Travis AFB ERP is to remediate all accident/disposal/spill sites (from 1984 or earlier) that may pose an immediate or potential threat to public health, welfare or the environment (TAFB 2019a).

In 1989, Travis AFB was added to the EPA's National Priorities List, and later, entered into a Federal Facility Agreement (FFA) with EPA and the State of California, to enact the CERCLA cleanup process. Although the entire base is considered a site under the working definition of CERCLA, the base was subdivided for ERP coverage into two geographic areas called Operable Units (OUs) (TAFB 2019a).

Environmental cleanup includes activities at many ERP sites on the Main Base. The ERP sites include landfills, fire protection training areas, spill sites, waste disposal sites, drum storage areas, leaking underground storage tanks (LUSTs) and piping, oil/water separators (OWSs), waste treatment plants, and other areas. Active hazardous waste disposal sites are managed under Travis's HWMP (TAFB 2020). Six inactive solid waste disposal sites on the base were investigated and remediated under the ERP program (TAFB 2019a).

The ERP operates three groundwater treatment plants under the authority of the 2014 Groundwater Records of Decision (ROD) signed with the EPA, Department of Toxic Substances Control and the SF Bay Regional Water Quality Control Board. Each treatment plant extracts contaminated groundwater from principally trichloroethylene (TCE) contaminated groundwater plumes underneath Travis AFB and after treatment, discharges the water to the North Gate Pond or Union Creek. The affluent and effluent are both tested at the treatment plants to ensure all contaminants are fully removed prior to discharge.

3.7 BIOLOGICAL / NATURAL RESOURCES

Biological/natural resources include living, native or naturalized plant and animal species and the habitats within which they occur. Plant associations are generally referred to as vegetation, and animal species are generally referred to as wildlife. Habitat can be defined as the resources and conditions present in an area that support a plant or animal such as grasslands, forests and wetlands.

Special status biological resources with federal legal protection include species listed as threatened or endangered under the ESA, and migratory birds protected under the Migratory Bird Treaty Act (MBTA) and Bald and Golden Eagle Protection Act (BGEPA). Other special status species that do not have federal legal protection, but that are monitored or managed on Travis AFB include species proposed, under review, or candidates for listing under the ESA; species listed, proposed, or candidates under the California ESA (CESA); California fully protected species; federal species of concern; California species of special concern; federal birds of conservation concern; DoD-Partners in Flight mission-sensitive priority bird species; California watch list species; Western Bat Working Group priority species; and plants considered rare by the California Native Plant Society (CNPS) or CDFW.

3.7.1 Regulatory Setting

EO 13112, *Invasive Species*, states that federal agencies subject to the availability of appropriations, and within Administration budgetary limits, use relevant programs and authorities to: (i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (iii) monitor invasive species populations accurately and reliably; (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (v) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and (vi) promote public education on invasive species and the means to address them. Furthermore, the EO directs agencies not to authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions.

The ESA (16 USC §1531 et seq.) conserves, protects, and restores threatened and endangered plants and animals and their habitats. It is administered by the USFWS and the National Marine Fisheries Service (NMFS) with the USFWS having primary responsibility for terrestrial and freshwater organisms and NMFS primarily responsible for marine fish and wildlife. Under the ESA, federal agencies are responsible for using their authority to conserve threatened and endangered species. All federal agencies must ensure any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a threatened and endangered species or result in the

destruction of critical habitat for these species, unless granted an exemption. The Secretary of the Interior determines which species are officially endangered or threatened, and the USFWS maintains the endangered species list.

Critical habitat is designated if USFWS determines that the habitat is essential to the conservation of a threatened or endangered species. In consultation for those species with critical habitat, federal agencies must ensure that their activities do not adversely modify critical habitat to the point that it would no longer aid in the species' recovery. Areas that are currently unoccupied by the species, but which are needed for the species' recovery, are protected by the prohibition against adverse modification of critical habitat.

Several provisions of the ESA allow DoD lands to be exempted or excluded from critical habitat. Under section 4(b)(2) of the ESA, an area may be excluded from critical habitat based on national security impacts. Under Section 4(a)(3)(B)(i) of the ESA, military lands that have an approved INRMP and cover the species in question can be found exempt from critical habitat designation. The USFWS and DoD will generally treat an operational INRMP as a suitable instrument for providing the installation with applicable exemptions or exclusions from designation of critical habitat (16 U.S.C. 1533(a)(3)(B)(i) and 1533(b)(2), respectively) if the Secretary determines in writing that such plan provides a benefit to the species for which critical habitat is proposed for designation (USFWS 2015). Unfortunately, sometimes USFWS and/or DoD does not catch the presence of DoD lands within proposed critical habitat; when it is not caught and changed, DoD lands can have critical habitat designated on them in the final rule. Travis and its GSUs have some critical habitat for these reasons and due to purchase of land after it was designated as critical habitat (Figure 11).

The California Department of Fish and Wildlife, under the California Natural Resources Agency, manages and protects the state's fish, wildlife, plant, and native habitats. The mission of the CDFW is to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public (CDFW 2018). The CESA (14 CCR §783 et seq.) functions similarly to the ESA for plant and animal species and subspecies within California. However, federal agencies are not legally required to protect or manage species listed under the CESA.

The MBTA of 1918 (16 USC §703-712), as amended, implements treaties and conventions between the United States, Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds. Unless otherwise permitted by regulations, the MBTA makes it unlawful to pursue, hunt, take, capture, or kill; attempt to take, capture or kill; possess, offer to or sell, barter, purchase, deliver, or cause to be shipped, exported, imported, transported, carried, or received any migratory bird, part, nest, egg, or product, manufactured or not. The MBTA also makes it unlawful to ship, transport or carry from one state, territory, or district to another, or through a foreign country, any bird, part, nest, or egg that was captured, killed, taken, shipped, transported, or carried contrary to the laws from where it was obtained; and import from Canada any bird, part, nest, or egg obtained contrary to the laws of the province from which it was obtained. The U.S. Department of the Interior has authority to arrest, with or without a warrant, a person violating the MBTA.

The 2003 Bob Stump National Defense Authorization Act (PL 107-314) gave the Secretary of the Interior authority to prescribe regulations to exempt the Armed Forces from the incidental taking of migratory birds during authorized military readiness activities. The final rule authorizing the DoD to take migratory birds in such cases includes a requirement that the Armed Forces must confer with the USFWS to develop and implement appropriate conservation measures to

minimize or mitigate adverse effects of the Proposed Action if the action will have a significant negative effect on the sustainability of a population of a migratory bird species.

A recent Solicitors Opinion (SO M-37050) was issued that states the MBTA prohibition on "taking" or "killing" of migratory birds applies only to deliberate acts intended to take migratory birds, their nests or their eggs. This replaces SO M-3741, Incidental Take Prohibited under the MBTA, which concludes that "the MBTA's broad prohibition on taking and killing migratory birds by any means and in any manner includes incidental taking and killing." In response, the Deputy Assistant Secretary of Defense issued a Memorandum for the Record (MFR) stating that until SO M-37050 is reconciled with existing rules, acts, Eos, and memorandums of understanding (MOUs), and legal clarification is given, the MFR advises Military Departments to continue to follow existing DoD guidance on the incidental take of migratory birds.

Bald and golden eagles are protected under the BGEPA (16 USC §668-668c). Enacted in 1940, the BGEPA prohibits anyone, without a permit issued by the Secretary of the Interior, from taking bald eagles, including their parts, nests, or eggs. The act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb."

EO 13186, *Conservation of Migratory Birds* (January 10, 2001), creates a more comprehensive strategy for the conservation of migratory birds by the federal government. EO 13186 provides a specific framework for the federal government's compliance with its treaty obligations to Canada, Mexico, Russia, and Japan. EO 13186 provides broad guidelines on conservation responsibilities and requires the development of more detailed guidance in a MOU. EO 13186 will be coordinated and implemented by the USFWS. The MOU will outline how federal agencies will promote conservation of migratory birds. EO 13186 requires the support of various conservation planning efforts already in progress; incorporation of bird conservation considerations into agency planning, including NEPA analyses; and reporting annually on the level of take of migratory birds.

EO 11514, *Protection and Enhancement of Environmental Quality* (March 5, 1970), states that the President, with assistance from the CEQ, will lead a national effort to provide leadership in protecting and enhancing the environment for the purpose of sustaining and enriching human life. Federal agencies are directed to meet national environmental goals through their policies, programs, and plans. Agencies should also continually monitor and evaluate their activities to protect and enhance the quality of the environment. Consistent with NEPA, agencies are directed to share information about existing or potential environmental problems with all interested parties, including the public, in order to obtain their views.

The Travis AFB INRMP (TAFB 2016) is prepared in cooperation with the U.S. Fish and Wildlife Service (USFWS) and the California Department of Fish and Wildlife (CDFW), and is signed by representatives of both agencies indicating mutual agreement concerning the conservation, protection, and management of the fish and wildlife resources addressed in the INRMP. The activities proposed in this EA are based on goals and objectives listed in the currently signed INRMP (TAFB 2016) and on the ISMP, IPSMP, GMP, APAP and WFMP which will be part of a new signed INRMP.

Travis AFB has consulted with the USFWS under Section 7 of the ESA to address activities proposed in this EA that may affect listed species on Travis AFB and its seven GSUs (*Programmatic Formal and Informal Consultation on the Proposed Effects of Activities Conducted at Travis Air Force Base on Six Federally Threatened and Endangered Species, Solano County, California*, PBO, 2017-F-2294, USFWS 2018a). All Avoidance and Minimization Measures (AMMs) from the PBO (USFWS 2018a) will be implemented and are a part of Alternative 2 (Appendix D) and all other Alternatives.

The PBO (USFWS 2018a; pgs. 4-11) includes concurrence that typical activities that occur at Travis AFB and its GSUs will have no effect (NE) and/or may affect but are not likely to adversely affect (NLAA) six listed species and their critical habitat: the federally threatened Central Valley population of the California tiger salamander (*Ambystoma californiense*, CTS), vernal pool fairy shrimp (*Branchinecta lynchi*, VPFS), Contra Costa goldfields (*Lasthenia conjugens*, CCG); and delta green ground beetle (*Elaphrus viridis*, DGGB); and the federally endangered vernal pool tadpole shrimp (*Lepidurus packardi*, VPTS) and Conservancy fairy shrimp (*Branchinecta conservation*, CFS).

The covered activities meeting NE, beneficial effect (BE), or NLAA conclusions include almost all of the invasive species management activities in this EA:

- mowing between May 1 and Oct 15,
- grazing and livestock management,
- the Vernal Pool Grassland Grazing study,
- invasive plant species management including the IPSMP (ManTech 2017),
- prescribed burns when they avoid CTS and CCG impacts,
- herbicide treatment as outlined in the IPSMP (ManTech 2017), and
- grassland restoration including manual removal of invasive species (e.g. hand-pulling).

The PBO also covers additional invasive species management activities for which a likely to adversely affect (LAA) determination is justified. Such activities include:

- herbicide application to uplands and dry jurisdictional vernal pools,
- federally listed species habitat management actions including removal of invasive plant species in and around vernal pools and other wetlands, fence installation for grazing, and pond drainage to control non-native fishes and bullfrogs,
- vernal pool and seasonal wetland restoration actions including removal of topsoil and grading activities, and
- fire management including fire suppression, firebreak maintenance, and prescribed burns.

Under the PBO consultation framework, all projects meeting the consultation criteria for Levels 2 (NLAA, BE) and Level 3 (LAA) will have project-specific analysis completed by Travis AFB which will be submitted to the USFWS for concurrence. A comprehensive PBO Project Analysis (PA) is being prepared for submission for this EA.

Travis AFB concluded that application of herbicides at the North Gate Pond had no effect to federally listed species due to lack of suitable habitat for any of the listed species.

Some additional consultations were completed before the PBO was received. Specific PAs or prior Consultations that are applicable to the Proposed Action in this EA include the following:

- Informal Consultation on the Aero Club Fence Installation (08ESMF00-2017-I-0252-2, Jan 2017)
- Informal Consultation and Reinitiation on the Vernal Pool Grassland Grazing Study (08ESMF00-I-0754, Jan & Jun 2018)
- Informal Consultation and Reinitiation on Sheep and/or Goat Grazing at Castle Terrace Conservation Area (08ESMF00-2018-I-0945-1, Feb 2018 & April 2018)
- Informal Consultation for the Sheep and Goat Grazing under the PBO (2019-1-1794-1, May 2019)
- Informal Consultation for Grazing Expansion (under review)

- Informal consultation for emergency firebreaks installed in response to imminent threats to human health, safety and property on 20 August 2020.

3.7.2 Affected Environment

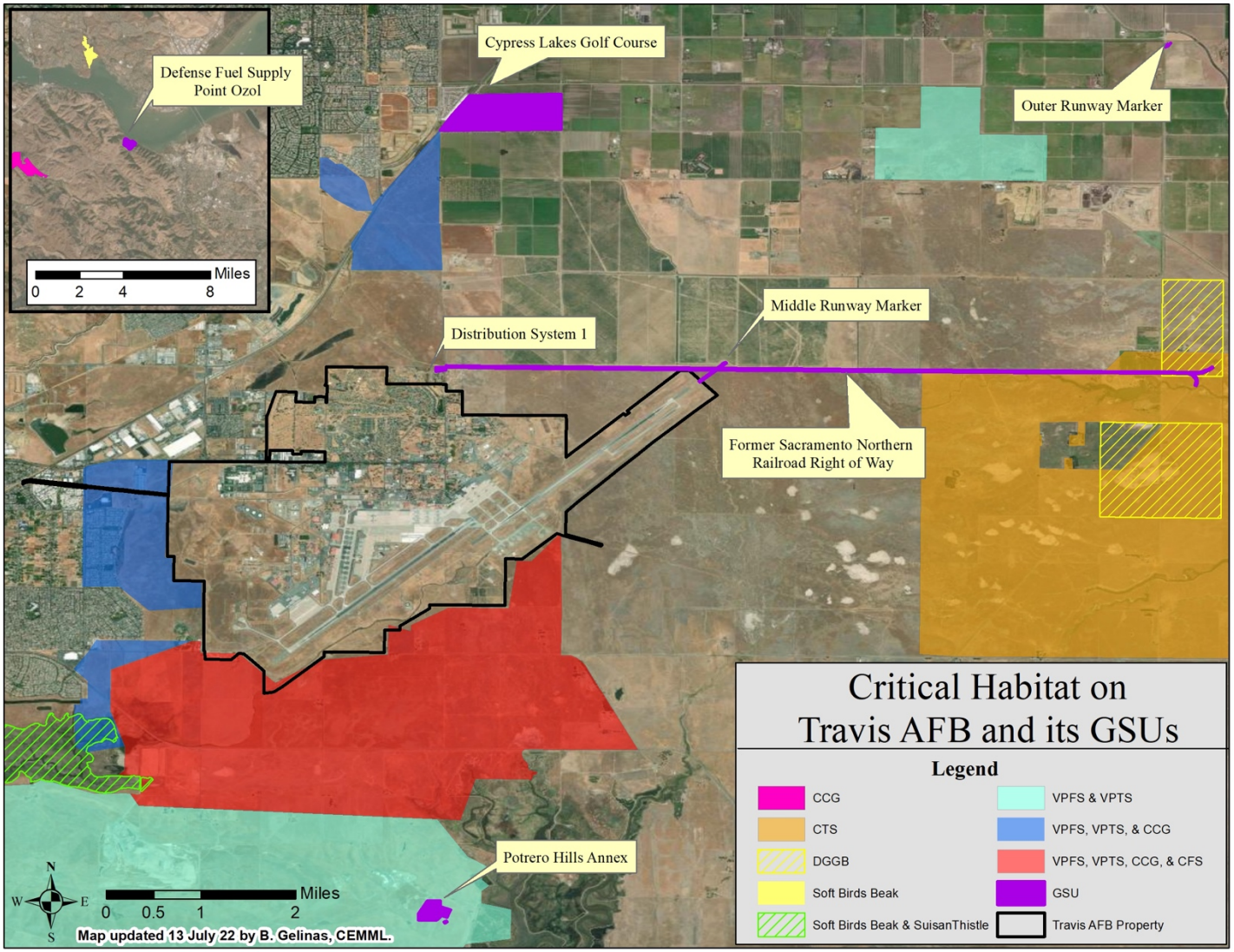
3.7.2.1 Native Vegetation Communities

The vegetation communities that occur on Travis AFB include lacustrine marsh, riparian vegetation, vernal pools, annual grassland and urban landscapes.

Two hundred and twenty-six herbaceous plant species occur on Travis AFB. Composites (Asteraceae) and grasses (Poaceae) are the most dominant families, comprising one-third of all species present. The herbaceous flora includes 109 species (48%) that are not native to California. Vernal pools provide habitat for over 110 species or just over 44% of all taxa found on the base. Furthermore, the three species listed by the California Native Plant Society (CNPS) as rare, threatened, or endangered that occur on Travis AFB reside in vernal pools. These are Contra Costa goldfields (*Lasthenia conjugens*), San Joaquin spearscale (*Atriplex joaquiniana*) and alkali milk vetch (*Astragalus tener* var*. tener*) (TAFB 2019a).

Lacustrine Marsh, Riparian Vegetation, & Northern Claypan Vernal Pools and Swales: Summarized under Section 3.5.1.4 Wetlands.

Figure 11. Critical Habitat on or near Travis AFB and its GSU



Annual Grassland: Grasslands comprise approximately 1,735 acres on Travis AFB. The dominant vegetation in these areas includes non-native, annual, upland species such as soft chess (*Bromus hordeaceus*), Italian ryegrass, rat-tail fescue (*Festuca myuros* var. *myuros*), filaree, wild oats (*Avena* spp.), ripgut brome, and harding grass (*Phalaris aquatica*). Some of these non-natives targeted for management have been mapped (Table 10, Figure 12). Native perennial grasses grow in abundance in a few areas but generally in lower densities and quantities and include owl's clover (*Castilleja* spp.), tarweed (*Centromadia* spp.), saltgrass, fiddleneck (*Amsinckia* spp.), purple needlegrass and popcorn flower (*Plagiobothrys* spp.) (Marty 2019). = This plant community supports a variety of birds, reptiles, and mammals (TAFB 2019a).

Highly disturbed grassland is found in the southeastern quadrant of the base, adjacent to Union Creek in an area formerly used for pheasant hunting. The vegetation in these disturbed grasslands typically consists of non-native broad-leaved, often invasive species, interspersed with non-native grass species. In general, disturbed grasslands occur in areas such as road fills and construction sites and in areas subject to recurrent disturbances like mowing. Such habitats are widely distributed but constitute only a small portion of the land area. They are also evident on old fire training areas and landfills. Some shrub vegetation grows in the grasslands on Travis AFB. The vegetation in these areas can contain a variety of native and non-native shrub and tree species (TAFB 2019a).

Table 10. List of Mapped Invasive Plant and Animal Species

Data (primarily in acres unless otherwise noted) is largely from the IPSMP (ManTech 2017) and SRCD 2016, 2017, 2019a and 2019b. If cells are blank, species may either not be present on base, has not been mapped, wasn't mapped that year, or was controlled and no longer present in previously mapped locations. In general, Prevention Stage species have not been found on base to date. Weeds have not been mapped base-wide or at GSUs. Information for invasive fauna does include GSUs. Only most commons species are listed or those species that have been given a priority stage. See Appendix A for a complete list of species. *Color Codes: blue = prevention, red = eradication stage, orange = containment stage, yellow = asset protection stage, purple = invasive fauna; white = native, nuisance species controlled under the APAP.*

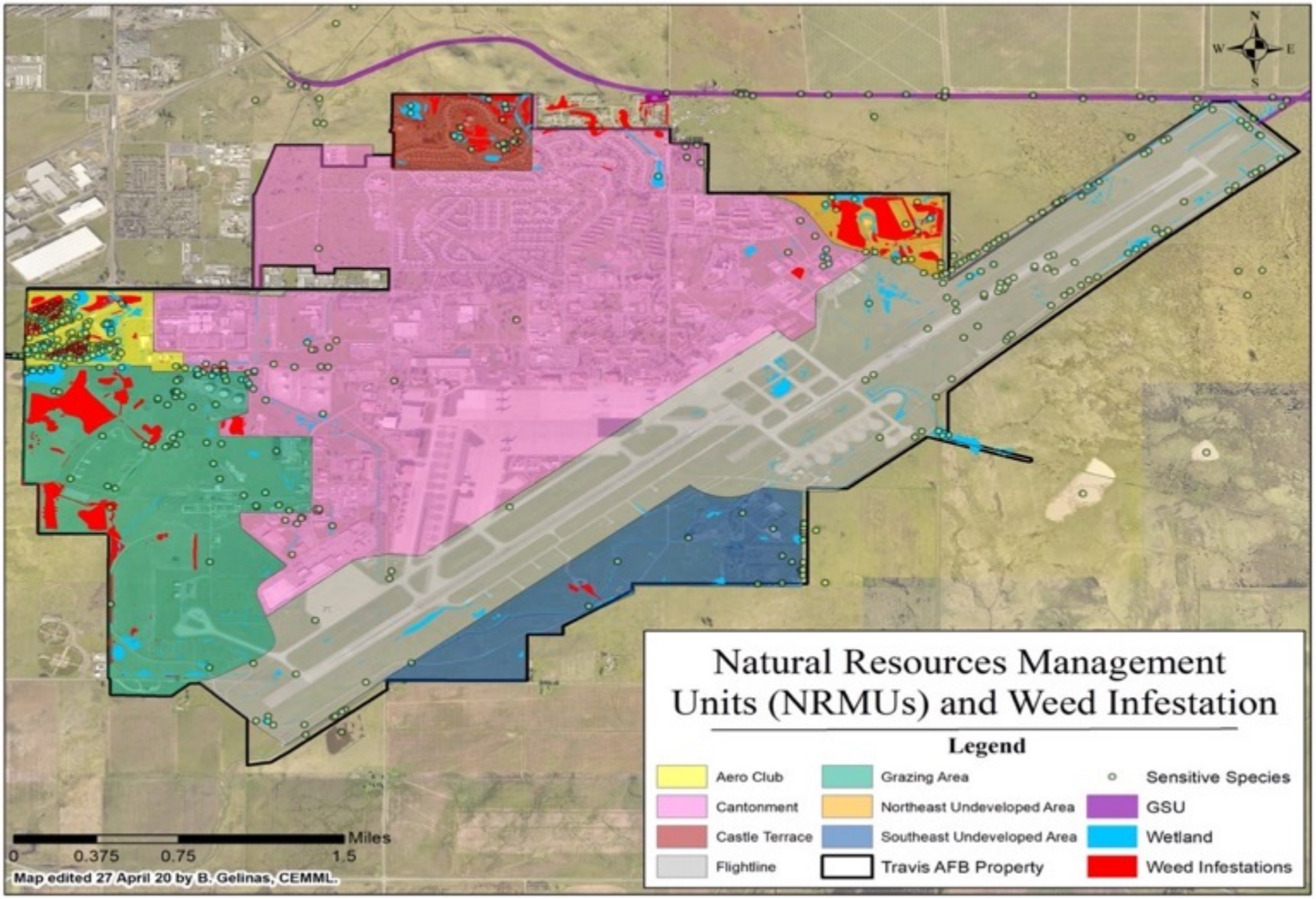
Common Name	2015	2016	2017	2018
Grand Total Acres	**111.6971**	**107.6751**	**35.137**	**40.521**
Grassland Habitat				
Arundo	0.317	0.317	0.19	0.3
Iceplant			0.03	
Treasure Flower	5.24	2.16	9.49	9.91
Artichoke Thistle	0.036	0.036		
Bristly Oxtongue	4.6	4.6		
Bull Thistle	0.05	0.05	0.03	0.032
Fennel	13.663	13.663	0.01	0.01
French Broom	0.008	0.008		
Himalayan Blackberry	0.09	0.04	0.07	0.1
Skeleton Weed	1.16	1.16		
Spanish Broom	0.07	0.07		
Stinkwort	0.03	0.03	5.44	

Common Name	2015	2016	2017	2018
Wooly Distaff Thistle			0.001	
Barb Goatgrass	12.46	12.1	10.07	0.004
Medusahead^				
Perennial Pepperwood	4.19	4.19	0.485	0.045
Purple Star-Thistle	11.721	11.301	7.462	1.26
Yellow Star-Thistle	54.156	54.15	0.016	28.6
Black Mustard%				
Italian Thistle%				
TOTAL	**107.791**	**103.875**	**33.294**	**40.261**
Wetland				
Arundo	0.01	0.01		
Bristly Oxtongue	0.88	0.88		
Fennel	0.04	0.04		
Skeleton weed	0.02	0.02		
Stinkwort	0.0001	0.0001	1.2	
Barb Goatgrass	0.43	0.33	0.13	
Perennial Pepperwood	1.407	1.404	0.06	0.04
Purple Star-Thistle	0.06	0.06	0.27	
Yellow Star-Thistle	1.059	1.056	0.183	0.22
Brazilian Waterweed	0.68*			
Eurasian water-millfoil	0.68*			
TOTAL	**3.9061**	**3.8001**	**1.843**	**0.26**
Non-Native Fauna%				
American bullfrog	10 ponds			
Mosquito fish	5 ponds/vernal pools			
Other non-native fish				
Red-eared sliders				2 Ponds, Union Creek
Introduced crayfish				

*Includes known locations at max 25% cover in one perennial pond in each of North Castle Terrace (0.5 ac) and the North Gate Pond (2.2 ac; HT Harvey 2014).
^Ubiquitous across all grasslands on base and thus not mapped.
%Present on base; not mapped.

Figure 12. Mapped Weed Infestations (2015-2019)

Not all invasive species, known or unknown, are mapped. This map is neither comprehensive or all inclusive. Populations that showed 100% control by 2018 were removed.



Urban Landscapes: Travis AFB recognizes the importance of the functional and aesthetic aspects of plants and landscaping. Cultivated vegetation on the base consists of landscaped and turf areas surrounding buildings, residences, play areas and recreation fields. The Travis AFB landscaping goal is to provide an attractive, low-maintenance landscaping environment that enhances the natural and human-made features of the base. The base has approximately 300 acres of irrigated, improved urban landscapes. Over 80 species of trees have been planted (TAFB 2019a).

Streams and Ponds: Aquatic plant species (native and non-native) found in Travis AFB's water bodies include riparian, emergent, floating and submerged aquatic vegetation and algae (Table 10). On the main base, inefficient conveyance of stormwater as part of a naturally functioning wetland and stream system can create a BASH concern, which is critical to Travis AFB. Stormwater drainage channels, Union Creek and North Gate Pond (as well as Valley View Pond which is not a target for weed control as it is not a BASH concern) are prone to infestation by algae and submersed, floating or emergent aquatic weeds, especially cattails and watermilfoil. The presence of these native and non-native aquatic species can slow or stop the flow of water. This drainage impediment can create a flood hazard near the active airfield or may negatively impact efficient stormwater drainage through Travis AFB, as well as increasing BASH concerns. In some cases, tules, cattails, and watermilfoil may act in a positive way to slow down water flow and deposit sediment as a BMP for stormwater pollution prevention control.

3.7.2.2 Terrestrial and Aquatic Wildlife

Common wildlife species associated with general vegetation types are described first, followed by classes of species, including mammals, birds, reptiles, fish, amphibians, and aquatic invertebrates. All of the following information came from the Draft INRMP (TAFB 2019a). The INRMP (TAFB 2016, 2019a) includes a list of all species observed on or known to occur on Travis AFB.

Lacustrine Marsh. Several of the ponds on Travis AFB that contain lacustrine marsh vegetation are known to support the western pond turtle, a California Species of Special Concern (CIRE 2017).

Riparian Vegetation. Representative wildlife that dominate this habitat at Union Creek include Red winged Blackbirds (*Agelaius phoeniceus*), Mallards (*Anas platyrhynchos*), Pacific tree frogs (*Pseudacris regilla*), western pond turtles (*Actinemys marmorata*), and California red sided garter snake (*Thamnophis sirtalis*). The state-listed Tricolored Blackbird (*Agelaius tricolor*) is also found using habitat within Union Creek on Travis AFB (CIRE 2017; Marty 2017a).

Representative wildlife species that dominate this habitat along the edge of ponds include the Red winged Blackbird, Brewer's Blackbird (*Euphagus cyanocephalus*), Anna's Hummingbirds (*Calypte anna*), Cliff Swallows (*Hirundo pyrrhonota*), Barn Swallows (*Hirundo rustica*), and Violet Green Swallows (*Tachycineta bicolor*). A wide variety of migratory birds also utilizes this habitat. Northwestern fence lizards (*Sceloporus occidentalis*), gopher snakes (*Pituophis melanoleucus*), and the house mouse (*Mus musculus*) are also abundant in this habitat (Roy F. Weston, Inc. 1995).

Northern Claypan Vernal Pools and Swales. Legally protected invertebrate and vertebrate species identified within the vernal pools at Travis AFB include vernal pool fairy shrimp (VPFS, *Branchinecta lynchi*), vernal pool tadpole shrimp (VPTS, *Lepidurus packardi*) and California tiger salamander (CTS, *Ambystoma californiense*) (CH2M Hill 2006).

Annual Grassland. The most abundant wildlife in the grasslands on the west side of the base include California ground squirrel (*Otospermophilus beecheyi*), Red winged Blackbird, Ring necked Pheasant (*Phasianus colchicus*), northwestern fence lizard, Pacific gopher snake (*Pituophis melanoleucus*), and deer mouse (*Peromyscus maniculatus*) (Roy F. Weston, Inc. 1995).

The grassland habitat next to Union Creek on the south side of the base supports numerous birds, reptiles, and small mammals. Dominant representatives include Red winged Blackbird, Killdeer (*Charadrius vociferous*), White-tailed Kite (*Elanus leucurus*), Western Meadowlark (*Sturnella neglecta*), Pacific tree frog, Northwestern fence lizard, gopher snakes, deer mouse, and house mouse (Roy F. Weston, Inc. 1995).

Turf and Landscaped Areas. Wildlife found in the landscaped areas on the base include Song Sparrow (*Melospiza melodia*), Red-winged Blackbird, Killdeer, House Sparrow (*Passer domesticus*), western harvest mouse (*Reithrodontomys megalotis*), and California ground squirrels (Roy F. Weston, Inc. 1995).

Mammals. Thirty-nine mammal species are found on the base. California ground squirrels and black tailed jackrabbits (*Lepus californicus*) are abundant throughout Travis AFB.

Birds. Over 175 species of birds have been found on Travis AFB. Of these, 36 species were confirmed as nesting on the base; all are common species, found regularly in vicinity of Travis AFB.

Reptiles. Seven species of reptiles on the base have been recorded (Roy F. Weston, Inc 1995). Northwestern fence lizards and gopher snakes were both abundant and occupied a wide range of habitats. The riparian zone associated with Union Creek was the only habitat occupied by Western pond turtles and the California red sided garter snake. California king snakes were observed to occupy only disturbed grassland. A striped racer (*Coluber lateralis*) was also observed in this habitat and in heavily grazed pasture. A western skink (*Plestiodon skiltonianus*) was observed in irregularly mowed grassland.

Amphibians. Roy F. Weston, Inc. (1995) identified the Pacific tree frog as the only common amphibian on the base primarily associated with riparian and early successional habitats. Invasive adult bullfrogs (*Rana catesbeiana*) and native western toads have since been identified in ponds in the Castle Terrace Conservation Area (Earth Tech 1999).

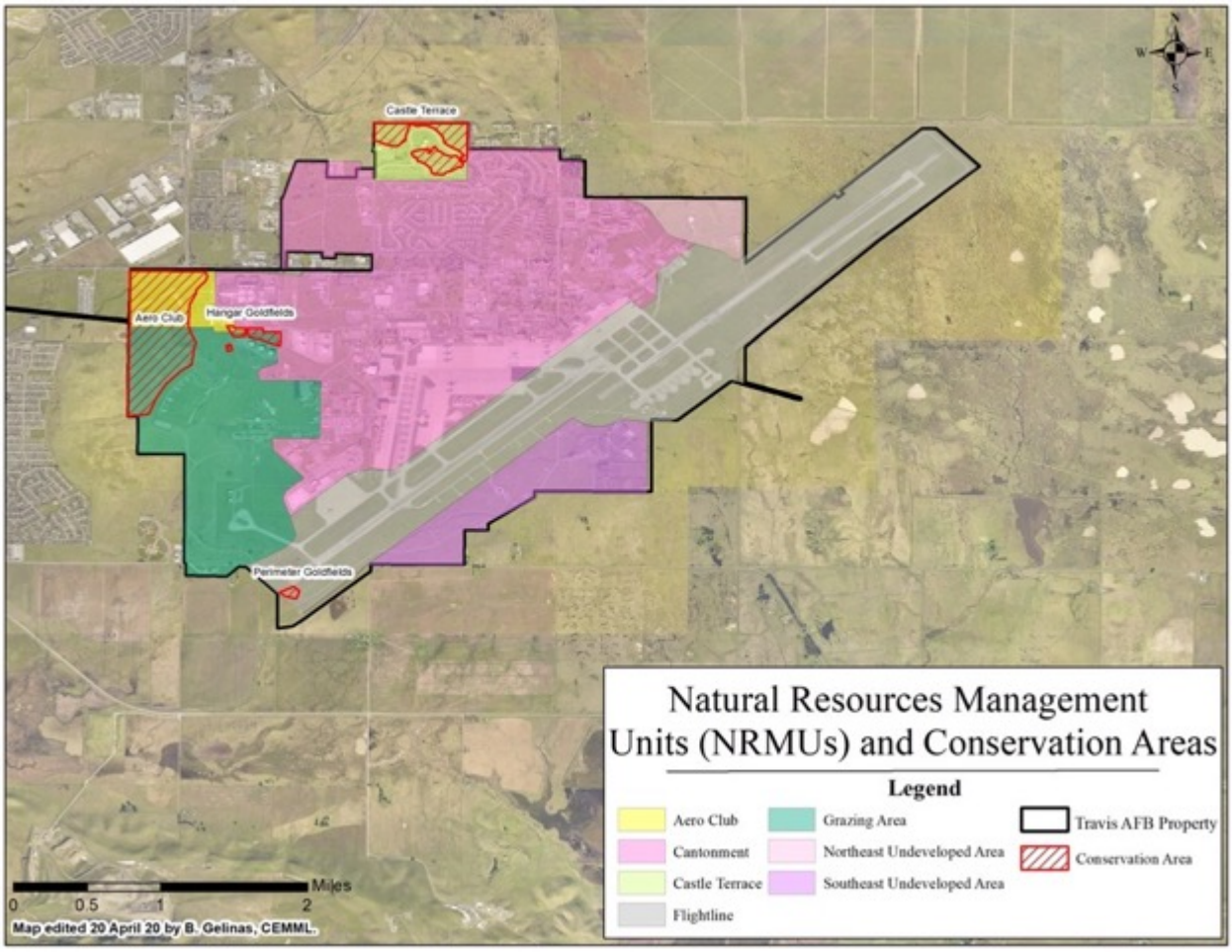
Fish. Five species of fish have been identified in the North Gate Pond, including largemouth bass, bluegill, green sunfish, western mosquito fish and channel catfish. Bluegills are the most abundant and share the environment with a healthy population of largemouth bass. Union Creek also supports an abundance of fish including western mosquitofish (*Gambusia affinis*), fathead minnow (*Pimephales promelas*), hitch (*Lavinia exilicauda*), threespine stickleback (*Gasterosteus aculeatus*), largemouth bass and rainwater killfish (*Lucania parva*). Other than the stickleback and hitch, the fish species are non-native (Roy F. Weston, Inc. 1995). Three salmonids were observed in a swale along Perimeter Road north of Fire Station 3 during a high rain year in spring of 2017; however, the species was not determined (Penn Craig personal communication 2017).

Invertebrates. Ricksecker's water scavenger beetle (*Hydrochara rickseckeri*) was found in several locations on the Main Base and the Former Sacramento Northern Railroad ROW (ManTech 2016). The California Fairy Shrimp and mid-valley fairy shrimp also occur (Marty 2016).

Invasive Fauna: Base-wide surveys in 2014 detected bullfrog only at a perennial pond in Castle Terrace though established populations are likely on base even though they weren't detected.

Other studies that have detected bullfrog include BioSystems 1993 in Union Creek (as cited by Westin 1994), Earth Tech 1999, Johnson & Shaffer 2010, and MEC 2020. Surveys in 2015 (ManTech 2016) detected bullfrogs in eight surveyed ponds at the Cypress Lakes Golf Course GSU, mosquito fish (*Gambusia affinis*) in three ponds, pumpkinseed (*Lepomis gibbosus*) in one pond, and stocked sport fish in one pond. Defense Fuel Supply Point Ozol GSU has introduced mosquito fish as a vector control per interviews with contractors which threatens an onsite vernal pool (ManTech 2016). Mosquito fish were also detected at the Former Sacramento Northern Railroad Right of Way GSU (ManTech 2016) and within four vernal pools on Travis AFB (CH2MHill 2006).

Figure 13. Natural Resources Management Units on Travis AFB



3.7.2.3 Special Status Species

All species listed as threatened or endangered by USFWS or the State of California, as well as proposed/candidates for listing by the USFWS or the CDFW are considered in the day to day management on all Travis AFB properties (Table 11). In general, species of concern includes (1) those species protected by federal laws including the MBTA and BGEPA, (2) species considered to be a bird of conservation concern (BCC) by USFWS and/or a DoD mission-sensitive bird priority species, and (3) those defined as species of special concern by the State of California (also in Table 11).

Detailed descriptions of federally threatened and endangered species occurrences within the action area can be found in the PBO (USFWS 2018a). Detailed descriptions of state listed species and other species of concern can be found in the INRMP (TAFB 2016, 2019a). All are incorporated here by reference.

Table 11. Special-Status Species on Travis AFB and its GSUs

Special-status species that occur or have the potential to occur on Travis properties (INRMP, TAFB 2019a; CDFW 2021)

Common Name	Scientific Name	Federal Status	State Status	Main Base Status	GSU Status
Plants					
Alkali milk vetch	*Astragalus tener* var. *tener*	None	CRPR 1B.2	Present	Suitable habitat on Railroad ROW GSU, Outer Runway Marker GSU, Middle Runway Marker GSU and Point Ozol GSUs
Baker's navarretia	*Navarretia leucocephala* ssp. *bakeri*	None	CRPR 1B.1	Presumed absent. Species not detected during floristic surveys.	Presumed absent. Species not detected during floristic surveys.
Bolander's water hemlock	*Cicuta maculate* var. *bolanderi*	None	CRPR 2B.1	Absent. Base lacks suitable habitat.	Absent. GSUs lack suitable habitat.
Brittlescale	*Atriplex depressa*	None	CRPR 1B.2	Present.	Present on Railroad ROW GSU
California alkali grass	*Puccinellia simplex*	None	CRPR 1B.2	Presumed absent. Species not detected during floristic surveys.	Presumed absent. Species not detected during floristic surveys.
Carquinez goldenbush	*Isocoma arguta*	None	CRPR 1B.1	Presumed absent. Species not detected during floristic surveys.	Presumed absent. Species not detected during floristic surveys.
Colusa grass	*Neostapfia colusana*	T	E	Presumed absent. Species not detected during floristic surveys.	Absent. GSUs lack suitable habitat to support species.
Congdon's tarplant	*Centromadia parryi ssp. congdonii*	None	CRPR 1B.1	Possibly occurs on base (needs verification)	Suitable habitat on Railroad ROW GSU
Contra Costa goldfields	*Lasthenia conjugens*	E	CRPR 1B.1	Present	Presumed absent. Species not detected during appropriately timed floristic surveys.
Coulter's goldfields	*Lasthenia glabrata* ssp. *coulteri*	None	CRPR 1B.1	Presumed absent. Species not detected during floristic surveys.	Presumed absent. Species not detected during floristic surveys.
Crampton's tuctoria/ Solano grass	*Tuctoria mucronata*	E	E	Presumed absent. Species not	Absent. GSUs lack suitable habitat to support species.

Common Name	Scientific Name	Federal Status	State Status	Main Base Status	GSU Status
				detected during floristic surveys.	
Dwarf downingia	*Downingia pusilla*	None	CRPR 2B.2	Presumed absent. Species not detected during floristic surveys.	Presumed absent. Species not detected during floristic surveys.
Delta tule pea	*Lathyrus jepsonii* var. *jepsonii*	None	CRPR 1B.2	Absent. Base lacks suitable habitat.	Absent. GSUs lack suitable habitat.
Heartscale	*Atriplex cordulata* var. *cordulata*	None	CRPR 1B.2	Presumed absent. Species not detected during floristic surveys.	Presumed absent. Species not detected during floristic surveys.
Long-styled sand-spurrey	*Spergularia macrotheca* var. *longistyla*	None	CRPR 1B.2	Presumed absent. Species not detected during floristic surveys.	Presumed absent. Species not detected during floristic surveys.
Marsh microseris	*Microseris paludosa*	None	CRPR 1B.2	Absent. Base lacks suitable habitat.	Absent. GSUs lack suitable habitat.
Mason's lilaeopsis	*Lilaeopsis masonii*	None	CRPR 1B.1	Absent. Base lacks suitable habitat.	Absent. GSUs lack suitable habitat.
Mt. Diablo buckwheat	*Eriogonum truncatum*	None	CRPR 1B.1	Presumed absent. Species not detected during floristic surveys.	Presumed absent. Species not detected during floristic surveys.
Pappose tarplant	*Centromadia parryi* ssp. *parryi*	None	CRPR 1B.2	Possibly occurs on base (needs verification)	Suitable habitat on Railroad ROW GSU
Saline clover	*Trifolium hydrophilum*	None	CRPR 1B.2	Presumed absent. Species not detected during floristic surveys.	Presumed absent. Species not detected during floristic surveys.
San Joaquin spearscale	*Extriplex joaquinana*	None	CRPR 1B.2	Present	Present on Railroad ROW GSU. Suitable habitat on Outer Runway Marker and Middle Runway Marker GSUs.
Slender-leaved pondweed	*Stuckenia filiformis* ssp. *alpina*	None	CRPR 2B.2	Presumed absent. Species not detected during floristic surveys.	Presumed absent. Species not detected during floristic surveys.
Soft salty bird's-beak	*Chloropyron molle* ssp. *molle*	E	CRPR 1B.2	Absent. Base lacks suitable habitat to support species.	Absent. GSUs lack suitable habitat to support species.
Suisun Marsh aster	*Symphyotrichum lentum*	None	CRPR 1B.2	Presumed absent. Species not	Presumed absent. Species not detected

Common Name	Scientific Name	Federal Status	State Status	Main Base Status	GSU Status
				detected during floristic surveys.	during floristic surveys.
Suisun thistle	*Cirsium hydrophilum* var. *hydrophilum*	E	CRPR 1B.1	Absent. Base lacks suitable habitat to support species.	Potential to occur in Rairoad ROW GSU
Two-fork clover	*Trifolium amoenum*	E	CRPR 1B.2	Presumed absent. Species not detected during floristic surveys.	Presumed absent. Species not detected during floristic surveys.
Vernal pool smallscale	*Atriplex persistens*	None	CRPR 1B.2	Presumed absent. Species not detected during floristic surveys.	Presumed absent. Species not detected during floristic surveys.
Fish					
Central Valley Chinook salmon	*Oncorhynchus tshawytsha*	T (Central Valley spring-run) E (Sacramento River winter-run)	T (spring-run) E (winter-run)	Potentially found spring-run on base in high flood event in 2017. Identification not confirmed.	Has not been identified on any GSUs
Central Valley steelhead	*Oncorhynchus mykiss*	T	None	Has not been identified on-base	Has not been identified on any GSUs
Delta smelt	*Hypomesus transpacificus*	T	T	Has not been identified on-base	Has not been identified on any GSUs
Green sturgeon	*Acipenser medirostris*	T	None	Has not been identified on-base	Has not been identified on any GSUs
Longfin smelt	*Spirinchus thaleicthys*	C	T	Has not been identified on-base	Has not been identified on any GSUs
Mammals					
Pallid bat	*Antrozous pallidus*	None	SSC, WBWG [1]:H	Identified on-base in acoustic survey	Has not been identified on any GSUs
Salt marsh harvest mouse	*Reithrodontomys raviventris*	E	E, FP	Has not been identified on-base	Has not been identified on any GSUs
Suisun Shrew	*Sorex ornatus sinuosus*	None	SSC	Has not been identified on-base	Has not been identified on any GSUs
Townsend's big-eared bat	*Corynorhinus townsendii*	None	SSC, WBWG :H	Identified on-base in acoustic survey	Has not been identified on any GSUs

Common Name	Scientific Name	Federal Status	State Status	Main Base Status	GSU Status
Western mastiff bat	*Eumops perotis*	None	SSC, WBWG :H	Identified on-base in acoustic survey	Has not been identified on any GSUs
Western red bat	*Lasiurus blossevillii*	None	SSC, WBWG :H	Identified on-base	Has not been identified on any GSUs
Amphibians					
California newt or Coast range newt	*Taricha torosa*	None	SSC	Has not been identified on-base	Has been found on Point Ozol GSU
California red-legged frog	*Rana aurora draytonii*	T	None	Has not been identified on-base	Has not been identified on any GSUs
California tiger salamander	*Ambystoma californiense*	T	T	Identified on-base	Suitable habitat exists on the Railroad ROW, Potrero Hills Annex and potentially the Cypress Lakes Golf Course.
Western spadefoot	*Spea hamondii*	Under Review	SSC	Has not been identified on-base	Has not been identified on any GSUs
Reptiles					
Giant garter snake	*Thamnophis gigas*	T	T	Has not been identified on-base	Has not been identified on any GSUs
Western pond turtle	*Actinemys marmorata*	Under Review	SSC	Identified on-base	Has been found on Cypress Lakes Golf Course and the Railroad ROW GSUs.
Birds					
Allen's Hummingbird	*Selasphorus sasin*	BCC	None	Identified on-base	Has not been identified on any GSUs
American White Pelican	*Pelecanus erythrorhynchos*	None	SSC	Identified on-base	Has been found on Potrero Hills Annex and Railroad ROW GSUs
Bald Eagle	*Haliaeetus leucocephalus*	BCC[2], BGEPA, MBTA[3]	E, FP	Identified on-base	Has not been identified on any GSUs
California Black Rail	*Laterallus jamaicensis coturniculus*	BCC	T, FP	Has not been identified on-base	Has not been identified on any GSUs
California Least Tern	*Sternula antillarum browni*	E	E, FP	Has not been identified on-base	Has not been identified on any GSUs
California Ridgway's Rail	*Rallus obsoletus*	E	E	Has not been identified on-base	Has not been identified on any GSUs
Cooper's Hawk	*Accipiter cooperii*	MBTA	WL	Identified on-base	Found on Potrero Hills Annex

Common Name	Scientific Name	Federal Status	State Status	Main Base Status	GSU Status
Ferruginous Hawk	*Buteo regalis*	BCC	WL	Identified on-base	Has not been identified on any GSUs
Golden Eagle	*Aquila chrysaetos*	BCC[2], BGEPA, MBTA[3]	FP	Identified on-base	Has not been identified on any GSUs
Greater Sandhill Crane	*Grus canadensis*	MBTA	T	Identified on-base	Has not been identified on any GSUs
Loggerhead Shrike	*Lanius ludovicianus*	BCC[2], MBTA	SSC	Known to nest on base	Found on Potrero Hills Annex and Railroad ROW GSU
Long-billed Curlew	*Numenius americanus*	BCC[2], MBTA	None	Identified on-base	Found on Cypress Lakes Golf Course
Marbled Godwitt	*Limosa fedoa*	BCC, MBTA	None	Identified on-base	Has not been identified on any GSUs.
Northern Harrier	*Circus cyaneus*	MBTA	SSC	Identified on-base	Found on Potrero Hills Annex and Railroad ROW GSU
Nuttall's Woodpecker	*Picoides nuttallii*	BCC, MBTA	None	Identified on-base	Found on Point Ozol and Cypress Lakes Golf Course
Oak Titmouse	*Baeolophus inornatus*	BCC	None	Identified on-base	Found on Point Ozol
Osprey	*Pandion haliaetus*	MBTA	WL	Identified on-base	Found on Point Ozol
Peregrine Falcon	*Falco peregrinus*	BCC, MBTA	FP	Identified on-base	Found on Point Ozol
Prairie Falcon	*Falco mexicanus*	BCC[2]	WL	Identified on-base	Found on Point Ozol
Rufous Hummingbird	*Selasphorus rufus*	BCC	None	Known to nest on-base	Has not been identified on any GSUs
Saltmarsh Common Yellowthroat	*Geothlypis trichas sinuosa*	MBTA	SSC	Has not been identified on-base	Has not been identified on any GSUs
Sharp-shinned Hawk	*Accipiter striatus*	MBTA	WL	Identified on-base	Found on Railroad ROW GSU
Short-billed Godwit	*Limnodromus griseus*	BCC, MBTA	None	Identified on-base	Has not been identified on any GSUs
Short-eared Owl	*Asio flammeus*	MBTA	SSC	Identified on base	Has not been identified on any GSUs
Suisun Song Sparrow	*Melospiza melodia maxillaris*	MBTA	SSC	Identified on base	Has not been identified on any GSUs
Swainson's Hawk	*Buteo swainsonii*	MBTA	T	Known to nest on base	Observed flying over Potrero Hills GSU and Cypress Lakes Golf Course

Common Name	Scientific Name	Federal Status	State Status	Main Base Status	GSU Status
Tricolored Blackbird	*Agelaius tricolor*	Proposed, BCC[2]	T	Known to nest on base	Found on Railroad ROW GSU
Western Burrowing Owl	*Athene cunicularia hypogea*	BCC[2], MBTA	SSC	Known to nest on base	Found on Potrero Hills Annex and Railroad ROW GSU
Whimbrel	*Numenius phaeopus*	BCC	None	Identified on base	Has not been identified on any GSUs
White-tailed Kite	*Elanus leucurus*	MBTA	FP	Known to nest on base	Has not been identified on any GSUs
White-faced Ibis	*Plegadis chihi*	MBTA	WL	Identified on base	Has not been identified on any GSUs
Yellow Warbler	*Dendroica petechia*	BCC	SSC	Identified on base	Has not been identified on any GSUs
Yellow-billed Magpie	*Pica nuttalli*	BCC	None	Known to nest on base	Found on Cypress Lakes Golf Course
Invertebrates					
Conservancy fairy shrimp	*Branchinecta conservatio*	E	ICP	Has not been identified on base	Has not been identified on any GSUs
Crotch bumble bee	*Bombus crotchii*	None	ICP	Has not been identified on base	Has not been identified on any GSUs
Delta green ground beetle	*Elaphrus viridis*	T	ICP	Has not been identified on base	Has not been identified on any GSUs
Hairy water flea	*Dumontia oregonensis*	None	ICP	Identified on base	Has not been identified on any GSUs
Monarch butterfly	*Danaus plexippus plexippus*	FR	ICP	Identified on base	Habitat (milkweed) identified on Railroad ROW and Point Ozol GSUs
Vernal pool fairy shrimp	*Branchinecta lynchi*	T	ICP	Identified on base	Found on Railroad ROW GSU, Outer Runway Marker GSU, Middle Runway Marker GSU and potential habitat exists on Point Ozol GSU
Vernal pool tadpole shrimp	*Lepidurus packardi*	E	ICP	Identified on base	Found on Railroad ROW GSU
Valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	T	ICP	Has not been identified on base	Has not been identified on any GSUs
Western bumble bee	*Bombus occidentalis occidentalis*	None	ICP	Has not been identified on base	Has not been identified on any GSUs

Common Name	Scientific Name	Federal Status	State Status	Main Base Status	GSU Status
BCC = Birds of Conservation Concern, USFWS BGEPA = Bald and Golden Eagle Protection Act, USFWS C = Candidate for listing CRPR = California Rare Plant Rank FP = Fully Protected, CDFW ICP = Invertebrate of Conservation Priority, CDFW SSC = Species of Special Concern, CDFW WL = Watch list, CDFW [1]Western Bat Working Group (WBWG) Priority Levels, H= High. [2] Species is also a Department of Defense Partners in Flight mission sensitive priority bird species (DoD 2016). [3] Only species with other federal or state status were included, not all species protected under the MBTA.					
Sources: USFWS 2008 Birds of Conservation Concern, ManTech 2016, USFWS 2018a, USFWS 2018b, USDA list of birds observed on Travis AFB from July 2014 to June 2019.					

3.8 EARTH RESOURCES

Earth resources consist of the earth's surface and subsurface materials. Within a given physiographic province, these resources typically are described in terms of geology, topography and soils, and geologic hazards and paleontology, when applicable. Geology and topography are not affected by invasive plant control activities or any methods including fire or grazing and are thus not discussed further.

Soils are the unconsolidated materials overlying bedrock or other parent material. Soils are typically described in terms of their type, slope and physical characteristics. Differences among soil types in terms of their structure, elasticity, strength, shrink-swell potential and erosion potential affect their abilities to support certain applications or uses. The susceptibility of the soil to erosion depends on several factors including, but not limited to, soil texture, saturation point and slope. Soil erodibility generally decreases with increasing clay and organic matter content, whereas uniform silts and sands tend to have high soil erodibility.

3.8.1 Regulatory Setting

Prime farmland is protected under the Farmland Protection Policy Act (FPPA) of 1981. The FPPA is intended to minimize the impact federal programs have on the unnecessary and irreversible conversion of farmland to nonagricultural uses. It assures that to the extent possible federal programs are administered to be compatible with state, local units of government, and private programs and policies to protect farmland (NRCS 2019). The implementing procedures of the FPPA and NRCS require federal agencies to evaluate the adverse effects (direct and indirect) of their activities on prime and unique farmland, as well as farmland of statewide and local importance, and to consider alternative actions that could avoid adverse effects.

For the purpose of FPPA, farmland includes prime farmland, unique farmland, and land of statewide or local importance. Farmland subject to FPPA requirements does not have to be currently used for cropland. It can be forest land, pastureland, cropland, or other land, but not water or urban built-up land (NRCS 2019).

3.8.2 Affected Environment

Topography: According to the NRCS, Travis AFB lies within the Pacific Border Province of the Pacific Mountain System in the California Trough Section (NRCS 2006). Small areas along the

western border are in the California Coast Ranges Section. This area includes the valley basins adjacent to the Sacramento and San Joaquin Rivers, fans and floodplains of tributary streams, and terraces and foothills around the edge of the valleys. Elevation ranges from sea level to 660 feet (200 meters) in the foothills surrounding the Central Valley. The valley floor is almost flat, and relief is small even along the borders of the area. The flatness of the valley floor contrasts with the rugged hills or gentle mountains that are typical of most of California's terrain (NRCS 2006).

Travis AFB is situated partially in the California Trough Section on the east (Central Valley) and partially in the California Coast Ranges Section on the west. The Coast Ranges bound the Trough Section to the west and consist of low ridges of bedrock that extend from the Vaca Mountains to the northwest of the Installation to the Montezuma Hills southeast of the Installation (NRCS, 2006). The Installation is generally flat with elevations ranging from 20 feet above mean sea level (amsl) in the southwest portion to 160 feet amsl in the northern portion. In general, Travis AFB slopes gently to 38 the south.

Geology and Soils: Travis AFB lies within the Central Valley, which is a large, flat valley that dominates the central portion of California and stretches nearly 400 miles (600 kilometers) north to south. Its northern half is referred to as the Sacramento Valley and its southern half is referred to as the San Joaquin Valley.

Travis AFB is in the southeastern portion of Sacramento Valley and is primarily underlain by Pleistocene-age alluvium consisting of sand, gravel, silt, and clay lenses, which is a body of ore, rock or a geological deposit that is thick in the middle and thin at the edges, resembling a convex lens. However, the northern portion of the Installation consists of recent origin alluvium with Tertiary outcrops interbedded with volcanic debris of the Tehama Formation, Pleistocene-Pliocene non-marine sediments, and Eocene marine sediments of the Markley Formation (NRCS, 2006 and NRCS 1974).

The soils have weathered under a distinctive climatic cycle characteristic of the Pacific coast soil region (NRCS 2018). The lower layers of most of the soils are dense and compact. They are comparatively impervious to air and retard the penetration of roots or water. Consequently, there is little drainage through the soil. Under the prevailing climate, the natural vegetation growing on these soils consists largely of annual grasses and herbaceous annual forbs. Tules, sedges and water-loving or alkali-resistant grasses cover drainages and areas with irrigation run off. Aside from some summer-growing forb species, most of the vegetation senesces and is dry in the summer months, and the fall rains help promote decomposition. The organic matter that accumulates is largely oxidized and decomposes during late spring and summer (TAFB 2019a).

Soils on the base have been considerably altered by historic agricultural practices, heavy construction and by imported fill. There are 16 soil types present at Travis AFB and GSUs (Table 12). These soil types were mapped by the USDA NRCS in the Web Soil Survey (NRCS 2018). Some of these soil types require special management considerations and may cause limitations to management actions. Such special considerations are reviewed in the Solano County Soils Survey and are too extensive to discuss here (Bates 1977, available online). Soils throughout the base support northern claypan vernal pools (TAFB 2019a).

3.9 UTILITIES AND INFRASTRUCTURE

3.9.1 Regulatory Setting

Infrastructure consists of the systems and physical structures that enable a population in a specified area to function. Infrastructure is wholly human made, with a high correlation between

Table 12. Soil Map Units on Travis AFB and GSUs.

Map Symbol	Map Unit Name	Main Base Area (acres)	GSU Area (acres)
AlC	Altamont-San Ysidro-San Benito complex, 2 to 9 percent slopes	341.6	-
AoA	Antioch-San Ysidro complex, 0 to 2 percent slopes	1914.7	22.8
AsA	Antioch-San Ysidro complex, thick surface, 0 to 2 percent slopes	1275.6	9.4
BP	Borrow Pit	34.4	-
Ca	Capay silty clay loam	16.4	189.5
CvD2	Corning gravelly loam, 2 to 15 percent slopes, eroded	92.3	-
DbE	Dibble-Los Osos loams, 9 to 30 percent slopes	82.4	1.6
DlC	Dibble-Los Osos clay loams, 2 to 9 percent slopes	224.9	-
MkA	Millsap sandy loam, 0 to 2 percent slopes	161.1	-
MmE	Millsholm loam, 15 to 30 percent slopes	37.2	27.8
Om	Omni clay loam	8.6	-
Pc	Pescadero clay loam	2.1	-
RoA	Rincon clay loam, 0 to 2 percent slope	-	16.5
SeA	San Ysidro sandy loam, 0 to 2 percent slopes	604.5	10.2
Sh	Solano loam	222.6	31.9
Sk	Solano-Pescadero complex	-	2.7
W	Water	58	1.6

the type and extent of infrastructure and the degree to which an area is characterized as "urban" or developed. The availability of infrastructure and its capacity for expansion are generally regarded as essential to the economic growth of an area. The infrastructure components discussed in this section include airfield, transportation, utilities, and solid waste management.

3.9.2 Affected Environment

The infrastructure and utility information presented in this section provides an overall general description of each infrastructure component at Travis AFB.

Water Supply: The Travis AFB water system utilizes both surface water and groundwater from five wells, and includes distribution piping, storage tanks, hydrants, and other appurtenances. Travis AFB currently receives approximately 90 percent of its water from the Travis AFB Water Treatment Plant, which is a conventional 7.5 million gallons per day plant with pre-ozonation owned and operated by the City of Vallejo. Lake Berryessa and Barker Slough serve as the surface water sources for this water (Jacobs 2016). Travis AFB purchases water from a California State Water Project that originates in Lake Oroville and flows through the Sacramento River to the North Bay Aqueduct pumping facility then to the water treatment plant located on the installation. The treatment plant also receives surface water from the Solano Project, which provides water from Lake Berryessa transported by the Putah South Canal to the terminal reservoir (TAFB 2015b). The remaining 10 percent of potable water is obtained from government-owned water wells. If the Travis AFB water treatment plant is down for maintenance, water is obtained from the groundwater wells at Cypress Lakes Golf Course a few miles north of the installation. Water from both sources is then disinfected and fluoridated (TAFB 2015b).

Sanitary Sewer and Wastewater System: The sanitary sewer system serves approximately 2,006 acres within Travis AFB. Industrial and domestic wastewater generated on the installation is collected and discharged to the Fairfield-Suisun Wastewater Treatment Plant, a publicly owned treatment works (POTW) located off the installation and operated by the Fairfield-Suisun Sewer District (FSSD) (Jacobs 2016). The installation's sanitary sewer system consists of pipes, OWSs, pump stations, and lift stations. Connections include lavatories, shower rooms, janitorial sinks, floor drains, and wash racks from industrial facilities as well as all family housing units (TAFB 2016).

Storm Drainage System: Stormwater runoff flows through Travis AFB from approximately 2,900 acres of up-gradient land to the north (Jacobs 2016). Surface water drainage on the installation flows from eight distinct drainage basins (sub-watersheds) based on topography and drainage patterns into the stormwater collection system on Travis AFB (TAFB 2016). The stormwater collection system consists of curb inlets, drop inlets, underground storm drains and open ditches that support drainage areas that discharge to several outfalls. The storm drain system is designed to handle a 10-year, 24-hour storm (TAFB 2015b). Stormwater from Travis AFB discharges to the south, flowing into several swamps, marshy areas, and troughs before discharging into Hill Slough and Loco Slough, and ultimately enters Suisun Bay, south of Travis AFB (TAFB 2015b).

Electrical System: The Western Area Power Administration (WAPA) provides 93 percent of electrical power at Travis AFB with the remaining 7 percent delivered by Pacific Gas and Electric (PG&E). The electrical distribution system, which is owned, operated, and maintained by City Light & Power, Inc. (CLP), a private electric utility, includes three substations and overhead and underground transmission lines. Approximately 80 percent of the transmission lines are underground. The electrical system serving the DGMC is operated by a separate contractor, and the housing distribution system is owned by Balfour Beatty Communities.

Natural Gas System: Travis AFB receives approximately 90 percent of its gas supply from Shell Energy and 10 percent from PG&E.

Communication Systems: All outside plant copper and fiber optic cables designated for official use on Travis AFB are owned by the Air Force and consist of approximately 83.5 miles of copper and 242 miles of fiber cable. Cable maintenance is provided through an operations and maintenance Base Telecommunications System contract, and commercial cables are leased from AT&T. The copper and fiber-optic cable plant supports the following communications requirements: administrative telephones; C2 telephones; fire and crash systems; security alarm systems; radio systems; Energy Monitoring and Control Systems (EMCS); and low-speed point-to-point data systems (Jacobs 2016).

Solid Waste: The municipal solid waste generated at Travis AFB is collected and disposed of through contracted services. Under a MOA between the City of Fairfield and Republic Services (Formerly Solano Garbage) and in accordance with the Travis AFB Integrated Solid Waste Management contract, Republic Services collects refuse and recyclable materials from collection points on Travis AFB. Republic Services transports the refuse to the off-installation Potrero Hills Landfill for disposal at least once a week. Recyclable materials are transferred to off-installation processing centers and then sold (TAFB 2017c).

3.10 TRANSPORTATION AND TRAFFIC

3.10.1 Affected Environment

Four gates provide vehicular access to Travis AFB. The Main Gate and Hospital Gate provide access from the west, utilizing Air Base Parkway from the city of Fairfield. The North Gate provides access from Vacaville and unincorporated areas of Solano County north of the installation, utilizing North Gate Road. Additionally, the South Gate is the principal point of access to Travis AFB for commercial traffic utilizing Petersen Road from the southwest.

Travis AFB contains more than 190 miles of roadways within the installation, with approximately 38 miles of those roads considered arterial. The capacity of roadways on the installation is generally good. Delays are limited to primarily to the gates during peak hours. The paving condition is adequate for the traffic usage (TAFB 2016).

3.11 ENERGY RESOURCES

3.11.1 Regulatory Setting

NEPA requires the identification of all potentially significant impacts to the environment, including energy impacts. Energy Conservation requires an analysis of a project's energy use to determine if the project may result in significant environmental effects due to wasteful, inefficient, or unnecessary use of energy, or wasteful use of energy resources. The goal of conserving energy implies efficient use of energy by decreasing overall energy consumption, decreasing reliance on natural gas and oil, and increasing reliance of renewable energy resources.

3.11.2 Affected Environment

Currently there are large amounts of energy usage in the project area given that the Proposed Action would take place base-wide and at the GSUs. The total employee population at Travis AFB is approximately 7,393 active duty military personnel, 3,257 Air Force Reserve, and 3,692 civilians. Housing facilities include 1,320 Family Units and 1,215 Dorm Rooms TAFB 2016). The Potrero Hills and Pt. Ozol GSUs have a number of regular personnel that work at these facilities though no living quarters are currently in use. Given the status of the Project Area as an active Air Force Installation, energy use is understandably high.

3.12 CLIMATE CHANGE

Climate change refers to long-term changes in temperature, precipitation, wind patterns, and other elements of the earth's climate system. An ever-increasing body of scientific research attributes these climatological changes to GHG emissions, particularly those generated from the production and use of fossil fuels. The U.S. EPA has not issued explicit guidance or methods on how to conduct project-level GHG analysis.

3.12.1 Regulatory Setting

While climate change has been a concern for several decades, the establishment of the Intergovernmental Panel on Climate Change by the United Nations and World Meteorological Organization in 1988 led to increased efforts devoted to GHG emissions reduction and climate change research and policy. These efforts are primarily concerned with the emissions of GHGs generated by human activity, including carbon dioxide, methane, nitrous oxide, tetrafluoromethane, hexafluoroethane, sulfur hexafluoride, and various hydrofluorocarbons. Carbon dioxide is the most abundant GHG; while it is a naturally occurring component of Earth's atmosphere, fossil-fuel combustion is the main source of additional, human-generated carbon dioxide.

A GHG emissions inventory estimates the amount of GHGs discharged into the atmosphere by specific sources over a period of time, such as a calendar year. Tracking annual GHG emissions allows countries, states, and smaller jurisdictions to understand how emissions are changing and what actions may be needed to attain emission reduction goals. U.S. EPA is responsible for documenting GHG emissions nationwide, and the California Air Resources Board does so for the state.

National GHG Inventory

The U.S. EPA prepares a national GHG inventory every year and submits it to the United Nations in accordance with the Framework Convention on Climate Change. The inventory provides a comprehensive accounting of all human-produced sources of GHGs in the United States, reporting emissions of carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, and nitrogen trifluoride. It also accounts for emissions of carbon dioxide that are removed from the atmosphere by "sinks" such as forests, vegetation, and soils that uptake and store carbon dioxide (carbon sequestration). The 1990–2016 inventory found that of 6,511 million metric tons of carbon dioxide equivalent GHG emissions in 2016, 81% consist of carbon dioxide, 10% are methane, and 6% are nitrous oxide; the balance consists of fluorinated gases (USEPA 2018). In 2016, GHG emissions from the agricultural sector accounted for 9% of U.S. GHG emissions and the commercial and residential economic sector accounted for 11%.

To date, no national standards have been established for nationwide mobile-source GHG reduction targets, nor have any regulations or legislation been enacted specifically to address climate change and GHG emissions reduction at the project level.

State GHG Inventory

The Air Resources Board collects GHG emissions data for transportation, electricity, commercial/residential, industrial, agricultural, and waste management sectors each year. It then summarizes and highlights major annual changes and trends to demonstrate the state's progress in meeting its GHG reduction goals. The 2019 edition of the GHG emissions inventory found total California emissions of 424.1 million metric tons of carbon dioxide equivalent for 2017, with the agricultural sector responsible for 8%, residential 7%, and commercial 5% of total GHGs (ARB 2019c). It also found that overall statewide GHG emissions declined from 2000 to 2017 despite growth in population and state economic output (ARB 2019d).

Assembly Bill 32 required the Air Resources Board to develop a Scoping Plan that describes the approach California will take to achieve the goal of reducing GHG emissions to 1990 levels by 2020, and to update it every five years. The Air Resources Board adopted its second updated plan, California's 2017 Climate Change Scoping Plan, which reflects the 2030 target established in EO B-30-15 and SB 32. The Assembly Bill 32 Scoping Plan and the subsequent updates contain the main strategies California will use to reduce GHG emissions.

The GHG emissions are analyzed as a cumulative impact due to the global nature of climate change. In assessing cumulative impacts, it must be determined if a project's incremental effect is "cumulatively considerable". To make this determination, the incremental impacts of the project must be compared with the effects of past, current, and probable future projects. Although climate change is ultimately a cumulative impact, not every individual project that emits GHGs must necessarily be found to contribute to a significant cumulative impact on the environment.

The Bay Area Air Quality Management District (BAAQMD) identified significance thresholds of 1,100 metric tons of carbon dioxide equivalent emissions per year for operational non-stationary emissions or compliance with qualified GHG reduction strategy, a significance threshold of 10,000

metric tons of carbon dioxide equivalent emissions per year from operational stationary GHG sources and no thresholds for construction-related activities (BAAQMD 2017). A qualified GHG reduction strategy is a general plan or climate action plan that requires adoption via a public review process following environmental review (BAAQMD 2017).

3.12.2 Affected Environment

The proposed project is in a portion of Solano County with a well-developed road and street network, accessed by several major roads. The project area is mainly undeveloped grasslands surrounding residential, industrial and commercial buildings. Traffic congestion during peak hours is uncommon except around base gates. The current air emissions of the Base including GHGs are reviewed in Section 3.4.3 and discussed in Section 4.5.

3.13 WILDFIRE

3.13.1 Regulatory Setting

In the past several years California has experienced extreme and devastating wildfires throughout the state. As a result, California now requires analysis of project impacts to wildfires.

3.13.2 Affected Environment

Wildfires are a regular occurrence on and around Travis AFB between May through October. According to the Wildland Fire Management Plan, 50 wildfires totaling 180 acres occurred on Travis AFB (TAFB 2019). Since 2015, several other wildfires have burned on the base including the Branscombe fire in 2018 that started on base and quickly ran off base to the south where it burned 3,400 acres destroying homes and infrastructure. Some documented causes of wildfires at the installation include USAF mission related activities, cigarettes, vehicle caused fires and fireworks. Travis AFB has a new but active prescribed fire program. Between 2018 and 2020, a total of three prescribed fires were implemented, with most occurring between June and September. The treated area ranged from 7 – 10 acres.

A Wildland Fire Management Plan was prepared for Travis AFB in 2019. The Wildland Fire Management Plan provides for wildland fire prevention, management, and safety using methods that protect public property and natural and cultural resources. Wildland fire management on Travis AFB is guided by Section 3P of AFMAN 32-7003, AFI 32-2001, Fire Emergency Services Program, the Air Force Civil Engineer Center Environmental Operations Fire Playbook, and Federal Wildland Management Policy. Travis AFB is responsible for suppressing Wildland Urban Interface fires and supporting natural resource suppression efforts during wildfires and prescribed burns.

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This EA provides a detailed analysis of the potential direct, indirect, and cumulative impacts that would result from implementation of the Proposed Actions. Direct impacts would be those effects that are caused by the action and occur at the same time and place (40 CFR §1508.1). Indirect impacts are those effects that would be caused by the Proposed Action and would occur later in time or further removed in distance but would still be reasonably foreseeable (40 CFR §1508.1). Cumulative impacts would be those that would result from the incremental impacts of the Proposed Action when added to other past, present, and reasonably foreseeable future actions. As appropriate, potential impacts are further discussed as being temporary, short-term, or long-term. For purposes of this EA, temporary effects are defined as those that would last for the duration of implementation of a given treatment or control method. Short-term impacts would last from the completion of a given treatment, or from the first treatment if repeated annually to three years. Long-term impacts are defined as those impacts that would occur from three to 10 years after a given treatment, or from the first treatment if repeated annually. Permanent impacts indicate an irretrievable loss or alteration.

In an EA, the magnitude of the impact is considered regardless of whether the impact is adverse or beneficial. Environmental consequences are weighed by their significance. Under NEPA, significance is based on context and intensity (40 CFR. § 1508.27); under in the state process, significance is contextualized as a significant effect on the environment resulting from the entire action. Context considers the geographic extent of the potential impact (local, regional, or greater extent) while intensity considers the severity of the impact.

The following terms are used to describe the magnitude of impacts in this EA:

- No Effect: The action would not cause a detectable change.
- Negligible: The impact would be at the lowest level of detection; the impact would not be significant.
- Minor: The impact would be slight but detectable; the impact would not be significant.
- Moderate: The impact would be readily apparent; the impact would not be significant.
- Major: The impact would be clearly adverse or beneficial; the impact has the potential to be significant. The significance of adverse and beneficial impacts is subject to interpretation and should be determined based on the final proposal. In cases of adverse impacts, the impact may be reduced to less than significant by mitigation, design features, and/or other measures that may be taken

4.2 LAND USE

4.2.1 Alternative 1 (No Action Alternative)

Under the No Action Alternative, there would be no change to existing conditions as described in Section 3 and there would be no new effects on land use.

4.2.2 Alternative 2 (Comprehensive Management)

Implementation of all proposed activities under Alternative 2 would result in overall negligible, beneficial, long-term, effects and minor, temporary, adverse effects on land use. The actions would occur entirely on Travis AFB property and the projects associated with Alternative 2 would

be sited in a manner compatible with Travis AFB's land uses, IDP (Jacobs 2016) and surrounding off-installation land uses. Invasive species projects are temporary and short-term in nature and besides causing temporary access restrictions, do not interfere with current or future land use of a site. Implementation of all proposed activities under Alternative 2 would result in overall negligible, non-significant impacts on land use.

Grazing

The program would be expanded to include grazing on undeveloped land. Grazing these new areas would not change the "undeveloped" land use classification. Current and future grazing areas would comply with existing land use plans and policies as identified in the Travis AFB IDP (Jacobs 2016). Any new grazing leases would be reviewed and approved by the Facility Board Working Group and signed off on by the Commander and/or delegate. Grazing leases signed by the 60th AMW Commander are for one-year terms with four option years and could be discontinued at any time per Section 3 of the Grazing Land Use Rules for mission critical reasons.

The IDP (Jacobs 2016) does not include plans for developing areas proposed for inclusion in the cattle grazing program in the short to long term (11+ years) though conflicting long-range maps in the IDP do show two or three projects in the 20-year long-range plan map. Either grazing expansion would not happen in these areas or they would be utilized temporarily until those projects were funded. Grazing infrastructure would easily be removed, and leases not renewed if future mission requirements necessitate development that is not in the IDP (Jacobs 2016). Therefore, the actions carried out under Alternative 2 would result in direct, reversible, minor, long-term, non-significant impacts on land use.

Fire Management Treatments

Cattle grazing and recreation would be limited for several months following a burn; required mission activities would proceed as needed. Grazing lessees would be advised of planned burn locations that may impact their cattle operations. These effects would be temporary, and a prescribed burn would likely have a neutral to beneficial long-term effect on livestock forage production especially since it reduces the cover of medusahead for up to four years, a plant that is unpalatable to livestock after May and dominates some pastures. There would be no restrictions on land use for mission projects except for the day of the fire. Prescribed fire does not impact land use categories or short to long-term use of the land. Construction and maintenance of firebreaks would not impact land use as they would be used for multiple purposes while also serving as firebreaks. Therefore, no significant impacts to land use are anticipated as a result of prescribed burns under Alternative 2. Prescribed burns would have a direct, temporary, short-term (1-3 months) minor adverse impact to land use within prescribed burn units (Figure 5).

Chemical Treatments

Cattle grazing and outdoor recreation may be limited for a period of several hours to several weeks after herbicide application, depending on the chemical used. Large-scale herbicide application would result in some loss of forage for livestock. Grazing lessees would be advised of planned herbicide applications that may impact their livestock operations. These effects would be temporary and invasive plant control would likely have a beneficial long-term effect on cattle forage. Chemical control activities would not have an impact on the mission's use of any land except for during and within several hours to days of treatment for personnel safety, generally. Therefore, no significant impacts to land use are anticipated as a result of chemical treatments under Alternative 2. Chemical treatments would have direct, minor, temporary, short-term adverse impact to land use.

Manual and Mechanical Treatments

Large-scale mechanical treatments would reduce available forage for grazing animals. However, these methods would target invasive plants generally less palatable to cattle, horses, sheep and goats. Even large-scale mechanical treatments would not significantly reduce forage on a grazing management unit or base-wide scale. These effects would be temporary and invasive plant control would likely have a beneficial long-term effect on livestock forage. Manual control treatments for invasive fauna such as bullfrogs are not expected to have an impact on land use. Manual and mechanical treatment does not have an effect on the mission's use of land except possibly during and after treatment for a period of time. All treatment would be sited in compliance with the IDP (Jacobs 2016) and generally take place in undeveloped lands not used for mission purposes. Invasive species treatments do not typically target land scheduled for disturbance but would treat them post-disturbance to prevent weed establishment. Short-term, temporary, minor, direct adverse impacts on outdoor recreation would occur. Outdoor recreation would be limited for a period of several hours after manual or mechanical control, but treatments would improve the long-term ecological aesthetic of an area, benefiting future users of the land. Therefore, no significant impacts to land use are anticipated as a result of manual or mechanical treatments under Alternative 2. Manual and mechanical treatments would have direct, temporary, short-term, minor adverse impact on land use.

Habitat Restoration

Livestock may be temporarily excluded from grazing in restored habitat for one year or longer after planting. Restored areas would be relatively small and would not significantly reduce forage on a grazing management unit or base-wide scale. Revegetation decisions would be compatible with future uses and management actions and would consider suitability and cost of available options as well as the suitability of the restoration site itself. Restoration do not have an effect on the mission's use of land except possibly during and after treatment for a short period of time. All restoration would be sited in compliance with the IDP (Jacobs 2016) and generally take place in undeveloped lands not used for mission purposes or post-mission disturbance for restoration purposes. Therefore, no significant impacts to land use are anticipated as a result of habitat restoration under Alternative 2. Habitat restoration may temporarily, moderately adversely affect land use, but would have a long-term beneficial impact.

4.3 AIR QUALITY

4.3.1 Alternative 1 (No Action Alternative)

Under the No Action Alternative, there would be no change and no new effects to air quality from the invasive species management program as described in Section 3.0.

Prescribed burns, grazing operations, mechanical/manual, chemical, fire/fuel breaks and habitat restoration conducted under the No Action Alternative have the potential for direct, temporary adverse effects to air quality. Such emissions contribute to baseline conditions and are a small percentage of total emissions for the Air Districts that encompass Travis AFB and its GSUs. On-going activities do not involve the use of equipment greater than 50 horsepower. While some of the herbicides proposed for use have the potential to emit VOCs, none of the active ingredients are subject to the California Department of Pesticide Regulation's nonfumigant VOC regulations (CA DPR 2020). For these reasons, there would not be significant adverse impacts to air quality as a result of the No Action Alternative. Impacts would be temporary, short-term, and minor.

4.3.2 Alternative 2 (Comprehensive Management)

Grazing

Grazing infrastructure construction may generate particulate emissions as fugitive dust from ground-disturbing activities (e.g., digging, soil piles) and from combustion of fuels in construction equipment. Fugitive dust emissions would be greatest during the initial site preparation activities and would vary from day to day depending on the construction phase, level of activity and prevailing weather conditions. The quantity of uncontrolled fugitive dust emissions from a construction site is proportional to the area of land being worked and the level of construction activity. Trough and well installation would require the greatest amount of ground disturbance and equipment, yet they only require approximately 225 square feet of disturbance. Grazing fence requires less than a one square foot area of disturbance for each post and most require no disturbance as posts would simply be pounded into the ground with no soil exposure. The area of disturbance required would be relatively small thus the effects to air quality from fugitive dust and fuel combustion would be negligible. Therefore, short-term, direct, temporary, minor adverse impacts to air quality from grazing infrastructure construction are anticipated.

GHGs from non-renewable sources often occur from ranching operations. GHGs, including carbon dioxide (CO2) and methane (CH4) have been linked to climate change. The EPA regulates GHGs from manure from livestock operations under 40 CFR Part 98, Subpart JJ. However, Subpart JJ does not apply to “pasture/range/paddock systems” (Subpart JJ, §98.360I), such as those on Travis AFB.

Under Alternative 2, GHGs would be generated primarily from vehicles used to manage cattle operations. The increase in cattle grazing would increase the maximum number of ranchers, ranch hands, and vehicles used for fence installation (identified as support contractor personnel) on the base from two to nine. The additional personnel were analyzed as mobile sources utilizing the ACAM (Table 13; Appendix E).

The General Conformity Rule applies to actions in air quality nonattainment or maintenance areas and considers both direct and indirect emissions. The rule applies only to federal actions that are considered “regionally significant” or where the total emissions from the action meet or exceed the de minimis thresholds presented in 40 CFR §93.153. Travis AFB is within a nonattainment area for PM2.5. The additional vehicle emissions would not result in an impact to the National Ambient Air Quality Standards or exceedance of General Conformity thresholds. Therefore, no significant effects to air quality would occur as a result of grazing expansion under Alternative 2.

Table 13. Estimated Air Pollutant Emissions for Proposed Personnel Increase (Mobile Source) at Travis AFB

Pollutant	Alternative Emissions[1]
PM10	0.021 tpy
PM2.5	0.001 tpy
Carbon Monoxide (CO)	0.134 tpy
Carbon Dioxide (CO_2)	23.8 tpy
Nitrogen Oxides (NO_x)	0.011 tpy
Sulfur Oxides (SO_x)	0.0002 tpy
VOC	0.021 tpy
NH_3	0.002 tpy

Pollutant	Alternative Emissions[1]
Lead	0.00 tpy

[1] Emissions estimated using the Air Conformity Applicability Model for 1 additional rancher and 2 additional base personnel as shown in Appendix E.

Fire Management Treatments

Construction and maintenance of firebreaks would have similar impacts to air quality as grazing infrastructure construction (see above) and are not expected to be significant but minor, short-term adverse effects. Most firebreaks would continue to be mowed with less than 50% of them exposing mineral soils. The additional equipment operation used for firebreak installation and other mechanical treatment were analyzed as construction site grading utilizing the ACAM (Table 14; Appendix E).

Smoke from prescribed fires and emissions from vehicles and equipment used for fire management would reduce visibility and overall air quality in the vicinity of these activities. These effects would be adverse, generally localized, temporary and would range from negligible to moderate. Moderate adverse effects would be very localized at the sites of prescribed fires and short-term, on the order of less than 24 hours.

Wildland fires would emit large amounts of trace gases and particles. The wide variety of pollutants released by wildland fire include GHGs (CO2, CH4, nitrous oxide (N2O)), and photochemically reactive compounds (e.g., carbon monoxide (CO), nonmethane volatile organic carbon (NMVOC), nitrogen oxides (NOx)) and fine and coarse PM) (Urbanski et al. 2009).

Prescribed burn contributions to air quality that most affect human health are increased levels of particulate matter (90% of total particulate matter from wildfires is PM2.5, but also PM10), Ozone (O3) and carbon monoxide (US EPA 2019). Wildland fires influence climate both directly, through the emission of GHGs and aerosols, and indirectly, via secondary effects on atmospheric chemistry (e.g. O3 formation) and aerosol and cloud microphysical properties and processes. Air quality impacts occur through the emission of primary pollutants (e.g., PM, CO, NOx) and the production of secondary pollutants (e.g. O3, secondary organic aerosols) when NMVOC and NOx released by fires undergo photochemical processing. Air quality would be degraded through local, regional and continental scale transport and transformation of fire emissions (Urbanski et al. 2009).

Total emissions for various air pollutants from the proposed prescribed burns were calculated for Alternative 2 (Table 15). Fuel loads used to estimate emissions are based on average, grazed/mowed residual matter values of 2,000 lbs/acre. The acreage used to estimate emissions (493 acres) reflects the maximum numbers of acres that would be burned annually under Alternative 2 (Table 2).

Table 14. Estimated Air Pollutant Emissions for Proposed Heavy Equipment Use (Site Grading Phase) at Travis AFB

Pollutant	Alternative Emissions[1]
PM10	1.99 tpy
PM2.5	0.003 tpy
Carbon Monoxide (CO)	0.058 tpy
Carbon Dioxide (CO_2)	16.6 tpy
Nitrogen Oxides (NO_x)	0.065 tpy

Sulfur Oxides (SO_x)	0.0001 tpy
VOC	0.010 tpy
NH_3	0.00002 tpy

[1] Emissions estimated using the Air Conformity Applicability Model for heavy equipment listed in Appendix E.

Table 15. Estimated Air Pollutant Emissions for Proposed Prescribed Burns at Travis AFB

Pollutant	Emission Factor[1]	Emissions per Acre (1 ton RDM/acre)	Comprehensive Mgt. Emissions (493 acres/year)
PM10	21.6 lbs/ton	10.8 lbs	5.32 tpy
PM2.5	6.4 lbs/ton	3.2 lbs	1.58 tpy
Carbon Monoxide (CO)	86 lbs/ton	43 lbs	21.20 tpy
Carbon Dioxide (CO_2)	3663.2 lbs/ton	1831.6 lbs	902.98 tpy
Methane (CH_4)	5.7 lbs/ton	2.85 lbs	1.40 tpy
Nitrous Oxide (N_2O)[2]	0.46 lbs/ton	0.23 lbs	0.11 tpy
Nitrogen Oxides (NOx)[3]	4.9 lbs/ton	2.45 lbs	1.20 tpy
Sulfur Oxides (SOx)[3]	0.74 lbs/ton	0.37 lbs	0.18 tpy

[1] Source: Consume 3.0 (Prichard et al. 2012).
[2] Source: AFCEC 2020. Air Emissions Guide for Air Force Transitory Sources Table 3-4.
[3] AFCEC 2020 does not include NO_x or SO_2 entries, therefore NO_x was set to the specific crop values from Darley (1979), where available, or to the average field crop or orchard crop Darley values where specific crops were not listed. SO_2 values were set to the average of the Jenkins (1996) field crop values for the field crops, and the average of the Jenkins walnut and almond values for the orchard crops. Darley data were not used for SO_2 because of known overestimates due the method used.
Lbs/ton = pounds per ton
tpy = tons per year

All prescribed fires require burn day authorization from the local air district and must be coordinated with the local air district, through the Travis AFB Air Quality Manager. Coordination with the air district would occur at least five days prior to the prescribed fire for weather considerations, the day prior to the prescribed fire for weather updates and the morning of the prescribed fire to determine state allocated acreage for the area.

In accordance with the WFMP (Chloeta 2019; Section 2.2.3.2), IAPs would specify conditions required for burning that would minimize impacts to air quality from prescribed fire, including compliance with the requirements of state and local air quality regulatory agencies. Per the WFMP, smoke management on Travis AFB and the GSUs would follow recommendations of the latest edition of the National Wildfire Coordinating Group Publication *Smoke Management Guide for Prescribed Fire (*February 2018, PMS 420-2).

Per the WFMP, open burning on Travis AFB and its GSUs must be done in accordance with Open Burning BAAQMD Regulation 5 and/or YSAQMD Rule 2.8 (find an extensive list of mandates in Chloeta 2019, WFMP Section 2.2.3.2 Page 34). These regulations are intended to provide for the continuation of agricultural burning, including prescribed fire, as a resource management tool and provide increased opportunities for prescribed fire and agricultural burning, while minimizing smoke impacts on the public. Because of California's long and recent history with large, catastrophic wildfires, prescribed fire is understood to be an important tool for protection of human life and safety as well as air quality from inevitably larger, uncontrolled events.

A Smoke Management Plan (SMP) must be submitted to the air district prior to the proposed burn. Each air district has developed specific requirements for SMPs based upon §80160 of 17 California CR Subchapter 2.

Adverse effects to air quality from prescribed fires primarily affect visibility and human health and are minor to moderate because the fires are permitted only when the applicable Air Quality Management District believes that adverse effects of smoke on human health would be minimized. Reduced visibility from smoke that drifts across roads would be mitigated by traffic controls during prescribed fires and in case of wildfire suppression. The primary concerns with smoke are generally at night when inversions would trap the smoke and elevate particulate levels or when a fire is very intense or large. Prescribed burns help limit large intense wildfires that would have greater impacts to the mission, environment, air quality and human health. Prescribed burns would be conducted during daytime hours and burn size would be limited to the numbers of acres approved for burning by the applicable air district.

All adverse impacts to air quality from wildland fire management activities would be temporary, short-term and moderate and would not affect regional air quality attainment status as all air district regulations would be followed. Emissions from fire response equipment is considered exempt. Therefore, no significant adverse impacts to air quality are anticipated as a result of Alternative 2 fire management activities.

Chemical Treatments

Herbicide application could result in the fugitive release of VOCs and organic hazardous air pollutants from both active and inactive ingredients. Air pollutants may be emitted during pesticide application and up to 30 days after application. Although particulates may be emitted due to the use of granular or dust/powder herbicides, particulate matter emissions are considered negligible (AFCEC 2018). VOC emissions were estimated for the maximum number of acres that would potentially be treated under Alternative 2 (200 acres, Table 16). Actual emissions would be lower if the maximum acreage is not treated within a given year. Although some of the herbicides proposed for use have the potential to emit VOCs, none of the active ingredients are subject to the California Department of Pesticide Regulation's nonfumigant VOC regulations, which as of 6 March 2020 only includes pesticides with the following active ingredients: abamectin, chlorpyrifos, gibberellins and oxyfluorfen (CA DPR 2020).

Another concern with herbicide application is herbicide drift causing negative affects to nearby receptors (i.e., non-target plants, wildlife or humans). Drift is most likely to occur with aerial application which is not planned for use at Travis AFB at this time. Spray drift is dependent primarily on droplet particle size, release height and wind speed. Release heights would generally be lower than those used in standard agricultural application methods.

By applying herbicides in accordance with product label requirements and BMPs listed in Appendix D, including weather-related use restrictions, droplet size and boom height restrictions, the risk of drift or volatilization would be minimized. Adverse impacts would be short-term, temporary and minor to moderate; therefore, no significant impacts to air quality are anticipated as a result of Alternative 2 chemical treatments.

Table 16. Estimated Volatile Organic Compound (VOC) Emissions from Herbicide Applications

Application rates and acres treated in this table are only estimates. Actual application rates and annual acreages would vary based on species distribution and product label recommendations.

Active Ingredient	Application Rate	Rate Unit	Acres Treated	Total VOC Emissions (lbs)	VOC Emission Rate (lbs/ac/application)
Aminopyralid, Triisopropanolamine salt	7	ounces/acre	100	2.97	0.03
Chlorsulfuron	1.5	ounces/acre	30	0.03	0
Glyphosate, Isopropylamine salt	2	gallons/acre	50	0	0
Imazamox, ammonium salt	1	gallons/acre	2.5	8.56	3.43
Imazapyr, Isopropylamine salt	0.75	gallons/acre	50	19.06	0.38
Triclopyr, Butoxyethyl ester (BEE)	2	gallons/acre	157.5	213.62	1.36
Triclopyr, Triethylamine salt (TEA) – in formulation with aminopyralid	2.25	gallons/acre	27.5	30.03	1.09
Triclopyr, Triethylamine salt (TEA)	2.67	gallons/acre	18.25	442.09	2.95
Triclopyr, Triethylamine salt (TEA) (Renovate 3)	2	gallons/acre	100	218.88	2.19
Triclopyr, Triethylamine salt (TEA)	0.5	gallons/acre	150	82.79	0.55
Clethodim	6	ounces/acre	100	52.64	0.26
Endothall, Mono [N,N-DIMETHYL ALKYLAMINE] Salt	6.8	gallons/acre	60 (2 applications)	399.31	3.33
Sulfometuron-Methyl	0.375	lbs/acre	322	1.23	0

Source: CA Department of Pesticide Regulation VOC Calculator (https://apps.cdpr.ca.gov/voc-calculator/)

Manual and Mechanical Treatments and Habitat Restoration

Combustive emissions from operation of hand-held gasoline powered equipment is considered de minimis and not regulated. Combustive emissions from heavy equipment and vehicles would be of short duration and similar in scale to that analyzed for other construction projects on the base which did not result in impacts to air quality. Mowing would be done using weed-whackers, riding mowers, multi-terrain loaders with a front-mounted mowing deck or similar equipment. There would be no impacts on air quality from manual treatment methods related to non-native fauna control. Only negligible to minor, direct and temporary neutral to adverse impacts to air quality are expected from these activities. Therefore, there would be no significant impacts to air quality as a result of manual and mechanical treatments or habitat restoration under Alternative 2.

Table 17 provides a summary of estimated air pollutant emissions from all activities proposed under Alternative 2.

Table 17. Total Estimated Air Pollutant Emissions for All Activities Under Alternative 2.

Pollutant	Alternative Emissions
PM10	7.331 tpy
PM2.5	1.584 tpy
Carbon Monoxide (CO)	21.392 tpy
Carbon Dioxide (CO_2)	943.38 tpy
Nitrogen Oxides (NO_x)	1.276 tpy
Sulfur Oxides (SO_x)	0.018 tpy
VOC	1468.3 tpy
NH_3	0.002 tpy
Lead	0.00 tpy

4.4 WATER RESOURCES

4.4.1 Alternative 1 (No Action Alternative)

4.4.1.1 Groundwater

No direct effects to groundwater would occur as a result of the No Action Alternative, but long-term, adverse, indirect effects could occur. On-going actions that have been analyzed individually in other documents would continue. Any new actions would be analyzed on a project-by-project basis using the USAF EIAP. Under the No Action Alternative, invasive plant biomass would be allowed to accumulate in the absence of adaptive grazing and limited prescribed burns. This would increase the risk of wildfire, and potentially result in larger and higher intensity burns. This may have the indirect effect of increased runoff, which could result in reduced groundwater levels through loss of recharge and lower stream base flow.

4.4.1.2 Surface Water

Under the No Action Alternative, greater plant biomass across more acreage would potentially create reduced runoff velocity creating better water quality and less erosion along Union Creek. Removal of native and non-native aquatic vegetation from North Gate Pond may lead to oxygen depletion, fish kills, algal blooms, and greater water temperatures through reduced shading though these effects are also likely to occur without vegetation control due to the shallow and small size of North Gate Pond.

Under the No Action Alternative, invasive plant biomass would be allowed to accumulate in the absence of expanded grazing and limited prescribed burns as well as limited mechanical and manual control methods. This would increase the risk of wildfire and potentially result in larger and higher intensity burns. Increased site runoff would result in a more rapid stream rise and an increased potential for flash floods. These burns would also have indirect impacts to water quality as a result of increased erosion and sediment and nutrient transport from storm water runoff from bare areas.

Under the No Action Alternative, current grazing programs would potentially impact surface waters through (1) deposition of nutrient-dense manure, (2) trampling impacts (e.g. erosion, compression, shear), (3) removal of vegetation biomass which would potentially cause increased overland flow with high water volumes, and (4) increased bare soil especially in areas around water troughs, supplements, and gates. Such impacts have not been significant or adverse in the past given that the grazing pastures are not located near Union Creek.

Therefore, the No Action Alternative would have both positive and adverse indirect effects on surface water.

4.4.1.3 Wetlands

Significant, long-term, adverse effects to wetlands would occur as a result of the No Action Alternative. Science has shown that wetlands can become overrun with vegetation in the absence of disturbances such as grazing and fire that remove biomass from the basins. Marty (2005) found that vernal pools excluded from grazing for three years showed a 50-80% reduction in the number of days the pools held continuous water. Under the No Action Alternative, aquatic and terrestrial invasive plant infestations would continue to spread and use an increasing amount of water. Where infestations occur in or near wetlands, there is the potential for decreased water availability and altered wetland hydrology if infestations continue to go untreated.

Under the No Action Alternative, current grazing programs would potentially impact wetlands in the same ways discussed above for surface water. Such impacts have not been significant or adverse in the past and some have been shown to produce beneficial impacts to vernal pools, as discussed above. Overall, grazing is beneficial to the landscape (Barry et al. 2015).

Overall, indirect, adverse, minor to moderate long-term impacts to wetlands are anticipated as a result of the No Action Alternative.

4.4.1.4 Floodplains

No direct impacts to floodplains would occur as a result of the No Action Alternative. There is the potential for increased property or infrastructure damage from flooding if decadent vegetation crowding water ways are not controlled, as has been the case in Union Creek. When live and dead plant material are not managed in waterways it can increase the height or frequency of flooding by blocking flow within the channel.

4.4.2 Alternative 2 (Comprehensive Management)

Under Alternative 2 no significant effects to water resources would occur. Livestock grazing would either be excluded from aquatic resources or would be adaptively managed in areas where they could access aquatic resources. Vegetated buffers would be used to protect aquatic resources from erosion resulting from prescribed burns. Herbicide-specific application buffers would be implemented around aquatic resources to prevent contamination. Any herbicide application in or adjacent to aquatic resources would be done using aquatic-approved herbicides and would follow the APAP best management practices and monitoring requirements. Erosion control measures would be implemented for any areas of exposed ground where soil has the potential to enter a waterway. Work under this alternative conducted in wetlands and 100-year floodplains is anticipated to have overall beneficial impacts by improving water flow and wetland hydrology. Ground disturbance within wetlands and floodplains would be minimized to the greatest extent possible, including limiting firebreak creation to non-soil disturbing methods within wetlands. A Notice of Intent to prepare an EA for Proposed Actions that would occur in floodplains and may affect wetlands was published soliciting public comments in the Daily Republic and Tailwind newspapers on 10 February and 19 February 2021 respectively. The notice invited the public to provide comments on the proposal and any practicable alternatives that may reduce impacts within 30 days.

4.4.2.1 Groundwater

Grazing

Groundwater may be impacted by grazing through decreased water infiltration due to loss of vegetation and compaction of soil which in turn cause increased runoff. If grazing operations are located near stream channels, changes to the channel morphology may impact groundwater by altering the direction and rate of groundwater flow and the depth to groundwater. Changes such as down-cutting lower the streambed and groundwater table (US EPA 1994) could also result from grazing of riparian systems. The location, topography and significant distance between streams and Travis's current and future grazing pastures make these potential adverse impacts unlikely.

Watering troughs would be installed in new pastures created for the grazing expansion. Where possible, troughs would be tied into existing waterlines, but some would require the installation of solar-powered wells that draw groundwater. Using groundwater for agricultural purposes is considered a "beneficial use" by the State Water Resources Control Board. A permit is required for the installation, modification or abandonment of water wells pursuant to the California Well Standards (Bulletins 74-81 & 74-90) and Solano County Code - Chapter 13.10 through Solano County Department of Environmental Management, Environmental Health Division.

Grazing would not impact the approximately 1,000 groundwater monitoring wells located on base as they have protective barriers (e.g. bollards) around them where they are needed.

By carefully monitoring and managing grazing in accordance with the GMP (Hopkinson 2017), impacts to groundwater would be negligible. Permitting through the County would ensure impacts from trough installation are also negligible. Therefore, significant impacts to groundwater are not anticipated as a result of expanding the grazing program under Alternative 2.

Fire Management Treatments

Prescribed burns and exposed soils within mineral firebreaks could create increased site runoff resulting in a more rapid stream rise and an increased potential for flash floods, resulting in reduced groundwater levels through loss of recharge and lower resultant stream base flow. As part of the planning process, prescribed burns and mineral firebreaks would be spaced to prevent concentration of potential impacts in a small area. This allows the ecosystem to assimilate the effects of fire management without substantial change and would help minimize potential indirect impacts to groundwater. Impacts to groundwater should be much less than larger, more intense wildfires that result from poor vegetation management. Indirect, temporary impacts to groundwater would result from prescribed burns or construction and maintenance of firebreaks due to loss of vegetation and associated increased runoff following precipitation events. Therefore, impacts to groundwater are not anticipated as a result of fire management activities under Alternative 2.

Chemical Treatments

There is the potential for herbicides to leach into groundwater. Major factors influencing herbicide movement from an upland site to surface water or groundwater include the herbicide's solubility in water, its photo- or biodegradation characteristics, its ability to bind with soil and organic matter and its ability to persist until it reaches a water source. In addition to chemical mobility, other factors would influence herbicide activity underground and result in groundwater contamination. For example, if microorganisms in the soil that decompose herbicides are absent, as found in some water-saturated soils, herbicides may persist longer than they would in unsaturated soils

(Eglin AFB 2008). Only aquatic application of herbicide has the potential to take place in water-saturated soils at Travis AFB though application would occur to water, not soils generally. All terrestrial application would be on dry soils. See Section 4.6.1.1 for additional information.

Table 18. Mobility, Ground and Surface Water Contamination Potential and Half-lives of Herbicide Active Ingredients in Water.

Herbicide	Mobility	Water Contamination Potential	Half-life in Water
Aminopyralid [1]	Mobile to highly mobile	Potential to reach groundwater in soils with low organic carbon content or shallow groundwater	0.6 days
Chlorsulfuron [2]	Mobile to highly mobile	Moderate potential to contaminate groundwater. High potential for surface runoff	Low pH: 22-23 days High pH: does not degrade
Clethodim[8]	Somewhat mobile	Low risk of surface and groundwater contamination	3 days
Endothall[6]	Highly mobile	Low risk of surface and groundwater contamination	4 -21 days depending on temp.
Glyphosate [3]	Slightly mobile to hardly mobile	Very low potential to contaminate groundwater	7 to 14 days
Imazamox [4]	Very mobile	Potential to contaminate groundwater	6.8 hours
Imazapyr [5]	Mobile	High potential to leach to groundwater, High surface water runoff potential	2.3 to 3 days
Sulfometuron Methyl [6]	Moderately mobile	Potential to leach to groundwater in permeable soils with shallow groundwater, High potential for surface runoff.	6 days to 7 months; slower at high pH.
Triclopyr [7]	Highly mobile	Potential to contaminate groundwater	0.6 to 9.3 days.

[1] U.S. EPA 2014a [3] U.S. EPA 2009 [5] U.S. EPA 2014c [7] U.S. EPA 2014d
[2] U.S. EPA 2012a [4] U.S. EPA 2014b [6] U.S. EPA 2008

Aquatic herbicide application to surface waters, which have the potential to reach groundwater, would occur under the NPDES Aquatic Pesticide Permit issued by the State Water Board and would be subject to compliance with the most recent version of the state-approved Travis AFB APAP (OTIE 2020). See Table 18 for mobility, groundwater contamination potential, and half-life in water of the active ingredients of herbicides proposed for use.

Long-term, short-term, temporary, adverse, negligible to moderate adverse impacts to groundwater from herbicides may result from chemical applications under Alternative 2. However, impacts are not expected to be significant due to the low intensity of impact, the state-approved aquatic application subject to compliance with NPDES Aquatic Pesticide Permit and Travis AFB APAP (OTIE 2020), adherence to herbicide application BMPs in Appendix D and the low use rates expected on Travis AFB and its GSUs.

Manual, Mechanical and Restoration Treatments

Manual and mechanical treatment may result in some loss of vegetative cover, but manually treated areas would be too small to significantly increase runoff and most mechanical treatments leave behind vegetation stubble and root structures that slow water movement. Restoration

treatments would either replace or increase vegetation cover over time, not reduce it. Manual, mechanical and restoration treatments may have short-term, temporary, negligible adverse impacts to groundwater but long-term beneficial impacts to groundwater. Therefore, adverse impacts to groundwater are not anticipated to be significant as a result of treatments under Alternative 2.

4.4.2.2 Surface Water

Grazing

Cattle grazing is currently excluded from Union Creek and all of the ponds on Travis AFB. One permanent pond in the Castle Terrace NRMU is subject to short-term sheep and goat grazing. Alternative 2 would expand cattle grazing to the permanent pond in the Castle Terrace NRMU and to grasslands adjacent to Union Creek. Sheep and goat grazing may be allowed on the banks of Union Creek if vegetation management there becomes a priority. Cattle and horse as heavier animals could have an impact on soil stability and pond/channel banks; large numbers of sheep/goats could also cause soil erosion. Cattle, in particular, are attracted to riparian zones. Livestock grazing may create conditions that decrease infiltration, increase runoff and increase sedimentation and erosion from rangelands. These direct but minor impacts would affect the hydrologic regime and water quality of receiving ponds, ranging from bank modification to problems associated with sedimentation.

The decrease in water infiltration normally associated with increased grazing intensities results in an increase in overland flow. This increase in runoff often results in increased erosion and sediment production. Also, the loss of vegetation resulting from livestock grazing leaves more bare ground, possibly increasing sedimentation. This input of additional runoff water into streams could result in channel modification and related effects. Heavy grazing could also affect channel structure and water quality through impacts to stream banks and deposition of manure. Heavy livestock grazing could also increase the level of bacterial pollutants (i.e., fecal coliform) in water, as well as nutrient enrichment. The level of severity is related primarily to intensity of grazing, the proximity of animals to the water, annual forage production, and other grazing management factors such as season of grazing, length of grazing season, and type of animal.

Under Alternative 2, cattle would not have direct access to Union Creek. They may have direct access to permanent, isolated ponds in the Castle Terrace NRMU but they are flat features that are not likely to sustain bank erosion issues nor sedimentation and overland flow issues discussed above. Any short-term sheep or goat grazing of Union Creek banks would be carefully monitored. Stocking rates would be kept at a level that does not result in adverse impacts to surface water. Under Alternative 2, livestock would be distributed so as to maintain density and diversity of vegetation and minimize erosion, sedimentation and adverse impacts to surface water.

While there is the potential for direct, permanent, minor to moderate adverse impacts to surface water as a result of expanding the grazing program under Alternative 2, these impacts would be avoided. By carefully monitoring and managing grazing in accordance with the GMP (Hopkinson 2017), impacts to hydrology and surface water would be minimized. Annual grazing monitoring is already a requirement of the program and would continue with special attention on any newly grazed water features. Therefore, no significant impacts to surface water are anticipated as a result of grazing expansion under Alternative 2.

Fire Management Treatments

Temporary, moderate, adverse effects to surface water quality could occur as a result of nutrient transport in runoff following burns or disturbed soils on firebreaks. Nutrient transport in runoff could occur downslope, into immediately adjacent waters, or downstream from a headwater wetland that is within a prescribed burn area or firebreak. Impacts to waters may result from:

- **Sediment** – soil material suspended in water resulting from erosion. Sediment from runoff causes cloudy water and covers the bottom of streams and lakes. These conditions limit the ability of aquatic organisms to breathe, feed and reproduce.
- **Nutrients** – chemical elements required by plants and animals to live and grow. Ash remaining after a burn contains readily available nutrients that would be transported into waters. Excess nutrients would be toxic to aquatic life, cause undesirable aquatic plant growth and change water color.
- **Elevated Water Temperature** – caused by direct sunlight resulting from canopy removal adjacent to waterways. Elevated water temperature limits the ability of aquatic organisms to breathe, feed and reproduce (TDA Division of Forestry 2003).

The topography around Union Creek is generally flat, so the run-off potential is fairly limited. Prescribed burns or firebreaks adjacent to a creek or other water body would allow for a vegetated buffer to be maintained between it and the fire management activity to trap sediment and ash before it would enter the water course/body. The exception to this would be when the vegetation along the edges of Union Creek or other water bodies are burned. Additionally, a Burned Area Emergency Response (BAER) program is in place at Travis AFB. All wildfires and prescribed burns are assessed before and/or after a burn to determine impacts to natural resources. Any emergency actions required to reduce erosion and water quality impacts are implemented before the rainy season (e.g., placement of straw waddles to catch sediment).

As part of the planning process, prescribed burns and firebreaks would be spaced to prevent concentration of potential impacts in a small area especially areas that would impact Union Creek and other water bodies. This would allow the ecosystem to assimilate the effects of burning without substantial change and would help minimize potential hydrologic impacts. Following a prescribed burn or recent construction or maintenance of a mineral or blacklined firebreak, there could be a minor increase in runoff resulting from loss of ground cover. Ground vegetation would re-establish following prescribed burns (not within mineral firebreaks), thus minimizing runoff potential.

Temporary, minor, adverse impacts to water quality and surface water would occur as a result of prescribed burns or firebreaks under Alternative 2. However, impacts are not expected to be significant due to established monitoring (i.e. BAER surveys, see BMPs in Appendix D), proximity to wetland and stream features, and low number of mineral firebreaks planned.

Chemical Treatments

There is the potential for surface water contamination due to improper herbicide application. Contamination would result from storm water runoff or directly spraying a water body or wetland with an herbicide not labeled for aquatic use. Additionally, approved aquatic herbicides would also be applied to surface waters. Major factors influencing herbicide movement from an upland site to surface water include the herbicide's solubility in water, its photo- or biodegradation characteristics, its ability to bind with soil and organic matter and its ability to persist until it reaches a water source. Wet, marshy areas generally contain higher levels of herbicides for longer periods of time than do upland areas. If applied to seasonally dry stream channels, herbicides or their decomposition products may move into surface waters when rainfall occurs. See Table 18 for

mobility, groundwater contamination potential and degradation processes/rates in water of the active ingredients of herbicides proposed for use.

Water monitoring conducted by the U.S. Forest Service from 1991-2001, involving glyphosate and triclopyr, found very low levels of water contamination for normal (i.e., not accidental) applications (USDA 2001). Studies by USGS found glyphosate contamination of surface waters; however, they coincided with runoff events that occurred after herbicide applications. In these studies, levels of glyphosate and its degradation product aminomethylphosphonic acid (AMPA) were detected significantly below the U.S EPA Maximum Contaminant Level (MCL) (USGS 2002). A surface water contamination study done on 64 pesticides and degradates in California urban areas without inputs from agricultural operations, found only one of the herbicides proposed for use at Travis AFB, triclopyr. It was detected below U.S. EPA benchmarks (Ensminger et al. 2013). In a meta-analysis of buffer studies, Zhang et al. (2010) reported that vegetation buffers of 30 meters (99 feet) with slopes at or less than 10% remove more than 85 percent of pollutants that end up in surface water.

Because there is the potential for surface water contamination and because Travis AFB would apply aquatic herbicides directly to surface waters for control of vegetation, an Aquatic Pesticide Application Plan (APAP, OTIE 2020) was prepared to satisfy a general requirement for obtaining coverage under the Statewide General NPDES Permit for Residual Aquatic Pesticide Discharges to WoTUS from Algae and Aquatic Weed Control Applications (NPDES Aquatic Pesticide Permit, Water Quality Order No. 2013-0002-DWQ). The plan includes BMPs to reduce water quality impacts (see Appendix D) and how those impacts would be monitored in accordance with the NPDES Aquatic Pesticide Permit. Only aquatic herbicides allowed by the NPDES Aquatic Pesticide Permit would be applied to Union Creek.

Short-term, negligible, adverse impacts to surface water from chemical treatment under Alternative 2 are possible. However, adherence to the APAP (OTIE 2020), NPDES Aquatic Pesticide Permit requirements including monitoring and other herbicide application BMPs, including an aquatic resources buffer for non-aquatic herbicides not covered by the NPDES Aquatic Pesticide Permit (generally 20 feet; see Appendix D) would minimize the risk of surface water contamination. Additionally, the vast majority of herbicide applications at Travis AFB would be greater than 100 feet from Union Creek or its branches. The majority of herbicide application also happens in the dry season, thus active ingredients and degradation products have time to decompose in dry-land settings without the risk of being moved into surface waters by runoff during storm events. Therefore, no significant adverse impacts to surface water are anticipated as a result of chemical treatments under Alternative 2.

Manual and Mechanical Treatments

Ground disturbance from manual treatments would occur from drawing up a plant by its roots or digging sufficient to leverage the roots out. Chronic erosion from the disturbance caused by manual and mechanical treatments would not occur as the disturbance footprint would be small, retain other groundcover, and would be short-term. There is a short-term risk of erosion from disturbed ground if a highly infested area has contiguous bare ground sufficient to initiate surface erosion or is on a feature such as a roadside slope that is subject to surface runoff. The risk is largely due to slope of the ground and erosiveness of the slope, whether it is a natural surface or not. Any disturbance within 100 feet of a water body, sufficient in size to cause surface erosion, would potentially deliver sediment to the water body (USDA 2013). Other treatments such as cutting, clipping, mowing and mulching do not cause ground disturbance.

Non-native fauna control may include the draining of one or more small ponds on an infrequent basis (not more often than every few years). Such drainage is required to eradicate invasive bullfrogs for instance. Ponds are expected to re-fill after treatment; therefore, no long-term adverse impacts are expected.

There is the potential for indirect, temporary adverse impacts to surface water quality from soil erosion following manual or mechanical treatments. Most adverse effects would be avoided by implementing erosion control measures before the rainy season and revegetating treated areas if needed. Also, the majority of manual and mechanical treatments are greater than 100 feet from Union Creek or its branches. Therefore, no significant impacts to surface water are anticipated as a result of manual or mechanical treatments under Alternative 2.

Habitat Restoration

There is potential for soil run-off from a restoration area if a site receives precipitation prior to seeding and installation of erosion control measures or if very heavy precipitation occurs shortly after seeding. Disking or other treatments that expose soil on a restoration projects may have indirect, temporary adverse effects on surface water quality. However, disking would not be used immediately adjacent to drainages without leaving a vegetated buffer. Also, the restoration areas would be fairly small and the ultimate goal of restoration treatments is to increase vegetative cover of native plants, so any negative effects would be minor and temporary Therefore, no significant impacts to surface water quality are anticipated as a result of restoration treatments under Alternative 2.

4.4.2.3 Wetlands

Grazing

Available scientific data indicate grazing is an essential component of vernal pool management (Marty 2005, 2015). The USFWS (2018) in the Travis PBO concurred with the Air Force's assessment that grazing activities would benefit federally-listed species and their wetland habitats through promotion of native species, minimization of soil erosion, reduction of non-native plant species, reduction of wildfire risk and prevention of undesirable plant species. USFWS (2018) concluded that grazing is one of the most compatible long-term management tools for grassland habitat on Travis AFB. Prior opinions by the USFWS (2005) state that threats to vernal pool habitat include exclusion of grazing in areas where grazing has been historically and inappropriate grazing regimes (i.e. over and under grazing). Since the expansion of grazing is in areas where historic grazing once occurred and will follow the GMP (Hopkinson 2017), grazing expansion under Alternative 2 is anticipated to have a beneficial impact on wetlands including vernal pools.

Alternative 2 would result in minor, beneficial impacts to other wetland vegetation and minor adverse impacts on erosion and water quality in those wetlands open to grazing. If heavy grazing occurs, negative impacts would include increased erosion, sedimentation and fecal pollution (US EPA 1994). See also Section 4.6.1.3 on adverse and beneficial impacts of grazing. Limiting the number of cattle with access to these areas, monitoring and ensuring proper distribution of the animals would help control invasive plants and enable more functional vegetation to reestablish in these sensitive areas, without increasing erosion or causing water quality impacts within the watershed. Under Alternative 2, wetland habitats would be monitored for impacts. Adverse impacts would be avoided by targeting 800 lbs/acre RDM in pastures with soils or slopes susceptible to erosion. If lower RDM targets are desired for resource management purposes, additional monitoring would occur as needed to prevent erosion issues.

Ground-disturbing activities associated with grazing infrastructure installation (e.g. post-driving, trenching, filling and scraping) adjacent to WoTUS would have temporary, minimal, adverse impacts. All new grazing infrastructure would be designed to avoid effects to sensitive habitats. All field-verified wetlands, drainages and vernal pools within 50 feet of proposed infrastructure locations would be protected by implementation of the AMMs in Appendix D.

In summary, Alternative 2 would result in primarily beneficial, negligible to moderate, short- and long-term impacts to wetlands with some risk of minor, adverse, short-term impacts. Based on the implementation of AMMs and past monitoring results from the current grazing program, Alternative 2 would not have a significant adverse impact on wetland habitat.

Fire Management Treatments

The creation of firebreaks (mown, handlines, bladed/graded/disked firebreaks, blacklined, graveled etc.) have the potential to negatively impact wetlands. Mineral firebreaks would not be used in wetlands and would maintain a 10-foot buffer around wetlands. When mineral firebreaks are installed, disking is the preferred method since it has less of an impact on natural resources than blading/grading especially on the clay soils found at Travis AFB. Blading/grading of firebreaks may be necessary in emergency situations. Even when wetlands are avoided, blading/grading creates an area that continues to get deeper as the blading/grading is repeated over time. Additionally, if material tends to accumulate on the edges of the bladed/graded firebreak if not knocked down after blading/grading is complete (Georgia Forestry Commission 2017). This disrupts the surface hydrology of the site and can disconnect drainages that continue on to neighboring properties. As blading/grading continues in the same areas, more surface soil is piled on either side of the firebreak and, over time, the firebreak gets closer to the claypan, which may be shallow in some areas.

Handlines and hand scraped firebreaks would cause soil and vegetation disturbance and in extreme cases would alter wetland hydrology. Mowed, blacklined, and/or wet lined firebreaks would be used to the greatest extent possible when conducting prescribed burns to avoid soil disturbance especially when in proximity to wetlands. Mineral firebreaks would not be used in wetlands except under emergency circumstances (e.g., escaped fire). Fireline construction would avoid all sensitive habitats and active wildlife dens and nests due to compliance with AMMs and BMPs in Appendix D. Torching would not require fire lines and would be extremely localized.

Prescribed fire would occur in dry wetlands thus the only impacts, expected to be largely beneficial, would be to vegetation (Marty 2015b). Late spring burns at nearby Jepson Prairie showed significant decreases in invasive grass cover and increases in native grasses and forbs as well as non-native forbs (Pollak & Kan 1998; Marty 2015b). Changes in vegetation composition within a wetland would improve inundation periods of wetlands but does not affect hydrology.

In summary, Alternative 2 may result in direct beneficial and adverse effects to wetlands. With the implementation of AMMs and BMPs (Appendix D) and avoidance of direct impacts to wetlands, no significant impacts to wetlands are anticipated as a result of fire management activities as part of Alternative 2.

Chemical Treatments

Many invasive plants use a greater amount of water than native plants, potentially altering wetland hydrology. Removal of these plants would help maintain natural hydrological regimes. As a result, long-term, direct, moderate beneficial impacts to wetlands are anticipated as a result of chemical treatments under Alternative 2.

The risks of contamination and environmental persistence of herbicides proposed for use are described in Sections 4.4.2.1, Groundwater, 4.4.2.2, Surface Water and 4.8.2.2, Soils. Chemical treatments have the potential for direct and indirect, temporary negative impacts to wetlands through soil and water contamination or through direct mortality of non-target plants. However, implementation of the BMPs in Section 2.4.2.2 would minimize the risk of soil and water contamination within wetlands. Herbicide would be applied in such a way as to minimize drift and other accidental exposure to non-target vegetation. Wetland-specific protection measures include: only applying herbicide in and around wetlands during the dry season, restricting application prior to rain events, using herbicides and adjuvants1 (i.e. additives, of which surfactants are a type) approved for aquatic use in and around wetlands and adhering to aquatic resource protection buffers.

The APAP (OTIE 2020), in compliance with the NPDES Aquatic Pesticide Permit requirements, also requires pre-, during, and post-treatment monitoring including water monitoring in vernal pools after direct application. As herbicide application to vernal pools would occur when pools are dry, the water samples would be taken from waters that fill vernal pools 1-5 months post-herbicide application. This monitoring would verify an absence of active herbicide ingredient as chemicals are expected to break down over the summer in soils and through direct exposure to sunlight.

Therefore, no significant adverse impacts to wetlands are anticipated as a result of Alternative 2 chemical treatments.

Manual and Mechanical Treatments and Habitat Restoration

No adverse impacts are anticipated as a result of using hand-held tools and equipment during any treatment type.

There is the potential for direct, short and long-term negative impacts and long-term beneficial impacts to wetlands as a result of invasive plant removal using heavy equipment. There is the potential for negative impacts to soils and biota from crushing or disturbance from excavation. As such, in wetlands, the use of heavy equipment and ride-on mowers would be limited to late spring and the dry season when the soil is no longer saturated. By restricting the use of heavy equipment to the dry season, no adverse impacts to wetlands are anticipated.

Aquatic native and non-native species control using excavators/heavy equipment may be implemented in Union Creek and the North Gate Pond. This treatment does not require a Section 404 permit as all material would be removed and except for de minimum fallback, no fill would be placed in the stream. Treatments would be done during the dry season. No excavation using heavy machinery would be used in or near vernal pools. These treatments to Union Creek are anticipated to reduce ponding of water and buildup of debris that would cause flooding at Outfall 1. By following the BMPs in Appendix D, the effect of mechanical treatments using heavy equipment would be minimized.

[1] An **adjuvant** is any substance (i.e. additive) in a herbicide formulation or added to the spray tank to improve herbicidal activity or application characteristics. Spray adjuvants are generally grouped into two broad categories--activator adjuvants and special purpose adjuvants. Source: https://extension.psu.edu/adjuvants-for-enhancing-herbicide-performance. See also Section 4.7.2.

Non-native fauna control methods such as pond draining would avoid impacts to other non-target wetland features. While ponds considered for draining are jurisdictional, they do not support sensitive species and would be returned to their prior states after treatment.

Habitat restoration is anticipated to have long-term direct and indirect beneficial impacts to wetlands. Disking would not be used for restoration plantings within wetlands. Wetland areas would be revegetated using wetland-specific seed mixes and/or container plants.

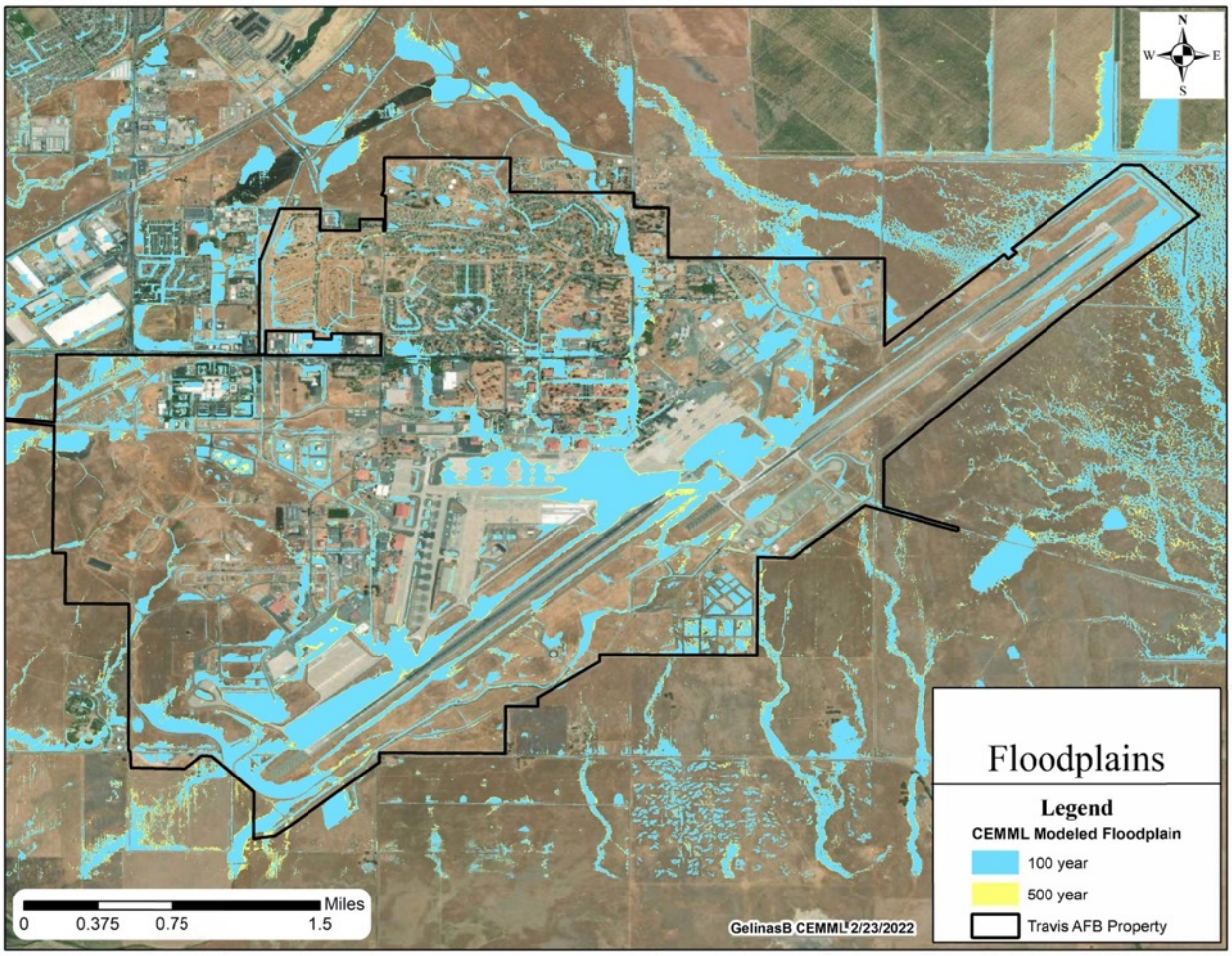
Therefore, no significant adverse impacts to wetlands are anticipated as a result of manual and mechanical treatments or habitat restoration under Alternative 2.

4.4.2.4 Floodplains

EO 11988, Floodplain Management, requires agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid the direct or indirect support of floodplain development whenever there is a practicable alternative. If an action must be located in a floodplain, E.O. 11988 requires that agencies minimize potential harm to people and property and to natural and beneficial floodplain values. The EO applies to major federal actions that would occur in a floodplain and that significantly affect the quality of the human environment.

A recent study identifying the 100 and 500-year floodplain extent on Travis AFB was reviewed and approved by the Federal Emergency Management Agency (Figure 14; CSU 2021). This study identified 300 buildings that are within either the 100 or 500 year floodplain. In addition, six each hazardous material and hazardous waste sites; 39 storage tanks and 20 percent of airfield fall with these floodplains. The maximum flood depth is projected to be 13 feet, and the maximum flood velocity is projected to be 6 feet/second.

Figure 14. Floodplains on Travis Air Force Base (CSU 2021)



None of the treatments included in Alternative 2 are considered floodplain development except grazing infrastructure (i.e. fencing). Fencing would be range or cattle fence with three to six strands of barbed wire and would not interfere with water's ability to flood an area or interfere with human access to any location. Fencing may catch excess vegetation, which might impede natural flood flows if placed in active floodways. None of the treatments included in Alternative 2 would modify the floodplain in such a way as to adversely affect floodwaters. Alternative 2 treatments would only occupy floodplains during treatments. In the case of grazing, animals may be present for up to 8 months and fences would be permanent but neither cause an increased risk to human health.

Impacts to floodplains from grazing would be similar to those presented under other water resources (Sections 4.6.1.2, 4.6.1.3, 4.6.2.2, and 4.6.2.3,).

Alternative 2 is anticipated to have direct and indirect beneficial long-term effects by restoring and preserving the natural and beneficial values served by floodplains. Without invasive species control programs, high biomass levels in floodplains would reduce overland flow and increase retention of floodwaters. Control of Union Creek native and non-native species (as is proposed in Alternative 2) would reduce blockage of water ways ensuring continued functioning of the stream system and floodplain. No treatment under Alternative 2 would have a significant, adverse impact on human safety, health or welfare in the event of a flood. The invasive plant treatments would

reduce the hazard and risk of flood loss by improving water flow and floodplain functionality by controlling invasive, native, and non-native vegetation growing in waterways and floodplains. Therefore, no significant impacts to floodplains are anticipated as a result of Alternative 2.

If this work is not conducted in floodplains, invasive plants currently degrading floodplains and water ways would not be controlled, which would lead to increased risk of flood damage and reduced floodplain functionality and biodiversity.

4.5 SAFETY AND OCCUPATIONAL HEALTH

4.5.1 Alternative 1 (No Action Alternative)

Grazing, Manual and Mechanical Treatments and Habitat Restoration

No new effects to health or occupational safety are anticipated as a result of continuation of the existing grazing program under the No Action Alternative.

No new effects to health or occupational safety are anticipated as a result of implementing manual and mechanical treatments or habitat restoration under the No Action Alternative. Under this alternative, safety and occupational health would be assessed for each project individually during the USAF EIAP.

Fire Management Treatments

Potential air quality impacts, including anticipated levels of particulate matter are addressed in Section 4.3.1, Air Quality. Under the No Action Alternative, safety and occupational health would be assessed for each planned prescribed burn and firebreak construction and maintenance project individually during the USAF EIAP.

Chemical Treatments

Past and ongoing herbicide applications for weed management applied by contractors on Travis AFB would continue at low levels on less than 40 acres per year in undeveloped areas under the No Action Alternative. Negligible, short-term adverse impacts are expected from current chemical control. There is the potential for herbicide exposure. Exposure is limited as most areas treated are not used for outdoor recreation or for any other purpose that would cause someone to come into contact with a sprayed area. The primary exception to this is control in the grazing pastures. These spray events are coordinated with the IPMC and all livestock managers with instructions on how to avoid exposure. Areas that are used for outdoor recreation are only treated a few days per year, reducing the significance and chance of exposure greatly. Finally, less than 12 mapped acres across the NRMUs are occupied by species controlled with herbicides under past and on-going efforts; approximately 30 acres of yellow star-thistle in the NEUDA NRMU would continue to be mowed and no additional chemical treatment of star thistles at the Equestrian Club would occur under the No Action Alternative. Therefore, no significant adverse impacts are expected from chemical control under the No Action Alternative.

4.5.2 Alternative 2 (Comprehensive Management)

Grazing

California Farm Bureau Federation policy recognizes that grazing is the most practical and environmentally acceptable way to prevent the buildup of excessive, dry vegetation that would lead to catastrophic wildfires. Alternative 2 would have a beneficial impact on safety due to the reduction of fire hazards.

Fire Management Treatments

Potential adverse air quality health impacts, including anticipated levels of particulate matter, are addressed in Section 4.5.2, *Air Quality* and were found not to be significant.

Prescribed burns would be conducted in accordance with safety requirements and procedures in the WFMP (Chloeta 2019), national standards and individual prescribed fire plans. Standards for prescribed burns would be implemented to protect workers. A prescribed fire plan, which would include a Job Hazard Analysis would be prepared for each burn. Safety would be promoted through training, removal of hazards, adhering to the Job Hazard Analysis and through provisions for PPE and devices. The equipment and number of trained personnel would be adequate to accomplish the intended purposes. Oversight and implementation of prescribed burns would be conducted by qualified personnel from the Beale AFB Wildland Fire Module. The Travis AFB Fire Department is responsible for obtaining all permits related to occupational health and safety. Regular implementation of prescribed burns may have a beneficial impact on human safety by reducing fuel loads, lessening the potential for a high-intensity wildfire and providing live fire training opportunities. Any safety and occupational health risks of construction and maintenance of firebreaks are minimal and addressed with proper training on use of equipment. Under Alternative 2, impacts to health and safety are expected to be insignificant to beneficial; therefore, no significant adverse impacts are expected.

Chemical Treatments

The analysis of the potential human health impacts associated with the use of chemical herbicides used the methodology of risk assessments generally accepted by the scientific community (NRC 1983; US EPA 1986).

Information used to determine that Alternative 2 chemical treatments would not have a significant adverse impact on human and occupational health are based on the Human Health Risk Assessments completed for the EA of Eradication and Control of Invasive Plants on the El Dorado National Forest (El Dorado EA; Carroll 2012; USDA 2013) and the Preliminary Draft EA for Non-Native and Noxious Plant Species Management on Beale AFB and Lincoln Receiver Site, California (Beale Weed EA; USAF 2021).

The El Dorado EA used herbicide-specific risk assessments completed by Syracuse Environmental Research Associates, Inc. (SERA) and analyzed chemical control of invasive species on 300 to 600 acres annually of USFS lands, an effort 50 – 300% higher than that proposed in this EA (i.e., 200 acres of chemical control). El Dorado National Forest is also subject to much higher public exposure rates due to its open access to the recreating public whereas the Proposed Action under Alternative 2 takes place primarily on a fenced military base with extensive access restrictions. Some chemical control would occur on Travis AFB GSUs which are not fenced and subject to higher amounts of public access. However, GSUs are rather remote and some not easily accessible by road. Surveys conducted on GSUs have observed only public use of the railway of the Former Sacramento Northern Right-Of-Way GSU. The Beale Weed EA analyzed chemical control of very similar invasive species and nearly identical herbicides on USAF lands on up to 2,000 acres of grassland and riparian habitat annually (20,000 gross acres projected for treatment over 10 years), 1000% the effort proposed in this EA. Beale AFB has very similar ecology, vegetation, invasive species, and public use of undeveloped areas and is thus an excellent basis for comparison to Travis AFB.

The Human Health Risk Assessments listed above, completed for similar projects, analyzed the potential for adverse health effects in workers and members of the public from the use of the

proposed herbicides. Workers include applicators, supervisors and other personnel directly involved in the application of the herbicides. The public includes personnel who are not directly involved in the herbicide application and who would be exposed through the drift of herbicide spray droplets, through contact with vegetation, by eating or placing in the mouth food items or other plant materials such as berries or shoots growing in or near treated areas, by eating game or fish containing herbicide residues or by drinking water that contains residues. The Human Health Risk Assessments examined the potential health effects on all groups of people who might be exposed to any of the herbicides proposed for use.

The Human Health Risk Assessment for the Beale Weed EA (Appendix H of USAF 2021) is almost 100 pages and is incorporated by reference. In essence, herbicide risk assessments compare possible herbicide doses for various exposure scenarios experienced by workers and the public with the EPA's established reference doses (RfDs). RfDs are based on doses shown to cause no observed ill effects in test animals in either short-term (acute) or long-term (sub-chronic or chronic) studies. For each type of dose assumed for workers and the public, a hazard quotient (HQ) was computed by dividing the potential dose of herbicide by the RfD. In general, if an HQ is ≤ 1, the risk of effects is considered negligible and below a level of concern. All HQ values and an explanation for those that exceed a level of concern (HQ is ≥ 1) are from the Beale Weed EA (Appendix H of USAF 2021).

The only reservation attached to the assessment, summarized below, is one associated with all risk assessments: absolute safety could never be proven, and the absence of risk could never be demonstrated. No chemical has been studied for all possible effects and the use of data from laboratory animals to estimate hazard or the lack of hazard to humans is a process that contains uncertainty. Prudence dictates that normal and reasonable care should be taken in the handling of herbicides.

Based on this information, the human health risks from exposure to herbicides, adverse impacts to worker and public safety would occur but would be minimized by applying herbicides in accordance with the IPSMP (ManTech 2017); the IPMP (HT Harvey 2014); the INRMP (TAFB 2016, 2019a); the USAF Pest Management Program; the NPDES Aquatic Pesticide Permit; all applicable federal, DoD, USAF, State of California and local directives and regulations; label instructions; and AMMs in Section 2.4.2.2. Workers would wear appropriate PPE (as specified on the product label) whenever applying herbicides. Therefore, no significant adverse impacts to safety and occupational health are anticipated as a result of chemical treatments under Alternative 2.

Manual and Mechanical Treatments and Habitat Restoration

There is a slight risk of direct impacts to workers from accidental injury from tools or heat exposure and the potential long-term effect of hearing damage from using equipment without appropriate PPE. All equipment used in performing work shall be of the proper type, appropriate size, operated at appropriate speed and be in such mechanical condition as to enable the operator to perform the work safely. All workers would be trained in the safe and proper use of any and all equipment used in manual and mechanical treatments including tools used for non-native fauna control (e.g. pellet guns, nets). Workers would wear all applicable PPE for a specific tool, which may include gloves, ear plugs, eye protection, steel-toed boots and/or chaps. Work would be done in accordance with applicable safety regulations and guidance in AFPD 91-2, *Safety Programs*. On mechanical fuels treatments, the project manager would make sure that work is done in compliance with the guidelines set forth by the NRM and that project work goals are met or setbacks are documented to improve future project safety and efficiency. Therefore, no significant

adverse impacts to occupational health and safety are anticipated as a result of Alternative 2 manual and mechanical treatments or habitat restoration.

4.6 HAZARDOUS MATERIALS / WASTE

4.6.1 Alternative 1 (No Action Alternative)

Grazing

There are several ERP sites within existing grazing areas including LF008, OT019, SD045, SD042 and LF044 (Table 19). Land Use Controls (LUCs) exist for ERP Site LF008 (groundwater) and LF044 (soil). The currently grazed lands on the remaining ERP sites do not possess land controls. There are no MMRP sites on Travis AFB. Under the No Action Alternative, neither the livestock nor the grazing lessees would have access to contaminated groundwater from the ERP sites. The use or release of hazardous materials usually results in the generation of hazardous waste. The current Grazing Management Program does not use, store or generate hazardous materials or waste. No hazardous materials or waste are known or expected to be present on or near grazing units. Therefore, no significant adverse effects are anticipated as a result of the No Action Alternative.

Table 19. ERP Sites Currently Grazed

Source: Arreola-Winey & Glass 2019a

Site	Distance from Subject Property	Description	Status
LF008	0.05 mi .	Groundwater contamination	LUCs are in place to restrict access for potable water usage. The area is within a fenced explosive safety zone. The site has alpha-chlordane pesticides at low concentrations in the groundwater.
OT019	0.02 mi	No contaminants	Site closed. Initial investigation did not identify contaminants that would warrant further investigation.
SD045	< 0.01 mi	Soil contamination	The site contaminants identified are metals. The selected remedy was soil removal and consolidated into an on-base corrective action management unit. The site is closed.
SD042	0.08 mi	Soil contamination	The site contaminants identified are semi volatile organic compounds (SVOCs) and metals. The selected remedy was soil removal and consolidated into an on-base corrective action management unit. The site is closed.
LF044	< 0.01 mi	Soil contamination	LUCS are in place for soil. Some soil has been removed, leaving asphalt, metals and polycyclic aromatic hydrocarbons (PAHs). The selected remedy is a fence around the area to prevent use of the site or disturbance of the soil. Berm north of Kinder Morgan Fuel Tanks has no contaminated soil. This portion of LF044 will be removed from existing LUCs.

Fire Management Treatments

Under the No Action Alternative, the locations proposed for prescribed burns and firebreaks are approved by the ERP on a project-by-project basis in order to avoid burning, mowing, disking, scraping or wet lining areas that may pose a potential environmental or safety hazard. The 2019 prescribed fires occurred on at least one ERP site (near WP017). The use or release of hazardous materials usually results in the generation of hazardous waste. Chemical retardants are not used during prescribed burns, so no generation of hazardous waste is anticipated. Aside from fuel used

in vehicles and drip torches, the current Wildland Fire Management Program would not use, store or generate hazardous materials or waste. No hazardous materials or waste are known or expected to be present on or near burn or firebreak sites. The Fire Management Program may impact Travis AFB ERP sites but those uses and impacts would be in line with allowed uses for those ERP sites. Therefore, no significant adverse effects are anticipated as a result of the No Action Alternative.

Chemical Treatments

The use or release of hazardous materials usually results in the generation of hazardous waste. Herbicides would continue to be used (Table 2) and applied in accordance with label instructions. Herbicide containers would be disposed of in accordance with label instruction and California state regulations. A Comprehensive Spill Program has been established that addresses procedures to minimize spill impacts. In the event of a spill, the applicator would notify the 60 CES spill response team. Herbicide control projects may impact Travis AFB ERP sites but those uses and impacts would be in line with allowed uses for those ERP sites. Therefore, no significant adverse effects are anticipated as a result of the No Action Alternative.

Manual and Mechanical Treatments and Habitat Restoration

Small-scale manual and mechanical treatments would continue. The use or release of hazardous materials usually results in the generation of hazardous waste. These activities are not anticipated to generate any hazardous waste. Current manual, mechanical and restoration treatments do not use, store or generate hazardous materials or waste. No hazardous materials or waste are known or expected to be present on or near control sites. Projects may occur on Travis AFB ERP sites but those uses and impacts would be in line with allowed uses for those ERP sites. Therefore, no significant adverse effects are anticipated as a result of the No Action Alternative.

4.6.2 Alternative 2 (Comprehensive Management)

Grazing

Under Alternative 2, current grazing areas would continue to be used. Expansion of the grazing program would also occur with additional ERP sites impacted. No ERP constraints were identified within any of the likely future pastures (see Figure 3, Table 20). The Three Tanks pastures are located adjacent to a fenced ERP site that has surface soil contamination (Polycyclic aromatic hydrocarbons (PAHs) and metals) from past disposal of construction debris. The area is fenced off and has LUCs regarding use of the property. The rancher and livestock would not have access to the site.

Some areas within two of the four South Airfield possible future pastures (Figure 3) are under investigation for possible Aqueous Film-Forming Foam (AFFF) contamination from past firefighting training activities.

Table 20. ERP Sites on or Adjacent to Likely Future Pastures (Figure 3)

Excludes sites already listed in Table 19. Source: Arreola-Winey & Glass 2019a

Site	Distance from Subject Property	Description	Status
CASTLE TERRACE PARCEL: No ERP sites are located on adjacent property.			
CORDELIA PARCEL			

Site	Distance from Subject Property	Description	Status
SD037	0.01	Contaminated soil and groundwater	LUCs are in place to restrict access to both soil and groundwater. Soil: Site contaminants identified in the soil are polycyclic aromatic hydrocarbon (PAHs), lead, and total petroleum hydrocarbons (TPH). The LUCs restrict unauthorized disturbance or relocation of the soil at this site. Additionally, the contaminated soil is covered by asphalt. Groundwater: The site is undergoing groundwater remediation for chlorinated solvents. The LUCs ensure the groundwater is not used for potable purposes until remediated to solvent concentrations that do not pose an unacceptable risk to human health.
SOUTH AIRFIELD PARCEL			
SD001	<0.01 mi	Contaminated sediments	This site is Union Creek in the south area of the Base. Sediments in Union Creek contained PAHs, metals and pesticides. These sediments were removed, and the site was closed in 2009.
THREE TANKS PARCEL			
SS046	<0.01 mi	Soil contamination	A recent soil excavation was completed to remove contaminants. The site is awaiting confirmation sampling and is expected to be closed out.
DP039	0.07 mi	Soil and groundwater contamination	LUCs are in place to restrict access to both soil and groundwater. Soil: All lead contaminated soil was removed and disposed of during installation of the bioreactor. The lead contaminated soil portion of the site is closed. Groundwater: The site contamination is chlorinated solvents. Remediation of the groundwater is ongoing using a bioreactor. LUCs for groundwater at this site are to restrict residential and industrial uses of this site.

Environmental baseline surveys were conducted for the five likely future pastures (Figure 3) (Arreola-Winey & Glass 2019a) and a Memorandum for Record was written for the potential future pastures (Arreola-Winey & Glass 2019b). An environmental baseline survey would be conducted for each new proposed pasture before it is developed and used for grazing. Any new grazing parcel would also be approved by the Facility Board Working Group chaired by the 60th AMW Base Commander or delegate. During these processes, any hazardous waste or restrictions resulting from ERP sites would be identified. All new solar well locations would be reviewed by ERP before installation through the Base Civil Engineer Work Clearance Request process to avoid accessing contaminated groundwater sites with solar wells.

The impact of livestock grazing on ERP sites is beneficial. Grazing livestock removes vegetation, which makes it easier to locate ERP monitoring wells and also reduces the fire hazard for vehicles that enter the area for ERP activities. Any grazing infrastructure would be placed so as to avoid potential remediation sites. The use or release of hazardous materials usually results in the generation of hazardous waste. The Grazing Management Program under Alternative 2 would not use, store or generate hazardous materials or waste. No hazardous materials or waste are known or expected to be present on or near proposed grazing sites save those discussed under

the ERP above. Therefore, expansion of the grazing program under Alternative 2 would not have a significant adverse impact on hazardous materials or waste.

Fire Management Treatments

The environmental consequences of Alternative 2 on hazardous materials and hazardous waste are similar to those under the No Action Alternative (see Section 4.8.1). Therefore, the Fire Management Program conducted under Alternative 2 would not significantly affect hazardous materials and waste.

Chemical, Manual and Mechanical Treatments and Habitat Restoration

Hazardous materials would be used under Alternative 2. The USAF has established procedures for the handling, storage and disposal of hazardous materials and waste. With the exception of a potential accidental release (spill), the use of hazardous materials and the generation of hazardous waste from invasive plant control activities are not anticipated to significantly impact natural resources. A Comprehensive Spill Program has been established that addresses procedures to minimize spill impacts. In the event of a spill, the applicator would notify the 60 CES spill response team and the NRM.

Projects may occur on Travis AFB ERP sites but those uses and impacts would be in line with allowed uses for those ERP sites.

Specific activities have been identified that may utilize hazardous materials such as lubricants and fuels associated with mechanical invasive plant control. Herbicides would be applied in accordance with label instructions and other applicable regulations and AMMs (Appendix D). Herbicide containers would be disposed of in accordance with label instruction and California state regulations. Although not anticipated, any additional hazardous materials/waste generated due to the implementation of Alternative 2 would be identified and removed in accordance with applicable state and federal regulations. Therefore, treatments under Alternative 2 would not have a significant adverse impact on hazardous materials/waste.

Manual and mechanical treatment of invasive species and habitat restoration activities would not significantly affect hazardous materials or waste.

4.7 BIOLOGICAL / NATURAL RESOURCES

4.7.1 Alternative 1 (No Action Alternative)

The No Action Alternative would have significant, long-term, adverse effects on biological/natural resources. Although the No Action Alternative would allow for some treatment of areas infested with invasive plants and addressed in prior project decisions, the majority of land infested by invasive plants identified for control would not be treated. Over time, the projected growth of these infestations would result in increasing negative impacts to vegetation, fish, wildlife, and native habitats. Under the No Action Alternative concurrence on effects to species listed under the ESA would require individual USFWS consultations on a project-by-project basis.

4.7.1.1 Vegetation

The No Action Alternative would have significant, long-term, adverse effects on native vegetation. Some of the invasive plants targeted for control on Travis AFB are early successional species, meaning they colonize areas that have been recently disturbed. Since invasive plants have the ability to deplete available resources to lower levels than native vegetation would tolerate, they

would quickly dominate disturbed sites, displacing native vegetation. When invasive plants dominate native plant communities, native plant species diversity decreases. Invasive plants would out-compete native species because they produce abundant seed, have fast growth rates, are more effective at extracting available resources and lack natural enemies. For example, yellow starthistle is able to compete effectively with desirable native species by producing abundant seeds and growing a deep taproot system that extracts more deep soil moisture during the dry season (DiTomaso et al. 2006). Some invasive plants also produce secondary compounds which would be toxic to native plants or animals. Invasive plants would also physically interfere with the germination of native vegetation. For example, dense thatch from medusahead infestations has been shown to inhibit the germination of desirable native vegetation (Young 1992). Invasive plant infestation would therefore lead to a decrease in native plant species, potentially impacting a larger ecological process such as wildlife behavior (Trammell & Butler 1995), fire ecology (Pellant 1996) and hydrology (Renz et al. 2012).

The No Action Alternative results in direct impacts to vegetation that are ecologically beneficial to native plants; however, the level of invasive species management effort is not optimal and is unlikely to provide long-term base-wide benefits to native vegetation.

4.7.1.2 Terrestrial Wildlife

The No Action Alternative does not result in direct adverse impacts to terrestrial wildlife or wildlife habitat. However, indirect, adverse impacts would result from the continued expansion of invasive species infestations on the base. Although the No Action Alternative would allow for chemical treatment of 40 acres and grazing of 630 acres infested with invasive plants, over 1,000 acres of invasive species would not be treated. Over time, the projected growth of these infestations would result in increasing impacts to habitats and wildlife populations. Any species of wildlife that depends on native understory vegetation for food, shelter or breeding may be adversely affected by invasive plants and animals.

The assortment of wildlife species supported by native habitats would be altered where invasive plants become established and displace native plants. Where invasive plants become abundant, they would cause highly detrimental effects on native wildlife species. These effects include altering vegetation type and structure, reducing natural food and cover species and changing the natural fire regime. Invasive plants are known or suspected of causing the following impacts to animals and to wildlife populations: direct injury to individuals from embedded seeds in animal body parts or scratches leading to infection; alteration of habitat structure leading to habitat loss or increased chance of predation; reduction in availability of native forage species, leading to lack of proper forage quantity or forage nutritional value at critical life periods; and poisoning due to direct or indirect ingestion of toxic compounds found on or in invasive plants (USDA 2013).

Habitats that become dominated by invasive plants are often not used, or used much less, by native and rare wildlife species. Invasive plants, such as yellow starthistle, would impact upland game bird habitat. In some situations, wildlife species may actually benefit from the presence of invasive plants. For example, tricolored blackbirds often nest in Himalayan blackberry brambles and non-native thistles and fennel. While some invasive plants may be beneficial to certain animals, the alteration of native plant communities overall has deleterious effects to wildlife populations and wildlife diversity. The expansion of invasive plant species would continue to adversely impact wildlife habitats and populations under the No Action Alternative.

4.7.1.3 Aquatic Wildlife

The No Action Alternative would allow non-native species to persist in riparian areas and wetlands, thus reducing the biodiversity and abundance of native species living and growing those habitats. Eventually, over time, changes in vegetation composition would affect the natural food web in the riparian areas and thereby indirectly impact aquatic species from changes in cover and food availability.

The No Action Alternative would only allow the control of native and non-native species in the North Gate Pond Valley View Pond and ditches, not Union Creek as a whole or vernal pools and wetlands across the base. Perennial pepperweed would eventually spread to all vernal pools in the Old Aero Club; pepperweed invasion would decrease food and habitat for several wildlife species (Zouhar 2004). Lack of control of cattails and other nuisance plants in Union Creek may lead to blockage of stream flow affecting fish that use the stream. Overall, the No Action Alternative would have a minor to moderate adverse impact on aquatic wildlife.

The no action alternative would not allow for control of invasive aquatic species like the American bullfrog. Bullfrogs occur in some of the larger ponds on base and are known to have negative impacts on special status species that use the ponds, like California tiger salamander (Ford et al. 2013). They have also been known to prey upon western pond turtle hatchlings (Nicholson et al. 2020).

4.7.1.4 Threatened and Endangered Species and other Special Status Species

The No Action Alternative would have significant, long-term, adverse effects on threatened and endangered and other special status species. Under the No Action Alternative, concurrence on effects to species listed under the ESA would require individual USFWS consultations on a project-by-project basis.

<u>California tiger salamander (CTS, Threatened, *Ambystoma californiense*) Central California Distinct Population Segment (DPS)</u>

California tiger salamanders are terrestrial salamanders that use vernal pools and ponds for breeding. When not breeding, they live in small mammal burrows or soil cracks in upland grassland (Loredo et al. 1996). Livestock grazing and other methods of non-native species control such as fire, manual, mechanical and chemical may help maintain the necessary hydrological conditions for completion of CTS' aquatic phase (Marty 2005, 2015); longer vernal pool inundation periods would produce significantly more metamorphosing CTS juveniles (Ford et al. 2013). In addition, invasive species control, by shortening the height of vegetation either through grazing, fire, or mowing for instance, would improve upland habitat conditions for California ground squirrels (*Otospermophilus beecheyi*), whose burrows CTS occupy. Finally, CTS require short grassland for movement within upland habitat (Barry et al. 2015) which is typically controlled under invasive species management programs by all the aforementioned methods.

Under the No Action Alternative, these benefits of invasive species control are limited to areas under current management. Therefore, the No Action Alternative would have either minor to moderate neutral to beneficial impacts on the California tiger salamander.

<u>Vernal Pool Fairy Shrimp (VPFS, Threatened, *Branchinecta lynchi*)), Vernal Pool Tadpole Shrimp (VPTS, Endangered, *Lepidurus packardi*), and Conservancy fairy shrimp (CFS, Endangered, *Branchinecta conservatio*)</u>

Under the No Action Alternative, indirect and adverse impacts would result, as no new invasive plant control would be implemented in or around vernal pools that are suitable habitat for shrimp. Also, control of non-natives inside vernal pools and wetlands would not occur, leading to direct, adverse, long-term impacts on branchiopod habitat. In general, invasive plant species within and surrounding vernal pools can alter pool hydrology by drawing down the available water, resulting in a reduced inundation period that may be too short for native invertebrate growth cycles. Furthermore, invasive grasses can increase levels of thatch (dead plant biomass) in vernal pool habitats. Non-native plant thatch build-up increases soil organic matter and consequently soil water-holding capacity; as a result, the surrounding soil holds more water, and less is retained in the vernal pool itself, reducing inundation periods (Marty 2015a). Finally, excessive vegetation growth within pools reduces the open water habitat available for shrimp to freely move around. Overall, the No Action Alternative would have moderate, long-term, adverse impacts on federally listed branchiopods.

Delta green ground beetle (DGGB, Threatened, *Elaphrus viridis*)

Under the No Action Alternative, no direct or indirect impacts to delta green ground beetle are likely from continued, limited management of invasive species. The closest known populations of DGGB to Travis AFB are located about 1,500-2,500 feet off-Base in playa pools on the Wilcox and Muzzy Ranches (adjacent to the eastern boundary of Travis AFB; CNDDB 2020). Habitat assessments on Travis AFB were conducted for the DGGB in 2012 and 2016 and found no evidence of appropriate habitat for this species.

While appropriate habitat for the DGGB likely does not exist on Travis AFB, critical habitat for the species was designated on the Former Sacramento Northern Railroad Right-of-Way GSU. Because little is known about the ecology of the species, including dispersal distances and upland habitat use, Travis AFB has established a 1- mile buffer around known DGGB habitat, which is located south and east of the runway on Travis AFB (USFWS 2018a). The only invasive species work occurring in these locations under the No Action Alternative are non-Air Force grazing of the Former Sacramento Northern Railroad Right-of-Way GSU and grounds maintenance mowing for BASH prevention purposes and firebreaks on the Main Base.

Grazing is expected to have a beneficial effect on delta green ground beetle and the populations known to occur on Jepson Prairie and the adjacent Wilcox and Muzzy Ranches are being grazed. Management practices that reduce the proliferation of invasive and non-native plants are important for maintaining delta green ground beetle habitat as invasive plant density and height significantly disrupt the beetle's feeding regime. Grazing is specifically mentioned as beneficial by the USFWS (USFWS 2009a) though presumably mowing would also be beneficial. A lack of grazing may also have a negative effect on the beetle (USFWS 2005). Cattle may negatively impact DGGB habitat as they tend to stand in and walk through shallow water in large numbers and would churn and pockmark the margins of vernal and playa pools.

Mowing would be expected to have similar effects to DGGB habitat as grazing though would avoid vernal pools that are wet. Firebreaks in this area under the No Action Alternative are only mowed.

The USFWS specifically views prescribed fire as a "neutral to beneficial" practice for maintenance of DGGB and its habitat. DGGB may prefer an open canopy habitat; therefore, fire may improve its habitat. The literature suggests that fire, which kills certain plants and removes dead plant litter, favors some native plant species and negatively affects some problematic nonnative plants (USFWS 2005).

Therefore, under the No Action Alternative, current management is expected to have negligible to minor neutral to beneficial impacts on DGGB.

*Monarch Butterfly (*Candidate Species*, Danaus plexippus plexippus)*

The No Action Alternative would have significant, long-term, adverse effects on suitable monarch butterfly habitat. Milkweed is crucial to the lifecycle of monarch butterflies. If invasive plant infestations are left unchecked, these plants would continue to overrun milkweed habitat, leading to localized extirpations or significant population declines.

Contra Costa goldfield (CCG, Endangered, *Lasthenia conjugens*)

Contra Costa goldfields have declined across their historic range as vernal pool habitat has been lost to development and the spread of invasive species. Unchecked exotic species invasion of pool basins and surrounding grasslands would decrease the period of inundation, increase competition and decrease habitat for pollinators of CCG (Marty 2005, 2015; George 2006). Even simple changes in management can have deleterious effects. For example, decreases in CCG cover were detected at the Aero Club despite initial success of a long-term restoration project. A change in management regime from a regular mow treatment to a single mow treatment per year may have caused the decline (Collinge et al. 2013, Marty 2017b).

Under the No Action Alternative, indirect and adverse impacts to unmanaged populations of CCG outside of current grazing pastures are likely. No significant adverse indirect or direct impacts are expected to currently managed populations of CCG unless management stops, changes or is poorly monitored.

4.7.2 Alternative 2 (Comprehensive Management)

4.7.2.1 Vegetation

The continued spread and establishment of invasive species would reduce native plant diversity by changing ecological processes and outcompeting native vegetation for limited resources (space, water, light and nutrients). Controlling and eradicating invasive plants would reduce the potential impacts to native vegetation from existing and new invasive species on Travis AFB. In addition, Alternative 2 includes the use of restoration as a component of integrated weed management. This would improve native vegetation cover in areas currently occupied by invasive species. To the degree that proposed treatments are effective, moderate beneficial impacts to native plant communities are expected. The dead vegetation created by the use of chemical treatments may increase fine fuels out of season with their normal senescence timing which could alter the timing of available fuels and possibly increase risk of wildfire.

Grazing

Grazing has direct and indirect, temporary and permanent adverse and beneficial impacts on native vegetation. The type of animal used to graze an area would determine the potential impacts to native vegetation. Cattle prefer to eat grass rather than forbs or shrubs; sheep prefer forbs and eat grass and shrubs; goats eat shrubs, forbs, grass and have a wide tolerance for plants that are toxic or too thorny/spiny for other livestock; and horses primarily eat grass and crop vegetation very close to the ground (Larson et al. 2015).

Excessive grazing could reduce the health and vitality of vegetation in several ways: trampling causes soil compaction, thus decreasing water infiltration, causing increased runoff, and decreased water availability to plants; vegetation is removed, which increases evaporation to the

soil surface; and physical damage to the vegetation occurs by rubbing, trampling and browsing. Altered vegetation patterns could result in greater susceptibility to drought, fire, insects and invasive plants (US EPA 1994).

Grazing may affect vegetation communities differently:

- **Grasslands**: Native bunchgrasses show varied responses to grazing: increasing in some instances, decreasing in others, or exhibiting no change (D'Antonio et al. 2002). Research conducted at Beale AFB showed cattle grazing reduced the height and reproductive stem production of purple needlegrass but did not appear to affect seedling numbers the following year (Marty et al. 2005). Furthermore, grazing from January to May appeared to increase purple needlegrass seedling survival. If native forbs are known to be abundant on any of the proposed units, sheep preference for forbs may present a problem that would need to be evaluated.
- **Vernal Pools**: Cattle grazing has been shown to protect native plant and animal biodiversity in vernal pool ecosystems in part by reducing vegetation growth in pool basins which reduces competitive with native species and evapotranspiration (Marty 2015a). See Section 4.6 for more details.
- **Riparian and Freshwater Marsh**: Livestock prefer to graze in riparian areas because they provide easily accessible water, shade, and an abundant supply of forage. Heavy grazing of riparian and marsh vegetation could lead to decreased stream quality. However, managed grazing could benefit these habitats when used to control invasive plants. Limiting the number of animals with access to riparian/marsh areas, controlling the timing of grazing, monitoring and ensuring proper distribution of the animals would help control invasive plants and enable more functional vegetation to reestablish in these sensitive areas, without increasing erosion or polluting the watershed. If excessive grazing occurs, negative impacts could include increased erosion, sedimentation and fecal pollution within the watershed. In general, in riparian areas, the RDM would be maintained at 800 lbs/acre. Riparian and marsh areas on Travis AFB, primarily adjacent to Union Creek, may be grazed in the future most likely by sheep or goats. Under Alternative 2, livestock would be closely monitored in riparian/marsh areas and removed from the area before excessive grazing occurs.

Travis AFB has a robust monitoring program that collects data on pasture use and RDM in accordance with the GMP (Hopkinson 2017b). Based on past monitoring, expanding the grazing program under Alternative 2 would have a minor neutral to beneficial impact on native vegetation communities. Therefore, no significant adverse impacts are expected.

Fire Management Treatments

Fire would generally promote plant species that are well adapted to fire and suppress plant species that are poorly adapted to fire. As a result, fire would cause dramatic and immediate changes in species composition and diversity. Under Alternative 2, prescribed burns would target annual grasses and forbs (that are typically dead at the time of burning) and avoid long-lived native vegetation such as oak trees. Fire has been found to increase native species diversity in grasslands and vernal pools (Marty 2015b).

Firebreaks would have varied impacts on native vegetation depending on the method: blacklines would have similar impacts as those described for prescribed fire; mowing would have little to no impact on native vegetation other than removal of biomass which would be beneficial to low-statured native plants; and mineral firebreaks would remove native vegetation in the short-term

though seed banks are likely to persist. The disturbance created by the installation of mineral firebreaks could create conditions favorable to invasive species; therefore, monitoring for invasive species would be essential in these areas.

Prescribed burns and firebreaks are likely to have direct, short-term adverse impacts to vegetation, and long-term beneficial impacts. Overall under Alternative 2, moderate, beneficial impacts to plant communities are expected.

Chemical Treatments

Long-term, beneficial impacts to native vegetation are anticipated from the chemical control of invasive plants that compete with native vegetation for resources. Potential adverse impacts to non-target vegetation from invasive plant treatment involving herbicide fall into four broad categories: direct exposure (direct spraying or over spraying), off-target drift, movement of chemicals in soil and accidental spills.

- **Direct Exposure**: Effects from direct exposure are dependent on a combination of factors including the non-target native plant species, the timing and method of application, and the herbicide being applied. The risk of direct exposure would also be dependent on the applicator's knowledge of non-target vegetation to be avoided and the selectivity of the application method. For all herbicide applications, potential for direct exposure would be limited to those plants in the immediate vicinity (within five feet) of targeted vegetation. Non-target species are often annuals as well so limited long-term impacts would be seen as a soil seed bank would be expected to persist. Alternative 2 has been designed to reduce impacts to non-target vegetation by always favoring the most selective/targeted treatment available whenever effective and feasible.
- **Off-Target Drift**: When using targeted spray applications, there is some potential for impacts from drift down-wind of application area. These impacts would range from reduced plant vigor, abnormal growth or necrosis to death depending on both the exposure (dose) and sensitivity of the affected plant. Herbicide drift is influenced by a number of factors including site topography and surrounding vegetation, spray droplet size, wind speed and direction and height of spray nozzle. AMMs would be implemented to reduce the potential of off-target drift as follows: (1) use coarse droplet size thereby limiting the presence of drift-able droplets, (2) restrictions on the maximum height of spray nozzle above the ground, and (3) restriction on wind speed and direction when applying herbicides (see Conservation Measures in Appendix D).
- **Other Off-Target Movement (wind erosion, runoff, leaching)**: Off-target impacts from herbicides are primarily a concern for chemicals that remain active in the soil (i.e., herbicide with pre-emergent properties), such as aminopyralid and chlorsulfuron. Off-target effects would occur from wind erosion moving treated soil, water moving across a treated area into an untreated area or herbicides moving in the soil. Potential for off-target movement is greatest for broadcast or spot applications where the herbicide is applied directly to the soil. Herbicides with residual pre-emergent properties would not be applied in areas with soils and topography conducive to erosion or run-off.
- **Accidental Spills**: There is always a remote risk of accidental spills or exposure scenarios other than those described above. To limit the potential for impacts from herbicide spills, mixing and loading of herbicides would occur at least 150 feet from any open water resources which tend to be where native plants occur (e.g. vernal pools, wetlands) (see Conservation Measures in Appendix D). A spill kit would be kept on-site or in a vehicle.

Overall, long-term, moderate beneficial impacts to native vegetation are anticipated from the chemical control of invasive plants that compete with native vegetation for resources.

Manual and Mechanical Treatments

Long-term positive impacts to native vegetation are anticipated from the removal of invasive plants that compete with native vegetation for resources. Hand-pulling and other mechanical methods for removing invasive species would be effective and highly selective, but there is a slight risk for temporary adverse impacts if work crews inadvertently trample, uproot or otherwise disturb non-target vegetation. If invasive plant material is left on-site and re-sprouts, it could suppress native vegetation. When using a weed whacker or mower, there is some risk of impacting non-target vegetation intermixed with the target invasive species. Tarping and mulching invasive species may cause localized effects to surrounding non-target native vegetation. Hand-pulling and other mechanical treatments in close proximity of sensitive plants would result in adverse impacts if crews trample, uproot or disturb non-target vegetation. If work is done within 100 feet of sensitive plant locations, the plant(s) would be flagged. Draining of ponds associated with invasive fauna control may have negative impacts to native aquatic species.

In general, all invasive species control projects are designed to have long-term beneficial impacts to native plants. Most native plants are annuals and are expected to have a persistent soil seed bank so even if current year vegetation is destroyed before seed set, impacts would be extremely limited temporally and spatially. Therefore, there would be no significant adverse impacts to native vegetation from manual and mechanical treatments under Alternative 2; impacted are expected to be beneficial long-term.

Habitat Restoration

Habitat restoration is designed to restore native and desirable vegetation and is anticipated to have a direct beneficial, long-term impact on native vegetation communities. Habitat restoration and enhancement treatments, such as replanting or reseeding, would promote desirable species and habitat conditions in conjunction with invasive plant control treatments.

4.7.2.2 Terrestrial Wildlife

Invasive species treatment methods described in Alternative 2 would result in indirect impacts to the habitat of terrestrial wildlife. Where invasive plants occur in large, dense patches, treatments would temporarily create bare ground by reducing plant cover. Where invasive animals occur in large numbers, removal would reduce the prey base temporarily for some terrestrial wildlife species. The removal of invasive plants would, in the short term, decrease the amount of vegetative cover available to wildlife. For the most part, invasive species treatments restore, rather than reduce, habitat available to native wildlife and the successful control of invasive species infestations provides long-term benefits by restoring and preventing further loss of native habitat. Removal of invasive species generally increases the diversity of native herbaceous, shrub, and wildlife species within treated areas. Large infestations and monocultures of invasive plants (e.g., yellow starthistle) do not support healthy wildlife populations and may reduce animal diversity (DiTomaso et al. 2006). The long-term benefits associated with restoring native plant communities far outweigh the small temporary and short-term impacts of removing invasive vegetation cover.

Birds nest in and feed on several of the invasive plants found on Travis AFB (e.g., thistle and mustard species). Although certain species benefit to some degree from the presence of invasive plants, use of these plants as a nesting or feeding source by birds such as the red-winged

(*Agelaius phoeniceus*) or tricolored blackbird (*Agelaius tricolor*) near the Travis AFB airfield creates a BASH concern, which is detrimental to both humans and wildlife. There is ample food and nesting habitat available for birds within native habitat, so removal of invasive plants is unlikely to reduce food availability or habitat quality for any native wildlife species to a meaningful degree. Reducing the presence of invasive species would benefit habitat for the vast majority of species which are adapted to and depend upon healthy native plant communities. Therefore, while short-term, minor adverse impacts may occur to native terrestrial wildlife as a result of invasive species treatments, long-term beneficial impacts are expected. There would be no significant adverse impacts under Alternative 2 on terrestrial wildlife.

Grazing

Annual grasslands at Travis AFB provide important foraging habitat and cover for a number of wildlife species. Expansion of the grazing program has the potential to have negative, neutral and beneficial effects to terrestrial wildlife.

Direct impacts include competition for palatable forage species, while indirect impacts include reduction in protective vegetation cover. This low vegetative cover; however, benefit many of the targeted species of concern (see Section 4.9.2.4). At the pasture scale, grazing management can benefit terrestrial species by creating breeding habitat for CTS and improved upland habitat with grazing. Examples of other species that benefit from grazing include burrowing owls (*Athene cunicularia*), ferruginous hawk (*Buteo regali*s), Swainson's hawk (*Buteo swainsoni*), and tricolored blackbird. In some cases, grazing exclusion has caused the species being "protected" to leave or disappear (Huntsinger & Bartolome 2014; Hopkinson 2017).

In some cases, grazing could produce negative impacts to native species including Cooper's hawk (*Accipiter cooperii*), Northern harrier (*Circus cyaneus*), and white-tailed kite (*Elanus caeruleus*) (Hopkinson 2017a). Importantly, only certain kinds of grazing may be harmful in many instances. For example, heavy grazing in mustard-dominated breeding areas is likely to negatively impact tricolored blackbirds but grazing is likely beneficial in its preferred foraging areas of annual grasslands (Hopkinson 2017a).

Ultimately, properly managed and monitored grazing would have positive, long-term moderate impacts on target wildlife at Travis AFB and is a beneficial natural resources management tool. Benefits to wildlife include creation of patchy habitat with high structural diversity for feeding, nesting and hiding and opening up areas of dense vegetation to improve foraging areas for a variety of wildlife. Expansion of the grazing program under Alternative 2 would enhance the ability of the NRM to prescribe wildlife habitat-improvement treatments.

Fire Management Treatments

Impacts to wildlife from prescribed fire in Alternative 2 would generally be negligible to minor, but moderately adverse to populations of small, less mobile animals that live in the center of prescribed fire subunits. Invertebrates like the DGGB, for instance, may be killed and unable to leave the burned area if unable to escape. The long-term impacts on most wildlife would be an indirect benefit of reduced invasive plant cover and reduced risk of high-intensity wildfire. Wildlife including raptors and small mammalian predators would be able to locate prey more easily in burned areas. These benefits to some species of wildlife would be temporary, localized and short-term but would recur following prescribed fires. Prescribed fires are conducted on a rotating basis to avoid burning extensive areas at one time, which is intended to allow wildlife to repopulate burn units from unburned areas.

Fire management could adversely impact some terrestrial wildlife species with the primary concern surrounding the potential for firebreak construction to do direct harm (see discussion on CTS in Section 4.9.2.4.3). All prescribed fire units will be surveyed by a qualified biologist for nesting wildlife species prior to burning. With the implementation of AMMs, any short-term adverse impacts of fire management treatments on terrestrial wildlife would be minor and temporary. No significant adverse impacts are expected, and long-term beneficial impacts are expected.

Chemical Treatments

The likelihood that an animal would experience adverse impacts from an herbicide depends on: (1) toxicity of the chemical, (2) the amount of chemical to which an animal is exposed, (3) the amount of chemical actually received by the animal (dose) and (4) the inherent sensitivity of the animal to the chemical. Assessments of the risks posed to wildlife from herbicides, surfactants and application methods proposed for use are based upon Human Health and Ecological Risk Assessments prepared by Syracuse Environmental Research Associates (SERA) (SERA 1996; 2003; 2004a, b; 2007; 2010; 2011a, b, c, 2016). There is insufficient data on species-specific responses to herbicides for free-ranging wildlife, so wildlife species were placed into groups based on taxa type (e.g., bird, mammal), with similar body size and diet. Reptiles were not considered in these assessments, so small birds should be considered a surrogate. Ecological Risk Assessments use the same methodology described for Human Health Risk Assessments in Section 4.7, *Safety and Occupation Health*.

Terrestrial animals might be exposed to herbicide from direct spray, the ingestion of contaminated media (i.e. vegetation, prey species or water), grooming activities or indirect contact with contaminated vegetation, and these sources of exposure were considered in the SERA Ecological Risk Assessments (SERA 1996; 2003; 2004a, b; 2007; 2010; 2011a, b, c, 2016). The Ecological Risk Assessments show that the highest exposures for terrestrial vertebrates would occur after the consumption of contaminated vegetation or contaminated prey. Direct spray with herbicides may have adverse effects to terrestrial insects from herbicide toxicity or surfactant-induced drowning. Other routes of exposure including dermal contact with contaminated vegetation, ingestion of contaminated water or the consumption of contaminated fish led to levels of exposure below the level of concern (HQ less than 1) for all species groups and all herbicides being considered in this project. If a group is not discussed for an herbicide below that means there are no exposure scenarios that generated HQs greater than 1.

Any other herbicides not evaluated in this document but chosen for use on Travis AFB in the future are likely to carry similar risks as they go through the same rigorous regulations and permitting processes through various state and federal entities and include extensive use information on their labels, as approved by the US EPA. Based on the available information, Alternative 2 is not expected to cause significant adverse impacts to terrestrial wildlife especially

Manual and Mechanical Treatments

All treatment methods would result in disturbance from human presence and noise. Because manual and mechanical techniques take longer than herbicide methods, the duration of disturbance, caused by the presence of people, may be comparatively longer. Treatments would take from one to two days to several weeks depending on the method and target plant species. Weed whackers, mowers and ATVs all have the potential to generate noise sufficient to flush birds from a nest or interfere with feeding of nestlings if conducted in proximity to nests. Nesting bird surveys would be done prior to any projects starting 15 Feb – 15 Sept. If nests are found, a buffer would be established around the nest where no work is permitted to occur. Small mammals

are likely to stay underground during activities and larger mammals are typically only present in the grasslands during dawn, dusk or at night when work would not occur. All manual and mechanical treatment work is slow enough and noisy enough to prompt and allow terrestrial wildlife to leave the area limiting direct mortality. While non-native fauna eradication methods often take place at night and thus may disrupt nocturnal terrestrial wildlife, impacts are expected to be minor and temporary. Therefore, no significant, adverse impacts would result from manual or mechanical treatments under Alternative 2.

Habitat Restoration

Habitat restoration is designed to restore native and desirable vegetation and is anticipated to have an indirect, permanent, beneficial impact on terrestrial wildlife by improving habitat conditions. Revegetation with desirable native species would be used to enhance ecosystem function, provide habitat to wildlife, suppress invasive plant regrowth and reduce the number of follow-up treatments required (Cal-IPC 2015).

4.7.2.3 Aquatic Wildlife

Grazing

Livestock grazing has the potential to adversely impact aquatic habitat and the organisms that occupy it. Poor livestock and wildlife grazing management could have adverse effects on stream hydrology and water quality. Potential impacts such as bacterial contamination, increased sedimentation and temperature changes would reduce the quality of the stream's ambient environment so as to affect the composition and health of aquatic organisms. Likewise, reduction of vegetation and increased runoff and flow may damage the stream's usefulness as aquatic habitat (US EPA 1994).

Under Alternative 2 grazing would generally not occur in riparian or marsh habitats on Travis AFB or its GSUs. Any grazing within riparian corridors, marshes, or other habitat adjacent to water course or bodies of water would be closely monitored and livestock would be removed if there are signs of streambank erosion, bare soil areas or increased sediment runoff. Livestock would continue to be excluded from most riparian areas on the base when not being used for targeted vegetation management.

Livestock grazing is likely necessary to maintain the hydrological conditions of vernal pools. A Sacramento County grazing exclosure study demonstrated that, after just 10 years without livestock grazing, vernal pools took up to two weeks longer to fill and dried 1-2 weeks earlier on average than comparison grazed pools (Marty 2015a). Livestock reduce non-native cover, which in turn reduces evapotranspiration, resulting in longer vernal pool inundation periods. In addition, Marty (2015) suggests that non-native plant thatch build-up in ungrazed pools increases soil organic matter and consequently soil water-holding capacity of the soil; as a result, the surrounding soil holds more water in an ungrazed vernal pool and less is retained in the vernal pool itself, reducing inundation periods. In its most recent five-year reviews for federally listed branchiopods (USFWS 2017a, b) which rely on vernal pools, the USFWS states that cessation of grazing is a threat to the species, while noting that overgrazing that modifies vernal pools by increasing sedimentation and nutrient inputs is also likely to be a threat. Close monitoring and ongoing studies would ensure these adverse impacts do not become significant or outweigh the beneficial impacts to the ecosystem. Therefore, grazing management and expansion under Alternative 2 would not result in significant, adverse impacts to aquatic wildlife or their habitat.

Fire Management Treatments

Aquatic habitat may be temporarily, indirectly adversely impacted by prescribed burns due to increases in turbidity caused by runoff and erosion from nearby burned uplands. Water temperatures may also be affected if vegetation that provided pre-fire shade is removed. Mineral firebreaks could indirectly affect aquatic wildlife through water contamination. Chemical fire retardants would not be used.

Prescribed fire would not typically be used to control woody biomass near waterbodies of which there is very little if any along Union Creek and other wetlands on Travis AFB, thus there is little risk of elevated water temperatures from a lack of shade as a result of prescribed burns. The topography along Union Creek and base-wide generally is relatively flat, so the run-off potential is limited. If prescribed burns are conducted adjacent to a creek or other water body a vegetated buffer would be maintained between it and the burn area to trap sediment and ash before it would enter the water course/body. The exception to this would be when vegetation along the edges of the creek or water body are being burned. BAER inspections would be conducted after all burns to assess potential impacts to nearby wetland resources and erosion control measures installed prior to the wet season to minimize turbidity and water quality impacts where needed. Mowed, wet lined and/or blacklined fireline perimeters would be the primary methods used where any riparian or wetland habitat is present. Therefore, no significant, adverse impacts to aquatic wildlife are anticipated as a result of prescribed burns as part of Alternative 2.

Chemical Treatments

Aquatic wildlife may be exposed to herbicides from accidental spills, direct application, overspray or runoff into the body of water that they are inhabiting. A review of Ecological Risk Assessments for aquatic species shows that most of the concern for aquatic species is associated with exposures scenarios for an accidental spill. Aquatic wildlife impacts were analyzed in the Ecological Risk Assessment completed for the Beale Weed EA (USAF 2021); potential adverse impacts to aquatic species from herbicides are expected to be similar to those analyzed in the that EA.

As with terrestrial wildlife, any other herbicides not listed specifically in this EA or this section but chosen for use on Travis AFB in the future are likely to carry similar risks as they go through the same rigorous regulations and permitting processes of various state and federal agencies. Chemical treatments under Alternative 2 are not expected to cause significant, adverse impacts to aquatic wildlife especially given the limited use of herbicides on base.

Manual and Mechanical Treatments

Manual and mechanical invasive and aquatic plant treatments would primarily have direct, beneficial, long-term impacts to aquatic wildlife by removing plants blocking water channels and/or clogging or shading water bodies. There is the potential for direct adverse impacts to species such as the western pond turtle from the removal of aquatic vegetation such as cattails and tules from Union Creek or the North Gate Pond which may provide habitat. Removal of vegetation would also increase water flows and cause increased water temperatures from lack of shading. Such vegetation has a rapid re-growth rate and the entirety of Union Creek would not be treated allowing for retreat of species from treatment areas and availability of alternative, temporary habitat.

Draining of ponds and use of other methods to control invasive fauna such as the American bullfrog may adversely impact native aquatic wildlife in the short-term, if present. Populations of native aquatic wildlife in any pond; however, are likely to be limited as many are prey for bullfrogs and fish. When invasive fauna are present, a sustainable, functional, healthy ecosystem is not

available for the persistence of native aquatic wildlife. For instance, one goal of bullfrog removal is the protection and creation of viable breeding habitat for CTS which are prey for the bullfrog while using the pond. Presence of bullfrogs in any CTS breeding pond creates a sink for CTS populations, which in turn has long-term moderate to significant adverse impacts on the CTS populations in the area. Removal of bullfrogs by various manual methods including pond draining, while it may kill any aquatic wildlife present, would provide beneficial, long-term impacts by creating a bullfrog-free pond for future recolonization by native wildlife. Such future recolonizations would not be subject to heavy predation by invasive fauna.

Therefore, manual and mechanical treatments under Alternative 2 would not result in significant, adverse impacts to aquatic wildlife or their habitat.

Habitat Restoration

Habitat restoration would have indirect, permanent beneficial impacts on aquatic habitats if and where it reduces bare soil, which would slow the speed of overland water flow. This would result in reduced slower storm runoff, reduced erosion and reduced water sedimentation. Where restoration treatments may not reduce bare soil, projects are not expected to have any impacts to aquatic resources. They would not be located directly next to aquatic resources or appropriate erosion control measures would be installed if needed before the first wet season. Under Alternative 2, no significant, adverse impacts to aquatic wildlife or habitats is expected from restoration treatments.

4.7.2.4 Special Status Wildlife Species

Activities associated with implementation of invasive and aquatic plant and animal species control activities have the potential to result in short-term, temporary, adverse impacts to special status wildlife species as well as long and short-term beneficial impacts. The activities that would directly or indirectly adversely impact these species include off-road site access, movement of workers and vehicles, herbicide exposure (Table 21 and 22), contamination of waterways and soil from vehicular leaks or improper maintenance, injury or death from prescribed fires or mineral firebreak installation and increased disturbance. The activities that would have direct or indirect beneficial impacts or no impacts are (1) restoration activities designed to result in long-term positive effects through the reduction of competitive pressures from invasive plants to native species and improvement of ponding duration and water quality in branchiopod habitat, (2) well managed grazing that meets biomass removal targets, (3) prescribed burns designed to miss sensitive locations and seasons, and (4) mechanical, manual and restoration control activities (especially mowing).

Travis AFB has consulted with the USFWS under Section 7 of the ESA to evaluate the potential effects to federally listed species and their habitats from invasive species management actions proposed in this EA on Travis AFB and its GSUs (*Programmatic Formal and Informal Consultation on the Proposed Effects of Activities Conducted at Travis Air Force Base on Six Federally Threatened and Endangered Species, Solano County, California*, PBO, 2017-F-2294, USFWS 2018a). All Avoidance and Minimization Measures (AMMs) from the completed PBO (USFWS 2018a) and the Revised Travis AFB PBA (May 2020), updated in order to reinitiate the next version of the PBO, would be implemented and are a part of Alternatives 1 and 2 (Appendix D).

The PBO (USFWS 2018a) includes concurrence that typical activities that occur at Travis AFB and its GSUs would have no effect (NE) and/or may affect but are not likely to adversely affect (NLAA) CTS, VPFS, CCG, DGGB, VPTS and CFS. The covered activities meeting NE, beneficial effect (BE) or NLAA conclusions include almost all of the invasive species management activities

Table 21. Toxicity of Herbicides to Various Taxonomic Groups

Species listed in parentheses indicate applicable potentially affected species listed under the ESA at Travis AFB. Source: USAF 2021

Herbicide		Amphibians & Reptiles (CTS)	Birds	Fish	Aquatic Invertebrates (VPFS, VPTS, CFS)	Terrestrial Invertebrates (DGGB, Monarch, bumble bees)
Active Ingredient	Trade Names					
Triisopropanolammonium salt of aminopyralid	Milestone, Capstone[a]	practically non-toxic to aquatic-phase amphibians[1]	practically non-toxic[2]	practically non-toxic[2]	practically non-toxic[2]	practically non-toxic[2]
Chlorsulfuron	Telar XP	no data available[3, d]	practically non-toxic[4]	practically non-toxic[4]	practically non-toxic[4]	practically non-toxic[4]
Isopropylamine salt of glyphosate	Roundup Pro	practically non-toxic[5], aquatic: practically non-toxic - moderately toxic[17, e], terrestrial: see birds[17]	slightly toxic[6,17]	practically non-toxic[6], slightly toxic - highly toxic[17]	may be slightly toxic[6,7], practically non-toxic - moderately toxic[17, e]	non-toxic[6]
Isopropylamine salt of glyphosate	Rodeo[b], Roundup Custom[b]	na, but see above	na, but see above	practically non-toxic - slightly toxic[17]	na, but see above	na, but see above
Ammonium salt of imazamox	Clearcast	no data available[8]	practically non-toxic[9]	practically non-toxic[9]	practically non-toxic[9]	practically non-toxic[9]
Isopropylamine salt of imazapyr	Arsenal [b], Habitat [b]	practically non-toxic[10]	practically non-toxic[11], no risk of concern[19]	practically non-toxic[11], no risk of concern[19]	practically non-toxic[11], no risk of concern[19]	practically non-toxic[11], no risk of concern[19]
Sulfometuron Methyl [c]	Oust XP	practically non-toxic[12, d]	practically non-toxic[12]	practically non-toxic[12]	practically non-toxic[12]	practically non-toxic[12]
Triclopyr butoxyethyl ester (BEE)	Garlon 4 Ultra	moderately to highly toxic[13]	slightly toxic[18]	moderately - highly toxic[18]	slightly - moderately toxic[18]	na
Triclopyr triethylamine salt (TEA)	Garlon 3A[b]	likely practically non-toxic[13]	practically non-toxic[14,18]	practically non-toxic[18]	practically non-toxic - moderately toxic[14,15,18]	practically non-toxic[14,18]

[a] Aminopyralid + Triclopyr, a.k.a. Milestone VM Plus; [b] aquatic approved formulations; [c] toxicity 'levels' are based primarily on acute testing methods, chronic effects are extrapolated; [d] aquatic phase-amphibian toxicity is based on fish assessments, terrestrial phase are based on bird assessments; supplemental data exist for chlorsulfuron; [e] toxicity varies with specific formulation and species, etc.

1. SERA 2007; 2. US EPA 2005c; 3. SERA 2016; 4. Oregon State University & Intertox 2006; 5. Vincent & Davidson 2015; 6. University of California at Davis 1996; 7. No toxicity is expected from labeled use of glyphosate, toxicity is from the surfactant (Monsanto 2002); 8. SERA 2010; 9. US EPA 1997; 10. Trumbo & Waligora 2009; 11. SERA 2011c; 12. US EPA 2008; 13. Berrill et al. 1994, Edington et al. 2003, Yahnke et al. 2017; 14. National Pesticide Information Center 2005; 15. Toxicity varies by formulation of finished product and species tested; 16. Garlon 4 formulation is highly toxic to salmonids (Wan et al. 1987); 17. US EPA 2015; 18. US EPA 1998; 19. US EPA 2006

Table 22. Toxicity of Adjuvants to Various Taxonomic Groups

Species listed in parentheses indicate potentially affected species listed under the ESA at Travis AFB. Source: USAF 2021

Adjuvant Name	Approved for Aquatic Use in CA	Surfactant Type	Action	Amphibians & Reptiles (CTS)	Birds	Fish	Aquatic Invertebrates (VPFS, VPTS, CFS)	Terrestrial Invertebrates (DGGB)
Agri-Dex	Yes	Crop oil concentrate	increase pesticide penetration	practically non-toxic in formulation with glyphosate IPA[1]	na	practically non-toxic[2], practically non-toxic in formulation with Arsenal[3]	practically non-toxic[2]	no toxicity observed[4]
Competitor	Yes	Modified vegetable oil	increase pesticide penetration	practically non-toxic in formulation with glyphosate IPA[1]	na	slightly toxic[2]	practically non-toxic[2]	na
Hasten-EA	Yes	Modified vegetable oil concentrate	increase pesticide penetration	na	na	practically non-toxic[3] (Hasten) in formulation with Arsenal - slightly toxic[5]	na	na
Dyne-Amic	Yes	Modified vegetable oil surfactant blend	increase pesticide penetration	no significant increase in mortality at environmentally-relevant concentrations and in formulation with glyphosate[6]	na	slightly toxic[2,7]	slightly toxic[2]	learning impairment following oral ingestion of 20µg[4]
Induce	Yes	Nonionic low foam wetter/spreader	increase pesticide penetration	na	na	moderately toxic[7]	na	no toxicity observed[4]
Grounded W	No	Deposition aid (sticker)	promotes even, uniform spray deposition	na	na	na	na	na

1. Vincent & Davidson 2015; 2. Washington State Department of Agriculture 2012; 3. Fisher et al. 2003; 4. Ciarlo et al. 2012; 5. Smith et al. 2004; 6. Johnson 2017; 7. Haller & Stocker 2003

in this EA. The PBO also covers additional invasive species management activities for which a likely to adversely affect (LAA) conclusion may be warranted. Under the PBO consultation framework, all projects meeting the consultation criteria for Levels 2 (NLAA, BE) and Level 3 (LAA) would have individual abbreviated project-specific analysis completed by Travis AFB called Project Analyses (PAs), following the Covered Project Analysis Template, and submitted to the USFWS for concurrence at the time the project is funded and approved. At this time, Section 7 is complete for all activities in this EA and the Service agrees that with implementation of the AMMs, activities may proceed. Therefore, invasive and aquatic species control activities under Alternative 2 would not result in significant, adverse impacts to special status species *populations* even if some individuals, for which the Air Force receives approval from the regulating authority (e.g. USFWS), are adversely impacted.

4.7.2.4.1 California Tiger Salamander (Threatened)

Activities associated with invasive and aquatic species management have the potential to result in beneficial and adverse impacts to CTS and their habitat within the footprint of each project. Ground disturbance may result in the loss of upland habitat used for dispersal, refugia and foraging. CTS may be killed or injured from operation of equipment including vehicles during project activities. Project activities may result in harassment from noise and vibration and may disturb CTS causing them to leave their upland refugia and increase their exposure to desiccation and predation. Implementation of the AMMs in Appendix D to minimize habitat alteration and destruction and loss of individuals including reducing the project footprint, clearly demarcating project boundaries, providing worker education programs, and having a Service-approved Biologist monitor project activities and relocate CTS out of harm's way would minimize the number of individuals affected as well as the intensity and exposure of any such impacts.

With the implementation of AMMs no significant adverse impacts to CTS *populations* are anticipated under Alternative 2, though individual CTS may be adversely impacted.

Grazing

Grazing activities would benefit CTS. The duration, intensity and frequency of current and future seasonal grazing on Travis AFB is designed to improve habitat for CTS; promote native species; minimize soil erosion; reduce non-native plant species; reduce wildfire risk; and prevent the spread of undesirable plant species.

Grazing should not alter CTS behaviors except to increase suitability of the habitat for migration and breeding. Grazing could collapse burrow systems thereby removing the opportunity for CTS to occupy such a burrow; however, the act of grazing should encourage small mammal occupancy, improving the density of active burrows (Ford et al. 2013). Use of rangelands by CTS has been researched though there is no evidence that CTS require specific grass height, RDM, forage mass or density or species composition for use or survival (Ford et al., 2013). CTS appear to treat tall vegetation as a “barrier” to dispersal, turning to walk along the line of tall vegetation (J. Alvarez pers. comm.). Cattle grazing may also improve conditions in breeding ponds and pools for CTS by maintain a longer hydroperiod (Marty 2005, 2015). Therefore, as a whole, grazing would not significantly affect CTS populations.

Fire Management Treatments

Prescribed fire on base would occur primarily in annual grasslands where CTS would be underground in small mammal burrows during the duration of the burn. Fire intensity and residence time in these grassland fires is expected to be at a level that would not negatively affect

soil temperatures below a few inches from the surface. Fire may have a beneficial effect on CTS habitat due to its ability to reduce biomass and thatch improving migratory corridors for CTS. New Activity-Specific Conservation Measures (Appendix D) would ensure no further effects to CTS occur. Burns would occur during daytime hours after 10 AM in High and Medium Risk areas when CTS are expected to be underground and protected from fire.

Both disking and blading/grading firebreaks may negatively impact fossorial mammal burrows and directly impact CTS by either cutting them while they are inside burrows or entombing them by collapsing or covering their burrows at the surface. Graded mineral firebreaks were installed in two areas on base during emergency operations associated with the LNU Lightning Complex Fire in August 2020. One of these areas, the Castle Terrace Conservation Area, is located in High Risk CTS habitat. This firebreak is approximately 2.5 acres and will be maintained in its current configuration. It will therefore have ongoing impacts to CTS habitat and potential take of CTS. This activity was covered under an Emergency Section 7 Consultation where the FWS determined that no mitigation was required (L. Pena pers. comm.).

The installation of 13,400 linear feet (7.5 acres) of new disked mineral firebreaks are planned for three areas considered as High Risk CTS habitat (Figure 5). All temporary or permanent habitat impacts will be mitigated based on the compensation guidelines in the 2018 PBO. Therefore, wildland fire management activities are not expected to significantly adversely impact CTS populations even though some individual take of CTS occurs as allowed and permitted by the USFWS.

Chemical Treatments

Some of the herbicides proposed for use are potentially toxic to reptiles and amphibians (Tables 21 and 22), so herbicide application has the potential to directly, adversely impact individual CTS if improperly applied. Application of herbicides to upland CTS habitat may result in some risk of herbicide exposure. Application of herbicides would not occur to known or suspected breeding ponds, which do not include vernal pools (where herbicides application in the dry season is expected). Herbicide exposure may cause injury or mortality to adult or juvenile CTS if selected herbicides have a known or unknown effect on amphibians or if applied carelessly or broadly across upland habitat during migratory periods (vs with targeted spray or application to target invasive species). If herbicides are applied before a rain event within the water runoff area of a breeding pond, herbicides could runoff into ponds and adversely affect CTS eggs or juveniles. If herbicide application is carefully applied to target plant species in low concentrations and volume, follows proposed conservation measures, is conducted during daylight hours, avoids migratory periods and ground inspections for CTS are conducted before control begins, adverse impacts would be minimized. Applications would occur in Low, Medium and High Risk CTS upland habitat.

Much research has been done on glyphosate, the most used herbicide globally. While glyphosate, for instance, is supposed to bind tightly to soil, contamination of surface water is possible through various mechanisms explored by Annett et al. (2014). Soil binding is affected by soil chemistry and physical characteristics. Glyphosate is supposed to be readily broken down by soil microorganisms though the range of possible half-lives is large (1.7 to 142 days per Giesy et al. 2000 as cited by Annett et al. 2014). Runoff into surface waters is via surface erosion or dilution (solubility in water) during rainfall events after herbicide application (Annett et al. 2014 citing Peruzzo et al. 2008). Annett et al. (2014) acknowledges that the correlation between glyphosate use and surface water detection is relatively low; however, the correlation between glyphosate's primary metabolites and surface water detection is stronger. Presence of glyphosate in surface waters is highly dependent on proximity (spatial and temporal) to herbicide application sites

(Annett et al. 2014). Finally, glyphosate is not expected to bioaccumulate (Wang et al. 1994) though there is some concerning research showing it may (Annett et al. 2014).

Research on toxicity of pesticides to amphibians (see also Section 4.9.2.3) show that skin absorption would occur from contact with treated soil or direct overspray and that pesticide risk assessments that rely on aquatic invertebrates and fish as well as mammals and birds are not sufficient to determine toxicity to aquatic and terrestrial amphibian life forms. Research into glyphosate toxicity to amphibians shows mixed results though direct exposure via overspray does have lethal effects (Bruhl et al. 2011). In general, Conservation Measures in Appendix D would minimize against significant, adverse impacts to CTS populations. Additional minimization measures may be provided in specific Project Analysis under the PBO if CTS exposure is likely, control occurs in High Risk areas, and/or broadcast spraying is planned during migratory periods within 1.3 miles of a breeding pond or where there are known records of CTS.

Herbicides would be applied in accordance with the AMMs in Appendix D. With the implementation of these measures no significant adverse impacts to CTS populations are anticipated even if some individual CTS may be adversely affected.

Manual and Mechanical Treatments and Habitat Restoration

Manual and mechanical treatments and habitat restoration have little potential to adversely affect CTS if AMMs are followed as CTS would be inactive during time periods when work is completed and burrows would be avoided to avoid entombment of CTS. Pond drainage and other methods to control invasive fauna such as bullfrogs would not conduct such activities in a way that would impact CTS. For instance, the only pond where drainage is planned has not had CTS records in it for at least a decade, likely because of the presence of bullfrogs. Therefore, manual and mechanical treatments and habitat restoration are not expected to significantly adversely impact CTS.

4.7.2.4.2 Vernal Pool Tadpole Shrimp (Endangered), Vernal Pool Fairy Shrimp (Threatened), and Conservancy Fairy Shrimp (Endangered)

Grazing

VPTS, VPFS and CFS may experience direct impacts due to grazing in the form of crushing or damage to cysts or adults due to herbivore trampling (Hathaway et al. 1996). However, this impact would be offset by the positive effects of grazing on vernal pool ecosystems. As discussed in other sections, vernal pool habitat generally benefits from grazing (Marty 2015a) which improves habitat conditions for these listed species. The USFWS acknowledges that while vernal pools may depend on grazing, injury to cysts may occur (Hathaway et al. 1996, USFWS 2007a). Cattle are expected to displace and move cysts around the soil profile during repeated and frequent hoof action but are not expected to crush cysts (USFWS 2018a).

Although branchiopod cysts are more vulnerable to breakage during the wet season (Hathaway et al. 1996), maximum positive impacts of grazing are achieved when grazing is allowed to occur during the wet season. Allowing grazing to occur as water levels draw down in pools has effectively suppressed invasive grasses in pool basins in Central Valley sites while significantly increasing native cover and diversity (Swiecki & Bernhardt 2008). Even when cattle enter the water of vernal pools, the force of their footstep displaces the water and may also displace any branchiopods thus moving them out of the way and avoiding breakage, injury or death. As discussed above, cattle are expected to displace or move cysts around and not crush or break them (USFWS 2018a)

Ground-disturbing activities (post-driving, trenching, filling, scraping) adjacent to WoTUS would have temporary, minimal impacts on federally listed VPFS, VPTS and CFS habitat but is not likely to adversely impact any protected species due to the implementation of AMMs (Appendix D). New infrastructure would be designed to avoid impacts to sensitive habitats, including known and potential vernal pool shrimp habitat. All new fence poles would be placed as far from federally listed vernal pool shrimp habitat as possible unless required to directly benefit the species (e.g. installation of grazing exclosure for study species impacts), so no direct impacts are anticipated. In some cases, removal of grazing infrastructure from occupied vernal pools may be necessary but would follow AMMs, thereby reducing and minimizing any resulting adverse impacts. Therefore, grazing expansion and other grazing management activities under Alternative 2 would not result in significant adverse impacts to listed vernal pool shrimp species, and are likely to result in long-term beneficial impacts.

Fire Management Treatments

Studies of wildland fire on vernal pool crustaceans have shown that fire does not pose a significant threat to cysts. In one study, cysts of the San Diego fairy shrimp (*Branchinecta sandiegoensis*) successfully hatched the first rainy season following a fire event (Wells et al. 1997). Prescribed burns are expected to improve VPFS, VPTS and CFS habitat by removing thatch from vernal pools and surrounding uplands, thereby improving the ecological function of the pools.

Firefighting actions such as maintaining mineral firebreaks and wildfire response actions often have negative impacts on vernal pool ecosystems when they plow through pool basins disrupting hydrology and injuring federally listed species that may be present. Prescribed burns would avoid damaging VPTS, VPFS and CFS habitat through implementation of AMMs and Conservation Measures (Appendix D) and include avoiding species habitat (e.g. vernal pools) when installing hand-lines and mineral firebreaks, delaying fires until 10 AM during CTS migratory periods and having biologists designate areas where fire equipment would be operated where it avoids sensitive habitats and the risk of damage or removal of branchiopod cysts. Mineral firebreaks will avoid all vernal pool and other wetland habitat with a buffer of 10 feet on all sides. As discussed in Section 4.6.2.3, mineral firebreaks may still have impacts on vernal pool hydrology depending on the method used and therefore adversely impact the listed species associated with them. Minimizing the use of graded/bladed/plowed firebreaks around vernal pools would reduce these impacts.

Therefore, fire management activities under Alternative 2 would not result in significant adverse impacts to listed vernal pool shrimp species and are likely to result in long-term beneficial impacts.

Chemical Treatments

Little is known about the impacts of herbicides on vernal pool branchiopods. One study conducted on San Diego fairy shrimp found that glyphosate, the active ingredient in Roundup, would be lethal to this species depending on the concentration of the chemical in the pool water (Ripley et al. 2002, 2003). No studies have measured glyphosate concentrations in Central Valley vernal pools, but a study in the northeastern United States found glyphosate levels in some vernal pools well above the range of the lethal dose levels indicated in the Ripley et al. study (Battaglin et al. 2009). These concentrations were found in a pool where the adjacent habitat had been sprayed for invasive species seven days before the sample collection.

Studies have found that the surfactants found in some formulations of commercial preparations of glyphosate may be toxic to aquatic life including amphibians (Battaglin et al. 2009; Reylea & Jones 2009), water flea (Cuhra et al. 2013) and fairy shrimp (Brausch & Smith 2007). In general,

aquatic organisms are more negatively impacted by surfactants than terrestrial organisms due to surfactant sorption to biological membranes (skin, gills), which disrupts biological functions. A study on the beaver-tail fairy shrimp (*Thamnocephalus platyurus*) assessed the acute toxicity of the surfactant POEA (polyethoxylated tallowamine) and found it to be extremely toxic at low concentrations (Brausch & Smith 2007). Because inert ingredients are not required to be specified on product labels by the manufacturer, it would be difficult to discern which or even whether an adjuvant (i.e. additive) is present in the formulation as well as whether or not it is harmful to wildlife (Cuhra et al. 2013). Herbicide application near vernal pools would follow the AMMs in Appendix D.

Additionally, any herbicide application within vernal pools would occur in the dry season and is subject to compliance with the NPDES Aquatic Pesticide Permit and associated APAP, which requires monitoring. As an added protection, Travis AFB would sample vernal pools once they fill with water in the wet season to check for any remaining chemicals approximately five months post application. Any future chemical application would be subject to concurrence by the USFWS based on any prior monitoring data and therefore are not expected to have significant adverse impacts on branchiopod populations, even if some individual branchiopods are impacted.

Manual and Mechanical Treatments

Manual and mechanical removal of invasive plants in VPTS, VPFS or CFS habitat may result in damage or destruction to cysts due to soil disturbance but is expected to improve habitat conditions for aquatic branchiopod life stages. Species targeted for removal in large branchiopod habitat include stinkwort, treasure flower and perennial pepperweed, invasive species known to invade vernal pools and wetlands (DiTomaso et al. 2013). To control these species and others that may invade in the future, manual or chemical removal would be used to eliminate the plant from vernal pools. Manual removal is preferred for vernal pools because it would both kill the target species and remove plant biomass that would impact branchiopod habitat as it decomposes. While hand tools (shovels) may be used, hand pulling would be the primary mode of removal, as hand pulling would cause the least amount of soil disturbance. All manual removal efforts would take care to avoid excessive disturbance to the soil and restrict chemical use to the target plant surface only. Carefully timed weed whacking may also be used to reduce plant biomass.

Mowing in and around branchiopod habitat would only occur when the soil is no longer saturated to prevent damage to vernal pools and cysts. Mowing during the dry season may help improve vernal pool function by reducing thatch within vernal pools.

As a result, manual invasive plant removal may have minor adverse impacts on individuals but is not likely to have significant, adverse impacts on VPFS, VPTS or CFS populations and is also expected to have long-term beneficial impacts on the species' populations as a whole.

4.7.2.4.3 Delta Green Ground Beetle (Threatened)

Impacts to DGGB under Alternative 2 are expected to be similar to those under Alternative 1 (see Section 4.9.1.4 for more in depth discussion of impacts from grazing, fire, and mowing). Additional activities that would occur under Alternative 2 include the installation of mineral firebreaks, manual or chemical weed control and restoration activities. Mineral firebreak installation is planned within the 1-mile buffer of known DGGB habitat. If present either above ground or within soil cracks, DGGB would be adversely impacted by this activity. Little information is available about the life history of DGGB aside from observations around playa pools, however they have been found on livestock paths at the Jepson Prairie Preserve several far from the pool edge (USFWS 2005).

In general, any and all conservation measures and AMMs targeted at protecting vernal pool habitat and other listed species are expected to protect DGGB from any adverse effects. Additionally, all DGGB life stages are expected to be underground in soil cracks during the summer months when most manual, mechanical, chemical or restoration activities would occur. Adults are most commonly seen from January to May and are thought to be otherwise underground in soil cracks or under dense vegetation, though this remains an understudied area. Travis AFB would conduct future surveys if new information comes to light that alters the scientific understanding of DGGB habitat requirements and changes the likelihood of its potential to occur on base.

Activities associated with invasive and aquatic species management activities under Alternative 2 are likely to have no effect on DGGB or its habitat over the majority of the Main Base and are not likely to have a significant, adverse impact where they co-occur with potential habitat.

4.7.2.4.4 Monarch Butterfly (Candidate Species)

Grazing

Overall grazing would have negligible, temporary, adverse effects on monarchs, but there could be moderate, short-term, adverse impacts in the form of crushing of host milkweed plants, eggs, and larvae, and damage to upland nectar sources. Livestock avoid foraging on milkweed itself due to its toxicity (Pfister et al. 2002). Milkweed and monarch butterflies have been documented within the current and proposed grazing pastures. Using BMPs, grazing is assumed to be beneficial to pollinator species by reducing RDM and controlling invasive species (Pelton et al. 2018) and improving diversity of flowering forbs. Currently, grazing on the base is conducted primarily during the dormant season (fall and winter) of local milkweed species and therefore impacts to both the host plant and the species itself would be negligible. If listed, grazing under Alternative 2 may affect, but is not likely to adversely affect monarchs.

Fire Management Treatments

Prescribed burns under Alternative 2 would have a moderate, temporary, negative impact and a moderate, long-term, beneficial effect on the monarch. There is limited information available as to the potential effects of prescribed fire on monarch butterflies and what information there is comes from the eastern population of monarchs in prairie habitat. However, in these habitats, monarchs have been shown to respond positively to prescribed fire, with more monarchs using areas that had previously burned areas. Milkweeds are a rhizomatous species, and both seeds and rhizomes are thought to sprout readily following fire. Furthermore, prescribed fire likely benefits milkweeds by reducing thatch and competition from invasive grasses and forbs, allowing plants to more readily establish, as native milkweeds typically germinate much later than other species and have trouble establishing in areas with high invasive plant pressures (Xerces 2018). Prescribed burns could adversely affect monarchs by destroying milkweed plants, killing monarchs (all life stages if present when burn occurs) and eliminating nectar resources. Smoke may also affect monarchs, but no studies have been conducted to ascertain the effects of smoke on monarchs (Xerces 2018).

Therefore, prescribed burns will not occur in habitat where monarch eggs or larvae are present to avoid take of monarchs. All roosting trees would be protected during prescribed burns. Following the established AMMs and buffers, prescribed fire is not expected to have any adverse effects on the species. However, fire is proposed for use with the specific goal of habitat enhancement within areas known to support milkweed. If listed, prescribed burns under Alternative 2 may affect, but are not likely to adversely affect monarchs or their habitat.

Chemical Treatments

Herbicide application could have moderate, temporary to long-term, adverse impacts to monarchs, based on the Ecological Risk Assessment completed for the Beale Weed EA (USAF 2021). Impacts to monarchs from herbicides are expected to be similar to those analyzed in that EA. Herbicides could indirectly impact monarchs by reducing or eliminating plant resources needed by monarchs and other pollinators for foraging and egg laying (Forrester et al. 2005; Russell et al. 2005; Dover et al. 2010). Herbicide use could also contribute to declines in nectar plants that would negatively affect monarchs (Bohnenblust et al. 2016). However, carefully timed herbicide application, with surveys to flag and buffer milkweed occurrences, would likely benefit monarch breeding habitat by reducing invasive plant infestations that directly compete with milkweeds and native nectar plants.

If use of herbicides near monarch breeding habitat is necessary, special precautions would be used as outlined in the herbicide specific AMMs (Appendix D). Special precautions include placing temporary physical barriers around plants, using low pressure application techniques, and only applying herbicide during low wind conditions. Pre-emergent herbicides could prevent germination and development of milkweed seedlings if applied where seed occurred. However, pre-emergent herbicides would not be used within 150 feet of milkweed localities. All individuals operating within monarch habitat during the growing season would be trained on and be required to demonstrate proficiency in milkweed identification before working in monarch habitat. Based on these measures, the chance of drift or overspray damaging or killing milkweed is discountable.

If invasive plant infestations are left unchecked, these plants would continue to overrun milkweed habitat, leading to localized extirpations or significant population declines. Controlling invasive plant species with herbicides in occupied and suitable monarch habitat is expected to restore and enhance milkweed and nectar plant resources. If listed, herbicide application under Alternative 2 may affect, but is not likely to adversely affect monarchs or their habitat.

Manual and Mechanical Treatments

Manual and mechanical treatments have the potential to cause moderate, short or long-term, adverse effects to monarchs by damaging or destroying milkweed and injuring the eggs or larvae of the monarch. However, damage to milkweed plants would be minimized by adherence to the AMMs in Appendix D. Furthermore, removal of invasive plant species is likely to improve habitat for the monarch over time by removing competition and allowing for the establishment of additional milkweed plants. All disturbed areas near monarch habitat would be reseeded with the base-approved seed mix.

Mowing may occur in areas where milkweed is found. Mowing could have detrimental effects to monarchs during the breeding season by destroying larval food sources and killing caterpillars and eggs. Excessive mowing could also reduce native plant diversity and suppress milkweed abundance. However carefully timed mowing could benefit milkweeds by reducing competition for resources with invasive plants and promoting growth (Xerces Society 2018). If mowing is conducted during the summer, a trained biologist would survey the project area and flag milkweed plants for avoidance. Use of mowing to control non-native plants using the established AMMs is likely to temporarily adversely affect the species by killing eggs and larvae on newly emerged milkweeds, however mowing is expected to have a long-term benefit to the species by improving habitat for both adults and larvae. If listed, manual/mechanical treatments under Alternative 2 may affect, but are not likely to adversely affect monarchs.

4.7.2.5 Special Status Plants

CCG is the only federally listed plant species that has been identified on base or the GSUs (Table 11). Other special status plant species listed as rare in the California Rare Plant Ranking (CRPR) System have been identified on Travis AFB and the Railroad Right of Way GSU (Table 11). These species all occur in similar habitat to CCG, and the proposed invasive plant control would presumably have similar impacts to these species (Table 11). Direct benefits to CCG would occur from the proposed invasive plant control if occurrences currently invaded by invasive species are treated. By carefully designing invasive plant treatments near CCG occurrences Alternative 2 would improve existing habitat quality and prevent further impacts to the species. In addition to removing invasive plants from known occurrences, Alternative 2 would also limit the threat of future invasion into threatened and sensitive plant occurrences from adjacent infested areas.

See Sections 4.9.1.1, 4.9.1.4, 4.9.2.1 and 4.9.2.4.2 for relevant discussions of impacts. CCG rely largely on the hydrology of vernal pools for their success which is discussed at length in relation to listed branchiopods which are also heavily reliant on vernal pool function.

The major invasive species management projects planned for CCG habitat include expanded grazing (cattle, sheep and goats) management, carefully managed mowing treatments, continuation of existing management, and removal of perennial pepperweed and stinkwort from vernal pools via manual, mechanical, and chemical control techniques.

Perennial pepperweed control is likely to have the largest impact and would therefore be conducted slowly, in small test treatment plots and with careful monitoring. Extensive conservation measures (Appendix D) would ensure no significant adverse impacts to the CCG populations and ensure long-term persistent of the species at Travis AFB. The effort involves careful hand-removal and/or mowing of pepperweed along with the chemical control of pepperweed in vernal pools occupied by a proxy species (a common *Lasthenia* spp.) with careful and extensive multi-year monitoring before chemical control would occur in pools with CCG.

As part of the emergency response to the LNU Lightning Complex Fire in August 2020, approximately 3,830 linear feet of graded firebreaks averaging approximately 40 feet wide (3.2 acres total) were installed along the perimeter fence in the Aero Club Goldfields Preserve (Figure 5). These firebreaks impacted wetland habitat in at least eight locations. Total impacted area was 13,056 square feet. Six of the eight impacted wetlands had known occurrences of the endangered Contra Costa Goldfields (CCG; *Lasthenia conjugens*). This activity was covered under an Emergency Section 7 Consultation where the FWS determined that no mitigation was required (L. Pena pers. comm.). These firebreaks will be maintained in the future, but all wetlands will be avoided during installation in the future.

Therefore, no significant adverse impacts to special status plants including CCG are anticipated as a result of Alternative 2.

4.8 EARTH RESOURCES

4.8.1 Alternative 1 (No Action Alternative)

4.8.1.1 Soils and Minerals

There would be no new direct, adverse impacts to soils and minerals as a result of the No Action Alternative. The No Action Alternative would indirectly impact soils by not treating the areas mapped with invasive plants. Current management is likely to decrease bare soil albeit at a cost

to plant diversity. Given that soil communities would be tightly coupled to plants (Wardle et al. 2004), the danger in dominance of any single plant or change from a diverse plant community assemblage to a single stemmed forb such as yellow starthistle is an accompanied shift in soil properties whereby a return to the prior desired vegetation becomes difficult (Seastedt et al. 2008). Most natural forest or native rangeland resists erosion in this climate regime; whereas continued high levels of bare soil would perpetuate a disturbed state.

Current management of the grazing regime limits bare soil and risk of erosion as does the relative flatness of the grazing pastures at Travis AFB. Current management of firebreaks does not include disking which would disturb soil and increase erosion potential. Limited ability to conduct prescribed burns also limits bare soil but also the nutrients gained from such fires. Manual, mechanical and restoration treatments are extremely limited under Alternative 1 limiting impacts to soil.

4.8.2 Alternative 2 (Comprehensive Management)

4.8.2.1 Soils and Minerals

Grazing

Cattle and other livestock may directly and indirectly impact soils and minerals, but most adverse impacts would be avoided by routine rangeland monitoring and carefully managed grazing. Ungulates would physically alter soil structure because their rather substantial mass is carried by relatively small hooves. The usual effect is compaction, which could lead to reduced water infiltration rates, which in turn increases surface runoff and erosion. Under Alternative 2, livestock would be closely monitored in riparian areas of Union Creek if such grazing is undertaken (unlikely; potential for use of sheep) and removed from an area if evidence of bank erosion or destabilization is observed.

Grazing would also alter nutrient distribution because herbivores mineralize organic matter and return it to the environment in solid, liquid and gaseous forms. Grazing in grasslands may accelerate carbon and nutrient cycling by effectively bypassing the microbial decomposition pathway. Under Alternative 2, suitable cattle stocking rates and relatively small pastures would avoid excessive nutrient redistribution (except around water troughs). The largest pasture is only 178 acres and in 2019 was recently split into three areas that would be managed separately; the next largest pasture is only 81 acres.

Six soil series, as mapped by the USDA Natural Resources Conservation Service (NRCS), occur in the grazing pastures at Travis AFB. These soil series have no associated NRCS range vegetation production data, perhaps because the soil series are considered primarily agricultural rather than range sites (i.e., they have a "higher" potential use than range). Erosion hazard is for the most part rated as slight for the Travis grazing area soils (Bates 1977). Erosion is a moderate hazard for the San Ysidro and San Benito components of the Altamont-San Ysidro-San Benito complex with 2-9% slopes, which together compose only 35% of the soil complex (Bates 1977) (Hopkinson 2017b).

Maintaining recommended levels of RDM by routinely monitoring grazed areas would minimize rainfall-induced soil erosion. Regular RDM monitoring and appropriate stocking rates would limit the potential for erosion and soil compaction. Therefore, no significant, adverse impact to soils are anticipated as a result of expanding the grazing program or other grazing management activities under Alternative 2.

Fire Management Treatments

Fire could temporarily adversely impact soil characteristics, erosion rates, patterns of vegetation and nutrient availability. The prescribed burns at Travis AFB within annual grasslands are not expected to result in a severe fire that would adversely impact the physical and chemical properties of the soils. The resulting moderately burned organics with partially consumed, shallow ash layers should stimulate vigorous regrowth of vegetation during succeeding summers. Livestock grazing would be excluded, where possible, from burned areas until vegetation has had a chance to re-establish.

Some repeated impacts to soil would be expected from mineral fire breaks or those that are covered in gravel. A gravel top is an approach that may be used to limit repeated disturbance of CTS upland habitat and soil (by effectively removing it as suitable habitat and covering the soil with gravel). Disking or blading/grading firebreaks to bare dirt may disrupt the first several inches of soil, disrupting soil microbial communities and increasing the risk of erosion. Selection and location of mineral firebreaks would limit erosion potential which is important for storm water management near Union Creek and wetlands.

Under Alternative 2, only minor amounts of soil erosion would result, and overall no significant adverse impacts are anticipated as a result of fire management activities.

Chemical Treatments

The majority of proposed herbicide use would be to spray the foliage of target plants, but some herbicides (e.g. aminopyralid, chlorsulfuron, imazapyr and Sulfometuron methyl) may be applied directly to soils as a pre-emergent. Direct application to soils is not planned at this time for pre-emergent purposes and is likely to be limited in the future. Herbicide residue that falls on or is applied to the soil surface may work its way through the soil solution into plant roots. The proposed herbicides are weak acids that dissociate into the parent acid, which is the active ingredient to penetrate plant tissue. After application, herbicides decompose in the soil along with treated plant materials. The main degradation pathways for herbicides are by soil microbial decomposition, light (photolysis) and water (hydrolysis).

Persistence of chemicals in soil depends on levels of soil biological activity. Moderate temperatures and moist conditions are generally more favorable to biological activity. Microbial activity ramps up at the start of the growing season, when mean soil temperatures rise over 44 degrees Fahrenheit (Davidson et al. 1998). Water limits microbial activity during the dry hot summer when soil moistures drops below 10%. Similarly, disturbed soils that have less water availability, and scarce soil microbes have less potential for metabolizing herbicides. Soils along roadsides and old compacted surfaces from equipment use and excavation may have less water-holding capacity and organic matter to support decomposition.

Significant adverse impacts to soils and soil biomes would be avoided by adhering to the herbicide application BMPs and AMMs in Appendix D. Herbicides do not appear to negatively impact soil biomes (with some possible exceptions, for example SERA 2007 on Aminopyralid); soil biomes are often responsible for the breakdown of herbicides. Adverse impacts to soil would manifest as a lack of vegetation or increased erosion protection (with a lack of binding agents produced by soil microbes). These negative impacts to soil have not been detected under Alternative 1; therefore, with the expansion of the use of herbicides under Alternative 2, no significant adverse impact to soils are anticipated as a result of herbicide application at Travis AFB or its GSUs.

Manual and Mechanical Treatments

Manual and mechanical treatments may have minor to moderate, direct and indirect, temporary adverse impacts to soils. Manual methods are hand-pulling or using hand tools or larger equipment plus techniques such as trapping, shooting, netting, and pond drainage for the control of non-native fauna such as bullfrogs. Ground disturbance would occur from pulling up a plant by its roots, digging sufficient to leverage the roots out, or plant removal using equipment such as an excavator. During bullfrog control, water from ponds may also be placed in the uplands but would not be placed on slopes such that it would cause erosion. Other treatments are not anticipated to result in soil disturbance. Disturbance from manual and mechanical treatments would be short-term and would not lead to chronic erosion from the relatively small disturbance footprint and retained groundcover. There is a short-term risk of erosion from disturbed ground if a highly infested area has contiguous bare ground sufficient to initiate surface erosion and on steep slopes. The risk is largely due to slope of the ground and erosive potential of the soil. Erosion of areas with bare soil would be minimized by implementing restoration treatments including revegetation and installation of temporary erosion control structures where necessary. Therefore, no significant, adverse impacts to soils are anticipated as a result of manual or mechanical treatments under Alternative 2.

Habitat Restoration

Habitat restoration would have long-term direct and indirect beneficial impacts to soils. Habitat restoration would benefit soils by restoring native vegetation, increasing vegetative cover and soil moisture retention and reducing soil erosion. Restoration sites where disking or drill seeding is used may have temporary negative impacts to soils, but these impacts would be short-lived and soil condition would ultimately be improved. Therefore, no significant, adverse impacts to soils are anticipated as a result of habitat restoration under Alternative 2.

4.9 UTILITIES AND INFRASTRUCTURE

4.9.1 Alternative 1 (No Action Alternative)

The No Action Alternative has the potential for moderate, short-term, adverse effects to utilities and infrastructure because prescribed fire would not be implemented under this alternative and fire risk would be heightened due to the accumulation of fuels. There would be no direct effects to infrastructure as a result of implementing the No Action Alternative. Utility locations would be identified during the AF EIAP for any activities involving ground disturbance. Prescribed Fire Plans would identify utility lines and other infrastructure near prescribed burn locations and measures needed to avoid adverse effects.

4.9.2 Alternative 2 (Comprehensive Management)

Alternative 2 would have significant, long-term, beneficial effects, but could also have minor to moderate, short-term, adverse effects on infrastructure and utilities. Expansion of the grazing program would benefit utilities and infrastructure by maintaining roads and waterlines, adding fencing, and reducing fire risk. Chemical treatments would have no effect on utilities and infrastructure. Overall, prescribed burns would have beneficial effects on infrastructure by reducing fuel loads but could negatively affect utilities and infrastructure if they got out of control. Negative effects would be avoided through the implementation of a Prescribed Fire Plan for each burn. Manual, mechanical and restoration treatments could involve excavation which could harm utilities and infrastructure if lines or pipes were broken. This would be avoided by obtaining the proper clearance prior to earth disturbing work.

Grazing

Expansion of the grazing program under Alternative 2 would have minor, long-term, beneficial effects on infrastructure. New fencing and wells/troughs would expand the livestock grazing capacity on the base. Access roads within grazing management areas would be maintained. Supplying water to new cattle troughs would not significantly increase the base-wide water demand, but any existing waterlines used would be maintained. New fencing could slightly increase the time it takes to access existing utilities if new pasture fencing is erected. The removal of biomass via grazing would reduce the likelihood of a high intensity fire under power lines.

Expansion of the grazing program will follow the strategy outlined in the GMP to expand grazing into areas of Travis AFB and the GSUs that have not been grazed in recent years. The strategy identifies approximately 596 acres on Travis AFB and 124 acres on its GSUs of land that could potentially be utilized for grazing (Figures 3 & 4). Up to 258,000 feet of linear fencing would be needed to enclose all additional grazing areas at Travis AFB and its GSUs. This will involve modifying existing fencing and installing new, permanent barbed wire fencing, and temporary electric fencing. No new access roads will be installed within the proposed grazing units, but existing access roads will be maintained. Each pasture will need at least one water trough and access gates as well as mineral supplements to help with animal distribution across the pasture.

Therefore, grazing under Alternative 2 would have beneficial effects on utilities and infrastructure.

Fire Management Treatments

Overall, prescribed burns would have short-term, moderate to significant, beneficial effects on infrastructure by reducing fuel loads. However, prescribed burns have the potential to negatively affect utilities and infrastructure if they got out of control. Wooden powerline poles are particularly vulnerable due to the proximity to wildland fuels. Negative effects would be avoided through the implementation of a Prescribed Fire Plan for each burn.

The Prescribed Fire Plan includes a description of unique features in or near the proposed burn area that could pose a hazard, issue, or constraint including infrastructure items such as fences and power poles. Any power poles that are next to or near containment lines would be identified and located prior to the day(s) of the burn and prepped prior to ignitions. The location of power poles and other unique features would be included in the Prescribed Fire Briefing Checklist and fire personnel would be informed of locations. Therefore, prescribed burns under Alternative 2 would have overall beneficial effects on utilities and infrastructure.

Chemical Treatments

Chemical treatments would have no effect on utilities and infrastructure

Manual/Mechanical and Restoration Treatments

Manual/mechanical and restoration treatments could involve excavation, and would have the potential to have moderate, short-term, adverse effects on utilities and infrastructure if lines or pipes are broken. An AF Form 103 and clearance from 811 North would be obtained prior to any work involving digging. During this process existing utilities would be identified for avoidance during excavation.

4.10 TRANSPORTATION AND TRAFFIC

4.10.1 Alternative 1 (No Action Alternative)

There would be no effects to transportation and traffic as a result of the No Action Alternative.

4.10.2 Alternative 2 (Comprehensive Management)

Under Alternative 2 short-term, minor impacts to transportation would occur during grazing infrastructure construction, prescribed burns, chemical treatments, and mechanical treatments. During these activities, an increase in traffic would be expected by contractors through the South Gate for large equipment and Main Gate for other vehicles. Increased traffic would include light construction vehicles and also contractors' personal cars through all gates. Construction vehicles on these roadways could disrupt traffic speeds and increase gate delays.

Smoke from prescribed burns could have temporary adverse effects on transportation and traffic by obscuring visibility for drivers. Prescribed fire signs would be posted along roadways and Security Forces would conduct traffic control as needed. Impacts would be short term in nature and localized. Therefore, there would be no significant effects on transportation and traffic as a result of Alternative 2.

4.11 ENERGY RESOURCES

4.11.1 Alternative 1 (No Action)

Under the No Action Alternative, current management activities would be maintained, including manual/mechanical activities, chemical applications, grazing, and burning. Energy resources are consumed during transportation to and from field sites. Additionally, manual and mechanical treatments, covering less than 50 acres annually, use oil and gasoline in equipment such as weed whackers and mowers. Chemical applications on less than 100 acres includes the use of ATV-mounted spray equipment, which uses oil and gasoline resources as well. Little electricity would be used during the course of invasive species management activities. Those activities that do require it, such as cattle watering sources and habitat enhancement projects, typically source it from renewable solar power. Use of energy resources would be much lower than for the majority of activities that take place on the AFB and use of the energy resources is not wasteful, inefficient, or unnecessary. Therefore, the effect is expected to be negligible under the No Action Alternative.

4.11.2 Alternative 2 (Comprehensive Management)

Under Alternative 2, the scale and range of management activities would increase across all categories (Table 2). Besides the energy resources consumed during transportation to and from field sites, equipment used for manual, mechanical and chemical treatments on up to 4,000 acres annually would use oil and gasoline. Little electricity would be used during the course of invasive species management activities and those activities that do require it, such as cattle watering sources and habitat enhancement projects, typically source it from renewable solar power. The use of energy resources associated with the increased effort to control invasive species would still be still much lower than the majority of activities on Travis AFB and is not wasteful, inefficient, or unnecessary. All energy use would be for temporary weed control projects and would not use energy resources continuously over time. Overall, Alternative 2 would have minor impacts to local and regional energy supplies.

4.12 CLIMATE CHANGE

As described in Section 4.2, for the purposes of this EA, GHG emissions from invasive species management activities can be divided into those produced during implementation or "construction" (e.g., habitat restoration, herbicide application, mechanical control, prescribed burns) and those produced during long-term operation or "operational" (e.g., long-term grazing operations). GHG emission projections are discussed in Section 4.5, *Air Quality*.

4.12.1 Alternative 1 (No Action)

Under the No Action Alternative, there would be no new air emissions. Therefore, no additional impacts to air quality in general and greenhouse gas emissions specifically would occur under this alternative.

4.12.2 Alternative 2

Per analysis in Section 4.5.2, maximum carbon dioxide equivalent emissions under Alternative 2 would be 942.4 tons of carbon dioxide equivalent per year. This increase comes primarily from proposed prescribed burns on 493 acres of grasslands with fuel loads averaging around 2,000 lbs per acre. These estimated emissions levels would not exceed the significant thresholds established for operational-related non-stationary activities by BAAQMD. Estimated emissions would not exceed those given by the YSAQMD, the air district to which Travis reports to, as they have yet to set them.

Both the YSAQMD and BAAQMD references do not address project types like the Proposed Action which includes natural resources land management activities such as grazing and prescribed burning. YSQAMD (2010) indicates that it's for "development projects" and BAAQMD (2017) addresses "impacts generated from land development construction and operation activities." Per the guidelines produced by the agencies, they are advisory and can be followed by other agencies at their own discretion.

CAL FIRE identifies five forestry strategies for reducing or mitigating GHG emissions. They include fuels reduction practices to reduce wildfire emissions and utilization of those materials for renewable energy. While prescribed burns at Travis AFB would not allow for the utilization of materials for renewable energy, it would target the reduction of wildfire emissions.

While Alternative 2 would result in GHG emissions during implementation, the proposed project would not conflict with any applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs. In fact, it's been widely recognized that the use of prescribed burns needs to increase in California to help address and prevent the catastrophic wildfire events that have occurred over the past several years in California that threaten 25% of the state's population who live in high-risk fire areas. Therefore, there would be negligible impacts from Alternative 2 and would not be significant.

4.13 WILDFIRE

4.13.1 Alternative 1 (No Action)

Under the No Action Alternative, there would be no change and no new effects to wildfire risk from the invasive species management program as described in Section 3.0. Limited prescribed burning, grazing operations, mechanical/manual, chemical, limited fire/fuel breaks and habitat restoration conducted under the No Action Alternative have the potential for direct, temporary adverse effects to wildfire risk.

4.13.2 Alternative 2

While invasive species activities may increase vehicle or ATV-traffic on little used gravel and dirt roads or off-road travel, thereby increasing the risk of fire, all staff are briefed on fire prevention strategies. Expanding the prescribed fire program increases the risk of escaped fires; however, only qualified firefighting personnel operating under an approved prescribed burn plan and prescription will be conducting the prescribed burns, greatly reducing the risk of escaped fire.

Overall, the Proposed Action would have a beneficial impact on wildfire severity as it would expand prescribed burning, grazing, firebreak installation and mowing practices which would reduce fuel loads and fire risk. The Proposed Action would not impair emergency response or evacuation plans, would not include installation of equipment such as utility lines that exacerbate wildfire risks, and would not expose people or structures to downstream flooding or landslides as a result of runoff or post-fire slope instability. Overall, Alternative 2 is expected to have beneficial impacts to wildfires.

4.14 OTHER NEPA CONSIDERATIONS

4.14.1 Unavoidable Adverse Effects

This EA identifies any unavoidable adverse impacts that would be required to implement the Proposed Action and the significance of the potential impacts to resources and issues. Title 40 CFR §1508.27 specifies that a determination of significance requires consideration of context and intensity.

Invasive plant treatment would impact the local project area at Travis AFB and its GSUs. The severity of potential impacts would be limited by regulatory compliance for the protection of the human and natural environment.

Unavoidable short-term adverse impacts associated with implementing the Proposed Action would include: temporary erosion and sedimentation from soil disturbance, a temporary increase in fugitive dust and air emissions during grazing infrastructure construction, air emissions from prescribed burns and herbicide application, intermittent noise, human and environmental exposure to herbicides, herbicide persistence in soil or water (typically less than one year based on half-lives; however, and thus short term) and minor alterations to local traffic and airfield operations. However, these impacts are considered minor because they would be confined to the immediate area (i.e. context) and would occur over limited acreage (i.e. intensity) (Table 2). Use of environmental and implementing controls required in permits and approvals obtained would minimize these potential impacts. Unavoidable, long-term, adverse impacts would include some level of soil compaction from grazing, herbicide persistence in special circumstances (e.g. anaerobic aquatic soils for Imazamox), and long-term persistence of herbicides in groundwater if reached (e.g. aminopyralid). The unavoidable, adverse impacts from grazing have been on-going for centuries in California and have occurred on Travis AFB since before it was a military base in the mid 1900's. For herbicide persistence and groundwater contamination, the amounts and levels of herbicide application under the Proposed Action are minute compared to typical agricultural operations that exist throughout the Sacramento Valley and California's Central Valley (i.e. low intensity). Therefore, the intensity of such adverse impacts would be low given the context and extent of invasive species control planned for the Base and its GSUs.

For the Proposed Action to be accomplished, these impacts would occur. The action is required to reduce the prevalence of invasive vegetation on Travis AFB and its GSUs in order to protect and preserve the military mission, ecosystem function and valued resources and programs. If allowed to spread unchecked, invasive plant species would degrade the remaining native habitat; interfere with management of sensitive resources, economic activities, and quality of life; and impede the military mission.

4.14.2 Relationship of Short-Term Uses and Long-Term Productivity

The relationship between short-term uses and enhancement of long-term productivity from implementation of the Proposed Action is evaluated from the standpoint of short-term effects and

long-term effects. Short-term effects would be those associated with the implementation of invasive plant treatments. The long-term enhancement of productivity would be those effects associated with operation and maintenance of new grazing areas, and the reduction of invasive plants where they currently impede the military mission.

The Proposed Action represents an enhancement of long-term productivity for operations at Travis AFB and its GSUs. The negative effects of short-term operational changes during implementation would be minor compared to the positive benefits from invasive species control. Immediate and long-term benefits would be realized for base operations and maintenance and natural resources after the first year of implementation of the Proposed Action.

4.14.3 Irreversible and Irretrievable Commitments of Resources

This EA identifies any irreversible and irretrievable commitments of resources that would be involved in the Proposed Action if implemented. An irreversible effect results from the use or destruction of resources (e.g., energy) that would not be replaced within a reasonable time. An irretrievable effect results from loss of resources (e.g., endangered species) that would not be restored as a result of the Proposed Action. The short-term irreversible commitments of resources that would occur include planning costs, materials and supplies and their cost, use of energy resources during construction, labor, generation of fugitive dust and air emissions, groundwater extracted for livestock watering, and creation of temporary noise. No long-term irretrievable commitments of resources would result.

4.15 CUMULATIVE EFFECTS

This EA considers the effects of cumulative impacts as required in 40 CFR §1508.7 and concurrent actions as required in 40 CFR §1508.25[1]. A cumulative impact, as defined by the CEQ (40 CFR §1508.7), is the "…*impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of which agency (federal or non-federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time*."

For the below analysis, actions announced that would occur at Travis AFB and its GSUs during the same time period as the Proposed Action (Table 23) are addressed. The resource areas affected by past, present and future actions that are expected to interact with the Proposed Action are listed for each project (Table 23). These announced future actions would be evaluated under separate NEPA actions conducted by the appropriate federal agency. Generally, past actions have shaped the resources to become the existing conditions described in Chapter 3 thus the focus of the analysis is on Present and reasonably foreseeable future actions that may occur on Travis AFB properties.

Table 23. Past, Present, and Reasonably Foreseeable Actions at Travis AFB and GSUs

Source: *EA for the Proposed Perimeter Fence Security Upgrade (December 2018) and Installation Development EA (TAFB 2019b) with additional updates based on known projects that use herbicides (Grounds Maintenance Contract and Pest Management Office).*

Action	Proponent/ Location	Timeframe	Description	Resource Area Interaction
Military Actions				

Action	Proponent/ Location	Timeframe	Description	Resource Area Interaction
Base Comprehensive Asset Management Plan	Travis AFB	Present, Future	Implement various projects to repair and upgrade existing facilities, roadways, utilities, the airfield, and security features.	Water Resources, Air Quality
Grounds Maintenance Contract	Travis AFB	Past, Present, Future	Vegetation management base-wide through the use of various methods including manual, mechanical and chemical. Focuses on developed and landscaped areas but also responsible for mowing all grasslands on base and maintaining all infrastructure including roads and road shoulders. Uses herbicides across the base.	Biological and Water Resources, Air Quality, Safety and Occupational Health, Hazardous Materials and Waste
Pest Management Office	Travis AFB	Past, Present, Future	Government office in charge of managing pests that include both flora and fauna. Typically focuses on building pests such as insects but also conducts wildlife trapping for nuisance mammals and vegetation management as well. Methods include the use of herbicides in and around buildings and landscaped areas generally. Use of herbicides on wildlands is unknown but thought to be limited.	Biological and Water Resources, Safety and Occupational Health, Hazardous Materials and Waste
Transportation Working Capital Fund	Travis AFB	Present, Future	Repair parking ramp PH-2-PH-11; construct new weigh-in motion scale system; renovate room 107 for hydraulic test equipment in Hanger 16; construct catwalks for fuel tanks in Building 564; replace 7.5-ton overhead crane in Building 818; renovate first floor restroom in Building 977; repair HVAC units and exhaust system in Building 803; repair hangar doors in Buildings 837 and 810; repair broken windows in Building 810; repair insufficient interior lighting in Building 812; design fire suppression systems in Building 800 area.	Air Quality
KC-46A Bed down	Travis AFB	Future	Currently being considered as an alternative location for bed down of KC-46A aircraft	Land Use, Water and Biological Resources, Noise, Air Quality

Action	Proponent/ Location	Timeframe	Description	Resource Area Interaction
Miscellaneous Projects	Travis AFB	Present, Future	Construct youth center base civil engineering complex, twin peaks soccer field, and permanent batch plant. Replace hydrant fuel area G and hot cargo pad. Construct C-5 memorial display Contingency Response Wing campus, war reserve material patient and staff parking, and Veterans Affairs dental clinic. Expand taxiway A and B and add updated taxiway lights and shoulders. Remediate lead contamination in skeet range vernal pools.	Biological and Water Resources, Air Quality, Land Use, Soils
Taxiway November	Travis AFB, Adjacent Lands	Future	Extend taxiways and base boundary. Remove Wilcox West Pond.	Biological and Water Resources, Land Use, Soils
LNU Fire Complex Emergency Firebreak	Travis AFB	Past	Emergency firebreaks were installed on 19 August 2020 to protect human life from approaching wildfires associated with the LUN Fire Complex burning on nearby lands. A mandatory evacuation order was issued for Travis AFB on 19 August as the fire was burning just 3.5 miles west of the base in Vacaville and heading east toward the Main Base. As part of the emergency response, mineral firebreaks were cut using heavy equipment through the Castle Terrace and Aero Club Conservation Areas to protect the western perimeter of the base. The fire was extinguished along the eastern flank and Travis AFB lifted the evacuation order on 24 August 2020.	Biological Resources, Water Resources, Soils, Air Quality
State and Local Actions				
Bogle Wind Turbine Project	Yolo County	Future	Construct and operate a single wind turbine that would generate up to 2.3 megawatts of electricity used to power the Bogle wine production facility (Yolo County 2017).	Noise, Biological Resources
PG&E Substation Expansion	Adjacent to Travis AFB (Southwest)	Future	Expand existing substation.	Biological Resources, Land Use
Freitas Cherry Ranch	Adjacent to Travis AFB (Southeast)	Future	Implement conservation easement on a 158-acre parcel as part of the Readiness and Environmental Protection Integration Program to preserve habitat and agricultural values around the installation.	Biological Resources, Land Use
Recology Hay Road Landfill Project	Solano County	Future	Lateral expansion of the landfill, with an addition that allows transfer of organics.	Biological Resources, Land Use

Action	Proponent/ Location	Timeframe	Description	Resource Area Interaction
Roberts' Ranch Master Planned Community	City of Vacaville	Future	Construct Robert's Ranch, a 248-acre master planned community, East of Leisure Town Growth Area in the City of Vacaville. This community will offer a variety of housing choices within a planned system of parks and trails providing connections throughout the project, with a buffer sensitive to nearby agriculture.	Biological and Water Resources, Land Use
Residential Development	Adjacent to Travis AFB (North)	Future	Construct 75 residential lots on a 51-acre site.	Biological Resources, Land Use
Vine Glen Estates	City of Vacaville	Future	Construct 145 residential lots on a 9-acre site	Biological Resources, Land Use
Bay Delta Conservation Plan (CDWR 2016)	Sacramento-San Joaquin Delta (Delta), East of Travis AFB	Future	Plan proposes to use canals or tunnels to convey 15,000-cubic feet per second of water from the Sacramento River (North delta) to Clifton Court Forebay (South delta).	Biological and Water Resources, Soils and Geology, Land Use

4.15.1.1 Land Use

Invasive species projects are temporary and short-term in nature and besides causing temporary access restrictions, do not interfere with current or future land use of a site. Invasive species management activities would not result in a change in land use designation and all land uses would be compatible with the IDP (Jacobs 2016). Combined with other projects planned for the base (Table 23), no significant cumulative effects to Travis AFB land use are expected. While many of the state and local projects change land use from open space to housing development, they don't occur on Travis AFB property and thus do not contribute to cumulative impacts for land use. Military actions that affect land use have already been accounted for in the IDP and are thus part of the Section 3 baseline environment.

4.15.1.2 Air Quality and Climate Change

The Proposed Action results in changes to air quality including increases in GHG emissions through potential increases in personnel, vehicle use, gasoline-powered equipment, additional cows, fugitive dust from fence installation, prescribed burns and herbicide use. Combined with other planned projects (Table 23), this would result in reduced air quality if dust control measures are not implemented. All construction projects on the base comply with standard measures to control fugitive dust, however, to minimize air quality impacts. Combined with other projects there may be a cumulative increase in GHGs produced but they aren't expected to be significant as they aren't expected to exceed CEQA thresholds of significance (Section 4.11.5). Cumulative impacts to air quality from prescribed burns would not affect regional air quality attainment status and even with the addition of additional present and future projects, would comply with Air Quality Resource Board limits. Any cumulative impacts from increased VOCs from the use of herbicides across several present and future projects combined with the Proposed Action aren't expected to reach a level of significance. Finally, emissions from small gasoline powered equipment would

contribute slightly to overall air emissions, but would not result in cumulative impacts to NAAQS, CAAQS, or exceedance of general conformity standards.

4.15.1.3 Water Resources

Environmental mobility, potential groundwater contamination, half-life in water of the active ingredients of herbicides as well as the potential for runoff, slowed infiltration, erosion, and unmanaged biomass provide pathways for impacts to water resources by the Proposed Action. The analysis in Section 4 determined that the impacts were not significant. The past, present and future projects, while they would cause similar impacts to water resources via the same mechanisms, the cumulative effects from all the activities would not be significant. Much of the impact from current and future projects is related to construction projects. Impacts to water resources are well mitigated through the use of erosion and runoff BMPs that are required to keep any soil onsite from reaching surface water. While several of the projects, including the Proposed Action under Alternative 5, may permanently remove wetlands, all projects are subject to permitting requirements under Section 401 and 404 of the Clean Water Act and compensatory mitigation and monitoring would be required to offset such impacts, reducing impacts to less than significant.

4.15.1.4 Safety and Occupational Health

The Proposed Action's use of herbicides would result in cumulative doses of herbicides to workers or the general public. Cumulative doses to the same herbicide result from (1) additive doses via various routes of exposure and (2) additive doses if an individual is exposed to other herbicide treatments.

Present and future projects that would contribute to cumulative impacts to safety and occupational health are the Grounds Maintenance Contract and Pest Management Office activities. Additional sources of exposure include vegetation management by pest management or ground maintenance, use of herbicides on adjacent agricultural lands, use of herbicide on utility rights-of-way, or home use by a worker or member of the general public.

While the amount of herbicides applied by present and future projects (Table 23) is unknown, agricultural pesticide use (i.e. pesticide application at parks, golf courses, cemeteries, rangeland, pastures, roadsides, railroad rights-of-way, post-harvest pesticide treatments of agricultural commodities, and fish, poultry, and livestock applications) is tracked by the California Department of Pesticide Regulation. The Proposed Action would only increase usage of herbicides included in the Proposed Action by approximately 5% of 2017 usage levels, the most recent year available (Table 24). Total pesticide use in Solano County in 2017 was over 1.3 million pounds (CA DPR 2019b) if you include all chemicals used. Use by Grounds Maintenance and Pest Management personnel and contractors would be much less than county-wide use.

Based on the magnitude of use of pesticides in the County and statewide, the cumulative effects of the Proposed Action along with present and future military actions (Table 23) are not likely to be significant.

Table 24. Solano County Pesticide Use in 2017

Includes only those chemicals proposed for use under the Proposed Action. Dozens more chemicals are used and tracked in Solano County and by personnel and contractors working under the Grounds Maintenance and Pest Management Shops. Source: CA DPR 2019a.

Chemical Name	Chemical Applied (lbs.)	Proposed Action * (lbs/yr)
AMINOPYRALID, TRIISOPROPANOLAMINE SALT	387	44
CHLORSULFURON	40	3
CLETHODIM	2,625	38
DIQUAT DIBROMIDE	454	
ENDOTHALL, MONO [N,N-DIMETHYL ALKYLAMINE] SALT	1,373	3,400
GLYPHOSATE, ISOPROPYLAMINE SALT	62,704	833
GLYPHOSATE, MONOAMMONIUM SALT	67	
GLYPHOSATE, POTASSIUM SALT	119,688	
IMAZAMOX, AMMONIUM SALT	51	21
IMAZAPYR, ISOPROPYLAMINE SALT	22	2
SULFOMETURON-METHYL	142	121
TRICLOPYR, BUTOXYETHYL ESTER	1,230	2,665
TRICLOPYR, TRIETHYLAMINE SALT	2,356	3,330
Grand Total	191,138	10,457 (5%)

**Estimate based on Table 16*

4.15.1.5 Hazardous Materials and Wastes

Under the Proposed Action, the amount of herbicide used on the base would increase. This would have a cumulative impact on the amount of hazardous waste generated, in the form of herbicide containers, when combined with existing invasive plant and pest control activities conducted by Travis AFB Pest Management personnel and Travis AFB Grounds Maintenance contractors. Containers from small in-house applications may be disposed of on base, but larger applications would be conducted by contractors, who would dispose of containers at appropriate off-base facilities. Therefore, there would not be a significant cumulative impact in the amount of hazardous waste generated.

4.15.1.6 Biological / Natural Resources

No significant impact to biological resources from the Proposed Action is expected based on the extensive analysis in Chapter 4. In general, invasive species management activities are conducted in order to provide conservation benefits. The exceptions are primarily fire management activities such as firebreak creation and maintenance especially if and when they go through wetlands (Alternative 5) and potentially herbicide use though impacts are expected to be short-term and not significant.

The cumulative effects of past, present and future projects (Table 23) added to the Proposed Action are not expected to be significant. While the many development projects off-base and the Taxiway November project on-base and adjacent lands are likely to impact federally listed species like CTS, the base and Solano County through their Habitat Conservation Plan and related programs have a long history of providing sufficient conservation measures and mitigation to avoid significant adverse effects that would cause the USFWS to conclude that any project is likely to jeopardize the continued existing of a species. Adherence to AMMs specified by USFWS during projects subject to Section 7 consultation would prevent or minimize adverse effects to

special status species. Implementation of erosion control BMPs would reduce the impact of erosion on water quality and aquatic organisms. Habitat restoration and tree mitigation requirements for individual projects would reduce the impacts to native plants and wildlife habitat. Implementing EDRR surveys of construction sites as part of the Proposed Action would further reduce cumulative impacts to habitat quality from construction projects.

4.15.1.7 Earth Resources

While soils and geology are expected to be impacted by several future projects (Table 23), they are largely planned for non-AF land and thus would not contribute cumulative impacts to the Proposed Action. Miscellaneous projects on Travis AFB expected to impact soils, like lead remediation or construction projects, are expected to be small projects and/or occur within the already developed lands on Travis AFB where soils have been tilled and disturbed already (and thus part of the environmental baseline). Soil impacts on undeveloped lands at Travis AFB from present and future projects are not expected to be significant and thus no cumulative impacts to earth resources are expected when combined with this Proposed Action.

4.15.1.8 Utilities and Infrastructure

Under Comprehensive Management, invasive species treatments would have overall beneficial effects on utilities and infrastructure by reducing fire hazards under electrical utility lines. Combined with other planned projects to upgrade and re-route electrical utility lines the Proposed Action would have cumulative beneficial effects on utilities and infrastructure.

4.15.1.9 Transportation and Traffic

Under Comprehensive Management, invasive species treatments may lead to minor increases or delays in traffic. When combined with other construction projects the increase would contribute to cumulative effects to transportation and traffic. Overall, cumulative impacts would be minor and adverse within the vicinity of the treatment areas and the Wheatland Gate and truck inspection point. Traffic controls would be used as needed to reduce adverse effects.

4.15.1.10 Energy Resources

The use of energy resources associated with the increased effort to control invasive species under Comprehensive Management would be minor. All energy use would be for temporary weed control projects and would not use energy continuously over time. Transportation and fire vehicles will be the greatest energy consumers. This increase in consumption will be temporary and will have negligible effects to overall energy use on base and would not contribute to long term cumulative energy use.

4.15.1.11 Wildfires

Under Comprehensive Management, invasive species treatments would have overall beneficial effects on wildfires risk by reducing fuels and improving firebreaks throughout Travis AFB. Therefore, no long-term cumulative effects are expected.

5.0 LIST OF PREPARERS AND REVIEWERS

This EA has been prepared under the direction of the AFCEC, USAF and Travis AFB.

Table 25. Preparers

Name/Organization	Education	Resource Area	Years of Experience
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6.0 PERSONS AND AGENCIES CONSULTED/COORDINATED

The following persons and agencies were contacted in the preparation of this EA (See Appendix B for additional information on agencies and government coordination):

Table 26. Persons and Agencies Consulted/Coordinated

Federal Agencies	
U.S. Fish and Wildlife Service Habitat Conservation Division, Sacramento Office 2800 Cottage Way, W-2605 Sacramento, CA 95825	National Oceanic and Atmospheric Administration Marine Fisheries Service CA Central Valley Office 650 Capitol Mall, Suite 5-100 Sacramento, CA 95814
State Agencies	
State of California Clearinghouse Governor's Office 1400 Tenth Street, Room 121 Sacramento, CA 95814 state.clearinghouse@opr.ca.gov	Dr. Knox Mellon State Historic Preservation Officer Department of Parks and Recreation P.O. Box 942896 Sacramento, CA 94296-0001
Local Agencies	
Solano County Department of Resource Management 675 Texas Street, Suite 5500 Fairfield, CA 94533	City of Fairfield Community Development Department 1000 Webster Street Fairfield, California 94533
City of Vacaville Community Development Department 650 Merchant Street Vacaville, CA 95688	City of Suisun City Community Development Department 701 Civic Center Blvd Suisun, CA 94588
Other Stakeholders	
Tribal Governments	

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APPENDIX A

Travis AFB Non-Native and Invasive Plant Species List including Surveillance Species

Travis AFB Non-Native and Invasive Plant Species List including Surveilance Species

This list includes all non-native secies known or with the potential to occur on Travis AFB and its GSUs based on current INRMP lists, prior reports, personal communications, and state mapping efforts (e.g. Cal-IPCs Weed Mapper). Those species with a "Travis Priority / Stage" are the species most likely to be actively targeted for future control by the invasive species management program at Travis AFB. Cal-IPC and CDFA Ranked species are the next set of species most likely to be targeted for control. The "Definition" column attempts to differentiate between non-native and invasive species for the ecosystems at Travis AFB and its GSUs as a way to identify species likely to be targeted for control. Many non-native species do not pose a risk to native species and may provide natural resources benefits such as providing suitable forage for livestock. Finally, many species on this list as well as native species may receive some incidental control primarily through grazing and prescribed fire programs but also manual, mechanical, chemical, and restoration activities though wont necessarily ever be the primary target of such activities. All invasive species control programs, with the exception of those covered by the APAP, has a primariy goal of improving native species diversity and distirbution; any short-term impacts to them are temporary.

Non-Native: Species growing beyond their natural range or natural zone of potential dispersal, including all domesticated and feral species and all hybrids involving at least one non-native parent species. Other terms that are often used as synonyms for non-native include alien, exotic, introduced and naturalized (Randall &Hoshovsky 2000). Not typically targeted for control as they do not pose an ecological risk to native species.

Invasive: A plant that is both non-native and able to establish on many sites, grow quickly, and spread to the point of disrupting plant communities or ecosystems. Species that displace natives or bring about changes in species composition, community structure, or ecosystem function (Cronk and Fuller 1995, White et al. 1993 as cited by Randall & Hoshovsky 2000). Executive Order 13112 defined invasive species as those species non-native to the ecosystem and whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

Common Name	Scientific Name	Travis or CalWeed Mapper Control Priority/Stage	Cal-IPC Rating	CDFA Ranking	Definition	Growth Habit	Family	Detected on Base
Russian knapweed	*Acroptilon repens*	Prevention	Moderate	B	Invasive	Perennial forb	**Asteraceae**	N
Barb goat grass	*Aegilops triuncialis*	Asset-Based Protection	High	B	Invasive	Annual grass	**Poaceae**	Y
Pacific bentgrass	*Agrostis avenacea*		Limited			Perennial grass	**Poaceae**	Y
Silver hairgraass	*Aira caryophyllea*				Non-Native	Annual grass	**Poaceae**	Y
Mouse ear	*Arabidopsis thaliana*					Annual forb	**Brassicaceae**	Y
Giant reed	*Arundo donax*	Eradication	High	B	Invasive	Perennial grass	**Poaceae**	Y
Slender oat	*Avena barbata*		Moderate		Non-Native	Perennial grass	**Poaceae**	Y
Wild oat	*Avena fatua*		Moderate		Non-Native	Annual grass	**Poaceae**	Y
Mediterranean lineseed	*Bellardia trixago*		Limited			Annual forb	**Orobanchaceae**	Y
Black mustard	*Brassica nigra*	Asset-Based Protection	Moderate			Annual forb	**Brassicaceae**	Y
Little rattlesnake grass	*Briza minor*					Annual grass	**Poaceae**	Y
Ripgut brome	*Bromus diandrus*		Moderate			Annual grass	**Poaceae**	Y
Soft brome	*Bromus hordeaceus*		Limited			Annual grass	**Poaceae**	Y
Red brome	*Bromus madritensis ssp. rubens*		High		Invasive	Annual grass	**Poaceae**	Y
Shepherd's purse	*Capsella bursa-pastoris*					Annual forb	**Brassicaceae**	Y
Italian thistle	*Carduus pycnocephalus*	Asset-Based Protection	Moderate		Invasive	Annual or biennial forb	**Asteraceae**	Y; Added 2018
Woolly distaff thistle	*Carthamus lanatus*	Containment	Moderate-Alert	B	Invasive	Annual forb	**Asteraceae**	ManTech 2017; N*
Purple star-thistle	*Centaurea calcitrapa*	Asset-Based Protection	Moderate	B	Invasive	Annual, biennial, or perennial forb	**Asteraceae**	Y
Tocalote, Malta starthistle	*Centaurea melitensis*	Prevention	Moderate	C	Invasive	Annual forb	**Asteraceae**	N
Yellow star-thistle	*Centaurea solstitialis*	Asset-Based Protection	High	C	Invasive	Annual or biennial forb	**Asteraceae**	Y
Large mouse ears	*Cerastium glomeratum*					Annual forb	**Caryophyllaceae**	Y
Skeleton weed	*Chondrilla juncea*	Containment	Moderate	A	Invasive	Perennial forb	**Asteraceae**	ManTech 2017 & HT Harvey 2014; N*
Bull thistle	*Cirsium vulgare*	Containment	Moderate	C	Invasive	Perennial forb	**Asteraceae**	Y
Poison hemlock	*Conium maculatum*		Moderate		Invasive	Perennial forb	**Apiaceae**	N by HT Harvey 2014; Y*
Orchard morning glory	*Convolvulus arvensis*					Perennial forb or vine	**Convolvulaceae**	Y
Pampas grass	*Cortaderia selloana*	Eradication	High		Invasive	Perennial grass	**Poaceae**	Y
Brassbuttons	*Cotula coronopifolia*		Limited			Perennial forb	**Asteraceae**	Y
Artichoke thistle	*Cynara cardunculus*	Containment	Moderate	B	Invasive	Perennial forb	**Asteraceae**	ManTech 2017; N*
Bermuda grass	*Cynodon dactylon*		Moderate		Invasive	Perennial grass	**Poaceae**	Y
Queen anne's lace	*Daucus carota*					Perennial forb	**Apiaceae**	Y
Stinkwort	*Dittrichia graveolens*	Containment	Moderate-Alert		Invasive	Annual forb	**Asteraceae**	Y
Brazilian waterweed	*Egeria densa*		High	C	Invasive	Perennial aquatic forb	**Hydrocharitaceae**	Y
Water hyacinth	*Eichhornia crassipes*		High-Alert	C	Invasive	Perennial aquatic forb	**Pontederiaceae**	N
Medusa head	*Elymus caput-medusae*	Asset-Based Protection	High	C	Invasive	Annual grass	**Poaceae**	Y
Stinkgrass	*Eragrostis cilianensis*					Annual grass	**Poaceae**	Y
Broad leaf filaree	*Erodium botrys*				Non-Native	Annual forb	**Geraniaceae**	Y
Redstem filaree	*Erodium cicutarium*		Limited		Non-Native	Annual forb	**Geraniaceae**	Y
White stemmed filaree	*Erodium moschatum*				Non-Native	Annual forb	**Geraniaceae**	Y
tall fescue	*Festuca arundinacea*		Moderate		Non-Native	Perennial grass	**Poaceae**	Y
Brome fescue	*Festuca bromoides*				Non-Native	Annual grass	**Poaceae**	Y
Rattail fescue	*Festuca myuros*		Moderate		Non-Native	Annual grass	**Poaceae**	Y
Italian ryegrass	*Festuca perennis*		Moderate		Non-Native	Annual or Perennial grass	**Poaceae**	Y
Fennel	*Foeniculum vulgare*	Containment	High		Invasive	Biennial or Perennial forb	**Apiaceae**	Y
Tiny bedstraw	*Galium murale*					Annual forb	**Rubiaceae**	Y
Nit grass	*Gastridium phleoides*					Annual grass	**Poaceae**	Y; Added 2018
Treasure flower	*Gazania linearis*	Eradication	Moderate-Alert		Invasive	Perennial forb	**Asteraceae**	Y; Added 2018
French Broom	*Genista monspessulana*	Containment	High	C	Invasive	Shrub	**Fabaceae**	ManTech 2017; N*
Cutleaf geranium	*Geranium dissectum*		Moderate		Non-Native	Annual forb	**Geraniaceae**	Y
Crane's bill geranium	*Geranium molle*				Non-Native	Annual or perennial forb	**Geraniaceae**	Y
Waxy mannagrass	*Glyceria declinata*	Eradication	Moderate		Invasive	Perennial grass	**Poaceae**	Y; Added 2018
Western manna grass	*Glyceria xoccidentalis*					Perennial grass	**Poaceae**	Y
Bristly ox-tongue	*Helminthotheca echioides*	Containment	Limited		Invasive	Annual or perennial forb	**Asteraceae**	Y
Perennial mustard	*Hirschfeldia incana*		Moderate			Perennial forb	**Brassicaceae**	N by HT Harvey 2014; Y*
Mediterranean barley	*Hordeum marinum ssp. gussoneanum*		Moderate			Annual grass	**Poaceae**	Y
Hare barley	*Hordeum murinum ssp. leporinum*		Moderate			Annual grass	**Poaceae**	Y
Smooth catsear	*Hypochaeris glabra*		Limited			Annual forb	**Asteraceae**	Y
Hairy dandelion	*Hypochaeris radicata*		Moderate			Perennial forb	**Asteraceae**	Y
Leafy bracted dwarf rush	*Juncus capitatus*					Annual forb	**Juncaceae**	Y
Narrow leaved wild lettuce	*Lactuca saligna*					Annual forb	**Asteraceae**	Y
Prickly lettuce	*Lactuca serriola*					Annual forb	**Asteraceae**	Y
Hawkbit	*Leontodon saxatilis*					Annual forb	**Asteraceae**	Y
Lens-podded hoary cress	*Lepidium chalepense*		Moderate - Alert	B	Invasive	Annual or perennial forb	**Brassicaceae**	N
Perennial pepperweed	*Lepidium latifolium*	Asset-Based Protection	High	B	Invasive	Perennial forb	**Brassicaceae**	Club in 2005 (CH2MHill 2005); just Castle Terrace and along Ellis St.
Narrowleaf cottonrose	*Logfia gallica*					Annual forb	**Asteraceae**	Y

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Bird's foot trefoil	*Lotus corniculatus*					Perennial forb	**Fabaceae**	Y
Scarlet pimpernel	*Lysimachia arvensis*				Non-Native	Annual forb	**Myrsinaceae**	Y
hyssop loosestrife	*Lythrum hyssopifolia*		Limited			Annual or perennial forb	**Lythraceae**	Y
Common mallow	*Malva neglecta*				Non-Native	Annual or perennial forb	**Malvaceae**	Y
Buttonclover	*Medicago orbicularis*				Non-Native	Annual forb	**Fabaceae**	Y; Added 2018
California burclover	*Medicago polymorpha*		Limited		Non-Native	Annual forb	**Fabaceae**	Y
White sweetclover	*Melilotus albus*				Non-Native	Annual or biennial forb	**Fabaceae**	Y
Annual yellow sweetclover	*Melilotus indicus*				Non-Native	Annual forb	**Fabaceae**	Y
Small flowered forget me not	*Myosotis micrantha*				Non-Native	Annual forb	**Boraginaceae**	Y
Eurasian milfoil	*Myriophyllum spicatum*		High	C	Invasive	Perennial aquatic forb	**Haloragaceae**	Y
Curved sicklegrass	*Parapholis incurva*				Non-Native	Annual grass	**Poaceae**	Y
Dallis grass	*Paspalum dilatatum*				Non-Native	Perennial grass	**Poaceae**	Y
Spotted ladysthumb	*Persicaria maculosa*				Non-Native	Annual forb	**Polygonaceae**	Y
Harding grass	*Phalaris aquatica*		Moderate		Invasive	Perennial grass	**Poaceae**	N by HT Harvey 2014; Y*
Cut leaf plantain	*Plantago coronopus*				Non-Native	Annual forb	**Plantaginaceae**	Y
English plantain	*Plantago lanceolata*		Limited		Non-Native	Perennial forb	**Plantaginaceae**	Y
Annual bluegrass	*Poa annua*				Non-Native	Annual grass	**Poaceae**	Y
Bulbous bluegrass	*Poa bulbosa*				Non-Native	Perennial grass	**Poaceae**	Y
Four leaved all seed	*Polycarpon tetraphyllum*					Annual forb	**Caryophyllaceae**	Y; Added 2018
Prostrate knotweed	*Polygonum aviculare ssp. depressum*					Annual or perennial forb	**Polygonaceae**	Y
Mediterranean beard grass	*Polypogon maritimus*					Annual grass	**Poaceae**	Y
rabbitfoot polypogon	*Polypogon monspeliensis*		Limited			Annual grass	**Poaceae**	Y
Buttercup	*Ranunculus muricatus*				Non-Native	Annual or perennial forb	**Ranunculaceae**	Y
Radish	*Raphanus sativus*		Limited			Annual or biennial forb	**Brassicaceae**	Y
Himalayan blackberry	*Rubus armeniacus*	Containment	High		Invasive	Shrub	**Rosaceae**	Y
Sheep sorrel	*Rumex acetosella*		Moderate		Invasive	Perennial forb	**Polygonaceae**	Y
Curly dock	*Rumex crispus*		Limited		Non-Native	Perennial forb	**Polygonaceae**	Y
Fiddleleaf dock	*Rumex pulcher*				Non-Native	Perennial forb	**Polygonaceae**	Y
Russian thistle	*Salsola australis*					Annual forb	**Chenopodiaceae**	Y
Shepherd's needle	*Scandix pecten-veneris*					Annual forb or vine	**Apiaceae**	Y
Common groundsel	*Senecio vulgaris*					Annual forb	**Asteraceae**	Y
Red sesbania	*Sesbania punicea*	Prevention	High	B	Invasive	Shrub	**Fabaceae**	N
Common catchfly	*Silene gallica*					Annual forb	**Caryophyllaceae**	Y
Milk thistle	*Silybum marianum*		Limited		Invasive	Annual or perennial forb	**Asteraceae**	N by HT Harvey 2014; Y*
Charlock mustard	*Sinapis arvensis*		LImited			Annual forb	**Brassicaceae**	Y
Prickly sow thistle	*Sonchus asper ssp.. asper*					Annual forb	**Asteraceae**	Y
Common sow thistle	*Sonchus oleraceus*					Annual forb	**Asteraceae**	Y
Johnsongrass	*Sorghum halepense*					Perennial grass	**Poaceae**	Y
Spanish broom	*Spartium junceum*	Containment	High	C	Invasive	Shrub	**Fabaceae**	Y
Corn spurry	*Spergula arvensis*					Annual forb	**Caryophyllaceae**	Y
Purple sand spurry	*Spergularia rubra*					Annual or perennial forb	**Caryophyllaceae**	Y
Chickweed	*Stellaria media*					Annual forb	**Caryophyllaceae**	Y
Smallflower tamarisk	*Tamarix parviflora*	Prevention	High	B	Invasive	Tree or shrub	**Tamaricaceae**	N
Common dandelion	*Taraxacum officinale*				Non-Native	Perennial forb	**Asteraceae**	Y
Tall sock-destroyer	*Torilis arvensis*	Prevention	Moderate		Invasive	Annual forb	**Apiaceae**	N
Purple salsify	*Tragopogon porrifolius*					Perennial forb	**Asteraceae**	Y
Field clover	*Trifolium campestre*				Non-Native	Annual forb	**Fabaceae**	Y
Shamrock clover	*Trifolium dubium*				Non-Native	Annual forb	**Fabaceae**	Y
Rose clover	*Trifolium hirtum*		Limited		Non-Native	Annual forb	**Fabaceae**	Y
White clover	*Trifolium repens*				Non-Native	Perennial forb	**Fabaceae**	Y
Subterranean clover	*Trifolium subterraneum*				Non-Native	Annual forb	**Fabaceae**	Y
Woolly clover	*Trifolium tomentosum*				Non-Native	Annual forb	**Fabaceae**	Y; Added 2018
Bird's eye speedwell	*Veronica persica*					Annual forb	**Plantaginaceae**	Y
Garden vetch	*Vicia sativa ssp. sativa*				Non-Native	Annual forb or vine	**Fabaceae**	Y
Hairy vetch	*Vicia villosa ssp. villosa*				Non-Native	Annual forb or vine	**Fabaceae**	Y
Bamboo	*Nandina, Phyllostackhys, or Pseudosasa sp.*					Shrub	**Poaceae**	Y
silver wattle	*Acacia dealbata*	CalWeed Mapper - Surveillance	Moderate			Tree	**Fabaceae**	N; CalWeed List
black acacia	*Acacia melanoxylon*	CalWeed Mapper - Surveillance	Limited			Tree	**Fabaceae**	N; CalWeed List
croftonweed	*Ageratina adenophora*	CalWeed Mapper - Surveillance	Moderate				**Asteraceae**	N; CalWeed List
creeping bentgrass	*Agrostis stolonifera*	CalWeed Mapper - Containment	Limited				**Poaceae**	N; CalWeed List
tree-of-heaven	*Ailanthus altissima*	CalWeed Mapper - Containment	Moderate	C	Invasive		**Simaroubaceae**	N; CalWeed List
alligator weed	*Altemanthera philoxeroides*	CalWeed Mapper - Containment	High-Alert	A	Invasive		**Amaranthaceae**	N; CalWeed List
sweet vernalgrass	*Anthoxanthum odoratum*	CalWeed Mapper - Surveillance	Moderate				**Poaceae**	N; CalWeed List
Australian saltbush	*Atriplex semibaccata*	CalWeed Mapper - Containment	Moderate				**Chenopodiaceae**	N; CalWeed List
fivehook bassia	*Bassia hyssopifolia*	CalWeed Mapper - Surveillance	Limited		Invasive		**Chenopodiaceae**	N; CalWeed List
annual false-brome	*Brachypodium distachyon*	CalWeed Mapper - Containment	Moderate				**Poaceae**	N; CalWeed List
field mustard	*Brassica rapa*	CalWeed Mapper - Containment	Limited				**Brassicaceae**	N; CalWeed List
rattlesnakegrass	*Briza maxima*	CalWeed Mapper - Surveillance	Limited				**Poaceae**	N; CalWeed List
Japanese brome	*Bromus japonicus*	CalWeed Mapper - Surveillance	Limited				**Poaceae**	N; CalWeed List
European sea-rocket	*Cakile maritima*	CalWeed Mapper - Surveillance	Limited				**Brassicaceae**	N; CalWeed List
plumeless thistle	*Carduus acanthoides*	CalWeed Mapper - Surveillance	Limited	A	Invasive		**Asteraceae**	N; CalWeed List
musk thistle	*Carduus nutans*	CalWeed Mapper - Surveillance	Moderate	A	Invasive		**Asteraceae**	N; CalWeed List
slenderflower	*Carduus tenuiflonus*	CalWeed Mapper - Containment	Limited	C			**Asteraceae**	N; CalWeed List
sea-fig, iceplant	*Carpobrotus chilensis*	CalWeed Mapper - Surveillance	Moderate				**Aizoaceae**	N; CalWeed List
diffuse knapweed	*Centaurea diffusa*	CalWeed Mapper - Surveillance	Moderate	A	Invasive		**Asteraceae**	N; CalWeed List
spotted knapweed	*Centaurea stoebe ssp. micranthos (= Centaurea maculosa)*	CalWeed Mapper - Eradication	High	A	Invasive		**Asteraceae**	N; CalWeed List
Canada thistle	*Cirsium arvense*	CalWeed Mapper - Containment	Moderate	B	Invasive		**Asteraceae**	N; CalWeed List
taro root	*Colocasia esculenta*	CalWeed Mapper - Containment	Mod-Alert				**Araceae**	N; CalWeed List
narrowleaf iceplant	*Conicosia pugioniformis*	CalWeed Mapper - Surveillance	Limited				**Aizoaceae**	N; CalWeed List
giant dracaena	*Cordyline australis*	CalWeed Mapper - Surveillance	Limited				**Laxmanniaceae**	N; CalWeed List
jubatagrass	*Cortaderia jubata*	CalWeed Mapper - Containment	High	B	Invasive		**Poaceae**	N; CalWeed List
orange cotoneaster	*Cotoneaster franchetii*	CalWeed Mapper - Surveillance	Moderate				**Rosaceae**	N; CalWeed List
Parney's cotoneaster	*Cotoneaster lacteus*	CalWeed Mapper - Surveillance	Moderate				**Rosaceae**	N; CalWeed List
silverleaf cotoneaster	*Cotoneaster pannosus*	CalWeed Mapper - Surveillance	Moderate				**Rosaceae**	N; CalWeed List
hawthorn	*Crataegus monogyna*	CalWeed Mapper - Containment	Limited				**Rosaceae**	N; CalWeed List
montbretia	*Crocosmia x crocosmiiflora*	CalWeed Mapper - Surveillance	Limited				**Iridaceae**	N; CalWeed List

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common crupina, bearded creeper	*Crupina vulgaris*	CalWeed Mapper - Surveillance	Limited	A	Invasive		**Asteraceae**	N; CalWeed List
hedgehog dogtailgrass	*Cynosurus echinatus*	CalWeed Mapper - Containment	Moderate				**Poaceae**	N; CalWeed List
Scotch broom	*Cytisus scoparius*	CalWeed Mapper - Containment	High	C	Invasive		**Fabaceae**	N; CalWeed List
Portuguese broom	*Cytisus striatus*	CalWeed Mapper - Surveillance	Moderate		Invasive		**Fabaceae**	N; CalWeed List
orchardgrass	*Dactylis glomerata*	CalWeed Mapper - Containment	Limited				**Poaceae**	N; CalWeed List
flixweed, tansy mustard	*Descurainia sophia*	CalWeed Mapper - Containment	Limited				**Brassicaceae**	N; CalWeed List
foxglove	*Digitalis purpurea*	CalWeed Mapper - Surveillance	Limited				**Plantaginaceae**	N; CalWeed List
common and Fuller's teasel	*Dipsacus fullonum and D. sativus*	CalWeed Mapper - Containment	Moderate				**Dipsacaceae**	N; CalWeed List
pride-of-Madeira	*Echium candicans*	CalWeed Mapper - Surveillance	Limited				**Boraginaceae**	N; CalWeed List
erect veldtgrass	*Ehrharta erecta*	CalWeed Mapper - Surveillance	Moderate				**Poaceae**	N; CalWeed List
Russian-olive	*Elaeagnus angustifolia*	CalWeed Mapper - Surveillance	Moderate				**Elaeagnaceae**	N; CalWeed List
red gum	*Eucalyptus camaldulensis*	CalWeed Mapper - Containment	Limited				**Myrtaceae**	N; CalWeed List
Tasmanian blue gum	*Eucalyptus globulus*	CalWeed Mapper - Containment	Moderate		Invasive		**Myrtaceae**	N; CalWeed List
oblong spurge	*Euphorbia oblongata*	CalWeed Mapper - Containment	Limited	B			**Euphorbiaceae**	N; CalWeed List
Japanese knotweed	*Fallopia japonica (= Polygonum cuspidatum)*	CalWeed Mapper - Surveillance	Mod-Alert	B	Invasive		**Polygonaceae**	N; CalWeed List
edible fig	*Ficus carica*	CalWeed Mapper - Containment	Moderate				**Moraceae**	N; CalWeed List
crown daisy	*Glebionis coronaria (= Chrysanthemum coronarium)*	CalWeed Mapper - Surveillance	Moderate				**Asteraceae**	N; CalWeed List
English ivy	*Hedera helix*	CalWeed Mapper - Containment	High		Non-Native		**Araliaceae**	N; CalWeed List
Algerian ivy	*Hedera canariensis*	CalWeed Mapper - Containment	High				**Araliaceae**	N; CalWeed List
licoriceplant	*Helichrysum petiolare*	CalWeed Mapper - Eradication	Limited				**Asteraceae**	N; CalWeed List
common velvet grass	*Holcus lanatus*	CalWeed Mapper - Surveillance	Moderate				**Poaceae**	N; CalWeed List
Canary Island hypericum	*Hypericum canariense*	CalWeed Mapper - Surveillance	Mod-Alert	B	Invasive		**Hypericaceae**	N; CalWeed List
common St. John's wort, klamathweed	*Hypericum perforatum*	CalWeed Mapper - Containment	Moderate	C	Invasive		**Hypericaceae**	N; CalWeed List
English holly	*Ilex aquifolium*	CalWeed Mapper - Surveillance	Mod-Alert				**Aquifoliaceae**	N; CalWeed List
yellowflag iris	*Iris pseudacorus*	CalWeed Mapper - Containment	Limited	C			**Iridaceae**	N; CalWeed List
dyer's woad	*Isatis tinctoria*	CalWeed Mapper - Surveillance	Moderate	B	Invasive		**Brassicaceae**	N; CalWeed List
kochia	*Kochia scoparia*	CalWeed Mapper - Containment	Moderate				**Chenopodiaceae**	N; CalWeed List
hairy whitetop	*Lepidium appelianum (= Cardaria pubescens)*	CalWeed Mapper - Surveillance	Limited				**Brassicaceae**	N; CalWeed List
ox-eye daisy	*Leucanthemum vulgare*	CalWeed Mapper - Surveillance	Moderate				**Asteraceae**	N; CalWeed List
Dalmatian toadflax	*Linaria dalmatica ssp. dalmatica (= Linaria genistifolia ssp. dalmatica)*	CalWeed Mapper - Eradication	Moderate	A	Invasive		**Plantaginaceae**	N; CalWeed List
yellow toadflax, butter and eggs	*Linaria vulgaris*	CalWeed Mapper - Surveillance	Moderate				**Plantaginaceae**	N; CalWeed List
sweet alyssum	*Lobularia maritima*	CalWeed Mapper - Surveillance	Limited				**Brassicaceae**	N; CalWeed List
Uruguay water-primrose	*Ludwigia hexapetala*	CalWeed Mapper - Containment	High-Alert		Invasive		**Onagraceae**	N; CalWeed List
Creeping water-primrose	*Ludwigia peploides*	CalWeed Mapper - Containment	High-Alert		Invasive		**Onagraceae**	N; CalWeed List
purple loosestrife	*Lythrum salicaria*	CalWeed Mapper - Containment	High	B	Invasive		**Lythraceae**	N; CalWeed List
white horehound	*Marrubium vulgare*	CalWeed Mapper - Containment	Limited				**Lamiaceae**	N; CalWeed List
pennyroyal	*Mentha pulegium*	CalWeed Mapper - Containment	Moderate				**Lamiaceae**	N; CalWeed List
crystalline iceplant	*Mesembryanthemum crystallinum*	CalWeed Mapper - Surveillance	Mod-Alert				**Aizoaceae**	N; CalWeed List
myoporum	*Myoporum laetum*	CalWeed Mapper - Surveillance	Moderate				**Scrophulariaceae**	N; CalWeed List
common forget-me-not	*Myosotis latifolia*	CalWeed Mapper - Surveillance	Limited				**Boraginaceae**	N; CalWeed List
parrotfeather	*Myriophyllum aquaticum*	CalWeed Mapper - Containment	High-Alert		Invasive		**Haloragaceae**	N; CalWeed List
tree tobacco	*Nicotiana glauca*	CalWeed Mapper - Containment	Moderate				**Solanaceae**	N; CalWeed List
olive	*Olea europaea*	CalWeed Mapper - Containment	Limited				**Oleagceae**	N; CalWeed List
Bermuda buttercup	*Oxalis pes-caprae*	CalWeed Mapper - Containment	Moderate				**Oxalidaceae**	N; CalWeed List
yellow glandweed	*Parentucellia viscosa*	CalWeed Mapper - Containment	Limited				**Orobanchaceae**	N; CalWeed List
kikuyugrass	*Pennisetum clandestinum*	CalWeed Mapper - Surveillance	Limited	C			**Poaceae**	N; CalWeed List
crimson fountaingrass	*Pennisetum setaceum*	CalWeed Mapper - Surveillance	Moderate	C	Invasive		**Poaceae**	N; CalWeed List
Canary Island date palm	*Phoenix canariensis*	CalWeed Mapper - Containment	Limited				**Arecaceae**	N; CalWeed List
Kentucky bluegrass	*Poa pratensis*	CalWeed Mapper - Containment	Limited				**Poaceae**	N; CalWeed List
curlyleaf pondweed	*Potamogeton crispus*	CalWeed Mapper - Containment	Moderate				**Potamogetonaceae**	N; CalWeed List
cherry plum	*Prunus cerasifera*	CalWeed Mapper - Containment	Limited				**Rosaceae**	N; CalWeed List
pyracantha, firethorn	*Pyracantha angustifolia, crenulata, seratus, etc.*	CalWeed Mapper - Containment	Limited				**Rosaceae**	N; CalWeed List
creeping buttercup	*Ranunculus repens*	CalWeed Mapper - Surveillance	Limited				**Ranunculaceae**	N; CalWeed List
castorbean	*Ricinus communis*	CalWeed Mapper - Surveillance	Limited				**Euphorbiaceae**	N; CalWeed List
black locust	*Robinia pseudoacacia*	CalWeed Mapper - Containment	Limited				**Fabaceae**	N; CalWeed List
hairy oat grass	*Rytidosperma pencillatum (= Danthonia pilosa)*	CalWeed Mapper - Surveillance	Limited				**Poaceae**	N; CalWeed List
ravennagrass	*Saccharum ravennae*	CalWeed Mapper - Surveillance	Mod-Alert				**Poaceae**	N; CalWeed List
oppositeleaf Russian thistle	*Salsola soda*	CalWeed Mapper - Surveillance	Moderate				**Chenopodiaceae**	N; CalWeed List
Russian thistle	*Salsola tragus*	CalWeed Mapper - Containment	Limited	C			**Chenopodiaceae**	N; CalWeed List
giant salvinia	*Salvinia molesta*	CalWeed Mapper - Eradication	High-Alert		Invasive		**Salviniaceae**	N; CalWeed List
bouncingbet	*Saponaria officinalis*	CalWeed Mapper - Surveillance	Limited				**Caryophyllaceae**	N; CalWeed List
Peruvian peppertree	*Schinus molle*	CalWeed Mapper - Surveillance	Limited				**Anacardiaceae**	N; CalWeed List
Brazilian peppertree	*Schinus terebinthifolius*	CalWeed Mapper - Surveillance	Limited				**Anacardiaceae**	N; CalWeed List
mediterraneangrass	*Schismus arabicus and S. barbatus*	CalWeed Mapper - Surveillance	Limited				**Poaceae**	N; CalWeed List
tansy ragwort	*Senecio jacobaea*	CalWeed Mapper - Surveillance	Limited	B			**Asteraceae**	N; CalWeed List
Australian fireweed	*Senecio minimus and S. glomeratus (= Erechtites minima and E. glomerata)*	CalWeed Mapper - Surveillance	Moderate				**Asteraceae**	N; CalWeed List
wild mustard, charlock	*Sinapis arvensis*	CalWeed Mapper - Containment	Limited				**Brassicaceae**	N; CalWeed List
London rocket	*Sisymbrium irio*	CalWeed Mapper - Surveillance	Moderate				**Brassicaceae**	N; CalWeed List
tropical needlegrass	*Stipa manicata*	CalWeed Mapper - Surveillance	Limited				**Poaceae**	N; CalWeed List
smilograss	*Stipa miliacea var. miliacea (= Piptatherum miliaceum)*	CalWeed Mapper - Containment	Limited				**Poaceae**	N; CalWeed List
athel tamarisk	*Tamarix aphylla*	CalWeed Mapper - Containment	Limited				**Tamaricaceae**	N; CalWeed List
saltcedar, tamarisk	*Tamarix ramosissima*	CalWeed Mapper - Containment	High	B	Invasive		**Tamaricaceae**	N; CalWeed List
common tansy	*Tanacetum vulgare*	CalWeed Mapper - Surveillance	Moderate				**Asteraceae**	N; CalWeed List
New Zealand spinach	*Tetragonia tetragonioides*	CalWeed Mapper - Surveillance	Limited				**Aizoaceae**	N; CalWeed List
Chinese tallowtree	*Triadica sebifera (= Sapium sebiferum)*	CalWeed Mapper - Surveillance	Mod-Alert				**Euphorbiaceae**	N; CalWeed List
common mullein, woolly mullein	*Verbascum thapsus*	CalWeed Mapper - Containment	Limited				**Scrophulariaceae**	N; CalWeed List
big periwinkle	*Vinca major*	CalWeed Mapper - Containment	Moderate				**Apocynaceae**	N; CalWeed List

Common Name	Scientific Name	Travis or CalWeed Mapper Control Priority/Stage	Cal-IPC Rating	CDFA Ranking	Definition	Growth Habit	Family	Detected on Base
Mexican fan palm	*Washingtonia robusta*	CalWeed Mapper - Containment	Mod-Alert				**Arecaceae**	N; CalWeed List
bulbil watsonia	*Watsonia meriana*	CalWeed Mapper - Surveillance	Limited	B			**Iridaceae**	N; CalWeed List
calla lily	*Zantedeschia aethiopica*	CalWeed Mapper - Surveillance	Limited				**Araceae**	N; CalWeed List
European beachgrass	*Ammophila arenaria*	CalWeed Mapper - Surveillance	High		Invasive		**Poaceae**	N; CalWeed List
fertile capeweed	*Arctotheca calendula (= Arctotheca calendula fertile)*	CalWeed Mapper - Surveillance	Mod-Alert				**Asteraceae**	N; CalWeed List
sterile capeweed	*Arctotheca prostrata (= Arctotheca calendula infertile)*	CalWeed Mapper - Surveillance	Mod-Alert	A	Invasive		**Asteraceae**	N; CalWeed List
bridal creeper	*Asparagus asparagoides*	CalWeed Mapper - Surveillance	Mod-Alert				**Asparagaceae**	N; CalWeed List
onionweed	*Asphodelus fistulosus*	CalWeed Mapper - Surveillance	Mod-Alert	Q			**Asphodelaceae**	N; CalWeed List
Saharan mustard, African mustard	*Brassica tournefortii*	CalWeed Mapper - Surveillance	High		Invasive		**Brassicaceae**	N; CalWeed List
cheatgrass	*Bromus tectorum*	CalWeed Mapper - Surveillance	High		Invasive		**Poaceae**	N; CalWeed List
Hottentot-fig, iceplant	*Carpobrotus edulis*	CalWeed Mapper - Surveillance	High		Invasive		**Aizoaceae**	N; CalWeed List
old man's beard	*Clematis vitalba*	CalWeed Mapper - Surveillance	Mod-Alert				**Ranunculaceae**	N; CalWeed List
Cape-ivy	*Delairea odorata*	CalWeed Mapper - Surveillance	High	B	Invasive		**Asteraceae**	N; CalWeed List
purple veldtgrass	*Ehrharta calycina*	CalWeed Mapper - Surveillance	High		Invasive		**Poaceae**	N; CalWeed List
spiny emex, devil's-thorn	*Emex spinosa*	CalWeed Mapper - Surveillance	Mod-Alert				**Polygonaceae**	N; CalWeed List
leafy spurge	*Euphorbia virgata (= Euphorbia esula)*	CalWeed Mapper - Surveillance	High-Alert	A	Invasive		**Euphorbiaceae**	N; CalWeed List
hydrilla	*Hydrilla verticillata*	CalWeed Mapper - Surveillance	High-Alert	A	Invasive		**Hydrocharitaceae**	N; CalWeed List
Scotch thistle	*Onopordum acanthium*	CalWeed Mapper - Surveillance	High	A	Invasive		**Asteraceae**	N; CalWeed List
gorse	*Ulex europaeus*	CalWeed Mapper - Surveillance	High	B	Invasive		**Fabaceae**	N; CalWeed List

Sources: All species listed as occuring on base [Yes (Y)] are from * sources, updated June 2019 for the June 2019 Draft INRMP Appendix C-2. Species listed as not occuring on base [No (N)] came from HT Harvey 2014. Exceptions or inconsistencies cite specific sources.

*Weston 1997; CH2MHill 2001; Baldwin et al. 2012; Auxilio 2015; Robison 2018, with updates to match Baldwin, et al. 2012.

CH2M Hill (2005) Draft Exotic Species Control Work Plan Travis Air Force Base, California. Prepared for AFCEE Contract F A 8903-04-D-8670. March. 40 pp.

H.T. Harvey & Associates (2014) Final Invasive Species Management Plan for Travis Air Force Base, Solano County, California.

ManTech (2017) Travis Air Force Base Updated Invasive Plant Species Management Plan (IPSMP).

Cal-IPC (2020) CalWeed Mapper. Available at: https://calweedmapper.cal-ipc.org/

INVASIVE SPECIES MANAGEMENT OPPORTUNITIES IN
Map extent

This report summarizes invasive plant management opportunities in Map extent. Opportunities are determined from maps of each species' current distribution and suitable range. Species are listed by three types of management opportunity:

- **Surveillance** – surveying to detect new infestations
- **Eradication** – complete removal of infestations
- **Containment** – limiting further spread of infestations



Below is a sample of opportunities in Map extent. This information should be combined with local knowledge to set local priorities (see "Using the Report" at the end of this document.) Click on a plant's name below to view a map of that species.

Opportunities:

These are some opportunities in Map extent. Tables on proceeding pages of this report contain a complete list of invasive plant management opportunities.

Surveillance:


Photo © Regents of the University of California
Ammophila arenaria
European beachgrass

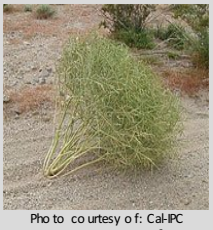
Photo courtesy of: Cal-IPC
Brassica tournefortii
Saharan mustard, African mustard


Photo © Regents of the University of California
Bromus tectorum
downy brome, cheatgrass


Photo courtesy of: Elizabeth Brusati
Carpobrotus edulis
Hottentot-fig, iceplant


Photo © Regents of the University of California
Delairea odorata
Cape-ivy

Eradication:


Photo © Regents of the University of California
Centaurea stoebe ssp. micranthos (=Centaurea maculosa)
spotted knapweed


Photo © Regents of the University of California
Salvinia molesta
giant salvinia


Photo courtesy of: Tony Morosco
Gazania linearis
gazania


Photo courtesy of: Lake Tahoe Basin WCG
Linaria dalmatica ssp. dalmatica (=Linaria genistifolia ssp. dalmatica)
Dalmatian toadflax


Photo © Regents of the University of California
Helichrysum petiolare
licoriceplant

Containment:


Photo © Regents of the University of California
Aegilops triuncialis
barb goatgrass


Photo © Regents of the University of California
Alternanthera philoxeroides
alligator weed


Photo © Regents of the University of California
Arundo donax
giant reed


Photo © Regents of the University of California
Bromus madritensis ssp. rubens
red brome


Photo courtesy of: Bob Case
Centaurea solstitialis
yellow starthistle

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Surveillance Opportunities

These opportunities entail regular surveys to detect new infestations of species not known to be present in the region. The strategic potential depends on the proximity of nearby infestations and the suitability of the area. The table below includes species occurring within 50 miles of the selected region.

	Suitable Range	
Plant Species: Grouped by Statewide Cal-IPC Rating	2010	2050
High (10 species)		
Ammophila arenaria European beachgrass	0 %	▬
Brassica tournefortii Saharan mustard, African mustard	0 %	▬
Bromus tectorum downy brome, cheatgrass	2 %	▲▲
Carpobrotus edulis Hottentot-fig, iceplant	0 %	▬
Delairea odorata Cape-ivy	2 %	▬
Ehrharta calycina purple veldtgrass	1 %	▬
Euphorbia virgata (=Euphorbia esula) leafy spurge	-	-
Hydrilla verticillata hydrilla	-	-
Onopordum acanthium Scotch thistle	0 %	▬
Ulex europaeus gorse	2 %	▬
Moderate (38 species)		
Acacia dealbata silver wattle	85 %	▬
Ageratina adenophora croftonweed, eupatorium	3 %	▲
Anthoxanthum odoratum sweet vernalgrass	-	-
Arctotheca calendula (=Arctotheca calendula fertile) fertile capeweed	-	-
Arctotheca prostrata (=Arctotheca calendula infertile) sterile capeweed	-	-
Asparagus asparagoides bridal creeper	0 %	▬
Asphodelus fistulosus onionweed	-	-
Carduus nutans musk thistle	0 %	▬
Carpobrotus chilensis sea-fig, iceplant	-	-
Carthamus lanatus woolly distaff thistle	10 %	▼
Centaurea diffusa diffuse knapweed	4 %	▬
Glebionis coronaria (=Chrysanthemum coronarium) crown daisy	0 %	▬
Clematis vitalba * old man's beard	-	-

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Surveillance Opportunities, Continued

Plant Species: Grouped by Statewide Cal-IPC Rating	Suitable Range 2010	Suitable Range 2050
Cotoneaster franchetii orange cotoneaster	2 %	▬
Cotoneaster lacteus Parney's cotoneaster	-	-
Cotoneaster pannosus silverleaf cotoneaster	19 %	▲
Cytisus striatus Portuguese broom		-
Ehrharta erecta erect veldtgrass	5 %	▲
Elaeagnus angustifolia Russian-olive	-	-
Emex spinosa spiny emex, devil's-thorn	0 %	▬
Senecio minimus and S. glomeratus (=Erechtites minima and E. glomerata) Australian fireweed	-	-
Gazania linearis gazania	-	-
Glyceria declinata waxy mannagrass	89 %	▼
Holcus lanatus common velvet grass	8 %	▲
Hypericum canariense Canary Island hypericum	0 %	▬
Ilex aquifolium English holly	1 %	▬
Isatis tinctoria dyer's woad	3 %	▬
Leucanthemum vulgare ox-eye daisy	3 %	▬
Linaria vulgaris yellow toadflax, butter and eggs	0 %	▬
Mesembryanthemum crystallinum crystalline iceplant	-	-
Myoporum laetum myoporum	0 %	▬
Pennisetum setaceum crimson fountaingrass	0 %	▲▲
Fallopia japonica (=Polygonum cuspidatum) Japanese knotweed	-	-
Saccharum ravennae ravennagrass	-	-
Salsola soda oppositeleaf Russian thistle	-	-
Triadica sebifera (=Sapium sebiferum) Chinese tallowtree	-	-
Sisymbrium irio London rocket	0 %	▲
Tanacetum vulgare common tansy	-	-

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Surveillance Opportunities, Continued

Plant Species: Grouped by Statewide Cal-IPC Rating	Suitable Range 2010	Suitable Range 2050
Limited (28 species)		
Acacia melanoxylon black acacia, blackwood acacia	0 %	▬
Bassia hyssopifolia fivehook bassia	-	-
Briza maxima big quakinggrass, rattlesnakegrass	49 %	▬
Bromus japonicus Japanese brome, Japanese chess		-
Cakile maritima European sea-rocket	0 %	▬
Lepidium appelianum (=Cardaria pubescens) hairy whitetop	-	-
Carduus acanthoides plumeless thistle	-	-
Conicosia pugioniformis narrowleaf iceplant	-	-
Cordyline australis giant dracaena	-	-
Crocosmia x crocosmiiflora montbretia	-	-
Crupina vulgaris common crupina, bearded creeper	-	-
Rytidosperma pencillatum (=Danthonia pilosa) hairy oat grass	-	-
Digitalis purpurea foxglove	-	-
Echium candicans pride-of-Madeira	1 %	▬
Lobularia maritima sweet alyssum	-	-
Myosotis latifolia common forget-me-not	7 %	▬
Stipa manicata (=Nassella manicata) tropical needlegrass	-	-
Pennisetum clandestinum kikuyugrass	2 %	▬
Ranunculus repens creeping buttercup	-	-
Ricinus communis castorbean	0 %	▲
Saponaria officinalis bouncingbet	-	-
Schinus molle Peruvian peppertree	-	-
Schinus terebinthifolius Brazilian peppertree	-	-
Schismus arabicus and S. barbatus mediterraneangrass	-	-

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Surveillance Opportunities, Continued

Plant Species: Grouped by Statewide Cal-IPC Rating	Suitable Range 2010	Suitable Range 2050
Senecio jacobaea tansy ragwort	-	-
Tetragonia tetragonioides New Zealand spinach	-	-
Watsonia meriana bulbil watsonia	-	-
Zantedeschia aethiopica calla lily	-	-

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Eradication Opportunities

Eradication entails complete removal of all infestations in the area. These opportunities result from a small number of isolated infestations. The spatial pattern for eradication is one infested quad surrounded by at least two concentric bands of absence quads. The strategic importance of an eradication opportunity can be further assessed based on the degree of isolation as well as the suitability of the surrounding area. Determining the feasibility of eradication requires surveying infestations in the field.

	Current Species Distribution (number of quads out of 18 total)				Suitable Range		
Plant Species: Grouped by Statewide Cal-IPC Rating	Infested	Spreading	Managed	Eradicated	2010	Infested	2050
High (2 species)							
Centaurea stoebe ssp. micranthos (=*Centaurea maculosa*) spotted knapweed	1	0	0	0	12 %	17 %	▼
Salvinia molesta giant salvinia	1	0	1	0	-	-	-
Moderate (2 species)							
Gazania linearis gazania	0	0	0	0	-	-	-
Linaria dalmatica ssp. dalmatica (=*Linaria genistifolia ssp. dalmatica*) Dalmatian toadflax	1	0	0	0	1 %	50 %	▬
Limited (1 species)							
Helichrysum petiolare licoriceplant	1	1	0	0	-	-	-

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Containment Opportunities

Containment entails limiting the spread from existing infestations. These opportunities result from larger groups of infested quads. The strategic importance of a containment opportunity can be further assessed based on how distinct the boundaries of the infestation are, how isolated it is, and the suitability of the surrounding area. Determining the feasibility of containment requires surveying infestations in the field.

	Current Species Distribution (number of quads out of 18 total)				Suitable Range		
Plant Species: Grouped by Statewide Cal-IPC Rating	Infested	Spreading	Managed	Eradicated	2010	Infested	2050
High (24 species)							
Aegilops triuncialis barb goatgrass	10	10	1	0	93 %	56 %	▼▼
Alternanthera philoxeroides alligator weed	3	0	0	0	-	-	-
Arundo donax giant reed	17	3	11	1	100 %	94%	▬
Bromus madritensis ssp. rubens red brome	17	0	0	0	26 %	100 %	▲
Centaurea solstitialis yellow starthistle	18	1	18	0	39 %	100 %	▲▲
Cortaderia jubata jubatagrass	5	0	0	0	6 %	83 %	▬
Cortaderia selloana pampasgrass	8	1	0	0	14%	80 %	▬
Cytisus scoparius Scotch broom	2	1	0	0	3 %	40 %	▬
Egeria densa Brazilian egeria	6	3	0	0	-	-	-
Eichhornia crassipes water hyacinth	6	0	3	0	-	-	-
Foeniculum vulgare fennel	13	10	1	0	66 %	87 %	▲
Genista monspessulana French broom	4	2	0	0	27 %	44%	▬
Hedera helix and H. canariensis English ivy, Algerian ivy	3	0	0	0	16 %	43 %	▲
Lepidium latifolium perennial pepperweed	16	5	5	0	100 %	89 %	▬
Ludwigia hexapetala and L. peploides Uruguay and creeping water-primrose	6	5	0	0	-	-	-
Lythrum salicaria purple loosestrife	4	4	0	0	-	-	-
Myriophyllum aquaticum parrotfeather	6	0	0	0	-	-	-
Myriophyllum spicatum Eurasian watermilfoil	7	2	0	0	-	-	-
Rubus armeniacus (=Rubus discolor) Himalayan blackberry	18	2	2	0	-	-	-
Sesbania punicea red sesbania, scarlet wisteria	5	0	4	0	94%	28 %	▼▼
Spartium junceum Spanish broom	1	0	1	0	33 %	11 %	▲
Elymus caput-medusae (=Taeniatherum caput-medusae) medusahead	17	0	1	0	74%	94%	▬
Tamarix parviflora smallflower tamarisk	7	0	4	0	-	-	-
Tamarix ramosissima saltcedar, tamarisk	5	0	0	0	-	-	-

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Containment Opportunities, Continued

Plant Species: Grouped by Statewide Cal-IPC Rating	Current Species Distribution (number of quads out of 18 total)				Suitable Range		
	Infested	Spreading	Managed	Eradicated	2010	Infested	2050
Moderate (42 species)							
Acroptilon repens Russian knapweed	5	2	0	0	95 %	31 %	▬
Ailanthus altissima tree-of-heaven	13	10	9	0	92 %	72 %	▬
Atriplex semibaccata Australian saltbush	1	0	0	0	9 %	11 %	▲▲
Avena barbata and A. fatua (slender) wild oat	18	0	0	0	-	-	-
Brachypodium distachyon annual false-brome, false brome	5	0	0	0	55 %	29 %	▼
Brassica nigra black mustard	18	1	1	0	-	-	-
Bromus diandrus ripgut brome	18	0	0	0	100 %	100 %	▬
Lepidium chalepense (=Cardaria chalepensis and C. draba) Lepidium chalepensis and L. draba	12	1	1	0	-	-	-
Centaurea calcitrapa purple starthistle	13	10	9	0	100 %	76 %	▬
Centaurea melitensis Malta starthistle, tocalote	4	1	0	0	55 %	27 %	▲▲
Chondrilla juncea rush skeletonweed	4	0	2	0	50 %	22 %	▼▼
Cirsium arvense Canada thistle	1	0	0	0	0 %	-	▬
Cirsium vulgare bull thistle	18	5	5	0	100 %	100 %	▬
*Colocasia esculenta ** taro root	2	0	0	0	-	-	-
Conium maculatum poison-hemlock	12	1	2	0	19 %	100 %	▲
Cynara cardunculus artichoke thistle	8	0	6	0	91 %	44 %	▼▼
Cynodon dactylon bermudagrass	18	0	0	0	-	-	-
Cynosurus echinatus hedgehog dogtailgrass	4	0	0	0	47 %	33 %	▬
Dipsacus fullonum and D. sativus common and Fuller's teasel	6	2	0	0	18 %	86 %	▬
Dittrichia graveolens stinkwort	13	1	7	0	95 %	72 %	▼▼
Eucalyptus globulus Tasmanian blue gum	5	0	2	0	20 %	63 %	▬
Festuca arundinacea tall fescue	1	0	0	0	-	-	-
Ficus carica edible fig	12	8	0	0	99 %	67 %	▬
Geranium dissectum cutleaf geranium	18	2	0	0	-	-	-

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Containment Opportunities, Continued

Plant Species: Grouped by Statewide Cal-IPC Rating	Current Species Distribution (number of quads out of 18 total) Infested	Spreading	Managed	Eradicated	Suitable Range 2010	Infested	2050
Hirschfeldia incana shortpod mustard, summer mustard	7	1	0	0	-	-	-
Hordeum marinum Mediterranean barley	18	0	0	0	-	-	-
Hordeum murinum hare barley	18	0	0	0	-	-	-
Hypericum perforatum common St. John's wort, klamathweed	4	0	0	0	-	-	-
Hypochaeris radicata rough catsear, hairy dandelion	5	0	0	0	-	-	-
Kochia scoparia kochia	2	0	0	0	-	-	-
Festuca perennis (=Lolium multiflorum) Italian ryegrass	18	0	0	0	99 %	100 %	-
Mentha pulegium pennyroyal	7	1	0	0	-	-	-
Nicotiana glauca tree tobacco	7	0	0	0	11 %	88 %	▲
Oxalis pes-caprae Bermuda buttercup, buttercup oxalis	1	1	0	0	-	-	-
Phalaris aquatica hardinggrass	9	6	0	0	-	-	-
Potamogeton crispus curlyleaf pondweed	3	3	0	0	-	-	-
Rumex acetosella red sorrel, sheep sorrel	13	0	0	0	-	-	-
Torilis arvensis hedgeparsley	18	4	0	0	90 %	100 %	-
Trifolium hirtum rose clover	18	0	0	0	-	-	-
Vinca major bigperiwinkle	5	1	0	0	34%	45 %	-
Festuca myuros (=Vulpia myuros) rattail fescue	18	0	0	0	-	-	-
Washingtonia robusta Mexican fan palm	2	2	0	0	-	-	-
Limited (36 species)							
Agrostis avenacea Pacific bentgrass	4	0	0	0	-	-	-
Agrostis stolonifera creeping bentgrass	2	0	0	0	-	-	-
Bellardia trixago bellardia	3	2	0	0	-	-	-
Brassica rapa birdsrape mustard, field mustard	18	1	0	0	-	-	-
Bromus hordeaceus soft brome	18	0	0	0	-	-	-
Carduus tenuiflorus and C. pycnocephalus slenderflower and Italian thistle	18	0	17	0	-	-	-

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Containment Opportunities, Continued

Plant Species: Grouped by Statewide Cal-IPC Rating	Current Species Distribution (number of quads out of 18 total)				Suitable Range		
	Infested	Spreading	Managed	Eradicated	2010	Infested	2050
Cotula coronopifolia brassbuttons	3	0	0	0	-	-	-
Crataegus monogyna hawthorn	1	1	0	0	-	-	-
Dactylis glomerata orchardgrass	10	0	0	0	25 %	100 %	▲
Descurainia sophia flixweed, tansy mustard	7	4	0	0	-	-	-
Erodium cicutarium redstem filaree	18	0	0	0	-	-	-
Eucalyptus camaldulensis red gum	2	0	2	0	-	-	-
Euphorbia oblongata oblong spurge	3	0	0	0	88 %	17 %	▼▼
Hypochaeris glabra smooth catsear	18	0	0	0	-	-	-
Iris pseudacorus yellowflag iris	2	0	0	0	-	-	-
Lythrum hyssopifolium hyssop loosestrife	6	0	0	0	-	-	-
Marrubium vulgare white horehound	10	0	0	0	-	-	-
Medicago polymorpha California burclover	18	0	0	0	-	-	-
Olea europaea olive	8	2	0	0	-	-	-
Parentucellia viscosa yellow glandweed, sticky parentucellia	1	1	0	0	56 %	7 %	▲
Phoenix canariensis Canary Island date palm	1	1	0	0	-	-	-
Helminthotheca echioides (=*Picris echioides*) bristly oxtongue	18	17	0	0	67 %	100 %	▼
Stipa miliacea var. miliacea (=*Piptatherum miliaceum*) smilograss	3	1	0	0	51 %	21 %	▲
Plantago lanceolata buckhorn plantain, English plantain	18	0	0	0	-	-	-
Poa pratensis Kentucky bluegrass	5	0	0	0	-	-	-
Polypogon monspeliensis rabbitfoot polypogon	18	0	0	0	-	-	-
Prunus cerasifera cherry plum	2	0	0	0	-	-	-
Pyracantha angustifolia, crenulata, seratus, etc. pyracantha, firethorn	7	0	0	0	-	-	-
Raphanus sativus radish	18	0	0	0	-	-	-
Robinia pseudoacacia black locust	6	0	0	0	-	-	-
Rumex crispus curly dock	18	0	0	0	-	-	-

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Containment Opportunities, Continued

Plant Species: Grouped by Statewide Cal-IPC Rating	Current Species Distribution (number of quads out of 18 total)				Suitable Range		
	Infested	Spreading	Managed	Eradicated	2010	Infested	2050
Salsola tragus Russian-thistle	13	7	7	0	-	-	-
Silybum marianum blessed milkthistle	17	4	0	0	99 %	94%	-
Sinapis arvensis wild mustard, charlock	2	0	0	0	-	-	-
Tamarix aphylla athel tamarisk	2	0	0	0	-	-	-
Verbascum thapsus common mullein, woolly mullein	7	0	0	0	-	-	-

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Legend and Terminology

For each species, statistics are generated from maps. The statistics are divided into two parts: current species distribution and suitable range.

Current Species Distribution

• Infested: Number of quads that are infested with this species (relative to total number of quads in the selected region of interest)
• Spreading: Number of quads where this species is spreading,
• Managed: Number of quads where this species is under management,
• Eradicated: Number of quads where this species has been eradicated,

An asterisk * by the species name indicates that the mapped distribution of this species has only been populated using Calflora data, and does not include any expert knowledge by quad data.

Suitable Range

• 2010: Percent of the selected region of interest that currently meets the minimum threshold for suitability for the species,
• Infested: Percent of the current suitable range that is infested.
• 2050: Change in suitability between 2010 and 2050, with an arrow representing an increase or decrease of greater than 10%, and a double arrow indicating change of greater than 40%.

- ▲▲ Increase of 40% or more
- ▲ Increase of 10% to 39%
- ▬ No change (less than 10% change either direction)
- ▼ Decrease of 10% to 39%
- ▼▼ Decrease of 40% or more

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Using This Report

This report, together with Regional Species Map Reports, summarizes management opportunities for the selected region. This report, together with Regional Species Maps, is designed to inform strategic management decisions at a landscape level. Regional coordinating bodies can use these reports as a starting place for setting priorities and establishing goals. Surveillance priorities can be focused to strengthen early detection. Eradication and containment priorities are based on factors such as how widely a species has spread. This landscape-level view provides a strategic foundation for developing and implementing on-the-ground programs.

Management opportunities are identified in three categories determined by the species' spatial distribution. While each plant species is listed in only one category, multiple management approaches can be appropriate in a given region. Assessing the feasibility of a particular management measure requires additional detailed assessment.

1. Surveillance – Surveillance entails regular surveys to detect new infestations of species not known to be present in a region. The strategic potential depends on the proximity of nearby infestations and the suitability of the area. The table in this report includes species occurring within 50 miles of the selected region.

2. Eradication – Eradication entails complete removal of all infestations in the area. These opportunities result from small, isolated infestations. The spatial pattern for eradication is one infested quad surrounded by at least two concentric bands of absence quads. The strategic importance of an eradication opportunity can be further assessed based on the degree of isolation as well as the suitability of the surrounding area. Determining the feasibility of eradication requires surveying infestations in the field.

3. Containment – Containment entails limiting the spread from existing infestations. These opportunities result from larger groups of infested quads. The strategic importance of a containment opportunity can be further assessed based on how distinct the boundaries of the infestation are, how isolated it is, and the suitability of the surrounding area. Determining the feasibility of containment requires surveying infestations in the field.

For each type of opportunity, plant species are organized by their rating in Cal-IPC's Inventory, which uses a uniform methodology to categorize non-native plants that pose a substantial threat to the state's wildlands. The Cal-IPC rating combines information about ecological impacts, invasive potential and ecological distribution to rate species as High, Moderate or Limited at a statewide level. Regional impacts may differ.

An asterisk ***** by the species name indicates that the mapped distribution of this species has only been populated using Calflora data, and does not include any expert knowledge by quad data.

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About This Report

This report is generated from an online mapping system developed by the nonprofit California Invasive Plant Council and hosted at Calflora. The site allows the state's network of local experts to maintain updated data on invasive plant distribution statewide. CalWeed Mapper is integrated with the Calflora invasive plant database to reflect new occurrence data submitted to Calflora. Maps and reports generated are snapshots of a dynamic system and should be revisited on a regular basis to ensure that information is current.

In order to cover 200 species over the entire state, the mapping approach used in this work is necessarily coarse. The maps are not sufficient for planning the details of on-the-ground management, which requires information at a much higher resolution. (As you generate such detailed information, please share your data with Calflora.org. More information may be found at CalWeedMapper under Spatial Data.) Cal-IPC interviewed hundreds of natural resource managers around the state to collect a baseline of “expert knowledge” on abundance, spread and management by USGS 7.5-degree quadrangle (approximately 8 mi x 6 mi). We also incorporated datasets of occurrence observations from Calflora, The Consortium of California Herbaria, and agencies throughout the state. However, the vast majority of the presence documented in these maps comes solely from expert knowledge; no occurrence observations exist in online databases.

We predict suitable range for a given species by using modeling software that combines the species' current distribution with environmental variables (model results are reviewed by invasive plant experts). The resulting maps show areas that have the highest probability of being suitable. Future suitable range is based on commonly used scenarios from the Intergovernmental Panel on Climate Change. Details about modeling methods can be found at CalWeedMapper under About.

The distribution and suitability maps are not expected to be 100% accurate. Data drawn from expert knowledge, while having the great benefit of drawing on the extensive experience of individual local resource managers, can nonetheless be inaccurate. Data drawn from GIS datasets, though of higher precision, may not always be accurate, either, since those conducting the mapping may have misidentified the species or not captured the location correctly. In addition, conditions on the ground may have changed since the observation was filed, making the record out of date.

By engaging local experts statewide to check each others' work, CalWeedMapper can steadily increase the accuracy of the maps. Our goal is to maintain up-to-date statewide maps of invasive plant distribution.

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APPENDIX B

Interagency and Intergovernmental Coordination (IICEP) and Public Participation

Agency Notification Letter

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 60TH AIR MOBILITY WING (AMC)

8 February 2021

MEMORANDUM FOR SEE DISTRIBUTION

FROM: Merlin J. Miller
60 CES/CD
411 Airmen Drive
Travis Air Force Base, CA 94535

SUBJECT: Notification and Solicitation of Comments for Invasive and Aquatic Species Management at Travis Air Force Base (AFB) and Geographically Separated Units (GSUs), Solano and Contra Costa Counties, California

1. The U.S. Air Force (USAF) is in the process of preparing a Draft Environmental Assessment in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended; Council on Environmental Quality Regulations (40 Code of Federal Regulations 1500-1508); USAF Environmental Impact Analysis Process (32 Code of Federal Regulations Part 989); and California Environmental Quality Act (CEQA). The proposed action manages invasive and aquatic species on Travis AFB protects and preserve the military mission while simultaneously helping to meet Section 7(a)1 obligations under the federal Endangered Species Act.

1. Under the Proposed Action, Travis AFB proposes to manage invasive species across the main base are (5,137-acres) and seven graphically separated units (GSU) cover 358 acres.

Additional work includes native and invasive aquatic species in Union Creek and other permeant water bodies on Travis AFB in order to satisfy resource management goals from the Integrated Natural Resources Management Plan, the Invasive Plant Species Management Plan, the Invasive Species Management Plan, the Grazing Management Plan, the Aquatic Pesticide Application Plan, and the Wildland Fire Management Plan. Implementation an integrated management process reduces the negative effects. Treatments may include but are not limited to: broad-scale actions such as grazing and prescribed fire; fire management activities (firebreak creation and maintenance); targeted treatments (manual/mechanical and chemical applications), and habitat enhancement activities and modifications. Annual work allows for predictable reduction of invasive species and improvement of federally listed species habitat.

2. The Environmental Assessment provides three alternative options for the proposed action: the proposed action without chemical herbicide applications and limited use of grazing: the proposed action excluding all locations with 25 feet of federally listed species habitat and known listed species records, and the No Action Alternative encompasses current management actions.

3. The Air Force requests your input on the Proposed Action as part of the consultation process with relevant agencies, property owners and stakeholders in accordance with Executive Order 12372, *Intergovernmental Review of Federal Programs*. This is the initial step in the review

process. The draft of the Environmental Assessment will be released as details on each Alternative is developed.

4. Please address all questions and comments to Seth Merdler; Travis AFB NEPA Program Manager; at (707) 424-7516; seth.merdler@us.af.mil; 411 Airman Dr, Travis AFB, CA 94535

2/8/2021

X Merlin J. Miller

Merlin J. Miller, GS-14, DAFC
Deputy Base Civil Engineer
Signed by: MILLER.MERLIN.J.1152847900

DISTRIBUTION:

Federal Agencies

U.S. Environmental Protection Agency,
Region 9
Director, Officer of Federal Activities
75 Hawthorne Street
San Francisco, CA 94105

U.S. Department of the Interior
U.S. Fish and Wildlife Service
CA/NV Operations Office
2800 Cottage Way, Room W-2605
Sacramento, CA 95825

State Agencies

State of California Clearinghouse
Governor's Office
1400 Tenth Street, Room 121
Sacramento, CA 95814
state.clearinghouse@opr.ca.gov

Dr. Knox Mellon
State Historic Preservation Officer
Department of Parks and Recreation
P.O. Box 942896
Sacramento, CA 94296-0001

County Agencies

Solano County
Department of Resource Management
675 Texas Street, Suite 5500
Fairfield, CA 94533

City Agencies

City of Fairfield
Community Development Department
1000 Webster Street
Fairfield, California 94533

City of Vacaville
Community Development Department
650 Merchant Street
Vacaville, CA 95688

City of Suisun City
Community Development Department
701 Civic Center Blvd
Suisun, CA 94588

Public Libraries

Fairfield-Suisun Community Library
1150 Kentucky Avenue
Fairfield, CA 94533

Suisun City Library
333 Sunset Avenue
Suisun City, CA 94585

Vacaville Public Library
1020 Ulatis Drive
Vacaville, CA 95687

Mitchell Memorial Library
510 Travis Avenue (Bldg 436)
Travis AFB, CA 94535

Document Root (Read-Only)

Selected Document

2021020214 - NOI - Invasive Species Management Environmental Assessment

United States Air Force (USAF)
Created - **2/5/2021** | Submitted - **2/10/2021** | Received - **2/10/2021** | Published - **2/10/2021** | Updated - **3/12/2021**
Seth M Merdler

Document Details

Lead Agency

United States Air Force (USAF)

Document Type

Notice of Intent

Document Status

Published

Title

Invasive Species Management Environmental Assessment

Document Description

Travis Air Force Base is proposing management methods to control invasive species on Travis AFB. An Environmental Assessment will be developed to evaluate the impacts of implementing those methods.

Attachments

2021020214_CDFW Comment.pdf

Invasive Species Management EA - Description of Proposed Actions and Alternatives.pdf

NOC - Invasive Species Management Plan EA - Travis AFB.pdf

Contacts

NEPA/EIPA Program Manager - *Seth Merdler*

411 Airmen Dr, Bldg 570
Sacramento, CA 94535
Phone : (707) 424-7516
seth.merdler@us.af.mil

Regions

Countywide | Northern California

Counties

Solano

Cities

Fairfield | Suisun City | Vacaville

Location Details

Cross Streets

Air Base Parkway

Zip Code - 94535 | **State Highways** - Highway 12 | **Airports** - Travis Air Force Base | **Schools** - Travis School District | **Waterways** - Union Creek

Local Action Types

General Plan Update

Development Types

Other (Natural Resources Improvements)

Project Issues

Aesthetics | Agriculture and Forestry Resources | Biological Resources | Cumulative Effects | Flood Plain/Flooding | Hazards & Hazardous Materials | Land Use/Planning | Vegetation | Wetland/Riparian | Wildfire

Review Agencies

Air Resources Board | Caltrans, Aeronautics | Caltrans, District 4 - Bay Area/Oakland | Caltrans, Trans Planning | Conservation, Department of | Fish and Wildlife, Region 3 - Bay Delta, Fairfield | Forestry and Fire Protection, Department of | Historic Preservation, Office of | Native American Heritage Commission, California | Natural Resources Agency, California | Parks and Recreation, Department of | Pesticide Regulation, Department of |
Regional Water Quality Control Board, Region 2 - San Francisco Bay, Oakland | SWRCB, Division of Drinking Water, District 2 | Toxic Substances Control, Department of | Water Resources, Department of

Review Period

Review Started

2/10/2021

Review Ended

3/11/2021

Signature

Title

Date

Representative Tribal Letter

Mr. Gene Whitehouse, Chairperson

United Auburn Indian Community

DEPARTMENT OF THE AIR FORCE
60TH CIVIL ENGINEER SQUADRON (AMC)

15 March 2021

Mr. Merlin J. Miller
Deputy Base Civil Engineer
60th Civil Engineer Squadron
411 Airman Drive, Bldg. 570
Travis AFB CA 94535

Gene Whitehouse
Chairperson
United Auburn Indian Community of the Auburn Rancheria
10720 Indian Hill Road
Auburn CA 95603

Dear Chairperson Whitehouse

The Travis Air Force Base (TAFB) proposes the Invasive Species Environmental Assessment Project (Project), which includes fire suppression and habitat management activities for the purpose of invasive species management at numerous locations on TAFB in Solano County, California, and its associated geographically separated units (GSUs). In accordance with Section 106 of the NHPA, and its implementing regulations at 36 CFR 800, the USAF is requesting your input regarding cultural resources of importance to Native American communities that may be affected by the undertaking.

The USAF has defined the undertaking's Area of Potential Effects (APE) based on project activities that will result in ground disturbance (see attached APE Map). The APE totals 21.59acres of discontinuous activity areas. This includes 11.3 acres of disking new firebreaks proposed in four locations, replacement of 5.4 miles of fencing at 14 locations (totaling 2.1 acres), and three firebreak (graded) segments, which total 8.09 acres. These graded firebreak segments were constructed in August 2020 along Castle Terrace and the Aero Club as part of an emergency response to the LNU Lightning Fire Complex. In terms of the vertical APE, ground disturbance is expected to be minimal (less than 2 feet) along much of the Project alignment for disk harrowing. Deeper excavations, which may extend up to three feet in depth, will be required for fence and gate post installation.

Geographically, the APE lies in various sections of Township 5 North, Range 1 West, and Township 5 North, Range 1 East, Mount Diablo Base Meridian (MDBM) of the Elmira, and Denverton, California USGS topographic maps. The APE encompasses areas throughout TAFB and along its perimeter. The record search conducted for the Project identified two archaeological sites in the APE, P-48-000970/CA-SOL-420H and the Burke Home Site (P-48-000735/CA-SOL-448H), both of which are historic-era farmsteads. CA-SOL-420H has been determined ineligible for listing in the National Register of Historic Places. CA-SOL-448H has been recommended ineligible. No prehistoric archaeological resources were identified in the vicinity of the Project APE.

Knowing that certain information is only available through consultation, we encourage your participation in this process and respectfully request a response within 30 days of receipt of this letter under the NHPA for this undertaking. Your participated in the Section 106 consultation process will not affect the handling or disposition of human remains, funerary objects, sacred objects, or objects of cultural patrimony under the Native American Graves Protection and Repatriation Act. In the event such items are discovered, we will contact you regarding their handling and disposition. My point of contact for this project is our Cultural Resource Manager, Ms. Leslie Peña. She may be reached at 707-424-0891, Leslie.pena.1@us.af.mil. Please feel free to contact her directly for additional information or with any questions you may have. Thank you for your assistance in this effort.

Sincerely

3/15/2021

X Merlin J. Miller

Merlin J. Miller GS-14 DAFC
Deputy Base Civil Engineer
Signed by: MILLER.MERLIN.J.1152847900

Attachment:
APE Map

Notification Responses

From: **MERDLER, SETH M GS-12 USAF AMC 60 CES/CENP** seth.merdler@us.af.mil
Subject: FW: Invasive and Aquatic Species Management at TAFB & GSUs
Date: March 8, 2021 at 4:05 PM
To: WEBER, DEANNE S GS-12 USAF AFCEC AFCEC/CZOW deanne.weber.1@us.af.mil, CHRISTOPHERSON, KIRSTEN E GS-14 USAF AFMC AFCEC/CZOW kirsten.christopherson@us.af.mil, Jaymee Marty martyjt@me.com, PENA, LESLIE L GS-12 USAF AMC 60 CES/CENP leslie.pena.1@us.af.mil

The CA Department of Fish and Wildlife requested a map so I provided the attached.

From: MERDLER, SETH M GS-12 USAF AMC 60 CES/CENP
Sent: Monday, March 8, 2021 3:33 PM
To: Culpepper, Amanda(Mandy)@Wildlife <Amanda.Culpepper@Wildlife.ca.gov>
Subject: RE: Invasive and Aquatic Species Management at TAFB & GSUs

Hello Mandy,

Thank you for reaching out. This is a general plan for all of Travis Air Force Base and Geographically Separate Units. The first image of the attached is Travis with the highlighted GSUs in purple. The next is just Travis. The third is the Rail Road Right of Way and the Cypress Lake Golf Course, The fourth is the Outer Runway Marker and the Defense Fuel Supply Point Ozol.

The last image is a map specific to Weed Infestation.

And yes a review period to March 18 will be acceptable.

Let me know what else I can do for you.
Thanks,
Seth

Seth Merdler
60 CES/CENP
NEPA Program Manager
Installation Tribal Liaison Officer
(707) 424-7516
DSN: 837-7516
seth.merdler@us.af.mil

From: Culpepper, Amanda(Mandy)@Wildlife <Amanda.Culpepper@Wildlife.ca.gov>
Sent: Monday, March 8, 2021 2:17 PM
To: MERDLER, SETH M GS-12 USAF AMC 60 CES/CENP <seth.merdler@us.af.mil>
Subject: [Non-DoD Source] Invasive and Aquatic Species Management at TAFB & GSUs

Hi Seth,

I reviewed the Notice and Solicitation of Comments for the Invasive and Aquatic Species Management Plan for Travis AFB and associated GSUs and am wondering if you have a map you could share of the project area?

Additionally, would it be possible to provide California Department of Fish and Wildlife with

Additionally, would it possible to provide California Department of Fish and Wildlife with an extension to March 18 to provide our initial comments?

Thanks so Much!

Mandy

Amanda (Mandy) Culpepper
Environmental Scientist I Marin and Solano Counties
California Department of Fish and Wildlife
(707) 428-2075* I amanda.culpepper@wildlife.ca.gov
2825 Cordelia Road, Suite 100, Fairfield, CA 94534
*I am currently working remotely and can be reached most effectively via email

---

CDFW is transitioning to the Environmental Permit Information Management System (EPIMS), an online system, for all Lake or Streambed Alteration (LSA) Notifications. **CDFW now *only* accepts standard and emergency Notifications through EPIMS**. For more information visit https://wildlife.ca.gov/Conservation/Environmental-Review/EPIMS.



Map of Travis AFB.docx

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State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Bay Delta Region
2825 Cordelia Road, Suite 100
Fairfield, CA 94534
(707) 428-2002
www.wildlife.ca.gov

GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director

March 11, 2021

Mr. Seth Merdler
NEPA/EIAP Program Manager
United States Air Force
411 Airmen Drive, Building 570
Sacramento, CA 94535
Seth.Merdler@us.af.mil

Subject: Invasive and Aquatic Species Management at Travis Air Force Base and Geographically Separated Units, Notification and Solicitation of Comments of a Draft Environmental Assessment, SCH No. 2021020214, Solano and Contra Costa Counties

Dear Mr. Merdler:

The California Department of Fish and Wildlife (CDFW) has reviewed the Notification and Solicitation of Comments of a draft Environmental Assessment (EA) for Invasive and Aquatic Species Management at Travis Air Force Base (AFB) and Geographically Separated Units (GSUs) (Project).

CDFW is a Trustee Agency with responsibility under the California Environmental Quality Act (CEQA) for commenting on projects that could impact fish, plant, and wildlife resources (Pub. Resources Code, § 21000 et seq.; Cal. Code Regs., tit. 14, § 15386). CDFW is also considered a Responsible Agency if a project would require discretionary approval, such as a California Endangered Species Act (CESA) Incidental Take Permit, a Native Plant Protection Act (NPPA) Permit, a Lake and Streambed Alteration (LSA) Agreement, or approval under other provisions of the Fish and Game Code that afford protection to the state's fish and wildlife trust resources. Pursuant to our authority, CDFW has the following concerns, comments, and recommendations regarding the Project.

CDFW has authority over actions that may disturb or destroy active nest sites or take birds. Fish and Game Code sections 3503, 3503.5, and 3513 protect birds, eggs, and nests. Migratory birds are also protected under the federal Migratory Bird Treaty Act.

Fully protected species, such as white-tailed kite (*Elanus leucurus*), may not be taken or possessed at any time (Fish and Game Code, §§ 3511, 4700, 5050, and 5515). Therefore, the draft EA should include measures to ensure complete avoidance of these species.

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PROJECT DESCRIPTION AND LOCATION

The Project is the management of invasive species and vegetation across Travis AFB (5,137 acres) and seven GSUs (358 acres). The U.S. Air Force (USAF) is the Lead Agency. The Project is located in unincorporated Solano County and Contra Costa County. Project activities will include grazing, fuel break creation and maintenance, mechanical removal of vegetation, manual removal of vegetation, herbicide application, prescribed fire, and habitat enhancement. Work is expected to be conducted annually and will satisfy goals identified in the Integrated Natural Resources Management Plan, Invasive Plant Species Management Plan, Invasive Species Management Plan, Grazing Management Plan, Aquatic Pesticide Application Plan, and Wildland Fire Management Plan.

The draft EA should incorporate a full Project description, including reasonably foreseeable future phases of the Project, that contains sufficient information to evaluate and review the Project's environmental impact. Please include a complete description of the following Project components in the Project description:

- Project locations, including a Project map.
- Footprints of permanent Project features such as fuel breaks and temporarily impacted areas, such as staging areas, access routes, and temporary vegetation treatment.
- Area and plans for any ground disturbing activities, fencing, stationary machinery, landscaping, habitat restoration, prescribed fire, and grazing.
- Operational features of the Project, including level of anticipated human presence (describe seasonal or daily peaks in activity, if relevant), livestock presence, artificial lighting/light reflection, noise, traffic generation, and other features.
- Vegetation treatment schedule, activities, equipment, and crew sizes.
- Targeted invasive species and any other vegetation that will be treated.
- Types of pesticides that will be used and description of label instructions

ENVIRONMENTAL SETTING

The draft EA should provide sufficient information regarding the environmental setting ("baseline") to understand the Project's, and its alternative's, potentially significant impacts on the environment.

CDFW recommends that the draft EA provide baseline habitat assessments for special-status plant, fish, and wildlife species located and potentially located within the Project area and surrounding lands, including but not limited to all rare, threatened, or

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endangered species. The draft EA should describe aquatic habitats, such as wetlands and/or waters of the U.S. or State, and any sensitive natural communities or riparian habitat occurring on or adjacent to the Project site. Fully protected, threatened or endangered, and other special-status species that are known to occur, or have the potential to occur in or near the Project site, include but are not limited to:

- California tiger salamander (*Ambystoma californiense*), CESA and ESA listed as threatened
- California red-legged frog (*Rana draytonii*), ESA listed as threatened, California Species of Special Concern (SSC)
- California Ridgway's rail (*Rallus obsoletus obsoletus*), CESA and ESA listed as endangered, Fully Protected Species
- California black rail (*Laterallus jamaicensis coturniculus*), CESA listed as threatened, Fully Protected Species
- California least tern (*Sternula antillarum browni*), CESA and ESA listed as endangered, Fully Protected Species
- Tricolored blackbird (*Agelaius tricolor*), CESA listed as threatened
- Swainson's hawk (*Buteo swainsoni*), CESA listed as threatened
- Burrowing owl (*Athene cunicularia*), SSC
- Northern harrier (*Circus hudsonius*), SSC
- Saltmarsh common yellowthroat (*Geothlypis trichas sinuosa*), SSC
- Short-eared owl (*Asio flammeus*), SSC
- Suisun song sparrow (*Melospiza melodia maxillaris*), SSC
- White-tailed kite, Fully Protected Species
- Salt marsh harvest mouse (*Reithrodontomys raviventris*), CESA and ESA listed as endangered, Fully Protected Species
- Suisun shrew (*Sorex ornatus sinuosus*), SSC
- Western pond turtle (*Emys marmorata*), SSC
- Longfin smelt (*Spirinchus thaleichthys*), CESA listed as threatened, ESA candidate for listing
- Conservancy fairy shrimp (*Branchinecta conservatio*), ESA listed as endangered, California Terrestrial and Vernal Pool Invertebrate of Conservation Priority (ICP)[1]
- Vernal pool tadpole shrimp (*Lepidurus packardi*), ESA listed as endangered, ICP
- Delta green ground beetle (*Elaphrus viridis*), ESA listed as threatened, ICP

[1] The list of California Terrestrial and Vernal Pool Invertebrates of Conservation Priority was collated during CDFW's Scientific Collecting Permit rulemaking process: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=157415&inline

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- Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), ESA listed as threatened, ICP
- Vernal pool fairy shrimp (*Branchinecta lynchi*), ESA listed as threatened, ICP
- Monarch butterfly (*Danaus plexippus* pop.1), ICP
- Hairy water flea (*Dumontia oregonensis*), ICP
- Western bumble bee (*Bombus occidentalis*), ICP
- Contra Costa goldfields (*Lasthenia conjugens*), ESA listed as endangered, California Rare Plant Rank (CRPR) 1B.1
- Soft salty bird's-beak (*Chloropyron molle* ssp. *molle*), ESA listed as endangered, NPPA rare, CRPR 1B.2
- Suisun thistle (*Cirsium hydrophilum* var. *hydrophilum*), ESA listed as endangered, CRPR 1B.1
- Two-fork clover (*Trifolium amoenum*), ESA listed as endangered, CRPR 1B.1
- Baker's navarretia (*Navarretia leucocephala* ssp*. bakeri*), CRPR 1B.1
- Carquinez goldenbush (*Isocoma arguta*), CRPR 1B.1
- Congdon's tarplant (*Centromadia parryi* ssp*. congdonii*), CRPR 1B.1
- Coulter's goldfields (*Lasthenia glabrata* ssp. *coulteri*), CRPR 1B.1
- Mason's lilaeopsis (*Lilaeopsis masonii*), NPPA rare, CRPR 1B.1
- Mt. Diablo buckwheat (*Eriogonum truncatum*), CRPR 1B.1
- Alkali milk-vetch (*Astragalus tener* var*. tener*), CRPR 1B.2
- Brittlescale (*Atriplex depressa*), CRPR 1B.2
- California alkali grass (*Puccinellia simplex*), CRPR 1B.2
- Delta tule pea (*Lathyrus jepsonii* var. *jepsonii*), CRPR 1B.2
- Heartscale (*Atriplex cordulata* var. *cordulata*), CRPR 1B.2
- Long-styled sand-spurrey (*Spergularia macrotheca* var. *longistyla*), CRPR 1B.2
- Marsh microseris (*Microseris paludosa*), CRPR 1B.2
- Pappose tarplant (*Centromadia parryi* ssp. *parryi*), CRPR 1B.2
- Saline clover (*Trifolium hydrophilum*), CRPR 1B.2
- San Joaquin spearscale (*Extriplex joaquinana*), CRPR 1B.2
- Suisun marsh aster (*Symphyotrichum lentum*), CRPR 1B.2
- Vernal pool smallscale (*Atriplex persistens*), CRPR 1B.2
- Bolander's water-hemlock (*Cicuta maculate* var. *bolanderi*), CRPR 2B.1
- Dwarf downingia (*Downingia pusilla*), CRPR 2B.2
- Slender-leaved pondweed (*Stuckenia filiformis* ssp*. alpina*), CRPR 2B.2

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Habitat descriptions and the potential for species occurrence should include information from multiple sources, such as aerial imagery; historical and recent survey data, field reconnaissance; scientific literature and reports; the U.S. Fish and Wildlife Service's (USFWS) Information, Planning, and Consultation System; and findings from positive occurrence databases such as the California Natural Diversity Database (CNDDB). Based on the data and information from the habitat assessment, the draft EA should adequately assess which special-status species are likely to occur on or near the Project site, and whether they could be impacted by the Project.

CDFW recommends that prior to Project implementation, surveys be conducted for special-status species with potential to occur, following recommended survey protocols if available. Survey and monitoring protocols and guidelines are available at: https://wildlife.ca.gov/Conservation/Survey-Protocols.

Botanical surveys for special-status plant species, including those with a California Rare Plant Rank (http://www.cnps.org/cnps/rareplants/inventory/), must be conducted during the blooming period for all species potentially impacted by the Project within the Project area and adjacent habitats that may be indirectly impacted by, for example, changes to hydrology, and require the identification of reference populations. Please refer to CDFW protocols for surveying and evaluating impacts to rare plants, and survey report requirements (https://wildlife.ca.gov/Conservation/Plants).

IMPACT ANALYSIS AND MITIGATION MEASURES

The draft EA should discuss all direct and indirect impacts (temporary and permanent), including reasonably foreseeable impacts, that may occur with implementation of the Project. This includes evaluating and describing impacts such as:

- Encroachments into riparian habitats, drainage ditches, wetlands, or other sensitive areas.
- Potential for impacts to special-status species.
- Loss or modification of breeding, nesting, dispersal, and foraging habitat, including vegetation removal, alteration of soils and hydrology, and removal of habitat structural features (e.g., snags, rock outcrops, overhanging banks).
- Permanent and temporary habitat disturbances associated with ground disturbance, noise, lighting, reflection, air pollution, traffic, livestock, or human presence.
- Obstruction of movement corridors, fish passage, or access to water sources and other core habitat features.

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The draft EA should also identify reasonably foreseeable future projects in the Project vicinity, disclose any cumulative impacts associated with these projects, determine the significance of each cumulative impact, and assess the significance of the Project's contribution to the impact. Although a project's impacts may be less-than-significant individually, its contributions to a cumulative impact may be considerable; a contribution to a significant cumulative impact, e.g., reduction of habitat for a special-status species, should be considered cumulatively considerable.

Based on the comprehensive analysis of the direct, indirect, and cumulative impacts of the Project, USAF should describe all feasible mitigation measures to avoid potentially significant impacts in the draft EA and mitigate potentially significant impacts of the Project on the environment. This includes a discussion of impact avoidance and minimization measures for special-status species, which are recommended to be developed in early consultation with CDFW, USFWS, and the National Marine Fisheries Service, as applicable. USAF should also review the draft Solano Habitat Conservation Plan avoidance, minimization, and mitigation measures to inform and guide the Project impacts and measures. Project-specific measures should be incorporated as enforceable Project conditions to reduce impacts to biological resources to less-than-significant levels.

ENVIRONMENTAL DATA

CDFW requests reporting any special-status species and natural communities detected during Project surveys to CNDDB. The CNNDB online field survey form and other methods for submitting data can be found at the following link: https://wildlife.ca.gov/Data/CNDDB/Submitting-Data. The types of information reported to CNDDB can be found at the following link: https://wildlife.ca.gov/Data/CNDDB/Plants-and-Animals.

If you have any questions, please contact Ms. Amanda Culpepper, Environmental Scientist, at Amanda.Culpepper@wildlife.ca.gov; or Ms. Melanie Day, Acting Senior Environmental Scientist (Supervisory), at Melanie.Day@wildlife.ca.gov.

Sincerely,

DocuSigned by:
Gregg Erickson
BE74D4C93C604EA...

Gregg Erickson
Regional Manager
Bay Delta Region

ec: State Clearinghouse (SCH No. 2021020214)
Andrew Chambers, CDFW Bay Delta Region
Andrea Boertien, CDFW Bay Delta Region
Robynn Swan, CDFW Bay Delta Region

From: **PENA, LESLIE L GS-12 USAF AMC 60 CES/CENP** leslie.pena.1@us.af.mil
Subject: FW: Sec.106: Travis Air Force Base Invasive Species Environmental Assessment Project
Date: March 16, 2021 at 10:59 AM
To: MERDLER, SETH M GS-12 USAF AMC 60 CES/CENP seth.merdler@us.af.mil, Jaymee Marty (martyjt@me.com)
martyjt@me.com

See response below from the Auburn Indian Community.

v/r
Leslie

From: Anna Cheng <acheng@auburnrancheria.com>
Sent: Tuesday, March 16, 2021 9:28 AM
To: PENA, LESLIE L GS-12 USAF AMC 60 CES/CENP <leslie.pena.1@us.af.mil>
Cc: Anna Starkey <astarkey@auburnrancheria.com>
Subject: [Non-DoD Source] Sec.106: Travis Air Force Base Invasive Species Environmental Assessment Project

Dear Ms. Pena,

On behalf of the United Auburn Indian Community, thank you for the notification and opportunity to consult for the above referenced project. We have reviewed the project location and determined that it falls outside of the UAIC's consultation area. Therefore, we will not be commenting on the project. We recommend reaching out to other surrounding Rancherias.

Best,
Anna Cheng

Anna Cheng
Tribal Historic Preservation Department| UAIC
10720 Indian Hill Road
Auburn, CA 95603
acheng@auburnrancheria.com |www.auburnrancheria.com

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APPENDIX C

Notice of Availability, Notice of Intent and IICEP Process

Payment Receipt

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Total	-371.88

PUBLIC NOTICE

INTENT TO PREPARE AN ENVIRONMENTAL ASSESSMENT FOR INVASIVE AND AQUATIC SPECIES MANAGEMENT AT TRAVIS AIR FORCE BASE (AFB) AND GEOGRAPHICALLY SEPARATED UNITS, SOLANO AND CONTRA COSTA COUNTIES CALIFORNIA

The United States Air Force (USAF) announces the intent to prepare an Environmental Assessment for the proposed management of invasive, non-native plant and animal species as well as nuisance aquatic plant species on Travis Air Force Base and Geographically Separated Units, lands owned by Travis Air Force Base but that are not contiguous with the Main Base. Because the Proposed Action would occur in wetlands and potential floodplains, and has the potential to result in impacts to wetlands, wetland buffers, and potential floodplains the action is subject to the requirements and objectives of Executive Order 11990, Wetlands, as amended and Executive Order 11988, Floodplain Management. As part of the Proposed Action, the USAF is considering Alternative 1 (No Action Alternative), Alternative 2 (Comprehensive Management; includes manual and mechanical removal, chemical control, grazing and prescribed burning), Alternative 3 (Limited Control Methods; excludes use of chemical applications and expansion of grazing areas), and Alternative 4 (Limited Control Locations; excludes control near federally listed species). The project area encompasses all of Travis Air Force Base and the seven Geographically Separated Units, totaling 5,137 and 358 acres, respectively. Only one Geographically Separated Unit, Defense Fuel Supply Point Ozol, which occupies about 52 acres, occurs in Contra Costa County. Travis Air Force Base and the other Geographically Separated Units are located in Solano County. Treatments would be conducted within these areas where invasive and non-native plants and animals and nuisance aquatic plant species occur. Travis Air Force Base and the Geographically Separated Units contain approximately 122 acres of wetlands that are potential Waters of the United States regulated under Section 404 of the CWA and 0 acres of Federal Emergency Management Agency-delineated floodplains though floodplains occur just outside the Base boundary and Union Creek (35.8 acres) flows through the Main Base. Wetland impacts in the long-term would be beneficial from the removal of non-native plant biomass and restoration of native vegetation in wetlands and adjacent uplands. Long-term impacts to potential floodplains would be beneficial, by reducing the hazard and risk of flood loss by improving water flow and floodplain functionality. Short-term, temporary impacts would occur to wetlands, wetland buffers and potential floodplains during control activities under the action alternatives. Under the No Action Alternative, minimal control activities would occur and invasive species would be expected to continue to spread into wetlands and floodplains causing ecological harm.

The USAF invites the public to provide comments on the proposal and any practicable alternatives that may reduce these impacts. Comments should be sent within 30 days from date of this publication to Mr. Seth Merdler, (707) 424-7516, seth.merdler@us.af.mil, 60 CES/CEIE, 411 Airmen Dr, Travis AFB, CA 94535.

DR# 00044827

Published: February 10, 2021

PUBLIC NOTICE

INTENT TO PREPARE AN ENVIRONMENTAL ASSESSMENT FOR INVASIVE AND AQUATIC SPECIES MANAGEMENT AT TRAVIS AIR FORCE BASE (AFB) AND GEOGRAPHICALLY SEPARATED UNITS, SOLANO AND CONTRA COSTA COUNTIES CALIFORNIA

The United States Air Force (USAF) announces the intent to prepare an Environmental Assessment for the proposed management of invasive, non-native plant and animal species as well as nuisance aquatic plant species on Travis Air Force Base and Geographically Separated Units, lands owned by Travis Air Force Base but that are not contiguous with the Main Base. Because the Proposed Action would occur in wetlands and potential floodplains, and has the potential to result in impacts to wetlands, wetland buffers, and potential floodplains the action is subject to the requirements and objectives of Executive Order 11990, Wetlands, as amended and Executive Order 11988, Floodplain Management. As part of the Proposed Action, the USAF is considering Alternative 1 (No Action Alternative), Alternative 2 (Comprehensive Management; includes manual and mechanical removal, chemical control, grazing and prescribed burning), Alternative 3 (Limited Control Methods; excludes use of chemical applications and expansion of grazing areas), and Alternative 4 (Limited Control Locations; excludes control near federally listed species). The project area encompasses all of Travis Air Force Base and the seven Geographically Separated Units, totaling 5,137 and 358 acres, respectively. Only one Geographically Separated Unit, Defense Fuel Supply Point Ozol, which occupies about 52 acres, occurs in Contra Costa County. Travis Air Force Base and the other Geographically Separated Units are located in Solano County. Treatments would be conducted within these areas where invasive and non-native plants and animals and nuisance aquatic plant species occur. Travis Air Force Base and the Geographically Separated Units contain approximately 122 acres of wetlands that are potential Waters of the United States regulated under Section 404 of the CWA and 0 acres of Federal Emergency Management Agency-delineated floodplains though floodplains occur just outside the Base boundary and Union Creek (35.8 acres) flows through the Main Base. Wetland impacts in the long-term would be beneficial from the removal of non-native plant biomass and restoration of native vegetation in wetlands and adjacent uplands. Long-term impacts to potential floodplains would be beneficial, by reducing the hazard and risk of flood loss by improving water flow and floodplain functionality. Short-term, temporary impacts would occur to wetlands, wetland buffers and potential floodplains during control activities under the action alternatives. Under the No Action Alternative, minimal control activities would occur and invasive species would be expected to continue to spread into wetlands and floodplains causing ecological harm.

The USAF invites the public to provide comments on the proposal and any practicable alternatives that may reduce these impacts. Comments should be sent within 30 days from date of this publication to Mr. Seth Merdler, (707) 424-7516, seth.merdler@us.af.mil, 60 CES/CEIE, 411 Airmen Dr, Travis AFB, CA 94535.

DR# 00044828

Published: February 19, 2021

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APPENDIX D

Impact Avoidance and Minimization Measures and Best Management Practices

AMMs, BMPs and Conservation Measures (CMs) define a set of conditions or requirements that an activity must meet to avoid or minimize potential effects on sensitive resources and to ensure consistency with the INRMP and compliance with inter-agency consultations. AMMs involving herbicides are an added layer of caution to the already regulated and approved use of these chemicals. AMMs are typically not optional and application of these measures is the basis for the environmental analysis. Some of them are required by Section 7 documents. In limited cases, AMMs may not be implemented due to project requirements and Section 7 consultations would be updated and coordinated accordingly. BMPs and CMs will be followed whenever possible. In all cases where the project is part of the INRMP, a long-term, population-level beneficial effect is expected to any impacted federally listed species.

These project AMMs and BMPs are based on site-specific resource conditions within the project area, including (but not limited to) the current invasive plant inventory, the presence of sensitive species and their habitats, proximity to water and potential for herbicide delivery to water, and the social environment. For emphasis, some AMMs include herbicide label guidance, INRMP, or APAP standards (OTIE 2020). The AMMs listed are not an exhaustive list of all base, DoD or State rules and regulations, or label guidance; however, all applicable rules and regulations and herbicide label guidance will be followed in implementing Alternative 2. In general, all projects will employ the lowest impact methods for effective management of invasive and aquatic species in areas with sensitive resources.

1.0 IPSMP Best Management Practices (ManTech 2017)

BMPs range from programmatic recommendations for how goals are accomplished to specific protocols for executing tasks. Weed control BMP's can be recommended to contractors, residents or Base divisions to guide their work and reduce the possibility that projects will introduce, spread or increase weed infestations. Some BMP's will apply to all groups, while others are very specific to Base residents, grounds maintenance personnel, grazing permittees, etc.

Prevention BMP 1: All livestock forage, seed, straw, and erosion control materials should be certified weed free. To prevent the spread of invasive plants, County Agricultural Commissioners and the California Department of Food and Agriculture (CDFA) offer inspection services to certify materials as "weed free". Weed Free Forage is defined as hay, feed, straw or straw mulch that has been inspected, and certified not to contain propagative plant parts or seeds found on the California noxious weed list, as listed in the California Code of Regulations, Title 3, Division 4, Chapter 6, Section 4500. Appendix D of the IPSMP supplies the Cal-IPC list of Weed Free Forage providers and the CA noxious weed list.

Prevention BMP 2: "Shaker plates" or similar devices should be installed in roads near entrances to construction sites and other areas of ground disturbance and construction equipment access on TAFB. Shaker plates are corrugated plates that vibrate and loosen seeds and soil attached to vehicles and equipment. Seeds and soil shaken loose from the vehicles and equipment are collected below the shaker plates. The plates should be monitored for the growth of weedy species, and any weeds observed to be germinating

should be sprayed with an appropriate herbicide following the guidelines described in Appendix B of the IPSMP as needed to prevent growth and the formation of seeds. Soil accumulating below the shaker plates should be periodically removed to retain the effectiveness of the shaker plates.

Prevention BMP 3: Tools used to manage or control vegetation, such as chainsaws, hand clippers, and pruners, should be washed before being used on TAFB and before being moved from one location to another (i.e., from one weed treatment site to another).

Prevention BMP 4: Earthmoving equipment brought onto TAFB should be washed before use and before being moved from one location on the installation to another (i.e., from one construction site to another). Washing should consist of using water or compressed air to remove any visible plant material, soil or compacted mud, gravel, sand, etc.

Prevention BMP 5: Weed BMPs 1–5 should be incorporated into permits (e.g., dig permits), leases, contracts, and similar agreements between TAFB and its contractors as appropriate.

Prevention BMP 6: Residents of Castle Terrace Housing, grounds maintenance and landscaping teams should be discouraged from planting any weed species, either those that are on the CA Noxious Weed list or the TAFB Watch List (Appendix A in IPSMP).

Prevention BMP 7: Biosecurity pamphlets or other instructional materials should be developed and distributed. These could consist of “Wanted” style posters for Watch List or Eradication-level species, general information about weed prevention, etc.

Prevention BMP 8: All plant debris potentially containing reproductive plant parts (i.e., seeds or plant fragments for species that reproduce vegetatively) removed using mechanical methods should be disposed of at an offsite landfill or green waste facility in such a manner as to prevent the potential spread of seeds or other propagules from the collected materials to other locations. This action may require, but is not limited to, bagging the material before it is transported within or off the site.

Prevention BMP 9: Every two to four years, the Watch List should be re-generated using the Cal-IPC Weed Mapper tool. Refining the list based on habitats available at TAFB would shorten the list and make it more user-friendly. This list should be used in concert with, not instead of, consultation with neighboring landowners and regional weed experts.

Grazing BMP 1: If grazing is implemented in the Castle Terrace area, graze at the minimum residual dry matter to provide habitat maintenance for CTS. The currently grazed pastures plus Aero Club should be grazed in accordance with the GMP and CCG Monitoring results.

Grazing BMP 2: All supplemental feed should be certified weed free forage (Prevention BMP 1).

Grazing BMP 3: The weed manager should regularly consult with the Equestrian Club to ensure that management of toxic species is effective. Grazing in Equestrian Club pastures will be managed more effectively after implementation of the GMP (Hopkinson 2017).

Grazing BMP 4: Horse riding trails should be regularly monitored for invasive species that may be introduced on tack, in hooves or in supplemental feed.

Grazing BMP 5: Horse grazing pastures that are overgrazed and currently heavily infested with star thistles should be grazed in accordance with the TAFB GMP to more effectively manage forage, invasive plants and RDM levels.

Mowing BMP 1. The use of mowing for invasive species control is generally discouraged at TAFB, but if it must be used, mowers should be cleaned prior to arrival at TAFB. Cleaning between locations while on Base is also recommended.

Mowing BMP 2. Schedule mowing events to coincide with the correct phenological stage for the target species to prevent dispersal of seed or rapid regrowth of the target weed or other species.

Mowing BMP 3. Ensure that mower height is appropriate for target weed species and desired effect.

Herbicide BMP 1: Schedule herbicide application to maximize kill rate with regard to weather conditions and target species phenology. The Weed Program Manager should be familiar with target species biology and seasonality of the Base and take these into account when scheduling herbicide application.

Herbicide BMP 2: When possible, time herbicide application to coincide with multiple species' phenology window to maximize efficiency.

Herbicide BMP 3: Ensure that the most effective herbicide for the target species is used. If necessary, develop a protocol for requesting that new herbicides be added to the list of DoD approved pesticides. Effectiveness also includes the assumption that the chemical will not have deleterious effects on any sensitive resources near the application site.

Herbicide BMP 4: Care must be taken on TAFB where invasive species co-occur with sensitive wetland, amphibian, plant and invertebrate resources. Choose appropriate herbicides (including surfactants) that are listed for aquatic use.

Herbicide BMP 5: Ensure that all herbicide applicators know and can recognize sensitive resources including listed wildlife and plants, nesting birds, burrows that may be occupied by CTS, etc. 60 CES/CEIEC currently conducts annual training with the Pest Management Shop that covers identification of sensitive and invasive species.

Herbicide BMP 6: Protect nearby non-target vegetation by minimizing drift and applying only enough herbicide to effectively treat the target plants. Minimize drift by applying herbicide under low wind conditions, and within the heat tolerances of herbicides that may be volatile.

Herbicide BMP 7: All contracted pesticide applicators must hold current QAL/C (minimum qualification) from the California Department of Pesticide Regulation.

2.0 ISMP Best Management Practices (HT Harvey 2014)

The following BMPs are recommended to prevent the establishment and spread of bullfrogs:

Pest Prevention BMP 1: The physical introduction of bullfrogs as a form of biological control, through the pet trade, or for other uses should be prohibited.

Pest Prevention BMP 2: Fertilizer runoff should be minimized. Runoff of fertilizers from residences can cause eutrophication and warming of water bodies. These increased temperatures and nitrogen levels can encourage the growth of aquatic weeds and algae, which may provide breeding habitat for bullfrogs. Managing fertilizer use and runoff from residences can prevent eutrophication of nearby water sources. In fact, a common practice for hindering the establishment of bullfrogs is to restrict the use of fertilizers near perennial water bodies. Regulating the use of fertilizers and the timing of fertilizing at TAFB could help prevent and control the establishment of bullfrogs, and nonnative aquatic weeds as well.

Pest Prevention BMP 3: Ephemeral pools should not be converted to perennial waters. The creation of perennial waters can increase use of the site by bullfrogs and provide a physical link to uninhabited pools that were otherwise too far from source pools for bullfrogs to colonize.

Pest Prevention BMP 4: The introduction of bullfrogs through fish stocking should be prevented. Any fish stocking methods exercised on base should ensure that no bullfrog eggs, tadpoles, or adults are introduced with target fish populations.

Pest Prevention BMP 5: The unnecessary removal of emergent vegetation from perennial pools should be kept to a minimum. Emergent vegetation provides cover for native aquatic species and may better allow for the coexistence of native species and bullfrogs. Removal of this vegetation also may increase water temperatures, which may in turn attract bullfrogs.

Pest Prevention BMP 6: Drift fencing should be installed around occupied sites under the direction of a qualified biologist. Drift fencing can be installed along the edge of a water body to help prevent bullfrog emigration to other sites. Research suggests the fencing should be at least 2 feet tall, be buried at least 6 inches in the ground, and include a 4-inch buried apron directed toward the pond. Drift fencing should not be installed around water bodies that support CTS without the approval of a qualified biologist.

Pest Treatment BMP 7: Depending on the population densities observed during spring surveys, perennial ponds should be dewatered at least every 3–4 years. Draining every other year is recommended, especially when perennial pools are located adjacent to CTS habitat (i.e., perennial ponds in the Castle Terrace Housing and Northeast Undeveloped Area NRMUs). Pools should be dewatered as early as August but preferably in September, at least 3 weeks before the first rainfall. Pools should remain dewatered for 3 weeks to effectively eliminate all bullfrog tadpoles and metamorphs that may burrow in the pond sediment.

Pest Treatment BMP 8: Some management methods include filling dewatered ponds with soil and compacting and/or grading the soil to return the ponds to their original conditions. This additional step, however, may necessitate additional agency permitting. To avoid this requirement, dewatered ponds should remain dewatered as long as possible

before the rainy season begins to ensure the complete drying of the pond and the culling of tadpoles and metamorphs that have burrowed into the soil.

Pest Treatment BMP 9: Fencing should be installed around pools during dewatering to prevent the emigration of adults and metamorphs. Fencing should be at least 2 feet tall, be buried 6 inches in the ground, and contain an underground apron angled toward the body of water. Fencing should be left in place during dewatering for 3 weeks afterward. Any bullfrogs attempting to emigrate during dewatering should be culled using a combination of netting and gigging methods.

Pest Treatment BMP 10: Ponds lacking CTS should be drained as quickly as possible to decrease the potential for tadpoles to metamorphose during dewatering.

Pest Treatment BMP 11: A drain should be installed in target water bodies to facilitate periodic draining. Installation of the drain may be cost effective in the long run.

Pest Treatment BMP 12: Direct removal methods, such as netting, gigging, shooting, trapping, and egg mass removal, should be employed only if dewatering is not an option. These methods, if adopted, must be implemented aggressively to successfully decrease population numbers. Partial removal of bullfrogs using these methods may effectively increase their survival rate because it may decrease competition for resources among the remaining individuals.

3.0 GMP Grazing Management Recommendations (GMR) (Hopkinson 2017)

Grazing management recommendations (GMR) are essentially BMPs. The following can be found in Section 8 of the GMP:

GMR 8.1 The Travis AFB grazing lease agreement should include specific stocking rate recommendations that allow for adjustments based on RDM and other evaluations, monthly reporting requirements, RDM targets, animal management specifications, and contingencies for low forage years. For the most part, such details are already clearly laid out in the 2016 Travis grazing land use regulations (GLUR).

GMR 8.2 For the initial grazing season following implementation of this grazing management plan, establish the stocking rate at 381 AUMs for the cattle pastures (Pastures 1-4) and 102 AUMs for the horse pastures (Pastures 6-10). See Table 6-3 for pasture- specific AUMs. The potential cattle grazing season extends from November 1 through June 30, with use of specific pastures at the discretion of the lessee. The horse grazing season is year- round. During the initial year, make monthly visual inspections of the pastures, preferably with the lessee in attendance to discuss forage quantity and prospects for the rest of the season; these visual inspections should broadly assess whether forage is adequate for allowed AUMs

GMR 8.3 Owing to the limited site-specific forage production data available for Travis' grazing pastures, collect annual production data for the pastures over several years. Such data should prove useful in setting appropriate stocking rates at Travis.

GMR 8.4 Map RDM in each pasture every fall, prior to the onset of germinating rains (generally undertaken in early October. If RDM minimum targets are not achieved for that season over a significant area of the pasture, the stocking rate for the following year should be adjusted and the season shortened for those pastures that did not meet RDM targets. Minimum RDM targets for Travis cattle and horse pastures are currently defined as 500 lbs per acre. Horse turnouts (Pastures 5 and 11-13) are considered sacrifice areas without RDM targets.

GMR 8.5 In years when rainfall is running significantly below average, re-evaluate forage production projections, animal numbers, and levels of utilization in mid- February. Following the February evaluation, modification of livestock use may be necessary. The lessee should be informed and participate in fall RDM evaluations and in any February evaluations.

GMR 8.6 Require the lessee to provide monthly AUM and animal number reports and then confirm these reports with occasional compliance monitoring.

GMR 8.7 No grazing prescriptions for the reported special status species currently appear necessary. Grazing in mustard-dominated tricolored blackbird nesting sites should be avoided. Given the limited data underpinning the production estimates, evaluate forage production, livestock use, and RDM in relation to the needs of special status species.

GMR 8.8 Supplemental feeding of livestock should be restricted to mineral and limited protein supplements. Salt and mineral licks and other supplements should be placed no less than 1⁄4 mile away from any vernal pools, riparian areas, or similar sensitive natural resources, unless there are specific management reasons for placing them nearer, as determined by the Travis NRM. In addition, livestock attractants should be placed to encourage more uniform distribution of livestock grazing; RDM mapping should prove useful in determining where attractants should be located.

GMR 8.9 Information on specific areas on Base that have been cultivated may prove useful in prioritizing future grassland restoration activities.

GMR 8.10 To improve livestock distribution, evaluate the potential for dividing Pasture 1 into 2 smaller pastures, using the pre-existing cross-fence near the munitions area (Bunkers B-958, etc.) in Pasture 1. If the cross-fence is not usable, consider installing a new cross-fence in that general location. In addition, a short cross-fence separating the central and southern portions of Pasture 1 at the narrow strip of Pasture 1 between the Base boundary fence and W Street could help improve livestock management. Installing cross-fencing typically involves the development of water sources for those new pastures without access to water.

GMR 8.11 Develop an early detection-rapid response program to find and eradicate incipient infestations of new invasive species or satellite populations of resident invasive species. Preventing spread of barbed goatgrass from the Castle Terrace Housing area into other areas of the Base should be an initial goal.

GMR 8.12 Travis' horse facilities are operating at maximum capacity, and the Equestrian Center plans to increase stabling capacity (Travis AFB 2016). As an increase in horse numbers will almost certainly result in increased use of the horse pastures or interest in

additional horse pastures, consult with the Equestrian Center management regarding their expansion plans and how increased horse numbers might affect use of the horse pastures.

GMR 8.13 Implement an adaptive management process in situations when the optimal management activity to achieve a particular management goal is not obvious. The adaptive management process entails setting clear goals, implementing management activities, monitoring management and control areas, analyzing monitoring data to determine if management activities have achieved the goals, and then using the monitoring data to decide on next management steps. Effectiveness monitoring protocols, including those for analysis and reporting, should be designed to meet the needs of the adaptive management process.

4.0 WFMP (Chloeta 2019)

Fire is generally considered beneficial to natural resources on TAFB in most cases. These ecosystems evolved with periodic fire and native vegetation responds well to fire. Threatened and endangered species are known to occur on TAFB. In general, these species are unaffected by fire but may be affected by firebreak creation and maintenance, as well as certain firefighting tactics. The WFMP does not include any explicit BMPs or AMMs though has a list of strategies, listed below, to implement management objectives and other requirements that are described throughout the document (labeled BMPs below with relevant sections listed).

Strategy 1.1: Maintain fuels at Explosive Ordinance (EOD) Range to reduce the likelihood of unwanted ignitions resulting from range activities.

Strategy 1.2: Vehicles are restricted to on-road use and shall park in areas with minimal vegetation, except in case of an emergency.

Strategy 1.3: All vehicles used in routine field operations shall be equipped with spark arrestors, shovels, and fire extinguishers**.**

Strategy 1.4: Enforce fire-safe practices including allowing smoking only in designated areas, requiring proper disposal of smoking debris, and requiring permits from FES for any open burning on a case-by-case basis.

Strategy 1.5: Implement the Avian Protection Plan to prevent bird electrocutions and reduce subsequent wildfires.

Strategy 4.1: Evaluate wildland fuel conditions and implement strategies, including a regular application of chemical, mechanical, and prescribed fire fuels treatments, to eliminate or minimize hazardous fuels.

Strategy 4.2: If possible and practical, use Minimum Impact Suppression Techniques (MIST) when fighting wildfires to avoid or minimize adverse impacts to natural and cultural resources.

Strategy 5.1: Evaluate wildland fuel conditions and implement strategies, including a regular application of chemical, mechanical, and prescribed fire fuels treatments, to improve natural resource quality in support of the mission.

Human Health and Safety BMP*:* Prescribed Burn Public Notification: When planning for prescribed fires, an approved notification list will be developed prior to ignition, and residences near the prescribed fire area will be notified in advance by phone or other media sources (i.e. newspapers, television, radio stations, message boards, etc.). The TAFB WFPCs will notify 60 AMW/PA whenever there is a wildfire or prescribed fire in progress (Chloeta 2019, WFMP Section 3.4,).

Natural Resources BMP: Conduct Emergency Stabilization (ES) actions such as the development and implementation of a Burned Area Emergency Response (BAER) plan and/or Burned Area Rehabilitation (BAR) plan. Such plans specify treatments to implement post-wildfire ES policies on an individual incident to include things like installation of erosion control measures near WOTUS (Chloeta 2019, WFMP Section 1.5.1,). Such BAER reports to date have only included impacts to natural and water resources.

General Fire BMPs

1. A site-specific PFP using the *AF Prescribed Fire Plan Template* or the PMS 484, *Interagency Prescribed Fire Planning and Implementation Procedures Guide*, upon which the AF PFP Template is based (Chloeta 2019, WFMP Section 3.6.3.1)
2. On a prescribed fire, the Prescribed Fire Burn Boss will adhere to the parameters set forth in the PFP. The Prescribed Fire Burn Boss will regularly check and record weather conditions to determine if the prescribed fire is in prescription (Chloeta 2019, WFMP Section 3.6.5).
3. Prior to ignition, the Prescribed Fire Burn Boss must request a Spot Weather Forecast through the NWS Fire Weather webpage. These tasks can be delegated to anyone at the Firefighter Type 1 (FFT1) level and above (Chloeta 2019, WFP Section 3.6.5).
4. At least 2 weeks prior to the planned prescribed fire, the Prescribed Fire Burn Boss will notify staff assigned to the project to ensure adequate planning of work and leave schedules (Chloeta 2019, WFMP Section 3.6.3.2.1).
5. The Prescribed Fire Burn Boss will also ensure that the NRM has identified sensitive natural resource concerns to be monitored during the prescribed fire and conducted pre-fire assessments if necessary (Chloeta 2019, WFMP Section 3.6.3.2.1).

5.0 Herbicide Application Requirements of Contracts

These provisions are required to be in contracts that include application of herbicides. These are set by AFCEC/COSC Command Entomologist/Pest Management Consultant and IPMCs at Base Level. All contracts that apply herbicides must be reviewed by the IPMCs and HQ Entomologists prior to award.

HERBICIDE APPLICATION REQUIREMENTS: The applicator shall provide all labor, tools, equipment, test equipment, personal protective equipment and clothing, material and parts, transportation and other incidentals necessary to implement herbicide application.

1. All herbicides and herbicide application shall comply with Department of Defense Instruction (DoDI) 4150.07 DoD Pest Management Program; AFI 32-1053 Integrated Pest Management Program; the Travis Integrated Pest Management Plan; Armed Forces Pest Management Board (AFPMB) list of Approved herbicides; and the State of California Pesticide Regulations, and be registered for use in the State of California. Only pesticides approved for use on the applicable base may be applied.
2. A list of those herbicides requested to be used must be submitted no later than (NLT) thirty (30) calendar days after agreement is signed and must be coordinated through EESOH-MIS at the applicable Base. A list of all herbicides to be applied is to be provided, with Safety Data Sheet (SDS) and labels, to the IPMC fifteen (15) calendar days prior to application. If non-approved herbicide is preferred, the applicator shall submit an AF Approval Request Form for Non-Standard Pesticides to the IPMC thirty (30) calendar days prior to application. Any non-standard herbicides need to have AFCEC/COSC Command Entomologist approval prior to use and will require a longer approval period.
3. Only personnel licensed/certified by the State of California shall apply herbicides. Copies of all herbicide application certifications shall be provided to the IPMC on the applicable base within 30 calendar days. All licenses/certifications must be in the proper category of the type of work being performed. Qualified Applicator Certificate, Qualified Applicator License, and Pest Control business license copies are to be provided.
4. Before any herbicide application is to begin, a Work Task will be submitted through the Air Force's NexGenIT TRIRIGA system by CES/CEIEC and to the IPMC for approval. It will include the pest to be controlled (grass and weed control), a map identifying the location pesticides are to be applied, the number of acres of application, the pesticides that will be applied, and copies of the SDS. The Work Task should be comprehensive of total effort thus only one would be done per year under this agreement.
5. Pesticide Mixing, Storage and Disposal: All pesticides shall be stored off- base. All unused pesticides, empty pesticide containers and residue shall be disposed of properly at an approved off-base disposal area. Chemical mixing for immediate application may be accomplished at the site of application/treatment and only state certified applicators may mix or apply pesticides. A spill container would be provided at mixing areas to ensure that no chemicals impact an area that is not being treated. An operational emergency eyewash kit would be available at each mixing location. In the event of spills or releases of any hazardous substances (example, substances listed in 40 Code of Federal Regulations (CFR) 302), the applicator shall immediately notify the Fire Department, Contracting Officer, CES/CEIEC, and IPMC.
6. Safety: Comply with all applicable parts of Title 29 CFR, Occupational Safety and Health Standards, Part 1910; Title 29, CFR, Safety and Health Standards for Federal Service Contracts, Part 1925; Title 40, CFR, Parts 150-189, and Title 49, CFR, Hazardous Materials Regulations, Part 171, while on an AF installation, to ensure safe working conditions for personnel and a safe environment for the occupants of AF facilities.

7. Provide pesticide use data to the IPMC on a monthly basis (not later than 10 days after close of month) for input into the IPMIS pesticide management database.

6.0 Project Analysis under the PBO for Wildfire Management at Travis AFB (2020)

A PA is under preparation for submission to the USFWS under the PBO (USFWS 2018a) for long-term prescribed fire program at Travis AFB. It includes AMMs from the PBO (Section 2.4.2.2.9) and includes several additional AMMs specific to prescribed fire activities. These AMMs were revised as part of the Revised PBA (May 2020) and are listed here:

FIRE-1. No firefighting retardant or foams will be used.

FIRE-2. In areas with CCG records, prescribed burns will be after CCG plants have senesced and seed dispersal is complete.

FIRE-3: When it is not practical to stage or operate vehicles or equipment on existing roadways and trails, vehicles and equipment will be staged and operated in an area designated by a SAB, where activities are least likely to impact special status species habitat.

FIRE-4: No temporary firebreak hand-lines will be allowed in vernal pools or seasonal wetlands unless required for emergency fire suppression.

FIRE 5: Prescribed burns will not start until 1000 (May-July) to avoid juvenile CTS in High and Medium Risk areas.

7.0 Herbicide Human Health and Safety BMPs

Based on the human health risk assessments (Section 4.5.2) for several chemicals most likely to be used on Travis AFB, the following BMPs have been developed to reduce the risk to human health from exposure to herbicides. Such measures are not taken by the IPMC when pesticides and herbicides are used in and around buildings on Travis AFB and may be an overabundance of caution against worst case scenarios that are already highly unlikely to occur.

1. Post signs at likely access points to an area where herbicide application is occurring to informing the public that an area has been sprayed. This will reduce the potential that freshly sprayed material will be consumed.
2. Herbicides will not be mixed within 150 feet of open water to avoid accidental spill into open water than could then be consumed by children or adult females. Secondary containment during mixing will also be used to avoid spills.
3. All applicators who use highly concentrated solutions of imazapyr will be advised to exercise particular caution to prevent prolonged skin contact with the concentrated solutions.
4. Steps shall be taken to prevent human consumption of water in a small body of water contaminated by a large spill of herbicide. Suggested steps include long-term signage until water samples test clean, and advertisements to housing residents, and the base newspaper.

Any adjuvants used on Travis AFB or its GSUs will be approved via the base IPMC. Annual Weed Work Plan Conservation Measures

When invasive plant species control actions started on Travis AFB in 2015, a categorical exclusion (CATEX) was completed to cover the small amount of planned activity. Actions were also analyzed under Section 7 of the ESA and a no effect decision was made based on the implementation of the following conservation measures (CM, essentially AMMs).

CM 1: Prior to the start of invasive species management activities, a qualified biologist shall provide education and training sessions for all individuals that will be involved with herbicide treatment and mechanical methods of invasive species removal. The training will focus on habitat sensitivity and identification of vernal pools and CTS. The training shall include species description and behavior, general measures to be taken to protect these species, the penalties for non-compliance. A fact sheet or other supporting materials containing this information will be prepared and distributed. Upon completion of training, employees will sign a form stating that they attended the training and understand all the conservation and protection measures. *[Training shall occur at each general site on the first day work is to commence at that site. Sites include Castle Terrace, Travis Grazing Areas, the NE Firing Range Open Space, Aero Club, and Hanger Goldfields Conservation Area. Training may be provided by approved biologists who will 1) review the locations of all wetlands and vernal pools within treatment areas, 2) flag all vernal pools per Minimization Measure #3 if necessary and/or show all field personnel what vernal pools look like (vernal pool obligate species). Weed Sprayer shall assign an on-site biologist to act as field lead to ensure these training measures are implemented and followed.]*

CM 2: Herbicides should not be sprayed in wetlands or waters of the US when water is present unless specifically targeting aquatic weeds and all permits and permissions are obtained for such use. Herbicides may not be used within the effective catchment or natural drainage area (as indicated by micro- and macro-topography) of a wetland where they may potentially run off into the wetland during the wet season (1 Nov to 1 May) or when the 2-week chance of rainfall is greater than 70% (Ripley et al. 2002/2003). Herbicides can be used up to the edge of a wetland during the dry season, where edges are marked or monitored in the field by a qualified biologist. Consultation with the FWS may be required if herbicides are to be used inside a vernal pool at any time of year. The following exceptions and clarifications apply:

a. No herbicide treatment will be conducted anywhere on the base where CCG has been mapped without monitoring by Dr. Marty.
b. Weeds within the effective catchment or natural drainage area (as indicated by micro- and macro-topography) of a wetland or vernal pool may be mechanically controlled during the wet or dry season. Mechanical control shall prioritize methods with no soil disturbance. If removal of roots is required to achieve successful results, the area should be checked for burrows. Digging shall occur with hand tools carefully as CTS can be found underground while digging. The top three inches of soil shall be set aside separately. Any other removed soil shall be placed in the hole left by the removed plant, packed down, and the top soil replaced to avoid effects to listed branchiopods.

CM 3: When working around sensitive habitats (i.e. vernal pools), invasive species management activities (herbicide treatment and mechanical removal) will include marking the area of treatment with a visual boundary (e.g. pin flags, orange barriers – orange barrier fencing will be installed 2 inches off the ground to ensure CTS or other wildlife to not become entangled.). The visual boundary will be removed once treatment has concluded. [*Pools in some of the vernal pool complexes have extremely wide ranging and convoluted shapes. To avoid confusion, training can be provided to include vernal pool obligate plant species as an additional indicator of the location of pool basins. If trainers are satisfied with the level of knowledge, flagging of individual pools need not occur in all areas.]*

CM 4: Invasive species management activities will occur between 30 minutes before sunrise and 30 minutes after sunset.

CM 5: All project related vehicle traffic will be restricted to established roads and other designated areas.

CM 6: No work requiring vehicles/equipment will be done when the ground is soft enough where travel will cause ½ inch or more depressions in the soil. *[Leave no equipment on site overnight.]*

CM 7: All trash (food related items such as wrappers, bottles, cans, food scraps, etc.) will be placed in closed containers and removed from the project site on a daily basis

CM 8: If there is a 50% or greater probability of rain forecasted by the National Weather Service by 07:00 am the day prior to a scheduled workday, then all work activities are cancelled for the next 24 hours. If any measurable amount of rainfall occurs (including trace amounts) work may not resume for 24 hours from rain cessation. The weather forecast and hourly weather data for TAFB can be found by entering the zip code 94535 (TAFB) at http://www.srh.noaa.gov/forecast.

CM 9: Lead Weed Biologist shall check areas to be sprayed each morning before herbicide spraying is conducted.

a. The biologist should do a more extensive and thorough pre-treatment check for CTS on the project site on days where the relative humidity the previous night was above 80%.

b. A site survey for birds must be performed by a qualified biologist before invasive species management activities are to take place to determine whether any protected species are present on or near the site. If protected birds are present and nesting on or near the site, invasive species management activities may be temporarily postponed until the nesting season is over. Other measures which may be necessary if protected species are found on or near the site during the site survey include: (1) the work crew may be prohibited from disturbing areas within a specified distance of owl burrows or bird nests; (2) the work crew will restrict activities during breeding and nesting seasons; (3) invasive species management activities will be temporarily delayed while birds are encouraged to relocate away from the area. *[Lead Weed Biologist shall complete this visual survey the morning of treatments that occur during nesting season from February through August and*

confirm lack of nesting birds. If nests are found, nest will be recorded, GPSd, and avoided for the remainder of the nesting season until chicks have hatched and fledged.]

CM 10: TAFB Environmental Office shall notify USFWS immediately by phone once informed by the Lead Weed Biologist of any incidents involving federally listed species, and with a written notification within five days, if any worker inadvertently kills or injures a special-status species, finds one injured, or trapped on the project site or during work. Work will stop immediately if an incident occurs until corrective actions are provided by USFWS.

CM 11: Operators and Contractors will be familiar with and exercise spill prevention and emergency spill response measures as required, including spill cleanup and proper waste disposal. Emergency response plans will be on site.

CM 12: All pesticide applicators must hold current QAL/C (minimum qualification) from the California Department of Pesticide Regulations and submit copies to the IPMC within 30 days of the contract award date.

CM 13: Herbicide application methods will be limited to spot spraying or stump application whenever possible and effective to treat weed infestation.

CM 14: Boom spray or ATV-mounted sprayers are limited to areas within low or medium risk CTS habitat per the PBO. If spraying in high risk habitat, spray events will avoid rain events by 72 hours (before or after) to avoid migrating adults. If spraying in high-risk habitat, spray event will not take place during period when metamorphs emerge from breeding ponds located within 2 miles of the application location (usually April to July).

CM 15: Any application of herbicides to jurisdictional wetlands and vernal pools are subject to compliance with the Travis NPDES Aquatic Weed Permit, APAP (OTIE 2020), NEPA, and Section 7 documents. No surfactants shall be used with herbicides when applied to water or within 20 feet of a wetland and/or within the natural drainage area of a wetland/vernal pool.

CM 16: Drift of herbicides will be limited by not spraying when wind speeds exceed 10 miles per hour or as indicated by label instruction to protect nearby non-target vegetation. *Drift will be further reduced by using the largest possible droplet size and lowest possible boom height (if applicable), according to label instructions*. Applicators will ensure that only the necessary amount of herbicide to effectively treat the target plants is used and that all herbicides are used within their given heat tolerances to avoid volatilization.

8.0 USFWS Programmatic Biological Opinion (USFWS 2017-F-2294, June 2018) Avoidance and Minimization Measures

Travis AFB has consulted with the USFWS under Section 7 of the ESA to address activities proposed in this EA under the Programmatic Formal and Informal Consultation on the Proposed Effects of Activities Conducted at Travis Air Force Base on Six Federally Threatened and Endangered Species, Solano County, California (PBO, 2017-F-2294, USFWS 2018a). Invasive species management activities avoid or minimize effects to listed species through the use of AMMs. These AMMs, defined during consultation with

the USFWS, ensure that to the extent possible, activities are designed to have NE on or are NLAA listed or sensitive resources through temporal or spatial avoidance. When this temporal or spatial avoidance is not possible, a scenario often present when invasive species are located adjacent to or co-occur with the listed species needing protection, a project is LAA a listed species. Even in these scenarios, AMMs will ensure the least amount of temporary or individual-level adverse effect and maximize long-term population-level beneficial effects. AMMs are generally simple, low-cost practices that are easily incorporated into a work day, and are observed by workers and supervisors.

All AMMs from the PBO, replicated below, will be implemented and are a part of Alternative 2 and Proposed Action. See Section **Error! Reference source not found.** for more information about the PBO. These measures are intended to avoid and minimize any potential adverse effects to listed species during implementation of the project activities. The general AMMs will be fully implemented as part of the project activities, and species-specific AMMs will be implemented based on the potential for the presence of federally threatened or endangered species.

General Minimization Measures

Monitoring

MM-1. A Service-approved Biologist (SAB) will conduct preconstruction surveys of all ground disturbance areas within sensitive habitats to determine if any federally listed species may be present prior to the start of construction. These surveys will be conducted prior to the start of construction activities in and around any sensitive habitat. If any federally listed species are found during the preconstruction surveys, the SAB will contact the Service to determine how to proceed. At least 10 business days prior to the onset of activities, Travis AFB will submit the name(s) and credentials of biologists who will conduct these preconstruction surveys if they have not previously received Service approval for similar surveys. No project activities will begin until proponents have received written approval from the Service that the biologist(s) is qualified to conduct the work.

MM-2. A SAB will monitor construction activities in or adjacent to sensitive habitats as required. The Biologist will ensure compliance with all applicable avoidance and minimization measures required to protect federally listed species and their habitats. If federally listed species are found that are likely to be affected by work activities, the SAB will have the authority to stop any aspect of the project that could result in unauthorized take of a federally listed species. If the Biologist exercises this authority, he/she must coordinate this with 60 CES/CEIE who will notify the Service and the CDFW by telephone within one working day and in writing within five working days.

MM-3. A SAB will conduct environmental awareness training for all construction personnel working within and near sensitive habitat on Base. Training will be provided at the start of work and within 15 days of any new worker arrival. The program will consist of a briefing on environmental issues relative to the proposed project. The training program will include an overview of the legal status, biology, distribution, habitat needs, and compliance requirements for each federally listed species that may occur in the project area. The presentation will also include a discussion of the legal protection for endangered species under the Act, including penalties for violations. A fact sheet

conveying this information will be distributed to all personnel who enter the project site. Upon completion of the orientation, employees will sign a form stating that they attended the program and understand all avoidance and minimization measures. These forms will be maintained at Travis AFB and will be accessible to the appropriate resource agencies.

Service Notification

MM-4. Travis AFB will track the areal extent and location of impacts resulting from projects covered under the PBO and will submit an annual report to the Service listing each project covered under the PBO and summarizing the impacts to each species and their habitat on a project by project basis.

Buffers and Site Restoration

MM-5. Wetlands/drainages/vernal pools, if present, will have erosion control measures (straw waddles, silt fencing) installed where hydrological continuity exists between the construction activities and the wetland. A SAB will determine whether erosion control measures should be utilized, weighing the potential for impacts to other species including CTS. Construction boundaries within the buffer will be designated with fencing or other suitable means to ensure no equipment and/or construction workers access protected wetland resources.

MM-6. All areas of upland ground disturbance or exposed soil will be reseeded with a native “weed-free” seed mix approved by the 60 CES/CEIE. Ground disturbance within vernal pools will require a restoration plan and two years of follow-up monitoring by a SAB. Note: direct impacts to wetlands require a Clean Water Act Section 404 permit issued by the US Army Corps of Engineers and Section 401 permit from the State Regional Water Quality Control Board.

Additional Measures

MM-7. Off-road travel outside of the demarcated construction boundaries will be prohibited.

MM-8. Prior to initiation of construction activities, sensitive areas, such as vernal pools, wetlands, riparian areas, and potential habitat for federally listed species (i.e., VPFS/VPTS, CCG, CTS), will be staked and flagged as exclusion zones where construction activities cannot take place. Orange construction barrier fencing (or an appropriate alternative method) will designate exclusion zones where construction activities cannot occur. The flagging and fencing will be clearly marked as an environmentally sensitive area. The contractor will remove all fencing, stakes and flagging within 60 days of construction completion.

MM-9. Any worker that inadvertently kills or injures a federally listed species, or finds one injured or trapped, will immediately report the incident to the on-site Biologist. The Biologist will inform the Travis NRM immediately (60 CES/CEIE). The Travis NRM will verbally notify the Sacramento Fish and Wildlife Office within one day and will provide written notification of the incident within five days.

MM-10. Motor vehicles and equipment will only be fueled and serviced in designated service areas. All fueling and maintenance of vehicles and other equipment and staging

areas will occur in a designated area with appropriate spill containment. Any newly established, project specific fueling and maintenance areas will be located at least 250 feet from any wetland/drainage habitat or water body. Prior to the onset of work, Travis AFB will ensure a plan to allow a prompt and effective response to any accidental spills is in place. All workers will be informed of the importance of preventing spills and of the appropriate measures to take should a spill occur.

MM-11. During construction activities, all trash will be properly contained, removed from the work site daily, and disposed of properly. Following construction, all refuse and construction debris will be removed from work areas. All garbage and construction-related materials in construction areas will be removed immediately following project completion.

MM-12. Unless otherwise designated as part of a habitat restoration plan, all excess soil excavated during construction occurring near vernal pools and other wetlands will be removed and disposed of outside the project area. Coordination with the Travis AFB Environmental Office and appropriate regulatory agencies is required prior to disposal of the excavated soil.

MM-13. The number of access routes, number and size of staging areas, and the total area of the activity will be limited to the minimum necessary to achieve the project goal. Routes and boundaries will be clearly demarcated, and these areas will avoid wetlands/drainage areas whenever feasible.

MM-14. All vehicle operators will follow the posted speed limit on paved roads and a 10 mile-per-hour speed limit on unpaved roads.

MM-15. No pets or non-military firearms will be allowed in the project area.

MM-17. No trenches will be left open at the end of the day; trenched areas will be compacted and restored to normal grade once the project is completed.

MM-18. No work requiring vehicles/equipment will be done when the ground is soft enough where travel will cause depressions.

Species-Specific Measures

California Tiger Salamander

CTS-1. Within 14 days of the start of construction activities, a SAB will perform a pre-construction survey and identify potential refuge habitats (burrows) suitable for CTS. In the unlikely event that a CTS is encountered, the Biologist will contact the Service for instructions.

CTS-2. A SAB will be on-site during all activities that could result in the take of listed species. As outlined in Programmatic Biological Assessment (PBA) Section 1.4.3, the qualifications of the biologist(s) will be presented to the Service for review and approval at least 10 working days prior to any groundbreaking activity at the project site. If any of the requirements associated with these measures are not being fulfilled, the Biologist will have the authority to stop project activities, through communication with the Project Manager.

CTS-3. Construction personnel will be instructed to exercise caution when commuting within the area to be disturbed.

CTS-4. Construction activities will occur between 30 minutes after sunrise and 30 minutes before sunset unless otherwise specific in the PA.

CTS-5. At the end of every work day, trenches, pits, and excavations shall be provided with escape ramps constructed of earth fill or wooden planks at a 3:1 slope. Before such trenches, pits, and excavations are filled, they will be thoroughly inspected for trapped wildlife.

CTS-6. If CTS exclusion barriers or fencing are used, a SAB will be on-site to conduct morning inspections of the barrier fencing before construction activities begin each day of work activity on work days and within 30 minutes of dawn on non-work days (includes weekends and holidays). If a CTS is observed within or near the barrier fencing, the individual will be relocated outside of the project area following the procedure provided in Section 4.4.5) and the Sacramento Fish and Wildlife Office will be contacted.

CTS-7. Seasonal Avoidance/Wet Season Procedures (Oct 16 – Apr 30): Work will not be conducted in the rain. The SAB will monitor the weather forecast and authorize work when the forecast indicates a period of dry days (5 – 10 days of no rain) before starting the project. The Travis Environmental Office will document through email notification to the Service when work will commence. The weather forecast and hourly weather data for Travis AFB will be monitored and can be found by entering the zip code 94535 (Travis AFB) at http://www.weather.gov/srh/. A SAB will be on-site for morning inspections before the start of work. Morning inspections consist of examination of all trenches, pits, excavations, equipment, California tiger salamander exclusionary barriers (if present), all suitable upland habitat including refugia habitat such as small woody debris, refuse, burrow entries, etc. will be properly inspected and all other areas within the project site. In addition, the project work crew will be notified to maintain vigilance regarding CTS activity. If feasible, the work crew will participate in the morning inspection(s). Modifications to this timing may be approved on a case-by-case basis by the Service.

CTS-8. Seasonal Avoidance Dry Season Rain/High Humidity Procedures (May 1 to October 15): Work will not be conducted if raining. The SAB will check the National Weather Service by 6:00 AM on the day prior to a scheduled work day to see if there is a 50% or greater probability of rain forecasted overnight. If there is, then before work begins the next morning, the SAB will conduct an even more extensive morning inspection. The inspection will include searching the work area and a wider perimeter of the area for presence of CTS. In addition, the work crew will be notified to maintain vigilance regarding CTS activity. If feasible, the work crew will participate in the morning inspection(s). Modifications to this timing may be approved on a case-by-case basis by the Service. The weather forecast and hourly weather data for Travis AFB should be monitored and can be found by entering the zip code 94535 (Travis AFB) at http://www.weather.gov/srh/

CTS-9. If dry season (May 1 – October 15) night time work is necessary, the following additional conservation measures shall be implemented:

a. Work would only occur within paved areas (greater than 20 feet from uplands)

b. A 6-inch high CTS exclusionary barrier will surround the work area during work, with ingress/egress access being the only break in the barrier.

c. A SAB will be onsite during all night time work and will routinely monitor the CTS exclusionary barrier and the project site.

d. Work will not be conducted at night time if there is a 50% or more chance of rain predicted overnight.

CTS-10. Water shall not be pumped, sprayed, or allowed to flow over undisturbed uplands that can support CTS as part of planned project activities outside of pre-approved requirements (i.e. dust control). Water applied for pre-approved requirements shall be applied in the minimum quantities necessary only to disturbed soils. If excess water accumulates as the result of construction activity, water may be pumped through a screened pump and removed from the construction area as deemed necessary by the on-site biologist in coordination with Travis NRM staff. If water inadvertently or purposefully enters construction trenches, pits, or excavations, a SAB will remain on site until water is pumped from the trench, pit, or excavation. Following pumping, the Biologist shall inspect the trench, pit, or excavation area and the surrounding uplands to determine if disturbance to CTS has occurred and implement any other measures necessary (e.g. placement of cover boards, exclusionary fencing or barriers) to protect CTS that may emerge due to the wet soil.

CTS-11. Pipes laid underground or stored on the ground shall be capped, covered, or taped in a manner that exclude CTS from entering the pipe prior to the completion of the construction project. Long-term storage of pipes and other construction material should be placed on asphalt and raised above the ground by no less than 1.5 inches (on top of 2 by 4 inch supports).

CTS-12. Trenches, pits, and excavations shall be covered in a manner that exclude CTS from entering during weekends, holidays, humid days, rain events, etc. Specifically, gaps no greater than one inch shall be allowed within cover materials if biologists will not be present the following day or if rain events or high humidity days are expected to occur. Before such trenches, pits, and excavations are filled, they will be thoroughly inspected for trapped wildlife.

CTS-13. Salamander exclusionary barriers or fencing may be erected in uplands between aquatic breeding sites and excavation areas if deemed necessary by Service personnel, NRM staff biologists or SAB to protect CTS. Fencing will follow the upland CTS sampling methodology approved by the USFWS (USFWS 2003) with the following modifications: fencing will be erected perpendicular to the straight pathway that CTS would be expected to travel from the aquatic breeding area, toward the construction site, and will extend 100 feet in either direction, beyond the scope of the work area. Pit fall traps will be installed at the ends of the fencing sections and checked daily before sunrise or covered securely when work is not scheduled. Even if traps are covered, the SAB will check exclusionary barriers on the worksite on work days and non-work days (includes weekends and holidays). Alternately, the fence may be constructed to direct CTS away

from the project site. In all cases, fencing will be constructed to protect migrating CTS from project impacts. Note that the location of the fencing may change during the construction season since CTS will largely be moving away from breeding ponds in the late spring/early summer but toward breeding ponds in the late fall/early winter.

CTS-14. At the end of the work day the work site will be enclosed by a 6-inch-high exclusionary barrier (with no gaps), sufficient to prevent CTS movement onto the work site. A SAB will monitor the installation of the barrier to ensure its integrity and will inspect the barrier during morning inspections prior to the start of work. The exclusionary barrier may be removed after the morning inspection and then re-installed at the end of the work day, but only after the SAB has inspected the work area to be re-enclosed. The SAB will check exclusionary barriers on the worksite on work days and non-work days (includes weekends and holidays).

CTS-15. If CTS are expected to be moving at the ground surface during construction activity, thermally stable cover boards may be placed at a frequency and in a configuration that will allow CTS to encounter them prior to reaching construction area. If cover boards are placed, they will be checked daily by a SAB and CTS collected will be moved to the designated CTS relocation area. Refer to the CTS Relocation Plan (Section 4.4.5) for the designated upland habitat nearest the project site.

CTS-16. Erosion control BMPs implemented in accordance with the Travis AFB Storm Water Pollution Prevention Plan will be placed so as not to create a hazard to CTS.

CTS-17. A SAB or Natural Resource Monitor (depending on effect level of project) shall perform construction site inspections to ensure the contractor completes the proposed action as described and complies with all proposed minimization measures.

CTS-18. Concrete waste and water from curing operations will be collected in washouts and will be disposed of properly and not allowed into watercourses or CTS upland habitat.

CTS-19. In the event that CTS are encountered on the project site, the SAB or Natural Resource Monitor will contact the Travis AFB NRM who will then contact the Service. If CTS are captured, they should be released as near as possible to the point of capture, in a manner that maximizes their survival. Refer to the CTS Relocation Plan.

Delta Green Ground Beetle

DGGB-1. No work will be conducted in the vicinity of vernal pool species' habitat between 16 Oct and 30 Apr, unless specifically approved by the Travis AFB NRM.

DGGB-2. Mowing in and around vernal pool habitat after seed set but during the dry season (1 May to 15 Oct) is considered a beneficial effect. Mowing conducted earlier in the season may be desirable to maintain appropriate conditions for vernal pool species including DGGB. If mowing occurs in or near vernal pools, it will occur only when the soil is no longer saturated to ensure tracks are not left in or near wetlands. The mower height will be set to avoid the flowering heads of sensitive vernal pool plant species.

DGGB-3. Projects that occur on road surfaces and along road shoulders will avoid direct impacts to wetland habitats.

DGGB-4. A SAB will mark vernal pool species' habitat and a reasonable buffer to be avoided with flagging material. The area will be protected by placing construction fencing or other appropriate protective fencing around the pools including a buffer. Fencing will be used in locations where project equipment and/or personnel will be situated adjacent to or in the near vicinity of suitable vernal pool species habitat. If in a High or Medium Risk CTS area, small mammal burrows will be avoided when placing stakes or posts.

DGGB-5. If herbicide spraying is required within and near vernal pool species' habitat, only herbicide without toxic surfactants, approved for use in aquatic environments will be used.

DGGB-6. If feasible, equipment used in projects requiring access to sites within vernal pool species' habitat will be situated outside of the habitat. To further minimize adverse effects, the following measures will be implemented at these sites:

a. No work shall occur within vernal pool habitat when water is present.

b. Ground disturbances such as trenching, and permanent disturbances such as pole installation will avoid hydrologically connected areas where feasible.

c. As necessary, a SAB will be present during access and project work within vernal pool habitat.

d. For projects adjacent to vernal pool species' habitat or hydrologically connected to the habitat, silt fencing, or other appropriate BMPs to prevent siltation shall be implemented prior to work within that area. A SAB will flag areas where silt fencing or BMPs shall be implemented. BMPs may include sand bags and weed-free straw bales or straw waddles. The biologist will consider potential impacts to CTS in Medium and High-Risk areas when recommending erosion control measures.

e. Spill containment kits will be present at all sites where petroleum-fueled equipment is used.

DGGB-7. If project activities encroach within the perimeter of a pool, the following measures will be implemented:

a. Construction equipment with pneumatic tires rather than tracked equipment will be used.

b. Non-sensitive vegetation present within adjacent habitat will be used as an equipment-parking platform. Alternately, boards or plates will be used to distribute the weight of construction equipment for access.

DGGB-8. Pre- and post-project surveys will quantify total habitat disturbances for annual and cumulative records for the USFWS and Travis AFB's INRMP. This quantification of habitat disturbance will specifically address the acreage of impacts to hydrologically connected habitat and acreage of impacts to vernal pools.

Vernal Pool Crustaceans and Contra Costa Goldfields

VP-1. No work will be conducted within 250 feet of federally-listed vernal pool species' habitat during the wet season (October 16 – April 30); unless specifically approved by the

Travis AFB NRM who will field verify soil saturation, visual ponding, and expected surface disturbance. The Service will be notified of any off-pavement work within 250-foot buffer approved between 16 Oct and 30 Apr.

VP-2. Mowing will be completed in and around vernal pool habitat, after CCG seeds set, but during the dry season (May 1 – October 15). Mowing conducted earlier in the season may be desirable to maintain appropriate conditions for vernal pools species including CCG. If mowing occurs in or near vernal pools, it will occur only when the soil is no longer saturated to ensure tracks are not left in or near wetlands. The mower height will be set to avoid the flowering heads of sensitive vernal pool plant species. Populations of CCG and known CTS breeding ponds will be avoided during the spring and early summer months.

VP-3. Projects that occur on road surfaces and along road shoulders will avoid direct impacts to wetland habitats.

VP-4. A SAB will mark vernal pool species' habitat and a reasonable buffer to be avoided with flagging material. The area will be protected by placing construction fencing or other appropriate protective fencing around the pools including a buffer. Fencing will be used in locations where project equipment and/or personnel will be situated adjacent to or in the near vicinity of suitable vernal pool species habitat. If in a High or Medium Risk CTS area, small mammal burrows will be avoided when placing stakes or posts.

VP-5. If herbicide spraying is required within and near vernal pool species' habitat, only herbicide without toxic surfactants, approved for use in aquatic environments will be used.

VP-6. If feasible, equipment used in projects requiring access to sites within vernal pool species' habitat will be situated outside of the habitat. To further minimize adverse effects, the following measures will be implemented at these sites:

a. No work shall occur within vernal pool habitat when water is present.

b. Ground disturbances such as trenching, and permanent disturbances such as pole installation will avoid hydrologically connected areas where feasible.

c. As necessary, a SAB will be present during access and project work within vernal pool habitat.

d. For projects adjacent to vernal pool species' habitat or hydrologically connected to the habitat, silt fencing, or other appropriate BMPs to prevent siltation shall be implemented prior to work within that area. A SAB will flag areas where silt fencing or BMPs shall be implemented. BMPs may include sand bags and weed-free straw bales or straw waddles. The biologist will consider potential impacts to CTS in Medium and High-Risk areas when recommending erosion control measures.

e. Spill containment kits will be present at all sites where petroleum-fueled equipment is used.

VP-7. If project activities encroach within the perimeter of a pool, the following measures will be implemented:

a. Construction equipment with pneumatic tires rather than tracked equipment will be used.

b. Non-sensitive vegetation present within adjacent habitat will be used as an equipment-parking platform. Alternately, boards or plates will be used to distribute the weight of construction equipment for access.

VP-8. Pre- and post-project surveys will quantify total habitat disturbances for annual and cumulative records for the USFWS and Travis AFB's INRMP. This quantification of habitat disturbance will specifically address the acreage of impacts to hydrologically connected habitat and acreage of impacts to vernal pools.

VP-9. Prescribed fires will not occur in CCG occupied habitat when the vegetation is green (April – June). Prescribed burns will be scheduled after CCG plants have senesced and seed dispersal is complete.

Herbicide Application (HA) (from the May 2020 Revised PBA)

HERB-1: Mechanical methods will be used for the removal of invasive plant species within 20 feet of mapped wetlands unless mechanical treatments are not an effective control for the target species.

HERB-2: Herbicides may not be used within the effective catchment or natural drainage area (as indicated by micro- and macro-topography) of a wetland where they may potentially run off into the wetland during the wet season (1 Nov to 1 May) or when the 2-week chance of rainfall is greater than 70% (Ripley et al. 2002/2003). Herbicides may be used up to the edge of a wetland during the dry season, where edges are marked or monitored in the field by a SAB. The following exception applies: No herbicide treatment will be conducted where CCG records occur without prior surveys and monitoring by a SAB.

HERB-3: Herbicides will not be sprayed in wet or dry wetlands, vernal pools or Waters of the US unless specifically targeting aquatic plants or those that invade wetlands, all Clean Water Act permits are in place, and the Service has issued an amended BO under the PBO with an incidental take statement.

HERB-4. Weeds within the effective catchment or natural drainage area (as indicated by micro- and macro-topography) of a wetland or vernal pool may be mechanically controlled during any season. Mechanical control shall prioritize methods with no soil disturbance. If removal of roots is required to achieve successful results, the area should be checked for burrows. Digging shall occur carefully with hand tools as CTS can be found underground while digging. The top three inches of soil shall be set aside. Any other removed soil shall be placed in the hole left by the removed plant, packed down, and the top soil replaced.

HERB-5: All mixing of herbicides will be conducted at least 150 feet from water;

HERB-6: Herbicide applicators will prescribe and use only non-ionic surfactants near open water. These surfactants are readily biodegradable and low in aquatic toxicity. An example is the TERGITOL 15-S surfactants by Dow.

HERB-7: When spraying on roadsides, applicators will use a surfactant such as GROUNDED® that increases soil particle absorption and modulates droplet size to prevent soil mobility and decrease aerial drift to prevent movement of chemical into sensitive habitat areas.

HERB-8: Formulations of glyphosate that contain a POEA surfactant are regarded as more toxic, unless there is compelling evidence to the contrary. Studies have found that the toxicity of the original Roundup and similar formulations containing POEA surfactants is far greater than the toxicity of technical grade glyphosate, Rodeo, or other formulations that do not contain surfactants (SERA 2011). Aquatic animals, including amphibians (Battaglin et al. 2009; Reylea and Jones 2009), water flea (*Daphnia* spp.; Cuhra et al. 2013) and fairy shrimp (Brausch and Smith 2007), appear to be the most sensitive to the effects of POEA-containing formulations.

HERB-9: During perennial pepperweed, arundo, or stinkwort control, herbicides will be applied with a hand-held backpack sprayer, targeted to hit only the target species with a focused nozzle and careful application.

HERB-10: All pesticide applicators must hold current Qualified Applicators License/Certificate from the California Department of Pesticide Regulations and submit copies to the Installation Pest Management Coordinator within 30 days of application.

HERB-11: The application of any pesticide, including herbicides will be conducted in accordance with approved Integrated Pest Management Plan, IPSMP, and INRMP which includes submission of monthly herbicide use reports, summarized in annual activity reports.

HERB-12: Herbicides will be applied according to the chemical manufacturer's instructions on the label.

HERB-13: Herbicide application methods will be limited to spot spraying or stump application whenever possible and effective.

HERB-43: Boom spray or ATV-mounted sprayer methods are limited to areas within Low or Medium Risk CTS habitat (Figure 2).

HERB-15: If herbicide use is required in High Risk CTS Habitat:

a. SAB shall check areas to be sprayed each morning before herbicide spraying is conducted to look for CTS. Herbicide application will occur after 1000.
b. Spray events will avoid rain events by 72 hours (before and after) to avoid migrating adults.
c. Spray events will not take place during metamorphs emergence within 1 mile of known breeding ponds (May to July).

HERB-16: Drift of herbicides will be limited by not spraying when wind speeds exceed 10 miles per hour or as indicated by label instruction to protect nearby non-target vegetation. *Drift will be further reduced by using the largest possible droplet size and lowest possible boom height (if applicable), according to label instructions*. Applicators will ensure that only the necessary amount of herbicide to effectively treat the target plants is used.

HERB-17: In High Risk CTS Areas triclopyr TEA will be used (as opposed to Triclopyr BEE which has been found to be moderately to highly toxic to multiple species of frog). The maximum label concentration (9 lbs acid equivalent/acre) will be used for spot treatments only. Spot application will minimize accidental spraying of insects, consumption of which may be the primary pathway of toxicity for frogs (BAFB 2020). Spot spraying will preferentially occur before seed set to reduce the likelihood of contaminated seed consumption by wildlife.

HERB-18: Because of the highly mobile nature of triclopyr, triclopyr TEA will be used whenever possible (vs triclopyr BEE), especially within 75 feet of sensitive aquatic resources. Triclopyr will also preferentially be applied in the dry season to avoid first flush runoffs from rainstorms that could create surface water contamination.

Grazing (from the May 2020 Revised PBA)

GRAZE-1. Conduct grazing compliance surveys monthly to verify that the grazing lease and grazing land use regulations are properly implemented.

GRAZE-2. Target a residual dry matter (RDM) range of 500-900 pounds per acre by October, through stocking rate manipulations and grazing season adjustments.

GRAZE-3. Reduce invasive plant species.

GRAZE-4. Monitor and collect fall RDM data.

GRAZE-5. Conduct an annual meeting with the cattle lessee and Travis Equestrian Center to review, discuss, and analyze results of that year's grazing practices, addressing needs for future changes.

GRAZE-6. A SAB will ensure installation of grazing equipment and infrastructure (e.g. fence posts) will avoid wetlands. In areas where a fence line will cross a vernal pool, wire spanners (instead of posts) would be added to support the strands to avoid impacting vernal pools.

GRAZE-7. Any off-road driving required within the proposed expanded grazing areas as part of livestock operations will be pre-surveyed by a Natural Resources Monitor to ensure all vernal pools are avoided.

GRAZE-8. Fence Construction will be timed to occur after vernal pool vegetation has senesced and before the pools fill with water. Only emergency repair work to prevent cattle from leaving pasture will be permitted by the NRM during the wet season. All emergency repair work will be completed on foot to minimize depressions caused by vehicular travel off road.

GRAZE-9. All grazing infrastructure work (e.g. gates, fencing, troughs, corrals, egress/ingress by vehicles to conduct such work, equipment laydown) that involves ground disturbing activities will avoid small mammal burrows and will not enter vernal pools.

GRAZE-10. Only non-destructive sampling techniques (e.g. cover estimates) will be used during vegetation monitoring within vernal pool basins.

GRAZE-11. All removal of old fencing material where the bottom wire(s) are buried in the soil will be completed by a SAB where they occur inside vernal pool basins or wetlands. Any dirt pulled up by the wire removal will be replaced where it came from. Any dirt that clings to the wire will be careful removed from the wire and placed back where it came from.

Fire Management Activities (from the May 2020 Revised PBA)

FIRE-1. No firefighting retardant or foams will be used.

FIRE-2. In areas with CCG records, prescribed burns will be after CCG plants have senesced and seed dispersal is complete.

FIRE-3: When it is not practical to stage or operate vehicles or equipment on existing roadways and trails, vehicles and equipment will be staged and operated in an area designated by a SAB, where activities are least likely to impact special status species habitat.

FIRE-4: No temporary firebreak hand-lines will be allowed in vernal pools or seasonal wetlands unless required for emergency fire suppression.

FIRE 5: Prescribed burns will not start until 1000 (May-July) to avoid juvenile CTS in High and Medium Risk areas.

Mowing Activities (from the May 2020 Revised PBA)

MOW-1. Mowing in and around vernal pool habitat after seed set but during the dry season (1 May to 15 October) is considered a beneficial effect. If mowing occurs in or near vernal pools during the wet season (16 October to 30 April), it will occur only when the soil is no longer saturated to ensure tracks are not left in or near wetlands.

MOW-2. The timing of any mow events in areas with known CCG records will be pre-approved by the Travis AFB NRM. A SAB will help determine mower heights and will monitor initial mowing events of CCG to ensure the mower height has been set appropriately. Monitor will not stay on site for the entire mowing event, just long enough to be confident that CCG will not be cut.

9.0 Informal Consultation on the Aero Club Fence Installation (08ESMF00-2017-I-0252-2, Jan 2017)

This Informal Consultation covered activities associated with the installation of grazing fence at the Old Aero Club, including the installation, removal, and repair of 12,000 feet of fence, gates, water troughs, and laydown/staging areas. It included many AMMs from the PBO (Section 2.4.2.2.9) in addition to the three below:

AMM 15. Prior to any installation activities, the access route for the fence will be flagged by a SAB. The route will avoid vernal pools, CCG, and small mammal burrows;

AMM 16. All installation work for grazing infrastructure (fencing, gates, and water trough) that involves ground disturbing activities will be conducted so that vernal pools, CCG, and small mammal burrows are avoided. Motorized vehicles and project materials will not enter vernal pools and small mammal burrow will be avoided; and

AMM 17. The fence will be routed through the proposed project area to avoid impacting vernal pools, CCG, and small mammal burrows. Where crossing a pool is unavoidable, no posts will be installed and wire spanners will be used instead. Post intervals will be adjusted as necessary along the fence line to avoid impacting vernal pools, CCG, and small mammal burrows.

10.0 Informal Consultation and Reinitiation on the Vernal Pool Grassland Grazing Study (08ESMF00-I-0754, Jan & Jun 2018)

This informal consultation covered proposed work that included installation of t-posts and sheep panels, within and outside, vernal pools in horse and cattle pastures on the Base, and the installation of electric fencing for cattle exclosures at the Aero Club. The fences are designed to exclude livestock for the Vernal Pool Grassland Grazing Study. Such exclosures are needed to monitor impacts of grazing to listed species and may be expanded with the expansion of new grazing sites. The consultation covered long-term grazing of the Aero Club pastures as well. Grazing of the Aero Club pasture was needed to provide listed species conservation benefits. Many of the AMMs included in the PBO (Section 2.4.2.2.9) were also includes in this Informal Consultation. Listed here are additional AMMs applicable to invasive species management:

1. All pools with historic occurrences of fairy shrimp will be avoided.
2. Hydrology monitoring will be conducted at locations where t-posts are installed within vernal pools at the cattle and horse pasture GMUs. Monitoring will be conducted using staff gages installed in the vernal pools. Data will be collected during the study throughout the wet season to assess maximum depth and period of inundation. This data will be collected during the experiment, and for at least 1 year after all fence materials have been removed. No t-posts will be installed in vernal pools at the Aero Club; therefore, hydrology monitoring will not be necessary at this location.
3. For the placement of t-posts in the 10 vernal pools in the horse/cattle pastures, the top layer of soil will be carefully pushed aside before pole installation and then replaced.
4. Only non-destructive sampling techniques (e.g. cover estimates) will be used in vegetation monitoring within vernal pool basins.
5. Follow the objectives and actions outlined in the Travis GMP for all future and existing grazing operations to specifically include:
    a. Conducting grazing compliance surveys monthly to verify grazing lease and grazing land regulations are properly implemented;
    b. Strive to reach the recommended range of target RDM levels (500-900 lbs./ac) by October of every year through stocking rate manipulations and grazing season adjustments (shorter or longer seasons);
    c. Reduce invasive species covers over the next ten years;
    d. Collection of fall RDM data followed by an annual meeting with the cattle lessee and Equestrian Center to review, discuss, and analyze results of past grazing practices and identify needed changes;
    e. Collection of 2017 baseline vegetation composition data to inform management prescriptions for weed control; and

f. Completion of the Aero Club Grazing Study for at least 5 years.

6. Any off-road driving required within the Aero Club as part of cattle operations will be monitored by a Natural Resources Monitor to ensure all vernal pools are avoided.

11.0 Informal Consultation and Reinitiation on Sheep and/or Goat Grazing at Castle Terrace Conservation Area (08ESMF00-2018-I-0945-1, Feb 2018 & April 2018)

This informal consultation covered the introduction of grazing by sheep and goats to the Castle Terrace Preserve. The purpose of the proposed project was to provide a conservation benefit to federally-listed species through the control of invasive plant species, management of RDM, reduction of thatch buildup, and improvement of native plant cover. Project also provided increased fire protection for nearby housing. The project followed AMMs from the PBO (Section 2.4.2.2.9) with the following exceptions:

AMM: No work will be conducted in the vicinity of vernal pool species' habitat between October 16 and **April 15**, unless specifically approved by the Travis AFB NRM who will field verify soil saturation, visual ponding, and expected surface disturbance. The Service will be notified of any off-pavement work within 250 feet approved between Oct 16 and April 15.

12.0 Informal Consultation for the Sheep and Goat Grazing under the PBO (2019-1-1794-1, May 2019)

This Informal Consultation under the PBO (USFWS 2018a) covered application of sheep and goat grazing activities for vegetation management at the Hanger Avenue Goldfields Conservation Area and the Castle Terrace Conservation Area. It included some installation of fencing for confinement and exclusion. All AMMs are identical to AMMs in the PBO (Section 2.4.2.2.9).

13.0 Aquatic Pesticide Application Plan for Travis AFB (OTIE 2020) Best Management Practices

BMPs are required to be part of the Travis APAP by the Statewide General NPDES Permit for Residual Aquatic Pesticide Order 2013-0002-DWQ from the California State Water Resources Control Board and will be followed during all herbicide application in or near WoTUS. The following BMPs aim to eliminate or reduce the discharge of pollutants and minimize the areal extent and duration of impacts to water quality. During implementation, the effectiveness of the BMPs are continually evaluated and refined as needed to enhance protection of surface water, as required by the NPDES permit.

13.1 Spill Prevention and Containment

Applicators take care when mixing and loading algaecides and aquatic herbicides and adjuvants. All label language is followed to ensure safe handling and loading of algaecides and aquatic herbicides. Application equipment is regularly checked and maintained to identify and minimize the likelihood of leaks developing or failure that would lead to a spill. If possible, algaecides and aquatic herbicides will be mixed and loaded

before leaving for the application site(s). If algaecides or aquatic herbicides are spilled, they will be prevented from entering any waterbodies to the extent practicable. Travis AFB vehicles contain and staff are trained in the use of absorbent materials such as kitty litter, “pigs” and “pillows.” Spills will be cleaned up according to label instructions, and all equipment used to remove spills will be properly contained and disposed of or decontaminated, as appropriate. Applicators will report spills as required by base policy and in a manner consistent with local, state and federal requirements.

13.2 Appropriate Application Rate Measures

The following BMPs help ensure the appropriate algaecide and aquatic herbicide application rate is used.

13.2.1 Site Scouting

The Natural Resources Manager will identify all sensitive areas, buffer zones, and will conduct a biological survey prior to pesticide application for areas identified on the Aquatic Pesticide Application Areas map, which includes all of Union Creek south of the runway (Areas G, H, I & J) and parts of the western fork (Areas C & D). A aquatic herbicide application is considered if a location is deemed to have exceeded a threshold, or if a given weed population is anticipated to exceed a threshold based on site and weather conditions, historical weed growth, or other information. Thresholds are based on maintenance of recreational and aesthetic beneficial uses, and the prevention of siltation and odors. Sites requiring aquatic herbicide treatment will then be surveyed by the Natural Resources Manager to determine potential herbicide impacts if applied.

13.2.2 Written Recommendations Prepared by PCA

Prior to application, a Pest Manager licensed by DPR scouts the area to be treated, makes a positive identification of pest(s) present, checks applicable product label(s) for control efficacy, and receives work order to do the pesticide treatment from the Facility Manager, determines rates of application and any warnings or conditions that limit the application so that non-target flora and fauna are not adversely impacted. For example, wind speed and air temperature may have significant impacts on the transport of aquatic herbicides. The PCA may place restrictions or prohibitions on aquatic herbicide applications based on site conditions to prevent impact to non- target sensitive species that may be downwind or downstream of the application area. Other factors considered by the PCA include day length, existing or anticipated precipitation, current and anticipated water exchange and water depth and movement. Licensed applicators with the category “Aquatic” must complete continuing education to stay licensed and therefore are up-to- date on the latest techniques for pest control. Pesticide application is not to occur in vernal pools on Travis AFB. Application of aquatic herbicides and algaecides requires formal consultation with the U.S. Fish & Wildlife Service for impacts to endangered species that reside in wetlands/vernal pools.

13.2.3 Applications Made According to Label

Aquatic herbicide applications are made according to the product label in accordance with regulations of the EPA, DPR, and the local Agricultural Commissioner. Travis AFB regularly monitors updates and amendments to the label so that applications are always in accordance with label directions.

13.2.4 Applications Made by Qualified Applicator Certificate Holders

Qualified Applicator Certificate holders licensed by DPR make applications or supervise applications recommended by the PCA. Licensed applicators have knowledge of proper equipment loading, nozzle selection, calibration and operation so that spills ate minimized, precise application rates are made according to the label and only target plants are treated. Licensed Qualified Applicator Certificate holders must complete continuing education to stay licensed, and therefore are up-to-date on the latest techniques for pest control.

13.2.5 Staff Education

Licensed Qualified Applicator Certificate holders and Qualified Applicator Licensees must complete 20 hours of continuing education every 2 years to remain licensed, thus ensuring that all applicators are up-to-date on the latest pest control regulations and techniques.

13.2.6 Other BMPs

The following list includes other BMPs that are considered prior to and during herbicides application events:

- Aquatic herbicides will only be applied when winds are less than 5 mph.
- Herbicide applications near aquatic resources will be done with a pressurized hydraulic sprayer and/or low-pressure backpack sprayers to prevent over application and excess herbicide runoff downstream.
- All pesticide application will follow herbicide conservation measures listed in the Travis AFB Programmatic Biological Opinion under the Endangered Species Act. They are as follows:

HA-1: Mechanical methods will be used for the removal of invasive plant species within 20 feet of the mapped wetlands. Herbicide treatment will not be applied within 20 feet from the edge of mapped wetlands, with the following exceptions: in areas where mechanical treatments within 20 feet of a wetland will not be effective in eliminating the infestation and herbicide application within this buffer is required when water is present in pools.

HA-2: Herbicide application will occur once pools are dry (May-June), allowing for a 4 to 6 month dry period.

HA-3: All mixing of herbicides will be conducted at least 150 feet from water and often off –base.

HA-4: Herbicide applicators will prescribe and use only non-ionic surfactants near open water. These surfactants are readily biodegradable and low in aquatic toxicity. An example is the TERGITOL^{TM} 15-S surfactants by Dow.

HA-5: When spraying on roadsides, applicators will use a surfactant such as GROUNDED® that increases soil particle absorption and modulates droplet size to prevent soil mobility and decrease aerial drift to prevent movement of chemical into sensitive habitat areas.

HA-6: Herbicides will be applied with a handheld backpack sprayer, targeted to hit only the pepperweed with a focused nozzle and careful application.

HA-7: Herbicides will only be an administered by State Licensed Qualified Applicators.

HA-8: The application of any pesticide, including herbicides will be conducted in accordance with approved Integrated Pest Management Plan, IPSMP, and INRMP which includes submission of monthly herbicide use reports, summarized in annual activity reports.

HA-9: Herbicides will be applied according to the chemical manufacturer's instructions on the label, along with other applicable conservation measures.

13.3 Water Users Coordination

Every calendar year and at least 15 days prior to the first application of algaecide or aquatic herbicide, Travis AFB will notify the potentially affected water users. As required by the algaecide and aquatic herbicide label, water users potentially affected by any water use restrictions will be notified prior to an application being made. For instance, residents on Travis AFB fish at North Gate Pond. Notification to these users could involve placing signage at fishing locations that notifies when pesticides were applied to the water body.

13.4 Fish Kill Prevention

13.4.1 Applications Made According to Label

All aquatic herbicide applications are made according to the product label in accordance with regulations of the U.S. EPA, CalEPA, DPR, Cal OSHA and the local Agricultural Commissioner. Precautions on the product label to prevent fish kills will be followed. For example, limitations on the surface water area treated will be followed to prevent dead algae or aquatic weeds from accumulating and then decaying and subsequently depressing the dissolved oxygen level. Depressed dissolved oxygen may adversely impact fish populations.

The following requirements are specific to preventing fish kills on North Gate Pond. These guidelines follow procedures used by Dr. Lars Anderson, USDA, who was consulted on the use of herbicides to treat pond weeds at North Gate Pond in 2003.

1. The product is applied directly into the pond water in three sections on separate days two to three weeks apart to make sure dissolved oxygen (DO) levels from the decaying plant material do not reach critical levels throughout the pond.
2. Restrict access to the pond during product application. Normal use can resume two days following application.
3. Personnel from 60 CES will monitor the vegetation and DO levels 0-1 day before treatment, 0-1 days after treatment, and again 2 weeks after each herbicide treatment to measure the success of the treatment and inform future management actions.
4. Guidelines for DO levels in ponds relating to fish health (http://www.water-research.net/index.php/dissovled-oxygen-in-water) shows a DO level of 3-5 PPM are considered stressful conditions for fish during a 12-24 hour period whereas 6 PPM supports spawning, >7 PPM supports growth and activity, and >9 supports abundant fish.

13.4.2 Written Recommendations Prepared by PCA

Prior to application, a Pest Manager licensed by DPR scouts the area to be treated, makes a positive identification of pest(s) present, checks applicable product label(s) for control efficacy, and prepares a written recommendation, including rates of application, and any warnings or conditions that limit the application so that fish are not adversely impacted.

13.4.3 Applications Made by Qualified Applicator Certificate Holders

Base Qualified Applicator Certificate holders, QALs, or those under their direct supervision make applications recommended by the PCA. These applicators have knowledge of proper equipment loading, nozzle selection, calibration, and operation so that spills are minimized, precise application rates are made according to the label, and only target algae or vegetation are treated. Calibration ensures that the correct quantity and rate of herbicide is applied.

13.5 Evaluation of BMP Effectiveness

The effectiveness of BMPs will be continuously evaluated during the year, as well as in-depth evaluation at the end of the year. The following data will be used to evaluate BMP effectiveness:

- Results of sampling and analysis as described here
- Feedback from field staff, including pest control efficacy, staff safety and efficiency
- After data from surface water quality monitoring has been reviewed, if results indicate that an aquatic herbicide was present at a time and location that are not protective of water quality, BMPs used in that area will be reevaluated and modified as needed to address potential cause(s) for the presence of the aquatic herbicide detection.

Note that the presence of an aquatic herbicide does not in and of itself suggest that a beneficial use has been impaired or that water quality has been adversely affected. Criteria used to evaluate protectiveness include, but are not limited to review of published beneficial uses, actual beneficial uses based on site-specific conditions, numeric criteria, if any, described in the appropriate Regional Water Quality Board Basin Plan, the General Permit, or as described in *A Compilation of Water Quality Goals* (Central Valley Regional Water Quality Board 2011).

13.6 Natural Resource Considerations & Minimizations Measures for Chemical Control of Perennial Pepperweed within Vernal Pools and Wetlands

The following outlines considerations and minimization measures specific to controlling perennial pepperweed in the event that herbicide applications are done in vernal pools and wetlands. Note that it is not planned for herbicides to be applied in vernal pools at Travis AFB. This section is included in the very controlled circumstance for vernal pools.

1. Trials will first be conducted in vernal pools without any historic or current records of listed branchiopods or *Lasthenia conjugens* but that do have cover of a common *Lasthenia* spp. Monitoring will occur on the common *Lasthenia*, which will be used as a proxy for what might happen when pools with *Lasthenia conjugens* are sprayed.
2. A trial of pepperweed control would not start until June when vernal pools and all native species have already set seed and vernal pools are dry. Application of an herbicide in June is not expected to interfere with the following season's germination as germination will not occur until the rainy season starts in October (5-7 month gap between treatment and germination) and preferred chemicals do not have residual activity.
3. The bloom period for *Lasthenia* is March-June (eJepson). If the pepperweed treatment (usually occurring in June) and *Lasthenia* flowering windows overlap, cut the flowering pepperweed before viable seed is produced. Come back and apply herbicide and/or further mow treatments after *Lasthenia* has set seed.
4. No herbicide will be applied to flowering or seeding *Lasthenia*.
5. Apply herbicide to one patch of pepperweed cooccurring with common *Lasthenia* that has already set seed and monitor the effects on both the following year.
6. All attempts will be made to avoid herbicide spray where *Lasthenia* occurs unless it co-occurs with perennial pepperweed.
7. Work will be monitored by a qualified biologist. Qualified herbicide applicators will be trained in vernal pool native species and *Lasthenia* avoidance.
8. Data on *Lasthenia* cover will be taken before treatments and the following year or two in treated pools and control pools, with results shared with the USFWS. Results will guide future decisions about herbicide control of pepperweed in the sensitive vernal pool ecosystem.
9. Work is targeting a plant considered to be a "noxious weed of great concern" by both Cal-IPC and CDFA. The Aero Club is a conservation area with high cover of federally listed *Lasthenia conjugens* and vernal pools. Actual test plots with common *Lasthenia* are to be determined but are likely to be outside the Aero Club Conservation Area.

10. Details on Herbicides: Telar XP (chlorsulfuron) is by far the most effective herbicide (even without a prior mow treatment) though is not allowed for use in wetlands per the General NPDES Permit for Residual Aquatic Pesticide Discharges (Order 2013-0002-DWQ). Roundup Custom (glyphosate) and/or Renovate 3 (triclopyr) are being considered for use. 2,4-D is a third but unlikely option given its restricted-use in California.
    a. Past research has found application of glyphosate at 3.33 kg/ha reduced biomass by ≥80% at two sites one year after applications if used in combination with a mow treatment" (Renz & DiTomaso 2006). "The change in the canopy structure of perennial pepperweed after mowing results in fewer aboveground sinks and greater deposition of herbicide to basal leaves where it can preferentially be translocated to the root system. Furthermore, the delay between mowing and resprouting synchronized maximal belowground translocation rates with herbicide application timing. These factors all appear to be involved in the observed enhanced control of perennial pepperweed when combining mowing and glyphosate" (Renz & DiTomaso 2004).
    b. Garlon 3A and 4 applications at label rates provided good control (Trumbo 1994). Garlon3A was applied as a 2 percent solution with 0.5 percent non-ionic surfactant added. Garlon4 was applied as a 1.5 percent solution with 0.5 percent non-ionic surfactant added. Currently, neither formulation of Garlon is registered for use over water in California. Triclopyr is broadleaf-specific, so it generally does not affect grasses. Garlon4 does not show residual soil activity (Howald 2020 citing Trumbo 1994).
    c. 2,4-D application at 2.11 kg ae/ha reduced pepperweed biomass by 78% in unmowed treatments (Renz 2002). Mowing did not seem to help at a Davis, CA site tested by Renz (2002) possibly because "the canopy architecture at the low density site was more open with many basal leaves present....and had a less developed roost system" reducing the need for mowing. 2,4-D is a restricted-use herbicide in California and would require an additional special permit (https://www.cdpr.ca.gov/docs/enforce/permitting.htm).
11. Methods of Herbicide Application: Targeted spraying will most likely be employed, though a qualified herbicide applicator will be consulted before trials begin. That is, spraying herbicide onto the foliage of individual target plants using a regulated nozzle, which helps to concentrate application toward target plants. This method uses a backpack-mounted wand sprayer.
    a. With regard to a more targeted application method, the most common method is to use a rope wick applicator, which often drips and makes it difficult to get adequate coverage on the plant. Also, with this method a more concentrated solution is used, since the volume being applied to the plant is lower. Another option is to hand apply herbicide to the leaves using a glove or sponge soaked in herbicide, though this can also lead to drips and is generally less safe (to humans) since there is closer contact with the concentrated product. In general, both of these hand application techniques are tedious and time consuming, but may lead to less herbicide on non-target areas.

b. If an emulsifiable concentrate/liquid formulation (such as glyphosate (Roundup Custom) or triclopyr (Renovate 3/Garlon)), is used, then the rope wick applicator is an option.

Doing a trial with different application rates may not be possible with use of a rope-wick applicator. A trial may be considered if targeted spraying is used.

14.0 Grazing Expansion Fencing Installation Avoidance and Minimization Measures (New)

AMMs are based on applied experience with the Aero Club grazing fence installation project in 2017.

1. Access routes will be established in upland areas, when feasible. Where it is necessary for access routes to go through a wetland feature, the work will be completed in the dry season (May 2-Oct 31) and matting will be put down to avoid effects to species and/or sensitive habitats.
2. T-posts will be spaced so as to avoid being placed in wetlands.
3. All current, and future fence lines may require annual repair and maintenance. These activities will be implemented so as to avoid and minimize any potential effects on suitable habitat for federally-listed shrimp to the extent possible.
4. Any existing fence that needs to be removed, will be left in place (wire and posts) if they occur in currently mapped wetlands.
5. All new posts for H-braces will be placed greater than 12.5 feet from any potential vernal pool shrimp habitat to avoid all direct and indirect effects.
6. Any holes dug for fence posts will not be left open overnight.
7. Any soil piles left from fence post holes will be removed from the site if they occur in a location where the soil could possibly run off into a vernal pool or wetland in the coming wet season.

15.0 Contracted Services Design Features from Air Force Manual 32-1053, Pest Management

1. Pest management contracts may be used when more cost effective than in-house services. All pest management contractors must use processes and procedures identified in the installation pest management plan. Contractors shall comply with the pesticide certification, licensing, and registration requirements of the state or country where the work is performed.
2. The MAJCOM Pest Management Coordinator (PMC) will review and approve all performance work statements for contracted pest management services. Installation personnel must receive MAJCOM PMC approval before making a request for procuring commercial pest management service.
3. The Civil Engineering contract management office will work with the installation contracting office to ensure all prospective contractors send proof that all their

APPENDIX E

Air Conformity and Applicability Model (ACAM) Reports

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

1. General Information

- Action Location
Base: TRAVIS AFB
State: California
County(s): Solano
Regulatory Area(s): San Francisco Bay Area, CA

- Action Title: INVASIVE SPECIES MANAGEMENT - Travis AFB

- Project Number/s (if applicable):

- Projected Action Start Date: 10 / 2023

- Action Purpose and Need:
The purpose of the Proposed Action is to manage invasive species on Travis AFB and its GSUs to reduce the prevalence of non-native plant and animal species in order to protect and preserve the military mission, ecosystem function, and valued resources and programs. The need for the Proposed Action is to address the threats of numerous non-native species on Travis AFB. There is a need for elimination or control of known priority infestations, and for prevention of the establishment of new infestations of invasive plants. If allowed to spread unchecked, non-native plant species will degrade the remaining native habitat; interfere with management of sensitive resources, economic activities, and quality of life; and impede the military mission. Non-native animal species cause habitat degradation and threaten the persistence of other animal species including special status species known from Travis AFB and its GSUs.

- Action Description:
Travis AFB proposes to manage non-native species on the installation and GSUs in order to satisfy resource management goals outlined in the installation INRMP (TAFB 2016a) and other installation management plans. Implementation of a procedural approach incorporating an integrated pest management (IPM) process will reduce the negative effects of these species under a manageable annual scope of work. Treatments could include but are not limited to broad-scale actions such as grazing and prescribed fire, targeted treatments including manual/mechanical and chemical applications, habitat enhancement activities, and biosecurity actions. The annual scope of work presented for each alternative and associated BMPs allow for predictable reduction of non-native species and inform the associated effects analyses presented in Chapter 4.

The current installation INRMP (TAFB 2016a) includes several goals, objectives, and projects that provide explicit drivers for non-native species management, framed in terms of conserving and benefiting sensitive, threatened, and endangered species and their habitats; reducing the potential for BASH incidents; and maintaining a sustainable rangeland ecosystem that reduces fire hazard and supports the Beale AFB livestock grazing
program. Over the past several years, new invasive plant management science and recommended methodologies have become available; invasive species mapping surveys have been performed; and local sensitive and invasive species data have been collected and analyzed. Travis AFB proposes to satisfy non-native species and resource management goals as outlined in the INRMP and other installation management plans in accordance with current available data and information, in the safest, most cost effective, efficient, and effectual way possible

Alternative 1 - No Action:
The No Action Alternative is required by law to be analyzed fully and serves as a baseline for comparison with the action alternatives. Under the No Action Alternative, current management activities will be maintained, including manual/mechanical activities, chemical applications, grazing, and burning. Implementation of these activities will lack a programmatic, cohesive approach and long-term strategy, and will not assimilate the most current science, effective treatment methods, or integrated approaches. While measures under this alternative will help slow the spread of non-native species, they are not enough to prevent the expansion of infestations. Current management addresses approximately 100 acres a year on average (excluding grazing operations),

which is less than 2 percent of the base, and therefore achieves little, if any net gain in control, conservation benefit, or mission support since non-native species continually re-invade when their sources are not adequately controlled.

Current management activities include limited and small scale manual/mechanical control (less than 50 acres annually); chemical applications for on less than 40 acres annually; grazing operations on approximately 547 acres (including GSUs) without the ability to expand grazing operations to new areas, change stocking rates, or vary residual dry matter (RDM) targets (a measure of consumed vegetation that is dependent on stocking rates) to adjust to annual weather variability or specific invasive species goals; and sporadic burning activities often limited to less than 50 acres. Environmental impacts for these activities are analyzed on a project-by-project basis using the AF EIAP.

The current limitations on grazing locations and the inability to vary grazing management techniques (i.e., targeted prescriptions, RDM, and stocking rates), together with currently limited fire management activities, create negative impacts on ungrazed wildlands, which are highly invaded, and perpetuate current problems such as the high cover of medusahead in current pastures.

The work being accomplished under this alternative is conducted solely by contract personnel. The estimated number of personnel is 9 support contract personnel, working 10 days per month with an average round trip vehicle mileage of 80 miles per day. Heavy equipment is used for creating firebreaks, mowing and some chemical treatments. Estimates for this work include 1 dozer for 2 days and 1 ATV or tractor with mower attachment for 10 days per year.

This alternative does not meet the purpose and need because current management activities lack a programmatic approach and long-term strategy; effective scale; and don't consider the most current science, data and analyses, and management recommendations. Ten years of range monitoring and survey data, analysis, and results; new science; and new management techniques and recommendations are now available but are not being utilized in current management activities. This alternative does not satisfy current INRMP and other management goals and does not optimize cost, efficacy, and efficiency.

Alternative 2 - Preferred Alternative:

Alternative 2, the Preferred Alternative, is to manage non-native species in order to reduce their prevalence using an efficient, sustainable, and long-term strategy that incorporates a programmatic, adaptive approach, maximizes opportunities for stewardship of sensitive resources, and utilizes a varied toolkit of control methods including manual/mechanical activities, chemical applications, grazing, and burning. The current Travis AFB INRMP (TAFB 2016a) contains several goals, objectives, and projects that provide explicit drivers for invasive species control. The Invasive Plant Species Management Plan (IPSMP; Mantech 2017) and Grazing Management Plan (Hopkinson 2017) were developed to guide their achievement. The Wildland Fire Management Plan (WFMP; Chloeta 2019) includes guidance for invasive plant control using prescribed burning. These documents are incorporated by reference in this EA, and are included as Appendices D, F & G respectively.

Alternative 2, Comprehensive Management, would manage invasive species to reduce their prevalence using an efficient, sustainable and long-term strategy that incorporates a programmatic, adaptive approach, maximizes opportunities for stewardship of sensitive resources and utilizes a varied toolkit of control methods including manual/mechanical activities, chemical applications, grazing and burning. The current INRMP (TAFB 2016a) and other Key Documents (Section 1.7) contains several goals, objectives and projects that provide explicit drivers for invasive species management.
Environmental analysis will focus on mowing, grazing, hand removal, mechanical removal, prescribed fire, chemical control and habitat restoration (e.g., native species planting) everywhere on Travis AFB and its GSUs though primarily focused within NRMUs which encompass undeveloped lands or those areas where federally listed species habitat or records occur on base. Analysis will focus on known invasive species, species that may arrive in the future or have otherwise not become a problem yet (Appendix B). Some known weed populations have been mapped but they are not all inclusive, base-wide or complete for any one species.

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

To increase the likelihood of successful long-term control, invasive species management experts recommend combining several management methods, tailored to situation-specific goals, constraints, and opportunities. The following methods and activities for invasive and aquatic species containment/control are considered under Alternative 2:
1. Continue and expand livestock grazing to up to 1,024 acres (Section 2.5.2.1, Figure 3 & 4) for cattle, sheep, goats, and horses, including prescribed grazing management strategies and techniques (e.g., continuous grazing, seasonal grazing, variable stocking rates, short duration high-intensity grazing methods), new grazing locations, and new infrastructure (e.g., permanent barbed wire fence, temporary or permanent electric fence, water troughs, solar wells including groundwater well and solar power and trough infrastructure, water tanks, trenched waterlines, and maintenance of all infrastructure).
2. Pest Animal Control (Section 2.5.2.2, see also ISMP) via indirect and direct methods including hand capture, trapping, netting, gigging, shooting, fencing, sediment excavation, chemical control, and manipulating the habitat to prevent the reproductive success or long- term survival of bullfrogs (e.g. dewatering of aquatic habitat).
3. Prescribed Burns (Section 2.5.2.3, Figure 5) to include prescribed fires up to 493 acres, torching/flaming, fire control lines, installation and/or maintenance of various kinds of firebreaks including targeted grazing, mowed, blacklined, temporary mineral via blading or scraping soil, and/or permanent mineral via gravel up to 3.6 miles of mineral firebreaks and
16.4 miles of mowed firebreaks annually.
4. Chemical Treatments (Section 2.5.2.4, Figure 6 & 12) including herbicide application via broadcast, spot-spray, or cut-stump treatments to terrestrial habitats in up to 200 acres annually; aquatic application applied directly to foliage growing at or above the water's surface in non-flowing waters, ephemeral vernal pools, swales and wetlands during the dry season.
5. Manual and Mechanical Treatments (Section 2.5.2.5, Figure 12, see also the IPSMP)
including mowing, hand-pulling, weed-whacking, and digging on up to 200 acres annually.
6. Habitat Enhancement Treatments (Section 2.5.2.6, see also the IPSMP) including soil preparation, digging, planting, drill or broadcast seeding, hydroseeding, tilling, and watering on up to 10 acres annually.
7. Monitoring, Tracking, and Surveying (see IPSMP) including measuring treatment efficacy, recording effects of invasive species, documenting weed spread, mapping and detecting new species, recording and tracking phenology over time.
8. Prevention Measures (see IPSMP) including education, equipment cleaning, and using weed- free mulch and fill.
As with Alternative 1, the work being accomplished under Alternative 2 will be conducted solely by contract personnel. The estimated number of personnel is 12 support contract personnel, working 10 days per month with an average round trip vehicle mileage of 80 miles per day. Heavy equipment will be used for creating firebreaks, mowing and some chemical treatments. Estimates for this work include 1 dozer for 2 days; 1 tractor pulling a disk for 3 days; and 1 ATV or tractor with mower attachment for 14 days per year.

- Point of Contact

Name: Camille Gracia
Title: Environmental Scientist
Organization: CZTQ
Email:
Phone Number:

- Activity List:

	Activity Type	Activity Title
2.	Construction / Demolition	Clearing of Invasive Species
3.	Personnel	3 Additional Personnel (Support Contractor)

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

Emission factors and air emission estimating methods come from the United States Air Force's Air Emissions Guide for Air Force Stationary Sources, Air Emissions Guide for Air Force Mobile Sources, and Air Emissions Guide for Air Force Transitory Sources.

2. Construction / Demolition

2.1 General Information & Timeline Assumptions

- Activity Location
County: Solano
Regulatory Area(s): San Francisco Bay Area, CA

- Activity Title: Clearing of Invasive Species

- Activity Description:
This is quantified in ACAM using the Site Grading construction phase. This will conservatively estimate the emissions generated from the equipment utilized to remove invasive species under the proposed Action. All other methods of removal are either exempt from Conformity or do not contribute to a net change in emissions for any of the NAAQS or precursors.

- Activity Start Date
Start Month: 10
Start Month: 2023

- Activity End Date
Indefinite: False
End Month: 10
End Month: 2023

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.010520
SO_x	0.000169
NO_x	0.065441
CO	0.057968
PM 10	1.992289

Pollutant	Total Emissions (TONs)
PM 2.5	0.002677
Pb	0.000000
NH_3	0.000017
CO_2e	16.6

2.1 Site Grading Phase

2.1.1 Site Grading Phase Timeline Assumptions

- Phase Start Date
Start Month: 10
Start Quarter: 1
Start Year: 2022

- Phase Duration
Number of Month: 1
Number of Days: 0

2.1.2 Site Grading Phase Assumptions

- General Site Grading Information

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Area of Site to be Graded (ft^2): 1000000
Amount of Material to be Hauled On-Site (yd^3): 0
Amount of Material to be Hauled Off-Site (yd^3): 0

- Site Grading Default Settings
Default Settings Used: No
Average Day(s) worked per week: 1

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Excavators Composite	1	8
Graders Composite	1	8
Other Construction Equipment Composite	1	8
Rubber Tired Dozers Composite	1	8
Scrapers Composite	1	8
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Capacity (yd^3): 20
Average Hauling Truck Round Trip Commute (mile): 20

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

2.1.3 Site Grading Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Excavators Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0648	0.0013	0.3170	0.5103	0.0136	0.0136	0.0058	119.72
Graders Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0806	0.0014	0.4657	0.5731	0.0217	0.0217	0.0072	132.92
Other Construction Equipment Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0507	0.0012	0.2785	0.3488	0.0105	0.0105	0.0045	122.61
Rubber Tired Dozers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.1919	0.0024	1.3611	0.7352	0.0536	0.0536	0.0173	239.51
Scrapers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.1723	0.0026	1.1176	0.7579	0.0447	0.0447	0.0155	262.87
Tractors/Loaders/Backhoes Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0383	0.0007	0.2301	0.3598	0.0095	0.0095	0.0034	66.884

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.114	000.003	000.084	000.992	000.047	000.020		000.023	00298.845
LDGT	000.288	000.004	000.178	001.871	000.048	000.021		000.024	00379.038
HDGV	000.600	000.011	001.339	008.875	000.183	000.078		000.045	01128.468
LDDV	000.026	000.003	000.125	000.281	000.060	000.032		000.008	00271.718
LDDT	000.094	000.003	000.533	000.594	000.112	000.082		000.008	00364.857
HDDV	000.194	000.014	004.796	001.133	000.211	000.117		000.028	01514.699
MC	004.452	000.002	001.252	023.791	000.019	000.009		000.054	00187.891

2.1.4 Site Grading Phase Formula(s)

- Fugitive Dust Emissions per Phase

$PM10_{FD} = (20 * ACRE * WD) / 2000$

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = (HA_{OnSite} + HA_{OffSite}) * (1 / HC) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase

$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)

WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

3. Personnel

3.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Solano
Regulatory Area(s): San Francisco Bay Area, CA

- Activity Title: 3 Additional Personnel (Support Contractor)

- Activity Description:
The personnel will drive aproximately 80 miles round trip

- Activity Start Date
Start Month: 10
Start Year: 2022

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.020729
SO_x	0.000247
NO_x	0.011269
CO	0.134454
PM 10	0.003248

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.001412
Pb	0.000000
NH_3	0.001662
CO_2e	23.8

3.2 Personnel Assumptions

- Number of Personnel
Active Duty Personnel: 0
Civilian Personnel: 0
Support Contractor Personnel: 3
Air National Guard (ANG) Personnel: 0

Reserve Personnel: 0

- Default Settings Used: No

- Average Personnel Round Trip Commute (mile): 80

- Personnel Work Schedule

Active Duty Personnel:	5 Days Per Week
Civilian Personnel:	5 Days Per Week
Support Contractor Personnel:	5 Days Per Week
Air National Guard (ANG) Personnel:	4 Days Per Week
Reserve Personnel:	4 Days Per Month

3.3 Personnel On Road Vehicle Mixture

- On Road Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	37.55	60.32	0	0.03	0.2	0	1.9
GOVs	54.49	37.73	4.67	0	0	3.11	0

3.4 Personnel Emission Factor(s)

- On Road Vehicle Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.114	000.003	000.084	000.992	000.047	000.020		000.023	00298.845
LDGT	000.288	000.004	000.178	001.871	000.048	000.021		000.024	00379.038
HDGV	000.600	000.011	001.339	008.875	000.183	000.078		000.045	01128.468
LDDV	000.026	000.003	000.125	000.281	000.060	000.032		000.008	00271.718
LDDT	000.094	000.003	000.533	000.594	000.112	000.082		000.008	00364.857
HDDV	000.194	000.014	004.796	001.133	000.211	000.117		000.028	01514.699
MC	004.452	000.002	001.252	023.791	000.019	000.009		000.054	00187.891

3.5 Personnel Formula(s)

- Personnel Vehicle Miles Travel for Work Days per Year

$VMT_P = NP * WD * AC$

VMT_P: Personnel Vehicle Miles Travel (miles/year)
NP: Number of Personnel
WD: Work Days per Year
AC: Average Commute (miles)

- Total Vehicle Miles Travel per Year

$VMT_{Total} = VMT_{AD} + VMT_C + VMT_{SC} + VMT_{ANG} + VMT_{AFRC}$

VMT_{Total}: Total Vehicle Miles Travel (miles)
VMT_{AD}: Active Duty Personnel Vehicle Miles Travel (miles)
VMT_C: Civilian Personnel Vehicle Miles Travel (miles)
VMT_{SC}: Support Contractor Personnel Vehicle Miles Travel (miles)
VMT_{ANG}: Air National Guard Personnel Vehicle Miles Travel (miles)
VMT_{AFRC}: Reserve Personnel Vehicle Miles Travel (miles)

- Vehicle Emissions per Year

$V_{POL} = (VMT_{Total} * 0.002205 * EF_{POL} * VM) / 2000$

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

V_{POL}: Vehicle Emissions (TONs)
VMT_{Total}: Total Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Personnel On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

AIR CONFORMITY APPLICABILITY MODEL REPORT
RECORD OF CONFORMITY ANALYSIS (ROCA)

1. General Information: The Air Force's Air Conformity Applicability Model (ACAM) was used to perform an analysis to assess the potential air quality impact/s associated with the action in accordance with the Air Force Manual 32-7002, Environmental Compliance and Pollution Prevention; the Environmental Impact Analysis Process (EIAP, 32 CFR 989); and the General Conformity Rule (GCR, 40 CFR 93 Subpart B). This report provides a summary of the ACAM analysis.

a. Action Location:

Base: TRAVIS AFB
State: California
County(s): Solano
Regulatory Area(s): San Francisco Bay Area, CA

b. Action Title: INVASIVE SPECIES MANAGEMENT - Travis AFB

c. Project Number/s (if applicable):

d. Projected Action Start Date: 10 / 2023

e. Action Description:

Travis AFB proposes to manage non-native species on the installation and GSUs in order to satisfy resource management goals outlined in the installation INRMP (TAFB 2016a) and other installation management plans. Implementation of a procedural approach incorporating an integrated pest management (IPM) process will reduce the negative effects of these species under a manageable annual scope of work. Treatments could include but are not limited to broad-scale actions such as grazing and prescribed fire, targeted treatments including manual/mechanical and chemical applications, habitat enhancement activities, and biosecurity actions. The annual scope of work presented for each alternative and associated BMPs allow for predictable reduction of non-native species and inform the associated effects analyses presented in Chapter 4.

The current installation INRMP (TAFB 2016a) includes several goals, objectives, and projects that provide explicit drivers for non-native species management, framed in terms of conserving and benefiting sensitive, threatened, and endangered species and their habitats; reducing the potential for BASH incidents; and maintaining a sustainable rangeland ecosystem that reduces fire hazard and supports the Beale AFB livestock grazing
program. Over the past several years, new invasive plant management science and recommended methodologies have become available; invasive species mapping surveys have been performed; and local sensitive and invasive species data have been collected and analyzed. Travis AFB proposes to satisfy non-native species and resource management goals as outlined in the INRMP and other installation management plans in accordance with current available data and information, in the safest, most cost effective, efficient, and effectual way possible

Alternative 1 - No Action:
The No Action Alternative is required by law to be analyzed fully and serves as a baseline for comparison with the action alternatives. Under the No Action Alternative, current management activities will be maintained, including manual/mechanical activities, chemical applications, grazing, and burning. Implementation of these activities will lack a programmatic, cohesive approach and long-term strategy, and will not assimilate the most current science, effective treatment methods, or integrated approaches. While measures under this alternative will help slow the spread of non-native species, they are not enough to prevent the expansion of infestations. Current management addresses approximately 100 acres a year on average (excluding grazing operations), which is less than 2 percent of the base, and therefore achieves little, if any net gain in control, conservation benefit, or mission support since non-native species continually re-invade when their sources are not adequately controlled.

Current management activities include limited and small scale manual/mechanical control (less than 50 acres annually); chemical applications for on less than 40 acres annually; grazing operations on approximately 547

acres (including GSUs) without the ability to expand grazing operations to new areas, change stocking rates, or vary residual dry matter (RDM) targets (a measure of consumed vegetation that is dependent on stocking rates) to adjust to annual weather variability or specific invasive species goals; and sporadic burning activities often limited to less than 50 acres. Environmental impacts for these activities are analyzed on a project-by-project basis using the AF EIAP.

The current limitations on grazing locations and the inability to vary grazing management techniques (i.e., targeted prescriptions, RDM, and stocking rates), together with currently limited fire management activities, create negative impacts on ungrazed wildlands, which are highly invaded, and perpetuate current problems such as the high cover of medusahead in current pastures.

The work being accomplished under this alternative is conducted solely by contract personnel. The estimated number of personnel is 9 support contract personnel, working 10 days per month with an average round trip vehicle mileage of 80 miles per day. Heavy equipment is used for creating firebreaks, mowing and some chemical treatments. Estimates for this work include 1 dozer for 2 days and 1 ATV or tractor with mower attachment for 10 days per year.

This alternative does not meet the purpose and need because current management activities lack a programmatic approach and long-term strategy; effective scale; and don't consider the most current science, data and analyses, and management recommendations. Ten years of range monitoring and survey data, analysis, and results; new science; and new management techniques and recommendations are now available but are not being utilized in current management activities. This alternative does not satisfy current INRMP and other management goals and does not optimize cost, efficacy, and efficiency.

Alternative 2 - Preferred Alternative:

Alternative 2, the Preferred Alternative, is to manage non-native species in order to reduce their prevalence using an efficient, sustainable, and long-term strategy that incorporates a programmatic, adaptive approach, maximizes opportunities for stewardship of sensitive resources, and utilizes a varied toolkit of control methods including manual/mechanical activities, chemical applications, grazing, and burning. The current Travis AFB INRMP (TAFB 2016a) contains several goals, objectives, and projects that provide explicit drivers for invasive species control. The Invasive Plant Species Management Plan (IPSMP; Mantech 2017) and Grazing Management Plan (Hopkinson 2017) were developed to guide their achievement. The Wildland Fire Management Plan (WFMP; Chloeta 2019) includes guidance for invasive plant control using prescribed burning. These documents are incorporated by reference in this EA, and are included as Appendices D, F & G respectively.

Alternative 2, Comprehensive Management, would manage invasive species to reduce their prevalence using an efficient, sustainable and long-term strategy that incorporates a programmatic, adaptive approach, maximizes opportunities for stewardship of sensitive resources and utilizes a varied toolkit of control methods including manual/mechanical activities, chemical applications, grazing and burning. The current INRMP (TAFB 2016a) and other Key Documents (Section 1.7) contains several goals, objectives and projects that provide explicit drivers for invasive species management.
Environmental analysis will focus on mowing, grazing, hand removal, mechanical removal, prescribed fire, chemical control and habitat restoration (e.g., native species planting) everywhere on Travis AFB and its GSUs though primarily focused within NRMUs which encompass undeveloped lands or those areas where federally listed species habitat or records occur on base. Analysis will focus on known invasive species, species that may arrive in the future or have otherwise not become a problem yet (Appendix B). Some known weed populations have been mapped but they are not all inclusive, base-wide or complete for any one species.

To increase the likelihood of successful long-term control, invasive species management experts recommend combining several management methods, tailored to situation-specific goals, constraints, and opportunities. The

following methods and activities for invasive and aquatic species containment/control are considered under Alternative 2:
1. Continue and expand livestock grazing to up to 1,024 acres (Section 2.5.2.1, Figure 3 & 4) for cattle, sheep, goats, and horses, including prescribed grazing management strategies and techniques (e.g., continuous grazing, seasonal grazing, variable stocking rates, short duration high-intensity grazing methods), new grazing locations, and new infrastructure (e.g., permanent barbed wire fence, temporary or permanent electric fence, water troughs, solar wells including groundwater well and solar power and trough infrastructure, water tanks, trenched waterlines, and maintenance of all infrastructure).
2. Pest Animal Control (Section 2.5.2.2, see also ISMP) via indirect and direct methods including hand capture, trapping, netting, gigging, shooting, fencing, sediment excavation, chemical control, and manipulating the habitat to prevent the reproductive success or long- term survival of bullfrogs (e.g. dewatering of aquatic habitat).
3. Prescribed Burns (Section 2.5.2.3, Figure 5) to include prescribed fires up to 493 acres, torching/flaming, fire control lines, installation and/or maintenance of various kinds of firebreaks including targeted grazing, mowed, blacklined, temporary mineral via blading or scraping soil, and/or permanent mineral via gravel up to 3.6 miles of mineral firebreaks and
16.4 miles of mowed firebreaks annually.
4. Chemical Treatments (Section 2.5.2.4, Figure 6 & 12) including herbicide application via broadcast, spot-spray, or cut-stump treatments to terrestrial habitats in up to 200 acres annually; aquatic application applied directly to foliage growing at or above the water's surface in non-flowing waters, ephemeral vernal pools, swales and wetlands during the dry season.
5. Manual and Mechanical Treatments (Section 2.5.2.5, Figure 12, see also the IPSMP)
including mowing, hand-pulling, weed-whacking, and digging on up to 200 acres annually.
6. Habitat Enhancement Treatments (Section 2.5.2.6, see also the IPSMP) including soil preparation, digging, planting, drill or broadcast seeding, hydroseeding, tilling, and watering on up to 10 acres annually.
7. Monitoring, Tracking, and Surveying (see IPSMP) including measuring treatment efficacy, recording effects of invasive species, documenting weed spread, mapping and detecting new species, recording and tracking phenology over time.
8. Prevention Measures (see IPSMP) including education, equipment cleaning, and using weed- free mulch and fill.
As with Alternative 1, the work being accomplished under Alternative 2 will be conducted solely by contract personnel. The estimated number of personnel is 12 support contract personnel, working 10 days per month with an average round trip vehicle mileage of 80 miles per day. Heavy equipment will be used for creating firebreaks, mowing and some chemical treatments. Estimates for this work include 1 dozer for 2 days; 1 tractor pulling a disk for 3 days; and 1 ATV or tractor with mower attachment for 14 days per year.

f. Point of Contact:

Name: Camille Gracia
Title: Environmental Scientist
Organization: CZTQ
Email:
Phone Number:

2. Analysis: Total combined direct and indirect emissions associated with the action were estimated through ACAM on a calendar-year basis for the "worst-case" and "steady state" (net gain/loss upon action fully implemented) emissions. General Conformity under the Clean Air Act, Section 1.76 has been evaluated for the action described above according to the requirements of 40 CFR 93, Subpart B.

Based on the analysis, the requirements of this rule are: _____ applicable
__X__ not applicable

Conformity Analysis Summary:

AIR CONFORMITY APPLICABILITY MODEL REPORT
RECORD OF CONFORMITY ANALYSIS (ROCA)

2022

Pollutant	Action Emissions (ton/yr)	GENERAL CONFORMITY	
		Threshold (ton/yr)	Exceedance (Yes or No)
San Francisco Bay Area, CA			
VOC	0.016	100	No
NOx	0.068	100	No
CO	0.092		
SOx	0.000	100	No
PM 10	1.993		
PM 2.5	0.003	100	No
Pb	0.000		
NH3	0.000	100	No
CO2e	22.6		

2023 - (Steady State)

Pollutant	Action Emissions (ton/yr)	GENERAL CONFORMITY	
		Threshold (ton/yr)	Exceedance (Yes or No)
San Francisco Bay Area, CA			
VOC	0.021	100	No
NOx	0.011	100	No
CO	0.134		
SOx	0.000	100	No
PM 10	0.003		
PM 2.5	0.001	100	No
Pb	0.000		
NH3	0.002	100	No
CO2e	23.8		

None of estimated emissions associated with this action are above the conformity threshold values established at 40 CFR 93.153 (b); Therefore, the requirements of the General Conformity Rule are not applicable.

Camille Gracia

Camille Gracia , Environmental Scientist

8/2/22

DATE

APPENDIX F

Invasive Species Management Plan (ISMP)

(HT Harvey 2014)

Auxilio Management Services

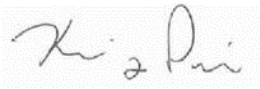
ENVIRONMENTAL SERVICES · TRAVIS INSTALLATION SUPPORT TEAM

DELIVERABLE:	Invasive Species Management Plan
TASK 7:	Invasive Species Management Plan
CONTRACT NO.:	W912BV-12-D-0017; Task Order DY01
CLIENT:	US Army Engineer District, Fort Worth Mr. Wayne Elliott Ms. Sarah Otto 819 Taylor Street Fort Worth, TX 76102-0300 (817) 886-1666
PRIME CONTRACTOR:	Auxilio Management Services 10955 Westmoor Drive, Suite 400 Westminster, CO 80021 720-327-1068

Brief Description of Deliverable

Please find attached the Invasive Species Management Plan. This deliverable is for Task 7, Invasive Species Management Plan, under contract number W912BV-12-D-0017; Task Order DY01. Please let me know if you have any questions, concerns, or comments.

Respectfully,



_____

Kelli Jo Price
President/CEO
Auxilio Management Service

H.T. HARVEY & ASSOCIATES
Ecological Consultants



Invasive Species Management Plan for Travis Air Force Base, Solano County, California



Prepared for:

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Prepared by:

H. T. Harvey & Associates
Project #3539-02
Contract #W912BV-12-D-0017
Task Order #DY0I

15 September 2014

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Executive Summary

Introduction

An integrated natural resources management plan (INRMP) directs the management of natural resources on Travis Air Force Base (TAFB). One of the goals of the INRMP is to employ a systematic approach to managing natural resources using a process that includes inventory, monitoring, management, assessment, and evaluation. This goal is supported by preparation of this invasive species management plan (Plan), which involves conducting a survey and producing appropriate GeoBase data; monitoring the spread of invasive species; evaluating the effectiveness of various methods of control, including mowing activities, pesticide application, and burns to control nonnative, invasive species; and modifying activities as necessary.

Another goal of the INRMP related to invasive species management is to maintain and enhance the hydrologic, physical, and ecological integrity of wetlands. Management activities in support of this goal include preparing and implementing a plan to reduce the number of bullfrogs, fish, and other predators of California tiger salamander (CTS) in ponds in the Castle Terrace Housing Natural Resource Management Unit (NRMU).

This Plan supports INRMP goals addressing the management of natural ecosystems at TAFB by:

- Characterizing the distribution and abundance of weed and pest species at TAFB
- Describing appropriate methods to manage populations of target weed and pest species
- Describing appropriate methods to monitor the response of target weed and pest species to treatment methods
- Prescribing an adaptive management approach to address unanticipated management concerns
- Describing strategies to avoid adversely affecting special-status species as a result of weed and pest control
- Proposing best management practices (BMPs) and other measures to achieve these objectives

The Plan focuses on the following weed species that are known to occur in plant communities at TAFB: barbed goat grass (*Aegilops triuncialis*), black mustard (*Brassica nigra*), Brazilian waterweed (*Egeria densa*), Eurasian water-milfoil (*Myriophyllum spicatum*), fennel (*Foeniculum vulgare*), Italian thistle (*Carduus pycnocephalus*), medusa head (*Elymus caput-medusae*), perennial pepperweed (*Lepidium latifolium*), purple star-thistle (*Centaurea calcitrapa*), treasure flower (*Gazania linearis*), and yellow star-thistle (*Centaurea solstitialis*). In addition, the following weed species are known to be prevalent in the region: bull thistle (*Cirsium vulgare*), giant reed (*Arundo*

donax), Harding grass (*Phalaris aquatica*), Himalayan blackberry (*Rubus armeniacus*), Lens' podded hoary cress (*Lepidium chalepense*), milk thistle (*Silybum marianum*), perennial mustard (*Hirschfeldia incana*), poison hemlock (*Conium maculatum*), Russian knapweed (*Acroptilon repens*), scarlet sesban (*Sesbania punicea*), skeleton weed (*Chondrilla juncea*), smallflower tamarisk (*Tamarix parviflora*), Spanish broom (*Spartium junceum*), stinkwort (*Dittrichia graveolens*), tall sock-destroyer (*Torilis arvensis*), tocalote (*Centaurea melitensis*), and water hyacinth (*Eichhornia crassipes*). The Plan focuses on these species as the targets of prevention and control because they are known to occur on TAFB or because they are more widely distributed regionally and could occur on TAFB in the future. The targeted weeds do not include most species of widely naturalized, nonnative annual grasses because control of these species is generally infeasible and because these species can provide important habitat benefits for many native species of wildlife.

The Plan focuses on using management and treatment practices to prevent and control the spread of damaging weeds that could threaten natural habitats and native species on TAFB. These threats include vegetation structure change, formation of monocultural stands, loss of habitat for special-status plants and animals, increased fire risk, and risk of propagule spread.

The Plan also focuses on using management practices to prevent the introduction and/or spread of the American bullfrog, which could threaten natural habitats and native species on TAFB. The threats include direct impacts on native species, alteration of native habitats, and introduction of disease.

This Plan also documents occurrences of nonnative, invasive plants and bullfrogs observed during surveys conducted at TAFB in spring 2014.

Weed Control Practices

This Plan prescribes BMPs to prevent, treat, and monitor weed infestations at TAFB. Control of weeds will focus on three strategies:

- Monitoring the NRMUs so that new infestations can be quickly identified
- Controlling weed species at a time that effectively interrupts that particular species' life cycle
- Establishing control methods that include monitoring areas after weeds have been treated and being prepared to retreat infestations multiple times

Weed populations can be controlled using several methods: hand/mechanical removal, fire management, herbicides, biological controls (e.g., livestock grazing), and soil solarization. Each has its own specific benefits and drawbacks.

Adaptive management is the process of developing alternative management strategies and methods based on the development of new information gathered through monitoring efforts, as well as through unforeseeable

conflicts with management objectives. If, during regular monitoring inspections, for example, the weed advisor determines that weed infestations on the site are becoming progressively larger, more numerous, more intense, or more damaging despite prior and ongoing weed control efforts, the weed advisor should prepare a dedicated site action plan that addresses the species of concern and recommends specific actions to effectively control these species. The site action plan may include modified prescriptions for vegetation management, specific herbicide recommendations, new weed maps prepared using a submeter Global Positioning System, and descriptions of other adaptive management approaches. The plan should identify specific success criteria that, if met, will allow weed control efforts to be reduced to the less intensive management approaches previously described in this Plan.

Pest Control Practices

This Plan recommends actions to prevent the introduction of, treat populations of, and monitor bullfrogs at TAFB. The presence of bullfrogs at TAFB presents challenging management concerns, especially in relation to management practices for CTS. TAFB manages for the presence of small ephemeral pools that provide habitat for larval CTS. Because they are ephemeral, these pools would not support habitat for adult bullfrogs; however, juvenile bullfrogs dispersing from breeding pools may occupy these ephemeral pools before returning back to perennial bodies to breed. While inhabiting these small pools, juvenile bullfrogs may predate larval CTS and could potentially eliminate CTS entirely from individual pools.

This Plan prescribes BMPs and monitoring approaches to treat bullfrog infestations at TAFB in concert with management of CTS populations. In some cases, complete eradication of bullfrogs may be impossible. Thus, an emphasis should be made on containing their spread and controlling new populations from establishing in natural areas.

Monitoring of bullfrog populations should be conducted by a qualified biologist to determine the response to management efforts. If, during the regular monitoring inspections, the biologist determines that bullfrogs have substantially established, geographically spread, or increased in number, the biologist should prepare a site action plan that recommends specific actions to effectively control this species. The site action plan may include modified prescriptions for bullfrog management and should identify specific success criteria that, if met, will allow control efforts to be reduced to the less intensive prevention and management approaches previously described in this Plan. Through monitoring efforts, the qualified biologist will determine the success of management efforts and alter management strategies to better accomplish the Plan objectives and meet Plan goals.

Weed Control Work Plan

The weed control work plan describes tasks associated with weed management, methods for prioritizing weed infestations for treatment, monitoring methods that will be used to detect new weed infestations and to assess how well prior weed treatment efforts have met defined goals and objectives, measures of success, and

adaptive management techniques to be implemented when monitoring indicates that goals and objectives have not been met. It supports objectives developed in the INRMP to help accomplish natural resource management goals for TAFB.

The following tasks are identified in the weed control work plan:

- Task 1: Prevent or minimize introduction and/or spread of weeds
- Task 2: Monitor TAFB for weed infestations
- Task 3: Prioritize treatment of target weeds
- Task 4: Direct and coordinate weed control efforts
- Task 5: Compile a weed control log
- Task 6: Prepare and submit a brief memo report
- Task 7: Enact a contingency plan if efforts to control weed infestations fail

Weed control success will be achieved if the extent of target weed populations in the NRMUs decreases, or at a minimum does not increase, after the first 5 years of Plan implementation. Initially, nonattainment of this target will serve as the threshold for determining whether adaptive management actions are necessary. These actions may include conservation actions, changes to the weed management approach, or revision of the Plan.

Pest Control Work Plan

The pest control work plan was created to support objectives developed in the INRMP to help accomplish plan goals for TAFB. Plan goals for TAFB include maintaining and enhancing the hydrologic, physical, and ecological integrity of wetlands. The plan was developed in part to inform TAFB personnel of ways to reduce CTS predators (e.g., bullfrogs) in CTS habitat and to develop and implement monitoring and adaptive management strategies to help meet Plan goals.

The following tasks are identified in the pest control work plan:

- Task 1: Prevent introduction and/or spread of American bullfrog
- Task 2: Prioritize management areas
- Task 3: Conduct treatment of priority management areas
- Task 4: Compile a treatment log
- Task 5: Conduct monitoring of treatment methods

- Task 6: Conduct additional treatment, if necessary
- Task 7: Develop alternative management strategies to address unanticipated management concerns, if necessary

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Appendix A. Treatment Recommendations for Target Weeds A-1

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Section 1. Introduction

1.1 Overview of Travis AFB

Travis Air Force Base (TAFB) is located in northern California, within the city limits of Fairfield, the county seat of Solano County (Figure 1). It is situated approximately 50 miles northeast of San Francisco and 40 miles southwest of Sacramento, approximately midway between the coastal zone and the interior valley of California. Local communities in the vicinity of the base include Vacaville to the north and Suisun City to the south. TAFB is bordered on the east, north, and south by agricultural lands and open space. On the west, the base is bordered by mixed urban uses, including commercial uses adjacent to the main entrance north of Travis Boulevard.

TAFB is located on approximately 5137 acres of fee-owned land. The base has lesser interests (easements) on an additional 1319 acres of land. TAFB is densely constructed with only limited areas set aside for outdoor recreation and natural resources. Since the 1940s, the installation has supported defense aviation activities that have included servicing and ferrying aircraft to the Pacific, long-range reconnaissance, air logistics support, and humanitarian operations. Open space is limited on the base. Large residential areas occupy the northern half of the base, commercial-administrative uses are located just south of these residential areas, and mission and airfield operations areas are located along the south side of the base.

1.2 Purpose of Invasive Species Management Plan

Air Force Instruction 32-7064, Integrated Natural Resources Management, addresses the management of natural resources on Air Force properties. The chief tool for managing installation ecosystems is the integrated natural resources management plan (INRMP). One of the goals of the INRMP prepared for TAFB (Goal 3) is to employ a systematic approach to managing natural resources using a process that includes inventory, monitoring, management, assessment, and evaluation (U.S. Air Force 2013). This goal is supported by Objective 3.3, which guides the development of appropriate management activities that maintain and protect natural resources at TAFB. These management activities include preparation of an invasive species management plan (Plan), which involves conducting a survey and producing appropriate GeoBase data (Project 3.3.4); monitoring the spread of invasive species by evaluating the effectiveness of various methods of control, including mowing activities, pesticide application, and burns to control nonnative, invasive species; and modifying activities as necessary (Project 3.3.5).

Another goal (Goal 2) of the INRMP is to maintain and enhance the hydrologic, physical, and ecological integrity of wetlands. This goal is supported by Objective 2.1, which aims to improve the ecological functioning of wetlands by applying an adaptive management process. Management activities in support of this goal include preparing (Project 2.1.5) and implementing (Project 2.1.6.) a plan to reduce the number of

bullfrogs, fish, and other predators of California tiger salamander (CTS) (*Ambystoma californiense*) in ponds at the Castle Terrace Housing Natural Resource Management Unit (NRMU). These projects also direct the implementation of treatment monitoring and the development of adaptive management strategies. H. T. Harvey & Associates (HTH) developed this Plan in support of these projects.

This Plan supports INRMP goals addressing the management of natural ecosystems at TAFB. Specifically, this Plan:

- Characterizes the distribution and abundance of weed and pest species at TAFB
- Describes appropriate methods to manage populations of target weed and pest species
- Describes appropriate methods to monitor the response of target weed and pest species to treatment methods
- Prescribes an adaptive management approach to address unanticipated management concerns
- Describes strategies to avoid adversely affecting special-status species as a result of weed and pest control
- Proposes best management practices (BMPs) and other measures to achieve these objectives

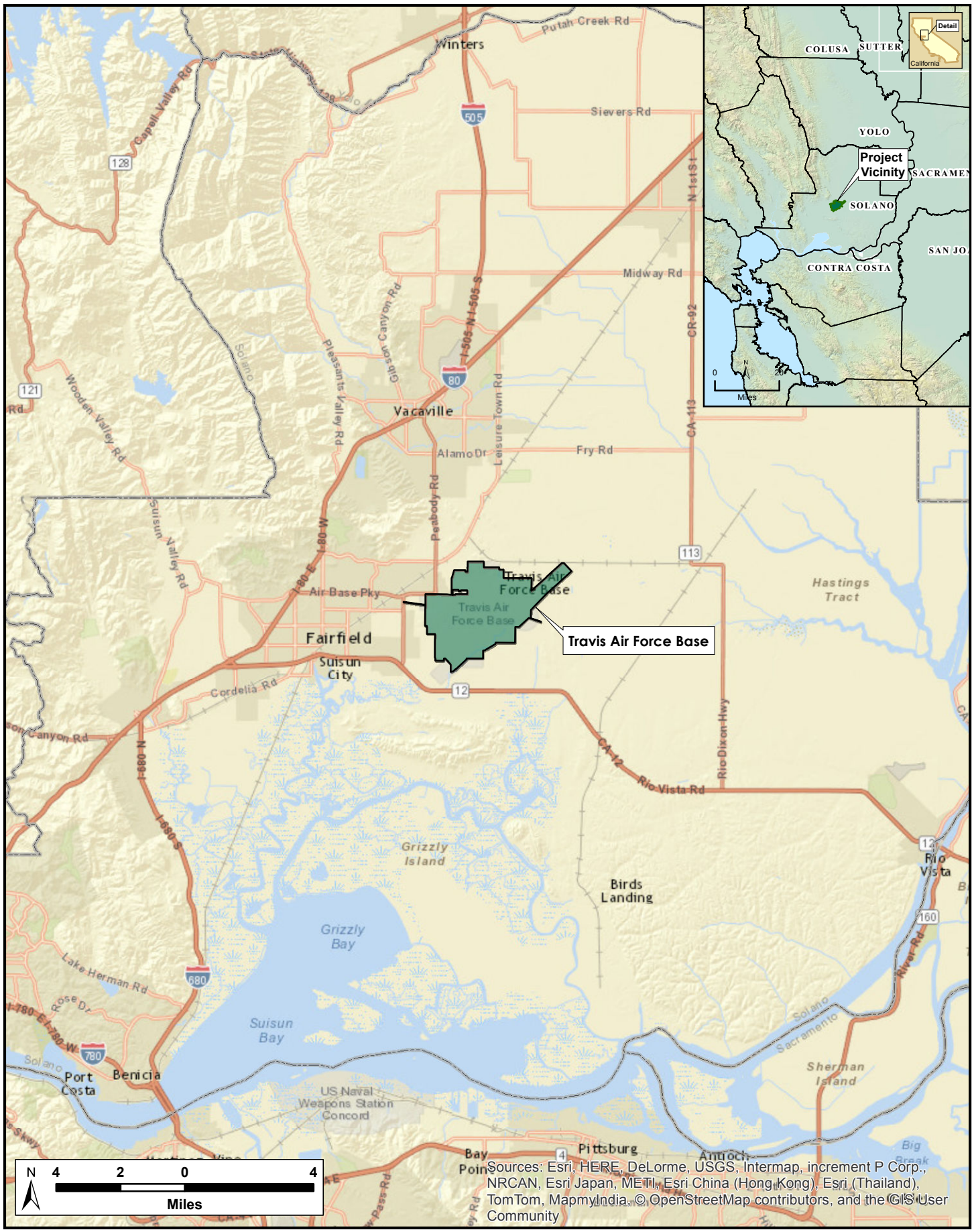
TAFB plans to initiate consultation with the U.S. Fish and Wildlife Service (USFWS) under Section 7 of the federal Endangered Species Act to obtain authorization for the incidental take of federally listed species that could occur during implementation of weed and pest control activities. Until such consultation is completed, management of weeds and pests will avoid impacts on special-status plant and wildlife species, including Contra Costa goldfields (*Lasthenia conjugens*), vernal pool fairy shrimp (*Branchinecta lynchi*), vernal pool tadpole shrimp (*Lepidurus packardi*), and CTS; wetlands; and other sensitive biological resources.

The INRMP for TAFB delineates discrete management units referred to as NRMUs. These management units were created to develop an integrated management strategy for the diversity of resources and mission activities supported by the installation. In the delineation of NRMUs, consideration was given to types of activities, both current and planned or proposed, and to the presence and condition of natural habitats and resources. Seven NRMUs have been delineated (Figure 2). NRMUs will form the basis for the development and implementation of weed and pest management strategies throughout TAFB.

The following subsections define the terms used in this Plan, outline risks associated with weeds and pests, and briefly identify the weed and pest species of concern:

- Section 2.0 identifies the general approach to prevention and treatment, BMPs, monitoring methods, treatment procedures, and adaptive management that will be used to prevent and control weed and pest problems on TAFB.

- Section 3.0 provides a description of each target weed and pest species, including relevant species-specific treatment considerations.
- Section 4.0 presents suggested 5-year work plans to treat and monitor target weeds and pests.
- Section 5.0 provides bibliographic information for all the sources cited in this Plan. Appendix A presents treatment recommendations for target weeds.



Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

N:\Projects3500\3539-01\02\Reports\Invasive Species Management Plan\September 2014\Figure 1 Vicinity Map.mxd

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Figure 1: Vicinity Map
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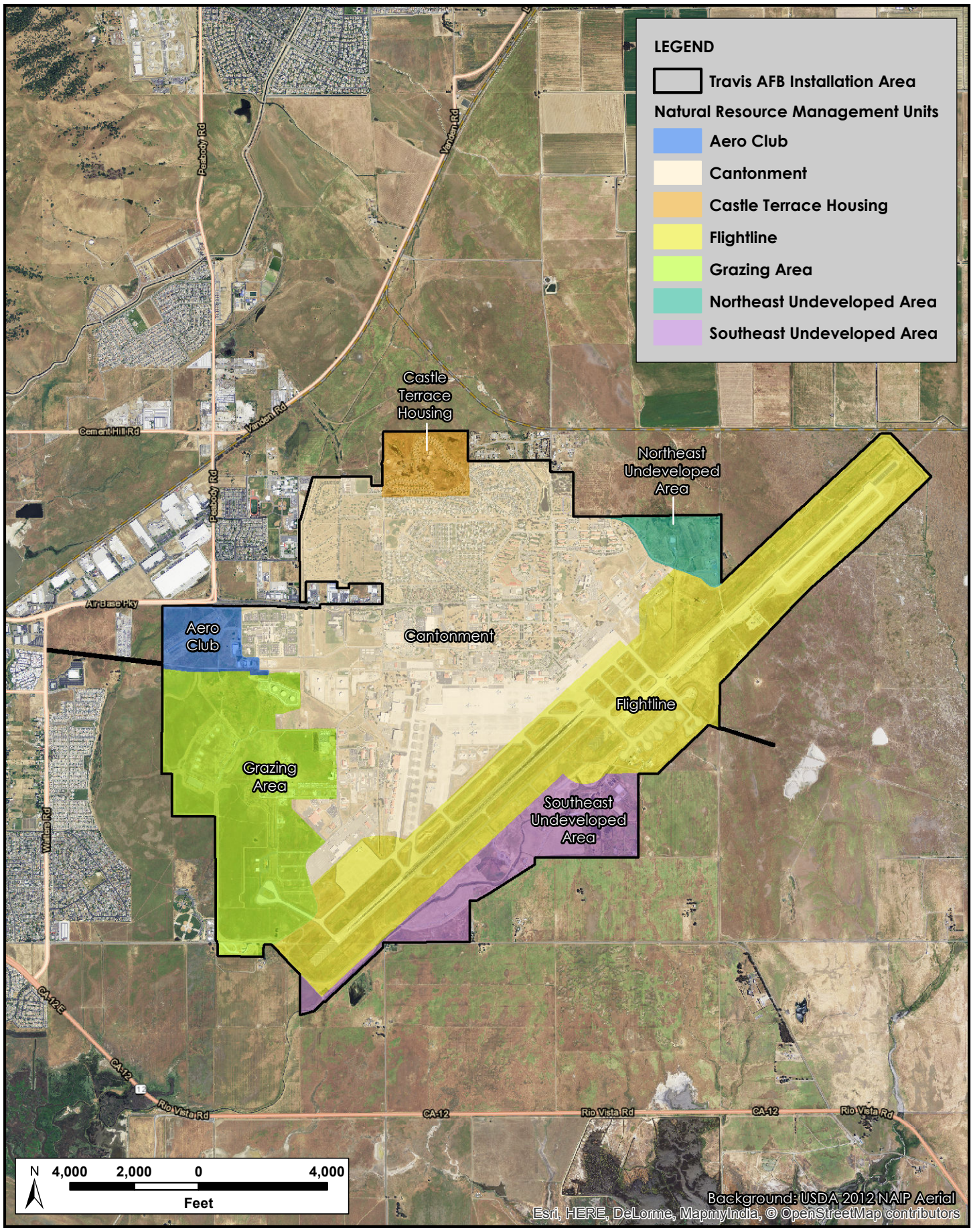
September 2014



N:\Projects3500\3539-01\02\Reports\Invasive Species Management Plan\September 2014\Figure 2 Natural Resource Management Units.mxd

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Figure 2: Natural Resource Management Units
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September 2014

1.3 Overview of Invasive Species

This Plan refers to invasive plant species as "weeds." The term includes all plants formally designated by the Secretary of Agriculture or other responsible California or federal official as such. These species usually have one or more of the following characteristics: "aggressive and difficult to manage, poisonous, toxic, parasitic, a carrier or host of serious insects or disease, and being nonnative or new to or not common to the United States or parts thereof" (U.S. Forest Service 1995). The U.S. Forest Service, the California Department of Food and Agriculture (CDFA), CDFA's Integrated Pest Control Branch, the University of California Statewide Integrated Pest Management Program, and the California Invasive Plant Council (Cal-IPC) maintain lists of plants or provide data on plants that could be considered noxious weeds. CDFA maintains a list of "noxious weeds" that are subject to regulation or quarantine by county agricultural departments; the University of California Statewide Integrated Pest Management Program lists "exotic and invasive pests and diseases that threaten California's agricultural, urban, or natural areas"; and Cal-IPC maintains the California Invasive Plant Inventory (Cal-IPC 2014).

For the purpose of this Plan, the term "weed" does not include most species of widely naturalized, nonnative annual grasses and forbs that have replaced the previously dominant native species and now provide the dominant and characteristic flora of California annual grasslands. At TAFB, these nonnative species include wild oat (*Avena* sp.) (Cal-IPC moderate impact rating [M]); ripgut grass (*Bromus diandrus*) (M); rattail sixweeks grass (*Festuca myuros*) (M); rye grass (*Festuca perennis*) (M); wild geranium (*Geranium dissectum*) (M); hare barley (*Hordeum murinum* ssp. *leporinum*) (M); Mediterranean barley (*Hordeum marinum* ssp. *gussoneanum*) (M); rose clover (*Trifolium hirtum*) (M); and other widely naturalized, nonnative plants. These species are dominant or common components of California annual grassland plant communities, either across the entire base or in selected areas. These species, along with other nonnative and native species, form the characteristic vegetation cover and structure of the grasslands at TAFB.

These nonnative annual grassland species cannot feasibly be eradicated from TAFB. Eradicating these species would require a large-scale and prohibitively expensive effort. More importantly, it would entail a substantial reduction in resources and habitat quality for native wildlife (most of which have adapted to the existing suite of dominant grassland species). Even if these nonnative grassland plant species could be eradicated from TAFB, the disturbance associated with removing these dominant species would substantially reduce habitat quality even for the remaining native plant species that compete with these nonnatives. Essentially, removing these species would lead to a highly disturbed and barren soil surface that would be extremely susceptible to colonization and infestation by additional weed species.

Therefore, this Plan focuses on using management and treatment practices to prevent and control the spread of weed species that act as, or have the potential to act as, truly damaging noxious weeds at TAFB and that do or could present a severe threat to natural habitats on the base and surrounding areas, as summarized below.

Vertebrate invasive species are referred to herein as "pests." They include any animal with a backbone, whether introduced, native, domestic, or wild, that would have negative impacts on native ecosystems and species. The only vertebrate pest targeted for management at TAFB is the American bullfrog (*Lithobates catesbeianus*). It is targeted for management because of its potential to adversely affect CTS.

1.3.1 Potential Weed Impacts

This Plan focuses on using management and treatment practices to prevent and control the spread of damaging weeds that could threaten natural habitats and native species on TAFB. The following negative ecological effects are associated with weeds:

- **Vegetation Structure Change.** Weeds could cause a permanent or long-lasting change in the environment by increasing vegetative cover or forming an impenetrable monoculture. This can create a dense vegetation and thatch layer that prevents more favorable vegetation from germinating and persisting. The infestation can essentially halt normal ecological processes that would allow an area to recover from disturbance.
- **Formation of Monocultural Stands.** Monocultures of weeds can result in the loss of mutualistic species necessary for native plant life cycles, such as seed dispersers, fossorial mammals, and pollinators. Monocultural stands of weeds also effectively exclude other plants, including native plants, from growth and germination.
- **Loss of Habitat for Special-status Plants.** Special-status plant species would not be expected to occur or persist in areas affected by dense weed infestation, and weeds could adversely affect special-status wildlife occurring on these lands.
- **Increased Fire Risk.** Weed infestations could significantly increase fire risks by providing additional fine fuels.
- **Risk of Propagule Spread.** If large infestations are allowed to develop or spread from current, smaller infestations, they could provide a source of propagules for further infestations in and near the area.

1.3.2 Potential Pest Impacts

This Plan focuses on using management practices to prevent and control the spread of American bullfrog, a species that could threaten natural habitats and native species on TAFB. The following negative ecological effects are associated with bullfrogs:

- **Direct Impacts on Native Species.** Bullfrogs are voracious generalist feeders that consume many native species of invertebrates and vertebrates, including fishes, reptiles, amphibians, water birds, and occasionally small mammals. Established bullfrog populations can compete directly with native species for limited food resources.

- **Alteration of Native Habitats.** In some cases, bullfrogs may affect aquatic vegetation production and structure and therefore nutrient cycling in native ecosystems. Pryor (2003) suggests that bullfrog tadpoles feeding on nitrogen-fixing algae may influence natural aquatic dynamics by decreasing algal biomass and nutrient cycling.
- **Introduction of Disease.** Recent research suggests that bullfrogs are host to and may spread the chytrid fungus (*Batrachochytrium dendrobatidis*), which can be severely pathogenic to native amphibians (Gervasi et al. 2013).

1.4 Summary of Vegetation Communities at Travis Air Force Base

Vegetation communities at TAFB consist of northern claypan vernal pool and California annual grassland. Plant species commonly found in vernal pools include Pacific foxtail (*Alopecurus saccatus*); annual hair grass (*Deschampsia danthonioides*); goldfields (*Lasthenia* spp.), including Contra Costa goldfields, which is federally listed as endangered; woolly-marbles (*Psilocarphus* spp.); popcorn flower (*Plagiobothrys* spp.); downingia (*Downingia* spp.); coyote thistle (*Eryngium* sp.); and spike rush (*Eleocharis macrostachya*). Special-status wildlife species identified in vernal pools at TAFB include vernal pool tadpole shrimp, which is federally listed as endangered; vernal pool fairy shrimp, which is federally listed as threatened; and CTS, which is federally and state listed as threatened. The highest quality vernal pools are in the northwestern portion of the base.

California annual grassland at TAFB is dominated by nonnative grasses and forbs, including wild oat, ripgut grass, rattail sixweeks grass, rye grass, wild geranium, hare barley, and Mediterranean barley. This plant community supports a variety of birds, reptiles, and mammals, including red-winged blackbird (*Agelaius phoeniceus*), ring-necked pheasant (*Phasianus colchicus*), northwestern fence lizard (*Sceloporus occidentalis*), Pacific gopher snake (*Pituophis melanoleucus*), and deer mouse (*Peromyscus maniculatus*).

Other plant communities include lacustrine marsh, riparian, and urban landscapes. At TAFB, marshes are mostly areas of emergent vegetation bordering the open water of ponds (lacustrine areas). Lacustrine marsh consists of emergent vegetation, such as cattails (*Typha latifolia*) and common tule (*Schoenoplectus acutus* var. *occidentalis*). Areas of open water adjacent to marshes support game fish, such as largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), channel catfish (*Ictalurus punctatus*), and green sunfish (*Lepomis cyanellus*). Riparian vegetation occurs along stream channels and banks. Dominant trees and shrubs in the riparian community at TAFB include red willow (*Salix laevigata*), arroyo willow (*Salix lasiolepis*), and coyote brush (*Baccharis pilularis*). Representative wildlife that uses this habitat includes red-winged blackbird, mallard (*Anas platyrhynchos*), Sierran treefrog (*Pseudacris sierra*), western pond turtle (*Actinemys marmorata*), and valley garter snake (*Thamnophis sirtalis fitchi*). Urban landscapes at TAFB include more than 42 species of planted trees. Wildlife found in landscaped areas includes song sparrow (*Melospiza melodia*), red-winged blackbird, killdeer (*Charadrius vociferus*), house sparrow (*Passer domesticus*), western harvest mouse (*Reithrodontomys megalotis*), and ground squirrel (*Spermophilus beecheyi*).

1.5 Summary of Weeds and Pests at Travis Air Force Base

1.5.1 Weeds at Travis Air Force Base

Weeds occurring regionally (Table 1) were identified from species in the Cal-IPC Inventory (Cal-IPC 2014) based on the experience of HTH ecologists, distribution information described in the Cal-IPC Inventory (Cal-IPC 2014), and other sources of distribution information (e.g., Consortium of California Herbaria [CCH] 2014). As described previously, for the purpose of this Plan, weeds do not include most species of widely naturalized, nonnative annual grasses because control of these species is generally infeasible and because these species can provide important habitat benefits for many native species of wildlife.

Weeds occurring on TAFB (Table 1) were identified through reconnaissance-level field surveys completed by HTH to support preparation of this Plan. HTH ecologists Hillary White, M.S., and Rebecca Nuffer, B.S., surveyed NRMUs at TAFB for weeds on 13–15 May and 16 June 2014 and documented the presence of the following weeds: barbed goat grass, black mustard, Brazilian waterweed, Eurasian water-milfoil, fennel, Italian thistle, medusa head, perennial pepperweed, purple star-thistle, treasure flower, and yellow star-thistle. Surveys focused on relatively undeveloped areas (e.g., the Cantonment NRMU was surveyed at only a cursory level) and were conducted by walking meandering transects throughout the NRMUs or by traveling along major roads and walking to vantage points when most of a given NRMU was not readily viewed from a roadway. Flat areas, drainages, areas along roads and fence lines, and areas that were previously disturbed were emphasized during mapping surveys. Although areas in the Cantonment NRMU were not emphasized during surveys, incidental observations of weeds in this area were occasionally noted and mapped. Weed cover was estimated according to cover classes described in DiPietro et al. (2002) and as presented in Table 2. The distributions of weed species mapped at TAFB at the time of the survey are shown in Figures 3–13 and described in Section 3.0. Weed infestations were mapped as points or small polygons for isolated, discrete infestations. Larger, diffuse infestations occurring regularly throughout a given NRMU were mapped according to their approximate average cover value in the NRMU.

Table 1. Weed Species Targeted for Prevention and Control on Travis Air Force Base

Common Name	Scientific Name	Cal-IPC Rating[1]	Growth Habit
Present on Travis Air Force Base			
Barbed goat grass	*Aegilops triuncialis*	High	Annual grass
Black mustard	*Brassica nigra*	Moderate	Annual forb, tall bolted stem
Brazilian waterweed	*Egeria densa*	High	Perennial aquatic forb
Eurasian water-milfoil	*Myriophyllum spicatum*	High	Perennial aquatic forb
Fennel	*Foeniculum vulgare*	High	Biennial or perennial forb
Italian thistle	*Carduus pycnocephalus*	Moderate	Annual or biennial forb
Medusa head	*Elymus caput-medusae*	High	Annual grass
Perennial pepperweed	*Lepidium latifolium*	High	Perennial forb
Purple star-thistle	*Centaurea calcitrapa*	Moderate	Annual, biennial, or perennial forb
Treasure flower	*Gazania linearis*	Moderate	Perennial forb
Yellow star-thistle	*Centaurea solstitialis*	High	Annual or biennial forb
Additional Species Prevalent in the Region			
Bull thistle	*Cirsium vulgare*	Moderate	Perennial forb
Giant reed	*Arundo donax*	High	Perennial grass
Harding grass	*Phalaris aquatica*	Moderate	Perennial grass
Himalayan blackberry	*Rubus armeniacus*	High	Shrub
Lens' podded hoary cress	*Lepidium chalepense*	Moderate - Alert	Annual or perennial forb
Milk thistle	*Silybum marianum*	Limited	Annual or perennial forb
Perennial mustard	*Hirschfeldia incana*	Moderate	Perennial forb
Poison hemlock	*Conium maculatum*	Moderate	Perennial forb
Russian knapweed	*Acroptilon repens*	Moderate	Perennial forb
Scarlet sesban	*Sesbania punicea*	High	Tree
Skeleton weed	*Chondrilla juncea*	Moderate	Perennial forb
Smallflower tamarisk	*Tamarix parviflora*	High	Tree or shrub
Spanish broom	*Spartium junceum*	High	Shrub
Stinkwort	*Dittrichia graveolens*	Moderate	Annual forb
Tall sock-destroyer	*Torilis arvensis*	Moderate	Annual forb
Tocalote	*Centaurea melitensis*	Moderate	Annual forb
Water hyacinth	*Eichhornia crassipes*	High	Perennial aquatic forb

Notes:

[1] Cal-IPC = California Invasive Plant Council. Cal-IPC ratings refer to the level of negative ecological impact presented by the species. See Cal-IPC (2014) for additional details on these ratings.

Table 2. Weed Cover Class and Percent Cover Categories

Cover Class	Percent Cover[1]
Trace, a few plants	Less than 1%
Low, occasional plants	1–5%
Moderate, scattered plants	6–25%
High, fairly dense	26–50%
Dense	51–75%
Very dense	76–95%
Solid stand	96–100%

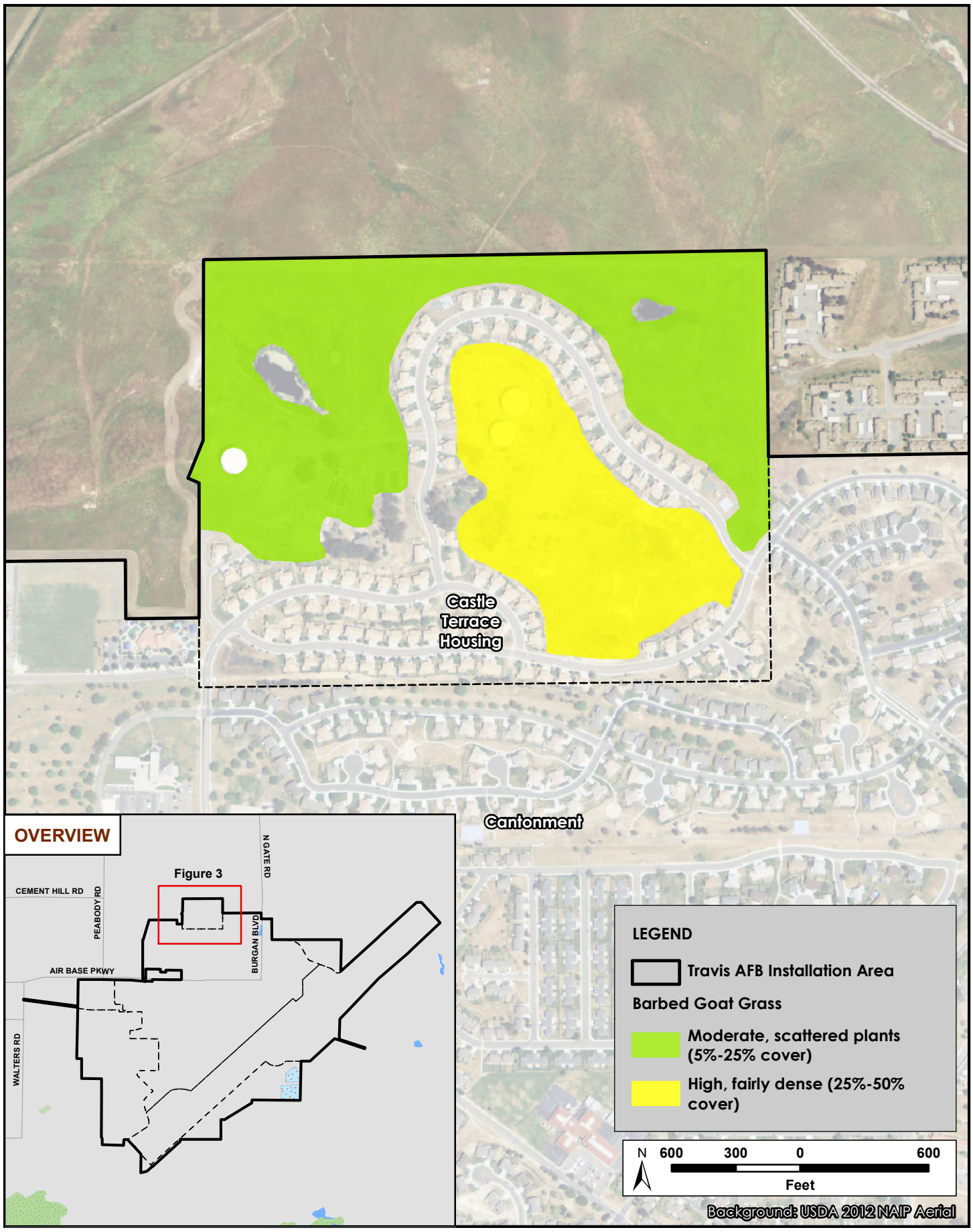
[1] Percent cover estimated using a modified Braun-Blanquet ranking scale.

Sources: Braun-Blanquet 1965; DiPietro et al. 2002

1.5.2 Pests at Travis Air Force Base

Pests that could occur on TAFB were identified based on the professional opinion and experience of HTH ecologists and on information provided by staff members of the Travis Installation Support Team (Travis IST). The American bullfrog is the only pest identified for control throughout TAFB.

HTH biologists Hillary White, M.S., and Rebecca Nuffer, B.S., conducted acoustic surveys for American bullfrog along all perennial water bodies at TAFB on 14–16 May and 13 June 2014. Because bullfrogs are active at all times of day and can be detected easily along water body margins, the HTH biologists slowly walked the perimeter of all lakes and ponds and listened for the distinctive alarm calls of adult and subadult bullfrogs. The biologists also inspected nearby open water areas to detect the presence of bullfrogs. One bullfrog call was detected at the perennial pond in the Castle Terrace Housing NRMU (Figure 14). No bullfrogs were detected anywhere else on base, including at the large duck pond on Burgan Boulevard. Despite detection of only one bullfrog at TAFB, it is highly likely that an established population exists on base, and staff members from the Travis IST have indicated that bullfrogs are a problem pest species throughout TAFB. Aquatic surveys could prove to be more definitive at characterizing bullfrog populations at TAFB.



N:\Projects3500\3539-01\02\Reports\Invasive Species Management Plan\September 2014\Figure 3 Distribution and Cover of Barbed Goat Grass.mxd

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Figure 3: Distribution and Cover of Barbed Goat Grass
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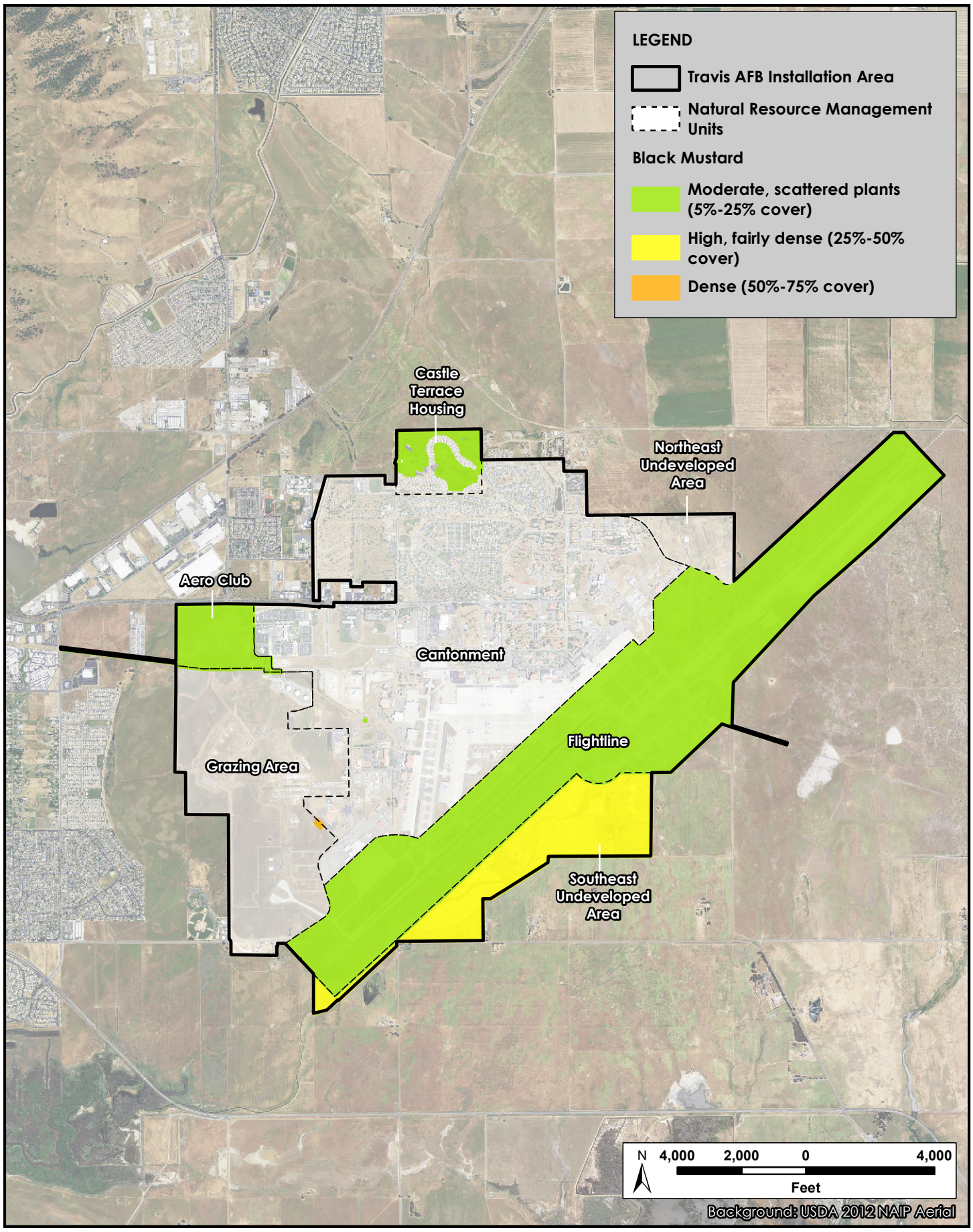
September 2014



N:\Projects3500\3539-01\02\Reports\Invasive Species Management Plan\September 2014\Figure 4 Distribution and Cover of Black Mustard.mxd

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Figure 4: Distribution and Cover of Black Mustard
Travis Air Force Base Invasive Species Management Plan (3539-02)
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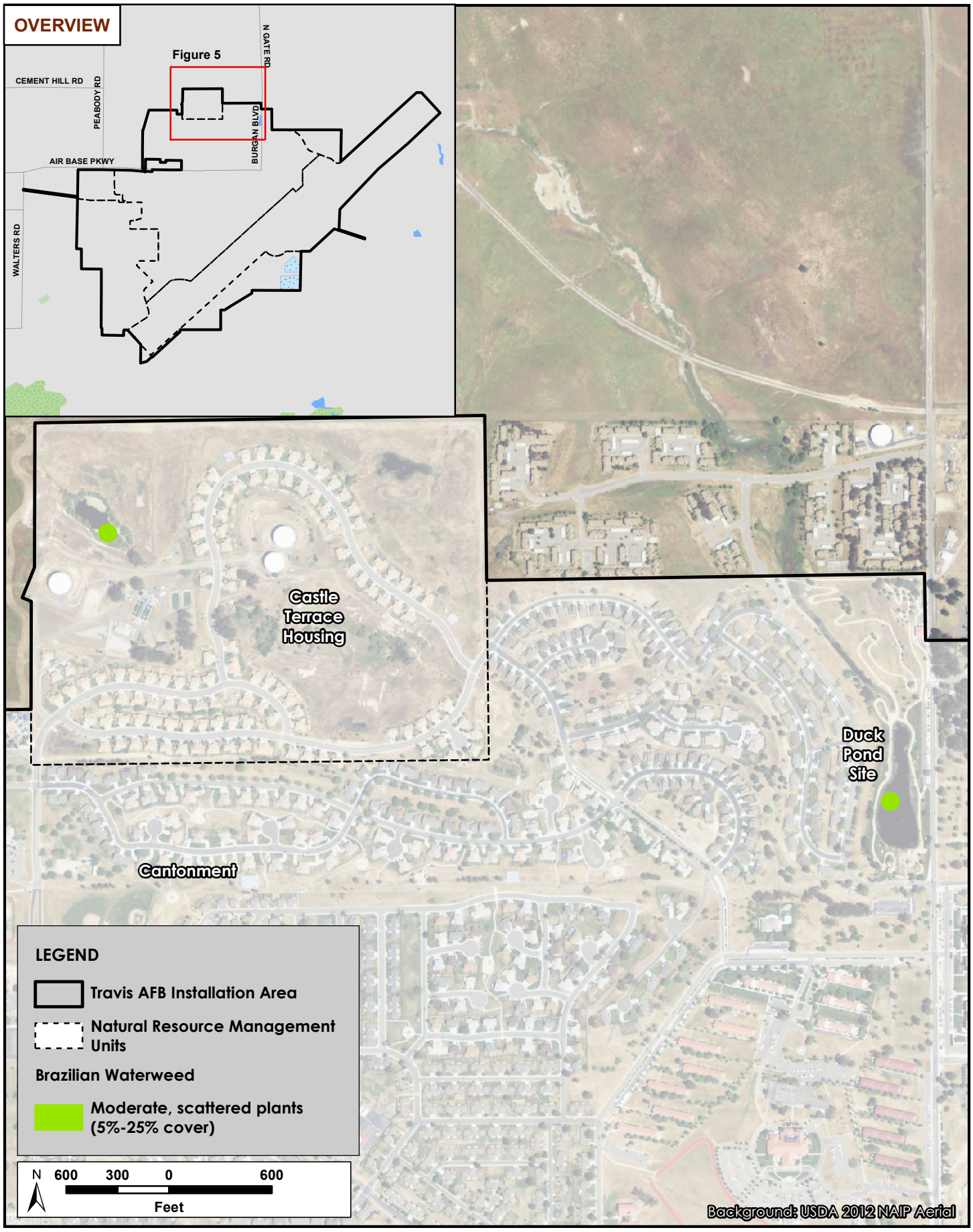

N:\Projects3500\3539-01\02\Reports\Invasive Species Management Plan\September 2014\Figure 5 Distribution and Cover of Brazilian Waterweed.mxd

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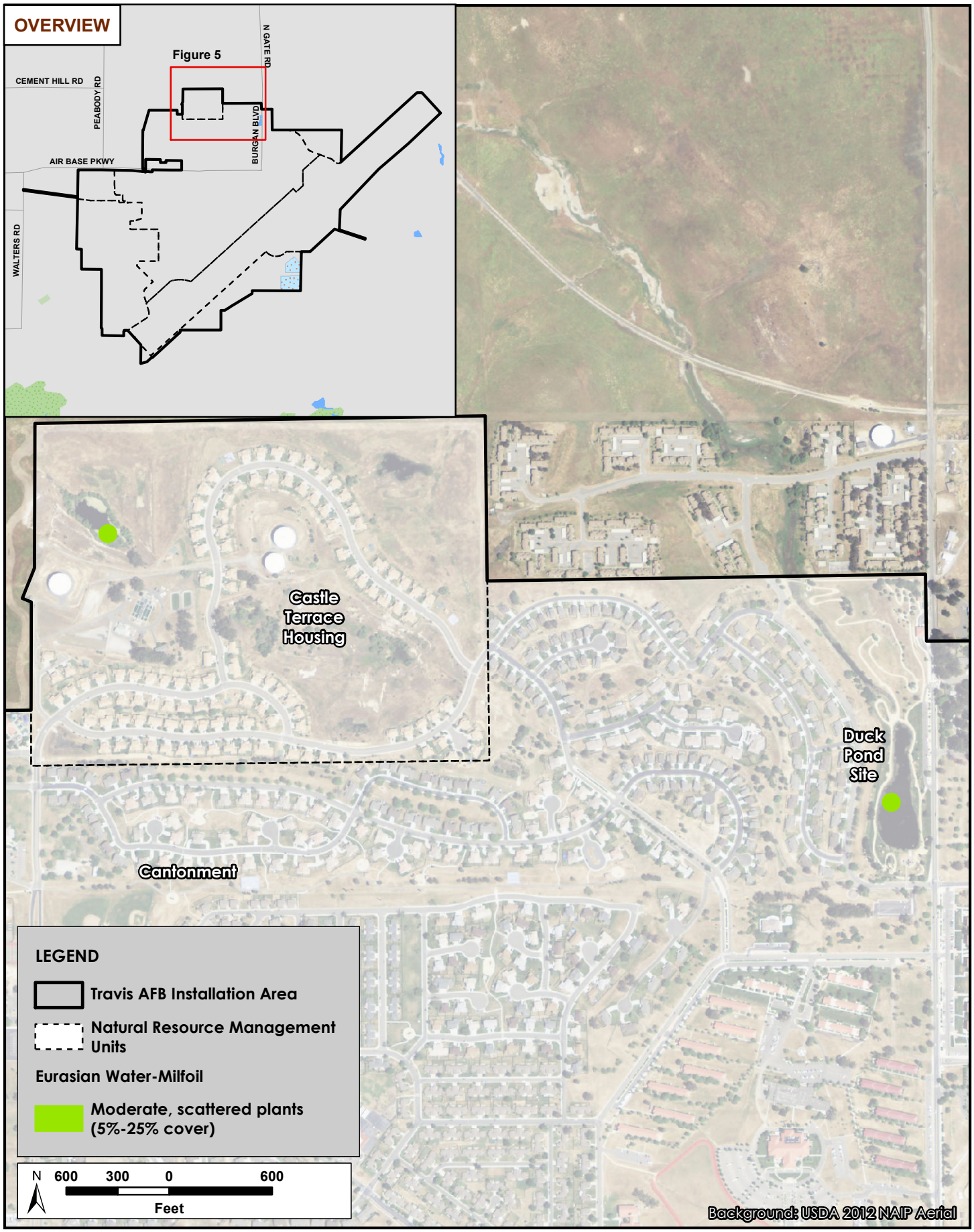
Figure 5: Distribution and Cover of Brazilian Waterweed
Travis Air Force Base Invasive Species Management Plan (3539-02)
September 2014



N:\Projects3500\3539-01\02\Reports\Invasive Species Management Plan\September 2014\Figure 6 Distribution and Cover of Eurasian Water-Milfoil.mxd

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Figure 6: Distribution and Cover of Eurasian Water-Milfoil
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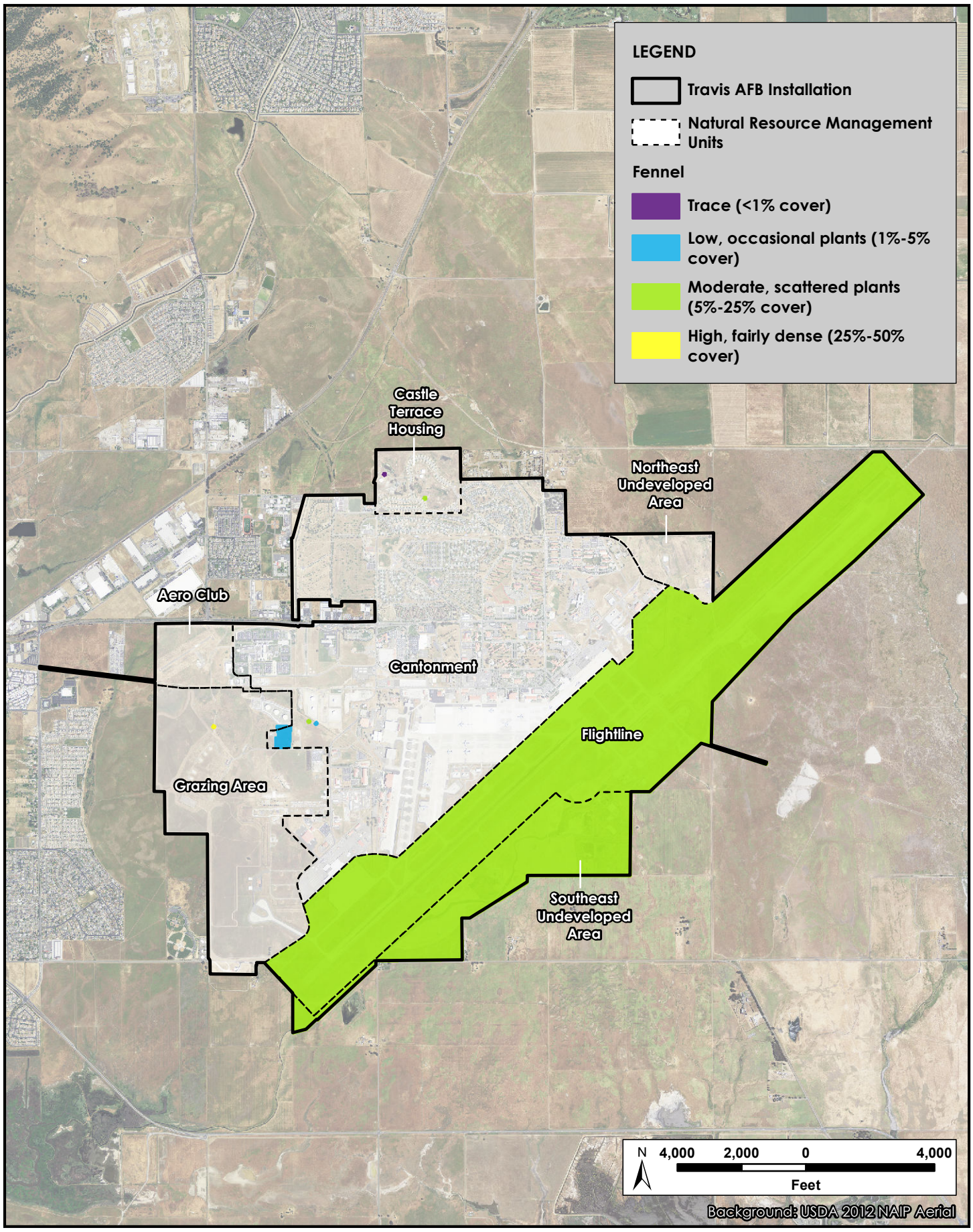

N:\Projects3500\3539-01\02\Reports\Invasive Species Management Plan\September 2014\Figure 7 Distribution and Cover of Fennel.mxd

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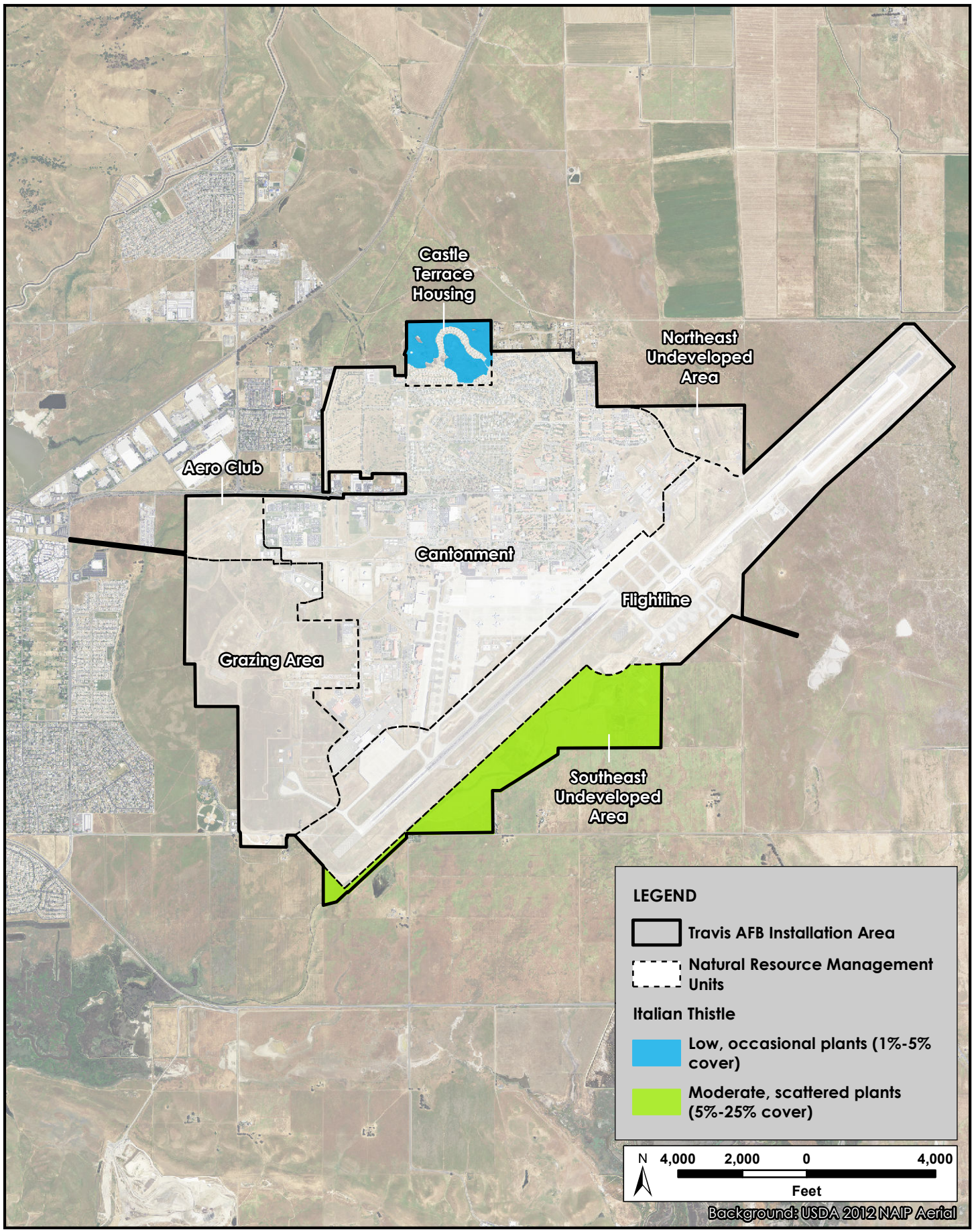
Figure 7: Distribution and Cover of Fennel
Travis Air Force Base Invasive Species Management Plan (3539-02)
September 2014



N:\Projects3500\3539-01\02\Reports\Invasive Species Management Plan\September 2014\Figure 8 Distribution and Cover of Italian Thistle.mxd

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Figure 8: Distribution and Cover of Italian Thistle
Travis Air Force Base Invasive Species Management Plan (3539-02)
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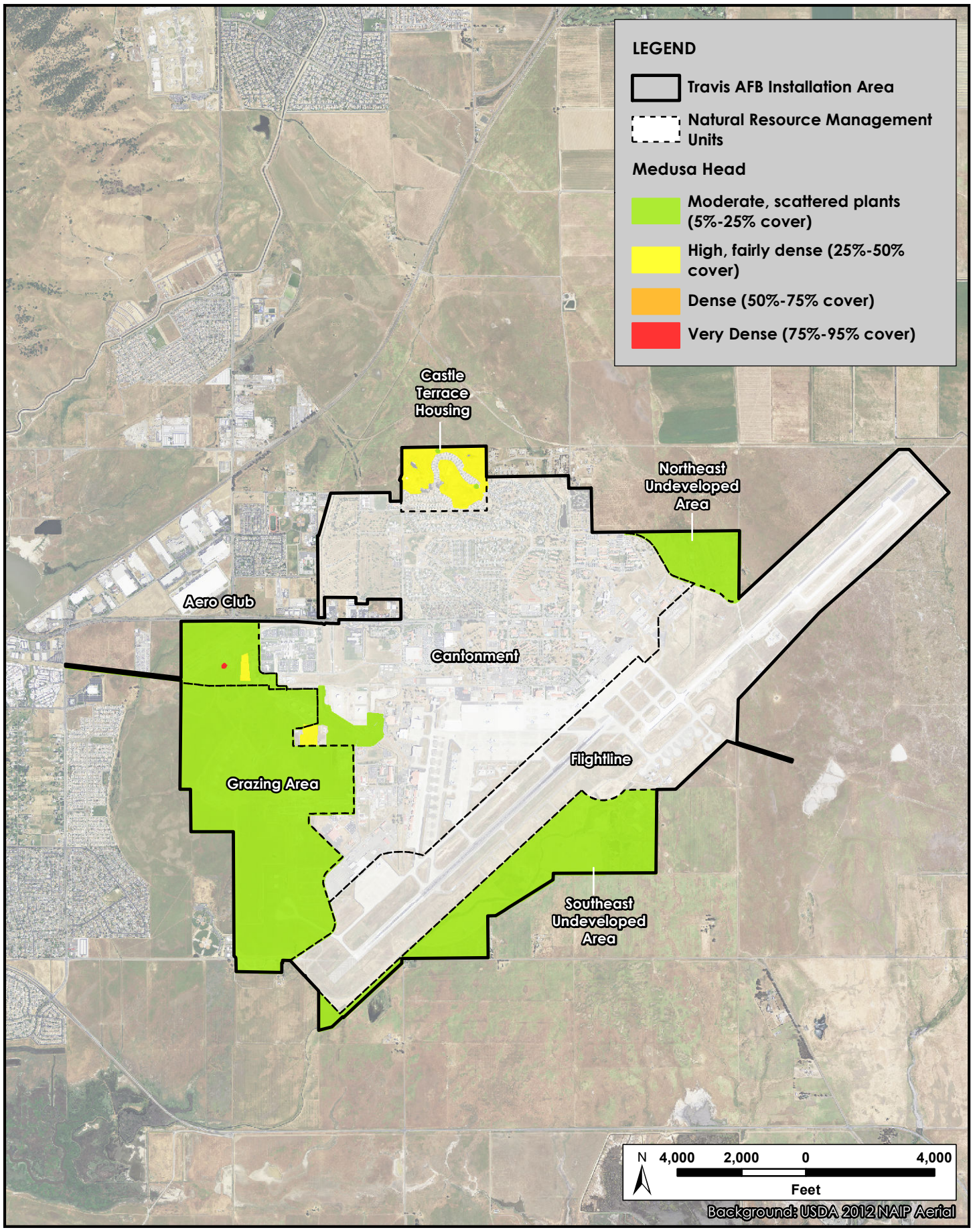

N:\Projects3500\3539-01\02\Reports\Invasive Species Management Plan\September 2014\Figure 9 Distribution and Cover of Medusa Head.mxd

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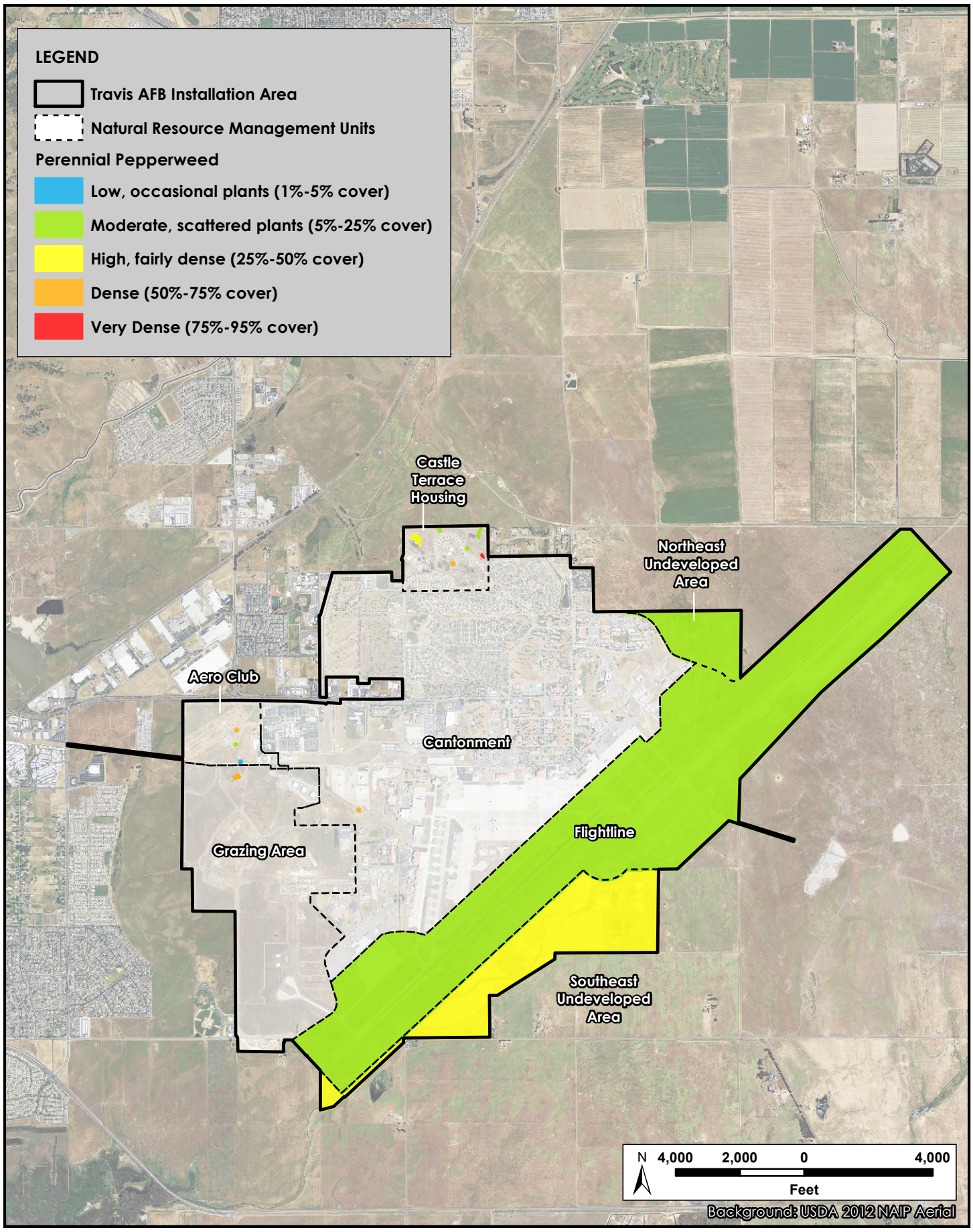
Figure 9: Distribution and Cover of Medusa Head
Travis Air Force Base Invasive Species Management Plan (3539-02)
September 2014



N:\Projects3500\3539-01\02\Reports\Invasive Species Management Plan\September 2014\Figure 10 Distribution and Cover of Perennial Pepperweed.mxd

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Figure 10: Distribution and Cover of Perennial Pepperweed
Travis Air Force Base Invasive Species Management Plan (3539-02)
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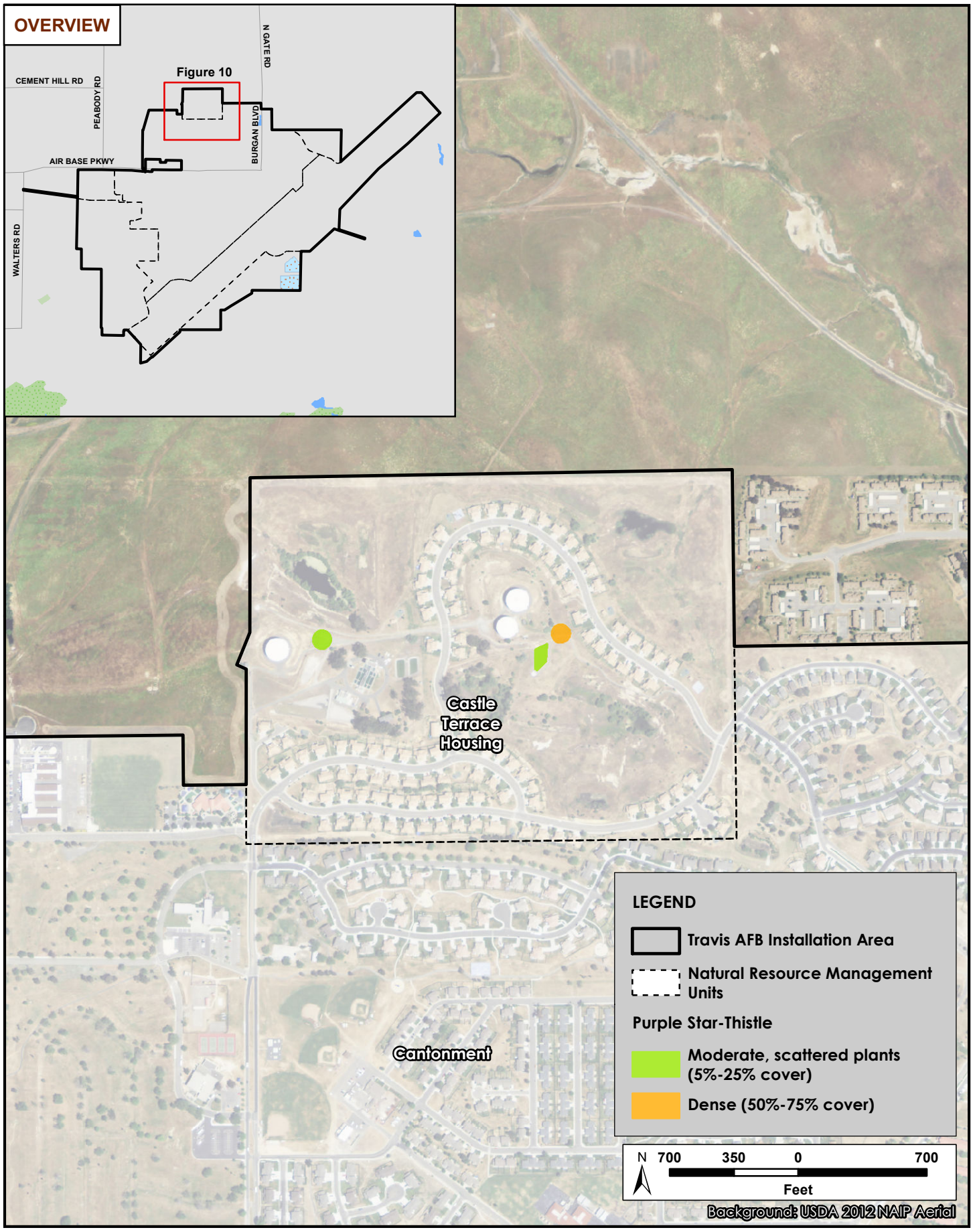

N:\Projects3500\3539-01\02\Reports\Invasive Species Management Plan\September 2014\Figure 11 Distribution and Cover of Purple Star-Thistle.mxd

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Figure 11: Distribution and Cover of Purple Star-Thistle
Travis Air Force Base Invasive Species Management Plan (3539-02)
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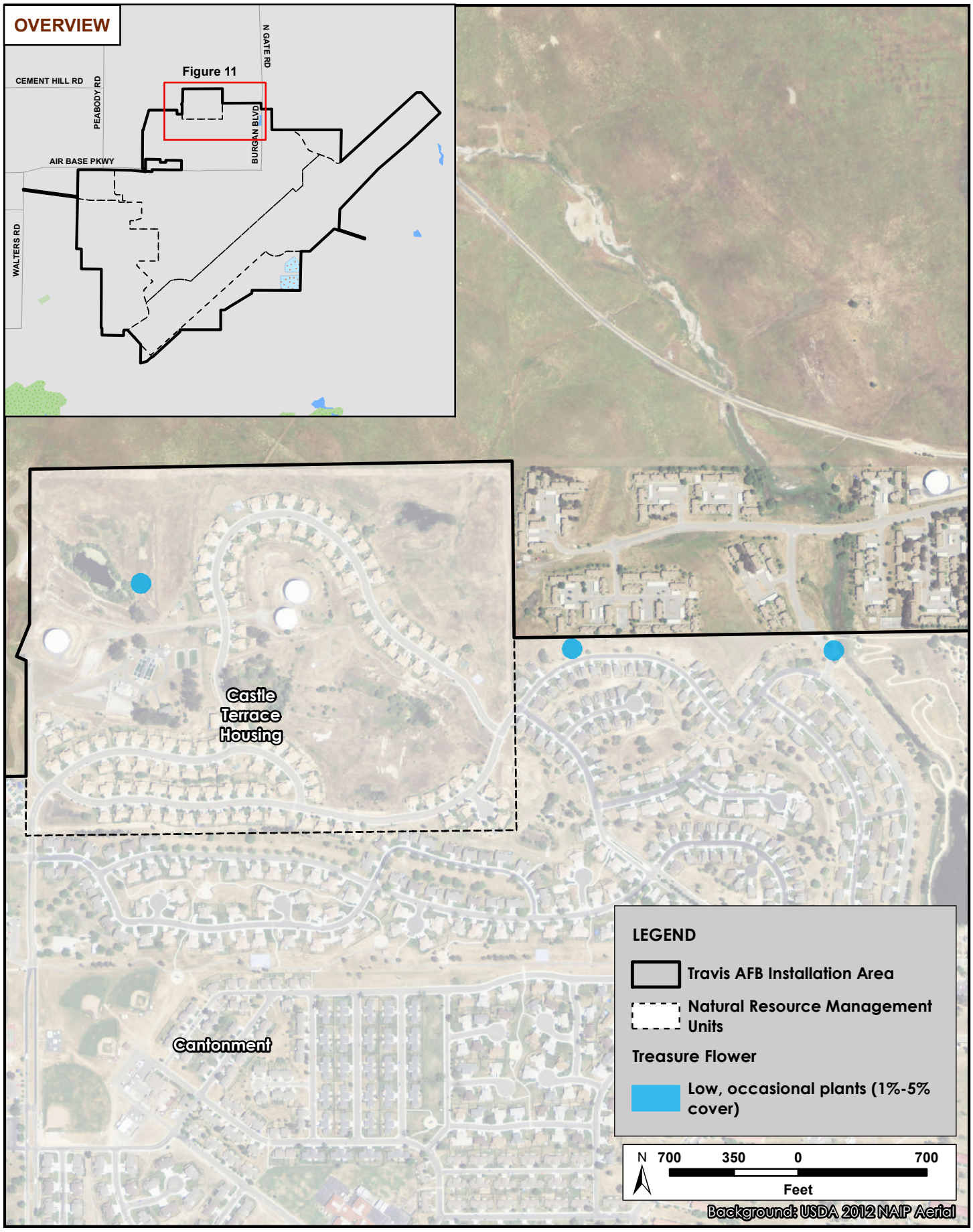

N:\Projects3500\3539-01\02\Reports\Invasive Species Management Plan\September 2014\Figure 12 Distribution and Cover of Treasure Flower.mxd

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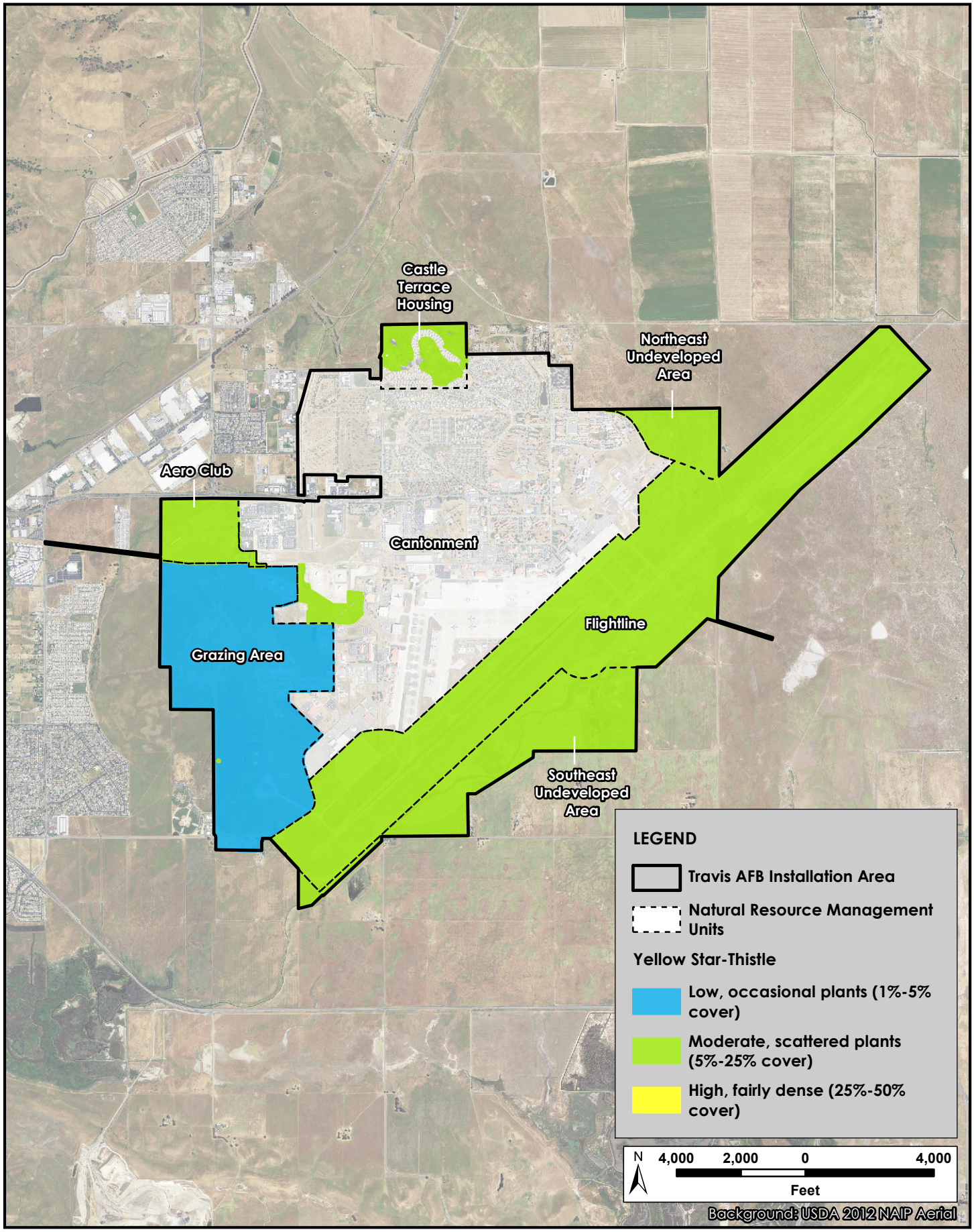
Figure 12: Distribution and Cover of Treasure Flower
Travis Air Force Base Invasive Species Management Plan (3539-02)
September 2014



N:\Projects3500\3539-01\02\Reports\Invasive Species Management Plan\September 2014\Figure 13 Distribution and Cover of Yellow Star-Thistle.mxd

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Figure 13: Distribution and Cover of Yellow Star-Thistle
Travis Air Force Base Invasive Species Management Plan (3539-02)
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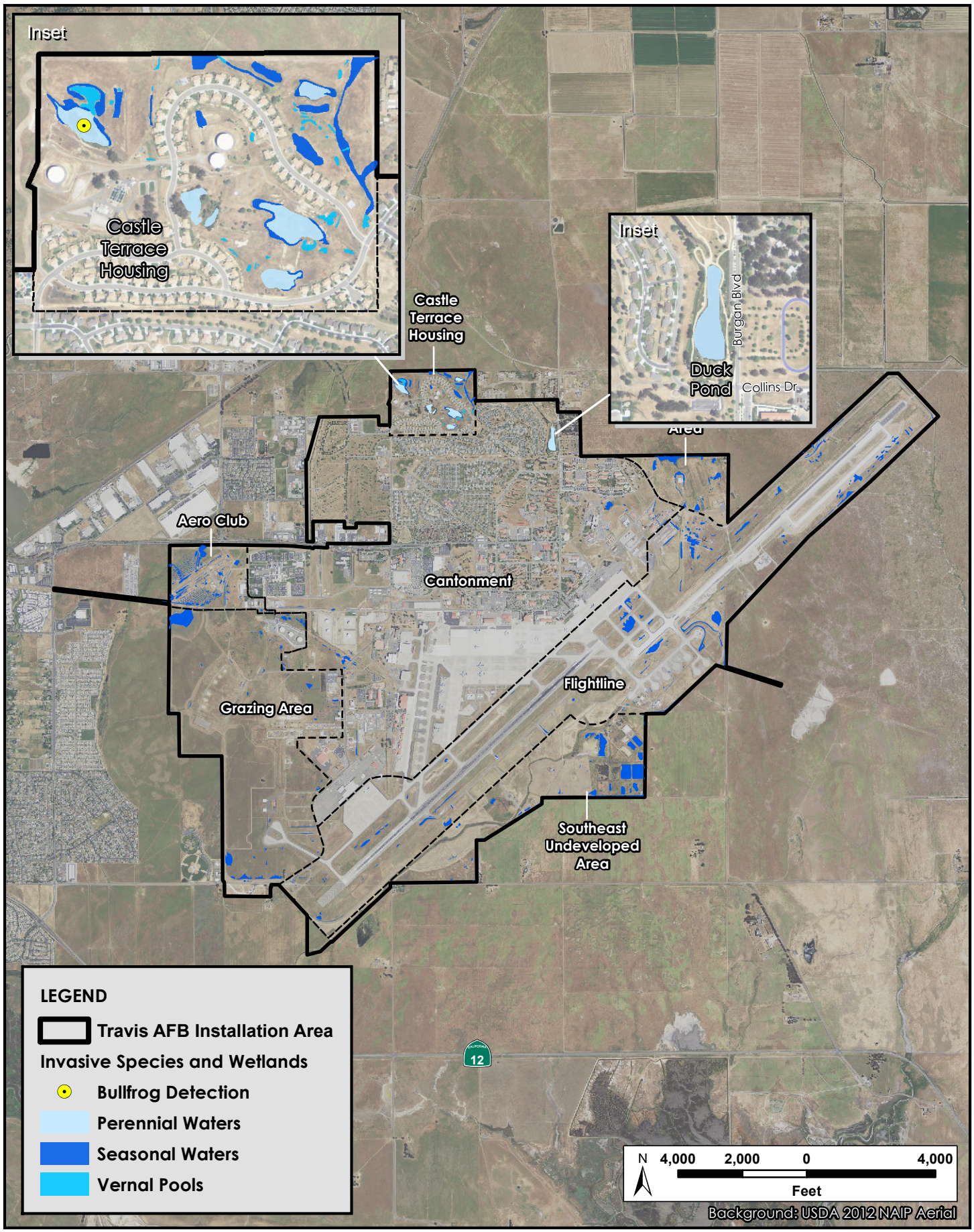

N:\Projects3500\3539-01\02\Reports\Invasive Species Management Plan\September 2014\Figure 14 Occurrence of American Bullfrog.mxd

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Figure 14: Occurrence of American Bullfrog
Travis Air Force Base Invasive Species Management Plan (3539-02)
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Section 2. Weed and Pest Control Practices

2.1 Weeds

Recommended management actions to prevent, treat, and monitor weed infestations in TAFB are described below. Implementation of these management actions should be overseen by an individual (or individuals) with education or training sufficient to allow the person to identify target weed species occurring on the installation and to recommend and oversee weed treatment. This weed advisor may be TAFB enlisted, civilian, or TAFB IST personnel. The weed advisor's role will be to conduct ongoing monitoring efforts; prescribe and evaluate weed control efforts in each NRMU; oversee and contribute to the completion of the weed control logs; coordinate with contractors hired to eradicate weed populations, including any California licensed qualified applicators (LQAs) employed to apply herbicides; coordinate (as needed) with a qualified plant or wildlife ecologist to ensure that all weed treatments avoid adverse effects on federally listed species, wetlands, and other sensitive biological resources; and evaluate efficacy of weed control efforts. The role of the weed advisor is described further in the following sections.

2.1.1 Prevention Approach

The first goal of weed control at any site is prevention of new infestations. New weed infestations cannot occur if no weed propagules occur in the area. Therefore, a primary consideration should always be to prevent or minimize (to the extent feasible) the introduction of new weeds onto the site (e.g., through the unintentional spread of seeds or other reproductive plant parts, such as rhizomes and stolons).

A major and controllable pathway by which humans introduce propagules into natural areas is by means of vehicles, equipment, and personnel. Therefore, actions to remove weed seeds from vehicles and equipment are important in preventing the spread of weeds. It is also important to remove weed infestations from frequently used travel routes leading into the interior of the site, such as along roads and staging areas. These actions are important because infestations in these locations can easily contribute to the spread of weeds to other areas throughout the base.

Other potential pathways for introduction of weed propagules should be considered and addressed. For example, fill soils should not be imported to the site from borrow pits already infested with weeds. All seed mixes and straw used in revegetation efforts should be weed-free mixes and weed-free rice straw, and supplemental feed used for any livestock grazed on the site should be imported from areas that do not support dense weed populations.

Maintenance of each NRMU's natural impediments to weed establishment also should be encouraged. Because soil disturbance contributes so heavily to weed establishment, it should be minimized wherever

possible. Also, because increased nutrient and water availability facilitates weed establishment, care should be taken to avoid or minimize such inputs to these semiarid habitats.

2.1.1.1 Prevention BMPs

The following BMPs are recommended for the prevention of weed infestations at TAFB:

- **Weed BMP 1**: All seed, straw, and other erosion control materials should be certified weed free.
- **Weed BMP 2**: "Shaker plates" or similar devices should be installed in roads near entrances to construction sites and other areas of ground disturbance and construction equipment access on TAFB. Shaker plates are corrugated plates that vibrate and loosen seeds and soil attached to vehicles and equipment. Seeds and soil shaken loose from the vehicles and equipment are collected below the shaker plates. The plates should be monitored for the growth of weedy species (Weed BMP 13), and any weeds observed to be germinating should be sprayed with an appropriate herbicide following the guidelines described below (Section 2.1.5) as needed to prevent growth and the formation of seeds. Soil accumulating below the shaker plates should be periodically removed to retain the effectiveness of the shaker plates.
- **Weed BMP 3**: Tools used to manage or control vegetation, such as chainsaws, hand clippers, and pruners, should be washed before being used on TAFB and before being moved from one location to another (i.e., from one weed treatment site to another).
- **Weed BMP 4**: Heavy equipment brought onto TAFB should be washed before use and before being moved from one location on the installation to another (i.e., from one construction site to another).
- **Weed BMP 5**: If applicable, any supplemental feed (e.g., hay) provided to livestock should be certified weed free.
- **Weed BMP 6**: Weed BMPs 1–5 should be incorporated into permits (e.g., dig permits), leases, contracts, and similar agreements between TAFB and its contractors as appropriate.

2.1.2 Treatment Approach

The control of weeds will focus on three strategies. The first strategy is to monitor the NRMUs so that new infestations can be quickly identified. Smaller infestations (i.e., incipient infestations) should be removed before they become large; larger infestations that have been established for a longer period of time are much more difficult to treat because they have created a large reserve seed bank. In addition, these infestations can themselves become troublesome propagule sources that may allow the spread of the infestation to other areas of the site. Because control methods can themselves cause some disturbance, the effects of removing large infestations must be monitored to assess further weed issues.

The second strategy is to control weed species at a time that effectively interrupts that particular species' life cycle. In general, this is almost always earlier in the growing season (e.g., late winter or early spring), before the plant has begun to reproduce or when the plant has produced 5% or less of its total seed. Also, it is typically more effective and much easier to eradicate weeds before a large taproot or other underground storage structure has developed, from which the plant can resprout after control techniques have been applied.

The third strategy is to establish control methods that include monitoring areas after weeds have been treated and being prepared to retreat infestations multiple times. This strategy is necessary because weed infestations almost always require multiple treatments to eradicate the latent seed bank. Initial treatments of infestations may be most effective if employed twice in a year, which will kill individuals that germinate or recover (resprout) after the earlier treatment.

Weed populations can be controlled using several methods, each with specific benefits and drawbacks:

- **Hand/Mechanical Removal.** Hand removal methods or the use of small hand-powered or handheld equipment (such as a Weed Wrench or weed whacker) is often the first method considered for removing small or new weed infestations. If hand removal methods are found to be ineffective, or the weed is too widespread for hand removal to be practical, then more intensive mechanical methods, such as mowing, may be effective. Whole weed plants removed using Weed Wrenches, and weed material left over from weed-whacking or mowing efforts, should always be collected and disposed of in a manner that prevents spread to other areas. This step is not critical if the weeds were treated before they produced viable propagules unless the weed is capable of vegetative reproduction (e.g., perennial pepperweed and many floating aquatic weeds).
- **Fire Management.** Some weed infestations may be effectively treated using handheld propane torches to treat seedlings. This method should be applied carefully and used only in winter or spring during or following rain events so that there is no risk of wildfire. Torching may be best employed as a retreatment method to control new individuals germinating from a latent seed bank where an infestation was identified and treated the previous year. This method can be used to kill small seedlings that have recently germinated, before the seedlings have begun to flower or have gotten too large to easily kill using brief heat. This treatment can reduce the seed bank in the soil by killing the germinated seeds and preventing weed reproduction that would lead to additional seed production during that year. The method has the advantages of requiring relatively low effort and being precise. It kills weeds before propagules have been set and therefore does not require the collection and disposal of weed material. Also, it does not involve the use of chemicals that could affect surrounding vegetation and wildlife.

  Prescribed burns are also useful for controlling some species, particularly those present over large areas (e.g., tens to hundreds of acres). In addition, prescribed fire reduces hazardous fuel loads, recycles nutrients back into the soil, promotes several native fire-adapted species, and may help reduce the reestablishment of invasive species (DiTomaso and Johnson 2006). Prescribed burns require careful

planning, coordination, and implementation to ensure success and may not be feasible in some portions of TAFB because of potential conflicts with mission-critical operations.

- **Herbicides.** Herbicides are often used for the effective management of dense or large weed infestations. This method can often successfully control infestations that cannot be effectively or reasonably controlled through other management actions. Consideration should be given to the herbicide's potential effect on the surrounding vegetation, habitats, and wildlife. Some herbicides should never be used where they may contaminate water bodies or wetlands. Preemergent herbicides are used before weeds germinate, such as during fall before the rainy season has begun, whereas postemergent herbicides are used when the weed plants have germinated and are actively growing. Herbicides must always be applied according to local and State regulations. Specifically, unless exemptions apply, the use of herbicides must be prescribed by a California licensed pest control advisor (PCA), and all herbicide application must be overseen by an LQA. An overview of California's licensing requirements for herbicide use may be found online (http://www.cdpr.ca.gov/docs/license/liccert.htm).

- **Biological Controls.** Livestock grazing during specific times can help control populations of nonnative plant species, including medusa head and other annual grassland species. Moderate grazing of nonnative annual grasses reduces cover and thatch that inhibit native plant species from germinating and growing and can prevent the formation of some types of weed infestations. Well-timed intensive grazing can also help to control infestations of weeds. However, overgrazing and extensive livestock use can also contribute to disturbance that may favor weed colonization. Some weed seeds can also pass through the digestive system of livestock without harm and be deposited in other areas with feces, creating another pathway for the spread of infestations.

- **Soil Solarization.** Heating soil to high temperatures can effectively kill many weed seeds. This method involves removing the aboveground vegetation so that only short vegetation or bare soil remains. Clear polyethylene plastic is then placed in the area during times of year when high amounts of solar radiation and high temperatures are expected, typically in July and August. The plastic is placed so that it covers the entire infestation and about 2 feet beyond the edges of the infested area, and the sheet is pulled tight over the ground. The plastic must then be left in place for at least 4–6 weeks. Although this method has the disadvantage of killing all other vegetation that may be present in the area, it can also reduce the amount of retreatment needed by killing much of the latent seed bank. This method is also most effective when used on moist soils; if soils cannot be kept moist during treatment, weeds are less likely to be controlled.

Section 3.0 describes the benefits and drawbacks of these methods for each weed species of concern.

2.1.2.1 Weed Population Profiles and Evaluation Matrix

In general, weed populations may be classified as incipient populations, widespread populations, and ubiquitous populations. Incipient populations are frequently the easiest and the least expensive to control because the species has not yet spread to many locations or established in great numbers. Widespread populations are more problematic because they have already spread to numerous locations and without quick abatement action are likely to quickly expand and cause extensive ecological harm. Small infestations (i.e.,

localized patches) of widespread plant populations should be removed first before they expand and substantially spread propagules. In addition, infestations that are likely to spread into uninfested areas of high sensitivity (e.g., vernal pool or other habitats for rare species) should be removed at the earliest opportunity.

Ubiquitous populations are the most difficult to control. In many cases, these species may have already caused substantial habitat degradation or other damage and may still be expanding; therefore, control may be difficult or impossible and, accordingly, very costly. For control to be effective, a long-term (e.g., 10-year) plan for containment often will be needed. Populations of ubiquitous weeds generally should be treated only when they pose significant threats to natural resources and long-term control of that weed population is feasible.

Additionally, several of the identified weed species have greater potential for spread (i.e., the potential to be invasive) because of their prolific seedling recruitment potential; rapidly spreading or creeping, perennial, root systems; rapid compensatory growth rates; reduced susceptibility to non-herbicidal control measures; or dual reproductive ability (i.e., sexually from seedling recruitment, and asexually from root sprouting and/or tillering following plant injury). With these biological plant characteristics, there is potential for more rapid spread on- and off-site, with resultant greater impact to increased infested acreage over time. These species should receive higher priority for initial treatment, particularly when considered in combination with temporal and spatial infestation characteristics for incipient or concentrated and confined patches of widespread species (as described above).

Preparation of an evaluation matrix aids in prioritizing weed populations for treatment. Such a matrix should list target weed species, the potential impact of each species on ecosystem functions, the potential for invasiveness, the relative cost to control each species, and the population profile type. These attributes would be used to prioritize species for treatment (see Section 4.1.3).

The matrix ultimately used by TAFB's staff should build off the preliminary matrix presented in Table 3, which should be verified and revised, if needed, throughout Plan implementation.

Table 3. Preliminary TAFB Invasive Plant Evaluation Matrix

Species	Ecosystem Effects[1]	Invasiveness[1]	Cost to Control[2]	Population Profile[3]
Barbed goat grass *(Aegilops triuncialis)*	A	A	Moderate to high	U
Black mustard *(Brassica nigra)*	B	B	Moderate to high	U
Brazilian waterweed *(Egeria densa)*	A	A	Moderate to high	I
Eurasian water-milfoil *(Myriophyllum spicatum)*	A	A	Moderate to high	I
Fennel *(Foeniculum vulgare)*	A	B	Low to moderate	WS
Italian thistle *(Carduus pycnocephalus)*	B	B	Low to moderate	WS
Medusa head *(Elymus caput-medusae)*	A	A	Moderate to high	U
Perennial pepperweed *(Lepidium latifolium)*	A	A	Moderate to high	U
Purple star-thistle *(Centaurea calcitrapa)*	B	B	Low to moderate	I
Treasure flower *(Gazania linearis)*	B	B	Low to moderate	I
Yellow star-thistle *(Centaurea solstitialis)*	A	B	Moderate to high	U

Notes:

[1] Ecosystem effects and invasiveness determined from California Invasive Plant Council's (Cal-IPC's) plant assessment forms (Cal-IPC 2014):

A = severe.

B = moderate.

[2] Cost to control based on professional judgment of H. T. Harvey & Associates biologists:

Moderate to high = Species with persistent seed banks or high seed output and/or species that require costly methods (e.g., prescribed burning, specialized herbicides) of treatment or are difficult to treat because they grow close to native plants.

Low to moderate = Species that can be controlled through hand removal or general herbicides and that are best treated during times when unintended adverse impacts on native species are easily avoided.

[3] Profile Type

I = Incipient (i.e., just beginning)—few small infestations; less than 0.1 acre average infestation size, fewer than 100 infestations, and less than 1 acre in total extent. These are presumed to be recent introductions or those relatively contained thus far.

WS = Widespread—many small infestations; less than 0.1 acre average infestation size, more than 100 infestations, and more than 1 acre in total extent. These are weeds that have spread rapidly and are now beginning to grow in infestation size.

U = Ubiquitous—few to many large or continuous infestations; greater than 0.1 acre average infestation size and more than 5 acres total extent. These are weeds that have already spread and grown considerably in infestation size.

2.1.2.2 Treatment BMPs

The following weed treatment BMPs should be employed as needed during operation and maintenance activities at TAFB:

- **Weed BMP 7**: All plant debris potentially containing reproductive plant parts (i.e., seeds or plant fragments for species that reproduce vegetatively) removed using mechanical methods should be disposed of at an offsite landfill or green waste facility in such a manner as to prevent the potential spread of seeds or other propagules from the collected materials to other locations. This action may require, but is not limited to, bagging the material before it is transported within or off the site.
- **Weed BMP 8**: Weed control efforts should be prioritized and should focus on the eradication of incipient populations throughout the base and the management and control of other populations, particularly populations with the potential to adversely affect federally listed species.
- **Weed BMP 9**: In general, the most intensive weed control efforts should be timed annually to effectively reduce weed seed production. Activities should be conducted when flowering has just started but before viable seeds have been produced. See Section 3.0 for specific relevant information on the biology, phenology, and a range of appropriate control methods for each weed species of concern.
- **Weed BMP 10**: Any weed control efforts required to occur in summer and fall, when many or most weed plants have matured and set seed, should employ mechanical methods to remove established weed plants.
- **Weed BMP 11**: Unless specific exemptions apply, any weed control using herbicides should be prescribed by a licensed PCA and should follow the guidelines described below. The PCA will determine the appropriate herbicide in accordance with these BMPs and applicable California and Solano County regulations.
    a. The weed advisor will be responsible for evaluating the suitability of spraying herbicides on any given day.
    b. The California Department of Pesticide Regulation has the authority to place special controls on the restricted pesticides to limit their use to trained individuals and their application to only times and locations approved by the county agricultural commissioners. To determine whether or not a pesticide is restricted, it is necessary to check the California Department of Pesticide Regulation Pesticide Products Registered as Restricted Materials database at http://apps.cdpr.ca.gov/label/restricted.cfm. If a restricted herbicide will be used, a restricted materials permit will be required.
    c. TAFB either should either hire a business with a valid Pest Control Business License to apply herbicides or should ensure that an employee with an appropriate Qualified Applicator License or Certificate (QAL or QAC) will apply all herbicides. In addition, all herbicide applicators must have

the proper training (annual and refresher) to handle and apply the specific type of herbicide each time that it will be used and must adhere to all applicable California laws regarding reporting, training, worker safety, and other requirements as stipulated in California regulations.

d. All herbicide application should be done according to the restrictions outlined in this Plan and the restrictions set forth by the State of California and the county agricultural commissioner permit requirements, as well as the manufacturers' directions. Herbicides should be mixed and applied in conformance with the product manufacturers' directions. The herbicide applicator should be equipped with splash protection clothing and gear, chemical-resistant gloves, chemical spill/splash wash supplies, and material safety data sheets for all hazardous materials to be used.

e. Herbicides should not be applied when wind speeds exceed 10 miles per hour. If spray is observed to be drifting to a nontarget location, spraying should be discontinued until conditions causing the drift have abated.

f. Herbicides should not be applied when standing water is present in the area or during or within 72 hours of a recent or predicted rain event, unless such spraying has been approved by the PCA.

g. Consultation with a qualified wildlife or plant ecologist (as appropriate and if the weed advisor is not qualified to fill this role) should be sought immediately before all planned weed herbicide use to determine whether potentially sensitive biological resources are located in the vicinity of proposed treatment areas. If sensitive biological resources (e.g., wetlands, rare plants, CTS, migratory bird nests) are found in or adjacent to planned herbicide use areas, the weed advisor (or plant or wildlife ecologist) should prescribe activity avoidance buffers or other appropriate measures (e.g., appropriately timed herbicide application) as needed to avoid all potentially adverse effects on these resources. If recommended, buffers should reflect California or federal requirements for avoidance buffers (e.g., a 250-foot buffer around potential federally listed vernal pool branchiopod habitat) or be based on the professional opinion of the weed advisor/qualified plant or wildlife ecologist, as appropriate. As discussed above, it is anticipated that TAFB will initiate consultation with USFWS regarding the potential effects of weed treatments on federally listed species and that appropriate measures to avoid and minimize adverse effects on listed species will be developed during the consultation process. When (or if) these measures are developed, they will replace the general guidelines described above.

h. The use of residual herbicides (i.e., herbicides having soil activity) should be prohibited within areas where sensitive plants (e.g., plants federally listed as threatened or endangered) could be adversely affected.

- **Weed BMP 12**: Treatment of all prioritized weed populations should occur at a minimum of once annually. Prioritized infestations should be retreated in consecutive years with the goal of fully eradicating discrete populations. When no new seedlings or resprouts are observed at treated sites for 3 consecutive normal-rainfall years, the weed population can be considered eradicated, and weed control efforts may cease for that infestation site.

2.1.3 Monitoring Approach

TAFB should be monitored for weed infestations by the weed advisor regularly. Specific, recommended monitoring tasks are described below.

2.1.3.1 Monitoring BMPs

The following BMPs are recommended for the monitoring weed infestations at TAFB:

- **Weed BMP 13**: The weed advisor should conduct regular inspections for weeds in the NRMUs, along major travel corridors, in active construction sites and other areas of ground disturbance, and along waterways. The frequency and intensity of weed inspections are expected to vary each year, based on the amount and timing of precipitation. In general, it is expected that the weed advisor will conduct inspections in late winter/early spring and late summer/early fall. The weed advisor should provide recommendations for specific weed control actions based on these inspections and should determine the effectiveness of ongoing weed control actions to determine whether contingency actions are needed.
- **Weed BMP 14**: The weed advisor should consult with qualified individuals (e.g., a PCA), if needed, to prescribe weed control treatments. In general, treatments should include a series of efforts in the late winter and early spring, when infestations identified by inspections are targeted for control actions, after weeds have germinated but before viable seeds have formed. Less extensive weed control actions that may take place at other times of the year include summer and fall control actions, such as soil solarization and tumbleweed removal.
- **Weed BMP 15**: The weed advisor should compile a weed control log. Contractors employed to carry out weed control actions may be required to fill in applicable elements, but the weed advisor should be responsible for overseeing the completion of all required elements and preparing the log. Also, the weed advisor should revisit control sites as needed to evaluate and document control efficacy.

  The weed control log should include a description of each weed control treatment enacted for each infestation, including:

  - Date(s) of control action
  - Species and population size of infestation
  - Description of whether it was an initial control effort for that infestation or an action recommended as a follow-up treatment
  - Location of infestation
  - Method used (e.g., hand pulling, mowing, herbicide type and application rate, solarization)
  - Personnel involved in the action (contractor, LQA, PCA, or other)
  - Time of treatment (i.e., start and end time)

- Climatic conditions, such as temperature, rainfall, and wind speed
- The results of consultations with the plant or wildlife ecologist conducted for Weed BMP 11
- Whether weed material was collected and disposed of appropriately, as described for Weed BMP 7

The log also should include a description of the efficacy of the weed control treatment, including the following information:

- Date of revisit
- Population size
- Qualitative observations on vigor, efficacy of treatment, and any associated habitat disturbance
- Recommendations for future control efforts of the population, if needed

2.1.4 Adaptive Management

Adaptive management is the process of developing alternative management strategies and methods based on the development of new information gathered through monitoring efforts, as well as unforeseen conflicts with intended management objectives. If, during the regular monitoring inspections described for Weed BMP 13, the weed advisor determines that weed infestations on the site are becoming progressively larger, more numerous, more intense, or more damaging despite prior and ongoing weed control efforts, the weed advisor should prepare a dedicated site action plan that addresses the species of concern and recommends specific actions to effectively control these species. The plan may include modified prescriptions for vegetation management, specific herbicide recommendations, remapping of all weeds, and other adaptive management approaches. The plan should identify specific success criteria that, if met, will allow weed control efforts to be reduced to the less intensive management approaches previously described in this Plan. The plan should also consider the effects of annual climate, which can result in weather-related, short-term changes in weed populations that may not require extensive remedial actions because the observed changes in weed populations are likely to be reversed in years when annual climate approximates the long-term average. If, in the opinion of the weed advisor, observed changes in weeds are likely related to weather patterns and are likely not a function of activities on the NRMUs and not likely to persist in years with more typical climatic conditions, adaptive management measures may not be required.

2.2 Pests

2.2.1 Prevention Approach

Bullfrogs present difficult management challenges because of their high reproductive rates, their generalist feeding habits, and their ability to travel long distances overland to colonize new water sources (Snow and Witmer 2010; Willis et al. 1956). Prevention measures should be developed to reflect the most common pathways for introduction and spread of the species. Bullfrogs have been introduced to the western United States from their native range for use as a biological control, for human consumption, through the pet trade,

and through fish stocking practices (Kraus 2009; Hayes and Jennings 1986). Hayes and Jennings (1986) suggest that human-influenced habitat modification, such as the conversion of ephemeral water bodies to perennial ones, removal of emergent vegetation, and an increase in water temperature all support the success and establishment of bullfrogs.

2.2.1.1 Prevention BMPs

The following BMPs are recommended to prevent the establishment and spread of bullfrogs include:

- **Pest BMP 1**: The physical introduction of bullfrogs as a form of biological control, through the pet trade, or for other uses should be prohibited.
- **Pest BMP 2**: Fertilizer runoff should be minimized. Runoff of fertilizers from residences can cause eutrophication and warming of water bodies. These increased temperatures and nitrogen levels can encourage the growth of aquatic weeds and algae, which may provide breeding habitat for bullfrogs. Managing fertilizer use and runoff from residences can prevent eutrophication of nearby water sources. In fact, a common practice for hindering the establishment of bullfrogs is to restrict the use of fertilizers near perennial water bodies. Regulating the use of fertilizers and the timing of fertilizing at TAFB could help prevent and control the establishment of bullfrogs, and nonnative aquatic weeds as well.
- **Pest BMP 3**: Ephemeral pools should not be converted to perennial waters. The creation of perennial waters can increase use of the site by bullfrogs and provide a physical link to uninhabited pools that were otherwise too far from source pools for bullfrogs to colonize.
- **Pest BMP 4**: The introduction of bullfrogs through fish stocking should be prevented. Any fish stocking methods exercised on base should ensure that no bullfrog eggs, tadpoles, or adults are introduced with target fish populations.
- **Pest BMP 5**: The unnecessary removal of emergent vegetation from perennial pools should be kept to a minimum. Emergent vegetation provides cover for native aquatic species and may better allow for the coexistence of native species and bullfrogs. Removal of this vegetation also may increase water temperatures, which may in turn attract bullfrogs.
- **Pest BMP 6**: Drift fencing should be installed around occupied sites under the direction of a qualified biologist. Drift fencing can be installed along the edge of a water body to help prevent bullfrog emigration to other sites. Research suggests the fencing should be at least 2 feet tall, be buried at least 6 inches in the ground, and include a 4-inch buried apron directed toward the pond.

2.2.2 Treatment Approach

Methods to control bullfrog populations generally fall into two categories: direct removal and indirect removal (Adams and Pearl 2007). Methods of direct removal include hand capture, trapping, netting, gigging, shooting, fencing and sediment excavation, and chemical control. These methods, however, are typically labor

intensive and may not reduce bullfrogs to desired numbers (Miera 1999). Hand capture, netting, gigging, and shooting are the most time consuming but least invasive methods for bullfrog control. Chemical control can have deleterious effects on many nontarget aquatic species. Snow and Witmer (2010) explored the use of floating traps modeled after those used for cane toad in Australia. They suggest that the use of traps for bullfrog control may be a practical management tool because it is less labor intensive than the other management approaches and is potentially more effective relative to other bullfrog management techniques.

Govindarajulu et al. (2005) suggests that direct removal of tadpoles may not be as effective as removing metamorphs or adults for decreasing population numbers. Partial removal of tadpoles may decrease competition for resources and may therefore increase survival rates and because removing adult bullfrogs may lead to higher survival of early metamorphs that otherwise may have been preyed on by cannibalistic adults. Studies show that the culling of metamorphs in fall is the most effective means of managing bullfrog populations (Govindarajulu et al. 2005; Orchard 2011).

Indirect removal strategies involve manipulating the habitat to prevent the reproductive success or long-term survival of bullfrogs (Adams and Pearl 2007). The most common method of habitat manipulation is the dewatering of aquatic habitat (Snow and Witmer 2010). Dewatering disrupts the 2-year development cycle of the bullfrog and substantially reduces or eliminates successful reproduction of the species.

Dewatering can be the most effective method of controlling bullfrog populations; however, it may have negative effects on native species that require a perennial water source. Therefore, the life cycle of CTS and other aquatic species must also be considered when determining the timing of dewatering to control bullfrog populations. Dewatering should occur for approximately 2–3 weeks after August but before the start of the rainy season—ideally in late September or early October (Ford et al. 2013). By that time, CTS adults and juveniles typically have completed the migration from breeding ponds to upland burrow refugia and would not be at risk during dewatering activities. The installation of screens over drain pipes during dewatering helps prevent native amphibians or fish from accidentally being removed from the pond. Care must be taken to ensure that the drained water does not cause erosion; pumping into a holding tank or spraying onto vegetated areas are two potential solutions. Ponds typically are drained with a pump; installing a drain at known management sites may facilitate periodic draining and may be cost effective in the long run, particularly if combined with other repairs.

Because bullfrogs are highly mobile and may burrow into sediments or leave the pond altogether during dewatering, special attention must be paid during the process of dewatering (Ford et al. 2013). Adult bullfrogs observed during drawdown should be removed using a combination of netting and gigging methods. One method to ensure the eradication of potential burrowing tadpoles is to compact the soil in the pond bottom after dewatering has occurred. Ponds lacking CTS should ideally be drained quickly to minimize the number of bullfrog tadpoles that could potentially metamorphose and migrate from breeding ponds (Ford et al. 2013).

Dewatering should be repeated at least once every 3–4 years, especially where the risk of bullfrog reintroduction is significant (Doubledee et al. 2003). Draining once every 2 years may be necessary at more densely populated sites. The most important considerations regarding dewatering are to begin draining late enough in the season (as early as August but ideally in September or October) to allow for the metamorphosis of CTS larvae and to complete the draining before fall rains begin.

2.2.2.1 Avoiding Impacts on Special-status Species

The presence of bullfrogs at TAFB presents management challenges, especially in relation to management practices for CTS. TAFB manages for the presence of small ephemeral pools that provide habitat for larval CTS. Because they are ephemeral, these pools would not support habitat for adult bullfrogs; however, juvenile bullfrogs dispersing from breeding pools may occupy these ephemeral pools before returning back to perennial bodies to breed. While inhabiting these small pools, juvenile bullfrogs may prey on larval CTS and could potentially eliminate CTS entirely from individual pools.

CTS require both aquatic and upland habitat for successful reproduction and survival. During the summer months, adult CTS inhabit underground burrows in upland habitats, such as valley grasslands, oak savanna, and oak woodland (Trenham 2001; Wang et al. 2009). With the onset of the rainy season, adult CTS migrate from their burrows, sometimes as far as 0.5 mile, to occupy small ephemeral pools for breeding. Breeding occurs from late November through February, following the onset of the first rains (Barry and Shaffer 1994). Metamorphosis of larval CTS takes 4–5 months and typically occurs in late spring and early summer, with some larvae remaining in larger pools until late August (Shaffer and Trenham 2005). After metamorphosis is complete, juvenile CTS migrate from their breeding pools to uplands, where they occupy abandoned small-mammal burrows (Holland et al. 1990).

Ephemeral pools used by CTS must retain water through the early summer months for successful reproduction to occur. In addition, large vernal pool complexes, rather than isolated pools, likely provide the best quality habitat because these areas can offer both breeding sites and nearby refuge habitat (Shaffer et al. 1994; Jennings and Hayes 1994).

CTS do not typically rely on water sources during the late summer months, which may allow for the implementation of carefully timed bullfrog control measures. Implementing bullfrog control measures at a CTS breeding site is important if the bullfrogs have been documented in the general area, even if the site is more than 1 mile from the nearest known bullfrog population (Ford et al. 2013).

A basewide ecological habitat survey (U.S. Air Force 1995) detected larval CTS within 40 feet of the base boundary. A 2004–2005 basewide vernal pool invertebrate survey conducted by EcoAnalysts identified a single female adult CTS along the railroad right-of-way, which is located on land controlled by TAFB but not a part of the contiguous main base. Vernal pool surveys of the Castle Terrace Housing NRMU in 2008 found CTS larvae in several of the pools (CH2M HILL 2008). Surveys conducted by the University of California,

Davis, in 2009 and 2010 confirmed that CTS breeds in the Castle Terrace Housing NRMU pond complex (Johnson and Shaffer 2010).

2.2.2.2 Treatment BMPs

In some cases, complete eradication of bullfrogs may be impossible. Therefore, this Plan focuses on containing their spread and preventing new populations from establishing in natural areas. The following treatment BMPs are recommended for implementation at TAFB:

- **Pest BMP 7**: Depending on the population densities observed during spring surveys, perennial ponds should be dewatered at least every 3–4 years. Draining every other year is recommended, especially when perennial pools are located adjacent to CTS habitat (i.e., perennial ponds in the Castle Terrace Housing and Northeast Undeveloped Area NRMUs). Pools should be dewatered as early as August but preferably in September, at least 3 weeks before the first rainfall. Pools should remain dewatered for 3 weeks to effectively eliminate all bullfrog tadpoles and metamorphs that may burrow in the pond sediment.
- **Pest BMP 8**: Some management methods include filling dewatered ponds with soil and compacting and/or grading the soil to return the ponds to their original conditions. This additional step, however, may necessitate additional agency permitting. To avoid this requirement, dewatered ponds should remain dewatered as long as possible before the rainy season begins to ensure the complete drying of the pond and the culling of tadpoles and metamorphs that have burrowed into the soil.
- **Pest BMP 9**: Fencing should be installed around pools during dewatering to prevent the emigration of adults and metamorphs. Fencing should be at least 2 feet tall, be buried 6 inches in the ground, and contain an underground apron angled toward the body of water. Fencing should be left in place during dewatering for 3 weeks afterward. Any bullfrogs attempting to emigrate during dewatering should be culled using a combination of netting and gigging methods.
- **Pest BMP 10**: Ponds lacking CTS should be drained as quickly as possible to decrease the potential for tadpoles to metamorphose during dewatering.
- **Pest BMP 11**: A drain should be installed in target water bodies to facilitate periodic draining. Installation of the drain may be cost effective in the long run.
- **Pest BMP 12**: Direct removal methods, such as netting, gigging, shooting, trapping, and egg mass removal, should be employed only if dewatering is not an option. These methods, if adopted, must be implemented aggressively to successfully decrease population numbers. Partial removal of bullfrogs using these methods may effectively increase their survival rate because it may decrease competition for resources among the remaining individuals.

2.2.3 Monitoring Approach

A qualified biologist should conduct surveys for bullfrogs in the priority areas described below. The frequency and intensity of surveys are expected to vary each year, based on the amount and timing of precipitation and the most advantageous timing for bullfrog detection. A qualified biologist should conduct acoustic and visual surveys for bullfrogs in perennial water bodies at TAFB. These surveys should be conducted in the late spring, when male bullfrogs begin to establish breeding territories and are the most active and vocal.

The following signs of a potential bullfrog infestation may be observable in and around perennial pools:

- **Visual Observation.** Although bullfrogs are nocturnal, they may be active at all times. Bullfrog tadpoles take up to 3 years to complete metamorphosis and may be seen swimming throughout the water column of perennial pools.
- **Egg Masses.** Bullfrog egg masses are laid in a thin, soft, jellylike sheet among emergent vegetation and may contain 8000–120,000 eggs. Egg masses are often observable among emergent vegetation in perennial pools during the breeding season (May through August) but may settle to the pond bottom quickly after deposition. The egg capsules are not distinct, and the eggs themselves are typically less than 1 millimeter in diameter.
- **Acoustic Observation.** Male bullfrogs are most active during the male calling season (March through September); however, both male and female bullfrogs emit an alarm call when they are approached. Oseen and Wassersug (2002) suggest that calling activity is positively associated with water temperature.

The recommended monitoring approach described above, along with the prevention and treatment BMPs, should be applied during operation and maintenance activities at TAFB.

2.2.4 Adaptive Management

Monitoring of bullfrog populations should be conducted by a qualified biologist to determine the response to management efforts. If, during the regular monitoring inspections described in Section 2.2.6, the qualified biologist determines that bullfrogs have geographically spread or increased in number, the qualified biologist should prepare a site action plan that recommends specific actions to effectively control this species. The plan may include modified prescriptions for bullfrog management and should identify specific success criteria that, if met, will allow control efforts to be reduced to the less intensive prevention and management approaches previously described in this Plan. Through monitoring efforts, the qualified biologist will determine the success of management efforts and alter management strategies to better accomplish the Plan objectives and meet Plan goals.

Section 3. Descriptions of Target Weeds and Pests

This section describes the biology, distribution, and impact of each target weed and pest species, and it summarizes relevant treatment considerations. More detailed treatment recommendations are presented in Appendix A.

3.1 Target Weeds

3.1.1 Barbed Goat Grass (Cal-IPC Rating: High)

Barbed goat grass (Photo 1) is an annual grass (family Poaceae) native to Mediterranean Europe and western Asia. It has a severe impact on California ecosystems (Cal-IPC 2014). Barbed goat grass germinates with the onset of fall rains and matures between May and August. It produces dense stands and slowly decomposing thatch that outcompetes and excludes desirable rangeland plants. Its jointed inflorescence produces long, barbed awns that can cause injury to livestock and other wildlife. This species invades disturbed sites typically in dry fields, pastures, and roadsides, including undisturbed grassland and rangeland and lower elevation oak woodlands. Seeds are dispersed when barbed awns attach to livestock and wildlife and when they are transported in hay. Seeds can remain dormant for 2–5 years (Davy et al. 2008).



Photo 1. Barbed Goat Grass

Barbed goat grass occurs as scattered plants and fairly dense stands in the Castle Terrace Housing NRMU (Figure 3). The total infestation area is approximately 70 acres.

The following text describes the most effective means of treating barbed goat grass:

- **Prevention**: Early detection and control of small infestations are key to preventing the formation of large, dense stands. When work is being conducted in areas infested with barbed goat grass, equipment (including undercarriages) should be carefully cleaned before it is moved to an uninfested area. The collection and export of fill soils, pasture hay, and crops from infested areas should be avoided or minimized to the maximum extent practicable.
- **Mechanical control**: Barbed goat grass is best controlled mechanically by intensive grazing or mowing at early stages of seed head emergence (Davy et al. 2008). Grazing or mowing early in the growing season

may favor barbed goat grass over desirable species because barbed goat grass matures more slowly than other rangeland grasses and forbs.

- **Fire management**: Prescribed burns should be applied to actively growing and healthy weed populations, but before mature seed set, for 2 consecutive years (Davy et al. 2008).
- **Herbicides**: Herbicide should be applied from fall through spring (September through March) to new seedlings exhibiting at least the three-leaf growth state but before 8-inch plant canopy height. For dense, large, primarily contiguous infestations, aerial or ground applications with broadcast boom technology should be used. For scattered individual plants or isolated patches, or where sensitive plant species are present, handheld or backpack applications should be used for spot treatment. Integration of herbicide treatment with mechanical and/or pyric measures will enhance treatment efficacy. All herbicides must be prescribed by a licensed PCA and applied in accordance with the BMPs specified in Section 2.0.

3.1.2 Black Mustard (Cal-IPC Rating: Moderate)

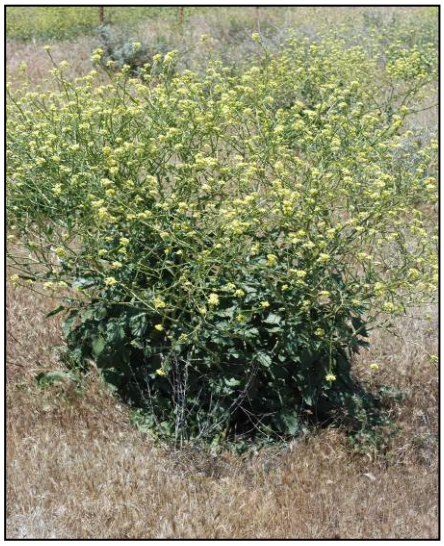
Photo 2. Black Mustard

Black mustard (Photo 2) is an annual forb in the mustard family (Brassicaceae) that is native to Eurasia. It has a moderate impact on California ecosystems (Cal-IPC 2014). Black mustard matures quickly in the spring and produces a large amount of biomass in infested areas, potentially outcompeting native species through shading or an early reduction in soil moisture. Reproduction occurs by seeds, which are sticky when wet and are thus easily transferred by equipment, vehicles, or people working in or traveling through infested areas when moisture is present (Cal-IPC 2014). Like other invasive mustard species, black mustard can build up a large, long-lived seed bank at infestation sites. For example, deeply buried black mustard seeds may remain viable for as much as 50 years under field conditions (DiTomaso and Healy 2007). This species often invades areas dominated by nonnative annual grasses and can contribute to type conversion of woodlands and scrublands into annual grasslands by adding to the early season fuel load of an area, which can increase the amount of fuel available for fires. Although this species is generally considered a successional plant, and thus might be expected to decrease in density or extent with increasing time since the last site disturbance, the typically large seed bank, in combination with the repeated disturbance associated with heavy grazing, can favor the establishment of long-term infestations (Cal-IPC 2014).

Black mustard occurs in random populations of individual plants or small patches throughout TAFB, with moderate stands in the Castle Terrace Housing, Aero Club, and Flightline NRMUs and fairly dense stands in the Southeast Undeveloped Area NRMU (Figure 4). The total infestation area is approximately 1990 acres.

The following text describes the most effective means of treating black mustard:

- **Prevention**: When work is being conducted in areas infested with black mustard, equipment (including undercarriages) should be carefully cleaned before it is moved to an uninfested area. The collection and export of fill soils, pasture hay, and crops from infested areas should be avoided or minimized to the maximum extent practicable.
- **Mechanical control**: Black mustard is best controlled mechanically by weed whacking or mowing plants (or hand pulling if feasible) each year after they have bolted but before they produce seed (dependent on annual climate, but likely February and March). The plants have a fairly weak root system, and, as annuals, they do not resprout from root fragments left in the soil. Over time, this can deplete the seed banks and allow native or grassy vegetation to dominate previously infested areas. Mowing, particularly at the wrong time, can produce plants that branch heavily from the base, and could produce even more seed than undisturbed plants. However, weed-whacking or mowing, timed to occur after bolting but before mature seed has been produced, may be the most feasible way to control infestations occurring over large areas of the site.
- **Herbicides**: Because black mustard emerges early in the growing season, often before native vegetation has broken dormancy, early postemergence herbicidal treatments may be the most effective chemical treatment (Bossard et al. 2000), but more research is needed to develop a standardized, optimized herbicide-based methodology for control. All herbicides must be prescribed by a licensed PCA and applied in accordance with the BMPs specified in Section 2.0.
- **Soil solarization**: Because of the problems associated with the long-lived seed bank of this species, mechanical removal followed by soil solarization may be more effective than mechanical removal alone in especially dense infestations.

3.1.3 Brazilian Waterweed (Cal-IPC Rating: High)

Brazilian waterweed (Photo 3) is an aquatic perennial herb in the waterweed family (Hydrocharitaceae) that is native to Argentina, Brazil, and Uruguay. It has a severe impact on California ecosystems (Cal-IPC 2014). Brazilian waterweed establishes by means of shoot and stem fragments in ponds, sloughs, shallow water developments, canals, lakes, reservoirs, and streams. It grows 15-foot-long stems and showy, white flowers that float on water. Brazilian waterweed forms dense stands that slow water movement, accumulate sediment, and reduce the abundance and diversity of native plants. It generally grows best in waters with high nutrient levels and where water movement is



Photo 3. Brazilian Waterweed

minimal. It tolerates a range of water qualities, temperatures, and depths but is most productive in shallow zones. Brazilian waterweed disperses when stem fragments break off and float away from the parent plant.

Brazilian waterweed occurs primarily as scattered infestations on the pond site in the Castle Terrace Housing NRMU and the duck pond site in the Cantonment NRMU (Figure 5). The total infestation area is approximately 0.4 acre.

The following text describes the most effective means of treating Brazilian waterweed:

- **Prevention**: When work is being conducted in water bodies infested with Brazilian waterweed, equipment should be carefully cleaned before it is moved to an uninfested area. The collection and export of soils from infested areas should be avoided or minimized to the maximum extent practicable.
- **Mechanical control**: Pulling, cutting, and digging with machines are not recommended as means of controlling Brazilian waterweed. Mechanical control is costly, provides temporary relieve, and encourages spread by fragmentation.
- **Biological control**: Two fish—the white amur or Chinese grass carp (*Ctenopharyngodon idella*) and the Congo tilapia (*Tilapia melanopleura*)—have been used to graze and control Brazilian waterweed (Cal-IPC 2014); however, use of these introduced species must be authorized by the California Department of Fish and Wildlife.
- **Herbicides**: Unless specifically registered for aquatic use, herbicides should never be used where they may contaminate water bodies or wetlands. Approved herbicides should be applied in a single application during active weed growth to the entire surface area of the water body. All herbicides must be prescribed by a licensed PCA and applied in accordance with the BMPs specified in Section 2.0.

3.1.4 Eurasian Water-milfoil (Cal-IPC Rating: High)



Photo 4. Eurasian Water-Milfoil

Eurasian water-milfoil (Photo 4) is an aquatic perennial herb in the water-milfoil family (Haloragaceae) that is native to Greenland, North Africa, Europe, and Asia. It has a severe impact on California ecosystems (Cal-IPC 2014). Eurasian water-milfoil establishes by means of stem and root fragments, and rarely by seed germination, in ponds, shallow water developments, canals, lakes, and streams. It grows branching stems near the water surface, forming dense floating mats that outcompete native aquatic plants and create optimal habitat for mosquitos. It generally grows best in waters with high nutrient levels and where water movement is minimal. Eurasian water-milfoil tolerates a range of water qualities, temperatures, and

depths. It can grow on sandy, silty, or rocky substrates but prefers fertile, fine-textured, inorganic sediments. This species disperses when stem and root fragments break off and float away from the parent plant.

Eurasian water-milfoil occurs primarily as scattered infestations on the pond site in the Castle Terrace Housing NRMU and the duck pond site in the Cantonment NRMU (Figure 6). The total infestation area is approximately 0.4 acre.

The following text describes the most effective means of treating Eurasian water-milfoil:

- **Prevention**: When work is being conducted in water bodies infested with Eurasian water-milfoil, equipment should be carefully cleaned before it is moved to an uninfested area. The collection and export of soils from infested areas should be avoided or minimized to the maximum extent practicable.
- **Mechanical control**: Pulling, cutting, and digging with machines alone are not recommended as means of controlling Eurasian water-milfoil. Mechanical control is costly, provides only temporary control, and encourages spread by fragmenting reproductive plant parts. Lowering water levels, followed by mechanical removal, exposure to freezing temperatures, prescribed burning, or deep flooding in spring can help control Eurasian water-milfoil. All stem and root fragments must be carefully removed.
- **Herbicides**: Unless specifically registered for aquatic use, herbicides should never be used where they may contaminate water bodies or wetlands. Approved herbicides should be applied in a single application during active weed growth to the entire surface area of the water body. All herbicides must be prescribed by a licensed PCA and applied in accordance with the BMPs specified in Section 2.0.

3.1.5 Fennel (Cal-IPC Rating: High)

Fennel (Photo 5) is a perennial forb in the carrot family (Apiaceae) that is native to southern Europe and the Mediterranean region. It has a high impact on California ecosystems (Cal-IPC 2014). The plant grows 4–10 feet tall and has finely dissected leaves. Its small yellow flowers are clustered in large, rounded, umbrellalike groups that bloom from May through September. Fennel alters the composition and structure of many plant communities by forming dense, uniform stands that outcompete and exclude native and desirable plants. Reproduction occurs from both root crowns and seeds. Seed production is prolific, peaking in August and September. Seeds are dispersed by water and animals and by humans when seeds cling to clothing or mud on vehicles. Fennel invades open disturbed sites of various types, including roadsides, road cuts, fallow fields, grasslands, riparian areas, and wetland sites.



Photo 5. Fennel

Fennel occurs as scattered individuals and patches primarily in the

Flightline and Southeast Undeveloped Area NRMUs, particularly adjacent to roadsides (Figure 7). The total infestation area is approximately 1800 acres.

The following text describes the most effective means of treating fennel:

- **Prevention**: When work is being conducted in areas infested with fennel, equipment (including undercarriages) should be carefully cleaned before it is moved to an uninfested area. The collection and export of fill soils, pasture hay, and crops from infested areas should be avoided or minimized to the maximum extent practicable.
- **Mechanical control**: Fennel is best controlled mechanically when infestations are small. Efforts should be made to minimize soil disturbance if plants are dug out by hand. Repeated cutting before seed set also may effectively control fennel.
- **Fire management**: Fennel can be controlled by means of prescribed burns in November and December followed by 2 consecutive years of herbicide sprays in spring. Seedlings may be killed using torches or flamethrowers in winter or early spring while conditions are moist and fire risks are low.
- **Herbicides**: Herbicide should be applied in fall before a hard freeze or in late winter to spring (February through April) to new seasonal growth. For dense, large, primarily contiguous infestations, aerial or ground applications with broadcast boom technology should be used. For scattered individual plants or isolated patches, or where sensitive plant species are present, handheld or backpack applications should be used for spot treatment. All herbicides must be prescribed by a licensed PCA and applied in accordance with the BMPs specified in Section 2.0.

3.1.6 Italian Thistle (Cal-IPC Rating: Moderate)

Italian thistle (Photo 6) is an annual or biennial forb in the composite family (Asteraceae) that is native to the Mediterranean, southern Europe, and North Africa to Pakistan. It has a moderate impact on California ecosystems (Cal-IPC 2014). Italian thistle is a competitive invader that can dominate sites and exclude native and desirable rangeland plants. Reproduction occurs by seeds. Plants germinate after the first substantial rains in fall, overwinter as rosettes, and produce flowering stalks in late spring before the dry season. Plants grow 1–7 feet tall, have winged stems, and have thimble-sized rose to pink to purple flowers that bloom from February through July. Seeds disperse by wind, vehicles, and animals. Italian thistle invades open disturbed sites of various types, including roadsides, firebreaks, and grasslands. Seeds can remain dormant for 8–10 years (Cal-IPC 2014).



Photo 6. Italian Thistle

Italian thistle occurs as scattered individuals throughout the Southeast Undeveloped Area and as occasional plants in the Castle Terrace Housing NRMU (Figure 8). The total infestation area is approximately 425 acres.

The following text describes the most effective means of treating Italian thistle:

- **Prevention**: When work is being conducted in areas infested with Italian thistle, equipment (including undercarriages) should be carefully cleaned before it is moved to an uninfested area. The collection and export of fill soils, pasture hay, and crops from infested areas should be avoided or minimized to the maximum extent practicable.
- **Mechanical control**: Italian thistle is best controlled mechanically when infestations are small. Efforts should be made to minimize soil disturbance if plants are dug out by hand. Repeated cutting before seed set may also effectively control Italian thistle, but only if repeated until the seed bank is depleted (up to 10 years). Sheep or goat grazing can control infestations after germination and before flowering when plants are 4–6 inches tall.
- **Herbicides**: Herbicide should be applied in spring and/or early summer (March through June) to actively growing plants through bolting (before flowering). For dense, large, primarily contiguous infestations, aerial or ground applications with broadcast boom technology should be used. For scattered individual plants or isolated patches, or where sensitive plant species are present, handheld or backpack applications should be used for spot treatment. All herbicides must be prescribed by a licensed PCA and applied in accordance with the BMPs specified in Section 2.0.

3.1.7 Medusa Head (Cal-IPC Rating: High)

Medusa head (Photo 7) is an annual grass that is native to Spain, Portugal, southern France, Morocco, and Algeria. It has a severe impact on California ecosystems (Cal-IPC 2014). Medusa head germinates with the onset of fall rains and matures usually in May, 2–4 weeks later than most other annual grasses. It produces dense stands and slowly decomposing thatch that outcompetes and excludes desirable rangeland plants, ties up nutrients, and contributes to fire danger. Medusa head has high silica content, making it unpalatable to livestock and wildlife, except early in the growing season. Its inflorescence produces long, compressed awns that twist and spread upon drying. This species invades disturbed sites in grassland and rangeland, chaparral, oak woodlands, and occasionally fallow fields. Seeds are dispersed when awns attach to livestock, wildlife, machinery, vehicles, and clothing and when they are transported in hay.



Photo 7. Medusa Head

Medusa head occurs as moderate stands of scattered plants in the Aero Club, Grazing Area, Northeast Undeveloped Area, and Southeast Undeveloped Area NRMUs and as fairly dense stands in the Castle Terrace Housing NRMU (Figure 9). The total infestation area is approximately 1440 acres.

The following text describes the most effective means of treating medusa head:

- **Prevention**: Early detection and control of small infestations are key to preventing the formation of large, dense stands. When work is being conducted in areas infested with medusa head, equipment (including undercarriages) should be carefully cleaned before it is moved to an uninfested area. The collection and export of fill soils, pasture hay, and crops from infested areas should be avoided or minimized to the maximum extent practicable.
- **Mechanical control**: Medusa head is best controlled mechanically by mowing before seed development or in combination with grazing before maturation.
- **Fire management**: Prescribed burns should be applied to actively growing and healthy weed populations in late spring, after seed set but before seeds heads have shattered.
- **Herbicides**: Herbicide should be applied in fall through spring (September through March) to new seedlings exhibiting at least the three-leaf growth state but before 8-inch plant canopy height. For dense, large, primarily contiguous infestations, aerial or ground applications with broadcast boom technology should be used. For scattered individual plants or isolated patches, or where sensitive plant species are present, handheld or backpack applications should be used for spot treatment. Integration of herbicide treatment with mechanical and/or pyric measures will enhance treatment efficacy. All herbicides must be prescribed by a licensed PCA and applied in accordance with the BMPs specified in Section 2.0.

3.1.8 Perennial Pepperweed (Cal-IPC Rating: High)



Photo 8. Perennial Pepperweed

Perennial pepperweed (Photo 8) is a perennial forb in the mustard family that is native to Eurasia. It has severe impacts on California ecosystems (Cal-IPC 2014). This species forms dense, nearly monospecific stands, in part as a result of extensive and vigorously sprouting rhizomes. Plants grow 3–8 feet tall. Stems and leaves are dull gray-green and waxy. Small white flowers develop in dense clusters and bloom from May through July. Perennial pepperweed readily colonizes moist habitats, such as alkaline wetlands (Cal-IPC 2014), or mesic areas in grasslands, such as swales, where it often forms large masses; however, HTH biologists have observed it in other grassland, agricultural, and alkaline habitats, generally forming sparse and isolated colonies. As previously mentioned, this species is rhizomatous, but it also grows from seed, pieces of root stock, and buried stems (Cal-IPC 2014).

Perennial pepperweed occurs as moderate stands of scattered individuals in the Castle Terrace Housing, Flightline, and Northeast Undeveloped Area NRMUs and as fairly dense stands in the Southeast Undeveloped Area NRMU, particularly along drainages. Relatively small dense stands are present in the Grazing Area, Aero Club, Cantonment, and Castle Terrace Housing NRMUs (Figure 10). One very dense stand was mapped in the Castle Terrace Housing NRMU. The total infestation area is approximately 1900 acres.

The following text describes the most effective means of treating perennial pepperweed:

- **Prevention**: When work is being conducted in areas infested with perennial pepperweed, equipment (including undercarriages) should be carefully cleaned before it is moved to an uninfested area. The collection and export of fill soils, pasture hay, and crops from infested areas should be avoided or minimized to the maximum extent practicable.
- **Mechanical control**: Hand-pulling perennial pepperweed has been shown to be ineffective at eradicating this species (Cal-IPC 2014). Pulled plants leave behind root segments that can readily resprout, which results in the persistence, and sometimes expansion, of the targeted colony.
- **Herbicides**: Herbicide treatments by foliar spray or wick application are generally used to control or reduce spot infestations or as a follow-up to more intensive mechanical or grazing-based treatments. All herbicides must be prescribed by a licensed PCA and applied in accordance with the BMPs specified in Section 2.0.

3.1.9 Purple Star-thistle (Cal-IPC Rating: Moderate)

Purple star-thistle (Photo 9) is an annual, or sometimes a short-lived perennial, of the composite family that is native to the Mediterranean region of southern Europe and northern Africa. It has a moderate impact on California ecosystems (Cal-IPC 2014). This species can produce dense stands that exclude and replace desirable native and rangeland species. Purple star-thistle forms rosettes in its first growing season. Mature plants are 1–4 feet tall and produce numerous spiny purple flowers from July through October. Reproduction is by seed. Seeds remain in the flower heads until after the plants die, break off at the soil, and roll with the wind. Seeds are also transported in hay and with farm and ranch machinery. Purple star-thistle invades numerous disturbed sites, including active and fallow agronomic fields, pastures, roadsides, waste places, and disturbed/degraded grasslands and rangelands. It tolerates a range of soil textures and precipitation zones, but it prefers finer textured soils and alluvium in areas typically exceeding 9 inches of precipitation.



Photo 9. Purple Star-thistle

Purple star-thistle occurs as small, moderate and dense stands in the Castle Terrace Housing NRMU (Figure 11). The total infestation area is approximately 1 acre.

The following text describes the most effective means of treating purple star-thistle:

- **Prevention**: When work is being conducted in areas infested with purple star-thistle, equipment (including undercarriages) should be carefully cleaned before it is moved to an uninfested area. The collection and export of fill soils, pasture hay, and crops from infested areas should be avoided or minimized to the maximum extent practicable.
- **Mechanical control**: Hand digging and cutting can control small infestation. Plants should be cut at least 2 inches below the soil surface before maturation. Care should be taken to avoid disturbing the soil.
- **Herbicides**: Herbicide should be applied in winter and spring (December through March) to rosettes or bolting plants or in fall (September through November) to new seedlings or rosettes. For dense, large, primarily contiguous infestations, aerial or ground applications with broadcast boom technology should be used. For scattered individual plants or isolated patches, or where sensitive plant species are present, handheld or backpack applications should be used for spot treatment. All herbicides must be prescribed by a licensed PCA and applied in accordance with the BMPs specified in Section 2.0.

3.1.10 Treasure Flower (Cal-IPC Rating: Moderate)

Treasure flower (Photo 10) is a perennial herb of the composite family that is native to southern Africa. It has a moderate impact on California ecosystems (Cal-IPC 2014) and has an Alert designation (Cal-IPC 2014) because of its significant potential for invading new ecosystems. Treasure flower is an escaped horticulture plant that establishes in disturbed sites, grasslands, and riparian zones. It forms thick groundcover and outcompetes native and desirable grasses and forbs (Cal-IPC 2014). Treasure flower grows as a basal rosette with oval-shaped, dull green leaflets with wooly undersides. It produces bright yellow and orange flowers, typically in June and July, but it has been observed in bloom year-round. Treasure flower is predominantly spread by seed but may also spread vegetatively by stolons and rhizomes. It generally grows best with open exposure and tolerates a range of soil textures.



Photo 10. Treasure Flower

Treasure flower occurs as scattered individuals on the Castle Terrace Housing NRMU and in the Cantonment NRMU near the duck pond (Figure 12). The total infestation area is approximately 1 acre.

The following text describes the most effective means of treating treasure flower:

- **Prevention**: Early detection and control of small infestations are key to preventing the development of thick groundcover. Garden waste should be properly disposed of to prevent the escape of seeds, rhizomes, and stolons. Special attention should be paid to riparian habitats where treasure flower is known to establish. Planting of native groundcover and other riparian vegetation, paired with early detection and eradication, may help prevent the establishment of treasure flower populations.
- **Mechanical control**: Treasure flower is difficult to control mechanically because it can resprout readily when cut, grazed, or burned (Cal-IPC 2014). Care should be taken to ensure removal of all plant parts if it is dug up by hand.
- **Herbicides**: Herbicide should be applied in spring and/or early summer (March through June) to actively growing plants before flowering. For dense, large, primarily contiguous infestations, aerial or ground applications with broadcast boom technology should be used. For scattered individual plants or isolated patches, or where sensitive plant species are present, handheld or backpack applications should be used for spot treatment. All herbicides must be prescribed by a licensed PCA and applied in accordance with the BMPs specified in Section 2.0.

3.1.11 Yellow Star-thistle (Cal-IPC Rating: High)

Yellow star-thistle (Photos 11 and 12) is an annual, or sometimes a short-lived perennial, of the composite family that is native to southern Europe and western Eurasia. It has a severe impact on California ecosystems (Cal-IPC 2014). It produces dense stands that displace native and desirable species. Yellow star-thistle germinates from seed with the onset of fall rains. It forms rosettes and deep tap roots over winter. Mature plants are 1–3 feet tall and produce numerous spiny yellow flower heads from April through September. It invades grasslands, woodlands, open hillsides, rangeland, pastures, riparian zones, and disturbed areas.



Photo 11. Yellow Star-thistle Seedling

Yellow star-thistle occurs as moderate stands of scattered plants in the Aero Club, Northeast Undeveloped Area, Flightline, and Southeast Undeveloped Area NRMUs and in the western region of the Cantonment NRMU, and it occurs as occasional plants throughout the Grazing Area NRMU (Figure 13). The total infestation area is approximately 2800 acres.

The following text describes the most effective means of treating yellow star-thistle:

- **Prevention**: When work is being conducted in areas infested with yellow star-thistle, equipment (including undercarriages) must be carefully cleaned before it is moved to an uninfested area. The collection and export of fill soils, pasture hay, and crops from infested areas must be avoided or minimized to the maximum extent practicable.
- **Mechanical control**: Mowing can provide effective treatment of infested areas if it is conducted at the correct time, which is immediately after the earliest 2–5% of plants have begun to produce flower heads (Benefield et al. 1999) and the lowermost branches are above the mower blades (Thomsen et al. 1996). Mowing too early may cause plants to become bushier and produce more flower heads. Treatments must continue for at least 2–3 years, after which spot eradication may be required indefinitely.



Photo 12. Yellow Star-thistle Flower

- **Biological control**: Responsible rangeland management, whereby range is grazed by sheep, goats, or cattle to a moderate degree, can help prevent establishment or spread of populations in grasslands. Infested areas can be treated by high-intensity grazing, typically in May and June (Cal-IPC 2014), just before the production of the spiny flower heads.
- **Fire management**: Yellow star-thistle seedlings may be effectively controlled by burning using the propane torch method if it is used early enough that a quick torch application is enough to burn the base of the seedling. Such methods must always be used during or after rain events, when soil moisture is high and the vegetation is damp, to prevent spread of fire.
- **Herbicides**: Herbicide treatments by foliar spray or wick application generally are used to control or reduce spot infestations or as a follow-up to more intensive mechanical or grazing-based treatments. Aminopyralid (sold as Milestone®) is particularly effective at controlling yellow star-thistle. All herbicides must be prescribed by a licensed PCA and applied in accordance with the BMPs specified in Section 2.0.

3.2 Vertebrate Pests

3.2.1 American Bullfrog

American bullfrogs (Photo 13) are native to the eastern United States and the Great Plains region (Snow and Witmer 2010). They were introduced to the western states in the early 1900s through trout stocking, pest management practices, and sport hunting (Santos-Barrera et al. 2009). Bullfrogs now inhabit every western state, Hawaii, Europe, Asia, the Caribbean, and South America (Snow and Witmer 2010). Being voracious generalist predators, bullfrogs often outcompete many native frogs and other amphibian and fish species in their native ecosystems. Even small initial populations of bullfrogs can quickly dominate aquatic systems. After they are established, bullfrog populations can be cost prohibitive and physically difficult to nearly impossible to control. Bullfrogs present difficult management challenges because of their high reproductive rates, their generalist feeding habits, and their ability to travel long distances overland to colonize new water sources (Snow and Witmer 2010; Willis et al. 1956).



Photo 13. American Bullfrog

Bullfrogs require perennial water sources, including lakes, reservoirs, and marshes, for successful development and reproduction. Adult bullfrogs lay large egg masses among emergent vegetation in these water bodies. Egg masses typically are laid in June and July, although they can be observed as early as May and as late as August (Govindarajulu et al. 2005). Metamorphosis of tadpoles takes from a few months to 3 years to complete; therefore, sufficiently deep perennial pools are required for successful development. After metamorphosing, juvenile bullfrogs typically disperse to ephemeral water sources, such as vernal pools and ephemeral ponds, and streams (Hallock and McAllister 2009).

Bullfrogs have been blamed for the decline of several native vertebrate species, including CTS (Hayes and Jennings 1986). Dispersing juvenile bullfrogs may prey on larval CTS in ephemeral pools. CTS has been documented at TAFB; therefore, control of current and potential bullfrog populations plays a vital role in the preservation of CTS.

American bullfrog was observed in a single pond located in the northwestern corner of the Castle Terrace Housing NRMU and is likely to occur within other suitable aquatic habitats throughout TAFB (Figure 14).

Section 4. Weed and Pest Control Work Plans

4.1 Weed Control Work Plan

This weed control work plan describes tasks associated with weed management, monitoring methods that will be used to detect new weed infestations and to assess how well prior weed treatment efforts have met defined goals and objectives, methods for prioritizing weed infestations for treatment, measures of success, and adaptive management techniques to be implemented when monitoring indicates that goals and objectives have not been met. It supports objectives developed in the INRMP to help accomplish natural resource management goals for TAFB. One of the goals of the INRMP (Goal 3) is to employ a systematic approach to managing wildlife resources using a process that includes inventory, monitoring, management, assessment, and evaluation (U.S. Air Force 2013). This goal is supported by Objective 3.3, which guides the development of appropriate management activities that maintain and protect natural resources at TAFB. Management activities include monitoring the spread of invasive species by evaluating the effectiveness of various methods of control, including mowing activities, pesticide application, and controlled burns, to control nonnative, invasive species and modify activities as necessary (Project 3.3.5). Tasks associated with these management activities are summarized in Table 4.

Table 4. Summary of Weed Control Work Plan Tasks

Goal 3: Employ a systematic approach to managing wildlife resources using a process that includes inventory, monitoring, management, assessment, and evaluation. Objective 3.3: Develop appropriate management activities that maintain and protect natural resources. Project 3.3.5: Monitor the spread of invasive species by evaluating various methods of control including mowing activities, pesticide application, and controlled burns to controlling non-native, invasive species and modify activities as necessary.	
Tasks	**Timeline**
Task 1: Prevent or minimize introduction and/or spread of weeds	Ongoing
Task 2: Monitor TAFB for weed infestations	Annually
Task 3: Prioritize treatment of target weeds	Annually
Task 4: Direct and coordinate weed control efforts	Annually
Task 5: Compile a weed control log	Annually
Task 6: Prepare and submit a brief memorandum report	Annually
Task 7: Enact a contingency plan if efforts to control weed infestations fail	As needed

4.1.1 Task 1: Prevent or Minimize Introduction and/or Spread of Weeds

Proactive prevention of weed introduction and spread is the most cost-effective strategy for managing invasive species. It reduces future maintenance needs and costs; reduces fire hazards and herbicide use; enhances access and safety; and protects wildlife habitat, special-status species, and native plant populations. Ongoing prevention measures should be implemented based on the prevention BMPs described in Section 2.1.2.

4.1.2 Task 2: Monitor TAFB for Weed Infestations

Monitoring weeds is essential to tracking areas of infestation, quickly detecting new infestations, evaluating treatment effectiveness, informing management decisions, and guiding adaptive management evaluations to meet the INRMP objectives at TAFB. Monitoring methods will include periodic surveys before and after treatments to determine changes in the distribution and abundance of target weeds, reviews of geographic information system datasets and reports in the Cal-IPC Inventory, and communication with managers at TAFB.

TAFB should be monitored for weed infestations by the weed advisor. As stated previously, the weed advisor will be an individual with training and experience sufficient to allow the individual to identify target weeds and to assist, in coordination with others (e.g., a licensed PCA and LQA), in the development of appropriate treatment techniques. The weed advisor may be a consultant, qualified military or civilian personnel stationed at TAFB, or a member of the TAFB IST.

The weed advisor should conduct regular inspections for weeds in the NRMUs. The frequency and intensity of weed inspections are expected to vary each year, based on the amount and timing of precipitation and the extent of weed infestations. At a minimum, inspections should be conducted from major roads and vantage points when most of a given NRMU is not readily viewed from a roadway. More detailed inspections should be conducted by walking fence lines and meandering transects throughout each NRMU. Particular attention should be paid to areas with known occurrences of special-status plants and animals (e.g., vernal pools, wetlands, and drainages) and areas where weed infestations were previously mapped or treated. Significant populations of weeds (more than several tens of yards square) should be mapped according to standardized methods described in the *California Weed Mapping Handbook* (DiPietro et al. 2002). Infestations of particularly problematic species should be mapped regardless of infestation size. Representative photographs should be taken of each infestation. The weed advisor will submit each map with a short letter report or technical memorandum to the Travis IST or natural resources manager for review, as described for Task 6, below.

4.1.3 Task 3: Prioritize Treatment of Target Weeds

The weed advisor, considering guidelines provided in Section 2.1.4 and the maps produced during Task 2, will develop a prioritized list of infestations to be treated each year. In general, a weed that is identified as incipient or established but confined (concentrated) in distinct and delineated patches should receive priority

for treatment, particularly when these infestations have the potential to adversely affect sensitive biological resources. Based on the evaluation matrix in Table 3, the select weeds (populations and/or individual plants) at TAFB with the highest priority for immediate treatment are the following:

- Barbed goat grass: this species primarily occurs in the Castle Terrace Housing NRMU. If this species were eliminated from this part of TAFB, it would be substantially eliminated from the base. Barbed goat grass is an aggressive, invasive grass that is actively expanding its range throughout northern California and, aside from its significant adverse ecological effects, substantially reduces the feasibility of other annual grassland management tools (e.g., livestock grazing).
- Brazilian waterweed and Eurasian water-milfoil: these species occur as isolated, incipient infestations within ponds at TAFB. Similar to barbed goat grass, these species present a significant potential for adverse ecological effects and have the potential to be eradicated from TAFB.
- Medusa head within the Aero Club NRMU: Although this species occurs in many locations at TAFB, the presence of vernal pools and the federally endangered Contra Costa goldfields make treatment of this species in the Aero Club NRMU a high priority.
- Perennial pepperweed: This species occurs over large portions of TAFB. While complete eradication is likely infeasible, TAFB should begin to treat this species in locations where it adversely affects native species and ecosystems or TAFB mission-critical activities (e.g. flightline operations) and where this species occurs as isolated, incipient infestations (i.e., in the Castle Terrace Housing, Aero Club, and Grazing NRMUs, see Figure 10). Finer-scale mapping of this species' distribution (Task 2) would help inform the development of additional, species-specific management actions.
- Treasure flower and purple star-thistle: These species occur as isolated, incipient infestations within the northern part of TAFB. Although their potentials for adverse ecological effects are less than other weeds found on TAFB, these species should be prioritized for treatment because they could likely be eradicated at minimal cost before they spread to other locations. Any eradication efforts focused on purple star-thistle should also consider and treat additional infestations within the Cantonment NRMU as this species is often observed in landscaped areas throughout TAFB. Although these infestations do not directly affect native species or ecosystems, they provide a seed source for the establishment of new infestations within TAFB's natural and open space areas.

In addition, the application of a computerized decision support model can help prioritize infestations and build from the initial, suggested prioritization described above. One such support model, the Weed Heuristics Invasive Populations Prioritization for Eradication Tool (WHIPPET) (www.cdfa.ca.gov/weedhome), is capable of prioritizing treatment areas in a regional setting with multiple infestations of multiple species. TAFB should consider the use of WHIPPET, or a similar method, as another method for prioritizing treatment of specific weed infestations identified in this Plan.

This suggested list of high-priority species and infestations may change over time based on the professional opinion of the weed advisor, results from the application of WHIPPET (if appropriate), and other information.

4.1.4 Task 4: Direct and Coordinate Weed Control Efforts

Weed control will include a series of efforts in the late winter and early spring when priority infestations (as identified for Task 3) are targeted for treatment after weeds have germinated but before seed has set. Less intensive weed control actions that may be taken during other times of the year include possible summer and fall actions, such as solarization and dewatering. Weed treatments will follow BMPs described in Section 2.1.5 and species-specific methods described in Section 3.1 and Appendix A. The herbicide recommendations and herbicide trade names mentioned in Appendix A provide guidance for herbicide use. A licensed PCA may consider this guidance in developing specific, written herbicide recommendations for infestation treatment; however, the herbicide recommendations in Appendix A do not substitute for the preparation of a written herbicide use recommendation by a licensed PCA, as required by California law.

4.1.5 Task 5: Compile a Weed Control Log

The weed control advisor will be responsible for maintaining a weed control log that will supplement the information provided in the brief memorandum reports and maps described for Task 2 and Task 6. The weed control log will describe all specific weed control actions undertaken each year and the efficacy of the weed control treatment for each infestation. Elements of the weed control log are detailed above (Weed BMP 15).

4.1.6 Task 6: Prepare and Submit a Brief Memorandum Report

The weed advisor will submit a brief memorandum report to TAFB's environmental program staff and the Travis IST each year that describes ongoing weed control efforts, provides the map(s) produced for the annual summer walkthrough, and assesses overall site efficacy of treatment actions. This report should specifically discuss weed control in priority areas in the NRMUs and identify particular areas of concern and success. This report should be submitted no later than the end of January each year and should describe weed control efforts and efficacy from the prior year.

4.1.7 Task 7: Enact a Contingency Plan If Efforts to Control Weed Infestations Fail

If the weed advisor determines that the priority weed infestations are becoming progressively larger, more numerous, more intense, and/or more damaging despite prior and ongoing weed control efforts, the weed inspections should be conducted at least three times yearly for a period of at least 2 consecutive years. This approach will allow for increased mapping precision and accuracy and aid identification of all infestations requiring weed removal. The weed advisor, working with other qualified individuals as necessary (e.g., plant ecologist or wildlife ecologist), will prepare a contingency plan that addresses the species of concern and recommends specific actions intended to enact effective control of these species. The contingency plan may

include, but would not limited to, modified grazing prescriptions, specific herbicide recommendations, remapping of all weeds using a submeter GPS, and other measures as prescribed by the plan. This contingency plan will be submitted to TAFB's environmental program staff and the Travis IST for review. It will also identify specific success criteria that if met, will allow weed control efforts to be reduced to less frequent and other normal adaptive control plan actions, as described in Section 2.1.8.

4.2 Pest Control Work Plan

This pest control work plan was created to support objectives developed in the INRMP to help accomplish Plan goals for TAFB. Plan goals for TAFB include maintaining and enhancing the hydrologic, physical, and ecological integrity of wetlands. Objectives supporting this goal include improving ecological functioning of wetlands by applying an adaptive management process. This Plan was developed in part to inform TAFB personnel of ways to reduce the number of bullfrogs in CTS habitat and to develop and implement monitoring and adaptive management strategies to help meet Plan goals. Tasks associated with bullfrog management activities are summarized in Table 6.

Table 5. Work Plan for Bullfrog Management in Support of INRMP Goals

Goal 2: Maintain and enhance the hydrologic, physical and ecological integrity of wetlands.	
Objective 2.1: Improve ecological functioning of wetlands by applying an adaptive management process.	
Project 2.1.6: Implement the plan to reduce California tiger salamander predators (e.g., bullfrogs, fish) from the ponds at the Castle Terrace Housing Area and monitor outcome of controlling invasive species and modify activities as necessary.	
Tasks	**Timeline**
Task 1: Prevent introduction and/or spread of American bullfrog	Ongoing
Task 2: Prioritize management areas	Annually/biennially
Task 3: Conduct treatment of priority management areas	Biennially to every 3–4 years
Task 4: Compile a treatment log	Biennially to every 3–4 years
Task 5: Conduct monitoring of treatment methods	Late spring/early summer (breeding season) following treatment
Task 6: Conduct additional treatment, if necessary	Postmonitoring
Task 7: Develop alternative management strategies to address unanticipated management concerns, if necessary	Postmonitoring

4.2.1 Task 1: Prevent Introduction and/or Spread of American Bullfrog

The most efficient and economical management approach for invasive species is prevention and early detection. If efforts are focused on preventing the establishment of bullfrog populations rather than on managing them after they have spread, resource requirements should be kept to a minimum. Ongoing prevention measures should be implemented based on the prevention BMPs described in Section 2.2.2.

4.2.2 Task 2: Prioritize Management Areas

The INRMP describes objectives to reduce the number of CTS predators in the Castle Terrace housing area. The Castle Terrace housing area supports known populations of CTS; therefore, it is a high-priority area for implementing predator management efforts. Because adult and juvenile bullfrogs are highly mobile and able to colonize new vernal pool complexes, however, it is important to consider the broader landscape and the potential pathways of bullfrog introduction and emigration. Bullfrog management should be a comprehensive effort that addresses a broad landscape of perennial waters, not just a single infested location. Thus, management efforts at TAFB should address not only the Castle Terrace Housing NRMU but any perennial pools that may provide a physical mechanism for bullfrog immigration and establishment into the Castle Terrace NRMU. A qualified biologist should prioritize areas necessitating management action. Priority management areas should be developed based on the following factors:

- Proximity of bullfrog-infested water bodies to vernal pool complexes that provide suitable habitat for CTS–bullfrogs near CTS habitat should be a high priority for management
- Proximity of bullfrog-infested water bodies to other perennial pools that lack bullfrogs but that could provide habitat for their potential spread–bullfrogs that could potentially disperse into ponds and other waterbodies that lack bullfrogs should be a higher priority for management
- Numbers of bullfrogs and probability of eradication–ponds that can be treated for bullfrogs and have a high probability of remaining bullfrog free or ponds with large numbers should be a higher priority for management

4.2.3 Task 3: Conduct Treatment of Priority Management Areas

After priority management areas have been established, an appropriate treatment plan must be established for the site. Dewatering is the recommended treatment method for larger ponds (where feasible) and areas with heavy bullfrog infestations near CTS habitat. Direct control methods, such as netting, gigging, and trapping, may be more appropriate for smaller populations where dewatering is not an option. Regardless of approach, treatment methods should be implemented according to the BMPs described in Section 2.2.

4.2.4 Task 4: Compile a Treatment Log

A qualified biologist should maintain a bullfrog treatment log that will describe all specific bullfrog management actions undertaken each year and the efficacy of the each action, based on monitoring conducted under Task 5.

4.2.5 Task 5: Conduct Monitoring of Treatment Methods

A qualified biologist will conduct follow-up monitoring to determine the success of treatment methods. Monitoring should employ acoustic and visual surveys for the presence of bullfrog adults, metamorphs, and tadpoles. Monitoring for the success of dewatering methods should be conducted in late spring after pools have been inundated with rainwater and bullfrogs are most active and vocal. If direct removal methods, such as netting, gigging, and trapping, are implemented in the place of dewatering, monitoring may be conducted any time following implementation because these results can be more readily observable. Results of monitoring should be recorded along with the information collected above under Task 4.

4.2.6 Task 6: Conduct Additional Treatment, If Necessary

During monitoring inspections, a qualified biologist will determine the success of implemented treatment methods based on preliminary surveys, intensity of treatment methods employed, and posttreatment bullfrog activity. If the biologist determines the bullfrogs are maintaining or increasing numbers, despite management, additional treatment may be warranted. The decision to implement additional treatment measures should be based on the level of success of previous treatment methods, the cost-effectiveness of treatment methods, and the level of risk presented by the potential infestation or reinfestation of bullfrog populations. Alternative treatment methods should be considered and implemented if monitoring efforts suggest the limited success of existing treatment methods.

4.2.7 Task 7: Develop Alternative Management Strategies to Address Unanticipated Management Concerns, If Necessary

If, during the regular monitoring inspections described in Task 5, the qualified biologist determines that bullfrogs have substantially established, geographically spread, or increased in number, the qualified biologist will prepare a site action plan that recommends specific actions to effectively control this species. This plan may include modified prescriptions for bullfrog management and will identify specific success criteria that, if met, will allow control efforts to be reduced to the less intensive prevention and management approaches previously described in this Plan. Adaptive management may involve alternative timing and intensity of treatment methods, as well as follow-up treatment measures. Through monitoring efforts, the qualified biologist will determine the success of management efforts and alter management strategies to better accomplish the Plan objectives to meet Plan goals.

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Appendix A. Treatment Recommendations for Target Weeds

Introduction

Information and recommendations summarized below are a compilation and synthesis of data, guidelines, and recommendations gleaned from sources listed in "General References" and "Special References" within Attachment A. This information is intended to supplement the general guidelines presented in Sections 2 and 3 of the Travis Air Force Base (TAFB) Invasive Species Management Plan (ISMP).

As described in the ISMP, management of invasive plants should involve a structured, integrated approach, incorporating multiple tools of herbicide, mechanical, and/or cultural treatments. The selection, use, and timing of specific measures, alone or in tandem with other integrated measures, will depend upon several factors, including:

- Weed species priority in terms of spread potential, aggressiveness, site impact assessment over time, and impact ratings (e.g., California Department of Food and Agriculture [CDFA], California Invasive Plant Council [Cal-IPC])
- Growth stage and vigor of the targeted weed species in relation to application windows
- Availability of pesticide applicators or mechanical equipment and operators within prescribed application windows

Familial and Species Commonality for Treatment

For the purpose of developing more detailed treatment recommendations, invasive plants found within TAFB have been grouped as defined below based on each species' reproductive biology, herbicide susceptibility, and applicability of other invasive plant treatment methods.

Italian thistle, **yellow star-thistle**, **purple star-thistle**, and **treasure flower** (**Group 1**) exhibit very similar (1) life histories (all within the Asteraceae; winter annuals or biennials); (2) maturation rate, timing, and seasonal growth potential relative to environmental conditions; (3) biology and synecology within the plant communities (associations or guilds) observed on TAFB; and (4) anticipated response to treatment (herbicidal, mechanical, and cultural). Therefore, these four species are subject to common management recommendations.

Perennial pepperweed and **black mustard (Group 2)** exhibit common characteristics (other than life history), particularly in terms of select herbicide susceptibility. They are significantly different from the Asteraceae species, however, in terms of biological variables and thus receive distinct management recommendations separate from these species.

Similarly, **medusa head** and **barbed goat grass (Group 3)** will receive separate treatment as grasses in terms of tabular and narrative control recommendations.

The remaining terrestrial species, **fennel (Group 4)**, will receive its own treatment recommendation, primarily for its susceptibility to select herbicides.

The aquatic species, **Brazilian waterweed** and **Eurasian water-milfoil (Group 5)**, are also grouped because of their aquatic biology and typically common susceptibility to aquatic herbicide(s) or mechanical and cultural treatment.

Herbicidal Treatment

As described in the ISMP, several herbicides are labeled and approved by the U.S. Environmental Protection Agency and California Department of Pesticide Regulation for use in California on range, pasture, seasonal wetland, and/or noncrop land uses. Prior to application of any herbicides on site, a written recommendation should be prepared by a California licensed and certified Pest Control Advisor (PCA). The PCA should consider the suggestions for treatment and control provided in the following tables and the associated narrative text. These suggestions are provided based on:

- High efficacy and cost-effectiveness in controlling the target species, with minimal hazard to nontarget species (i.e., absence of activity on associated, nontarget plant community), where possible, at labeled rates and application timing
- Low product (active ingredient and carrier) volatility during and following application
- Selected herbicides exhibiting residual effects in the soil, resulting in season-long control of germinating seedlings (where needed and feasible, based on target species; suitable soil characteristics; anticipated adequate soil moisture for activation and movement into the target species' root zone; etc.)
- Labeling and capability for application adjacent to open water, and on seasonally dry wetlands
- Very low acute and chronic mammalian toxicity

These suggestions should not substitute for a written PCA herbicide recommendation.

Treatment in Residual Herbicide Exclusion Areas

As described in the ISMP (Weed BMP 11), on terrestrial sites exhibiting sensitive plant species (i.e., California or federally listed rare, threatened, or endangered species), vernal pools, California tiger salamander (*Ambystoma californiense*) habitat, or within buffer zones established and delineated surrounding these sensitive species, use of residual herbicides (i.e., herbicides having soil activity) should be minimized or avoided until TAFB has completed formal consultation with the U.S. Fish and Wildlife Service (USFWS). Examples of sensitive species that have been previously documented as present on TAFB include:

- *Astragalus tener* A. Gray var. *tener*, alkali milkvetch (California Rare Plant Rank 1B.2)
- *Atriplex depressa* Jeps., brittlescale (California Rare Plant Rank 1B.2)

- *Atriplex joaquiniana* A. Nelson, San Joaquin saltbush, San Joaquin orache, San Joaquin spearscale (California Rare Plant Rank 1B.2)
- *Lasthenia conjugens* E. Greene, Contra Costa goldfields (California Rare Plant Rank 1B.1, federally listed as endangered)
- California tiger salamander (California and federally listed as threatened)
- *Branchinecta lynchi*, Vernal pool fairy shrimp (federally listed as threatened)
- *Lepidurus packardi*, Vernal pool tadpole shrimp (federally listed as endangered)

Within these exclusion or buffer zones, only herbicides exhibiting foliar activity (i.e., foliar mode[s] of absorption and initial translocation within the plant) are therefore recommended until formal USFWS consultation is completed. These latter herbicide recommendations are provided in Tables 1 and 2, for dicot target species (Groups 1, 2, and 4) and monocot target species (Group 3), respectively (Tables 1 and 2).

For **aquatic** weed infestation sites, preferred herbicides may exhibit foliar activity on emergent species (i.e., target species exhibiting exposed leaf organs at or above the water surface), or water-residual activity on submerged species (i.e., target species with all plant tissues or organs below the water surface). There are no known residual herbicide exclusion zones on aquatic weed infestation sites on the TAFB property.

Selective versus Nonselective Herbicides

Typically, herbicides applied singly or in combination as broad-scale treatments (i.e., over larger land areas that exhibit uniform weed distribution[s] and abundance) cannot be selective between target and nontarget species. Broadleaf-selective herbicides generally cannot exhibit genera- or species-specific selectivity within the dicot plant class. Similarly, grass-selective herbicides generally cannot avoid injury to nontarget grasses (monocots) in the same or associated plant community within a prescribed treatment area.

In this context, broadcast herbicide application must be considered cautiously if nontarget plant injury cannot be tolerated. Spot treatment of individual plants or of confined, distinct patches or populations may be possible using directed spray techniques (e.g., use of backpack sprayers). Additionally, variation in growth stage between target and nontarget species (e.g., warm- versus cool-season species; winter annuals versus summer annuals) may provide temporal windows of treatment for the target species that will minimally or not affect nontarget species in the same plant community, particularly where nonresidual herbicides (i.e., foliar-active only) are used. Additionally, herbicide application techniques are available that take advantage of physical canopy height differences between target (taller) and nontarget plants (shorter), where feasible (e.g., rope wick, carpet roller, and similar "wiper"-type application equipment). Conversely, land managers may need to determine if some degree of nontarget, recoverable plant injury (i.e., not mortal) can be tolerated in the interest of effectively controlling aggressive, rapidly spreading target species (i.e., high-priority species).

One prominent herbicidal treatment exception (as an example) demonstrating intra-class selectivity are herbicide active ingredients such as clopyralid and aminopyralid (marketed under the trade names Transline™ and Milestone™, as examples), which are typically selective for control of plants only within the Asteraceae, Fabaceae, and Solanaceae families. These herbicide ingredients are recommended for control of the identified

Table 1. Foliar Nonresidual Herbicide Recommendations for Control of Dicot (Groups 1, 2, and 4) Species on Residual Herbicide Exclusion and Buffer Areas[1]

Herbicide	Application Timing/Methods	Application Rates	Mode of Action	Precautions
Preferred: 2,4-D amine (@ 4 lb gal-1 ai) (e.g., Weedar 64™) + Dicamba (@ 4 lb gal-1 ai) (e.g., Clarity™) *Alternative:* 2,4-D LV (low-vol) ester (@ 4 lb gal-1 ai) (e.g., Weedone LV4™)	Apply in winter and spring (Dec – Mar) to rosettes or bolting plants, or in fall (Sept – Nov) to new seedlings or rosettes. For dense, large, primarily contiguous infestation(s), recommend aerial or ground application using broadcast boom technology. For scattered individual plants or isolated patch(es), or where sensitive plant species are present, recommend spot treatment using hand-held or backpack application.	2,4-D (broadcast) 2.0 pints ac-1 (1.0 lb ac-1) (2.3 L ha-1) 2,4-D (spot-treatment) 0.7 fl oz gal-1 (1,000 ft2) (20.7 ml gal-1) Dicamba (broadcast) 0.5 pint ac-1 (0.25 lb ac-1) (0.6 L ha-1) Dicamba (spot-treatment) 0.18 fl oz gal-1 (1,000 ft2) (5.3 ml gal-1) Use higher rates after bolting through early flower.	2,4-D (phenoxyaliphatic acid chemical family) and Dicamba (benzoic acid chemical family): Hormone disruptor; auxin growth regulator. Selective foliar contact activity. Downward symplastic translocation by xylem and phloem. Affects meristematic tissue in shoots and roots, lipid synthesis, and cuticle formation.	Essentially nonselective for dicot plants; apply cautiously or as spot-treatment where nontarget dicot injury cannot be tolerated or minimized. No grazing, haying, or dairy restrictions. Can treat nonirrigation ditch banks, seasonally dry wetlands, and up to the edge of open or flowing water.

1 The mention of specific herbicide product trade (brand) name(s) in this document is not, and should not be construed as, an endorsement or a specific recommendation for the use of that product. The herbicide products mentioned are provided only as common trade (brand) name examples of the active chemical ingredients recommended for use on the target species. Chemical control options may differ, depending upon restrictions and guidelines issued by the Solano County, California Department of Food and Agriculture, California Department of Pesticide Regulation, U.S. Air Force regulations, or chemical applicator.

Table 2. Foliar Nonresidual Herbicide Recommendations for Control of Monocot (Group 3) Species on Residual Herbicide Exclusion and Buffer Areas

Herbicide	Application Timing/Methods	Application Rates	Mode of Action	Precautions
Preferred: Glyphosate (@ 4 lb gal-1 ai) (e.g., Roundup Pro™, Touchdown Total™)	Apply in fall through spring (Sept – Mar) to new seedlings exhibiting at least 3-leaf growth stage, but prior to 8-in (20-cm) plant canopy height. For dense, large, primarily contiguous infestation(s), recommend aerial or ground application using broadcast boom technology. For scattered individual plants or isolated patch(es), or where sensitive plant species are present, recommend spot treatment using hand-held or backpack application.	Glyphosate (broadcast) 4.0 pints ac-1 (2.0 lb ac-1) (4.6 L ha-1) Glyphosate (spot-treatment) 2.7 fl oz gal-1 (1,000 ft2) (80.0 ml gal-1) Use higher rates at later plant maturity through early flowering.	Glyphosate: Inhibits formation of aromatic amino acids, disrupting protein synthesis and cell formation. Nonselective foliar contact activity. Downward symplastic translocation by xylem and phloem.	Essentially nonselective for most dicot and monocot plants. Greater efficacy on annuals vs. perennials. Apply cautiously or as spot-treatment where nontarget injury cannot be tolerated or minimized. No grazing, haying, or dairy restrictions. Can treat nonirrigation ditch banks, seasonally dry wetlands, and up to the edge of open or flowing water.

target thistle and starthistle weed species (see Table 3 below) in nonbuffer areas where residual herbicides can be used.

However, nontarget species taxonomically within the three target plant families (which may include species such as Contra Costa goldfields) may also be adversely affected, particularly under broadcast treatment scenarios, so use of these herbicides should be carefully planned and executed.

Suggested herbicides to be used in those instances with no restrictions on the use of residual herbicides (i.e., where the potential for injury to nontarget species can be tolerated) are summarized in Tables 3–7).

Mechanical or Manual Treatment and Prescribed Fire

Mechanical or manual treatment (e.g., mowing, weed-eating, tillage) (Tables 8 and 9) or the use of prescribed fire (Table 10), may also be employed to complement herbicide use in an integrated weed management approach. However, these methods when applied as stand-alone treatments to perennial or aquatic weeds seldom achieve any significant measure of long-term control beyond seasonal suppression. And, in some cases, the inappropriate use of these methods may actually cause weed infestations to worsen by inadvertently distributing reproductive plant fragments (e.g., mechanical removal of Brazillian waterweed and Eurasian water-milfoil). Appropriate uses of mechanical or manual removal or prescribed fire include pretreatment of biennial or perennial species that are dense, are of long-standing duration as a population, and, in particular, exhibit mature growth stage(s). In these cases mechanical or manual treatment or the use of prescribed fire can (1) reduce or eliminate current-year, mature seed production and (2) stimulate young regrowth that can subsequently be more effectively treated with systemic or contact herbicides.

For annual species, prescribed fire is often a valuable management tool and is effective at reducing weed root reserves, weed seed banks, and aboveground weed biomass. Prescribed fire has been shown to be particularly effective as part of an integrated management approach for yellow star-thistle (see DiTomaso et al. 2006:Chapter 5, pages 23–27), medusa head (e.g., Pollak and Kan 1998), and barbed goat grass (DiTomaso et al. 2001). Repeated controlled burning in late spring to early summer (May and June) may significantly reduce thatch layers, weed seed banks, plant reproduction, and incipient spread of these winter annual species for several years. Burning in late May and early June is effective because these species are typically immature and have not yet produced viable seeds, while associated nontarget annuals have set their seeds and died, providing enough dry, fine fuel to promote a fire of sufficient intensity to consume the immature target species.

Table 3. Herbicide Recommendations for Control of Group 1 Species on *Nonexclusion Areas Where Residual Herbicide Use Is Permissible*

Herbicide	Application Timing/Methods	Application Rates	Mode of Action	Precautions
Preferred: Aminopyralid (@ 2.0 lb gal-1 ai) (e.g., Milestone™) *Alternative:* Clopyralid (@ 3.0 lb gal-1 ai) (e.g., Transline™ or Stinger™)	Apply in spring and/or early summer (Mar – June) to actively growing plants through bolting (prior to flowering). For dense, large, primarily contiguous infestation(s), recommend aerial or ground application using broadcast boom technology. For scattered individual plants or isolated patch(es), recommend spot treatment using hand-held or backpack application.	Aminopyralid (broadcast) 3.0 to 7.0 fl oz ac-1 (0.24 to 0.51 L ha-1) Aminopyralid (spot-treatment) 2.0 to 4.8 ml per 1,000 ft2 (5.0 to 14.0 ml gal-1) Clopyralid (broadcast) 5.3 to 21.3 fl oz ac-1 (0.42 to 1.70 L ha-1) Clopyralid (spot-treatment) 7.3 to 15.0 ml per 1,000 ft2 (18.3 to 43.7 ml gal-1) Use higher rates after bolting through early flower. As an example, for aminopyralid, the 7.0 fl oz ac-1 rate is recommended for later growth stages. For spot treatments, apply up to 14.0 fl oz ac-1, but not more than 50% of an acre may actually be treated.	Auxin-like (picolinic acid chemical family) growth regulators, with foliar contact and soil residual activity. Systemic, phloem- and xylem-mobile herbicide absorbed by leaves and roots. Accumulates in meristematic tissues. Preemergence and postemergence activity for full season control.	Very selective for the plants in the Asteraceae, Fabaceae, and Solanaceae families. May harm other, nontarget (desirable) plants in Asteraceae, Solanaceae, and/or Fabaceae families. Very low mammalian toxicity. No grazing, haying, or dairy restrictions. Can treat nonirrigation ditch banks, seasonally dry wetlands, and up to the edge of open or flowing water. Aminopyralid application in split seasons is permitted by the label, but cannot exceed maximum application rate per acre for each annual growing season (7.0 fl oz ac-1).

Table 4. Herbicide Recommendations for Control of Group 2 Species on *Nonexclusion Areas Where Residual Herbicide Use Is Permissible*

Herbicide	Application Timing	Application Rates	Mode of Action	Precautions
Preferred: Chlorsulfuron (75% ai) (e.g., Telar XP™) + 2,4-D amine (@ 4 lb gal^{-1} ai) (e.g., Weedar 64™) *Alternative:* Oxyfluorfen (@ 2.0 lb gal^{-1} ai) (e.g., Goal 2XL™) + 2,4-D amine (@ 4 lb gal^{-1} ai) (e.g., Weedar 64™)	Apply in spring on young, actively growing plants up to early flower growth stage. Chlorsulfuron (as a stand-alone application) may also be applied in late fall, prior to target species emergence. For dense, large, primarily contiguous infestation(s), recommend aerial or ground application using broadcast boom technology. For scattered individual plants or isolated patch(es), recommend spot treatment using hand-held or backpack application.	Chlorsulfuron (broadcast) 1.0-3.0 dry oz ac^{-1} (0.08-0.23 kg ha^{-1}) Chlorsulfuron (spot-treatment) 1.0 gram (0.25 teaspoon) gal^{-1} 2,4-D (broadcast) 2.0 pints ac^{-1} (1.0 lb ac^{-1}) (2.3 L ha^{-1}) 2,4-D (spot-treatment) 0.7 fl oz gal^{-1} (1,000 ft^2) (20.7 ml gal^{-1}) Oxyfluorfen (broadcast) 1.0 lb (4 pints) ac^{-1} (1.1 kg ha^{-1}) Oxyfluorfen (spot-treatment) 1.5 fluid ounces gal^{-1} (44.0 ml gal^{-1})	Chlorsulfuron: Sulfonylurea chemical family. Amino acid (branched-chain AHAS/ALS) inhibitor. Minimal foliar contact activity; primarily soil residual activity. Systemic, phloem and xylem mobile herbicide absorbed by leaves and roots. Preemergence and postemergence activity for full season control. Oxyfluorofen: Diphenyl ether chemical family. Cell membrane disruption. Nonsystemic, not translocated via phloem and xylem. Postemergence contact and residual activity on leaves and roots.	Using herbicide combinations (i.e., tank-mixing) postemerge that incorporate other herbicide chemistry/modes of action (e.g., 2,4-D amine) may increase treatment efficacy and reduce chemical cost. However, broader-spectrum activity will also increase potential injury to nontarget species. Use lower rates when weeds are seedlings or rosettes, prior to bolting. Use higher rates after bolting through early flower.

Table 5. Herbicide Recommendations for Control of Group 3 Species on *Nonexclusion Areas Where Residual Herbicide Use Is Permissible*

Herbicide	Application Timing/Methods	Application Rates	Mode of Action	Precautions
Preferred: Sethoxydim (@ 1.5 lb gal-1 ai) (e.g., Poast™) *Alternative:* Glyphosate (@ 4 lb gal-1 ai) (e.g., Roundup Pro™, Touchdown Total™)	Apply in fall through spring (Sept – Mar) to new seedlings exhibiting at least 3-leaf growth stage, but prior to 8-in (20-cm) plant canopy height. For dense, large, primarily contiguous infestation(s), recommend aerial or ground application using broadcast boom technology. For scattered individual plants or isolated patch(es), or where sensitive plant species are present, recommend spot treatment using hand-held or backpack application. Integration of herbicide treatment with mechanical and/or pyric measures will enhance treatment efficacy; see recommendations below.	Sethoxydim (broadcast) 2.0 pints ac-1 (0.38 lb ac-1 ai) (2.3 L ha-1) Sethoxydim (spot-treatment) 2.0 fl oz gal-1 (1,000 ft2) (60.0 ml gal-1) Glyphosate (broadcast) 4.0 pints ac-1 (2.0 lb ac-1) (4.6 L ha-1) Glyphosate (spot-treatment) 2.7 fl oz gal-1 (1,000 ft2) (80.0 ml gal-1) Use higher rates at later plant maturity through early flowering.	Sethoxydim: Cyclohexanedione chemical family. Systemic grass meristem destruction via inhibition of lipid biosynthesis. Downward symplastic translocation via phloem to leaf growing points. Affects meristematic tissue in shoots and roots, lipid synthesis, and cuticle formation. Glyphosate: Inhibits formation of aromatic amino acids, disrupting protein synthesis and cell formation. Nonselective foliar contact activity. Downward symplastic translocation by xylem and phloem.	Sethoxydim and glyphosate: Selective for monocot control; however, nonselective within monocot plant class. Apply cautiously or as spot-treatment where nontarget monocot injury cannot be tolerated or minimized. No grazing, haying, or dairy restrictions. Can treat nonirrigation ditch banks, seasonally dry wetlands, and up to the edge of open or flowing water. POAST™ herbicide – incorporation tillage applied 7 days or later after treatment may provide extended control further into the growing season.

Table 6. Herbicide Recommendations for Control of Group 4 Species on *Nonexclusion Areas Where Residual Herbicide Use Is Permissible*

Herbicide	Application Timing	Application Rates	Mode of Action	Precautions
Preferred: 2,4-D LV (low-vol) ester (@ 4 lb gal-1 ai) (e.g., Weedone LV™) + Dicamba (@ 4 lb gal-1 ai) (e.g., Clarity™) *Alternative:* 2,4-D amine (@ 4 lb gal-1 ai) (e.g., Weedar 64 ™) + Dicamba (@ 4 lb gal-1 ai) (e.g., Clarity™)	Apply in fall prior to hard freeze, or in late winter to spring (Feb – Apr) to new seasonal growth. For dense, large, primarily contiguous infestation(s), recommend aerial or ground application using broadcast boom technology. For scattered individual plants or isolated patch(es), or where sensitive plant species are present, recommend spot treatment using hand-held or backpack application.	2,4-D (broadcast) 3.0 pints ac-1 (1.5 lb ac-1) (3.5 L ha-1) 2,4-D (spot-treatment) 1.1 fl oz gal-1 (1,000 ft2) (33.0 ml gal-1) Dicamba (broadcast) 1.0 pint ac-1 (0.50 lb ac-1) (1.2 L ha-1) Dicamba (spot-treatment) 0.36 fl oz gal-1 (1,000 ft2) (10.6 ml gal-1) Use higher rates after bolting through early flower.	2,4-D (phenoxyaliphatic acid chemical family) and Dicamba (benzoic acid chemical family): Hormone disruptors; auxin growth regulators. Selective foliar, systemic activity. Downward symplastic translocation by xylem and phloem. Affects meristematic tissue in shoots and roots, lipid synthesis, and cuticle formation.	Essentially nonselective for dicot plants; apply cautiously or as spot-treatment where nontarget dicot injury cannot be tolerated or minimized. No grazing, haying, or dairy restrictions. Can treat nonirrigation ditch banks, seasonally dry wetlands, and up to the edge of open or flowing water.

Table 7. Herbicide Recommendations for Control of Group 5 Species on Aquatic Sites

Herbicide	Application Timing	Application Rates	Mode of Action	Precautions
Preferred: Fluridone (5%) (@ 0.05 lb lb^{-1} ai) (e.g., Sonar PR™ or Whitecap™) *Alternatives:* Endothall (e.g., Aquathal™) Diquat (e.g., Reward™) Triclopyr-TEA (e.g., Renovate 3™) 2,4-D aquatic formulations (e.g., Aquacide™) Glyphosate aquatic formulations (e.g., Rodeo™, AquaMaster™, AquaPro™) (*for control of floating leaved plants).*	Apply as a single application during active weed growth to the entire surface area of the pond according to the rates in the table to the right. At 150 ppb or less dosage, there are no water restrictions for drinking, fishing, swimming, livestock consumption, or irrigation. Safe for fish populations. Best efficacy when applied to whole water bodies (full surface area treatment) that exhibit little water movement or flow. ** Note -- Consult with a licensed and certified aquatic weed control specialist to amplify and/or refine these recommendations.	Sonar PR™ dosage: Average Water Depth of Treatment Site (feet) / Pounds of Sonar PR™ Per Treated Surface Acre: 45 ppb / 90 ppb 1 — 2.5 — 5.0 2 — 5.0 — 10.0 3 — 7.5 — 15.0 4 — 10.0 — 20.0 5 — 12.5 — 25.0 6 — 15.0 — 30.0 7 — 17.0 — 34.0 8 — 19.5 — 39.0 9 — 22.0 — 44.0 10 — 24.5 — 49.0 Use higher application rate for dense aquatic weed mass. Use the lower rate for ponds less than 5 surface acres (2 ha) with an average water depth less than 4 feet (1.2 m); or in shallow areas (e.g., littoral shoreline areas).	Fluridone: Slow-acting, systemic meristem destruction via inhibition of chlorophyll/carotenoid pigment biosynthesis. Downward symplastic translocation via phloem to leaf growing points. Affects meristematic tissue in shoots and roots. Granular or pellet formulations are more effective when treating areas of higher water exchange or if low water levels must be maintained over long time periods.	Split or multiple applications may be used where dilution of treated water is anticipated. The sum of all applications should not exceed a total of 90 ppb (maximum labeled rate) per annual growth cycle. Split applications may be desirable when a lower dose (e.g., 45 ppb) is applied with sufficient time to ensure efficacy and enhance selectivity (particularly if ingress/egress flows dilute dose concentrations). Consult with state or local water authorities; permits may be required for application.

Table 8. Mechanical/Manual Measures for Integrated Management of Identified *Nonaquatic* Weed Species

Mechanical Measure	Application Timing	Application Techniques	Maintenance Requirements	Precautions
Mowing/shredding/ mastication	Prior to seed head maturation. With yellow star-thistle, mowing should occur no later than very early flowering stage (less than 2% of spiny heads in flower) because of high seed viability and maturation rates.	Cutting height sufficiently low to remove all seed heads, but high enough to avoid rocks and other debris. Various types of equipment available for use: standard bladed brush hog; flail header/shredder; weed whipping; etc.	Repeated as necessary within growing season to maintain uniform, consistent seed head removal. Scout for fallen, intact seed heads, and remove, where possible.	Mowing alone is not an eradication measure; suppression only. Its purpose is to prevent seed head formation and reduce the weed seed bank in soil over time. Plants may resprout or continue growth after mowing. Plants that are repeatedly mowed may persist as short-lived perennials, or assume shorter stature and resume flowering below mowing height. Mowing may increase amount of toxin ingested by grazing animals by increasing palatability of leaf regrowth in poisonous species. Equipment access may be limited or hazardous on steeper slopes.
Manual grubbing, hoeing, digging	Apply as soon as plants are detected, preferably in early growth stages. Remove plants prior to bolting and flower formation. Optimal for removal of new plants (incipient infestations), small populations, or in final years following long-term management and reduction of larger infestations.	Remove by hand-pulling; digging or grubbing by shovel or similar tool. Plant removal is facilitated when soil is moist and not compacted.	Scout for germinating seedlings or small rosettes (first year plants) that are understory to mature (second year) plants; pull or grub along with more mature plants. Monitor in spring and fall in successive years to detect and remove new plants.	Plants with potential for seed maturation should be bagged and disposed of offsite. Labor-intensive; not economically or logistically feasible for large, dense infestations. Minimize soil disturbance during removal.

Table 9. Mechanical/Manual Measures for Integrated Management of Identified *Aquatic* Weed Species

Mechanical Measure	Application Timing	Application Techniques	Maintenance Requirements	Precautions
Mechanical cutting, shredding, mat harvesting, cabling or chaining – larger or widespread populations (generally greater than 1.0 acre). Manual cutting, pulling, digging – smaller, isolated populations (generally less than 1.0 acre). ** Note -- consult with a licensed and certified aquatic weed control specialist to amplify and/or refine these recommendations.	Anytime during active plant growth that produces vegetative and/or reproductive organs accessible to the cutting or harvesting equipment. Preferably performed prior to maturation of flowers or other reproductive organs.	Floating mechanical harvesters are available from a variety of manufacturers that cut and remove large or dense mats of aquatic species on larger water bodies. These are typically not feasible for small water bodies such as ponds, sloughs, etc. Chaining or cabling is effective for biomass reduction, but typically does not remove biomass. Requires vehicles on two sides of the water body for pulling the cable or chain – thus, best for linear water bodies with bilateral road access (e.g., canals, ditches). May be possible for small ponds with continuous perimeter vehicular access. Manual digging or pulling of soil-rooted aquatic species can be accomplished in shallow water depths. All roots and vegetative fragments must be removed. Cut or harvested aquatic weed material should be deposited in dry areas for dehydration or composting prior to burial or other disposal offsite.	Repeated as necessary within growing season to maintain uniform, consistent vegetative and/or reproductive organ removal. Monitoring and prevention or minimization of aquatic species introductions are the most important methods of control. Disposal of aquarium waste water in water bodies should be closely monitoring and prevention measures enforced. Anchored bottom screens or polyethylene plastic sheeting (e.g., Visqueen™) can be installed to reduce or prevent incipient sprouting of new individuals, but must be cleaned of sediments periodically.	Mechanical or manual removal alone is not an eradication or control measure; temporary suppression only, and may enhance fragmentation. Plants may resprout or continue growth after cutting or harvesting. Equipment access may be limited or hazardous on steeper shoreline slopes. Scout for cut plant fragments, and collect/remove as feasible. Brazilian waterweed and Eurasian water-milfoil exhibit very high vegetative spread potential, and are often further spread as viable fragments by mechanical cutting or harvesting methods. Labor-intensive; often not economically or logistically feasible for large, dense infestations. Native or desirable aquatic vegetation may also be injured or removed by mechanical methods.

Table 10. Prescribed Fire Measures for Integrated Management of Identified Weed Species

Mechanical Measure	Application Timing	Application Techniques	Maintenance Requirements	Precautions
Prescribed fire. Consult California Department of Forestry and Fire Protection (CAL FIRE), or consultant with specialty in prescribed fire conductance and management, for use of prescribed fire.	Apply to actively growing and healthy weed populations, but prior to mature seed set. Treatment should be planned according to resource needs in consideration of (1) ability to prevent/control potential erosion after burning, (2) reduction of weed pressure and competition with associated desirable species during the growing season, and/or (3) optimal timing to provide maximum manageable (or preferred) fire intensity (e.g., heat level, duration, frequency) to reduce weed seed bank and/or current year's standing seed crop (preferably in "milk" or "soft-dough" stage).	Apply using hand-held flamers or drip torches, in accordance with a CAL FIRE approved prescribed burning plan. Generally, apply initially to outer perimeter of target weed population(s), allowing fire to burn into the infestation interior, in correspondence with favorable/facilitating weather conditions, soils, fine and ladder fuels quantities and qualities, slope and aspect, and structure avoidance.	Repeated as necessary seasonally and/or annually to maintain uniform, consistent reduction of weed seed bank, competitive vegetative growth, and seed head formation. For herbicide applications, apply to mature weed populations in order to reduce standing biomass and stimulate new regrowth susceptible to herbicide injury. Scout and adapt management for response of biennial or perennial species within the burn area.	Burning alone is typically not an adequate eradication or control measure; suppression only. Its purpose is to prevent seed head formation and reduce the weed seed bank in soil over time. Biennial and perennial plants may resprout or continue growth after burning. Burning may increase amount of toxin ingested by grazing animals by increasing palatability of leaf regrowth following fire in poisonous species. Equipment access for fire management may be limited or hazardous on steeper slopes.

Biological Control

Several biological agents have been released for use in integrated management programs to assist in controlling annual and biennial thistles, including yellow star-thistle. However, biological control agents must be host-specific to avoid potential adverse impacts on taxonomically similar nontarget species, and they are seldom successful when used as the sole treatment. More importantly, particularly in relation to infestation conditions at the TAFB property, biological control agents are effective only when populations of the target weed species are sufficient to (1) nutritionally and reproductively sustain the biological control agent over time (i.e., via repeat insect generations) and (2) provide ecotypes of the host plant that are adequate in population, palatability, and nutrition to ensure retention on the target release site.

Yellow star-thistle may be the only target species that meets these latter criteria, having sufficient population density and distribution to support a biological control agent at least for short-term (3- to 5-year) duration. Several biological control agents have proven effective for use in integrated management programs for yellow star-thistle (see DiTomaso et al. 2006:Chapter 6, pages 32–40). If yellow star-thistle populations achieve dense or widely distributed populations on TAFB, specific biocontrol recommendations can be formulated at that time. In accordance with Cal-IPC recommendations, there is no biological control agent or organized biological control program for purple star-thistle. Two species of *Bangasternus* seed head weevils that have been introduced to control yellow star-thistle are reported to have biotypes that feed on purple star-thistle in Europe, but they have not been introduced to North America. No other biological controls are sufficiently host specific or effective for the vast majority of the remaining weeds on TAFB.

Cultural Management

Several cultural management techniques are applicable to the treatment of weeds (Tables 11 and 12). For terrestrial weeds, concentrated livestock grazing approaches (sheep or cattle) using high-intensity and short-duration grazing systems (or similar) in spring (i.e., early vegetative growth stage, before seed maturation and floret awn) have been shown to assist in their control, particularly when alternated with herbicide treatment. Livestock must be removed after the seed heads form to limit seed dispersal and injury to mouthparts of grazing animals. Spring grazing by sheep can reduce medusa head cover, especially in areas where medusa - head litter had been burned, clipped, or previously grazed. Similarly, species of grass carp have been used in some instances to provide limited control of aquatic weeds. Better control of aquatic weeds may be obtained through dewatering or through the use of dyes and colorants that deprive aquatic vegetation of light and disrupt photosynthesis; however, the use of these techniques is frequently limited in natural waterbodies or other aquatic habitats that provide habitat and recreational benefits.

Cultural methods are more commonly used to enhance the ability of weed treatment sites to resist further weed invasion by maintaining or restoring the health, vigor, and competitiveness of native plant communities. Conscientious management and restoration of native plant communities provides long-term, sustainable capability to suppress invasive species with minimal augmentation from herbicidal or mechanical measures. One example is the use of the native perennial bunchgrass, bottlebrush squirreltail (*Elymus elymoides* [Raf.]

Table 11. General Guidelines for Cultural Weed Management Measures

Cultural Measure	Application Timing	Application Techniques	Maintenance Requirements	Precautions
Livestock grazing management	Applied annually during the growing season for target species.	Employ managed grazing systems that incorporate high-intensity, short-duration (or similar) stocking rates and rotational pasture deferment or rest, in order to increase amount, distribution, seasonal availability, and quality of desired forage species. ** Note -- Consult with a California-licensed Certified Rangeland Manager to refine these recommendations.	Assure adequate vegetative residue (stubble) cover to maintain erosion control, habitat values, and ecological condition for wildlife and livestock.	Italian thistle may be a nitrate accumulator. Ingestion by grazing animals may cause nitrate poisoning, especially after mechanical or prescribed fire treatment that stimulates young regrowth.
Revegetation	Applied to severely disturbed sites, as needed, to control erosion, provide forage for wildlife and livestock, as applicable. Seeding is typically performed at or near the onset of the winter monsoonal precipitation period, approximately November – December.	Seeding using compatible mixtures of adapted native species. Mixture(s) should emphasize high proportion of grasses as the dominant growth-form component, in order to maximize erosion control, site stabilization, and self-sustainable competition with invasive species encroachment. Drilled seedings are recommended on mild slopes, whereas broadcast seedings are preferred on steeper slopes that may limit equipment access. Seeding specifics (species, methods, equipment, and maintenance measures) can be formulated, upon request.	Grazing exclusion may be needed during establishment, typically 1–3 years following seeding. Managed and monitored grazing incorporating pasture rotation thereafter to promote health and vigor of established vegetation.	If physical disturbance yields significant amounts of bare ground on steeper slopes, stabilization measures may be needed to minimize surface runoff and rill erosion, and reduce moisture, temperature, and wind extremes at the soil surface. Avoid fertilization; additional soil nitrates will exacerbate potential nitrate accumulation in thistles, and enhance secondary weed encroachment.

Table 12. General Guidelines for Cultural *Aquatic* Weed Management Measures

Cultural Measure	Application Timing	Application Techniques	Maintenance Requirements	Precautions
Natural predation by grazing fish.	Apply prior to annual growing season growth initiation, as applicable. Preferably performed prior to significant vegetative growth, or development of reproductive organs. ** Note -- consult with a licensed and certified aquatic weed control specialist to amplify and/or refine these recommendations.	Two fish, the white amur or Chinese grass carp (Ctenopharyngodon idella) and the Congo tilapia (Tilapia melanopleura), have been introduced into water bodies for control of aquatic weed species. Currently, only the sterile (triploid) grass carp can be used in California. Permitted uses are authorized by select county Agricultural Commissioners, and by the California Department of Fish and Wildlife, with certain restrictions.	Maintain introduced fish populations that are adequate for the size of the aquatic weed populations. Replenishment following fish mortality may be needed. In small water bodies, reduction of target aquatic weed species may shift grazing emphasis to native or desirable plants, resulting in injury or mortality.	Grass carp have been shown ineffective on Eurasian water-milfoil. Native or desirable aquatic vegetation may also be injured or removed by fish predation.
Desiccation through water removal.	Applied during active plant growth to inhibit or kill existing plant growth; or during dormant periods to dehydrate perennial root systems in moist sediments. Preferably performed prior to maturation of flowers or other reproductive organs.	Drain or otherwise remove water from the collection basin or structure.	Maintain dewatering desiccation for a continuous duration of at least one year (full growing season), to enhance success of treatment. Freezing of plants during winter may also be a secondary, beneficial effect.	May not be logistically feasible because of recreational or habitat requirements. Native or desirable aquatic vegetation may also be injured or removed by desiccation treatment.
Light deprivation.	Apply prior to annual growing season growth initiation, as applicable. Preferably performed prior to significant vegetative growth, or development of reproductive organs.	Apply light-limiting dyes to water body, or other means of shading (floating shade barriers or similar covers).	Must maintain adequate dye levels or shading structures for long duration (full growing season) to enhance success of treatment.	May not be logistically feasible because of recreational or habitat requirements. Native or desirable aquatic vegetation may also be injured or removed by light deprivation.

Swezey) to suppress invasion by annual grasses like medusa head and barbed goatgrass (Hironaka and Sindelar 1973). Other examples of successful native grassland restoration are provided by Stromberg et al. (2007). Restoration without first significantly suppressing or removing competitive weed species (dicots and particularly annual grass weed species), however, has shown limited success.

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APPENDIX G

Invasive Plant Species Management Plan (IPSMP)

(ManTech 2017)

Travis Air Force Base

Updated Invasive Plant Species Management Plan



13 February 2017

Prepared for:

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Prepared Under:

Air Force Project Number and Title: AFCE777715, Management, Invasive Species, California
Funding Document Number: F2MUAA4227G002
NAVFAC Contract N62742-14-D-1863, Delivery Order FZN8

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Acronyms and Abbreviations

ac	acre
^{o}C	degrees Celsius
AFB	Air Force Base
BASH	bird air strike hazard
BMP	Best Management Practice
CA	California
Cal-IPC	California Invasive Plant Council
CDFA	California Department of Food and Agriculture
CCG	Contra Costa goldfields
CDFW	California Department of Fish and Wildlife
cm	centimeters
CTS	California tiger salamander
DPS	distinct population segment
ft	feet/foot
FR	Federal Regulation
ha	hectare
in	inches
INRMP	Integrated Natural Resources Management Plan
IPMC	Installation Pest Management Coordinator
MSRS	ManTech SRS Technologies, Inc.
m	meter
mi	mile
NLT	No Later Than
NRMU	Natural Resources Management Unit
RCD	Resource Conservation District
RDM	residual dry matter
TAFB	Travis Air Force Base
UDA	undeveloped area
US	United States
USAF	United States Air Force
USFWS	United States Fish and Wildlife Service
VPFS	vernal pool fairy shrimp
VPTS	vernal pool tadpole shrimp

1.0 Introduction

1.1 Background

Biological invasions, defined as disruptions of natural communities and ecosystems by an increase in distribution and abundance of exotic species (Muller-Scharer *et al.* 2004), cause extensive damage to human economies and natural systems every year. This damage may be in the form of decreased agricultural yields, expenditures on chemical or mechanical control (including potential losses from the side effects pesticides cause to human and natural area health), and biodiversity or ecosystem function losses. On Federal lands, exotic species (weeds, invasive species, non-native species) may also lead to losses where they threaten sensitive species that Federal land managers are required to conserve. Legislation often invoked to justify invasive species control programs includes the National Environmental Policy Act, Endangered Species Act and Executive Orders (EO) that explicitly require control of exotic species. For instance, EO 13751, enacted in 2016, states that the United States (US) prevents the introduction, establishment and spread of invasive species as a matter of policy. The Order estimates that invasive species cost billions of dollars of damage each year in the US (EO 13751).

Control of exotic species is thus driven by expediency and policy on Federal lands. However, land managers faced with extensive infestations of weeds and limited budgets must choose strategies that will result in the best possible results within means of available resources, rather than attempting to eradicate each and every exotic species. A thoughtful analysis of the intersection between available resources, characteristics and extent of the invasive problem and conservation methods for sensitive resources should be completed before expending potentially unnecessary or ineffective efforts. On Travis Air Force Base (TAFB or Base), a long-standing and entrenched population of a suite of weed species threatens various sensitive resources as well as the quality of life for Base residents and accomplishment of military objectives and missions.

1.2 Purpose and Scope

Despite decades of invasion pressure and changes in land management beginning with the arrival of Spanish explorers, TAFB retains valuable natural resources and sensitive species that can be effectively managed and conserved within the context of Base activities. Air Force Instruction 32-7064, Integrated Natural Resources Management, addresses the management of natural resources on Air Force properties. The chief tool for managing installation ecosystems is the Integrated Natural Resources Management Plan (INRMP). The INRMP states Goals and Objectives to guide management, and Goals G.1 and C.1 as well as Objectives D.3.2 and C.1.1 (Table 1-1) provide explicit drivers for invasive species control at TAFB. Taken together, these Goals and Objectives frame invasive species control in terms of conservation of and benefit to sensitive, threatened and endangered species. Currently, TAFB has Critical Habitat designations on or nearby the Base for Contra Costa goldfields (*Lasthenia conjugens,* CCG) and California tiger salamander (*Ambystoma californiense,* CTS). However, a well-designed and effectively

implemented INRMP can be the basis for an exemption to designations of Critical Habitat, as stated in Section 4(a)(3)(B)(i):

> "The Secretary shall not designate as critical habitat any lands or other geographical areas owned or controlled by the Department of Defense, or designated for its use, that are subject to an integrated natural resources management plan prepared under section 101of the Sikes Act (16 U.S.C. 670a), if the Secretary determines in writing that such plan provides a benefit to the species for which critical habitat is proposed for designation."

The terms of such an exemption were clarified in 2012 as follows: "Exemption of an area covered under an INRMP under the Sikes Act is based on the statutory condition that the Secretary has determined the plan provides a benefit to a species" (Federal Register Docket Number FWS–HQ–ES–2012–0096). This Invasive Species Management Plan is designed to further the Goals and Objectives presented in the INRMP to provide benefits to listed species, particularly CCG and CTS.

Table 1-1. INRMP Invasive Species Goals and Objectives.

	Number	Explanation
Goal: The purpose towards which an endeavor is directed	Goal C.1	Maintain and enhance the ecological integrity of sensitive habitats and species affected by invasive species.
	Goal D.3	Protect and enhance existing populations and habitats of threatened and endangered species. Assess status, develop long-term plans and conduct actions for recovery.
Objective: Measureable step taken to achieve a specified Goal	Objective C.1.1	Reduce the impacts of invasive species to sensitive habitats and species.
	Objective D.3.2	Protect and enhance habitat for state threatened and endangered species and species of concern.

This document replaces the vegetation sections of the 2014 HT Harvey Invasive Species Management Plan, which included control of wildlife species as well as vegetation management (HT Harvey and Associates 2014). The purpose of this document is to present a sustainable long-term strategy for managing the vegetation at TAFB to maximize the opportunities for stewardship of sensitive species and resources and reduce the prevalence of undesirable non-native plants. This plan presents both base-wide approaches for managing weeds and site-specific strategies for each Natural Resource Management Unit. This plan is intended to be used by TAFB Natural Resource staff and contractors who manage vegetation on Base. It includes protocols for preventing the spread of existing weeds and introduction of new species, methods for controlling specific weed species known to occur on TAFB and general management strategies for the habitats and sensitive species of TAFB.

1.3 Base Setting

Travis Air Force Base occupies approximately 4,900 acres (ac) (2,000 hectares [ha]) in Northern California, approximately 45 miles (mi) (72 kilometers [km]) inland from San Francisco (Figure 1-1). Since the 1940's, the installation has supported defense aviation activities that have included servicing and ferrying aircraft to the Pacific Ocean, long-range reconnaissance, air logistics support, and humanitarian operations. The Base experiences the Mediterranean climate typical of much of California. Precipitation falls between November and March, and averages approximately 23 inches (58.4 centimeters [cm]) per year. Summer months from April to October are generally dry. Coastal fog and cool air blows in from the ocean during much of the summer, but temperatures may exceed 109 degrees Fahrenheit (^{o}F) (43 degrees Celsius [^{o}C]) when hot summer winds blow from the north.

The Base is primarily composed of densely-built military installations, housing and training areas with little open space or natural areas requiring management (USAF 2016). However, the Mediterranean climate and soils of the Base support an extensive complex of vernal pools and grassland, which are a rare habitat type that supports several endangered and threatened species (CDFW 2010). Vegetation and invasive species management on TAFB is driven by vernal pool conservation, the rare plant and animal species associated with the pools, and by airfield operations that require bird air strike hazard (BASH) reduction. Currently, non-native plant species and vegetation management includes herbicide application, mowing, grazing and monitoring. Four Natural Resources Management Units (NRMU) within TAFB contain the majority of the open space and natural resources (Figure 1-2). Each of these Units has unique assets such as its particular complement of sensitive resources, and they also differ in their current management and problematic invasive species.

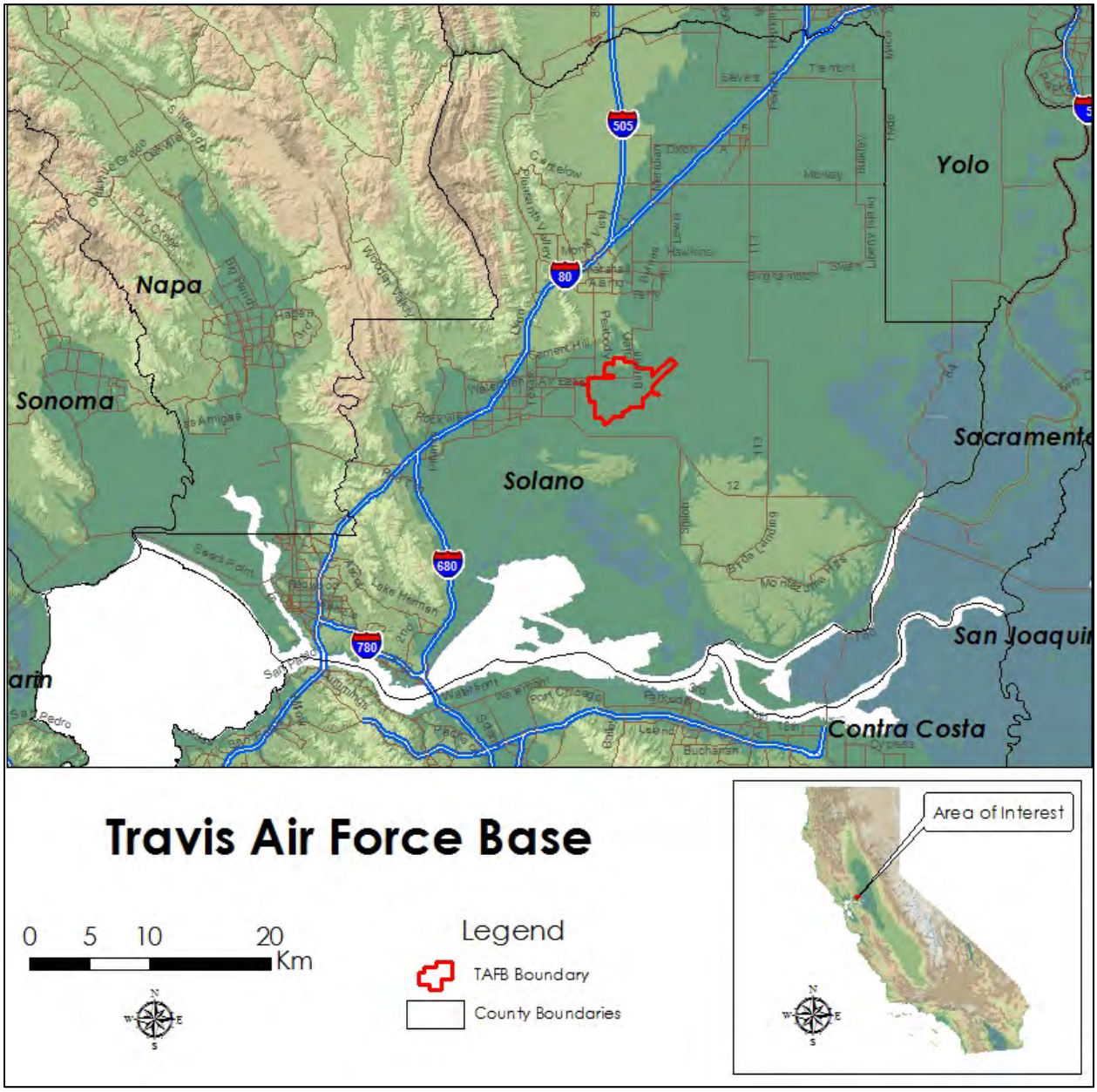

Figure 1-1. Travis Air Force Base extent and location within Central California.

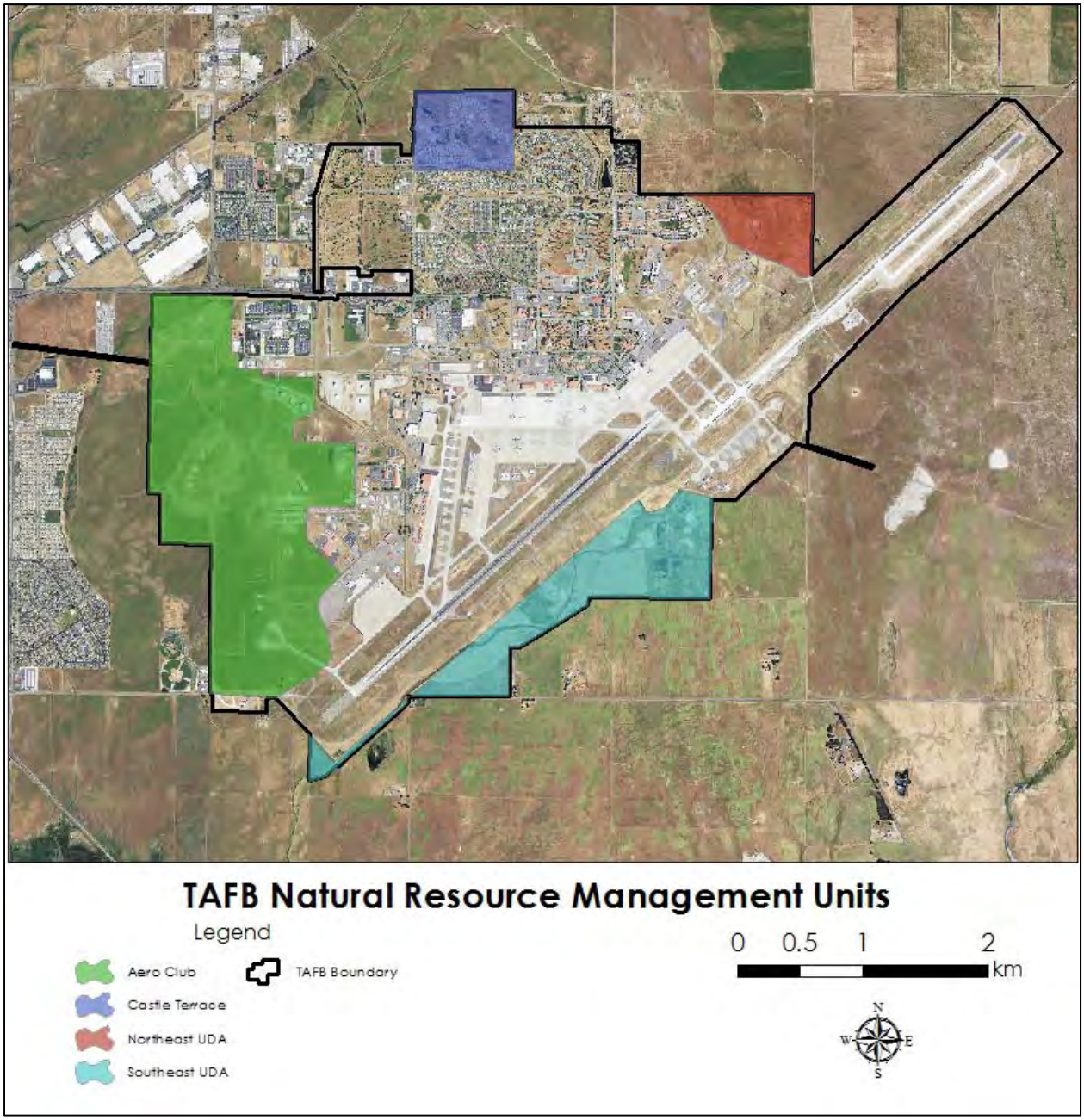

Figure 1-2. Natural Resources Management Units.

2.0 Native Species Landscape

2.1 Ecological Communities Background

Historic, pre-European vegetation of TAFB was most likely dominated by Valley Grassland, which was characterized by highly diverse communities of forbs and geophytes with occasional grasses (Minnich 2008; Evett and Bartoleme 2013). Vernal pools embedded within these upland communities would have supported springtime displays of colorful annual species during their brief seasons, and the occasional oak grove probably lined the more reliable waterways (USAF 2016). The exact composition of California's pre-European landscapes remains unknown because non-native species were introduced by 18th century explorers and colonists prior to botanical research (Minnich 2008).

The land that is currently administered by TAFB experienced historic-era disturbances that dramatically altered huge swaths of California: introduced European species of herbivores instead of the native deer, elk, pronghorn and bear; intensive cultivation for mono-specific stands of crops instead of Native American land management practices that included burning for forage production; and invasion of Mediterranean Basin and Eurasian species such as brome grasses and myriad exotic forbs. The invasive flora of TAFB today is a mix of accidental and deliberate introductions spanning over three hundred years. Some arrived as forage or clung to introduced livestock, others with agriculture and, more recently, ornamentals were brought to California for landscaping. In addition, the air traffic that arrives at TAFB through military operations has the potential to introduce new species from anywhere in the world.

The vegetation of the Base today is the result of this complex history of disturbance and invasion of the original Valley Grassland system, as well as varying levels of control of non-native plant species. Despite these disturbances and invasions, TAFB retains significant natural resource value and is home to several sensitive, endangered or rare species. Vegetation communities at TAFB consist of northern claypan vernal pool and California annual grassland. Native plant species commonly found in vernal pools include Pacific foxtail (*Alopecurus saccatus*); annual hair grass (*Deschampsia danthonioides*); goldfields (*Lasthenia* spp.), including Contra Costa goldfields (*Lasthenia conjugens*; CCG), which is federally listed as endangered; woolly-marbles (*Psilocarphus* spp.); popcorn flower (*Plagiobothrys* spp.); downingia (*Downingia* spp.); coyote thistle (*Eryngium* sp.); and spike rush (*Eleocharis macrostachya*). Special-status wildlife species identified in vernal pools at TAFB include vernal pool tadpole shrimp (*Lepidurus packardi*; VPTS), which is federally listed as endangered; vernal pool fairy shrimp (*Branchinecta lynchi*; VPFS), which is federally listed as threatened; and California tiger salamander (*Ambystoma californiense*; CTS), which is federally and State listed as threatened. The highest density of vernal pools are in the northwestern portion of the Base.

California annual grassland at TAFB is dominated by non-native grasses and forbs, including wild oat, ripgut grass, rattail sixweeks grass, Italian rye grass, wild geranium, hare barley, and Mediterranean barley. This plant community supports a variety of birds, reptiles, and mammals, including red-winged blackbird (*Agelaius phoeniceus*), ring-necked pheasant (*Phasianus colchicus*), northwestern fence lizard (*Sceloporus occidentalis*), Pacific gopher snake (*Pituophis melanoleucus*), and deer mouse (*Peromyscus maniculatus*).

Other plant communities include lacustrine marsh, riparian, and urban landscapes. At TAFB, marshes are mostly areas of emergent vegetation bordering the open water of ponds (lacustrine areas). Lacustrine marsh consists of emergent vegetation, such as cattails (*Typha latifolia*) and common tule (*Schoenoplectus acutus* var. *occidentalis*). Areas of open water adjacent to marshes support game fish, such as largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), channel catfish (*Ictalurus punctatus*), and green sunfish (*Lepomis cyanellus*).

Riparian vegetation occurs along stream channels and banks. Dominant trees and shrubs in the riparian community at TAFB include red willow (*Salix laevigata*), arroyo willow (*Salix lasiolepis*), and coyote brush (*Baccharis pilularis*). Representative wildlife that uses this habitat includes red-winged blackbird, mallard (*Anas platyrhynchos*), Sierran treefrog (*Pseudacris sierra*), western pond turtle (*Actinemys marmorata*), and valley garter snake (*Thamnophis sirtalis fitchi*) (USAF 2016. Urban landscapes at TAFB include more than 42 species of planted trees. Wildlife found in landscaped areas includes song sparrow (*Melospiza melodia*), red-winged blackbird, killdeer (*Charadrius vociferus*), house sparrow (*Passer domesticus*), western harvest mouse (*Reithrodontomys megalotis*), and ground squirrel (*Spermophilus beecheyi*)

2.2 Sensitive Resources

2.2.1. Contra Costa Goldfields (*Lasthenia conjugens*)

Vernal pools are a particularly important resource on TAFB. These ephemeral wetlands are the result of wintertime inundation of persistent depressions that lie on top of impermeable layers of clay or occasionally other non-porous layers such as bedrock. Then, as the California summer proceeds, the pools dry down, resulting in a cycle that requires considerable specialization for plants to survive. The wetland species that typify the vernal pool flora are highly adapted to this harsh cycle, with the majority being annual species that can perform an entire life cycle during the brief period of ideal conditions between complete inundation and total desiccation.



Figure 2-1. Contra Costa goldfields plants.

CCG were listed as federally endangered by the USFWS on 18 June 1997 (62 Federal Register [FR] 33029 - 33038). The vernal pool endemic, federally endangered species CCG is a quick germinating, annual species (Figure 3). As an adaptation to its vernal pool habitat, it has lost the pappus common to many members of its family (USFWS 2008). Because wind-dispersing seeds are more likely to land in inhospitable grassland habitat than on a

pool edge, the loss of the dispersal mechanism ensures that existing CCG populations retain their seeds for the next wet cycle (Ornduff 1966). However, the sedentary nature of the seeds results in dispersal limitation and a reliance on pollinators for gene flow (Ornduff 1966; Collinge and Ray 2009). The species has declined severely across its historic range as vernal pool habitat is lost to development and invasion, making it a priority species for TAFB. Unchecked exotic species invasion of pool basins and surrounding grasslands can decrease the period of inundation, increase competition and decrease habitat for pollinators of CCG (Marty 2005; George 2006; Marty 2015). Contra Costa goldfields are found primarily in the northern and western portions of the Base, but all vernal pools are considered suitable habitat and managed as occupied (Figure 2-2).

Construction and maintenance activities in 1997 at the Aero Club resulted in damage to some of the pools and the inadvertent loss of CCG plants and habitat. To mitigate these losses and ensure long-term protection of CCG populations on TAFB, the damaged Aero Club pools were subsequently restored and a vernal pool complex of 256 pools was constructed within undeveloped portions of the Aero Club (Collinge 1999). These pools were seeded with vernal pool species, including CCG. Subsequent monitoring of this restoration effort resulted in numerous publications and data about the resident CCG population and the vernal pools' hydrology and vegetation. During the first six years following the initiation of restoration efforts, the overall response of hydrology, CCG and other vernal pool endemic species was positive, with many pools falling within the allowed range of variation from reference pools (CH2M Hill 2005). In a recent reevaluation of the restoration effort, Collinge *et al*. (2013) reported that native species have declined in both the constructed and reference pools at the Aero Club, and that hydrologic conditions (both period of inundation and maximum depth) were declining in the constructed pools. They suggest that additional seeding of vernal pool endemics and native species or removal of exotic species may correct the course of the restoration trajectory back toward a more native-dominated system (Collinge *et al*. 2013).

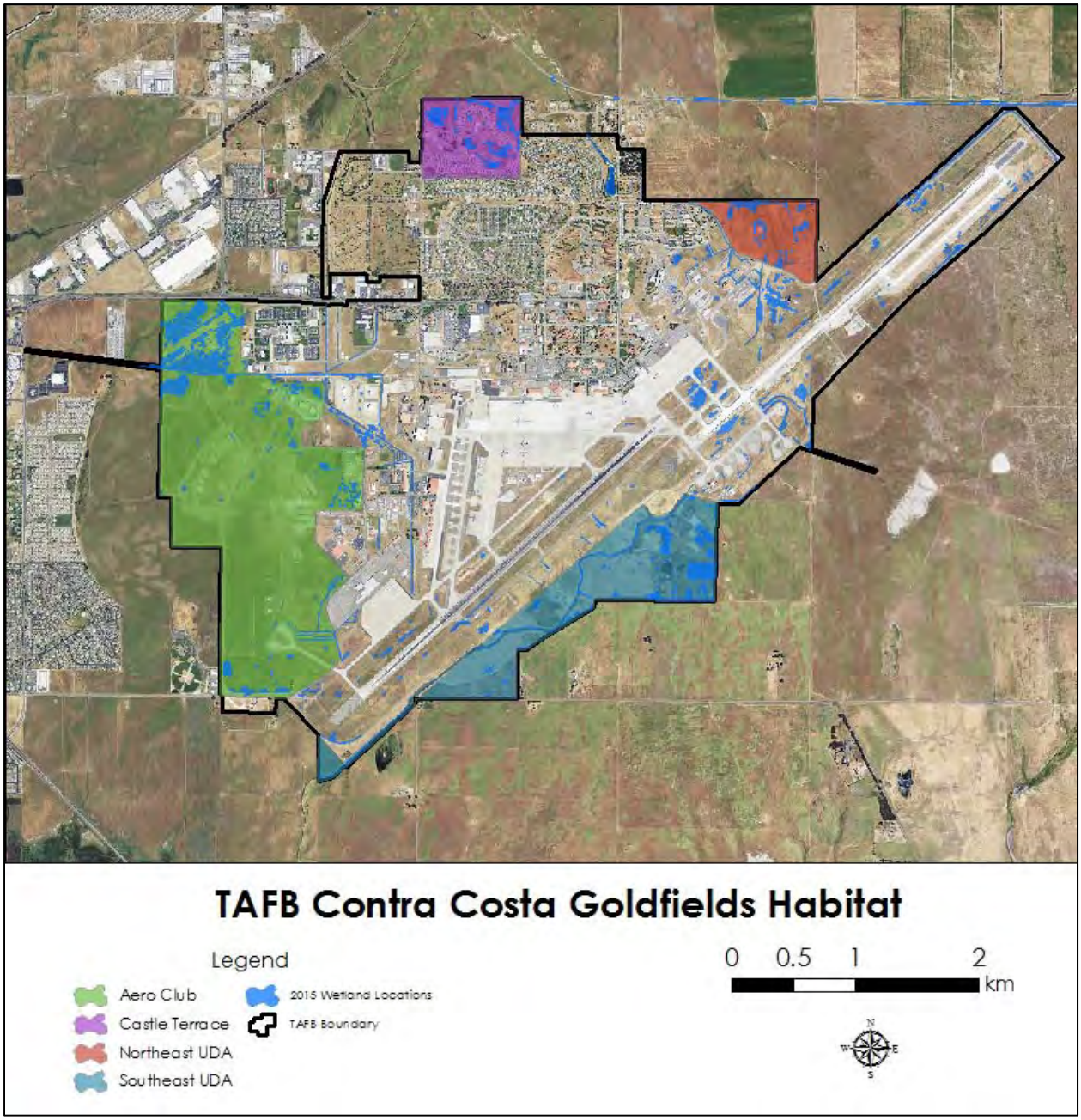

Figure 2-2. Travis Air Force Base Contra Costa goldfields locations. All mapped wetlands shown are considered potential habitat for CCG due to the possibility of latent seedbanks.

2.2.2. Vernal Pool Tadpole Shrimp (*Lepidurus packardi*) and Vernal Pool Fairy Shrimp (*Branchinecta lynchi*)

Along with CCG that ring the periphery of vernal pools, a rich assemblage of aquatic insects and invertebrates inhabit the basins themselves. Two federally endangered species of large branchiopods, VPTS and VPFS occur on or nearby TAFB (Figure 2-3). VPTS were listed as federally endangered on 19 September 1994 (59 FR 48136 – 48153). VPTS occurs on the Jepson Prairie, TAFB, and near Montezuma in Solano County and on the Sacramento National Wildlife

Refuge in Glenn County (USFWS 2005). VPTS are members of the aquatic crustacean order Notostraca. Tadpole shrimp are characterized by a large, shield-like carapace that covers the anterior half of their body. Species in the genus *Lepidurus*, of which VPTS is a member, are further distinguished from other tadpole shrimp genera by the presence of a supra-anal plate between their cercopods.



Figure 2-3. Vernal pool tadpole (left) and vernal pool fairy shrimp (right).

VPTS breed exclusively within vernal pools during the wet season. After reproducing, all adults die and their offspring survive as dormant cysts in the soil after seasonal wetlands dry. These cysts then begin a new lifecycle upon rehydration the next year. VPTS currently occur on the periphery and just outside TAFB (Figure 2-4).

The second federally endangered branchiopod species, VPFS, currently occupy a larger range than VPTS, and are distributed throughout the California Central Valley, western Riverside County, and near Medford, Oregon (Eriksen and Belk 1999). VPFS were listed as federally threatened by the USFWS on 19 September 1994 (59 FR 48136 – 48153). VPFS are members of the aquatic crustacean order Anostraca. Male identification is made by examination of the characterization of the antennae. In males, the second (distal) segment of the antenna extends ventrally from the first (basal) segment and is more than half the length of the basal segment. On the basal segment, there is a small elongate puvillus and ridge-like outgrowth on the proximal end and a small mound-like bulge on the distal surface just past the midpoint. Females are identifiable by their heart shaped egg sac (Eng *et al*. 1990).

This species is considerably more common on TAFB than VPTS and has a similar life cycle and dependence on vernal pools (Figure 2-4). The United States Fish and Wildlife Service (USFWS) estimates that over 3.9 million ac (1,610,000 ha) of vernal pool habitat existed in the Central Valley of California and vast areas of this habitat have been converted to developed areas and agriculture, while much of the remaining land is heavily invaded by non-native species (USFWS 2005).

This invasion has had severe impacts on the delicate cycles and function of vernal pools. In particular, the high amount of thatch which builds up when non-native grasses grow unchecked can create anoxic conditions as it decays, which negatively affects gill breathing organisms such as large branchiopods (Rogers 1998; Marty 2015). Species such as waxy mannagrass (*Glyceria declinata*) can invade pool basins and change food web dynamics which can result in decreasing populations of branchiopods (Rogers 1998). Higher levels of non-native species within and

surrounding vernal pools draw down the available water, resulting in a reduced inundation period that may be too short for native invertebrate growth cycles. Both branchiopod species benefit from management that favors native species over exotics, particularly well timed and carefully monitored grazing regimes (Marty 2015).

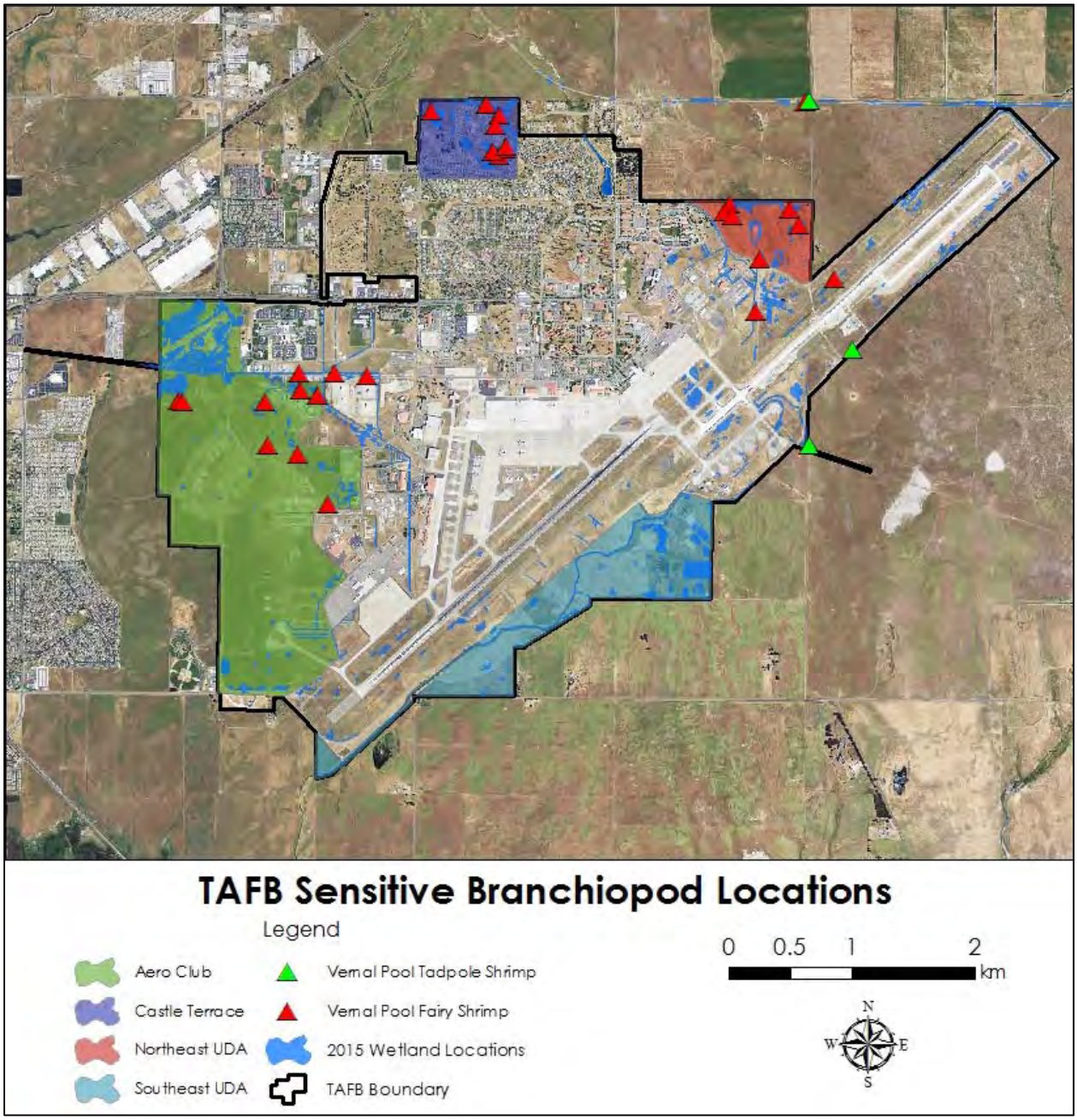

Figure 2-4. TAFB sensitive large branchiopod locations.

2.2.3. California tiger salamander (*Ambystoma californiense*)

On TAFB, both vernal pools and uplands, primarily non-native annual grassland mixed with exotic forbs, are vital to the breeding, dispersal and summer dormancy of the rare CTS. The

Central California population of California tiger salamander was listed as federally threatened on 4 August 2004 (69 FR 47212). Salamanders have been detected primarily around the borders of TAFB, and USFWS considers all of TAFB as potential upland habitat due to numerous known breeding ponds within 1.3 mi (2.1 km) of the majority of TAFB grasslands (Figure 2-6). Within the borders of the installation, breeding salamanders have been detected at one pond, and two live and two dead salamanders have been observed since January 2014 (Craig, pers. comm. 2017).

CTS are generally black with white to pale yellow spots or stripes (Figure 2-5). They can be distinguished from the related barred tiger salamander (with which they hybridize) by a more flattened head profile (Stebbins 2003). CTS are divided into three distinct population segments (DPS), with the Central DPS occupying the San Joaquin-Sacramento River valleys and the bordering foothills and coastal valleys (81 FR 12930 12931).



Figure 2-5. California Tiger Salamander.

CTS life history is highly dependent upon the same rain/ dry cycles as vernal pools. During the winter and spring wet season, adult CTS occupy vernal pools, stock ponds and occasionally streams if they are free of predators (Ford *et al.* 2013). Ideal nurse pools have high turbidity and little to no emergent vegetation. Emergent vegetation, particularly non-native species, may cause pools to dry down before tadpoles are fully developed, and they provide cover for predatory insects (Ford *et al.* 2013; Marty 2015). Rainfall during the wet season triggers movement into breeding pools, and breeding generally occurs from December to March with males occupying the pools for longer periods than females (Cook *et al.* 2006). CTS may travel as far as 1.4 mi (2.2 km) to breed (Orloff 2011). Larval CTS remain in an aquatic stage until pools begin to dry down, and the longer the inundation period, the larger these larvae are when they metamorphose and disperse.

After breeding, adult salamanders return to the upland habitat, where they spend the summer in subterranean burrows. Metamorphosed larvae disperse and find burrows after their pools dry. Salamanders are not equipped to build their own burrows, so they rely on fossorial mammals such as California ground squirrels to construct summer quarters (Ford *et al.* 2013). For both CTS and fossorial mammals, it is important to maintain uplands with short vegetation, although some patches of taller vegetation will provide escape cover. Species such as Harding grass (*Phalaris aquatica*) can form dense stands that present an impassible barrier to juvenile CTS dispersal and adult transit to breeding pools, and armed species such as yellow starthistle may also discourage residency by fossorial mammals. Management of suitable upland habitat is equally important to the maintenance of predator free and sufficiently inundated breeding pools. Carefully grazed pastures can support the longer-inundated breeding pools and short, passable vegetation required by CTS in winter and summer, respectively (Ford *et al.* 2013).

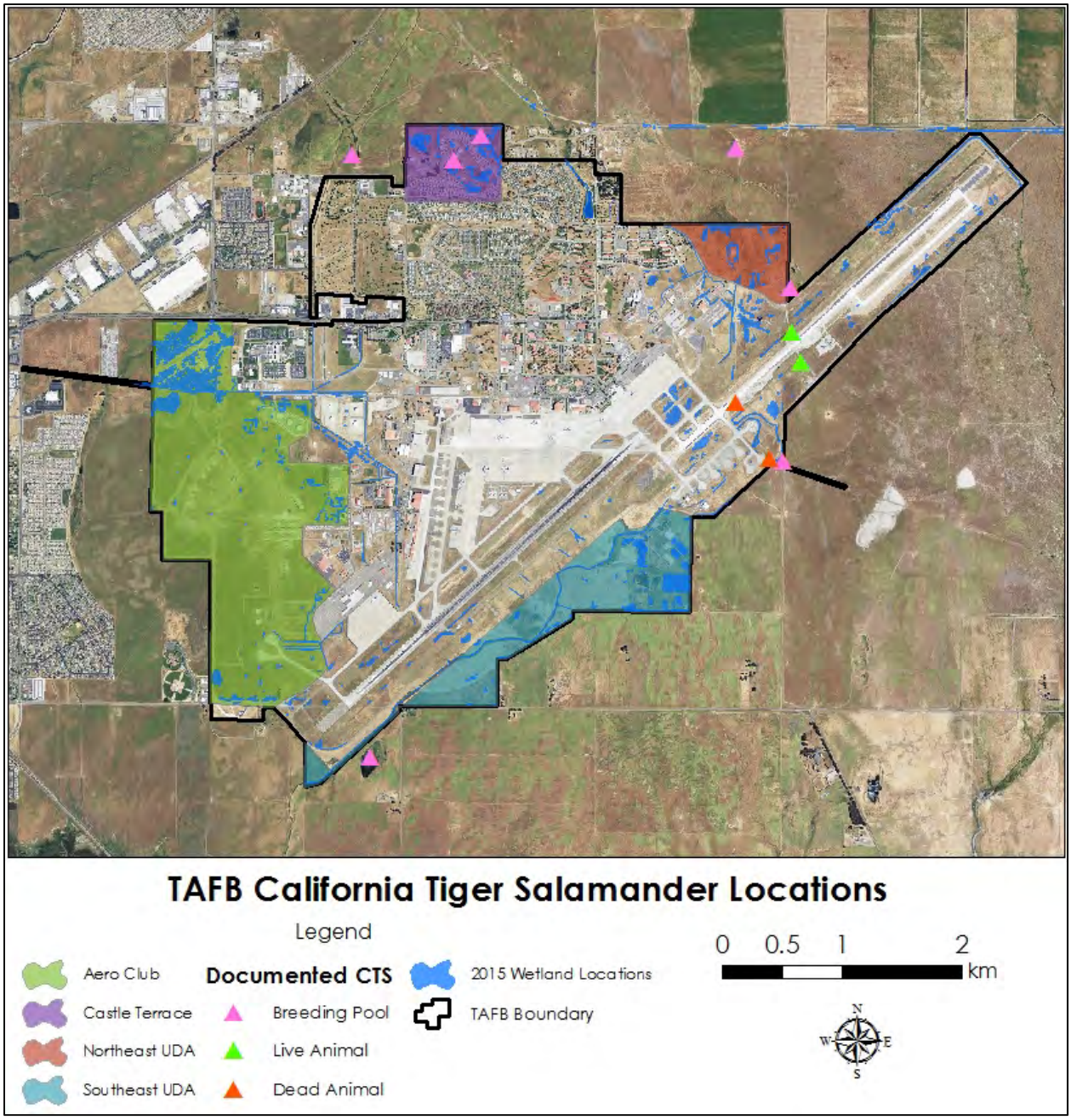

Figure 2-6. Travis Air Force Base California tiger salamander locations.

2.3 Minimization/Conservation Measures and Permitting

Currently, herbicide application at TAFB is performed under a Categorical Exclusion, and an upcoming fire Environmental Analysis will also cover invasive species management activities (Wilson, pers. comm.). Invasive species management activities avoid all effects to listed species through the use of conservation or minimization measures. Conservation measures ensure that all activities are designed to have no effect on listed or sensitive resources through temporal or spatial avoidance. These measures should be simple, low cost practices that are easily

incorporated into a work day, and must be understood and followed by workers and supervisors. Education is the key to compliance with minimization measures.

Solano Resource Conservation District (RCD) has adopted standard measures for education of workers; wetland avoidance; CCG, vernal pool invertebrate and habitat avoidance; CTS and small mammal burrow avoidance; and migratory and nesting bird avoidance (Solano County RCD 2016). These measures are detailed in Appendix G. Minimization measures should be adapted as needed to reflect increasing information about avoiding effects, or as changes to species' statuses are enacted (Wilson, pers. comm.). In particular, if the US Fish and Wildlife Service review of tricolored blackbird's (*Agelaius tricolor*) status results in a threatened or endangered listing, additional measures should be developed. TAFB will develop a plan to guide management of this species as it is also a concern for airfield operations (Wilson, pers. comm.).

3.0 Invasive Species Landscape

Invasive species arrive at a site in a variety of ways and at various points in the site's history. At TAFB, site history, current military use and neighboring land use contribute to the invasive flora in complex interactions. The greatest site history influence is agriculture. Beginning in the 1890's, the region was settled, grazed, and farmed with dryland wheat and barley (TAFB 2016). Over the next decades, myriad grains, forage species and ornamental species were deliberately introduced, along with many accidental associates in hay, seeds, equipment, etc. Although this type of agriculture is no longer practiced on TAFB itself, much of the surrounding region is still in crop production and capable of maintaining source populations. Furthermore, the legacy of farming persists long after the last crops are harvested. Disturbed agricultural soils with altered nutrient balances and compaction levels, introduced species and suppressed populations of native species interact to create novel assemblages that may be further invaded as new species arrive. A history of agricultural cultivation is linked to the absence of native perennial bunchgrasses and native annual forbs in California grasslands (Bartolome *et al.* 2007).

Current activities contribute to the invasive flora of a site as well. Military operations, Base maintenance and even natural resources management can all act as vectors to introduce new species to TAFB. Vectors associated with Military operations include aircraft, personnel and equipment that are deployed and return from anywhere in the world. Base maintenance can introduce or spread invasive plants through contaminated equipment (especially mowers and earthmoving equipment) or create disturbance for weeds to colonize. Natural resources activities such as grazing, surveys and restoration can also introduce new species or distribute existing propagules to new locations within Base.

TAFB has managed both sensitive species and invasive species for many years, but a concerted effort to manage both together may be more effective. For instance, these two groups intersect in the vernal pool habitats at TAFB. As with much of California's Mediterranean influenced vegetation, invasive species pose an alarming threat to vernal pool systems. The extreme abiotic fluctuations protect vernal pool basins themselves from many exotics, but several species (perennial pepperweed [*Lepidium latifolium*], for example) have begun to invade the basins more recently (Gerlach *et al.* 2009).

The matrix of vernal pools is embedded within grassland habitats that tend to be highly invaded by Mediterranean origin annual grasses such as bromes and fescues, which may in fact provide acceptable and functional habitat for native mammals, birds and amphibians. However, these grasslands are in turn becoming increasingly invaded by much worse grasses and exotic forbs and shrubs. On TAFB, yellow starthistle (*Centaurea solstitialis*), medusahead (*Elymus caput-medusae*), barb goatgrass (*Aegilops triuncialis*) and purple starthistle (*Carduus pycnocephalus*) considerably degrade the quality of upland habitat for CTS (Figure 2-7). For both vernal pools and upland CTS habitat, managing the weeds from the standpoint of maximizing the benefit to the sensitive resource may yield more satisfying results than attempting to target all (or even most) weeds for eradication. In addition, proper management of invasive species meets many of the INRMP goals and objectives for sensitive species management, as discussed in Section 1.2.



Figure 2-7. Infestation of yellow starthistle on Travis Air Force Base, 2016.

Although attempts have been made to map many of these species on TAFB, recent observations suggest that several species may defy yearly mapping (HT Harvey and Associates 2014). In particular, MSRS staff observed yellow starthistle growing in different densities and in different areas from one year to the next (Ball, pers. comm. 2016). This suggests that the seed bank for this species, and probably several others present on TAFB, is well distributed across Base, and microclimatic factors determine which area's seedbank expresses itself strongly in a given year. Maps from prior years may therefore be useless in determining where to allocate treatment resources in a current year. Therefore, this plan recommends a programmatic approach to weed control that is structured around the invasion curve concept depicted in Figure 2-8. This concept will provide TAFB with a framework to structure invasive species planning and make decisions about how to address specific target weeds.

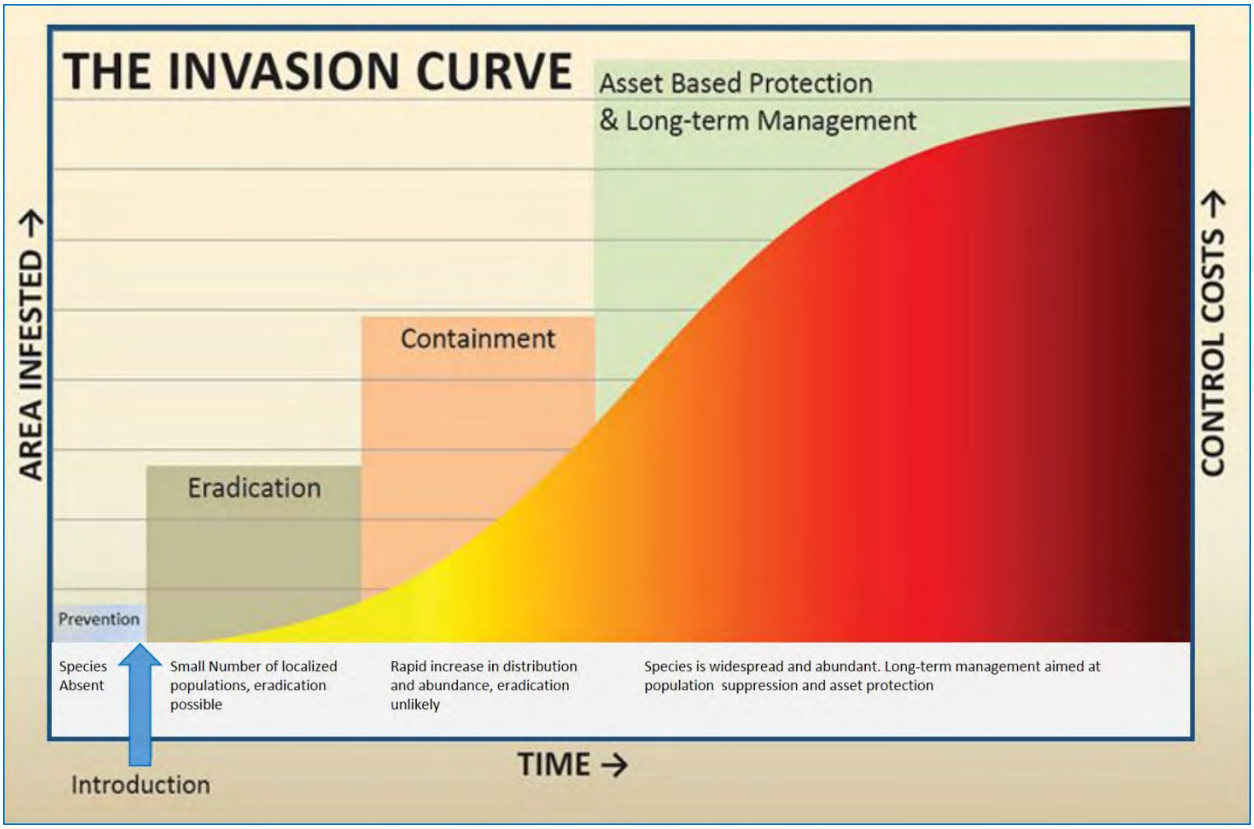

Figure 2-8. The Invasion Curve.

3.1 The Invasion Curve

The Invasion Curve is built around the idea that prevention is the most cost-effective form of invasive species control, while treatment of entrenched, pervasive weeds is the most costly. Any available information on each species' biology and distribution as well as broad management goals are used to determine where to place a target weed along the curve. Four steps of increasingly widespread (and costly) management are available, and each one involves different treatment techniques. As a species moves along the curve through time, the area it infests increases, as does the expense of controlling it. This is not simply due to an increase in area; as the time of residency increases, so does the soil seed bank and any ecosystem-altering effects of the infestation. Invasive species are capable of interfering with many ecosystem processes such as soil nutrient cycle changes, fire regime changes, etc., all of which result in increased costs to land managers as restoration becomes more intensive and native habitat is degraded. In addition, the presence of sensitive resources and their interactions with a specific invasive species should inform the weed management techniques planned.

3.1.1. Prevention

Preventing introductions is much less costly than eradicating an established population, and most biosecurity controls apply to a wide range of target species (biosecurity is the practice of controlling vectors to prevent introduction of harmful species, and is the fundamental concept for this area of the Invasion Curve). In contrast, eradication and containment strategies are

much more expensive and must be tailored specifically to the target organism. This early part of the curve represents species that are established in nearby areas and may invade, or species that may be brought in by any of the vectors described in the beginning of Section 3 above. Base-wide biosecurity protocols will greatly benefit management at this stage.

Biosecurity is the practice of controlling vectors to prevent introduction of harmful species. A good biosecurity program ensures that vehicles, personnel and equipment are free of weed seeds, non-native invertebrates, pathogens and pests of any kind. Biosecurity programs may require extensive changes in how entities on Base perform daily tasks, and creating the awareness of the importance of preventing later problems is key. Continuous education, alerts about new species or potential vectors, and consequences for failures to comply with biosecurity measures should all be considered. Development of a full-scale biosecurity plan for TAFB is beyond the scope of this Plan, but basic management practices are described below (Section 4.1.1).

Developing and regularly updating a Watch List for the Base is an important step in preventing new arrivals. The California Invasive Plant Council (Cal-IPC) has developed the WeedMapper tool as a method for developing Watch Lists for a particular area. This tool leverages expert knowledge, occurrence information from various plant distribution datasets including Calflora and the Consortium of California Herbaria, and predictive climate models to generate lists of invasive species with the potential to occur in a given area, usually a county. Appendix A lists all species generated by the tool for Solano County, with no further refinement for habitat or likelihood of arrival at TAFB itself. This results in an extensive Watch List, which could be refined or maintained as is. Collaboration with regional experts should be considered and the list updated every two to four years.

In addition, the species listed by HT Harvey and Associates as “Prevalent in the Region (Not Detected on Base to Date)” has been updated and presented in Table 2-1 (HT Harvey and Associates 2014). The list was updated with species observed by MSRS staff in 2016 field visits or reported in species lists for MSRS documents (MSRS 2015). If any of the species on either the Table 3-1 or WeedMapper lists are observed at TAFB, they should be documented and removed immediately. If possible, the vector that introduced the original propagule should be determined so that it can be analyzed and possibly addressed to prevent further introductions.

Table 2-1. Prevention-stage species with potential to arrive on TAFB.

Invasion Curve	CAL-IPC Rating	Common and Scientific Name	Habitat Infested	Effects
Prevention Stage	High	Scarlet Sesban (*Sesbania punicea*)	wetlands	obstructs waterways, contributes to erosion, fixes nitrogen, toxic
		Smallflower tamarisk (*Tamarix parviflora*)	wetlands	reduces groundwater, accumulates and deposits salts on soil surface, increases fire and flood hazard
		*Waxy mannagrass (*Glyceria declinata*)	vernal pools	compromises vernal pool hydrology and nutrient cycles
		Russian knapweed (*Acroptilon repens*)	uplands	forms dense, allelopathic stands, accumulates and deposits zinc, toxic to horses
	Moderate	Tall sock-destroyer (*Torilis arvensis)*	uplands	burs create nuisance for livestock and pets
		Tocalote (*Centaurea melitensis*)	uplands	may increase erosion, reduce vigor of nearby natives
	Unlisted	Lens-podded hoary cress (*Lepidium chalepensis*)	uplands	dense stands degrade wildlife habitat and forage, may slow water drainage and increase flood risk, unpalatable to livestock

3.1.2. Eradication

Catching new species while they are in the second stage of the curve means that eradication can only address small populations that have not had the opportunity to establish substantial widespread seedbanks or alter ecosystems. Even species that are well-established in small populations but that have not yet spread over a wide area may be targeted for eradication, as long as resources are set aside for long-term monitoring of sites where they have been removed. Well maintained and consistently collected data will make eradication programs more efficient and effective. Consistency in treatment from one year to the next is critical for eradication programs, especially for species with persistent long lived seed banks.

Two species at TAFB can be classified as Stage Two Eradication Species: giant reed, and treasure flower (Table 2-2). The primary vector of these species was likely grounds maintenance, as treasure flower is sold as a landscaping species. Giant reed is an ornamental, but is also cultivated for erosion control and windbreaks. Since grounds maintenance and ornamental plantings have potentially already resulted in establishment of invasive species, the planting lists and practices of this division should be scrutinized. Only those species with low chances of escaping cultivation should be planted in landscaping, or better yet, plantings should utilize native species.

Table 2-2. Eradication-stage species documented on TAFB.

Invasion Curve	CAL-IPC Rating	Common and Scientific Name	Habitat Infested	Effects
Eradication Stage	High	Giant reed (*Arundo donax*)	wetlands	obstructs waterways, flammable, high evapotranspiration, agricultural pest fungus host
	Moderate	Treasure flower (*Gazania linearis*)	uplands	creates monospecific stands

3.1.3. Containment

As a given species establishes viable populations and begins to spread outward, containment becomes the most cost-effective strategy and the focus should be on monitoring the original introduction site, if known, curtailing the spread outward from that site and targeting any newly established populations for immediate control. Management techniques available at this stage include herbicide application, hand removal, targeted grazing, and carefully timed mowing. The majority of TAFB's species fall into the Containment Stage because of the high probability of reintroduction even if local populations are satisfactorily addressed. There are few if any natural barriers between TAFB and the surrounding rangelands, much of which supports the same weed species as the Base. Furthermore, seed banks for many of these species persist for years, so even areas that do not currently exhibit an infestation can be reinvaded from a latent seed source. Lastly, the international nature of travel to TAFB, which supports worldwide military missions, raises the possibility of new introductions. Ten species are in the Stage Three Containment category (Table 2-3). Some of these species represent the legacy of agriculture or well-established ornamental populations, and all are well-established in California.

Table 2-3. Containment-stage species documented on TAFB.

Invasion Curve	CAL-IPC Rating	Common and Scientific Name	Habitat Infested	Effects
Containment Stage	High	Fennel (*Foeniculum vulgare*)	uplands	can create monospecific stands
		Himalayan blackberry (*Rubus armeniacus*)	wetlands	creates dense monospecific stands, impedes wildlife access to riparian zones
		French broom (*Genista monspessulana*	uplands	degrades wildlife habitat with dense stands, increases fire hazard, increases soil nitrogen
		Spanish broom (*Spartium junceum)*	uplands	creates dense monospecific stands, impedes wildlife access, fixes nitrogen, increases fire hazard
	Moderate	Bull thistle (*Cirsium vulgare*)	uplands	reduces forage quality
		Artichoke thistle (*Cynara cardunculus*)	uplands	displaces desirable vegetation, degrades wildlife habitat and forage
		Skeleton weed (*Chondrilla juncea*)	uplands	competitive with natives, degrades crops
		Stinkwort (*Dittrichia graveolens*)	uplands	causes contact dermatitis, barbed pappus can be lethal to livestock
		Wooly distaff thistle (*Carthamus lanatus*)	uplands	competitive with forage species, spines injurious to livestock
	Limited	Bristly ox-tongue	uplands	forms dense stands, degrades forage quality

3.1.4. Asset-Based Protection

At this stage, management should shift from a focus on the weed species itself to focusing on landscape-scale decision making. First, managers should consider if the species in question is altering conditions such as fuel loads, soil erodibility, hydrology, etc. or degrading habitat for any target sensitive species. For instance, the annual grasses of Mediterranean origin that grow across much of the Base, although non-native and capable of degrading some habitats, probably provide more ecosystem service benefits than they cause damage. On the other hand, yellow starthistle is equally common, but this species degrades habitat for CTS and reduces grazing opportunities, both of which are considered assets for TAFB. In addition, management at this stage must focus on large-scale control measures such as grazing, timed mowing or restoration planting rather than techniques such as spot-spraying or hand pulling.

The remaining seven species of the TAFB invasive species list fall into this category (Table 2-4). These species are the most entrenched and widespread of the TAFB invasive flora. Asset-based Protection-level species will only be targeted for control when they directly threaten a TAFB resource, operation or sensitive species as they are very likely to continually reinvade any treatment site. Treatment of these species, once begun, will generally be an annual requirement at the site. For instance, if mowing and spraying is used to prevent black mustard from reducing visibility along roadsides, these treatments will need to be repeated annually to maintain control.

Table 2-4. Asset-Based Protection Stage Species Documented from TAFB.

Invasion Curve	CAL-IPC Rating	Common and Scientific Name	Habitat Infested	Effects
Asset-based Protection Stage	High	Barb goatgrass (*Aegilops triuncialis*)	uplands	high-silica thatch can suppress natives, late maturing and drought tolerant, barbed awns dangerous to livestock
		Medusa head (*Elymus caput-edusae*)	uplands	dense stands reduce forage and wildlife habitat, produces thick thatch that changes soil temperature and moisture, suppresses natives, increases RDM and results in under-grazing
		Perennial Pepperweed (*Lepidium latifolium*)	vernal pools	forms dense stands, shallow roots allow erosion, reduces forage quality, accumulates and deposits salts
		Yellow star-thistle (*Centaurea solstitialis*)	uplands	forms dense, spiny stands that impede wildlife passage, toxic to horses
	Moderate	Black Mustard (*Brassica nigra*)	uplands	forms dense stands, possibly allelopathic, increases fire hazard, toxic to livestock
		Italian thistle (*Carduus pycnocephalus*)	uplands	spines discourage wildlife and decrease forage quality
		Purple star-thistle (*Centarea calcitrapa*)	uplands	spines discourage wildlife and decrease forage quality

3.2 Cal IPC Rating

Weed impacts vary, from those that cause mere nuisances to people and pets, to those that are not only toxic, but can drastically change fire regimes or ecosystem functions in riparian zones. In addition, weeds vary in biological characteristics important to their control, such as longevity of seedbank, susceptibility to control measures, speed of spread, etc. Cal-IPC has developed a standard ranking system that takes all of these factors into account and generates a severity of High, Moderate, or Limited impact. The Cal-IPC Invasive Plant ranking system evaluates the known biological information on a particular species within three subject sections: Ecological Impact, Invasive Potential, and Ecological Amplitude and Distribution (Cal-IPC 2014). Each section has a numeric severity ranking, and the sections are added to achieve the overall ranking of High, Moderate, or Limited.

- **High-rated** species have severe ecological impacts on ecosystems, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal and establishment. These species are usually widely distributed ecologically, both among and within ecosystems.
- **Moderate-rated** species have substantial and apparent but generally not severe ecological impacts on ecosystems, plant and animal communities, and vegetation

structure. Their reproductive biology is conducive to moderate to high rates of dispersal, though establishment is generally dependent on ecological disturbance. Ecological amplitude and distribution may range from limited to widespread.

- **Limited-rated** species have minor ecological impacts. Their reproductive biology and other invasiveness attributes result in low to moderate rates of invasion. Ecological amplitude and distribution tend to be generally limited (however, they may be locally persistent and problematic). These species may be more problematic than their rank reveals if there is a lack of published literature.

This rating system, when applied to TAFB's invasive species list, further prioritizes species that should be managed. Within each Invasion Curve level, those species that are High-rating in Cal-IPC's calculation are the most urgent. The combination of Cal-IPC Rate and Invasion Curve Level yields management information on which species to treat, and the most effective strategy with which to treat them. This analysis is repeatable and should be revisited at regular intervals on the order of every five to eight years, as weed populations grow, shrink, or appear.

4.0 Invasive Species Management

Invasive species management at TAFB is driven by management of sensitive resources. Due to the constant reinvasion pressure from the surrounding agricultural and developed landscape, invasive species are best managed by limiting their detrimental effects on sensitive resources. This requires a Weed Program Manager who can synthesize data and reports from various monitoring programs and determine management needs on a yearly or monthly basis, manage a basic biosecurity program, and disseminate best management practices to user groups whose activities affect invasive species.

4.1 Weed Program Manager

The first step towards a cohesive and effective weed management program at TAFB is the designation of a Weed Manager position. This position could be either the existing Natural Resources Manager or a contracted position. This individual would coordinate efforts to monitor weed populations and their treatment, devise and enforce biosecurity measures, and set out priorities for each year's work. Consolidating the responsibilities for invasive species management into one position will allow for flexibility and quick responses to management needs. The weed manager should be familiar with the Base's natural resources, operations and invasive plants, and be able to conduct basic data management and analysis.

Key roles would include acting as a liaison with facilities management, military operations, weed control contractors, the grazing permittee and other groups to ensure biosecurity is enforced, maintaining awareness of regional invasive species topics such as new control techniques, incipient invaders, etc. as well as organizing and planning for treatment activities each year and monitoring control efforts to inform the next years' priorities. The weed manager should synthesize data from the grazing plan, the CCG monitoring research and weed contractor data as well as information from Base users to determine weed control priorities. Base users that should be consulted regularly include fire and airfield managers, grounds management, roadside mowers, Equestrian Center users and residents. All of these groups have valuable input on weed control decisions from their unique perspectives.

All pest management activities on Air Force Installations are under the purview of the Installation Pest Management Coordinator (IPMC), including vertebrate, invertebrate and plant pest activities (USAF 2016). The Weed Program Manager will ensure that all of the below requirements are met for any invasive species control work performed:

1. All herbicides and herbicide application shall comply with DoDI 4150.07 DoD Pest Management Program; AFI 32-1053 Integrated Pest Management Program; the Integrated Pest Management Plan at each applicable base (Beale and Travis AFB); Armed Forces Pest Management Board (AFPMB) list of Approved herbicides; and the State of California Pesticide Regulations, and be registered for use in the State of California. Only pesticides approved for use on the applicable base may be applied (See Appendix E for list of approved pesticides).

2. A list of those herbicides requested to be used must be submitted to the AFCEC ESCA Administrator NLT 30 calendar days after agreement is signed and must be coordinated through the HazMart at the applicable AFB. A list of all herbicides to be applied is to be provided, with SDS and labels, to the IPMC 15 calendar days prior to application. If non-approved herbicide is preferred, the applicator shall submit an AF Approval Request Form for Non-Standard Pesticides to the IPMC 30 calendar days prior to application. Any non-standard herbicides need to have command approval prior to use and will require a longer approval period.

3. Only personnel licensed/certified by the State of California shall apply herbicides. Copies of all herbicide application certifications shall be provided to the AFCEC ESCA Administrator and IPMC on the applicable base within 30 calendar days. All licenses/certifications must be in the proper category of the type of work being performed. Qualified Applicator Certificate, Qualified Applicator License, and Pest Control business license copies are to be provided.

4. Before any herbicide application is to begin, an AF Form 332 will be staffed through the Base Work Order system by CES/CEIEC and to the IPMC for approval. It will include the pest to be controlled (grass and weed control), a map identifying the location pesticides are to be applied, the number of acres of application, the pesticides that will be applied, and copies of the MSDS or SDS.

5. Pesticide Mixing, Storage and Disposal: All pesticides shall be stored off-base. All unused pesticides, empty pesticide containers and residue shall be disposed of properly at an approved off-base disposal area. Chemical mixing for immediate application may be accomplished at the site of application/treatment and only state certified applicators may mix or apply pesticides. Contractor shall provide a spill container at mixing areas to insure that no chemicals impact an area that is not being treated. The contractor shall have an operational emergency eyewash kit available at each mixing location. In the event the contractor spills or releases any hazardous substances (example, substances listed in 40 Code of Federal Regulations [CFR] 302), the contractor shall immediately notify the Fire Department, ESCA PM, CES/CEIEC, and IPMC.

6. Safety: The contractor shall comply with all applicable parts of Title 29, CFR, Occupational Safety and Health Standards, Part 1910; Title 29, CFR, Safety and Health Standards for Federal Service Contracts, Part 1925; Title 40, CFR, Parts 150-189, and Title 49, CFR, Hazardous Materials Regulations, Part 171, while on an Air Force installation, to ensure safe working conditions for contract personnel and a safe environment for the occupants of Air Force facilities.

7. The contractor shall establish an AF Integrated Pest Management Information System (IPMIS) account at https://web.ipmis-helpdesk.org/ to enter and document state pesticide applicator certification categories and expiration dates.

8. The contractor will provide pesticide use data to the IPMC on a monthly basis for input into the IPMIS pesticide management database.

9. The IPMC for Travis AFB is Mr. Henry Pringle (henry.pringle.2@us.af.mil). Cooperator may submit questions to Mr. Pringle but shall copy Mr. Penn Craig (penn.craig@us.af.mil) and Ms. Lauren Wilson (lauren.wilson.8@us.af.mil).

4.1.1. Biosecurity

Biosecurity is the practice of controlling vectors to prevent introduction of harmful species. As discussed above, biosecurity is the least costly form of weed control, and it decreases the risk that a species will embark upon the increasing trajectory of the Invasion Curve. Biosecurity measures effective at preventing arrival of one species are generally equally effective on many others, and although biosecurity measures may seem costly at first, they will save resources in the long run. Effective biosecurity for the Base would require participation from residents, contractors and Air Force personnel.

Biosecurity should focus on the main vectors of weed propagule material on TAFB: military operations, personnel and equipment, Base maintenance activities, and natural resources activities. Controlling these vectors and minimizing their ability to import weed propagules requires a combination of education, on-the-ground inspections and installation of equipment that prevents invasive species introduction. Consolidating these aspects of biosecurity into a single position is the most effective way to ensure that they are all considered and given equal weight.

4.1.2. Regular Monitoring

Monitoring should occur at known infestation areas at least twice yearly, particularly those that are the focus of eradication or containment efforts. A spring survey should be used to guide effort for the season, while a fall survey can be used to collect data on effectiveness of treatments and locate new populations that should be treated the next year. Yearly monitoring and analysis of treatment results will allow Base management to adapt resource allocation and methodology appropriately. In addition, surveys are vital to ensuring that any newly-arrived species is documented and addressed in a timely fashion. Monitoring for new arrivals should focus on the watch lists species provided in Table 2-1, but also allow for the possibility of arrival of species new to the region or even unknown in California. The international nature of TAFB's military mission increases the risk of introductions of entirely new taxa.

Existing or soon to be implemented monitoring, data collection and research can be used to track invasive species and their effects. Implementation reports from Solano County RCD or any other weed contractors, Grazing Plan monitoring and CCG Monitoring all supply useful weed data. However, if the Weed Program Manager determines that additional data is required, the following surveys and methods may be adopted. After implementation of the Grazing Plan and CCG Monitoring Study, the Weed Program Manager should consider these disparate monitoring

strategies and determine if there are redundancies that could be eliminated to streamline all monitoring for the Base.

Spring Survey

The spring survey can be conducted multiple times in informal fashion using driving or brief walking transects and anecdotal data collection. This survey should accomplish the following tasks:

1. Rapid Response-Identify incipient populations of new species or expansions of known species to target for immediate control.
2. Phenology Tracking- multiple visits can ensure that the most appropriate growth stage for treatment is accurately predicted, maximizing effectiveness of treatments such as mowing, targeted grazing or herbicide application.

Fall Survey

The fall survey should be more intensive and consist of the data collection efforts that will be used to track progress, as well as supply data for the Management Prioritization discussed in Section 4.2. This survey should efficiently collect monitoring data that can be used to analyze the overall ecosystem health and effects of any treatments including grazing, mowing, herbicide treatment or burning. Step-point transects that collect vegetation data and small mammal burrow density are relatively easy to perform, can be implemented by a single technician, and supply robust data for analysis. This type of transect is an adaptation of the point-intercept transect concept, and is thus a good method for determining cover and frequency of common species (Elzinga *et al.* 1998). The results of this monitoring methodology can be used to determine if the Desired Condition metrics presented in Section 6 are being met.

In order to track conditions in each NRMU within and across years, random transect locations should be chosen each year. The density of transects should be dictated by homogeneity of the area of interest, but a good starting density for TAFB would be one 50-point transect every 6 acres. This density can be adjusted upward or downward depending on results. The equipment required for this type of transect is minimal: a GPS to navigate to the transect start point, a compass, a pin flag, data sheets and knowledge of the plant species present.

Transect methodology is as follows: Select transect start points using GIS at an initial rate of one transect per 6 ac (2.4 hectares). Generate a list of random numbers between zero and 359 to use as random compass bearings. Navigate to the transect start and use the compass and random number list to determine transect bearing. Take one pace (two steps) from the start point. Holding the pin plumb, slide the pinflag through the vegetation until it hits the ground and record all of the species touching the pin, as well as the ground cover (litter, bare ground, rock, etc.). Along each transect, count the number of small mammal burrows within one meter of both sides of the line to document a two-meter belt transect for burrow density. Collect 50 points along each transect, then move to the next random location and repeat. Step-point transects can also be used within infestation boundaries to directly test control effects. For instance, for species that defy ocular cover estimates such as barb goatgrass, additional step-point transects could be located within infestation boundaries.

An ArcGIS geodatabase that incorporates both spatial and tabular data is ideal for tracking the control program through time and determining future steps. Data that should be collected (by Solano County RCD or any other contractors performing weed control) and analyzed yearly includes spatial data on where treatments occurred, where new populations were found, and what areas were surveyed. Tabular data should include the type of treatments performed (hand removal, herbicide application, mowing, etc.), amount and type of herbicide used (including concentrations and surfactants), numbers of plants treated and kill rate. Standardizing the data collected, regardless of who performs the work, will ensure that comparisons across years will have the power to calculate effectiveness and modify resource allocation accordingly. These tables can also be exported for inclusion in annual reports or updates to the Base INRMP.

4.1.3. Restoration Treatments

Weed control often results in a vacuum that can readily be filled by nearby, possibly worse invasive species. Restoration treatments such as replanting or reseeding can be useful in preemptively filling the vacuum with desirable species, but such treatments must be compatible with future uses and management actions, including future weed control efforts. At TAFB, restoration treatments must be designed to address the large scale of many of the infestations, the primary usage of grazing, the possibility of continual invasion by the same or new invasive species, and any future weed control treatments including herbicide application, burning, etc. The dominant vegetation at TAFB is non-native annual grasses, and selecting native species that will germinate, establish and persist is challenging, as the large body of grassland restoration literature attests (Hopkinson, pers. comm.). In addition, any reseeding or replanting must also consider effects on the sensitive species present at the site.

As the primary management tool of TAFB is grazing for the benefit of sensitive species, reinvasion of broadleaf weed, barb goatgrass or medusahead treatment sites by annual grasses such as *Bromus*, *Avena*, *Festuca*, etc. (all high-quality forage species with extensive representation in the seedbank at TAFB) may be acceptable if the site is properly grazed thereafter. However, if the Weed Program Manager determines that restoration treatments are required due to invasion by problematic weed species or significant degradation of forage quality, reseeding or replanting using native grass species may suit the majority of the considerations stated above. Some species that could be used include purple needlegrass (*Stipa pulchra*), blue wildrye (*Elymus glaucus*), creeping wildrye (*Elymus triticoides*), or meadow barley (*Hordeum brachyantherum*). However, the site should be carefully analyzed prior to seeding or planting as TelarXP®, a commonly used broadleaf-specific herbicide, may also kill species of the *Elymus* genus. Follow up treatments of seeding have been effective in treating both medusahead and yellow starthistle, if the phasing of the combined treatments is well-designed for the specific site (James *et al.* 2015, Kyser *et al.* 2013).

4.1.4. Maintenance of this Plan

Lastly, the Weed Program Manager should review this plan annually. As implementation reports, monitoring and research results are available, they should be incorporated into the

document as appendices. With increasing allocation of effort, a better understanding of minimization measures can be used to refine and improve the entries in Section 2.3 and Appendix G. The world of research and applied weed science is constantly evolving and improving, and as new control and monitoring techniques become available, this plan should be updated to reflect the best available information.

4.2 Management Prioritization for Containment and Asset Protection Species

The invasive species of TAFB range in severity from introduced ornamentals that are possible to eradicate to entrenched populations of noxious weeds that must be managed in the context of the resources they directly threaten. Invasive plants present a significant barrier to conservation of sensitive resources, and if allowed to spread unchecked they will degrade the remaining native habitat and interfere with management of sensitive resources. In turn, each sensitive resource is subject to deleterious effects of different invasive species. Given that the resources directed toward invasive species and sensitive resource management are always finite, prioritizing which species to actively manage is vital. The invasive species that are capable of degrading habitat for endangered plants, impeding military missions or interfering with Base operations such as grazing should be more aggressively addressed. These are the 17 species listed in Tables 3-3 and 3-4.

Sensitive species, resources, and activities such as CCG, grazing and military operations are threatened or impeded by different species and to different degrees at TAFB. A low level of one weed may have a large deleterious effect on CCG, while it does not impede any military missions. Therefore, some threshold must be determined to trigger when to direct resources toward controlling a particular infestation. This threshold should be directly tied to the resource in question, and be measurable using currently implemented monitoring. Important upcoming initiatives that will supply monitoring data along with data collected under this Plan include the CCG grazing monitoring and the TAFB Grazing Monitoring Plan (Hopkinson in prep.; Marty in prep.). These research and management documents will supply much-needed data on the effects of invasive species on sensitive resources which should be used to inform development or refinement of the initial thresholds suggested below. In some cases, a robust, published threshold is unavailable for a particular resource, and these should be determined over time by the Weed Program Manager.

4.2.1. CCG Weed Management

Threats

Both direct destruction of plants and their habitats, and hydrologic changes to pools threaten CCG. At TAFB, these threats can take the form of improperly managed grazing and competition from invasive plants which can directly alter the hydrology of vernal pools (Marty 2005, 2015). The intersection of improperly managed grazing and invasive species is the buildup of thatch. Non-native grasses and some non-native forbs can accumulate dense thatch layers that change degrade water quality and prevent germination of native species. Over-grazing and congregation of cattle around water troughs or supplement blocks can degrade vernal pool habitat and may cause trampling of individual plants, while the removal of grazing can allow

rampant growth of invasive species that can compete with CCG and alter hydrology. The greatest concentration of CCG coincides with currently grazed lands or areas that will be grazed beginning in 2018, and TAFB has taken particular care to manage the cattle grazing where it coincides with CCG habitat (MSRS 2016). This management includes monitoring to ensure that each years' grazing level is calibrated to the previous year's effect. This feedback loop is designed to strike a balance between over- and under-grazing that will maximize the benefit for vernal pool resources. In addition, in the TAFB Fire Management Plan, Appendix F presents a prescribed burning plan that is designed to benefit sensitive species in the Aero Club area, including CCG and vernal pool fairy shrimp. Benefits to these species will derive from the control of yellow starthistle and medusahead, as well as the reduction of thatch and fine fuels (USAF 2015).

Non-native species can shade out native forbs and cause pools to dry down more quickly as a result of increased transpiration (Marty 2005).The invasive species with greatest potential to damage CCG at TAFB are perennial pepperweed and yellow starthistle. Perennial pepperweed establishes stands within vernal pools and draws down water resources as well as directly competes for space with native vernal pool inhabitants. Yellow starthistle primarily grows on the higher ground surrounding vernal pools, but in dense infestations it does creep downslope into the pools themselves (Morghan *et al.* 2003). Yellow starthistle's deep taproots draw up large quantities of soil moisture, its dense growth competes for light and space and the spines discourage grazing by livestock (DiTomaso *et al.* 2006).

Management Threshold

Although both insufficient grazing and over-grazing can harm CCG, the TAFB Grazing Management Plan and the CCG Monitoring Plan are designed to evaluate the effects of grazing on the species (Hopkinson in prep.; Marty in prep.). Earlier monitoring from 1999 to 2013 indicated that grazing would benefit CCG (Collinge 1999; Collinge and Ray 2009; Collinge *et al.* 2013), and TAFB is currently proposing to expand grazing to more of the CCG habitat in 2018. The grazing will be managed to control non-native grasses and forbs that compete with CCG and prevent them from lowering water levels early in the year. This is an excellent case study for how resource thresholds can be used to trigger invasive species control. Depending on the results of the monitoring implemented under the Grazing Plan and CCG Monitoring Plan, additional invasive species control may be necessary for CCG.

In particular, the cover of perennial pepperweed, medusahead and yellow starthistle should be analyzed to determine if any of these are depressing the cover of CCG. If so, grazing regimes can be altered or herbicide application can be introduced to control the pepperweed and yellow starthistle. A phased combination treatment could be attempted for medusahead per the TAFB Fire Management Plan. Appendix B gives the best timing and herbicide formulation for each weed species should herbicide application be required.

4.2.2. Listed Branchiopods Weed Management

Threats

Branchiopods that inhabit TAFB vernal pools face similar threats to CCG. In particular, timing and duration of the inundation period are critical. Pools must remain wet for long enough for a complete life cycle, and then dry sufficiently for the cysts to become dormant. Water quality is an additional factor in branchiopod ecology, and this can be negatively affected by the buildup of litter produced by non-native species (Marty 2015). Litter buildup can both cause anoxic conditions in the pool, and may also directly decrease inundation period. As litter builds up and incorporates organic matter into the soil, that soil has a higher water-holding capacity, which leads to more below-ground moisture and less ponding above (Marty 2015). Both of these effects can be detrimental to gill-breathing branchiopods with specific tolerances for inundation period.

Yellow starthistle and perennial pepperweed threaten to destabilize vernal pool hydrology through thatch buildup, competition or extremely high evapotranspiration rates. Yellow starthistle has fast-growing roots that can draw deep soil moisture from as far as 6.6 feet (ft) (2 meters [m]) deep. The plants can deplete soil moisture early in the season, allowing them to compete with native species and create drought conditions even in normal rain years (DiTomaso *et al.* 2006). High evapotranspiration rates paired with deep roots allow yellow starthistle to deplete soil moisture, while simultaneously avoiding competition with shallow-rooted neighbors. Although yellow starthistle rarely invades pool basins themselves, this ability to alter hydrology within the basin is a threat to vernal pool-reliant native species. Perennial pepperweed, which is capable of growing within the basins, also over-utilizes water resources in vernal pools, while annual grass species such as Italian ryegrass, Avena and Brome species, produce large quantities of biomass each year that contribute the dense litter that can degrade water quality.

Management Thresholds

The monitoring program established for CCG as well as the TAFB Grazing Plan will also indicate if grazing regimes need to be adjusted for branchiopod conservation (Hopkinson in prep.; Marty in prep.). Yearly collection of residual dry matter (RDM) will provide data for tracking litter accumulation, while cover data will indicate how well grazing is suppressing non-native species. If these metrics indicate that grazing is excessive or under-utilizing forage, the next year's grazing parameters should be adjusted accordingly. If a problematic species appears that is not adequately reduced by grazing, the addition of herbicide application should be considered. Appendix B gives the best timing and herbicide formulation for each weed species should herbicide application be required.

4.2.3. California Tiger Salamander Weed Management

Threats

Invasive species pose threats to CTS and to the small mammals they rely on. Decreased vernal pool inundation period and changes in plant species composition can decrease survivorship of

larvae. CTS larvae are exposed to depredation in less-turbid pools or those with cover for predaceous insects (Ford *et al.* 2013). Excessive emergent vegetation, which is frequently composed of non-native species, can provide cover for these insects, and CTS are less likely to breed in pools with greater than 35% emergent vegetation (Bobzien and DiDonato 2007). Cattle grazing can decrease emergent vegetation, increase inundation period and stir sediment to create turbidity, so grazing has been recognized as a compatible land use for CTS breeding (Ford *et al.* 2013). Grazing can also improve or maintain upland CTS habitat, used for summer burrows and transit to and from breeding pools. CTS upland habitat management focuses on attracting small mammals that construct burrows and maintaining vegetation that is navigable by breeding and dispersing CTS. Although the exact optimal density of burrows at a site has not been researched, burrow-producing rodents should be "relatively common" (Ford *et al.* 2013). If data are available from TAFB that demonstrate a link between a particular level of activity, this would be a valuable addition to the CTS literature. Ground squirrels tend to prefer short vegetation, and spiny or dense-growing species may discourage them from occupying a site.

With the exception of the pools in Castle Terrace where breeding has been documented, TAFB vernal pools are not suitable for CTS breeding, although off-Base nearby pools are. Therefore, upland habitat for summer residents and connectivity routes that cross the Base between breeding pools should be the focus of TAFB CTS conservation. Spiny or dense invasive species can discourage residency by fossorial mammals, leading to a decline in burrows for CTS to use (Ford *et al.* 2013). This type of vegetation can also impede travel by dispersing juveniles or adults seeking breeding pools. In general, the presence of healthy rodent populations, low herbaceous cover and occasional taller cover patches are indications of suitable CTS summer habitat.

Management Thresholds

The weed manager should consider data from the Grazing Plan and CCG monitoring program when evaluating weed impacts to CTS, but qualitative surveys that can evaluate the density of small mammals and amount of herbaceous cover will be equally important. The Grazing Plan developed for the Castle Terrace Housing area indicates that a vegetation height of 1-3 inches (2.5 to 7.5 cm) and maintenance of minimum RDM are ideal for CTS (Wilson 2015). Areas that are devoid of active small mammal burrows also indicate poor quality CTS habitat, and these areas should be considered for improvement. The best tool for managing CTS habitat is grazing, but should the weed manager determine that additional treatments are required to encourage CTS or small mammal usage, herbicide application may be considered. Appendix B gives the best timing and herbicide formulation for each weed species if herbicide application is indicated.

4.2.4. Grazing Weed Management

Threats

Grazing represents a valuable resource for TAFB. First, it is an important tool for managing vernal pool grasslands, as discussed in the previous three sections. Second, allowing horses to graze at TAFB increases the quality of life for residents who can participate in the Base

Equestrian Club (USAF 2016). Lastly, the TAFB Grazing Management Plan indicates that the grazing program can be expanded to manage areas other than the current allotment, which would increase the value of the grazing program even further.

Threats to grazing include species that cause mechanical injury to grazers through spines or awns, degrade the forage quality or because of toxicity. Because different animals react differently to toxins, the type of grazer using a given pasture should be taken into account. For instance, sheep and cattle will graze the early stages of yellow starthistle, but it is toxic to horses. Other species such as barb goat-grass can be grazed at very early stages but can cause mechanical damage to grazers and are unpalatable as they age. Medusahead is of particular concern in the grazing allotments due to its ability to significantly degrade forage quality. As medusahead abundance increases, steer weight gain decreases significantly, and infested pastures effectively have lower stocking rates as a result (James *et al.* 2016). As stocking rates decline in pastures with medusahead infestations, they retain higher RDM values as the unpalatable vegetation is left in the form of thick thatch. This results in a feedback loop that worsens the medusahead infestation and reduces the conservation value of grazing.

Management Thresholds

Consultation with the grazing permittee(s) and Equestrian Club members should be augmented with the data collected under the Grazing Plan to determine if weeds are degrading grazing opportunities. In particular, when RDM levels are above target in pastures with medusahead, this may indicate that the infestation has reached a level where the feedback loop of lower forage quality has begun. If the action of the grazing itself is insufficient to control weeds, herbicide application, prescribed burning or mixed species grazing may be needed (Appendix B).

4.2.5. Recreational Activities Weed Management

Threats

The Base also provides housing and recreational opportunities for military families, including the Castle Terrace Special Natural Area and its interpretive trail, equestrian opportunities and hiking or running trails. Any invasive species that may be toxic or irritating to people and pets can become a problem in military housing or recreational areas. Outdoor recreation areas are used for physical fitness activities such as running and walking, and these activities may be curtailed by species such as yellow starthistle. The North Gate Park Pond also provides some recreational opportunities in the form of picnic areas and fishing. Eurasian water-milfoil is currently infesting this pond, and other aquatic weeds may be introduced that would degrade the water quality or fish habitat.

Management Thresholds

Management of weeds that degrade recreational opportunities relies on qualitative assessments of trails, ponds and parks. These areas should be regularly surveyed for species that can degrade their quality for recreation. Maintaining recreation facilities not only increases the quality of life for residents, but it can also instill interest and a desire to be good stewards in

those residents. Consultation with users or surveys of residents should be considered to guide weed management in recreation areas.

4.2.6. Grounds Maintenance Weed Management

Threats

TAFB roads, sidewalks and trails must be maintained for visibility and fire abatement, as well as aesthetics. Transportation corridors including roads, sidewalks, trails and parking areas can be degraded by roadside weeds that reduce visibility or increase fire danger and erosion. Grounds maintenance also includes decorative plantings that may be invaded by wildland weeds.

Management Threshold

The weed manager should consult with grounds maintenance personnel so that the two programs are able to coordinate efforts and leverage each other's presence on the ground and resources. Making sure grounds maintenance personnel are aware of wildland weeds will help conserve the natural resource of TAFB. Likewise, if wildland weeds are escaping into grounds maintenance areas, a combined effort will be more effective than each group attempting to tackle the problem alone.

4.2.7. Military Mission Weed Management

Threats

The military mission of TAFB consists of supporting defense aviation activities including servicing and ferrying aircraft to the Pacific Ocean, long-range reconnaissance, air logistics support, and humanitarian operations. These missions can be impeded by invasive species that increase fire risk or provide habitat for pest species (especially birds near the airfield, which can become hazards to aircraft). For instance, yellow starthistle seeds provide a food source for birds such as tricolored blackbird, and infestations around the airfield could draw in these and other seed-eaters, increasing the risk of Bird Air Strike Hazards.

Management Threshold

The Weed Program Manager should consult with military operations managers and BASH personnel to determine if invasive plants are increasing fire risks, creating wildlife habitat in dangerous proximity to the flight line, impeding road visibility, etc. Regular surveys by BASH personnel can be used to gauge phenology and the need for treatment for some airfield weeds. If tricolored blackbird presence is tied to yellow starthistle seed production, control of starthistle should focus on preventing seeding, rather than only focusing on lowering the density or a achieving a prescribed vegetation height.

5.0 Weed Management Toolkit

Having a varied toolkit of available methods to control invasive species allows for a more nuanced approach to selecting and killing only the target species, making each application of herbicide or other removal technique as efficient as possible. Mechanical methods may be preferable in some situations or with certain species, particularly tree species. Some trees and shrubs can be killed by girdling or cutting down at the base, while others may need a combination of mechanical and chemical treatments. Grazing may be the preferred method to control suites of annual grass species, and this has the added benefit of maintenance of sensitive species habitat. Although implementation of a prescribed burn would require extensive organization and coordination with TAFB administration, this method may be appropriate in some situations.

- **Hand/Mechanical Removal.** Hand removal methods or the use of small hand-powered or handheld equipment (such as a Weed Wrench or weed whacker) is often the first method considered for removing small or new weed infestations. Whole weed plants removed using Weed Wrenches, and weed material left over from weed-whacking or mowing efforts, should always be collected and disposed of in a manner that prevents spread to other areas. This step is not critical if the weeds are treated before they produced viable propagules unless the weed is capable of vegetative reproduction (e.g., perennial pepperweed and many floating aquatic weeds).

  Hand removal may also be a good option for containing the leading edge of an infestation where target plants are mixed with desirable native species. Caution should be used in hand removal efforts that result in turned soil. These disturbed, bare areas can be quickly recolonized by the target weed or other weed species. Minimize disturbance where possible, and consider revegetating or seeding turned soil. For perennial species, especially trees, hand removal can take the form of girdling, but this will only be effective if the species is incapable of resprouting below the girdling cut.

- **Herbicides.** Herbicides are often used to manage dense or large weed infestations. This method can often successfully control infestations that cannot be effectively or reasonably controlled through other management actions. Consideration should be given to the herbicide's potential effect on the surrounding vegetation, habitats, and wildlife. Some herbicides should never be used where they may contaminate water bodies or wetlands. Pre-emergent herbicides can be used before weeds germinate, such as during fall before the rainy season has begun, whereas post-emergent herbicides are used when the weed plants have germinated and are actively growing. Selectivity of the herbicide is one of the most important considerations when choosing a chemical to apply in a wildland setting. Some herbicides are selectively more toxic to a range of species such as a group of families or broadleaf species only, while others are toxic to the majority of types of plants. Chemical companies conduct extensive testing on these effects, but actual toxicity in the field to many native plants is unknown. When adequate background information is lacking, small-scale tests should be conducted to ensure that desirable or sensitive species are not damaged by an herbicide prior to its application at a large scale.

Herbicides must always be applied in accordance with the Air Force Pest Management Program, TAFB Pest Management Plan, General National Pollutant Discharge Elimination System Permit for Residual Aquatic Pesticide Discharges and all applicable federal, United States Air Force, Department of Defense, State of California, and local directives and regulations. The Department of Defense maintains a list of approved pesticides, the 2015 version of which is supplied as Appendix E.

- **Grazing.** Livestock grazing during specific times and at carefully monitored levels can help control populations of non-native plant species, including medusa head and other annual grassland species. Particularly in grassland/vernal pool complexes, grazing can have direct benefits to sensitive species. Moderate grazing of non-native annual grasses reduces cover and thatch that inhibit native plant species from germinating and growing and can prevent the formation of some types of weed infestations. Well-timed intensive grazing can also help to control infestations of weeds. However, overgrazing and extensive livestock use can also contribute to disturbance that may favor weed colonization. Some weed seeds can also pass through the digestive system of livestock without harm and be deposited in other areas with feces, creating another pathway for the spread of infestations. The type of animal used in a grazing program changes the outcome, as cattle, horses, sheep and goats all graze differently and prefer different types of forage. For details on grazing at TAFB, consult the Grazing Plan (Hopkinson, in prep.)
- **Fire Management.** Some weed infestations may be effectively treated using handheld propane torches to treat seedlings. This method should be applied carefully and used only in winter or spring during or following rain events so that there is no risk of wildfire. Torching may be best employed as a retreatment method to control new individuals germinating from a latent seed bank where an infestation was identified and treated the previous year. This method can be used to kill small seedlings that have recently germinated, before the seedlings have begun to flower or have gotten too large to easily kill using brief heat. This treatment can reduce the seed bank in the soil by killing the germinated seeds and preventing weed reproduction that would lead to additional seed production during that year. The method has the advantages of requiring relatively low effort and being precise. It kills weeds before propagules have been set and therefore does not require the collection and disposal of weed material. Also, it does not involve the use of chemicals that could affect surrounding vegetation and wildlife.

  Prescribed burns are also useful for controlling some species, particularly those present over large areas (e.g., over 98 ac [40 ha]). In addition, prescribed fire reduces hazardous fuel loads, recycles nutrients back into the soil, promotes several native fire-adapted species, and may help reduce the reestablishment of invasive species (DiTomaso and Johnson 2006). Prescribed burns require careful planning, coordination, and implementation to ensure success and may not be feasible in some portions of TAFB because of potential conflicts with mission-critical operations. The TAFB Fire Management Plan includes a prescribed burn plan for the Aero Club that would benefit several sensitive species including CCG by targeting yellow starthistle and medusahead as well as accumulated annual grass thatch (USAF 2015). This plan could be used as a template for proposing, guiding and implementing

prescribed burns in other areas of TAFB as well, depending on the weed species present and the potential benefits to sensitive species.

- **Mowing.** Regular mowing performed for fuels control, grounds maintenance, etc. is not an effective invasive species control technique, and should be distinguished from a carefully timed and precisely executed weed mowing treatment. Mowing using tractors or hand-held string trimmers can be used to control annual species, but is generally less effective in controlling perennials. When mowed, many perennial species respond with rapid regrowth, although reproduction can be depressed if mowing is timed correctly or with sufficient frequency. For annual species control, mowing must be carefully timed to coincide with the target species phenology. Ideal timing for annual grasses (including barb goatgrass, medusahead and various bromes, fescues and hordeums) coincides with the earliest stages of seed-set when embryos are still milky and vegetation is no more than six inches (15cm) tall (Darris and Gonzalves 2008; Stromberg and Kephart n.d.). If performed after this stage, when new seeds have become viable, mowing is likely to make the infestation more severe by spreading the seeds. In the case of barb goatgrass, early mowing will result in an explosion of tillers that will produce more seed, while mowing that is performed too late will disperse the seeds (DiTomaso *et al* 2013). Mowing presents a biosecurity threat from equipment that is used off Base that may transport weed seeds or vegetative propagules, as well as equipment that moves on Base from an area infested with a weed to an area that does not yet support it. In general, mowing is a technique for temporarily limiting the height of vegetation, and as such is not a recommended weed control strategy for TAFB. Where its use is absolutely necessary, it should be performed at the correct stage and with appropriate cleaning BMP's implemented between sites.

5.1 Best Management Practices for TAFB Weed Management

Best Management Practices (BMPs) range from programmatic recommendations for how goals are accomplished to specific protocols for executing tasks. Weed control BMP's can be recommended to contractors, residents or Base divisions to guide their work and reduce the possibility that projects will introduce, spread or increase weed infestations. Some BMP's will apply to all groups, while others are very specific to Base residents, grounds maintenance personnel, grazing permittees, etc. The BMP sections below are intended to be easily separated out from the larger document and provided to the appropriate user groups.

5.1.1. Prevention BMP's

- **Prevention BMP 1**: All livestock forage, seed, straw, and erosion control materials should be certified weed free. To prevent the spread of invasive plants, County Agricultural Commissioners and the California Department of Food and Agriculture (CDFA) offer inspection services to certify materials as "weed free". Weed Free Forage is defined as hay, feed, straw or straw mulch that has been inspected, and certified not to contain propagative plant parts or seeds found on the California noxious weed list, as listed in the California Code of Regulations, Title 3, Division 4, Chapter 6, Section 4500. Appendix D supplies the Cal-IPC list of Weed Free Forage providers and the CA noxious weed list.

- **Prevention BMP 2**: "Shaker plates" or similar devices should be installed in roads near entrances to construction sites and other areas of ground disturbance and construction equipment access on TAFB. Shaker plates are corrugated plates that vibrate and loosen seeds and soil attached to vehicles and equipment. Seeds and soil shaken loose from the vehicles and equipment are collected below the shaker plates. The plates should be monitored for the growth of weedy species, and any weeds observed to be germinating should be sprayed with an appropriate herbicide following the guidelines described in Appendix B as needed to prevent growth and the formation of seeds. Soil accumulating below the shaker plates should be periodically removed to retain the effectiveness of the shaker plates.
- **Prevention BMP 3**: Tools used to manage or control vegetation, such as chainsaws, hand clippers, and pruners, should be washed before being used on TAFB and before being moved from one location to another (i.e., from one weed treatment site to another).
- **Prevention BMP 4**: Earthmoving equipment brought onto TAFB should be washed before use and before being moved from one location on the installation to another (i.e., from one construction site to another). Washing should consist of using water or compressed air to remove any visible plant material, soil or compacted mud, gravel, sand, etc.
- **Prevention BMP 5**: Weed BMPs 1–5 should be incorporated into permits (e.g., dig permits), leases, contracts, and similar agreements between TAFB and its contractors as appropriate.
- **Prevention BMP 6**: Residents of Castle Terrace Housing, grounds maintenance and landscaping teams should be discouraged from planting any weed species, either those that are on the CA Noxious Weed list or the TAFB Watch List, attached as Appendix A.
- **Prevention BMP 7**: Biosecurity pamphlets or other instructional materials should be developed and distributed. These could consist of "Wanted" style posters for Watch List or Eradication-level species, general information about weed prevention, etc.
- **Prevention BMP 8**: All plant debris potentially containing reproductive plant parts (i.e., seeds or plant fragments for species that reproduce vegetatively) removed using mechanical methods should be disposed of at an offsite landfill or green waste facility in such a manner as to prevent the potential spread of seeds or other propagules from the collected materials to other locations. This action may require, but is not limited to, bagging the material before it is transported within or off the site.
- **Prevention BMP 9**: Every two to four years, the Watch List should be re-generated using the Cal-IPC Weed Mapper tool. Refining the list based on habitats available at TAFB would shorten the list and make it more user-friendly. This list should be used in concert with, not instead of, consultation with neighboring landowners and regional weed experts.

5.1.2. Grazing BMPs

- **Grazing BMP 1:** If grazing is implemented in the Castle Terrace area, graze at the minimum RDM to provide habitat maintenance for CTS. The currently grazed pastures plus Aero Club should be grazed in accordance with the Grazing Plan and CCG Monitoring results.

- **Grazing BMP 2:** All supplemental feed should be certified weed free forage (see Prevention BMP 1 above).
- **Grazing BMP 3:** The weed manager should regularly consult with the Equestrian Club to ensure that management of toxic species is effective. Grazing in Equestrian Club pastures will be managed more effectively after implementation of the TAFB Grazing Plan (Hopkinson, in prep.).
- **Grazing BMP 4:** Horse riding trails should be regularly monitored for invasive species that may be introduced on tack, in hooves or in supplemental feed.
- **Grazing BMP 5:** Horse grazing pastures that are overgrazed and currently heavily infested with star thistles should be grazed in accordance with the TAFB Grazing Management Plan to more effectively manage forage, invasive plants and RDM levels.

5.1.3. Mowing BMPs

- **Mowing BMP 1.** The use of mowing for invasive species control is generally discouraged at TAFB, but if it must be used, mowers should be cleaned prior to arrival at TAFB. Cleaning between locations while on Base is also recommended.
- **Mowing BMP 2.** Schedule mowing events to coincide with the correct phenological stage for the target species to prevent dispersal of seed or rapid regrowth of the target weed or other species.
- **Mowing BMP 3.** Ensure that mower height is appropriate for target weed species and desired effect.

5.1.4. Herbicide BMPs

- **Herbicide BMP 1:** Schedule herbicide application to maximize kill rate with regard to weather conditions and target species phenology. The Weed Program Manager should be familiar with target species biology and seasonality of the Base and take these into account when scheduling herbicide application.
- **Herbicide BMP 2:** When possible, time herbicide application to coincide with multiple species' phenology window to maximize efficiency.
- **Herbicide BMP 3:** Ensure that the most effective herbicide for the target species is used. If necessary, develop a protocol for requesting that new herbicides be added to the list of DoD approved pesticides. Effectiveness also includes the assumption that the chemical will not have deleterious effects on any sensitive resources near the application site.
- **Herbicide BMP 4:** Care must be taken on TAFB where invasive species co-occur with sensitive wetland, amphibian, plant and invertebrate resources. Choose appropriate herbicides (including surfactants) that are listed for aquatic use. In addition, applicators at TAFB may need to hold an Aquatic Pesticide Application License to spray because of the jurisdictional nature of the vernal pools. Determining this need should be a priority.

- **Herbicide BMP 5:** Ensure that all herbicide applicators know and can recognize sensitive resources including listed wildlife and plants, nesting birds, burrows that may be occupied by CTS, etc.
- **Herbicide BMP 6:** Protect nearby non-target vegetation by minimizing drift and applying only enough herbicide to effectively treat the target plants. Minimize drift by applying herbicide under low wind conditions, and within the heat tolerances of herbicides that may be volatile.
- **Herbicide BMP 7:** All pesticide applicators must hold current Qualified Applicator Certificates (minimum qualification) from the California Department of Pesticide Regulation.

5.1.5. Monitoring BMPs

- **Monitoring BMP 1:** The weed program manager should conduct regular inspections for weeds at known infestation locations, along major travel corridors, in active construction sites and other areas of ground disturbance, and along waterways, per the surveys outlined in Section 4.1.2. The frequency and intensity of weed inspections are expected to vary each year, based on the amount and timing of precipitation. In general, the weed program manager should conduct inspections in late winter/early spring and late summer/early fall. These surveys should be feasible to conduct in one day and should be a general area survey rather than detailed mapping of infestations. Detailed infestation mapping should only be performed for Eradication-level species or when a species may be directly threatening a sensitive resource (see Section 4.2 above).
- **Monitoring BMP 2:** The weed program manager should determine protocols and scheduling for specific weed control actions based on the regular inspections and should determine the effectiveness of ongoing weed control actions to determine whether contingency actions are needed. Initially, this should consist of a review of existing data collection (Grazing Plan, CCG Monitoring Plan and Implementation Reports from contractors performing invasive species control work). If this existing information is determined to be insufficient to address the Weed Program's data needs, the optional monitoring methodology outlined in Section 4.1.2 should be incorporated.
- **Monitoring BMP 3:** The weed program manager should maintain and regularly update a database of spatial and tabular data that allows tracking of weed populations and control efforts. Spatial data should include both general area surveys from BMP 1 and any detailed infestation mapping data that are available.

6.0 Natural Resource Management Unit Considerations

Currently, Base management is adapted to address unique conditions and uses of seven NRMU's, four of which require management of invasive species: Castle Terrace, Aero Club, and the Northeast and Southeast Undeveloped Areas (UDA; Figure 6-1). Each of these areas contains listed and sensitive resources which require special attention when addressing invasive species control.

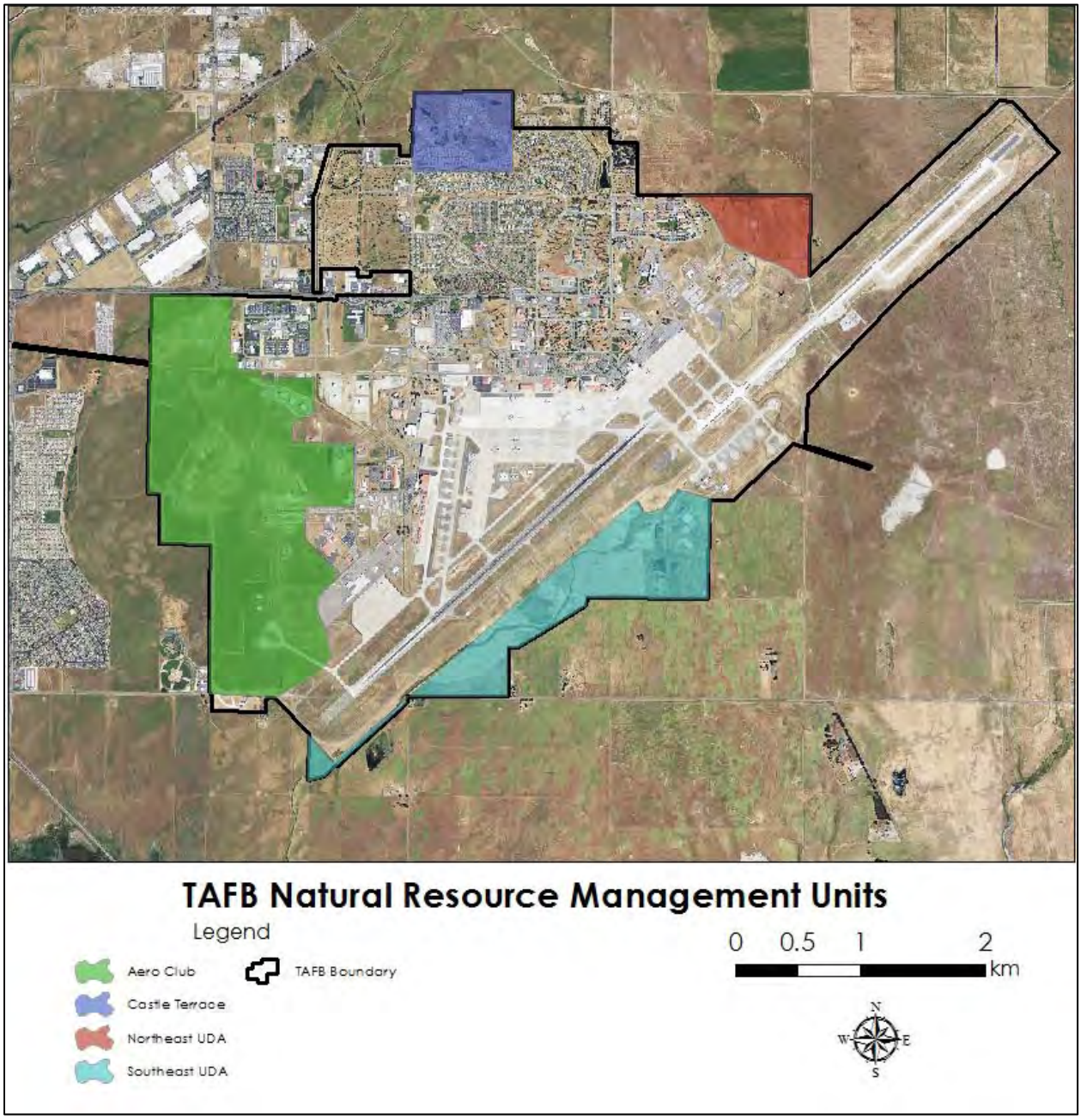

Figure 6-1. Natural Resource Management Units.

6.1 Aero Club

6.1.1. Current Conditions

This Plan combines NRMU's A and B, which are distinct Units in the TAFB INRMP (USAF 2016). The two units, Aero Club and Grazing Area, contain similar vernal pool habitat and after 2018 both will be grazed. This combined unit has a high concentration of natural resources, with populations of CCG, potential for both listed large branchiopods, non-breeding season habitat for CTS and extensive vernal pools. The combined Unit is the largest of the four Units addressed by this Plan, covering 840 ac (340 ha). The dominant uses for this unit include the helipad for a medical center, munitions storage bunkers, open space, vernal pool conservation, grazing allotments for cattle and horses, recreation, Equestrian Club facilities and physical fitness training (UASF 2016).

6.1.2. Desired Conditions

In the northern half of the Aero Club, which will be grazed beginning in 2018, improvements in conservation of CCG is the primary focus. As such, the amount of total vegetation should be at a level that does not compete with CCG, as measured by the yearly monitoring (Marty in prep.) (Table 6-1). Invasive thistles and fennel should be reduced throughout the Unit. For the southern portion that is currently being grazed, management should strive for successful grazing that maintains both vernal pool habitat and CTS upland habitat (Table 6-1).

Table 6-1. Desired Conditions for Aero Club.

	Indicator	Metric	Timeframe
Northern Aero Club (grazing initiates 2018)	Total vegetation	Non-native not competing with CCG (per monitoring data)	2 years after introduction of grazing
	Yellow starthistle	Reduce to level of not interfering with hydrology	Within 5 years
	Perennial pepperweed	Reduce to level of not interfering with hydrology	Within 5 years
	Bristly oxtongue	Reduce to <25% cover	Within 5 years
	Fennel	Reduce to <10% cover	Within 5 years
Southern Aero Club (currently grazed)	Palatable forage	80% cover or greater	Within 5 years
	Starthistles in Horse Pastures	Reduced to levels not posing toxic threat	Within 3 years
	Skeleton weed	Reduce to <10% cover	Within 5 years
	Bull thistle	Reduce to <10% cover	Within 5 years
	Wooly distaff thistle	Reduce to <10% cover	Within 5 years
	Small mammal burrows	Present and active	Within 3 years
	Total vegetation	Non-native not competing with CCG	Within 3 years

6.1.3. Current Management

Portions of this area surrounding the helipad are mowed yearly. The southern half of this Unit is currently being grazed by cattle and horses, and the northern half (the Aero Club) will be grazed with cattle after installation of a fence, likely to occur in 2018. Although many non-native grass species are prevalent in this Unit, they will likely decline as the area is managed under a carefully designed and monitored grazing plan. TAFB is developing a Grazing Plan to optimize the use of grazing for management goals Base-wide, and this plan should inform grazing monitoring and practices into the future (Hopkinson, in prep.). Both under-and over grazing are occurring on TAFB, with overly high RDM values recorded in areas with medusahead infestations and low values in some horse pastures, resulting in high levels of starthistles which are toxic (Wilson, pers comm.). Solano County RCD treated giant reed in 2016, with only partial control. They recommend using cut stump treatment rather than foliar application in future treatments (Solano County RCD 2016). Medusahead management is an urgent need in the grazing areas, as it is degrading the quality of the forage and causing high RDM values as the cattle avoid consuming it (Wilson, pers. comm.).

6.1.4. Weed Management Recommendations

Mowing is a less-effective management tool than grazing for the Aero Club because it is not as selective as cattle grazing (cattle prefer grasses over forbs, leading them to suppress non-native annual grasses to the benefit of native forbs) and mowing is generally conducted as a single event which may miss the appropriate phenological stage of one or more susceptible weeds. The exotic species with the highest potential to negatively affect the vernal pool resources of the NRMU are yellow starthistle and perennial pepperweed. In the uplands, yellow and purple starthistle, medusahead and fennel may degrade the quality of pasturage, impede travel by CTS and prevent colonization by burrowing mammals. Although grazing is anticipated to give good control of the majority of the problematic species in this Unit, occasional additional management may be required. For instance, the medusahead population may require prescribed burning, per the TAFB Fire Management Plan, which includes a prescribed burn plan for the Aero Club (TAFB 2015).

If the Weed Program Manager determines that this unit is acting as a source population of fennel that is being exported to other areas of Base, the fennel should be treated with herbicide (Appendix B). Other species that are not controlled with grazing (particularly the medusahead) should also be addressed if they increase in density or area. Implementing mixed-species grazing, such as bringing in goats occasionally may control forb species that are not preferred by cattle. Goat grazing should only be implemented when CCG is not flowering, to prevent the animals from consuming CCG or other rare vernal pool species.

Aero Club Weed Management Actions

- During annual monitoring survey, immediately control any plants present on the Eradication Table (Table 3-2), Prevention Table (Table 3-1), or Watch list (Appendix A).

- Monitor fennel density and expansion annually to determine if it is acting as source population and generating satellite populations nearby. Control with herbicides if there is an annual expansion trend or 20% increase in density.
- Monitor expansion/density of other weeds listed on the asset-based protection list.
- Consider a strategy to introduce prescribed burning per the TAFB Fire Management Plan. Burns should be designed to target medusahead to improve forage quality and increase forage utilization.
- Consider alternate grazing strategies such as intensive goat grazing .

6.2 Castle Terrace

6.2.1. Current Conditions

Castle Terrace, in the northern part of the Base, is primarily used as Base housing but its open space areas may also be a viable option for grazing, and a grazing plan specifically for this NRMU was developed although it has not been implemented (Wilson 2015). Small parks and playgrounds look out over the open space areas, which are fenced with low chain link barriers. Its natural resources include vernal pools, perennial ponds, CCG, CTS, and VPFS, as well as an area of native bunchgrass grassland (USAF 2016). The area is designated as an Open Space/Wetlands Preserve Area with an interpretive nature trail.

6.2.2. Desired Condition

The desired conditions for Castle Terrace center on the removal or reduction of several problematic weed species and the creation/maintenance of CTS, VPFS and VPTS habitat (Table 6-2).

Table 6-2. Desired Conditions for Castle Terrace.

Indicator	Metric	Timeframe
Yellow starthistle	Reduce to <20% cover	Within 5 years
Barb goatgrass	Reduce to <20% cover	Within 8 years
Perennial pepperweed	Reduce to <10% cover	Within 5 years
French broom	Reduce to <10% cover	Within 5 years
Treasure flower	Eradicate from NRMU	Within 3 years
Small mammal burrows	Present and active	Within 3 years
Vegetation height	2.5-7.5cm tall	Within 5 years

6.2.3. Current Management

Currently, this 128 ac (52 ha) NRMU is mowed regularly for fuel break management on flat terrain and control of invasive species using mechanical and chemical techniques. Monitoring is conducted in the constructed and natural vernal pools as well (USAF 2016). In 2015, the Solano County RCD treated: accessible populations of giant reed; barb goatgrass; Himalayan blackberry; treasure flower; and purple starthistle. These efforts have yielded good results, particularly where herbicide application or mowing treatments were coordinated with firebreak

and grounds maintenance activities (Solano County RCD 2016). In addition, a portion of this NRMU burned in a naturally-occurring fire in 2015 (Wilson, pers. comm.).

6.2.4. Weed Management Recommendations

Highly problematic weeds include barb goatgrass, perennial pepperweed, medusahead and treasure flower. Treasure flower should be prioritized for eradication as per Section 3.1.2, as should Himalayan blackberry (in this NRMU only). At minimum, the mowing program should be scrutinized and an appropriate schedule should be determined to maximize control through timing. If possible, the recommendations made in the Castle Terrace Grazing Plan should be implemented (Wilson 2015).

Improving the viewscape through controlling weeds may also improve quality of life for residents as well as improve the utility of the nature preserve. The interpretive trail should be regularly surveyed for weed species that can be nuisances to people and pets, and trail margins should be maintained to prevent growth of weeds that can easily dispersed throughout Base by hikers. Well-maintained trails and interpretive signs can have the added benefit of increasing residents' knowledge of and appreciation for the open spaces and natural resources management of the Base, which in turn should lead to better understanding and compliance with BMP's.

The topographic variation at the Castle Terrace NRMU is currently a challenge to the mowing program, but could be leveraged as an asset instead. Little native scrub habitat exists on TAFB, and either coastal sage scrub or oak woodland may be an option for these slopes. CTS will utilize these vegetation types as summer habitat, so the loss of grassland would not reduce usable space for CTS. Grassland should be maintained in swales and around vernal pools, and shrubs should not be allowed to encroach into these lower areas. This would require more intensive invasive species management followed by outplanting efforts, but a stable shrub or woodland vegetation matrix surrounding the grasslands may be a more sustainable long-term solution.

Castle Terrace Weed Management Actions

- During annual monitoring survey, immediately control any plants present on the Eradication Table (Table 3-2), Prevention Table (Table 3-1), or Watch list (Appendix A).
- Eradicate treasure flower throughout Unit, duck pond recreation area, and from source populations off base around the water tank Geographically Separated Unit.
- Work with Balfour Beatty and PRIDE to time the one-time mowing event to provide for optimum barbed goat grass control and to avoid conflicts between mowing and herbicide control of treasure flower.
- Survey interpretive trails and control growth of 1) weeds along trail margins whose seeds we want to minimize distribution of by hikers, 2) weeds considered a nuisance to people and pets (YST/PST).
- Install interpretive signs created in 2015; maintain in good condition.

- Consider implementing a horse grazing experiment, which is understudied as a wildlands management technique (Wilson 2015). If a horse or cattle grazing regime is considered, an analysis of fencing needs should be initiated first.
- Targeted sheep grazing may be a good option as a rotation with other grazers or with mowing, particularly if the topographic variation of Castle Terrace results in uneven mowing or grazing on slopes (sheep can be herded and will range across slopes and hill tops [Wilson 2015]).
- Consider creation of coastal sage scrub or oak woodland on hard-to-mow slopes to decrease habitat for problem weeds. Prevent shrub/tree encroachment into flats and swales to maintain open vernal pool and CTS habitat.

6.3 Northeast Undeveloped Area

6.3.1. Current Conditions

The two Undeveloped Areas border the airfield and as such are subject to management for BASH as well as invasive species. The Northeast Undeveloped Area is the smallest of the NRMU's at just over 98 ac (40 ha). It is currently used as open space and for long term storage of contaminated soil, but its vernal pools support CTS and VPFS.

6.3.2. Desired Conditions

The Northeast Undeveloped Area is valuable as upland CTS habitat, and is in close proximity to a documented CTS breeding pool. Therefore, improvement and maintenance of CTS upland habitat should be the focus (Table 6-3). As a secondary metric, reduction or eradication of several of the invasive species should be implemented.

Table 6-3. Desired Conditions for Northeast Undeveloped Area.

Indicator	Metric	Timeframe
Small mammal burrows	Present and active	Within 3 years
Yellow starthistle	Reduce to <30% cover	Within 5 years
Purple starthistle	Reduce to <30% cover	Within 5 years
Treasure flower	Eradicate from NRMU	Within 5 years
Fennel	Reduce to <20% cover	Within 5 years
Spanish broom	Reduce to <10% cover	Within 5 years
Giant reed	Eradicate from NRMU	Within 3 years

6.3.3. Current Management

This NRMU is mowed in the flat areas, but this leaves large tracts of unmowed areas on berms and rolling hills (Figure 6-2). Unmowed areas are densely infested with thistles. Substantial infestations of yellow and purple starthistle, as well as fennel, treasure flower, medusahead, Spanish broom and giant reed require management in this area.



Figure 6-2. Mowed and unmowed portions of Northeast UDA. Note the starthistle infestation.

6.3.4. Management Recommendations

The combination of highly problematic grasses as well as dense yellow starthistle will require development of a detailed, multi-year phased approach to this NRMU. At minimum, the mowing regime should be scrutinized and adapted to better control weeds in this Unit. Equipment that can mow along slopes could be utilized, and timing should be adjusted to target specific species rather than vegetation height alone. In addition, mowing targeted at barb goatgrass and medusahead needs to be deconflicted with yellow starthistle control. These infestations may require treatment in a multi-year phased approach that combines initial control of yellow starthistle with later mixed-species grazing to address the invasive grasses. A combination, phased treatment for yellow starthistle consisting of October burning, drill seeding with native grasses in December, and a January application of Milestone® at 3 fluid ounces per acre was particularly effective at Fort Hunter Liggett (Kyser *et al.* 2013). This treatment could be replicated in small-scale test plots to determine appropriate timing, and if successful could be replicated at TAFB. In particular, determining the proper timing for the burning will be critical to balance the safety challenges of fall burning with maximizing benefit of the treatment. The giant reed and treasure flower infestations in this NRMU should be targeted for eradication as per section 3.1.2.

If possible, the addition of mixed-species grazing per the Grazing Plan should be considered (Hopkinson, in prep.). This would require either an analysis of the contaminated soil to ensure that it is safe for grazing, or animals that will not enter the human food chain could be used.

The small size of the pasture may mean that cattle grazing is not feasible, in which case goats could be rented to control the yellow starthistle in particular. As this species is toxic to horses, it should be controlled prior to any horse grazing on the site, but the Equestrian Club could be contacted to determine if the Unit would suit a small number of horses as a pasture.

Northeast Undeveloped Area Weed Management Actions

- During annual monitoring survey, immediately control any plants present on the Eradication Table (Table 3-2), Prevention Table (Table 3-1), or Watch list (Appendix A).
- Monitor medusahead/barbed goat grass phenology and notify PRIDE when to conduct its May mowing to target the non-native grasses. If grazing is not feasible, additional weedwhacking or mowing may be required in combination with herbicide application to address yellow starthistle infestations.
- Add slopes to mowing contract for PRIDE; track phenology of starthistles and notify PRIDE to target control at these species.
- Eradicate treasure flower and giant reed populations.
- Set up a goat or sheep grazing contract for three years to control YST/PST. Fence the area and add grazing parcel to grazing leases for cows or the Equestrian Center. Discontinue PRIDE mowing regimes once grazing is instituted as the control technique. If grazing does not occur during the wet season in any given year, mowing should be re-instituted as described above.

6.4 Southeast Undeveloped Area

6.4.1. Current Conditions

The Southeast UDA is just over 290 ac (120 ha) adjacent to the airfield so portions of it are mowed to meet BASH objectives. CCG and CTS have been documented in this Unit, along with vernal pools. The primary drainage for the Base, Union Creek, runs through this Unit, providing it with riparian vegetation such as cattails and willows. A complex of oxidation ponds need to be addressed in this NRMU. The basins have been used for firefighting training and may contain contaminated soils. These basins currently support a mix of exotic forbs and little else. However, this vegetation has supported tricolored blackbird, a species that is currently under review by the Fish and Wildlife Service. If invasive species control is performed in areas where tricolored blackbirds have nested, additional minimization measures may be required beyond those required by the Migratory Bird Treaty Act (see Section 2.3). Starthistles, fennel, medusahead, perennial pepperweed and mustard are pervasive throughout this Unit.

6.4.2. Desired Conditions

The Southeast UDA lies adjacent to the airfield, and thus the primary management concern is bird air strike hazard reduction, as well as CTS upland habitat (Table 6-4). The target allocation of man hours should encompass maintenance and monitoring activities if weed reduction and eradication efforts are successful.

Table 6-4. Desired Conditions for Southeast Undeveloped Area.

Indicator	Metric	Timeframe
Small mammal burrows	Present and active	Within 3 years
Stinkwort	Reduce to <10% cover	Within 5 years
Oxidation Ponds	Not acting as source of weeds	Within 5 years
Vegetation height	Suitable for BASH reduction	Within 3 years

6.4.3. Current Management

Management in this unit focuses on wildlife hazard abatement such as mowing and removing vegetation along Union Creek in the Southeast UDA.

6.4.4. Management Recommendations

Mowing scheduling can be improved to meet BASH objectives and reduce bird usage of these areas as well as manage non-native annual grasses within the Unit. During a June 2016 visit, MSRS staff observed meadow larks and blackbirds utilizing a mowed grassland adjacent to the runway. This vegetation should be maintained at the recommended height for BASH mitigation to reduce its attractiveness to birds.

The Grazing Plan recommendations for grazing some areas of this Unit should be considered to control weeds, particularly medusa head and yellow starthistle. Goat grazing may be a better alternative to mechanical removal of riparian vegetation, as long as erosion is not increased along Union Creek.

Currently, the oxidation ponds act as an extensive source population of many of TAFB's problem weed species. These ponds may contain contaminated soils and are constructed of concrete. Restoring them would require analysis of the soils, removal of contaminated soil, removal of concrete decompaction and recontouring prior to any reintroduction of native species. However, with the limited space for natural areas on TAFB, maintaining these ponds as refuges for invasive species is counterproductive.

Southeast Undeveloped Area Weed Management Actions

- During annual monitoring survey, immediately control any plants present on the Eradication Table (Table 3-2), Prevention Table (Table 3-1), or Watch list (Appendix A).
- Develop restoration plan for defunct oxidation ponds.
- Ensure that mowing scheduling is in accordance with BASH objectives, and coordinate Union Creek vegetation clearing to suit BASH needs, erosion prevention and weed management.
- Implement Grazing Plan recommendations for introducing grazing, particularly mixed-species grazing that could target yellow starthistle and medusahead (Hopkinson, in prep.).

7.0 Conclusion

Biological invasions disrupt natural communities and ecosystems through increases in distribution and abundance of exotic species, and they cause extensive damage to human economies and natural systems every year (Pimentel *et al.* 2005). Costs to the US economy are estimated at $120 billion per year and 42% of federally endangered or threatened species are primarily listed because of threats from invasive species (Pimentel *et al.* 2005). For TAFB, losses may include disruptions to the military mission, lowered returns on grazing, and most importantly, degradation to sensitive species habitat which require additional allocation of funds and effort. The primary driver for invasive species control at TAFB is conservation of sensitive species and improvement of sensitive species habitat.

The vegetation of TAFB is the result of extensive agricultural disturbance and biological invasion, but it retains important elements of native vegetation, sensitive species and open space. The entrenched populations of the majority of the weed species precludes eradication of all non-native plants, but each sensitive resource can be managed such that the invasive threat is minimized. This plan is designed to give managers of TAFB concise and executable measures to prevent the arrival of weeds, eradicate those species that are possible to remove and minimize the damage wrought by the remainder, all of which is organized around the concept of improving habitat for the sensitive species occurring on TAFB. As conditions change, new weeds may arrive, others may be controlled and the sensitive resources of the Base may change as well. This plan should be revisited and updated on a regular basis.

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Appendix A. TAFB Watchlist: CalWeedMapper Report for Solano County

This appendix was developed in November 2016 using The CalWeedMapper tool available from CalIPC and CalFlora. This tool leverages plant occurrence reports and expert opinion from CalFlora to determine, on a USGS 7.5-degree quadrangle, which weeds may be present at a particular locality. As a modeling exercise, the resultant lists are understood to be coarse and suggestive, and many of the species that appear on a county list are highly unlikely to appear at a particular site due to habitat requirements. This liberal delineation is most suitable for a watchlist that is updated periodically. Updates could include re-running the CalWeedMapper tool every three to five years to update it with newly reported occurrences, refining the list to reflect available habitat types at TAFB, or including information tailored to the global reach of the Base. With aircraft, personnel and equipment deployed and returning from across the world, the possibility of new-to-California species introductions is possible.

This weed report is intended to be used by TAFB managers and contractors during monitoring and treatment activities as a watchlist, and any species on the list that is detected should be prioritized for eradication as soon as phenology allows. If possible, the vector that introduced the original propagule should be determined so that it can be analyzed and possibly addressed to prevent further introductions. A full integration of this tool with TAFB management would also include feeding information back in to the system by submitting weed distribution reports to CalFlora.

INVASIVE SPECIES MANAGEMENT OPPORTUNITIES IN Solano County

This report summarizes invasive plant management opportunities in Solano County. Opportunities are determined from maps of each species' current distribution and suitable range. Species are listed by three types of management opportunity:

- **Surveillance** – surveying to detect new infestations
- **Eradication** – complete removal of infestations
- **Containment** – limiting further spread of infestations

Below is a sample of opportunities in Solano County. This information should be combined with local knowledge to set local priorities (see "Using the Report" at the end of this document.) Click on a plant's name below to view a map of that species.



Opportunities:

These are some opportunities in Solano County. Tables on proceeding pages of this report contain a complete list of invasive plant management opportunities.

Surveillance:


Photo courtesy of: Cal-IPC
Brassica tournefortii
Saharan mustard, African mustard


Photo courtesy of: California Department of Food and Agriculture
Hydrilla verticillata
hydrilla


Photo © Regents of the University of California
Onopordum acanthium
Scotch thistle


Photo © Regents of the University of California
Ageratina adenophora
crofton weed, eupatorium


Photo © Regents of the University of California
Arctotheca calendula
(=Arctotheca calendula fertile)
fertile capeweed

Eradication:


Photo © Regents of the University of California
Ammophila arenaria
European beachgrass


Photo © Regents of the University of California
Centaurea stoebe ssp. micranthos
(=Centaurea maculosa)
spotted knapweed


Photo © Regents of the University of California
Ehrharta calycina
purple veldtgrass


Photo courtesy of: CDFA
Limnobium laevigatum
South American spongeplant


Photo courtesy of: Julian Meisler
Ludwigia peploides
creeping water-primrose

Containment:


Photo © Regents of the University of California
Aegilops triuncialis
barb goatgrass


Photo © Regents of the University of California
Alternanthera philoxeroides
alligator weed


Photo © Regents of the University of California
Arundo donax
giant reed


Photo © Regents of the University of California
Bromus madritensis ssp. rubens
red brome


Photo © Regents of the University of California
Bromus tectorum
downy brome, cheatgrass

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Surveillance Opportunities

These opportunities entail regular surveys to detect new infestations of species not known to be present in the region. The strategic potential depends on the proximity of nearby infestations and the suitability of the area. The table below includes species occurring within 50 miles of the selected region.

	Suitable Range	
Plant Species: Grouped by Statewide Cal-IPC Rating	2010	2050
High (3 species)		
Brassica tournefortii Saharan mustard, African mustard	0 %	▬
Hydrilla verticillata hydrilla	-	-
Onopordum acanthium Scotch thistle	0 %	▬
Moderate (21 species)		
Ageratina adenophora croftonweed, eupatorium	9 %	▲
Arctotheca calendula (=Arctotheca calendula fertile) fertile capeweed	-	-
Asphodelus fistulosus onionweed	-	-
Brachypodium sylvaticum perennial false-brome	-	-
Carduus nutans musk thistle	0 %	▬
Carpobrotus chilensis sea-fig, iceplant	-	-
Centaurea diffusa diffuse knapweed	9 %	▬
Glebionis coronaria (=Chrysanthemum coronarium) crown daisy	0 %	▬
Cirsium arvense Canada thistle	0 %	▬
Cytisus striatus Portuguese broom		-
Emex spinosa spiny emex, devil's-thorn	0 %	▬
Glyceria declinata waxy mannagrass	90 %	▼
Hypericum canariense Canary Island hypericum	4%	▬
Ilex aquifolium English holly	6 %	▬
Isatis tinctoria dyer's woad	2 %	▬
Leucanthemum vulgare ox-eye daisy	5 %	▬
Linaria vulgaris yellow toadflax, butter and eggs	1 %	▬
Fallopia japonica (=Polygonum cuspidatum) Japanese knotweed	-	-
Saccharum ravennae ravennagrass	-	-
Spartina anglica common cordgrass	-	-

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Surveillance Opportunities, Continued

Plant Species: Grouped by Statewide Cal-IPC Rating	Suitable Range 2010	Suitable Range 2050
Tanacetum vulgare common tansy	-	-
Limited (18 species)		
Carduus acanthoides plumeless thistle	-	-
Conicosia pugioniformis narrowleaf iceplant	-	-
Cordyline australis giant dracaena	-	-
Crocosmia x crocosmiiflora montbretia	-	-
Crupina vulgaris common crupina, bearded creeper	-	-
Rytidosperma pencillatum (=Danthonia pilosa) hairy oat grass	-	-
Echium candicans pride-of-Madeira	6 %	▬
Limonium ramosissimum Algerian sea lavendar	-	-
Myosotis latifolia common forget-me-not	14%	▬
Stipa manicata (=Nassella manicata) tropical needlegrass	-	-
Phytolacca americana common pokeweed	-	-
Saponaria officinalis bouncingbet	-	-
Schinus terebinthifolius Brazilian peppertree	-	-
Schismus arabicus and S. barbatus mediterraneangrass	-	-
Senecio jacobaea tansy ragwort	-	-
Undaria pinnatifida wakame	-	-
Watsonia meriana bulbil watsonia	-	-
Zantedeschia aethiopica calla lily	-	-

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Eradication Opportunities

Eradication entails complete removal of all infestations in the area. These opportunities result from a small number of isolated infestations. The spatial pattern for eradication is one infested quad surrounded by at least two concentric bands of absence quads. The strategic importance of an eradication opportunity can be further assessed based on the degree of isolation as well as the suitability of the surrounding area. Determining the feasibility of eradication requires surveying infestations in the field.

	Current Species Distribution (number of quads out of 28 total)				Suitable Range		
Plant Species: Grouped by Statewide Cal-IPC Rating	Infested	Spreading	Managed	Eradicated	2010	Infested	2050
High (6 species)							
Ammophila arenaria European beachgrass	1	0	0	0	0 %	-	▬
Centaurea stoebe ssp. micranthos (=Centaurea maculosa) spotted knapweed	1	0	0	0	8 %	17 %	▬
Ehrharta calycina purple veldtgrass	1	0	0	0	7 %	14 %	▬
Limnobium laevigatum South American spongeplant	1	0	0	0	-	-	-
Ludwigia peploides creeping water-primrose	1	0	0	0	-	-	-
Salvinia molesta giant salvinia	1	0	1	0	-	-	-
Moderate (5 species)							
Asparagus asparagoides bridal creeper	1	0	0	0	0 %	-	▬
Ehrharta erecta erect veldtgrass	1	0	0	0	15 %	13 %	▬
Gazania linearis gazania	1	0	0	0	-	-	-
Linaria dalmatica ssp. dalmatica (=Linaria genistifolia ssp. dalmatica) Dalmatian toadflax	1	0	0	0	1 %	33 %	▬
Myoporum laetum myoporum	1	0	0	0	5 %	17 %	▬
Limited (3 species)							
Digitalis purpurea foxglove	1	0	0	0	-	-	-
Helichrysum petiolare licoriceplant	1	1	0	0	-	-	-
Spartina patens saltmeadow cord grass	1	0	0	0	-	-	-

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Containment Opportunities

Containment entails limiting the spread from existing infestations. These opportunities result from larger groups of infested quads. The strategic importance of a containment opportunity can be further assessed based on how distinct the boundaries of the infestation are, how isolated it is, and the suitability of the surrounding area. Determining the feasibility of containment requires surveying infestations in the field.

	Current Species Distribution (number of quads out of 28 total)				Suitable Range		
Plant Species: Grouped by Statewide Cal-IPC Rating	Infested	Spreading	Managed	Eradicated	2010 Infested	2050	
High (30 species)							
Aegilops triuncialis barb goatgrass	15	13	3	0	91 %	54%	▼▼
Alternanthera philoxeroides alligator weed	4	0	0	0	-	-	-
Arundo donax giant reed	28	6	19	0	100 %	100 %	▬
Bromus madritensis ssp. rubens red brome	28	0	0	0	22 %	100 %	▲
Bromus tectorum downy brome, cheatgrass	2	0	0	0	2 %	50 %	▲
Carpobrotus edulis Hottentot-fig, iceplant	5	0	0	0	0 %	100 %	▬
Centaurea solstitialis yellow starthistle	28	0	28	0	41 %	100 %	▲▲
Cortaderia jubata jubatagrass	11	0	0	0	15 %	100 %	▬
Cortaderia selloana pampasgrass	19	3	0	0	23 %	100 %	▬
Cytisus scoparius Scotch broom	7	4	2	0	6 %	88 %	▬
Delairea odorata Cape-ivy	2	2	0	0	13 %	29 %	▬
Egeria densa Brazilian egeria	9	6	0	0	-	-	-
Eichhornia crassipes water hyacinth	8	0	6	0	-	-	-
Foeniculum vulgare fennel	24	21	1	0	63 %	100 %	▲
Genista monspessulana French broom	9	7	0	0	29 %	60 %	▬
Hedera helix and H. canariensis English ivy, Algerian ivy	9	2	2	0	21 %	75 %	▲
Lepidium latifolium perennial pepperweed	27	7	6	0	100 %	96 %	▬
Ludwigia hexapetala and L. peploides Uruguay and creeping water-primrose	13	8	0	0	-	-	-
Lythrum salicaria purple loosestrife	6	5	1	0	-	-	-
Myriophyllum aquaticum parrotfeather	9	3	0	0	-	-	-
Myriophyllum spicatum Eurasian watermilfoil	15	6	0	0	-	-	-
Rubus armeniacus (=Rubus discolor) Himalayan blackberry	28	2	2	0	-	-	-
Sesbania punicea red sesbania, scarlet wisteria	9	0	8	0	95 %	32 %	▼▼
Spartina alterniflora hybrids smooth cordgrass and hybrids	3	1	3	0	-	-	-

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Containment Opportunities, Continued

Plant Species: Grouped by Statewide Cal-IPC Rating	Current Species Distribution (number of quads out of 28 total)				Suitable Range		
	Infested	Spreading	Managed	Eradicated	2010	Infested	2050
Spartina densiflora dense-flowered cordgrass	2	0	0	0	-	-	-
Spartium junceum Spanish broom	6	0	1	0	30 %	46 %	▲
Elymus caput-medusae (=*Taeniatherum caput-medusae*) medusahead	25	0	1	0	81 %	89 %	▬
Tamarix parviflora smallflower tamarisk	13	0	8	0	-	-	-
Tamarix ramosissima saltcedar, tamarisk	11	2	2	0	-	-	-
Ulex europaeus gorse	1	0	0	0	8 %	17 %	▬
Moderate (55 species)							
Acacia dealbata silver wattle	1	0	0	0	87 %	4%	▬
Acroptilon repens Russian knapweed	6	2	1	1	95 %	22 %	▼
Ailanthus altissima tree-of-heaven	24	17	14	0	90 %	86 %	▲
Anthoxanthum odoratum sweet vernalgrass	1	0	0	0	-	-	-
Arctotheca prostrata (=*Arctotheca calendula infertile*) sterile capeweed	1	1	0	0	-	-	-
Atriplex semibaccata Australian saltbush	7	0	0	0	20 %	50 %	▲
Avena barbata and A. fatua (slender) wild oat	28	0	0	0	-	-	-
Brachypodium distachyon annual false-brome, false brome	11	1	0	0	53 %	42 %	▬
Brassica nigra black mustard	28	0	0	0	-	-	-
Bromus diandrus ripgut brome	28	0	0	0	100 %	100 %	▬
Lepidium chalepense (=*Cardaria chalepensis and C. draba*) Lepidium chalepensis and L. draba	20	2	2	0	-	-	-
Carthamus lanatus woolly distaff thistle	2	2	0	0	17 %	18 %	▼
Centaurea calcitrapa purple starthistle	23	15	16	0	100 %	85 %	▬
Centaurea melitensis Malta starthistle, tocalote	12	7	0	0	54%	50 %	▲▲
Chondrilla juncea rush skeletonweed	3	0	2	0	54%	11 %	▼▼
Cirsium vulgare bull thistle	28	7	5	0	100 %	100 %	▬
Conium maculatum poison-hemlock	21	3	3	0	27 %	100 %	▲
Cotoneaster franchetii orange cotoneaster	2	0	0	0	8 %	40 %	▬

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Containment Opportunities, Continued

Plant Species: Grouped by Statewide Cal-IPC Rating	Current Species Distribution (number of quads out of 28 total)				Suitable Range		
	Infested	Spreading	Managed	Eradicated	2010	Infested	2050
Cotoneaster lacteus Parney's cotoneaster	2	0	0	0	-	-	-
Cotoneaster pannosus silverleaf cotoneaster	2	0	0	0	23 %	15 %	▬
Cynara cardunculus artichoke thistle	18	0	13	0	93 %	64 %	▼▼
Cynodon dactylon bermudagrass	28	4	0	0	-	-	-
Cynosurus echinatus hedgehog dogtailgrass	9	0	0	0	50 %	45 %	▬
Dipsacus fullonum and D. sativus common and Fuller's teasel	9	5	0	0	23 %	75 %	▬
Dittrichia graveolens stinkwort	20	2	12	0	96 %	71 %	▼▼
Elaeagnus angustifolia Russian-olive	5	0	0	0	-	-	-
Senecio minimus and S. glomeratus (=Erechtites minima and E. glomerata) Australian fireweed	1	0	0	0	-	-	-
Eucalyptus globulus Tasmanian blue gum	11	2	2	0	28 %	73 %	▬
Festuca arundinacea tall fescue	3	0	0	0	-	-	-
Ficus carica edible fig	17	14	0	0	99 %	61 %	▬
Geranium dissectum cutleaf geranium	28	2	0	0	-	-	-
Hirschfeldia incana shortpod mustard, summer mustard	17	2	0	0	-	-	-
Holcus lanatus common velvet grass	7	0	0	0	17 %	70 %	▬
Hordeum marinum Mediterranean barley	28	0	0	0	-	-	-
Hordeum murinum hare barley	28	0	0	0	-	-	-
Hypericum perforatum common St. John's wort, klamathweed	7	1	0	0	-	-	-
Hypochaeris radicata rough catsear, hairy dandelion	14	0	0	0	-	-	-
Kochia scoparia kochia	3	0	0	0	-	-	-
Festuca perennis (=Lolium multiflorum) Italian ryegrass	28	1	0	0	99 %	100 %	▬
Mentha pulegium pennyroyal	13	4	0	0	-	-	-
Mesembryanthemum crystallinum crystalline iceplant	1	0	0	0	-	-	-
Nicotiana glauca tree tobacco	16	2	0	0	17 %	100 %	▲▲
Oxalis pes-caprae Bermuda buttercup, buttercup oxalis	8	5	0	0	-	-	-

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Containment Opportunities, Continued

Plant Species: Grouped by Statewide Cal-IPC Rating	Current Species Distribution (number of quads out of 28 total)				Suitable Range		
	Infested	Spreading	Managed	Eradicated	2010	Infested	2050
Pennisetum setaceum crimson fountaingrass	4	0	0	0	0 %	100 %	▲▲
Phalaris aquatica hardinggrass	18	8	0	0	-	-	-
Potamogeton crispus curlyleaf pondweed	7	5	0	0	-	-	-
Rumex acetosella red sorrel, sheep sorrel	23	0	0	0	-	-	-
Salsola soda oppositeleaf Russian thistle	3	2	0	0	-	-	-
Triadica sebifera (=Sapium sebiferum) Chinese tallowtree	2	1	0	0	-	-	-
Sisymbrium irio London rocket	4	0	0	0	0 %	-	▲
Torilis arvensis hedgeparsley	28	5	0	0	87 %	100 %	▬
Trifolium hirtum rose clover	28	0	0	0	-	-	-
Vinca major bigperiwinkle	10	6	0	0	37 %	56 %	▬
Festuca myuros (=Vulpia myuros) rattail fescue	28	0	0	0	-	-	-
Washingtonia robusta Mexican fan palm	11	2	0	0	-	-	-
Limited (48 species)							
Acacia melanoxylon black acacia, blackwood acacia	6	0	0	0	2 %	100 %	▬
Agrostis avenacea Pacific bentgrass	9	2	0	0	-	-	-
Agrostis stolonifera creeping bentgrass	9	0	0	0	-	-	-
Bassia hyssopifolia fivehook bassia	5	0	0	0	-	-	-
Bellardia trixago bellardia	10	2	0	0	-	-	-
Brassica rapa birdsrape mustard, field mustard	28	0	0	0	-	-	-
Briza maxima bigquakinggrass, rattlesnakegrass	5	0	0	0	50 %	25 %	▬
Bromus hordeaceus soft brome	28	0	0	0	-	-	-
Bromus japonicus Japanese brome, Japanese chess	2	0	0	0	-	-	-
Cakile maritima European sea-rocket	1	0	0	0	0 %	-	▬
Lepidium appelianum (=Cardaria pubescens) hairy whitetop	2	0	0	0	-	-	-
Carduus tenuiflorus and C. pycnocephalus slenderflower and Italian thistle	28	1	27	0	-	-	-

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Containment Opportunities, Continued

Plant Species: Grouped by Statewide Cal-IPC Rating	Current Species Distribution (number of quads out of 28 total)				Suitable Range		
	Infested	Spreading	Managed	Eradicated	2010	Infested	2050
Cotula coronopifolia brassbuttons	10	0	0	0	-	-	-
Crataegus monogyna hawthorn	2	1	0	0	-	-	-
Dactylis glomerata orchardgrass	16	2	0	0	28 %	100 %	▲
Descurainia sophia flixweed, tansy mustard	8	5	0	0	-	-	-
Erodium cicutarium redstem filaree	28	0	0	0	-	-	-
Eucalyptus camaldulensis red gum	5	0	4	0	-	-	-
Euphorbia oblongata oblong spurge	10	1	3	0	91 %	36 %	▼▼
Hypochaeris glabra smooth catsear	28	0	0	0	-	-	-
Iris pseudacorus yellowflag iris	10	0	0	1	-	-	-
Lobularia maritima sweet alyssum	2	0	0	0	-	-	-
Lythrum hyssopifolium hyssop loosestrife	13	0	0	0	-	-	-
Marrubium vulgare white horehound	19	0	0	0	-	-	-
Medicago polymorpha California burclover	28	0	0	0	-	-	-
Olea europaea olive	11	4	0	0	-	-	-
Parentucellia viscosa yellowglandweed, sticky parentucellia	5	2	0	0	60 %	23 %	▲
Pennisetum clandestinum kikuyugrass	1	0	0	0	8 %	17 %	▬
Phoenix canariensis Canary Island date palm	8	3	0	0	-	-	-
Helminthotheca echioides (=*Picris echioides*) bristly oxtongue	28	28	0	0	63 %	100 %	▼
Stipa miliacea var. miliacea (=*Piptatherum miliaceum*) smilograss	11	9	0	0	50 %	50 %	▲
Plantago lanceolata buckhorn plantain, English plantain	28	0	0	0	-	-	-
Poa pratensis Kentucky bluegrass	9	0	0	0	-	-	-
Polypogon monspeliensis rabbitfoot polypogon	28	0	1	0	-	-	-
Prunus cerasifera cherry plum	3	0	0	0	-	-	-
Pyracantha angustifolia, crenulata, seratus, etc. pyracantha, firethorn	12	0	0	0	-	-	-
Ranunculus repens creeping buttercup	3	1	0	0	-	-	-

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Containment Opportunities, Continued

Plant Species: Grouped by Statewide Cal-IPC Rating	Current Species Distribution (number of quads out of 28 total)				Suitable Range		
	Infested	Spreading	Managed	Eradicated	2010	Infested	2050
Raphanus sativus radish	28	0	0	0	-	-	-
Ricinus communis castorbean	2	0	0	0	2 %	50 %	▲
Robinia pseudoacacia black locust	15	1	0	0	-	-	-
Rumex crispus curly dock	28	0	0	0	-	-	-
Salsola tragus Russian-thistle	21	10	11	0	-	-	-
Schinus molle Peruvian peppertree	1	0	0	0	-	-	-
Silybum marianum blessed milkthistle	28	5	0	0	99 %	100 %	▬
Sinapis arvensis wild mustard, charlock	6	0	0	0	-	-	-
Tamarix aphylla athel tamarisk	3	0	0	0	-	-	-
Tetragonia tetragonioides New Zealand spinach	1	0	0	0	-	-	-
Verbascum thapsus common mullein, woolly mullein	12	0	0	0	-	-	-

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Legend and Terminology

For each species, statistics are generated from maps. The statistics are divided into two parts: current species distribution and suitable range.

Current Species Distribution

- Infested: Number of quads that are infested with this species (relative to total number of quads in the selected region of interest)
- Spreading: Number of quads where this species is spreading,
- Managed: Number of quads where this species is under management,
- Eradicated: Number of quads where this species has been eradicated,

Suitable Range

- 2010: Percent of the selected region of interest that currently meets the minimum threshold for suitability for the species,
- Infested: Percent of the current suitable range that is infested.
- 2050: Change in suitability between 2010 and 2050, with an arrow representing an increase or decrease of greater than 10%, and a double arrow indicating change of greater than 40%.

▲▲ Increase of 40% or more
▲ Increase of 10% to 39%
▬ No change (less than 10% change either direction)
▼ Decrease of 10% to 39%
▼▼ Decrease of 40% or more

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Using This Report

This report, together with Regional Species Map Reports, summarizes management opportunities for the selected region. This report, together with Regional Species Maps, is designed to inform strategic management decisions at a landscape level. Regional coordinating bodies can use these reports as a starting place for setting priorities and establishing goals. Surveillance priorities can be focused to strengthen early detection. Eradication and containment priorities are based on factors such as how widely a species has spread. This landscape-level view provides a strategic foundation for developing and implementing on-the-ground programs.

Management opportunities are identified in three categories determined by the species' spatial distribution. While each plant species is listed in only one category, multiple management approaches can be appropriate in a given region. Assessing the feasibility of a particular management measure requires additional detailed assessment.

1. Surveillance – Surveillance entails regular surveys to detect new infestations of species not known to be present in a region. The strategic potential depends on the proximity of nearby infestations and the suitability of the area. The table in this report includes species occurring within 50 miles of the selected region.

2. Eradication – Eradication entails complete removal of all infestations in the area. These opportunities result from small, isolated infestations. The spatial pattern for eradication is one infested quad surrounded by at least two concentric bands of absence quads. The strategic importance of an eradication opportunity can be further assessed based on the degree of isolation as well as the suitability of the surrounding area. Determining the feasibility of eradication requires surveying infestations in the field.

3. Containment – Containment entails limiting the spread from existing infestations. These opportunities result from larger groups of infested quads. The strategic importance of a containment opportunity can be further assessed based on how distinct the boundaries of the infestation are, how isolated it is, and the suitability of the surrounding area. Determining the feasibility of containment requires surveying infestations in the field.

For each type of opportunity, plant species are organized by their rating in Cal-IPC's Inventory, which uses a uniform methodology to categorize non-native plants that pose a substantial threat to the state's wildlands. The Cal-IPC rating combines information about ecological impacts, invasive potential and ecological distribution to rate species as High, Moderate or Limited at a statewide level. Regional impacts may differ.

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About This Report

This report is generated from an online mapping system developed by the nonprofit California Invasive Plant Council and hosted at Calflora. The site allows the state's network of local experts to maintain updated data on invasive plant distribution statewide. CalWeed Mapper is integrated with the Calflora invasive plant database to reflect new occurrence data submitted to Calflora. Maps and reports generated are snapshots of a dynamic system and should be revisited on a regular basis to ensure that information is current.

In order to cover 200 species over the entire state, the mapping approach used in this work is necessarily coarse. The maps are not sufficient for planning the details of on-the-ground management, which requires information at a much higher resolution. (As you generate such detailed information, please share your data with Calflora.org. More information may be found at CalWeedMapper under Spatial Data.) Cal-IPC interviewed hundreds of natural resource managers around the state to collect a baseline of “expert knowledge” on abundance, spread and management by USGS 7.5-degree quadrangle (approximately 8 mi x 6 mi). We also incorporated datasets of occurrence observations from Calflora, The Consortium of California Herbaria, and agencies throughout the state. However, the vast majority of the presence documented in these maps comes solely from expert knowledge; no occurrence observations exist in online databases.

We predict suitable range for a given species by using modeling software that combines the species' current distribution with environmental variables (model results are reviewed by invasive plant experts). The resulting maps show areas that have the highest probability of being suitable. Future suitable range is based on commonly used scenarios from the Intergovernmental Panel on Climate Change. Details about modeling methods can be found at CalWeedMapper under About.

The distribution and suitability maps are not expected to be 100% accurate. Data drawn from expert knowledge, while having the great benefit of drawing on the extensive experience of individual local resource managers, can nonetheless be inaccurate. Data drawn from GIS datasets, though of higher precision, may not always be accurate, either, since those conducting the mapping may have misidentified the species or not captured the location correctly. In addition, conditions on the ground may have changed since the observation was filed, making the record out of date.

By engaging local experts statewide to check each others' work, CalWeedMapper can steadily increase the accuracy of the maps. Our goal is to maintain up-to-date statewide maps of invasive plant distribution.

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Appendix B. Species-Specific Treatment Options

Artichoke thistle

Similar in many ways to the agricultural crop, artichoke thistle is likely to be a wild biotype of that vegetable, although with greatly reduced flower heads. It infests the west coast states, generally in coastal areas associated with historic or recent overgrazing (DiTomaso *et al.* 2013). An extract of the flowers can be used as a vegan substitute for rennet in cheesemaking (de Sá and Barbosa 2009). Adult plants interact with seedlings in complex patters; inhibiting their nearest-neighbor offspring (seedlings within 2-2.6 ft (60-80 cm)) but providing favorable environments beyond that distance (Marushia and Hold 2008). These large, spine-armed thistles create dense monocultures, crowding out desirable species and degrading forage. Plants generally flower in their second year and can live for many years (DiTomaso *et al.* 2013).

- **Mechanical control:** Cultivation or pulling is effective only when a large portion of the taproot is removed. Removal of above-ground material can stimulate resprouting, which can then be sprayed. Goats are the only livestock known to browse the spiny plants, and they can reduce seed production.
- **Herbicides:** most herbicides are best applied during rosette to bolting stage, with the exception of imazapyr, which can be applied later at flowering. See Table B-1 for herbicide application recommendations.

Barb Goat Grass

Barb goat grass is an annual grass (family Poaceae) native to Mediterranean Europe and western Asia. It has a severe impact on California ecosystems (Cal-IPC 2014). Barbed goat grass germinates with the onset of fall rains and matures between May and August. It produces dense stands and slowly decomposing thatch that outcompetes and excludes desirable rangeland plants. Its jointed inflorescence produces long, barbed awns that can cause injury to livestock and other wildlife. This species invades disturbed sites typically in dry fields, pastures, and roadsides, including undisturbed grassland and rangeland and lower elevation oak woodlands. Seeds are dispersed when barbed awns attach to livestock and wildlife and when they are transported in hay. Seeds can remain dormant for 2–5 years (Davy *et al.* 2008).

- **Mechanical control**: Barbed goat grass is best controlled mechanically by intensive grazing or mowing at early stages of seed head emergence (Davy *et al.* 2008). Grazing or mowing early in the growing season may favor barbed goat grass over desirable species because barbed goat grass matures more slowly than other rangeland grasses and forbs. On TAFB, two years of mowing in the Castle Terrace area have been performed, and these efforts should begin yielding data on effectiveness in early 2017. If successful, these methods could be reproduced in the other goat grass infestations (Wilson, pers. comm.)
- **Herbicides**: Herbicide should be applied from fall through spring (September through March) to new seedlings exhibiting at least the three-leaf growth state but before 8-inch plant canopy height. For dense, large, primarily contiguous infestations, aerial or ground applications with broadcast boom technology should be used. For scattered individual

plants or isolated patches, or where sensitive plant species are present, handheld or backpack applications should be used for spot treatment. See Table B-1 for herbicide application recommendations.

Black Mustard

Black mustard is an annual forb in the mustard family (Brassicaceae) that is native to Eurasia. It has a moderate impact on California ecosystems (Cal-IPC 2014). Black mustard matures quickly in the spring and produces a large amount of biomass in infested areas, potentially outcompeting native species through shading or an early reduction in soil moisture. Reproduction occurs by seeds, which are sticky when wet and are thus easily transferred by equipment, vehicles, or people working in or traveling through infested areas when moisture is present (Cal-IPC 2014). Like other invasive mustard species, black mustard can build up a large, long-lived seed bank at infestation sites. For example, deeply buried black mustard seeds may remain viable for as much as 50 years under field conditions (DiTomaso and Healy 2007). This species often invades areas dominated by non-native annual grasses and can contribute to type conversion of woodlands and scrublands into annual grasslands by adding to the early season fuel load of an area, which can increase the amount of fuel available for fires. Although this species is generally considered a successional plant, and thus might be expected to decrease in density or extent with increasing time since the last site disturbance, the typically large seed bank, in combination with the repeated disturbance associated with heavy grazing, can favor the establishment of long-term infestations (Cal-IPC 2014).

- **Mechanical control**: Black mustard is best controlled mechanically by weed whacking or mowing plants (or hand pulling if feasible) each year after they have bolted but before they produce seed (dependent on annual climate, but likely February and March). The plants have a fairly weak root system, and, as annuals, they do not resprout from root fragments left in the soil. Over time, this can deplete the seed banks and allow native or grassy vegetation to dominate previously infested areas. Mowing, particularly at the wrong time, can produce plants that branch heavily from the base, and could produce even more seed than undisturbed plants. However, weed-whacking or mowing, timed to occur after bolting but before mature seed has been produced, may be the most feasible way to control infestations occurring over large areas of the site.
- **Herbicides**: Because black mustard emerges early in the growing season, often before native vegetation has broken dormancy, early postemergence herbicidal treatments may be the most effective chemical treatment (Bossard *et al.* 2000), but more research is needed to develop a standardized, optimized herbicide-based methodology for control. See Table B-1 for herbicide application recommendations.

Bristly Ox-Tongue

Bristly ox-tongue is thistle in the Asteraceae family that may display annual or biennial habits. It infests rangelands in dense stands, particularly in coastal grasslands in California. Cal-IPC considers it of Limited invasiveness, but a large patch on TAFB is currently degrading the quality of forage and could act as a source population for the other pastures on Base. This species

primarily disperses by wind action, but can also cling to equipment, personnel or livestock (DiTomaso *et al.* 2013).

- **Herbicides:** As a member of the Asteraceae family, the Aster-specific herbicides are likely to perform well (eg. Milestone®). See Table B-1 for herbicide application recommendations.
- **Mechanical control:** Small infestations can be pulled, uprooted or hoed if material up to 2 inches deep is removed (Elkhorn Slough 2000). Mowing repeatedly may suppress but is unlikely to control this species.
- **Burning:** No studies exist to confirm the effect of burning, but as a late season plant that tends to occur with annual grasses, it may be possible to target it with burning before the seeds are viable (DiTomaso *et al.* 2013).

Bull Thistle

Bull thistle, another member of the Aster family, is found in every state of the US, generally in already disturbed areas such as rangelands and road edges. It reduces the quality of forage and outcompetes native plants. Its large size (up to 7 ft (2 m) tall), prickly hairs and deep green foliage with large purple flowers make it unmistakable. Livestock (other than cattle) will consume young plants (DiTomaso *et al.* 2013). Seed dispersal mechanisms include wind, water and animals, making this species easy to spread, particularly in agricultural areas. Biosecurity controls are important in preventing the spread or reintroduction of this species (Graham *et al.* n.d.).

- **Herbicides:** As a member of the Asteraceae family, the Aster-specific herbicides are likely to perform well (eg. Milestone®), and most herbicides should be applied to rapidly growing plants. See Table B-1 for herbicide application recommendations.
- **Mechanical Control:** pulling, hoeing, etc. must be performed before flowering to prevent seeding, but if the root is severed below the surface, they will be effective. Mowing must be repeated throughout the flowering season as plants that are mowed too early will recover and flower.

Fennel

Fennel is a perennial forb in the carrot family (Apiaceae) that is native to southern Europe and the Mediterranean region. It has a high impact on California ecosystems (Cal-IPC 2014). The plant grows 1.3-3m tall and has finely dissected leaves. Its small yellow flowers are clustered in large, rounded, umbrellalike groups that bloom from May through September. Fennel alters the composition and structure of many plant communities by forming dense, uniform stands that outcompete and exclude native and desirable plants. Reproduction occurs from both root crowns and seeds. Seed production is prolific, peaking in August and September. Seeds are dispersed by water and animals and by humans when seeds cling to clothing or mud on vehicles. Fennel invades open disturbed sites of various types, including roadsides, road cuts, fallow fields, grasslands, riparian areas, and wetland sites.

- **Mechanical control**: Fennel is best controlled mechanically when infestations are small, and a large portion of the crown should be removed. Efforts should be made to minimize soil disturbance if plants are dug out by hand. Repeated cutting before seed set also may effectively control fennel.

  Herbicides: Herbicide should be applied in fall before a hard freeze or in late winter to spring (February through April) to new seasonal growth. For dense, large, primarily contiguous infestations, aerial or ground applications with broadcast boom technology should be used. For scattered individual plants or isolated patches, or where sensitive plant species are present, handheld or backpack applications should be used for spot treatment. See Table B-1 for herbicide application recommendations.

French Broom

A nitrogen fixer, French broom is a member of the Fabaceae family that was introduced to the US as an ornamental. As well as degrading native habitat and pastures with dense and unpalatable forage, this species enriches the soil and encourages invasion by other non-native species (DiTomaso *et al.* 2013). This species produces increased seed rain and builds a larger seedbank in introduced populations than in its native territory (Herrera *et al.* 2011). This large, long-lived seedbank reacts strongly to fire, with a surge of seedlings and dense growth, so fire treatments should be carefully planned and follow up treatments will likely be required to control the seedling flush (Pauchard *et al.* 2008). Lastly, this species can be toxic to humans and livestock other than goats (DiTomaso *et al.* 2013).

- **Mechanical control:** Resprouting will occur unless the entire root is removed, and disturbing the soil can stimulate the seedbank. However, pre-flowering mowing or trimming can decrease seed production and deplete energy reserves. Mechanical control methods should be combined with herbicide application (DiTomaso *et al.* 2013).
- **Herbicides:** Foliar herbicides are most effective when applied to rapidly growing plants, but cut stump and basal bark applications are more flexible in timing and can be applied any time. Cut stump herbicide treatments should be applied immediately after cutting. See Table B-1 for herbicide application recommendations.

Giant Reed

Giant reed is a perennial member of the grass family (Poaceae) native to the Mediterranean region and Asia (DiTomaso *et al.* 2013). Primarily problematic in riparian zones, this species can grow up to 7.6 m tall with thick canes and rhizomes that choke channels, increase flooding and siltation and degrade wildlife habitat. The bamboo-like canes bear leaves up to 1m long. Plants reproduce vegetatively by rhizomes and stem fragments that disperse by water movement. Giant reed increases biomass in riparian corridors, which must be removed during control efforts.

- **Mechanical control**: Small plants (less than 2 m in height) and new infestations can be hand-removed if all rhizomes are extracted. Removal of more entrenched populations can be done with backhoe or similar equipment, but this can damage desirable riparian

vegetation and create disturbance for other invasive species to colonize. Mowing or cutting can be used to decrease biomass and expose surfaces for herbicide application.

- **Herbicides**: Herbicide should be applied in mid-summer to fall after flowering but before plants enter dormancy. Two to three years of treatment may be necessary in well-established infestations. See Table B-1 for herbicide application recommendations.

Himalaya Blackberry

Himalaya blackberry is a member of the rose family (Rosaceae). It was introduced as a cultivar from Eurasia and escaped to disturbed areas, moist sites such as canals, open fields and natural areas (DiTomaso *et al.* 2013). It is highly competitive and quickly crowds or shades out native vegetation, replacing riparian vegetation with a thorny barrier that blocks passage by wildlife and livestock. Roots can reach over two meters deep, and are capable of resprouting. Fruit may be dispersed by wildlife.

- **Mechanical control**: Any mechanical control techniques must remove the canes, roots and root crowns to prevent resprouting. If resprouts are regularly cut back while flowering, root reserves can be exhausted.

- **Herbicides**: Herbicide can be applied in a basal bark, foliar or dormant stem leaf treatment. Because the fruits are harvested by people, avoiding herbicide during fruit set is advised. See Table B-1 for herbicide application recommendations.

Italian Thistle

Italian thistle is an annual or biennial forb in the composite family (Asteraceae) that is native to the Mediterranean, southern Europe, and North Africa to Pakistan. It has a moderate impact on California ecosystems (Cal-IPC 2014). Italian thistle is a competitive invader that can dominate sites and exclude native and desirable rangeland plants. Reproduction occurs by seeds. Plants germinate after the first substantial rains in fall, overwinter as rosettes, and produce flowering stalks in late spring before the dry season. Plants grow 0.3-2 m tall, have winged stems, and have thimble-sized rose to pink to purple flowers that bloom from February through July. Seeds disperse by wind, vehicles, and animals. Italian thistle invades open disturbed sites of various types, including roadsides, firebreaks, and grasslands. Seeds can remain dormant for 8–10 years (Cal-IPC 2014).

- **Mechanical control**: Italian thistle is best controlled mechanically when infestations are small. Efforts should be made to minimize soil disturbance if plants are dug out by hand. Repeated cutting before seed set may also effectively control Italian thistle, but only if repeated until the seed bank is depleted (up to 10 years). Sheep or goat grazing can control infestations after germination and before flowering when plants are 4–6 inches (10-15 cm) tall.

- **Herbicides**: Herbicide should be applied in spring and/or early summer (March through June) to actively growing plants through bolting (before flowering). For dense, large, primarily contiguous infestations, aerial or ground applications with broadcast boom

technology should be used. For scattered individual plants or isolated patches, or where sensitive plant species are present, handheld or backpack applications should be used for spot treatment. See Table B-1 for herbicide application recommendations.

Medusahead

Medusahead is an annual grass that is native to Spain, Portugal, southern France, Morocco, and Algeria. It has a severe impact on California ecosystems (Cal-IPC 2014). Medusa head germinates with the onset of fall rains and matures usually in May, 2–4 weeks later than most other annual grasses. It produces dense stands and slowly decomposing thatch that outcompetes and excludes desirable rangeland plants, ties up nutrients, and contributes to fire danger. Medusa head has high silica content, making it unpalatable to livestock and wildlife, except early in the growing season. This high-silica thatch is highly resistant to decomposition, resulting in dense layers that can change soil moisture and temperature (Kyser *et al.* 2014). Its inflorescence produces long, compressed awns that twist and spread upon drying. This species invades disturbed sites in grassland and rangeland, chaparral, oak woodlands, and occasionally fallow fields. Seeds are dispersed when awns attach to livestock (particularly sheep), wildlife, machinery, vehicles, and clothing and when they are transported in hay. Most seeds germinate within three years, so two to three years of control are required.

- **Mechanical control**: Medusa head is best controlled mechanically by mowing before seed development or in combination with grazing before maturation, but the period of effectiveness of either mowing or grazing is extremely short. Control measures must be completed when other species are senescent but before medusahead flowers. If mowing is performed, the mower must cut low enough to clip below incipient flowerheads. Flail mowers or weed whacking in small areas is recommended over disc mowers. Mechanical control can improve thatch conditions to allow competitors to establish, but should be implemented in combination with herbicide application. Where populations are thinned but not eradicated, individual remaining plants are freed from intra-specific competition and produce similar cover values to dense infestations (Kyser *et al.* 2014)
- **Prescribed burning**: Medusahead response to burning has been positive in the Central Valley and foothills, especially with two consecutive years of burning (DiTomaso *et al*. 2013). As with many techniques, timing is critical and fire should be timed to fall between early seed set but before seed maturity (Kyser *et al.* 2014). Burning also serves to remove the high-silica thatch that prevents germination and establishment of more desirable species. However, burning two years consecutively may present a challenge if weather conditions preclude the second burn or if insufficient fuel is left to carry it. Although burning may be highly effective for the TAFB medusahead infestation, the investment of resources for implementing a burn is considerably higher than many other restoration techniques. The TAFB Fire Management Plan presents a prescribed burning plan for the Aero Club that could be used as a model for other infestations as well (USAF 2015).
- **Herbicides**: Herbicide should be applied in fall through spring (September through March) to new seedlings exhibiting at least the three-leaf growth state but before 8 inch plant canopy height. For dense, large, primarily contiguous infestations, aerial or ground

applications with broadcast boom technology should be used. For scattered individual plants or isolated patches, or where sensitive plant species are present, handheld or backpack applications should be used for spot treatment. Integration of herbicide treatment with mechanical and/or pyric measures will enhance treatment efficacy. In a meta-analysis of medusahead control research, following herbicide treatments with reseeding extended the effectiveness of initial control, probably because the lack of a native seedbank precluded recovery of desirable natives to compete with resurging medusahead (James *et al.* 2015). See Table B-1 for herbicide application recommendations.

Perennial Pepperweed

Perennial pepperweed is a perennial forb in the mustard family that is native to Eurasia. It has severe impacts on California ecosystems (Cal-IPC 2014). This species is rhizomatous, but it also grows from seed, pieces of root stock, and buried stems (Cal-IPC 2014). This species forms dense, nearly monospecific stands, in part as a result of extensive and vigorously sprouting rhizomes. Plants grow 1-3 m tall. Stems and leaves are dull gray-green and waxy. Small white flowers develop in dense clusters and bloom from May through July. Perennial pepperweed readily colonizes moist habitats, such as alkaline wetlands (Cal-IPC 2014), or mesic areas in grasslands, such as swales, where it often forms large masses. Perennial pepperweed is particularly problematic in vernal pools, where it can cause early dessication and changes to hydrology. On TAFB, the intersection of perennial pepperweed and sensitive vernal pool habitat and federally Listed species is particularly important. Control of perennial pepperweed must be compatible with listed branchiopod and plant species.

- **Mechanical control**: Hand-pulling perennial pepperweed has been shown to be ineffective at eradicating this species (Cal-IPC 2014). Pulled plants leave behind root segments that can readily resprout, which results in the persistence, and sometimes expansion, of the targeted colony. Cattle, sheep, and goats will graze it, especially rosettes in early spring.
- **Herbicides**: Herbicide treatments by foliar spray or wick application are generally used to control or reduce spot infestations or as a follow-up to more intensive mechanical or grazing-based treatments. See Table B-1 for herbicide application recommendations.

Purple Starthistle

Purple starthistle is an annual, or sometimes a short-lived perennial, of the composite family that is native to the Mediterranean region of southern Europe and northern Africa. It has a moderate impact on California ecosystems (Cal-IPC 2014). This species can produce dense stands that exclude and replace desirable native and rangeland species. Purple starthistle forms rosettes in its first growing season. Mature plants are 0.3-1.3 m tall and produce numerous spiny purple flowers from July through October. These spines can cause mechanical injury to livestock, pets and people and significantly degrade the quality of forage. Reproduction is by seed. Seeds remain in the flower heads until after the plants die, break off at the soil, and roll with the wind. Seeds are also transported in hay and with farm and ranch machinery. Purple starthistle invades numerous disturbed sites, including active and fallow agronomic fields, pastures, roadsides, waste places, and disturbed/degraded grasslands and rangelands. It

tolerates a range of soil textures and precipitation zones, but it prefers finer textured soils and alluvium in areas typically exceeding 9 inches (22.9 cm)of precipitation.

- **Mechanical control**: Hand digging and cutting can control small infestation. Plants should be cut at least 2 inches (5 cm) below the soil surface before maturation. Care should be taken to avoid disturbing the soil.
- **Herbicides**: Herbicide should be applied in winter and spring (December through March) to rosettes or bolting plants or in fall (September through November) to new seedlings or rosettes. For dense, large, primarily contiguous infestations, aerial or ground applications with broadcast boom technology should be used. For scattered individual plants or isolated patches, or where sensitive plant species are present, handheld or backpack applications should be used for spot treatment. See Table B-1 for herbicide application recommendations.

Skeletonweed

Skeletonweed is well-dispersed across the western states, including California, where it invades roadsides, croplands and rangelands. It is a long-lived perennial plant, but it overwinters as a rosette. It reproduces vegetatively and with asexual seed production; these seeds may persist up to eight years (US Forest Service 2014). The easily-fragmented roots can produce new rosettes from a depth of up to 3 ft (1 m) (DiTomaso *et al.* 2013).

- **Mechanical control:** the ability to resprout from small, deep fragments makes mechanical control ill-advised for all but the youngest of plants. Grazing may increase this species as hooves turn and rebury root fragments that regenerate.
- **Herbicides:** Asteraceae-specific herbicides (eg. Milestone®) give good control when applied before flowering. A two-stage treatment consisting of an early spring application followed by a later fall application may provide the best control, but this may need to be replicated for up to three years (US Forest Service 2014). See Table B-1 for herbicide application recommendations.

Spanish Broom

Spanish broom, a nitrogen-fixing member of the Fabaceae family, was brought as an ornamental from the Mediterranean and has spread along the Pacific coast. It infests a wide range of habitats and tolerates an equally wide range of conditions (DiTomaso *et al.* 2013). The flowers and seeds are toxic, and the foliage is mildly toxic to livestock other than goats. The twiggy growth habitat and dense growth of broom can make it a highly flammable species, and it can resprout vigorously after a fire (Sanhueza and Zalba 2012). Seeds are dispersed through explosive dehiscence, and can remain viable for up to 30 years (DiTomaso *et al.* 2013).

- **Mechanical control:** pulling young plants can be effective if the entire root is excised, but disturbance can stimulate the soil seedbank. Pruning will result in resprouting unless combined with herbicide application, but if repeated can deplete the plant's energy over time.

- **Herbicides**: Foliar herbicides are most effective when applied to rapidly growing plants, but cut stump and basal bark applications are more flexible in timing and can be applied any time. Cut stump herbicide treatments should be applied immediately after cutting. See Table B-1 for herbicide application recommendations.

Stinkwort

Stinkwort, a member of the Asteraceae family, is native to southern Europe and the Middle East, where it is used in traditional medicine and is currently being researched for its potential medicinal properties (Aghel *et al.* 2011). Unlike many of California's invasive plants, the history of introduction of stinkwort is well-described. In 1984, the plant was collected as an undetermined specimen and later identified, then began appearing more frequently in the mid 1990's (Preston 1997). Currently, stinkwort infests large portions of central California and coastal portions of southern California, and is rapidly expanding (DiTomaso *et al.* 2013). Commonly found in disturbed sites such as roadsides, this unpleasant plant causes contact dermatitis in humans and the pappus bristles can kill livestock by puncturing intestines. Stinkwort is an annual with a long lifecyle beginning with wintertime germination and persisting until as late as December when it flowers and seeds.

- **Mechanical control:** Contact with stinkwort can result in contact dermatitis, so workers should wear protective clothing when pulling, hoeing or spraying it. Pulling and hoeing are effective prior to flowering, after which the plants should also be bagged and removed from the site. Mowing is unlikely to be effective, as the lowest flower-producing branches are below the height of mowers.
- **Chemical control:** The sticky foliar oils can impede effectiveness of non-ester formulations of herbicides such as triclopyr (DiTomaso *et al.* 2013). Apply herbicides during rapid growth stages, which is generally after senescence of desirable natives. See Table B-1 for herbicide application recommendations.

Treasure Flower

Treasure flower is a perennial herb of the composite family that is native to southern Africa. It has a moderate impact on California ecosystems (Cal-IPC 2014) and has an Alert designation (Cal-IPC 2014) because of its significant potential for invading new ecosystems. Treasure flower is an escaped horticulture plant that establishes in disturbed sites, grasslands, and riparian zones. It forms thick groundcover and outcompetes native and desirable grasses and forbs (Cal-IPC 2014). Treasure flower grows as a basal rosette with oval-shaped, dull green leaflets with wooly undersides. It produces bright yellow and orange flowers, typically in June and July, but it has been observed in bloom year-round. Treasure flower is predominantly spread by seed but may also spread vegetatively by stolons and rhizomes. It generally grows best with open exposure and tolerates a range of soil textures.

- **Mechanical control**: Treasure flower is difficult to control mechanically because it can resprout readily when cut, grazed, or burned (Cal-IPC 2014). Care should be taken to ensure removal of all plant parts if it is dug up by hand, but this is likely to be effective on small infestations if they are monitored carefully for resprouts.

- **Herbicides**: Herbicide should be applied in spring and/or early summer (March through June) to actively growing plants before flowering. For dense, large, primarily contiguous infestations, aerial or ground applications with broadcast boom technology should be used. For scattered individual plants or isolated patches, or where sensitive plant species are present, handheld or backpack applications should be used for spot treatment. See Table B-1 for herbicide application recommendations.

Wooly Distaff Thistle

One of seven thistle species found on TAFB, wooly distaff thistle is found in scattered states in the western US and is most problematic in central coastal California. It is most problematic in cereal crop agriculture, but can also degrade forage quality and injure livestock with spines (DiTomaso *et al.* 2013). Seeds can persist in the soil up to eight years and the majority do not disperse long distances from the parent. However, because a number of seeds will cling to the dead stalks of the parent plant throughout the winter, this species can be spread by cattle and equipment longer distances (Burrill 1994).

- **Mechanical control:** early control of rosettes can be effective if the root is severed just below the soil surface to prevent resprouting. Mowing is only effective if repeated and performed before flowering as immature seeds can mature after plants have been cut.
- **Herbicides:** As a member of the Asteraceae family, the Aster-specific herbicides perform well (eg. Milestone®). Late winter or early spring is the best time to apply, after rosette formation and just before bolting. See Table B-1 for herbicide application recommendations.

Yellow Starthistle

Yellow starthistle is an annual, or sometimes a short-lived perennial, of the composite family that is native to southern Europe and western Eurasia. It has a severe impact on California ecosystems (Cal-IPC 2014). It produces dense stands that displace native and desirable species. Yellow starthistle germinates from seed with the onset of fall rains. It forms rosettes and deep tap roots over winter. Mature plants are 0.3-1 m tall and produce numerous spiny yellow flower heads from April through September. It invades grasslands, woodlands, open hillsides, rangeland, pastures, riparian zones, and disturbed areas. This species is toxic to horses, and the mature spines can cause mechanical injury to livestock. In addition, yellow starthistle forms a very deep taproot that can access deep soil moisture. In combination with its high rate of transpiration, this cases depletion of soil moisture reserves that would be utilized by other deep-rooted native taxa.

- **Mechanical control**: Mowing can provide effective treatment of infested areas only if it is conducted at the correct time, which is immediately after the earliest 2–5% of plants have begun to produce flower heads (Benefield *et al.* 1999; DiTomaso *et al.* 2013) and the lowermost branches are above the mower blades (Thomsen *et al.* 1996; DiTomaso *et al.* 2013). Mowing too early may cause plants to become bushier and produce more flower heads. Treatments must continue for at least 2–3 years, after which spot eradication may be required indefinitely.

- **Biological control**: Responsible rangeland management, whereby range is grazed by sheep, goats, or cattle to a moderate degree, can help prevent establishment or spread of populations in grasslands. Infested areas can be treated by high-intensity grazing, typically in May and June (Cal-IPC 2014), just before the production of the spiny flower heads.
- **Herbicides**: Herbicide treatments by foliar spray or wick application generally are used to control or reduce spot infestations or as a follow-up to more intensive mechanical or grazing-based treatments. See Table B-1 for herbicide application recommendations. A combination, phased treatment consisting of October burning, drill seeding with native grasses in December, and a January application of Milestone® at 3 fluid ounces per acre was particularly effective at Fort Hunter Liggett (Kyser *et al.* 2013). This treatment could be replicated in small-scale test plots to determine appropriate timing, and if successful could be replicated at TAFB.

An overview of all control methods including mechanical/manual, grazing, chemical and biological control is provided in Table B-1 below.

Treatment Options for TAFB Weed Species

Common/ Scientific Name	Mechanical/ Manual	Grazing	Chemical
Herbicides in Red Lettering are not currently authorized in the DoD herbicide use list.			
Artichoke Thistle (*Cynara cardunculus*)	Only when a large portion of the taproot is removed. Removal of above-ground material stimulates resprouting	Goats will graze and can reduce seed production. No other livestock will graze	**Aminopyralid: Timing-** Postemergence in winter to spring, ideally before bolting. **Spectrum:** Broadleaf selective. **Effectiveness-** One of the most effective in treating thistles.
			Triclopyr: Timing- Postemergence to rapidly growing, up to bud stage. **Spectrum**- Broadleaf selective, may injure desirable species. **Effectiveness**- most effective on smaller plants.
			Imazapyr: Timing- Postemergence at flowering. **Spectrum**- Non-selective. **Effectiveness**- best as spot treatment, residual activity can harm desirable species.
Barb Goat Grass (*Aegilops triuncialis*)	Close (4") mowing after flowering but before seeds reach soft boot stage. Weedwhack if not accessible to mower	No	**Glyphosate: Timing**- Postemergence in late winter to early spring to rapidly growing non-stressed plants before flowering. **Spectrum**- Non-selective, may kill desirable plants. **Effectiveness**- Increased by adding ammonium sulfate.
			Propoxycarbazone-sodium: Timing- Postemergence from 2-leaf to 2-tiller stage when plants are growing rapidly. **Spectrum**- Broad-spectrum, perennial grass species vary in tolerance. **Effectiveness**- Only partial control.
			Sulfometuron: Timing- Preemergence or early postemergence in fall or late winter before grass is 3". **Spectrum**- Mixed selectivity, fairly safe on native perennial grasses. **Effectiveness**- Not stated.
			Clethodim mid season
			Sulfometuron+chlorsulfuron: **Timing**- Preemergence in fall. **Spectrum**- Mixed selectivity, fairly safe on native perennial grasses. **Effectiveness**- Not stated.

Common/ Scientific Name	Mechanical/ Manual	Grazing	Chemical
Black Mustard (*Brassica nigra*)		Palatable to goats, sheep	**Dicamba: Timing**- Postemergence when weeds are small. **Spectrum**- Broadleaf selective. **Effectiveness**- Increased when mixed with Diflufenzopyr.
			Triclopyr: Timing- Postemergence when weeds are small. **Spectrum**- Broadleaf selective, may injure desirable species. **Effectiveness**- Ester formulation more effective than amine formulation.
			Glyphosate: Timing- Postemergence before flowering. **Spectrum**- Broad spectrum. **Effectiveness**- Only fair control of mustards. Best on seedlings.
			Chlorsulfuron: Timing- Preemergence or early postemergence when weeds are germinating or activly growing. **Spectrum**- Primarilly active on broadleaf species. **Effectiveness**- Good control on most mustards.
			Propoxycarbazone-sodium: **Timing**- Postemergence when plants are growing rapidly. **Spectrum**- Broad-spectrum. **Effectiveness**- Good control on most mustards.
			Rimsulfuron: Timing- Preemergence in spring or fall. **Spectrum**- Controls several annual grasses and broadleaves. **Effectiveness**- Degrades rapidly in dry conditions, moisture is necessary for activation.
			Sulfometuron: Timing- Preemergence or early postemergence. **Spectrum**- Broad-spectrum. **Effectiveness**- Higher in areas with 20 " rainfall or more.

Common/ Scientific Name	Mechanical/ Manual	Grazing	Chemical
Bristly Oxtongue (*Picris echiodes*)	Hand pulling only effective when root removed 2" below surface	Unknown	**Aminopyralid: Timing-** Postemergence in winter to spring, ideally before bolting or in fall to seedlings and rosettes. **Spectrum:** Broadleaf selective. **Effectiveness-** One of the most effective in treating thistles, but higher rates required after plants bolt.
			Glyphosate: Timing- Postemergence to seedlings or plants no later than bolting stage. **Spectrum**- Non-selective. **Effectiveness**- Studies with yellow starthistle show good control and similar results expected for bristly oxtongue
			Clopyralid: Timing- Postemergence in spring/summer up to bolting or in fall to seedlings and rosettes. **Spectrum**- Broadleaf selective, very safe on grasses. **Effectiveness**- not stated, but very effective for yellow star-thistle.

Common/ Scientific Name	Mechanical/ Manual	Grazing	Chemical
Bull thistle (*Cirsium vulgare*)	Mowing immediately before flowering or when plants are just starting to flower, with repeated mowing throughout the season.	Sheep, goats and horses will eat young plants, and can have significant effect on in the early stages of infestation. Goats will eat flowerhead, and can completely eliminate seed dispersal from mature plants. Light grazing by sheep can increase problem.	**Aminopyralid: Timing**- Postemergence in spring to early summer in rosette to bolting stage, or in fall to seedlings. **Spectrum**- Broadleaf selective, generally safe on grasses. **Effectiveness**- Residual activity will kill emerging seedlings.
			Clopyralid: Timing- Postemergence in spring up to flower bud stage. **Spectrum**- Broadleaf selective, very safe on grasses. **Effectiveness**- not stated.
			Triclopyr: Timing- Postemergence to rapidly growing plants. **Spectrum**- Broadleaf selective, safe for most grasses. **Effectiveness**- More effective on smaller plants.
			Chlorsulfuron: Timing- Postemergence to rapidly growing plants up to bud stage. **Spectrum**- Broadleaf selective, safe for most grasses. **Effectiveness**- not stated.
			Imazapyr: Timing- Postemergence at flowering. **Spectrum**- Non-selective. **Effectiveness**- Long residual activity, best used as a spot treatment.

Common/ Scientific Name	Mechanical/ Manual	Grazing	Chemical
Fennel (*Foeniculum vulgare*)		No	**Triclopyr: Timing**- Postemergence to fully developed but before flowering. Best treatment is during the wet season **Spectrum**- Broadleaf selective. **Effectiveness**- Standard treatment for fennel and very effective. Can be used in combination with glyphosate.
			Glyphosate: Timing- Postemergence to fully developed but before flowering. **Spectrum**- Non-selective. **Effectiveness**- Very effective, less so when plants have bolted.
French Broom (*Genista monspessulana*)	Pulling moderately effective on small plants but not on established shrubs. Entire root must be extracted. Soil disturbance stimulates seedbank. Pruning can reduce seed set.	No, toxic or unpalatable to livestock except goats.	**Imazapyr: Timing**- late summer or early fall before leaf drop. Can be applied as a cut stump, basal bark or foliar application. **Spectrum**- Non-selective. **Effectiveness**-effective in Australia, likely to be effective in CA
			Glyphosate: Timing- Postemergence during rapid growth. Foliar late summer/early fall. Cut stump in late summer early fall or during dormancy. **Spectrum**- Non-selective. **Effectiveness**- good control but with some resprouting.
			Triclopyr: Timing-Foliar postemergence during rapid growth, cut stump and basal anytime except during sap rise. **Spectrum:** Broad-leaf selective, does not kill grasses. **Effectiveness**- not stated

Common/ Scientific Name	Mechanical/ Manual	Grazing	Chemical
Giant reed (*Arundo donax*)	Mowing can be useful if followed by herbicide treatment.	Goats most effective, especially Angoras and spanish goats.	**Glyphosate: Timing**- Postemergence , mid-summer to fall application after flowering, before dormancy. Follow-up in spring to germinating seedlings. **Effectiveness**- Best option for control in pure stands, 2-3 years treatment necessary. Can be used after repeated mowing. Dense stands best treated via arial application. Undiluted, can be used to treat cut stumps with no regrowth.
			Imazapyr: Timing- Postemergence fall, similar to glyphosate. **Spectrum**- Broad spectrum. **Effectiveness**- Has soil residual ativity and can damage restoration efforts.
			Glyphosate+Imazypyr: Timing- Postemergence in fall is most effective. **Spectrum**- Broad spectrum. **Effectiveness**- Combo is thought to provide better control at lower rates of each herbicide.

Common/ Scientific Name	Mechanical/ Manual	Grazing	Chemical
Himalayan blackberry (*Rubus armeniacus*)	No.	Goats	**Triclopyr: Timing**-Aug-Nov. **Spectrum:** Broadleaf selective, safe on grasses. **Effectiveness**- Not stated
			Fluroxypyr: Timing- Postemergence to rapidly growing plants. **Spectrum**- Broadleaf selective, safe for most grasses. **Effectiveness**- Reduced control if plants are under stressed conditions.
			Aminopyralid+Triclopyr: Timing- Postemergence, mid-summer or early fall after flowering and start of fruit set. Basal bark treatment- Any time of year (mid fall if plants are commonly harvested to avoid human contact). Dormant stem leaf treatment- Late fall/ winter. Safe for most grasses. **Spectrum**- Broad spectrum, broadleaf, woody plants. **Effectiveness**- Better control in combination.
			Glyphosate: Timing- Postemergence in late summer, when canes are growing rapidly, full leaf maturity and after berries are formed. **Spectrum**- Broad spectrum of grasses, broadleaf and woody plants. **Effectiveness**- Complete foliage coverage to obtain good control. Burning or mowing 40-60 days after spraying increases control (Reference B).
			Sulfometuron: Timing- Early postemergence when germinating or activly growing. **Spectrum**- Broad spectrum to non-selective. **Effectiveness**- Only effective on small/not fully mature plants. Add surfactant for increased control.
			Hexazinone: Timing- Pre or postemergence when germinating or actively growing. **Spectrum**- Non-selective in non-cropland and selective in reforestation practices. **Effectiveness**- High rates can cause bare ground, only supresses Himalaya blackberry growth. can be mixed with triclopyr for better control.
			Tebuthiuron: Timing- Preemergence before the start of spring growth or before expected rainfall. **Spectrum**- Used for woody plant control. **Effectiveness**- May injure non-target species.

Common/ Scientific Name	Mechanical/ Manual	Grazing	Chemical
Italian thistle (*Carduus pycnocephalus*)	Mowing after plants have bolted and about to flower, requires repeated treatment for 4-7 weeks.	Goats, cattle, horses and sheep will eat parts of flower or rosette.	**Aminopyralid: Timing**- Preemergence in winter to early spring and postemergence to seedling in spring. **Spectrum**- Broadleaf selective. **Effectiveness**- One of the most effective in treating thistles.
			Clopyralid: Timing- Postemergence in spring up to flower bud stage. **Spectrum**- Broadleaf selective, very safe on grasses. **Effectiveness**- not stated, but very effective for yellow star-thistle.
			Dicamba: Timing- Postemergence to rapidly growing plants. **Spectrum**- Broadleaf selective. **Effectiveness**- Increased effectiveness on other types of thistle when mixed with Diflufenzopyr. More effective on smaller plants.
			Fluroxypyr: Timing- Postemergence to rapidly growing plants. **Spectrum**- Broadleaf selective, safe for most grasses. **Effectiveness**- not stated.
			Triclopyr: Timing- Postemergence to rapidly growing plants. **Spectrum**- Broadleaf selective, safe for most grasses. **Effectiveness**- More effective on smaller plants.
			Glyphosate: Timing- Postemergence to rapidly growing plants in bud stage. **Spectrum**- Non-selective. **Effectiveness**- Repeat application may be necessary, more effective with ammonium sulfate.

Common/ Scientific Name	Mechanical/ Manual	Grazing	Chemical
Lens' podded hoary cress (*Lepidium chalepense*)	In pasture controlled by ceasing irrigation, removing outlying plants, decreased grazing and general management of grassland health.	Sheep and goats	**Glyphosate: Timing**- Postemergence at early bud stage. **Spectrum**- Non-selective, spot treatment may be best approach. **Effectiveness**- Re-treatment may be necessary, drought stress will limit effectiveness. Increased effectiveness when mixed with ammonium sulfate.
			Chlorsulfuron: Timing- Postemergence from bud to bloom stage, or rosettes in fall. **Spectrum**- Mixed selectivity, generally safe on grasses. **Effectiveness**- One of the most effective treatments.
			Imazapyr: Timing- Postemergence in spring when plants are flowering. **Spectrum**- Non-selective. **Effectiveness**- Leaves more bare ground than other tratments even after 1 year.
			Sulfometuron: Timing- Pre or postemergence before or during rainy season when plants are germinating and growing rapidly. **Spectrum**- Broad spectrum to non-selective. **Effectiveness**- not stated.
Medusa head (*Elymus caputmedusae*)	Late season mowing at boot to early flowering stage can help to supress, but will distribute seed if after seed set.	Heavy grazing at boot to flowerhead emergence can supress medusa head.	**Aminopyralid: Timing**- Preemergence in fall. **Spectrum**- Broadleaf selective. **Effectiveness**- 14% *Milestone*(spot treatment rate)/acre gave ~90% control
			Glyphosate: Timing- Postemergence for selective control in spring before heading. Non-selective control in late season before seads are produced. **Spectrum**- Non-selective. **Effectiveness-**not stated.
			Sulfometuron: Timing- Pre to early postemergence. **Spectrum**- Broad spectrum. **Effectiveness**- More effective when applied in fall (preemergence).

Common/ Scientific Name	Mechanical/ Manual	Grazing	Chemical
Perennial Pepperweed (*Lepidium latifolium*)	Mowing at bolting or flower bud stage followed by herbicide application to resprouting shoots at flower bud stage.	Cattle, sheep, and goats will graze, especially rosettes in early spring to supress, but once removed, plants quickly resprout.	**Triclopyr: Timing**-Mar-Jun or in Fall after 1st rain. **Spectrum:** Broad-leaf selective, does not kill grasses. **Effectiveness**- not stated
			Glyphosate: Timing- Postemergence from seedling to bloom stage. Most effective at flower bud or flowering stage. **Spectrum**- Non-selective. **Effectiveness**- Good control option if reseeding is planned shortly after application.
			Chlorsulfuron: Timing- Postemergence from seedling to flowering stage. Most effective at flower bud or flowering stage. **Spectrum**- Mixed selectivity, generally safe on grasses. **Effectiveness**- Not stated.
			Imazapyr: Timing- Postemergence from seedling to flowering stage. Most effective at bud to late flowering stage. **Spectrum**- Non-selective. **Effectiveness**- Leaves more bare ground than other treatments. Also effective following early season mowing and/or discing.

Common/ Scientific Name	Mechanical/ Manual	Grazing	Chemical
Purple star-thistle (*Centarea calcitrapa*)	Mowing not effective but can reduce seed production if timed at full bloom.	No	**Aminopyralid: Timing**- Preemergence in winter to early spring and postemergence to seedling treatment in spring up to flower bud stage. **Spectrum**- Broadleaf selective. **Effectiveness**- One of the most effective in treating thistles. Generally safe on grasses.
			Clopyralid: Timing- Postemergence in spring up to flower bud stage. **Spectrum**- Broadleaf selective, very safe on grasses. **Effectiveness**- not stated.
			Dicamba: Timing- Postemergence to rapidly growing plants. **Spectrum**- Broadleaf selective. **Effectiveness**- Increased effectiveness on other types of thistle when mixed with Diflufenzopyr. More effective on smaller plants.
			Fluroxypyr: Timing- Postemergence to rapidly growing plants**. Spectrum-** Broadleaf selective, safe for most grasses. **Effectiveness-** not stated.
			Triclopyr: Timing- Posteemergence to rapidly growing plants. **Spectrum**- Broadleaf selective, safe for most grasses. **Effectiveness**- not stated.
			Glyphosate: Timing- Postemergence to rapidly growing plants in bud stage. **Spectrum**- Nonselective. **Effectiveness**- Repeat application may be necessary, more effective with ammonium sulfate.
			Chlorsulfuron: Timing- Postemergence in fall to new rosettes, or to rosettes in spring beforebolting. **Spectrum**- Mixed selectivity but generally safe on grasses. **Effectiveness-** not stated.
			Imazapyr: Timing- Pre or postemergence. **Spectrum**- Non-selective. **Effectiveness**- not stated.

Common/ Scientific Name	Mechanical/ Manual	Grazing	Chemical
Perennial mustard (*Hirschfeldia incana*)	Manual removal over a period of years will exhaust seed bank.	Not likely	**Glyphosate: Timing**- Early postemergence to small plants. **Spectrum**- Non-selective. **Effectiveness**- Provides supression, more effective when ammonium sulfate is added.
			Chlorsulfuron: Timing- Preemergence or early postemergence. **Spectrum**- Primarilly active on broadleaf species. **Effectiveness**- Good control on most mustards. Most effective preemergence. Use surfactant for postemergence application.
			Sulfometuron: Timing- Preemergence to early postemergence. **Spectrum**- Broad spectrum. **Effectiveness**- not stated.
Russian knapweed (*Acroptilon repens*)	Mowing in summer followed by herbicide application in fall can be effective.	No	**Aminopyralid: Timing**- Postemergence, bud stage to senescence. **Spectrum**- Broad-spectrum, generally safe on grasses. **Effectiveness**- One of the most effective herbicides for Russian knapweed, can provide up to 2 years of control (Reference D).
			Clopyralid: Timing- Postemergence, bud stage to senescence. **Spectrum**- Selective, safe on grasses and other broadleaf species. **Effectiveness**- Can be mixed with aminopyralid for more effective control.
			Glyphosate: Timing- postemergence, bud stage to senescence. **Spectrum**- Non-selective. **Effectiveness**- Does not control as well as other treatments, will not kill seeds or inhibit germination.
			Chlorsulfuron: Timing- Postemergence at flower bud stage, fall rosette stage, or winter. **Spectrum**- Broad-spectrum. **Effectiveness**- not stated.

Common/ Scientific Name	Mechanical/ Manual	Grazing	Chemical
Scarlet Sesban (*Sesbania punicea*)	Cutting at ground level followed by herbicide is effective. Heavy equipment removal can be effective but not practical if location is in waterlogged area.	No	**Triclopyr: Timing**- When plants are growinng rapidly. **Spectrum**- Selective. **Effectiveness**- Mixed with fluroxypyr provides effective control.
			Glyphosate: Timing- Rapidly growing plants. Foliar treatment in late summer/ early fall. Cut stump treatment in late summer/ early fall or dormant season. Treatment should occur immediately after cutting. **Spectrum**- Non-selective. **Effectiveness**- not stated.
			Imazapyr: Timing- Late summer/ early fall before leaves drop. **Spectrum**- Broad spectrum. **Effectiveness**- Cut stump application.
Skeleton weed (*Chondrilla juncea*)	Frequent mowing may exhaust root storage, supressing weed.	Continual grazing can reduce populations if seed germination is prevented. However, shallow burial of seeds by grazing animals can increase population.	**Aminopyralid: Timing**- Spring from rosette to flowering stage. **Spectrum**- Broadleaf-selective, safe on grasses. **Effectiveness**- Longer residual and higher activity than clopyralid.
			Dicamba: Timing- Postemergence to rapidly growing plants. May require repeat treatment. **Spectrum**- Broadleaf selective. **Effectiveness**- Increased effectiveness when mixed with Diflufenzopyr.
			Clopyralid: Timing- Postemergence to rosettes in fall, or up to bolting in spring. **Spectrum**- Broadleaf selective. Very safe for grasses. **Effectiveness**- Can be mixed with dicamba.
			Glyphosate: Timing- Rapidly growing plants in bud stage. **Spectrum**- Non-selective. **Effectiveness**- Repeat applications may be necessary. Effectiveness may be increased when mixed with ammonium sulfate.
			Imazapyr: Timing- Preemergence or postemergence to rapidly growing plants. **Spectrum**- Non-selective. **Effectiveness**- not stated.

Common/ Scientific Name	Mechanical/ Manual	Grazing	Chemical
Smallflower tamarisk (*Tamarix parviflora*)	Cutting followed by herbicide	Cattle and goats will graze if there is no other vegetation; has little nutritional value. Goats may be able to provide some control after a cutting or burn.	**Triclopyr: Timing**- Any time but best in summer or fall and not water stressed. **Spectrum**- Woody and herbaceous broadleaf selective. **Effectiveness**- Cut stump treatment very effective. Basal bark treatments to smaller trees with thin bark. Foliar treatment to trees 3-4' tall.
			Glyphosate: Timing- Any time but best in summer or fall and not water stressed. **Spectrum**- Non-selective. **Effectivenss**- Only provides partial control. Foliar application most effective after a rain event.
			Imazapyr: Timing- Any time but best in summer or fall. **Spectrum**- Non-selective. **Effectiveness**- Very effective control.
			Imazapyr + Glyphosate: **Timing**- Any time but best in summer or fall. **Spectrum**- Non-selective. **Effectiveness**- not stated.
Spanish broom (*Spartium junceum*)	Cutting followed by herbicide treatment.	Goats can help control respouting after burn treatment.	**Triclopyr: Timing**- Postemergence when plants are rapidly growing. Cut stump and basal bark treatments can be done at any time as long as the ground is not frozen. **Spectrum**- Broadleaf selective. **Effectiveness**- Cut stump treatment- apply immediately after plant is cut. Basal bark treatment at 12-18" from the ground.
			Glyphosate: Timing- Foliar treatments in late summer/ early fall. Cut stump treatment in late summer, early fall or dormant season. **Spectrum**- Non-selective. **Effectiveness**- Good control with some resprouts.
			Imazapyr: Timing- Best during late summer to early fall. Cut stump or basal bark treatment. **Spectrum**- Non-selective. **Effectiveness**- apply immediately after plant is cut. Basal bark treatment at 12-18" from the ground. May leave bare ground.

Common/ Scientific Name	Mechanical/ Manual	Grazing	Chemical
Stinkwort (*Dittrichia graveolens*)	Mowing multiple times during a growing season may provide control.	No	**Dicamba: Timing**- Postemergence to rapidly growing plants. **Spectrum**- Broadleaf selective. **Effectiveness**- Dicamba + MCPA is a standard treatment for stinkwort in AU.
			Triclopyr: Timing- Postemergence to rapidly growing plants, Smaller plants are easier to contol. **Spectrum**- Broadleaf selective, safe for most grasses. **Effectiveness**-
			Glyphosate: Timing- Postemergence to rapidly growing plants in late spring to early summer after desirable competitors have senesced. **Spectrum**- Non-selective. **Effectiveness**- Can be increased with the addition of ammonium sulfate.
Tall sock-destroyer (Hedgeparsley) (*Torilis arvensis*)	Mowing at flowering stage can be effective, secondary treatment may be required.	Can provide some control if grazed at a high stock density before flowering.	**Triclopyr: Timing**- Postemergence when plants are rapidly growing, best applied in spring. **Spectrum**- Broadleaf selective. **Effectiveness**- Not stated.
			Glyphosate: Timing- Postemergence when plants are rapidly growing. **Spectrum**- Non-selective. **Effectiveness**- Not stated.
			Chlorsulfuron: Timing- Preemergence or early postemergence. **Spectrum**- Primarilly active on broadleaf species. **Effectiveness**- Not stated.

Common/ Scientific Name	Mechanical/ Manual	Grazing	Chemical
Tocalote (Malta star-thistle) (*Centaurea melitensis*)	See yellow star-thistle	See yellow star-thistle	**Aminopyralid: Timing**- Pre and postemergence. **Spectrum**- Broadleaf selective. **Effectiveness**- Most effective when applied at postemergence seedling to rosette stage. One of the most effective treatments for all thistles.
			Clopyralid: Timing- Pre and postemergence from seedling to mid-bolting, most effective application at later rosette stage but before bolting. **Spectrum-** Selective. **Effectiveness-** Very effective on thistles. Safe for most grasses.
			Triclopyr: Timing- Postemergence from seedling to bolting stage. **Spectrum**- Broadleaf selective, typically does not harm grasses. **Effectiveness**- Not stated.
			Glyphosate: Timing-Postemergence to plants from bolting to beginning flowering. **Spectrum**- Nonselective. **Effectiveness**- Most effective herbicide for late season control.
			Chlorsulfuron: Timing- Preemergence only. **Selectivity**- Mixed selectivity. **Effectiveness**- Not stated.
Treasure flower (*Gazania linearis*)	Not recommended (rhizomes resprout) but possible for small infestations	no	Aminopyralid: **Timing**-Mar-May during active growth before seed set. **Spectrum**- Broadleaf selective. **Effectiveness:** not stated

Common/ Scientific Name	Mechanical/ Manual	Grazing	Chemical
Wooly distaff thistle (*Carthamus lanatus*)	Hoeing effective for small populations if crown severed just below soil surface. Mowing after bolting before flower buds develop can prevent seeding. Seed can mature in cut flowerheads.	No	**Aminopyralid: Timing**- Pre and postemergence up to early rosette stage. **Spectrum**- Broadleaf selective. **Effectiveness**- Most effective when applied at postemergence seedling to rosette stage. One of the most effective treatments for all thistles.
			Clopyralid: Timing- Pre and postemergence from seedling small rosette stage. **Spectrum**- Selective. **Effectiveness**- Very effective on thistles, but can damage legumes as well. Aminopyralid is better
			Triclopyr: Timing- Postemergence from seedling to small rosette stage. **Spectrum**- Broadleaf selective, typically does not harm grasses. **Effectiveness**- Good control, but Aminopyralid is better.

Common/ Scientific Name	Mechanical/ Manual	Grazing	Chemical
Yellow star-thistle (*Centaurea solstitialis*)	Mowing most effective when 2-5% of population of seedheads in bloom; too early (before seedheads have reached spiny stage, and damaging competitive grass) or too late (after seed set) will increase infestation. Best used in integrated approach, in later years of long term management program. Best results when by mowing once in early flowering stage and again 4-6 weeks later during floral bud stage. Not always sucessful- can damage biocontrol agents, injure late growing forbes and reduce fall/ winter forage for wildlife/livestock.	High intensity, short duration- sheep, goats, cattle when plants have bolted, before they produce spiny heads. Goats continue to browse in flower stage. Best used in an integrated management plan. Must be continued for at least 3 years in severe infestation.	**Aminopyralid: Timing**- Pre to postemergence when plants are in seedling to mid rosette stage. **Spectrum**- Broadleaf selective. **Effectiveness**- one of the most effective for thistles, and is safe on grasses. Preemergence application can cause severe suppression of invasive annual grasses.
			Clopyralid: Timing- Pre and postemergence from seedling to mid-bolting, later rosette stage. Earlier application may not provide full season control. **Spectrum**- Selective. **Effectiveness**- Very effective on thistles, but can damage legumes as well. Safe for most all grasses.
			Triclopyr: Timing- Postemergence from seedling to bolting stage. **Spectrum**- Broadleaf selective, typically does not harm grasses. **Effectiveness**- not stated.
			Glyphosate: Timing-Postemergence to plants from bolting to beginning flowering. **Spectrum**- Nonselective. **Effectiveness**- Most effective herbicide for late season control.

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Appendix C. California Noxious Weed List

California law defines a noxious weed thus:

> ""Noxious weed" means any species of plant that is, or is liable to be, troublesome, aggressive, intrusive, detrimental, or destructive to agriculture, silviculture, or important native species, and difficult to control or eradicate, which the director, by regulation, designates to be a noxious weed. In determining whether or not a species shall be designated a noxious weed for the purposes of protecting silviculture or important native plant species, the director shall not make that designation if the designation will be detrimental to agriculture." (Food and Agriculture Code, Division 4, Part 1, Chapter 1, Article 1. Definitions 5004).

Noxious weeds lists are compiled by the California State Department of Food and Agriculture, and so are not binding to the Air Force. However, the list can be used as an indicator of which weeds are most likely to have detrimental impact and can be used to guide management on Air Force lands. Although primarily targeted at alien species that may cause direct economic harm to crops, those species may also cause harm to wildlands and should be eradicated where found.

Table C-1. California State Noxious Weed List.

USDA Code	Scientific Name	Common Name
ACPA8	Acacia paradoxa DC.	kangaroothorn
ACNO7	Acaena novae-zelandiae Kirk	
ACNO4	Acaena novae-zelandica Kirk, orth. var.	biddy biddy
ACPA14	Acaena pallida (Kirk) Allen	pale biddy-biddy
ACBR5	Achnatherum brachychaetum (Godr.) Barkworth	punagrass
ACRE3	Acroptilon repens (L.) DC.	Russian knapweed
AECY	Aegilops cylindrica Host	jointed goatgrass
AEGE	Aegilops geniculata Roth	
AEOV2	Aegilops ovata L. p.p.	ovate goatgrass
AETR	Aegilops triuncialis L.	barb goatgrass
AEGIN	Aeginetia L.	
AERU	Aeschynomene rudis Benth.	rough jointvetch
AGAD2	Ageratina adenophora (Spreng.) R.M. King & H. Rob.	crofton weed
ALECT2	Alectra Thunb.	
ALMA12	Alhagi maurorum Medik.	camelthorn
ALNE3	Allium neapolitanum Cirillo	
NOIN3	Nothoscordum inodorum (Aiton) G. Nicholson	false garlic
ALPA20	Allium paniculatum L.	panicled onion
ALVI	Allium vineale L.	wild garlic
ALPH	Alternanthera philoxeroides (Mart.) Griseb.	alligatorweed
ALSE4	Alternanthera sessilis (L.) R. Br. ex DC.	sessile joyweed
AMTR	Ambrosia trifida L.	giant ragweed
ARSE8	Araujia sericifera Brot.	bladderflower
ARCA45	Arctotheca calendula (L.) Levyns	capeweed
ASFI2	Asphodelus fistulosus L.	onionweed
AVST	Avena sterilis L.	animated oat
AZPI	Azolla pinnata R. Br.	mosquito fern
CACA	Cabomba caroliniana A. Gray	Carolina fanwort
CACH42	Cardaria chalepensis (L.) Hand.-Maz.	
CACH10	Cardaria chalapensis (L.) Hand.-Maz., orth. var.	lens podded hoarycress
CADR	Cardaria draba (L.) Desv.	lens podded hoarycress

USDA Code	Scientific Name	Common Name
CAPU6	Cardaria pubescens (C.A. Mey.) Jarmolenko	lens podded hoarycress
CAAC	Carduus acanthoides L.	plumeless thistle
CANU4	Carduus nutans L.	musk thistle
CAPY2	Carduus pycnocephalus L.	Italian thistle
CATE2	Carduus tenuiflorus W. Curtis	slenderflowered thistle
CALA20	Carthamus lanatus L.	woolly distaff thistle
CALAC3	Carthamus lanatus L. ssp. creticus (L.) Holmboe	
CABA5	Carthamus baeticus (Boiss. & Reut.) Nyman	smooth distaff thistle
CALE52	Carthamus leucocaulos Sm.	whitestem distaff thistle
CAOX6	Carthamus oxyacanthus M. Bieb.	
CAOX2	Carthamus oxyacantha M. Bieb., orth. var.	wild safflower
CEEC	Cenchrus echinatus L.	southern sandbur
CELO3	Cenchrus longispinus (Hack.) Fernald	mat sandbur
CESP4	Cenchrus spinifex Cav.	
CEIN4	Cenchrus incertus M.A. Curtis	coast sandbur
CECA2	Centaurea calcitrapa L.	purple starthistle
CEDI3	Centaurea diffusa Lam.	diffuse knapweed
CEIB	Centaurea iberica Trevir. ex Spreng.	Iberian starthistle
CESO3	Centaurea solstitialis L.	yellow starthistle
CESTM	Centaurea stoebe L. ssp. micranthos (Gugler) Hayek	
CEMA4	Centaurea maculosa auct. non Lam.	knapweed
CESU	Centaurea sulphurea Willd.	Sicilian starthistle
CEVIS2	Centaurea virgata Lam. ssp. squarrosa (Willd.) Gugler	
CESQ	Centaurea squarrosa Willd.	squarrose knapweed
CHJU	Chondrilla juncea L.	skeletonweed
CHTE2	Chorispora tenella (Pall.) DC.	purple mustard
CHAC	Chrysopogon aciculatus (Retz.) Trin.	pilipiliula
CIAR4	Cirsium arvense (L.) Scop.	Canada thistle
CIJA2	Cirsium japonicum Fisch. ex DC.	Japanese thistle
CIOC2	Cirsium ochrocentrum A. Gray	yellowspine thistle
CIUN	Cirsium undulatum (Nutt.) Spreng.	wavyleaf thistle
COBE2	Commelina benghalensis L.	Benghal dayflower
COAR4	Convolvulus arvensis L.	field bindweed

USDA Code	Scientific Name	Common Name
COSQ	Coronopus squamatus (Forssk.) Asch.	swinecress
CRVU2	Crupina vulgaris Cass.	bearded creeper, common crupina
CUME	Cucumis melo L.	
CUMED	Cucumis melo L. var. dudaim (L.) Naud.	dudaim melon
CUMY	Cucumis myriocarpus E. Mey. ex Naud.	paddy melon
CUSCU	Cuscuta L.1	dodder
CURE	Cuscuta reflexa Roxb.	giant dodder
CYCA	Cynara cardunculus L.	artichoke thistle
CYNOD	Cynodon Rich.	bermudagrass
CYES	Cyperus esculentus L.	yellow nutsedge
CYRO	Cyperus rotundus L.	purple nutsedge
CYSC4	Cytisus scoparius (L.) Link	Scotch broom
DIAB	Digitaria abyssinica (Hochst. ex A. Rich.) Stapf	
DISC5	Digitaria scalarum (Schweinf.) Chiov.	African couch grass
DIVE2	Digitaria velutina (Forssk.) P. Beauv.	velvet fingergrass
DRAR7	Drymaria arenarioides Humb. & Bonpl. ex Schult. [excluded]	alfombrilla
EIAZ2	Eichhornia azurea (Sw.) Kunth	anchored waterhyacinth
EICR	Eichhornia crassipes (Mart.) Solms	waterhyacinth
ELRE4	Elymus repens (L.) Gould	
ELRE3	Elytrigia repens (L.) Desv. ex Nevski	quackgrass
EMAU	Emex australis Steinh.	three-cornered jack
EMSP	Emex spinosa (L.) Campd.	devil's thorn
EUES	Euphorbia esula L.	leafy spurge
EUOB4	Euphorbia oblongata Griseb.	oblong spurge
EUSE12	Euphorbia serrata L.	serrate spurge
EUTE10	Euphorbia terracina L.	Geraldton carnation spurge
GAOF	Galega officinalis L.	goatsrue
GEMO2	Genista monspessulana (L.) L.A.S. Johnson	French broom
GYPA	Gypsophila paniculata L.	baby's breath
HAHA8	Halimodendron halodendron (Pall.) Voss	Russian salt tree
HAGL	Halogeton glomeratus (M. Bieb.) C.A. Mey.	halogeton
HECI	Helianthus ciliaris DC.	blueweed

USDA Code	Scientific Name	Common Name
HEMA17	Heracleum mantegazzianum Sommier & Levier	giant hogweed
HECO10	Heteropogon contortus (L.) P. Beauv. ex Roem. & Schult.	tanglehead
HYVE3	Hydrilla verticillata (L. f.) Royle	hydrilla
HYMO6	Hydrocharis morsus-ranae L.	frogbit
HYPO3	Hygrophila polysperma (Roxb.) T. Anderson	Miramar weed
HYNI	Hyoscyamus niger L.	black henbane
HYPE	Hypericum perforatum L.	klamathweed
IMBR	Imperata brasiliensis Trin.	Brazilian satintail
IMBR2	Imperata brevifolia Vasey	satintail
IMCY	Imperata cylindrica (L.) P. Beauv.	cogongrass
IPAQ	Ipomoea aquatica Forssk.	Chinese waterspinach
IRDO	Iris douglasiana Herb.	Douglas iris
IRMI	Iris missouriensis Nutt.	western blue flag
ISTI	Isatis tinctoria L.	dyer's woad
ISRU	Ischaemum rugosum Salisb.	murain-grass
IVAX	Iva axillaris Pursh	povertyweed
LAMA15	Lagarosiphon major (Ridley) Moss	oxygen weed
LELA2	Lepidium latifolium L.	perennial peppercress
LECH2	Leptochloa chinensis (L.) Nees [excluded]	Asian sprangletop
LISP2	Limnobium spongia (Bosc) Rich. ex Steud.	spongeplant
LIIN5	Limnophila indica (L.) Druce	ambulia
LISE3	Limnophila sessiliflora (Vahl) Blume	ambulia
LIDAD	Linaria dalmatica (L.) Mill. ssp. dalmatica	
LIGED	Linaria genistifolia (L.) Mill. ssp. dalmatica (L.) Maire & Petitm.	Dalmatian toadflax
LYFE4	Lycium ferocissimum Miers	
LYFE3	Lycium ferrocissimum Miers, orth. var.	African boxthorn
LYSA2	Lythrum salicaria L.	purple loosestrife
MALE3	Malvella leprosa (Ortega) Krapov.	alkali mallow
MEQU	Melaleuca quinquenervia (Cav.) S.F. Blake	melaleuca
MEMA	Melastoma malabathricum L.	

USDA Code	Scientific Name	Common Name
MICO16	Mikania cordata (Burm. f.) B.L. Rob. [excluded]	mile-a-minute
MIMI5	Mikania micrantha Kunth	mile-a-minute
MIDI8	Mimosa diplotricha C. Wright	
MIIN80	Mimosa invisa Mart., non Mart. ex Colla	giant sensitive plant
MIPE2	Mimosa pellita Kunth ex Willd.	
MIPI	Mimosa pigra auct. non L.	catclaw mimosa
MOHA2	Monochoria hastata (L.) Solms [excluded]	monochoria
MOVA	Monochoria vaginalis (Burm. f.) C. Presl ex Kunth	pickerel weed
MORAE	Moraea Mill.	
HOMER	Homeria Vent.	Cape tulip
MOCO8	Moraea collina Thunb.	
HOCO6	Homeria collina (Thunb.) Salisb.	Cape tulip
MOFL2	Moraea flaccida (Sweet) Steud.	
HOFL4	Homeria flaccida Sweet	Cape tulip
MOOC2	Moraea ochroleuca (Salisb.) Drapiez	
HOOC	Homeria ochroleuca Salisb.	Cape tulip
MOPA8	Moraea pallida (Baker) Goldblatt	
HOPA11	Homeria pallida Baker	Cape tulip
MUSC	Muhlenbergia schreberi J.F. Gmel.	nimblewill
NATR3	Nassella trichotoma (Nees) Hack.	serrated tussock
NYME	Nymphaea mexicana Zucc.	banana waterlily
OESI3	Oenothera sinuosa W.L. Wagner & Hoch	
GASI	Gaura sinuata Nutt. ex Ser.	wavy-leaved gaura
OESU3	Oenothera suffrutescens (Ser.) W.L. Wagner & Hoch	
GACO5	Gaura coccinea Nutt. ex Pursh	scarlet gaura
OEXE	Oenothera xerogaura W.L. Wagner & Hoch	
GADR	Gaura drummondii (Spach) Torr. & A. Gray	Drummond's gaura
ONAL5	Ononis alopecuroides L.	foxtail restharrow
ONAC	Onopordum acanthium L.	Scotch thistle
ONIL	Onopordum illyricum L.	Illyrian thistle
ONTA	Onopordum tauricum Willd.	Taurian thistle

USDA Code	Scientific Name	Common Name
OPAU10	Opuntia aurantiaca Lindl.	jointed prickly pear
OROBA	Orobanche L.1	broomrape
ORCO4	Orobanche cooperi (A. Gray) A. Heller	Cooper's broomrape
ORRA	Orobanche ramosa L.	branched broomrape
ORLO3	Oryza longistaminata A. Chev. & Roehr.	red rice
ORPU13	Oryza punctata Kotzchy ex Steud.	red rice
ORRU	Oryza rufipogon Griffiths	perennial wild red rice, red rice
OTAL	Ottelia alismoides (L.) Pers.	duck-lettuce
PAAN4	Panicum antidotale Retz.	blue panicgrass
PASC6	Paspalum scrobiculatum L.	Kodo-millet
PEHA	Peganum harmala L.	harmel
PECL2	Pennisetum clandestinum Hochst. ex Chiov.	kikuyugrass
PEMA80	Pennisetum macrourum Trin.	African feathergrass
PEPE24	Pennisetum pedicellatum Trin.	kyasuma-grass
PEPO14	Pennisetum polystachion (L.) Schult.	
PEPO4	Pennisetum polystachyon (L.) Schult., orth. var.	missiongrass
PHLO4	Physalis longifolia Nutt.	long-leaf groundcherry
PHVI17	Physalis viscosa L.	grape groundcherry
PIST2	Pistia stratiotes L.	water lettuce
POAME	Polygonum amphibium L. var. emersum Michx.	kelp
POCU6	Polygonum cuspidatum Siebold & Zucc.	Japanese knotweed
POPO5	Polygonum polystachyum Wall. ex Meisn.	Himalayan knotweed
POSA4	Polygonum sachalinense F. Schmidt ex Maxim.	giant knotweed
PRAL11	Prosopis alpataco Phil.	mesquite
PRAR6	Prosopis argentina Burkart	mesquite
PRBU2	Prosopis burkartii Muñoz	mesquite
PRCA9	Prosopis caldenia Burkart	mesquite
PRCA10	Prosopis calingastana Burkart	mesquite
PRCA11	Prosopis campestris Griseb.	mesquite
PRCA12	Prosopis castellanosii Burkart	mesquite
PRDE4	Prosopis denudans Benth.	mesquite
PREL5	Prosopis elata (Burkart) Burkart	mesquite

USDA Code	Scientific Name	Common Name
PRFA2	Prosopis farcta (Banks & Sol.) J.F. Macbr.	Syrian mesquite
PRFE2	Prosopis ferox Griseb.	mesquite
PRFI4	Prosopis fiebrigii Harms	mesquite
PRHA4	Prosopis hassleri Harms ex Hassler	mesquite
PRHU3	Prosopis humilis Gillies ex Hook. & Arn.	mesquite
PRKU2	Prosopis kuntzei Harms ex Hassler	mesquite
PRPA4	Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	kiawe
PRPA10	Prosopis palmeri S. Watson	mesquite
PRRE2	Prosopis reptans Benth.	tornillo
PRRO4	Prosopis rojasiana Burkart	mesquite
PRRU4	Prosopis ruizlealii Burkart	mesquite
PRRU5	Prosopis ruscifolia Griseb.	mesquite
PRSE5	Prosopis sericantha Gillies ex Hook. & Arn.	mesquite
PRST3	Prosopis strombulifera (Lam.) Benth.	Argentine screwbean
PRTO3	Prosopis torquata DC.	mesquite
PRVE	Prosopis velutina Wooton	
PRAR4	Prosopis articulata S. Watson	velvet mesquite
ROAU	Rorippa austriaca (Crantz) Besser	Austrian field cress
ROSY	Rorippa sylvestris (L.) Besser	creeping yellow field cress
ROCO6	Rottboellia cochinchinensis (Lour.) W.D. Clayton	itchgrass
RUFR80	Rubus fruticosus L. [excluded]	wild blackberry complex
RUMO4	Rubus moluccanus L. [excluded]	wild blackberry
SASP	Saccharum spontaneum L.	wild sugarcane
SASA7	Sagittaria sagittifolia L. [excluded]	arrowhead
SACO8	Salsola collina Pall.	spineless Russianthistle
SAPA8	Salsola paulsenii Litv.	barbwire Russianthistle
SATR12	Salsola tragus L.	common Russianthistle
SAVE6	Salsola vermiculata L.	wormleaf salsola
SAAE	Salvia aethiopis L.	Mediterranean sage
SAVI18	Salvia virgata Jacq.	southern meadow sage
SAAU	Salvinia auriculata Aubl.	giant salvinia, salvinia
SABI9	Salvinia biloba Raddi	giant salvinia
SAHE7	Salvinia herzogii de la Sota	giant salvinia
SAMO5	Salvinia molesta Mitchell	giant salvinia

USDA Code	Scientific Name	Common Name
SCHI	Scolymus hispanicus L.	golden thistle
SEJA	Senecio jacobaea L.	tansy ragwort
SESQ	Senecio squalidus L.	Oxford ragwort
SEFA	Setaria faberi Herrm.	giant foxtail
SEPUP3	Setaria pumila (Poir.) Roem. & Schult. ssp. pallidefusca (Schumach.) B.K. Simon	
SEPA82	Setaria pallidifusca (Schumach.) Stapf & C.E. Hubbard, orth. var.	cattail grass
SOCA19	Solanum cardiophyllum Lindl.	heartleaf nightshade
SOCA3	Solanum carolinense L.	Carolina horsenettle
SODI	Solanum dimidiatum Raf.	Torrey's nightshade
SOEL	Solanum elaeagnifolium Cav.	white horsenettle
SOLA	Solanum lanceolatum Cav.	lanceleaf nightshade
SOMA	Solanum marginatum L. f.	white-margined nightshade
SOTA3	Solanum tampicense Dunal	wetland nightshade
SOTO4	Solanum torvum Sw.	turkeyberry
SOVI2	Solanum viarum Dunal	tropical soda apple
SOAR2	Sonchus arvensis L.	perennial sowthistle
SOHA	Sorghum halepense (L.) Pers.	johnsongrass
SPER	Sparganium erectum L.	exotic bur-reed
SPAL3	Spermacoce alata Aubl. [excluded]	borreria
SPSA3	Sphaerophysa salsula (Pall.) DC.	Austrian peaweed
STRIG	Striga Lour.	witchweed
STAS2	Striga asiatica (L.) Kuntze	witchweed
SYAS	Symphytum asperum Lepechin	rough comfrey
TACA8	Taeniatherum caput-medusae (L.) Nevski	medusahead
TAMI3	Tagetes minuta L.	wild marigold
TRTE	Tribulus terrestris L.	puncturevine
TRPR5	Tridax procumbens L.	coat buttons
ULEU	Ulex europaeus L.	gorse
URPA	Urochloa panicoides P. Beauv.	liverseed grass
VIAL2	Viscum album L.	European mistletoe
ZYFA	Zygophyllum fabago L.	Syrian beancaper

Appendix D. List of Weed-free Forage Providers

Weed-Free Hay and Straw Providers - California and Nevada

October 2016 Update

CALIFORNIA (Alphabetized by and within county)

Alpine	**Phone**	**Address**	**City, ZIP Code**	**Product Details (hay, straw, wattles, etc.)**
Gansberg Ranch	530-694-2268	2277 Foothill Rd.	Markleeville, 96120	grass hay
Colusa				
Hay Connection (John Foster Hay)	530-681-0306	352 Vawter Rd.	Arbuckle, 95912	erosion control straw, hay
Shadinger Arbuckle Ranch	530-476-0725	633 Gabby Rd.	Arbuckle, 95912	rice straw, wheat straw, straw wattles (erosion control)
Cal-Vista Erosion	530-476-0706	459 State Hwy. 99 W.	Arbuckle, 95912	certified rice straw wattles
Glenn				
K & R Farming	530-934-4500	6439 County Rd. 48	Willows, 95988	rice straw
Rick Green	530-570-0459	2130 County Rd. S.	Willows, 95988	rice straw
Inyo-Mono				
Curti Ranch	775-291-4073	999 Cunningham Wy.	Coleville, 96107	grass hay
All Five Ranch	760-920-2265	P.O. Box 597	Big Pine, 93513	alfalfa, Hay
Kern				
Western Fiber Co.	661-747-5581	4234 Sandrini Rd.	Arvin, 93203	straw wattles
Merced				
Hugh Yamshon	209-769-4494	2821 Healy Rd.	Merced, 95341	alfalfa hay
Karen Macedo (Broker)	209-722-7911	935 Northwood Dr.	Merced, 95348	alfalfa hay and possibly other products
Placer				
Echo Valley Ranch	530-823-8320	205 Nevada St.	Auburn, 95603	rice straw, alfalfa pellets
San Joaquin				
Lee's Lockeford Hay Station	209-727-0131	18503 N. Hwy. 88	Lockeford, 95237	wheat straw, alfalfa pellets
John Vander Meulen	209-484-7202	12784 Carrolton Ave	Escalon, 95320	Wheat straw
Stanilaus				
Scott LaMunyon Farms	209-535-8164	Will deliver locally	Waterford, 95386	oat hay
Shasta				
Hawes Ranch & Farm supply	530-365-2332	21923 Dersch Rd.	Anderson, 96007	wheat, rice straw
McArthur Ranch, Inc.	530-336-6815	26312 Jim Day Rd.	McArthur, 96007	alfalfa grass, alfalfa straw
Siskiyou				
Clint Custer	530-598-0732	2212 South Hwy	Etna, 96027	38 ac alfalfa/grass hay Cert. # 72215-1, and 77 ac wheat straw Cert. # 90315-1, **NAISMA certified**, baled with NAISMA twine
Brandon Fawaz	530-524-0354	349 Collier Way	Etna, 96027	6 ac wheat straw Cert # 80715-1, **NAISMA certified**, baled with NAISMA twine
Jeff Boyd	530-667-4828	692 Second St.	Tulelake, 96134	63 ac Wheat straw Cert. # 81815-1, **NAISMA certified**, baled with NAISMA twine
Sonoma				
Frizelle-Enos	707-992-0144	10035 Main St.	Penngrove, 94951	rice straw, alfalfa pellets
Tuolumne				
Hurst Ranch	209-984-3016	17415 State Hwy. 108	Jamestown, 95327	rice straw ©
Yolo				
Chamberlain Farms	530-662-2620	34530 County Road 29	Woodland, 95695	wheat straw, rice straw
NEVADA				
For Nevada Weed Free Forage Producers, see here: http://agri.nv.gov/Plant/Noxious_Weeds/NV_Certified_Weed_Free_Producer_Links/				

For more information about weed free certification go to:
http://www.cal-ipc.org/ip/prevention/weedfreeforage.php

1. If you need a large amount of material for the coming year, contact vendors early in the growing season to make sure sufficient weed free forage /straw will be certified and available for your project needs.
2. Ask your vendor for a proof of certification, in the form of a copy of CDFA Form 66-079 “Certificate of Quarantine Compliance (CQC)” associated with the inspection of the specific forage/straw materials. This is the legal document verifying that the materials have been inspected and certified.
3. Many vendors can order these materials upon request.
4. For upland restoration or mulching projects, certified weed free rice straw is considered the most weed free option.

Pellet Providers (not certified) - California

September 2015 Update **Pelletized Feed**

CALIFORNIA (Alphabetized by and within county)

Alameda	**Phone**	**Address**	**City, ZIP Code**	**Product**
Bay Area Hay & Feed	925-389-6005	101 N. Greenville Rd.	Livermore, 94550	alfalfa pellets
EJ Cattle & Feed Supply	925-960-9074	7900 Carneal Rd.	Livermore, 94551	alfalfa pellets
Livermore Feed & Farm	925-447-4203	3170 Fourth St.	Livermore, 94550	alfalfa pellets
Western Saddlery	800-833-5085	7038 Commerce Cir.	Pleasanton, 94588	alfalfa pellets
Amador				
Feed Barn	209-223-2809	11261 Prospect Dr.	Jackson, 95642	alfalfa pellets
Rancher's Outlet	209-245-6631	6980 Hwy. 16	Plymouth, 95669	alfalfa pellets
Butte				
Northern Star Mills	530-342-7661	510 Esplanade	Chico, 95926	alfalfa pellets
Skyview Feed & Pet	530-877-1019	677 Birch St.	Paradise, 95969	alfalfa pellets
Calaveras				
Country Feed & More	209-754-9100	833 G Hwy. 49	San Andreas, 95249	alfalfa pellets
McDillard's Feed	209-785-8000	3566 Spangler Ln., #1	Copperopolis, 95228	alfalfa pellets
Spence Ranch Feed & Supply	209-736-4310	1291 N. Hwy. 49	Altaville, 95221	alfalfa pellets
Valley Springs Feed	209-772-3589	10 Main St.	Valley Springs, 95252	alfalfa pellets
Contra Costa				
Alamo Hay & Grain	925-837-4994	3196 Danville Blvd.	Alamo, 94507	alfalfa pellets
Byron Feed	925-634-4353	3800 Holway Dr.	Byron, 94514	alfalfa pellets
Concord Feed & Fuel	925-940-1211	228 Hookston Rd.	Pleasant Hill, 94561	alfalfa pellets
Rodie's Feed	925-672-4600	8863 Marsh Creek Rd.	Clayton, 94517	alfalfa pellets
El Dorado				
Clifton & Warren	530-622-6771	574 Placerville Dr.	Placerville, 95667	alfalfa pellets
Coloma Feed & Hardware	530-626-6300	7170 Hwy. 49, #1	Lotus, 95651	alfalfa pellets
Cool Feed & Ranch Supply	530-887-0200	2968 Hwy. 49, Ste. M	Cool, 95614	alfalfa pellets
Double Diamond Feed	530-622-4001	692 Pleasant Valley Rd.	Diamond Springs, 95619	alfalfa pellets
Garden Valley Feed	530-333-2320	4702 Marshall Rd.	Garden Valley, 95633	alfalfa pellets
Hay Lady	530-333-1550	2977 Church St.	Georgetown, 95634	alfalfa pellets
Lee's Feed	530-677-4891	4110 Mother Lode Dr.	Shingle Springs, 95682	alfalfa pellets
Mt. Aukum General Store	530-620-3015	8080 Mount Aukum Rd.	Mount Aukum, 95656	alfalfa pellets
R & S Hay Barn	530-295-3990	4451 Missouri Flat Way	Placerville, 95667	alfalfa pellets, rice straw
Fresno				
Academy Feed	559-875-2855	494 S. Academy Ave.	Sanger, 93657	alfalfa pellets
Auberry Feed	559-855-8555	32970 Auberry Rd.	Auberry, 93602	alfalfa pellets
Bucke's Feed & Grain	530-865-4427	1308 Railroad Ave.	Orland, 95963	alfalfa pellets
Canyon Feed	559-855-7480	29533 Auberry Rd., #101	Prather, 93651	alfalfa pellets
Clovis Feed	559-299-9596	1490 Tollhouse Rd.	Clovis, 93611	alfalfa pellets
D & D A1 Feed	559-322-3333	5092 N. Academy Ave.	Clovis, 93619	alfalfa pellets
Western Farm Supply	559-266-3276	445 N. Brawley, Ste. C	Fresno, 93706	alfalfa pellets

Pellet Providers (not certified) - California

September 2015 Update **Pelletized Feed**

CALIFORNIA (Alphabetized by and within county)

Humboldt	**Phone**	**Address**	**City, ZIP Code**	**Product**
Fortuna Feed	707-725-3333	126 Dinsmore Dr.	Fortuna, 95540	alfalfa pellets
The Farm Store	707-443-7397	3956 Jacobs Ave.	Eureka, 95501	alfalfa pellets
Kern				
Granite Station Saddlery/Feed	661-399-3186	7156 Golden State, B	Bakersfield, 93308	alfalfa pellets
Lake				
Ag Unlimited	707-278-3131	2532 Big Valley Rd.	Lakeport, 95453	alfalfa pellets
CJ's Ranch Supply	707-987-9771	21713 Hwy. 29	Middletown, 95461	alfalfa pellets
Rainbow Ag	707-279-0550	1975 Argonaut Rd.	Lakeport, 95453	alfalfa pellets
Madera				
3-V Feed	559-661-0038	28342 Hwy. 145	Madera, 93638	alfalfa pellets
Box Feed	559-877-4787	32941 Rd. 222, #1	North Fork, 93643	alfalfa pellets
Mountain Feed	559-683-7383	35424 Hwy. 41	Coarsegold, 93614	alfalfa pellets
Valley Feed	559-674-6735	121 N. Gateway Dr.	Madera, 93637	alfalfa pellets
Marin				
Novato Horse & Pet Supply	415-892-1030	7546 Redwood Blvd.	Novato, 94945	alfalfa pellets
Toby's Feed Supply	415-663-1223	11250 CA-1	Point Reyes Station, 94956	alfalfa, oat, timothy pellets
Marin Tack and Feed	415-456-2929	6880 Sir Francis Drake Blvd.	Forest Knolls, 94933	oat pellets
Merced				
Ford's Farm Supply	209-854-3805	1302 South Ave.	Gustine, 95322	alfalfa pellets
Monterey				
Hawkins Ranch	805-937-1567	812 Hawkins Wy.	Santa Maria, 93908	alfalfa pellets
California Hay Barns	831-757-5088	1031 Industrial St.	Salinas, 93901	alfalfa pellets
Napa				
Wilson's Feed & Supplies	707-252-0316	1700 Yajome St.	Napa, 94558	alfalfa pellets
Nevada				
CJ's Hay	530-273-5249	18381 McCourtney Rd.	Grass Valley, 95949	alfalfa pellets
Featherlite Trailer	530-273-8870	13317 Hwy. 49	Grass Valley, 95949	alfalfa pellets
Pearson Feed	530-432-1420	17905 Penn Valley Rd.	Penn Valley, 95946	alfalfa pellets
Ridge Feed & Supply	530-273-3886	12892 Ridge Rd.	Grass Valley, 95949	alfalfa pellets
Placer				
California Hay Barns	916-652-7301	3031 Penryn Rd.	Penryn, 95663	alfalfa pellets
Colfax Feed & Country Store	530-346-2600	140 North Main St.	Colfax, 95713	alfalfa pellets
Echo Valley Ranch	530-823-8320	205 Nevada St.	Auburn, 95603	alfalfa pellets, rice straw
Foothill Feed & Gift	916-652-7121	3293 Taylor Rd., A	Loomis, 95650	alfalfa pellets
Sierra Hay & Feed	916-645-3638	150 Flocchini Cir., #100	Lincoln, 95648	alfalfa pellets
Sierra Mountain Feed/Supply	559-338-2729	35625 E. Kings Canyon Rd.	Squaw Valley, 95675	alfalfa pellets
Superior Livestock Supply	916-434-8174	641 H St.	Lincoln, 95648	alfalfa pellets
The Hay Barn	530-268-1122	10101 Streeter Rd., Ste. H	Auburn, 95602	alfalfa pellets

Pellet Providers (not certified) - California

September 2015 Update **Pelletized Feed**

CALIFORNIA (Alphabetized by and within county)

Sacramento	Phone	Address	City, ZIP CODE	Product
Elk Grove Milling, Inc.	916-684-2056	8320 Eschinger Rd.	Elk Grove, 95757	alfalfa pellets
Elverta Feed Pet & Tack	916-991-5048	7831 Rio Linda Blvd.	Elverta, 95626	alfalfa pellets
Nick Nimmo Hay	209-745-4712	13208 Stockton Blvd.	Galt, 95632	alfalfa pellets
Paul Wagner Feed	916-991-3659	1331 Claire Ave.	Sacramento, 95838	alfalfa pellets
River Valley Feed	916-991-0077	6549 16th St.	Rio Linda, 95673	alfalfa pellets
Sheldon Feed & Supply	916-686-6400	8928 Grantline Rd.	Elk Grove, 95624	alfalfa pellets
Western Feed & Supply	916-643-1864	5935 Don Wy.	Carmichael, 95608	alfalfa pellets
Western Feed & Pet Supply	916-988-1011	8980 Greenback Ln.	Orangevale, 95838	alfalfa pellets
San Benito				
Tres Pinos Ranch Supply	831-628-3718	6980 Airline Hwy.	Tres Pinos, 95075	alfalfa pellets
San Bernardino				
Standing Bar G Productions	760-240-5870	9233 Deep Creek Rd.	Apple Valley, 92308	alfalfa pellets
San Diego				
East County Feed	619-562-2208	10845 Woodside Ave.	Santee, 92071	alfalfa pellets
Terry's Hay & Grain	760-749-9328	27350 Valley Center Rd.	Valley Center, 92082	alfalfa pellets
San Joaquin				
Frontier Feed & Supply	530-365-8072	5544 Deschutes Rd.	Anderson, 96007	alfalfa pellets
Lee's Lockeford Hay Station	209-727-0131	18503 N. Hwy. 88	Lockeford, 95237	alfalfa pellets, wheat straw
Old McGowen Feed	209-824-8074	6910 E. Lathrop Rd.	Manteca, 95336	alfalfa pellets
Vaca Hay Service	209-271-6674	21007 Hansen Rd.	Tracy, 95304	alfalfa pellets
San Mateo				
Azevedo Feed	650-726-6160	1815 Miramontes Point Road	Half Moon Bay, 94019	alfalfa cubes
Half Moon Bay Feed & Fuel	650-726-4814	331 Main St.	Half Moon Bay, 94019	alfalfa pellets
Pastorino Hay & Ranch	650-726-6155	921 Miramontes St.	Half Moon Bay, 94019	alfalfa pellets
Portola Valley Feed	650-851-1750	884 Portola Rd.	Portola Valley, 94028	alfalfa pellets
Santa Clara				
Dave's Hay Barn	408-292-3337	1055 Commercial	San Jose, 95116	alfalfa pellets
Express Hay	408-779-6621	14905 Olive Ave.	Morgan Hill, 95037	alfalfa pellets
Ganado Feed	408-286-4655	2331 S. 7th St.	San Jose, 95112	alfalfa pellets
Sam's Downtown Feed & Pet	408-287-9090	759 W San Carlos St.	San Jose, 95126	alfalfa pellets, rice straw
Silva Ranch	408-683-2348	12310 Santa Teresa Blvd.	San Martin, 95046	alfalfa pellets
Santa Cruz				
Corralitos Feed	831-722-7884	2895 B Freedom Blvd.	Watsonville, 95076	alfalfa cubes
Santa Clara				
Sam's Downtown Feed & Pet	408-287-9090	759 W. San Carlos St.	San Jose, 95126	alfalfa pellets
Shasta				
Frontier Feed & Supply	530-365-8072	5544 Deschutes Rd.	Anderson, 96007	alfalfa pellets
Solano				
Higby's Country Feed	707-678-9007	8470 Currey Rd.	Dixon, 95620	alfalfa pellets
Western Ranch Supply	707-448-6568	103 Aegan Wy.	Vacaville, 95687	alfalfa pellets

Pellet Providers - California and Nevada

September 2015 Update — **Pelletized Feed**

CALIFORNIA (Alphabetized by and within county)

Sonoma	Phone	Address	City, ZIP CODE	Product
Dave's Hay Barn	707-546-6677	3395 Petaluma Hill Rd.	Santa Rosa, 95404	alfalfa pellets
Farm Yard Feed	707-894-5992	27705 Dutcher Creek Rd.	Cloverdale, 95425	alfalfa pellets
Frizelle-Enos	707-992-0144	10035 Main St.	Penngrove, 94951	alfalfa pellets, rice straw
Western Farm Center	707-545-0721	21 W. 7th St.	Santa Rosa, 95401	alfalfa pellets
RiverTown Feed and Pet Country Store	707-762-4505	200 1st St.	Petaluma, 94952	alfalfa pellets
Stanislaus				
Melvin T Wheeler & Son	209-526-9770	5301 Woodland Ave.	Modesto, 95356	alfalfa pellets
Modesto Feed	209-526-9589	5437 McHenry Ave.	Modesto, 95356	alfalfa pellets
Oakdale Feed & Seed	209-847-7581	141 N. Yosemite Ave.	Oakdale, 95361	alfalfa pellets
Stanislaus Farm Supply	209-538-7070	624 E. Service Rd.	Modesto, 95358	alfalfa pellets
Turlock Feed & Livestock	209-669-0133	290 S. 1st St.	Turlock, 95380	alfalfa pellets
Sutter				
Sutter Orchard Supply	530-673-8068	573 Bridge St.	Yuba City, 95991	alfalfa pellets
Tehama				
Richfield Feed	530-824-4633	5605 Hwy. 99 W.	Corning, 96021	alfalfa pellets
Tuolumne				
Bolton Feed	209-533-2083	20117 Hwy. 108	Sonora, 95370	alfalfa pellets
Hurst Ranch	209-984-3016	17415 State Hwy. 108	Jamestown, 95327	alfalfa pellets, rice straw
Radovich Hay & Lumber	209-984-4463	18389 Main St.	Jamestown, 95327	alfalfa pellets
Sonora Feed & Supply	209-532-5046	13765 Terrace Dr.	Sonora, 95370	alfalfa pellets
Yolo				
Harlan Feed	530-662-8994	37587 Harlan Ln.	Woodland, 95695	pellets
Yuba				
Whitehorse Ranch & Feed	530-675-0420	16558 Frenchtown Rd.	Brownsville, 95919	alfalfa pellets
NEVADA				
Eastern Sierra Feed	775-782-3143	1245 Waterloo Ln.	Gardnerville, 89410	alfalfa pellets
Foothill Feed & Trailer Sales	775-852-0999	1330 Geiger Grade Rd.	Reno, 89521	alfalfa pellets
Green's Feed, Inc.	775-323-1502	4701 N. Virginia St.	Reno, 89506	alfalfa pellets, wheat straw
One Stop Ranch & Feed	775-284-0377	760 Glendale Ave.	Sparks, 89431	alfalfa pellets
Sierra Feed	775-853-6700	7460 S. Virginia St.	Reno, 89511	alfalfa pellets, alfalfa, hay
Silverado Mercantile	775-463-5577	15 US Hwy. 95A N.	Yerington, 89447	alfalfa pellets

For more information about weed free certification go to:

http://www.cal-ipc.org/ip/prevention/weedfreeforage.php

1. If you need a large amount of material for the coming year, contact vendors early in the growing season to make sure sufficient weed free forage/straw will be certified and available for your project needs.
2. Ask your vendor for a proof of certification, in the form of a copy of CDFA Form 66-079 "Certificate of Quarantine Compliance (CQC)" associated with the inspection of the specific forage/straw materials. This is the legal document verifying that the materials have been inspected and certified.
3. Many vendors can order these materials upon request. Send updates to Bobbi_Simpson@nps.gov.
4. For upland restoration or mulching projects, certified weed free rice straw is considered the most weed free option.

Appendix E. Department of Defense List of Approved Pesticides and TAFB Specially Approved Pesticides.

The Department of Defense maintains a list of Approved Pesticides, and Solano County RCD has sought additional approvals for a range of herbicides not on that list. As of 2016, ten formulations with a total of seven active ingredients are allowable on TAFB (Table E-1).

Table E-1. Approved Pesticides for TAFB.

Brand Name	Active Ingredient	EPA Reg #
Garlon 4 Ultra	triclopyr	62719-572
Garlon 3A	triclopyr	62719-37
Milestone VM	aminopyralid + triclopyr	62719-572
Transline	clopyralid	62719-259
Telar XP	chlorsulfuron	352-654
Roundup Custom	glyphosate	524-343
Roundup Pro	glyphosate	524-475
Fusilade II	Fluazifop-propanoaate	100-1084
Envoy Plus	Clethodim	59639-132
Volunteer	Clethodim	59639-3-55467

ARMED FORCES PEST MANAGEMENT BOARD (AFPMB) STANDARD PESTICIDES LIST AVAILABLE TO DOD COMPONENTS AND AGENCIES

December 1, 2015

This list contains pesticides that the Armed Forces Pest Management Board (AFPMB) has approved for DLA/DSCR stockage. DoD policy (DoD Instruction 4150.07) requires that the use of most of these pesticides whether procured from DLA or locally, must be pre-approved by a professional pest management consultant. This is usually done when the consultant approves the Installation's pest management plan. DoD policy also requires that only trained and certified applicators may apply pesticides on DoD installations. Only authorized personnel should procure and use these pesticides. Note: For Contingencies, see the Contingency Pesticide List and AFPMB Technical Guide 24. Changes on List are highlighted in bold red..

NSN 6840-	Item (Alternative Trade Name)	Unit Package	AAC *	Price	Unit Issue	Users+

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1. HERBICIDES/FUNGICIDES/ALGACIDES						
The following herbicides must be applied by a DoD certified pesticide applicator or under the direct supervision of a DoD Certified pesticide applicator.						
01-360-4741 SDS Label	Fungicide, Methylisothiocyanate (MITC-FUME) ***RESTRICTED USE PESTICIDE***	18 tubes	J	47.99	CO	A, N, F
01-457-6588 SDS Label	Fungicide, Azoxystrobin, 50% (Heritage)	(6) 1- lb. cont.	H	6700.10	BX	A, N, F, M
01-561-9603 SDS Label	Herbicide, Aminopyralid, 40.6% (Milestone VM)	(2) 2.5-gal co	J	2221.61	BX	A, N, M, F
00-392-7593 SDS Label	Herbicide, Bromacil, 21.9% lithium salt of bromacil, liquid (Hyvar X-L)	(4) 1-gal co	H	**528.17**	BX	A, F, M, N
01-408-9079 SDS Label	Herbicide, Bromacil, 80%, wettable powder (Hyvar- X)	(12) 4-lb bags	H	2322.20	BX	A, M, N
01-005-7523 SDS Label	Herbicide, Diquat, 35.3%, water soluble liquid (Reward)	1-gal co	H	487.40	GL	F, N
00-815-2799 SDS Label	Herbicide, Diquat, 35.3%, water soluble liquid (Reward)	(2) 2.5-gal co	H	**1096.55**	BX	A, N, F
01-341-9346 SDS Label	Herbicide, Diuron, mínimum 80% diuron, granular	25-lb bag	H	270.80	BG	A, N, F, M
00-001-7710 SDS Label	Herbicide, Diuron-Bromacil mixture, 40% bromacil, 40% diuron, granular (Krovar I DF)	6-lb bag	H	**134.59**	BG	A, N, F, M
01-630-3501 SDS Label	Herbicide, Diuron-Bromacil mixture, 40% bromacil, 40% diuron, granular (Krovar I DF)	25 lb bag	Z	242.00	BG	F
01-356-6001 SDS Label	Herbicide, Fluridone, 5%, pellets (Sonar SRP)	40-lb co	J	660.12	CO	A, N
01-356-8888 SDS Label	Herbicide, Fluridone 41.7% liquid (Sonar A.S.)	1 qt co	H	1196.38	QT	A, N
01-525-5869 SDS Label	Herbicide, Imazapic ammonium salt 23.6% liquid (Plateau)	(2) 1-gal co	J	1458.00	BX	A, N, M, F
01-108-9578 SDS Label	Herbicide, Isopropylamine salt of glyphosate, 41%, water soluble liquid (Roundup Pro/Ranger Pro/Razor Pro/Glyfos Pro)	(2) 2.5-gal co	H	**197.51**	BX	A, N, F, M

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NSN 6840-	Item (Alternative Trade Name)	Unit Package	AAC *	Price	Unit Issue	Users+
01-388-0142 SDS Label	Herbicide, Isopropylamine salt of glyphosate, 41%, water soluble liquid (Roundup Pro/Ranger Pro/Razor Pro/Glyfos Pro)	30-gal drum	H	1235.59	DR	A, F, N
01-356-8893 SDS Label	Herbicide, Isopropylamine salt of glyphosate**,** 53.8**%**, water soluble liquid (Rodeo/Aquamaster)	(2) 2.5-gal co	H	456.91	BX	A, F, M, N
01-377-7113 SDS Label	Herbicide, Isopropylamine salt of glyphosate, 2.0**%**, water soluble liquid (Roundup Ready-to-Use)	24-oz pump spray bottle	H	9.34	BT	N, F
01-399-0673 SDS Label	Herbicide, Ammonium salt of glyphosate, 73.3% and 2.9% Diquat dibromide, water soluble liquid (Quik Pro)	5 pkg.	H	23.94	BX	A,F, M
01-545-4540 SDS Label	Herbicide, Ammonium salt of glyphosate, 73.3% and 2.9% Diquat dibromide, water soluble liquid (Quik Pro)	6.8 lb co	H	260.76	CO	A, N, M, F
01-356-8902 SDS Label	Herbicide, Isopropylamine salt of imazapyr, **26.7% (Arsenal Powerline)**	(2) 2.5-gal co	H	2960.62	BX	A, N, F, M
01-532-5403 SDS Label	Herbicide, Isopropylamine salt of imazapyr, 28.7% (Habitat)	(2) 2.5-gal co	H	2333.15	BX	A, N, M
01-318-7417 SDS Label	Herbicide, Oryzalin, 40.4% (Surflan A.S.)	1-gal bot	H	407.27	GL	A, N, F, M
00-145-0013 SDS Label	Herbicide, Prometon, 25% prometon, emulsifiable concentrate (Pramitol 25E)	(2) 2.5-gal co	H	319.84	BX	A, F, N
01-356-8891 SDS Label	Herbicide, Methyl Sulfometuron, 75% (Oust XP)	48-oz co	H	295.26	CO	A, N, M
01-319-2890 SDS Label	Herbicide, Tebuthiuron (Spike 80 DF)	4-lb bag	J	141.36	BG	A, N, F
01-457-6576 SDS Label	Herbicide, Tebuthiuron-Diuron, 1% Tebuthiuron, 3% Diuron (Spraykil SK-13)	40 lb. container	H	238.84	CO	A, N, M
01-552-1822 SDS Label	Herbicide, Triclopyr, 60.45% (Garlon 4 Ultra)	(2) 2.5-gal co	H	722.12	BX	A, N, M, F
00-577-4194 SDS Label	Herbicide, 2,4-Dichlorophenoxy-acetic acid (2,4-D), oil miscible/water emulsifiable liquid (low volatile ester form)	(2) 2.5-gal co	H	209.15	BX	A, N, M
00-664-7060 SDS Label	Herbicide, 2,4-Dichlorophenoxy-acetic acid (2,4-D), water soluble liquid (amine salt form)	(2) 2.5-gal co	H	151.61	BX	A, N, M
01-377-7110 SDS Label	Herbicide, 2,4-Dichlorophenoxy-acetic acid (2,4-D), 0.128%, 0.22% MCPP and 0.05% Dicamba water soluble liquid (Weed-B-Gon MAX)	24-oz pump spray bottle	H	12.24	BT	F, N
2. REPELLENTS						
The following repellents must be applied by trained personnel or a DoD certified pesticide applicator.						
01-334-2666 SDS Label	Insect Repellent, clothing application, 40% permethrin, liquid (2-Gal sprayer)	(12) 151-ml bot	H	157.98	BX	A, N, F, M
All DoD personnel following label and SDS familiarization may apply the following repellents.						
01-284-3982 SDS Label	Insect Repellent, personal application, Ultrathon (3M/EPA 58007-1)	(12) 2-oz tubes	H	100.30	BX	A, N, F, M
01-278-1336 SDS Label	Insect Repellent, clothing application, aerosol (Permethrin Arthropod Repellent)	(12) 6-oz cans	H	83.24	BX	A, N, F, M
01-137-8456 SDS Label	Insect Repellent, personal application, 5% benzocaine, 10% precipitated sulfur (Chigg-Away)	118-ml bot	H	6.85	BT	A, N, F, M
01-288-2188 SDS Label	Insect Repellent, personal application & sunscreen, 20% DEET/SPF15 (Sunsect)	(12) 2-oz tubes	H	81.35	BX	A, N, F
01-452-9582 SDS Label	Insect Repellent, personal application & sunscreen, 20% DEET/SPF15 **(**Sunsect)	320 packets	H	448.45	BX	A, N, F
01-345-0237 SDS Label	Insect Repellent, clothing application, permethrin (IDA)	12 kits	H	62.16	BX	A, N, F, M
01-584-8393 SDS Label	Insect Repellent, personal application, 30% DEET (SP532-Ultra30/LippoDEET)	(12)-2 oz tubes	H	76.99	BX	A, N, M, F
01-584-8598 SDS Label	Insect Repellent, personal application, 25% DEET , pump spray bottles(Cutter Backwoods DEET Insect Repellent)	(12)-6 oz BT	H	79.80	BX	A, N, F, M
01-619-4795	Insect Repellent, personal application, 20% Picaridin, pump spray bottle	(12)-3.4 oz BT	H	77.25	BX	A, N, M,

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NSN 6840-	Item (Alternative Trade Name)	Unit Package	AAC *	Price	Unit Issue	Users+
	(NATRAPEL Insect Repellent)					F

3. INSECTICIDES						
The following insecticides must be applied by a DoD certified pesticide applicator or under the direct supervision of a DoD Certified pesticide applicator.						
01-543-0662 SDS Label	Insecticide, Abamectin, 0.011%, (Advance 360A Dual Choice Ant Bait Stations)	72 bait stations	H	**88.68**	BX	A, N, M, F
01-561-9766 SDS Label	Insecticide, Abamectin, 0.05% (Avert Dry Flowable Cockroach Bait Formula 1)	12-30 gram tubes	H	**396.22**	BX	A, N, M, F
01-561-9649 SDS Label	Insecticide, Abamectin, 0.05% (Avert Cockroach Bait Stations Formula 1)	4 bags. Each bag contains 72 bait stations	H	**300.16**	BX	A, N, F, M
00-145-0016 SDS Label	Insecticide, Aluminum phosphide, 55 % tablets (Phostoxin/Fumitoxin) *****RESTRICTED USE PESTICIDE*****	100 tablets	H	**41.72**	CN	A, N, F
00-442-5698 SDS Label	Insecticide, Aluminum phosphide, 55 % pellets (Phostoxin/Fumitoxin) *****RESTRICTED USE PESTICIDE*****	1660 pellets	H	**76.39**	BT	A, N, F, M
01-377-7049 SDS Label	Insecticide, *Bacillus thuringiensis*, 10% (Summit BTI. Briquets)	100 Briquets	H	**130.85**	BX	A, N, F, M
01-565-8241 SDS Label	Insecticide, *Bacillus thuringiensis(Vectobac WDG)*	24-1 lb bags/CO	H	**1413.24**	CO	A, N, M, F
01-287-3938 SDS Label	Insecticide, Boric Acid, aerosol (Perma-Dust PT 249)	(12) 9 oz cans	V	119.26	BX	A, N, F, M
01-525-6888 SDS Label	Insecticide, Bifenthrin, 7.9% liquid (**Talstar P Professional**)	1-qt co	H	**68.00**	QT	A, N, M, F
01-104-0887 SDS Label	Insecticide, Carbaryl, 43.4%, liquid (Carbaryl 4L)	(2) 2.5-gal co	H	403.82	BX	F, N
01-525-7139 SDS Label	Insecticide, Chlorfenapyr, 21.45% liquid (Phantom)	(4) 75-oz co	H	1051.88	BX	A, N, F, M
01-313-7359 SDS Label	Insecticide, beta-cyfluthrin, 11.8% (Tempo SC Ultra)	(12) 240-ml bot	H	**634.37**	BX	A, N, F, M
01-383-6251 SDS Label	Insecticide, beta-cyfluthrin, 10% (Tempo Ultra WSP)	(32) 50 gm packs	H	**461.77**	BX	A, N, F, M
01-561-9717 SDS Label	Insecticide, Cyfluthrin, 0.1%, aerosol (PT CY-KICK CS)	12 x 17.5 oz cans/box	H	**168.84**	BX	A, M, F, N
01-561-9669 SDS Label	Insecticide, Lambda-cyhalothrin, 0.05% aerosol (PT 221L Residual)	12 x 17.5 oz cans/box	H	**159.25**	BX	A, M, N, F
01-390-4822 SDS Label	Insecticide, Cypermethrin, 40% (Demon WP)	1-lb jar	H	**84.82**	LB	A, N, F, M
01-573-5024 SDS Label	Insecticide, Deltamethrin, 0.03% (Kills Bedbugs II)	(4) 1- gal jugs	D	**113.48**	BX	A,N,F, M
01-431-3345 SDS Label	Insecticide, Deltamethrin, 0.05% (Delta Dust)	1-lb co	H	**16.81**	LB	A, N, F, M
01-561-9745 SDS Label	Insecticide, Deltamethrin, 0.06%, aerosol (D-Force Residual)	8 x 14 oz cans/box	H	**105.68**	BX	A, N, M, F
00-142-9438 SDS Label	Insecticide, Dichlorvos, 20% (plastic strips)	48 strips	**V**	**237.32**	BX	A, N, F, M
01-603-5650 SDS Label	Insecticide, Dichlorvos, 20% (NUVAN PROSTRIPS + 65 Gram)	6 packs per box (3 strips per pack)	**H**	452.04	BX	A, N, M, F
01-603-5654 SDS Label	Insecticide, Dichlorvos, 20% (NUVAN PROSTRIPS 16 Gram)	6 packs per box (12 strips per pack)	J	535.88	BX	A, N, M, F
01-628-4751 SDS Label	Insecticide, Dichlorvos,10.75% (Ovitrap Mosquito Trap-N-Kill)	12 traps per box	**H**	**99.29**	BX	A, F, N, M
01-647-8840 SDS Label	**Insecticide, Dichlorvos (Nuvan Directed Spray Aerosol)**	**12 -17 oz aerosols per box**	**Z**	**500.00**	**BX**	**A, N, M, F**

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NSN 6840-	Item (Alternative Trade Name)	Unit Package	AAC *	Price	Unit Issue	Users+
01-647-8844 SDS Label	**Insecticide, Dinotefuran, % (Quikstrike Fly Bait)**	**5- lb co**	**Z**	**36.00**	**CO**	**A, N, M, F**
01-412-4634 SDS Label	Insecticide, D-Phenothrin, 2%, aerosol	12-oz can	H	**17.12**	CN	A, N, F, M
66-131-2263 SDS Label	**Insecticide, D-Phenothrin 2% and Permethrin 2% (Callington 1-Shot Aircraft Insecticide)** ***** For use in Disinsection of Aircraft Cargo Holds**	150 gram can	**H**	**54.30**	CN	N, F
01-586-8718 SDS Label	Insecticide, Allethrin-Permethrin Mixture 0.25% and 0.15% , aerosol (Ace House & Garden Bug Killer 2)	15-oz can	**H**	**8.00**	CN	A, N, M, F
01-067-2137 SDS Label	Insecticide, D-trans Allethrin and Resmethrin, 0.125% and 0.2% , aerosol (Kill Zone House & Garden Insect Killer Formula 4)	14-oz can	Y	3.80	CN	A, N, F, M
01-573-4964 SDS Label Supplemental	Insecticide, Etofenprox, 20% (Zenivex E20)	(2) 2.5-gal co	H	2875.38	BX	A,N,M
01-619-6396 SDS Label	Insecticide, Etofenprox 1.0%; Tetramethrin 0.5% and Piperonyl Butoxide 1.5% (ZENPROX Aerosol)	(6) 16-oz cans	H	102.39	BX	A, N, F, M
01-183-7244 SDS Label	Insecticide, Methomyl, 1.1%, Fly bait (Golden Malrin/Stimukil)	5-lb can	H	**22.15**	CN	A, N, F, M
01-287-3913 SDS Label	Insecticide, Hydramethylnon (Amdro Fire Ant Bait; **PROBAIT Fire Ant Bait)**	(12) 6-oz bot	H	**620.02**	BX	A, N, F, M
01-501-2905 SDS Label	Insecticide, Hydroprene, 90.6% (Gentrol Point Source)	20 devices/box	H	**52.56**	BX	A, M, N
01-585-9976 SDS Label	Insecticide, Hydroprene, 0.36%(Gentrol Aerosol)	(12) 16 –oz cans	H	**215.65**	BX	A, N, M F
01-424-2494 SDS Label	Insecticide, Fenoxycarb (Award Brand of Logic)	25-lb bag	H	441.90	BG	A, N, F, M
01-585-9950 SDS Label	Insecticide, Fipronil, 0.0143% (Top Choice Fire Ant Granules) *****RESTRICTED USE PESTICIDE*****	50-lb bag	H	**314.60**	BG	A, N, M, F
01-224-1269 SDS Label	Insecticide, Fipronil, cockroach, large size (Combat Source Kill Max R2)	8 bait stations/ box/ 12 boxes	H	**171.48**	PG	A, N, F, M
01-180-0167 SDS Label	Insecticide, Fipronil, cockroach, regular size (Combat Source Kill Max R1)	12 bait stations/ box/ 12 boxes	H	**154.55**	PG	A, N, F, M
01-483-3065 SDS Label	Insecticide, Fipronil (Maxforce FC Roach Killer Bait Gel)	24-60 gram reservoirs/ box	H	**353.22**	BX	A, N, M
01-471-5650 SDS Label	Insecticide, Fipronil (Maxforce FC Roach Killer Bait Gel)	4-30 gram reservoirs/box	H	**29.21**	BX	N, M
01-500-4579 SDS Label	Insecticide, Fipronil (Maxforce FC Ant Killer Bait Gel)	4 reservoirs/box	H	**34.31**	BX	A, N, M
01-602-8269 SDS Label	Insecticide, Fipronil (Maxforce FC Magnum Roach Killer Bait Gel)	12-33 gram reservoirs per box	H	**345.35**	BX	A, N, M, F
01-298-1122 SDS Label	Insecticide, Fipronil (MaxForce FC Ant Bait)	96 stations	H	**126.01**	PG	A, N, F, M
01-483-3072 SDS Label	Insecticide, Fipronil (Termidor 80WG)	24 co/box	H	3972.16	BX	A, N, M
01-483-3068 SDS Label	Insecticide, Fipronil (Termidor SC)	4-78 oz BT/box	H	**1365.40**	BX	A, N, M
01-318-7416 SDS Label	Insecticide, Hydroprene, 9.0%, emulsifiable concentrate (Gentrol IGR)	(10) 1-oz bot	H	**83.27**	BX	A, N, F, M
01-591-2150 SDS Label	Insecticide, Imidacloprid (Temprid SC)	400 ml CO	H	**157.33**	CO	A,N, F, M
01-518-5807 SDS Label	Insecticide, Imidacloprid (Maxforce Granular Fly Bait)	5 lb co	H	**51.94**	CO	A, N, F, M
01-555-9369 SDS Label	Insecticide, Imidacloprid (Maxforce Fly Spot Bait)	(50) 2 oz pkg/box	H	**399.61**	BX	A, N, M, F
01-457-6580 SDS Label	Insecticide, Imidacloprid, 0.5% granular (Merit 0.5 g)	30 lb. bag	H	**232.97**	BG	A, N, F, M
01-647-8857 SDS Label	**Insecticide, Imidacloprid, 0.025% (Kaput Rodent Flea Control Bait)** ****Restricted Use Pesticide****	**25-lb co**	**Z**	**100.00**	CO	**A, N, M, F**
01-428-6646	Insecticide, Lambda-cyhalothrin, 9.7% (Demand CS)	(8) 8 oz bottle	H	**495.72**	BX	A, N, F,

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NSN 6840-	Item (Alternative Trade Name)	Unit Package	AAC *	Price	Unit Issue	Users+
SDS Label						M
01-431-3357 SDS Label	Insecticide, Lambda-cyhalothrin (Surrender Pestab)	40 tablets	V	74.90	CO	A, N, F, M
00-655-9222 SDS Label	Insecticide, Malathion, 57.0%, emulsifiable concentrate, class 2	1-gal co	H	65.29	GL	A, N, F, M
00-685-5438 SDS Label	Insecticide, Malathion, 57.0%, emulsifiable concentrate, class 2	5-gal can	H	296.36	CN	A, N, F, M
00-926-1481 SDS Label	Insecticide, Malathion, 96.5%, liquid, (Fyfanon ULV)	54-gal drum	H	4018.39	DR	A, N, F, M
01-169-1842 SDS Label	Insecticide, Malathion, 96.5%, liquid, (Fyfanon ULV)	5-gal can	H	354.13	CN	A, N, F, M
01-424-2495 SDS Label	Insecticide, Methoprene (Altosid XR Briquets)	220 Briquettes	H	1200.92	BX	A, N, F, M
01-511-0535 SDS Label	Insecticide, Methoprene (Altosid Pellets)	(2) 22 lb co/box	H	2221.91	BX	A, N, F, M
01-424-2493 SDS Label	Insecticide, Methoprene (Altosid Liquid Larvicide Conc.)	(2) 2.5-gal co	H	9436.37	BX	A, N, F, M
01-591-2155 SDS Label	Insecticide, Methoprene (Precor 2000 Plus)	12 aerosols/box	H	229.61	BX	A, N, M, F
01-270-9765 SDS Label	Insecticide, Naled, 87.4, liquid (Dibrom)	30-gal drum	H	7613.95	DR	A, F, N
01-532-5414 SDS Label	Insecticide, Naled, 78%, liquid (Trumpet EC)	30-gal drum	J	5475.14	DR	A, N, F, M
00-597-6111 SDS Label	Insecticide, Naphthalene, ball form	14-oz box	H	7.49	BX	A, N, F, M
01-467-0994 SDS Label	Insecticide, Nithiazine, Fly Strips (Quikstrike), 2 strips per package	(12) PG/box	H	269.45	BX	A, N, F
00-174-1825 SDS Label	Insecticide, P-Dichlorobenzene, crystal/flake	100-lb drum	J	390.00	DR	A, N, F
00-174-1824 SDS Label	Insecticide, P-Dichlorobenzene, crystal **GSA**	1-lb can	J	17.04	LB	N, F, M
01-606-8581 SDS Label	Insecticide, Permethrin-Piperonyl Butoxide (20.6+ 20.6%), All Pro Aqualuer 20-20	(2)-2.5 gal co/box	H	1592.33	BX	A, N, F, M
01-550-5660 SDS Label	Insecticide, Permethrin-Piperonyl Butoxide (4.6+4.6%) , (Kontrol 4-4)	(2) 2.5-gal co	H	343.98	BX	A, N, F, M
01-104-0780 SDS Label	Insecticide, Pyrethrins, 3% pyrethrins with synergists, liquid (ULV fog concentrate)	1-gal bot	H	227.48	GL	A, N, F, M
00-459-2443 SDS Label	Insecticide, Phenothrin 0.120% and Allethrin 0.129%, aerosol (Wasp-Freeze Wasp & Hornet Killer)	(12) 17.5-oz cans	H	116.44	BX	A, N, F, M
01-619-6467 SDS Label	Insecticide, Etofenprox 0.50%; Tetramethrin 0.2% and Piperonyl Butoxide 1.0% (Zoecon Wasp-X Wasp and Hornet Spray)	(12) 16-oz cans	H	107.59	BX	A, N, F, M
00-823-7849 SDS Label	Insecticide, Pyrethrin, aerosol (PT 565 Plus XLO)	(12) 20-oz cans	H	248.36	BX	A, N, F
01-359-8533 SDS Label	Insecticide, Resmethrin (Scourge) ***Restricted Use Pesticide***	5-gal can	H	772.38	CN	A, N, F
01-457-6583 SDS Label	Insecticide, Spinosad, 11.6% (Conserve SC)	1 quart co	H	222.92	QT	A, N, M
01-617-0886 SDS Label	Insecticide, Spinosad, 0.50% and (Z)-9-tricosene (Pheromone) (Conserve Fly Bait)	4 lb. co	J	36.00	CO	N, M, F
01-474-7751 SDS Label	Insecticide, Sumithrin-Piperonyl Butoxide, 10%-10%, (Anvil 10+10 ULV)	(2) 2.5-gal/box	H	2379.58	BX	A, M, N
01-474-7706 SDS Label	Insecticide, Sumithrin-Piperonyl Butoxide, 10%-10%, (Anvil 10+10 ULV)	250 gal co	J	----------	CO	A, N
01-424-3132 SDS Label	Insecticide, Temephos (Abate 4E; ALLPRO Provect 4E Larvicide)	2.5-gal co	H	1598.63	CO	A, N, F, M
01-498-9270 SDS Label	Insecticide, Temephos (5% Skeeter Abate; ALLPRO Provect 5G Larvicide)	2-22 lb. co	H	282.18	EA	A, F, N

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NSN 6840-	Item (Alternative Trade Name)	Unit Package	AAC *	Price	Unit Issue	Users+
4. EPA 25 (b) EXEMPT PESTICIDE PRODUCTS						
The following are EPA 25(b) exempt pesticides that have been approved by the AFPMB for stock listing.						
01-606-9951 SDS Label	Insecticide, Geraniol, 1.3%; aerosol (Terminix Natural Pest Control Flying Insect Killer)	(6) 14 oz cans	J	53.59	BX	A, N, F, M
01-607-0000 SDS Label	Insecticide, Thyme Oil, 4.1%; (TyraTech Tech Dust Natural Insecticide)	10 lb. pail	J	91.10	CO	A, N, F, M
5. RODENTICIDES						
The following rodenticides must be applied by trained personnel or a DoD certified pesticide applicator.						
00-089-4664 SDS Label	Rodenticidal Bait, Anticoagulant, 0.005% Diphacinone	40 blocks	H	**115.44**	BX	A, N, F, M
01-577-2202 SDS Label	Rodenticide, Anticoagulant, (Kaput Combo Bait Pellets), 0.020% Imidacloprid and 0.025% Warfarin	250 packets/bx	H	188.57	BX	A, N, F, M
01-598-2617 SDS Label	Rodenticidal Bait, Anticoagulant, 0.005% Bromadiolone (Maki), pellets	175 pkgs/CO	H	**163.23**	CO	A, N, M. F
01-598-4840 SDS Label	Rodenticidal Bait, Anticoagulant, 0.005% Brodifacoum (Talon-G), pellets	2 pails each w/150 pkgs per box	H	**178.95**	BX	A, N, M, F
01-501-2858 SDS Label	Rodenticidal Bait, Anticoagulant, 0.005% Bromadiolone, (Contrac Blox), 1 oz bait blocks	18-lb co	H	**93.78**	CO	A, N, M, F
01-503-5348 SDS Label	Rodenticidal Bait, Anticoagulant, 0.005% Brodifacoum, (Final Blox), 20 gram bait blocks	18-lb co	H	**102.55**	CO	A, M, N
00-753-4972 SDS Label	Rodenticide, Anticoagulant, concentrate 0.106% sodium salt of diphacinone (LIQUA-TOXII)	50 pouches	V	**90.15**	BX	A, N, F, M
01-598-4844 SDS Label	Rodenticide, Anticoagulant, concentrate 0.106% sodium salt of diphacinone (LIQUA-TOXII)	4 packages per box (8 packets per package)	H	**134.51**	PG	A, N, M, F
01-435-9318 SDS Label	Rodenticide, 10% zinc phosphide (ZP Tracking Powder) *****RESTRICTED USE PESTICIDE*****	(4) 500-g bot	H	47.48	BX	N
01-619-6419 SDS Label	Rodenticide, Anticoagulant, Difethialone 0.0025% (First Strike Soft Bait Rodenticide)	16 lb. co	**H**	**253.48**	CO	A, N, M, F
6. SURFACTANTS						
Surfactants are not pesticides, but are wetting agents that lower the surface tension, allowing easier spreading, and lower the interfacial tension between two liquids. Some pesticides, particularly herbicides, either require the use of a surfactant or performance may be improved by the addition of a surfactant. Refer to the pesticide label to determine if a surfactant is recommended by manufacturer.						
01-546-3053 SDS Label	Surfactant, Pesticide, Spray Adjuvant (Cygnet Plus)	(2) 2.5-gal co	H	**148.01**	BX	A, N, M, F
01-356-8896 SDS Label	Surfactant, Pesticide, Spray Adjuvant (Cide-Kick II)	(2) 2.5-gal co	H	256.91	BX	A, N, M, F
01-356-8897 SDS Label	Surfactant, Pesticide, Spray Adjuvant (Cide-Kick)	(2) 2.5-gal co	H	**242.99**	BX	A, N, M, F

+User Code A=Army, N=Navy, F=Air Force, M=Marines SOS (DSCR-Richmond/DLA Aviation) =SMS

***ACQUISITION ADVICE CODES (AAC)**

D. DOD INTEGRATED MATERIAL MANAGER (IMM) STOCKED, AND ISSUED. Issue, transfer, or shipment is not subject to specialized controls other than those imposed by the Integrated Material Manager/Military Service supply policy.
   1. The item is centrally managed, stocked, and issued.
   2. Requisitions will be submitted in accordance with Military Service requisitioning procedures.

G. GENERAL SERVICES ADMINISTRATION (GSA) INTEGRATED MATERIAL MANAGED, STOCKED AND ISSUED. Identifies GSA managed items available from GSA Supply Distribution Facilities. Requisitions and fund citations will be submitted in accordance with GSA/Military Service requisitioning procedures.

H. CENTRAL CONTRACT - NOT STOCKED ITEM. Direct delivery under central contract # (non-stocked items) issue, transfer, or shipment is not subject to specialized controls other than those imposed by IMM/Service/Agency supply policy.
   1. The item is centrally managed and procured.
   2. Normal issue is by direct shipment from the vendor to the user at the order of the ICP or IMM. However, orders for quantities less than the vendor's minimum order of quantity may be issued from stock by ICP or IMM supply distribution facilities.
   3. Requisitions and fund citations will be submitted in accordance with IMM/Service/Agency requisitioning procedures.
   4. Generally, delivery will be made within applicable Service/Agency guidelines addressing customer-required time frame.

I. DIRECT ORDERING FROM A CENTRAL CONTRACT/SCHEDULE. Issue, transfer, or shipment is not subject to specialized controls other than those imposed by Integrated Material Manager/Military Service supply policy. The item is covered by a centrally issued contractual document, or by a multiple award Federal Supply schedule for GSA managed items, which permits using activities to place orders on vendors for direct delivery to the user.

J. NOT STOCKED, CONTROLLED PROCURED. Identifies IMM/Military Service centrally managed but not stocked items. Long lead times must be anticipated, since procurement will be initiated only after receipt of a requisition. Requisitions will be submitted in accordance with IMM/Military Service requisitioning procedures.

K. CENTRALLY STOCKED FOR OVERSEAS ONLY. Main means of supply is local purchase. Item is stocked in domestic supply system for those overseas activities unable to procure locally due to non-availability of procurement sources or where local purchase is prohibited. Requisitions will be submitted by overseas activities in accordance with Service/Agency requisitioning procedures. NOTE: CONUS activities will obtain supply support through local procurement procedures.

L. LOCAL PURCHASE. IMM/Military Service managed items authorized for local purchase, as a normal means of support, by the Military Service, or base, post, camp, or station level. Items not stocked in wholesale distribution system of IMM/Military Service ICP. The local purchase forms authorized by the individual IMM/Military Service must be used. NOTE: GSA FSS items are included.

V. TERMINAL ITEM. Identifies items in stock; but future procurement is not authorized. Requisitions may continue to be submitted until stocks are exhausted. Preferred items National Stock Number (NSN) normally provided by the application of the phrase, "When Exhausted Use (NSN)". Requisitions will be submitted in accordance with IMM/Military Service requisitioning procedures as applicable.

X. SEMIACTIVE ITEM-NO REPLACEMENT. A potentially inactive NSN which must be retained in the supply system as an item of supply because (1) stocks of the item are on hand or in use below the wholesale level and (2) the NSN is cited in equipment authorization documents TO&E, TA, TM, etc. or in-use assets are being reported.
   1. Items are authorized for central procurement but not authorized for stockage at wholesale level.
   2. Requisitions for in-use replacement will be authorized in accordance with individual Military Service directives.
   3. Requisitions may be submitted as requirements generate. Repetitive demands may dictate at ACC change to permit Wholesale stockage.

Y. TERMINAL ITEM. Further identifies AAC V items on which wholesale stocks have been exhausted. Future procurement not authorized.
   1. Requisitions will not be processed to the wholesale suppliers.
   2. Internal Services' requisitioning may be continued in accordance with Military Service requisitioning policies.

Z. INSURANCE/NUMERIC STOCKAGE OBJECTIVE ITEM. Items, which may be required occasionally or intermittently and prudence requires that a nominal quantity of material be stocked due to the essentiality or the lead-time of the item.
   1. The item is centrally managed, stocked and issued.
   2. Requisitions will be submitted in accordance with IMM/Military Service requisitioning procedures.

DLA/DSCR POC:

CLIFFORD MYERS

Appendix F. TAFB Fire Management Plan

DEPARTMENT OF THE AIR FORCE

HEADQUARTERS 60th AIR MOBILITY WING (AMC)

TRAVIS AIR FORCE BASE CA 94535-5000

Travis Air Force Base
Wildland Fire Management Plan

January 2015

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DEPARTMENT OF THE AIR FORCE
60TH CIVIL ENGINEER SQUADRON (AMC)

"FOR OFFICIAL USE ONLY"

MEMORANDUM FOR DISTRIBUTION

FROM: 60 CES/CC
411 Airmen Drive, Bldg 570
Travis AFB CA 94535-5056

SUBJECT: Travis Air Force Base Wildland Fire Management Plan

1. The attached Travis Air Force Base Wildland Fire Management Plan (WFMP) is prepared IAW procedures and requirements IAW AFI 32-7064, *Integrated Natural Resources Management*.

2. This plan identifies responsibilities of 60 AMW units and other agencies required to support wildland fire management.

3. The OPR for this plan is 60 CES Fire Emergency Services Flight, Travis AFB.

4. The designated Wildland Fire Program Manager is the Travis AFB Fire Chief, 60 CES/CEF, 424-0850.

5. All addressees of this plan are requested to advise 60 CES Environmental Element, 424-4321, if there are any factors that may prevent the execution of this plan.

6. This document is UNCLASSIFIED and does not come within the scope of directives governing the protection of information affecting the national security. Although this plan is UNCLASSIFIED, it is FOR OFFICIAL USE ONLY.

2/2/2015

X 

PATRICK J. CARLEY, Lt Col, USAF, P.E.
Commander
Signed by: CARLEY.PATRICK.J.1180898154

Attachment:
Travis AFB Wildland Fire Management Plan

"The information herein is For Official Use Only (FOUO) which must be protected under the Freedom of Information Act of 1966 and Privacy Act of 1974, as amended. Unauthorized disclosure or misuse of this PERSONAL INFORMATION may result in criminal and/or civil penalties."

RECORD OF CHANGES

CHANGE NUMBER	DATE ENTERED	POSTED BY

RECORD OF ANNUAL REVIEW

REVIEWED BY	DATE REVIEWED	REMARKS

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Section 1. Purpose, Goals and Objectives

The purpose of the Travis Air Force Base (TAFB) Wildland Fire Management Plan is to reduce wildfire potential, protect and enhance valuable natural resources, and implement ecosystem management goals and objectives on Travis AFB. This Plan directly supports the mission and is consistent with TAFB emergency operations plans.

The following goals and objectives define the Wildland Fire Management Program in accordance with the 2012 TAFB Installation Natural Resources Management Plan (INRMP) and Air Force Instruction (AFI) 32-7064, *Integrated Natural Resources Management*. The overall goal is to reduce total costs and losses from wildfire by protecting assets at risk through focused pre-fire management and increasing initial attack success. This goal is met by accomplishing the following objectives:

- Contain wildfires within wildlands so they do not become a threat to human health and safety.
- Manage natural lands to reduce wildfire risk so wildfires do not impede the TAFB mission.
- Employ fire suppression methods that do not damage or destroy important natural resources within TAFB or on adjacent land.

Section 2. Wildland Fire Organization

Travis AFB follows the Air Force Incident Management System (AFIMS) for all emergency operations. The Air Force uses the National Response Plan and National Incident Management System to implement AFIMS in order to have a comprehensive, national, all-hazards approach to incident management across a spectrum of activities (USAF 2013). This system provides the foundation for wildfire incidents and is completely scalable, allowing the Incident Commander (IC) to increase and decrease emergency response assets depending on the demands of the incident.

In response to a major wildfire on TAFB, the IC prepares an ICS Form 207 (Appendix A) to document TAFB assets and organizational structure. The IC is responsible for managing all operations including designating and managing emergency personnel and equipment as well as coordinating mutual aid resources based on the nature of the incident. For larger incidents, an Emergency Operations Center may be convened to support the IC.

Section 3. Interagency Cooperation and Mutual Aid Agreements

Travis AFB Fire Emergency Services Flight has developed a partnership for wildland fire management support through the Solano County Mutual Aid Agreement. This agreement authorizes TAFB to provide support to and request support from local fire protection authorities during wildfire incidents on and off base. A copy of the Solano County Mutual Aid Agreement is included as Appendix B.

Section 4. Smoke Management and Air Quality

Travis AFB falls under the Bay Area Air Quality Management District (BAAQMD). The district restricts open burning to minimize the effects on air quality and public health. The BAAQMD defines open burning as the "burning of waste materials most commonly from agricultural crops or prescribed burns and can be a large source of air pollution and smoke" (BAAQMD 2010). Smoke from agricultural burning contains very fine particles, gases and some toxic chemicals that can be deeply inhaled into the lungs and can cause health problems.

The BAAQMD maintains exceptions to open burning prohibitions for several types of regulated fires. Travis AFB is eligible to conduct prescribed burns for wildland vegetation management and is covered under the hazardous material exception (see Appendix C: BAAQMD Regulation 5-401 dated June 19, 2013, also refer to: http://www.baaqmd.gov/ for the latest version). Wildland vegetation management burn plans for areas greater than 10 acres must be submitted to the Air Pollution Control Officer no later than December 31 for fires planned the following year. The smoke management during prescribed burns must follow the BAAQMD Prescribed Burning Smoke Management Plan requirements listed in BAAQMD Regulation 5.

Section 5. Safety and Emergency Operations

The first priority in every wildland fire management activity is fire fighter and public safety. Wildland firefighter training and certification standards for Air Force personnel involved in wildland firefighting activities follow the guidelines established by NFPA 1051, Standard for Wildland Fire Fighter Professional Qualifications and NFPA 1002, Standard for Fire Apparatus Driver/Operator Professional Qualifications. The TAFB TFES SOG 32-08-04, Wildland Emergencies (Appendix D) and the TAFB TFES FMP 32-01, Administration and Organization (Appendix E) provide firefighters with additional guidance and safety considerations specific to TAFB FD personnel.

Section 6. Risk Assessment and Decision Analysis Process

Sound operational risk management provides the foundation for this plan. Risk assessment and management is performed in accordance with AFI 32-2001, *Fire Emergency Services Program*, and authorizes the Fire Chief to establish local policies (USAF 2008). FES Risk assessment and response procedures are directed by DoD Fire and Emergency Services Program (DoD Instruction 6055.06) and applied to base specific wildland fire activities and hazards. TFES Standards of Cover (SOC), "Wildland Response" (Pg. 13) incorporates those directives into local Risk Assessment planning. The goals of the Risk Assessment Plan are:

1. Limit exposure of fire department personnel to situations and occurrences that could have harmful or undesirable consequences; and

2. Provide the safest possible work environment, through the proper use of personal protective equipment (PPE) for the responders, while recognizing the risks inherent to the FES mission.

The responders initial hazard analysis and decision making processes outlined in the SOC Risk

Assessment section have been developed with many considerations incorporated: firefighter safety, industry mandated protective services, TAFB priority assets, and or areas identified most at risk from a wildfire incident.

Section 10 discusses weather and wildland fuel considerations pertinent to risk assessment for conducting prescribed burns as well as responding to wildfires.

Section 7. Wildfire History

Fire has historically been excluded from this landscape through active fire suppression and land management activities (e.g. grazing, firebreaks) that reduce fire risk for at least the last 100 years. However, summer and fall wildfires have occurred, predominantly adjacent to highly-trafficked roads. No prescribed burns have been conducted on TAFB though there were plans to burn the former TAFB Aero Club site in 2006-2007. A burn plan was written for that prescribed burn and is included in Appendix F as an example to follow for future prescribed fire planning.

All wildfires are tracked in the Air Force's Automated Civil Engineering System (ACES). A total of 50 wildfires have occurred on TAFB since 2008 burning 180 acres. Complete incident reports are also maintained in the ACES database. All wildfire activity will also be reported to the Air Force Wildland Fire Center as required in AFI 32-7064.

Section 8. Natural and Cultural Resources Considerations

Travis AFB has a number of significant natural resources issues that should be considered during wild and prescribed fire planning and management. The dominant habitat on TAFB is annual grassland with scattered wetland habitat called vernal pools. The dominant species in the grasslands are non-native annual grasses and forbs (non-grasses) including bromes, wild oats, a variety of fescues and several species of filaree and thistle. The vernal pools hold water and therefore contain a different assemblage of native plant species that are also almost exclusively annual in nature. These annual plants typically green up with the first rains between October and December and dry in the spring as rainfall ceases and temperatures rise. Between the months of May through October, the dead plants, now one-hour fuels, are a wildfire hazard.

Historically, fire occurred naturally in this landscape and does not harm the rare plants and animals that inhabit the vernal pools and uplands. Appropriately-timed fires can actually be used to decrease populations of certain non-native weed species including yellow starthistle (Zouhar 2002) and medusahead grass (DiTomaso et al. 2006), two common weeds found on TAFB. A study that measured the response of vernal pool vegetation to prescribed fire at four sites in the Sacramento Valley including a site located 5 miles east of TAFB concluded that fire had a positive effect on the native vernal pool plant community while reducing the cover of non-native annual grasses (Marty 2007).

The vernal pools on TAFB may be considered to be jurisdictional wetlands protected by Section 404 of the Clean Water Act. Therefore, no soil disturbing activity is allowed inside the pool basins. Numerous vernal pools on base contain threatened and endangered plant and animal species that are protected by the Endangered Species Act. One species in particular, the California tiger salamander (CTS), lives most of the year in the grasslands surrounding their

breeding sites. Almost all the grassland habitat on TAFB provides potential upland nesting habitat for this species. Ground-disturbing activities within 1.3 miles of a CTS breeding pond may require consultation with the United States Fish and Wildlife Service (USFWS) and may require a federal take permit under the Endangered Species Act (TAFB 2013).

The special status of vernal pools as well as their surrounding uplands require firefighting activities, including creating firebreaks, to be restricted except when absolutely essential. In cases where disturbance to endangered species and/or wetland habitat is unavoidable, the incident must be reported to the appropriate agencies so they can assess the damage and determine mitigation requirements.

Section 9. Mission Impact Considerations

Implementation of the WFMP could have both negative and positive impacts to the mission of Travis AFB. Suppressing wildfire involves the use of firefighting resources that are then not available for immediate emergency response on aircraft or structure fires. This fact highlights the need to emphasize fire prevention and manage the unimproved areas to reduce the wildfire risk. Managing the unimproved areas, however, can be expensive and may require environmental permits (e.g. firebreak construction).

The implementation of a prescribed fire program would generally benefit the natural resources on TAFB by reducing non-native grass cover, increasing the cover of native species and decreasing populations of certain weeds (Marty 2007). However, the timing of the burns is critical to achieve positive results. Fires that occur later in the fire season (Jul-Oct), after the seeds of many of the non-native annual grass and forb species are safely secured in the soil, have the potential to negatively impact the vegetation community by promoting non-native species (Gerhardt and Collinge 2007).

A typical prescribed fire in annual grasslands consumes 75-100 percent of fine fuels, and therefore reduces fire risk for at least one season post-burn. Fuel consumption from a wildfire varies a lot more mainly because the fire behavior is much more erratic. The use of prescribed fire increases the risk of smoke-related mission impacts, specifically to the flying mission if a wind shift occurs. Additionally, an escaped prescribed fire can cause damage to people and property if not quickly contained.

Section 10. Wildland Fuel Factors

Travis AFB has over 950 acres of unimproved grounds dominated by annual vegetation that remains dry during the hot, dry summer and fall and can pose a wildfire threat (Figure 1). Union Creek runs through the Base, but is managed to maintain sparse vegetation due to the bird aircraft strike hazard (BASH) presented by riparian vegetation.

The predominant management methods used in these unimproved areas to reduce fuel loads include mowing and grazing. As of 2013, the Air Force standard grounds maintenance contract allowed for one mow per year to a height not to exceed 14 inches. Adjacent semi-improved and

Figure 1: Map of TAFB indicating land use type and acreage

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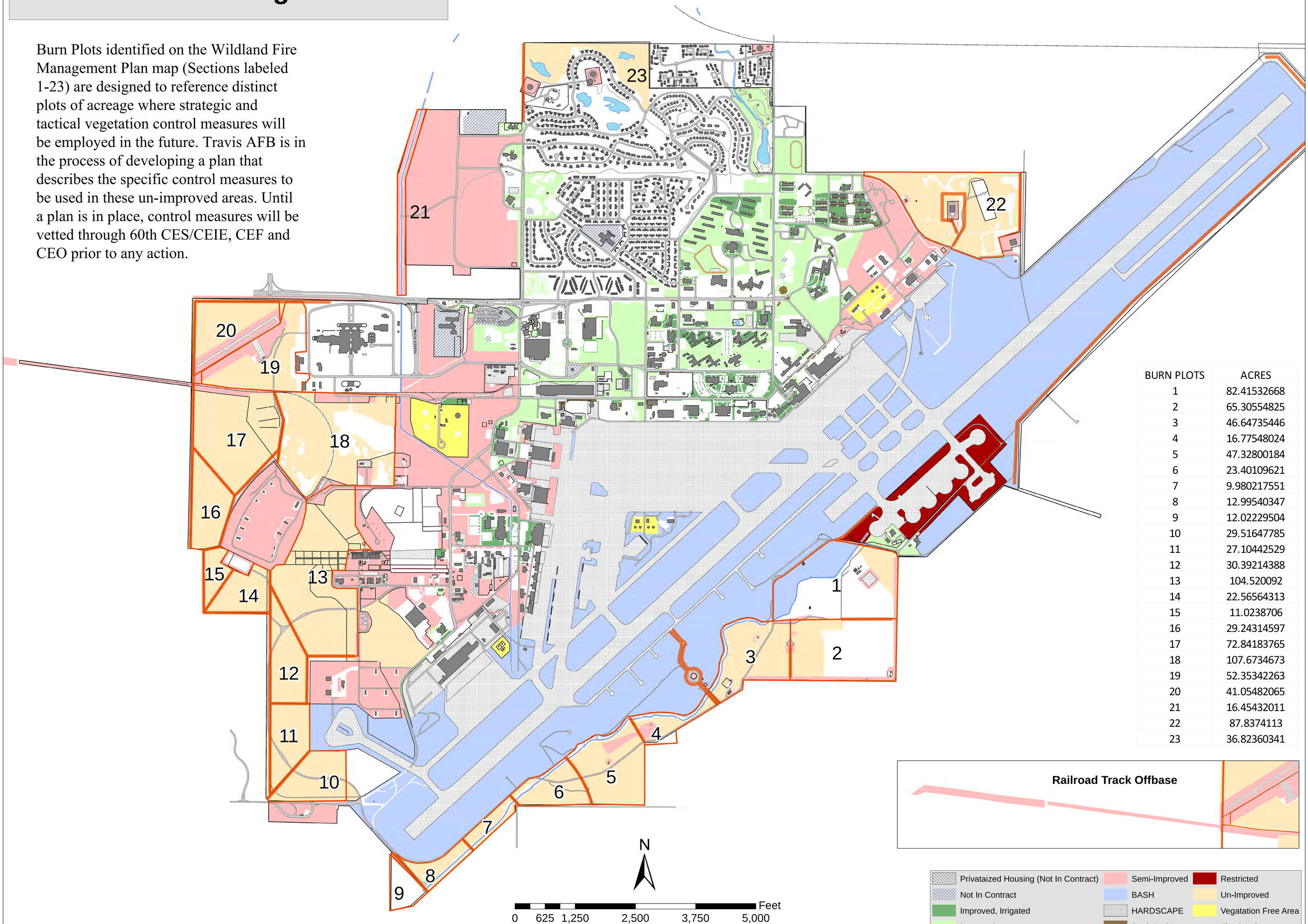
Wildland Fire Management Plan

Burn Plots identified on the Wildland Fire Management Plan map (Sections labeled 1-23) are designed to reference distinct plots of acreage where strategic and tactical vegetation control measures will be employed in the future. Travis AFB is in the process of developing a plan that describes the specific control measures to be used in these un-improved areas. Until a plan is in place, control measures will be vetted through 60th CES/CEIE, CEF and CEO prior to any action.



BURN PLOTS	ACRES
1	82.41532668
2	65.30554825
3	46.64735446
4	16.77548024
5	47.32800184
6	23.40109621
7	9.980217551
8	12.99540347
9	12.02229504
10	29.51647785
11	27.10442529
12	30.39214388
13	104.520092
14	22.56564313
15	11.0238706
16	29.24314597
17	72.84183765
18	107.6734673
19	52.35342263
20	41.05482065
21	16.45432011
22	87.8374113
23	36.82360341

- Privataized Housing (Not In Contract)
- Not In Contract
- Improved, Irrigated
- Improved
- Semi-Improved
- BASH
- HARDSCAPE
- Rock Bed Area
- Restricted
- Un-Improved
- Vegatation Free Area
- Fire Breaks
- Burn Plots

X:\CECT\PROJECTS\YEAR 2012\MAR 15 Wild Land Fire Management Map(SrA Bahia)

April 13, 2012

airfield areas account for another 1,500 acres that are not irrigated and could pose a wildfire threat once the grasses have dried in the summer and fall. The semi-improved grass height is maintained shorter than 10 inches under the maintenance contract. Grass heights in the airfield areas are maintained between 7 and 14 inches.

Vegetation management can reduce fuel loading but does not eliminate fire risk. Weather conditions have a major impact on fire behavior and must be taken into account when either fighting wildfires or conducting prescribed burns. Wind speeds in excess of 10 mph are common at TAFB. Prevailing winds are from the southwest, coming off of the San Francisco Bay, and bring air with higher relative humidity. During the spring, summer and fall, winds blowing over land from the north can be very strong and bring air that is much lower in relative humidity than the prevailing southwest winds. Air temperature is often much higher when the north winds blow bringing a very high risk of wildfire.

The BehavePlus fire model (Andrews 2011) was used to develop predictions of fire behavior for a range of fuel moisture values and wind speeds for the one-hour fuels found throughout most of the unimproved grounds on TAFB (Table 1). One-hour fuels are fine dead fuels whose moisture content reaches equilibrium with the surrounding atmosphere within an hour. This fuel type includes all dead herbaceous vegetation occurring on TAFB. A heading fire (a fire running with the wind) can exhibit extreme fire behavior (Table 1 (a), (b)) when fuel moisture is low and wind speeds are high. For example, a heading fire being driven by a 10 mph forecast wind in fuels with a fuel moisture content of 6%, a very common combination at TAFB, will travel 266 feet in one minute with flame lengths up to 7.5 feet.

A backing fire (fire spreading in the opposite direction of the wind) is often used during prescribed burn operations to maintain manageable fire behavior. Table 1 (c) and (d) show the surface spread and flame lengths associated with backing fires at various 1-hour fuel moisture and wind speeds combinations. For the same example given earlier (10 mph winds, 6% fuel moisture), a backing fire would only travel 8 feet per minute with maximum flame lengths reaching only 1.4 feet.

Table 1. Results of BehavePlus Fire Model

Runs include (a) the maximum surface rate of spread (chains/hour) for a heading fire; (b) the flame length (ft) for a heading fire; (c)) the maximum surface rate of spread (chains/hour) for a backing fire; and (d)) the flame length (ft) for a backing fire. Maximum wind speed was capped at 10 because model output remained unchanged above that speed for all but the 1% fuel moisture scenario.

(a) **Rate of spread** (ch/hr) for heading fire

1-hour Fuel Moisture (%)	Mid-flame Wind Speed (mph)									
	1	2	3	4	5	6	7	8	9	10
1	13.5	32.3	64.6	111.0	171.7	247.0	337.1	442.0	562.0	697.2
2	11	26.3	52.6	90.4	139.8	201.1	274.4	359.8	457.5	567.5
3	9.4	22.4	44.9	77.2	119.4	171.7	234.3	307.2	390.6	446.5
4	8.4	20.1	40.2	69.1	106.9	153.7	209.8	275.1	345.1	345.1
5	7.8	18.6	37.3	64.2	99.3	142.8	194.8	255.5	297.3	297.3
6	7.4	17.6	35.3	60.7	93.9	135.0	184.3	241.6	270.1	270.1
7	7.0	16.6	33.3	57.2	88.5	127.3	173.7	227.7	242.1	242.1
8	6.4	15.2	30.5	52.4	81.1	116.6	159.1	198.7	198.7	198.7
9	5.5	13.1	26.3	45.2	70.0	100.6	135.7	135.7	135.7	135.7
10	4.2	10.1	20.2	34.6	53.6	64.8	64.8	64.8	64.8	64.8

(b) **Flame length** (ft) for heading fire

1-hour Fuel Moisture (%)	Mid-flame Wind Speed (mph)									
	1	2	3	4	5	6	7	8	9	10
1	2.3	3.4	4.7	6.0	7.3	8.7	10.0	11.3	12.6	15.3
2	1.9	2.9	3.9	5.1	6.2	7.3	8.4	9.5	10.7	11.8
3	1.7	2.5	3.5	4.5	5.4	6.4	7.4	8.4	9.4	10.0
4	1.6	2.3	3.2	4.1	5.0	5.9	6.8	7.7	8.6	8.6
5	1.5	2.2	3.0	3.9	4.8	5.6	6.5	7.3	7.9	7.9
6	1.4	2.1	2.9	3.8	4.6	5.4	6.3	7.1	7.5	7.5
7	1.4	2.0	2.8	3.4	4.1	4.9	6.0	6.8	7.0	7.0
8	1.3	1.9	2.6	3.4	4.1	4.9	5.6	6.3	6.3	6.3
9	1.1	1.7	2.3	3.0	3.7	4.3	5.0	5.0	5.0	5.0
10	0.9	1.3	1.9	2.4	2.9	3.2	3.2	3.2	3.2	3.2

(c) **Rate of spread** (ch/hr) for a backing fire

1-hour Fuel Moisture (%)	Mid-flame Wind Speed (mph)									
	1	2	3	4	5	6	7	8	9	10
1	3.4	4.7	6.4	8.0	9.4	10.8	11.9	13.0	14.0	14.8
2	2.7	3.8	5.2	6.5	7.7	8.8	9.7	10.6	11.4	12.1
3	2.3	3.3	4.4	5.5	6.6	7.5	8.3	9.0	9.7	10.1
4	2.1	2.9	4.0	5.0	5.9	6.7	7.4	8.1	8.7	8.7
5	2.0	2.7	3.7	4.9	5.5	6.2	6.9	7.5	7.9	7.9
6	1.8	2.6	3.5	4.4	5.2	5.9	6.5	7.1	7.4	7.4
7	1.7	2.4	3.3	4.1	4.9	5.5	6.2	6.7	6.8	6.8
8	1.6	2.2	3.0	3.8	4.5	5.1	5.6	6.1	6.1	6.1
9	1.4	1.9	2.6	3.2	3.8	4.4	4.8	4.8	4.8	4.8
10	1.1	1.5	2.0	2.5	2.9	3.2	3.2	3.2	3.2	3.2

TABLE 1. (continued)

(d) **Flame length** (ft) for a backing fire

1-hour Fuel Moisture (%)	Mid-flame Wind Speed (mph)									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	1.2	1.4	1.6	1.8	1.9	2.0	2.1	2.2	2.3	2.4
2	1.0	1.2	1.4	1.5	1.6	1.7	1.8	1.9	1.9	2.0
3	0.9	1.0	1.2	1.3	1.4	1.5	1.6	1.7	1.7	1.7
4	0.8	1.0	1.1	1.2	1.3	1.4	1.5	1.5	1.6	1.6
5	0.8	0.9	1.0	1.2	1.3	1.3	1.4	1.5	1.5	1.5
6	0.8	0.9	1.0	1.1	1.2	1.3	1.3	1.4	1.4	1.4
7	0.7	0.8	1.0	1.1	1.2	1.2	1.3	1.3	1.4	1.4
8	0.7	0.8	0.9	1.0	1.1	1.2	1.2	1.3	1.3	1.3
9	0.6	0.7	0.8	0.9	1.0	1.0	1.1	1.1	1.1	1.1
10	0.5	0.6	0.6	0.7	0.8	0.8	0.8	0.8	0.8	0.8

Section 11. Monitoring Requirements

At a minimum, monitoring of wildfires will include mapping the burned area with a GPS unit or from aerial photos and recording the habitat types impacted by the fire including any impacts to wildlife. A qualitative assessment of habitat condition will be conducted the year following the burn during the spring to assess vegetation recovery with special emphasis on any vernal pool habitat impacted and any signs of non-native species invasion. If during the qualitative assessment, negative impacts are recorded, a more detailed assessment should be conducted to quantify those impacts. Potential restoration or rehabilitation efforts should be based on the results of the quantitative assessment.

Prescribed burns are conducted to achieve specific objectives and will include follow-up monitoring to assess whether the objectives have been met. Specific natural resource management objectives may include: reduce non-native grass cover, particularly medusahead grass in the grasslands and vernal pools; increase native plant species diversity in and around the vernal pools; and reduce the risk of wildfire by consuming flashy fuels and reducing accumulated thatch. The burned area should be monitored the spring following the fire to determine whether these objectives have been met.

Section 12. Public Relations

The 60th Air Mobility Wing Public Affairs Office will issue all official statements regarding wildland fire events at Travis AFB. Information dissemination will originate from the Incident Commander to the Emergency Operations Center (EOC) or directly to the public affairs official that may be present during incident stabilization or prescribed fires. Installation notification procedures are still being developed for prescribed burns. Additional guidance for establishing a Public Information Officer to work within the AFIMS construct is described in AFI 10-2502 *Air Force Incident Management Guidance for Major Accidents and Natural Disasters*.

Section 13. Funding Requirements

Various sources of funding may be used to fund the wildland fire management activities outlined in this plan depending on the activity being conducted. Consult http://www.baaqmd.gov/ for permit requirements and fees associated with burning agricultural land.

AFI 32-7064 (USAF 2004) establishes the following guidance for funding wildland fire activities:

1. Wildland fire management activities that are conducted for the purpose of compliance with environmental laws and regulations will be supported by conservation funds.
2. Wildfire suppression, prescribed burning and other wildland fire management activities to support training, range use, munitions testing and evaluation, or other mission activity will be supported by the responsible activity through direct funding or reimbursement.
3. Funding for wildfire prevention and fuels management for hazard reduction is an installation operations and maintenance responsibility.

Section 14. Personnel Training and Certification Standards

Certification of individuals involved in activities that support implementation of this plan will depend on their level of involvement in the wildland fire organization. All Air Force personnel actively involved in wildland firefighting activities will meet the applicable NFPA or NWCG standards, AF, National, or state accreditation standards for those activities. All Firefighter training will be conducted in accordance with the Air Force Career Field Education Training Plan (CFETP) and Air Force Civil Engineer Center (AFCEC) guidelines.

DoD personnel participating in wildland firefighting activities will be trained in one of three ways:

- DoD Firefighter Certification System (FFCS): Wildland Firefighter I (CDC 10511W) Minimum requirement synonymous with duties outlined for AFSC 3E731, 3E751 Firefighter or Driver/Operator duty position. Additionally, Wildland Firefighter II (CDC 10512W) will be a requirement synonymous with the duties of the AFSC 3E771 Lead Firefighter/ Crew Chief duty position. It should be noted that the AFSC 3E731 firefighter or 3E751 Driver operator are not limited to the Wildland Firefighter I certification level alone and may advance to the Wildland Firefighter II level if desired. However, the AFSC 3E771, Lead Firefighter, Crew Chief must obtain the higher certification level to meet the responsibilities of the Wildland Firefighter II and duty position held. Verification of certification completion can be reviewed at http://www.dodffcert.com/ (D. Richert, personal communication, March 23, 2012).
- California State "Red Card" Certification: Firefighters have the option to become trained and certified under the California State Fire Marshal

system. Typically referred to as a "Red Card", it is a method of credential verification of attending prescribed training. The combination of that prescribed training is based on the jurisdiction but will contain the following California State Approved and delivered curriculum as follows:

- I-200, ICS for Single Resources and Initial Action Incidents
- S-190, Introduction to Wildland Fire Behavior
- S-130, Firefighter Training
- S-131, Advanced Firefighter Training
- S-234, Ignition Operations Course

- NWCG (National Wildfire Coordination Group): NWCG is a nationally recognized organization in the wildland certification realm, as they have produced most of the training curriculum that all other agencies utilize, they are recognized at state level where another certification body exists. Federal agencies have consolidated minimum standards and information for frequently used positions not included in PMS 310-1. The *Qualifications Supplement to NWCG PMS 310-1* can be found at the NWCG Qualifications Document Web site http://www.nwcg.gov/pms/docs/docs.htm. Position qualification can vary but will follow the minimum for certification applicable to TFES:
  - Firefighter Type 1 (FFT1)
  - Firefighter Type 2 (FFT2)
  - Crew Boss, Single Resource (CRWB)
  - Engine Boss, Single Resource (ENGB)
  - Firing Boss, Single Resource (FIRB)
  - Prescribed Fire Burn Boss Type 1 (RXB1)
  - Prescribed Fire Burn Boss Type 2 (RXB2)
  - Prescribed Fire Manager Type 1 (RXM1)
  - Prescribed Fire Manager Type 2 (RXM2)
  - Structure Protection Specialist (STPS)

TFES recognizes and encourages the aforementioned training and certification resources as a stand-alone. Notably, the DoD Wildland Firefighter I and II courses are relatively new in development and delivery therefore creating a redundancy in training and certification. Currently AFCEC does not recognize State or National levels of certification, by means of reciprocity, extended from the DOD Firefighter Certification System. The complete transition to the DOD system for these two courses will take considerable time and energy. However, TFES Mutual Aid partnerships in the Solano Co. region tend to have responders trained and certified under the California System of "Red Card", typically delivered via NWCG curriculum. Therefore, there is an inherent benefit to complete State and National certifications alike. Naturally, additional levels of training within all three certification branches are available for duty specific positions and are always great additions to the TFES knowledge base.

Annual refresher training will consist of training on Lookouts, Communications, Escape Routes and Safety Zones (LCES), fire shelter training, local protocols, lessons learned,

and basic firefighter training requirements outlined in AFI 32-2001 FESAP (FES Annual Plan 2013). RT-130 is standard training.

Section 15. Environmental Impact Analysis Process

Actions proposed in this Plan may constitute a major federal action as defined in 40 CFR Part 1508.18(b)(2). Major federal actions must be evaluated for potential environmental effects in accordance with 32 CFR Part 989 (AFI 32-7064 2004).

Section 16. Fire Breaks

Travis AFB has historically maintained firebreaks along perimeter fence areas, fire training areas, explosives ordnance ranges, and high fire risk areas and assets. Fire breaks are maintained by disking and mowing depending on terrain and environmental conditions. Disking of firebreaks typically begins in mid-March and continues until mid-May while some soil moisture remains to reduce dust in compliance with air quality standards. Fire breaks near vernal pools are required to be mowed since disking is considered a regulated activity under Section 404 of the Clean water Act, requiring a permit from the US Army Corp of Engineers.

Firebreak maintenance is currently accomplished by the 60th Civil Engineer Squadron Operations Flight. Figure 1 shows the current fire break configuration on TAFB. While disking is the primary method for creating fire breaks, other methods that reduce fuel loads may include mowing, grading, herbicide treatment, prescribed fire, and improving or expanding existing roads and shoulders.

A primary goal for the Wildland Fire Management Program is to reduce the extent of firebreaks maintained on TAFB. Firebreaks are expensive to maintain and can damage critical habitat for a number of species including those listed as threatened and endangered. Of particular concern is the impact of disking or grading on vernal pools and the surrounding grassland habitat which provides upland nesting habitat for CTS and the Western burrowing owl. Approximately 50-75 percent of the grassland habitat on base is considered by the USFWS to be potential nesting habitat for CTS and therefore requires consultation when ground disturbance is proposed. The Travis AFB INRMP (TAFB 2013) has additional information about these species, their habitat requirements and associated regulatory issues.

An evaluation of the existing historical firebreak configuration was performed in May 2013 by 60 CES Operations and Asset Management personnel. A major change in the grounds maintenance contract in 2013 allows for the mowing of nearly all semi-improved and unimproved areas on Base. This will reduce fuel loads significantly. For 2013 and beyond, the width of the disked firebreaks will be reduced to 20-30 feet (two passes). The disked breaks will be harrowed to smooth out the soil so the areas can be mowed rather than disked in the future. Elimination of the majority of disking on Base will save the Air Force a significant amount of money and will reduce negative impacts to the CTS.

Section 17. References

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APPENDIX A.

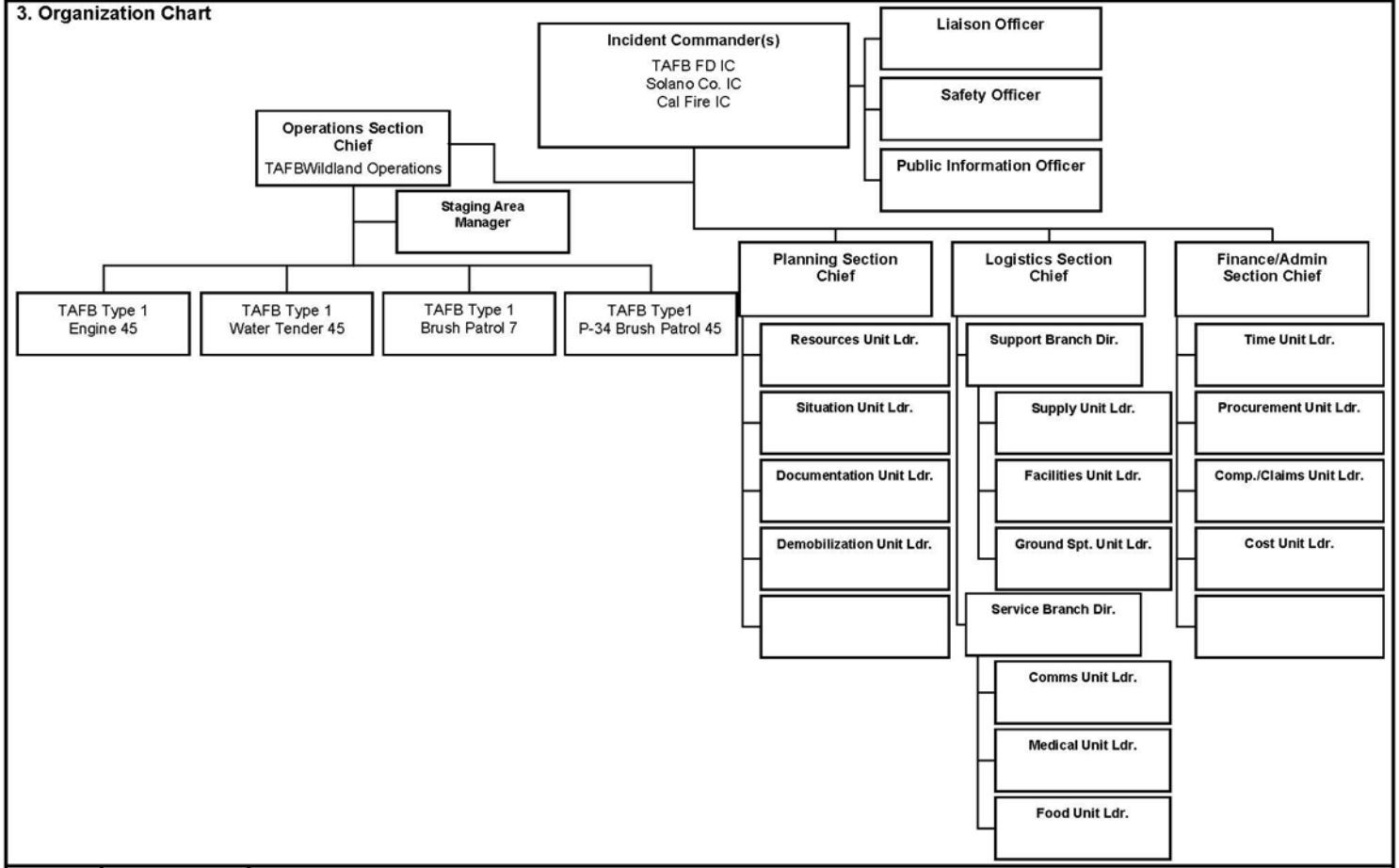
INCIDENT ORGANIZATION CHART (ICS 207)

INCIDENT ORGANIZATION CHART (ICS 207)

1. Incident Name:

2. Operational Period: Date From: Date To:
Time From: Time To:

3. Organization Chart



ICS 207	IAP Page ___	**4. Prepared by:** Name:_____ Position/Title: _____ Signature: _____ Date/Time: _____

APPENDIX B.

MUTUAL AID AGREEMENT AND MATRIX

COUNTY OF SOLANO

FIRE AND RESCUE OPERATIONAL AREA

MUTUAL AID AGREEMENT

1996

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DEFINITION AND TERMS

AUTOMATIC AID

An obligatory form of mutual aid, based on a written or verbal agreement, whereby one or more fire agencies will provide immediate response of resources to an emergency incident within the jurisdiction of another fire agency.

ALTERNATIVE FIRE AND RESCUE COORDINATOR

A Solano County chief fire officer, recommended by the Operational Area Fire and Rescue Coordinator, and approved by the Fire Chiefs of Solano County, who will serve as an alternate to said Fire and Rescue Coordinator.

DISPATCHING

The use of protocol lists, by Solano County Dispatch, to select the proper agency and type and kind of fire fighting apparatus, to fill the mutual aid request of a party to a mutual aid agreement.

FIRE AND RESCUE COORDINATOR

A Solano County chief fire officer, selected by the Fire Chiefs of Solano County, to carry out the functions of the Office of Emergency Services Operational Area Fire and Rescue Coordinator. Specific responsibilities are outlined in *Election Process, Region and Operational Area Fire and Rescue Coordinators.* pp. 3,4, California Office of Emergency Services, 3/89.

IMMEDIATE NEED

A request for resources requiring a Code 3 response (red lights and siren).

INCIDENT COMMANDER

The fire authority member responsible for the overall management of an incident.

INCIDENT COMMAND SYSTEM

A management model for dealing with emergencies, from a single resource incident to complex incident(s). The basis of the model is its ability to expand as an incident intensifies either by growth of the emergency itself or expanding into other jurisdictions.

MUTUAL AID

An agreement in which two or more parties agree to furnish resources and facilities and to render services to each and every other party of the agreement to prevent and combat any type of disaster or emergency.

OPERATIONAL AREA

An immediate level of the state fire and rescue organization, normally consisting of a county and all fire and rescue organizations within the county.

REQUESTING FIRE OFFICIAL

Any member of an agency that is a party to this agreement and is authorized to request mutual aid resources.

RESOURCES

Any personnel, apparatus, and equipment under the control of a party to this Agreement.

STANDARDIZED EMERGENCY MANAGEMENT SYSTEM

A recommendation, pursuant to Government Code Section 8607, to include in disaster plans and mutual aid agreements, a standardized response operation, specifically the use of the Incident Command System.

COUNTY OF SOLANO

FIRE AND RESCUE OPERATIONAL AREA
MUTUAL AID AGREEMENT

THIS AGREEMENT is made this____day of _____, 1996 by and between The CITY OF BENICIA, the CITY OF DIXON, the CITY OF FAIRFIELD, the CITY OF RIO VISTA, the CITY OF SUISUN CITY, the CITY OF VACAVILLE, and the CITY OF VALLEJO, all municipal corporations, organized and existing under and by virtue of the laws of the State of California; the COUNTY OF SOLANO, the AMERICAN CANYON FIRE PROTECTION DISTRICT, the CALIFORNIA MEDICAL FACILITY FIRE DEPARTMENT, the CORDELIA FIRE PROTECTION DISTRICT, the DELTA FIRE PROTECTION DISTRICT, the EXXON BENICIA REFINERY FIRE DEPARTMENT, the GORDON VALLEY FIRE DEPARTMENT, the MONTEZUMA FIRE PROTECTION DISTRICT, the RYER ISLAND FIRE PROTECTION DISTRICT, the SUISUN FIRE PROTECTION DISTRICT, the VACAVILLE FIRE PROTECTION DISTRICT, and the CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION, all organized and existing under and by virtue of the laws of the State of California; and the SECRETARY OF THE AIR FORCE (Travis Air Force Base) acting pursuant to the authority of 42 U.S.C. (1856)(a).

ARTICLE I

A. INTRODUCTION

The Solano County fire service has benefited from a strong and coordinated mutual aid system. Historically, Solano County's mutual aid system was one of the first of its type. As such, our county system (1975 edition of the agreement) was modeled as Appendix A in Charles W. Bahme's *Fire Officers Guide to Disaster Control*, (National Fire Protection Association, 1978, pp. 351.).

Solano County fire services have used mutual aid when fires have exceeded the capability of any single jurisdiction. Mutual aid planning and activation is a component of agency disaster plans and is incorporated by intent, through legislative action, by Government Code section 8607.

Further, the parties hereto are geographically located in proximity to each other and mutual assistance is of value.

ARTICLE II

A. BENEFIT

It is to the mutual advantage and benefit of the parties hereto that each of the other parties agree to render supplemental fire and rescue assistance when so requested. Should an event in any jurisdiction develop or appear to develop to a magnitude that immediate control by a single jurisdiction is inadequate, the forces of one or more of the parties hereto may be called to assist.

B. PURPOSE

The specific purpose of this agreement is to provide for the mutual aid coordination, organization, activation, mobilization, operation, and de-mobilization of fire protection, rescue resources, and first responder basic life support resources of the parties hereto; to be prepared to accept and utilize out-of-county resources as well as to provide mutual aid resources to other counties.

ARTICLE III

A. REFERENCES

1) Agreement for Day-to-Day Mutual Aid, Solano County (July 1959).

2) Amendment to Agreement for Day-to-Day Mutual Aid, Solano County (August 1959).

3) Solano County Emergency Services Ordinance #1192, January 1983.

4) Solano County Multi-Hazard Function Plan.

5) California Fire Service and Rescue Emergency Mutual Aid Plan, June 1978.

6) California Emergency Services Act (California Government Code, Section 8550, et seq.).

7) California Master Mutual Aid Agreement, revised September 1988.

ARTICLE IV

A. CONSIDERATION

The consideration under this Agreement is the mutual advantage of protection afforded to each of the parties under this Agreement. There shall not be any monetary compensation required from any party to another party as a condition of assistance provided under this Agreement. A party to this agreement requesting mutual aid and directly benefiting from the additional resources and manpower provided by those parties to the Agreement responding to the mutual aid request, shall indemnify, hold harmless, protect and defend, the responding parties, its officers, agents and employees, and volunteers from all claims, suits, actions or other proceedings of every kind and description, brought forth on account of injuries to or death of any person or damage to property which may arise as a result of the party's performance of this Agreement, including the negligence of the responding party. No party to this agreement nor any other person(s) shall have any right or cause of action because of loss by fire or rescue by reason of this agreement or any term thereof.

B. INSURANCE

The parties hereto agree that each shall bear sole responsibility for providing liability and workers' compensation insurance coverage for all of its paid and volunteer fire fighters performing services under this agreement. It is understood that each party's employees have no rights, benefits or special employment status conferred by reason of this Agreement.

ARTICLE V

A. STANDARDIZED EMERGENCY MANAGEMENT SYSTEM

California Code of Regulations, Title 19, Division 2, Office of Emergency Services, Standardized Emergency Management System shall regulate Operational Area Fire and Rescue response and recovery procedures. The Solano County Fire and Rescue system shall utilize the Incident Command System as the primary method and criteria used to conduct Operational Area Fire and Rescue operations. A Solano County Chief Fire Officer, selected by the Solano County Fire Chiefs, shall serve as the Operational Area Fire and Rescue Coordinator in matters affecting mutual aid requests and resource management.

B. ACTIVATION OF AGREEMENT

The provisions of the Agreement shall be invoked only when, in the opinion of the appropriate requesting fire official or his/her duly authorized representative, local resources have been exhausted.

C. STANDARDIZED DISPATCHING

Requests for mutual aid shall be initiated through Solano County Dispatch by an authorized representative of a participating agency. Upon receipt of such a request, Solano County Dispatch personnel shall notify requested agencies utilizing prearranged protocols provided by parties to this Agreement.

D. NOTIFICATION

The Operational Area Fire and Rescue Coordinator or his/her alternates, shall be advised by Solano County Dispatch of all mutual aid request(s) when a State of California Office of Emergency Services engine is dispatched. Further, notification shall be provided when two or more mutual aid units are dispatched to any requesting agency.

E. IMMEDIATE NEED

Any party to this agreement may request immediate need mutual aid from an adjoining fire jurisdiction which is a party to this Agreement or who is a party to a separate agreement between the requesting and responding agencies. It shall be the responsibility of the requesting agency to notify Solano County Dispatch immediately when this type of request is made.

F. AUTOMATIC AID

Nothing in this Agreement shall prevent any party from contracting for Automatic Aid with any another party or parties. When developing Automatic Aid agreements, care should be exercised to ensure that the overall benefits of an area wide mutual aid plan are not compromised.

ARTICLE VI

A. JURISDICTIONAL RESPONSIBILITY

It is understood and agreed that this Agreement does not relieve any of the parties hereto from the necessity and obligation of providing adequate fire protection within their own jurisdictions. Each party agrees that it shall be diligent in maintaining fire protection resources under its control within accepted safety standards and requirements.

B. THIRD PARTY CLAUSE

This Agreement is exclusive to the parties and shall not be construed as, or deemed to be, an Agreement for the benefit of any third party or parties not subject to this agreement, and no third party or parties shall have any right of action hereunder for any cause

whatsoever. Any services performed or expenditures made in connection with furnishing mutual aid under this Agreement by any party hereto shall be conclusively deemed to be for the direct protection and benefit of the inhabitants and property of such party.

ARTICLE VII

A. FURNISHING AID

When a local emergency cannot be met with the equipment and personnel of any party hereto, that party may request from the other parties to this Agreement, equipment and personnel to deal with said emergency. Agencies furnishing aid to the requesting party agree their resources may be used as active participants in mitigating the emergency or providing emergency stand-by services. Private fire departments under this agreement will provide resources (equipment and the supporting personnel) but the personnel will not engage in a managerial capacity or advise on strategic or tactical operational decisions.

B. RESOURCE CAPABILITY

No party to this agreement shall be required to meet a mutual aid request if that party's personnel or resources would be unable to meet their own fire protection needs if said request was filled.

C. CONTROL OF RESOURCES

Responding mutual aid units will come under the direction of the Incident Commander within whose jurisdiction the emergency has occurred. However, the providing jurisdiction shall supervise and direct their own personnel and equipment as far as is possible.

D. BALANCE OF RESOURCES

The Solano County Operational Area Fire and Rescue Coordinator or his/her alternate, shall attempt to ensure that equipment and personnel are not requested in such a manner that any party hereto would be unable to respond to an emergency arising within their own jurisdiction. Resources will be dispatched so no part of Solano County is without adequate resources or the ability to meet other request for assistance if so needed. It shall be the responding agency's(ies) responsibility to assure that their agency(ies) has/have adequate resources remaining

E. AIRCRAFT - MILITARY OR FOREIGN NATIONS

In the event of a crash of aircraft owned or operated by the United States or military aircraft of any foreign nation within the area to which the parties to the Agreement

or his/her representative may, under certain limited situations, assume full command on arrival at the scene of the crash. Parties hereto may claim reimbursement for the direct expenses and losses which are additional firefighting costs above the normal operating cost incurred while fighting such aircraft fire as provided in 44 C.F.R., Part 151.

F. ADDITIONAL RESOURCES

When the resources of Solano County fire agencies are so committed that further mutual aid requests within the county would be unanswered, the Solano County Operational Area Fire and Rescue Coordinator will advise the Regional Fire and Rescue Coordinator. Provisions will be made for out-of-county resources to be dispatched for in-county use or for stand-by should their use be needed within Solano County.

G. RELEASE OF RESOURCES

Resources of responding agencies shall be released when their services are no longer necessary or if recalled by their agency because of a local emergency.

ARTICLE VIII

A. AGREEMENT PARTICIPATION

Any public or private agency possessing fire protection resources that desires to become a party to this Agreement may submit a written application to the Solano-Napa County Fire Chiefs' Association. Said Association shall in turn notify all the parties to the Agreement of said application and shall forward it to the Solano County Operational Area Fire and Rescue Coordinator. If no party to this Agreement files a written Notice of Disapproval with said Coordinator within thirty (30) days from the date of receipt of the written application, said agency applicant shall become a party to this Agreement and amendments thereto. In the event any party to said agreement, for valid reasons, files a written Notice of Disapproval, supported by a majority of the parties of this Agreement during a regularly scheduled meeting of the Solano-Napa County Fire Chiefs' Association, said applicant shall be deemed denied.

B. TERM OF AGREEMENT

The Agreement shall be effective from the date it is executed until it is rescinded by a formal agreement. This Agreement may be terminated at any time by agreement of a majority of the parties. Any party to this Agreement may withdraw as a party to this Agreement prior to the termination of this Agreement upon giving thirty (30) calendar days written notice to the other parties. Notice shall be deemed to have been given three days after such notice is posted by first class U.S. Mail, or alternatively, sent by confirmed facsimile to each existing party to this Agreement.

C. APPLICABLE IMMUNITIES

Nothing in this agreement shall be deemed to replace, revoke, change or interfere with any of the immunities for fire and other emergency related activities to which the parties hereto are entitled.

IN WITNESS WHEREOF THE PARTIES HERETO HAVE EXECUTED THIS AGREEMENT AS FOLLOWS:

CITY OF BENICIA

Attest: _____
Clerk, City of Benicia

By: _____
City Manager, City of Benicia

CITY OF DIXON

Attest: _____
Clerk, City of Dixon

By: _____
Mayor, City of Dixon

CITY OF FAIRFIELD

Attest: _____
Clerk, City of Fairfield

By: _____
Mayor, City of Fairfield

CITY OF RIO VISTA

Attest: _____
Clerk, City of Rio Vista

By: _____
Mayor, City of Rio Vista

CITY OF SUISUN CITY

Attest: _____
Clerk, City of Suisun City

By: _____
Mayor, City of Suisun City

CITY OF VACAVILLE

Attest: _____
Clerk, City of Vacaville

By: _____
Mayor, City of Vacaville

CITY OF VALLEJO

Attest: _____
Clerk, City of Vallejo

By: _____
Mayor, City of Vallejo

COUNTY OF SOLANO

By:_____
Chairperson, Board of Supervisors

Attest:_____
Clerk, Solano County Board of Supervisors

AMERICAN CANYON FIRE PROTECTION DISTRICT

By: Ben Anderson
Chairperson, Board of Directors/ Commissioners, American Canyon Fire Protection District

Attest: [signature]
Clerk, American Canyon Fire Protection District

CORDELIA FIRE PROTECTION DISTRICT

By: L. L. Rivera
Chairperson, Board of Directors/ Commissioners, Cordelia Fire Protection District

Attest: [signature]
Clerk, Cordelia Fire Protection District

DELTA FIRE PROTECTION DISTRICT

By:_____
Chairperson, Board of Directors/ Commissioners, Delta Fire Protection District

Attest:_____
Clerk, Delta Fire Protection District

EXXON BENICIA REFINERY FIRE DEPARTMENT

By: [signature]
EXXON COMPANY U.S.A.
(a division of Exxon Corporation)

NAPA COUNTY FIRE DEPARTMENT
[MORGAN VALLEY FIRE DEPT.]

By: [signature]
Chairperson, Board of Supervisors
For Napa County Fire Department

Attest: Teri Sisson, Deputy
Clerk, Napa County Board of Supervisors

APPROVED JAN 21 1997
BOARD OF SUPERVISORS
COUNTY OF NAPA

MARY JEAN MCLAUGHLIN
CLERK OF THE BOARD

BY Michelle Price Deputy

APPROVED AS TO FORM
Office of County Counsel
By: [signature]
Date: January 8, 1997

MONTEZUMA FIRE PROTECTION DISTRICT

By: _____
Chairperson, Board of Directors/ Commissioners, Montezuma Fire Protection District

Attest: _____
Clerk, Montezuma Fire Protection District

RYER ISLAND FIRE PROTECTION DISTRICT

By: _____
Chairperson, Board of Directors/ Commissioners, Ryer Island Fire Protection District

Attest: _____
Clerk, Ryer Island Fire Protection District

SUISUN FIRE PROTECTION DISTRICT

By: _____
Chairperson, Board of Directors/ Commissioners, Suisun Fire Protection District

Attest: _____
Clerk, Suisun Fire Protection District

VACAVILLE FIRE PROTECTION DISTRICT

By: _____
Chairperson, Board of Directors/ Commissioners, Vacaville Fire Protection District

Attest: _____
Clerk, Vacaville Fire Protection District

CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION

By: _____
Chief, Napa-Lake Ranager Unit California Department of Forestry and Fire Protection

CALIFORNIA MEDICAL FACILITY FIRE DEPARTMENT

By: _____
Warden, California Medical Facility

TRAVIS AIR FORCE BASE
FIRE DEPARTMENT

By: _____
Commander, Travis Air Force Base
For the Secretary of the Air Force

-END OF DOCUMENT-

The Fire Chiefs of Solano County have reviewed on 14 February 2008 the 1996 Mutual Aid Agreement and agree it is still in effect. We further add that the Valero Benicia Oil Refinery Fire Department and the Travis Air Force Base Fire Department Fire Department although not mentioned by name in the original 1996 document stand by this document. Travis was a signatory to the 1996 agreement and Valero stands by the commitment made by Exxon in 1996 as reaffirmed by the Valero Fire Chief's signature.

IN WITNESS WHEREOF THE PARTIES HERETO HAVE EXECUTED THIS AGREEMENT AS FOLLOWS:

AMERICAN CANYON FIRE DEPARTMENT

Signature: _____

BENECIA FIRE DEPARTMENT

Signature: _____

CALIFORNIA DEPARTMENT OF FORESTRY DEPARTMENT/ CAL FIRE

Signature: _____

CALIFORNIA MEDICAL FACILITY FIRE DEPARTMENT

Signature: _____

CORDELIA FIRE DEPARTMENT

Signature: _____

DELTA FIRE DEPARTMENT

Signature: _____

DIXON FIRE DEPARTMENT

Signature: _____

FAIRFIELD FIRE DEPARTMENT

Signature: _____

MONTEZUMA FIRE DEPARTMENT

Signature: _____

RIO VISTA FIRE DEPARTMENT

Signature: _____

SUISUN CITY FIRE DEPARTMENT

Signature: _____

SUISUN DISTRICT FIRE DEPARTMENT

Signature: _____

TRAVIS AIR FORCE BASE FIRE DEPARTMENT

Signature: _____

VACAVILLE FIRE DEPARTMENT

Signature: _____

VACAVILLE FIRE PROTECTION DISTRICT

Signature: _____

VALLEJO FIRE DEPARTMENT

Signature: _____

VALERO BENECIA OIL REFINERY FIRE DEPARTMENT

Signature: _____ FIRE CHIEF

END OF DOCUMENT

The Fire Chiefs of Solano County and neighboring Sacramento County have reviewed on 6 August 2009 the 1996 Mutual Aid Agreement and agree it is still in effect. In addition the Fire Department's of Isleton and River Delta agree to participate in this Mutual Aid agreement and abide by the terms of it.

IN WITNESS WHEREOF THE PARTIES HERETO HAVE EXECUTED THIS AGREEMENT AS FOLLOWS:

Attest: _____

ISLETON FIRE DEPARTMENT

Attest: _____

RIVER DELTA FIRE DEPARTMENT

STAFF SUMMARY SHEET GARLAND, CATT, CCE

	To	Action	Signature (Surname), Grade, Date		To	Action	Signature (Surname), Grade, Date
1	60 AMW/JA	Coord	Previous	6	349 AMW/CC	Info	Brig Gen Miller 2 Jul 09
2	60 MSG/CD	Coord	Coord given	7	60 AMW/CC	Sign	06/8 JUL09
3	60 MSG/CC	Coord	but original SSS lost	8			
4	60 AMW/DS	Coord		9			
5	60 AMW/CV	Info		10			

Grade and Surname of Action Officer	Office Symbol	Phone	Suspense Date
YN-02 John A. Speakman	60 CES/CEF	4-0850	9 May 2009

Subject	SSS Date
Memorandum of Agreement for Automatic Response	8 April 2009

Summary

1. **PURPOSE:** Obtain 60 AMW/CC approval and signature on proposed Memorandum of Agreement document at Tab 1.

2. **BACKGROUND:** Currently, Travis Fire Emergency Services (TFES) has in-place Mutual-aid Agreements with several of the local Emergency Services Organizations (ESO) neighboring the base including Vacaville Fire Protection District. Under these agreements, emergency response from TFES is not automatic. An ESO would have to request that TFES respond to an emergency off base.

3. **DISCUSSION:** The proposed Memorandum of Agreement will allow TFES to respond to the area of North Gate Rd; Canon Rd from North Gate Rd to Vanden Rd; Vanden Rd from Canon Rd to Peabody Rd; McCrory Rd to Meridian Rd and Meridian Rd to the Cypress Lakes Golf Course automatically. TFES will initially be requested by Solano dispatch along with Vacaville Fire Protection District when an emergency is reported pertaining to this area. This will eliminate the delay caused by the ESO having to request assistance from TFES. This agreement will provide TFES improved opportunities to prevent fire spread onto Travis AFB as manifested by the August 2008 Wild Land Urban Interface Fire. Additionally, it will provide improved fire protection to this area of the local community in which many vehicle accidents involve personnel assigned to Travis AFB.

4. **RECOMMENDATION:** 60 AMW/CC approve and sign the proposed Memorandum of Agreement document at Tab 1.

D. WADE LAWRENCE, Lt Col, USAF
Commander, 60th Civil Engineer Squadron

1 Tab
Memorandum of Agreement for Automatic Response

DEPARTMENT OF THE AIR FORCE
60TH AIR MOBILITY WING (AMC)

This agreement, entered into this 1st day of Jan 2009, between the Secretary of the Air Force acting pursuant to the authority of 42 U.S.C. 1856a and Vacaville Fire Protection District is securing to each the benefits of automatic aid in fire incident response, in the protection of life and property from fire, hazardous materials incident and in fire fighting. This agreement will cover the area of North Gate Road, Canon Road from North Gate to Vanden Roads and McCrory and Meridan Roads to the Cypress Lakes Golf Course.

It is agreed that:

a. On request to a representative of the Travis Air Force Base fire department by a representative of the Vacaville Fire Protection District (through Solano County Dispatch), firefighting equipment and personnel of the Travis Air Force base fire department will be dispatched to any point within the area for which the Vacaville Fire Protection District normally provides fire protection incident response as designated by the representatives of the Vacaville Fire Protection District and the area that is listed above.

b. Any dispatch of equipment and personnel pursuant to this agreement is subject to the following conditions:

(1) Any request for aid hereunder shall include a statement of the amount and type of equipment and personnel requested and shall specify the location to which the equipment and personnel are to be dispatched, but the amount and type of equipment and the number of personnel to be furnished shall be determined by a representative of the responding organization.

(2) The responding organization shall report to the officer in charge of the requesting organization at the location to which the equipment is dispatched, and shall be subject to the orders of that official or both organizations will operate under a Unified Command.

(3) The responding organization shall be released by the requesting organization when the services of the responding organization are no longer required or when the responding organization is needed within the area for which it normally provides fire protection.

(4) In the event of a crash of an aircraft owned or operated by the United States or military aircraft of any foreign nation within the area for which the Vacaville Fire Protection District normally provides fire protection, the chief of the Travis Air Force Base fire department or his or her representative may assume full command on arrival at the scene of the crash.

(5) Where local agencies do not assign an incident safety officer, an Air Force representative will be assigned to act as the incident safety officer for Travis Air Force Base to observe Air Force operations.

c. Both parties agree to implement the National Incident Management System during all emergency responses on and off installations in accordance with NFPA 1561.

d. Each party waives all claims against every other party for compensation for any loss, damage, personal injury, or death occurring as a consequence of the performance of this agreement.

e. All equipment used by Travis Air Force Base in carrying out this agreement will, at the time of action hereunder, be owned by it; and all personnel acting for Travis Fire Department under this agreement will, at the time of such action, be an employee of Travis Air Force Base.

For Vacaville Fire Protection District

HOWARD WOOD, Fire Chief
Vacaville Fire Protection District

For the Secretary of the United States Air Force

MARK C. DILLON, Colonel, USAF
Commander

TRAVIS FIRE DEPARTMENT
STRUCTURE FIRE

REVISED 01/2014

ALARM	ENGINE	TRUCK	SQUAD	WILDLAND	TENDER	CHIEF OFFICER	SPEC CALL
FIRST	**TRV E 45**				**TRV WT 45**	**TRV 45A1**	
	TRV E 46					**TRV 45 A2**	
STATION COVERAGE		**TRV T 46**					
NOTES	**GENERAL FIRE DEPARTMENT RECALL**						
SECOND	**FRF E 39**	**TRV T 46**					**TRV A 45**
	FRF E 41						
STATION COVERAGE	**SUC E47**						
NOTES							
THIRD	**SUC E 47**				**MTZ WT 51**	**FRF BT 37**	**IMST**
	VAC E 74						**AREA COORD**
							FIU
STATION COVERAGE	**SUI E 33**						
NOTES							
FOURTH	**SUI E 33**	**VAC T 71**				**VAC BT 71**	
	CFD E 31						
STATION COVERAGE	**VVF E 64**						
NOTES							

Remaining Resources	Type 1 Engine	Truck	Squad	Wildland	Tender	Chief Officer	Special Call
	MTZ	**SUC**			**SUI**		
	DIX	**VLJ**			**VVF**		
	CFD	**DIX**					
	VLJ	**ACY**					
	BNC						
	CMF						
	RVS						

TRAVIS FIRE DEPARTMENT
VEGETATION FIRE

REVISED 01/2014

ALARM	ENGINE	TRUCK	SQUAD	WILDLAND	TENDER	CHIEF OFFICER	SPECIAL CALL
FIRST	TRV E 45			TRV B45	TRV WT 45	TRV 45A1	
	TRV E 46					TRV 45A2	
NOTES	GENERAL FIRE DEPARTMENT RECALL						
SECOND	VAC E 74			FRF B 39		SUC BT 47	AREA COORDINATOR
				FRF B 37			
				SUI B 33			
STATION COVERAGE	SUC E 47	TRV T 46					
NOTES							
THIRD	SUC E 47			MTZ B 51	SUI WT 33	FRF BT 37	IMST
				CMF B 70			FIU
				VV B 64			
STATION COVERAGE	CFD E 31	TRV T 46					
NOTES							
FOURTH	CFD E 31			SUC B 47		VAC BT 71	
				MTZ B 251			
STATION COVERAGE	VVF E 64	TRV T 46					
NOTES							

Remaining Resources	Type 1 Engine	Truck	Squad	Wildland	Tender	Chief Officer	Special Call
	VVF			BNC		SUI	
	ACY			CFD		MTZ	
	VLJ			VLJ		VLJ	
				SUI		RVS	
				DIX			
				RVS			

APPENDIX C.

BAAQMD REGULATION 5 & PRESCRIBED BURNING SMOKE MANAGEMENT PLAN

REGULATION 5
OPEN BURNING

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REGULATION 5
OPEN BURNING

5-100 GENERAL

5-101 Description: This Regulation forbids open burning within the District with certain exceptions.

(Amended November 2, 1994)

5-110 Exemptions: The following fires are exempt from this Regulation:

110.1 Fires set only for cooking of food for human beings.

110.2 Fires burning as safety flares or for the combustion of waste gases.

110.3 The use of flame cultivation when the burning is performed with LPG or natural gas-fired burners designed and used to kill seedling grass and weeds and the growth is such that the combustion will not continue without the burner.

110.4 Fires set for the purposes of fire training using one gallon or less of flammable liquid per fire.

(Amended 12/19/90; 11/2/94; 3/6/02; 7/9/08)

5-111 Conditional Exemptions: The following special conditions must be met for fires allowed by subsections 5-401.1 through 401.17 unless specifically exempted, altered, or further restricted in that subsection, or unless otherwise waived in writing by the APCO prior to burning, and these conditions shall be complied with during any burning permitted under those subsections. In addition, a condition, requirement, or parameter stated in or imposed by a smoke management plan approved by the APCO may supersede any one of these conditions.

111.1 No burning shall take place before 10:00 a.m. local time on any day.

111.2 No additional materials or fuel shall be ignited, nor shall any material or fuels be added to any fire after two hours before sunset on any day.

111.3 No material or fuel shall be ignited, nor shall any material or fuel be added to any fire when the wind velocity is less than five (5) miles per hour except for crossfiring, or when the wind direction at the site shall be such that the direction of smoke drift is toward a populated area in order to minimize local nuisances caused by smoke and particulate fallouts.

111.4 Prior to ignition, all piled material shall have dried for a minimum of 60 days, and be managed to ensure that burning the material does not produce smoke after sunset on any day.

111.5 All material to be burned shall be reasonably free of dirt or soil.

111.6 Piled material shall be limited to a base area not to exceed 25 square yards and the height shall be at least 2/3 of the average width of the pile.

111.7 Ignition material shall be limited to those listed by the State Director of Forestry, as follows: orchard torches; drip torches; pressurized diesel torches; propane or LPG torches; commercial petroleum gel materials, pressurized or solid (napalm or blivets); commercial safety fuses; commercial type ignition grenades, e.g. Fenner, etc.; fuses; commercial fuse lighters and matches. All fires shall be ignited so as to burn as rapidly as possible within conditions of safety and minimum pollution.

111.8 Ignition shall be initiated at or near the top of the piled material. No additional material, except ignition material, shall be added to the fire.

111.9 Tonnage, volume or acreage of material burned on any given day and/or at any specified site is subject to limitations set by the APCO, but may not exceed any limits set by the ARB.

(Amended 12/19/90; 11/2/94;3/6/02)

5-112 Limited Exemption, Recreational Fires: A fire set for recreational purposes is exempt from the requirements of Section 301.

(Adopted July 9, 2008)

5-200 DEFINITIONS

5-201 **Agricultural Fire:** A fire used for the purpose of initiating, continuing or maintaining agriculture as a gainful occupation. Fuels are limited to materials grown on the site and shall not include feed or fertilizer containers, finished or treated wood, plastic or rubber products, plumage, hides, fur, offal or fecal material or refuse from plant or animal processing other than from initial crop harvesting, pruning or attrition of fruit and nut trees, vines and cane crops.

(Amended 11/2/94; 3/6/02)

5-202 **Fire:** Any combustion of combustible materials of any type outdoors.

(Amended July 9, 2008)

5-203 **Flue:** Any duct or passages for air, gases, or the like, such as a stack or chimney.

5-204 **Gainful Occupation:** Any occupation from which there is proof of gross profit or loss as evidenced by tax receipts, sales slips or other such documents.

5-205 **Deleted December 19, 1990**

5-206 **Permissive Burn Day:** Any day that is so declared by the APCO when, in his opinion, air pollution caused by open burning will not adversely affect ambient air quality or downwind population. In declaring such permissive burn days, the meteorological criteria established by the ARB for the San Francisco Bay Area Air Basin shall be used as a guideline.

(Amended November 2, 1994)

5-207 **Treated Brush:** Material which has been felled, crushed or uprooted with mechanical equipment, or has been desiccated with herbicide.

5-208 **Hazardous Material:** For purposes of this Regulation, any combustible or flammable material which may pose a fire or explosion hazard including but not limited to, natural vegetation or other native growth cleared away to create or maintain a firebreak around any building or structure on a property as required to comply with Section 4291 of the State Public Resources Code to reduce the risk of a wildfire.

(Adopted 3/17/82; Amended 12/19/90; 11/2/94; 3/6/02)

5-209 **Public Fire Official:** An officer of a public agency charged with the responsibilities of setting or allowing fires. Public fire official includes but is not limited to, local, state, and federal officers.

(Adopted December 19, 1990)

5-210 **Contraband:** Any illegal or prohibited good that has been confiscated by a public law enforcement agency, including but not limited to explosives, pyrotechnics and illegal drugs.

(Adopted 12/19/90; Amended 11/2/94)

5-211 **Deleted March 6, 2002**

5-212 **Stubble:** The remaining stalk, stem, or trunk of a herbaceous plant or cereal grass (primarily oats, wheat and hay) after harvest of a field crop.

(Adopted November 2, 1994)

5-213 **Prescribed Burning:** The planned, controlled application of fire to vegetation to achieve a specific natural resource management objective(s) on land areas selected in advance of that application. The fire is conducted within the limits of a plan and prescription that describes both the acceptable range of weather, moisture, fuel, and fire behavior parameters to achieve the desired effects. For the purposes of this regulation, prescribed burning also means any Forest Management fire, Range Management fire, Hazardous Material fire not related to Public Resources Code Section 4291, or any Crop Replacement fire for the purpose of establishing an agricultural crop on previously uncultivated land, that is expected to exceed 10 acres in size or burn piled vegetation cleared or generated from more than 10 acres of land. These specific fire types shall be regulated as Wildland Vegetation Management fires and subjected to all of the requirements applicable to subsection 5-401.15. In addition, prescribed burning includes any naturally-ignited wildland fire managed for resource benefits that is subject to the applicable requirements in Section 5-408.

(Adopted 11/2/94; Amended 3/6/02)

5-214 **Backfiring:** A field crop burn ignition technique where the fire is ignited at the downwind side of the burn area, so that the fire must burn into the wind towards the fuel source.

(Adopted November 2, 1994)

5-215 **Stripfiring:** A field crop burn ignition technique where the fire is ignited in parallel strips by walking straight through the burn area into the wind.

(Adopted November 2, 1994)

5-216 '**X' or Crossfiring:** A field crop burn ignition technique where the fire is ignited in two semi-circle arch patterns that almost intersect in the middle of the burn area. The first fire is lit by walking into the wind from the downwind side. The second fire is lit by walking with the wind from the headwind side of the field. This technique is used during light (less than five miles per hour) and variable winds only.

(Adopted November 2, 1994)

5-217 **Property:** A single parcel of real property, as determined by the County Assessor. The term also includes contiguous parcels under the same ownership.

(Adopted November 2, 1994)

5-218 **APCO:** The Air Pollution Control Officer of the Bay Area Air Quality Management District or the designee thereof.

(Adopted November 2, 1994)

5-219 **ARB:** The Air Resources Board of the State of California.

(Adopted November 2, 1994)

5-220 **District:** The Bay Area Air Quality Management District.

(Adopted November 2, 1994)

5-221 **Forest:** A vegetation type or plant community covering a tract of land, which is named and described as a series, habitat or unique stand according to the California Native Plant Society (CNPS) classification system set forth in the most current edition of *A Manual of California Vegetation* published by CNPS, and dominated by trees growing more or less closely together. For the purposes of this regulation, the dominant vegetation form must be described as a broadleaf deciduous, broadleaf evergreen, conifer, or mixed broadleaf-conifer forest. Forest does not include chaparral, scrub and grassland communities, or the eucalyptus series, as these vegetation types are described in the CNPS classification system.

(Adopted March 6, 2002)

5-222 **Marshland:** A type of wetland ecosystem periodically or permanently inundated to a depth of up to 2 meters (6.6 feet) that supports a cover of low or tall emergent vegetation. Habitats within these water-land areas include diked, seasonally managed wetlands, unmanaged tidal wetlands, open bays, sloughs, and associated upland grasslands.

(Adopted March 6, 2002)

5-223 **Curtailment Period:** Any period so declared to the public by the APCO when negative impact upon public health is anticipated, as defined in Regulation 6-3-203.

(Adopted July 9, 2008)

5-224 **Recreational Fires:** A fire used for social, cultural or other activities including, but not limited to, campfires, bonfires, ceremonial fires, handwarming fires, raku or pit pottery curing fires, or fires conducted as part of an unusual event such as fire walking provided only clean dry wood and fire starter is used, and the activity is not part of a business for gainful occupation.

(Adopted July 9, 2008)

5-300 STANDARDS

5-301 **Prohibition of Fires:** Except as provided in this regulation:

301.1 A person shall not ignite, cause to be ignited, permit to be ignited, or suffer, allow, or maintain any fires within the District.

301.2 No burning shall take place within the District on other than a permissive burn day, or in excess of any acreage burning allocation or limitation.

301.3 A person shall not violate any condition, requirement, or parameter stated in or imposed by a smoke management plan approved by the APCO, or any special condition or administrative requirement in this regulation.

(Amended 11//94; 3/6/02)

5-302 **Mandatory Curtailment for Recreational Fires:** No person shall ignite, cause to be ignited, permit to be ignited, or suffer, allow, or maintain any recreational fires during curtailment periods.

(Adopted July 9, 2008)

5-400 ADMINISTRATIVE REQUIREMENTS

5-401 **Allowable Fires:** The following fires may be allowed on permissive burn days:

401.1 Disease and Pest: Agricultural fires set for the purpose of disease and pest prevention. The fire must be set or allowed by the Agricultural Commissioner of the County in the performance of official duty. Prior reporting pursuant to Section 5-406 must be made to the APCO, by the person setting the fire.

(Amended 12/19/90; 11/2/94; 3/6/02)

401.2 Crop Replacement: Agricultural fires set for the purpose of establishing an agricultural crop in a location that formerly contained another type of agricultural crop or on previously uncultivated land. The fire must be set or allowed by the public fire official having jurisdiction, in the performance of official duty, and must be necessary for the crop replacement to proceed. Fires are limited to a period beginning October 1 and ending April 30; however, upon the determination of the APCO that heavy winter rainfall has prevented such burning, the burn period may be extended to no later than June 30. Prior reporting pursuant to Section 5-406 must be made to the APCO by the person setting the fire.

(Amended 12/19/90; 11/2/94; 3/6/02)

401.3 Orchard Pruning and Attrition: Agricultural fires set for the purpose of disposal of periodic prunings and attrition losses from fruit trees, nut trees, vineyards and cane fruits. Fires must be set or allowed by the public fire official having jurisdiction, in the performance of official duty, and must be necessary to maintain and continue the growing of the fruit trees, vineyards and cane fruits as a gainful occupation. Fires are limited to a period beginning November 1 and ending April 30; however, upon the determination of the APCO that heavy winter rainfall has prevented such burning, the burn period may be extended to no later than June 30. When pruning is performed between February 15 and April 30 for integrated pest management purposes, the following minimum drying time periods shall apply: trees and branches over six inches in diameter: 30 days; for grape vines and branches less than or equal to six inches in diameter: 15 days. Prior reporting pursuant to Section 5-406 must be made to the APCO by the person setting the fire.

(Amended 3/15/81; 12/19/90; 11/2/94; 3/6/02)

401.4 Double Cropping Stubble: Agricultural fires set for the purpose of disposal of grain stubble from agricultural land from which both grain and vegetable crops are harvested during the same calendar year. Fires must be set or allowed by a public fire official having jurisdiction, in the performance of official duty, and must be necessary to remove the grain stubble and straw before a field vegetable crop can be planted. All material to be burned shall be free of visible surface moisture. No fires shall take place before 10:00 a.m. local time on any day. Fires are limited to a period beginning June 1 and ending August 31. Prior reporting pursuant to Section 5-406 must be made to the APCO by the person setting the fire.

(Amended 12/19/90; 11/2/94; 3/6/02)

401.5 Stubble: Agricultural fires set for the purpose of disposal of stubble and straw. Fires must be set or allowed by a public fire official having jurisdiction, in the performance of official duty, and must be necessary to maintain and continue the growing of field crops as a gainful occupation. Fire ignition techniques shall be limited to backfiring, stripfiring, and 'X' or crossfiring unless an alternate technique is approved by the APCO in writing where a specific field condition is determined not to lend itself to these techniques in a given year. All material to be burned shall be free of visible surface moisture. After 0.15 inches or more rainfall, the material must pass the "crackle" test

pursuant to Section 5-601 prior to burning. No fires shall take place before 10:00 a.m. local time on any day. Fires are limited to a period beginning September 1 and ending December 31. Outside of Sonoma County, no more than 100 acres of any property shall be burned in a single day. Within Sonoma County, no person shall conduct a burn without receiving an acreage burning allocation from the APCO and no more than 500 acres total of all properties shall be burned in a single day. In addition, no more than 100 acres of any property shall be burned in a single day. If by 12:00 p.m. local time the daily 500-acre burn acreage limitation has not been allocated, up to 200 acres of any property may be burned in a single day provided:

a. the additional acreage burning allocation has been approved verbally by the APCO; and
b. no more than two fields exceeding 100 acres total are burned simultaneously on the same property.

(Amended 12/19/90; 11/2/94; 3/6/02)

401.6 Hazardous Material: Any fires set for the purpose of the prevention or reduction of a fire hazard, including the disposal of dangerous materials. The fire must be set or allowed by any public fire official having jurisdiction, in the performance of official duty. The fire must, in the opinion of such officer, be necessary, and the fire hazard not able to be abated by any other means. However, these fires may also be conducted to dispose of materials generated to comply with an order or notice issued by an fire official pursuant to Section 4291 of the State Public Resources Code provided all of the following conditions are satisfied:

a. only natural vegetation or other native growth may be burned;
b. the amount of material to be burned shall be greater than 5 cubic yards cleared annually from a single property;
c. the material is burned where it was grown without being moved to a different location unless approved by the APCO;
d. the material is inaccessible for removal by vehicle and available alternatives to burning such as shredding, chipping, composting, disking, plowing, and harrowing are not feasible; and
e. the material, if ignited accidentally, would result in a fire of such magnitude as to immediately threaten life or adjacent improved property or resources and require an excessive fire suppression effort.

No fires involving piled material shall be ignited or take place before 9:30 a.m. local time on any day. Prior reporting pursuant to Section 5-406 must be made to the APCO by the person setting the fire.

(Amended 12/19/90; 11/2/94; 3/6/02)

401.7 Fire Training: Fires set for the exclusive purpose of instruction of either public or industrial employees in fire fighting methods. The fire must be set or allowed by the public fire official having jurisdiction, in the performance of official duty, and must be, in his opinion, necessary. Notwithstanding contrary provisions of Section 5-111, a fire fighting agency may set one fire per quarter calendar year for the purpose of training volunteer or seasonal fire fighters. This may be done on other than a permissive burn day if the APCO is notified in writing or facsimile at least two weeks in advance. Fires may be conducted outside of the burn hour limits in subsections 5-111.1 and 111.2 if the APCO is notified in writing or facsimile at least seven calendar days in advance. Prior reporting pursuant to Section 5-406 must also be made to the APCO for other fire training by the person setting the fire.

(Amended 12/19/90; 11/2/94; 3/6/02)

401.8 Flood Debris: Agricultural fires set for the purpose of removing wood and vegetation debris deposited by floodwaters. The fire must be set or allowed by the public fire official having jurisdiction, in the performance of official duty, and must be necessary for the continuing or maintaining of agriculture as a gainful occupation. Fires are limited to a period beginning October 1 and ending May 31. Prior reporting pursuant to Section 5-406 must be made to the APCO by the person setting the fire.

(Amended 12/19/90; 11/2/94; 3/6/02)

401.9 Irrigation Ditches: Agricultural fires set for the purpose of controlling growth of vegetation in irrigation ditches and canals. The fire must be set or allowed by a public fire official having jurisdiction, in the performance of official duty, and must, in the opinion of such officer, be necessary to avoid interference with water flow or drainage into irrigated land. Prior reporting pursuant to Section 5-406 must be made to the APCO by the person setting the fire.

(Amended 12/19/90; 11/2/94; 3/6/02)

401.10 Flood Control: Fires set for the purpose of disposal of material which is lying or growing within natural channels or flood control channels. The fire must be set or allowed by a public official in charge of flood control activities. The fire must, in the opinion of such official, be a necessary incident to the clearing and maintenance of water courses and flood control channels for preventing or eliminating a flood hazard. Prior reporting pursuant to Section 5-406 must be made to the APCO by the person setting the fire.

(Amended 12/19/90; 11/2/94)

401.11 Range Management: Fires set for the purpose of range management and grazing. The fire must be set or allowed by the State Director of Forestry, or public fire official having jurisdiction, in the performance of official duty, and must be necessary to maintain and continue the grazing of animals as a gainful occupation. Brush to be burned shall be treated at least six months prior to burn if determined to be technically feasible by the State Director of Forestry or public fire official. Unwanted trees over 6 inches in diameter shall be felled prior to burn and dried for a minimum of six months. Feasibility shall be subject to the approval of the APCO. Subsections 5-111.1 and 5-111.6 may be waived by the State Director of Forestry or fire official when determined necessary in the public interest. Fires are limited to a period beginning July 1 and ending April 30. Prior reporting pursuant to Section 5-406 must be made to the APCO by the person setting the fire.

(Amended 12/19/90; 11/2/94; 3/6/02)

401.12 Forest Management: Fires set for the purpose of removing forest debris and for forest management. The fire must be set or allowed by a public fire official having jurisdiction, in the performance of official duty, and must, in his opinion, be necessary. Subsections 5-111.1 and 5-111.6 may be waived by the fire official when deemed necessary in the public interest. All materials shall be piled or windrowed unless deemed poor practice by the fire official. Fires are limited to a period beginning November 1 and ending April 30. Prior reporting pursuant to Section 5-406 must be made to the APCO by the person setting the fire.

(Amended 12/19/90; 11/2/94; 3/6/02)

401.13 Marsh Management: Fires set for the purpose of improvement of marshland for wildlife habitat. The fire must be declared necessary by the California Department of Fish and Game. No such fire may be allowed on a given piece of land more than once in any 2 year period. The California Department of Fish and Game shall provide the APCO such information as may be deemed necessary by the APCO to verify the necessity of each burn and land area burning frequencies. Any person seeking to set fires under this provision shall also comply with the requirements of Section 5-410 and receive written APCO approval of the smoke management plan prior to any burn. No fires shall take place before 10:00 a.m. or after 3:00 p.m. local time, nor shall any existing burning be allowed to continue after 3:00 p.m. local time on any day. Fires are limited to a Spring burning period beginning February 1 and ending March 31, and a Fall burning period beginning September 1 and ending October 15; however, upon the determination of the APCO in consultation with the California Department of Fish and Game and the Solano County Mosquito Abatement District, that heavy winter rainfall has prevented such burning, the burn period beginning February 1 and ending March 31 may be extended to no later than June 30. Outside of the Suisun Resource Conservation District (SRCD), no person shall conduct a burn without receiving an acreage burning allocation from the APCO and no

more than 100 acres of any property shall be burned in a single day. For fires conducted within the boundaries of the SRCD:

a. no person shall conduct a burn without receiving an acreage burning allocation from the APCO;

b. total daily acreage to be burned shall be determined by the APCO, but in no case shall the total acreage burning allocation exceed 300 acres/day during the Fall burning period and 600 acres/day during the Spring burning period. In addition, no more than 100 acres of any property and no more than 100 acres of all properties designated by the same SRCD hundred-series ownerships shall be burned in a single day during the Fall or Spring burning period.

(Amended 3/15/81; 5/20/81; 8/3/83; 11/2/94; 3/6/02)

401.14 Contraband: Fires set for the purpose of disposing of contraband. The fire must be set or allowed by any peace officer or public fire official, in the performance of official duty. The fire must, in the opinion of such officer, be necessary and the material not be able to be disposed of by any other means. Prior reporting must be made to the APCO by the person setting the fire pursuant to Section 5-406.

(Adopted 12/19/90; Amended 11/2/94)

401.15 Wildland Vegetation Management: Prescribed burning by a state or federal agency, or through a cooperative agreement or contract involving the state or federal agency, conducted on land predominately covered with chaparral, trees, grass, coastal scrub, or standing brush. Any person seeking to set fires under this provision shall comply with the requirements of Section 5-408 and receive written approval of the smoke management plan by the APCO prior to any burn. Until June 1, 2002, this fire may be conducted on other than a permissive burn day, as defined in Section 5-206, if approved by the APCO pursuant to subsection 5-408.2. Effective June 1, 2002, fires may not be conducted on other than a permissive burn day.

(Adopted November 2, 1994)

401.16 Filmmaking: Fires set as part of commercial film or video production activities for motion pictures and television. The fire shall be set or allowed by the public fire official having jurisdiction, in the performance of official duty. Any person seeking to set fires under this provision shall comply with the requirements of Section 5-409 and receive APCO approval in writing at least 10 working days prior to the burn. This fire may be done on other than a permissive burn day, as defined in Section 5-206, if approved by the APCO pursuant to subsection 5-409.2.

(Adopted November 2, 1994)

401.17 Public Exhibition: Fires set as part of a planned civic event designed to educate or otherwise benefit the public. The fire shall be set or allowed by the public fire official having jurisdiction, in the performance of official duty. Any person seeking to set fires under this provision shall comply with the requirements of Section 5-409 and receive APCO approval in writing at least 10-working days prior to the burn. This fire may be conducted on other than a permissive burn day, as defined in Section 5-206, if approved by the APCO pursuant to subsection 5-409.2.

(Adopted 11/2/94; Amended 3/6/02)

5-402 Deleted November 2, 1994

5-403 Agricultural Land Use: Debris from land clearing shall not qualify under subsections 5-401.1, 5-401.2, 5-401.3, 5-401.4 or 5-401.5 unless applicant certifies, under penalty of perjury, that said land is to remain in agricultural use for a gainful occupation for a period of one year subsequent to the burning, and that applicant has not caused or contributed to the need for the burning of the material for any reason other than the promotion of agricultural use of the land for a gainful occupation. However, the County Agricultural Commissioner may waive this Section by certifying that burning of the material under subsection 5-401.1 is, in his opinion, the only safe method of disposal. Failure to comply with the conditions of this Section shall be

considered a violation of this Regulation. Each pile burned in violation shall be cited as a separate offense.

(Amended 11/2/94; 3/6/02)

5-404 **Emergency Waivers:** A public officer authorized under subsections 5-401.1, 5-401.6 and 5-401.10 to grant permission for open burning may grant waivers from subsections 5-111.1 through 5-111.9 when, in his judgment, such emergency or summary action is necessary for the public safety. When such action is taken, the authorizing authority shall certify the following in a written report submitted to the APCO within 10 calendar days following the completion of burning: a description and quantity of the material burned and an explanation of the reasons for granting the permission.

(Amended 11/2/94; 3/6/02)

5-405 **Deleted March 6, 2002**

5-406 **Prior District Notification; Disease and Pest, Crop Replacement, Orchard Pruning and Attrition, Double Cropping Stubble, Forest Management, Flood Debris, Fire Training, Flood Control, Irrigation Ditches, Range Management, Hazardous Material, and Contraband:** The person setting the fire shall provide electronic, typewritten, legibly handwritten, or computer printed notification to the District prior to the burn on a District-approved form or facsimile thereof. If notification is submitted by mail, the document must be postmarked at least 5 calendar days prior to the burn. The notification form must be completely filled out with accurate information to satisfy this requirement. For structural fire training, written notification shall also be made to the APCO at least 10 working days prior to the burn pursuant to the requirements of Regulation 11-2-401.3 (Asbestos Demolition, Renovation and Manufacturing).

(Adopted 12/19/90; Amended 11/2/94; 3/6/02)

5-407 **Deleted November 2, 1994**

5-408 **Wildland Vegetation Management Burn Requirements:** Any person who seeks to conduct or conducts prescribed burning pursuant to subsection 5-401.15 shall comply with the following requirements:

408.1 Submit a smoke management plan to the APCO for review at least 30 calendar days prior to the proposed burning that is consistent with the most current USEPA guidance on wildland and prescribed fires (*Interim Air Quality Policy on Wildland and Prescribed Fires*, USEPA 1998, or any subsequent document that supersedes this document), and provides the following information:

- a. location and specific objectives of each proposed burn;
- b. acreage, tonnage, type, and arrangement of vegetation to be burned;
- c. directions and distances to nearby sensitive receptor areas;
- d. fuel condition, combustion and meteorological prescription elements for the project;
- e. projected burn schedule and expected duration of project ignition, combustion, and burn down (hours or days);
- f. specifications for monitoring and of verifying critical parameters including meteorological conditions and smoke behavior before and during the burn;
- g. specifications for disseminating project information to public;
- h. contingency actions that will be taken during the burn to reduce exposure if smoke intrusions impact any sensitive receptor area;
- i. certification by a qualified professional resource ecologist, biologist, or forester that the proposed burning is necessary to achieve the specific management objective(s) of the plan;
- j. a copy of the environmental impact analysis prepared for the plan that includes an evaluation of alternatives to burning, if such an analysis was required by state or federal law or statute;
- k. project fuel loading estimate (tons vegetation/acre) by vegetation type(s) and a description of the calculation method; and
- l. particulate matter emissions estimate including referenced emission factor(s) and a description of the calculation method used.

408.2 Until June 1, 2002, permission to burn on other than a permissive burn day shall be governed by the 48-hour forecast issued by the APCO. Effective June 1, 2002, permission to burn shall be governed by the acreage burning allocation issued by the APCO.

408.3 Until June 1, 2002, prior to ignition, notify the APCO on the day of each burn. Effective June 1, 2002, receive an acreage burning allocation from the APCO prior to ignition.

408.4 For each day on which burning occurs, report the total acreage and tonnage of vegetation actually burned to the APCO by telephone no later than 12:00 p.m. local time the following day.

408.5 Within 30 calendar days following completion of the burn project, provide a written post-burn evaluation to the APCO that addresses whether the project objectives were met and describes actual smoke behavior.

Effective June 1, 2002, any fire official seeking to conduct prescribed burning in a geographical area considered for a potential naturally-ignited wildland fire managed for resource benefits that is expected to exceed 10 acres in size shall annually register each burn project in writing with the APCO by December 31 each year, with updates as they occur. Once a decision is made to manage the fire for resource benefits, the fire official shall provide a smoke management plan for the burn project to the APCO, upon request.

(Adopted 11/2/94; Amended 3/6/02)

5-409 Filmmaking and Public Exhibition Burn Petitions: Any person seeking to conduct a fire pursuant to subsection 5-401.16 or 401.17 shall comply with the following requirements:

409.1 Submit an open burning petition to the APCO that provides the following information, as applicable:

a. date(s) and specific location(s) of each proposed burn;

b. type and quantity (tonnage, acreage, or volume) of each material to be burned;

c. the projected fuel use rate in BTU per hour, if known, calculated using the higher heating value of each fuel; and

d. the burn duration.

409.2 Permission to burn on other than a permissive burn day shall be subject to written approval of the open burning petition by the APCO.

409.3 Prior to ignition, notify the APCO on the day of each burn.

409.4 If the APCO grants written approval, such approval shall be available at the burn location for inspection by the APCO, upon request.

(Adopted 11/2/94; Amended 3/6/02)

5-410 Marsh Management Burn Requirements: Effective June 1, 2002, any person who seeks to conduct or conducts a fire pursuant to Subsection 5-401.13 shall:

410.1 In order to receive an acreage burning allocation, at least 30 calendar days prior to the proposed burning, submit a smoke management plan to the APCO for review using a District-approved form;

410.2 In securing the written necessity statement required by California Health and Safety Code Section 41861, submit to the California Department of Fish and Game (DFG) and the APCO information that (1) identifies the non-burning alternatives considered by the property owner(s) given the recommendations or needed improvements described in existing Individual Ownership Management Plans, updated Individual Ownership Adaptive Management Habitat Plans, Wildlife Management Plans or other resource management plans as applicable; and (2) explains why water management practices and non-burn vegetation management practices cannot currently achieve the management objective(s) of the proposed fire and the property. Where DFG is conducting a burn on state lands, this information shall be submitted by DFG to the APCO prior to the proposed burning;

410.3 Prior to the proposed burning, submit the written statement required by Health and Safety Code Section 41861 to the APCO;

410.4 For each day on which burning occurs, report the total acreage of vegetation actually burned to the APCO by telephone no later than 12:00 p.m. local time the following day.

(Adopted March 6, 2002)

5-411 Open Burning Fees: Notification, smoke management plans, acreage burning allocations, and petitions as required by the provisions in this regulation are subject to the fees contained in Regulation 3, Schedule V.

(Adopted June 19, 2013)

5-500 MONITORING AND RECORDS

5-501 Open Burning Records: Effective June 1, 2002, any person subject to Section 5-408 or 5-410 shall comply with the following requirements:

501.1 The person who conducts the fire shall maintain records on a daily basis that document and verify the actual acreage burned. Such documentation shall include the following information:

a. date and location of burn
b. a description of the method(s) or technique(s) used to verify the actual acreage burned
c. data collected that supports the burn acreage determination, and
d. type of vegetation and acreage actually burned.

501.2 Such records shall be retained for twelve months and made available to the APCO, upon request.

(Adopted 12/19/90; Amended 11/2/94; 3/6/02)

5-600 MANUAL OF PROCEDURES

5-601 Appraisal of Field Crop Fuel Moisture; The "Crackle" Test: Any person who wants to conduct an evaluation of fuel moisture in field crop stubble or straw remaining after harvest pursuant to subsection 5-401.5 shall satisfy the following criteria prior to burning:

601.1 Sampling: To ensure representative sampling, sample in accordance with the following requirements:

a. obtain samples from several different areas of the field
b. select some samples from underneath the straw mat including the bottom layer
c. a handful of sample material is considered a sufficient size to test.

601.2 Evaluation: The field is considered dry enough to burn, or passes the "crackle" test when:

a. each sample is tested just prior to burning
b. each sample tested makes an audible "crackle" when it is bent sharply.
c. If the sample does not pass the test, then the area from which the sample was selected cannot be burned until such material is considered dry enough to burn.

(Adopted November 2, 1994)

APPENDIX D.

TAFB TFES SOG 32-08-04 Wildland Emergencies

60TH CIVIL ENGINEER SQUADRON

TRAVIS FIRE EMERGENCY SERVICES

SOG 32-08-04

Wildland Emergencies

OPR: Operations Section | Certified by: Fire Chief (GS-13 John A. Speakman)
Supersedes None | Pages: 5

This Standard Operating Guideline (SOG) implements Air Force Instruction 32-2001, Fire Emergency Services Program with respect to the mitigation of Wildland emergencies. This SOG outlines the roles and responsibilities of all personnel when responding to Wildland incidents. Compliance with the SOG is mandatory for all Travis Fire Emergency Services Flight personnel.

CHAPTER 1-RESPONSIBILITIES

1.1 Fire Chief: The Fire Chief is responsible for the management of the wildland fire program. The Fire Chief ensures that resources are adequate to effectively mitigate wildland fire incidents within the Travis AFB jurisdiction.

1.2 Incident Commander (IC): Responsible for overall management of mitigation efforts during wildland incidents. The IC will manage wildland incidents in accordance with TFES FMP 32-02, *Incident Management System*. The IC is ultimately responsible for the safety of all response personnel, and may assume or delegate the responsibilities of Accountability Officer and Safety Officer.

CHAPTER 2-GENERAL PRACTICES

2.1 General Practices: TFES is very limited on the vehicles that are used off road to combat these fires. The open cab P-24, P-34 RIV, and P-27 Brush Truck are the only vehicles allowed off the hard surface automatically and P-26 water tender will be considered as situation and terrain dictact. The two enclosed cab pumpers (KME/PIERCE) are to be used on the paved streets ONLY.

2.2 Off road vehicles need to secure their tailboards prior to moving off the hard surface

2.2 ARFF Apparatus Limits: TFES recognizes that ARFF vehicles can be used to combat wildland fire from paved surfaces only. (P-23/T-3000)

CHAPTER 3-GENERAL WILDLAND EMERGENCY PROCEDURES

3.1 Wildland Emergencies will typically be dispatched by the Travis Emergency Communications Center (ECC) after notification by the Travis AFB 911 System. The ECC will utilize the appropriate emergency dispatch checklist to initiate the response.

3.2 All Wildland emergencies require the establishment of the incident management system in accordance with TFES FMP 32-02, *Incident Management System*.

3.3 The following are a list of considerations for fire officers and incident commanders to consider when developing mitigation action options during ARFF incidents.

-The Crew Chief should establish Investigation/Fire Attack/Command mode.
-The Crew Chief should establish the fire attack strategy
-The Driver Operator may continue to drive or spot the apparatus in a safe position depending on the attack strategy. The Driver Operator should keep the apparatus in a position to access the identified escape route or safety zone.
-The Nozzleman should assist the Crew Chief as directed.
-Determine the size and extent of the fire
-Ensure that adequate resources are responding
--Additional resources shall be assigned by the Incident Commander
-Wind speed and direction are primary indicators in establishing the spread potential
-Identify threatened exposures
-Always identify escape routes and safety zones
-Be alert to changing conditions and fire behavior
-Watch for spot fires

CHAPTER 4-RESPONSE PROCEDURES

4.1 Response - Areas to consider in response are size-up and situational awareness. This would include fuel, weather, topography, current and expected fire behavior, rate of spread, location, access, resources, and potential threats. Life hazards, property threatened and evacuations.

4.2 First Arriving Apparatus:

-The Crew Chief should establish Investigation/Fire Attack/Command mode.
-The Crew Chief should establish the fire attack strategy
-The Driver Operator may continue to drive or spot the apparatus in a safe position depending on the attack strategy. The Driver Operator should keep the apparatus in a position to access the identified escape route or safety zone.
-The Nozzleman should assist the Crew Chief as directed
-Determine the size and extent of the fire
-Ensure that adequate resources are responding
--Additional resources shall be assigned by the Incident Commander
-Wind speed and direction are primary indicators in establishing the spread potential
-IDENTIFY THREATENED EXPOSURES

-ALWAYS IDENTIFY ESCAPE ROUTES AND SAFETY ZONES
-Be alert to changing weather conditions and fire behavior
-Watch for spot fires

4.3 First arriving SFO - The SFO should assume or establish Command of the incident

-The "Command" vehicle location should be outside the firefighting zone in a safe area
-Transfer of command should include situation status, actions taken and resource assignments
-Identify and communicate incident priorities and strategy
-Consider additional resources. They should be ordered by number and type
-Set-up an Incident Command structure

4.4 Mobile Attack - (Pump & Roll) is the preferred method when making a direct attack on fast moving, low- intensity wild land fires when conditions allow its use. The major requirement for this method is that the fire be in terrain that the apparatus can safely negotiate
-A minimum of 3 personnel are required to operate in the field, however a 4 person crew is desired for efficiency.

CHAPTER 5-HAZARDS AND ADDITIONAL CONSIDERATIONS

5.1 All Mobile Attack firefighting operations should be made from the black (Burned area) for Firefighters safety, and to minimize heat exposure.
5.2 Good communication is essential, either verbal or visual. It is critical between Driver and Nozzle Operator for safety.
5.3 If visual contact is lost the Driver shall stop or the Nozzle Operator will hit the windshield with a burst of water signaling the Driver to stop. Emergency lighting and headlights shall be on at all times while operating in the field.

5.4 Additional Considerations: Equipment positioning
-Back equipment in
-Level area
-Leward side away from heavy fuels
-Avoid chutes & draws
-Maintain crew continuity
-Structure preparations as time and conditions allow
-Shut off gas, clear combustibles around tanks
-Clear roof of combustibles
-Cover vents
-Remove and scatter fuels away from structure (reducing fuel continuity)
-Close windows and doors, including garage, leaving unlocked (with fire threat)
-Have garden hoses charged

CHAPTER 6-TACTICS

6.1 Direct Attack
- -Flanking Action
- -Pincer Attack
- -Tandem Attack

6.2 Indirect Attack

- -Parallel Attack

6.3 Combination Attack

6.4 Progressive Hose Lay

- -Utilize the use of the preconnected 1 1/2'" hose line for the main attack line
- -Utilize the progressive hose packs to extend the attack line
- -Ensure 100' of 1" hose is inserted at least every 200' along the hose lay

6.5 Mop Up - Should take place once the fire has been contained. Determine the distance inside the control line to be overhauled based on current and expected weather and fire behavior.

6.6 Structure Protection

6.7 Structure Triage Category - Select the appropriate structure triage category based on the forecasted fire behavior, the surrounding area terrain and any defensible space

- -Not Threatened - Safety Zone and present and construction features or defensible space make it unlikely that the structure will ignite during initial fire front contact
- -Threatened Defensible - Safety Zone and present and construction features, lack of defensible space, or other challenges requires firefighters to implement structure protection tactics during fire front contact
- -Threatened Non-Defensible - Either there is no Safety Zone present or the structure has challenges that do not allow firefighters to safely commit to stay and protect the structure during fire front contact

6.8 Water Use

- -DO NOT AUTOMATICALLY DEPLOY LINES AT EVERY STRUCTURE! Only deploy hose lines and apply water to control fire spread
- -DO NOT connect engine to hydrants or other fixed water supplies while actively protecting a structure
- -1 1/2" hose lines with a minimum of 50 GPM are required for structure protection
- -Maintain at least 100 gallons for personnel protection. Refill as soon as safely possible

CHAPTER 7-TERMINATION OF EMERGENCIES

5.1 Termination of an incident occurs when mitigation efforts have succeeded in extinguishing the fire, rescuing personnel (not recovering), protecting the environment, and stabilizing the scene. The IC has specific responsibilities when terminating an incident, and they are listed below.

-Ensuring 100% accountability of all personnel
-Ensuring 100% accountability of all resources
-Ensuring security of an incident if required
-Determining TFES responsibilities for the recovery phase of operations if any

5.2 Depending upon the size and complexity of an incident, the transfer of command to a Recovery Officer (ROC) may be necessary. This process is detailed in TFES FMP 32-02, *Incident Management System*.

CHAPTER 8-TERMINOLOGY

Terminology used within this SOG shall be consistent with the glossary of wildland fire terminology used by the National Wildfire Coordinating Group (NWCG).

2/3/2014

X John A. Speakman

JOHN A. SPEAKMAN, GS-13, DAF
Chief, Fire Emergency Services Flight
Signed by: SPEAKMAN.JOHN.A.1167558778

ATTACHMENT 1-REFERENCES

DoDI 6055.06
AFI 32-2001

APPENDIX E.

TAFB TFES FMP 32-01, Administration and Organization

60TH CIVIL ENGINEER SQUADRON

TRAVIS FIRE EMERGENCY SERVICES

FMP 32-01

ADMINISTRATION AND ORGANIZATION

6 JANUARY 2014

OPR: Administration Section | Certified by: Fire Chief (GS-13 John A. Speakman)
Supersedes: SOP 2, Command | Pages: 28

This Flight Management Plan (FMP) implements Air Force Instruction 32-2001 and DoDI 6055.06. This FMP establishes the Travis Fire Emergency Services Flight (TFES) as the primary agency responsible to the jurisdiction of Travis Air Force Base. This FMP sets the practices specific to the administration and organization of resources. Adherence to this FMP is mandatory for all members, and will be reviewed annually for currency and relevance.

CHAPTER 1–ADMINISTRATION

1.1 Mission Statement: Provide fire emergency services for base community through innovative public education and training initiatives. Prevent loss of life by advocating engineering and life safety features within work and living environments. Execute emergency response and provide command and control to minimize loss of life, property, and reduce environmental impact. Maintain full spectrum of emergency services by leveraging equipment, training, manpower and resources in support of the mission.

1.2 Vision Statement: "Execute and Provide" Execute proactive fire emergency services focused on mission capability through public awareness, engineering and prevention. Provide effective response to mitigate emergencies.

1.3 Values Statement:
-Dedicated to Integrity: Courage, Honesty and Accountability
-Devoted to Service: Discipline, Respect and Follower-ship
-Committed to Excellence: Personal, Crew, Shift, Department, Squadron, Wing and Air Force

1.4 Organizational Principles
-Support a safe, healthy, and diverse workplace
-Establish and maintain the highest quality fire suppression program

-Establish a strong community relations program, particularly in the area of fire prevention and public education.

1.5 Focus Areas:
-Fire fighter safety
-Efficient Operations
-Professional Behavior

1.6 TFES Program Services: TFES manages specific programs to ensure adequate delivery to the community. These programs are divided into "sections" and given specific areas of responsibility. The four sections are listed below with a narrative description outlining the purpose and intent of each.

Administration Section: The purpose of the Administrative Section is to ensure adequate delivery of all program services. It is comprised of the Fire Chief, Deputy Fire Chief, Secretary, NCOIC of Logistics, Special Operations Officer, and if mission requirements dictate, Assistant Chief of Special Operations, and the Assistant Chief of Readiness. The Administrative Section provides support to the Operations, Fire Prevention, and Training Sections with regards to personnel management, resource utilization, off-installation mutual aid support, operational risk management, occupational safety and health, military supervision, civilian management, budgetary practice, task prioritization, inspection compliance, Prime BEEF management, and awards and recognition. Administrative personnel must meet minimum grade and qualification requirements. The work schedule is specific to each duty position, and the Fire Chief is identified as the supervisor of the Administrative Section.

Operations Section: The Operations Section is the largest section in the flight, and provides suppression and mitigation services to the community. This section is responsible for the delivery of structural, ARFF, EMS, wildland, hazmat, and technical rescue services consistent with the TFES Community Risk Assessment and TFES Standards of Cover. This section is managed by the Assistant Chief of Operations (A/C Ops). The Operations Section employs an alternative work schedule (2 on/3 off) for all personnel except for the A/C Ops and Station Chiefs. The Operations Section also supervises the Emergency Communication Center (ECC). The NCOIC of Emergency Communications (NCOIC ECC) is assigned from the Administrative Section to assist the Operations Section with this program.

Fire Prevention Section: The Fire Prevention Section manages all programs related to fire prevention, code enforcement, and public education. The Assistant Chief of Prevention (A/C Prev) manages this section, and is assigned Fire Inspectors to ensure the adequate delivery of services. Responsibilities include fire inspections (fire safety surveys), plans review, permit issuance, fire safety deficiency identification, code interpretation, flightline extinguisher services, fire evacuation drills, commercial kitchen compliance, and specified educational briefings. The Fire Prevention Section is the focal point for TFES annual Fire Prevention Week activities.

Training Section: The Training Section manages all aspects of FES training. The section is managed by the Assistant Chief of Training (A/C Tng). The Training Section provides guidance

to all personnel regarding requirements of certification and proficiency training. The program is managed consistently with USAF requirements. This program oversees AFSC skill-upgrade training, proficiency training, formal training, live fire training, vehicle licensing and certification, as well as local training and certification requirements specific to mission requirements.

1.7 TFES Management Document Plan: TFES will maintain a library of management documents that sets the roles and responsibilities of military and civilian personnel. Every document will be reviewed annually as part of the *Annual Report* process and adjusted/revised to ensure relevancy and accuracy. All management documents are signed by the Fire Chief and provided to each member to facilitate compliance. Each document will be reviewed annually, and recertified bi-annually by the Fire Chief.

Strategic Level Documents: These documents include the *TFES Community Risk Assessment, TFES Standards of Cover, TFES Strategic Master Plan,* and *TFES Fire Emergency Services Self-Inspection Manual (FESSAM).*

Flight Management Plans (FMP): Flight Management Plans serve as parent documents. Substantiation for an FMP level document is based on the scale and scope of the program. Each FMP is given a "32" prefix which denotes Civil Engineering. The following constitute the FMP plan.

-TFES FMP 32-01, *Administration and Organization*
-TFES FMP 32-02, *Incident Management System*
-TFES FMP 32-03, *Fire Prevention and Public Education*
-TFES FMP 32-04, *Operational Risk Management*
-TFES FMP 32-05, *FES Training and Education*
-TFES FMP 32-06, *Occupational Safety and Health Program*
-TFES FMP 32-07, *Emergency Communications Program*
-TFES FMP 32-08, *Emergency Operations Management*

Standard Operating Guides (SOG): Standard Operating Guidelines are explanatory documents written to further define the roles and responsibilities of members. SOGs are numbered consistently with the parent document. Substantiation for an SOG level document is based on the scale and scope of the program as well as the length of content to adequately express roles and responsibilities. The SOG library fluctuates depending on mission requirements. Documents can be added or retracted given their accuracy and relevance.

Flight Policy Letters (PL): Flight Policy Letters are used when changes/additions are required to management documents to sustain program effectiveness. PLs are temporary and may be written throughout the calendar year. TFES will review all PLs during the Annual Report process to ensure the appropriate FMP/SOG is adjusted to include the new policy.

Incident Command (IC) Checklists: Incident Command checklists provide ICs with a template for organizing and employing resources to mitigate emergencies.

Emergency Dispatch Checklists: Dispatch checklists provide ECC dispatchers with a template for collecting, disseminating, and recording emergency information. These checklists also provide a quick reference for dispatchers to make immediate notifications and fill external agency requests of the IC.

1.8 Duty Positions and Responsibilities

TFES employs a traditional United States Air Force (USAF) organizational structure. TFES is composed of civilian and military members assigned to specific positions within the organization based on rank and qualification. Below is a narrative for each position within the flight to include those that may be staffed as mission requirements dictate. Members may be placed in positions inconsistent with their rank and qualification if mission requirements dictate it and the Fire Chief approves the appointment.

Fire Chief: The Fire Chief is responsible for overall management of the Fire Emergency Services Flight. The Fire Chief is the Flight Chief, and is responsible for the distribution of resources to meet program objectives. The Fire Chief executes all programs (incident management system, fire prevention, etc.) with delegated authority from the Installation Commander (60 AMW/CC) through the Base Fire Marshall (60 CES/CC). The Fire Chief is responsible for the development and implementation of flight management plans (FMP), standard operating guidelines (SOG) that define the roles and responsibilities of all members. The Fire Chief is required to meet the training and certification requirements identified in the 3E7X1 CFETP. These requirements include DoD/IFSAC Fire Officer IV, DoD/IFSAC Fire Instructor II, DoD/IFSAC Fire Inspector II, DoD/IFSAC Hazardous Materials Incident Commander, and Air Force Incident Management System (AFIMS) course. It is encouraged that the Fire Chief attends the Air Force Institute of Technology (AFIT) 427, *Fire Emergency Services Flight Superintendent's Course*. The Fire Chief will comply with all requirements set forth in the civilian job description.

Deputy Fire Chief: The Deputy Fire Chief is the senior military member of the flight. This position is reserved for a Senior Master Sergeant (SMSgt) or E-8. The Deputy Fire Chief is responsible to the Fire Chief for all matters related to the management and supervision of military members. The Deputy Fire Chief advises the Fire Chief on all matters pertaining to good order and discipline, and sets the standard of performance for all military ranks. The Deputy Fire Chief is responsible for the management of all deployment/contingency related programs (ARTS/SORTS, UTC assignment, etc.). As the senior military official, the Deputy Fire Chief is responsible for ensuring all military members of the flight are educated on their roles and responsibilities as Airmen, Non-Commissioned Officers, and Senior Non-Commissioned Officers. The Deputy Fire Chief is the final review authority for all official military reports (EPR, Decorations, LOC/LOR, etc.) to verify accuracy given the presence of quality force indicators. The Deputy Fire Chief is required to meet the training and certification requirements identified in the 3E7X1 CFETP. These requirements include DoD/IFSAC Fire Officer III, DoD/IFSAC Fire Instructor II, DoD/IFSAC Fire Inspector II, DoD/IFSAC Hazardous Materials Incident Commander, and Air Force Incident Management System (AFIMS) course. It is encouraged that the Deputy Fire Chief attends the Air Force Institute of Technology (AFIT) 427, *Fire Emergency Services Flight Superintendent's Course.*

Assistant Chief of Operations: The Assistant Chief of Operations (A/C Ops) is responsible for the management of the Operations Section. TFES has two A/C Ops (one MSgt/one GS-11) who share the responsibilities of the position. The Assistant Chief of Operations is the initial Incident Commander (IC) for all incidents that warrant it. The A/C Ops manages all personnel within the Operations Section. The A/C Ops oversees the additional duties program to ensure code compliance and program continuity. The A/C Ops oversees the scheduled annual leave program and maintains an accurate staffing forecast for the calendar year. The A/C Ops are the Operations Section representatives for all matters related to policies and procedures. The A/C Ops is the review authority for all FMPs, SOGs, and checklist with a concentrated focus on emergency response protocols. The A/C Ops will utilize ACES-FD to the fullest extent possible. The A/C Ops is the approving official for all NFIRS incident reports. The A/C Ops are required to meet the training and certification requirements identified in the 3E7X1 CFETP. These requirements include DoD/IFSAC Fire Officer III, DoD/IFSAC Fire Instructor II, DoD/IFSAC Fire Inspector II, DoD/IFSAC Hazardous Materials Incident Commander, and Air Force Incident Management System (AFIMS) course. TFES also requires the completion of the TFES Incident Command Credentialing course, as well as the local Emergency Operations Center (EOC) course.

Assistant Chief of Prevention: The Assistant Chief of Prevention (A/C Prev) is responsible for the management of the Fire Prevention Section. This section provides fire inspection, plans review, permit issuance, public education, preliminary fire investigation, and code enforcement services. The A/C Prev is military MSgt/E-7 position. The A/C of Prev has delegated authority from the Fire Chief to execute and enforce the fire prevention and public education programs on Travis Air Force Base. The duties and responsibilities of the A/C of Prev include management of the Fire Prevention Section, interpreting and enforcing code compliance, developing and delivering public education. The A/C Prev will utilize ACES-FD to the fullest extent possible to document and track all inspection and fire safety deficiency (FSD) information. The A/C Prev will ensure all reports are completed on time and submitted to the appropriate level of authority. The A/C Prev also oversees the quality assurance program for service and maintenance of flightline halon fire extinguishers as well as the cleaning of commercial kitchen hood and duct exhaust systems. The A/C Prev is required to meet the training and certification requirements identified in the 3E7X1 CFETP. These requirements include DoD/IFSAC Fire Officer II, DoD/IFSAC Fire Instructor II, DoD/IFSAC Fire Inspector III, DoD/IFSAC Hazardous Materials Incident Commander, and Air Force Incident Management System (AFIMS) course. It is also preferred that the A/C Prev be certified through the TFES Incident Commander Credentialing course, as well as the local Emergency Operations Center (EOC) course.

Assistant Chief of Training: The Assistant Chief of Training (A/C Tng) is responsible for managing all aspects of the TFES training and education program. The A/C Tng will manage all training and education programs consistently with USAF regulations and career field guidance. The A/C Tng will develop the annual training plan specific to continuing education and proficiency requirements. The A/C Tng manages the CERTEST program and ensures the protection of test information in accordance with USAF regulations. The A/C Tng will oversee the AFSC skill level upgrade program as well as managing Air Force Training Records (AFTR). The A/C Tng has a responsibility to the Vehicle Control Officer (VCO) with respect to

establishing local apparatus license training and certification requirements. The A/C Tng will coordinate all formal training requests. The A/C Tng will utilize ACES-FD to the fullest extent possible. The A/C Tng is required to meet the training and certification requirements identified in the 3E7X1 CFETP. These requirements include DoD/IFSAC Fire Officer II, DoD/IFSAC Fire Instructor III, DoD/IFSAC Fire Inspector II, DoD/IFSAC Hazardous Materials Incident Commander, and Air Force Incident Management System (AFIMS) course. It is also preferred that the A/C Tng be certified through the TFES Incident Commander Credentialing course, as well as the local Emergency Operations Center (EOC) course.

Assistant Chief of Health and Safety (A/C HS): The Assistant Chief of Special Operations is a position that will be filled when mission requirements dictate and personnel assignments permit. The responsibilities of the A/C SO vary depending upon the manner in which the position is filled. The Fire Chief will provide specific details about programs and projects that the A/C SO will accomplish. These projects may include but are not limited to quality assurance, accreditation, WIT Wing Inspection Team, environmental compliance, hazardous materials management, Prime BEEF management, enlisted performance report management, or physical fitness management. The term of service is flexible, and can be retraced when resources are required elsewhere. Minimum qualifications for this position vary according to the rank of the person assigned and the specific tasks to be completed. Typically, this position requires DoD/IFSAC Fire Officer III, DoD/IFSAC Fire Instructor II, DoD/IFSAC Fire Inspector II, DoD/IFSAC Hazardous Materials Technician, DoD/IFSAC Hazardous Materials Incident Commander, and Air Force Incident Management System (AFIMS) course. It is also preferred that the A/C HS be certified through the TFES Incident Commander Credentialing course, as well as the local Emergency Operations Center (EOC) course.

Assistant Chief of Operations and Readiness: The Assistant Chief of Operations and Readiness (A/C Ops/Readiness) is a position that will be filled when mission requirements dictate and personnel assignments permit. They are responsible for the management of military readiness, including readiness training, mobility equipment management, AEF assignments, and any additional tasking's assigned by the Fire Chief or Deputy Fire Chief. The recommended training requirements are the same as the Deputy Fire Chief.

NCOIC of Logistics: The NCOIC of Logistics (NCOIC Log) is appointed by the Fire Chief to manage the department's supply acquisition and logistics program. This NCOIC is responsible for managing the flight's appropriate funds in a manner consistent with USAF and 60th CES regulation and guidance. The NCOIC Log prepares all budgetary documents for planning and execution, and ensures compliance with DoD and USAF fiscal instructions. The NCOIC Log maintains an accountability of all issued equipment items, and maintains adequate reserve stock levels of mission essential tools, equipment, and specialized firefighting agents. He/she also maintains the flight CACRL, OCO, DRMO accounts and is responsible for maintaining an accurate accountability of identified high value items. The NCOIC Log will utilize ACES-FD to the fullest extent possible. The NCOIC Log must remain current on all training requirements set forth by the 60th Comptroller Squadron. The NCOIC Log is an administrative position, normally reserved for a SSgt/TSgt who holds a 7-skill level.

NCOIC of Emergency Communications Center: The NCOIC of the Emergency Communications Center (NCOIC ECC) will be appointed by the Fire Chief. The NCOIC ECC is an administrative position normally reserved for a SSgt/TSgt with a 7-skill level. The NCOIC ECC is responsible to manage the ECC. The NCOIC ECC establishes and oversees the ECC operator schedule, and manages all FMP, SOG, and dispatch related checklists with a focus on initial alarm processing and the dispatch of emergency resources. The NCOIC ECC will utilize ACES-FD to the fullest extent possible. He/she is also responsible for maintaining all assigned equipment specific to alarm processing, dispatch, and communication. The NCOIC ECC develops and implements the ECC dispatcher certification program, as well as delivers proficiency training consistent with the TFES Annual Training Plan. The NCOIC ECC is responsible for providing all required reports to the appropriate authority in a timely manner. The NCOIC ECC represents the continuity of the ECC and ensures a smooth transition between dispatchers. The NCOIC of ECC must be certified to the DoD/IFSAC Telecommunicator I/II level, and must be TFES ECC dispatcher certified.

NCOIC of Training: The NCOIC of Training (NCOIC Tng) is a supplemental position that will be filled when mission requirements and staffing levels dictate. The NCOIC Tng reports directly to the A/C Tng who determines the scope of the position as well as the roles and responsibility surrounding the appointment. The minimum requirements of the position vary based on the situation in which the position is filled. Typically, this position is filled by a 7-skill level SSgt/TSgt.

Special Operations Officer: The Special Operations Officer (SOO) is a dedicated position reserved for a civilian GS-09. The SOO manages the flight's hazardous materials, technical rescue, and emergency medical care programs. The scope of the SOO position includes support to the EET and Accreditation programs. The SOO also oversees the occupational safety and health program ensuring all members meet NFPA and USAF requirements. The SOO acts as the liaison to civilian agencies with respect to mutual aid support agreements. The SOO is responsible to ensuring all personnel are trained and qualified for technical rescue and hazardous materials, and provides quality assurance for all equipment testing and maintenance requirements. The SOO acts as the TFES representative to the Solano County IMST and Solano County HazMat Response Teams. This position is structured for a 60-hour work week, with the fixed 24-hour shift to be determined by the Fire Chief. The SOO is supervised by the Deputy Fire Chief. The minimum qualifications for this position are DoD/IFSAC Fire Officer III, DoD/IFSAC Fire Instructor II, DoD/IFSAC Fire Inspector II, DoD/IFSAC Hazardous Materials Technician, DoD/IFSAC Hazardous Materials Incident Commander, and Air Force Incident Management System (AFIMS) course. It is also preferred that the SOO be certified through the TFES Incident Commander Credentialing course, National Registry of Emergency Medical Technicians (NREMT), as well as the local Emergency Operations Center (EOC) course.

Station Chief: The Station Chief is responsible for managing the day to day activities of the Operations Section as dictated by the A/C Ops. The responsibilities of this position are shared by two personnel (one E-6/E-7 and one GS-09). Each Station Chief is assigned to an A/C Ops, and provides leadership and direction during emergency and non-emergency situations. The Station Chief is responsible for maintaining mission capability while supporting the professional requirements of all members. The Station Chief oversees the staffing roster, and makes the

necessary adjustments to maintain adequate capability. The Station Chief directs all non-emergency related training and details and enforces the prescribed duty schedule. The Station Chief provides quality assurance to the Operations Section with respect to the performance of daily non-emergency related duties (vehicle inspection, additional duties, adherence to dress/appearance standards, etc.). The Station Chief also acts as the substitute section supervisor when the A/C Ops is not on duty. Typically, this position requires DoD/IFSAC Fire Officer II, DoD/IFSAC Fire Instructor II, DoD/IFSAC Fire Inspector II, DoD/IFSAC Hazardous Materials Technician, DoD/IFSAC Hazardous Materials Incident Commander, and Air Force Incident Management System (AFIMS) course. It is also required that the Station Chief be certified through the TFES Incident Commander Credentialing course, as well as the local Emergency Operations Center (EOC) course.

Crew Chief: Crew Chiefs are responsible for directing personnel placed under them on emergency incidents to ensure the directions of the IC are accomplished. Crew Chiefs are responsible to ensure all personnel beneath them comply with all FMPs, SOGs, as well as incident specific directives issued by the IC. The Crew Chief is responsible for the condition and readiness of his/her apparatus, equipment, and personnel assigned. Crew Chiefs are encouraged to be licensed/certified on the apparatus they are assigned to. Crew Chiefs may act as the IC for incidents that do not require the response of a command and control (C2) element. Typically, Crew Chiefs are GS-08 (civilian) or E-5/E-6 (military) who meet the minimum qualifications of DoD/IFSAC Fire Officer I, DoD/IFSAC Hazardous Materials Technician. GS-08 civilians should refer to SCPD 9G772 for a complete listing of their duties and responsibilities. E-5/E-6 military members are required to meet the minimum certification requirements found in the 3E7X1 CFETP.

Fire Inspector: Fire Inspectors are assigned to the Fire Prevention Section and work an administrative schedule. Fire Inspectors report directly to the A/C Prev, and are responsible for executing the fire prevention and public education programs. Fire Inspectors conduct fire safety surveys (inspections), identify FSDs, issue permits, conduct site visits, enforce code compliance, provide briefings related to fire safety, perform preliminary fire investigations, provide quality assurance to civilian contractors, conduct installation risk assessments, evaluate adequacy of TFES Pre-Fire Plans, perform detection and suppression acceptance testing, and coordinate on AF 332 CES Work Orders.

Driver/Operator: Driver/Operators are responsible for the inspection, preventative maintenance, operation, and testing of apparatus during emergency and non-emergency situations. Driver/Operators are responsible for the accountability of all fixed and mobile equipment, and must be able to properly deploy each during emergency incidents. Driver/Operators are required to provide quality training to unlicensed personnel through the vehicle certification program. Driver/Operators are responsible for the condition of equipment and apparatus under their care to include fuel level, firefighting agent levels, serviceability, lubrication levels, functionality, and cleanliness. Driver/Operators are required to document appropriately using AF Form 1800s and AF Form 1071s. Driver/Operators are responsible to operate all apparatus according to applicable traffic laws. Personnel must be qualified to the appropriate DoD/IFSAC Driver/Operator series and have completed the local vehicle certification program for all apparatus they are assigned to. Driver/Operators are required to

carry their AF Form 2293, US Air Force Motor Vehicle Identification Card with the appropriate vehicle assignment code anytime they operate a government owned vehicle. GS-07 civilians should refer to SCPD 9G783 for a complete listing of their duties and responsibilities.

Emergency Communication Center Dispatcher: Dispatchers are responsible for the processing of emergency incident information and the dispatch of all emergency responders. Dispatchers are assigned to the ECC temporarily, and report to the NCOIC ECC during their assignment. Dispatchers are responsible for utilizing appropriate emergency and non-emergency checklists when performing their duties. The duties of dispatchers are explained in TFES FMP 32-09, Emergency Communications Program. Dispatchers must be certified to the DoD/IFSAC Telecommunicator I/II level as well as certified to the local Emergency Communication Center Dispatcher program.

Firefighter: Firefighters are the basic personnel level. Firefighters are responsible for executing all tactical objectives at the direction of Driver/Operators, Crew Chiefs, and Incident Commanders. The responsibilities of firefighters are incident specific and addressed in emergency response related standard operating guidelines. Non-emergency responsibilities of firefighters include ensuring the serviceability of all personal protective equipment, fixed and mobile apparatus equipment, self-contained breathing apparatus, and familiarity with incident specific roles and responsibilities.

CFAI Accreditation Manager: The CFAI Accreditation Manager (CFAI/AM) position can be a dedicated position or delegated as an additional duty depending upon the requirements of the TFES accreditation program. TFES is committed to the CFAI accreditation, and will manage all programs in an effort to attain and sustain accreditation status. The CFAI/AM is responsible to manage the accreditation effort to meet the vision of the Fire Chief. The CFAI/AM will conduct program status and provide compliance feedback at least annually. The requirements for this position are set by the CFAI and include graduation of the CFAI Self-Assessment and Standards of Cover (SOC) courses.

Additional Rater (Enlisted Evaluation System): The position of Additional Rater is specific to the USAF Enlisted Evaluation System. Additional Raters have responsibilities that are outlined in AFI 36-2406, Enlisted Evaluation System. Additional Raters are expected to provide counseling and mentorship to Immediate Supervisors with respect to the implementation of the USAF appraisal system. Additional Raters provide an additional level of supervision that does not relieve Immediate Supervisors of their professional responsibilities. The Deputy Fire Chief is responsible for assigning Additional Raters for appraisal purposes. Typically the additional rater is the section supervisor, if a SNCO is assigned, or the Deputy Fire Chief.

Supervisor of Civilians: Personnel identified as supervisors for civilian employees will comply with all USAF regulations as well as those outlined in the collective bargaining agreement. Civilian supervisors will conduct performance feedback, submit deserving civilians for recognition, and complete required appraisals. Military members who are identified as civilian supervisors will accomplish all training requirements, and conduct supervisory duties consistent with civilian supervisors. Supervisors are required to attend the required web-based training prior to the appointment.

Wing Inspection Team (WIT) Member: Personnel are appointed WIT members as an additional duty. WIT members play a crucial role in the continued improvement of the department, and must perform their duties free from the fear of reprisal and retribution. WIT members are reportable to the 60th AMW/Wing Plans office, and charged with the protection of exercise sensitive information. WIT members have the responsibility to educate, facilitate, evaluate, articulate, nominate, and re-educate. These six steps represent the cycle from which WIT members have a positive influence on the future performance of the department. WIT members are required to hold a 7-skill level and must complete all local requirements for appointment.

Team Chief: Team Chiefs are responsible for managing all aspects of their team's (2on/3off) requirements. This position is reserved for E-6/TSgts who hold a 7-skill level, but may be filled by qualified and competent E-5/SSgts who hold a 7-skill level. Team Chiefs are responsible for overseeing all training requirements for their personnel with respect to mobility, upgrade, proficiency, and ancillary training. The Team Chief provides mentorship and leadership to all members beneath them, and ensures military members fulfill their obligations with respect to supervision. Team Chiefs are appointed by the A/C Ops. Typically, this position requires DoD/IFSAC Fire Officer II, DoD/IFSAC Fire Instructor II, DoD/IFSAC Fire Inspector II, DoD/IFSAC Hazardous Materials Technician, DoD/IFSAC Hazardous Materials Incident Commander, and Air Force Incident Management System (AFIMS) course. It is also preferred that Team Chiefs be certified through the TFES Incident Commander Credentialing course, as well as the local Emergency Operations Center (EOC) course.

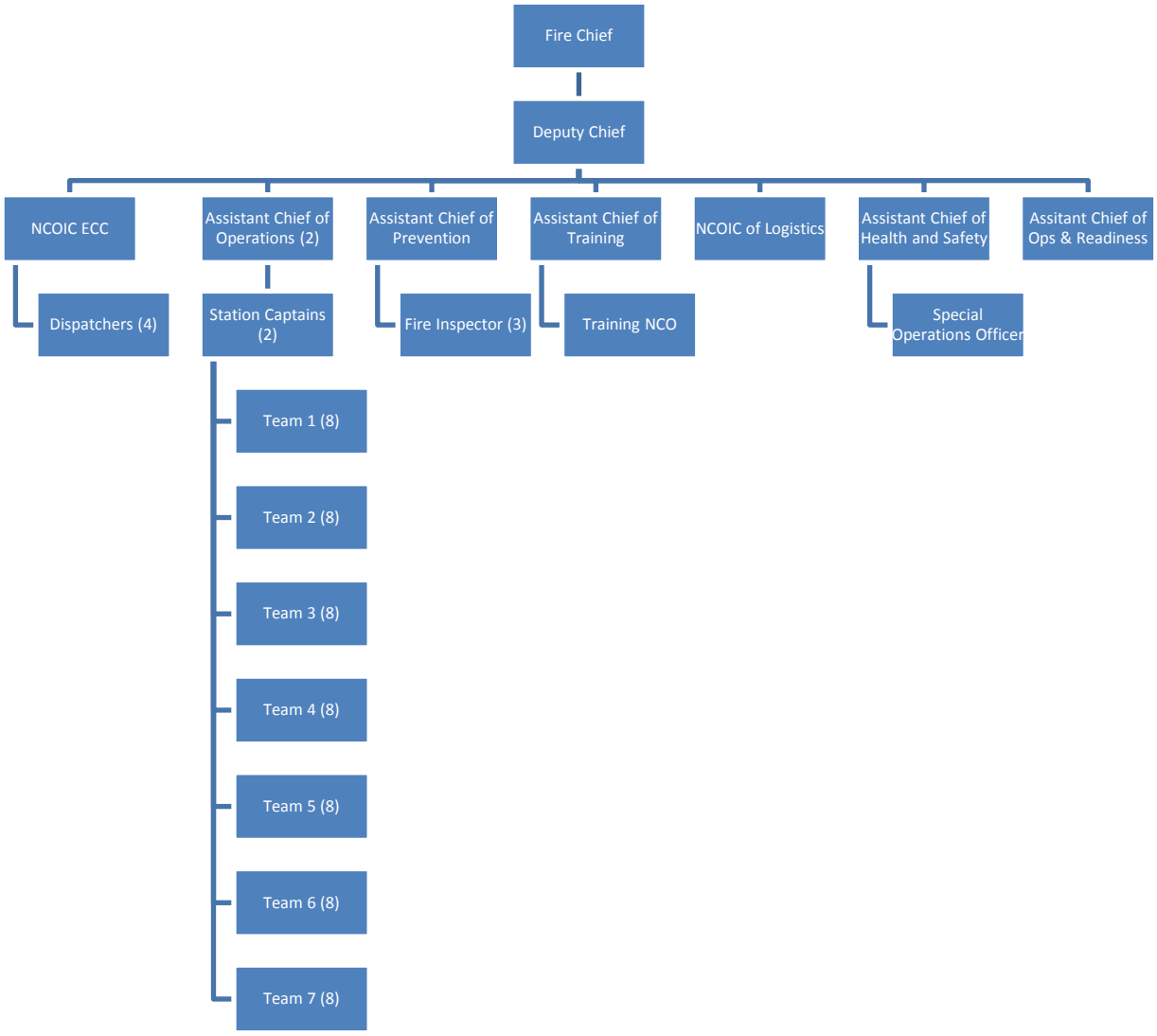
Immediate Supervisor (Enlisted Evaluation System): The immediate supervisor is the single most important link in the military chain of command. The immediate supervisor is responsible for managing all aspects related to a supervisee's career. The roles and responsibilities are outlined in more detail in the appropriate USAF regulations. This FMP outlines the general and specific responsibilities of TFES immediate supervisors. When conflicts between USAF and local guidance exist, all personnel will conform to the guidance set forth in USAF or DoD instructions. The minimum qualifications for Immediate Supervisors are the successful graduation of Airman Leadership School (ALS). Senior Airman (SRA), who do not have a projected promotion date, will not be assigned as Immediate Supervisors unless they have attended ALS. The Deputy Fire Chief will be consulted when this situation arises. Responsibilities of immediate supervisors are listed below.

-Ensuring all in-processing requirements are completed according to established timelines and in their entirety
-Performing all required formal, informal, written, and verbal performance feedback sessions
-Nominating and recognizing supervisees for superior performance
-Ensuring supervisee remains current on all mobility related training and certification requirements
-Ensuring supervisee remains current on all occupational related training and certification requirements

-Ensuring supervisee is educated on all USAF specific personnel programs (EES, PCS, etc.)
-Managing skill up-grade requirements for supervisee
-Ensuring adequacy and currency of supervisee Air Force Training Records (AFTR)
-Assisting supervisee will all issues pertaining to military specific requirements (PCS, TDY, DTS, etc.)
-Maintaining the link between supervisee and flight management with respect to personal or professional incidents that affect the member
-Accurately evaluating the performance of subordinate to include necessary counseling and required appraisals
-Overseeing the physical fitness of subordinate to ensure compliance with USAF standards
-Nominating subordinates for decorations when performance warrants it
-Establishing realistic performance goals for subordinates depending on rank and aspirations of individual
-Assisting with any out-processing requirements of subordinates during separation and PCS

Military Member (Enlisted Evaluation System): All military members are expected to execute their responsibilities with respect to their rank and assignment. The roles and responsibilities of each are outlined in more detail in USAF regulations. It is the expectation of the TFES that all military members adhere to USAF regulations, and conduct themselves in a professional manner at all times. Military members are ultimately responsible for their own actions. Lack of supervision, guidance, or leadership does not constitute substandard behavior. Military members are expected to understand the various systems and programs that affect their careers with respect to promotion, appraisal, recognition, assignment, separation, and retention. Military members will be held to the performance and conduct standards set forth in USAF instructions.

1.9 Organizational Structure



CHAPTER 2-GENERAL PRACTICES AND PROCEDURES

2.1 Work Schedules: The work schedule for all personnel varies and depends upon their assignment within the flight. The following is the work schedule by section assignment with respect to hourly commitments. Supervisors of each section have the authority to deviate temporarily from the approved work schedule. Deviations that affect production or civilian hourly accumulation must be coordinated and approved by the Fire Chief.

Traditional 40 hour week: This schedule is the traditional Monday through Friday schedule. Duty time is 0700 hours to 1600 hours. Personnel assigned to this schedule are afforded one hour for lunch between 1100 and 1300 hours. This schedule allows the personnel to perform their assignments, attend scheduled appointments, maintain levels of training and certification, maintain fitness standards, and carry-out military and job position responsibilities. Personnel assigned to this schedule will observe all federal holidays as well as command directed changes to the schedule. The Fire Chief has the authority to adjust this work schedule for all or some to meet mission requirements.

Civilian 60 hour week: This schedule is specific to civilian duty positions that allow for the accumulation of 60 hours weekly. Duty time is 0630-1530 hours daily with the addition of a 24-hour shift weekly. The 24-hour shift is assigned by the Fire Chief, and observed regardless of date significance (i.e. holidays, down-days, etc.). The Fire Chief has the authority to adjust the 24-hour shift assignment to meet mission requirements. Personnel on this schedule are afforded a 1-hour lunch break between 1100-1300 hours. This schedule allows for personnel to perform their assignments, attend scheduled appointments, maintain levels of training and certification, maintain fitness standards, and carry-out civilian employment and job position responsibilities.

24-Hour Shift: This schedule is specific to the Operations Section. Duty time is 0700-0700 hours and covers a period of 24-hours. Military and civilian Assistant Chiefs and Station Chiefs are assigned to this schedule to maintain continuity. This shift is structured on a two week rotation with each member assigned a fixed "Kelly Day". Personnel assigned to this shift are allotted a 1 hour 30 minute lunch period from 1130-1300 hours. This schedule allows for personnel to perform their assignments, attend scheduled appointments, maintain levels of training and certification, maintain fitness standards, and carry-out civilian employment and job position responsibilities. Certain military requirements may be required to be fulfilled during "off-duty" time. The Fire Chief reserves the right to compensate military members for "off-duty" time lost to official business. Personnel assigned to this schedule work assigned days regardless of date significance. Civilian employees assigned to this schedule must adhere to provisions set forth in Travis Air Force Base Civilian Employee Collective Bargaining Agreement. The Fire Chief has the authority to adjust this work schedule for all or some to meet mission requirements.

2 On/3 Off Shift: This alternative work schedule is specific to the Operations Section. Duty time is 0700-0700 hours and covers a period of 48-hours. This shift is structured on a two week cycle. Personnel are assigned to one of seven teams. Each team rotates through two consecutive 2 on/3 off cycles followed by a 2 on/2 off cycle for a total of 6 shifts inside 14 calendar days. Personnel assigned to this shift are allotted a 1 hour 30 minute lunch period from 1130-1300 hours. This schedule allows for personnel to perform their assignments, attend scheduled appointments, maintain levels of training and certification, maintain fitness standards, and carry-out civilian employment and job position responsibilities. Certain military requirements may be required to be fulfilled during "off-duty" time. The Fire Chief reserves the right to compensate

military members for "off-duty" time lost to official business. Personnel assigned to this schedule work assigned days regardless of date significance. Civilian employees assigned to this schedule must adhere to provisions set forth in Travis Air Force Base Civilian Employee Collective Bargaining Agreement. The Fire Chief has the authority to adjust this work schedule for all or some to meet mission requirements.

12-Hour Dispatch Shift: This schedule is specific to the Emergency Communications Center. Duty time is 0600-1800 hours (day shift) and 1800-0600 hours (night shift). Four operators are assigned to this schedule and alternate consecutive days of work. Paired ECC dispatchers will work Monday, Tuesday, Friday, Saturday, and Sunday the first week, and Wednesday and Thursday the following week. This schedule only allows for personnel to perform their primary duty. ECC dispatchers must attend scheduled appointments, maintain levels of training and certification, maintain fitness standards, and carry-out military specific responsibilities during "off-duty" time. Personnel assigned to this schedule work assigned days regardless of date significance. The Fire Chief has the authority to adjust this work schedule for all or some to meet mission requirements.

2.2 Duty Schedules: Duty days are defined as a normal work day (weekdays) that has not been specifically scheduled for specialized training or purpose (i.e. wingman day, prime beef week, etc.). The focus for duty schedules depends upon job position, rank, assigned schedule, and mission requirement. Below is the optimum duty schedule. An "X" under a specific section denotes adherence. All sections that do not adhere to the responsibilities of this duty schedule will determine time and details specific to their programs.

TFES Optimum Duty Day Schedule

Time	Detail/Responsibility	Administrative	Operations	Prevention	Training
0700-0715	Roll Call/Shift Change	X	X	X	X
0715-0930	Daily preventative maintenance, inspection of vehicles and equipment, operational checks, CCPT		X		
0930-0945	Coffee Break	X	X	X	X
0945-1130	Scheduled training, details, and projects	X	X	X	X
1130-1300	Lunch	X	X	X	X
1300-1515	Scheduled training, details, and projects	X	X	X	X
1515-1530	Coffee Break	X	X	X	X
1530-1700	Physical conditioning, station details, and projects	X (Optional for personnel that attend Squadron PT.	X	X	X
1700-0630	"Standby status", required standby		X		

	support, emergency response, required training will not extend past 2000 hours.				
0630-0700	Wake-up call, standby status		X		

Roll Call Procedures: All TFES members are required to attend formation at 0700 hours, Monday through Friday, at their particular station of assignment. The "uniform of the day" will be worn. "Off-going" civilians are not required to attend roll call as it will extend past their 24-hour or 48-hour shift. Roll call provides the opportunity for all members to share pertinent information as well as conduct briefings in mass forum. Personnel assigned to fire apparatus will display gear on the "on-coming" side to facilitate equipment inspections. The senior military member is responsible for conducting roll call in a professional manner to include initiating and dismissing personnel. The ECC will perform a confidence check of the public address system and all emergency dispatch tones by announcing roll call and department status over both the public address and radio communication systems.

Staff Meetings: Staff meetings are conducted weekly at 0730 hours on Tuesday or appropriate when schedule conflicts exist. The Fire Chief determines the date/time, mixture of staff members, and purpose of the staff meetings. Personnel in attendance are expected to provide status of programs specific to the meeting's agenda. Staff meeting agendas may include status of training, accreditation, readiness, and/or other topics deemed appropriate by the Fire Chief.

TFES Annual Calendar: The TFES utilizes a web-based SharePoint calendar to consolidate all scheduled responsibilities. The Fire Chief will determine calendar content, and ensure accuracy.

2.3 Administrative Support to Operations Section: It is imperative that all administrative personnel understand that they have an inherent responsibility to support the Operations Section in the delivery of service programs. All 3E7X1 personnel must prepare to support emergency response operations either as part of the Initial Response Force (IFR), Effective Response Force (ERF), or capabilities sustainment force. Administrative personnel may supplement the Operations Section to facilitate training or appointments with the approval of the Fire Chief and Deputy Fire Chief, when available. The Fire Chief will determine compensatory time, if possible, when administrative personnel are required to supplement the Operations Section. Administrative personnel supporting the Operations Section are encouraged not to disturb the predetermined schedule by imparting administrative priorities to take advantage of an available workforce.

Operations Support to Administrative Sections: It is recognized that many of the administrative functions receive support from personnel assigned to the Operations Section. Administrative personnel will not task operations personnel in a manner that conflicts with a member's ability to respond to emergencies. Approval from the A/C Ops or Station Chief is required when operations personnel are needed to support administrative functions. The

priorities of administrative personnel or the time sensitive nature of tasks will not affect the administration of the Operations Section or personnel.

2.4 Recall Procedures: All TFES personnel are subject to the emergency support recall process. TFES has procedures for several different types of recall notifications with respect to civilian and military personnel, emergency or mobility support, and proximity of living quarters. Each recall type is structured in the manner of a "pyramid" recall. Measureable requirements are established to ensure continuity of the mission. All TFES personnel must account for recall reporting requirements when determining location of personal residence. The table below describes the TFES recall program.

TFES Personnel Recall Program

Recall Type	Report Time Requirement	Reportable Uniform	Reportable Equipment	Military Adherence	Civilian Adherence	Initiation Authority	Recall Official
Emergency /All Firefighters	Less than 15 minutes (on-base)/less than 1 hour (off-base)	Cotton attire	Issued Turn-Out Gear/SCBA	X	Optional	IC	ECC
Emergency /All Military	Less than 15 minutes (on-base)/less than 1 hour (off-base)	Cotton attire	Issued Turn-Out Gear/SCBA	X		IC	ECC
Emergency /On-Base Only	Less than 15 minutes	Cotton attire	Issued Turn-Out Gear/SCBA	X		IC	ECC
Non-Emergency /All Firefighters	Less than 1 hour	Uniform of Day	As required	X		Fire Chief/ Deputy Fire Chief	A/C Ops
Non-Emergency /All Military	Less than 1 hour	Uniform of Day	As required	X		Fire Chief/ Deputy Fire Chief	A/C Ops
Prime BEEF recall	Less than 1 hour	Uniform of Day	As required	X		Commander/ Fire Chief/ Deputy Fire Chief	A/C Ops

2.5 TFES Leave Policy: TFES employs two separate personnel leave systems consistent with AF regulations for military and civilian members. Local policies do exist that are consistent for both military and civilian personnel. All military members will utilize the AF Leaveweb tool, and civilian members will utilize ATAAPS to submit leave requests.

Military members accrue 2.5 days of leave per month of service, and cannot exceed a leave balance of 60 at the turn of the fiscal year. Military members are afforded leave of absences for various reasons. All military members must understand the types of leave as well as the provisions under which they are granted. Military members must adhere to all provisions set forth in AF Instructions as well as local policies for submitting, taking, and returning from leave. Military members do not have a "sick" leave program. Members unfit for duty must follow local protocols, and be placed on "quarters" status. A physician will determine the length of quarters given a member's condition. Personnel are expected to adhere to all medical directions. Personnel who abuse the quarters/sick call program will be subject to administrative action.

Civilian leave requests will be managed in accordance with provisions set forth in the Negotiated Agreement. Civilian members are afforded leave of absences as either scheduled vacation leave or as sick leave. Scheduled vacation leave is taken in hourly increments, and requires the approval of the leave authority. Civilians accrue "sick" leave separately from vacation leave. Civilians who use sick leave must notify the A/C Ops. Civilians who are incapacitated or otherwise cannot report to duty due to illness are required to contact their supervisor no later than (NLT) 3 hours after the start of the duty day. Civilians who abuse the sick leave program will be subject to administrative action. Civilians are also afforded the ability to take leave of absences in the event of an emergency. Civilian emergency leave must be approved by the A/C Ops (Operations Section) or the Deputy Fire Chief (Administrative Section).

Annual Scheduled Leave Forecast: Individual section supervisors are responsible for projected scheduled leave NLT 31 January of the calendar year. All military and civilian members are encouraged to schedule at least 14 days of leave for the upcoming calendar year. Military and civilian members are responsible for managing their personal "use or lose" balances when projecting their scheduled leave. Leave will not be authorized for personnel with negative balances unless an emergency arises. Military and civilian members are responsible for maintaining a positive leave balance. It is encouraged that all personnel maintain a minimum of 7 days leave for use in emergency situations.

Unscheduled Leave Request: Members must submit unscheduled leave requests prior to the projected first day of leave. Members will realize that leave requests are subject to disapproval depending on mission capabilities and staffing requirements. Civilian leave requests will be managed in accordance with provisions set forth in the collective bargaining agreement.

Forecasted and Unscheduled Leave Disapproval: All members must realize that the potential exists for forecasted and unscheduled leave to be denied. Assistant Chiefs or section supervisors will coordinate alternatives with members whose forecasted leave cannot be approved. Unscheduled leave is dependent upon the availability of resources to meet mission requirements.

Leave Disapproval For Failing to Adhere to Military Standards: Military members are subject to additional requirements specific to fitness, training, and proximity to official military movements. Military members must meet currency and proficiency requirements prior to submitting or embarking on forecasted or unscheduled leave. Leave authorization rests with the Assistant Chiefs or section supervisors, following a recommendation from the immediate

supervisor. Military leave is a right/benefit of service, and will not be viewed as a privilege. Members who feel their leave has been denied inconsistently with USAF regulations are encouraged to seek counsel and redress with the 60th CES/CC (actual leave approval authority) after utilizing the chain of command. Reasons for military leave to be denied are listed below.

-Current staffing levels are not sufficient given grade, licensing, or certifications
-Member failed to meet fitness standards, and a leave occurrence could negatively impact preparation for subsequent tests
-Member failed to meet skill-upgrade, mobility, or proficiency training requirements
-Member failed to execute duties and responsibilities commensurate with rank and position
-Members are projected a military movement in which leave conflicts with USAF guidance

Travel Restrictions When Not On Leave Status: Civilians are not bound by a time or distance standard. Military members must adhere to the provisions set forth in the 60th Civil Engineer Squadron (CES) leave policy letter. This policy restricts military members not on leave to remain within six hours of Travis AFB when not on a specific leave status. TFES utilizes web-based mapping tools (Yahoo Maps, Google Maps, etc.) as the basis for determining compliance with this policy. Members who violate the travel restrictions will be subjected to administrative action.

Special Passes/Non-Chargeable Leave: Special passes and non-chargeable leave are authorized in compliance with applicable Air Force (AF) standards. The Fire Chief is the approval authority for all non-chargeable absences. Special passes can be used as a performance based reward tool. This program is limited to granting absence for one duty day that will not, in conjunction with regularly scheduled "off-time" exceed 72 hours in length.

2.6 TFES Uniform Policy: Military and civilian firefighters have separate regulations that govern duty uniforms. Military members will adhere to AFI 36-2903, *Dress and Appearance* when both on and off-duty. Civilian members will comply with AFI 32-2006 *Uniform for Civilian Employees, Travis MOU, and TFES Policy Letter*.

-All fire station duty uniforms will conform to NFPA 1975, *Standard on Station/Work Uniforms for Fire and Emergency Services.* All military personnel will be provided an initial 4 sets of NFPA compliant Airman Battle Uniforms (ABU). NFPA compliant ABUs will be replaced by the department when they are determined to be unserviceable or out of regulations. Civilian members receive an annual clothing allowance that will be used to maintain their uniforms in serviceable condition.

-The department provides an initial compliment (2 sets each) of "downtime" gear. The department will replace on a one for one basis any items that are determined to be unserviceable. The downtime gear has expressed purposes, and is the only approved clothing to be worn by on-duty firefighters besides their duty uniforms.

-Military members assigned to administrative sections must wear NFPA compliant ABUs as well as cotton PT gear during duty hours due to the potential for them to support emergency

operations. Military members are required to wear AF PT gear when participating in organized PT outside the department or when performing required fitness assessments.

-All operational military and civilian personnel are required to wear steel toed safety boots. The style, color, and serviceability of footwear must conform to the applicable AF regulation. Athletic shoes that conform to dress and appearance standards are acceptable when wearing the downtime uniform.

When fire fighters are working in and/or around the fire station they may remove their ABU blouse only if they are wearing the above described T-shirt. When thermal underwear is worn, a long-sleeved shirt or jacket must be worn to cover the sleeves of the underwear shirt.

-Section supervisors or Assistant Chiefs have the authority to deviate from this policy to prevent undue wear and tear of the duty uniform or to reduce the physical stress of turnout gear during exercises.

2.7 Physical Training/Fitness (PT) Program: The physical fitness requirements for military and civilians differ, but it is the expectation that all members will engage in a physical training routine to maintain readiness to perform mission essential tasks safely. Specific PT criteria have been established given the varying duty schedules.

-All personnel: All personnel are not limited on the number of exercise sessions they may engage in. The requirements below are the minimum that must be accomplished. All personnel are afforded the opportunity to conduct additional exercise sessions daily as allowed by the section supervisors. Additional fitness sessions will not conflict with prescribed fitness schedules or degrade mission capability.

-Administrative: Military personnel are required to perform PT with 60th CES Monday, Wednesday, and Friday @0645 hours. Members are expected to report to duty following organized PT NLT 0830 hours.

-Operations: Military personnel are required and civilians are highly encouraged to participate in PT every duty day from 1530 hours to 1700 hours. Civilian members who do not exercise during the prescribed times above are required to continue with station details, projects, or training.

-ECC Dispatchers: Military personnel are required to maintain satisfactory fitness levels while assigned to the ECC. Daytime dispatchers will coordinate with the NCOIC to schedule daily PT sessions Monday thru Friday and the Operations Section on weekends and holidays. Operations will provide the night dispatcher relief from 1830 to 2000 hours each shift. Operations will provide relief for all dispatchers during absence of the NCOIC or when the NCOIC is covering a dispatcher's shift. Dispatchers may be required to ride a vehicle and workout at the fire station if staffing requirements dictate.

-Military members are required to adhere to standards set forth in AFI 36-2905, *Fitness Standard*. Personal fitness is an individual responsibility. Failure to maintain standards can have severe repercussions on a member's career. Members will adhere to all provisions found in AFI

36-2905 as well as the 60th CES Fitness Policy Letter. TFES will appoint a Non-Commissioned Officer (NCO), as PT Manager, to manage the flight's PT program. This NCO is required to attain all training and certifications as required by AF instruction. TFES will appoint additional Physical Training Leaders (PTL) to assist the PT Manager with administration of the program. The PT Program employs several tenets which are designed to prevent fitness assessment (FA) failures, and to rehabilitate members who fail to uphold standards. These tenets are listed below.

-Ensuring all personnel are afforded the opportunity to maintain personal fitness levels by providing adequate resources and time.

-Educating all personnel on fitness standards and repercussions of FA failures with respect to enlisted performance reports, decorations, permanent change of station, retainability, and/or promotion eligibility.

-Scheduling all personnel to ensure members do not enter into a delinquent status with respect to FA testing.

-Conducting "mock" PT assessments to assess the readiness of an individual to perform an official USAF FA. Mock PT assessments will be conducted between 42 and 14 days prior to projected official USAF FA. Members who fail to meet the minimum standard for any test component or who fail to achieve a composite score of 80 will be placed on remedial PT. Mock PT failures will not prevent a member from satisfying their official FA. The PT Manager will determine the necessary exercise regimen for members identified through the mock PT process. The concept behind mock PT assessments is to identify potential failures before they happen, and allow enough time to rehabilitate prior to the official FA.

-Members who fail to meet AF standards during an official FA will be processed according to the AFI and 60th CES Fitness Policy Letter. Members whose failure is the first over the previous 24 months will receive a letter of counseling (LOC) from the PT Manager or Deputy Fire Chief. The PT Manager will open a "case file" consistent with AFI requirements. Successive failures will be processed by the 60th CES Unit Fitness Program Manager (UFPM). Administrative actions for successive failures (2nd, 3rd, 4th, etc.) are progressive in nature and include letters of reprimand (LOR), unfavorable information files (UIF), control rosters, and retention recommendations.

2.7.1 Remedial PT Program: The remedial PT program is intended for military members who fail to meet AF standards or who have been identified as being in danger of failing to meet AF standards. Specific guidelines have been set for members who have failed an official FA while those identified through mock PT testing have the latitude to work with their immediate supervisor and the PT manager to ensure readiness for upcoming official FAs. Appointment to the Remedial PT program is documented on an official memorandum for record, letter of counseling, or letter of reprimand template. Remedial PT consists of the following requirements.

-Members who have failed their official FA are required to adhere to the provisions of other fitness regulations as well as those set by the PT Manager. Members are required to conduct 5 exercise sessions weekly. Attendance at the 60th CES Fitness Bull Camp is mandatory and

counts as 3 exercise sessions. The other 2 sessions will be conducted at Fire Station 1 at 1500 hours on Tuesdays and Thursdays regardless of schedule. Members will utilize AF Form 1975, *Personal Fitness Record* to track all exercise sessions and mock PT assessments. The PT Manager will review all AF Form 1975s monthly and file appropriately in the member's case file. Members will perform monthly mock PT assessments to measure fitness improvement. The failure of a member to adhere to any fitness provisions to include those in this FMP constitutes failure to follow direct orders, and will serve as the basis for administrative action.

-Members who have not failed an official FA, but who have been placed on remedial PT will conduct a counseling session with the PT Manager or Deputy Fire Chief. Members placed on remedial PT will have to satisfy additional mock PT assessments prior to their scheduled official FA. The frequency, intensity, and type of exercise will be determined through conference with the member, immediate supervisor, and PT Manager. The Deputy Fire Chief will be notified when personnel are placed on remedial PT and may impose certain requirements for all involved depending on the situation. The member's history, exercise habits, and mock PT results will determine if 5 exercise sessions will be required weekly. The Deputy Fire Chief is the authority when conflicts between the member, immediate supervisor, and PT Manager exist.

2.8 Hours of Operations: TFES is a 24-hour emergency services department. Administrative support is available between 0700 and 1600 hours Monday through Friday. Quiet hours are identified as 2000-0630 hours nightly.

-Visiting hours for personal reasons is limited to 1130-1300 hours (lunch break) and 1700-2000 hours (downtime). The conduct of visitors is the responsibility of the member "sponsoring" the visit. All visitors will be reminded that, even during downtime, all fire stations are professional work centers obligated to follow the rules and regulations set forth by the USAF. If visitors conduct is unacceptable, the senior ranking person (military or civilian) has the authority to revoke visiting privileges. If a person refuses to vacate when asked, 60th Security Forces will be notified to assist. At no time is it acceptable for personnel to engage in physical contact when conflicts arise.

2.9 Public, Restricted, and Private Quarters: All fire stations have public, restricted, and private areas identified. Public areas are all offices, administrative support, training and conference rooms, and all lavatories. Visitors are allowed to frequent these areas without escort. Restricted areas are those areas of a fire station in which the equipment, apparatus, or processes pose a hazard to uneducated and untrained visitors. These areas also include those that, when visitors are present, may interfere with the quality of life of other members. These areas are the gymnasiums, kitchens, recreational areas, apparatus bays, locker mezzanines, air compressor rooms, and supply rooms. These areas require an escort presence. Private quarters are the individual bedrooms or bunkrooms of on-duty members. Visitors, even family members are prohibited from entering these areas regardless of escort presence.

2.10 Civilian Hiring/Promotion/Demotion/Separation Program: TFES adheres to policies set forth in USAF standards as well as the collective bargaining agreement. Local practices are consistent with those mandated by the Air Force Personnel Center.

2.11 In-Processing Requirements: Civilian members will accomplish all in-processing requirements set by the Installation's Office of Personnel Management. Civilian members will also complete all job specific in-processing and complete all tasks according to set timelines upon issue. Military members will be assigned a "sponsor" to facilitate a seamless integration into the department. The presence of a sponsor does not relieve an individual of the responsibility to complete all in-processing requirements according to established timelines.

-Military members are required to report to the department prior to the member's report no later than date (RNLTD). In-bound personnel will be processed into the department and briefed on local in-processing requirements. Certain items on the issued in-processing checklist merit focus and include respirator questionnaire, restricted area badge request, network computer access paperwork, permissive TDY for house hunting, basic allowance for subsistence paperwork, and First Term Airman's Counsel (FTAC) if applicable.

-The goal of this program is to assist new members with their transition. Maintaining good communication between member, sponsor, immediate supervisor, and Deputy Fire Chief are key to ensuring the needs of the in-bound member are met.

-The member will submit the completed in-processing checklist to the Deputy Fire Chief for inclusion in the member's personal information file (PIF).

2.12 Out-Processing Requirements: Civilian members will accomplish all out-processing requirements set by the Office of Personnel Management as well as those local requirements set by the department. Military members will accomplish all PCS and separation out-processing in accordance with requirements set by the installation and department. Supervisors are expected to play an active role in assisting members during their out-processing of the department. Military members are afforded between 2 and 5 out-processing (prior to final out-processing date) days in which they will be relieved of all positional responsibilities. This range accounts for marital status and out-processing requirements.

2.13 Awards and Recognition Program: The department maintains a local military and civilian firefighter recognition program, and supports all Travis Air Force Base, USAF, and DoD awards and recognition programs. Members are encouraged to research submission and qualification criteria for all recognition programs outside the department. The responsibility of the Travis Firefighter Recognition Program is delegated to the Deputy Fire Chief.

-All personnel, with respect to affiliation, are eligible for both quarterly and annual firefighter awards. The Deputy Fire Chief will solicit nominations for both categories from all members. Once all nominations have been collected the Deputy Fire Chief will initiate a closed voting system where all members are eligible to vote for each category. The Deputy Fire Chief will submit voting results to the Fire Chief for recognition.

-The annual award winners will also be recognized as part of the Solano County Firefighter of the Year as sponsored by the local Rotary Club.

2.11 Personal Conduct: Given the unique responsibilities of emergency responders all personnel are required to adhere to the following provisions. These provisions are wide ranging and intended to ensure the highest levels of professional behavior and that emergency response capabilities are maintained. All members must understand the roles and responsibilities of the positions they are assigned to as well as the responsibility to represent TFES in the most professional manner possible.

-All personnel assigned to an emergency vehicle will adhere to all policies governing non-emergency vehicle movement, crew continuity, and personal accessibility. Members are restricted to fire stations and the immediate vicinity thereof to ensure reception of emergency response notifications.

-All personnel will conduct themselves in a manner that is cordial and respectful to all employees and visitors. TFES has a zero tolerance policy for offensive behavior and members may be subject to administrative action if they violate this policy.

-Military protocol dictates that proper customs and courtesies will be observed at all fire stations. Members will show respect, standing and greeting, to all senior non-commissioned officers (SNCO), field grade, and company grade officers upon recognition. Military protocol also dictates that any fire station will be "called to attention" when the 60th CES/CC, 60th MSG/CC, 60th AMW/CC, or any O-6 (Colonel) or higher enters or leaves.

-Certain practices that misinterpreted as traditions are prohibited within the confines of all fire stations. These practices include those defined as hazing according to USAF regulation. At no time is it acceptable for members to engage in physical contact. Military members must adhere to conduct standards both on and off duty, and understand the consequences of violating personal and professional conduct standards.

-Personnel are prohibited from taking pictures at any emergency scene unless required for official purposes or authorized by Fire Chief or Deputy. Under no circumstances shall any picture involving injuries or fatalities be taken.

-FES personnel are authorized to use DoD motor vehicles for travel to Military Dining Facilities, NAF/AAFES/DECA operated eating establishments to include commissary, shoppette, base gymnasium, and intramural sports when on duty. Response capabilities must be maintained at all times.

-Use of Alcohol. Consumption of alcoholic beverages to include beer and wine is prohibited by on-duty fire fighters. Additionally, members reporting to work should avoid use of alcohol for a minimum of eight hours prior to reporting for duty. Any on duty fire fighter suspected of being under the influence of alcohol or other illegal substance will be relieved of emergency response duties and turned over to the 60th SFS for evaluation.

-TFES Driving While Intoxicated (DWI)-Driving Under the Influence (DUI) prevention program: The consequences of DWI/DUI are far reaching and completely preventable. The TFES manages a non-reprisal/non retribution program in which any civilian or military member

may request assistance. All personnel are encouraged to contact the ECC as an alternative to driving under the influence of alcohol or drugs. The ECC will coordinate with on-duty personnel to support retrieval of the member, and return them to their place of residence or to one of the fire stations. This policy is intended to be a "back-up" plan, and all members are encouraged to properly plan their evenings prior to leisure activities. On-duty personnel will support the request when staffing levels permit; otherwise it is the understanding that all military personnel may be subject to provide this service when requested by the A/C Ops on duty. This program depends on the principles that DWI/DUI prevention is everyone's duty as well as the importance of taking care of another. There is no reprisal for individuals who cannot support ride requests, and in the event that no one is available the request WILL be supported by on-duty personnel. Travel limits of this program are Solano County in general, but can be extended to remote locations when necessary. Those individuals who cannot be retrieved will have commercial transportation coordinated to prevent impaired personnel from operating motor vehicles.

2.12 Appropriate Use of Internet/E-Mail: Personnel will strictly comply with all guidance and restrictions concerning appropriate use of the Internet and electronic mail (e-mail), as prescribed in AFI 33-119 Electronic Mail (E-Mail) Management and Use, and AFI 33-129, Transmission of Information via the Internet.

-Access to the Internet from a government owned computer is for official business only. Any downloading of compressed files (ZIP files) or executable files (EXE. files) is strictly prohibited as these types of files are common carriers of computer viruses.

-The following activities involving the use of government-provided computer hardware or software are specifically prohibited: storing, processing, displaying, sending, or otherwise transmitting offensive language or material. Offensive material includes, but is not limited to, "hate literature" such as racist literature, materials, or symbols (for example: swastikas, neo-Nazi materials and so forth) and sexually explicit or suggestive materials.

-Air Force e-mail systems are provided to support Air Force missions only. Only use e-mail systems for official, authorized, and ethical activities that are in the best interest of the Air Force.

-Unacceptable use of Air Force e-mail systems include, but is not limited to, the following: sending harassing, intimidating, abusive, or offensive material to or about others that violates Air Force standards of behavior. This includes, but is not limited to, humor considered to be in poor taste or offensive, political or religious lobbying, and pornographic material.

-Using the Internet and/or e-mail, for other than authorized purposes may result in adverse administrative or disciplinary action.

CHAPTER 3-EMERGENCY RESPONSE PROTOCOLS

3.1 Services Provided: Travis AFB firefighters respond to any emergency event on the installation that poses risk to people or property and employ management actions within the limits of available resources. These include incidents that are natural or man-made and require fire suppression or hazard mitigation; rescue or containment of hazardous materials (including

chemical, biological, radiological, nuclear, and high yield explosive (CBRNE agents), resulting from accidents or terrorism. In addition, the scope of services includes assisting the primary emergency medical services (EMS) provider within the limits of available resources.

3.2 Selective Response Procedures: TFES employs a selective response concept to ensure that the Initial Response Force (IRF) and Effective Response Force (ERF) are consistent with guidance set forth in AFI 32-2001. The Assistant Chief of Operations reserves the right to exceed minimum response requirements given the scope and complexity of the initial dispatch information. Specific information about selective response can be found in TFES FMP 32-08, *Emergency Operations Management*.

CHAPTER 4-FACILITIES MANAGEMENT

4.1 Facility Manager Appointment: A facility manager will be appointed to manage requirements for all fire stations. Roles and responsibilities of facility managers are outlined according to 60th CES guidelines. The facility manager is responsible for protecting the serviceability of all facilities as well as coordinating inspections and maintenance. The facility manager is also responsible for educating and ensuring compliance from all personnel on usage and safety standards.

4.2 Damage to Facilities: Personnel are required to report all accidental damage to facilities. Personnel are required to fill out the appropriate mishap/safety reports to the Flight Safety Officer NLT 24 hours from the time of incident. An investigation will be conducted by the Flight Safety Officer to determine root cause of accident to ensure prevention of similar accidents in the future. Personnel whose damage is caused by negligence, malicious acts, or intentional destruction will be held accountable for the damage incurred. Members will be subject to adverse administrative action as well as being financially culpable for damage.

CHAPTER 5-APPRATUS MANAGEMENT

5.1 Roles and Responsibilities: TFES personnel operate government owned vehicles (GOV) in accordance with applicable regulations. TFES SOG 32-01-04, *Vehicle Utilization and Maintenance Program* outlines roles and responsibilities as well as general acceptable practices in more detail.

5.2 Vehicle Control Officer: One or more vehicle control officers (VCO) will be appointed to manage all aspects related to the acquisition, use, maintenance, performance, inspection, testing, and retirement of government owned vehicles. The VCO also acts as the liaison between the department and all USAF entities with respect to personnel licensing/certification.

5.2 Accidents and Reporting: TFES personnel will report any damage to vehicles immediately upon identification. Specific procedures for accident reporting and investigation are established and are referenced in TFES SOG 32-01-04. All personnel are expected to understand the proper reporting procedures. Personnel whose accidents are caused through negligence, complacent behavior, failure to follow established policies, or malicious and intentional acts will be held accountable for damage incurred. Members who willfully damage government property (to

include GOVs) will be subject to adverse administrative action as well as being financially culpable for damage.

CHAPTER 6-CIVILIAN PERSONNEL MANAGEMENT

6.1 Civilian Personnel Management: All civilian employees are subject to established regulations, instructions, and standards given their particular position as either union bargaining employees or non-union bargaining employees.

6.2 American Federation of Government Employees (AFL-CIO) Chapter 1764: Those members eligible may seek inclusion in the local chapter of the AFL-CIO. The TFES will abide by all provisions in the most current agreement. Members have the ability to seek counsel and guidance on all matters relative to civilian personnel management.

- The Union will be given notice IAW the Travis Negotiated Agreement when policies and procedures will change working conditions. This does not include those changes to the daily schedule that are necessitated to facilitate training needs or meet mission requirements.

-TFES strives to provide a quality work environment for all personnel military and civilian. It is the intent to manage all resources consistently with established regulations in an effort to satisfy all queries or potentials for grievances at the lowest level. This ideology in no way prohibits union bargaining employees from exercising their rights, and in no way sets the precedence for reprisal or retaliatory action against those who do exercise their rights.

CHAPTER 7-MILITARY PERSONNEL MANAGEMENT

7.1 Military Personnel Management: All military members are subject to DoD and USAF regulations and standards in relation to evaluation, promotion, assignment, and all other military specific programs.

7.2 Contingency Support and Preparation: The department has an understood responsibility to prepare its military members to support contingency operations. All military members will be assigned to a deployment unit type code (UTC). Training and equipment requirements are specific to assigned UTC and location of temporary duty (TDY). It is the responsibility of the Deputy Fire Chief to manage the Prime BEEF program, as well as ensuring that the needs of members deployed are being met with respect to professional military responsibilities and personal family requirements.

-It is ultimately the responsibility of the military member to ensure personal readiness. The Deputy Fire Chief, section supervisors, Assistant Fire Chiefs, and Immediate Supervisors have a responsibility to mentor and supervise. Military members must ensure currency of all Prime BEEF, Home Station Training (HST), and personal readiness requirements. It is the expectation that all military members will maintain the currency of their personal mobility folders as well as a stocked personal mobility bag consistent with 60th CES requirements at all times.

10/1/2014

X John A. Speakman

JOHN A. SPEAKMAN, GS-13, DAF
Chief, Fire Emergency Services Flight
Signed by: SPEAKMAN.JOHN.A.1167558778

ATTACHMENT 1--REFERENCES

AFI 10-2501, *Air Force Emergency Management (EM) Program Planning and Operations*

AFI 32-2001, *Fire Emergency Services Program*

NFPA 1521, *Standard for Fire Department Safety Officer, Current Edition*

APPENDIX F.

TAFB DRAFT PRESCRIBED BURN PLAN

PRESCRIBED BURN PLAN

Site: **Travis AFB, CA**
Burn Unit: **Aero Club**

Fire Planner(s):

Name:	*Jaymee Marty*	_____	_____
Title:	Environmental Engineer 60 CES/CEV	*Signature*	*Date*

Incident Commander (IC):

Name:		_____	_____
Title:		*Signature*	*Date*

Natural Resource Manager:

Name:	*Bob Holmes*	_____	_____
Title:	Natural Resource Manager 60 CES/CEV	*Signature*	*Date*

Travis AFB Fire Chief:

Name:		_____	_____
Title:	Fire Chief 60 CES/CEF	*Signature*	*Date*

1. **LOCATION:**
   Site: Travis AFB, CA
   Burn Unit: Aero Club
   Map Location:
   Unit Area:
   County/State: Solano County/California
   Ownership: USAF, Travis AFB

2. **SOURCES OF EMERGENCY ASSISTANCE (location & phone #):**
   Fire: Travis AFB Fire Protection Flight, Travis AFB, CA

   Law Enforcement:

   Medical: David Grant Medical Center

   Nearest burn trauma facility:

   Nearest Phone to Unit: Cellular phones with crew:

3. **PERMITS AND OFFICIAL NOTIFICATIONS:**
   Burn Permit/Notification Required? Yes / No
   Source(s): Prior to burn:
   Day of burn:

   Air Quality Permit/Notification Required? Yes / No
   Source(s): Prior to burn:

   Day of burn:

   Other Notifications Required? Yes / No

4. NOTIFICATIONS:

All fires:
Neighbors within 1 mile of the burn units will be notified in writing of all prescribed burn plans.

Name	Address	Phone

5. UNIT DESCRIPTION:

Vegetation Types	Fuel Models	% of Unit Area	% Slope	Aspect
Short Grass	#1	100%	0-5%	South

Fire Unit Narrative Description (include description of surrounding fuels):

The Aero Club site is 100% Fuel Model 1 with almost no slope except for low mima mounds located throughout the unit which are less than three feet in height (Figure 1). Between the mima mounds are seasonal vernal pools. Most of this site burned in a wildfire that started on Airbase Parkway and burned south in 2000. The southwestern corner of this unit also burned in 2005 again from a wildfire starting on Airbase Parkway. The unit is surrounded by similar vegetation. An Aero Club facility, taxiways and a runway are situated in the center of the burn unit. This facility will be vacant when the prescribed burns occur.

The unit's south boundary is a fence line just north of an abandoned railroad track. The eastern boundary of the unit is delineated by a road that runs from north to south along the entire edge of the unit. The road will serve as the control line along the eastern boundary.

The unit's north boundary is designated by a chain-link adjacent to Airbase Parkway. A 20 foot wide disked strip will be located to the south of this fence along the entire northern boundary of the unit. The western end of this fence turns to the south and runs along the entire edge of the burn unit. There are no gates along this boundary fence. A 20-foot wide disked strip will be in place as a control line along this western fence boundary.

Maps Attached:

- Site location map: Yes / No
- Site burn unit map: Yes / No
- Burn unit map with ignition pattern, hazards, etc: Yes / No
- Smoke Screening Map Yes / No
- Map to Hospital Yes / No

6. PRESCRIBED BURN JUSTIFICATION:

Unit Habitat Description:

Fire has historically been excluded from this landscape for the last 100 years except for some summer wildfires along roads. The upland grasslands are primarily mixed alien grasses and forbs (*Bromus* spp., *Avena* spp., *Erodium* sp., *Hordeum* spp., *Festuca* spp, *Lactuca* sp.) with some native forbs present. Two particularly invasive and destructive species that occur throughout the grassland are medusahead (*Elymus caput-medusae*) and Yellow starthistle (*Centaurea solstitialis*). These plants can be effectively controlled with properly timed burning.

The unit has high quality vernal pools and swales scattered throughout the grassland matrix that contain the federally listed species Contra Costa goldfields (*Lasthenia*

conjugens). The vernal pools are dominated by native annual forbs and grasses. The topography of Travis AFB is flat with slopes ranging from 0-10%. Topography consists of mima mounds and vernal pools. Elevation ranges from about sea level to 30 feet.

All fuels are mostly continuous annual grasses and forbs that should be approximately 90% dead. Surface fuels are 2-24 inches tall and litter depth is 0-3 inches. Fuel loading ranges from 0.5 to 1.0 ton/acre.

The following rare species may benefit, directly or indirectly, from the prescribed burn program:

Contra Costa goldfields (*Lasthenia conjugens*)
Vernal pool fairy shrimp (*Branchinecta lynchi*)
Western burrowing owl (*Athene cunicularia*)

Burn Unit Management Goal(s):

1. Provide firing, suppression, ICS and other fire-related training for Fire Department personnel, and other local Fire Protection Agency personnel.
2. Reduce non-native grass cover, particularly medusahead grass in the grasslands and vernal pools.
3. Increase native plant species diversity in and around the vernal pools.
4. Reduce the risk of wildfire by consuming flashy fuels and reducing accumulated thatch.
5. Increase cooperation between Solano County Fire Agencies and the Travis AFB Fire Protection Flight in planning and implementing prescribed burns for the purpose of firefighter training and vegetation management.

Specific Burn Objectives:

1. Reduce thatch component by 75%.
2. Consume 75-90% of on the ground 1-hour fuels.

7. FUEL AND WEATHER PRESCRIPTION (give acceptable ranges)

Required Parameters:	**MAX**	**MIN**	**PREFERRED**
Wind Direction(s)	**S to W**		**Southwest**
Midflame Windspeed (average mph)	15	1	8-10
1-Hour Fuel Moisture (%)	12	4	9
All Wind Directions			
10-Hour Fuel Moisture (%)	N/A	N/A	N/A
100-Hour Fuel Moisture (%)	N/A	N/A	N/A
Live Fuel Moisture (%)	N/A	N/A	N/A
Atmospheric Mixing Height (ft)	None	1,700	1,700+
KBDI	350	150	250

Guidance Parameters:	**May**	**June**	**MAX**	**MIN**
Mean Max Air Temperature (ºF)	73	80	95	50
Mean RH (%)	63	60	85	25
Days Since Rain	N/A	N/A	N/A	1

List any combinations of parameters that you will exclude from your burn window (e.g. high windspeeds with low 1-hour fuel moisture).

- If southwest midflame wind speeds are over 10 mph combined with 1-hour fuel moisture less than 6%, the Incident Commander will determine if backup resources are sufficient for suppression of anticipated fire behavior inside unit or in the event of escape. These conditions may produce spread rates in excess of 100 ch/hour and flame lengths over 4ft. If available resources are not sufficient the Incident Commander will limit ignition to backing fires inside of an established blackline or suspend ignition. No ignition will be started if the Incident Commander determines that expected fire behavior will exceed on-hand suppression capabilities. Ignition will not be conducted under a north wind condition.

8. PREDICTED FIRE BEHAVIOR (From BEHAVE): Use this information as a guide to the potential range of behavior from a free-burning fire, and for contingency planning.

	Fuel Model#1
Max. Headfire Flame Length	4 ft
Min. Headfire Flame Length	1.1 ft
Max. HF Rate of Spread	107 ch/hr
Min. HF Rate of Spread	9.9 ch/hr
Max. Backfire Flame Length	1.1 ft
Min. Backfire Flame Length	0.4 ft
Max BF Rate of Spread	6.4 ch/hr
Min. BF Rate of Spread	1.5 ch/hr

9. FIRE BEHAVIOR NARRATIVE (Describe *desired* fire behavior. How will you manipulate fire behavior to meet management and control objectives?):

Desired fire behavior will be inferred from observations to determine if fire intensities are sufficient to consume fuels as described in Section 6. Due to the size and shape of this unit, interior ignition will be necessary. Fire intensity will be controlled with the use of various ignition patterns that may include strip headfires, spot headfires, flanking fires and backing fires. Backing fires will be used initially to establish at least 50 feet of black on the downwind control lines. Once sufficient black is established, head fires may be used to accelerate the burn only if weather parameters comply with the guidance in section 7 above.

It should be noted that as the season progresses bringing higher temperatures, there is the potential for maximum fire behavior.

10. SMOKE MANAGEMENT PLAN

Smoke screening procedures completed? Yes / No

List <u>downwind/downdrainage</u> smoke sensitive areas (give distance):

- David Grant Medical Center, ¼ mile east of unit
-

Map of smoke sensitive areas attached? Yes / No

Describe desirable smoke behavior and smoke management actions:

Preferably smoke will lift and disperse to the NE. Ignition will only occur under conditions that allow the smoke to rise and dissipate. Smoke behavior will be observed during the test burn to assess this. Headfires will be initiated as soon as possible to improve smoke uplift. If smoke conditions change and sensitive sites are impacted, the fire will be extinguished using standard suppression techniques.

Crew members will place signs along Airbase Parkway east and west of the burn unit to alert drivers of the burn operations. If necessary, a crew member will be assigned to monitor smoke along Airbase Parkway to ensure smoke-related safety hazards are not present.

11. CREW ORGANIZATION

Qualified Incident Commander(s): 1
Crew Number: 10+
Organization chart attached? Yes / No

12. EQUIPMENT

Required items:

Engines on site	-minimum of 4
Radios	-IC and Division Commanders and one per engine
Protective clothing	-All firefighters shall wear full Nomex clothing, goggles, Nomex face protection, leather gloves, helmet, leather boots, fire shelter.
First aid kit	-One per vehicle
Weather kit	-One

13. BURN DURATION

Time (indicate minutes or hours) for:

Blackline Preparation (if required by IC): 5 hours
Sub-unit A: 3 hours
Sub-unit B: 3 hours
Mop-up: 2 hours for each sub-unit
Total Duration: 13 hours (Including blackline preparation)

14. MANAGING THE BURN (Describe each of the following):

Firebreak preparations:

Control to the north and west will be provided by a 20-foot wide disked fire break. Given a southwest wind direction backing fires will be ignited along the northern control line and allowed to burn in 50 feet for additional control before any interior ignition occurs. Control to the east will be provided by igniting backing fires off of the road. A blackline may be created along this boundary, beforehand if deemed necessary by Incident Commander. Along the unit's south boundary adjacent to the fence-line, head and flank fires will be ignited with the back-fire being immediately extinguished within a mowed strip that has had all loose vegetation removed south of the fence.

Firing techniques and ignition pattern:

Due to the size and configuration of this unit it may need to be burned in 2 days. An additional day may be required, if the Incident Commander deems that blacklining is required. Anticipated sub-units are: (see unit map for Drop Point (DP) locations)

Sub-unit A (Figure 2): DP1 to DP2 to DP3 to DP4 to DP5 to DP6, approximately 40 acres.

Sub-unit B (Figure 3): DP7 to DP8 to DP9 to DP10 to DP11 to DP12 to DP13 to DP14, approximately 30 acres.

Ignition will begin at approximately 10:00 AM after all notifications have been made and crews briefed. The burn may occur on any week or weekend day that meets prescription. Test fires will be conducted prior to burning. The plan anticipates southwesterly winds, the prevailing direction at Travis AFB. The burn will not be conducted with north winds. Starting points may vary within the stated prescription if deemed necessary by the Incident Commander. The sequence of burning will be to burn sub-unit A first and then sub-unit B.

All sub-units of this prescribed fire will be run as a two-division fire. A test fire will be completed prior to primary ignition, normally at the subunit northeast corner. The test fire will be large enough to assess potential fire behavior. If conditions are considered to be within prescription, the unit firing operations will begin. The test fire may be extinguished as part of a suppression training exercise. The Incident Commander may direct the burn operation as deemed fit for safety and training based upon weather conditions and available resources.

The following sub-unit narratives are guides for the IC.

Sub-unit A: Initial ignition is anticipated to occur at DP1. A large safety zone should be created in the area of DP1 to provide a safety zone for all personnel and equipment during early stages of the burn. Division B will proceed west from DP1 to DP6 along the disked strip (or black line if one is installed) adjacent to and south of the perimeter fence igniting backing fires into the unit. An engine will be positioned on the north side of the perimeter fence to provide for initial attack should slop-over occur to north of unit. If the entire unit is being burned at one time, Division B will continue west from DP6 to DP5. Division A will then proceed south from DP5 to DP4 upon direction from the IC igniting along the disked firebreak immediately adjacent and east of the perimeter fence igniting head fires and or interior strip fires.

Division A will proceed south from DP1 along the road also igniting backing fires. Once approximately 50 feet of black is established along the north and east lines of the unit, Division A will proceed northwest from DP 2 to DP 3 on a mowed strip igniting head fires off of a wet line. A follow-up engine will patrol behind the ignition engine and provide for initial attack should slop-over occur to the east of the unit. The IC may decide to use the small triangular unit delineated by DP1, DP2 and DP3 for training personnel in which case the larger unit would be burned starting at DP6. Once the DP 1, 2, 3 triangle corner is burned out and at least 100 feet of black has burned into the unit from the north control line, Division A will light heading fires from DP3 to DP4. Divisions A and B will tie in at DP4.

Sub-unit B: Initial ignition is anticipated to occur at DP9 in northeast corner of the unit. Division A will proceed south along the road igniting backing fires. A follow-up engine will patrol behind the ignition engine and provide for initial attack should slop-over occur to the east of the unit. Upon reaching DP10 and once sufficient black is burned out along the north and east control lines, Division A will proceed west on the north side of the fenceline along a mow strip igniting head fires to DP11 and eventually

all the way to DP12 where the two divisions will tie in. The IC may decide to use the triangle area delineated by DP9, DP10, DP11, and DP8 to conduct training. If that is the case, then ignition of the remainder of unit B will begin at DP7.

If burned as a single unit, Division B will proceed southwest from DP9 to DP8 igniting along the edge of the aircraft parking area. Since this ignition will create headfires, Division B will only begin ignition once the IC determines sufficient black is in place along the eastern control line. Upon reaching DP8, Division B will proceed north to DP7 igniting backing fires off of a wet line. Once sufficient black has been built along the control line between DP7 and DP8, Division B will commence ignition along the taxiway that forms the northern control line of the unit to DP14. Division B will then proceed northwest from DP14 to DP13 lighting a backing fire off of a wet line. Once sufficient blacklining is developed along the line between DP13 and DP14, Division B will begin firing along the disked line adjacent to the fence from DP13 to DP12 where they will tie in with Division A.

Crew communication:

See attached communication plan. Crewmembers with two-way radios will speak short sentences in plain language.

Fire behavior and weather monitoring:

Incident Commander and division supervisors will monitor fire behavior. A designated crew member from a holding engine will record weather data as required by the Incident Commander. Lookouts will be assigned to each division. A safety officer will be designated by the Incident Commander during the crew briefing.

Additional water resources:

**Need to add additional water sources here.

Holding:

An engine will be posted at all times of active burning in the black along the north boundary to monitor and provide initial attack for any spot fire north of the unit. Additionally, if enough holding resources are available, the IC may post an engine on base to the east to provide initial attack on any slop over to the east of the units.

Contingencies (include safety zones, escape routes, secondary control lines, escape response procedures):

Safety zones/escape routes: All firefighters will be within a safety zone or immediately adjacent to one during active firing. Safety Zones are black, disked lines, roads, and the Aero Club taxiways/runways. Personnel escape routes and safety zones, fire breaks, drainages and already burned areas, will be reviewed during the pre-burn briefing.

Escape response procedures:

East of Unit: Division A holding engine will provide initial attack. Division B holding engine will also respond. All firing will cease once a spot fire is announced. All spot fires will be attacked by first establishing an anchor point. Initial attack will focus on the north side of the spot since the wind will probably be from the southwest which will keep escape on preserve property. If on-hand resources cannot immediately control the spot fire, the IC will call Solano County Dispatch for outside assistance.

North of Unit: Division B holding engine will provide monitoring and initial direct attack to any spot fires north of the unit. Division A holding engine will also respond. All firing will cease once a spot fire is announced. All spot fires will be attacked by first establishing an anchor point. Initial attacks will focus on the north side of the spot since the wind will probably be from the southwest which will keep escape on preserve property. If the responding resources on hand cannot immediately extinguish the spot fire, the IC will call Solano County Dispatch for outside assistance.

Potential hazards to crew:

Barbed-wire and chain link fences occur along most of the perimeter of the unit. Crews will be made aware of gates and any cut opened locations. The topography of the preserve includes intermittent drainages that may make driving conditions hazardous. All engine operators will be given a map showing topographic relief. Airbase Parkway is a highly traveled road and extreme caution should be used when entering and exiting the roadway. Road guards will be set up along Airbase Parkway if smoke becomes a problem. Signs will be posted ½ mile north and south of the burn unit along Airbase Parkway to alert drivers to the burning operation.

Crew considerations:

Vernal pools occur within the units. Crews will not use foam. Crews should not create any hand-lines unless directed by the Incident Commander.

Mop-up:

Mop-up will begin immediately upon reaching the final division break. Divisions will reverse direction and extinguish all smolders within 50 feet of disked lines, and flammable green. If it is not possible to reach the above objectives, one engine will remain until nightfall. The unit will be inspected the following day after 10:00 am for smolders that may pose an escape hazard.

Follow-up assignments:

Incident Commander will maintain contact with local law enforcement authorities in the event smoke settles on major roads. Personnel will remain on major roads to slow traffic unless relieved by law enforcement. After mop-up is complete, an engine crew will return to the unit on the following day and continue mop-up if necessary.

15. LEGAL CONSIDERATIONS

Describe the ownership/management responsibility of this site:

The burn units are all located within Travis Air Force Base which has the responsibility for managing the habitat. A hired contractor will lead all of the prescribed burn using TAFB and other resources from the local community.

PRE-BURN CHECKLIST AND CREW BRIEFING

Site: Travis AFB **Fire Unit:** Aero Club **Date:**

A. PRIOR TO CREW BRIEFING

☐ Fire Unit is as described in plan.
☐ Required firebreaks complete.
☐ Permits obtained (if required). Give permit #'s:
☐ Official and neighbor notifications complete.
☐ Required equipment is on-site and functioning.
☐ Planned ignition and containment methods are appropriate.
☐ List of emergency phone numbers are in each vehicle.
☐ Planned contingencies and mop-up are appropriate.

B CREW BRIEFING

☐ Each crew member has a burn unit map.
☐ Fire Unit size and boundaries discussed.
☐ Fire Unit hazards discussed.
☐ Purpose of burn.
☐ Anticipated fire and smoke behavior.
☐ Review of equipment and troubleshooting.
☐ Check crew qualifications.
☐ Review organization of crew and assignments.
☐ Review methods of ignition, holding, mop-up, communications.
☐ Review contact with the public; traffic concerns.
☐ Location of vehicles, keys, and nearest phone.
☐ Location of back-up equipment, supplies, and water.
☐ Review all contingencies including escape routes.
☐ Review mop-up procedures.
☐ Answer questions from crew.
☐ Give crew members the opportunity to decline participation.

C. PRIOR TO IGNITION

☐ Weather and fuel conditions are within prescriptions.
☐ Weather forecast, obtained within two hours of ignition, says prescribed weather will hold for two hours past expected duration of burn.
☐ Crew members have required protective clothing.
☐ Crew members have matches.
☐ Conduct test burn.

D. BEFORE LEAVING BURN UNIT

☐ Mop-up completed as described in prescription.
☐ Next morning inspection arranged.
☐ Notifications of completed burn (if required).

E. NOTE ANY MODIFICATIONS TO RX

Incident Commander: **Date:**



Figure 1. Location of burn units at Aero Club.

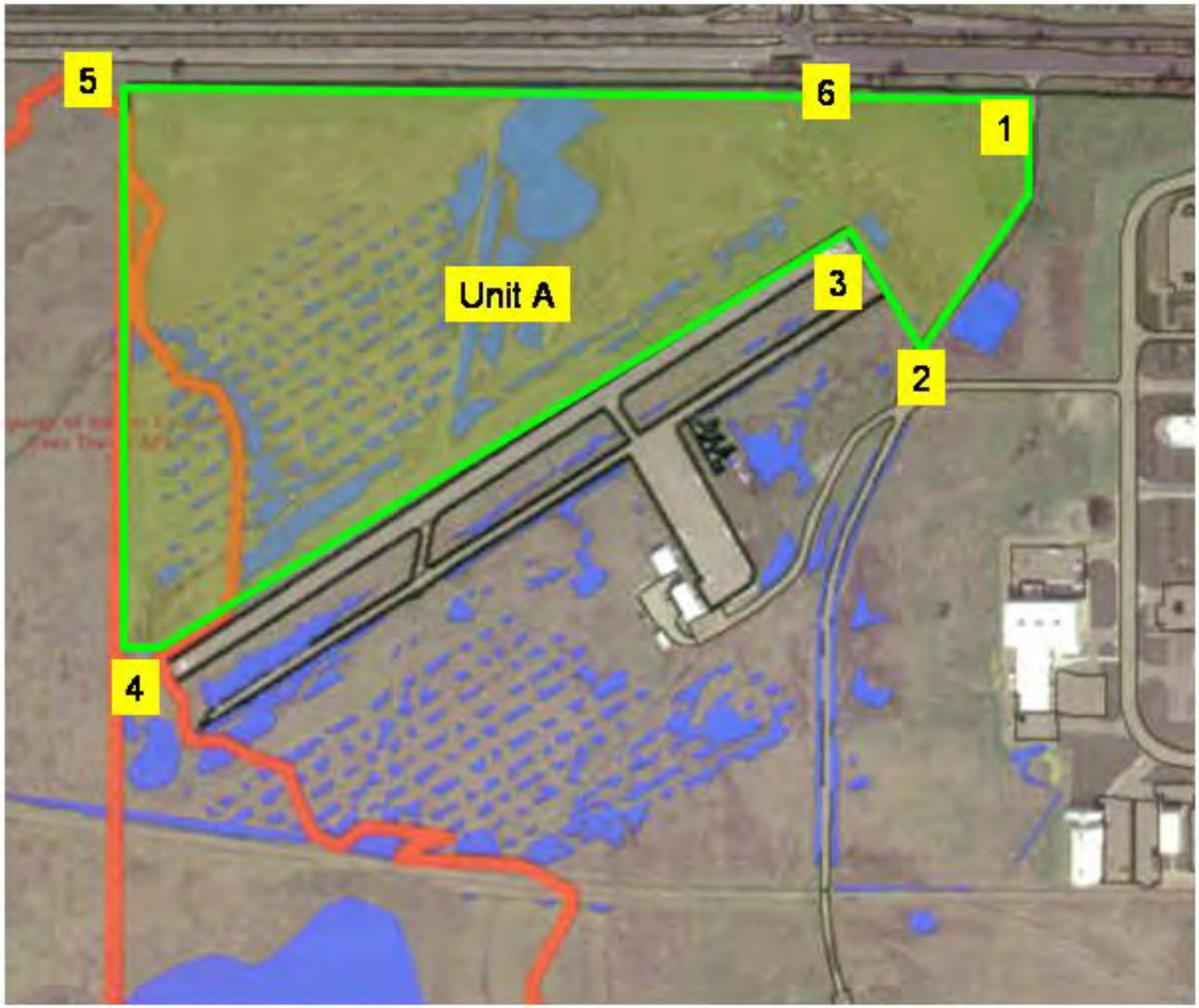


Figure 2. Detail of burn sub-unit A.

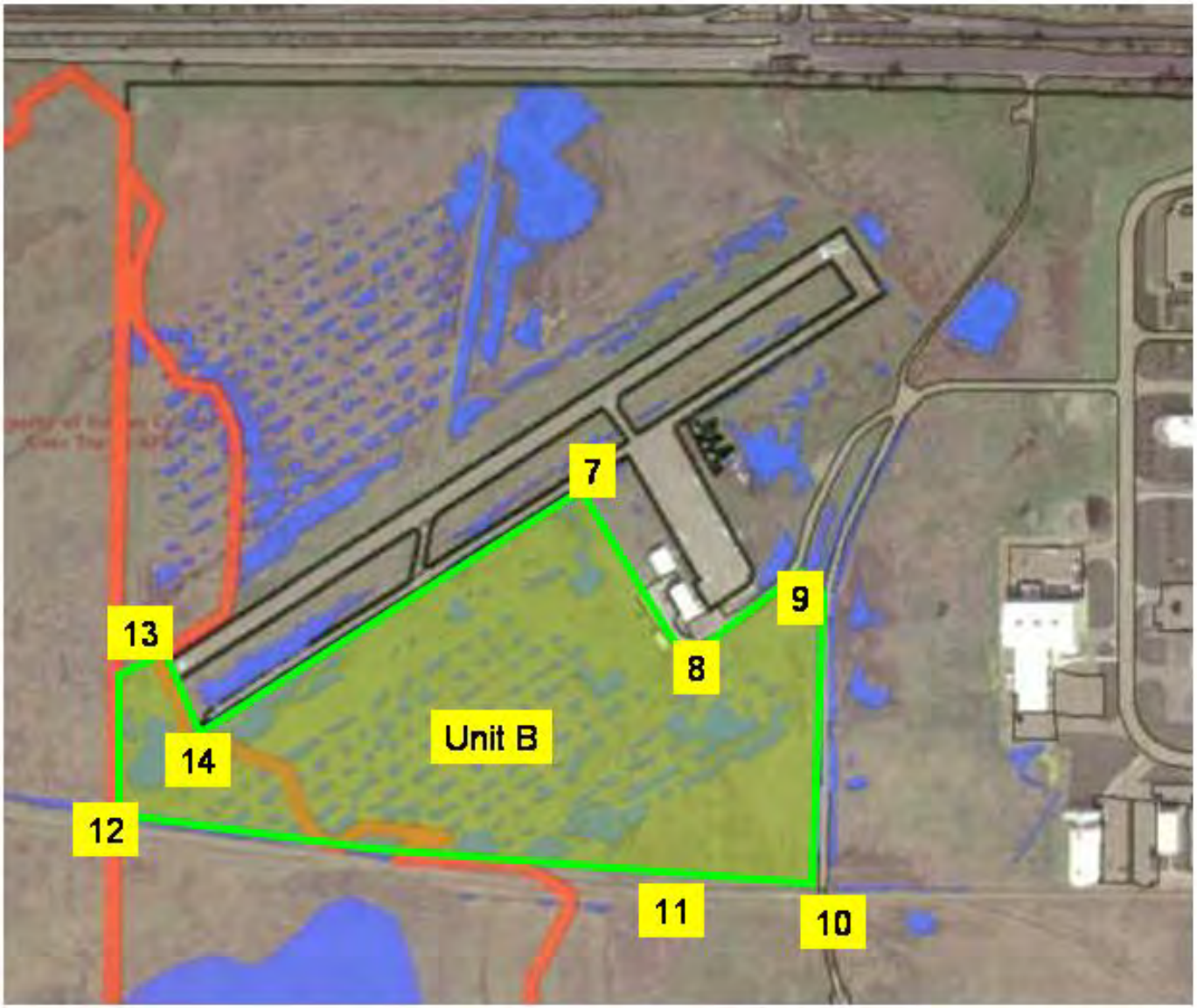


Figure 3. Detail of burn sub-unit B.

Appendix G. Solano Resource Conservation District 2016 Implementation Report.

Invasive Plant Mapping and Management
Travis AFB, CA

January 2015 – June 2016 Summary



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FINAL August 11, 2016

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1.0 Introduction

Travis Air Force Base (TAFB) is located in central Solano County, California, and is currently undergoing efforts to map and eradicate priority invasive plant species to protect sensitive native species and habitats. In late 2014, Solano Resource Conservation District (SRCD) was hired to provide technical assistance in alignment with the existing Integrated Natural Resources Management Plan (INRMP) and Invasive Species Management Plan (ISMP) for Travis Air Force Base. This report summarizes invasive plant population mapping and management effort conducted by SRCD from January 2015 through June 2016.

2.0 Methodology

2.1 Mapping

The INRMP delimits TAFB into seven distinct areas referred to as Natural Resource Management Units (NRMUs) based on their current use, projected use, and natural resources that need to be considered when making management decisions (Figure 1). Fine-scale mapping of invasive plant populations occurred in and immediately around four of these units in the spring and summer of 2015: Castle Terrace Housing, Aero Club, Grazing Area, and Northeast Undeveloped Area. These units were chosen as a focus primarily because of the high coincidence of sensitive native species and invasive plant populations that are most likely to threaten them.

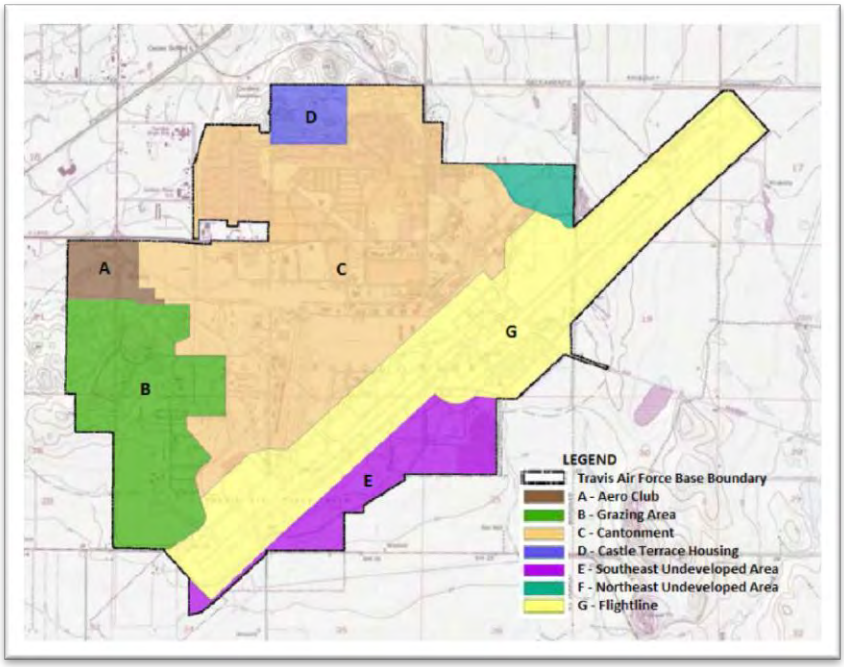

Figure 1: Natural Resource Management Units (NRMUs) of Travis Air Force Base

Wandering transects were used to find individual stands, and the perimeter of the patches were mapped using a Trimble Juno 3B handheld GPS unit. (Figures 2-5) Infestation

density was visually estimated and ranked as very low (<5%), low (5-25%), moderate (26-50%), high (51-75%), or very high (76-100%). Table 1 summarizes gross acreage of mapped species and their relative density in each NRMU.

Table 1: Gross acreage of mapped invasive plants summarized by NRMU

	Very Low (<5%)	Low (5-25%)	Moderate (25-50%)	High (50-75%)	Very High (>75%)	Grand Total
Aero Club		**9.3461**	**5.2005**	**5.8675**		**20.4141**
bristly ox tongue				5.4411		5.4411
fennel		0.0032				0.0032
perennial pepperweed		0.064		0.3928		0.4568
purple star thistle		0.0013				0.0013
yellow star thistle		9.2776	5.2005	0.0336		14.5117
Castle Terrace Housing	**0.9674**	**6.3552**	**10.8181**	**0.4421**	**1.4279**	**20.0107**
Arundo				0.1258	0.0479	0.1737
barbed goatgrass		3.4523	10.1567	0.1064	0.2405	13.9559
fennel		0.1791	0.0246			0.2037
French broom					0.0085	0.0085
perennial pepperweed		0.41	0.0898			0.4998
purple star thistle	0.0174	0.4314				0.4488
treasure flower	0.95	1.8595	0.547	0.1284	1.131	4.6159
wooly distaff thistle				0.0098		0.0098
Himalayan blackberry		0.0229		0.0717		0.0946
Grazing Area	**0.0253**	**10.1248**	**41.4532**	**8.5298**		**60.1331**
Arundo			0.128			0.128
bull thistle		0.0497				0.0497
fennel		0.0356	2.7331	5.0028		7.7715
perennial pepperweed		0.275	1.0465			1.3215
purple star thistle	0.0253	1.6045	5.7481	2.3792		9.7571
skeleton weed			0.1732	0.2039		0.3771
wooly distaff thistle		0.0133	0.008	0.5595		0.5808
yellow star thistle		8.1467	31.6163	0.3844		40.1474
Northeast Undeveloped Area	**0.0122**	**0.7586**	**0.5136**	**5.5662**		**6.8506**
Arundo				0.0168		0.0168
fennel		0.3487	0.4689	4.9498		5.7674
perennial pepperweed	0.0008		0.0447	0.5996		0.6451
purple star thistle	0.0114	0.3402				0.3516
spanish broom		0.0697				0.0697
Grand Total	**1.0049**	**26.5847**	**57.9854**	**20.4056**	**1.4279**	**107.4085**

Naturally, several plant populations extended just beyond NRMU boundaries. For example, the majority of treasure flower plants occur east of Castle Terrace Housing, in the areas surrounding Norton Heights family housing and the duck pond. These areas are technically within the boundaries of the northeastern portion of the Cantonment NRMU. For ease of reference, these populations were included in maps and tables associated with Castle Terrace NRMU. The Southeast Undeveloped Area was also surveyed using wandering transects, but due to ubiquitous invasive plant infestations, general notes were taken regarding species occurrence and abundance, rather than mapping individual patches. (Figure 6)

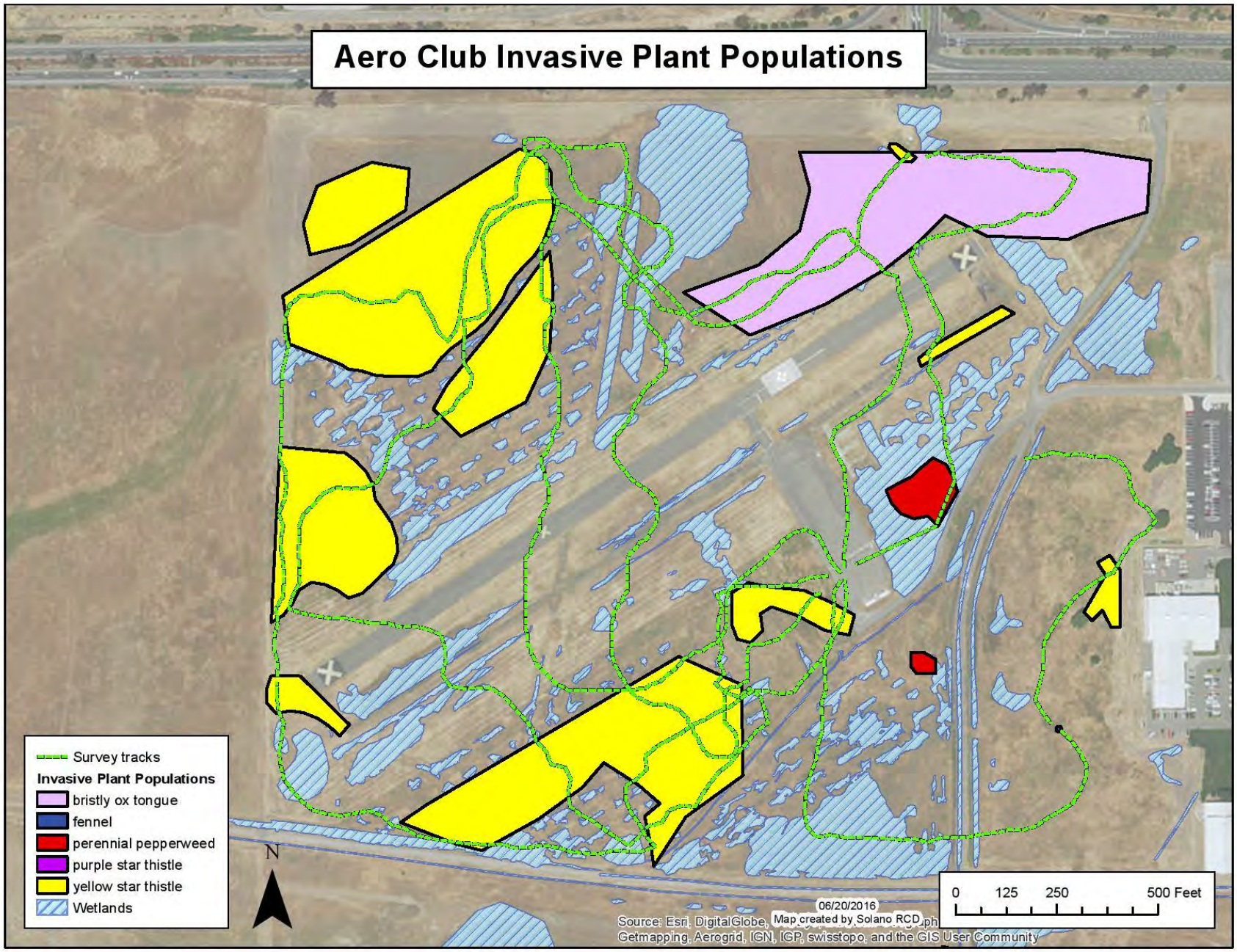

Figure 2: Invasive plants mapped in Aero Club NRMU

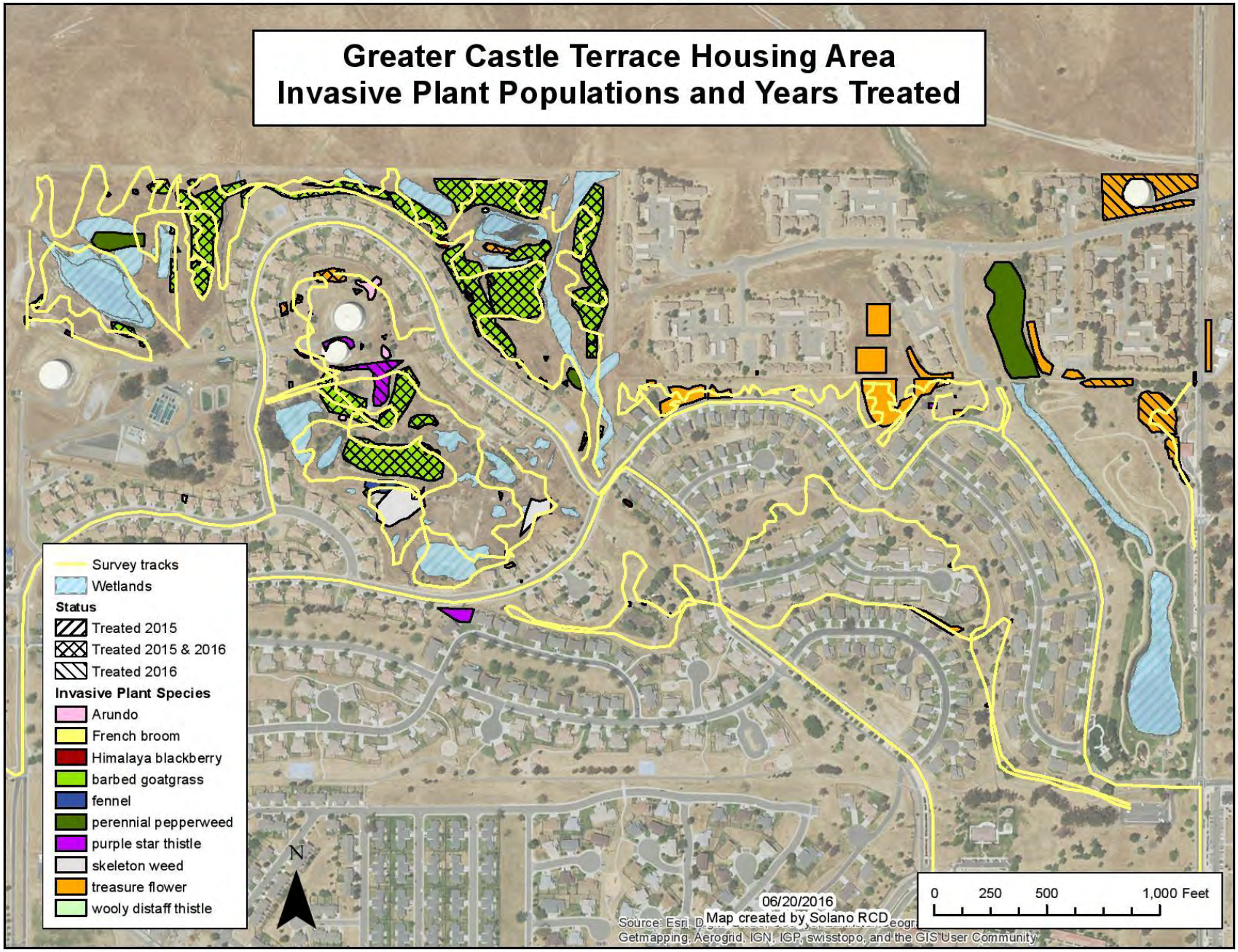

Figure 3: Invasive plants mapped in Castle Terrace Housing and surrounding areas

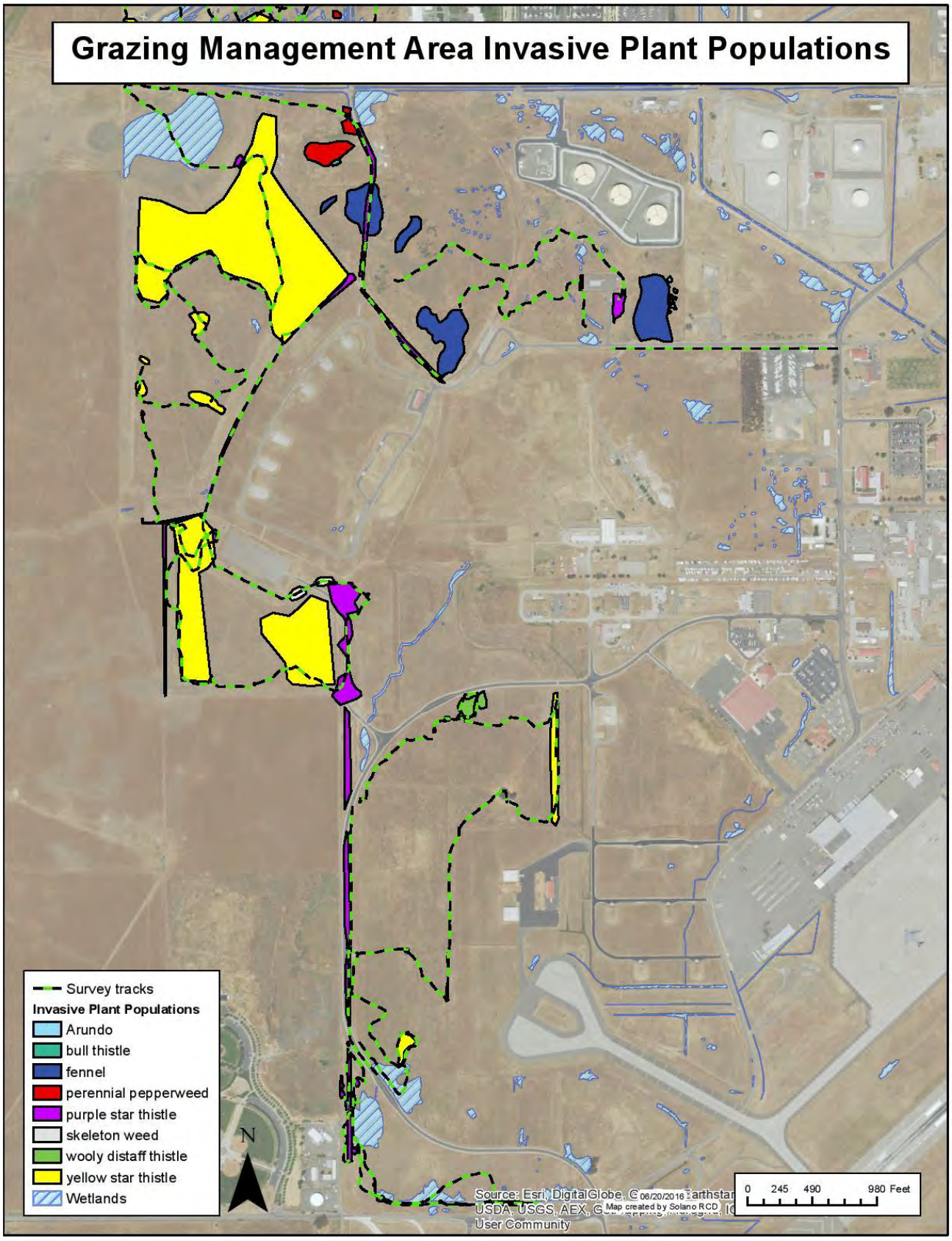

Figure 4: Invasive plants mapped in the Grazing Area

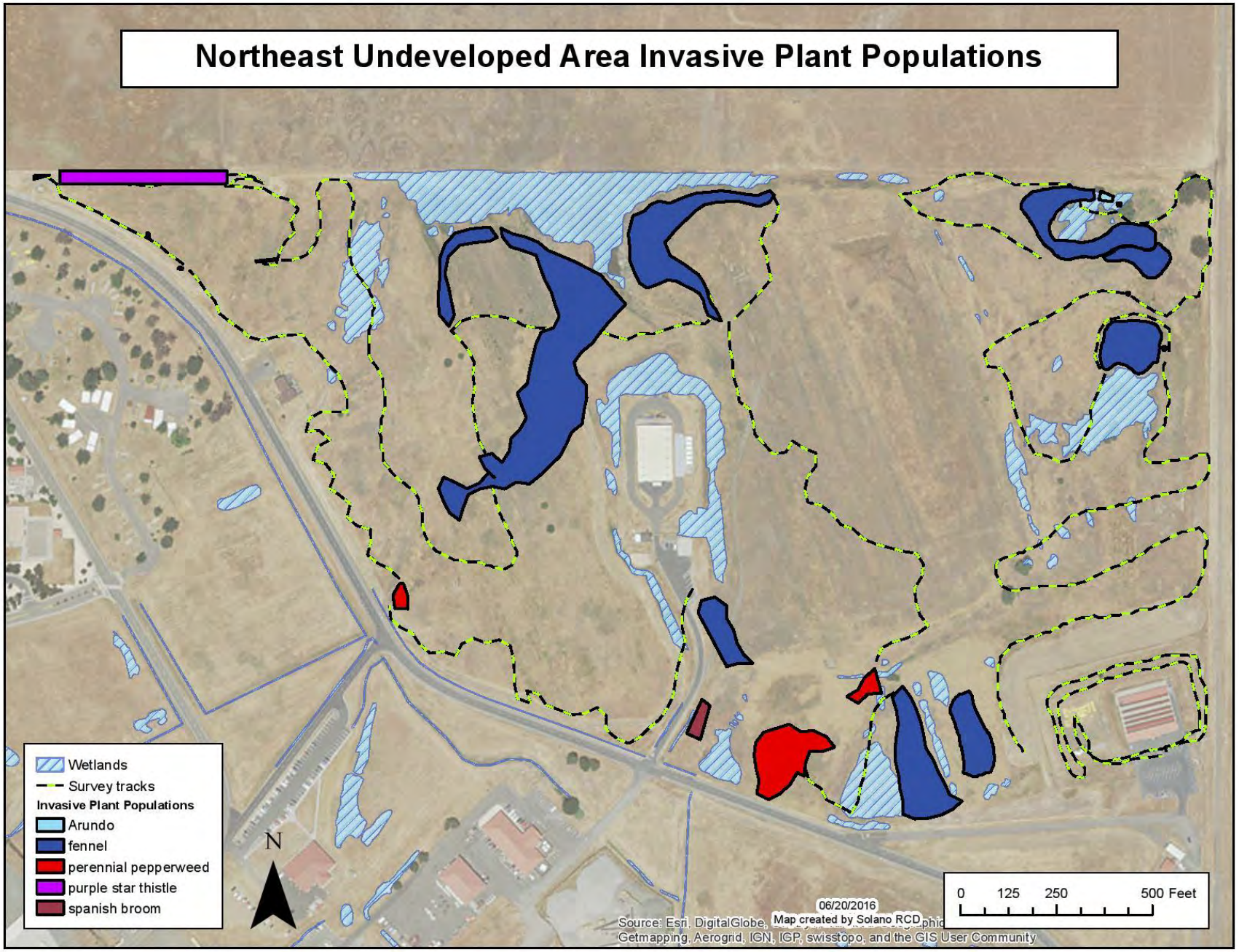

Figure 5: Invasive plants mapped in the Northeast Undeveloped Area

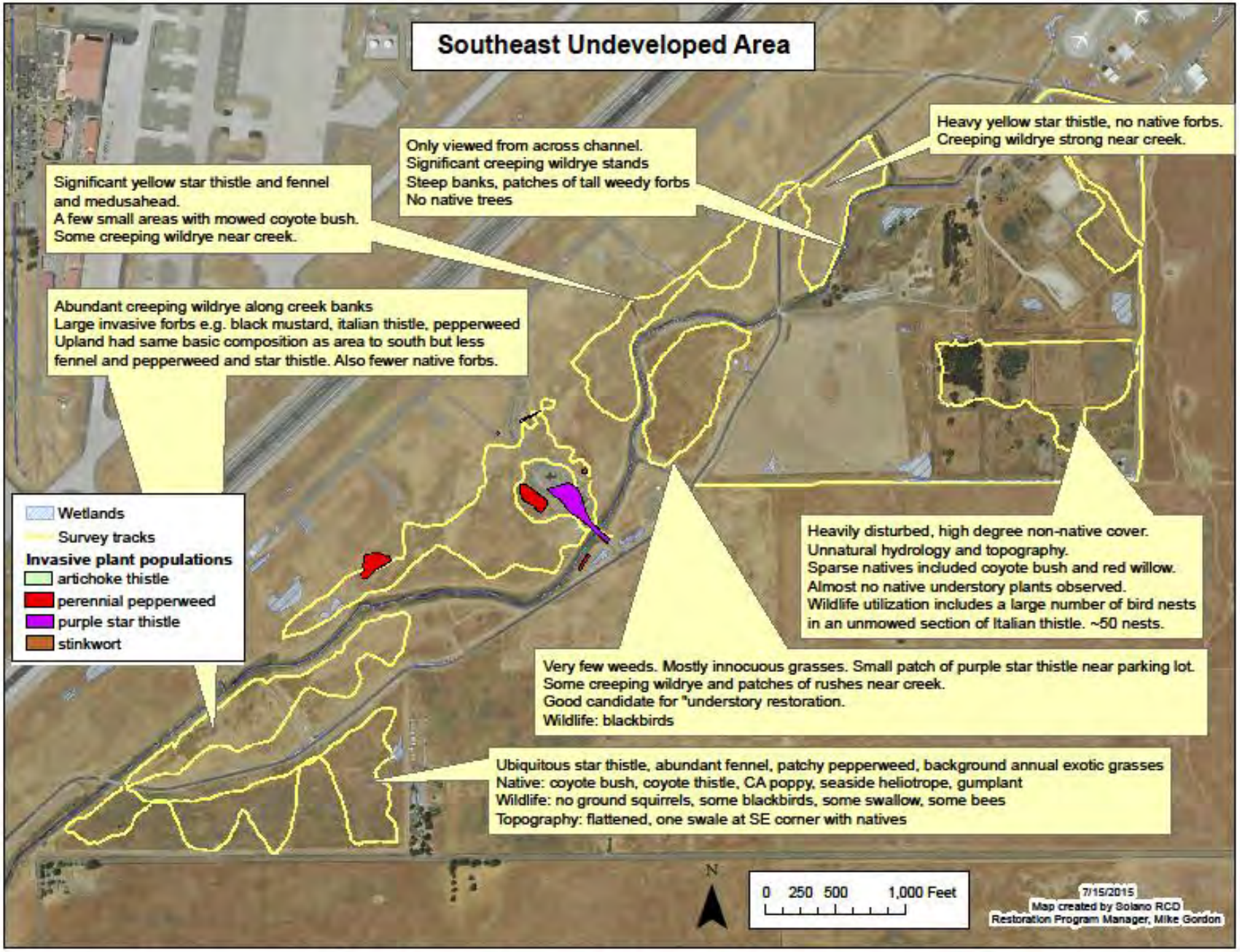

Figure 6: Invasive plant population occurrences and general abundance in the Southeast Undeveloped Area

2.2 Conservation and Avoidance Measures

Measures to avoid impact to sensitive species and habitats were finalized in March 2016 before any weed control activities were resumed for the year. These protocols focused on the protection of California Tiger Salamander and species associated with vernal pool habitats in general. Because of this, these conservation measures are especially crucial to conducting weed control efforts for species that grow in and around wetland habitats at TAFB, such as barbed goatgrass, treasure flower, Arundo, perennial pepperweed. All staff involved in control activities were therefore trained by a qualified biologist, with respect to identification of vernal pool habitats and species, and avoidance measure for California Tiger Salamander.

2.3 Weed treatment

Treatment of weed populations began in May 2015. Invasive plant species were prioritized based on their population extent, potential impact to sensitive habitats, and the probability of containment and eradication. Table 2 summarizes treatments made from May 2015 through May 2016.

Table 2: Summary of invasive plant population treatments

Date	Target Species	Acres treated	Treatment Method	Herbicide Used	Amount Used
May 2015	barbed goatgrass	14	Mechanical	N/A	N/A
October 2015	Himalayan blackberry	0.1	Chemical	triclopyr (Garlon 3A)	4 oz
October 2015	Arundo	0.4	Chemical	glyphosate (Roundup Custom)	74 oz
May 2016	barbed goatgrass	14	Mechanical	N/A	N/A
May 2016	treasure flower, purple star thistle	1.2	Chemical	aminopyralid (Milestone)	11 oz

2.3.1 Arundo (Arundo donax)

Isolated patches of Arundo were chemically treated in early November 2015 in the Grazing Area and portions of Castle Terrace Housing. Application methods varied depending on patch accessibility and size.

In the Castle Terrace Housing NRMU, the majority of Arundo patches occur within a fenced area surrounding two water towers, which was inaccessible at the time of treatment. Only one stand in

Castle Terrace could be accessed, but was growing closely with willow trees and other native vegetation. Concerns that a foliar spray application would cause damage to non-target plant damage led to a cut-stump herbicide application instead. Individual canes were therefore cut using a brushcutter with blade attachment, and a concentrated solution of glyphosate (Roundup Custom) was applied to the cut surface within 1-2 minutes. Visual surveys conducted in the following spring in 2016 have so far shown this treatment method to be very successful, as the treated Arundo patch could not be found.

Arundo patches in the Grazing Management Area near Ellis Drive are more isolated, close to a vehicle-accessible road, and could be easily reached by ATV. These were treated with a 3% glyphosate (brand name Roundup Custom) foliar spray, which was applied using an ATV-mounted spray gun. Due to delays in herbicide approvals and permission to access the area using an ATV, this application was not made until early November, 2015. Visual surveys in May 2016 revealed only partial control.

2.3.2 Barbed goatgrass (Aegliops triuncialis)

Barbed goatgrass was mechanically controlled in early May of both 2015 and 2016 using mowing and weedwhacking equipment. Treatments were timed so that barbed goatgrass was in the early flowering stage but before seed maturation. Grasses were mowed to a maximum height of 4", and lower whenever possible.

The majority of barbed goatgrass is found in an unimproved area in the northern portion of the Castle Terrace NRMU. This area is mowed once annually for fire prevention under contract with PRIDE Industries (Figure 7). Remaining patches occur along steep slopes or in the central natural resource area of Castle Terrace, which is not contracted to be maintained currently. In 2015, SRCD mowed all barbed goatgrass patches using a rented tractor and flail mowing equipment, an ATV-pulled rotary mower, or weedwhackers along slopes and in areas where mowing equipment could not access. In 2016, SRCD was able to coordinate with PRIDE Industries to have them adjust the timing of their annual fuels-reduction mowing such that barbed goat grass was also mowed at the optimal treatment time. Follow-up treatments were conducted shortly after the PRIDE mowing event to weedwhack and mow areas that were missed by PRIDE mowers or areas their mowers could not access.

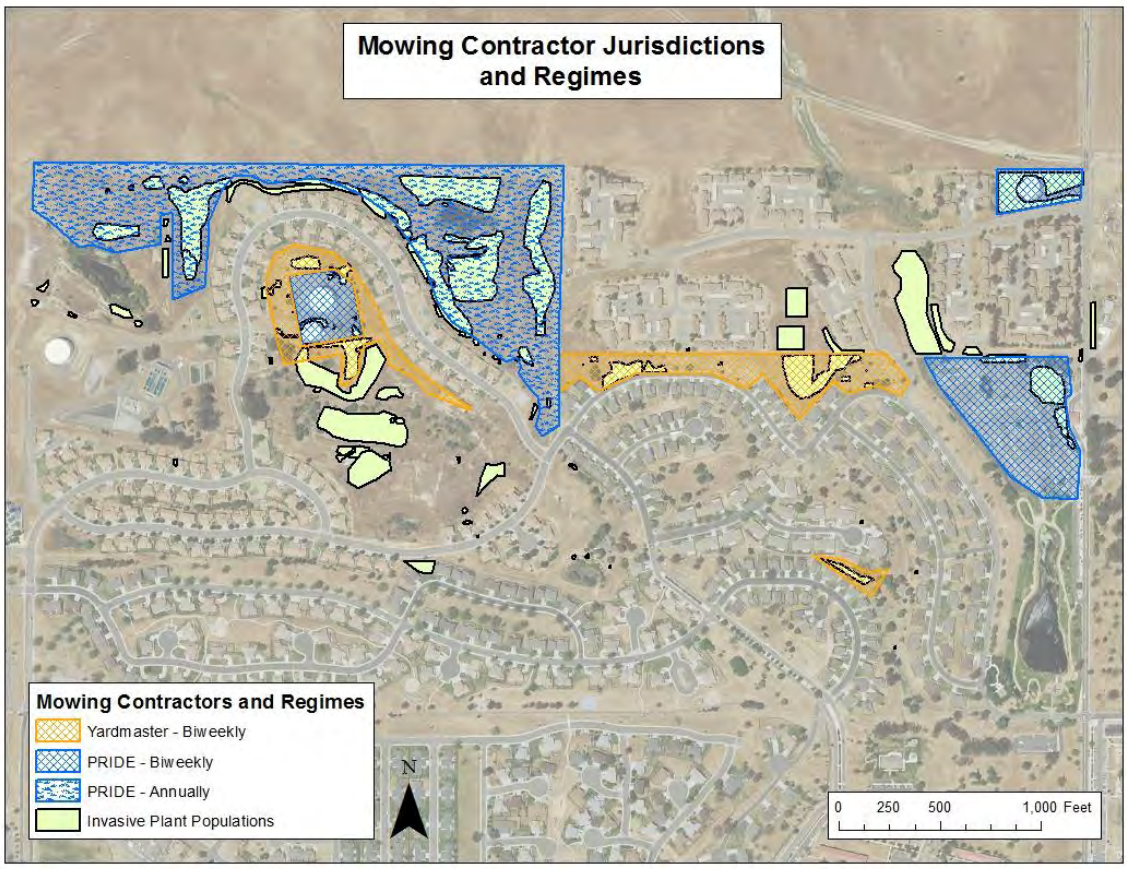

Figure 7: Mowing regimes and contractors in and around Travis family housing

2.3.3 Himalayan blackberry (Rubus armeniacus)

In the Castle Terrace Housing NRMU, Himalayan blackberry only occurs in scattered patches that collectively cover less than 0.1 acre. Because of their limited extent, blackberry was targeted due to the likelihood of eradication from Castle Terrace. A foliar application of triclopyr (brand name Garlon 3A) was sprayed in September 2015 using backpack sprayers. By waiting until after blackberry fruits had senesced, this late-season application limited possible ingestion of herbicide by the public. This timing is also generally considered more effective since herbicide uptake to the crown and plant roots is higher as plants are beginning to go dormant for the season.

During follow-up surveys in May 2016, treated patches could not be found. Two unmapped patches were discovered, but based on their size and level of establishment; these were likely missed during initial mapping efforts and are not new infestations.

2.3.4 Treasure flower (Gazania linearis) *and purple star thistle* (Centaurea calcitrapa)

Treasure flower and purple star thistle control has consisted of hand-pulling and targeted herbicide applications in the Castle Terrace Housing and duck pond areas. Patches of these species that are small, sparse, or that occur within 20 feet of mapped wetlands were removed manually in the spring of 2015 and 2016. However, the majority of these species are found outside the wetland buffer zone and in considerably larger numbers than are feasible to remove manually.

Chemical control of these populations using aminopyralid (brand name Milestone) was recommended to SRCD by a licensed Pest Control Advisor. This herbicide targets a smaller range of plant families compared to most herbicides, and is very effective on plants in the Asteraceae family, such as treasure flower and purple star thistle. Due to delays in herbicide approvals, large-scale treatment did not begin until May 2016.

Around Castle Terrace Housing, many areas where treasure flower and purple star thistle are found are mowed bi-weekly beginning in early April by two separate mowing contractors: PRIDE Industries or Yardmaster, Inc. (Figure 7). Coordination of a 4-week suspension of mowing was attempted so that an effective herbicide application could be made. Ideally, this would give plants approximately two weeks of regrowth after the previous mow event and two weeks of herbicide uptake after application. However, areas maintained by Yardmaster, Inc. were mowed two days prior to the scheduled herbicide application, leaving very little surface area for pesticide uptake. Consequently, only treasure flower and purple star thistle patches within areas maintained by PRIDE Industries were treated in mid-May 2016. These area were sprayed with Milestone at 7oz/acre rate using a combination of backpack sprayers, an ATV mounted spray gun, and a 15' ATV boom sprayer. Mowing activities were coordinated such that they did not resume in sprayed areas for at least two weeks after application.

3.0 Discussion and Recommendations

3.1 Mapping and Monitoring

Changes in the density of some invasive plant populations are difficult to track using the current methods of estimation. Although patches are categorized into coverage classes, these are broad visual estimations and extremely subjective, especially for infestations that cover large areas such as barbed goatgrass. Incorporating more standardized and quantifiable methods would improve the accuracy of

monitoring and help determine the efficacy of weed treatments over time to guide management choices in the future. Monitoring protocol is currently being developed, and completion is expected by 2017.

3.2 Weed Treatment

3.2.1 Arundo (Arundo donax)

Only partial control of the Grazing Area Arundo was achieved, with approximately 50% of the stand resprouting or recovering from the treatment. This is likely due to the late timing of the foliar application. Ideally, foliar application would take place in mid-summer to early fall, after flowering and before dormancy. Conversely, plants that were treated using cut-stump methods in Castle Terrace were not found in May 2016, suggesting that this method is significantly more effective. Follow-up surveys in late summer should be conducted to look for late-appearing resprouts.

Though the foliar spray does not appear to have been as effective, cut-stump herbicide applications are significantly more time consuming, and less feasible on a large scale. For larger patch sizes, foliar applications can be improved using more appropriate timing and alternative herbicide options. In other arundo donax removal projects that SRCD has conducted/participated/worked on, foliar application of glyphosate mixed with imazapyr has provided greater kill rates with less resprouting compared to glyphosate alone, leading to fewer applications. The largest drawback of using imazapyr is that it also works as a pre-emergent herbicide, sometimes for several years. These bare patches could eventually give way to more aggressive non-native weed invasions in the future. To reduce these chances, an alternative option would be to install native plants from container stock to increase competition and close open spaces that would be easily invaded by surrounding invasive plants.

3.2.2 Barbed goatgrass (Aegliops triuncialis)

Although barbed goatgrass patch density does not appear to have diminished considerably since the 2015 treatment, no new populations were found in 2016 and overall extent has not changed considerably. Mechanical control of annual grass weeds often takes several years before notable changes are seen due to annual germination from the pre-treatment seed bank. This is especially true in the case of barbed goatgrass, due to the production of two seed types in each generation: a larger, fertile seed that germinates the same season, and a smaller seed that remains dormant for up to five years, but more commonly two. Because of this life strategy, significant changes in goatgrass density would not be expected in the second year of treatment. The main goal of using well-timed mowing is

to reduce new inputs to the seed bank over time. However, even the most perfectly timed mowing event will inevitably miss some inflorescences, due to phenological variability. To achieve a complete prevention of new seed production, several mowing events may be necessary.

Another option to consider in the future would be exploring the use of herbicides to treat barbed goatgrass populations. Grass-specific herbicides, such as clethodim or fluazifop-propanoaate, could be tested in smaller, isolated patches that are not accessible by mower and must otherwise be weedwhacked. If applied earlier in the season, these herbicides would systemically kill barbed goatgrass plants before flowering begins to occur, thus reducing the chances of any new inputs to the seedbank that could potentially occur before or after mowing events. The largest concern to this approach would be accidental selection for broad-leaf weeds, which would be largely unaffected by these herbicides. By effectively removing the majority of competition from annual grasses, broadleaf weeds may invade in their place. Trial applications to small, dense patches of barbed goat grass where native grass species are absent would be prudent.

3.2.3 Himalayan blackberry (Rubus armeniacus)

The September 2015 application of triclopyr has proven extremely effective thus far. Treated populations were not extensively established, which likely increased the effectiveness of the application. These areas should be surveyed again in late summer to look for re-sprouts that may have not been visible during the May 2016 monitoring.

3.2.4 Treasure flower (Gazania linearis) *and purple star thistle* (Centaurea calcitrapa)

Timing herbicide applications with spring and summer mowing regimes was the main challenge of treating treasure and purple star thistle at TAFB. In 2016, mowing began in early April, but herbicide approval was delayed until early May. Mowing events were likely frequent enough to prevent viable seed-set and spread, but coordination of a 4-week pause in mowing between multiple parties was complicated and not entirely successful. In future treatments, herbicide applications should be made as soon as plants are beginning to flower, but before mowing events begin in April. Table 3 shows a list of the 2016 contacts used to coordinate with mowing contractors.

Table 3: Contacts for mowing contractors in Travis family housing areas

Mowing Contract Agency	Point of Contact	Title	Organization/Program	E-mail	Phone
PRIDE Industries	Eric Dukes	Supv. Service Contracts Evaluator	60th Civil Engineer Squadron Travis Air Force Base	eric.dukes.1@us.af.mil	(707) 424-8407 Commercial (707) 837-8407 DSN
	Kelly Bowman	Service Contracts Evaluator	60th Civil Engineer Squadron Travis Air Force Base	kelly.bowman.1@us.af.mil	(707) 424-3917 Commercial (707) 837-3917 DSN
	Kevin Cartwright	Project Manager	PRIDE Industries	kevin.cartwright@g.prideindustries.com	(707) 437-4772
	Mike Buchanan	Grounds Supervisor	PRIDE Industries	mike.buchanan@g.prideindustries.com	(707) 437-4772
Yardmaster, Inc.	Mark Dupree	Community Manager	Balfour Beaty Communities Travis Family Housing	MDupree@bbcgrp.com	(707) 207-3376 office (610) 504-5076 mobile
	Jon Mannel	Grounds Supervisor	Balfour Beaty Communities Travis Family Housing	Jmannel@bbcgrp.com	
	Mark Cole		Yardmaster, INC	mcole@yardmaster.com	

Another consideration for future treatments would be to include other herbicides where possible. The main benefit of using aminopyralid is that it targets very few plant families, so that less susceptible species are left behind rather than large patches of dead vegetation. However, in the treatment area around the northeastern water tower, most plants mixed among the treasure flower are also non-native species and are in plant families affected by aminopyralid. To improve the efficacy of treatment, mixing other broad-leaf specific herbicides, such as triclopyr (Garlon 3A) could be considered in less sensitive and more invaded areas, such as around the northeastern water tower.

4.0 RCD Invasive Species Management *Conservation Measures*

The below standard conservation measures will be implemented as follows with RCD specific guidance in italicized brackets:

1. Prior to the start of invasive species management activities, a qualified biologist shall provide education and training sessions for all individuals that will be involved with herbicide treatment and mechanical methods of invasive species removal. The training will focus on habitat sensitivity and identification of vernal pools and CTS. The training shall include species description and behavior, general measures to be taken to protect these species, the penalties for non-compliance. A fact sheet or other supporting materials containing this information will be prepared and distributed. Upon completion of training, employees will sign a form stating that they attended the training and understand all the conservation and protection measures. *[Training shall occur for the RCD at each general site on the first day work is to commence at that site. Sites include Castle Terrace, Travis Grazing Areas, the NE Firing Range Open Space, and the Aero Club. Training may be provided by Travis Contract Biologist Ms. Deanne Weber or through RCD subcontract with Dr. Jaymee Marty who will 1) review the locations of all wetlands and vernal pools within treatment areas,2) flag all vernal pools per Minimization Measure #3 if necessary and/or show all field personnel what vernal pools look like (vernal pool obligate species). RCD shall assign an on-site biologist to act as field lead to ensure these training measures are implemented and followed.]*.
2. Herbicide treatment may not be applied within 20 feet from the edge of mapped wetlands. Mechanical methods will be used for the removal of invasive plant species within 20 feet of the mapped wetlands. The following exceptions and clarifications apply:
    a. No herbicide treatment will be conducted in the Aero Club, or anywhere on the base where Contra costa goldfields (*Lasthenia conjugens*) has been mapped. *[Contra costa goldfields populations shown on the map in orange points and brick red polygons will be avoided except for the following test:*
        i. *[The Solano RCD will target perennial pepperweed at one vernal pool at the Aero Club that contains the threatened Contra costa goldfields. Dr. Jaymee Marty, on a different contract, will conduct plant cover surveys before and after mechanical and chemical treatments to determine cover responses of the listed species. Pepperweed shall be mechanically controlled first, with re-sprouts hand painted with a targeted herbicide which has no residual effects and low collateral damage to native plants. Several test plots (if room allows) within the pool should be conducted to look at different chemical concentrations and/or different herbicides and will include a no treatment area. Solano RCD shall wait for written approval from AFCEC/CZOW before commencing with this experiment; approval shall include a map that designates the goldfields vernal pool to be treated for pepperweed. Ms. Deanne Weber or Dr. Jaymee Marty shall be on site for the first hour of treatment to monitor and provide any special instructions]*.
    b. Perennial pepperweed and other wetland invasive species may be controlled within vernal pool boundaries outside of Contra costa goldfields occupied habitat during the dry season. Herbicide shall be directly applied to plants when pools are dry and soils hard while avoiding all native species with overspray.
    c. Weeds within the 20 foot boundary of vernal pools may be mechanically controlled during the wet season. No mechanical control is allowed within ponding water in the wet season to avoid effects to listed vernal pool invertebrates. Mechanical control shall prioritize methods with no soil disturbance. If removal of roots is required to achieve successful results, the area should be checked for burrows. Digging shall occur with hand tools carefully as CTS can be found underground while digging.
3. When working around sensitive habitats (i.e. vernal pools), invasive species management activities (herbicide treatment and mechanical removal) will include marking the area of treatment with a visual boundary (e.g. pin flags, orange barriers - orange barrier fencing will be installed 2 inches off the ground to ensure CTS or other wildlife to not become entangled.). The visual boundary will be removed once treatment has concluded. [*Pools in some of the vernal pool complexes have extremely wide ranging and convoluted shapes. To avoid confusion, training may be improved upon request to include vernal pool obligate plant species as an additional indicator of the location of pool basins. If trainers are satisfied with the level of knowledge, flagging of individual pools need not occur in all areas.]*

4. Invasive species management activities will occur between 30 minutes before sunrise and 30 minutes after sunset.
5. All project related vehicle traffic will be restricted to established roads and other designated areas.
6. No work requiring vehicles/equipment will be done when the ground is soft enough where travel will cause ½ inch or more depressions in the soil. *[The RCD shall leave no equipment on site overnight.]*
7. All trash (food related items such as wrappers, bottles, cans, food scraps, etc.) will be placed in closed containers and removed from the project site on a daily basis
8. If there is a 50% or greater probability of rain forecasted by the National Weather Service by 07:00 am the day prior to a scheduled workday, then all work activities are cancelled for the next 24 hours. If any measurable amount of rainfall occurs (including trace amounts) work may not resume for 24 hours from rain cessation. The weather forecast and hourly weather data for Travis AFB can be found by entering the zip code 94535 (Travis AFB) at http://www.srh.noaa.gov/forecast.
9. The biological monitor will check the area to be treated thoroughly every morning before work begins. [*RCD lead biologist shall check areas to be sprayed each morning before herbicide spraying is conducted]*.
    a. The biologist should do a more extensive and thorough pre-treatment check for CTS on the project site on days where the relative humidity the previous night was above 80%.
    b. A site survey for birds must be performed by a qualified biologist before invasive species management activities are to take place to determine whether any protected species are present on or near the site. If protected birds are present and nesting on or near the site, invasive species management activities may be temporarily postponed until the nesting season is over. Other measures which may be necessary if protected species are found on or near the site during the site survey include: (1) the work crew may be prohibited from disturbing areas within a specified distance of owl burrows or bird nests; (2) the work crew will restrict activities during breeding and nesting seasons; (3) invasive species management activities will be temporarily delayed while birds are encouraged to relocate away from the area. *[RCD biologist shall complete this visual survey the morning of treatments that occur during nesting season from February through August and confirm lack of nesting birds. If nests are found, nest will be recorded, GPSd, and avoided for the remainder of the nesting season until chicks have hatched and fledged]*.
10. TAFB Environmental Office shall notify USFWS immediately by phone once informed by the Solano RCD of any incidents involving federally listed species, and with a written notification within five days, if any worker inadvertently kills or injures a special-status species, finds one injured, or trapped on the project site or during work. Work will stop immediately if an incident occurs until corrective actions are provided by USFWS. Solano RCD shall contact Ms. Deane Weber immediately at 707-424-5126.
11. Operators and Contractors [*Solano RCD Staff*] will be familiar with and exercise spill prevention and emergency spill response measures as required, including spill cleanup and proper waste disposal. Emergency response plans will be on site.

Travis AFB Biological Training Support:

Deanne Weber, Biologist, Natural Resources
411 Airmen Drive, Bldg 570, Travis AFB, CA 94535-2001
DSN: 837-5126; Comm: (707) 424-5126
Email: deanne.weber.ctr@us.af.mil

5.0 Checklist for pesticide application:

Before application:

- Verify chemical is on DoD list.
- Verify chemical is on TAFB approved list.
- Confirm chemical approval with HAZ-Mart (Table 4). If not, submit Approval Request for Non-Standard Pesticide form.
- If spraying in or around TAFB family housing areas, notify Mr. Mark Dupree with Balfour Beatty Communities, preferably 30 days before the 2-3 week window of time that herbicide application will occur.
- Send maps and spray plan (1-2 page synopsis to include application location, target species, chemicals to use, amounts estimated) to Travis Installation Support Team Points of Contact. Verify that application will not impact wetlands and sensitive species (refer to Section 4.0: RCD Invasive Species Management, Conservation Measures).
- Contact the Pest Shop to notify of plan to spray.

Day before

- Check weather: if chance of precipitation for date of application is 50% or higher at 7:00am on the previous day, cancel all work activities.
- Work will not resume until 24 hours have passed since last rain amount (including trace amounts). Use National Weather Service website for forecast and past weather: http://www.srh.noaa.gov/forecast; zip code 94535

Day of application

- Check wind patterns. No spraying in 10mph winds or greater.
- Flag sensitive species habitat boundaries (vernal pool boundaries) within treatment area
- Check for California Tiger Salamander (more thoroughly if last night's relative humidity >80%) and any gopher mounds or animal burrows
- Notify Local Departments e.g. Firing Range, Fire Training Facility, Balfour Beatty
- Bring with you:
    - Herbicide recommendations from PCA
    - Herbicide labels and SDS
    - Copy of 332 Work Request/Agreement
    - Copy of Qualified Applicator License
    - Map of treatment area

After application

Send report to Pest Shop with pesticide use information (date, applicators, location, chemical, amount, etc.).

Table 4: Herbicides approved for use at Travis Air Force Base as of 2016

Brand Name	Active ingredient	Target weed(s)	Manufacturer	EPA Reg #	DoD	Travis PMP	Date of Approval to Use Non-Standard Pesticide	Notes
Garlon 4 Ultra	triclopyr	fennel Himalayan blackberry	Dow AgroSciences	62719-527	yes	no*	3/23/2016	*Renovate 3 is listed and has the same active ingredient and is included on the Travis PMP list of approved herbicides
Garlon3A	triclopyr	fennel Himalayan blackberry	Dow AgroSciences	62719-37	no	no*	3/23/2016	*Renovate 3 is listed and has the same active ingredient and is included on the Travis PMP list of approved
Milestone VM	aminopyralid + triclopyr	thistles treasure flower	Dow AgroSciences	62719-572	yes	no	4/5/2016	
Transline	clopyralid	thistles treasure flower	Dow AgroSciences	62719-259	no	no*	4/19/2016	*Lontrel is listed and has the same active ingredient, and is included on the Travis PMP list of approved herbicides
Telar XP	chlorsulfuron	pepperweed	DuPont	352-654	no	no	3/23/2016	
Roundup Custom	glyphosate	pepperweed goatgrass** Arundo	Monsanto	524-343	no	no	4/19/2016	replacement for Aquamaster and Rodeo (aquatic-safe formulations of Roundup) **glyphosate is only effective on goatgrass if sprayed before flowering
Roundup Pro	glyphosate	pepperweed goatgrass** Arundo	Monsanto	524-475	yes	yes*	3/23/2016	* on the contingency list **glyphosate is only effective on goatgrass if sprayed before flowering
Fusilade II	Fluazifop-propanoaate	barbed goatgrass	Syngenta Professional Products	100-1084	no	yes	4/19/2016	this herbicide targets grass species, not broadleaf plants
Envoy Plus	Clethodim	barbed goatgrass	Valent Professional Products	59639-132	no	no	4/19/2016	this herbicide targets grass species, not broadleaf plants
Volunteer	Clethodim	barbed goatgrass	TENKOZ	59639-3-55467	no	no	4/19/2016	this herbicide targets grass species, not broadleaf plants

6.0 Photos



Figure 8: Before and after photos of 2015 Castle Terrace barbed goatgrass mowing by SRCD staff



Figure 9: Before and after photos of weedwhacked barbed goatgrass along slopes by SRCD staff



Figure 10: Treasure flower infestation surrounding northeastern water tower near north access gate



Figure 11: Before and after photos of manual removal of treasure flower near wetlands

APPENDIX H

Wildland Fire Management Plan (WFMP)

(Chloeta 2019)

2019

Travis Air Force Base

WILDLAND FIRE MANAGEMENT PLAN



60TH AIR MOBILITY WING

Prepared by

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Cover Photos: Wildfire at Travis Air Force Base, 6 July 2017.

TIER 1 Wildland Fire Management Plan

Installation: Travis Air Force Base

Effective Date: _____

Approved By:

Signature: _____ **Date:** _____
JEFF NELSON, Col., USAF
Installation Commander, 60 AMW

Signature: _____ **Date:** _____
MICHELLE STEINMAN, GS-13
Chief, Air Force Wildland Fire Branch
AFCEC/CZOF

This Wildland Fire Management Plan has been prepared in accordance with regulations, standards and procedures of Section E3.8 of the Department of Defense Instruction 6055.06, *DoD Fire and Emergency Services (F&ES) Certification Program*, 21 December 2006 and Section 13 of the Air Force Instruction 32-7064, *Integrated Natural Resources Management*, 22 Nov 2016.

The signature above indicates approval of the Plan for Implementation.

The completion of this plan alone does not satisfy the requirements of a Prescribed Fire Plan.

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Executive Summary

The Travis Air Force Base (TAFB) Wildland Fire Management Plan (WFMP) is written as an integral, and supporting, part of the 2016 TAFB Integrated Natural Resources Management Plan (INRMP) as mandated by Chapter 13 of Air Force Instruction (AFI) 32-7064, *Integrated Natural Resources Management*, 22 November 2016 (AFI 32-7064). While wildfire suppression and prescribed fire activities are the primary activities described in this document, it also includes information and references to other related natural resource management activities including, but not limited to, ecological monitoring, Threatened and Endangered (T&E) species management, forestry activities, and more. While fire is not a common occurrence on TAFB, it is a fire-adapted landscape. Fire management is a pivotal activity that affects nearly all other natural resource management activities. Without a successful fire management program, there can be only limited success in the overall natural resource management program. Lack of a successful natural resource management program would have direct negative impacts on TAFB's military mission. This plan addresses the specific fire-related supporting goals and objectives identified in the INRMP. Implementation of this WFMP will assure achievement of fire-related resource management and mission support objectives.

The Wildland Fire Management Program on the lands of the 60th Air Mobility Wing (60 AMW) at TAFB near Fairfield, California is mandated by Chapter 13 of the AFI 32-7064 to manage natural resources and to minimize the effects of wildfire on installation values to protect. Prescribed fire is a cost-effective tool that can be used to meet these needs. These efforts will improve floral and faunal diversity, improve rangeland habitat quality, control certain invasive species, and reduce hazardous fuels that could currently intensify wildfires. Non-fire fuels treatments as well as preparedness and readiness actions are also important for minimizing the effects of wildfire and are recommended as part of this WFMP. TAFB will implement this WFMP to comply with all applicable laws and regulations.

TAFB will implement improvements to its land and firefighting resources that will enhance the response and capabilities of firefighters. Chief among these is formally establishing 60th Fire Emergency Services (60 CES/CEF, hereafter TAFB FES) as the primary initial attack responders, as is working to increase the operational qualifications of FES personnel. Focusing on preparedness and readiness actions are also major purposes of this WFMP. This plan establishes a Wildland Fire Program Coordinator (WFPC) to oversee the planning and implementation of wildland fire projects. Additional proponents of this plan include the Natural Resource Manager (NRM), FES Fire Chief (FC), Air Force Wildland Fire Branch (AFCEC/CZOF), and the Wildland Support Module (WSM), currently being established at Beale Air Force Base (BAFB). Actions in this WFMP that impact Native American communities will be presented to interested Native American tribes in accordance with DoD and AFI guidance and federal law as discussed further in Chapter 2.

This plan will be reviewed annually to ensure the latest information is consistently incorporated into Air Force (AF) wildfire prevention and suppression procedures. An ad hoc review committee will be convened by the WFPC and NRM and will consider fire activity, and prevention and response effectiveness, and success at meeting INRMP ecosystem management goals and objectives. They will conduct an audit of fire occurrences and expenses and ecosystem management objectives and recommend what, if any, changes are necessary to improve the wildland fire management program. In addition, this plan is a living document and may be changed as necessary to account for the constantly evolving requirements placed on

the Wildland Fire Management Program and the annually updated INRMP. A major revision may need to be conducted at least once every 5 years.

Chapter 1. Introduction

A wildland fire is defined as any non-structure fire that occurs in vegetation or natural fuels including:

- **Wildfires** – Unplanned fires including natural fires (e.g. lightning), munitions-caused fires, unauthorized human-caused fires, escaped prescribed fire projects, etc.
- **Prescribed Fires** – Any fire purposely ignited by prescribed fire personnel to meet specific land management objectives.

The importance of wildland fire management to the Department of Defense (DoD) is described by Department of Defense Instruction 6055.06, *DoD Fire and Emergency Services (F&ES) Certification Program*, 21 December 2006 (DoDI 6055.06), which mandates that any installation with burnable vegetation have a WFMP. In order to facilitate interagency cooperation and standardization, this plan is written following the general guidance and standard chapter format of the *Interagency Fire Management Plan Template*, July 2008 and its associated Checklist, with slight modifications to streamline and to address mission-specific aspects of wildland fire management not encountered by other federal land management agencies.

1.1 Purpose of the WFMP

The WFMP is written as a supporting document for implementation of the INRMP as mandated by AFI 32-7064. It also supports a coordinated approach to wildfire response and risk mitigation that includes FES, installation Natural Resources (NR) personnel and the AFCEC/CZOF. This plan addresses the specific fire-related supporting goals and objectives identified in the INRMP as well as existing Standards of Cover (SOCs) and Standard Operating Guides (SOGs) for wildfire response. Implementation of this WFMP will assure achievement of fire-related resource management and mission support objectives.

This WFMP has been developed to provide guidance for the suppression and prevention of wildfires on TAFB lands and to implement ecosystem management and fuels reduction goals using mechanical fuels treatments and prescribed fire in support of the 2016 INRMP.

The scope of this WFMP is to lay out responsibilities and procedures for prescribed fire management and the prevention, preparedness, and suppression of wildfires on all TAFB lands in a manner that is safe, efficient, effective, and highly professional. This WFMP identifies and references appropriate planning documents that support and detail specific elements of the program.

The goal is to convey the methods and protocols necessary to minimize wildfire severity and size as well as the use of mechanical and prescribed fire treatments for ecosystem management and fuels reduction. This plan supports the installation mission by outlining the direction of wildfire suppression and the utilization of vegetation treatments to minimize damage to the landscape and impacts to the military mission by wildfire.

Implementation of this plan will satisfy applicable requirements established by Chapter 13 of AFI 32-7064. It is incorporated into the INRMP for TAFB as a component plan.

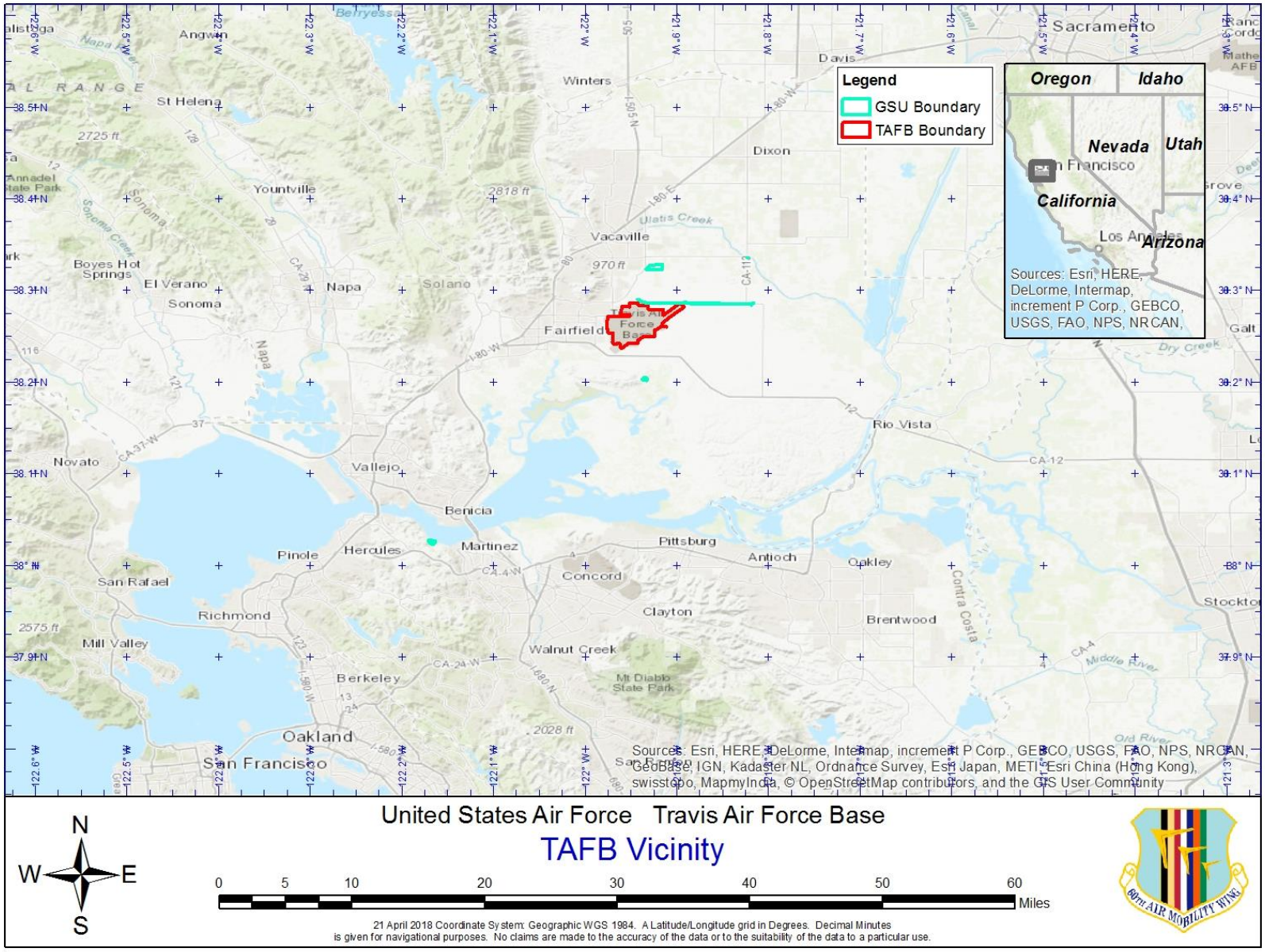
1.2 General Description of the WFMP Area

According to *Description of Ecological Subregions: Sections of the Conterminous United States*, 2005 (Ecological Subregions), TAFB is partly located in the Suisun Hills and Valleys Subsection of the Central California Coast Section, within the California Coastal Chaparral Forest and Shrub Province and partly located in the Delta Basins Subsection of the Great Valley Section, within California Dry Steppe Province. TAFB is comprised of approximately 5,039 acres in Solano County, just east of Fairfield, California. The major drainage in the area is Union Creek. The nearest airports with commercial service are Sacramento International Airport (SMF), Oakland International Airport (OAK), and San Francisco International Airport (SFO).

There are 4 primary points of entry onto the installation, including the Main Gate off of Airbase Parkway, the Hospital Gate off of Airbase Parkway, the South Gate off of Peterson Road, and the North gate off of Burgan Boulevard.

TAFB is bordered on the north, east, and south by agricultural lands and open space. It is bordered by mixed urban uses on the west, including commercial uses adjacent to the main entrance. On the south and east is the Wilcox Ranch, which is a 1,342-acre area owned by the Solano Land Trust, Solano County, and the City of Fairfield, and is protected by easements to protect vernal pool habitat. See Figure 1.1 for the location of TAFB.

Figure 1.1: TAFB Vicinity Map



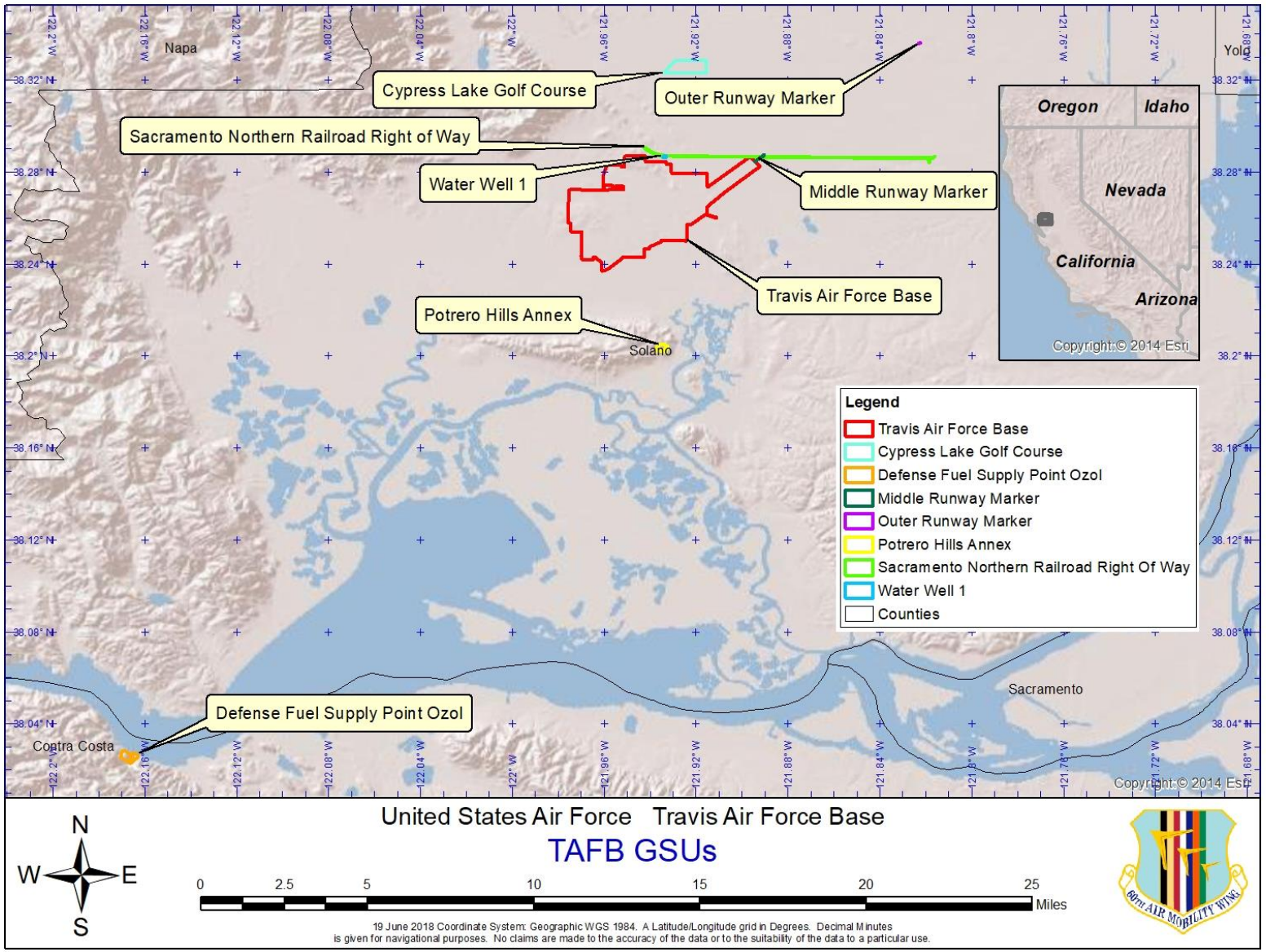
Wildland fire management on TAFB is a twofold process, involving both prescribed fire as a preventative measure and ecosystem management tool and wildfire management. As described in Section 3.8.1.2 of AFI 32-7064, fire and other disturbance regimes may be used as a component to ecosystem management when practical and consistent with the military mission. Prescribed fires reduce fuel load in an area, making subsequent wildfires easier to control or preventing them completely. Prescribed fire can also be a useful tool to maintain open grasslands, which are important for native wildlife species. TAFB has a Mutual Aid Agreements (MAA) in place with Solano County, which covers the City of Benicia, the City of Dixon, the City of Fairfield, the City of Rio Vista, the City of Suisun City, the City of Vacaville, the City of Vallejo, the County of Solano, the American Canyon Fire Protection District (FPD), the California Medical Facility Fire Department (FD), the Cordelia FPD, the Delta FPD, the Montezuma FPD, the Suisun FPD, the Vacaville FPD, and the California Department of Forestry and Fire Protection (CAL FIRE). This MAA can be found in Appendix 1.1. An updated MAA is currently in draft form.

There are 7 AF-owned Geographically Separated Unit (GSU) attached to TAFB (see Table 1.1 and Figure 1.2).

Table 1.1: Areas Covered in the Wildland Fire Complex

Areas Covered within the WFMP	Total Acres (Burnable Acres)
Travis Air Force Base	5,038.7 (3,572.2)
Cypress Lakes Golf Course	207.5 (197.3)
Defense Fuel Supply Point Ozol	51.4 (44.6)
Middle Runway Marker	1.9 (1.6)
Outer Runway Marker	0.2 (0.2)
Potrero Hills Annex	24.8 (19.8)
Sacramento Northern Railroad Right of Way (former)	70.0 (70.0)
Water Well 1	1.8 (0.9)

Figure 1.2: TAFB GSUs



1.2.1 General Description of Any GSU Owned by the AF and Used by the Installation

1.2.1.1 Cypress Lakes Golf Course (CLGC)

According to Ecological Subregions, CLGC is located in the Delta Basins Subsection of the Great Valley Section, within the California Dry Steppe Province. It is comprised of 207.5 acres in Solano County, California, about 3 miles north of TAFB. The nearest town is Vacaville, California. Access to CLGC from Vacaville is by taking Fry Road east, turning right (south) on Meridian Road, turning right (west) on Cypresswood Drive, and continuing into the GSU. CLGC is bordered by agriculture to the south and northwest and by rangeland on all other sides. CLGC is covered under the Solano County MAA to assist with wildfire as needed.

1.2.1.2 Defense Fuel Supply Point Ozol (DFSPO)

According to Ecological Subregions, DFSPO is located in the Suisun Hills and Valleys Subsection of the Central California Coast Section, within the California Coastal Chaparral Forest and Shrub Province. It is comprised of 51.4 acres in Contra Costa County, California, about 18 miles southwest of TAFB. The nearest town is Martinez, California. Access to DFSPO from Martinez is by taking George Miller Trail to the northwest and continuing into the GSU. DFSPO is bordered by the Carquinez Strait on the northeast and forest and rangeland on all other sides. It is expected that the AF will soon relinquish control over DFSPO, so this GSU will not be covered further in this WFMP. Currently, fire management on DFSPO is the responsibility of the East Bay Regional Parks District and Contra Costa County.

1.2.1.3 Middle Runway Marker (MRM)

According to Ecological Subregions, MRM is located in the Delta Basins Subsection of the Great Valley Section, within the California Dry Steppe Province. It is comprised of 1.9 acres in Solano County, California, about adjacent to the northeast end of the TAFB airfield. The nearest town is Vacaville, California. Access to MRM from Vacaville is through TAFB itself. MRM is bordered by agriculture to the north, by TAFB on the southwest, and by rangeland on all other sides. MRM is covered under the Solano County MAA to assist with wildfire as needed.

1.2.1.4 Outer Runway Marker (ORM)

According to Ecological Subregions, ORM is located in the Delta Basins Subsection of the Great Valley Section, within the California Dry Steppe Province. It is comprised of 0.2 acres in Solano County, California, about 5 miles northeast of TAFB. The nearest town is Vacaville, California. Access to ORM from Vacaville is by taking Fry Road east, turning right (south) on Rio Dixon Road, and turning left (east) into the GSU. ORM is bordered by rangeland on all sides. ORM is covered under the Solano County MAA to assist with wildfire as needed.

1.2.1.5 Potrero Hills Annex (PHA)

According to Ecological Subregions, PHA is located in the Suisun Hills and Valleys Subsection of the Central California Coast Section, within the California Coastal Chaparral Forest and Shrub Province. It is comprised of 24.8 acres in Solano County, California, about 3 miles south of TAFB. The nearest town is Fairfield, California. Access to PHA from Fairfield is by taking California State Highway 12 east, turning

right (south) on Branscombe Road, and continuing into the GSU. PHA is bordered by rangeland on all sides. PHA is covered under the Solano County MAA to assist with wildfire as needed.

1.2.1.6 Sacramento Northern Railroad Right of Way (former, SNRROW)

According to Ecological Subregions, SNRROW is partly located in the Suisun Hills and Valleys Subsection of the Central California Coast Section, within the California Coastal Chaparral Forest and Shrub Province and partly located in the Delta Basins Subsection of the Great Valley Section, within California Dry Steppe Province. It is comprised of 70.0 acres in Solano County, California, adjacent to the abandoned housing on the north side of TAFB. The nearest town is Fairfield, California. Access to SNRROW from Fairfield is by taking Cement Hill Road east, continuing east on Vanden Road, turning right (east) on Canon Road, and turning right (south) on Gate Road, which bisects the GSU. SNRROW is bordered by rangeland on all sides, as well as agriculture along portions of the north boundary and developed land on portions of the south boundary. SNRROW is covered under the Solano County MAA to assist with wildfire as needed.

1.2.1.7 Water Well 1 (WW1)

According to Ecological Subregions, WW1 is located in the Suisun Hills and Valleys Subsection of the Central California Coast Section, within the California Coastal Chaparral Forest and Shrub Province. It is comprised of 1.8 acres in Solano County, California, about, adjacent to the abandoned housing on the north side of TAFB. The nearest town is Fairfield, California. Access to WW1 from Fairfield is by taking Cement Hill Road east, continuing east on Vanden Road, turning right (east) on Canon Road, turning right (south) on Gate Road, and turning left into the GSU. WW1 is bordered by rangeland on the north and developed land on all other sides. WW1 is covered under the Solano County MAA to assist with wildfire as needed.

1.2.2 General Description of Any GSU Leased by the AF and Used by the Installation

There are no leased GSUs attached to TAFB.

1.3 General Description of the DoD Mission

The host organization at TAFB is the 60 AMW, which is a unit of the Air Mobility Command (AMC). The 60 AMW is the largest air mobility organization in terms of personnel in the Air Force with a versatile all-jet fleet of C-5M Super Galaxy and C-17 Globemaster III cargo aircraft and KC-10 Extender refueling aircraft. The unit's primary roles are to provide rapid, reliable airlift of American fighting forces anywhere on earth in support of national objectives and to extend the reach of American and allied air power through mid-air refueling. Wing activity is primarily focused in the Pacific and Indian Ocean area, including Alaska and Antarctica. However, the 60 AMW crews can fly support missions anywhere in the world to fulfill its motto of being "America's First Choice" for providing true Global Reach.

The 60 AMW maintains a work force of approximately 7,063 active-duty military and 3,268 civilian personnel, including personnel from the Department of Defense, Department of Homeland Security and Department of Veterans Affairs. In addition, more than 3,078 reservists assigned to the associate 349th Air Mobility Wing (349 AMW). The wing is organized into four groups: Operations, Maintenance, Mission

Support and Medical. Additionally, the wing commander has the support of 17 staff agencies. The wing is composed of the following units:

- 60th Operations Group (60 OG).
  - 60th Operations Support Squadron (60 OSS).
  - 6th Air Refueling Squadron (6 ARS).
  - 9th Air Refueling Squadron (9 ARS).
  - 21st Airlift Squadron (21 AS).
  - 22nd Airlift Squadron (22 AS).
- 60th Maintenance Group (60 MXG).
  - 60th Aerial Port Squadron (60 APS).
  - 60th Aircraft Maintenance Squadron (60 AMXS).
  - 60th Maintenance Squadron (60 MXS).
  - 60th Maintenance Operation Squadron (60 MOS).
  - 660th Aircraft Maintenance Squadron (660 AMXS).
  - 860th Aircraft Maintenance Squadron (860 AMXS).
- 60th Mission Support Group (60 MSG).
  - 60th Civil Engineer Squadron (60 CES).
  - 60th Communications Squadron (60 CS).
  - 60th Contracting Squadron (60 CONS).
  - 60th Logistics Readiness Squadron (60 LRS).
  - Airman and Family Readiness Center.
  - 60th Security Forces Squadron (60 SFS).
  - 60th Force Support Squadron (60 FSS).
- 60th Medical Group (60 MDG).
  - David Grant USAF Medical Center (DGMC).
  - 60th Aerospace Medicine Squadron (60 AMDS).
  - 60th Dental Squadron (60 DS).
  - 60th Diagnostics and Therapeutics Squadron (60 MDTS).
  - 60th Inpatient Squadron (60 IPTS).
  - 60th Medical Operations Squadron (60 MDOS).
  - 60th Medical Support Squadron (60 MDSS).
  - 60th Surgical Operations Squadron (60 SGCS).

Other major tenant units include the following:

- 349th Air Mobility Wing (349 AMW).
- 621st Contingency Response Wing (621 CRW).

1.3.1 General Discussion of Wildland Fire Impacts to the DoD Mission

The priority of all fire management activities is the safety of TAFB residents, the public, adjacent land owners, and firefighters, with protection of infrastructure and military assets a secondary priority. Otherwise, the priority of fire management activities is to manage wildland fire and fuels to promote mission success. Wildland fire management operations, in particular prescribed fire, support mission considerations by removing overgrown fuels, improving ecosystem health, perpetuating fire-dependent species, reducing invasive species, and reducing the overall risk of wildfire. Although prescribed fire has

not been conducted on TAFB, it has been found to be beneficial to similar native vernal pool plant community.

Wildfires and/or fire suppression operations can interfere with missions and threaten military assets. Wildfires, particularly under severe conditions, have the potential to pose a significant risk to AF personnel and their families, as well as to infrastructure on AF property and private property, should the fire spread off the installation. Missions are occasionally cancelled or postponed as a preventative measure during periods of high fire danger. Certain missions may require a smoke-free environment and can be impacted from smoke from wildfires or prescribed fires. Smoke can also reduce readiness by disrupting flight lines. In a worst-case scenario, smoke could potentially contribute to traffic accidents that lead to injury or death. Airspace use during aerial ignition or firefighting operations have the potential to negatively impact the ability of TAFB to achieve their primary mission. Bare ground from past wildfires may increase blowing dust which could impact operations for a longer period of time. Fires during the late summer/early fall may promote some non-native grass and forb species (Gerhardt and Collinge 2007). Soil disturbance from firefighting operations can negatively impact vernal pool habitat and the sensitive species that rely on it including species protected by the Endangered Species Act (ESA). Such disturbance could require emergency consultation under ESA Section 7 and expensive AF-funded mitigation. Disruption in operations can, in turn disrupt training schedules.

1.3.2 General Discussion of DoD Mission Impacts to Wildland Fire Activities

The mission itself can have impacts on wildland fire management. For instance, the mission introduces several new ignition sources into the environment. These ignition sources include the Explosives Ordinance Disposal (EOD) range, as well as the potential for fires to start as a result of human habitation, roads, and powerlines. In particular, fires have started as a result of human activity associated with the Take Charge and Move Out (TACAMO) complex. Prescribed fire has a narrow prescription window under which it would have a high degree of likelihood of both meeting objectives and being controllable. This window overlaps significantly with weather conditions required for DoD operations. Because of this, and the fact that smoke and particulate matter from prescribed fires could impact DoD operations, windows for the appropriate use of prescribed fire are further narrowed. If fuels cannot be treated using prescribed fire, the installation may be unable to meet INRMP implantation requirements under the Sikes Act (16 USC 670a-670o, 74 Stat. 1052 [Sikes Act]). In general, prescribed fire can only be implemented at times and under weather conditions when it will not interfere with ongoing military missions, however the installation is committed to adjusting scheduling to allow for prescribed fire to be implemented.

Constraints exist that may affect ongoing prescribed fire and wildfire operations. Military mission activity and associated safety footprints can limit access for prescribed fire, and for wildfire suppression. Areas with potential Hazardous Materials (HazMat) or other contamination can affect the ability to carry out prescribed fires and fight wildfires due to safety considerations. Security clearance is required of firefighters and issues may arise when outside personnel are providing mutual aid during wildland fire operations. Limited access points may affect tactics, especially on wildfires that cross jurisdictional boundaries. Missions involving flight may result in airspace restrictions that would impact the use of aerial firefighting resources. Close coordination between wildland fire crews and mission planners is required in order to assure safety and avoid conflicts. The commitment of the installation to protect natural resources

has resulted in a constraint requiring all vehicles used in fire suppression to remain on roads, unless there is a threat to human life or safety.

1.4 Significant Values to Protect

1.4.1 Personnel Safety

The primary concern during any fire is human safety and protection. Firefighters on the line, in the air, and at the command post must all be properly trained, outfitted, and informed of all threats and safety risks.

1.4.2 Structures and Infrastructure

Structures and infrastructure are present on TAFB, primarily in the housing area, main administrative area, airfield area, and Munitions Storage Area (MSA). Primary values to protect include wooden powerline poles, buildings, towers, weapons storage bunkers, and above-ground fuel storage tanks. Larger values such as buildings usually will be adjacent to managed fuels, such as lawns, or unburnable areas such as pavement or bare ground, however several values, due to their contents and/or proximity to dense fuels, may have a higher risk of damage from fire. Of particular concern are the TACAMO area, the abandoned housing adjacent to the northern boundary, a private residence adjacent to the southern boundary, the MSA, the hospital complex, compressed gas storage on the south side of the hospital, and the horse corrals and associated pole barns. See Section 3.5.2.4 for specific values to protect.

1.4.3 Natural Resources

Fire is generally considered beneficial to natural resources on TAFB in most cases. These ecosystems evolved with periodic fire and native vegetation responds well to fire. T&E species are known to occur on TAFB. In general, these species are unaffected by fire but may be affected by firebreak creation and maintenance, as well as certain firefighting tactics. T&E species known to occur on TAFB will be discussed in more detail in Section 3.5.1.8.

Aerially applied fire retardant has the potential to affect water quality if applied into the wetland itself. In general, restricting the use of heavy equipment in these habitats, as well as restricting the use of retardant and foam within 300 feet of any waterway in accordance with the *Guidelines for Aerial Delivery of Retardant or Foam near Waterways*, April 2000, will satisfy most concerns. See Section 3.5.2.4 for other specific natural resource values to protect.

A natural resources checklist is provided in Appendix 1.5.

1.4.4 Cultural Resources

The entirety of the installation and GSUs has been surveyed. No cultural resources eligible for listing in the National Register of Historic Places (NRHP) as archaeological resources are known. Approximately 30 potential historic buildings and structures have been identified. No known Native American sites or issues are associated with the installation. Increased visibility after a fire increases the ability of archeologists to locate artifacts but it also has the same effect for looters. Heat from fire can affect the ability of an archeologist to distinguish legitimate artifacts, such as human heat-treated chert, obsidian, or rocks associated with hearths, from those that have merely been heat-treated by a wildfire. Historic structures made of wood and paper-based products may be damaged by fire, as can maker's marks on glass

artifacts. Foot and equipment traffic related to firefighting activities can damage the integrity of a site and the subsequent interpretation of historic and prehistoric sites and their ability to be nominated to the NRHP. Consult the Cultural Resources Manager (CRM) and the Integrated Cultural Resources Management Plan (ICRMP) for more details on cultural resources. A checklist of recommended cultural resource actions can be found in Appendix 1.2.

1.5 WFMP Roles and Responsibilities

A list of contacts related to wildland fire management on TAFB can be found in Appendix 1.3.

1.5.1 Wildland Fire Program Coordinator (WFPC)

As per Section 13.2.2 of AFI 32-7064, "The WFMP designates a Wildland Fire Program Manager (WFPM) and defines the roles and responsibilities for wildland fire management on the installation."

For the purpose of this document the WFPM and WFPC are interchangeable. At TAFB, the NRM will serve as the WFPC.

The WFPC will:

- Initiate, coordinate, and ensure appropriate installation engagement and timely completion of the WFMP. As a component plan to the INRMP, implementation of the WFMP should be coordinated quarterly with the NRM to maximize ecological benefits of the fire program.
- Serve as the primary installation Point of Contact (POC) for the AFCEC/CZOF fuels treatment implementation, data collection, and large wildfire reporting.
- Assist with requests for Incident Qualification Cards for installation assets as specified in the WFMP.
- As soon as practical, report any significant wildfire incident that occurs on or threatens property under AF jurisdiction to the AFCEC/CZOF via the Regional Fire Management Officer (RFMO). A significant wildfire incident is defined as:
    - Any wildfire greater than 100 acres.
    - Any wildfire, regardless of size, that has met any of the following criteria:
        - Significant threat to installation infrastructure/resources.
        - Major or extended impact on AF missions.
        - Loss of life.
        - Negative impact to public health and safety.
        - Threat to T&E species as determined by the NRM.
- Work with the WSM Lead and AFCEC/CZOF training manager to identify National Wildfire Coordinating Group (NWCG) qualification requirements in the installation's WFMP.
- Serve as the primary POC between the installation and the AFCEC/CZOF for all matters concerning wildland fire.
- Coordinate with the installation assets and WSM Lead to ensure that manpower, supplies, equipment, and other cooperative resources are available to meet the required goals and objectives of the WFMP.

- Be responsible for coordinating all internal and external notifications dealing with wildland fire activities.
- Coordinate with the AFCEC/CZOF's training manager with all matters related to training and qualifications.
- Coordinate with the installation NRM to assess the need for Emergency Stabilization (ES) actions (such as the development of a Burned Area Emergency Response [BAER] plan) and/or development of a Burned Area Rehabilitation (BAR) plan.
- Ensure all wildland and prescribed fire boundaries and other fire related resources (i.e. firebreaks, hazard suppression areas, etc.) are mapped, added to the Environmental Geodatabase (Natural Resources Dataset), and maintained annually to ensure accuracy. Applicable standard AF layers include FireArea_A, FireBreakLine_L, FuelBreakLine_L, FuelMgmtArea_A, HazSuppressionArea_A, PresecribedBurnUnit_A, and WildlandUrbanInterfaceArea_A.

1.5.2 FES Fire Chief (FC)

The TAFB FES is currently responsible for suppressing wildfires and the FES FC is responsible for ensuring wildfire readiness and response for the installation and for ensuring that the WFMP accurately reflects FES SOCs, SOGs, roles, and responsibilities. The FES FC is also responsible for ensuring that the FES flight has the minimum NWCG wildfire suppression training and equipment, as well as the MAAs necessary to safely respond to initial attack incidents on the installation. The FES FC shall be familiar with the provisions outlined in this plan and provide qualified personnel to support the wildland fire management program as necessary. The FES FC will coordinate to ensure that the planned actions for which the FES FC is the proponent (fuels/fire hazard reduction related activities) in the WFMP are covered under the National Environmental Policy Act (42 U.S.C. §4321 et seq. [NEPA]) process.

1.5.3 Natural Resources Manager (NRM)

The TAFB NRM will be involved with development of the WFMP as it applies to the installation to ensure that all planned actions in the WFMP are evaluated for environmental impacts per NEPA/EIAP, and directly supportive of, the respective INRMP. Related to this, the NRM will coordinate to ensure that the planned actions for which the NRM is the proponent (ecosystem related activities) in the WFMP are covered under the National Environmental Policy Act (42 U.S.C. §4321 et seq. [NEPA]) process.

1.5.4 Incident Commander (IC)

All wildfires occurring on an AF installation and staffed with AF employees or cooperators will be supervised by a qualified IC. If an NWCG qualified IC is not available, one will be ordered through the local dispatch center.

The IC is a single individual responsible to the installation for all incident activities, including the development of incident management strategies and tactics, and the ordering, deployment, and release of resources. The IC will:

- Provide a size-up to dispatch as soon as possible upon arrival on scene. A size-up checklist is in the PMS 461/NFES 001077, *Incident Response Pocket Guide*, April 2018 (IRPG).
- Complete and file an incident report with the installation dispatch center.

- Assess potential management by suppression and/or by wildfire for resource benefit as incident objective(s).
- Contact the AFCEC/CZOF AFMO with incident updates and recommended plan of action.
- Use guidance in this WFMP.
- Secure a Delegation of Authority to implement the selected suppression response and manage an organization to implement effective strategies and tactics.
- Minimize suppression impacts where possible without reducing the effectiveness of the actions being undertaken.
- Determine resource needs and order as needed through local dispatch.
- Ensure all resources assigned and those incoming receive a briefing and document these briefings. Refer to the Briefing Checklist in the IRPG.
- Continually re-assess incident complexity using the checklist in the IRPG.
- When a more qualified IC is needed, inform dispatch and delegated unit administrator and place the order for a higher-level IC.
- Provide all resources, including mutual aid resources (in person or by radio) an incident briefing prior to initiating a tactical assignment.
- Investigate all wildfires to determine fire cause. Document findings on an *Activity Log* (ICS 214) and determine if negligence or criminal intent were factors. If the IC suspects a fire cause is suspicious, a qualified Wildland Fire Investigator (INVF) can be ordered. The point of origin will be protected for investigation purposes.
- Depending on incident complexity, additional responsibilities for the IC may apply. Utilize AFI 32-7064, NWCG PMS 210, *Wildland Fire Incident Management Field Guide*, April 2013 (PMS 210), and AFCEC/CZOF for more detailed description of IC responsibilities.
- A copy of the ICS 214 will be submitted to the NRM if it relates to natural resources (e.g. bird electrocution). Information from the ICS 214 will also be included in the "FireArea" Data Layer Specification within the Environmental GIS Geodatabase under the attribute "causeType.

The WFPC will ensure that a Delegation of Authority is provided to all qualified ICs, of any type, that command or may command a wildfire on TAFB of any size. This includes an annual Delegation of Authority provided to all initial attack ICs (Type 5 and Type 4) on the installation. A sample *Agency Administrator's Delegation of Authority to the Incident Commander* can be utilized to create an TAFB-specific Delegation of Authority for future use. The installation will use the current AFI 32-7064 or the NFES 2724, *Interagency Standards for Fire and Aviation Operations*, January 2018 (Red Book) for supporting guidelines which include the Agency Administrator's Briefing to Incident Management Team (IMT). An outgoing IC will in-brief an incoming IC using the Briefing Checklist found in the IRPG. Once a fire has expanded beyond the capabilities of the initial attack resources, or it is apparent that it will exceed these capabilities, the initial attack IC must request assistance.

1.5.5 Wildland Support Modules (WSM)

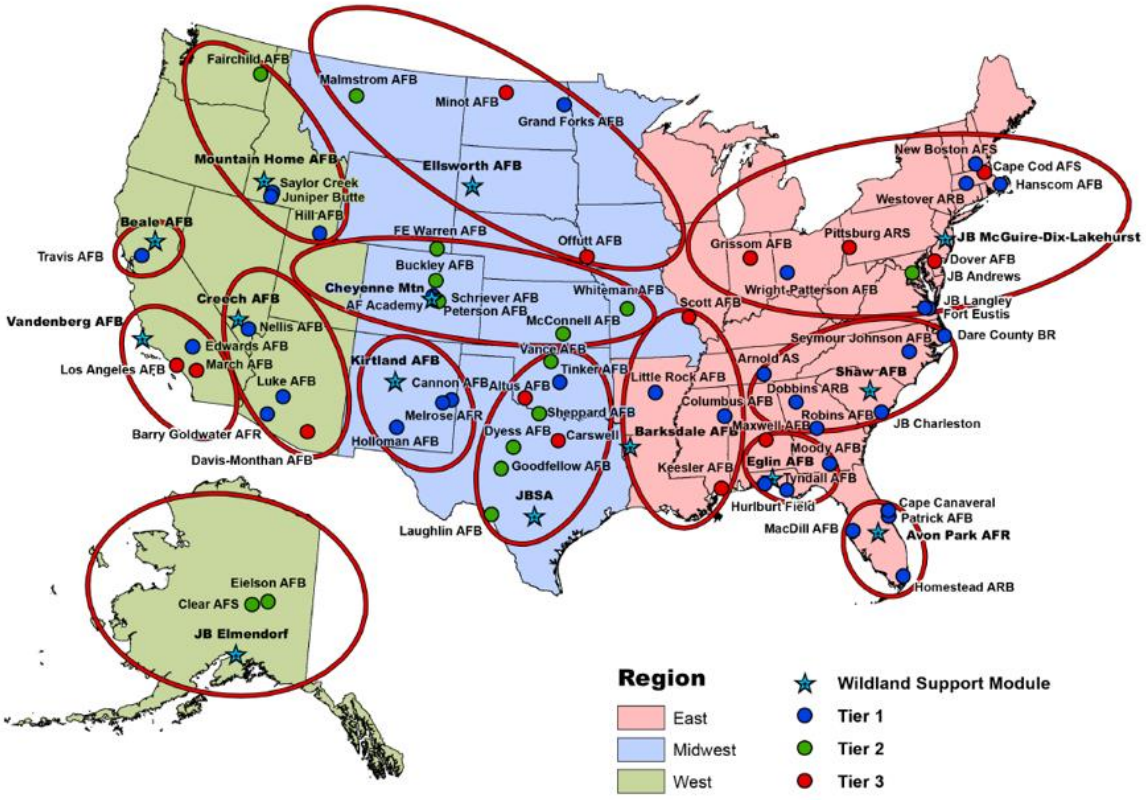
AFCEC/CZOF will primarily use the WSMs, in conjunction with the NWCG-qualified and available installation personnel, to execute validated wildland fire management program requirements.

More details on the WSM can be found in *Air Force Wildland Fire Center Playbook*, 2017 (AFCEC/CZOF Playbook).

The WSMs shall provide a high quality, mobile, qualified and experienced resource for installations to implement the goals and objectives of the WFMP. WSMs shall maintain expertise to plan and conduct prescribed fire, accredited training delivery, and mechanical fuels reduction services. The WSM is available for wildfire suppression when requested by FES to the WSM Lead and not on Temporary Duty (TDY) status to other installations.

TAFB will in the future be served by the WSM at BAFB near Marysville, California, approximately 89 miles northeast, with a response time of approximately 2 hours. The WSM at BAFB serves only BAFB and TAFB. Until a Lead is assigned for the BAFB WSM, contact the designated AFMO regarding wildland fire matters on TAFB. WSM Areas of Responsibility (AORs) are depicted in Figure 1.3.

Figure 1.3: WSM Areas of Responsibility



The WSM program facilitates the use of fire and other management techniques involving planned and unplanned wildland fire events. WSMs are highly skilled and versatile fire crews, which provide technical and ecological-based expertise in the areas of long term planning, ignitions, holding and suppression, prescribed fire preparation and implementation support, hazard fuels reduction, and fire effects monitoring, resulting in fire fulfilling its natural or historic role to meet resource and management objectives.

The WSM provides fully qualified and equipped personnel to conduct prescribed fire and mechanical fuels reduction activities for the purposes of ecosystem management and mitigation of wildfire as a threat to the ecosystem. Activities are conducted in accordance with INRMP and installation mission objectives. At a minimum, the WSM shall collaborate all activities extensively with the installation NR staff and FES to ensure all actions are aligned to a common goal. Per AFI 32-7064, installation operations and maintenance funding will be required for activities aimed at wildfire prevention and fuels management for hazard reduction. WSMs are funded using environmental funding only.

1.5.6 Installation Commander (60 AMW/CC)

60 AMW/CC or his designee is responsible for appointing the WFPC and for reviewing and approving the WFMP. A Delegation of Authority will specifically delegate duties from 60 AMW/CC to the WFPC. See Appendix 1.4 for a sample Delegation of Authority from 60 AMW/CC to the WFPC.

1.5.7 AF Wildland Fire Branch (AFCEC/CZOF)

AFCEC/CZOF provides technical and operational support to installations for a wide range of wildland fire-related products and services, including writing and updating WFMPs, prescribed fire implementation, use of Decision Support Tools during wildfire emergencies, interagency liaisons, tracking of NWCG qualifications, and wildland fire training. AFCEC/CZOF is also responsible for issuing, maintaining, and tracking the NWCG certifications and qualifications for AF personnel, to include contractors and volunteers where appropriate. AFCEC/CZOF is responsible for planning, implementing, and managing WSMs. Finally, AFCEC/CZOF is responsible for programming and execution of Operations and Maintenance Environmental Quality funds, programmed under the authority of either the Sikes Act or the Endangered Species Act, to support AFCEC Wildland Fire Branch activities including the WSMs.

If the resources in the WSMs are limited and cannot accomplish wildland fire requirements organically or in cooperation with qualified installation assets, AFCEC/CZOF will exercise reach back assistance from interagency detailers to supplement AFCEC/CZOF staff. After assessing interagency detailers capability, AFCEC/CZOF may utilize qualified contracted personnel to assist with wildland fire fuels requirements. AFCEC/CZOF shall provide direction, support, and review processes that ensure WSM operations are safe, effective, and meet the WSM operations standards as outlined in this document.

1.5.8 Environmental Operations Division West Region (AFCEC/CZOW)

AFCEC/CZOW programs Environmental Quality (EQ) requirements and manages contracts and cooperative agreements for the Conservation Office and NRM which, at TAFB, support pre- and post-fire monitoring requirements and BAER analyses for natural resource impacts only among other functions. AFCEC/CZOW, through the Travis Installation Support Sections (ISS), provides technical support to installation NRMs.

Chapter 2. Policy, Land Management Planning, and Partnerships

2.1 AF Wildland Fire Policy

The governing policy for wildland fire management can be found in DoDI 6055.06, Chapter 13 of AFI 32-7064, Chapter 3.2.4 of AFI 32-2001, *Fire Emergency Services (FES) Program*, (AFI 32-2001), the AFCEC/CZOF Playbook, and *Review and Update of the 1995 Federal Wildland Fire Management Policy*, January 2001 (FWFMP), as implemented through the *Guidance for Implementation of Federal Wildland Fire Management Policy*, February 2009 (FWFMP Guidance).

2.1.1 Federal Interagency Wildland Fire Policy

This WFMP meets relevant AFI and FWFMP, as implemented through the FWFMP Guidance by implementing and following these guiding principles:

- Firefighter and public safety is the priority in every fire management activity.
- Support the AF mission by managing wildland fire fuels to protect assets, structures, infrastructure, natural areas, and other identified values at risk from catastrophic wildfire.
- The role of wildland fire as an essential ecological process and natural change agent has been incorporated into the planning process.
- INRMP and pertinent resource management plans set the objectives for the use and desired future condition of the various public lands.
- WFMPs, programs, and activities support land and resource management plans and their implementation.
- Sound risk management is a foundation for all wildland fire management activities. Risks and uncertainties relating to wildland fire management activities must be understood, analyzed, communicated, and managed as they relate to the cost of either doing or not doing an activity.
- Wildland fire management programs and activities are economically viable, based upon values to be protected, costs, and land and resource management objectives.
- WFMPs and activities are based upon the best available science.
- WFMPs and activities incorporate public health and environmental quality considerations.
- Federal, state, tribal, local, interagency, and international coordination and cooperation are essential.
- Standardization of policies and procedures for wildland fire management among AF installations is an ongoing objective.

This WFMP supports TAFB's compliance with the Sikes Act in management of natural resources on DoD lands as a component plan of the INRMP.

2.1.2 AF Wildland Fire Cost-Effectiveness Policy

Maximizing cost-effectiveness of any fire operation is the responsibility of all involved, including those who authorize, direct, or implement operations. Cost-effectiveness is the most economical use of resources necessary to accomplish project/incident objectives. Accomplishing the objectives safely and efficiently will not be sacrificed for the sole purpose of "cost-saving." Appropriate oversight will ensure that expenditures are commensurate with values to be protected. Other factors besides those in the

biophysical environment may influence decisions, including those from the social, political, and economic realms. AFCEC/CZOF will provide direction and support in this area.

2.1.3 Cohesive Wildland Fire Management Strategy

This WFMP meets the direction in The National Strategy, the final phase in the Development of *A National Cohesive Wildland Fire Management Strategy* (National Cohesive Strategy) because it emphasizes the following primary goals:

- *Restore and maintain landscapes:* Landscapes across all jurisdictions are resilient to fire-related disturbances in accordance with management objectives.
- *Fire adapted communities:* Human populations and infrastructure can withstand a wildfire without loss of life and property.
- *Wildfire response:* All jurisdictions participate in making and implementing safe, effective, efficient risk-based wildfire management decisions.

The National Strategy sets broad, strategic, and national-level direction as a foundation for implementation of actions across the Nation.

2.1.4 AF and DoD Guidance

The WFMP incorporates and adheres to DoD and AF policy by giving full consideration to the use of wildland fire as a natural process and as a tool in the land management planning process and by providing for the following:

- Wildfires, whether on or adjacent to lands administered by the AF, which threaten life, improvements, or are determined to be a threat to natural and cultural resources under the AF's jurisdiction, will be considered emergencies and their suppression given priority over other AF programs.
- Installations shall cooperate in the development of interagency preparedness plans to ensure timely recognition of approaching critical wildfire situations, to establish processes for analyzing situations and establishing priorities, and for implementing management responses to these situations.
- Installations will enforce rules and regulations concerning the unauthorized ignition of wildfires, and aggressively pursue violations.

This WFMP addresses a full range of potential wildfires and considers a full spectrum of tactical options (from monitoring to intensive management actions) for wildfires in order to meet Fire Management Unit (FMU) objectives. It affirms these key elements of AFI interim policy:

- Firefighter and public safety is the first priority of the wildland fire management program and all associated activities.
- Only trained and qualified personnel will be responsible for, and conduct, wildfire management duties and operations.
- Fire management planning, preparedness, wildfire and prescribed fire operations, other hazardous fuels operations, monitoring, and research will be conducted on an interagency basis with involvement by all partners to the extent practicable.
- AFCEC/CZOF, in conjunction with the AFCEC/CZOW ISS and the NRM, has coordinated, reviewed, and approved this WFMP with the installation to ensure consistency

with approved land management plans, values to be protected, and natural and cultural resource management plans, and that it addresses public health issues related to smoke and air quality.

- Fire, as an ecological process, has been integrated into the INRMP and related resource management plans and activities on a landscape scale, across agency boundaries, based upon the best available science.
- Wildfire is used to meet identified resource management objectives and benefits when appropriate.
- Prescribed fire and other treatment types will be employed whenever they are the appropriate tool to reduce hazardous fuels and the associated risk of wildfire to human life, property, and cultural and natural resources and to manage our lands for habitats as mandated by statute, treaty, and other authorities.
- Management response to wildfire will consider firefighter and public safety, cost-effectiveness, values to protect, and natural and cultural resource objectives.
- Staff members will work with mission planners, local cooperators, and the public to prevent unauthorized ignition of wildfires on AF lands.

2.1.5 Installation Specific Fire Management Policy

Wildland fire management policy on TAFB is governed by the WFMP, as well as the following SOC and SOG (see Appendix 2.1).

- TAFB Fire Emergency Services Standard of Cover.
- Standard Operating Guide 32-08-04 – Wildland Emergencies, 2018.

No other installation-specific policy documents are currently in place.

2.2 Land & Resource Management Planning

2.2.1 Relationship to INRMP

The TAFB INRMP, approved July 2016 is the primary document directing natural resource-related activities on the installation. This document includes overarching natural resource management goals, objectives, and projects. The following goals, objectives, and projects are relevant to fire and fuels management and are taken directly from the INRMP:

GOAL A.2: Incorporate natural resources information into all TAFB management decisions, providing for effective completion of base missions.

Objective A.2.1: Maintain effective communications and information accessibility for responsible ecosystem management of TAFB.

Project A.2.1.7: Produce a wildland fire response protocol for Natural Resource Specialist input into fire suppression activities and rehabilitation funding and projects.

Project A.2.1.8: Perform BAER analysis and implementation.

Objective A.2.2: Increase the use and application of GeoBase for natural resource protection and management.

Project A.2.2.4: Produce a fire management Geographic Information System (GIS) database (risk analysis, fuel types, history, fuelbreaks and other).

GOAL A.3: Preserve and enhance native ecosystems for fish and wildlife species.

Objective A.3.2: Integrate fish and wildlife management with other natural resource management plans.

Project A.3.2.2: Develop prescribed burn wildlife habitat priorities and coordinate with Wildland Fire Management.

Project A.3.2.3: Identify and prioritize habitat projects according to the Invasive Species Management Plan in conjunction with Agricultural Outleasing and Wildland Fire Management.

Objective A.3.3: Maintain and enhance habitat and recovery for state and federal T&E species.

Project A.3.3.2: Manage vegetation using mowing, grazing, and or prescribed burning in the Aero Club and Castle Terrace Conservation Areas to enhance listed species habitat.

Objective A.3.6: Implement the Avian Protection Plan to prevent bird electrocutions and reduce subsequent power outages and grass fires.

Project A.3.6.1: Monitor avian electrocutions, perform study to prioritize poles needing retrofit, purchase retrofit materials, and coordinate work with base Electric Shop.

Project A.3.6.2: Provide updated training to the base Electric Shop at least once every 2 years.

GOAL C.1: Maintain and enhance the ecological integrity of sensitive habitats and species affected by invasive species.

Objective C.1.1: Reduce the impacts of invasive species to sensitive habitats and species.

Project C.1.1.2: Evaluate various methods of control including mowing activities, pesticide application, and controlled burns to control non-native, invasive species.

GOAL D.1: Maintain compliance with federal and state mandates for threatened and endangered species.

Objective D.1.5: Complete consultation with the United States Fish and Wildlife Service (USFWS) and mitigation for firebreak impacts that occurred to listed vernal pool species during the 2005 wildfire at the Aero Club.

Project D.1.5.1: Finalize and implement a compensation plan at the Aero Club for damage to vernal pools created by response to a wildfire in 2005.

GOAL D.3: Protect and enhance existing populations and habitats of threatened and endangered species. Assess status, develop long-term plans and conduct actions for recovery.

Objective D.3.1: Protect and enhance Federally listed species and species of concern.

Project D.3.1.4: Produce a protocol for natural resource specialist response to wildfire suppression and input into fire rehabilitation plans.

GOAL E.1: Adaptively manage all resources in the rangeland ecosystem to be consistent with the military mission and all environmental regulations.

Objective E.1.3: Evaluate mechanical and non-mechanical techniques to manipulate plant communities in grazing units.

Project E.1.3.2: Develop prescribed burn projects with wildland fire management to control invasive plants and manage native plant communities.

Overall goals of the TAFB INRMP include:

- GOAL 1: Integrate management of TAFB natural resources with cooperating agencies.
- GOAL 2: Ensure compliance with Sikes Act, Section 670-e2.
- GOAL A.1: Integrate management with cooperating agencies for the conservation, protection and management of TAFB fish and wildlife resources.
- GOAL A.2: Incorporate natural resources information into all TAFB management decisions, providing for effective completion of base missions.
- GOAL A.3: Preserve and enhance native ecosystems for fish and wildlife species.
- GOAL B.1: Protect and manage wetlands at TAFB in accordance with current laws, regulations, and mitigation obligations.
- GOAL B.2: Ensure that recreation uses are consistent with sound natural resource management and wildlife habitat protections.
- GOAL B.3: Obtain information on the status of base wetlands and drainages.
- GOAL C.1: Maintain and enhance the ecological integrity of sensitive habitats and species affected by invasive species.
- GOAL C.2: Restore ecosystem function and biodiversity in habitats degraded by invasive species.
- GOAL C.3: Increase control of target invasive species.
- GOAL D.1: Maintain compliance with federal and state mandates for T&E species.
- GOAL D.2: Conduct inventories and surveys for presence of federally listed species.

- GOAL D.3: Protect and enhance existing populations and habitats of threatened and endangered species. Assess status, develop long-term plans and conduct actions for recovery.
- GOAL E.1: Adaptively manage all resources in the rangeland ecosystem to be consistent with the military mission and all environmental regulations.
- GOAL F.1: Manage known pest species.
- GOAL F.2: Work with other on-base organizations in pest management.
- GOAL G.1: Support the use of recreation areas on TAFB.
- GOAL G.2: Support the Cypress Lakes Golf Course.
- GOAL H.1: Standardize Conservation Law Enforcement program effectively in accordance with environmental laws, agency requirements, and AF requirements.
- GOAL I.1: Protect and enhance the desirable natural and man-made features in the landscape effectively while supporting the military mission.
- GOAL I.2: In a manner consistent with the military mission, prevent and minimize nonpoint source pollution.
- GOAL I.3: Minimize or eliminate potential negative impacts of golf course management to achieve the highest standards of environmental excellence.

2.2.2 Other Relevant Plans

In addition to this WFMP, the following plans are in place at TAFB and are either stand-alone plans, or are component plans that comprise the 2016 INRMP:

- Bird/Wildlife Air Strike Hazard (BASH) Plan.
- Burrowing Owl Management Plan (BOMP).
- Castle Terrace Recreational and Management Plan (CTRMP).
- Cypress Lakes Golf Course Environmental Management Plan (CLGCEMP).
- Grazing Management Plan (GMP).
- Hazardous Waste Management Plan (HWMP).
- ICRMP.
- Integrated Pest Management Plan (IPMP).
- Invasive Species Management Plan (ISMP).
- Union Creek Vegetation Easement (UCVE).

2.2.3 Environmental Compliance

The AF has procedures for assessing and analyzing the environmental effects of specific prescribed fire, fuels reduction, and wildfire suppression rehabilitation actions. These procedures follow law, policy, and regulations relating to the following:

- Defense Appropriations Act of 1991, Legacy Resource Management Program (P.L. 101-511, 104 Stat. 1856; DAA).
- Executive Order 11514: Protection and Enhancement of Environmental Quality (EO 11514).
- Executive Order 11593: Protection and Enhancement of the Cultural Environment (EO 11593).
- Executive Order 11988: Floodplain Management (EO 11988).
- Executive Order 11990: Protection of Wetlands (EO 11990).

- Executive Order 13112: Invasive Species (EO 13112).
- Executive Order 13175: Consultation and Coordination with Indian Tribal Governments (EO 13175).
- Executive Order 13186: Responsibilities of Federal Agencies to Protect Migratory Birds (EO 13186).
- Archeological Resources Protection Act of 1979 (16 U.S.C. §470 et seq.; ARPA).
- Bald and Golden Eagle Protection Act of 1940 (16 U.S.C. §668-668c; BGEPA).
- Clean Air Act of 1972 (42 U.S.C. Ch. 85, Subch. I §7401 et seq.; CAA).
- Clean Water Act of 1963 (33 U.S.C. §1251 et seq.; CWA).
- Endangered Species Act of 1973 (16 U.S.C. §1531 et seq.; ESA).
    - Emergencies (50 CFR Part 402.05).
    - Formal Consultation (50 CFR Part 402.14(c)).
    - Memorandum: Alternative Approaches for Streamlining Section 7 Consultation on Hazardous Fuels Treatment Projects, 11 October 2002 (Memorandum)
- Federal Land Use Policy and Management Act of 1976 (P.L. 94-579; 43 U.S.C. §1701 et seq.; FLUPMA).
- Federal Noxious Weed Act of 1974 (P.L. 93-629; 7 U.S.C. §2801 et seq.; FNWA)
- Fish and Wildlife Conservation Act of 1980 (P.L. 96-366; 16 U.S.C. §2901 et seq.; FWCA)
- Migratory Bird Treaty Act of 1918 (16 U.S.C. §703 et seq.; MBTA).
- National Environmental Policy Act 1969 (42 U.S.C. §4321 et seq.; NEPA).
    - Environmental Impact Analysis Process (32 CFR Part 989).
- National Historic Preservation Act of 1966 (54 U.S.C. §300101 et seq.; NHPA).
- Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. §3001 et seq.; NAGPRA).
- Public Rangelands Improvement Act of 1978 (43 U.S.C §1361 et seq.; PRIA).
- Sikes Act of 1960 (16 USC 670a-670o, 74 Stat. 1052; Sikes Act).
- DoDI 4715.03, Natural Resources Conservation Program, 5 October 2017 (DoDI 4715.03).
- DoDI 6055.06, DoD Fire and Emergency Services Certification Program (DoDI 6055.06).
- AFPD 32-70, Environmental Quality, 20 July 1994 (AFPD 32-70).
- AFI 32-2001, Fire Emergency Services (FES) Program (AFI 32-2001).
- AFI 32-7061, The Environmental Impact Analysis Process, 28 March 2014 (AFI 32-7061).
- AFI 32-7062, Comprehensive Planning, 12 August 2010 (AFI 32-7062).
- AFI 32-7064, Integrated Natural Resources Management, 22 November 2016 (AFI 32-7064).
- AFI 32-7065, Cultural Resources Management, 6 October 2016 (AFI 32-7065).
- California Environmental Quality Act of 1970 (Public Resources Code §21000 et seq.; CEQA).
- California Senate Bill 901 – Wildfires (SB 901).
- Native Plant Protection Act of 1977 (Fish and Game §1900 et seq.; NPPA).
- California Endangered Species Act of 1984 (Fish and Game §2050 et seq.; CESA).
- Smoke Management Guidelines for Agricultural and Prescribed Burning (17 California CR, Subch. 2; SMGAPB).
- Bay Area Air Quality Management District (BAAQMD) Regulation 5 – Open Burning (BAAQMD Regulation 5).

- Yolo-Solano Air Quality Management District (YSAQMD) Rule 2.8 – Open Burning, General (YSAQMD Rule 2.8).
- YSAQMD Rule 6.1 – Agricultural Burning (YSAQMD Rule 6.1).

These procedures call for site specific and interdisciplinary analysis of the effects of each action and require consultation with pertinent agencies, including but not limited to the USFWS, California Office of Historic Preservation (OHP), California Department of Fish and Wildlife (CDFW), California Environmental Protection Agency (CalEPA), California Air Resources Board (CARB), BAAQMD, CAL FIRE, and United States Army Corps of Engineers (USACE).

2.2.3.1 NEPA Compliance

The procedures and policy for performing an environmental impact analysis are documented in 32 CFR Part 989. The AF uses Request for Environmental Impact Analysis (AF Form 813) to document the need for environmental analysis or for certain categorical exclusion (CATEX) determinations for proposed actions. This form is retained with the Environmental Assessment (EA) or Environmental Impact Statement (EIS). No NEPA documentation was available at the time of writing, but an EA is being drafted for the implementation of wildland fire activities including the establishment of new roads and firebreaks. Consult with the installation NEPA Coordinator for more details.

All prescribed fires, mechanical fuels treatments, and chemical fuels treatments must comply with NEPA requirements. Also, regardless of the NEPA type, all project NEPA copies need to be placed within the project documentation file. An EA must be prepared for each Prescribed Fire Plan (PFP) unless the field office's approved WFMP or planning documents and the accompanying environmental document adequately discuss the action or a CATEX covers the activity.

At a minimum, NR projects including prescribed fire and mechanical fuels treatments will be proposed on TRIRIGA service requests and evaluated by the installation NEPA manager to determine if more advanced environmental analysis is warranted.

NEPA analysis is not required for wildfires because wildfires are unplanned events. Suppression activities are covered by a CATEX from NEPA, though emergency ESA consultation must be conducted during or immediately following a wildfire if the wildfire or suppression actions could potentially impact a federally listed species. Minimizing potential smoke incursions into non-attainment areas will require aggressive suppression actions during periods of air quality alerts.

2.2.3.2 Air Quality

Individual PFPs will specify conditions required for burning that will minimize impacts to air quality from prescribed fire, including compliance with the requirements of state and local air quality regulatory agencies. Smoke management on TAFB will follow recommendations of the latest edition of the NWCG PMS 420-2/NFES 001279, *NWCG Smoke Management Guide for Prescribed Fire*, February 2018 (PMS 420-2), as well as California regulations, as stated below.

Smoke management in California is governed by CARB, who implements the guidelines found in 17 California CR, Subch. 2. Smoke management is further governed by local air quality management

districts (air districts). TAFB, MRM, PHA, WW1, and the western portion of SNRROW are within the BAAQMD, who implements the guidelines found in BAAQMD Regulation 5. CLGC, ORM, and the eastern portion of SNRROW are within the YSAQMD, who implements the guidelines found in YSAQMD Rule 2.8 and YSAQMD Rule 6.1. The purpose of these guidelines is to provide direction to air pollution control and air districts in the regulation and control of agricultural burning, including prescribed fire, in California. These guidelines are intended to provide for the continuation of agricultural burning, including prescribed fire, as a resource management tool, and provide increased opportunities for prescribed fire and agricultural burning, while minimizing smoke impacts on the public. The regulatory actions called for are intended to assure that each air district has a program that meets air district and regional needs.

The BAAQMD mandates the following will be followed regarding prescribed burning on TAFB:

- No burning shall take place without received written approval from the air district. (BAAQMD Regulation 5-401.15)
- No burning shall take place other than on a permissive burn day (5-401.15)
- Permission to burn shall be governed by the acreage burning allocation issued by the air district (5-408.2). The air district covering BAFB restricts prescribed burning due to air quality concerns from the nearby San Francisco metropolitan area. The air district typically will permit 200 acres of prescribed burning per day, though agricultural burning is prioritized over ecosystem management burning.
- Receive an acreage burning allocation from the air district prior to ignition (5-408.3)
- For each day on which burning occurs, report the total acreage and tonnage of vegetation actually burned to the air district by telephone no later than 12:00 p.m. local time the following day. (5-408.4)
- Within 30 calendar days following completion of the burn project, provide a written post-burn evaluation to the air district that addresses whether the project objectives were met and describes actual smoke behavior. (5-408.5)
- Any fire official seeking to conduct prescribed burning in a geographical area considered for a potential naturally-ignited wildland fire managed for resource benefits that is expected to exceed 10 acres in size shall annually register each burn project in writing with the air district by December 31 each year, with updates as they occur. Once a decision is made to manage the fire for resource benefits, the fire official shall provide a smoke management plan for the burn project to the air district, upon request. (5-408.5)
- No burning shall take place before 1000 local time on any day. (5-111.1)
- No additional materials or fuel shall be ignited, nor shall any material or fuels be added to any fire after two hours before sunset on any day. (5-111.2)
- No material or fuel shall be ignited, nor shall any material or fuel be added to any fire when the wind velocity is less than five (5) miles per hour except for crossfiring, or when the wind direction at the site shall be such that the direction of smoke drift is toward a populated area in order to minimize local nuisances caused by smoke and particulate fallouts. (5-111.3)
- Prior to ignition, all piled material shall have dried for a minimum of 60 days, and be managed to ensure that burning the material does not produce smoke after sunset on any day. (5-111.4)
- All material to be burned shall be reasonably free of dirt or soil. (5-111.5)

- Piled material shall be limited to a base area not to exceed 25 square yards and the height shall be at least 2/3 of the average width of the pile. (5-111.6)
- Ignition material shall be limited to those listed by the State Director of Forestry, as follows: orchard torches; drip torches; pressurized diesel torches; propane or LPG torches; commercial petroleum gel materials, pressurized or solid (napalm or blivets); commercial safety fuses; commercial type ignition grenades, e.g. Fenner, etc.; fuses; commercial fuse lighters and matches. All fires shall be ignited so as to burn as rapidly as possible within conditions of safety and minimum pollution. (5-111.7)
- Ignition shall be initiated at or near the top of the piled material. No additional material, except ignition material, shall be added to the fire. (5-111.8)
- Tonnage, volume or acreage of material burned on any given day and/or at any specified site is subject to limitations set by the air district, but may not exceed any limits set by the ARB. (5-111.9)

A Smoke Management Plan (SMP) must be submitted to the air district through 60th Environmental Element (60 CES/CEIE) for review at least 30 calendar days prior to the proposed burn. Each air district has developed specific requirements for SMPs based upon §80160 of 17 California CR, Subch. 2.

2.2.3.3 ESA Consultation

Consultation under the ESA regarding wildfires is governed by 16 U.S.C. §1531 et seq. Section 7. Where fire suppression actions could potentially impact T&E species, as soon as practicable after a suppression action, the NRM will determine whether the action has caused any adverse impacts to T&E species or their habitat. Impacted areas include the burn area itself, firelines or firebreaks constructed, or aerially delivered retardant or foam applied within 300 feet of a waterway. If the NRM judges that there have been no adverse effects on T&E species or their habitat, there is no requirement for further consultation with USFWS or National Marine Fisheries Service (NMFS). If it is determined that there were adverse actions on T&E species or their habitat, the installation must consult with USFWS and NMFS as required by 50 CFR 402.05. In the case of an extended attack wildfire, emergency consultation must be initiated as soon as practical during the fire. Post-fire consultation is appropriate for initial attack wildfires. Mitigating actions required under Section 7 will be funded by installation or EQ Operations and Maintenance (O&M) funding. For this reason, it is critical that T&E species locations be communicated to wildland fire managers so that suppression actions within their habitats can be avoided except to protect life safety. Wildland fire managers should request a map of T&E species locations from the NRM to ensure that any planned wildland fire actions do not impact T&E species or to determine whether any locations impacted by wildfire are home to T&E species. Consult with the NRM prior to conducting any wildland fire actions in locations where T&E species are present.

Fuels treatment projects, including prescribed fires and mechanical fuels reduction, are subject to ESA Section 7 if they have the potential to impact T&E species or their habitat. Section 7 consultation with USFWS will be initiated by the NRM, who will provide information required in 50 CFR 402.14(c). The USFWS has developed design criteria for fuels treatment projects to streamline their approval process under Section 7. Design criteria are listed in a memorandum from the USFWS. As with wildfire

suppression actions, avoidance of impacts to T&E species or their habitat will be a priority to avoid potentially costly mitigation of impacts requiring installation or EQ O&M funds.

A Programmatic Biological Opinion (PBO), effective 1 June 2018, covers wildland fire management actions, including firebreak installation, disking in two locations only, and grazing, among other topics. Consult the NRM for additional information.

Chapter 3. Wildland Fire Management & Wildfire Risk Mitigation

3.1 Area Wide Management Considerations

3.1.1 Wildland Fire Management Goals, Strategies, and Guidance from INRMP or Similar Installation Plans

The overarching goal of the wildland fire management program at TAFB is firefighter and public safety during wildland fire events on the installation.

The WFMP is a stand-alone document that supports the TAFB INRMP which outlines management goals and strategies for this installation. This plan is meant to complement the INRMP and provide detailed land management procedures that are essential to achieving the ecosystem management goals outlined in the INRMP.

The implementation of the WFMP will help achieve the natural resource management goals for TAFB discussed previously in Section 2.2.1.

The INRMP goals were formulated from a comprehensive analysis of regulatory requirements, the current condition of the natural resources on TAFB and a consideration of the value of these resources to the people who live and work on the installation. Chapter 8 the INRMP identifies the specific objectives and projects that will be implemented to achieve each goal.

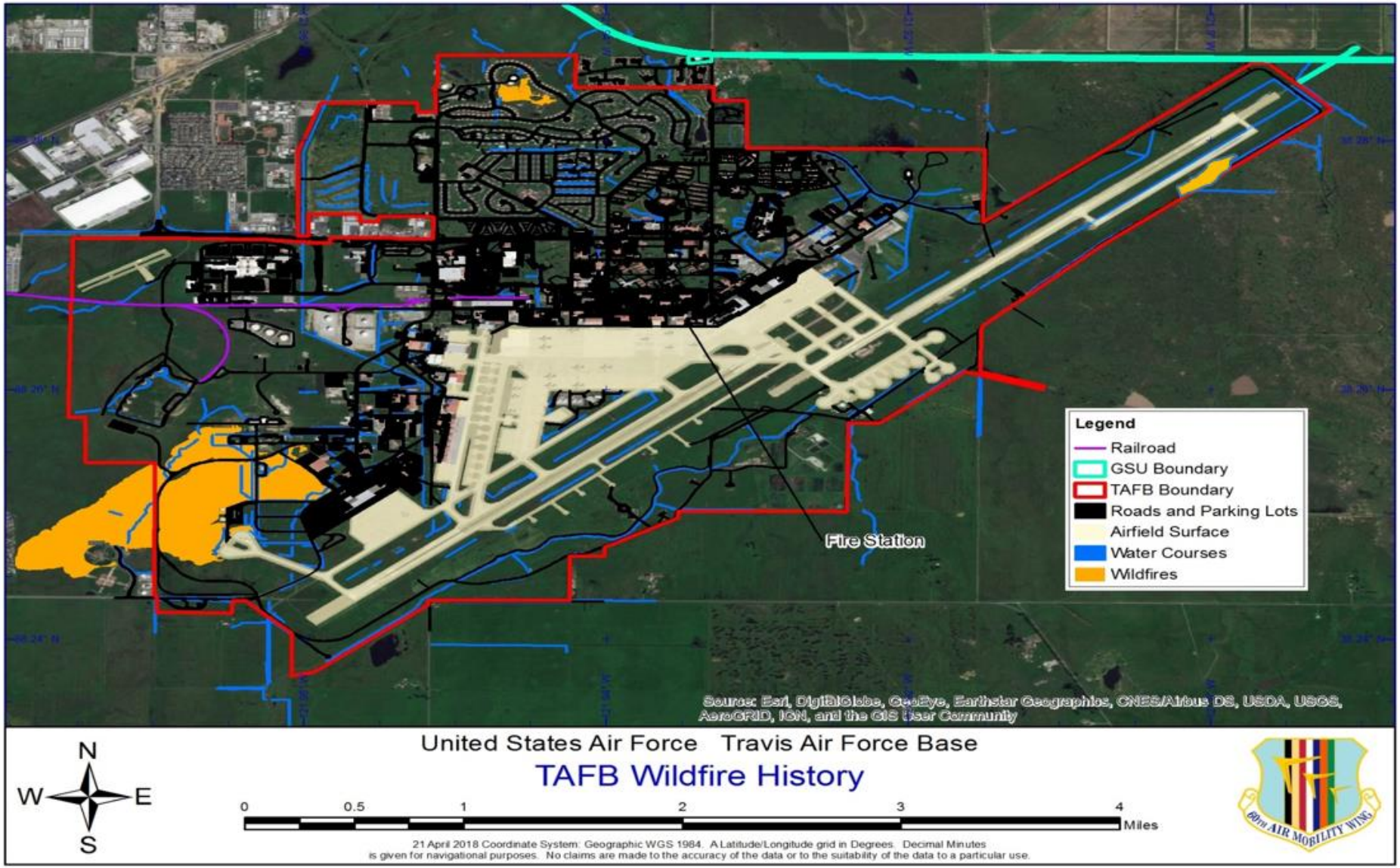
Objectives in the INRMP are multi-use with equal emphasis on the protection of mission resources through the reduction of hazardous fuels and the restoration and enhancement of native ecosystems and habitats. Hazardous fuels reduction of the understory vegetation is very important to all natural resource operations conducted at TAFB. Many of the installation personnel, facilities, and operations would be adversely affected if a wildfire were to ignite within the natural areas. The smoke from a wildfire could compromise flight lines or missions and the heat of the flames could threaten buildings and other strategic facilities with catastrophic results. Prescribed fire and alternate fuels reduction measures create a safer atmosphere for an undisturbed continuation of installation operations, and have the secondary benefit of restoring natural ecosystems and improving habitat for flora and fauna.

3.1.2 Wildfire and Prescribed Fire History

3.1.2.1 Wildfire History

According to the 2015 WFMP, 50 wildfires totaling 180 acres occurred from 2008 through January 2015. Limited GIS data for wildfires are available; however, data in recent years is more complete. Two fires occurred in 2017. A 06 July fire burned 249 acres, including 154 on TAFB. A fire on 06 September covered five acres. Another fire on 9 March 2016 burned approximately 249.5 acres (150.8 on TAFB). Several other fires in 2016 without dates burned a total of 11.1 acres. The largest fire in Travis AFB's history happened in 2018. The 4000+ wildfire started on the installation and moved off destroying homes and infrastructure. Figure 3.1 depicts the above-mentioned wildfires.

Figure 3.1: TAFB Wildfire History Map



3.1.2.2 Prescribed Fire History

No prescribed fires have been conducted on TAFB.

3.2 Wildland Fire Management Partnerships

TAFB utilizes partnerships for both the implementation of fuels reduction activities, as laid out in the INRMP, and in the suppression and response to wildfire incidents. Without these partnerships, wildland fire could have the potential to hinder the overall objectives and mission of the installation.

3.2.1 Internal Partnerships

TAFB NR efforts are aided by the following partnerships within TAFB and the 60 AMW:

- **Air Force Civil Engineer Center (AFCEC)** – provides technical expertise to assist base level natural resource management.
- **Air Force Safety Center (AFSEC/SEFW)** – assists and advises on safety matters to maintain compliance with federal and DoD regulations.
- **Air Force Wildland Fire Branch (AFCEC/CZOF)** – provides technical and operational support to installations for a wide range of wildland fire-related products and services.
- **TAFB Fire Protection and Emergency Services (FES)** – provides incident command and primary wildland firefighting response force for TAFB.
- **TAFB Environmental Management Element (60 CES/CEIE)** – provide the input, data, and support needed to maintain a high-quality NR program.
- **TAFB NR Manager (NRM)** – responsible for steering the NR program through the collection and interpretation of data, adjusting management practices, building community partnerships, briefing leadership, and generally ensuring the base natural resources continue to support the military mission.
- **TAFB Air Mobility Wing Public Affairs Office (60 AMW/PA)** – interfaces between 60 AMW, the media, and civilian groups to disseminate environmental and educational information.
- **TAFB Security Forces Squadron (60 SFS)** – provides TAFB security services, as well as search and rescue capabilities.
- **TAFB Medical Support Squadron (60 MDSS)** – provides TAFB medical services.
- **Installation Support Section (ISS) Staff** – AFCEC/CZOW personnel who provide support to base level natural resource management through expert advice and management recommendations, as well as the evaluation and support of projects developed to directly support natural resource management.
- **TAFB Control Tower** – controls air operations at TAFB.

3.2.2 External Partnerships

TAFB has partnerships with external partners to provide guidance for natural resource and wildland fire activities on TAFB, including:

- **Fire Departments (FDs) and Volunteer Fire Departments (VFDs)** – provide mutual aid for wildfire response and suppression.
- **National Oceanographic and Atmospheric Administration (NOAA)** – a federal agency responsible for providing weather forecasts during wildfires and prior to prescribed fires.

- **United States Army Corps of Engineers (USACE)** – a federal agency responsible for permitting and management of activities involving riparian areas.
- **United States Department of Agriculture (USDA) Wildlife Services** – a federal agency providing technical assistance regarding BASH and wildlife issues.
- **USDA Natural Resources Conservation Service (NRCS)** – a federal agency providing technical assistance for natural resources and agricultural processes.
- **United States Fish and Wildlife Service (USFWS)** – a federal agency providing oversight and guidance for natural resource activities that have a potential to affect terrestrial and select marine resources, especially those protected under the ESA.
- **California Office of Historic Preservation (OHP)** – a state agency providing oversight and guidance for natural resource activities that have a potential to affect cultural resources.
- **California Department of Fish and Wildlife (CDFW)** – a state agency providing oversight and guidance for natural resource activities that have a potential to affect terrestrial resources.
- **California Environmental Protection Agency (CalEPA)** – a state agency providing oversight and guidance for natural resource activities.
- **California Air Resources Board (CARB)** – an entity of CalEPA providing oversight and guidance for natural resource activities that have a potential to affect air quality.
- **California Department of Forestry and Fire Protection (CAL FIRE)** – a state agency providing assistance with fire management and suppression.

Additionally, TAFB maintains an MAA for wildfire suppression with the Solano County, as discussed further in Section 4.1.3:

3.3 Wildfire Prevention

3.3.1 Wildfire Occurrence

Wildfires can burn any time of the year at TAFB, but the primary peak in wildfire occurrence is from June through October, after grasses have cured. During dry years, fire season can begin as early as March and run as late as November.

Primary ignition sources on TAFB are cigarette butts discarded on the roadside, catalytic converters, or dragging metal. This has been a persistent problem in the southernmost portion of TAFB along perimeter road near the TACAMO facility. In addition, air show parking has resulted in some wildfires. Overall, improvements at TAFB are at a very low risk from wildfire. Most areas of TAFB are developed or managed for short vegetation, such as the golf course and the airfield. Undeveloped areas have a high potential for rapid fire spread under some weather and fuel conditions. There is a high likelihood that fires left unchecked would affect properties adjacent to the installation, so use of natural ignitions for resource benefit will not occur on TAFB or its GSUs. Likewise, fires from off-site are at a high risk of crossing onto the installation.

3.3.2 Prevention Activities

The primary objective of prevention activities is to prevent human-caused wildfires and encourage installation personnel to implement mitigation measures around at-risk AF assets.

This objective is primarily achieved by:

- Making personnel aware of precautions to prevent an unwanted ignition.
- Informing visitors of fire danger through personal contact and posted signs.
- Implementing trail and/or area closures during periods of extreme fire danger.
- Coordinating with internal and external partners during periods of extreme fire danger.

Prevention Program Goals are to:

- Reduce the likelihood and frequency of human-caused wildfires.
- Reduce emergency suppression costs.
- Reduce fire size and intensity by developing programs such as fuels reduction/modification.
- Establish a cost-effective prevention program.
- Integrate and coordinate the prevention program with FES, CAL FIRE, nearby land management agencies, and wildfire protection organizations.
- Promote the creation of incentives for building and maintaining fire-safe structures and fire-safe communities to reduce the unwanted consequences of fire.
- Minimize damage from wildfires.
- Incorporate prevention programs into the wildland fire management outreach program.

Prevention priorities of the installation are to:

- Prevent catastrophic fires and human-caused wildfires (highest priority).
- Minimize losses from wildfire while considering resource management objectives.
- Collaborate through an interagency approach among all federal, state, county, and municipal agencies/entities.
- Investigate human-caused wildfires.

Specific prevention activities include:

- Cross-training with local agencies.
- Fire prevention meetings with internal stakeholders and contractors.
- Meeting with mutual aid partners at the beginning of high fire danger periods.
- Posting current fire behavior and danger levels to local message boards.
- Educating youth of the dangers pertaining to playing with lighters or other fire-causing items.
- Inspecting structures for ember traps, volatile vegetation, etc.
- Informing military commanders of current fire danger while utilizing the EOD Range.
- Maintaining equipment, such as vehicles, Personal Protective Equipment (PPE), tools, All-Terrain Vehicles (ATVs) and/or Utility Task Vehicles (UTVs), radio communications, etc. to be effective and successful in suppression efforts.

As described in Section 2.9 of AFI 32-7064, fire and other disturbance regimes may be used as a component to ecosystem management when practical and consistent with the military mission. Prescribed fires reduce fuel load in an area, making subsequent wildfires easier to control or preventing them

completely. Prescribed fire can also be a useful tool for habitat management by reducing non-native species and promoting natives.

3.4 Public Information, Education, and Outreach

During a wildfire, it is the responsibility of the IC to make initial and periodic status updates to 60 AMW/PA as needed. This will be done through a Public Information Officer (PIO), if one is assigned to the incident. The information will include current and predicted fire behavior, rates of spread, fire impact or threat to installation activities or infrastructure, detours, or other pertinent public safety information.

When planning for prescribed fires, an approved notification list will be developed prior to ignition, and residences near the prescribed fire area will be notified in advance by phone or other media sources (i.e. newspapers, television, radio stations, message boards, etc.). The TAFB WFPCs will notify 60 AMW/PA whenever there is a wildfire or prescribed fire in progress.

The outreach goal is to enhance knowledge and understanding of wildland fire management policies and practices through internal and external communication and education. Information about fire ecology and the differences between planned and unplanned ignitions will be incorporated into outreach programs and informal contacts. Information and education are critical to increasing support for prescribed fires. Wildfire prevention centers around education and awareness. Education begins with schools teaching children about fire safety and the detriments of wildfire. Prescribed fire classes for interested landowners can be used to reduce the chance of an escaped fire on adjacent land.

Signs indicating current fire danger can be placed in high traffic areas to warn local residents and installation personnel when fire danger is high. Local television news channels can be contacted as to when to mention fire danger warnings to the public and to publicize prescribed fire activities on the installation.

Integrated education and outreach activities are considered a standard component of any comprehensive wildland fire management plan, and decreasing human caused ignitions that could result in a catastrophic wildfire is a goal of AFCEC and AFCEC/CZOF. Educating the public adjacent to installations about the need for responsible prescribed fire utilization as a land management tool is essential to developing and maintaining fire adapted communities per the National Cohesive Strategy.

Communication and cooperation with the public is a critical component of any natural resource management effort. The goal of public outreach efforts is to encourage understanding of, support for, and involvement in the many management and monitoring programs at TAFB. Without the support of partner organizations and local citizens, it becomes very difficult to run effective management programs.

Currently, TAFB published pamphlets and materials explaining safe cooking practices and cigarette disposal. TAFB also has a fire prevention week. Presentation of other wildland fire-related topics, including information on planned prescribed fires, would be a low-cost prevention activity. This can be accomplished during other outreach efforts, such as Earth Day, and Arbor Day events. Other public outreach opportunities where a wildland fire message could easily be integrated include:

- Newspaper notifications.
- Participation in the Smokey Bear program.

- Seasonal fire prevention campaigns.
- National Public Lands Day.
- Natural resource awareness programs on the installation.
- Tours and classes with local colleges, schools, Scout groups, etc.
- Hunter briefings.
- Newsletters, pamphlets, brochures, posters, videos, interpretive signage, and other NR program educational materials.
- Research partnership and internships.
- Volunteer involvement.

Community involvement from installation personnel will include dissemination of information to the public on well-established national interagency wildland fire prevention and mitigation programs such as *Firewise*, *Fire Adapted Communities*, and *Ready, Set, Go!* The directive for community assistance as part of a comprehensive wildland fire management program has been set forth by AFCEC and AFCEC/CZOF, in support of the National Cohesive Strategy.

3.5 Wildland Fire Management Units (FMUs)

FMUs are areas defined by similar overall strategic fire management objectives with consideration for specific (or dominant) constraints, requirements, and guidelines for implementation. Unique characteristics (such as fuels, topography, and natural resource concerns) are also considered and depicted graphically when appropriate. Table 3.1 summarizes these FMUs.

Table 3.1: List of TAFB FMUs

#	FMU Name	Primary Response to Wildfire	Acres (Burnable)	Primary Fuel Models
1	Developed Areas and GSUs	Full Suppression	4,334 (2,885)	NB9, GR1, GR2, GS1
2	Prescribed Fire Units	Full Suppression	1,010 (977)	GR1, GR2, GS1, GS2

3.5.1 Common Characteristics of Wildland FMUs

3.5.1.1 Climate

The climate of TAFB is a Mediterranean climate characterized by mild, wet winters and warm, dry summers. The following weather summary is derived from data collected at Fairfield/TAFB weather station, California from 1 January 2008 to 31 December 2017. Annual precipitation is about 18.3 inches. The majority of the annual precipitation falls from November through March. Average monthly low temperatures can be as low as 38°F in December and January and can be as high as 58°F in July and August. Average monthly high temperatures can reach 90°F in July and can be as low as 58°F in December and January. Average 10-meter wind speeds range from about 7.0 Miles Per Hour (MPH) to 17.3 MPH, with peak 10-meter wind gusts much higher. The dominant wind direction is west-southwest. Occasional 2- to 3-day periods of north winds, called foehn winds, occur and bring extremely dry and hot conditions along with extreme fire danger. Table 3.2 provides a summary of the monthly weather averages for TAFB.

Table 3.2: Monthly Weather Averages for TAFB

Month	Average Low Temp.	Average High Temp.	Average 10-Meter Wind Speed	Dominant 10-Meter Wind Direction	Average Precipitation
January	38°F	58°F	7.0 MPH	North-Northeast	3.8”
February	42°F	62°F	9.1 MPH	West-Southwest	3.3”
March	45°F	67°F	10.5 MPH	West-Southwest	2.5”
April	47°F	72°F	12.2 MPH	West-Southwest	1.2”
May	51°F	79°F	15.0 MPH	West-Southwest	0.5”
June	56°F	86°F	15.5 MPH	West-Southwest	0.1”
July	58°F	90°F	17.3 MPH	West-Southwest	0.0”
August	58°F	89°F	16.5 MPH	West-Southwest	0.0”
September	57°F	89°F	14.0 MPH	West-Southwest	0.2”
October	51°F	79°F	10.1 MPH	Southwest	1.0”
November	43°F	66°F	8.2 MPH	Southwest	2.3”
December	38°F	58°F	9.1 MPH	North	3.4”
Weather data from the Fairfield/TAFB weather station for the period of 1 January 2008 through 31 December 2017.					

Fire weather is much less dependent upon averages and more dependent upon extremes. The Brooks California Remote Automated Weather Station (RAWS) displays data from May 1990 through current and is the closest RAWS station to TAFB, located 34 miles to the north-northwest and approximately 250 feet higher in elevation than TAFB. The average monthly maximum temperature ranges from 70.4°F in December to 107.9°F in July. The overall maximum temperature recorded was 114°F on 11 August 1996. The average monthly minimum Relative Humidity (RH) ranges from 9.2% in October to 22.8% in January. The overall minimum RH recorded was 4% on multiple occasions. The average monthly mean 20-foot wind speed ranges from 3.4 MPH in November to 4.6 MPH in April and June. The overall maximum monthly mean 20-foot wind speed recorded was 6.3 MPH in April 2013. The average monthly maximum 20-foot wind gust ranges from 25.3 MPH in August to 41.4 MPH in December. The overall maximum 20-foot wind gust recorded was 57 MPH on 30 April 2013.

According to the EPA 430-F-16-007, *What Climate Change means for California*, August 2016, the average temperature in the northern Central Valley has risen 1°F to 1.5°F in the last century. Climate change may result in altered fire regimes in California. Higher temperatures and drought are likely to increase the severity, frequency, and extent of wildfires, which could harm property, livelihoods, and human health. Increased wildfire smoke can reduce air quality and increase medical visits for chest pains, respiratory problems, and heart problems.

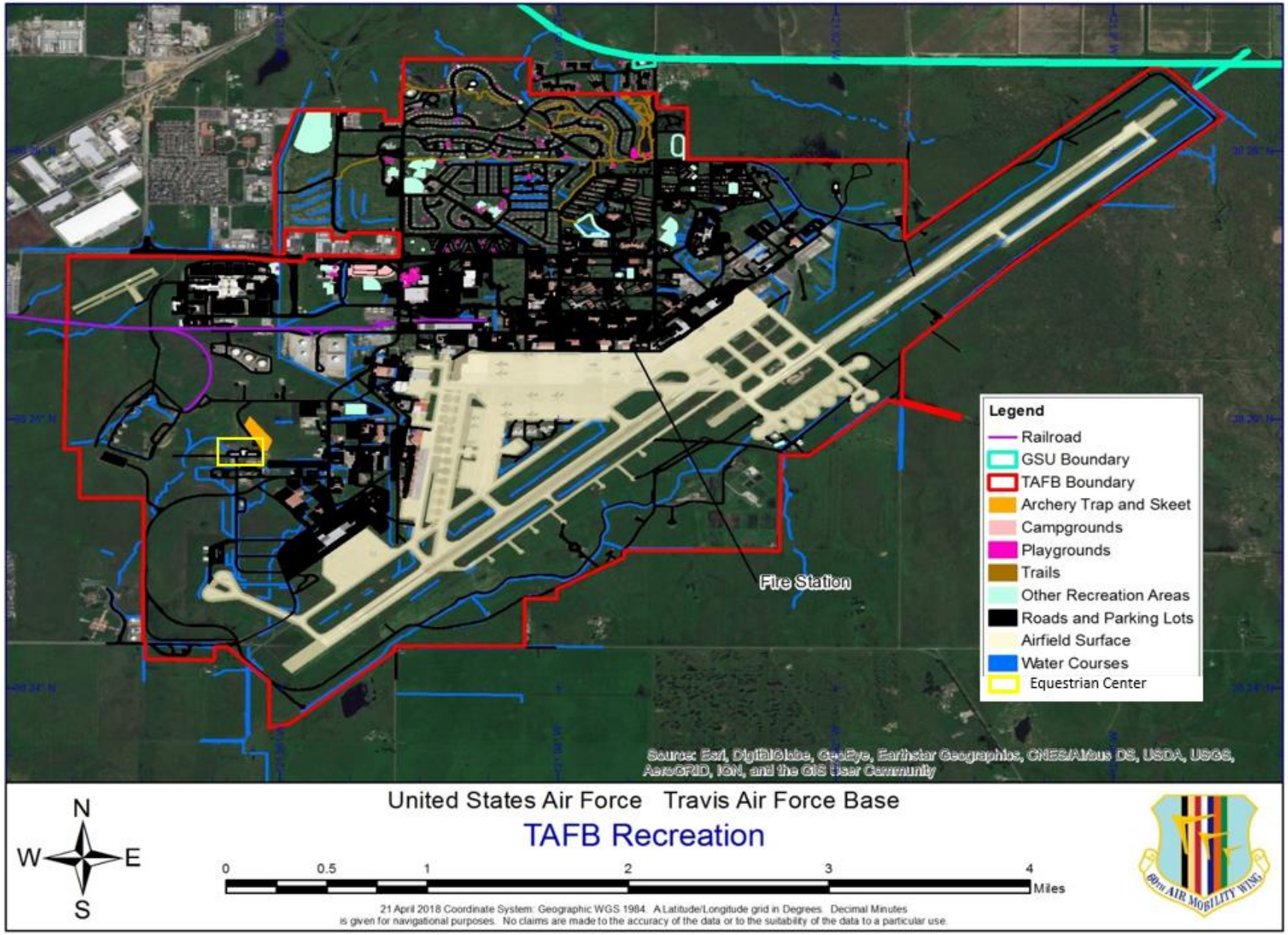
3.5.1.2 Topography

Topography on TAFB and its GSUs is level to gently sloping. TAFB has a general southern aspect. Elevations at TAFB range from approximately 15 feet above Mean Sea Level (MSL) to approximately 140 feet above MSL. The GSUs all fall within this elevation range with the exception of PHA, which is on a hilltop with an elevation range of 140 to 204 feet above MSL.

3.5.1.3 Public Use

Access to base recreational facilities is managed by 60 SFS and 60 CES. Facilities are available to military and civilian employees. There is currently no hunting on TAFB or its GSUs. TAFB offers freshwater fishing at the Duck Pond. In addition to fishing, other public use opportunities are available at TAFB including an interpretive nature trail, running at the former Aero Club runway, an equestrian center, a Family Camp (FamCamp) with Recreational Vehicle (RV) hookups, several picnic or park areas, a parcour and jogging course, and a skeet and trap range. The Cypress Lake Golf Course is one of the GSUs and is also available for recreation to all citizens. A recreation map depicting recreation areas for TAFB can be found in Figure 3.2.

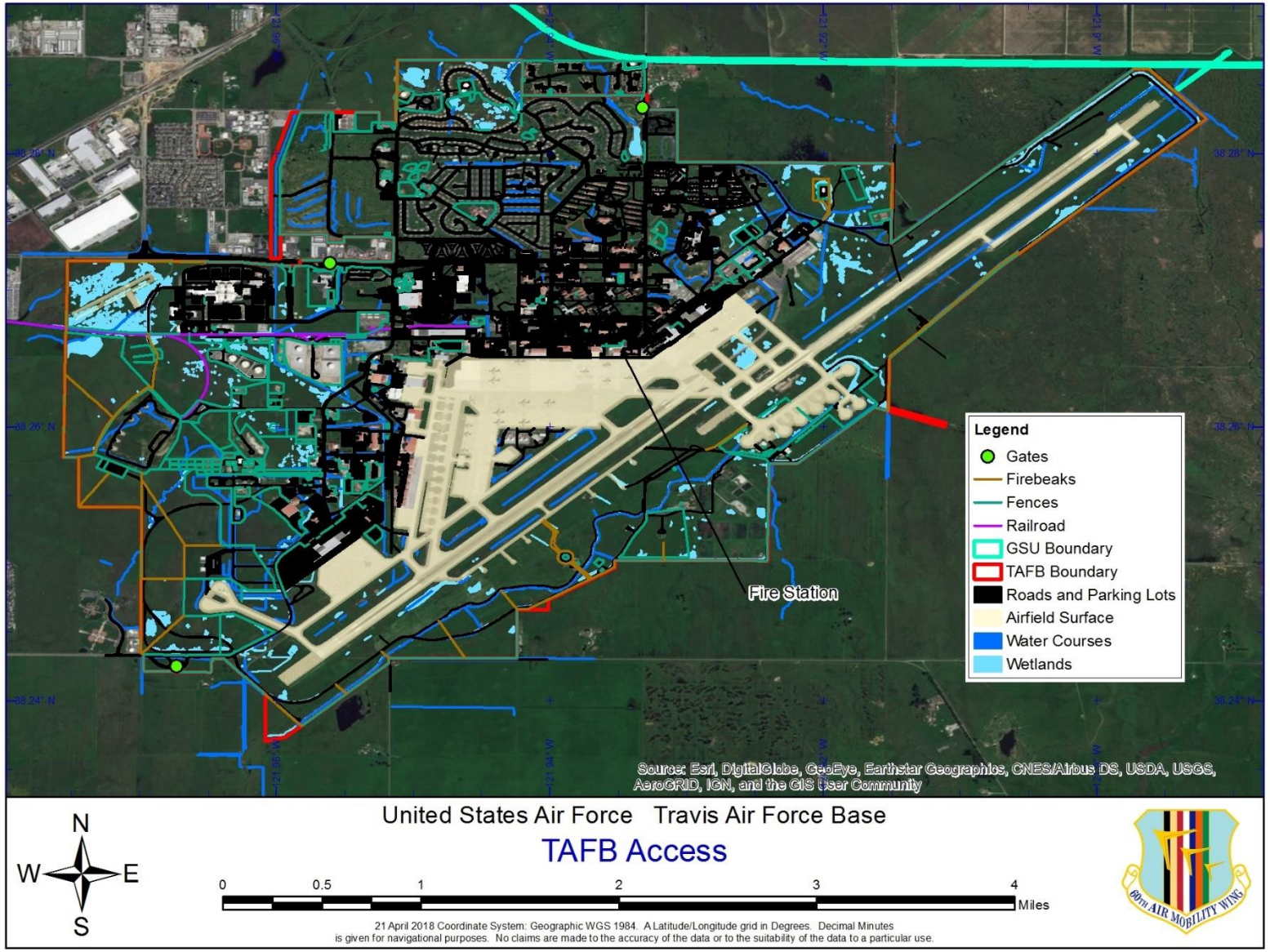
Figure 3.2: TAFB Recreation Map



3.5.1.4 Access

There are 4 primary points of entry onto the installation, including the Main Gate off of Airbase Parkway, the Hospital Gate off of Airbase Parkway, the South Gate off of Peterson Road, and the North gate off of Burgan Boulevard. Most areas of TAFB are accessible off-road by wildland firefighting apparatus. However, due to the presence of sensitive habitats, off-road vehicular access is restricted to circumstances where there is a direct threat to life and property and no other alternative exists. An access map for TAFB can be found in Figure 3.3.

Figure 3.3: TAFB Access Map



3.5.1.5 Vegetation

Much of the TAFB has been disturbed by development of the main base and airfield. The remaining significant natural areas are comprised of 4 main habitat types. Most uplands are currently annual grasslands and are dominated by non-native species such as soft chess (*Bromus hordeaceus*), rye grass (*Festuca perennis*), rattail sixweeks grass (*Festuca myuros*), storksbill (*Erodium* species), oats (*Avena* species), ripgut grass (*Bromus diandrus*), Harding grass (*Phalaris aquatica*), yellow star-thistle (*Centaurea solstitialis*), medusa head (*Elymus caput-medusae*), and a forb that lacks a common name according to the Jepson Manual (*Geranium dissectum*). Some areas support native perennial grasses including a barley that lacks a common name according to the Jepson Manual (*Hordeum brachyantherum*) and purple needle grass (*Stipa pulchra*). Areas with greater shrub cover often contain coyote brush (*Baccharis pilularis*), blue gum (*Eucalyptus globulus*), pepper tree (*Schinus molle*), and black locust (*Robinia pseudoacacia*).

Interspersed amongst the annual grasslands are northern claypan vernal pools and swales. These wetlands include species such as a grass that lacks a common name according to the Jepson Manual (*Alopecurus saccatus*), annual hair grass (*Deschampsia danthonioides*), goldfields (*Lasthenia species*), including the federally endangered Contra Costa goldfields (*Lasthenia conjugens*), slender woolly-marbles (*Psilocarphus tenellus*), popcornflower (*Plagiobothrys* species), another forb that lacks a common name according to the Jepson Manual (*Downingia* species), the barley that lacks a common name, coyote-thistle (*Eryngium vaseyi*), yet another forb that lacks a common name according to the Jepson Manual (*Lythrum hyssopifolia*), a grasslike plant that lacks a common name according to the Jepson Manual (*Eleocharis macrostachya*), flowering-quillwort (*Triglochin scilloides*), alkali milkvetch (*Astragalus tener* variety *tener*), and San Joaquin spearscale (*Extriplex joaquinana*).

Riparian vegetation along Union Creek consists of beardless wild rye (*Elymus triticoides*), broadleaved pepperweed (*Lepidium latifolium*), Harding grass, salt grass (*Distichlis spicata*), red willow (*Salix laevigata*), arroyo willow (*Salix lasiolepis*), coyote brush, and small patches of scrub/shrub vegetation.

North Gate Park Pond is a lacustrine marsh that was created by the impoundment of Union Creek. Common plants include floating vegetation such as duckweed (*Lemna* species), Eurasian watermilfoil (*Myriophyllum spicatum*), and leafy pondweed (*Potamogeton foliosus*), along with emergent vegetation such as broad-leaved cattail (*Typha latifolia*). The edges of these ponds support vegetation dominated by grass species (family *Poaceae*) and some species of dock (*Rumex* species).

The ecosystems on TAFB and its GSUs provide potential habitat for 4 sensitive plant species (see Table 3.3). All require wetland habitat, with the most suitable habitat occurring on the northwestern or western portion of the installation. One plant, the Contra Costa goldfields, has been documented on TAFB and critical habitat has been designated on 13 acres near the South Gate, a triangular parcel south of Runway 03R/21L (not within the fenced boundary of the installation), and the western portion of SNRROW extending to Walters Road. This plant species would be negatively impacted from fire management if individuals were disturbed by Off-road Vehicle (ORV) use, firebreak creation, or if fire retardant were used where they occur. Boggs Lake hedge-hyssop (*Gratiola heterosepala*), Crampton's tuctoria (*Tuctoria mucronata*), and colusa grass (*Neostapfia colusana*) have all been located near TAFB, but currently none

have been documented on the installation or its GSUs. These species would have similar effects from fire management as the Contra Costa goldfields.

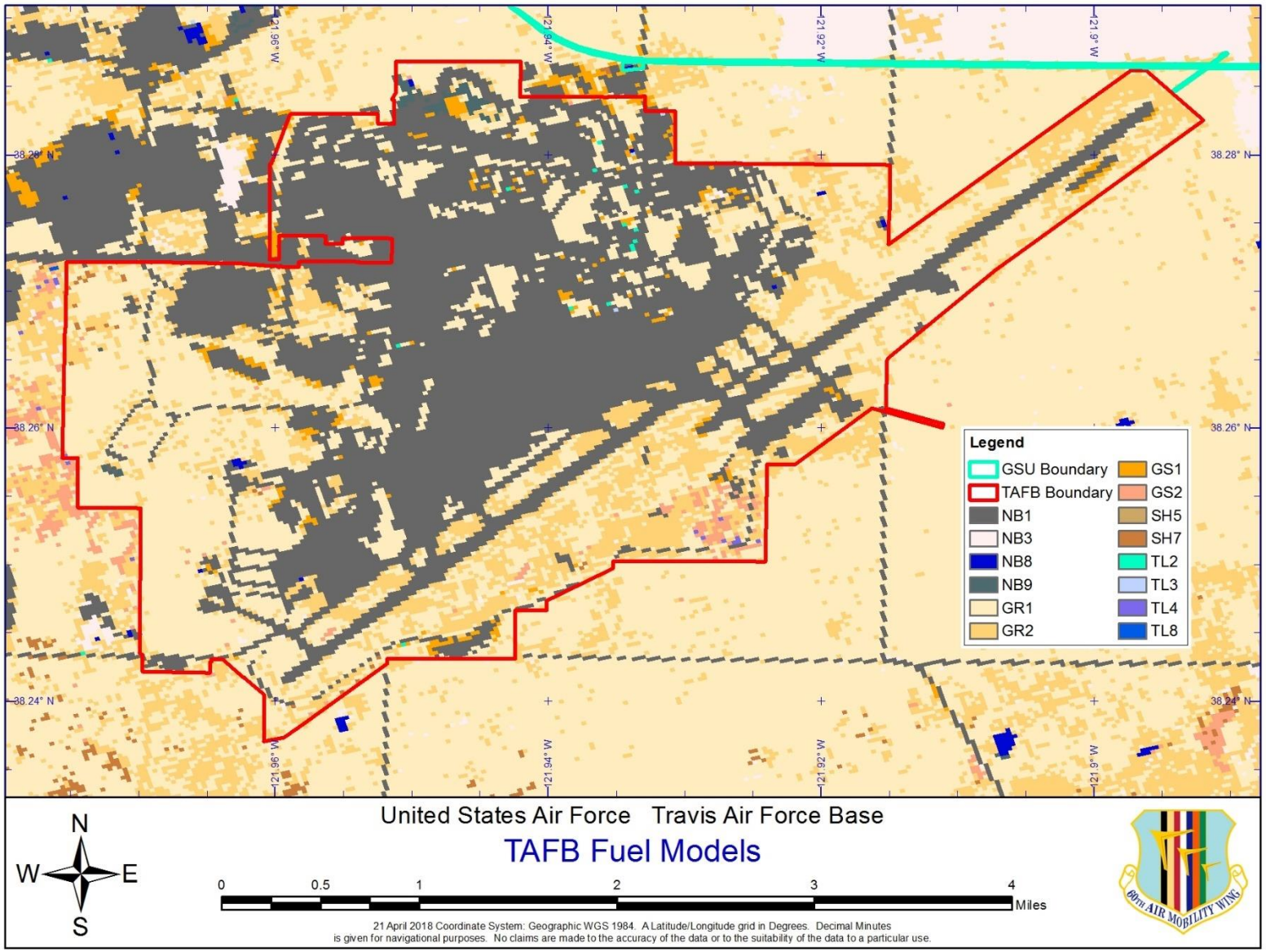
Table 3.3: Sensitive Plant Species Documented or With Potential to Occur on TAFB or its GSUs

Common Name	Scientific Name	Threats from Fire Management	Federal Status	State Status
Contra Costa Goldfields	*Lasthenia conjugens*	ORV Use, Firebreak Creation, Retardant	Endangered	None
Boggs Lake Hedge-hyssop[1]	*Gratiola heterosepala*	ORV Use, Firebreak Creation, Retardant	None	Endangered
Crampton's Tuctoria[1]	*Tuctoria mucronata*	ORV Use, Firebreak Creation, Retardant	Endangered	Endangered
Colusa grass[1]	*Neostapfia colusana*	ORV Use, Firebreak Creation, Retardant	Threatened	Endangered
[1]Not found on TAFB or its GSUs.				

3.5.1.6 Fuel Conditions

Fire Behavior Fuel Models (FBFMs) follow *Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model*, 2005. According to data available at the LANDFIRE Data Distribution webpage, the dominant FBFMs at TAFB and its GSUs are GR1 and GR2, with GS1 and GS2 also common (see Figure 3.4). In all, 13 total FBFMs, which include 4 unburnable FBFMs (NB1: Urban/Developed, NB3: Agricultural, NB8: Open Water, and NB9: Bare Ground) are present on TAFB. Of the remaining 9 burnable FBFMs, 2 represent grass fuels (GR1 and GR2), 2 represent grass-shrub fuels (GS1 and GS2), 1 represents shrub fuels (SH7), and 4 represent timber litter fuels (TL2, TL3, TL4, and TL6). The following are descriptions of the 9 burnable FBFMs.

Figure 3.4: TAFB Fuel Models Map



3.5.1.6.1 GR1 (101) – Short, Sparse Dry Climate Grass (Dynamic):

The primary carrier of fire in GR1 is sparse grass, though small amounts of fine dead fuel may be present. The grass in GR1 is generally short, either naturally or by grazing, and may be sparse or discontinuous. The moisture of extinction of GR1 is indicative of a dry climate fuelbed, but GR1 may also be applied in high-extinction moisture fuelbeds because in both cases predicted spread rate and flame length are low compared to other grass fuel models. This FBFM is the dominant burnable FBFM on TAFB in both natural and managed landscapes, and is also present at all GSUs.

3.5.1.6.2 GR2 (102) – Low Load, Dry Climate Grass (Dynamic):

The primary carrier of fire in GR2 is grass, though small amounts of fine dead fuel may be present. Load is greater than GR1, and fuelbeds may be more continuous. Shrubs, if present, do not affect fire behavior. This FBFM is the second most dominant burnable FBFM on TAFB in both natural and managed landscapes, and is also present at all GSUs except ORM.

3.5.1.6.3 GS1 (121) – Low Load, Dry Climate Grass-Shrub (Dynamic):

The primary carrier of fire in GS1 is grass and shrubs combined. Shrubs are about 1 foot high. Grass load is low. Spread rate is moderate. Flame length is low. Moisture of extinction is low. This FBFM is common at TAFB, primarily at the margins of urban or developed areas, and is also present at CLGC, SNRROW, and WW1.

3.5.1.6.4 GS2 (122) – Moderate Load, Dry Climate Grass-Shrub (Dynamic):

The primary carrier of fire in GS2 is grass and shrubs combined. Shrubs are 1 to 3 feet high. Grass load is moderate. Spread rate is high. Flame length is moderate. Moisture of extinction is low. This FBFM is common at TAFB, primarily around the TACAMO complex, and is also present at PHA and SNRROW.

3.5.1.6.5 SH7 (147) – Very High Load, Dry Climate Shrub:

The primary carrier of fire in SH7 is woody shrubs and shrub litter. It has a very heavy shrub load with a depth of 4 to 6 feet. Spread rate is lower than SH7, but flame length is similar. Spread rate is high. Flame length is very high. This FBFM is uncommon but present at TAFB, primarily in managed landscapes, and is also present at SNRROW.

3.5.1.6.6 TL2 (182) – Low Load Broadleaf Litter:

The primary carrier of fire in TL2 is a low load of compact broadleaf (hardwood) litter. Spread rate is very low. Flame length is very low. This FBFM is uncommon but present at TAFB, primarily in managed landscapes, and is also present at CLGC.

3.5.1.6.7 TL3 (183) – Moderate Load Conifer Litter:

The primary carrier of fire in TL3 is moderate load conifer litter. Load of coarse fuels is light. Spread rate is very low. Flame length is low. This FBFM is uncommon but present at TAFB, primarily in managed landscapes, and is also present at CLGC.

3.5.1.6.8 TL4 (184) – Small downed logs:

The primary carrier of fire in TL4 is moderate load of fine litter and coarse fuels. It includes small diameter downed logs. Spread rate is low. Flame length is low. This FBFM is uncommon but present at TAFB, primarily in managed landscapes.

3.5.1.6.9 TL6 (186) – Moderate Load Broadleaf Litter:

The primary carrier of fire in TL6 is moderate load broadleaf litter, less compact than TL2. Spread rate is moderate. This FBFM is uncommon but present at CLGC.

3.5.1.6.10 Unburnable Fuel Models:

Four unburnable FBFMs are present on TAFB and its GSUs and included the following:

- NB1 (91) – Urban/Developed. This FBFM is common at TAFB, CLGC, ORM, SNRROW, and WW1.
- NB3 (93) – Agricultural. This FBFM is present at TAFB, CLGC, and SNRROW.
- NB8 (98) – Open Water. This FBFM is present at TAFB, CLGC, PHA, and WW1.
- NB9 (99) – Bare Ground. This FBFM is present at TAFB and PHA.

3.5.1.7 Soils

Most soils at TAFB have been altered by historic agricultural practices, heavy construction, and imported fill. Soils are classified mostly as loams, sandy loams, or clay loams. Soils support northern claypan vernal pools and there is typically very little drainage through the soil.

3.5.1.8 Wildlife

The ecosystems on TAFB and its GSUs provide the necessary food, water, and cover for a variety of wildlife species including at least 28 mammal species, 61 bird species, 7 reptile species, 4 amphibian species, and 5 fish species. Fire management within these ecosystems has its effects on wildlife communities. In general, mechanical fuels treatments, along with prescribed fire and naturally burning surface-severity fire, are considered good for wildlife habitat quality.

A variety of sensitive wildlife species occur or have the potential to occur on TAFB or its GSUs (see Table 3.4). Two amphibian species have the potential of occurring on TAFB or its GSUs, including the California red-legged frog (*Rana draytonii*) and the California tiger salamander (*Ambystoma californiense*). The California red-legged frog requires wetland habitat but has not been documented on TAFB or its GSUs. If present, this species would be negatively impacted from fire management if individuals were disturbed by ORV use, firebreak creation, or if fire retardant were used where they occur. The California tiger salamander requires wetland and upland and has been documented on TAFB. Potential habitat exists at SNRROW, ORM, MRM, and PHA. Critical habitat is designated at SNRROW. This species would have similar effects from fire management as the California red-legged frog. In fact, ground disturbing activities within 1.3 miles of a known breeding pond may require consultation with USFWS and may require a take permit under the ESA.

Three special status bird species have been documented as occurring on TAFB or its GSUs, including the Swainson's hawk (*Buteo swainsoni*), the tricolored blackbird (*Agelaius tricolor*) and the western burrowing owl (*Athene cunicularia* subspecies *hypugaea*). Swainson's hawks are known to nest

on CLGC. Tricolored blackbirds are known to occur in the vicinity of Union Creek and the airfield on TAFB and are, therefore, also a BASH risk. Burrowing owls nest on TAFB in rodent burrows throughout the grasslands. Fire management may negatively impact these species during the nesting season if activities create disturbance near nesting sites. All sites considered for prescribed burning activities will need to be surveyed for active bird nests to avoid taking these and other migratory bird species.

Four special-status invertebrate species are known to occur or potentially could occur on TAFB and its GSUs, including the Delta green ground beetle (*Elaphrus viridis*), the vernal pool fairy shrimp (*Branchinecta lynchi*), the vernal pool tadpole shrimp (*Lepidurus packardi*), and the Conservancy fairy shrimp (*Branchinecta conservatio*). All require wetland habitat, with the most suitable habitat occurring on the northwestern or western portion of the installation. The Delta green ground beetle is not known to occur on TAFB or its GSUs, but has been documented on neighboring properties. Critical habitat has been designated on the SNRROW. Additionally, since so little is known about the ecology of the species including dispersal distances and upland habitat use, TAFB has established a 1-mile buffer around known and potential Delta green ground beetle habitat within which this species will be considered in project consultation. The vernal pool fairy shrimp occurs on TAFB and the vernal pool tadpole shrimp occurs on SNRROW. Critical habitat for these 2 species have been designated on 13 acres near the South Gate, a triangular parcel south of Runway 03R/21L (not within the fenced boundary of the Base), the western portion of SNRROW, and PHA. The Conservancy fairy shrimp is not known to occur on TAFB or its GSUs, but has been documented on neighboring properties. Critical habitat has been designated on 13 acres near the South Gate and south of Runway 03R/21L. All 4 species would be negatively impacted from fire management if individuals were disturbed by ORV use, firebreak creation, or if fire retardant were used where they occur.

Fire management could potentially have negative impacts on sensitive habitats, especially wetlands. In general, restricting the use of heavy equipment in these habitats, as well as restricting the use of retardant and foam within 300 feet of any waterway in accordance with the *Guidelines for Aerial Delivery of Retardant or Foam near Waterways*, April 2000, will satisfy most concerns. Fire crews will be made aware of the location of all sensitive resources. The NRM will examine all areas impacted by wildland fire as soon as it is safe in order to advise on potential adverse impacts to ecologically sensitive locations. A more complete description of wildlife can be found in the TAFB INRMP.

Table 3.4: Sensitive Wildlife Species Documented or Potential to Occur on TAFB or GSUs

Common Name	Scientific Name	Threats from Fire Management	Federal Status	State Status
Fish				
Central Valley Chinook salmon[1]	*Oncorhynchus tshawytsha*	None	T- spring-run E- winter-run	T- spring-run E- winter-run
Central Valley steelhead [1]	*Oncorhynchus mykiss*	None	Threatened	None
Delta smelt [1]	*Hypomesus transpacificus*	None	Threatened	Threatened
Green sturgeon [1]	*Acipenser medirostris*	None	Threatened	None
Mammal				
Salt marsh harvest mouse	*Reithrodontomys raviventris*	Negligible	Endangered	Endangered
Amphibians				
California Red-legged Frog[1]	*Rana draytonii*	ORV Use, Firebreak Creation, Retardant	Threatened	None
California Tiger Salamander	*Ambystoma californiense*	ORV Use, Firebreak Creation	Threatened	Threatened
Western Spadefoot	*Spea hamondii*	Wildfire suppression activities	Under Review	SSC
Reptiles				
Giant garter snake[1]	*Thamnophis gigas*	ORV Use, Firebreak Creation, Retardant	Threatened	Threatened
Western pond turtle	*Actinemys marmorata*	None	Under review	SSC
Birds				
Ridgway's Rail	*Rallus obsoletus*	Negligible	Endangered	Endangered
Swainson's Hawk	*Buteo swainsoni*	Negligible	None	Threatened
Tricolored Blackbird	*Agelaius tricolor*	ORV Use, Firebreak Creation	Proposed	Threatened
Invertebrates				
Delta Green Ground Beetle[1]	*Elaphrus viridis*	ORV Use, Firebreak Creation, Retardant	Threatened	None
Vernal Pool Fairy Shrimp	*Branchinecta lynchi*	ORV Use, Firebreak Creation, Retardant	Threatened	None
Vernal Pool Tadpole Shrimp	*Lepidurus packardi*	ORV Use, Firebreak Creation, Retardant	Endangered	None
Conservancy Fairy Shrimp[1]	*Branchinecta conservatio*	ORV Use, Firebreak Creation, Retardant	Endangered	None
Valley elderberry longhorn beetle[1]	*Desmocerus californicus dimorphus*	ORV Use, Firebreak Creation, Retardant	Threatened	None

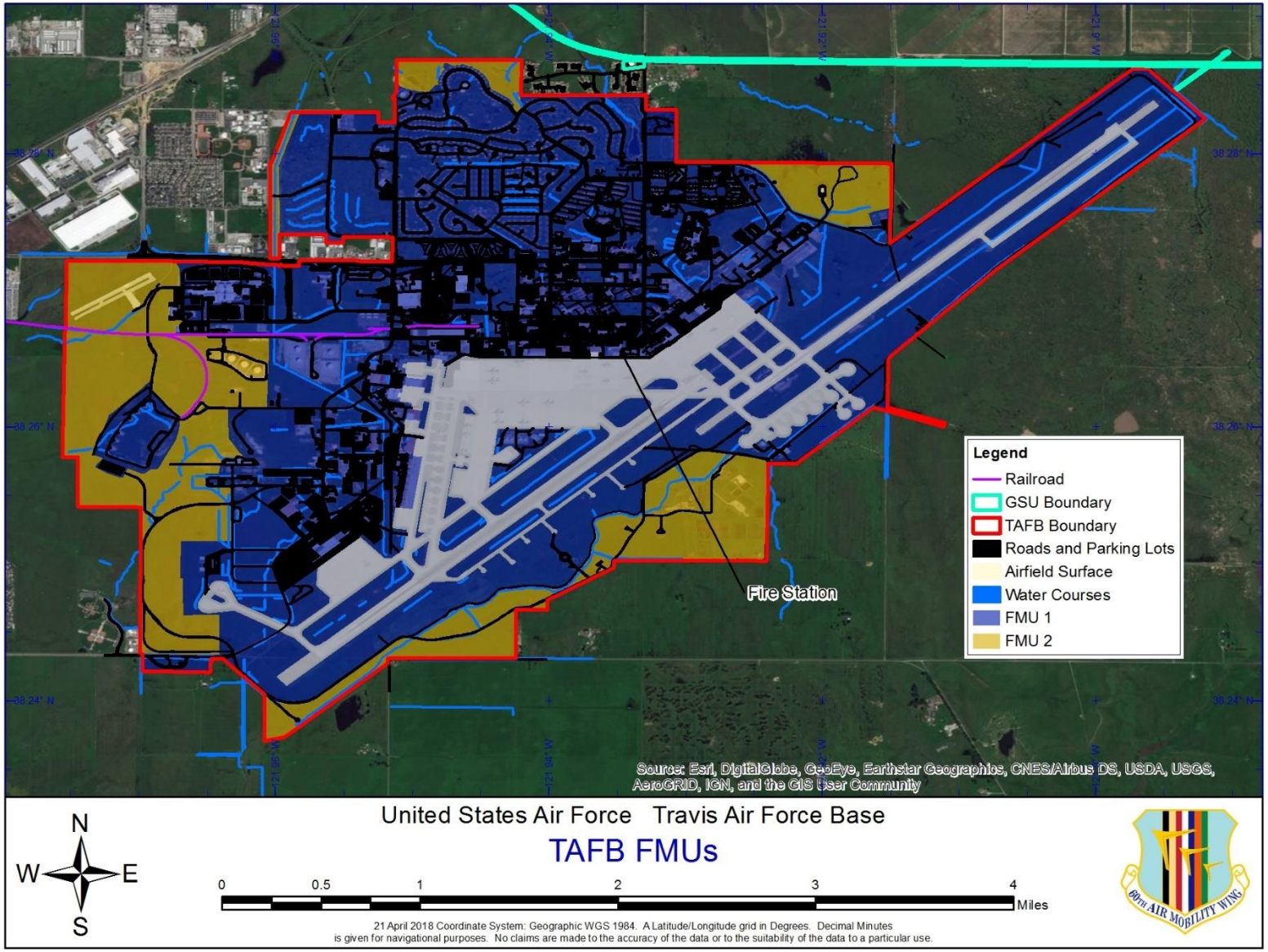
[1]Not found on TAFB or its GSUs.
BCC = Bird of Conservation Concern.
SSC – Species of Special Concern.

3.5.2 FMUs – Specific Descriptions

3.5.2.1 Wildland FMU Description

The FMUs of TAFB are based primarily on fire management objectives and strategies, presence or absence of high-density development, and location. Figure 3.5 depicts the FMUs for TAFB. The GSUs, part of FMU 1, are not depicted on this map. Below are descriptions of each FMU.

Figure 3.5: TAFB FMU Map



3.5.2.1.1 FMU 1: TAFB Developed Area and GSUs

This FMU consists of the developed portion of TAFB, as well as its GSUs. It is 4,334 acres in size, 2,885 acres of which are considered burnable. Due to the presence of infrastructure and high human population, all wildfires in this FMU will be fully suppressed. Most buildings and other infrastructure are located inside this FMU. Buildings serve a variety of purposes including residences, dormitories, schools, hospitals, office buildings, maintenance facilities, storage facilities, communications facilities, utilities, sheds, services, recreation, fuel storage, and HazMat storage. The above structures, powerline poles, and some scattered sensitive areas would require protection during fire operations. A small portion of this FMU northwest of the southwestern end of the airfield is used for cattle grazing and a small portion east of the northern MSA is used for horse grazing. While nearly 67% of this FMU is considered burnable, a large proportion of this consists of lawns, sports fields, ornamental trees, and other maintained vegetation. It could be argued that this too is unburnable as most of the time it is likely to be too green to carry fire or mowed to a height where fire will not spread quickly. Remaining areas consisting of wetlands and grasslands would burn similarly to these vegetation types in FMU 2. The dominant fuel types in this FMU include non-burnable urban development and grass and grass-shrub FBFMs. Topography in this FMU is generally level or slightly sloping with varying aspects. This FMU consists of a large, contiguous area, plus a smaller area consisting of an MSA and all GSUs. Wildfire history is spotty, but wildfires have occurred in this FMU on at least 2 occasions. Mechanical fuels treatment history is unavailable. Use of prescribed fire is not prohibited in this area, but it will not be used widely for natural resources purposes. It may be used to manage for BASH or for fuels reduction near values at risk.

3.5.2.1.2 FMU 2: TAFB Prescribed Fire Units

This FMU consists of the portions of TAFB considered prescribed fire units. It is 1,010 acres in size, 977 acres of which are considered burnable. Due to the proximity to infrastructure and adjacent private lands, all wildfires in this FMU will be fully suppressed. Suppression by indirect attack is preferred and can create results similar to prescribed fire when conditions allow safe backfiring off of firebreaks to create enough black to hold the advancing fire. Suppression by direct attack will likely be the most common strategy under most circumstances, though special consideration will be made for potential effects on sensitive resources. The majority of the FMU is undeveloped with the exception of scattered structures. The above structures, along with powerline poles and some scattered sensitive areas would require protection during fire operations. A large portion of this FMU along the western installation boundary is used for cattle grazing and a small portion east of the northern MSA is used for horse grazing. Nearly all of this FMU is considered burnable with only the area surrounding the previously mentioned structures, as well as roads and surface water considered non-burnable. The dominant fuel types in this FMU include grass and grass-shrub FBFMs. Topography in this FMU is generally level or slightly sloping with varying aspects. This FMU is discontinuous and borders a large portion of the installation boundary. Two fires occurred in 2017. A 06 July fire burned 249 acres, including 154 on TAFB. A fire on 06 September covered five acres. Another fire on 9 March 2016 burned approximately 249.5 acres (150.8 on TAFB). Several other fires in 2016 without dates burned a total of 11.1 acres. In 2018, a 4000 acre fire started on the installation and moved off causing destruction to homes. Mechanical fuels treatment history is unavailable.

3.5.2.2 Wildland FMU Goals and Objectives

Fire management goals for TAFB are as listed below. Table 3.5 shows how these goals will be implemented within the individual FMUs.

Table 3.5: Goals by FMU

Objective	Strategy	FMU	
		1	2
Objective 1	Strategy 1.1		X
	Strategy 1.2	X	X
	Strategy 1.3	X	X
	Strategy 1.4	X	X
Objective 2	Strategy 2.1	X	X
	Strategy 2.2	X	X
	Strategy 2.3	X	X
Objective 3	Strategy 3.1	X	X
	Strategy 3.2	X	X
	Strategy 3.3	X	X
	Strategy 3.4	X	X
	Strategy 3.5	X	X
	Strategy 3.6	X	X
	Strategy 3.7	X	X
	Strategy 3.8	X	X
	Strategy 3.9	X	X
	Strategy 3.10	X	X
	Strategy 3.11	X	X
	Strategy 3.12	X	X
	Strategy 3.13	X	X
Objective 4	Strategy 4.1	X	X
	Strategy 4.2	X	X
Objective 5	Strategy 5.1		X

General Fire Management Goal, Objectives, and Strategies

Overarching Fire Management Goal: ***Implement a safe, professional wildland fire management program to facilitate the military mission at TAFB, including enhancing and maintaining training areas, reduction of hazardous fuels and other potential wildfire hazards, and implementing the Sikes Act compliant Travis INRMP by providing a conservation benefit to federally listed species and state species of concern.***

Objective 1: Prevent unwanted human-caused ignitions.

- **Strategy 1.1:** Maintain fuels at EOD Range to reduce the likelihood of unwanted ignitions resulting from range activities.
- **Strategy 1.2:** Vehicles are restricted to on-road use and shall park in areas with minimal vegetation, except in case of an emergency.
- **Strategy 1.3:** All vehicles used in routine field operations shall be equipped with spark arrestors, shovels, and fire extinguishers.
- **Strategy 1.4:** Enforce fire-safe practices including allowing smoking only in designated areas, requiring proper disposal of smoking debris, and requiring permits from FES for any open burning on a case-by-case basis.
- **Strategy 1.5:** Implement the Avian Protection Plan to prevent bird electrocutions and reduce subsequent wildfires.

Objective 2: Take all appropriate preparedness actions to reduce or eliminate wildfire risk to values to protect.

- **Strategy 2.1:** Complete a Type 3 Wildfire Risk Assessment.
- **Strategy 2.2:** Develop an Asset and Infrastructure Protection Plan to outline mitigation strategies for individual values at risk (see Section 3.11).
- **Strategy 2.3:** Build and maintain all improvements in accordance with the recommendations found on the Firewise Ember Threat and the Home Ignition Zone webpage.

Objective 3: Ensure readiness for wildfire initial attack.

Strategy 3.1: Make firefighter and public safety the highest priority during wildland fire operations.

Strategy 3.2: Develop and implement a Wildfire Preparedness Plan including a Readiness Activities checklist, and a Step-up Plan (see Section 4.1.1).

Strategy 3.3: Develop and maintain a system of permanent firebreaks for strategic firefighting purposes.

Strategy 3.4: Incorporate NWCG training standards into the TAFB wildland fire program organizational structure to accommodate cooperation and integration with other federal and state wildland fire organizations across jurisdictional boundaries.

Strategy 3.5: Ensure that all personnel engaged in wildland fire meet and maintain minimum physical fitness requirements.

Strategy 3.6: Ensure that all personnel engaged in wildland fire activities are wearing the required PPE.

Strategy 3.7: Develop and maintain MAAs and/or cooperative agreements with local, state, federal, and private wildland fire management agencies and maintain communications and meetings with these entities to discuss wildland fire issues and related needs.

Strategy 3.8: Ensure that all personnel are aware of the appropriate notifications that are to be made upon detection of any wildfire, using procedures as outlined in this plan.

Strategy 3.9: Obtain adequate fire suppression equipment.

Strategy 3.10: Maintain fire suppression equipment in ready state by performing routine maintenance and readiness checks.

Strategy 3.11: Have on hand enough trained personnel to respond to a worst-case wildfire, given the current conditions.

Strategy 3.12: Respond to, size up, and control wildfires, using procedures as outlined in this plan.

Strategy 3.13: Annually review fire procedures, including coordination, reporting, and assistance procedures prior to fire season.

Objective 4: Utilize all available tools to manage wildland fuels to support the mission.

Strategy 4.1: Evaluate wildland fuel conditions and implement strategies, including a regular application of chemical, mechanical, and prescribed fire fuels treatments, to eliminate or minimize hazardous fuels.

Strategy 4.2: If possible and practical, use Minimum Impact Suppression Techniques (MIST) when fighting wildfires to avoid or minimize adverse impacts to natural and cultural resources.

Objective 5: Implement prescribed fire and mechanical fuels treatments to meet specific natural resource land management objectives outlined in the INRMP.

Strategy 5.1: Evaluate wildland fuel conditions and implement strategies, including a regular application of chemical, mechanical, and prescribed fire fuels treatments, to improve natural resource quality in support of the mission.

3.5.2.3 Wildland FMU Planned Fuels Treatments

In the short term, disking, grazing, and prescribed fire will be used to reduce fuels in target areas shown in Figure 3.6 pending approval under National Environmental Policy Act (NEPA), Clean Water Act (CWA), and Endangered Species Act (ESA). Most areas shown on Figure 3.6 as "disc area" in yellow are general locations, and generally do not have widths larger than 25 feet. They also, in some cases, represent primary and alternate locations (i.e. see Aero Club) or show off-base locations. As capacity is built, planned fuels treatments will include more widespread prescribed fire treatments, as well as mechanical fuels treatments, chemical fuels treatments, and grazing. These treatments may be conducted throughout each of the FMUs, where appropriate and as described below. Annual meetings involving the ISS and key NR and FES personnel will be held to plan upcoming fuels treatments projects.

Recommended prescribed fire treatments are based upon the natural fire regimes that existed prior to European settlement. The primary BpS at TAFB is BpS 0511290: California Central Valley and Southern Coastal Grassland and has an MFRI for replacement-severity fire of about 4 years, which will be the objective for all prescribed fire units within FMU 2. Research has shown that the beneficial effects of prescribed fires decrease after several years but are typically observable for at least 3 years following a prescribed (Pollak and Kan 1998, Marty 2015) fire so the 4-year interval is likely to support vegetation composition targets from the INRMP. This should not be interpreted as meaning that prescribed fire would never be appropriate elsewhere. Some objectives, such as reducing fuels in the Wildland Urban Interface (WUI), may be best met with prescribed fire and new units will be made to meet these objectives, as needed. Recommended prescribed fire units for TAFB are depicted in Figure 3.7.

Additional mechanical fuels treatments will focus on mowing activities that target tall grasses and control of invasive species. Timing of such treatments is essential in order to prevent target species from producing mature seeds in the year of control. Often, several mowing treatments may be required to meet conservation and fuels reduction goals as single mowings in June tend to simply push grass down instead of cutting and removing the biomass, creating a thick thatch layer. Many unimproved areas are currently mowed to a height not to exceed 14 inches, while semi-improved areas are mowed to a height not to exceed 10 inches. The airfield is mowed to maintain vegetation height between 7 and 14 inches.

Annual mowing currently takes place as a way to manage grassland fuels. It can also provide control of non-native species if timed correctly to reduce plants ability to produce seeds in a given year. Annual mowing can also complicate control of non-native species. For instance, mowing of yellow-star thistle shortens the height at which the plant flowers, eliminating mowing as an effective method of control for this ubiquitous species that threatens the AF mission by providing a BASH risk to airfield operations and reducing water holding capacities of sensitive vernal pool systems. Another example is where poorly

executed annual mowing contributes to increasing levels of dead thatch, reducing competitiveness for native plants.

Chemical fuels treatments are limited to the control of invasive species. These treatments will serve the primary purpose of habitat improvement.

Grazing can be used as a tool to manage wildland fuel loads as well as to improve natural resource quality in ecosystems that evolved with grazing. A grazing program currently exists at TAFB and will be continued. Grazing is used along with prescribed fire and mowing to control non-native annual grass and forb species. In addition, goat grazing is being considered to manage fuels adjacent to the abandoned housing area and other natural areas. Contract short duration, high intensity grazing operations may be used to target specific plant phenologies or long-term low intensity grazing may be implemented to provide control over 6-12 months on a long-term sustainable basis. Grazing units are depicted in Figure 3.8.

Figure 3.6: TAFB Current Short-term Fuels Treatment Plan Map

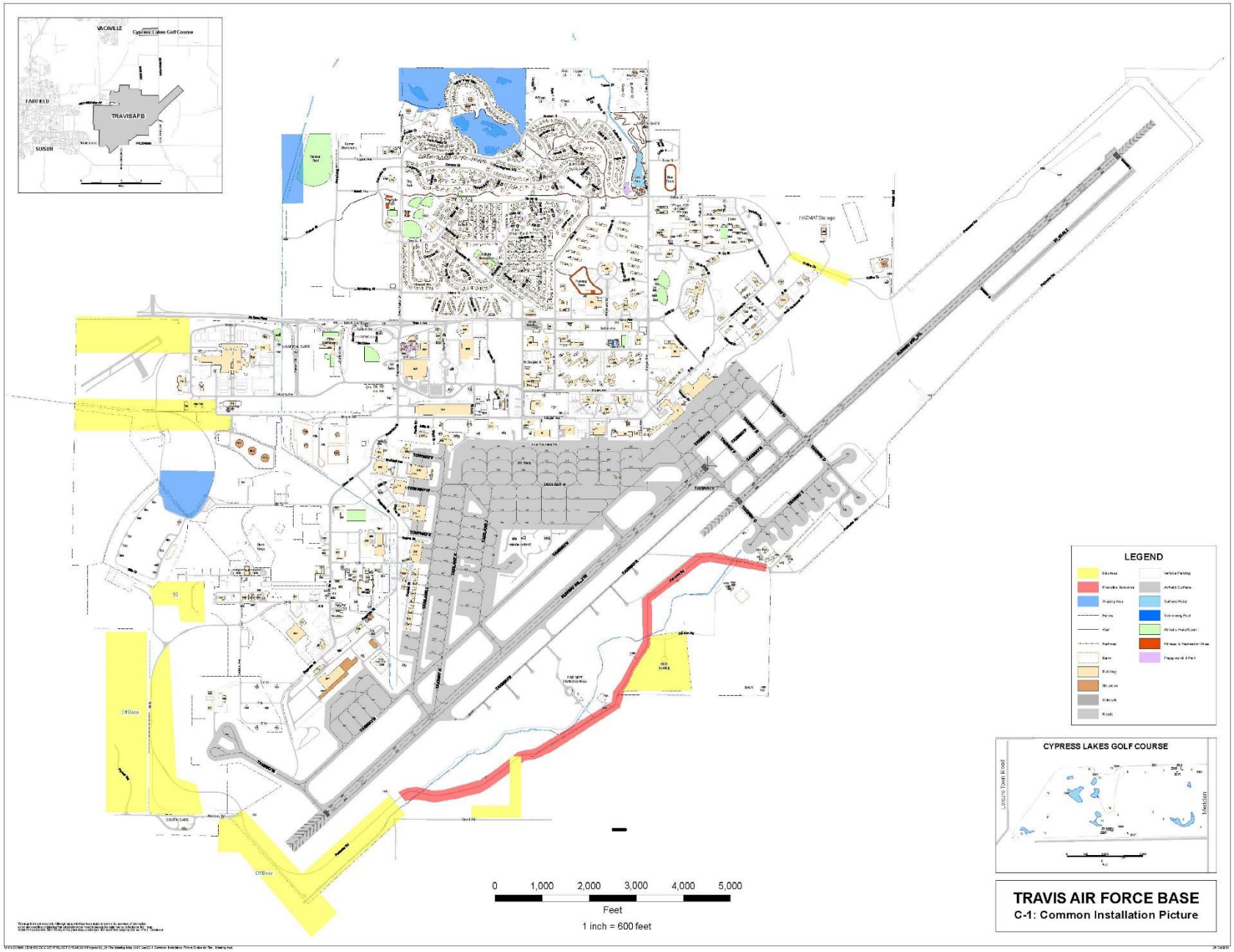


Figure 3.7: TAFB Recommended Prescribed Fire Map

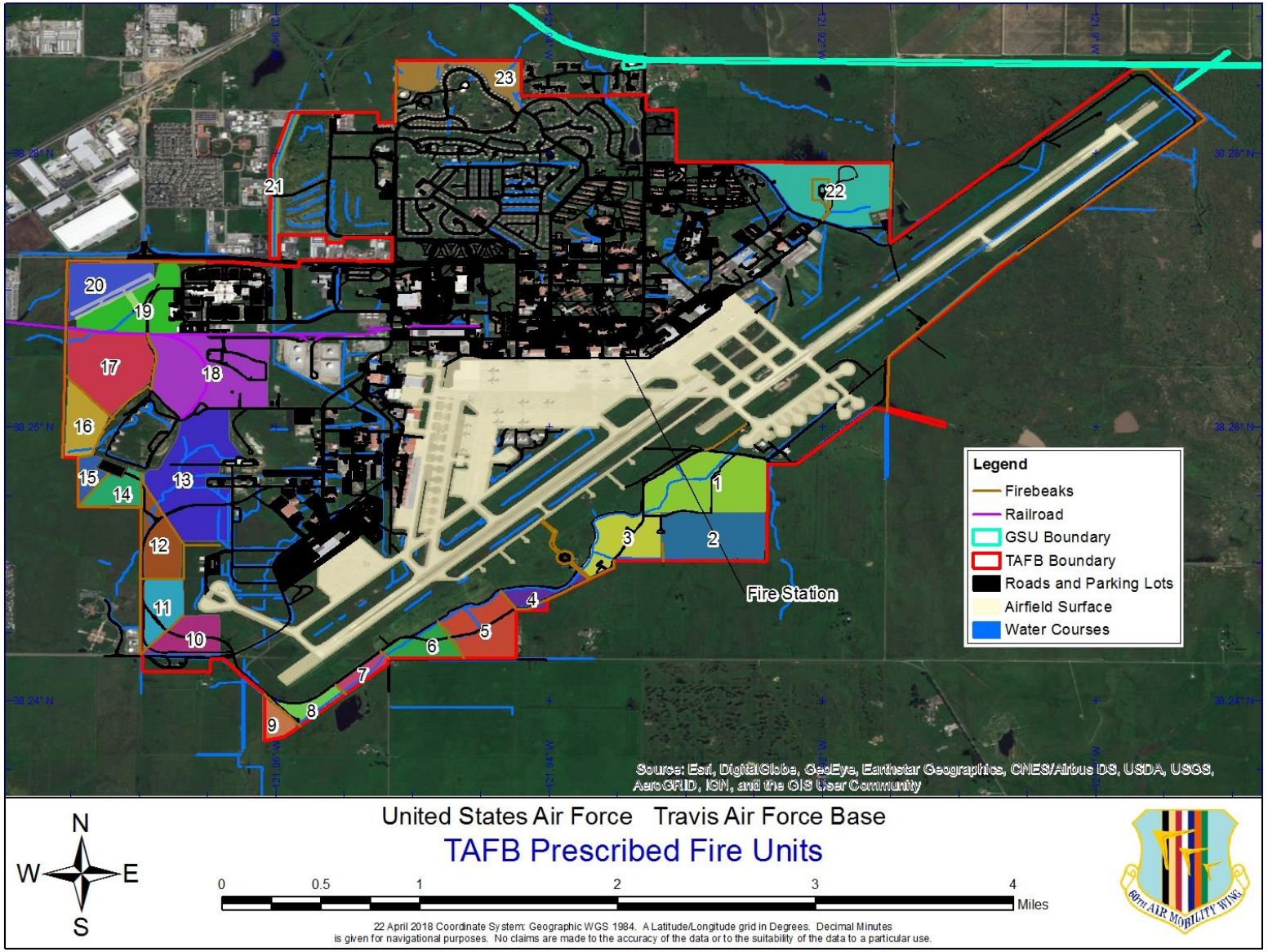
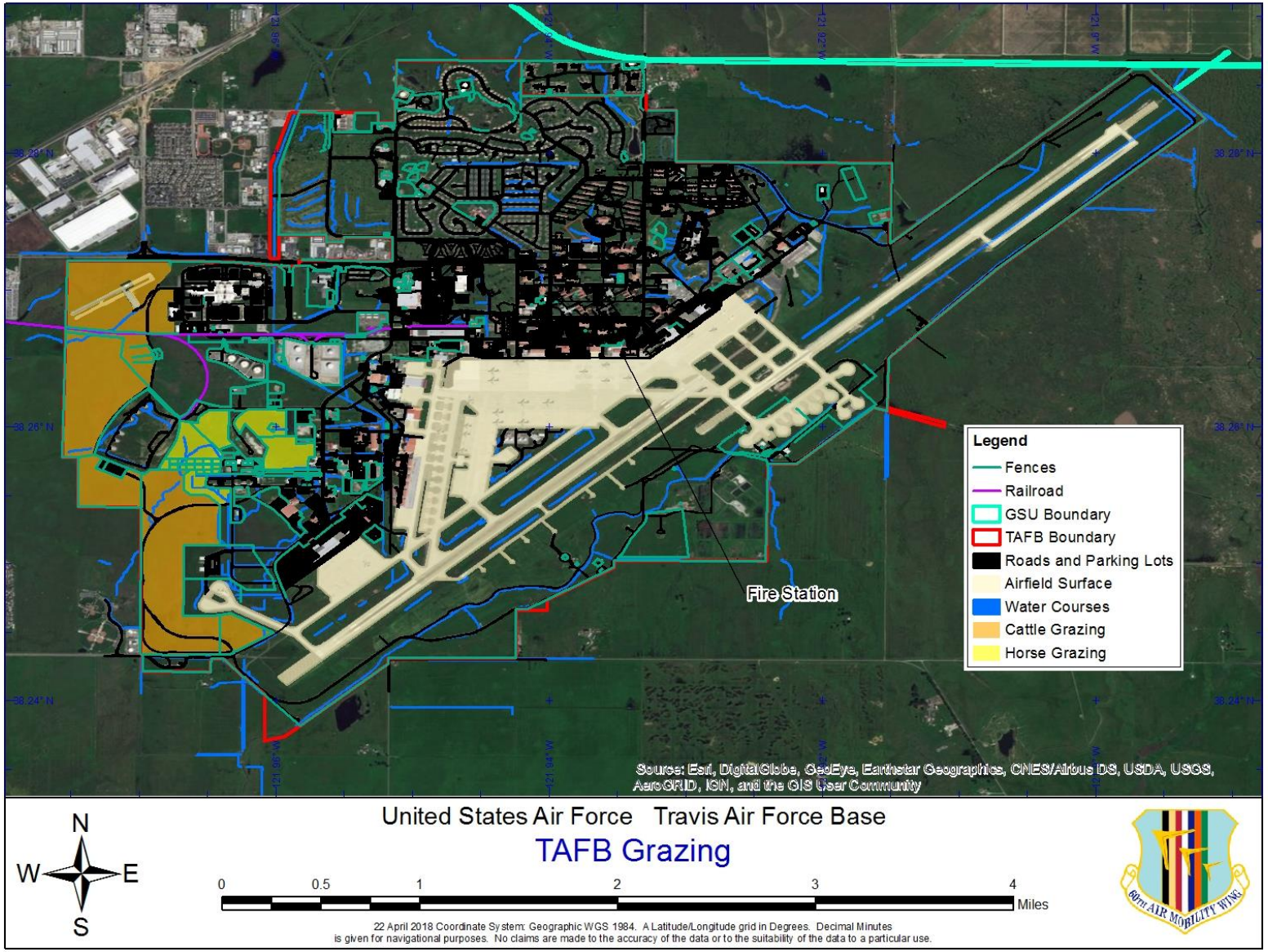


Figure 3.8: TAFB Grazing Map



3.5.2.4 Wildland FMU Values to Protect

Values to protect for TAFB are as listed below. Table 3.6 identifies the FMUs within which these values occur.

Table 3.6: Values to Protect by FMU

Value	FMU	
	1	2
Human Safety	X	X
Buildings and Structures	X	X
Fuel Storage	X	X
HazMat Generation or Storage	X	X
Powerline Poles	X	X
Flight Line	X	
T&E Habitat (Restrict Equipment)	X	X
T&E Habitat (Restrict Retardant)	X	X
Invasive Species	X	X
Cultural Resources	X	X
Rangeland Resources	X	X
Air Quality	X	X
Munitions Storage Area/EOD Range	X	X
Adjacent Private Lands	X	X

The following are values to protect for TAFB:

- ***Human Safety:*** The highest priority value to protect will always be the safety of human life and health. No effort to protect any other value will be made if it requires an unusual risk to human life or safety.
- ***Buildings and Structures:*** Buildings and structures are numerous and widely scattered in FMU 1. There are a lower density of buildings and structures in FMU 2. TAFB does a good job reducing fuels around buildings and structures but it is important to recognize that under certain weather and fire behavior conditions, buildings and structures may need additional protection. Of particular concern are the TACAMO area, the MSA, the hospital complex, and the horse corrals and associated pole barns. Buildings and structures are depicted in Figure 3.9.
- ***Fuel Storage:*** Fuel storage areas may be separate from the facilities where they will be used. Fuels are typically reduced around these areas. Protection of these values under certain weather and fire behavior conditions may require backfiring from firebreaks, but point protection is a strategy that can be used in many circumstances. Of particular concern is the compressed gas storage on the south side of the hospital. Due to the hazardous nature of these areas, extreme caution will be exercised and all decisions must be based upon the most extreme fire behavior possible, not the current observed fire behavior.
- ***HazMat Generation or Storage:*** HazMat generation areas include power plants, medical facilities, laboratories, gas stations, research and testing operations, fueling operations, and industrial/maintenance shops. HazMat storage areas may be separate from the facilities where they were generated. Fuels are typically reduced around these areas. Protection of these values under certain weather and fire behavior conditions may require backfiring

from firebreaks, but point protection is a strategy that can be used in many circumstances. Due to the hazardous nature of these areas, extreme caution will be exercised and all decisions must be based upon the most extreme fire behavior possible, not the current observed fire behavior. If a HazMat area is impacted by fire, access downwind must be restricted due to the dangers associated with exposure to airborne gasses and particulate matter originating from HazMat.

- ***Powerline Poles:*** Many powerlines provide power to values that are critical to national security. Powerline poles may be made of wood or non-flammable material such as metal or concrete. Newer powerlines are typically made of metal or concrete. Older powerlines are susceptible to damage from fire and may require pre-suppression actions to protect them from the effects of future fires.
- ***Flight Line:*** It is critical that, to the extent possible, the airfield is kept free of smoke that could reduce visibility or impact mission-critical flights. This is most applicable during prescribed fire operations.
- ***T&E Habitat:*** T&E Habitat is discussed in detail in Section 3.5.1.8. Protection involves restricting the use of heavy equipment and the use of fire retardant or foam, as a general rule, unless necessary to protect human life, safety, or property. On-installation preserves for Contra Costa goldfields habitat is depicted in Figure 3.10. Wetlands, which are the locations of most other T&E species are depicted in Figure 3.11. In addition, ground disturbing activities within Low and Medium Risk for California tiger salamander, as determined by the Travis Programmatic Biological Opinion (see Figure 3.12), may require consultation with USFWS and may require a take permit under the ESA. This includes the majority of the installation.
- ***Invasive Species:*** Many plant communities are highly susceptible to encroachment by invasive species post-mechanical disturbance, however fire can also be used to manage invasive species with proper timing.
- ***Cultural Resources:*** Cultural resources are discussed in detail in Section 1.4.4. Locations of sensitive resources, including cultural resources, are depicted in Figure 3.10.
- ***Rangeland Resources:*** While fires are generally beneficial for livestock forage quality and quantity, rangeland improvements such as fencelines, working pens, corrals, waterlines, and tanks may be negatively impacted by fire and may require protection, prior to prescribed fire or during wildfire suppression. Those damaged by fire will need immediate rehabilitation post-fire. Locations of grazing pastures and fences are depicted in Figure 3.8.
- ***Air Quality:*** Air quality must be insured in the interest of public health, particularly during prescribed fires. Areas of particular interest are those where people live congregate, or work, as well as facilities housing values that may be contaminated by particulate matter found in smoke.
- ***Munitions Storage Area/EOD Range:*** The Munitions Storage Area and the EOD Range may contain Unexploded Ordinance (UXO) that could pose a hazard to firefighters. While these may or may not be values that themselves necessarily need protection, keeping these areas from burning increases safety of firefighters and, as such, keeping fires from burning in these areas, or providing a no entry zone around them when fires are burning in them, is

important. Locations of the Munitions Storage Area and EOD Range on TAFB are depicted in Figure 3.13.

- ***Adjacent Private Lands:*** Adjacent private lands are susceptible to fires moving off TAFB. Of particular concern are the abandoned housing adjacent to the northern boundary and a private residence adjacent to the southern boundary.

Figure 3.9: TAFB Values to Protect Map – *see also Figure 3.11 which includes additional sensitive areas.*

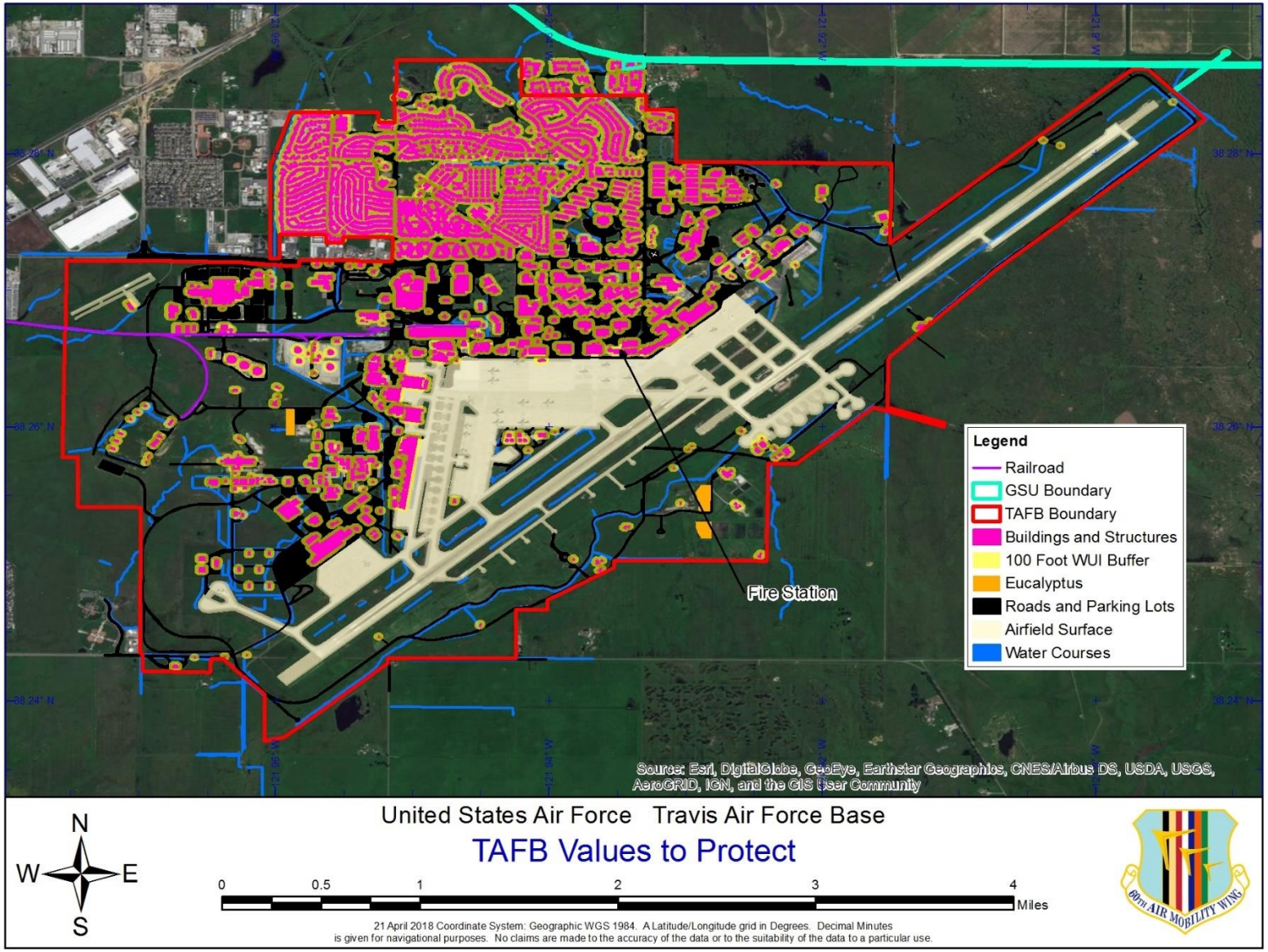


Figure 3.10: TAFB Sensitive Areas Map

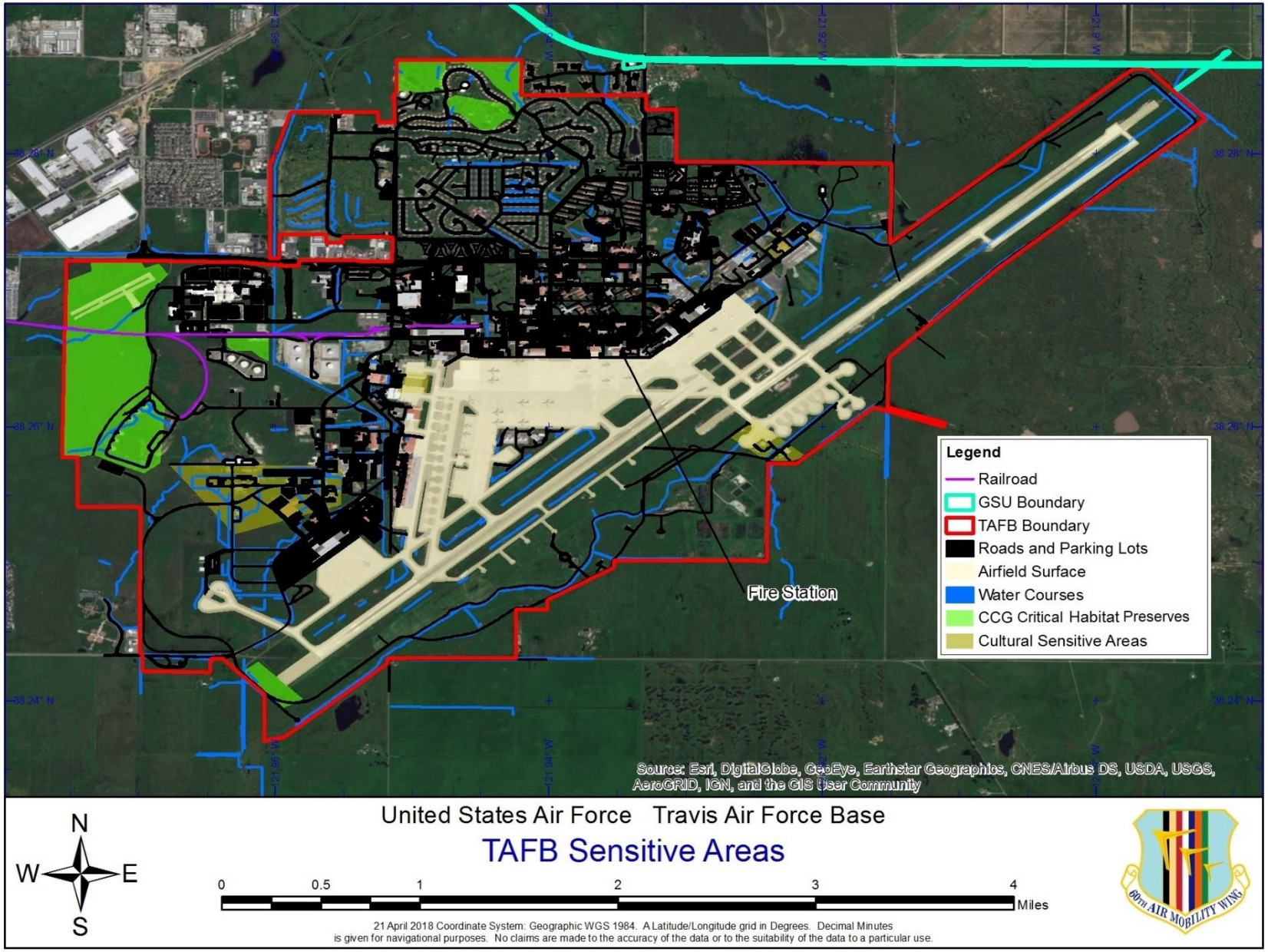


Figure 3.11: TAFB Wetlands Map

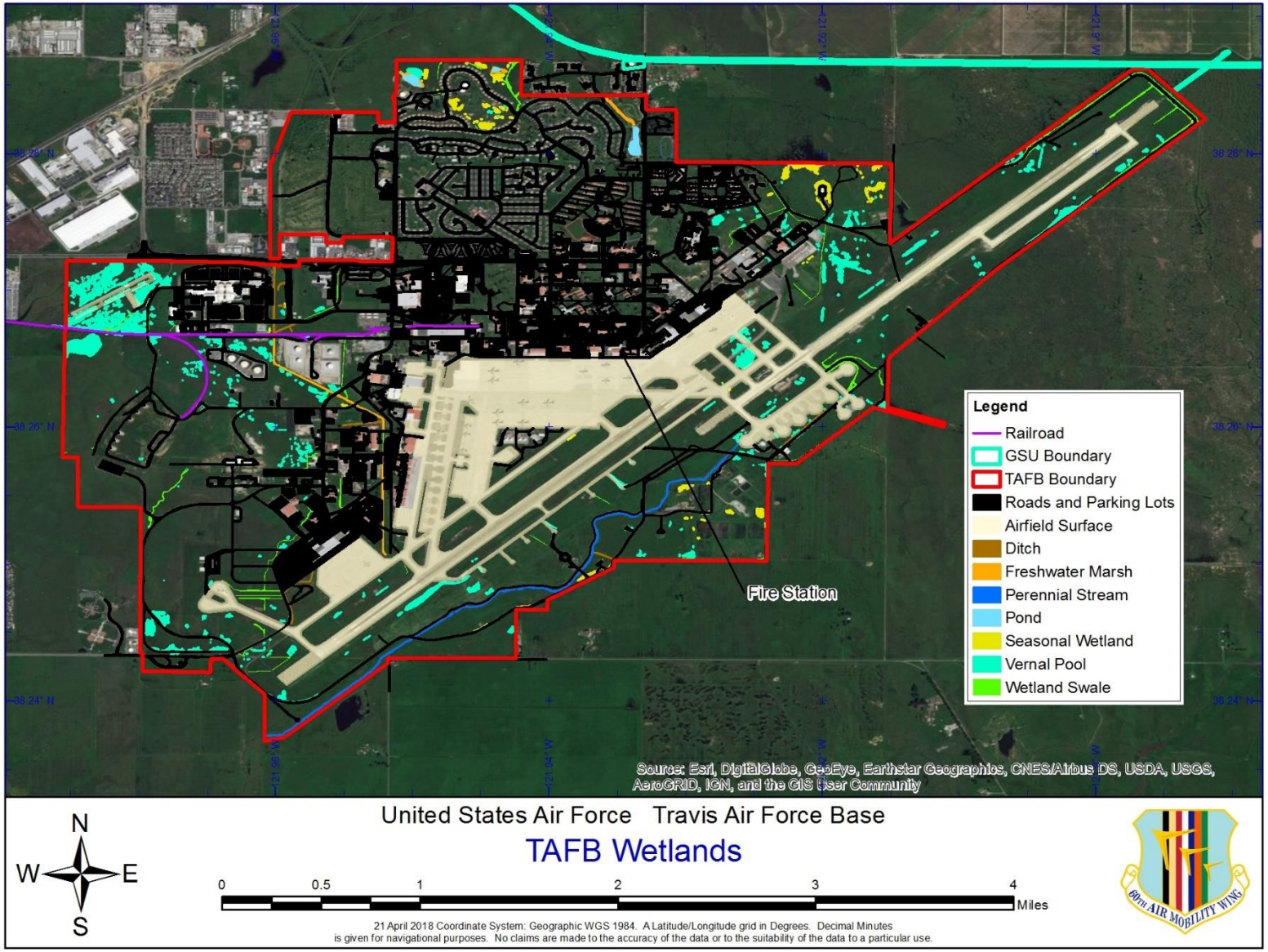
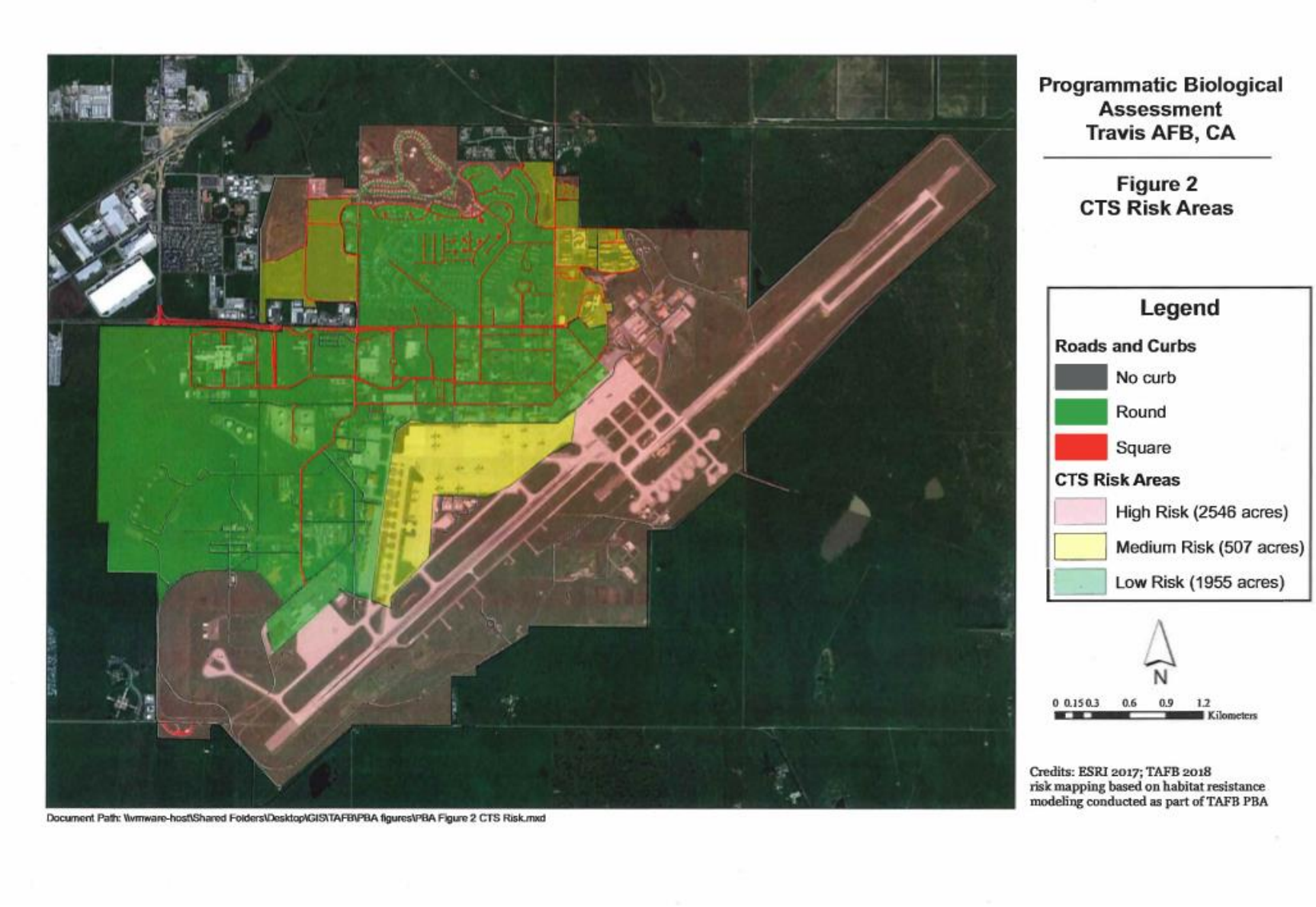


Figure 3.12: TAFB California Tiger Salamander Risk Areas Map

(taken directly from the June 2018 Programmatic Biological Assessment: Effects of Activities Conducted at Travis Air Force Base, California, on Six Federally Threatened and Endangered Species)



3.5.2.5 Wildland FMU Safety Considerations

The safety of installation and cooperator firefighters is of the utmost concern in all wildland fire operations. Several national requirements, including the PMS 310-1, *National Incident Management System (NIMS): Wildland Fire Qualification System Guide*, October 2017 (PMS 310-1), are in place to aid the conduct of safe operations. It is of the highest importance that all firefighters have the training and experience for their positions and equipment they operate. All personnel will be issued fire-resistant clothing, a hard hat with chinstrap, fire shelter, leather gloves, leather boots a minimum of 8 inches tall, eye protection and hearing protection. Personnel must use the appropriate PPE in conjunction with their assigned task. Additionally, chainsaw chaps are available and required for sawyer assignments. PPE requirements are detailed in Section 4.1.1.2.1. Safety considerations for TAFB are as listed below. Table 3.7 identifies safety considerations relevant to individual FMUs.

Table 3.7: Safety Considerations by FMU

Safety Concern	FMU	
	1	2
Entrapment	X	X
Heat Stress	X	X
Smoke Exposure	X	X
Fatigue	X	X
WUI Firefighting	X	X
Driving	X	X
Traffic and Public Safety	X	X
Public Evacuation Routes	X	
Railroad	X	X
Barbed or Razor Wire	X	X
Powerlines	X	X
Fuel Storage Areas	X	X
Munitions Storage Area	X	
EOD Area		X
HazMat Storage Area	X	X
Difficulty of Movement	X	X
Chainsaw Usage	X	X
Snags	X	
Poisonous Plants	X	X
Venomous Animals	X	X
Predatory Animals	X	X
Smoke Impacts	X	X

The following are safety considerations relevant on TAFB:

- ***Entrapment:*** Fuels are especially flashy on portions of the installation.
- ***Heat Stress:*** Heat stress is a concern during any fire or fuels management operation.
- ***Smoke Exposure:*** Smoke exposure causes respiratory injury and can decrease the ability to think clearly and make sound decisions.
- ***Fatigue:*** Fatigue also can decrease the ability to think clearly and make sound decisions.
- ***WUI Firefighting:*** Firefighting in WUI areas provide unique hazards.

- ***Driving:*** Driving, particularly off-road driving, is hazardous, especially when coupled with smoke exposure and/or fatigue.
- ***Traffic and Public Safety:*** Smoke can make roadways hazardous due to decreased visibility and the tendency for the public to drive too fast for conditions.
- ***Public Evacuation Routes:*** Local residents being evacuated can pose a hazard to firefighters working on or near roads because their minds are often elsewhere, thinking about the whereabouts of loved ones or the property they just left behind.
- ***Railroad:*** Trains cannot stop quickly, so extra care will be taken when fighting fire near railroad tracks.
- ***Barbed or Razor Wire:*** Barbed or razor wire are often encountered while fighting fire and can cause cuts and/or puncture wounds.
- ***Powerlines:*** Powerlines pose an electrocution threat when they are down or when electricity arcs through smoke.
- ***Fuel Storage Areas:*** Fuel storage areas pose an explosion hazard.
- ***Munitions Storage Area:*** The MSA Area poses an explosion hazard.
- ***EOD Area:*** Areas with possible UXO pose an explosion hazard.
- ***HazMat Storage Areas:*** HazMat storage areas, particularly when on fire, often emit gasses and particulate matter that are dangerous to be exposed to.
- ***Difficulty of Movement:*** Wetlands can make movement difficult. This can make escape down escape routes to safety zones difficult.
- ***Chainsaw Usage:*** Chainsaw usage can result in severe cuts and amputations, as well as burns from fuel geysers.
- ***Snags:*** Snags have killed many firefighters when they fall as a result of wind in bug-killed, frost-killed, or fire-weakened trees, or as a result of tree felling operations.
- ***Poisonous Plants:*** Poisonous plants can cause severe skin or respiratory irritation or allergic reactions.
- ***Venomous Animals:*** Bites from venomous animals can cause severe skin irritation, allergic reactions, or tissue damage.
- ***Predatory Animals:*** Bites from predatory animals can severely injure or kill firefighters.
- ***Smoke Impacts:*** Smoke can make it more difficult for aviation resources to operate safely and can be a hazard to public health of nearby populations.

3.5.2.5.1 Special Safety Information

Firefighter and public safety is the first priority in every wildland fire management activity. The WFMP will ensure that installation-specific safety and emergency operations protocols are identified to mutual aid crews and in PFPs.

3.5.2.5.1.1 Use of Red Lights and Sirens

Red lights and sirens are to be used by AFCEC/CZOF fire personnel only to provide visibility or an audible signal or warning while on the scene of a wildfire or prescribed fire. AFCEC/CZOF personnel are not authorized or properly trained to use these devices while traveling to a fire on public highways. Red lights are required to be turned on when at a fire scene unless the Prescribed Fire Burn Boss (RXB#) or IC gives permission to turn them off.

3.5.2.5.1.2 Communicating Safety Concerns

Any safety issues that have the potential to cause an aviation-related mishap will be reported on the Aviation Safety Communiqué (SAFECOM) webpage. This website is intended as an "accident prevention tool" developed for the Department of the Interior (DOI) and the US Forest Service (USFS) and uses the OAS-34/FS-5700-14 Safety Communiqué Form to report aviation safety issues. It is also important to review SAFECOMs that have been submitted from other programs in order to learn from their mistakes.

A number of items can be found on the National Interagency Fire Center (NIFC) webpage as works in progress resulting from the Wildland Firefighter Safety Awareness Study. Constant reminders of the 10 Standard Fire Orders and the 18 Situations That Shout Watch Out help keep the individual's attention on safety. In compliance with the NWCG standards, annual safety refresher training is a requirement.

3.5.2.5.1.3 Unexploded Ordinance (UXO) Areas

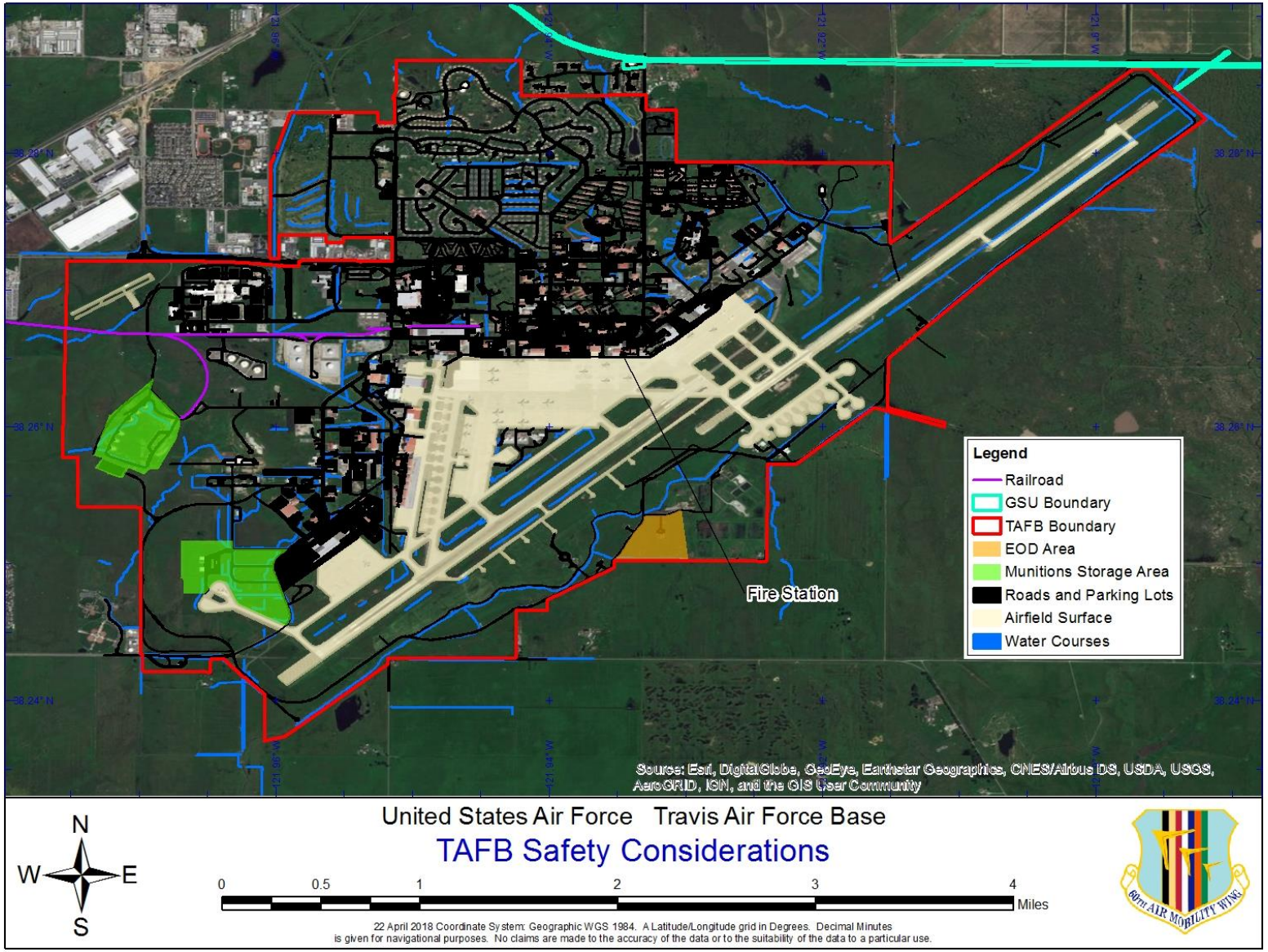
A number of DoD mission considerations affect firefighter safety. The most critical is the issue of UXO. Because of the installation's history, the potential for encountering UXO is low, except in the EOD Area or MSA. Fires can cause some UXO to explode, as can bulldozers used in suppression activities, posing a serious risk to firefighter safety. Therefore, extreme caution should be exercised by personnel leading heavy equipment in these areas. Engines and other heavy equipment will stay on existing roads and firebreaks. Personnel must refrain from disturbing UXO if any is found. If UXO is encountered during wildland fire operations, the WFPC will be notified immediately, who will in turn contact EOD for further guidance.

A map of safety considerations can be found in Figure 3.13.

3.5.2.5.1.4 Wildland Urban Interface (WUI)

During a wildfire in the WUI, firefighter and public safety will be the top priority, with protection of structures and other values at risk as a secondary goal. Defensible space will be created around structures and other values at risk as a mitigation measure to reduce the risk of a future wildfire impacting them. Firefighters in the WUI will base all decisions on anticipated fire behavior based upon fuels, topography, predicted weather, and other information. Fires in the WUI can be mitigated through implementation of education programs discussed in Section 3.4. A map of WUI areas on TAFB can be found in Figure 3.9. WUI areas on TAFB are based on a 100-foot defensible space buffer applied to structures adjoining wildlands.

Figure 3.13: TAFB Safety Considerations Map



3.5.2.6 Wildland FMU Fire Risk Mitigation Strategies

Overall wildfire risk on TAFB is low, though not non-existent. Fire risk mitigation strategies will primarily consist of efforts to prevent wildfire ignitions, implementing fire and non-fire fuels treatments, and creating defensible space in the WUI areas of the installation to reduce the probabilities of a wildfire spreading to the structures in the developed areas of the installation. Table 3.8 lists steps that can be taken to reduce the wildfire risk.

Table 3.8: Recommended Wildfire Risk Mitigation Strategies

Task	Responsible Party	Recommended Schedule
Firebreak Maintenance: Conduct routine disking of the firebreaks around the installation and the prescribed fire units.	60 CES	Every year to maintain mineral cover
Prescribed Fire-Hazardous Fuels: Use prescribed fire to manage hazardous fuels near values to protect, particularly in the WUI. – *non-environmental funding required*	FES AFCEC/CZOF	As needed.
Prescribed Fire-Environmental: Use prescribed fire to manage natural resources; secondary benefits include fuels reduction.	60 CES/CEIEC, FES, AFCEC/CZOF	Recommended fire return interval is 4 years.
Grazing: Continue to implement grazing as a land management tool to reduce grass heights and dry thatch. Expand use of grazing, if possible.	60 CES/CEIEC	As needed
Outreach/Notification: Conduct public outreach and notification as described in Section 3.4.	60 AMW/PA, NR, FES	Annually.
Preposition: Preposition wildland firefighting resources in areas most at risk from wildfire on high fire danger days.	FES	Daily when high fire danger exists.
Fire-resistant Construction: Choose fire-resistant materials for new construction and renovations, and for outdoor fixtures, such as outdoor furniture.	60 CES	During new construction or renovations or as fixtures are replaced.
Eliminate Ember Traps: Close or screen any holes, gaps, or other openings in buildings that may allow embers to enter.	60 CES	Conduct initial inspection within 1 year and maintain annually or as needed.
Native Plantings: Consider using "xeriscaping" landscaping within WUI where adequate irrigation of vegetation is not available.	60 CES	N/A.
Manage WUI Fuels: Remove flammable vegetation and debris within 30 feet of WUI structures. This zone is known as the "Structure Ignition Zone."	60 CES	Conduct initial removal within 1 year and maintain annually or as needed.
Reduce Ladder Fuels: Prune trees 6 feet above the ground to eliminate ladder fuels.	60 CES	Annually.
Powerline Maintenance: Keep vegetation under powerlines mowed.	60 CES	Annually.
Community Wildfire Protection Plan (CWPP): Write a CWPP covering the developed parts of TAFB to identify values at risk, ignition likelihood, and mitigation plans for individual structures.	FES	Within 1 year.

Risk mitigation strategies relevant to individual FMUs are presented in Table 3.9.

Table 3.9: Risk Mitigation Strategies by FMU

Risk Mitigation Strategy	FMU	
	1	2
Firebreak Maintenance	X	X
Prescribed Fire	X	X
Outreach/Notification	X	X
Preposition	X	X
Fire-resistant Construction	X	X
Eliminate Ember Traps	X	X
Native Plantings	X	X
Manage WUI Fuels	X	X
Reduce Ladder Fuels	X	X
Powerline Maintenance	X	X
Type 3 Wildfire Risk Assessment	X	X
Community Wildfire Protection Plan	X	

TAFB will in the future be served by the WSM at BAFB. Members are qualified to NWCG standards. The crew's overhead is competent in managing a fast moving, complex wildfire. Training of crew members will be ongoing along with a physical fitness program. Minimum personnel qualifications are discussed further in Section 4.1.1.1.7 and additional recommended wildfire suppression equipment is discussed further in Section 4.1.1.2.

3.6 Management of Planned Fuels Treatments

TAFB will use a combination of fire and non-fire fuels treatments to meet natural resource objectives established in the INRMP. Fuels treatments will primarily be conducted to manage native plant communities and will have the secondary benefit of wildfire risk reduction. AFCEC/CZOF will primarily use the WSMs, in conjunction with NWCG qualified and available installation personnel, to execute validated prescribed fire requirements.

3.6.1 Processes to Identify and Prioritize Fuels Treatments

Fuels treatments will be identified and prioritized based upon the anticipated treatment outcomes in relation to the objectives of the INRMP. Projects to improve public safety will be prioritized above all others, with projects supporting the military mission following. The WFPC will meet with the assigned WSM Lead and the Travis NRM to identify and prioritize projects and fuels treatments needed to support INRMP and WFMP objectives. Per AFI 32-7064 Section 13.7.3, funding for wildfire prevention and fuels management for hazard reduction is an Installation Operations and Maintenance (O&M) responsibility. The WSM is funded from the Environmental Quality (EQ) O&M Conservation budget thus WSM will conduct projects that meet natural resources goals from the INRMP unless Installation O&M funds are provided.

3.6.2 Fuels Treatment Performance Information and Targets

Replacement-severity prescribed fire will be implemented in previously determined prescribed fire units in grassland areas of TAFB every 4 years. Target MFRI is based upon what is estimated to be the historical MFRI for BpS 0511290: California Central Valley and Southern Coastal Grassland, the dominant

BpS in these areas. Existing prescribed fire units are located in FMU 2. This should not be interpreted as meaning that prescribed fire would never be appropriate elsewhere. Some objectives, such as reducing fuels in the WUI, may be best met with prescribed fire and new units will be made to meet these objectives, as needed. Table 3.10 summarizes the recommended prescribed fire acreage targets by FMU.

Recommended prescribed fire units for TAFB are depicted in Figure 3.7.

Recommended mechanical fuels treatments involve the maintenance of all disked mineral firebreaks and the routine mowing of all non-mineral firebreaks. In addition, vegetation will be maintained annually in a zone extending out at least 30 feet from values to protect, as well as in other areas where fuels management or restoration objectives can be met by targeted mowing. Section 3.5.2.3 contains details.

Recommended chemical fuels treatments are limited to chemical control of invasive species. These treatments will serve the primary purpose of habitat improvement.

Grazing can be used as a tool to manage wildland fuel loads as well as to improve natural resource quality in ecosystems that evolved with grazing. A grazing program currently exists at TAFB and will be continued. Grazing units are depicted in Figure 3.8.

3.6.3 Prescribed Fire Project Implementation

Prescribed fire is defined as fire applied in a knowledgeable manner to fuels on a specific land area under selected weather conditions to accomplish predetermined and well-defined management objectives. Prescribed fire is a desirable and economically sound practice on the vegetation types present on TAFB. Few, if any, alternative treatments have been developed that can compete with fire from the standpoint of cost-effectiveness.

Priorities for what a prescribed fire is meant to accomplish will be established in a review of management goals, analysis of past fire records, and a series of field checks to determine need, adequate fuel load, and to identify any potential safety problems in the area to be burned. Each prescribed fire must have its own PFP with the size of the prescribed fire specified. A detailed record of events will be kept for the day of the prescribed fire.

3.6.3.1 Prescribed Fire Planning

Prescribed fire projects will be implemented to attain goals and objectives of the INRMP and to support AF mission requirements. Implementation will follow state prescribed fire regulations and will follow a site-specific PFP using the *AF Prescribed Fire Plan Template* (AF PFP Template; see Appendix 3.1 or AFCEC/CZOF) or the PMS 484, *Interagency Prescribed Fire Planning and Implementation Procedures Guide*, July 2017 (PMS 484), upon which the AF PFP Template is based. RXB#s must comply with PMS 420-2 and the California smoke management regulations found in 17 California CR, Subch. 2. An NWCG RXB#, qualified at the complexity level of the prescribed fire to be conducted, is required. If qualified individuals are not available on the installation to write prescriptions or implement plans, outside resources may be used on a contractual basis.

All prescribed fire planning will be coordinated through the assigned WSM Lead. Any proposed PFPs for prescribed fires in the controlled airfield area must be approved in advance by AFSEC/SEFW. The approved AF PFP template (see Appendix 3.1 or the AFCEC/CZOF) or equivalent will be completed along with the complexity analysis following the PMS 424, *Prescribed Fire Complexity Rating System Guide*, July 2017 by a qualified RXB#. Contact the WSM Lead or AFCEC/CZOF for assistance with the PFP.

3.6.3.1.1 Areas which have Prescribed Fire Requirements

Prescribed fire will be implemented based upon recommendations in Section 3.5.2.3, along with Table 3.10 and Table 3.11, and as needed to support the mission.

Table 3.10: TAFB Recommended Prescribed Fire Targets

FMU	Total Acres in Prescribed Fire Units	Desired MFRI (Years)	Range of Acceptable MFRIs (Years)	Desired Annual Acres	Range of Acceptable Annual Acres
1	0	N/A	N/A	N/A	N/A
2	986	4	2-6	247	164-493

Table 3.11: Recommended Prescribed Fire Rotation for TAFB

Unit	Acreage	Year
1	82.4	2019
2	65.3	2022
3	46.6	2021
4	16.8	2022
5	47.3	2019
6	23.4	2022
7	10.0	2022
8	13.0	2022
9	12.0	2021
10	29.5	2019
11	27.1	2020
12	30.4	2022
13	104.5	2020
14	22.6	2022
15	11.0	2021
16	29.2	2022
17	72.8	2019
18	107.6	2020
19	52.3	2021
20	41.0	2021
21	16.4	2019
22	87.8	2021
23	36.5	2022

3.6.3.2 Prescribed Fire Operations

Prescribed fire operations will adhere to protocol set forth in the approved PFP for that specific unit/site. At Regional or National Preparedness Levels (PL) 4 or 5 (see the current NIFC Incident Management Situation Report), consult AFCEC/CZOF for instruction on prescribed fire authorization. Cooperators and contractors may be used by AFCEC/CZOF to implement prescribed fires but must meet NWCG Interagency Service standards. Cooperators, such as members of FDs with current MAAs, must have appropriate qualifications certified by their agency. Those who supervise AF employees or contractors during prescribed fires must meet AF standards.

3.6.3.2.1 Operational Checklist

The following can be used as an operational checklist during prescribed fire implementation:

- The autumn prior to the upcoming prescribed fire season, 60 CES/CEIE will brief the Environment, Safety, and Occupational Health Council (ESOHC) and the 60 MSG Commander Update Brief (CUB) of upcoming prescribed fire operations.
- Several days before the prescribed fire (timeframe will vary depending upon other activities), obtain approval for prescribed fire timing from Senior Leaders (60th Civil Engineer [60 CES/CC], along with 60th MSG Commander [60 MSG/CC] or 60th Deputy MSG Commander [60 MSG/CD]) via phone or e-mail.
- At least 30 days prior to the planned prescribed fire, the RXB# will ensure all local, state, and smoke management permits are in place and current (including Yolo-Solano Air Quality Management District), and that adjacent landowners with living quarters within 1 mile of a prescribed fire are aware a prescribed fire is being planned.
- At least 2 weeks prior to the planned prescribed fire, the RXB# will notify staff assigned to the project to ensure adequate planning of work and leave schedules. The RXB# will also ensure that the NRM has identified sensitive natural resource concerns to be monitored during the prescribed fire and conducted pre-fire assessments if necessary.
- At least 1 week before the prescribed fire, all engines, tools, supplies, etc., will be checked and coordination with 60 CES Operations Flight Horizontal will be made for needed heavy equipment.
- At least 5-7 days prior to the planned prescribed fire, notifications will be made via e-mail by the RXB#. The WFPC will confirm that these contacts have been made according to the PFP notification list.
- At least 2 days (48 hours) prior to the planned prescribed fire, adjacent landowners with living quarters within 1 mile of a prescribed fire will be notified of the planned prescribed fire date.
- 2 days before the prescribed fire (or on the previous Friday for a Monday or Tuesday ignition), notify the following by e-mail:
    - FES.
    - 60 CES/CC.
    - 60th Deputy Civil Engineer (60 CES/CD).
    - 60 CES-CEIE.
    - 60 AMW Safety (60 AMW/SE).
    - 60 MSG/CC.
    - 60 MSG/CD.

        - 60 AMW Vice Commander (60 AMW/CV).
        - Airfield Management.
        - Wing Scheduling.
        - 60 OSS.
        - 60 SFS.
        - Yolo-Solano Air Quality Management District
    - The day prior to the planned prescribed fire, RXB#s will report to the WFPC.
    - On the morning of the planned prescribed fire:
        - Obtain acreage burning allocation from Yolo-Solano Air Quality Management District
        - Obtain weather information from sources such as the National Weather Service (NWS) Fire Weather webpage.
        - Prescribed fire notifications will be made by the RXB#. At a minimum, the following will be notified:
            - FES.
            - NRM.
            - 60 CES Operations Flight Horizontal.
            - Command Post.
            - Control Tower.
            - 60 AMW/SE.
            - 60 OSS.
            - Airfield Management.
            - CAL FIRE.
            - 60 CES/CEIE.
            - Senior Leaders (60 CES/CC, 60 MSG/CC, 60 MSG/CD).
            - Local FDs.
            - Any other entities as specified in the approved PFP.
        - Media notifications will be completed as designated in the PFP.
        - Warning signs and/or road guards will be used to advise motorists of a prescribed fire in progress, especially if smoke could reduce visibility.
        - AF roads adjacent to prescribed fire units will be closed temporarily, as needed.
        - All resources on the prescribed fire will receive a complete operational briefing.
        - Designate a safety officer.
        - Prescribed fires will not be ignited until all contingency resources are confirmed as being in the required status specified in the PFP.
        - Test fires will be used to assess holding capability and smoke dispersal. Weather forecasts for the day of the prescribed fire and the next 2 forecast periods will be obtained.
    - After the prescribed fire is complete:
        - Senior Leaders (60 CES/CC, 60 MSG/CC, 60 MSG/CD), FES FC, Deputy FES FC, CAL FIRE, and local FDs will be notified.
        - The prescribed fire will be mopped up and confirmed controlled by the RXB#.

- For each day on which burning occurs, report the total acreage and tonnage of vegetation actually burned to the air district by telephone no later than 1200 local time the following day.
- Within 30 calendar days following completion of the burn project, provide a written post-burn evaluation to the air district that addresses whether the project objectives were met and describes actual smoke behavior.

Prior to ignition of a prescribed fire, the RXB# must determine if the current and forecasted weather parameters meet the prescription criteria as stated in the PFP. Additional factors include such smoke management parameters as mixing height, transport wind speed, and ventilation rate.

3.6.3.2.2 Prescribed Fire Public Notification

When planning for prescribed fires, an approved notification list will be developed prior to ignition of the fire and residences in the smoke impact area will be notified in advance by phone or other media sources. Use the elements in the PFP to help determine who will be notified.

Example 1: Prescribed fire planned adjacent to or visible from highway. Prescribed fire leadership will contact Sheriff's Office or Department of Transportation to keep them informed of operations.

Example 2: Prescribed fire planned in view of residential homes. Prescribed fire leadership will use neighborhood kiosks with prescribed fire information, contact information and a Quick Response (QR) code to link to electronic media to inform residents in a more up to date manner.

There will be information periodically given about the prescribed fire program to local media. 60 AMW/PA will handle PIO responsibilities. The NRM will work with 60 AMW/PA to ensure these contacts are made. Notification will be given to all internal and external stakeholders who may be impacted by prescribed fire operations. Required notifications are a required component of a PFP.

Prescribed fire notifications are done on the day of the prescribed fire by the RXB# or FES Dispatch (ECC) and are done via email 5-7 days before a planned prescribed fire. The WFPC will confirm that these contacts have been made according to the PFP notification list. Adjacent landowners with living quarters within 1 mile of a prescribed fire will be notified of plans to burn at least 30 days prior to the opening of the prescribed fire window and again at least 48 hours ahead of the scheduled prescribed fire once a date is selected.

3.6.3.2.3 Multiple Concurrent Prescribed Fire Projects

If multiple non-adjacent prescribed fires are being conducted on TAFB grounds at the same time, prescribed fire resources committed to 1 prescribed fire cannot be considered a contingency resource for any other prescribed fire. They can; however, be released at the discretion of the RXB# of the unit assigned to assist other prescribed fires, if needed.

3.6.3.2.4 Smoke Management

Smoke management on TAFB and its GSUs will follow recommendations of the latest edition of the NWCG PMS 420-2 and the California smoke management regulations found in 17 California CR, Subch. 2. Individual PFPs will specify conditions required for burning that will minimize impacts to air quality from prescribed fire, including compliance with the requirements of state and local air quality regulatory agencies.

Smoke Management Guidelines for Prescribed Fire:

- TAFB will adhere to smoke management regulations set forth by the SAPCB. NRM will obtain and use weather and smoke management forecasts issued as part of fire weather forecasts. Particular attention will be paid to the ventilation rate, or the combination of mixing height and transport wind speed. Smoke impacts will be modeled in the PFP using a modeling software such as VSMOKE or HYSPLIT, or by requesting that HYSPLIT is run as part of a spot weather forecast.
- Caution will be used when burning near or upwind of smoke sensitive areas (SSAs) and permitted when wind will carry smoke into the upper atmosphere away from public roads, airports, and populated areas. Specific SSA on TAFB include, but are not limited to, the airfield, main travel routes, and buildings such as the medical facility, schools, and the family housing area.
- No burning will be permitted if an SSA is within ½ mile downwind of the proposed prescribed fire and under atmospheric conditions where smoke impacts cannot be mitigated to avoid impacting the area. Poor smoke dispersal is most likely to occur during persistent atmospheric inversions and low winds. Smoke will typically be heaviest when high concentrations of fuels burn.
- Because smoke flows downhill and tends to pool in stream drainages and other low-lying areas at night, nighttime burning will be avoided if possible.
- Smoke planning will incorporate the following:
    - Plot the direction of the smoke plume.
    - Identify SSAs.
    - Determine fuel type(s) which influences smoke intensity and duration.
    - Minimize smoke by burning during the middle of the day when possible, in small blocks when needed, and mopping up along roads early.
    - Have an emergency plan. Be prepared to extinguish a prescribed fire if it is not burning according to the plan or if weather conditions change.

The following techniques can be used to reduce the emissions:

- Reduce the area burned by:
    - Isolating fuels. Large logs, snags, deep pockets of duff, sawdust piles, squirrel middens, or other fuel concentrations that have the potential to smolder for long periods of time can be isolated from burning. This can be accomplished by several techniques including:
        - Constructing fireline around the fuels of concern.
        - Not lighting individual or concentrated fuels.
        - Using natural barriers.

        - Scattering the fuels.
        - Spraying with foam or other fire-retardant material. Preventing these fuels from burning is often faster, safer, and less costly than mop up, and allows targeted fuels to remain following the prescribed fire.
    - Mosaic burning. Landscapes often contain a variety of fuel types that are noncontinuous and vary in fuel moisture content. Prescribed fire prescriptions and lighting patterns can be assigned to use this fuel and fuel moisture non-homogeneity to mimic a natural wildfire and create patches of burned and non-burned areas or burn only selected fuels. Areas or fuels that do not burn do not contribute to emissions.
- Reduce fuel load by:
    - Mechanical removal such as chipping the area to slow the fire in certain areas.
    - Mechanical processing.

3.6.3.3 Prescribed Fire Conversion to Wildfire and Required Reviews

A prescribed fire, or a portion or segment of a prescribed fire, must be declared a wildfire by those identified in the plan with the authority to do so, when either or both of the following criteria are met:

- Prescription parameters are exceeded and holding and contingency actions cannot secure the fire by the end of the next burning period.
- The fire has spread outside the project area or is likely to do so, and the associated contingency actions have failed or are likely to fail and the fire cannot be contained by the end of the next burning period.

All prescribed fires converted to a wildfire will have a Declared Wildfire Review (DWR) in accordance with PMS 484. Immediate notification to dispatch and NR, as well as to AFCEC/CZOF, is required when a prescribed fire is converted to a wildfire. After the incident is over, the process will focus on the "what" and not the "who" of what led to the conversion in the form of an After-Action Review (AAR). The following are the minimum requirements that must be addressed in the prescribed fire unit PFP regarding conversion to wildfire:

- Wildfire declaration (by whom).
- IC assignment: If a wildfire is declared, the RXB# or appropriate level FES IC will be the IC. An ICT4 or ICT5 will be identified prior to ignitions.
- Notifications: RXB# or IC will:
    - Notify Dispatch as soon as the prescribed fire is converted to a wildfire.
    - Notify all personnel on the fireline of the conversion and identify the IC.
    - Remove any firefighters not red carded at the arduous fitness level.
    - Give timely updates to Dispatch.
- Extended attack actions and opportunities to aid in wildfire:
    - Individuals working on the converted prescribed fire will only do so at their qualified level as determined by the Incident Qualifications and Certification System (IQCS).

IC will initiate immediate recall of off-duty firefighters and mutual aid when it becomes apparent that TAFB resources are inadequate to control any escaped prescribed fire.

3.6.4 Non-Fire Fuels Treatments

All fuels treatment activities must be done with the approval of the NRM to ensure the most efficient use of resources, non-duplication of tasks, project goal tracking, prevention of the spread of noxious plants, limited disturbance of sensitive areas, proper use of pesticides, and to prevent accidental ignitions. Planned mechanical fuels treatments will primarily include maintenance of all mineral and non-mineral firebreaks and annual vegetation maintenance extending out at least 30 feet from values to protect, using the priorities outlined in Section 3.5.2.3.

3.6.4.1 Fuels Treatment Regulatory Compliance

When conducting non-fire fuels treatments, the installation must identify and adhere to all federal, state, or local laws applicable on installation lands regarding the environmental impact of the planned action. All federal actions not previously covered under a CATEX must undergo NEPA analysis. Where actions may affect cultural resources, CRM must be consulted to ensure proper coordination with OHP and to determine if the action is consistent with the ICRMP. If T&E species or their habitat may be affected, as determined by the NRM, the NRM will need to consult with the USFWS, under Section 7 of the ESA. If the action is taking place in a wetland or riparian area, the NRM and Travis Water Quality Program Manager will be consulted to ensure any applicable permits are obtained from the USACE. All permitting will be routed through Environmental Element (60 CES/CEIEC) for review, approval, and signature. The WSM and WFPC shall have no contact with environmental regulators. Proponents of the action or WSMs shall prepare all appropriate documentation.

3.6.4.2 Areas Scheduled for Mechanical or Chemical Fuels Treatments

See Section 3.5.2.3 for planned non-fire fuels treatments.

3.6.5 Prescribed Fire Monitoring Protocol

On a prescribed fire, the RXB# must adhere to the parameters set forth in the PFP. The RXB# must regularly check and record weather conditions to determine if the prescribed fire is in prescription. Prior to ignition, the RXB# must request a Spot Weather Forecast through the NWS Fire Weather webpage. These tasks can be delegated to anyone at the Firefighter Type 1 (FFT1) level and above.

On non-fire fuels treatments, the project manager will make sure that work is done in compliance with the guidelines set forth by the NRM and that project work goals are met or setbacks are documented to improve future project safety and efficiency. The Travis EQ-funded Conservation project titled "POST FIRE REHAB" will provide pre- and post-fire vegetation and wildlife monitoring and reporting to determine whether natural resources goals and objectives were met. Work can also be done by qualified WSM staff in coordination with the NRM and AFCEC/CZOW Travis ISS.

3.7 Fuels Treatment Reporting Requirements

3.7.1 Prescribed Fire Reporting

In accordance with AFI 32-7064, installations conducting prescribed fire will report their activities to the AFCEC/CZOF. Tier 1 installation prescribed fire activities will be coordinated, conducted, and reported through the assigned WSMs. TAFB is a Tier 1 installation.

WSMs will write and submit the prescribed fire reports to the WFPC and NRM for review and approval. The WSM shall then submit the prescribed fire report to AFCEC/CZOF for inclusion in the AF Wildland Fire Database within 10 days of treatment completion. The prescribed fire report will include:

- Installation/range.
- Treatment date.
- Acres treated.
- Start time.
- Control time.
- Fire zone/prescribed fire unit.
- Anderson fuel model.
- Prescribed fire objective.
- All equipment used on the treatment and the assigned organization.
- All personnel used on the treatment and their assigned organization.
- NWCG positions personnel held on the treatment.
- GIS data showing treatment boundaries.
- GIS data for any fire containment activities (firelines, dozer lines, etc.).
- Prescribed fire results/success based upon the objective.
- Lessons learned.
- Future recommendations.
- Follow-up actions needed.

For instructions on reporting, contact AFCEC.CZOF.FIRECENTER@US.AF.MIL.

3.7.2 Mechanical Treatment Reporting

Mechanical treatments supported by the WSMs will be reported to AFCEC/CZOF. WSMs will submit the mechanical treatment report to the WFPC and NRM for review and approval. The mechanical treatment report will include:

- Installation/range.
- Treatment date.
- Acres and miles treated.
- Treatment type.
- Treatment objective.
- Start time.
- End time.
- Location of treatment.
- All equipment used on the treatment and the assigned organization.
- All personnel used on the treatment and their assigned organization.
- GIS data showing treatment boundaries.

- Treatment results/success based upon the objective.
- Lessons learned.
- Future recommendations.
- Follow-up actions needed.

For instructions on reporting, contact AFCEC.CZOF.FIRECENTER@US.AF.MIL.

3.8 Fuels Funding Processes

Fuels funding will follow guidelines found in Chapter 13, Section 7 of AFI 32-7064. The WFPC and NRM along with the WSM Lead will work with AFCEC/CZOF to determine fuels requirements and assist in forecasting funding needed to meet those requirements. Identification of the funding requirements to train and equip wildland fire management personnel ensures safe, effective, and cost-efficient operations in support of the WFMP. The WSM Lead, Assistant Fire Management Officer (AFMO), AFCEC/CZOW Travis ISS and AFCEC/CZOF will identify the appropriate sources of funding for wildland fire activities.

Wildland fire management activities that are conducted for the purpose of compliance with environmental laws and regulations will be supported by conservation funds. Wildfire suppression, prescribed fire, and other wildland fire management activities to support training, range use, munitions testing and evaluation, or other mission activity will be supported by the responsible activity through direct funding or reimbursement. Funding for wildfire prevention and fuels management for hazard reduction is an installation O&M responsibility. The WSM is funded by EQ O&M Conservation dollars under the authority of the Sikes Act and ESA thus activities prioritized to meet hazard reduction shall be funded by the Installation or alternative source.

3.9 Debris Burning

Planned fuels treatments could result in a substantial amount of debris. It is critical for this debris to either be removed using prescribed fire or other methods. By not removing the debris, suppression efforts will be hindered due to the amount of fuel available for consumption by a wildfire. While debris burning has not been extensively used on TAFB, future debris burning is possible and is approved if burning is done in accordance to the AF PFP template (see Appendix 3.1 or the AFCEC/CZOF) at a minimum. Debris burning is occasionally done on CLGC. All applicable state regulations for debris burning will be followed.

3.10 Fire and Fuel Break System and Maintenance Plan

Firebreaks provide strategic locations for indirect attack of wildfires on TAFB, which in turn greatly reduces the need for direct attack with heavy ground-disturbing equipment which can result in significant resource damage. In general, direct attack will be used only when necessary. New firebreaks follow previous disturbance where possible to minimize resource damage.

Recommended mechanical fuels treatments primarily involve the maintenance of all mineral firebreaks and the routine mowing of all non-mineral firebreaks. Proposed disked firebreaks are depicted in Figure 3.7. All new firebreaks will follow previous disturbance where possible to minimize resource damage. Mineral firebreaks will be at least 8-12 feet wide and not exceed 20-30 feet wide (2 disk passes). They will also be harrowed smooth to allow for mowing in the future. Firebreaks near wetlands will be mowed rather than disked in order to protect sensitive habitats. Firebreaks will be maintained by 60 CES

Operations Flight Horizontal. In addition, vegetation will be maintained annually in a zone extending out at least 30 feet from values to protect will occur. A guide to vegetation clearance standards around structures can be found in the Firewise Ember Threat and the Home Ignition Zone webpage.

3.11 Asset and Infrastructure Protection Plan

No known asset or infrastructure protection plan exists currently for the installation. A stand-alone plan is recommended to be composed during future WFMP revision processes. For any asset protection plan, firefighter and public safety is the first priority. There is no standardized template for such a plan but several helpful resources are available on the Forests and Rangelands CWPP webpage, including *Preparing a Community Wildfire Protection Plan: A Handbook for Wildland-Urban Interface Communities*, March 2004 and *Community Guide to Preparing and Implementing a Community Wildfire Protection Plan*, August 2008. The WFPC will lead the development of this plan. The following steps are recommended for plan preparation:

- Convene decisionmakers.
- Involve agencies under current Memorandums of Understanding (MOUs)/MAAs and the USFS.
- Engage interested parties.
- Establish an installation base map.
- Develop a risk assessment.
- Establish installation hazard reduction priorities and recommendations to reduce structural ignitability.
- Develop an action plan and assessment strategy.
- Finalize the asset and infrastructure protection plan.

It is recommended that, at a minimum, facilities adopt vegetation clearance standards found on the Firewise Ember Threat and the Home Ignition Zone webpage.

Chapter 4. Wildland Fire Operational Guidance

4.1 Management of Wildfires (Unplanned Ignitions)

Any wildfire reported on base will be reported to the ECC Center. The WFPC or his designee will be notified as soon as practical. FES will conduct initial response of all wildfires. FES will continue to attack any fires until they are contained if within NWCG qualifications. If at any point, FES can no longer actively contain the fire, the ECC Center would be contacted by the on-scene IC. At this point, the WFPC would become the installation liaison to the incoming IC to ensure that the installation mission is thoroughly considered in all efforts and actions to contain the fire.

Beale AFB will soon host a WSM. The nearest WSM is currently located at Vandenberg Air Force Base (VAFB) near Lompoc, California. The WSM will provide a high-quality resource to assist with wildland fire management on TAFB. The WSM will provide wildland fire management support activities such as fuels treatment planning, conducting training for NR and FES personnel, and implementing prescribed fire on BAFB and on TDY status to other AF installations in California. To potentially order the WSM, contact the WSM Lead, whose contact information can be found in Appendix 1.3. The WSM is available for wildfire suppression only at the request of installation FES and if available.

The overarching fire management guidance from the INRMP calls for wildfires to be contained within wildlands so that they do not become a threat to human safety, and to be allowed to burn when appropriate for ecological objectives when such actions do not endanger human safety, infrastructure, or sensitive resources. Suppression response will be swift and appropriately sized based upon the IC's size-up and resource needs to contain such new ignitions within 1 operational period. The primary objective of initial attack and extended attack operations will be firefighter and public safety over all other considerations. Protection of cultural and biological resources will be prioritized, but protection of those resources will be secondary to the primary objective. Strategies and tactics used will be at the discretion of the IC to achieve the suppression objectives with the following considerations as guidance:

- If possible, consult the CRM and NRM or their representative Resource Advisor (READ) prior to the usage of heavy equipment in firefighting operations. Inform the CRM of cultural sites discovered during wildland fire operations.
- Use MIST to the greatest extent possible in sensitive cultural areas and in or near wetlands.
- Retardant will not be used within 300 feet of any drainage, wetland, vernal pool, or other water source. The only exception to this rule will be for the protection of life or safety (public and firefighter).
- Repair ground disturbed by suppression activities to pre-incident condition.
- Natural recovery is the preferred choice for recovery following wildfires. However, when natural recovery is not likely, ES treatments may be needed to prevent further degradation of cultural and natural resources in the burned area. Any seeding or planting will use seeds and plant materials from native sources whenever feasible.

If a wildfire exceeds the capacity of the installation personnel to contain, then assistance will be requested from surrounding FDs with current MAAs as well as CAL FIRE. If an incident transitions into extended attack despite these local mutual aid resources' assistance, AFCEC/CZOF and the Northern California Geographic Area Coordination Center (ONCC) will be notified immediately.

4.1.1 Preparedness

Preparedness is defined as activities that lead to a safe, efficient, and cost-effective fire management program in support of land and resource management objectives through appropriate planning and coordination prior to wildfire ignitions. This includes actions which are completed on a routine basis prior to each fire season as well as actions conducted in response to increasing fire danger. Preparedness activities will need to be scaled to available funding each year and will prioritize the goals and objectives of the INRMP. Some examples of preparedness are:

- Pre-season wildfire planning with state and local coordinators.
- WUI assessments on-installation and with adjacent landowners.
- Tactical and initial response planning.

There is currently no formal stand-alone wildfire preparedness plan in place at the installation. TAFB does, however, hold meetings with local stakeholders, publishes information in the newspaper offering fire prevention tips, and hosts an in-house 3-day wildland fire academy covering various topics. The following is a list of preparedness efforts suggested for FES and NRM to undertake with TAFB cooperators to improve wildfire preparedness:

- Obtain NWCG training and complete necessary Position Task Books (PTBs) for all FES and/or NR personnel assigned to wildfires or participating on prescribed fires, commensurate with the position being held on the incident/project.
- Maintain NWCG compliant equipment, typed appropriately and stocked to Normal Unit Stocking (NUS; also referred to as National Unit Stocking or Normal Unit Strength; see Appendix M of the NFES 2724, *Interagency Standards for Fire and Aviation Operations*, January 2018 [Red Book]) levels, for on-installation initial attack suppression assignments as well as off-installation extended attack details.
- Conduct daily equipment checks during fire season to ensure readiness.
- Conduct an annual wildfire readiness review utilizing interagency standards.
- Conduct WUI assessments on-installation and with adjacent landowners.
- Conduct annual interagency cooperator meetings with all wildland fire stakeholders to increase collaboration and thereby safety and efficiency of efforts.
- Conduct annual initial/extended attack wildfire drills with local interagency cooperators, to be coordinated by the WFPC and hosted by FES.

Fire weather conditions are monitored through the ONCC Predictive Services Weather webpage.

4.1.1.1 Training and Qualifications

Standards for fire job position certification, required training and experience, physical fitness testing, and medical examinations will follow the guidelines of the NFES 2724, *Interagency Standards for Fire and Aviation Operations*, January 2018 (Red Book), the PMS 310-1, *Federal Wildland Fire Qualifications Supplement*, January 2018 (PMS 310-1 Supplement), and additional guidance from AFCEC/CZOF. The PMS 310-1 and the PMS 310-1 Supplement, developed under the sponsorship of the NWCG, is designed to:

- Establish minimum requirements for training, experience, physical fitness level, and currency standards for wildland fire positions, which all participating agencies have agreed to meet for national mobilization. Standards may be augmented to meet specific needs

within an agency, but the augmentation may not be imposed by an agency on its cooperators who meet the minimums outlined in this guide.

- Allow cooperating agencies to jointly agree upon training, experience, physical fitness level, and currency standards to meet fire management needs for wildland fire.
- Establish minimum qualifications for personnel involved in prescribed fires on which resources of more than 1 agency are utilized. Any organization or agency providing resources to fill a national interagency request for all types of wildland fire incidents will meet the minimum NWCG requirements described in this guide. NWCG recognizes the ability of cooperating agencies at the local level to jointly define and accept each other's qualifications for initial attack, extended attack, large fire operations, and prescribed fire.

IQCS is the official wildland fire system of record used by the federal government. It uses the positions performance standards, and their respective qualifications and certification requirements, directly from the PMS 310-1 and the PMS 310-1 Supplement. IQCS is used to track personnel information related to an individual's qualifications, certification currency, and history. It can be exported to the Resource Ordering and Status System (ROSS).

4.1.1.1.1 Training and Qualifications Responsibilities

AFCEC/CZOF is responsible for certifying, issuing, maintaining, and tracking the NWCG certifications and qualifications for AF personnel, to include contractors and volunteers where appropriate. AF personnel whose Job Series is in the 0400 Natural Resources Management and Biological Sciences, or 0300 General Administrative, Clerical, and Office Service Occupational Groups that support wildland fire operations, as well as contractors and volunteers that assist them, must meet the training and qualification standards specified in the PMS 310-1 and the PMS 310-1 Supplement. The following are responsibilities as they relate to training and qualifications:

- WFPC:
  - Providing AFCEC/CZOF with documentation of all wildland fire training, completed PTBs, and Work Capacity Tests (WCTs).
  - Coordinating with the AFCEC/CZOF Training Manager for all matters regarding training and qualifications.
- Commanders, Directors, Supervisors, and Leaders:
  - Ensuring individuals assigned to Incident Command System (ICS) positions are qualified.
  - Ensuring individuals are available for scheduled training.
  - Notifying the WFPC when qualification of personnel expires.
- IC:
  - Managing a training and qualification program on the incident, should one be used.
  - Considering the qualifications of outside FDs or cooperating responders for duties at the incident.
  - Ensuring qualified/certified personnel are assigned fire duties.
  - Ensuring that when personnel are assigned in a trainee position, they are directly supervised by someone who is fully qualified.
- Individual Firefighters:
  - Showing proof of qualifications and completing training.

- Informing their supervisor when qualification requirements have expired.

A complete work chart breakdown for all NWCG positions can be found in the PMS 308, *NIMS Wildland Fire Qualification System Flow Chart*, October 2015. Standards for fire job position training and experience, annual refresher training, physical fitness testing, and medical examinations will follow the guidelines of the NFES 2724, *Interagency Standards for Fire and Aviation Operations*, January 2018 (Red Book), AFCEC/CZOF, and the installation (for AF-specific positions).

All military, civilian, contractor, and emergency services personnel involved in wildland fire management must possess certifications appropriate for their expected level of involvement in the wildland fire organization. All AF personnel must meet applicable NWCG standards for wildland fire activities. Additionally, AF personnel who participate in wildland fire activities will be certified, as a minimum requirement, in Cardio-Pulmonary Resuscitation (CPR) and Standard First Aid by the American Red Cross or comparable certification authority. All personnel operating ATVs or UTVs on the fireline are required to obtain ATV/UTV safety certification from the ATV Safety Institute (ASI) or an equivalent certifying agency. ATV operator certification is valid for 5 years, though biennial refresher training is recommended. Any instructor utilized must be NWCG qualified and must adhere to the standards stated in PMS 901-1, *Field Manager's Course Guide*, November 2017.

All personnel that are assigned to a wildfire beyond the initial response or participating on a prescribed fire are required to successfully complete as a minimum IS-100.b – Introduction to the Incident Command System, IS-700.A – NIMS An Introduction, S-130 – Firefighter Training, S-190 – Introduction to Wildland Fire Behavior, and L-180 – Human Factors in the Wildland Fire Service in addition to the WCT at the appropriate level for the fireline position. This can be completed entirely online, except for the instructor-led 1-day field exercise. Onsite firefighters will be physically capable of firefighting and know how to operate the necessary equipment. FES firefighters have taken the majority of these courses already.

All assigned TAFB FES personnel, whether on wildfires or prescribed fires, must meet NWCG training standards. Individuals will not be assigned to duties for which they are not adequately trained or certified, unless they are assigned as a trainee under the direct supervision of a qualified person. The PMS 310-1 and PMS 310-1 Supplement will be used for standard training requirements for wildfire and prescribed fire positions.

4.1.1.1.2 Fitness Standards

Unless not agreed to under their unionized position description, personnel assigned to wildland fire duties are required to meet fitness standards in the PMS 310-1 and PMS 310-1 Supplement specified for the ICS position to which they are assigned. Both FES personnel and NR employees are required to annually complete both the RT-130 – Annual Fireline Safety Refresher Training (8 hours) and the WCT, in accordance with the PMS 307/NFES 1109, *Work Capacity Test Administrator's Guide*, April 2003, appropriate to their qualifications. Personnel not possessing the level of NWCG qualification pertinent to

the position they are fulfilling on a wildfire incident or prescribed fire project, shall not be allowed onto the fireline.

To ensure compliance with the PMS 310-1 and Section 7.5 of the AFCEC/CZOF Playbook, meeting the above fitness standards should be incorporated into the position descriptions of all unionized FES personnel who may be assigned to wildland fire duties outside the WUI.

4.1.1.1.2.1 Fitness Categories

The following are descriptions of the level of work capacity for the 4 fitness categories:

- ***Arduous:*** Duties involve fieldwork requiring physical performance, over an extended period, calling for above-average endurance and superior conditioning. These duties may include a demand for extraordinarily strenuous activities in emergencies under adverse environmental conditions and over extended periods of time. Requirements include running, walking, climbing, jumping, twisting, bending, and lifting more than 50 pounds. The pace of work typically is set by the emergency.
- ***Moderate:*** Duties involve field work requiring complete control of all physical faculties and may include considerable walking over irregular ground, standing for long periods of time, lifting 25 to 50 pounds, climbing, bending, stooping, squatting, twisting, and reaching. Occasional demands may be required for moderately strenuous activities in emergencies over long periods of time. Individuals usually set their own work pace.
- ***Light:*** Duties mainly involve office type work with occasional field activity characterized by light physical exertion. Activities may include climbing stairs, standing, operating a vehicle, and long hours of work, as well as some bending, stooping, or light lifting. Individuals almost always can govern the extent and pace of their physical activity.
- ***None:*** Duties are normally performed in a controlled environment, such as an incident base or camp.

4.1.1.1.2.2 Fitness Testing

The WCT is used to determine whether individuals are fit enough to perform wildland firefighting duties. The individual carries a backpack a prescribed level distance within a prescribed time:

- ***Arduous:*** Individual must walk 3 miles in 45 minutes or less carrying a 45-pound backpack. This is often referred to as the "pack test".
- ***Moderate:*** Individual must walk 2 miles in 30 minutes or less carrying a 25-pound backpack. This is often referred to as the "field test".
- ***Light:*** Individual must hike 1 mile in 16 minutes with no pack. This is often referred to as the "walk test".

No time adjustment for elevation is given at TAFB.

Personnel whose job descriptions state they are primary wildland firefighters are required to meet the Arduous fitness criteria annually. AF personnel, contractors, and volunteers that serve as collateral duty wildland fire personnel must meet the appropriate fitness level for the position they are performing in accordance with standards in the PMS 310-1 and the PMS 310-1 Supplement.

AF personnel whose job description requires participation in wildland fire management activities as a primary or secondary firefighter on AF installations must meet the pre-employment medical and physical examination criteria contained in the most recent version of National Fire Protection Association (NFPA) 1582, *Standard on Comprehensive Occupational Medical Program for Fire Departments*.

4.1.1.1.3 Training Method

The following describes the training method:

- The Wildland Firefighter Qualification Program is an "educational-based" and "performance-based" qualifications program that aligns with the NWCG qualification system.
- The educational base of the program uses the completion of approved training courses with a passing score on an examination.
- The performance base of the program uses hands on evaluation under realistic conditions to ensure potential performance under live field conditions and is recorded in an individual's PTB.
- Qualification is based upon completion of NWCG formal classroom instruction followed by demonstrating the abilities to perform the position in the completion of an NWCG PTB.

4.1.1.1.4 Training Components

The following describes the training components:

- ***Courses of Instruction:*** Courses of instruction have been developed by the NWCG and Federal Emergency Management Agency (FEMA) for each position in the ICS in accordance with NIMS. These courses have been designed to teach the basic information required to gain a general understanding of the position and provide technical knowledge required to perform duties required by the job. These courses are like college courses in that they start out at a basic level (100-level basic firefighter skills) and work up through higher levels of the ICS (up to 500-level national ICS skills). Courses are to be taught by trained and qualified instructors, experienced in the skill being taught. In all cases, only qualified and trained instructors shall be used. Instructor requirements for each course can be found in PMS-901-1. TAFB may provide its own instructors for basic level (100- and 200-level) if qualified and approved by the AFCEC/CZOF Training Manager, but may bring in qualified personnel from other state or federal agencies to teach at higher levels. TAFB personnel meeting NWCG requirements for teaching higher level courses are permitted to do so.
- ***PTBs:*** PTBs are used to document performance demonstrations. PTBs are NWCG published booklets that apply to a specific position in the ICS. PTBs can be found on the NWCG PTB webpage. A PTB contains all critical tasks that are required to perform a given job. Wildland fire managers and supervisors will use these booklets to keep track of an individual's training experience. There will be a PTB for most positions included in the program. The tasks in each PTB have been established by the NWCG. PTBs have been designed in a format that allows documentation of a trainee's ability to perform each task. Tasks pertaining to tactical decision making and safety are flagged and require a position performance on a wildfire. Remaining tasks can be evaluated through other means such as simulation or other emergency and non-emergency work. Successful completion of all

tasks required of the position will be the basis for recommending certification for a specific position in the ICS. AFCEC/CZOF is the only AF organization that can agency certify an AF PTB.

4.1.1.1.5 Initial Certification

The following describes the initial certification:

- Certification of a qualification for ICS positions will be documented and tracked by the AFCEC/CZOF Training Manager. Upon completion of each training course, the WFPC will provide documentation to AFCEC/CZOF identifying personnel that successfully completed the training, and their organization. The AFCEC/CZOF Training Manager is responsible for maintaining all records and will provide the WFPC a list of all qualified personnel upon request. Additionally, the AFCEC/CZOF Training Manager will enter this documentation into IQCS and issue Incident Qualification Cards (red cards) as appropriate to identify to outside agencies that the individual is qualified to perform in a specified position.
- The quality of experiences gained in each position will be closely evaluated when making a recommendation for advancement to the next higher position or to a different position. The quality of experience may relate to the number of assignments in which an individual performed, the size of the incident, and the complexity of operations overseen.
- This program will not determine the number of times an individual should serve as a trainee or how many times a given position should be filled before advancement. Determination will be made by the supervisor or final PTB evaluator based upon task evaluations, position performance evaluations, and their own judgment on the quality of an individual's experience. Supervisors will submit recommendations for advancement or change in positions to the WFPC who will then furnish the documentation/information to AFCEC/CZOF Training Manager.
- Personnel will not be assigned any wildland fire duties without proper certification. Personnel that are fully qualified in a position may be assigned the next level position as a trainee provided they have an initiated PTB and are directly supervised by an individual that is fully qualified in the position being evaluated.

4.1.1.1.5.1 Training Courses

Any instructor utilized must be NWCG qualified and must adhere to the standards stated in PMS 901-1. The following describes the procedures for required training courses:

- Training certification requirements include completion of all NWCG-required training courses and the PTB. Use of the training courses is required to prepare the employee to perform in the position. An employee will not be given a position assignment unless they have completed all necessary training courses and applicable PTBs.
- Training courses provide the specific skills and knowledge required to perform expected duties. These are available in the PMS 310-1 and the PMS 310-1 Supplement.
- Required training has been held to the minimum required for safe operations on a wildfire. All training will be available and is intended as the primary means by which personnel can prepare for qualification.

4.1.1.1.5.2 NWCG Position Task Books

The following describes the procedures for PTBs:

- NWCG PTBs can be initiated/issued by the FES FC, WFPC, RFMO, or their designees for AF personnel that meet the appropriate prerequisites in accordance with the PMS 310-1 and the PMS 310-1 Supplement.
- AF minimum standards for certification of a PTB will be in accordance with the PMS 310-1 and the PMS 310-1 Supplement. Standards may be augmented to meet specific needs within an installation or WSM at the discretion of the FES FC, WFPC, RFMO, or their designees.
- Once the PTB and required training are completed and a recommendation for agency certification has been made by the final evaluator, 2 additional signatures will be required for agency certification. The PTB will be forwarded for review and verification of compliance to the FES FC, WFPC, or RFMO, (or their designee) for the second signature on the Agency Certification PTB page (see Appendix 4.1). The PTB will then be forwarded to the AFCEC/CZOF Training Manager for final signature/agency certification and updated in IQCS.

4.1.1.1.5.3 Incident Qualification Card (Red Card) Issuance

The following describes the procedures for issuing Incident Qualification Cards:

- The installation FES FC will submit a request to AFCEC/CZOF for FES personnel requiring an Incident Qualification Card (optional, not a core requirement). This request will state the specific requirement for obtaining an Incident Qualification Card and must be signed by the FES FC. FES personnel that meet NWCG standards as described in the appropriate qualification standards document may be issued Incident Qualification Cards on a case-by-case basis. All installation requests for Incident Qualification Cards must prioritize their personnel.
- For non-FES personnel, the request must come from the local installation WFPC as designated in the WFMP or the RFMO for WSMs (or their designee). All personnel must meet NWCG standards, including WCT requirements, as described in the appropriate qualification standards document and demonstrate a valid need for the qualification.

4.1.1.1.6 Currency Requirements

The following describes the currency requirements:

- For FES personnel requiring Incident Qualification Cards, the FES FC (or designee) will submit a completed AF IQCS Individual Responder Update Form to AFCEC/CZOF by the end of each month in which their personnel participated in wildland fire activity.
- For non-FES personnel, the AF IQCS Individual Responder Update Form will be submitted by the local installation WFPC as designated in the WFMP or the RFMO for WSMs.
- Unless otherwise noted, the maximum time allowed for maintaining currency is 5 years for all positions. There are exemptions from this rule for dispatch, aviation, and Faller (FAL#) positions, which have a 3-year currency limit.
- Currency requirements for positions may be met by performing the position or may be met by performing any higher position or any specified lower position as identified in the PMS 310-1 and the PMS 310-1 Supplement. This type of position experience will be considered

as qualifying only if the individual has previously met all training and prerequisite experience requirements for the position. Serving in a position for which the individual is qualified will maintain the currency of a prerequisite position, if the individual was previously qualified in that position.

- Annual refresher training is required to maintain currency and must cover 4 core topics as a minimum: Entrapment Avoidance, Current Issues, Other Hazards and Safety Issues, and Fire Shelter.
- Recertification includes evaluation of personnel for certification in cases where position qualifications have been lost because of a lack of current experience. A key component in the certification or recertification process is the subjective evaluation by management of an individual's capability to perform in a position. Managers can request recertification of prior qualified personnel by submitting a memo to AFCEC/CZOF Training Manager stating the reasons for recertification and any mitigating issues that can show the individual has either maintained or re-learned skills necessary to accomplish the job. AFCEC/CZOF Training Manager may design a specific individual refresher course prior to recertification.

4.1.1.1.7 NWCG Qualification and Equipment Requirements Specific to Installation

Currently, no TAFB FES personnel hold NWCG qualifications. Future qualifications can be tracked using Table 4.1.

Table 4.1: Current TAFB NWCG Qualifications

Personnel	FES or NRM	NWCG Qualification	Additional NWCG Qualification Needed

The majority of wildfire responses on TAFB are of low frequency, low complexity and short (single operational period) duration. However, the potential exists for large fires that could threaten values to protect due to the presence of flashy fuels. To adequately respond to this level of occurrence, TAFB FES or MAA cooperators will maintain, at a minimum, the following number and types of NWCG certifications on staff (Table 4.2). Prescribed fire qualifications will either be held by NR or WSM personnel (Table 4.3). Prescribed fire can and should be used extensively for training purposes for both installation personnel as well as local interagency partners in order to help build capacity.

Table 4.2: Minimum TAFB NWCG Qualification Requirements

NWCG Mnemonic	Wildfire Suppression Position Title	Number Needed per Shift
ICT4	Incident Commander Type 4	2
ICT5	Incident Commander Type 5	2
ENGB	Engine Boss, Single Resource	2
FFT1	Firefighter Type 1	3
FFT2	Firefighter Type 2	5
EMTB	Emergency Medical Technician, Basic	1
FAL2	Intermediate Faller	1
FAL3	Basic Faller	1
INVF	Wildland Fire Investigator*	1
Notes: Personnel may hold more than 1 qualification. *Only 1 total needed, rather than 1 per shift.		

Table 4.3: Minimum TAFB NWCG Prescribed Fire Qualification Requirements

NWCG Mnemonic	Prescribed Fire Position Title	Number Needed per Shift
RXB2	Prescribed Burn Boss Type 2	1
FIRB	Firing Boss, Single Resource	2
Notes: Personnel may hold more than 1 qualification.		

4.1.1.2 Readiness

Seasonal preparedness will include readiness reviews prior to the historic fire season for personnel and equipment using standard forms found on the NIFC Interagency Preparedness Review Checklists webpage. Additionally, an inventory of cache supplies will be conducted on an annual basis. The WFPC will prepare communication and medical plans and they will be reviewed annually. A current radio plan and frequency list is available through the 60th Communications Squadron Frequency Coordinator (60 CS/SCOT). A proposed readiness activities table can be found in Appendix 4.2.

A step-up plan must be developed by the WFPC utilizing an analysis of historic fire weather. This analysis must identify National Fire Danger Rating System (NFDRS) indices that will be used to determine daily fire danger. The step-up plan must identify staffing levels needed for each adjective level. A proposed step-up plan can be found in Appendix 4.3. The ONCC Predictive Services Outlooks webpage provides maps showing Southern Area fire danger, fuel dryness, weather observations, NFDRS indices, and forecasts. There is currently no dedicated wildland fire equipment at TAFB. It is expected that a Type 3 wildland engine will be acquired in FY2018.

In order to have a fully compliant and capable wildland fire suppression capability, it is recommended that the additional equipment be acquired by TAFB FES (Table 4.4).

Table 4.4: Recommended Additional TAFB FES Equipment

Quantity	Resource
2	Type 6 Wildland Engine

4.1.1.2.1 Personal Protective Equipment (PPE)

PPE is required for all personnel engaged in wildland fire operations on TAFB. PPE includes the equipment and clothing required to mitigate the risk of injury from or exposure to hazardous conditions encountered during the performance of duty. NWCG standard PPE for wildland firefighting includes the following per person:

- Protective outerwear, such as Nomex® shirt and fire pants.
- Fire resistant gloves.
- Wildland Fire boots:
  - 8-inch minimum boot height.
  - All leather uppers (no synthetic collars or panels).
  - Lace up (no zippers).
  - Defined heel.
  - Oil-resistant soles.
  - Rating of "Good" or "Better" on sole heat resistance.
  - Non-slip sole.
  - No steel toe.
- Hard hat.
- Eye protection.
- Hearing protection.
- Fire shelter ("new generation").
- Web gear.
- Food/hydration.
- IRPG.
- Chainsaw chaps (if applicable).
- Flat (bastard) files (if applicable).

All PPE must meet standards set forth in NFPA 1977, *Standard on Protective Clothing and Equipment for Wildland Fire Fighting*.

4.1.1.2.2 Water Resources

TAFB has multiple water sources available on the installation. Most developed areas are served by hydrants. It should be noted that hydrants in the abandoned housing area are no longer charged. Numerous surface water sources can be found across the installation, some of which can be used for drafting and some as dip sites.

Due to its deleterious effects on drinking water, Aqueous Film Forming Foam (AFFF) for firefighting containing Perfluorooctanesulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA) organic

compounds is being phased out for use by AFCEC. Due to the significant remediation actions required in areas of PFOA/PFOS contamination, use of firefighting foam will be avoided in areas where direct impact or runoff into drinking water sources will occur unless such use is determined necessary by the IC to protect public safety. Should any AFFF be released, a site inspection is required by AFCEC to sample groundwater, surface water, soil, and sediment for contamination. More information on PFOS/PFOA contamination from AFFF can be found in the *Air Force Response to PHOS/PFOA Fact Sheet*, November 2017.

4.1.1.3 Wildland Fire Aviation Management

Due to the aviation mission and the importance of aerial firefighting resources, there may be an inherent conflict between flight operations and wildland fire operations in the event of a wildfire. To ensure the safety of both aerial firefighting resources and military aircraft, if needed the IC will contact the ECC Center or the control tower to request all aviation missions in the fire area to be halted and attempt to end ongoing missions in the area as quickly and safely as possible to clear the airspace for firefighting resources. If an initial attack wildfire incident is adjacent to the installation boundary, then the appropriate fire dispatch center will contact the ECC Center. The ECC Center will then notify the FES FC or his designated Senior Fire Officer (SFO) and/or control tower. In the event of an extended attack wildfire on the installation requiring aviation resources, a Temporary Flight Restriction (TFR) shall be filed with the Federal Aviation Administration (FAA) through the control tower.

Any fire-related aviation operations will follow applicable guidelines of AFI 32-7064 and to the NFES 2724, *Interagency Standards for Fire and Aviation Operations*, January 2018 (Red Book), which establishes uniform safety, communications, and organizational standards for firefighting operations across organizations. In addition, the PMS 510, *Interagency Helicopter Operations Guide*, June 2016 (PMS 510) and the PMS 501, *Interagency Aerial Ignition Guide*, May 2015 (PMS 501) will be used as a general guide for aerial operations.

4.1.1.4 Wildfire Detection

Early detection of wildfires increases the effectiveness of initial attack response. Any agency, unit leader, or individual noticing a fire is responsible for reporting it to the ECC Center as soon as it is detected. Although fire occurrence is low, the number of visitors and terrain allow for relatively easy visual detection of fires by the public or AF personnel.

Weather conditions will be monitored during wildfires and prescribed fires. It is the responsibility of the IC on a wildfire, and the RXB# on a prescribed fire to see that weather conditions are monitored. Weather monitoring may be as simple as estimating wind speed and direction by ocular observation on a small wildfire, to taking regular detailed observations during a prescribed fire using a belt weather kit. Fire behavior expected under the measured weather conditions will be compared with actual behavior on postfire assessments.

According to an analysis of local fire weather and occurrence data from nearby Point Reyes National Seashore, California, conditions indicating possible adverse fire behavior during late-winter and spring include:

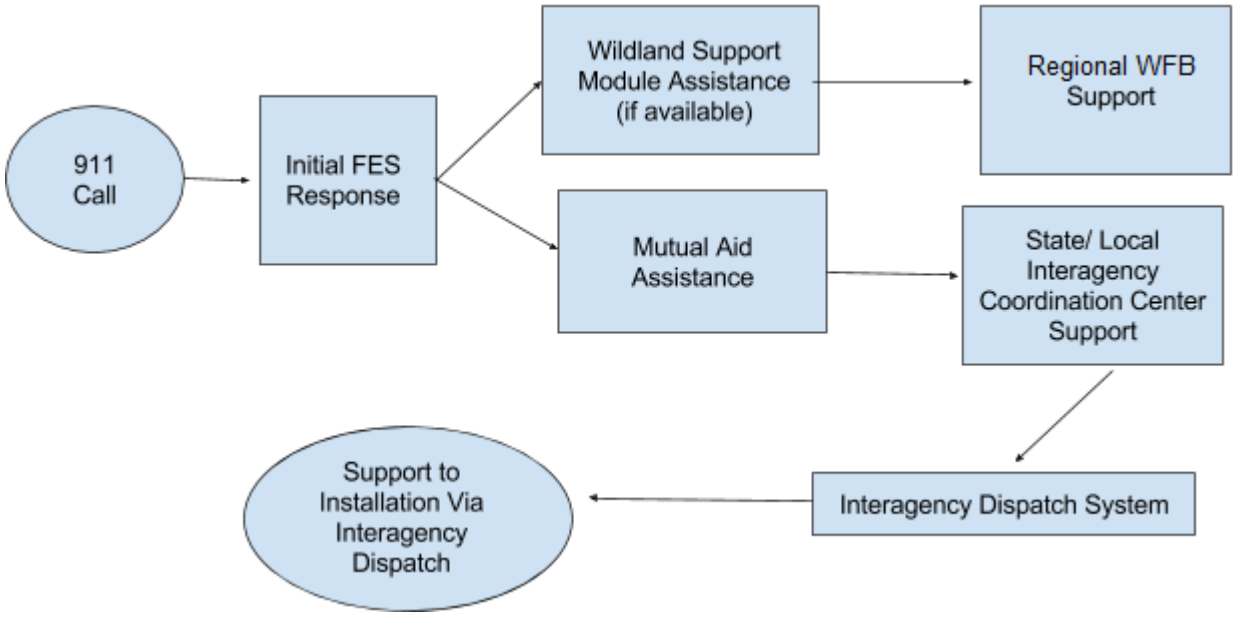
- 20-foot wind speed >15 MPH
- Winds shifting and gusty.

- RH ≤25%.
- Temperature >80°F.
- Approaching cold fronts. (possible strong, gusty winds and thunderstorms).

4.1.1.5 Initial Report of Wildfire and Initial Attack Dispatching

TAFB FES is responsible for suppressing wildfires on the installation. Utilizing the AF Incident Management System, the FES FC or a designated SFO will become the Initial Attack IC of any wildfire on installation property. The IC will initially size up the incident to determine the safest and most efficient Incident Action Plan (IAP) to provide the maximum protection for the safety of personnel, facilities, and natural resources. The ECC Center operator will make notifications to Solano County, if needed, once size-up information is available. The ECC Center will also contact the WSM if necessary. All wildland fire personnel will document wildfires on an ICS 214. The first arriving response time standard to a wildfire on TAFB is 4-5 minutes. DoDI 6055.06 requires direct wildland attack capability within 10 minutes of arrival of the initial wildland fire company at the fire scene. On-installation wildfire response procedures are summarized in Figure 4.1.

Figure 4.1: On Installation Wildfire Response



Current MAAs are required for off installation wildfire response. Response procedures will be written into the MAAs, which must be followed.

4.1.1.6 Use of Decision Support Tools

The WFMP will be the primarily decision support tool for initial attack operations. Sound operational risk management will be the foundation for all wildfire management plans and activities. Forecast fire weather and expected fire behavior are keys to all management decisions and will be monitored daily. TAFB does not have a RAWS fire weather station that monitors and calculates NFDRS fire danger. The Brooks California RAWS is located 34 miles to the north-northwest and approximately 250 feet higher in elevation than TAFB. Fire weather forecasts are available at NWS Fire Weather webpage. It is the

responsibility of the IC on a wildfire and the RXB# on a prescribed fire to see that weather conditions are monitored.

4.1.2 Wildfire Investigation

Enforcement of policies outlined in the INRMP follows guidance specified in the Sikes Act and AFI 32-7064. Enforcement activities are determined by Security Forces with input from the NRM, who provides oversight of natural resource law enforcement operations on the installation and ensures that all such enforcement operations are conducted in accordance with established federal and state wildlife laws and DoD and AF regulations. No Conservation Law Enforcement Officers (CLEO) currently support TAFB. An AFCEC-funded USFWS CLEO position at Beale is expected to be filled in FY18.

Any fire that damages property, be it installation lands or private property, will be investigated for cause, origin, and responsibility. Investigations may range from a documented determination of cause by an IC to a criminal investigation by a qualified arson investigator, such as a State Fire Investigator, Air Force Office of Special Investigations (AFOSI), or INVF ordered through dispatch or the Emergency Operations Center (EOC).

Currently if a wildfire occurs with a known cause, no investigation will be conducted and the IC will document the determined cause of the wildfire. If an investigation into the origin is required, the WFPC will ensure an investigation is completed and bring in external resources if warranted.

4.1.2.1 Reviews and Formal Investigations

4.1.2.1.1 Informal Reviews

The following are the procedures for informal reviews:

- All wildfires and prescribed fires will be informally reviewed. All informal reviews will be conducted as constructive critiques aimed at determining the facts related to the specific fire. Reviews are intended to resolve operational issues, not impose punitive actions. Reviews are also conducted for the following purposes:
  - To examine the progress of an ongoing fire incident and to confirm effectiveness of decisions or to correct deficiencies.
  - To identify new or improved procedures, techniques, or tactics.
  - To determine the cost-effectiveness of a fire operation.
  - To review the safety of suppression actions.
  - To review the effectiveness of the ICS.
  - To examine impacts to natural resources.
  - To provide lessons learned for future responses to minimize impact to natural resources.
- The WFPC or comparable NR staff members can conduct informal reviews. Informal reviews alone are sufficient for all fires less than 10 acres in which no unusual events occurred.

4.1.2.1.2 After Action Reviews (AAR)

AARs are conducted by participating personnel immediately after all wildfire suppression actions and prescribed fire operations. The IC and other personnel as needed will review each significant initial

attack, and all extended attack operations. AARs for prescribed fires will be held by the RXB#. The purpose of these reviews will be to address safety, organizational, operational, fiscal, and biological issues with regard to suppression actions on wildfires and to offer a venue for learning opportunities on all fire operations. Following a major wildfire incident, the WFPC will conduct an AAR immediately after the fire is contained. The AAR will be included as a portion of the Wildland Fire Investigation Report (WFIR). The NRM will be consulted to provide feedback on biological issues encountered during the fire and be given a copy of the AAR upon completion.

4.1.2.1.3 Formal Investigations

The following are the procedures for formal investigations:

- 60 AMW/CC will decide after any major incidents if a formal investigation is necessary. 60 AMW/CC will base this decision on advice or recommendations from the fire investigator(s), the Staff Judge Advocate, Inspector General, or the NRM or designee. If 60 AMW/CC deems a formal investigation is required, an investigating officer or review board shall be assigned to conduct a formal investigation. Formal investigations will be executed in accordance with AFI 32-2001. 60 AMW/CC shall review the findings and recommendations of the assigned investigating officer or review board.
- Normal post-fire investigations (like structural fires) will be conducted by the WFPC or FES. These offices will act together to form a team to investigate and determine the cause of the fire. A qualified INVF will head this investigation team.
- Surveys:
  - Besides reports and reviews that are completed after a wildfire, a post-fire survey of the burned area will be required depending on the fire's location and vegetation damaged. The post-fire analysis may be combined with any of the informal or formal investigations. A post-fire analysis will need to determine all or some of the following:
    - The effect the fire may have had on native or non-native flora and fauna resources and cultural resources.
    - The effectiveness of the pre-suppression measures to include fuels modifications.
    - The effectiveness of the suppression measures used.
    - The effectiveness of fire/fuel models used.
  - A post-fire survey of the fire area will be conducted with the coordination of the NR element.
  - The effects of fire on T&E species or effects from catastrophic fire events must be surveyed at the earliest possible time. Soliciting support from other cooperators or contracting subject matter experts is encouraged.
  - If, during the survey, it becomes evident that a wildfire has affected a T&E species, the USFWS will be notified by the NRM.
- Post-fire analysis will be made to determine the effects of the fire as described in Section 5.2.1. This analysis will be completed prior to the following wet season and be incorporated into normal land/natural resource condition studies. Data will be gathered to the extent possible and shared with other cooperating agencies to better understand the fire ecology of TAFB.

- Damaging fires may require post-fire restoration, rehabilitation, and revegetation. This may involve dead and down timber removal, planting or seeding trees, or erosion mitigation.

4.1.3 Wildland Fire Mutual Aid and/or Cross Boundary Operations

AF installations are encouraged to develop regional partnerships for wildland fire management support by means of reciprocal agreements with other federal, state, local, and private entities to share human, logistical, and operational resources (see Section 13.3.3 of AFI 32-7064). Emergency assistance and MAAs will conform to the guidelines stated in DoDI 6055.06 and AFI 32-2001.

Requests for mutual aid by the TAFB IC or outside agency requests for installation resources will be routed through the ECC Center. The FES FC, 60 MSG/CC, 60 AMW/CC command post, and appropriate dispatch centers will all be immediately notified by E-911 of the mutual aid requested or provided.

The ECC Center is the central dispatch entity for fire protection assets. The center will be the information source for wildfire status, deployment of resources, and initial contact point for responding mutual aid resources. The center is tasked with all fire ground communications that are directed to mutual aid agencies and is the link between the IC and CAL FIRE, County, or City fire resources. Once inbound mutual aid resources have arrived at a predetermined staging area, appropriate ground communication links between mutual aid agencies and command will be established.

TAFB currently has an MAA with Solano County. A master MAA with CAL FIRE is in place as well.

Copies of each of these MAAs are located in Appendix 1.1. These MAAs will be revisited on an annual basis collaboratively between the assisting entity, the FES FC, and, if different, the WFPC.

Unified command will be established when the installation is responding to a vegetation fire that has crossed or is likely to cross an installation boundary.

4.1.4 Wildfire Incident Management

Wildfires occurring on AF managed lands will have a response consistent with firefighter safety, known and potential hazards, and resource values at risk. Consistent with Department of Homeland Security (DHS) Presidential Directive/HSPD-5, *Management of Domestic Incidents*, 22 February 2003, AF wildfire response will incorporate NIMS standards into the organizational structure to facilitate cooperation and integration with other federal and state wildland fire organizations across jurisdictional boundaries.

Installation resources will conduct initial attack of wildfires and will be dispatched through the ECC Center. The primary objectives will be firefighter and public safety. The NFES 2724, *Interagency Standards for Fire and Aviation Operations*, January 2018 (Red Book) may be used as a reference. ICs will follow the direction in Section 1.5.4 for managing the initial attack response. A *Wildland Fire Risk and Complexity Assessment* (WFRCA) can be completed to determine the proper level of IC or IMT needed. In addition to the preceding link, this form can be found in the PMS 210. If the fire moves into extended

attack, another WFRCA can be completed. Typically, an extended attack fire would be indicative of a Type 3 incident. The vast majority of fires on TAFB are of Type 4 or Type 5 complexity. If the fire poses a threat to structures or could affect multiple resources, an EOC will be stood up to assist in the management of the incident.

If a Type 2 or Type 1 IMT is recommended by the WFRCA, the WFPC must discuss the order with the 60 AMW/CC and AFCEC/CZOF. The order would then be placed through ONCC. Within California, the ONCC and the Southern California Geographic Area Coordination Center (OSCC) share 4 Type 1 and 7 Type 2 IMTs. Any order for an IMT, whether it be Type 1 or Type 2, would need to come from the installation WFPC in consultation with AFCEC/CZOF, to ONCC for fulfillment. It is highly recommended that TAFB establish an MOU with ONCC.

4.1.4.1 Dispatching beyond Initial Attack

The WFPC will notify AFCEC/CZOF of any wildfire on or threatening AF infrastructure as soon as practical. Reports will include as a minimum, the date, fire name, fire location (latitude and longitude), total fire area, number of resources assigned, injuries to date, and an assessment of damage to infrastructure, and geospatial data as it becomes available.

Wildfires 100 acres or larger in timber fuels, or 300 acres or larger in grass fuels will require completion of an Incident Status Summary (ICS 209 WF) daily for the incident duration. The ICS 209 WF will be sent to ONCC and AFCEC/CZOF.

The IC will notify the ECC Center and the WFPC whenever it appears a fire will escape initial response efforts, leave installation lands, or when fire complexity will exceed the capabilities of command or operational forces. Additional resources needed beyond mutual aid resources will be ordered by the ECC Center first through standing MAAs and then through ONCC, which will mobilize any additional resources, including higher level ICs, IMTs, or additional operational resources.

The ECC Center or WFPC will notify AFCEC/CZOF, which will aid with extended attack support such as:

- Mobilizing the WSM, if needed and available.
- Assisting the WFPC with completing a Delegation of Authority, if needed.

4.1.4.2 Delegation of Authority to IC

The WFPC will ensure that a Delegation of Authority is provided to all qualified ICs, of any type, that command or may command a wildfire on TAFB of any size. This includes an annual Delegation of Authority provided to all initial attack ICs (Type 5 and Type 4) on the installation. A sample *Agency Administrator's Delegation of Authority to the Incident Commander* can be utilized to create a TAFB-specific Delegation of Authority for future use. The installation will use the current AFI 32-7064 or the NFES 2724, *Interagency Standards for Fire and Aviation Operations*, January 2018 (Red Book) for supporting guidelines which include the Agency Administrator's Briefing to IMT.

4.1.4.3 Resource Allocation and Prioritization

In the event of multiple ignitions on the installation, the IC will prioritize the suppression response. The protection of life, property, and resources must be considered in that order when determining priorities. Fires in the initial attack phase would also generally be given higher priority than those in the extended attack phase.

The Annual Operating Plan (AOP) developed in conjunction with local cooperators during the annual meeting must outline the priority process and determine a decision-making matrix. If significant fire activity is occurring on lands managed by the cooperators group, a local Multi-Agency Coordinating Group (MAC Group) may be initiated.

4.1.4.4 Wildfire Reporting Requirements

Initial response reporting for all wildfires is accomplished through Automated Civil Engineering System – Fire Department (ACES-FD) by the responding FES. In the event a wildfire exceeds the capability of the local FES and a WSM is called to assist, the WSM Lead will retrieve the ACES-FD fire report, complete an AFCEC/CZOF Fire Report form, collect spatial data from the fire's perimeter and submit it to AFCEC/CZOF for inclusion in the Wildland Fire Database.

AFCEC/CZOF integrates ACES-FD records not captured by a WSM into the AFCEC/CZOF database and uses remote sensed satellite imagery and other GIS data to map and analyze wildland fire perimeters that can be detected.

FES utilizes the Fire Emergency Response Network System (FERNS) and National Fire Incident Reporting System (NFIRS) for documenting wildfire starts on the installation. Additionally, FES completes the following ICS forms as part of an IAP:

- ICS 201 – Incident Briefing (initial size-up only).
- ICS 202 – Incident Objectives.
- ICS 203 – Organization Assignment List.
- ICS 204 WF – Division/Group Assignment List.
- ICS 205 – Incident Radio Communications Plan.
- ICS 205A – Communications List.
- ICS 206 WF – Medical Plan.
- ICS 207 – Incident Organization Chart.
- ICS 208 – Safety Message/Plan.

For significant wildfires affecting AF assets or missions, AFCEC/CZOF, in partnership with the installation, provides updates to the AFCEC Environmental Management Directorate Operations Branch (AFCEC/CZO) for dissemination to AF and DoD leadership. As soon as practical, the installation WFPC will report any significant wildfire incident that occurs on or threatens property under AF jurisdiction to AFCEC/CZOF via the RFMO.

A significant wildfire incident is defined as:

- Any wildfire greater than 100 acres.
- Any wildfire, regardless of size, that has met any of the following criteria:

- Significant threat to installation infrastructure/resources.
- Major or extended impact on AF missions.
- Loss of life.
- Negative impact to public health and safety.
- Threat to T&E species.

Significant wildfires defined by threat to T&E species will also be reported to the AFCEC/CZOW ISS.

At a minimum, reports will include the following:

- Date.
- Fire name.
- Fire location (latitude and longitude).
- Fire size(acres).
- Number of personnel/resources involved.
- Fire injuries.
- Infrastructure damage.
- Geospatial data on fire boundary.
- Impacted species.
- Types of impact to listed species.
- Status of Emergency Section 7 consultation.

For uncontrolled wildfires lasting more than 24 hours, the installation WFPC will provide AFCEC/CZOF, via the RFMO, a daily report on the potential for fire growth, current and expected weather, resource values at risk, multi-jurisdictional agency involvement, and information on additional resources needed. For any wildfires greater in size than 100 acres in timber fuel types or 300 acres in grass fuel types, information will need to be reported to ONCC.

An AFCEC/CZOF level review will be conducted if any of the following occur:

- Fire crosses the installation boundary onto another jurisdiction.
- Fire resulted in adverse media attention.
- Fire involved serious injury or death, significant property damage, or has the potential to do so.
- Fire results in controversy involving another agency.

All entrapments and fire shelter deployments will be reported and investigated as soon as possible after the entrapment or deployment incident.

For instructions on reporting, contact AFCEC.CZOF.FIRECENTER@US.AF.MIL.

4.1.4.5 Wildfire Damage Repair

NRM is responsible for evaluating wildfire suppression damage, recommending repair needs, and monitoring repair measures to ensure that the area is restored to as close to the natural condition as possible. NRM can also assist in identifying areas requiring protection, if possible, during initial attack in order to

prevent unnecessary damage to natural resources, however this requires coordination between FES and appropriate specialists from NR. For incidents suppressed during initial attack, this damage will be assessed by NRM following the issuance of a containment declaration by the IC. While firefighting resources are still on scene to perform repair work, as appropriate, and without jeopardizing the control declaration, fireline and other damage caused by the suppression of the wildfire will be repaired under the supervision of the NRM or their representative.

For extended attack incidents, a READ can be ordered by the AFCEC/CZOF AFMO through the ROSS, who will be assigned to the fire and will work with NRM to assess wildfire suppression damage and coordinate with Operations to perform repair work to sections of fireline, as they are no longer needed, and to repair any infrastructure damaged because of suppression forces and actions. They also help develop the suppression repair plan and standards for the IAP, as well as provide input on the turnback standards. Repair of suppression damage will occur prior to crew release from the fire and will include at a minimum the following:

- Removing all trash from incident facilities, work areas, and firelines.
- Replacing soil dug from firelines to refill them to level, adding water bars as needed.
- Felling and bucking up hazardous trees and snags.
- Flush cutting all stumps as close to ground level as practicable.
- Rolling back and compacting sod overturned by plowing (with a grader or by hand) to preserve native grass root stock.
- Identifying and inventorying potential invasive plant species in suppression areas.

4.1.4.5.1 Emergency Stabilization (ES)

ES refers to planned actions to stabilize and prevent unacceptable degradation to natural and cultural resources, to minimize threats to life or property resulting from the effects of a fire, or to repair, replace, or construct physical improvements necessary to prevent degradation of land or resources. BAER refers to an agency response to a wildfire implementing the ES program.

A BAER plan is an ES document that specifies treatments approved to implement post-wildfire ES policies on an individual incident. This plan/report is prepared by an interdisciplinary team of specialists during or immediately after the containment of a wildfire. DOI uses the term “plan” and the USFS uses the term “report”. The ES plan and BAER plan are synonymous. The *Interagency Burned Area Emergency Response Guidebook*, Version 4.0, February 2006 provides guidance on how the DOI and USFS implement the ES program and may be useful to guide ES actions on TAFB.

Each installation will determine if the emergency nature of a fire event warrants the development of a BAER plan. If so, the BAER plan must be developed expeditiously and is frequently developed by a local unit or designated BAER team. The WFPC is responsible for ordering or assigning teams to develop BAER plans. The installation may not have sufficient expertise to conduct burned area assessments. Resource specialists from cooperating installations, partner agencies, and/or the AFCEC/CZOF may be needed to assist in developing a BAER plan. AFCEC/CZOW currently uses the EQ-funded and titled project "POST FIRE REHAB" to conduct a post-fire analysis similar to a BAER and BAR plan to look at natural resources impacts only. Such plans are then implemented with the same project if funds are available

and impacts severe enough to warrant rehabilitation. For large fires or significant impacts, funds from AFCEC/CZOF or the Installation will be required.

The Solano Resource Conservation District (RCD) produced a BAER report for TAFB in 2017. The WFPC will review this plan following a wildfire incident and determine whether it remains applicable to the present burned area.

4.1.4.5.2 Burned Area Rehabilitation (BAR)

BAR refers to non-emergency efforts undertaken within 3 years of a wildfire to repair or improve fire-damaged lands which are unlikely to recover to management-approved conditions, or to repair or replace minor facilities damaged by fire.

A BAR plan is a document that specifies treatments required to implement post-fire rehabilitation policies. This plan may be programmatic (prepared in advance) and applicable to clearly defined types of incidents and situations, or prepared by an interdisciplinary team of specialists (BAR team) during or immediately following the containment of a wildfire. The *Interagency Burned Area Rehabilitation Guidebook*, Version 1.3, October 2006 provides guidance on how the DOI implements the BAR program and may be useful to guide BAR actions on TAFB.

Chapter 5. Monitoring and Evaluation

5.1 WFMP Review and Updates

WFMPs will be reviewed annually and updated as outlined in the national WFMP review process in the AFCEC/CZOF Playbook. WFPC and NRM are responsible for determining WFMP updates needed annually. Revisions of WFMPs will be required during the completion of a new (or significantly revised or updated) INRMP and thus will follow the revision schedule of the INRMP from that point forward.

This WFMP will undergo an annual review process to determine the validity of the content and whether any changes/updates are needed. At TAFB this process is performed by the NRM and the WFPC. A table for keeping track of the Annual Review History can be found in Appendix 5.1. Signatures of the WFPC, NRM, and 60 CES/CC, or their designees, are required on the Annual Review History. Contact AFCEC/CZOF for technical assistance with the WFMP review.

5.2 Treatment Effectiveness Monitoring

5.2.1 Fire Effects Monitoring

Fire effects monitoring is the short- and long-term data gathering done prior to and after each prescribed fire to show trends. This data collection will show the level of effectiveness that an activity will or will not achieve. Monitoring schedules will be made based upon the objective(s) of the prescribed fire. This will ensure the timely capture of data so that the success or failure to achieve objective(s) may be evaluated. Several methods of monitoring are available to choose from once objectives and limitations are defined. The NR staff will be responsible for collection and storage of this data.

It may be helpful to determine whether prescribed fire treatments are meeting objectives by assessing factors such as fuel loading, invasive species cover, native species cover, sensitive species habitat quality, etc. before and after prescribed fires. There are numerous methods to measure fuel loading, however using a photo series is a good way to minimize the time and cost involved. The *Fuel and Fire Effects Monitoring Guide*, which was developed by the USFWS, may be a useful reference when designing fuels and fire effects monitoring methods. Regardless of the methods used, every fuels monitoring program must be designed to measure whether fuels reduction objectives and natural resource objectives have been met.

WSMs will be used to support pre- and post-fire NR monitoring efforts, guided and directed by the NRM.

5.2.2 Non-fire Fuels Treatment Effects Monitoring

Non-fire fuels treatment effects monitoring is the long-term data gathering done prior to and after each fuels treatment. It can show trends that are supported by non-fire fuels management strategies. Several methods of monitoring are available to choose from once objectives and limitations are defined. Proponents of non-fire fuels treatments will pay for and perform monitoring of these treatments, with approval and review by the NRM. For invasive plant issues and monitoring and control actions, refer to the INRMP and other installation or site-pertinent plans.

Conclusion and Recommendations

- Recommended mechanical fuels treatments will consist of disking of all mineral firebreaks, annual vegetation maintenance extending out at least 30 feet from values to protect, and occasional mowing. In addition, prescribed grazing will be used. These can be found in Section 3.10.

- TAFB has an opportunity to utilize prescribed fire to meet many of its natural resource objectives. Recommended prescribed fire fuels treatments can be found in Section 3.5.2.3.

- Public outreach and notification procedures should be formalized in accordance with Section 3.4.

- During periods of high wildfire danger, FES should preposition resources as available in areas where wildfire starts are most likely.

- New construction and building maintenance should follow fire-resistant and fire-adapted principles, including using non-flammable materials, sealing ember traps on buildings, utilizing native landscaping when possible, eliminating ladder fuels near structures, and creating defensible space around structures in the WUI.

- Vegetation underneath powerlines must be kept low to minimize potential for starting wildfires.

- It is recommended that FES personnel continue training and working on additional PTBs to enhance their qualifications. Recommended minimum NWCG qualifications can be found in Table 4.2 and Table 4.3.

- FES and NR do not currently possess any wildland firefighting equipment. Recommended equipment can be found in Table 4.4.

- It is recommended that a Type 3 Wildfire Risk Assessment, including a current fuel loading analysis, be prepared for TAFB by AFCEC/CZOF.

- In addition to existing preparedness efforts, additional preparedness efforts will be implemented and a stand-alone wildfire preparedness plan will be developed by FES and NR (see Section 4.1.1).

- A stand-alone asset and infrastructure protection plan will be created to outline mitigation strategies for individual assets at risk (See Section 3.11).

- At a minimum, facilities will adopt vegetation clearance standards found on the Firewise Ember Threat and the Home Ignition Zone webpage.

- A stand-alone readiness activities plan will be created in order to adequately prepare for wildfires. A proposed readiness activities plan can be found in Appendix 4.2.

- A stand-alone step-up plan utilizing NFDRS indicators will be created in order to adequately prepare for wildfires. A proposed step-up plan can be found in Appendix 4.3.

WFMP Terminology

Air Force Wildland Fire Branch (AFCEC/CZOF)
Part of the Civil Engineering Directorate, AFCEC/CZOF was founded in 2012 to manage increasing wildland fire threats to Air Force missions and is a collaborative operation with the U.S. Fish and Wildlife Service and the U.S. Forest Service to focus on fire threats using risk-based data and maximizing shared resources.

Emergency Operations Center (EOC)
A pre-designated facility established by an agency or jurisdiction to coordinate the overall agency or jurisdictional response and support to an emergency.

Incident Commander (IC)
This ICS position is responsible for overall management of the incident and reports to the Agency Administrator for the agency having incident jurisdiction. This position may have 1 or more deputies assigned from the same agency or from an assisting agency(s).

National Fire Protection Association (NFPA)
A private, non-profit organization dedicated to reducing fire hazards and improving fire service.

National Wildland Fire Coordinating Group (NWCG)
An intergovernmental body that provides national leadership to develop, maintain and communicate standards, guidelines, qualifications, training, and other capabilities that enable interoperable operations among federal and non-federal entities for wildland fire program management.

Preparedness Level
Increments of planning and organizational readiness dictated by burning conditions, fire activity, and resource availability. Response and support to non-fire incidents requiring a significant commitment of resources may also affect Preparedness Levels.

Prescribed Fire Burn Boss
Person responsible for supervising a prescribed fire from ignition through mop up.

Red Book
The NWCG Interagency Standards for Fire and Aviation Operations. Guidelines for implementation of national interagency wildland fire operations policy.

Wildland Support Module
Provides fully qualified and equipped personnel to conduct prescribed fire and mechanical fuels reduction activities for the purposes of ecosystem management and mitigation of wildfire as a threat to the ecosystem. Activities are conducted in accordance with INRMP and installation mission objectives. At a minimum, the WSM shall collaborate all activities extensively with the installation NR staff and FES to ensure all actions are aligned to a common goal.

A complete listing of wildland fire terminology and their most current definitions can be found at https://www.nwcg.gov/glossary/a-z.

List of Acronyms

21 AS	21st Airlift Squadron
22 AS	22nd Airlift Squadron
349 AMW	349th Air Mobility Wing
6 ARS	6th Air Refueling Squadron
60 AMDS	60th Aerospace Medicine Squadron
60 AMW	60th Air Mobility Wing
60 AMW/CC	60th Air Mobility Wing Installation Commander
60 AMW/CV	60th Air Mobility Wing Vice Commander
60 AMW/PA	60th Air Mobility Wing Public Affairs Office
60 AMW/SE	60th Air Mobility Wing Safety
60 AMXS	60th Aircraft Maintenance Squadron
60 APS	60th Aerial Port Squadron
60 CES	60th Civil Engineering Squadron
60 CES/CC	60th Civil Engineer
60 CES/CD	60th Deputy Civil Engineer
60 CES/CEI	60th Installation Management Flight
60 CES/CEIE	60th Environmental Element
60 CES/CEIEC	60th Environmental Compliance
60 CES/CEF	60th Fire Emergency Services
60 CONS	60th Contracting Squadron
60 CS	60th Communications Squadron
60 CS/SCOT	60th Communications Squadron Frequency Coordinator
60 DS	60th Dental Squadron
60 FSS	60th Force Support Squadron
60 IPTS	60th Inpatient Squadron
60 LRS	60th Logistics Readiness Squadron
60 MDG	60th Medical Group
60 MDOS	60th Medical Operations Squadron
60 MDSS	60th Medical Support Squadron
60 MDTS	60th Diagnostics and Therapeutics Squadron
60 MOS	60th Maintenance Operation Squadron
60 MSG	60th Mission Support Group
60 MSG/CC	60th Mission Support Group Commander
60 MSG/CD	60th Deputy Mission Support Group Commander
60 MXG	60th Maintenance Group
60 MXS	60th Maintenance Squadron
60 OG	60th Operations Group
60 OSS	60th Operations Support Squadron
60 SFS	60th Security Forces Squadron
60 SGCS	60th Surgical Operations Squadron
621 CRW	621st Contingency Response Wing
660 AMS	660th Aircraft Maintenance Squadron

860 AMS	860th Aircraft Maintenance Squadron
9 ARS	9th Air Refueling Squadron
AAR	After Action Review
ACES-FD	Automated Civil Engineering System – Fire Department
AD	Administratively Determined
AF	Air Force
AFCEC	Air Force Civil Engineer Center
AFCEC/CZO	AFCEC Environmental Management Directorate Operations Branch
AFCEC/CZOF	Air Force Wildland Fire Branch
AFCEC/CZOW	Environmental Operations Division East Region
AFFF	Aqueous Film Forming Foam
AFI	Air Force Instruction
AFMO	Assistant Fire Management Officer
AFOSI	Air Force Office of Special Investigations
AFSEC/SEFW	Air Force Safety Center
AMC	Air Mobility Command
AOP	Annual Operating Plan
AOR	Area of Responsibility
APE	Area of Potential Effect
ARPA	Archeological Resources Protection Act
ASI	ATV Safety Institute
ATV	All-Terrain Vehicle
BAAQMD	Bay Area Air Quality Management District
BAER	Burned Area Emergency Response
BAFB	Beale Air Force Base
BAR	Burned Area Rehabilitation
BASH	Bird/Wildlife Aircraft Strike Hazard
BCC	Bird of Conservation Concern
BGEPA	Bald and Golden Eagle Protection Act
BOMP	Burrowing Owl Management Plan
BpS	Biophysical Setting
CAA	Clean Air Act
CAL FIRE	California Department of Forestry and Fire Protection
CalEPA	California Environmental Protection Agency
CARB	California Air Resources Board
CATEX	Categorical Exclusion
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CLEO	Conservation Law Enforcement Officer
CLGC	Cypress Lakes Golf Course
CLGCEMP	Cypress Lakes Golf Course Environmental Management Plan
CPR	Cardio-Pulmonary Resuscitation
CRM	Cultural Resources Manager

CSU	Colorado State University
CTRMP	Castle Terrace Recreational and Management Plan
CUB	Commander Update Brief
CWA	Clean Water Act
CWPP	Community Wildfire Protection Plan
DAA	Defense Appropriations Act
DFSPO	Defense Fuel Supply Point Ozol
DGMC	David Grant USAF Medical Center
DHS	Department of Homeland Security
DIVS	Division/Group Supervisor
DoD	Department of Defense
DOI	Department of the Interior
DWR	Declared Wildfire Review
EA	Environmental Assessment
EIS	Environmental Impact Statement
EMTP	Paramedic
ENGB	Engine Boss, Single Resource
EOC	Emergency Operations Center
EOD	Explosive Ordinance Disposal
EQ	Environmental Quality
ES	Emergency Stabilization
ESA	Endangered Species Act
ESOHC	Environment, Safety, and Occupational Health Council
FAA	Federal Aviation Administration
FAL2	Intermediate Faller
FAL3	Basic Faller
FAL#	Faller
FamCamp	Family Camp
FBFM	Fire Behavior Fuel Model
FC	Fire Chief
FD	Fire Department
FEMA	Federal Emergency Management Agency
FERNS	Fire Emergency Response Network System
FES	Fire Emergency Services
FFT1	Firefighter Type 1
FFT2	Firefighter Type 2
FIRB	Firing Boss, Single Resource
FLUPMA	Federal Land Use Policy and Management Act
FMU	Fire Management Unit
FNWA	Federal Noxious Weed Act
FPD	Fire Protection District
FWCA	Fish and Wildlife Conservation Act
GIS	Geographic Information System
GMP	Grazing Management Plan

GSU	Geographically Separated Unit
GVW	Gross Vehicle Weight
HazMat	Hazardous Material
HWMP	Hazardous Waste Management Plan
IAP	Incident Action Plan
IC	Incident Commander
ICRMP	Integrated Cultural Resources Management Plan
ICS	Incident Command System
ICT4	Incident Commander Type 4
ICT5	Incident Commander Type 5
IMT	Incident Management Team
INRMP	Integrated Natural Resources Management Plan
INVF	Wildland Fire Investigator
IQCS	Incident Qualifications and Certification System
IPMP	Integrated Pest Management Plan
IRPG	Incident Response Pocket Guide
ISMP	Invasive Species Management Plan
ISS	Installation Support Section
MAA	Mutual Aid Agreement
MAC Group	Multi-Agency Coordinating Group
MBTA	Migratory Bird Treaty Act
MFRI	Mean Fire Return Interval
MIST	Minimum Impact Suppression Techniques
MOU	Memorandum of Understanding
MPH	Miles Per Hour
MRM	Middle Runway Marker
MSA	Munitions Storage Area
MSL	Mean Sea Level
NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Policy Act
NFDRS	National Fire Danger Rating System
NFIRS	National Fire Incident Reporting System
NFMA	National Forest Management Act
NFPA	National Fire Protection Association
NHPA	National Historic Preservation Act
NIFC	National Interagency Fire Center
NIMS	National Incident Management System
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
NPPA	Native Plant Protection Act
NR	Natural Resources (Program)
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NRM	Natural Resources Manager

NUS	National Unit Stocking
NUS	Normal Unit Stocking
NUS	Normal Unit Strength
NWCG	National Wildfire Coordinating Group
NWS	National Weather Service
O&M	Operations and Maintenance
OAK	Oakland International Airport
OHP	California Office of Historic Preservation
ONCC	Northern California Geographic Area Coordination Center
ORM	Outer Runway Marker
ORV	Off-road Vehicle
OSCC	Southern California Geographic Area Coordination Center
PBO	Programmatic Biological Opinion
PFOA	Perfluoroocanoic Acid
PFOS	Perfluorooctanesulfonic Acid
PFP	Prescribed Fire Plan
PHA	Potrero Hills Annex
PIO	Public Information Officer
PL	Preparedness Level
POC	Point of Contact
PPE	Personal Protective Equipment
PRIA	Public Rangelands Improvement Act
PTB	Position Task Book
QR	Quick Response
RAWS	Remote Automated Weather Station
READ	Resource Advisor
RFMO	Regional Fire Management Officer
RH	Relative Humidity
ROSS	Resource Ordering and Status System
RSB	Regional Support Branch
RSS	Regional Support Section
RV	Recreational Vehicle
RXB2	Prescribed Fire Burn Boss Type 2
RXB#	Prescribed Fire Burn Boss
SAFECOM	Aviation Safety Communiqué
SFO	San Francisco International Airport
SFO	Senior Fire Officer
SMF	Sacramento International Airport
SMGAPB	Smoke Management Guidelines for Agricultural and Prescribed Burning
SMP	Smoke Management Plan
SNRROW	Sacramento Northern Railroad Right of Way (former)
SOC	Species of Concern
SOC	Standard Operating Cover
SOG	Standard Operating Guide

SSA	Smoke Sensitive Area
T&E	Threatened and Endangered
TACAMO	Take Charge and Move Out
TAFB	Travis Air Force Base
TDY	Temporary Duty
TFR	Temporary Flight Restriction
UCVE	Union Creek Vegetation Easement
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
UTV	Utility Task Vehicle
UXO	Unexploded Ordinance
VAFB	Vandenberg Air Force Base
VFD	Volunteer Fire Department
WCT	Work Capacity Test
WFAS	Wildland Fire Assessment System
WFIR	Wildland Fire Investigation Report
WFMP	Wildland Fire Management Plan
WFPC	Wildland Fire Program Coordinator
WFPM	Wildland Fire Program Manager
WFRCA	Wildland Fire Risk and Complexity Assessment
WSM	Wildland Support Module
WUI	Wildland Urban Interface
WW1	Water Well 1
YSAQMD	Yolo-Solano Air Quality Management District

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Yolo-Solano Air Quality Management District Rule 6.1 – Agricultural Burning.

Appendix 1.1 TAFB MAAs

The following MAAis in place at TAFB for fire protection and incident response:

- County of Solano MAA (1996).



Mutual Aid Agreement.pdf

Appendix 1.2 Cultural Resources Checklist

The following is a cultural resources checklist adapted from National Park Service guidelines for review of cultural resource concerns prior to implementation of wildland fire projects. During a wildfire, procedures outlined in PMS 313, *Resource Advisor's Guide for Wildland Fire*, August 2017, will be followed.

Strategic Wildland Fire Management Planning

Installation cultural resource staff:

- Ensure that cultural resources are thoroughly evaluated and discussed in the INRMP.
- Regularly review the ICRMP and ensure that the plan is complete and up to date.
- Regularly coordinate with the wildland fire management program to ensure that cultural resources are considered at all stages of fire planning and good communication is maintained between cultural resource and wildland fire management programs.
- Participate in the development and review of installation WFMPs.
- Prepare funding proposals for cultural resource inventory within the Area of Potential Effect (APE) of fuels reduction projects as soon as a fuels reduction project is proposed.
- Ensure that planning activities comply with federal cultural resource laws, executive orders, and policies:
    - Coordinate with installation Section 106 coordinator to ensure that NHPA Section 106 compliance is completed in concordance with NEPA compliance activities.
    - Develop installation-specific NHPA Section 106 programmatic agreement, if appropriate.
    - Ensure that appropriate tribal leadership is contacted for consultation if applicable, as per NAGPRA (25 U.S.C. §3001 et seq.), DOI policy, and Executive Order 13175: Consultation and Coordination with Indian Tribal Governments (EO 13175).

Annual Wildland Fire Management Planning

Installation cultural resource staff:

- Annually identify, document and update records on cultural resources with potential to be adversely affected by fire:
    - Ensure that updated information is reflected in relevant documents (WFMPs, PFPs, etc.).
- Participate in annual review of WFMP and update cultural resource information as indicated:
    - Evaluate past performance of mitigation measures and identify areas of needed improvement for stewardship of cultural resources.
    - Obtain information about upcoming fuels reduction activities that may affect cultural resources.
- Develop or update the installation's READ manual.
- Ensure that notification lists are current and reside in appropriate offices (with the FES FC, WSM Lead, ECC Center, CRM, etc.).

- Ensure that planning activities comply with federal cultural resource laws, executive orders, and policies:
  - Coordinate with installation Section 106 coordinator to ensure that NHPA Section 106 compliance is completed in concordance with NEPA compliance activities.
  - Develop installation-specific NHPA Section 106 programmatic agreement, if appropriate.
  - Ensure that appropriate tribal leadership is contacted for consultation, if applicable, as per NAGPRA, DOI policy, and EO 13175.

Fuels Treatment Planning

- Review fuels treatment plans when project is proposed and when the plan is implemented.
- Ensure cultural resource mitigations are appropriately included in each treatment plan.
- Coordinate cultural resource documentation and assessment activities to support specific fuels projects:
  - Ensure that cultural resource inventory is complete before fuels reduction activities.
  - Determine eligibility of cultural resources for inclusion on NRHP.
  - Determine potential for adverse effects on significant cultural resources within APE from fuels reduction activities.
  - Provide assessment analyses and mitigation to wildland fire management program.
- Ensure that planning activities comply with federal cultural resource laws, executive orders, and policies:
  - Coordinate with Section 106 coordinator for NHPA Section 106 compliance.
  - Determine whether planned activities qualify for NHPA Section 106 programmatic agreements.

Project/Event Planning

Planning for Unplanned Ignitions

- Ensure that issues and concerns about cultural resources are incorporated into planning documents, and that mitigation protocols are included. Locations of critical resources that might be threatened by post-fire events such as flooding, slides, erosion, or debris flows, and the types of treatments to be carried out or excluded are listed.
- Ensure that private and sensitive information regarding location of cultural resources is protected but accessible to wildland fire managers.
- During periods of potential or existing high fire activity, ensure cultural resource advisors are prepared and ready to participate in active fire planning and management activities.
- Ensure that cultural resources will be considered in any post-fire rehabilitation or restoration, including: protection goals and measurable objectives for the BAER program.
- Update contact information for cultural resource specialists who can prepare post-fire treatment plans, as well as individuals who can implement the treatments proposed.
- Ensure that planning activities comply with federal cultural resource laws, executive orders, and policies:
  - Coordinate with installation Section 106 coordinator to ensure that NHPA Section 106 compliance is completed in concordance with NEPA compliance activities.

- Ensure that appropriate tribal leadership is contacted for consultation, if applicable, as per NAGPRA, DOI policy, and EO 13175.

Fuels Treatment Planning

- Review fuels treatment plans when a project is proposed and when the plan is implemented.
- Ensure cultural resource mitigations are appropriately included in each treatment plan.
- Coordinate cultural resource documentation and assessment activities to support specific fuels projects:
  - Ensure that cultural resource inventory is complete before fuels reduction activities.
  - Determine eligibility of cultural resources for inclusion on NRHP.
  - Determine potential for adverse effects on significant cultural resources within APE from fuels reduction activities.
  - Provide assessment analyses and mitigation to wildland fire management program.
- Ensure that planning activities comply with federal cultural resource laws, executive orders, and policies:
  - Coordinate with Section 106 coordinator for NHPA Section 106 compliance.
  - Determine whether planned activities qualify for alternative NHPA Section 106 process.
  - Ensure that appropriate tribal leadership is contacted for consultation, if applicable, as per NAGPRA, DOI policy, and E.O. 13175.
- Ensure that monitors will be present during the fuels treatment activity.
- Ensure that monitors will inspect area after fuels treatments to ensure planned actions resulted in the desired protection.
- Ensure that planning activities comply with federal cultural resource laws, EO 13175, and policies.

Appendix 1.3 Installation and Interagency Contact Information

TAFB FES (60 CES/CEF)			
Contact Name	**Position**	**Phone**	**Email**
John Speakman	FES FC	707-424-0850	john.speakman@us.af.mil
Don Richert	FES Assistant FC		
Brian Partido	FES Deputy FC	707-424-6772	brian.partido@us.af.mil
	FES Dispatch		
TAFB NR (60 CES/CEIE)			
Contact Name	**Position**	**Phone**	**Email**
Penn Craig	NRM, CRM, Wildlife Biologist	707-424-8354	penn.craig@us.af.mil
Matthew Blazek	Biologist, NEPA, Acting 60 CES/CEIE Chief, Installation Tribal Liaison Officer	707-424-5127	matthew.blazek@us.af.mil
Xuyen Lieu	Air Quality	707-424-5103	xuyen.lieu@us.af.mil
Luann Tetirick	Water Quality	707-424-3587	luann.tetirick@us.af.mil
Jon Carlson	Environmental Compliance Chief	707-424-2984	jonathan.carlson.9@us.af.mil
Behdad Sanai	Colorado State University (CSU) GIS		behdad.sanai@colostate.edu

TAFB 60 AMW Important Contacts			
Contact Name	**Position**	**Phone**	**Email**
Lieutenant Colonel Bartholomew	60 CES/CC	707-424-2492	casey.bartholomew@us.af.mil
Brian Sassaman	60th Installation Management Flight (60 CES/CEI)	707-424-8225	brian.sassaman.1@us.af.mil
Matthew Foster	Housing	707-24-1406	matthew.foster.31@us.af.mil
Merrie Schilterlowe	60 AMW/PA	707-424-0135	merrie.schilterlowe@us.af.mil
	60 SFS	707-424-2800	
Michael Ault	EOD	707-424-2040	
AFCEC/CZOF			
Contact Name	**Position**	**Phone**	**Email**
Timothy Bradley	RFMO - West		timothy.bradley.8@us.af.mil
Vacant	AFMO - West		
Vacant	WSM Lead (Beale AFB)		
Michelle Steinman	Branch Chief	210-395-8412 201-260-9238	michelle.steinman.1@us.af.mil
Roger Kennedy	Training PM		roger.kennedy@us.af.mil
Contact Name	**Position**	**Phone**	**Email**
Kirsten Christopherson	ISS Lead	707-424-8622	kirsten.christopherson@us.af.mil

AFCEC/CZOW Regional Support Branch (RSB)			
Contact Name	**Position**	**Phone**	**Email**
Katy Breyer	Regional Support Section (RSS) - West		joseph.hockaday@us.af.mil
Cooperating Agencies & Other			
Contact Name	**Position**	**Phone**	**Email**
	CAL FIRE – Sonoma-Lake-Napa Unit	707-967-1400	
	Solano County Fire Department	707-428-7071	

Appendix 1.4 Sample Delegation of Authority



Sample

Wildland Fire Program Coordinator Delegation of Authority

United States Air Force

For

Travis Air Force Base

DELEGATION OF AUTHORITY FOR WILDLAND FIRE MANAGEMENT

The Wildland Fire Program Coordinator (WFPC) for the installation **Travis Air Force Base**, is hereby delegated authority to act on my behalf for the following duties and actions within the Zone:

1. Initiate, coordinate and ensure appropriate installation engagement and timely completion of the Wildland Fire Management Plan (WFMP).

2. Serve as the primary installation Point of Contact (POC) for the Air Force Wildland Fire Branch (AFCEC/CZOF) fuels treatment implementation, data collection, and large wildfire reporting.

3. Assist with requests for Incident Qualification Cards for installation's assets as specified in the WFMP.

4. As soon as practical, the installation's WFPC will report any significant wildfire incident that occurs on or threatens property under Air Force (AF) jurisdiction to AFCEC/CZOF via the Regional Fire Management Officer (RFMO).

   A significant wildfire incident is defined as:
   - Any wildfire greater than 100 acres.
   - Any wildfire, regardless of size, that has met any of the following criteria:
     - Significant threat to installation infrastructure/resources.
     - Major or extended impact on AF missions.
     - Loss of life.
     - Negative impact to public health and safety.

- Threat to Threatened and Endangered (T&E) species.

5. Work with the Wildland Support Module (WSM) lead and the AFCEC/CZOF training manager to identify National Wildfire Coordinating Group (NWCG) qualification requirements in the installation's WFMP.

6. Serve as the primary POC between the installation and AFCEC/CZOF for all matters concerning wildland fire.

7. Coordinate with the installation assets and WSM Lead to ensure that manpower, supplies, equipment, and other cooperative resources are available to meet the required goals and objectives of the WFMP.

8. Be responsible for coordinating all internal and external notifications dealing with wildland fire activities.

9. Coordinate with AFCEC/CZOF's training manager with all matters related to training and qualifications.

10. If needed, the WFPC will coordinate with installation's Natural Resource Manager (NRM) to assess the need for a Burned Area Emergency Response (BAER) Plan and/or a Burned Area Rehabilitation (BAR) Plan.

This delegation of authority for wildland fire management program operations will be in effect from ***DATE*** to ***DATE***, unless superseded. It will be reviewed as part of the annual WFMP review process.

_____ _____
Installation Commander Date

_____ _____
Wing Commander Date

_____ _____
Installation Fire Chief Date

Appendix 1.5 Natural Resources Checklist

The following checklist will be followed by TAFB NR prior to and during wildland fire operations. Additional guidance can be found in the PMS 313, *NWCG Resource Advisor Guide (2017).*

FMU: _____

Compartment/Burn Unit: _____

Proposed Burn Date/Date of Wildfire: _____

1. List species using the compartment:
   _____
   _____
   _____
   _____

2. Are any of the above species listed as Endangered, Threatened, or a Species of Special Concern? List the species.
   _____
   _____

3. Describe any actions needed prior to and during the burn (field survey, Section 7 consultation, etc).
   _____
   _____
   _____
   _____
   _____

4. List the resident and migratory bird species using compartment.
   _____
   _____
   _____

5. List any birds currently nesting in the compartment.
   _____
   _____
   _____

6. List any other sensitive resources located in the compartment.
   _____
   _____
   _____

7. Describe any actions needed to prior or during the fire.

_____
_____
_____
_____
_____

Appendix 2.1 Standard Operating Procedures

The following SOCs and SOGs are in place at TAFB.

- Travis Fire Emergency Services Standards of Cover.



Complete TFES Standards Of Cover.

- Standard Operating Guide 32-08-04 – Wildland Emergencies, 2018.



Complete TFES SOG 32-08-04, Wildland I

Appendix 3.1 AF Standard Prescribed Fire Plan

The following is a copy of the AF Standard PFP Template. For assistance with the plan contact AFCEC/CZOF. A copy of the Aero Club burn unit PFP is attached for reference.


USAF_PFP_08-22-2016.docx



2015 Aero Club PFP.pdf

Appendix 4.1 AF Agency Certification Position Task Book Page

The following is a copy of the Agency Certification Position Task Book Page.



Agency Certification Task Book Page.pdf

Appendix 4.2 Proposed TAFB Wildland Fire Management Readiness Activities

The following are recommended annual fire management readiness activities.

Annual Installation Wildland Fire Management Readiness Activities												
Activities – Complete before end of month	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Prepare Pre-season Risk Analysis	X											
Update Interagency Fire Agreements/AOP's	X											
Weather Station Maintenance and Calibration	X						X					
Inventory Wildland Fire Engine and Cache		X										
Pre-Season Engine Preparation		X										
Verify Gross Vehicle Weight (GVW) Compliance		X						X				
IQCS Committee Meet to Determine Training Needs, Determine Priority Trainee's, and Certify Incident Qualification Cards for Upcoming Fire Season			X									
Each Shift Meet to Review Priority Trainees, Personnel Responsibilities, Required Forms, Notification Procedures, Rental Car Usage, etc.				X								
Upload the Current Qualification Information into ROSS				X								
Meet with Each Shift to Discuss Previous Fire Season at the Discretion of the Assistant or Battalion Chiefs					X							X
Annual Fire Refresher and Fitness Test					X							X
Review and Update Wildland Fire Management Plan						X						
Prescribed Fire Plan Preparation									X	X	X	
Winterize Wildland Fire Management Equipment											X	
IQCS Committee Meet to Identify Employees that will Attend Training Based upon the Department's Needs and the Number of Slots Obtained. Nomination Forms will be Completed and Submitted by the NWCG Program Manager												X

Appendix 4.3 Proposed TAFB Wildland Fire Management Step-up Plan

The following is a recommended wildfire specific action guide.

WILDFIRE SPECIFIC ACTION GUIDE					
Fire Danger	**Low**	**Moderate**	**High**	**Very High**	**Extreme**
Response Guide	• 1 Type 6 Engine	• 1 Type 6 Engine	• 2 Type 6 Engines	• 2 Type 6 Engines	• 2 Type 6 Engines
Staffing Guide	1 ICT5 1 ENGB 1 FFT1 1 FFT2	1 ICT5 1 ENGB 1 FFT1 1 FFT2	1 ICT4 2 ENGB 2 FFT1 2 FFT2	1 ICT4 1DIVS 2 ENGB 3 FFT1 5 FFT2	1 ICT4 1 DIVS 2 ENGB 3 FFT1 5 FFT2
Administrative Actions	Routine.	Routine.	May deny leave requests & cancel non-essential TDYs for Primary Duty firefighters. Overtime approved as needed to meet "Staffing Guide" above.	All scheduled leave and TDYs subject to cancellation for Primary Duty and Secondary Duty firefighters. Overtime approved as needed to meet "Staffing Guide" above.	All scheduled leave, TDYs and days off subject to cancellation for all qualified firefighters. Overtime approved as needed to meet "Staffing Guide" above.
Fire Detection Actions (Civil Air Patrol, Fire Towers, etc.)	None.	None.	At least 1 patrol per day when ignition sources are present (range use, lightning).	At least 2 patrols per day when ignition sources are present (EOD Range use, lightning). Ground patrols may be necessary from 1200-1800.	Patrols as needed when ignition sources are present (EOD Range use, lightning). Ground patrols are necessary from 1200-1800.

WILDFIRE SPECIFIC ACTION GUIDE					
Fire Danger	**Low**	**Moderate**	**High**	**Very High**	**Extreme**
Public Education	Routine. Update fire danger sineage.	Routine. Update fire danger sineage.	Extra precautions with campfires. Update fire danger sineage.	No campfires. PA requested on WUI fires. Circulate fire danger statements through e-mail and/or media outlets. Update fire danger sineage.	No campfires. PA requested on WUI fires. Circulate fire danger statements through e-mail and/or media outlets. Update fire danger sineage.
Change in Personnel Duties	None.	None.	All fire qualified personnel carry PPE and keep dispatch apprised of location. Consider preposition of FES resources during missions that could start wildfires between 1200 and 1800.	Fire Leadership focus on planning and readiness. Preposition FES resources during all missions that could start wildfires.	All qualified Collateral Duty firefighters available to assist. Fire response is priority. Fire Leadership focus on planning and readiness. Preposition resources in WUI.

WILDFIRE SPECIFIC ACTION GUIDE					
Fire Danger	**Low**	**Moderate**	**High**	**Very High**	**Extreme**
Installation Support	None	May need NR support.	Need for NR support is likely.	Need for NR support is likely. May need WSM support. Activate AD hires, if available.	Need for NR or WSM support is likely. AD hires on duty daily, if available.
External Support from CAL FIRE, FDs with Current MAAs, etc.	None	None	Not generally needed unless staffing levels are low and/or fire occurrence is high.	Check with CAL FIRE on resource availability. Check for other DoD fire personnel available for TDY, order as funding allows.	Order additional resources as needed (and approved by leadership if additional funding is required).
Mission Restrictions	Little to no fire danger anticipated. No operational restrictions on missions.	Little to no fire danger anticipated. No operational restrictions on missions.	Consider closing EOD Range.	Consider closing EOD Range.	Close EOD Range.

WILDFIRE SPECIFIC ACTION GUIDE					
Fire Danger	**Low**	**Moderate**	**High**	**Very High**	**Extreme**
Suppression Efforts and Mission Impacts	No difficulty in control or mop up expected.	Little difficulty in control or mop up expected.	Control through direct attack possible but may be difficult.	Fast moving, high intensity fires are difficult to control. Aircraft are more likely to be used in suppression efforts, tying up airspace. All local resources may be committed at times, requiring additional restrictions on mission activity.	Extreme, erratic fire behavior can be expected. All fire starts are potentially dangerous and likely to take several days for suppression. 100% commitment of local resources and presence of resources from outside agencies is high, including various fire suppression aircraft. Air space restrictions are likely to be in place at fire scene(s).

WILDFIRE SPECIFIC ACTION GUIDE					
Fire Danger	**Low**	**Moderate**	**High**	**Very High**	**Extreme**
Notifications	Routine	Routine	If going to "Very High" for 3 or more days looks imminent, notify "Very High +" email list.	Use "Very High +" notification list for all mission related updates on wildfire status, etc. Extra effort to keep PA, cooperators, and leadership apprised of fire situation.	Use "Very High +" notification list for all mission related updates on wildfire status, etc. Extra effort to keep PA, cooperators, and leadership apprised of fire situation.

Notes:

Fire Danger: is based upon the NFDRS adjective fire danger categories. Current and forecasted fire danger can be found on the Wildland Fire Assessment System (WFAS) Fire Danger Rating webpage.

Response Guide: describes the typical "response team", or "initial attack crew" that would be dispatched. There may be exceptions to these numbers, based upon various factors including values at risk, firefighter or equipment availability, firefighter experience and qualifications, fuel loading, etc. Engine typing is dependent upon terrain and values at risk.

Staffing Guide: refer to FES staffing guidelines.

Administrative Actions: are implemented based upon needs as determined above. Denial of leave requests and cancellation of TDYs and days off will be based upon a number of factors including: 1) can we meet numbers of qualified firefighters in the staffing guide, 2) can the firefighter be called back in to duty in a timely manner (<2 hour response), 3) will firefighters be out of the local area (>2 hr. response), 4) specialized skills that may be required, i.e., FAL2, Class A CDL, ICT4, etc., 5) was leave scheduled at least 2 weeks in advance, or was it requested with less time, and 6) Primary Duty vs. Secondary Duty vs. Collateral Duty firefighter classification. Regarding #6, Primary Duty firefighters would be the first affected by any of these administrative actions and Collateral Duty firefighters would be last. This includes

consideration for overtime opportunities as well as potential denial or cancellation of leave, days off, and TDYs. This does not include emergency leave due to bona fide family emergency or personal illness.

Fire Detection Actions: are implemented as shown, but may be adjusted due to aircraft availability, mission activity, etc.

Public Education: refers to our efforts to keep the general public apprised of the fire situation and restrictions that are placed on recreational activities, particularly at higher danger levels.

Change in Personnel Duties: refers to changes in general work assignments that affect wildland fire qualified personnel.

Installation Support: includes any locally available resources that can be used for fire suppression work, including local contract employees that can be picked up as Administratively Determined (AD) firefighters through ONCC.

External Support from CAL FIRE, FDs with Current MAAs, etc.: includes CAL FIRE, mutual aid resources, and resources ordered through the ONCC such as helicopters, air tankers, fire crews, etc.

Mission Restrictions: refers to mitigations that will be made by missions in order to prevent wildfires.

Suppression Effort and Mission Impacts: describes how fire danger levels relate to suppression efforts, and how those can affect mission activity

Notifications: specifies the notifications that take place under the different fire danger levels. "Routine" notifications are made to those on appropriate notification lists for all wildfires. Notifications listed are those that are above and beyond the “Routine” and "Fire-related Emergency" notification procedures.

Appendix 5.1 Certification of Annual WFMP Review

This WFMP will undergo an annual review process to determine the validity of the content and whether any changes/updates are needed. At TAFB this process is performed by the NRM and the WFPC. A table for keeping track of the Annual Review History can be found in Appendix 5.1. Signatures of the WFPC, NRM, and 60 CES/CC, or their designees, are required on the Annual Review History.

Annual Review History		
Review Date	**Reviewer Signature**	**Reviewer Title**

APPENDIX I

Aquatic Pesticide Application Plan (APAP)

(OTIE 2020)

FINAL

Aquatic Pesticide Application Plan (APAP) Environmental Travis Air Force Base Fairfield, California December 2013 Modified 03 June 2020

Prepared for:

Air Force Civil Engineer Center
2261 Hughes Ave., Suite 155
Lackland AFB, Texas 78236-9853

Contract Number: GS10F0059N
Delivery Order Number: FA8903-14-F-0009

Prepared by:

Oneida Total Integrated Enterprises (OTIE)
1777 N. California Blvd., Suite 310
Walnut Creek, CA 94596

CERTIFICATION

AQUATIC PESTICIDE APPLICATION PLAN

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signed and Agreed:

03 June 2020

X

, GS-13, DAF
Flight Chief, Installation Management

AQUATIC PESTICIDE APPLICATION PLAN

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signed and Agreed:

03 June 2020

X

Richard Cavada, PMP
Business Unit Leader

X

Kristin Schultheis
Soil Scientist

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ACRONYMS AND ABBREVIATIONS

Term	Description
°C	degrees Celsius
µg/L	microgram per liter
µS/cm	microSiemens per centimeter
2,4-DCP	2,4-dichlorophenol
AFB	air force base
AMPA	aminomethylphosphonic acid
APAP	Aquatic Pesticide Application Plan
BASH	bird/wildlife/ air strike hazard
BMP	best management practice
Cal OSHA	California Occupational Safety and Health Administration
CalEPA	California Environmental Protection Agency
Cal-IPC	California Invasive Plant Council
CHQ	2,4-dichloroanisole, chlorohydroquinone
COC	chain of custody
DO	dissolved oxygen
DPR	Department of Pesticide Regulations
EPA	United States Environmental Protection Agency
FB	field blank
FD	field duplicate
GSU	Geographically Separated Unit
H_2O_2	hydrogen peroxide
H_2SO_4	sulfuric acid
HCl	hydrochloric acid
HDPE	high-density polyethylene
HNO_3	nitric acid
IPMC	Installation Pest Management Coordinator
IPMP	Integrated Pest Management Plan
L	liter
MB	method blank
mg/L	milligrams per liter
MRP	monitoring and reporting program
MS	matrix spike
MSD	matrix spike duplicate
N/A	not applicable
NEPA	National Environmental Policy Act
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NTU	nephelometric unit
PCA	Pest Control Advisor
PPM	parts per million
QA	quality assurance
QC	quality control
RPD	relative percent difference
SIP	State Implementation Policy
SU	standard unit
TCP	3,5,6-trichloro-2-pyridinol
TKN	total Kjeldahl nitrogen
TMP	3,5,6-trichloro-2-methoxypridine
URS	URS Group, Inc.
USGS	United States Geological Survey
VOA	volatile organic analyte

1.0 INTRODUCTION

1.1 Regulatory Background

This Aquatic Pesticide Application Plan (APAP) was developed to comply with the requirements of the State of California's Water Quality Order 2013-0002-DWQ, the Statewide General National Pollutant Discharge Elimination System Permit for Residual Aquatic Pesticide Discharges to Waters of the United States (U.S.) from Algae and Aquatic Weed Control Applications Permit CAG990005 (General Permit), adopted by the State Water Resource Control Board on March 5, 2013. This APAP was revised to accommodate additional weed control activities and to respond to Water Board comments.

The General Permit regulates point-source discharge to waters of the United States of aquatic pesticides (algaecides and aquatic herbicides) used for algae and aquatic weed control. Herbicides are designed to control and kill unwanted plants. . The General Permit regulates the point-source discharges of residues resulting from pesticide applications using products containing 2,4-D, acrolein, calcium hypochlorite, copper, diquat, endothall, fluridone, glyphosate, hydrogen peroxide, imazamox, imazapyr, penoxsulam, peroxyacetic acid, sodium carbonate peroxyhydrate, sodium hypochlorite, triclopyr-based algaecides and aquatic herbicides, and adjuvants containing ingredients represented by the surrogate nonylphenol.

The General Permit covers only discharges of algaecides, and aquatic herbicides that are currently registered for use in California by the California Department of Pesticide Regulation (DPR), or that become registered for use and contain the above-listed active ingredients and ingredients represented by the surrogate of nonylphenol.

The General Permit does not cover indirect or non-point source discharges, whether from agricultural or other applications of pesticides to land that may be conveyed in stormwater run-off.

Due to lawsuits brought against the Environmental Protection Agency (EPA), several scientific assessments are underway for numerous pesticides. Once complete, findings may result in usage limitations. Lawsuits filed against EPA alleged that EPA did not complete requirements under Section 7 of the Endangered Species Act, which requires federal agencies to determine whether their actions are likely to adversely affect federally listed species. There is a San Francisco Bay Area interim use limitation in effect for 69 active ingredients for Solano County that acts to ensure there are no adverse effects to federally listed species. Only one of the 11 federally listed species targeted under the injunction occurs on Travis AFB, the California tiger salamander. None of the 69 active ingredients in the injunction are included in this APAP, except 2,4-D and diquat dibromide.

Separate from the interim use limitation, EPA is currently completing nationwide effects determinations for four additional chemicals, one of which, glyphosate, is included in this APAP. Effects determinations and initiation of Section 7 consultation for glyphosate is expected by 14 August 2021 (EPA 2020), which may affect glyphosate-approved use requirements.

The interim use limitation requires implementing protective measures specific to region and species, with some exceptions and modifications (https://www.epa.gov/endangered-species/interim-use-limitations-eleven-threatened-or-endangered-species-san-francisco-bay). If Travis AFB conducts its own Section 7 on its herbicide activities, the interim use limitation does not apply. For Travis AFB, the protective measures in the form of no-use buffer zones are detailed in the two bullets below. Neither protective measure is expected to be implemented; however, as none of the pesticides listed for these areas are included in this APAP.

- Within an area adjacent to the southwestern boundary, do not apply listed pesticides within 300 feet of the high water line of salt or brackish water marshes or 200 feet of cordgrass/pickleweed stands.

- Within an area encompassing much of the area north of Air Base Parkway and the eastern half of the runway, do not apply select pesticides within 200 feet of fresh-water ponds, streams, pools, vernal pools, or other ephemeral or permanent water body that hold water for at least 12 weeks. See EPAs interactive map (https://www.epa.gov/endangered-species/san-francisco-bay-area-map-tool-identify-interim-pesticide-use-limitations).

Exceptions for invasive species and noxious weed programs include a reduction of the no-use buffer to 20 feet for state- or federally-designated invasive species or noxious weeds provided that the program is administered by a public entity, applications are limited to localized spot treatments using hand-held devices, applications are overseen by a certified applicator, applications are not made when precipitation is occurring or is forecast to occur within 24 hours after application, and if 2,4-D is used, only the amine formulation is allowed. Other exceptions and modification exist for rodent control, termite treatments, and public health vector control programs.

1.2 Facility Description

Travis Air Force Base (AFB) is located east of Fairfield in Solano County, California. Travis AFB is a fully operational U.S. Department of Defense Base with active duty personnel on station from the U.S. Air Force, Navy, and Army, as well as civilian and contract personnel. Travis AFB is bordered by the City of Fairfield on the west, and farmland/pasture to the north, south and east. The topography of the land is essentially flat. Travis AFB encompasses a total of approximately 5,137 acres plus seven Geographically Separated Units (GSUs) of 357 acres. Travis AFB is located within Regional Water Board Region 2. Travis AFB receives most of its surface water by way of Union Creek or drainage from on-site runoff (see Figure 1 and Figure 2).

1.3 APAP Overview

The Notice of Intent (NOI) submitted to the State Water Resources Control Board (State Water Board) concurrent with this APAP uses the Travis AFB's *Integrated Pest Management Plan* (IPMP). The IPMP employs the techniques of "threshold triggers" for action. Travis AFB's application of aquatic herbicides uses these thresholds as action limits for work initiation.

This APAP describes the project site, aquatic plant and algae nuisances, aquatic pesticide products expected to be used, the monitoring and reporting program (MRP), and best management practices (BMPs) to be followed, as well as the other conditions addressed in the General Permit, Section VIII C, titled *Aquatic Pesticide Use Requirements, Aquatic Pesticide Application Plan*.

The General Permit, Section VIII C, *Aquatic Pesticide Use Requirements, Aquatic Pesticide Application Plan* requires the APAP to contain the following elements:

1) Description of the water system to which algaecides and aquatic herbicides are being applied.
2) Description of the treatment area in the water system.
3) Description of types of weed(s) and algae that are being controlled and why.
4) Algaecide and aquatic herbicide products or types of algaecides and aquatic herbicides

expected to be used and if known their degradation byproducts, the method in which they are applied, and if applicable, the adjuvants and surfactants used.

5) Discussion of the factors influencing the decision to select algaecide and aquatic herbicide applications for algae and weed control.

6) If applicable, list the gates or control structures to be used to control the extent of receiving waters potentially affected by algaecide and aquatic herbicide application and provide an inspection schedule of those gates or control structures to ensure they are not leaking.

7) If the Discharger has been granted a short-term or seasonal exception under State Water Board Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (Policy) Section 5.3 from meeting acrolein and copper receiving water limitations, provide the beginning and ending dates of the exception period, and justification for the needed time for the exception. If algaecide and aquatic herbicide applications occur outside of the exception period, describe plans to ensure that receiving water criteria are not exceeded because the Dischargers must comply with the acrolein and copper receiving water limitations for all applications that occur outside of the exception period.

8) Description of monitoring program.

9) Description of procedures used to prevent sample contamination from persons, equipment, and vehicles associated with algaecide and aquatic herbicide application.

10) Description of the BMPs to be implemented. The BMPs shall include, at the minimum:

    a) Measures to prevent algaecide and aquatic herbicide spill and for spill containment during the event of a spill.

    b) Measures to ensure that only an appropriate rate of application consistent with product label requirements is applied for the targeted weeds or algae.

    c) The Discharger's plan in educating its staff and algaecide and aquatic herbicide applicators on how to avoid any potential adverse effects from the algaecide and aquatic herbicide applications.

    d) Discussion on planning and coordination with nearby farmers and agencies with water rights diversion so that beneficial uses of the water (irrigation, drinking water supply, domestic stock water, etc.) are not impacted during the treatment period.

    e) A description of measures that will be used for preventing fish kill when algaecides and aquatic herbicides will be used for algae and aquatic weed controls.

11) Examination of Possible Alternatives. Dischargers should examine the alternatives to algaecide and aquatic herbicide use to reduce the need for applying algaecides and herbicides. Such methods include:

    a) Evaluating the following management options, in which the impact to water quality, impact to non-target organisms including plants, algaecide and aquatic herbicide resistance, feasibility, and cost effectiveness should be considered:

        i) No action.
        ii) Prevention.
        iii) Mechanical or physical methods.
        iv) Cultural methods.
        v) Biological control agents.
        vi) Algaecides and aquatic herbicides.

If there are no alternatives to algaecides and aquatic herbicides, Dischargers shall use the

minimum amount of algaecides and aquatic herbicides that is necessary to have an effective control program and is consistent with the algaecide and aquatic herbicide product label requirements.

b) Using the least intrusive method of algaecide and aquatic herbicide application.

Applying a decision matrix concept to the choice of the most appropriate formulation. This APAP is organized to address the 11 elements listed above.

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2.0 WATER SYSTEM DESCRIPTION

Travis AFB occupies approximately 5,137 acres plus seven Geographically Separated Units (GSUs) of 357 acres, and receives most of its surface water by way of Union Creek or drainage from on-site authorized stormwater runoff. Union Creek splits into two forks prior to entering Travis AFB property. The eastern fork enters Travis AFB and flows into Duck Pond before flowing underground to outfalls toward the southern portion of Travis AFB. Water in Duck Pond can be released into the underground stormwater system by way of two control valves into the downstream portions of the eastern fork of Union Creek. The western fork flows through Travis AFB, rejoins the eastern fork, and exits near the southwest corner of Travis AFB at designated outfalls. Refer to Figure 3 for the locations of surface water features.

Water is also collected by Travis AFB's authorized stormwater drainage channels. The open stormwater drainage channels are earth-lined conveyances designed and maintained to move water to Union Creek and off Travis AFB.

Vernal pools and swales are found within the grassland habitat as well. Vernal pools are shallow depressions or small, shallow ponds that fill with water during the rainy season (primarily from precipitation with some flow from immediate upland areas) and then dry out during the spring (March – June), becoming completely dry by late spring or early summer. This hydrologic regime supports the unique plant and animal communities, characteristic of vernal pools. The vernal pools on Travis AFB are classified as northern claypan vernal pools. These pools occur on deep alluvial soils. Vernal swales are ecologically and floristically related to vernal pools; however, vernal swales are drainage ways or poorly defined depressions that are seasonally inundated, holding standing water for relatively short periods. These wetlands are scattered throughout the installation, but are generally absent in the highly developed central and northern areas. Over 600 vernal pools and swales have been identified on Travis AFB. These sites are either single pools, or hydrologically associated pool clusters, varying in size from less than 50 square feet to one acre (TAFB 2016).

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3.0 TREATMENT AREA DESCRIPTION

All areas on Travis AFB where aquatic vegetation meets treatment thresholds are subject to treatment.

Application and treatment areas are earth-lined authorized stormwater drainage channels, Union Creek, Duck Pond, wetlands, and vernal pools (Figure 3). Travis AFB maintains channels that range from approximately 5 to 25 feet wide and up to 5 feet deep. Union Creek measures 15 feet depth in some areas. Duck Pond has a surface area of approximately 2.2 acres and is up to approximately 12 feet deep.

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4.0 WEEDS AND ALGAE DESCRIPTION

Weeds (native and non-native) found in Travis AFB's water bodies include riparian, emergent, floating, and submerged aquatic vegetation and algae. Vegetation includes, but is not limited to:

- Eurasian watermilfoil (*Myriophyllum spicatum*) (invasive non-native)
- Cattails (*Typha* spp.) (native)
- Bulrush/tule (*Schoenoplectus* spp.) (native)
- Smartweed (*Persicaria* spp.) (native and non-native species potentially present)
- Duckweed (*Lemna* spp.) (native)
- Filamentous algae
- Perennial pepperweed (*Lepidium latifolium*) (invasive non-native)
- Arundo (*Arundo donax*) (invasive non-native)
- Stinkwort (*Dittrichia graveolens*) (invasive non-native)

The presence and location of these weeds and other plants throughout Travis AFB varies from year to year.

Around the airfield, inefficient conveyance of stormwater and management of wildlife habitat as part of a naturally-functioning wetland and stream system can create a bird/wildlife aircraft strike hazard (BASH), which is of critical concern to Travis AFB. Stormwater drainage channels, Union Creek and Duck Pond are prone to infestation by algae that can be submersed, floating or emergent aquatic weeds, especially cattails and watermilfoil. The presence of these native and non-native weeds can slow or stop the flow of water, preventing efficient drainage and resultant off-site movement of water. This drainage impediment can potentially create a flood hazard or may negatively impact efficient stormwater drainage through Travis AFB, as well as increasing BASH concerns. However, in some cases these tules, cattails, and watermilfoil may act in a positive way to slow down water flow and deposit sediment as a BMP for stormwater pollution prevention control. Travis AFB faces challenges in achieving a balanced solution, weighing these opposing concerns.

The current habitat management for BASH is limited to terrestrial habitat control (e.g., mowing, herbicide treatment). BASH management for Union Creek includes terrestrial habitat control and emergent vegetation control. Travis AFB also needs to reduce BASH habitat concerns in and around its water conveyances by controlling the growth of aquatic and riparian vegetation through the use of pesticides under the General Permit.

Duck Pond, located on the main base, is maintained for recreational fishing and as an aesthetic feature for personnel on base and is managed for species of special status (western pond turtle and migratory birds). Management at Duck Pond will primarily focus on the shoreline plant community, including native cattails and bulrush, by targeting invasive shoreline plants. The may be an occasion to manage algae and submersed aquatic vegetation (rooted and unrooted). through the use of pesticides.

Perennial pepperweed is ranked High by the California Invasive Plant Council (Cal-IPC) and invades wetlands and vernal pools, rapidly forming large, dense stands that displace desirable vegetation. Arundo is ranked High by Cal-IPC that displaces native vegetation, shades out shorter plant species, and forms mono-typic stands along shorelines. Stinkwort is ranked Moderate Alert by Cal-IPC and invades vernal pools and wet areas along with upland grassland areas.. At Travis

AFB, the federally endangered Contra Costa goldfields (*Lasthenia conjugens*) occurs in vernal pools and is directly threatened by existing populations of perennial pepperweed. Other federally listed species potentially affected include vernal pool fairy shrimp (*Branchinecta lynchi*), vernal pool tadpole shrimp (*Lepidurus packardi*), and California tiger salamander (*Ambystoma californiense*) all of which occur in vernal pool habitat at Travis AFB. Control is required to meet conservation recovery goals for these species at Travis AFB per the Integrated Natural Resources Management Plan (TAFB 2016), required by the Sikes Act (16 U.S.C 670).

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5.0 AQUATIC PESTICIDES AND ADJUVANTS USED AND APPLICATION METHODS

Below, Table 1 summarizes the aquatic pesticide products used by Travis AFB:

Table 1 - Aquatic Herbicides Available for Use

Herbicide[1]	Method	Degradation Byproducts[2]
Fluridone	Submersed boom, or spreader.	n-methyl formamide (NMF) and 3-trifluoromethyl benzoic acid
Endothall	Submersed boom, spreader (granules), handgun or boom sprayer.	carbon, hydrogen, and oxygen
Diquat	Submersed boom, handgun (Power sprayer), or boom sprayer.	None
Triclopyr	Backpack sprayer, handgun (Power sprayer), or boom sprayer.	3,5,6-trichloro-2-pyridinol (TCP) 3,5,6-trichloro-2-methoxypridine (TMP)
Glyphosate [4]	Backpack sprayer, handgun (Power sprayer), or boom sprayer.	Aminomethylphosphonic acid (AMPA)
2,4-D	Backpack sprayer, handgun (Power sprayer), or boom sprayer.	1,2,4-benzenetriol, 2,4-dichlorophenol (2,4-DCP), 2,4-dichloroanisole, chlorohydroquinone (CHQ), 4-chlorophenol and volatile organics.
Imazapyr	Backpack sprayer, handgun (Power sprayer), or boom sprayer.	Pyridine hydroxy-dicarboxylic acid, pyridine dicarboxylic acid (quinolinic acid), and nicotinic acid.
Penoxsulam	Backpack sprayer, handgun (Power sprayer), or boom sprayer.	As penoxsulam breaks down, twelve degradation products are created. Six of these are more persistent in the environment than penoxsulam itself: BSTCA: 3-[[[2-(2.2-difluoroethoxy)-6-(trifluoromethyl)phenyl]-sulfnyl]animo]-1H-1,2,4-triazole-5-carboxylic acid 2-animo TCA: 2-animo-1,2,4-triazole carboxylic acid 5-OH-XDE-638 (5-OH-penoxsulam): 2-(2,2-difluoroethoxy)-N-(5,6-dihydro-8-methoxy-5-oxo[1,2,4]triazolo[1,5-c]pyrimidin-2-yl)-6- SFA: 2-(2,2-difluoroethoxy)-N-(iminomethyl)-6-(trifluoromethyl)-benzenesulfonamide sulfonamide: 2-(2,2,-difluoroethoxy)-6-(trifluormethyl)-benzenesulfonamide 5,8-diOH: 2-(2,2,-Difluoroethoxy)-t-trifluoromethyl-N-(5,8-dihydroxy-[1,2,4]triazolo[1,5-c]pyrimidin-2-yl)benzenesulfonamide
Imazamox	Backpack sprayer, handgun (Power sprayer), or boom sprayer.	Nicotinic acid and di- and tricarboxylic acids

Herbicide[1]	Method	Degradation Byproducts[2,3]
Sodium Carbonate Peroxyhydrate	Handgun, boom sprayer (liquid), or spreader (granules).	Hydrogen peroxide (H_2O_2) and sodium carbonate
Acrolein [5]	Submersed boom	Carbon monoxide, formaldehyde, and glycolaldehyde
Calcium hypochlorite	Boom, handgun, spreader	Chlorine and oxygen
Copper [5]	Boom, handgun, spreader	Copper is an element, and so is not broken down like other herbicides. Copper precipitates out of the water over a few days and settles into the sediments, where it persists indefinitely and accumulates over time.
Hydrogen peroxide	Boom, handgun	Water and oxygen
Peroxyacetic acid	Boom, handgun	Water, oxygen, and carbon dioxide
Sodium hypochlorite	Boom, handgun, spreader	Chlorine and oxygen

Notes:
[1]Adjuvants are not included in this list and will be selected as appropriate based on herbicide of choice and must be labeled for aquatic use. Adjuvants containing ingredients represented by the surrogate nonylphenol will not be used in the lakes ponds, and lagoons.

[2] Source: Wisconsin Department of Natural Resources Chemical Fact Sheets (http://dnr.wi.gov/lakes/plants/factsheets/)

[3]Source: Strek 1998

[4] As discussed in Section 1.2, EPAs effects determinations and Section 7 consultations with U.S. Fish and Wildlife Service may affect future use requirements for glyphosate.

[5] Per Section 8.0, acrolein and copper are not planned for use on Travis AFB. They are is included on this table in case of future use.

All pesticide applications are made in strict accordance with the product label. For example, an application of endothall, which is a liquid, to lakes/ponds for the control of algae will be made with a handgun spray nozzle at a rate calibrated to deliver the desired target concentration of material per acre-foot of water in the pond, as calculated per the label for algae control. An additional example is for the control of emergent vegetation in drainage channels. In this case, an application of Glyphosate tank mix will be made by working upstream with a backpack sprayer, handgun, or boom sprayer. These applications are not completed if wind speed exceeds a threshold that may result in unintentional drift, as prescribed on the label.

The herbicides used to control algae and submersed aquatic vegetation (rooted and unrooted) in standing/flow-through water bodies (e.g., Duck Pond) mentioned above will not control tules/cattails/bulrushes because they are not designed to do so and are ineffective.

The quantity of aquatic herbicide product required is determined by the Pest Manager who follows the label directions in making a recommendation. The amount of material used is highly variable and depends on the type, location, and density of weeds, the weed area to be treated, amount of water flowing in a canal, temperature and hardness of the water. All these factors are considered by the Pest Manager prior to making an application.

As appropriate, the DPR-licensed Pest Control Advisor (PCA) will consider and use adjuvants (surfactants, emulsifiers, pH control agents, drift retardants, etc.) to increase the efficacy of the aquatic herbicide so that the least possible material is used in the most efficient manner to control algae and aquatic weeds. Adjuvants also reduce the unintentional movement of aquatic herbicide applications to off-site locations that may have sensitive receptors. The PCA is in regular contact with the manufacturer's representatives to gain knowledge and assess new or modified adjuvants that will improve efficacy or further decrease off-target movement.

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6.0 DISCUSSION OF FACTORS INFLUENCING AQUATIC HERBICIDE SELECTION

The selection of and decision to use an aquatic herbicide is based on the recommendation of the Installation Pest Management Coordinator (IPMC) or contracted PCA. The IPMC will consult with Travis AFB Headquarters, Air Mobility Command's Medical Entomologist, the Natural Resources Manager, and a PCA. These consultations will consider a variety of control options and application areas. These options may include mechanical and cultural techniques that, alone or in combination with chemical controls, are the most efficacious and protective of the environment. Evaluating all potential control methods is part of Travis AFB's integrated pest management approach; therefore, a non-pesticide control method such as mechanical removal (raking out weeds or chaining) may be selected as part of a test program. A more detailed description is presented in Section 12 of this document.

Additionally, the IPMC will not select environmentally sensitive areas such as vernal pools and/or seasonal swales to apply pesticides (except the perennial pepperweed, arundo, and stinkwort control program's use of glyphosate, imazapyr, and triclopyr managed by the Natural Resource Manager), which could provide suitable habitat to support federally-listed species, including branchiopods and breeding habitat for California tiger salamander. The Natural Resources Manager will identify all sensitive areas, buffer zones, and may conduct a biological survey prior to pesticide application for areas identified on the Aquatic Pesticide Application Areas map as requiring a site briefing, which includes all of Union Creek south of the runway (Areas G, H, I & J) and parts of the western fork (Areas C & D).

Effective treatment of aquatic weeds by Travis AFB is determined by the use of the principles of integrated pest management and by the application of threshold criteria listed in Travis AFB's IPMP (Travis AFB, 2011-2016). For example, if a population of weeds equals or exceeds a certain threshold, an aquatic herbicide application is made.

Thresholds are met when weeds/algae create problematic habitat or cause problems and/or concerns in:

- Stormwater channels and/or any other drainage conveyances.
- Typically associated with impediments to flow.
- BASH concerns and/or sediment build-up in Travis AFB channels.
- Endangered Species Act (16 U.S.C 1531 et seq.) listed species

Algaecide and aquatic herbicide applications may also be made prior to threshold exceedance. For example, based on:

- Predicted growth rate
- Density
- Historical weed trends
- Seasonal hot weather
- Water availability
- Experience/process knowledge

Weeds may reasonably be predicted to cause future problems. Accordingly, they may be treated soon after emergence or when appropriate based on the selected herbicide to be used. Even though weeds may not be an immediate problem at this phase, treating them before they mature reduces the amount of aquatic herbicide needed. Younger weeds are more susceptible and there is less plant mass to target. Generally, treating weeds earlier in the growth cycle results in less total aquatic herbicide used.

Selection of appropriate aquatic herbicide(s) and rate of application performed is based upon:

- Identification of the algae or aquatic weed
- Its growth state
- The appearance of that weed on the product label as a plant it controls

Vernal pool water levels and phenology of the weed and native species in the pool. Note that herbicide application is not planned for Travis AFB vernal pools. It is included here only for trials conducted under very controlled circumstances, and conditions when the vernal pools are dry.

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7.0 GATES AND CONTROL STRUCTURES

Two control valves can be used to release water from the North Gate Pond into the underground stormwater system downstream of the eastern fork of Union Creek. As applicable or necessary, Travis AFB staff will close valves during an algaecide or aquatic herbicide application to control the extent, if any, that receiving waters will be affected by residual algaecides or aquatic herbicides.

For areas where there is no gate or control structure, read the pesticide label for instructions on how to limit the spread of pesticides beyond the targeted plants. This applies to Union Creek Areas C through J (refer to Figure 2). Reading and following the label instructions is to be done for all applications, regardless of the presence or lack of gates and control structures.

To evaluate the presence of leaks, valves within the treatment area will be inspected prior to and during the application. Form 1 shows the form used to document this inspection. If leaks develop on closed valves, they will be stopped as soon as practicable.

Water does not flow out of vernal pools thus no gates or control structures exist or are needed. Note that herbicide application is not planned for Travis AFB vernal pools. It is included here only for trials conducted under very controlled circumstances, and conditions when the vernal pools are dry.

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8.0 STATE IMPLEMENTATION POLICY (SIP) SECTION 5.3 EXCEPTION

Travis AFB is not planning to use copper or acrolein to control aquatic vegetation. As such, a SIP Section 5.3 Exception is not necessary. If Travis AFB decides to use copper or acrolein, it may apply for a SIP Section 5.3 Exception; if an exception is granted, this section will be amended to include the information as outlined in the required California Environmental Quality Act documentation. This amendment will be noted in the Annual Report.

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9.0 MONITORING AND REPORTING PROGRAM (MRP)

The General Permit requires that dischargers comply with the MRP outlined in Attachment C of the General Permit. The MRP must be designed to address two key questions:

- Question 1: Does residual algaecide and aquatic herbicide discharge cause an exceedance of receiving water limitations?
- Question 2: Does the discharge of residual algaecides and aquatic herbicides, including active ingredients, inert ingredients, and degradation byproducts in any combination cause or contribute to an exceedance of the "no toxics in toxic amount" narrative toxicity objective?

The monitoring program in this APAP must also describe the tasks and time schedules in which these two key questions will be addressed. Monitoring must take place at locations that are being planned to be applied or may be applied as described in this APAP.

The General Permit Fact Sheet in Attachment D of the General Permit describes the goals of the MRP as follows:

1. Identify and characterize algaecide or aquatic herbicide application projects conducted by the Discharger.
2. Determine compliance with the receiving water limitations and other requirements specified in this General Permit.
3. Measure and improve the effectiveness of the APAP.
4. Support the development, implementation, and effectiveness of BMPs.
5. Assess the chemical, physical, and biological impacts on receiving waters resulting from algaecide or aquatic herbicide applications.
6. Assess the overall health and evaluate long-term trends in receiving water quality.
7. Demonstrate that water quality of the receiving waters following completion of resource or weed management projects are equivalent to pre-application conditions.
8. Ensure that projects that are monitored are representative of all algaecide or aquatic herbicide and application methods used by the Discharger.

Attachment C of the General Permit provides MRP guidelines that Travis AFB will use to meet the goals listed above; the MRP in this APAP is consistent with the above goals.

All activities conducted under this APAP will comply with the EPAs interim use limitation for 69 chemicals at Travis AFB, within areas subject to the injunction (https://www.epa.gov/endangered-species/san-francisco-bay-area-map-tool-identify-interim-pesticide-use-limitations). The only active ingredient this applies to is 2,4-D. Glyphosate may have future restrictions yet to be identified, pending a completed effects analysis and consultation by EPA (See Section 1.1).

9.1 Monitoring Procedures

Monitoring must take place for all active ingredients at locations that are described and scheduled in this APAP. Monitoring must include frequent and routine visual, physical, and chemical monitoring on a pre-determined schedule including background monitoring, event monitoring, and post-event monitoring, as summarized in the table below.

Monitoring for discharges to vernal pools will follow the same procedures as other applications though most applications will not be applied to open water thus physical and chemical monitoring (Table 2) are likely to be marked not applicable on data sheets. The one exception is for post-event monitoring which will occur once pools have filled with water; monitoring will check for presence of herbicide in waters to support ESA consultations and reporting. Post-event monitoring will occur in every vernal pool with historical records of listed species plus up to six pools without such records, annually. Number of sampling events is the same for all chemicals including glyphosate. Typically, active ingredients will be applied to dry jurisdictional vernal pools (~May-Oct) that fill with water after the rainy season starts (~November), 1-6 months after herbicide application. Travis AFB's new Endangered Species Act (ESA) Programmatic Biological Opinion (PBO) allows Travis to conduct herbicide applications near habitat suitable for federally listed species (e.g. vernal pools) and requires conformance to minimization measures. In situations where this APAP applies (application to vernal pools), additional project analysis under the PBO will be required and submitted to USFWS for approval, ensuring compliance with the ESA.

Table 2 – Monitoring Requirements

Sample Type	Constituent/ Parameter	Units	Sample Method	Minimum Sampling Frequency	Sample Type Requirement	Required Analytical Test Method
Visual	Monitoring area description (pond, lake, open waterway, channel, etc.)	Not applicable	Visual Observation	1	Background, event and post-event monitoring.	Not Applicable
	Appearance of waterway (sheen, color, clarity, etc.)					
	Weather conditions (fog, rain, wind, etc.)					
Physical	Temperature[2]	ºF	Grab[4]	5	Background, event and post-event monitoring.	6
	pH[3]	Number				
	Turbidity[3]	NTU				
	Electric Conductivity[3] at 25 degrees Celsius (°C)	µmhos/cm				
Chemical	Active Ingredient[7]	µg/L	Grab[4]	5	Background, event and post-event monitoring.	6
	Nonylphenol[8]	µg/L				
	Hardness (if copper is monitored)	mg/L				
	Dissolved Oxygen[2,9]	mg/L				

Sample Type	Constituent/ Parameter	Units	Sample Method	Minimum Sampling Frequency	Sample Type Requirement	Required Analytical Test Method

[1]All applications at all sites.
[2]Field testing.
[3]Field or laboratory testing.
[4]Samples shall be collected at 3 feet below the surface of the water body or at mid water column depth if the depth is less than 3 feet.
[5]Collect samples from a minimum of six application events for each active ingredient in each environmental setting (flowing water and non-flowing water) per year, except for glyphosate. If there are less than six application events in a cxyear, collect samples during each application event for each active ingredient in each environmental setting (flowing water and non-flowing water). If the results from six consecutive sampling events show concentrations that are less than the receiving water limitation/trigger for an active ingredient in an environmental setting, sampling shall be reduced to one application event per year for that active ingredient in that environmental setting. If the yearly sampling event shows exceedance of the receiving water limitation/trigger for an active ingredient in an environmental setting, then sampling shall return to six application events for that active ingredient in each environmental setting. For glyphosate, collect samples from one application event from each environmental setting (flowing water and non-flowing water) per year.
[6]Pollutants shall be analyzed using the analytical methods described in the Code of Federal Regulations Title 40 Section 136.
[7] 2,4-D, acrolein, calcium hypochlorite, copper, diquat, endothall, flumioxazin, fluridone, glyphosate, hydrogen peroxide, imazamox, imazapyr, penoxsulam, peroxyacetic acid, sodium carbonate peroxyhydrate, sodium hypochlorite, and triclopyr.
[8]This item is required only when a surfactant is used.
[9]Water Quality Order 2013-0002-DWQ requires levels of dissolved oxygen to be maintained below the Regional Water Board Basin Plan's dissolved oxygen objectives for receiving water after application.

9.1.1 Visual Monitoring

Visual monitoring will be performed for all algaecide and aquatic herbicide applications at all sites and be recorded by qualified personnel.

Form 1, the Aquatic Pesticide Application Log or its equivalent, or Form 2, an Aquatic Herbicide Field Monitoring and Sampling Form for Static Water, or its equivalent, or Form 3, an Aquatic Herbicide Field Monitoring and Sampling Form for Moving Water will be used. Records from this monitoring will be kept with the application records of Travis AFB.

9.1.2 Monitoring Locations and Frequency

Water quality sampling for glyphosate will be conducted for one application event from each environmental setting (flowing water [i.e., moving] and non-flowing water [i.e., static]) per year. No water quality sampling is required for applications of products that contain sodium carbonate peroxyhydrate. For application of all other algaecides and aquatic herbicides listed on the Permit, Travis AFB will collect samples from a minimum of six application events for each active ingredient in each environmental setting per year. If there are less than six application events in a year for an active ingredient, Travis AFB will collect samples for each application event in each environmental setting. If the results from six consecutive sampling events show concentrations that are less than the applicable receiving water limitation/trigger in an environmental setting, Travis AFB will reduce the sampling frequency for that active ingredient to one per year in that environmental setting. If the annual sampling shows exceedances of the applicable receiving water limitation/trigger, Travis AFB will be required to return to sampling six applications the next year, and until sampling may be reduced again. Sites will be chosen to represent the variations in treatment that occur, including algaecide or aquatic herbicide use, hydrology, and

environmental setting, conveyance or impoundment type, seasonal, and regional variations. The exact location(s) of sample site(s) will be determined after site scouting and a decision to make an aquatic herbicide application are made per Travis AFB's IPM approach. Form 1 is the form used to document pesticide application. Form 2 and Form 3 are the forms used to document monitoring and sampling for static or moving water applications.

9.1.3 Sample Locations

Sampling will include background, event, and post-event monitoring as follows:

9.1.3.1 Background Monitoring

In moving water, the background sample is collected upstream of the treatment area at the time of the application event, or in the treatment area within 24 hours prior to the start of the application.

For static water, the background sample is collected in the treatment area within 24 hours prior to the start of the application.

9.1.3.2 Event Monitoring

The event monitoring sample for flowing water is collected immediately downstream of treatment area immediately after the application event, but after sufficient time has elapsed such that treated water would have exited the treatment area.

The event monitoring sample for non-flowing (static) water is collected immediately outside the treatment area immediately after the application event, but after sufficient time has elapsed such that treated water would have exited the treatment area.

The location and timing for the collection of the event monitoring sample may be based on a number of factors including, algae and aquatic weed density and type, flow rates, size of the treatment area, and duration of treatment.

9.1.3.3 Post-Event Monitoring

The post-event monitoring sample is collected within the treatment area within one week after the application.

One full set of three samples (i.e., background, event monitoring and post-event monitoring) will be collected during each treatment from the representative site(s) in Travis AFB according to the monitoring frequency and locations described earlier.

Additionally, one field duplicate (FD) and one field blank (FB) will be collected and submitted for analysis for each analyte with each sampling event. The FD and FB samples will be collected at the event site immediately after application. Forms 1 through 3 are the field sampling forms to be used.

Once Travis AFB determines that an aquatic herbicide application is needed, the exact locations of sample collection will be determined using guidance presented above.

9.1.4 Sample Collection

If the water depth is 6 or more feet, the sample will be collected at a depth of 3 feet. If the water

depth is less than 6 feet, the sample will be collected at the approximate mid-depth. Samples will be collected in a manner that minimizes the amount of suspended sediment and debris in the sample and minimizes loss of monitored constituent. Sample collection locations will be altered if access or other problems are encountered in the field.

9.1.5 Field Measurements

In conjunction with sample collection, temperature will be measured during or shortly after sample collection. Turbidity, electrical conductivity/salinity, pH, and dissolved oxygen may be measured in the field using field meters as available or analyzed in the laboratory. A field meter calibration log must be kept and made available to authorities upon request for inspection.

9.1.6 Sample Preservation and Transportation

If preservation is required for the monitored constituent, the preservative will be placed in the sample by the container analytical laboratory or vendor prior to sample collection. Once a sample is collected and labeled it will immediately be placed in a dark, cold (4°C) environment, which is typically an ice chest with ice. Delivery to the laboratory typically occurs on the same day of sample collection.

9.1.7 Sample Analysis

All samples requiring laboratory analyses will be collected and analyzed by a laboratory certified for such analyses by the California Department of Public Health. All analyses will be conducted in accordance with the latest edition of *Guidelines Establishing Test Procedures for Analysis of Pollutants* (Guidelines), promulgated by the U.S. Environmental Protection Agency (EPA) per the Code of Federal Regulations Title 40 Section 136. Field analysis for the parameters of temperature, dissolved oxygen, electrical conductivity, and pH may be performed using a portable multi-parameter meter (YSI brand or equivalent) with a sufficiently long probe cable.

The meter(s), if used, will be maintained and calibrated at regular intervals according to the manufacturer specifications. Table 3 shows the constituents that each sample must be analyzed for.

Table 3 - Required Sample Analysis

Analyte	EPA Method	Reporting Limit	Hold Time (Days)	Container	Chemical Preservative
Temperature[1]	Field test with calibrated portable instrument or 170.1	N/A	N/A	N/A	N/A
Turbidity[2]	Field test with calibrated portable instrument or 180.1	0.02 NTU	2	100 mL HDPE	None
Electrical Conductivity[2]	Field test with calibrated portable instrument or 120.1	1 µS/cm at 25°C	28	100 mL HDPE	None
pH2	Field test with calibrated portable instrument or 150.1 or 150.2	0.1 SU	Immediately	100 mL HDPE	None

Analyte	EPA Method	Reporting Limit	Hold Time (Days)	Container	Chemical Preservative
Dissolved Oxygen2	Field test with calibrated portable instrument or 360.1 or 360.2	1.0 mg/L	Immediately	250 mL Amber Glass	None
TKN, Total Nitrogen, Nitrite (NO_2), and Nitrates (NO_3)	351.1-4 or 353.1	1.0 mg/L	28 days	100 mL HDPE	H2 SO4 OR HCL, cold
*Copper (total)	200.7	1 µg/L	180	250 mL HDPE	pH<2 w/HNO_3
Hardness	130.1 or 130.2	5 mg/L	1	250 mL HDPE	None
*Triclopyr	8151-modified	0.1 µg/L	7	1L Amber Glass	None
*Endothall	548.1	40 µg/L	7	2x40 mL VOA	HCI
*2,4-D	8151	0.5 µg/L	7	1L Amber Glass	None
*Diquat	549.1 or 549.2	40 µg/L	7	500 mL Amber HDPE	H_2SO_4
*Fluridone	NCL-SOP	0.1 µg/L	7	2 x40 mL VOA	None
*Glyphosate	547	0.5 µg/L	14	2 x40 mL VOA or other glass container	Sodium Thiosulfate
*lmazapyr	8321	1 µg/L	7	1L Amber Glass	None
*Penoxsulam	NCL-SOP	0.1 mg/L	7	2 x40 mL VOA	None
Imazamox	NCL-SOP	1 mg/L	7	2 x40 mL VOA	None
*Nonylphenol[3]	NCL SOP 272	1 µg/L	7	IL Amber Glass	None
*Sodium Carbonate Peroxyhydrate	Spectrophotometer (for H_20_2)	1.0 mg/L	7	250 mL HDPE	None

Notes:

	Must be sampled for at every sample site for all herbicide applications.
	Must be sampled for at applications to lakes/ponds to confirm the absence of copper.
	Must be sampled for at every sample site for herbicide applications when the active ingredient (herbicide) is listed on the• label of the pesticide applied.

*Signifies active ingredient (herbicide). Chemical analysis is only required if the active ingredient(s) is used in treatment.

[1]Must be field measured.

[2]May be field or laboratory measured.

[3]Required only when nonylphenol surfactant is used.

Analyte	EPA Method	Reporting Limit	Hold Time (Days)	Container	Chemical Preservative

µg/L – microgram per liter
µS/cm- microSiemens per centimeter
°C – degrees Celsius
H_2SO_4 – sulfuric acid
HCl – hydrochloric acid
HDPE- high density polyethylene (plastic) bottle
HNO_3 – nitric acid
L – liter
mg/L- milligram per liter
mL – milliliter
N/A - Not applicable
NTU – nephelometric unit
SU - Standard Units
TKN - Total Kjeldahl nitrogen
VOA - Volatile Organic Analyte vial

9.2 Reporting Procedures

Luann Tetirick, Water Quality Program Manager for Travis AFB, is the contact for this project and is reached at (707) 424-3587. Ms. Tetirick will be responsible for receiving, reviewing, and providing feedback on project reports to the Water Board.

9.2.1 Annual Report

An annual report for each reporting period, from January 1 to December 31 will be prepared and submitted by March 1 of the following year. In years when no aquatic herbicides are used, a letter stating that no applications were applied will be submitted in lieu of an annual report. The Annual Report will be submitted to the appropriate Deputy Director and Regional Board Executive Officer. All reports submitted in response to the Water Quality Order will comply with the provisions stated in the Standard Provisions (Attachment B) and Monitoring and Reporting Program (Attachment C), of the General Permit. The Annual Reports will contain the following information:

- An executive summary discussing compliance or violation of the General Permit, and the effectiveness of the APAP to reduce or prevent the discharge of pollutants associated with algaecide and aquatic herbicide applications.
- A summary of monitoring data, including the identification of water quality improvements, or degradation as a result of the algaecide or aquatic pesticide application, if appropriate, and recommendations for improvements to the APAP (including proposed BMPs and monitoring program based on the monitoring results). All receiving water monitoring data will be compared to receiving water limitations and receiving water monitoring triggers.

Travis AFB will collect and retain all information on the previous reporting year. When requested by the Deputy Director or Executive Officer of the applicable San Francisco Regional Water Board, Travis AFB will submit the annual information collected, including:

1. An Executive Summary discussing compliance or violation of the Permit and the effectiveness of the APAP to reduce or prevent the discharge of pollutants associated with herbicide applications.
2. A summary of monitoring data, including the identification of water quality improvements or degradation as a result of algaecide or aquatic herbicide application, if appropriate, and recommendations for improvement to the APAP (including proposed BMPs) and monitoring program based on the monitoring results. All receiving water monitoring data must be compared to applicable receiving water limitations and receiving water monitoring triggers.
3. Identification of BMPs and a discussion of their effectiveness in meeting the Permit

requirements.

4. A discussion of BMP modifications addressing violations of the Permit.
5. A map showing the location of each treatment area.
6. Types and amounts of aquatic herbicides used at each application event during each application.
7. Information on surface area and/or volume of treatment area and any other information used to calculate dosage, concentration, and quantity of each aquatic herbicide used.
8. Sampling results shall indicate the name of the sampling agency or organization, detailed sampling location information (including latitude and longitude or township/range/section if available), detailed map or description of each sampling area (address, cross roads, etc.), collection date, name of constituent/parameter and its concentration detected, minimum levels, method detection limits for each constituent analysis, name or description of water body sampled, and a comparison with applicable water quality standards, description of analytical quality assurance/quality control (QA/QC) plan. Sampling results shall be tabulated so that they are readily discernible.
9. Summary of Aquatic Pesticide Application Logs (Form 1).

9.2.2 24-Hour and 5-Day Reporting

The discharger and or applicator will orally report any non-compliance. This includes any unexpected or unintended effect of the use of an algaecide or aquatic herbicide that may danger health or the environment. This information will be provided orally within 24 hours from the time the discharger or applicator becomes aware of the circumstances. A written report of the non- compliance will be provided within 5 days of the time the discharger and or applicator becomes aware of the noncompliance.

9.3 Sampling Methods and Guidelines

The purpose of this section is to present methods and guidelines for the collection and analysis of samples necessary to meet the APAP objective of assessing adverse impacts, if any, to beneficial uses of water bodies treated with algaecides and aquatic herbicides.

This section describes the techniques, equipment, analytical methods, and quality assurance and quality control procedures for sample collection and analysis. Guidance for the preparation of this section included:

- NPDES Storm Water Sampling Guidance Document (EPA 1992)
- Guidelines and Specifications for Preparing Quality Assurance Project Plans (EPA 1980)
- U.S. Geological Survey, National Field Manual for the Collection of Water Quality Data (USGS 1995).

9.3.1 Surface Water Sampling Techniques

All surface water samples will be grab samples and will be collected with an open-faced container placed directly into the water. If the water depth is 6 feet or greater the sample will be collected at a depth of 3 feet or approximately half the water depth, if possible. If the water depth is less than 6 feet, the sample will be collected at the approximate mid-depth. As necessary, an intermediary sampling device (e.g., long-handled cup sampler or Van-Dorn style sampler) will be

used for locations that are difficult to access. Appropriate cleaning technique is discussed in Section 9.3.4.

During collection, the samples will be collected in a manner that minimizes the amount of suspended sediment and debris in the sample. Surface water grab samples will be collected directly by the sample container or by an intermediary container in the event that the sample container cannot be adequately or safely used or the container includes a chemical preservative. Intermediary samplers will either be HDPE (plastic), stainless steel or glass. Stainless steel and glass containers will be washed thoroughly and triple rinsed before collection of the next sample. Alternatively, disposable HDPE or glass intermediary sample containers can be used once, and discarded after sampling.

9.3.2 Sample Containers

Clean, empty sample containers with caps will be supplied in protective cardboard cartons or ice chests by the subcontractor laboratory. The containers will be certified clean by either the laboratory or the container supplier. To ensure data quality control, the sampler will use the appropriate sample container as specified by the laboratory for each sample type. Sample container type, holding time, and appropriate preservatives are listed in Table 3. Each container will be affixed with a label indicating a discrete sample number for each sample location. The label will also indicate the date and time of sampling and the sampler's name.

9.3.3 Sample Preservation

Samples are to be prepared and preserved per instructions specific to each analyte as provided by the laboratory. Collected samples are to be refrigerated at 4°C, stored in a dark place, and transported to the analytical laboratory. Preservatives shall be added to sampling bottles before sampling occurs by the laboratory supplying the containers and performing the analysis, as necessary. Refer to Table 3.

9.3.4 Sampling Equipment Cleaning

In the event that sampling equipment will be used in more than one location, the equipment will be thoroughly cleaned with a non-phosphate cleaner, triple-rinsed with distilled water, and then rinsed once with the water being sampled prior to its first use at a new sample collection location. Store the wash and rinse-water in an appropriately labelled container. Read the pesticide label for disposal instructions.

9.3.5 Sample Packing and Shipping

All samples are to be packed and transported the day the samples are collected to provide ample time for samples to be analyzed within the required holding time.

Ice will be included in ice chests containing samples that require temperature control. Samples will be packaged in the following manner:

1. Sample container stickers will be checked for secure attachment to each sample container.
2. The sample containers will be placed in the lined ice chest. Bubble-wrap, suitable foam padding, or newspaper will be placed between sample containers to protect the sample containers from breakage during shipment and handling.
3. The chain of custody (COC) will be placed inside a plastic bag and placed inside the ice

chest. The COC will indicate each unique sample identification name, time and place of sample collection, the sample collector, the required analysis, turnaround time, and location to which data will be reported.

4. The ice chest will then be readied for pick-up by a courier or delivered directly to the laboratory.

9.4 Field Sampling Operations

9.4.1 Field Logbook

A logbook will be maintained by members of the sampling team to provide a record of the individual(s) conducting the sample, sample location, significant events, observations, and measurements taken during sampling. Entries will be signed and dated. Field data will be recorded with permanent ink. Field logbooks are intended to provide sufficient data and observations to enable project team members to reconstruct events that occurred during the sampling. The field logbook entries will be legible, factual, detailed, and objective. Use the field monitoring and sampling forms to record relevant field data; Form 2 for applications in static water and Form 3 for applications in moving water. The logbook may be used to keep the field meter calibration log and made available to authorities upon request for inspection.

All sampling events that will take place in vernal pools will be conducted by, accompanied by, or trained by a qualified biologist as determined by the Natural Resources Manager and/or required by applicable ESA Section 7 document.

9.4.2 Alteration of Sampling Techniques

It is possible that actual field conditions may require a modification of the procedures outlined here. Specifically, water levels, weather, other environmental parameters and hazards including stream flow, rainfall and stormwater use may pose access and/or sampling problems. In such instances, variations from standard procedures and planned sampling locations and frequencies will be documented by means of appropriate entry into the field logbook.

9.4.3 Flow Estimation

A flow meter calibrated according to the manufacturer's directions will be p1aced as close to the center of the stream or creek as possible and a reading taken in feet per second. Alternatively, the time a common floating object (branch, leaf, etc.) travels a known distance will be estimated and represented in feet per second. A minimum distance of approximately 25 feet will be used. Flow estimation measurements will be made for all moving water sampling locations.

9.4.4 Chain-of-Custody (COC)

The COC record will be employed as physical evidence of sample custody. The sampler will complete a COC record to accompany each sample shipment from the field to the laboratory. The COC will specify: time, date, location of sample collection, specific and unique sample number, requested analysis, sampler name, required turnaround time, time and date of sample transaction between field and laboratory staff, preservative, if any, and name of receiving party at the laboratory.

Corrections to the COC will be made by drawing a line through, initialing, and dating the error, and entering the correct information using a marker with water proof ink. Erasures are not

permitted.

Upon receipt of the samples, laboratory personnel will check to ensure that the contents of the ice chest(s) are accurately described by the COC. Upon verification of the number and type of samples and the requested analysis, a laboratory representative will sign the COC, indicating receipt of the samples.

The COC record form will be completed in duplicate. Upon sample delivery, the original copy will be left with the laboratory and a copy will be kept by the sampler, either electronically (as a scan) or three-hole punched, and placed in the field logbook.

9.4.5 Sample Label

The laboratory will often provide sample labels. The label will contain information on the specific project (i.e., Travis Air Force Base APAP), the unique individual sample identification number (i.e., Duck Pond-BG), the date and time the sample was collected, and the name of the sampler (i.e. S. Burkholder).

Prior to sampling, the water resistant label will be completed with waterproof ink and will be affixed to the appropriate container.

9.4.6 Corrections to Documentation

Documents will not be destroyed or thrown away, even if they are illegible or contain inaccuracies that require a replacement or correction. If an error is made on a document used by an individual, that individual will make corrections by making a line through the error and entering the correct information. Corrections will be initialed and dated.

9.4.7 Document Control

A central file location will be established and used to store documentation such as the field logbook and laboratory data. These documents will be stored by Travis AFB's Pest Manager who is responsible for compliance, in accordance with this APAP.

9.4.8 Sample Kit

Prior to departing to the field to collect samples, the following equipment will be prepared for use:

- Laboratory-supplied sampling bottles (one set for each sample to be collected plus spares, plus QA/QC samples)
- Sample labels (one for each sample container to be collected plus spares)
- Permanent, water-proof ink marker
- COC forms
- Field data logbook
- Flow meter (optional for moving water applications)
- Ziploc-type bags for paperwork
- Non-phosphate cleaner (e.g., Liqui-Nox®)
- Deionized or distilled water
- Ice or blue ice packs
- Clear mailing tape
- Plastic ice chest(s)

- Grab pole
- Gloves
- Rubber boots
- Stop or wrist watch

9.5 Quality Assurance/Quality Control (QA/QC)

. Quality Assurance (QA) is a program implemented to ensure integrity of data & cover all aspect of sample collection and analysis. Quality Control (QC) is a sub set of QA that addresses data reliability, accuracy & precision. Any data set can exist in one of 4-states: (i) in accurate & imprecise, (ii) accurate but imprecise, (iii) precise but inaccurate, and (iv) accurate & precise. Thus, accurate & precise data is considered reliable data. This section describes the QA/QC process.

9.5.1 Precision

Precision is a measure of the reproducibility of measurements under a given set of conditions. It is a quantitative measure of the variability of a group of measurements compared to the average value of the group and is expressed as the relative percent difference (RPD). Sources of error in precision (imprecision) can be related to both laboratory and field techniques. Specifically, lack of precision is caused by inconsistencies in instrument setting, measurement and sampling techniques and record keeping.

Laboratory precision is estimated by generating analytical laboratory matrix spike (MS) and matrix spike duplicate (MSD) sample results and calculating RPD. In general, laboratory RPD values of less than 25 percent will be considered acceptable.

Field precision is estimated by collecting field duplicates (FDs) in the field and calculating RPD. In general, field RPD values of less than 35 percent will be considered acceptable. Refer to the discussion of FDs in Section 9.6.5.

9.5.2 Accuracy

Accuracy is a measure of how close data are to their true values and is expressed as percent recovery (% R), which is the difference between the mean and the true value expressed as a percentage of the true value. Sources of error (inaccuracy) are the sampling process, field contamination, preservation, handling, sample matrix effects, sample preparation, analytical techniques and instrument error.

Laboratory accuracy is estimated using reference standards and matrix spike (MS) and matrix spike duplicates (MSD) samples. Acceptable accuracy is between 75 and 125 percent. Refer to the earlier discussion of MS and MSD. Field accuracy cannot be measured as true field values are not known.

9.5.3 Completeness

Completeness is defined as the percentage of measurements made which are judged to be valid measurements. The completeness objective is that sufficiently valid data is generated to allow for submittal to the Water Board. Completeness will be assessed by comparing the number of valid sample results to the number of samples collected. The objective for completeness is 80 percent.

9.5.4 Representativeness

Representativeness refers to a sample or group of samples that reflects the predominant characteristics of the media at the sampling point. The objective in addressing representativeness is to assess whether the information obtained during the sampling and analysis represents the actual site conditions.

9.5.5 Field Duplicate (FD)

The purpose of a FD is to quantify the precision, or reproducibility, of the field sampling technique. It involves the duplication of the technique used for a particular field sample collection method and the subsequent comparison of the initial and duplicate values. This comparison is measured as the relative percent difference (RPD). RPD is calculated as follows:

RPD = [(Sample 1 – Sample 2) / (Average of Samples 1 and 2)] X 100

An acceptable field RPO value is: S 35 percent.

. A Field duplicate (FD) is collected each time a sampling event occurs. For example, if six sampling events had occurred in one year, then one FD should have been collected with each event for a total of six samples in that year.

9.5.6 Field Blank (FB)

The purpose of the field blank (FB) is to assure that the field sampling technique, equipment, or equipment cleaning technique or materials do not impart a false positive or negative result during the collection of the sample. An FB will be prepared with distilled water or equivalent and allowed to come into contact with the sampling device in a manner identical to the actual sample. The only acceptable values for analytes in the FB is less than the RL for the compounds of interest, or an expected, previously determined, background value.

A FB is collected each time a sampling event occurs. For example, if six sampling events had occurred in one year, then one FB should have been collected with each event for a total of six samples in that year.

Table 4 summarizes the field and laboratory QA/QC samples that will be analyzed.

Table 4 - Summary of QA/QC Sample Analysis, Actions, and Validation Criteria

QA/QC Sample	Action Required	QA/QC Parameter Estimated	Value Required for Valid Data
Field			
Field Blank	Collect in field with each sampling event	False Negative/Positive	0 or no more than 20 percent of known Background
Field Duplicate	Collect in field with each sampling event	Precision	RPO :S 35 percent
Laboratory			
Matrix Spike	Prepared by Laboratory	Accuracy	75 < %R < 125 percent
Matrix Spike Duplicate	Prepared by Laboratory	Precision	RPD < 25 percent
Method Blank	Prepared by Laboratory	False Negative/Positive	0 or no more than 20 percent of known Background

9.5.7 Laboratory Quality Assurance and Quality Control

Laboratory precision and accuracy will be monitored by a series of laboratory-generated quality control samples. As long as sufficient sample volume is collected and submitted to the laboratory, no additional effort is required by field activities to generate laboratory quality control samples. Each set of field samples will have associated with it the following set of laboratory quality control samples.

9.5.7.1 Method Blank (MB)

The purpose of an method blank (MB) is to assure that the analytical technique does not impart a false positive result during the preparation or analysis of the sample. An MB will be prepared by the laboratory from high purity distilled or deionized water. The only acceptable values for analytes in the MB are half the RL or an expected, previously determined, background value.

9.5.7.2 Matrix Spike (MS)

The purpose of a matrix spike (MS) is to quantify accuracy and to assure that the analytical technique does not impart a false negative or positive result during the preparation or analysis of the sample. It involves the introduction of the analyte (or an analyte surrogate) of interest into the actual sample matrix and then quantitating it.

The amount detected divided by the amount added to the matrix is expressed as a percent recovery (%R). Acceptable values of %R range from 75 to 125 percent. Percent recovery is calculated as follows:

%R = [(Spike Amount Detected- Sample Value) I Amount Spiked] x 100

9.5.7.3 Matrix Spike Duplicate (MSD)

The purpose of a matrix spike duplicate (MSD) is to quantify laboratory precision. An acceptable RPD is less than or equal to 25 percent. The MSD involves duplication of the MS resulting in two data points from which relative percent difference (RPD) is calculated as follows:

RPD = [(MS - MSD) I (Average of MS and MSD)] X 100

9.5.8 Data Validation

Data validation will use data generated from the analytical laboratory and the field. The criteria for evaluating data are summarized in Table 4. References that can be used to assist in data validation include *EPA Contract Laboratory Program National Functional Guidelines for Superfund Inorganic Data Review* (EPA 2010) and *EPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Data Review* (EPA 2008).

The purpose of data validation is to ensure that data collected are of sufficient quality for inclusion in reports to the State Water Board. In order to serve, this purpose, the following information must be available in order to evaluate data validity:

1. Date of sample collection, required to identify sample holding time.
2. Location of samples, required to identify sample.
3. Laboratory QA/QC procedures, required to assess analytical accuracy, precision, and sample integrity. A laboratory QA/QC sample set consists of a MS, a MSD, and a MB. A laboratory QA/QC sample set will be analyzed by the laboratory for each field sample batch. Sufficient sample volume and number will be supplied to the laboratory in order to prepare and evaluate the laboratory QA/QC sample set.
4. Analytical methods, required to assess appropriateness and acceptability of analytical method used.
5. Detection limits, required to assess lower limit of parameter identification.
6. Holding times, preservation, and dates of extraction and analysis, required to assess if a sample was extracted and analyzed within the specified time limits and if a sample was stored at the appropriate temperature.
7. Field QA/QC procedures, required to assess field precision and sample integrity. A field QA/QC sample set consists of FB and FD samples. A field QA/QC sample set will be analyzed by the laboratory for one sampling event per year. Sufficient sample volume and number will be collected in the field and supplied to each laboratory in order to prepare and evaluate the field QA/QC samp1e set.

9.5.9 Data Qualification

Data collected for compliance with the Permit will be qualified through the analytical laboratory data validation process described in Section 9.6.8. This process will ensure all data has been thoroughly reviewed and qualified as valid. During the data validation process, data qualifiers will be used to classify sample data. The following qualifiers will be used:

- A: Acceptable. The data have satisfied each of the sampling and analysis requirements and are quantitatively acceptable (i.e., valid) and will be used for compliance purposes.
- R: Reject. Data not valid. This qualifier will be used for samples that cannot be uniquely identified by date of collection or sample location or that fail holding time, detection limit requirements, or criteria established in Table 4. Invalid data will not be presented in reports submitted to the Water Board.

9.5.10 Corrective Action

9.5.10.1 Field or Laboratory QA/QC Exceedance

If previously described criteria for valid data are not met, then corrective action as follows will be taken:

1. The laboratory will be asked to check their QA/QC data and calculations associated with the sample in question. If the error is not found and resolved, then:
   a. The extracts or the actual samples, which will be saved until the data are validated, will be reanalyzed by the laboratory if they are within holding time limitations. These new results will be compared with the previous results. If the error is not found and resolved, then:
   b. If field analytical equipment is used, then calibration records will be reviewed. If the error is not found, then:
   c. The sampling procedure and sample preparation will be re-checked and verified. If the procedures appear to be in order and the error is not resolved, then:
   d. The data will be deemed invalid and not used.
2. Upon discovery of the source of an error, all reasonable attempts will be made to address the cause of the error and remedy the problem.

9.5.11 Data Reporting

The results of sampling and analysis will be summarized and submitted to the Water Board in the Annual Report. The data will be tabulated so that they are readily discernible.

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10.0 PROCEDURES TO PREVENT SAMPLE CONTAMINATION

Measures will be taken to prevent sample collection contamination from persons, equipment and vehicles associated with algaecide and aquatic herbicides application, as follows:

- Background monitoring sample collection will be carried out prior to application equipment or algaecides/aquatic herbicides being handled.
- Background monitoring sampling, as well as post event monitoring sampling (within one week), if appropriate, may be carried out from shore within the sampling areas to eliminate the potential for contamination.
- Sampling equipment, with particular emphasis on ice chest and sample bottles, will be transported separately from algaecides or aquatic herbicides and application equipment on the day of the application event.
- Background monitoring will take place prior to the application event.
- For event monitoring, sampling will be carried out after application equipment and all application related equipment and devices including personal protection equipment used during the application has been removed from the sampling location or boat (if used), if no other boats are available to support sampling efforts.
- If possible, sample collection will be done no closer than 50 feet from application equipment and preferably upwind. If there are multiple personnel supporting applications, one will be designated the sample collector while the other will be responsible for boat operation.
- During sample bottle handling and sample collection, disposable rubber gloves will be used when collecting a water sample. Gloves will be changed between sampling locations.
- The pre-labeled sample bottle will be completed with time and date of sample collection immediately after removing from the sample ice chest and replaced in the ice chest immediately after sample collection.
- In the event that sampling equipment will be used in more than one location, the equipment will be thoroughly cleaned with a non-phosphate cleaner, triple-rinsed uncontaminated water, and then rinsed once with the water being sampled prior to its first use at a new sample collection location, as described in Section 9.3.4.
- Once sampling has been completed, water samples will be delivered immediately to the laboratory, if possible.
- If background and event samples cannot be delivered on the same day, sample bottles will be stored in a clean refrigerator or ice chest with adequate ice until samples can be delivered the next business day.

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11.0 DESCRIPTION OF BMPS

Travis AFB regularly implements the following BMPs to eliminate or reduce the discharge of pollutants and minimize the areal extent and duration of impacts to water quality. During implementation, the effectiveness of the BMPs are continually evaluated and refined as needed to enhance protection of surface water. The following BMPs will be to ensure the safe, efficient and efficacious use of algaecides and aquatic herbicides.

11.1 Spill Prevention and Containment

Applicators take care when mixing and loading algaecides and aquatic herbicides and adjuvants. All label language is followed to ensure safe handling and loading of algaecides and aquatic herbicides. Application equipment is regularly checked and maintained to identify and minimize the likelihood of leaks developing or failure that would lead to a spill. If possible, algaecides and aquatic herbicides will be mixed and loaded before leaving for the application site(s).

If algaecides or aquatic herbicides are spilled, they will be prevented from entering any waterbodies to the extent practicable. Travis AFB vehicles contain and staff are trained in the use of absorbent materials such as kitty litter, “pigs” and “pillows.” Spills will be cleaned up according to label instructions, and all equipment used to remove spills will be properly contained and disposed of or decontaminated, as appropriate. Applicators will report spills as required by base policy and in a manner consistent with local, state and federal requirements.

11.2 Appropriate Application Rate Measures

The following BMPs help ensure the appropriate algaecide and aquatic herbicide application rate is used.

11.2.1 Site Scouting

The Natural Resources Manager will identify all sensitive areas, buffer zones, and will conduct a biological survey prior to pesticide application for areas identified on the Aquatic Pesticide Application Areas map (Figure 3), which includes all of Union Creek south of the runway (Areas G, H, I & J) and parts of the western fork (Areas C & D).

A aquatic herbicide application is considered if a location is deemed to have exceeded a threshold, or if a given weed population is anticipated to exceed a threshold based on site and weather conditions, historical weed growth, or other information. Thresholds are based on maintenance of recreational and aesthetic beneficial uses, and the prevention of siltation and odors. Sites requiring aquatic herbicide treatment will then be surveyed by the Natural Resources Manager to determine potential herbicide impacts if applied.

11.2.2 Written Recommendations Prepared by PCA

Prior to application, a Pest Manager licensed by DPR scouts the area to be treated, makes a positive identification of pest(s) present, checks applicable product label(s) for control efficacy, and receives work order to do the pesticide treatment from the Facility Manager, determines rates of application and any warnings or conditions that limit the application so that non-target flora and fauna are not adversely impacted. For example, wind speed and air temperature may have significant impacts on the transport of aquatic herbicides. The PCA may place restrictions or prohibitions on aquatic herbicide applications based on site conditions to prevent impact to non-target sensitive species that may be downwind or downstream of the application area. Other

factors considered by the PCA include day length, existing or anticipated precipitation, current and anticipated water exchange and water depth and movement. Licensed applicators with the category "Aquatic" must complete continuing education to stay licensed and therefore are up-to-date on the latest techniques for pest control.
Pesticide application is not to occur in vernal pools on Travis AFB. Application of aquatic herbicides and algaecides requires formal consultation with the U.S. Fish & Wildlife Service for impacts to endangered species that reside in wetlands/vernal pools.

11.2.3 Applications Made According to Label

Aquatic herbicide applications are made according to the product label in accordance with regulations of the EPA, DPR, and the local Agricultural Commissioner.

Travis AFB regularly monitors updates and amendments to the label so that applications are always in accordance with label directions.

11.2.4 Applications Made by Qualified Applicator Certificate Holders

Qualified Applicator Certificate holders licensed by DPR make applications or supervise applications recommended by the PCA. Licensed applicators have knowledge of proper equipment loading, nozzle selection, calibration and operation so that spills ate minimized, precise application rates are made according to the label and only target plants are treated. Licensed Qualified Applicator Certificate holders must complete continuing education to stay licensed, and therefore are up-to-date on the latest techniques for pest control.

11.2.5 Staff Education

Licensed Qualified Applicator Certificate holders and Qualified Applicator Licensees must complete 20 hours of continuing education every 2 years to remain licensed, thus ensuring that all applicators are up-to-date on the latest pest control regulations and techniques.

11.2.6 Other BMPs

The following list includes other BMPs that are considered prior to and during herbicides application events:

- .Aquatic herbicides will only be applied when winds are less than 5 mph.
- Herbicide applications near aquatic resources will be done with a pressurized hydraulic sprayer and/or low-pressure backpack sprayers to prevent over application and excess herbicide runoff downstream.
- All pesticide application will follow herbicide conservation measures listed in the Travis AFB Programmatic Biological Opinion under the Endangered Species Act. They are as follows:
    - **HA-1:** Mechanical methods will be used for the removal of invasive plant species within 20 feet of the mapped wetlands. Herbicide treatment will not be applied within 20 feet from the edge of mapped wetlands, with the following exceptions: in areas where mechanical treatments within 20 feet of a wetland will not be effective in eliminating the infestation and herbicide application within this buffer is required when water is present in pools.
    - **HA-2**: Herbicide application will occur once pools are dry (May - June), allowing for a 4 to 6 month dry period.

- **HA-3**: All mixing of herbicides will be conducted at least 150 feet from water and often off –base.
- **HA-4:** Herbicide applicators will prescribe and use only non-ionic surfactants near open water. These surfactants are readily biodegradable and low in aquatic toxicity. An example is the TERGITOL™ 15-S surfactants by Dow.
- **HA-5:** When spraying on roadsides, applicators will use a surfactant such as GROUNDED® that increases soil particle absorption and modulates droplet size to prevent soil mobility and decrease aerial drift to prevent movement of chemical into sensitive habitat areas.
- **HA-6:** Herbicides will be applied with a hand held backpack sprayer, targeted to hit only the pepperweed with a focused nozzle and careful application.
- **HA-7:** Herbicides will only be an administered by State Licensed Qualified Applicators.
- **HA-8:** The application of any pesticide, including herbicides will be conducted in accordance with approved Integrated Pest Management Plan, IPSMP, and INRMP which includes submission of monthly herbicide use reports, summarized in annual activity reports.
- **HA-9:** Herbicides will be applied according to the chemical manufacturer's instructions on the label, along with other applicable conservation measures.

11.3 Water Users Coordination

Every calendar year and at least 15 days prior to the first application of algaecide or aquatic herbicide, Travis AFB will notify the potentially affected water users. As required by the algaecide and aquatic herbicide label, water users potentially affected by any water use restrictions will be notified prior to an application being made. For instance, residents on Travis AFB fish at North Gate Pond. Notification to these users could involve placing signage at fishing locations that notifies when pesticides were applied to the water body..

11.4 Fish Kill Prevention

11.4.1 Applications Made According to Label

All aquatic herbicide applications are made according to the product label in accordance with regulations of the U.S. EPA, CalEPA, DPR, Cal OSHA and the local Agricultural Commissioner. Precautions on the product label to prevent fish kills will be followed. For example, limitations on the surface water area treated will be followed to prevent dead algae or aquatic weeds from accumulating and then decaying and subsequently depressing the dissolved oxygen level. Depressed dissolved oxygen may adversely impact fish populations.

The following requirements are specific to preventing fish kills on North Gate Pond. These guidelines follow procedures used by Dr. Lars Anderson, USDA, who was consulted on the use of herbicides to treat pond weeds at North Gate Pond in 2003.

1. The product is applied directly into the pond water in three sections on separate days two to three weeks apart to make sure dissolved oxygen (DO) levels from the decaying plant material do not reach critical levels throughout the pond.

2. Restrict access to the pond during product application. Normal use can resume two days following application.

3. Personnel from 60 CES will monitor the vegetation and DO levels 0-1 day before treatment, 0-1 days after treatment, and again 2 weeks after each herbicide treatment to measure the success of the treatment and inform future management actions.

4. Guidelines for DO levels in ponds relating to fish health (http://www.water-research.net/index.php/dissovled-oxygen-in-water) shows a DO level of 3-5 PPM are considered stressful conditions for fish during a 12-24 hour period whereas 6 PPM supports spawning, >7 PPM supports growth and activity, and >9 supports abundant fish.

11.4.2 Written Recommendations Prepared by PCA

Prior to application, a Pest Manager licensed by DPR scouts the area to be treated, makes a positive identification of pest(s) present, checks applicable product label(s) for control efficacy, and prepares a written recommendation, including rates of application, and any warnings or conditions that limit the application so that fish are not adversely impacted.

11.4.3 Applications Made by Qualified Applicator Certificate Holders

Base Qualified Applicator Certificate holders, QALs, or those under their direct supervision make applications recommended by the PCA. These applicators have knowledge of proper equipment loading, nozzle selection, calibration, and operation so that spills are minimized, precise application rates are made according to the label, and only target algae or vegetation are treated. Calibration ensures that the correct quantity and rate of herbicide is applied.

11.5 Evaluation of BMP Effectiveness

The effectiveness of BMPs will be continuously evaluated during the year, as well as in-depth evaluation at the end of the year. The following data will be used to evaluate BMP effectiveness:

- Results of sampling and analysis as described here
- Feedback from field staff, including pest control efficacy, staff safety and efficiency

After data from surface water quality monitoring has been reviewed, if results indicate that an aquatic herbicide was present at a time and location that are not protective of water quality, BMPs used in that area will be reevaluated and modified as needed to address potential cause(s) for the presence of the aquatic herbicide detection.

Note that the presence of an aquatic herbicide does not in and of itself suggest that a beneficial use has been impaired or that water quality has been adversely affected. Criteria used to evaluate protectiveness include, but are not limited to review of published beneficial uses, actual beneficial uses based on site-specific conditions, numeric criteria, if any, described in the appropriate Regional Water Quality Board Basin Plan, the General Permit, or as described in *A Compilation of Water Quality Goals* (Central Valley Regional Water Quality Board 2011).

11.6 Natural Resource Considerations & Minimizations Measures for Chemical Control of Perennial Pepperweed within Vernal Pools and Wetlands

The following outlines considerations and minimization measures specific to controlling perennial pepperweed in the event that herbicide applications are done in vernal pools and wetlands. Note that it is not planned for herbicides to be applied in vernal pools at Travis AFB. This section is included in the very controlled circumstance for vernal pools.

1. Trials will first be conducted in vernal pools without any historic or current records of listed branchiopods or *Lasthenia conjugens* but that do have cover of a common *Lasthenia* spp. Monitoring will occur on the common *Lasthenia*, which will be used as a proxy for what might happen when pools with *Lasthenia conjugens* are sprayed.
2. A trial of pepperweed control would not start until June when vernal pools and all native species have already set seed and vernal pools are dry. Application of an herbicide in June is not expected to interfere with the following season's germination as germination will not occur until the rainy season starts in October (5-7 month gap between treatment and germination) and preferred chemicals do not have residual activity.
3. The bloom period for *Lasthenia* is March-June (eJepson). If the pepperweed treatment (usually occurring in June) and *Lasthenia* flowering windows overlap, cut the flowering pepperweed before viable seed is produced. Come back and apply herbicide and/or further mow treatments after *Lasthenia* has set seed.
4. No herbicide will be applied to flowering or seeding *Lasthenia*.
5. Apply herbicide to one patch of pepperweed cooccurring with common *Lasthenia* that has already set seed and monitor the effects on both the following year.
6. All attempts will be made to avoid herbicide spray where *Lasthenia* occurs unless it co-occurs with perennial pepperweed.
7. Work will be monitored by a qualified biologist. Qualified herbicide applicators will be trained in vernal pool native species and *Lasthenia* avoidance.
8. Data on *Lasthenia* cover will be taken before treatments and the following year or two in treated pools and control pools, with results shared with the USFWS. Results will guide future decisions about herbicide control of pepperweed in the sensitive vernal pool ecosystem.
9. Work is targeting a plant considered to be a "noxious weed of great concern" by both Cal-IPC and CDFA. The Aero Club is a conservation area with high cover of federally listed *Lasthenia conjugens* and vernal pools. Actual test plots with common *Lasthenia* are to be determined but are likely to be outside the Aero Club Conservation Area.
10. Details on Herbicides: Telar XP (chlorsulfuron) is by far the most effective herbicide (even without a prior mow treatment) though is not allowed for use in wetlands per the General NPDES Permit for Residual Aquatic Pesticide Discharges (Order 2013-0002-DWQ). Roundup Custom (glyphosate) and/or Renovate 3 (triclopyr) are being considered for use. 2,4-D is a third but unlikely option given its restricted-use in California.
    a. Past research has found application of glyphosate at 3.33 kg/ha reduced biomass by ≥80% at two sites one year after applications if used in combination with a mow treatment" (Renz & DiTomaso 2006). "The change in the canopy structure of perennial pepperweed after mowing results in fewer aboveground sinks and greater deposition of herbicide to basal leaves where it can preferentially be translocated to the root system. Furthermore, the delay between mowing and resprouting synchronized maximal belowground translocation rates with herbicide application timing. These factors all appear to be involved in the observed enhanced control of perennial pepperweed when combining mowing and glyphosate" (Renz & DiTomaso 2004).
    b. Garlon 3A and 4 applications at label rates provided good control (Trumbo 1994). Garlon3A was applied as a 2 percent solution with 0.5 percent non-ionic surfactant added. Garlon4 was applied as a 1.5 percent solution with 0.5 percent non-ionic surfactant added. Currently, neither formulation of Garlon is registered for use over water in California. Triclopyr is broadleaf-specific, so it generally does not affect grasses. Garlon4 does not show residual soil activity (Howald 2020 citing Trumbo 1994).

c. 2,4-D application at 2.11 kg ae/ha reduced pepperweed biomass by 78% in unmowed treatments (Renz 2002). Mowing did not seem to help at a Davis, CA site tested by Renz (2002) possibly because "the canopy architecture at the low density site was more open with many basal leaves present….and had a less developed roost system" reducing the need for mowing. 2,4-D is a restricted-use herbicide in California and would require an additional special permit (https://www.cdpr.ca.gov/docs/enforce/permitting.htm).

11. Methods of Herbicide Application: Targeted spraying will most likely be employed, though a qualified herbicide applicator will be consulted before trials begin. That is, spraying herbicide onto the foliage of individual target plants using a regulated nozzle, which helps to concentrate application toward target plants. This method uses a backpack-mounted wand sprayer.

    a. With regard to a more targeted application method, the most common method is to use a rope wick applicator, which often drips and makes it difficult to get adequate coverage on the plant. Also, with this method a more concentrated solution is used, since the volume being applied to the plant is lower. Another option is to hand apply herbicide to the leaves using a glove or sponge soaked in herbicide, though this can also lead to drips and is generally less safe (to humans) since there is closer contact with the concentrated product. In general, both of these hand application techniques are tedious and time consuming, but may lead to less herbicide on non-target areas.

    b. If an emulsifiable concentrate/liquid formulation (such as glyphosate (Roundup Custom) or triclopyr (Renovate 3/Garlon)), is used, then the rope wick applicator is an option.

Doing a trial with different application rates may not be possible with use of a rope-wick applicator. A trial may be considered if targeted spraying is used.

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12.0 EXAMINATION OF POSSIBLE ALTERNATIVES

12.1 Alternative Management Options Evaluation

As appropriate BMPs are identified and demonstrated by reliable sources, Travis AFB will evaluate them and consider them for implementation. Reliable sources include, for example, the University of California Cooperative Extension.

If aquatic weed thresholds can be maintained at acceptable levels with efficient use of alternative control techniques, then these techniques will be considered and implemented as feasible. Travis AFB has assessed the effectiveness of the following techniques as alternatives or supplements to the control of aquatic pests.

12.1.1 No Action

As feasible, this technique is used. For example, consistent with the IPMP program used by Travis AFB, a threshold is typically reached prior to treatment. Prior to reaching a threshold, no control is considered.

12.1.2 Prevention Habitat Modification

A potential method for the control of submersed aquatic vegetation is to line Travis AFB's drainage channels. Channels can be lined with plastic or rubber liners, or be permanently lined with concrete. Liners generally keep submersed weeds under control for a short period of time by limiting the amount of growing substrate (dirt). However, sediment will eventually build up in lined channels and must be manually removed to keep the channel weed-free. This technique is typically very costly and still requires ongoing maintenance that can fragment weeds, increase sediment loads downstream, and can have adverse impacts on water quality.

12.1.2.1 Native Species Establishment

No appropriate native plants have been found to establish within waterways to out compete the problematic native and non-native weed species of interest identified in Section 4.0 (page 4-1) and not create similar or other operational or aesthetic problems. As such, aquatic vegetation must be removed or controlled to maintain the weed density tolerances established by Travis AFB.

After the removal of non-native invasive species along drainage channel banks, the introduction and re-establishment of native species can be successful. This technique provides competition for non-desirable species and reduces the need for weed abatement. Limitations to this approach include availability of suitable native species, availability of labor to plant and maintain native species, safe access to banks for work crews, and providing erosion and sediment control measures such that water quality of adjacent water bodies are not impaired. Plant characteristics such as growth patterns and the potential to invade crops must be considered as well as the timing for introduction of native plants (e.g., wet season/running water). This technique can be expensive, may take many years, and may be subject to regulatory agency (i.e., California Department of Fish and Wildlife, U.S. Army Corps of Engineers, etc.) approval. Finally, many of the species identified for removal are in fact native species that occur and proliferate in ways characteristic of a natural wetland and stream system, thus a native species establishment alternative method does not exist.

12.1.3 Mechanical or Physical Methods Mechanical Removal

Mechanical removal includes bucket dredging (with appropriate permit authorizations) hand or

motor-driven cutting along banks where possible. The grade of the banks of stormwater drainage channels throughout Travis AFB is too steep to permit mowing without specialized equipment that may or may not be available, grazing or hand cutting of weeds. Grazing of steep banks is often possible with smaller animals such as sheep and goats, especially along lower Union Creek south of the airfield. Such grazing programs operate under fee-for-service contracts costing between $500-$2,000 per acre.

Specific upland dredge spoil locations, which have been used in past years, have not received an environmental analysis under the National Environmental Policy Act and may negatively impact other species that may be listed, threatened, or endangered.

In the pond, mechanical removal of rooted/un-rooted plants and algae could employ the use of a non-mechanically powered row boat. Personnel may use rakes or netting to remove species of concern. Hand removal of tules/cattails/bulrushes may be employed with or without the use of a row boat.

In general, mechanical control techniques are expensive, very labor intensive per unit length of waterway treated, not as effective, worsen downstream weed problems by moving plant fragments throughout Travis AFB, and may cause temporary water quality degradation. The equipment and labor required to perform these techniques are not available on Base, without hiring an outside contractor. This may cause delays in removal that lead to increased plant material to remove and increased cost.

Mechanical removal also places staff at risk of slip, trip and fall hazards as well as insect and snake bites, risks the spilling of motor oil and fuel from two-cycle motorized brush cutters, and equipment operation can increase air pollution. Travis AFB estimates that the cost per mile of mechanically treated water way is significantly higher than the cost of labor, product and equipment of the application of aquatic herbicide. The increased cost of mechanical aquatic weed abatement does not include the cost of the aforementioned risks (stormwater pollution abatement, workman's compensation claims. etc.).

In some instances, however, the use of mechanical techniques may be necessary due to the presence of aquatic resources sensitive to the use of aquatic herbicides. Travis AFB estimates that mechanical removal is 10 to 25 times more expensive than using chemical controls. This additional expense does not include the cost for disposal such as dredge disposal or for obtaining required permits.

Environmental impacts due to the use of mechanical techniques include the creation of water-borne sediment and turbidity due to people and equipment working in the water. This suspended sediment can adversely affect aquatic species by lowering dissolved oxygen and preventing light penetration, by clogging gills and/or being buried.

Mechanical removal methods may also impact State Species of Special Concern including western pond turtle (Actinemys marmorata), who may not get out of the way of dredging equipment or hand-removal actions. Chemical treatment would have unknown impacts to the species and is likely dependent on the chemicals used, their concentrations, presence of flowing vs. stagnant water, and the chemicals proximity to any turtles present. Mechanical methods and the chemical methods outlined in this APAP require an environmental analysis under the National Environmental Policy Act (NEPA) to determine if any sensitive species are negatively impacted in any by using the proposed method. Associated NEPA documentation has been completed for North Gate Pond, formerly called Duck Pond.

Downstream deposition of sediment may cause additional problems including creating new areas for weed establishment, division and re-establishment of aquatic weeds, and adverse impacts to

stream hydrology resulting in bank erosion. In addition, gaining access to water to accomplish mechanical removal requires that potentially beneficial habitat maybe disturbed in route to the target pests. This disturbance may interrupt native species nesting and breeding. The costs for trucking and waste disposal are not included. Waste must be taken to traditional landfills and cannot be taken to green waste disposal due to:

- The concern that redistribution of the material may occur and subsequently result in re-establishment.
- The concern that tules contain silica, which is resistant to successful green waste bio-decomposition.

Perennial pepperweed seedlings are easily controlled by hand-pulling or tillage but these techniques may not control established plants because shoots can quickly resprout from vast root reserves. In addition, seedlings are not often encountered. Root segments as small as 1 inch are capable of producing new shoots. Finally, mowing stimulates pepperweed to resprout and produce new growth though if combined with herbicide treatment has been shown to be effective (DiTomaso et al. 2013).

Arundo thrives when cut and controlled mechanically, sprouting again with vigor. The species is often controlled with a combination of herbicide and hand removal, which reduces the surface area that herbicide needs to be applied to, reducing the overall amount of herbicide needed.

While manual or mechanical control of stinkwort is effective, stinkwort occurs in several vernal pool complexes at Travis AFB filled with concrete rubble that make mechanical and manual control ineffective and a safety issue. The amount of stinkwort present also limits manual control options because they would be too time-consuming.

12.1.3.1 Prescribed Burns

This option is most suitable for emergent and terrestrial weeds and is not suitable for submerged aquatic weeds. Burning is not effective at reducing perennial pepperweed stands.

12.1.3.2 Grazing

This option is most suitable for emergent and terrestrial weeds and is not suitable for submerged aquatic weeds. Impacts to water quality from animal feces while they exist, would be expected to be limited and are often lower than background levels from wildlife. Other impacts from grazing animals include increases in turbidity and bank erosion though this can be reduced with the use of small grazing animals like sheep and goats (costs for grazing of small ruminants can be expensive as previously stated).

In general, grazing may be a suitable alternative control option and will be considered, where feasible. For instance, grazing is being considered as a viable and desirable weed control option along downstream/southern reaches of Union Creek. Grazing is a viable prevention measure for controlling the cover/extent of perennial pepperweed and will be implemented in some affected areas and monitored for effectiveness. However, because perennial pepperweed can reproduce vegetatively from roots and root fragments, grazing will never eradicate the species by itself. Stinkwort can be toxic if ingested by livestock. Livestock are not known to consume Arundo.

12.1.3.3 Tilling or Disking

This option is not suitable for the control of aquatic weeds because it would increase bank erosion and likely impact desirable species and habitat. Cultivation and tillage to control perennial

pepperweed typically increases infestation by dispersing root fragments and is generally not possible due to the potential presence of federally listed species in the soil.

12.1.4 Biological Control Agents

Goats and sheep are often used for grazing in and along riparian areas. As discussed previously, grazing may be suitable for emergent and terrestrial weeds and is not suitable for submerged aquatic weeds or algae. See Section 12.1.3.2 for further discussion of grazing as a possible alternative.. Grazing will be considered as an alternative control, as feasible.

12.1.5 Algaecides and Aquatic Herbicides

The selection of and decision to use an algaecide or aquatic herbicide is based on the recommendation of a PCA. The PCA considers a variety of control options that may include mechanical and cultural techniques that alone or in combination with chemical controls are the most efficacious and protective of the environment.

Evaluating alternative control techniques is part of Travis AFB's integrated pest management approach; therefore, an alternative treatment may be selected as part its program. Alternative control techniques and detailed description of each of these is presented in Section 12.1. In general, alternative control techniques are expensive, labor intensive, not as effective, and cause temporary water quality degradation. Use of herbicides may also cause temporary water quality degradation. The equipment and labor required to perform these techniques is not always readily available. This may cause delays in removal leading to increased plant material to remove and increased cost.

The quantity of algaecide and aquatic herbicide required for an application is determined by a PCA that has followed the label directions in making a recommendation. The rate at which an algaecide and aquatic herbicide is used is highly variable and depends on the type, time of year, location, and density and type of aquatic weeds, water presence, and goal of the application. All these factors are considered by the PCA prior to making a recommendation for an application.

12.2 Least Intrusive Alternative Evaluation

Travis AFB uses various methods including mechanized vehicles (trucks, etc.) and personnel with backpack sprayers to make algaecide and aquatic herbicide applications. Combined with the need to hold, safely transport and properly apply algaecides and aquatic herbicides, Travis AFB's techniques are the least intrusive as feasibly possible. Please refer to Table 1 for application methods.

12.3 Decision Matrix Application

As previously stated, a PCA scouts the area to be treated, makes a positive identification of pest(s) present, checks appropriate algaecide and aquatic herbicide product label(s) for control efficacy, and prepares a written recommendation. The written recommendation includes rates of application, and any warnings or conditions that limit the application.

The PCA may also recommend that an adjuvant be used to enhance the efficacy of the algaecide or aquatic herbicide.

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FIGURES

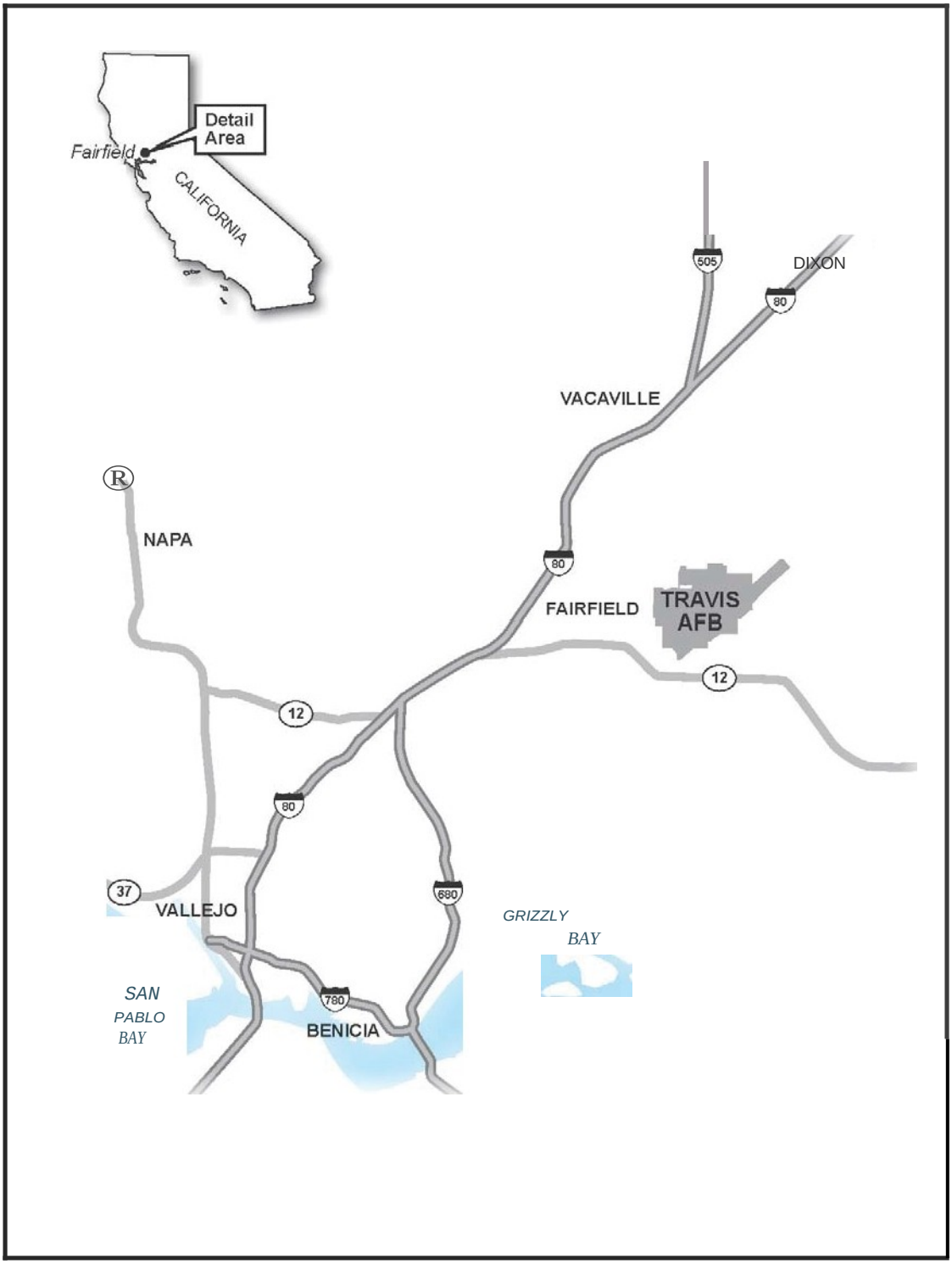

Figure 1 - Site Location - Travis AFB, Fairfield, Solano County, California

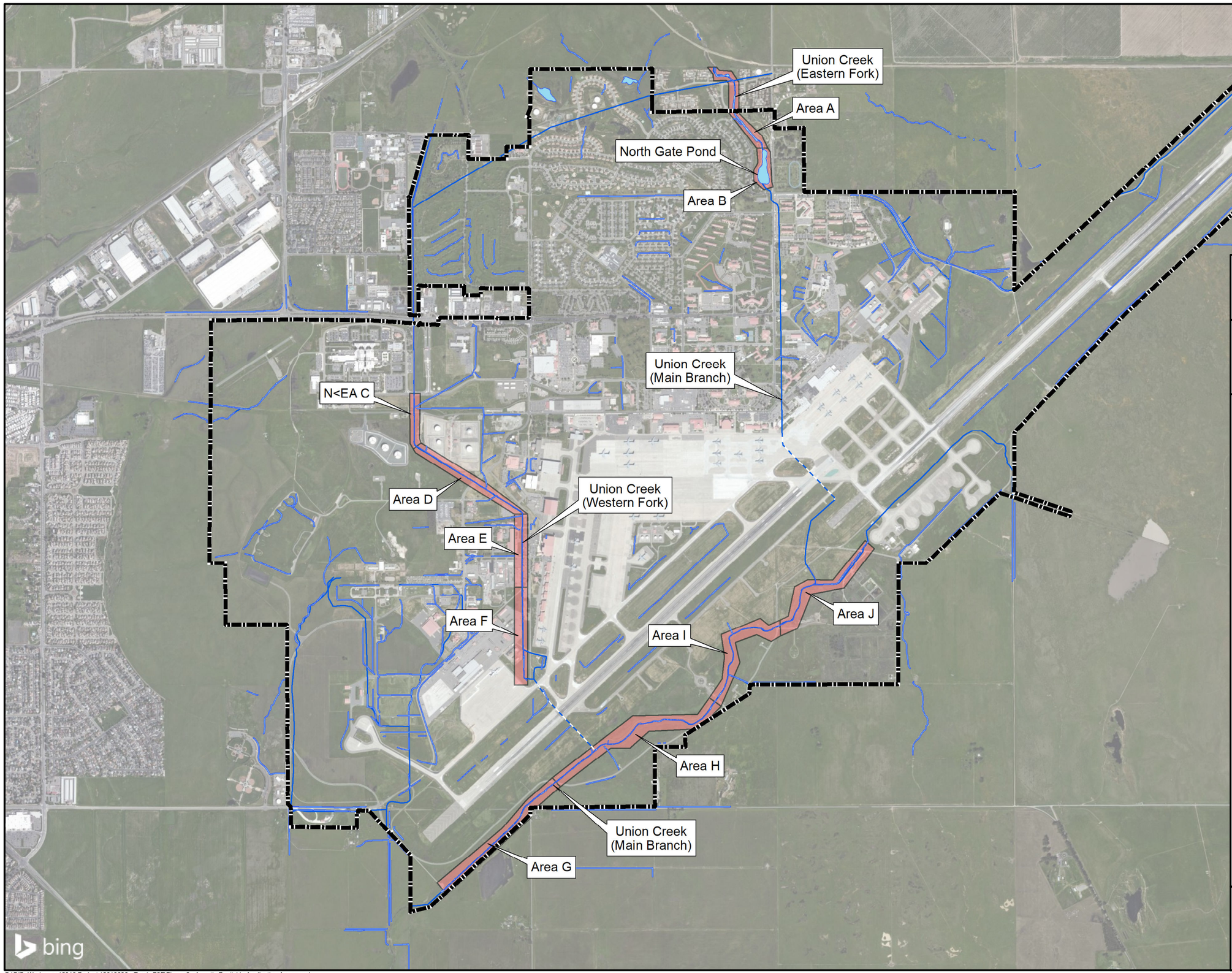

Figure 2
Aquatic Pesticide Application Areas

Air Force Civil Engineer Center
Travis Air Force Base, California

Legend

- Water Body
- Watercourse Beneath Runway
- Watercourse
- Aquatic Pesticide Application Areas
- Travis Air Force Base Boundary

Note: North Gate Pond formerly called Duck Pond

N

0 2,000 4,000
Feet

OTIE
An Oneida ESC Group Company

G:\GIS_Workspace\2019 Projects\2019086 - Travis F2F\Figure 2 - Aquatic Pesticide Application Areas.mxd

Union Creek (Eastern Fork)

North Gate Pond

Denverton Creek

B4

B7

Union Creek (Main Branch)

Union Creek (Western Fork)

B3

IV

III

B2

V

II

VI

I

Union Creek (Main Branch)

Flows into Suishan Marsh

bing

Figure 3
Surface Water Feature Map

Air Force Civil Engineer Center
Travis Air Force Base, California

Legend

- Outfall
- Ditch
- Freshwater Marsh
- Perennial Stream
- Pond
- Seasonal Wetland
- Vernal Pool
- Vernal Swale
- Wetland Swale
- Wetland swale (culverted)
- Water Body
- Watercourse Beneath Runway
- Watercourse
- Travis Air Force Base Boundary

Note: North Gate Pond formerly called Duck Pond

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G:\GIS_Workspace\2019 Projects\2019086 - Travis F2F\Figure 3 - Surface Water Feature Map.mxd

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Form 1 – Aquatic Herbicide Application Log

Aquatic Herbicide Application Log

rev 12.2013

****IMPORTANT** To Be Completed EVERY TIME an Aquatic Herbicide Application is Made**

I. GENERAL

Date_____ Location_____ Start Time_____ Stop Time_____

Agency_____ Personnel_____

Weather_____

Total Area Treated (Acre or linear feet)_____ Target Weed(s)_____

☐ If NO applications made this month check here and list month:_____

II. PESTICIDE & ADJUVENT INFORMATION

Herbicide #1 Used:_____ Rate or Target Concentration:_____ Total Amount Applied_____

Herbicide #2 Used:_____ Rate or Target Concentration:_____ Total Amount Applied_____

Adjuvant #1 Used:_____ Rate or Target Concentration:_____ Total Amount Applied_____

Adjuvant #2 Used:_____ Rate or Target Concentration:_____ Total Amount Applied_____

Method of Application:_____ Application made **With** water flow / **Against** water flow / **Not Applicable** (Circle One)

III. TREATED WATERBODY INFORMATION

Waterbody type (Circle One: lined canal, unlined canal, creek, drain, ditch, reservoir, lake, pond) Other:_____

Water flow (feet/sec, cfs)_____ Water Depth (feet): _____ Water temperature (^{O}F):_____

Percent weed cover_____ Sheen: (circle one) **yes** **no**

Color: (circle one) **none** **brown** **green** other:_____ Clarity (circle one) **poor** **fair** **good**

Other Information:_____

IV. POST TREATMENT EFFICACY & IMPACT

Describe post treatment efficacy (circle one) **poor** **fair** **good** **unknown**

Describe post treatment efficacy (circle one) **none** **some** **significant** **unknown**

If other than "none" or "unknown", describe:_____

V. GATES, WEIRS, CHECKS OR OTHER CONTROL STRUCTURES (ONLY FILL OUT IF APPLICABLE)

A. Are there any gates or control structures in the treatment area that may discharge to streams, rivers, lakes, or other natural waterways?	**Yes**	**No**	**N/A**
(If the answer to question A is Yes then answer question B-F the table below, otherwise leave blank)			
Before Application			
B. Have flow control structures been closed & sealed to prevent aquatic pesticide from discharging to natural waterways?	**Yes**	**No**	
C. Have necessary flow control structures been inspected for leaks?	**Yes**	**No**	
D. If leaks were found, were they sealed or otherwise prevented from allowing water to discharge to natural waterways prior to application?	**Yes**	**No**	
During Application			
E. Were necessary flow control structures inspected for leaks?	**Yes**	**No**	
F. If leaks developed, was the application stopped until the leak could be sealed or prevented from allowing water to discharge to natural waterways?	**Yes**	**No**	

If the answer of any of the above questions is No, explain:_____

Gate	Time Closed	Time Opened	How was time opened determined:

VI. CERTIFICATION

I_____ (print name) certify that the APAP has been followed (sign here): X_____

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Form 2 – Aquatic Herbicide Field Monitoring & Sampling Form – Static Water

Aquatic Herbicide Field Monitoring & Sampling Form – Static Water

IMPORTANT Attach Relevant Aquatic Herbicide Application Log (AHAL) Form

Agency:_____ Site Name:_____

SAMPLE #1: Background (BG)

Collect within the treatment area within 24 hours prior to the start of the application.

Draw Sample Location and Include identifiable Points of Reference

N

Scale 1" = _____

Sampler Name:_____

Date:_____ Time:_____

Weather Conditions (fog, rain, wind, etc.):

_____

Monitoring Area/Site Description (pond, lake, channel open waterway, etc.):

_____

Sample Waypoint or GPS Coordinates:

_____

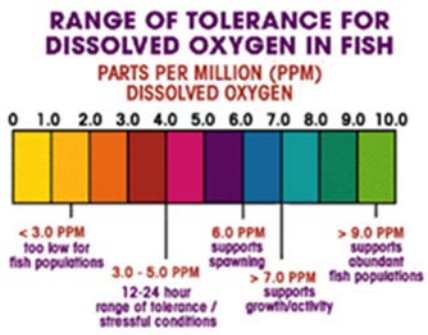
DO (mg/L):_____ (see further information below)

EC (µs/cm):_____ pH: _____

Turbidity (NTU):_____ Temp. (°C):_____

Chemical Sample Collected for (Circle One or More):

Active Ingredient: _____ Nonylphenol Hardness



Address any DO measurements that are out of the acceptance range and corrective actions that were implemented:

_____

_____

_____

_____

DO YOU NOTICE	YES	NO	UNKNOWN	IF YES, DESCRIBE YOUR OBSERVATIONS
Floating Materials				
Sheen				
Settleable Substances				
Suspended Material				
Odors				
Water Coloration				
Water Clarity				
Aquatic Community Degradation				

IMPORTANT Attach Relevant Aquatic Herbicide Application Log (AHAL) Form

Agency:_____ Site Name:_____

~~SAMPLE~~ #2: Event Monitoring (Event)

Collect immediately outside the treatment area immediately after the application event, but after sufficient time has elapsed such that treated water would have exited the treatment area. The timing for the collection of this sample will be a site-specific estimation based on algae and aquatic weed density and type, size of the application area, and duration of treatment.

Draw Sample Location and Include Identifiable Points of Reference

N

1"= _____

Sampler Name:_____

Date:_____ Time:_____

Weather Conditions (fog, rain, wind, etc.):

_____

Monitoring Area/Site Description (pond, lake, channel open waterway, etc.):

_____

Sample Waypoint or GPS Coordinates:

_____

Target Vegetation:_____

Length of Treated Area (feet): _____

Application Start Date:_____ Start Time:_____

Application End Date:_____ End Time:_____

Application made with or against water flow (Circle One)?

Yes No N/A

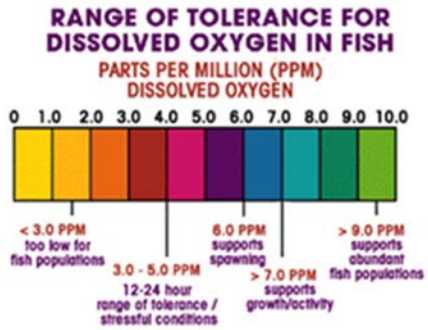
DO (mg/L):_____ (see further information below)

EC (µs/cm):_____ pH: _____

Turbidity (NTU):_____ Temp. (°C):_____

Chemical Sample Collected for (Circle One or More):

Active Ingredient: _____ Nonylphenol Hardness



Address any DO measurements that are out of the acceptance range and corrective actions that were implemented:

_____

_____

_____

_____

DO YOU NOTICE	YES	NO	UNKNOWN	IF YES, DESCRIBE YOUR OBSERVATIONS
Floating Materials				
Sheen				
Settleable Substances				
Suspended Material				
Odors				
Water Coloration				
Water Clarity				
Aquatic Community Degradation				

Aquatic Herbicide Field Monitoring & Sampling Form – Static Water

IMPORTANT Attach Relevant Aquatic Herbicide Application Log (AHAL) Form

Agency:_____ Site Name:_____

SAMPLE #3: Post-Event Monitoring (Post)

Collect within treatment area within 7 days of application.

Draw Sample Location and Include Identifiable Points of Reference

N

1"= _____

Sampler Name:_____

Date:_____ Time:_____

Weather Conditions (fog, rain, wind, etc.):

_____

Monitoring Area/Site Description (pond, lake, channel open waterway, etc.

_____

Sample Waypoint or GPS Coordinates:

_____

DO (mg/L):_____

Address DO measurements that are out of the acceptance range and corrective actions that were implemented:

_____

_____

EC (µs/cm):_____ pH: _____

Turbidity (NTU):_____ Temp. (°C):_____

Chemical Sample Collected for (Circle One or More):

Active Ingredient: _____ Nonylphenol Hardness

Post-Treatment Efficacy (circle one):

Poor Fair Good Unknown

Impacts to water quality (circle one):

Positive Negative Unknown

Comments: _____

_____

Date Field Blank (FB) Collected:_____

Date Field Duplicate (FD) Collected: _____

Sample	Date and Time Samples, COC and Cooler shipped to lab	Method of Shipment
Background		
Event		
FB & FD		
Post		

DO YOU NOTICE	YES	NO	UNKNOWN	IF YES, DESCRIBE YOUR OBSERVATIONS
Floating Materials				
Sheen				
Settleable Substances				
Suspended Material				
Odors				
Water Coloration				
Water Clarity				
Aquatic Community Degradation				

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Form 3 – Aquatic Herbicide Field Monitoring & Sampling Form – Moving Water

Aquatic Herbicide Field Monitoring & Sampling Form – Moving Water

IMPORTANT Attach Relevant Aquatic Herbicide Application Log (AHAL) Form

Agency:_____ Site Name:_____

SAMPLE #1: Background (BG)

Collect upstream of, or within the treatment area within 24 hours prior to the start of the application.

Draw Sample Location and Include identifiable Points of Reference

N

Scale 1" = _____

Sampler Name:_____

Date:_____ Time:_____

Weather Conditions (fog, rain, wind, etc.):

_____

Monitoring Area/Site Description (pond, lake, channel open waterway, etc.):

_____

Approximate Water Speed (feet/second):_____

Sample Waypoint or GPS Coordinates:

_____

Target Vegetation:_____

Site Description:_____

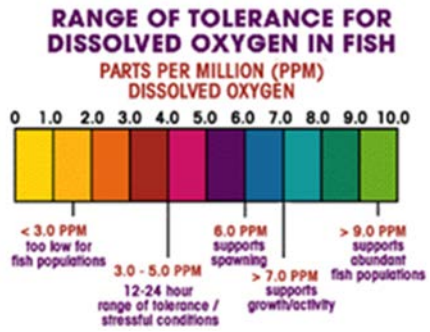
DO (mg/L):_____ (see further information below)

EC (µs/cm):_____ pH: _____

Turbidity (NTU):_____ Temp. (°C):_____

Chemical Sample Collected for (Circle One or More):

Active Ingredient: _____ Nonylphenol Hardness



Address any DO measurements that are out of the acceptance range and corrective actions that were implemented:

_____

_____

_____

_____

DO YOU NOTICE	YES	NO	UNKNOWN	IF YES, DESCRIBE YOUR OBSERVATIONS
Floating Materials				
Sheen				
Settleable Substances				
Suspended Material				
Odors				
Water Coloration				
Water Clarity				
Aquatic Community Degradation				

IMPORTANT Attach Relevant Aquatic Herbicide Application Log (AHAL) Form

Agency:_____ Site Name:_____

~~SAMPLE~~ #2: Event Monitoring (Event)

Collect immediately downstream of the treatment area immediately after the application event, but after sufficient time has elapsed such that treated water would have exited the treatment area. The timing for the collection of this sample will be a site-specific estimation based on algae and aquatic weed density and type, flow rates, and size of the application area, and duration of treatment.

Draw Sample Location and Include Identifiable Points of Reference

N

1"= _____

Sampler Name:_____

Date:_____ Time:_____

Weather Conditions (fog, rain, wind, etc.):

_____

Monitoring Area/Site Description (pond, lake, channel open waterway, etc.):

_____

Approximate Water Speed (feet/second):_____

Sample Waypoint or GPS Coordinates:

_____

Herbicide Applied (Surfactants?):_____

Target Vegetation:_____

Length of Treated Area (feet): _____

Application Start Date:_____ Start Time:_____

Application End Date:_____ End Time:_____

Application made with or against water flow (Circle One)?

Yes No N/A

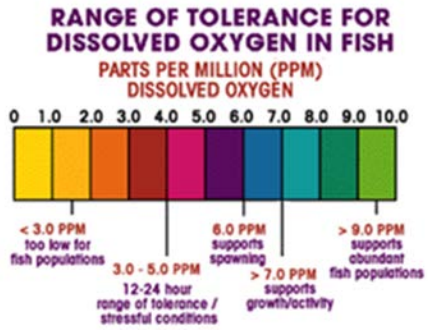
DO (mg/L):_____ (see further information below)

EC (µs/cm):_____ pH: _____

Turbidity (NTU):_____ Temp. (°C):_____

Chemical Sample Collected for (Circle One or More):

Active Ingredient: _____ Nonylphenol Hardness



Address any DO measurements that are out of the acceptance range and corrective actions that were implemented:

_____

_____

_____

_____

DO YOU NOTICE	YES	NO	UNKNOWN	IF YES, DESCRIBE YOUR OBSERVATIONS
Floating Materials				
Sheen				
Settleable Substances				
Suspended Material				
Odors				
Water Coloration				
Water Clarity				
Aquatic Community Degradation				

IMPORTANT Attach Relevant Aquatic Herbicide Application Log (AHAL) Form

Agency:_____ Site Name:_____

_____

SAMPLE #3: Post-Event Monitoring (Post)

Collect within treatment area within 7 days of application.

Draw Sample Location and Include Identifiable Points of Reference

N

1"= _____

Sampler Name:_____

Date:_____ Time:_____

Weather Conditions (fog, rain, wind, etc.):

_____

Monitoring Area/Site Description (pond, lake, channel open waterway, etc.):

_____

Sample Waypoint or GPS Coordinates:

_____

DO (mg/L):_____

Address DO measurements that are out of the acceptance range and corrective actions that were implemented:

_____

_____

EC (µs/cm):_____ pH: _____

Turbidity (NTU):_____ Temp. (°C):_____

Chemical Sample Collected for (Circle One or More):

Active Ingredient: _____ Nonylphenol Hardness

Post-Treatment Efficacy (circle one):

Poor Fair Good Unknown

Impacts to water quality (circle one):

Positive Negative Unknown

Comments: _____

Date Field Blank (FB) Collected:_____

Date Field Duplicate (FD) Collected: _____

Sample	Date and Time Samples, COC and Cooler shipped to lab	Method of Shipment
Background		
Event		
FB & FD		
Post		

DO YOU NOTICE	YES	NO	UNKNOWN	IF YES, DESCRIBE YOUR OBSERVATIONS
Floating Materials				
Sheen				
Settleable Substances				
Suspended Material				
Odors				
Water Coloration				
Water Clarity				
Aquatic Community Degradation				

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APPENDIX J

Grazing Management Plan (GMP)

(Hopkinson 2017b)

Grazing Management Plan

Travis Air Force Base, California



Prepared for the US Air Force by
Peter Hopkinson[1]
Center for Environmental Management of Military Lands
Colorado State University
Fort Collins, Colorado

[1]Certified Rangeland Manager M93, State of California

August 2016
(revised February 2017)

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Acronyms used in this plan

AFB: Air Force Base

AUE: animal unit equivalent

AUM: animal unit month

BASH: Bird/Wildlife Aircraft Strike Hazard

CAHFS: California Animal Health and Food Safety Laboratory, UC Davis

CEMML: Center for Environmental Management of Military Lands, Colorado State University

CTS: California tiger salamander (*Ambystoma californiense*)

DAF: United States Department of the Air Force

GIS: geographical information system

GLUR: grazing land use regulations

GMU: grazing management unit

GPS: global positioning system

INRMP: Integrated Natural Resources Management Plan

lbs: pounds

NISC: National Invasive Species Council

NRCS: USDA Natural Resources Conservation Service

RCD: Resource Conservation District

RDM: residual dry matter

RMAT: Range Management Assistance Team

SCS: USDA Soil Conservation Service

TAFB: Travis Air Force Base

UC ANR: University of California Agriculture and Natural Resources

US: United States

USAF: United States Air Force

USDA: United States Department of Agriculture

USDI: United States Department of the Interior

USFWS: United States Fish and Wildlife Service

YST: yellow starthistle (*Centaurea solstitialis*)

Acknowledgements
Many thanks to:
Professor James Bartolome for invaluable advice;
Dan Macon for advice and recommendations and for contacting CAHFS on our behalf;
Bill Traylor for showing me his Travis AFB cattle operation;
Luke Macaulay and Felix Ratcliff for wildlife species information;
Morgan Ball for maps and advice;
Behdad Sanai for maps and GIS support;
Paul Block for NRCS soils data and maps;
Sonja Hunt and Kristine Moyer for showing me the Travis Equestrian Center;
Jaymee Marty for reviewing the first draft of the plan; and
Lauren Wilson, Penn Craig, Kirsten Christopherson, and other USAF staff for their assistance in preparing this plan.

Cover photo: Travis AFB Grazing management unit 4, facing east, October 22, 2015; courtesy of Lauren Wilson.

1.0 Introduction

Travis Air Force Base (AFB) is located in Solano County, California, within the city of Fairfield. In common with many military installations, Travis AFB requires a sizable land base as part of its defense mission and for security and safety purposes (Holmes 1996). Although much of Travis' land is developed, there are several small, fairly undisturbed natural resource areas (Travis AFB 2016). In compliance with relevant laws and regulations, Travis manages its natural resources to meet conservation and other management goals (Travis AFB 2016). As part of this natural resources management, Travis has operated a livestock grazing program since 1977 (RMAT 2000). Travis' grazing program is broadly intended to:

> "Provide for the multiple use of the premises for military purposes, domestic livestock grazing, public recreation, water conservation, and wildlife habitat[; and]
> To preserve and enhance natural resources (Travis AFB 2016, 86).

This grazing management plan is designed to help guide Travis AFB and its grazing lessees in their grazing management actions so that the Base meets its natural resource management goals.

2.0 Background

Travis AFB covers 5,137 acres, of which 360 acres are currently part of Travis' grazing program, 276 acres grazed by cattle in 4 pastures and 84 acres occupied by horses in 9 pastures/turnouts (Table 2-1 and Figure 2-1). Several additional rangeland sites at Travis have the potential to be incorporated into the grazing program to meet natural resource and military mission goals (see Appendix B). Land uses surrounding the Base include agriculture and open space to the north, east, and south and urban and commercial uses to the west (Travis AFB 2016). Prior to the early 1940s, the land that Travis now occupies was used for sheep and cattle grazing (Dingler 2002; Goerke-Shrode 2007).

Travis' livestock grazing program started in October 1977 with the lease of 145 acres for cattle grazing (Holmes 1996; RMAT 2000). The land leased for grazing was necessary for "the quantity-distance criteria for explosive storage and handling facilities" and so could not be declared excess (Holmes 1996). The US Army Corps of Engineers Sacramento District advised Travis regarding leasing the land, monitored the lease, and collected the grazing fees (Holmes 1996). In March 1982, Dr. Mel George of UC Davis toured Travis' grazing land and subsequently helped develop a cattle grazing management plan for the Base and wrote a horse pasture management plan (George 1982; Holmes 1996). By 1996, 605 acres of Travis were being grazed, 475 leased for cattle grazing and 130 acres for horse pastures under a use license with the Travis Saddle Club (Holmes 1996). The same acreage for cattle and horse grazing was reported in 2000 and 2003 (RMAT 2000; Travis AFB 2003).

The lease currently in force for the cattle pastures dates back to 2003, with a 5-year term and for 280 acres of grazing land; the lessee was Tony Garcia, Valley Cattle Company (DAF 2003-2012; see Appendix D). In 2007, a supplemental agreement transferred the lease to Tony Martin and Bill Traylor of J/V Angus. In 2009 and 2010, supplemental agreements extended the

term of the lease to September of the following year, and in 2011, extended the term to September 2016, with a reduced cattle-grazing area of 244 acres down from the initial 280 acres[1]. In 2012, in a further supplemental agreement, Bill Traylor became the sole lessee. Since the expiration of the lease's term in September 2016, Mr. Traylor continues to graze his livestock on Travis under the terms of the 2003 lease and supplemental agreements through a "holdover" arrangement (Lauren Wilson, pers. comm., December 2016). Starting with the 2017/2018 grazing season, Travis cattle-grazing leases will have 5-year terms and will be sent out for rebidding every five years, in accordance with the general provisions of Air Force Instruction 32-9003 (DAF 1997; Lauren Wilson, pers. comm., December 2016). Appendix E contains grazing land use regulations, drafted in 2016, that are likely to be incorporated into the new lease.

Table 2-1: Travis AFB pasture livestock type and size (acres); spatial data provided by Travis AFB, February 2017.

TAFB pasture	Livestock use	Size (acres)
Pasture 1	cattle	178
Pasture 2	cattle	81
Pasture 3	cattle	15
Pasture 4	cattle (corral)	2
	Total cattle grazing area	**276**
Pasture 5	15 horse turnouts	9
Pasture 6	horse	16
Pasture 7	horse	13
Pasture 8	horse	19
Pasture 9	horse	15
Pasture 10	horse (not currently used)	11
Pasture 11	5 horse turnouts	0.8
Pasture 12	2 horse turnouts	0.4
Pasture 13	1 horse turnout	0.05
	Total horse pasture/turnout area	**84**

The current cattle grazing lessee, Bill Traylor, runs a cow-calf and stocker operation at Travis (Pers. comm., February 2016). In central California, cow-calf operations maintain a mother cow herd year-round and produce calves that are typically sold after weaning in late spring. Stocker operations graze weaned calves on rangeland for several months, in central California usually during late winter and spring, before selling them or moving them elsewhere in the summer. Mr. Traylor indicates that he brings his animals onto Base in November or

[1] The southern section of Pasture 1 was removed from grazing during a road construction project (DAF 2003-2012; Appendix D, D2-D6). Although not addressed in subsequent lease supplemental agreements, the southern portion of Pasture 1 is currently used for cattle grazing again, although slightly reduced in size because of the new road.

December and usually removes them by May, although the lease allows him to keep the animals on Base through June (Pers. comm., February and August 2016; DAF 2003-2012). Per Mr. Traylor's annual report for the 2015/ 2016 season, he brought the bulk of his cattle onto Travis on November 14, 2015, and removed the last of his livestock on July 23, 2016 (Traylor 2016; see Appendix G).

Interestingly, the 2003 lease's land use regulations state that the Travis grazing season will last from November 1 to June 30 of each year (DAF 2003-2012; Appendix D, D33), while Section 8.0 of the Travis AFB Integrated Natural Resources Management Plan (INRMP) from that period, which is attached to the lease as an exhibit and, per the land use regulations, "imposes certain obligations on the lessee", states that the "primary grazing season" lasts from October 1 to May 1 (Appendix D, D42). Statements in lease supplementary agreement no. 6 from 2012 suggest that the months of May and June are included in the grazing season (Appendix D, D2). Another important discrepancy between the lease's land use regulations and the accompanying INRMP Section 8.0 is the amount of residual dry matter that must remain at the end of the grazing season (see Appendix A for further details).

The Travis Equestrian Center (also referred to as the Travis Saddle Club) has maintained horse barns, riding facilities, and associated horse pastures and turnouts since at least the early 1980s (George 1982), although not in its current location[2]. The move to the current location in the 1980s involved the loss of approximately half of Travis' horse-pasturing capacity (Kristine Moyer, pers. comm., September 2016). The current INRMP notes that the horse facilities are operating at maximum capacity and that plans are in progress to increase stabling capacity (Travis AFB 2016, 97).

The Travis Equestrian Center does not currently operate under a lease or license, in accordance with a Department of the Air Force memorandum (DAF 1996; Appendix F). The operations of the Equestrian Center are governed by Travis Air Force Base Instruction 34-201 (Travis AFB 2011; Appendix F).

In writing this grazing management plan, I employed many useful documents on the rangeland resources and grazing program at Travis AFB, including:
1) the 1982 pasture management plan for the Travis Saddle Club (George 1982);
2) a 1996 grazing management document (Holmes 1996);
3) the 2000 report by the Range Management Assistance Team (RMAT 2000);
4) the 2003 grazing management plan (Section 8 of the 2003 Travis AFB Integrated Natural Resources Management Plan; Travis AFB 2003);
5) the 2003 Travis cattle grazing lease (DAF 2003-2012; Appendix D); and
6) the 2016 Travis AFB Integrated Natural Resources Management Plan (Travis AFB 2016).

[2] Per a Travis AFB internal letter dated June 1, 1983, at the time, the Saddle Club was to be displaced by the Composite Medical Facility and moved to its current location (Clark 1983).

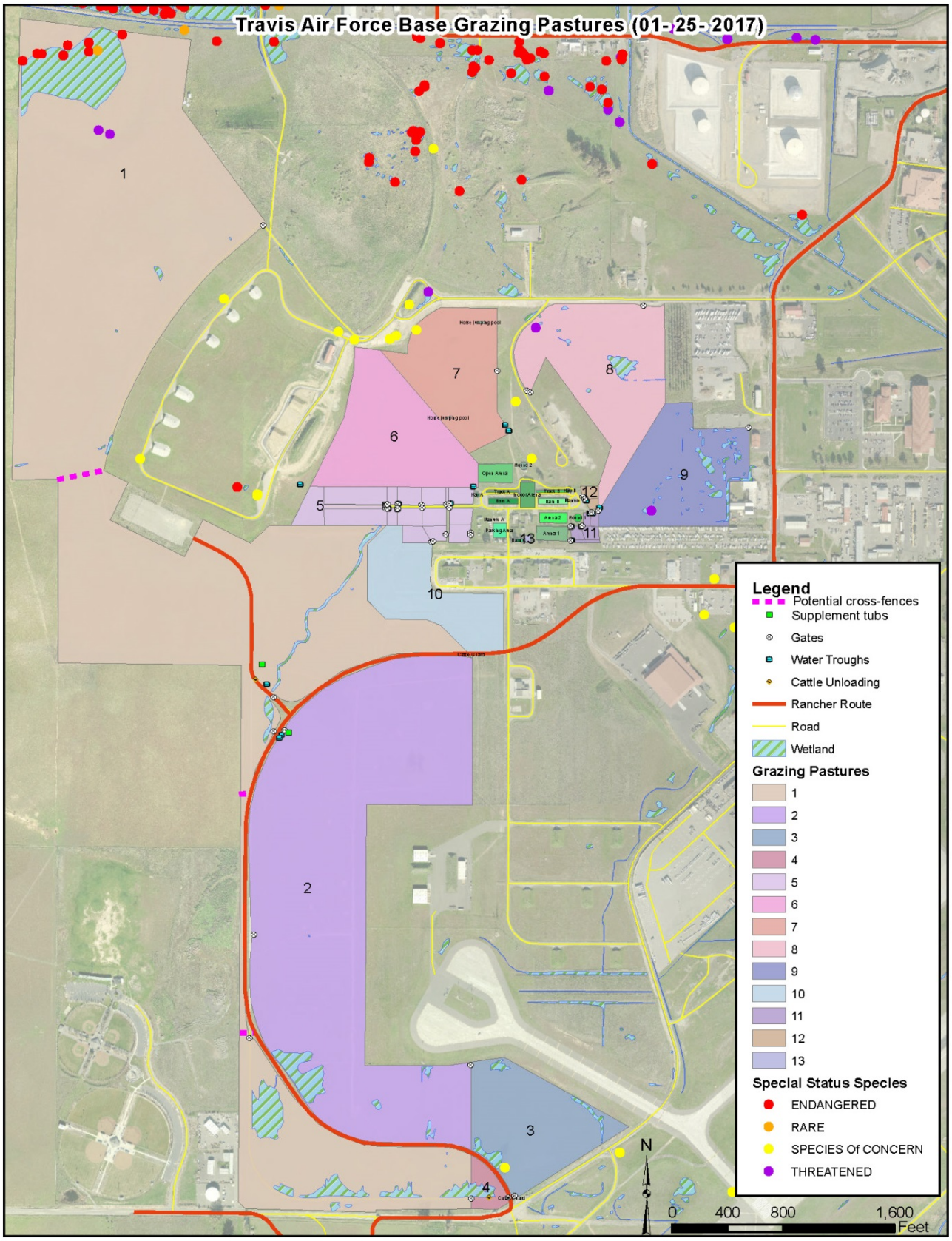

Figure 2-1: Travis AFB grazing pastures 1-4 (cattle) and 5-13 (horse); map produced by Behdad Sanai, Travis AFB.

3.0 Goals of the Travis AFB grazing program

Travis AFB's ecosystem management goals are laid out in the Travis AFB Integrated Natural Resources Management Plan (Travis AFB 2016, 101-103). The INRMP's broad goal is "the maintenance and improvement of the natural environment at TAFB" (Travis AFB 2016, 100). Travis' natural resources staff provided the following specific, range--related goals around which to develop this grazing management plan (Table 3-1).

Table 3-1: Travis AFB grazing management goals, justification, and specific objectives; INRMP objectives from the Travis AFB Integrated Natural Resources Management Plan (Travis AFB 2016, 101-103).

Goal	Justification	Objectives
1. Protect and enhance vernal pool ecosystem functions and processes.	ESA (16 USC 1531-1544) listed fauna protection (no listed flora), Clean Water Act jurisdictional water protection; INRMP objectives A.3.3, A.3.4, C.1.1, C.2.1, D.3.1, D.3.2, E.1.2.	1.1 Graze vernal pool ecosystem to maintain or increase inundation periods within vernal pools to support vernal pool native plants and animals. 1.2 Maintain residual dry matter (RDM) at recommended levels.
2. Protect and provide a conservation benefit for federal and state listed species, state species of concern, and other at-risk species, including rare rangelands plants.	ESA 16 USC 1533 Section 4.(a)(B)(i) requirement to provide conservation benefit for listed species to achieve exemption from critical habitat; Support of State Wildlife Action Plan and state wildlife laws; Supports conservation value of rangelands; INRMP objectives A.3.3, A.3.4, C.1.1, C.2.1, D.3.1, D.3.2, E.1.2.	2.1 Implement objectives 4.1, 4.2, 4.3, and 5.1 below. General – in grasslands, move towards a habitat mosaic to support multiple special status species (and their prey) with varying requirements (grazed, lightly/rotationally grazed, ungrazed).

Goal	Justification	Objectives
3. Maintain and improve rangeland ecosystem functions and processes	Enables achievement of Goals 1, 2, and 4; INRMP objectives C.1.1, C.2.1, C.3.2, C.3.3, E.1.1, E.1.2, E.1.3.	3.1 Maintain residual dry matter (RDM) at recommended levels to minimize soil erosion. 3.2 Reduce cover of widespread invasive plant species.
4. Maintain or increase populations of native rangeland plants that contribute to floral and faunal biological diversity.	Provides for the conservation and rehabilitation of natural resources and sustains the long-term ecological integrity of the resource base and the ecosystem services it provides; per Sikes Act (16 USC 670a Section 101 (a)(3)(A)(i)) and DoDI4715.03 (4.a.); INRMP objectives C.1.1, C.2.1, C.3.2, C.3.3, E.1.1, E.1.2, E.1.3.	4.1 Reduce cover of widespread invasive species medusahead (*Elymus caput-medusae*). 4.2 Reduce cover of widespread invasive species yellow starthistle (*Centaurea solstitialis*). 4.3 Eliminate incipient populations of new invasive species, such as barbed goatgrass (*Aegilops triuncialis*), by implementing a rapid response protocol. 4.4 Monitor native species richness in grazed pastures.
5. Manage and improve rangeland vegetation to provide high quality livestock forage on a sustainable basis to maintain benefits received from livestock grazing leases.	INRMP objectives C.1.1, C.2.1, C.3.2, C.3.3, E.1.2, E.1.3.	5.1 Eliminate known populations of barbed goatgrass within five years, an invasive species unpalatable to livestock. 5.2 Implement Objectives 4.1, 4.2.

Goal	Justification	Objectives
6. Meet Bird/Wildlife Aircraft Strike Hazard (BASH) requirements and implement land management measures that discourage use by wildlife.	INRMP objectives A.2.3, C.3.3, E.1.3.	6.1 Maintain vegetation height between 7-14 inches. 6.2 Limit forb (wildflower) abundance. 6.3 Limit patches of bare ground. 6.4 Limit edge effects. 6.5 Reduce cover of widespread invasive species yellow starthistle.
7. Reduce wildland fire risk and its potential effects on base facilities and natural resources.	Protect mission infrastructure and human health and safety.	7.1 Reduce fine herbaceous fuels through managed livestock grazing.
8. Ensure no net loss in the capability of Travis grazing program lands to support the military mission of the installation.	Requirement of the Sikes Act (16 USC 670a et seq.).	8.1 Maintain fencing integrity to avoid livestock in sensitive military areas. 8.2 Remove livestock carcasses from pastures within 24 hours to reduce BASH risks. 8.3 Ensure ranching practices are flexible, and ranchers are available within 24 hours' notice if livestock needs to be moved for mission priorities.
9. Ensure compliance with applicable federal and state laws and regulations related to natural resource protection.	INRMP objectives D1.2, D.2.1, E.1.1.	9.1 Conduct grazing compliance surveys monthly to verify grazing lease and grazing land use regulations are properly implemented. 9.2 Comply with Base Regulations.

4.0 Condition of rangeland resources

4.1 Climate

The Travis AFB area has a typical California Mediterranean climate with cool, wet winters and hot, dry summers. Annual average precipitation is about 25 inches; 85% of that rain falls between November and March (Table 4-1; Travis AFB 2016). Averages can be misleading, however, as rainfall amount and pattern vary significantly from year to year (Figure 4-1), with

consequent fluctuations occurring in vegetation production and species composition between years. Travis' average annual low temperature is 47°F and its average annual high is 73°F (Travis AFB 2016).

The Fairfield area, including Travis AFB, is known for its almost continuous wind, blowing primarily from the Pacific Ocean and the San Francisco Bay but also from the north. During the summer, the north winds are hot and dry, producing temperatures over 100°F and substantially increasing the risk of wildfire (Travis AFB 2016).

Table 4-1: 1981-2010 mean monthly and annual rainfall in inches for Fairfield, California (Western Regional Climate Center, www.wrcc.dri.edu, accessed February 2017).

Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
4.81	4.99	3.33	1.44	0.73	0.21	0.01	0.03	0.20	1.23	3.05	4.84	24.88

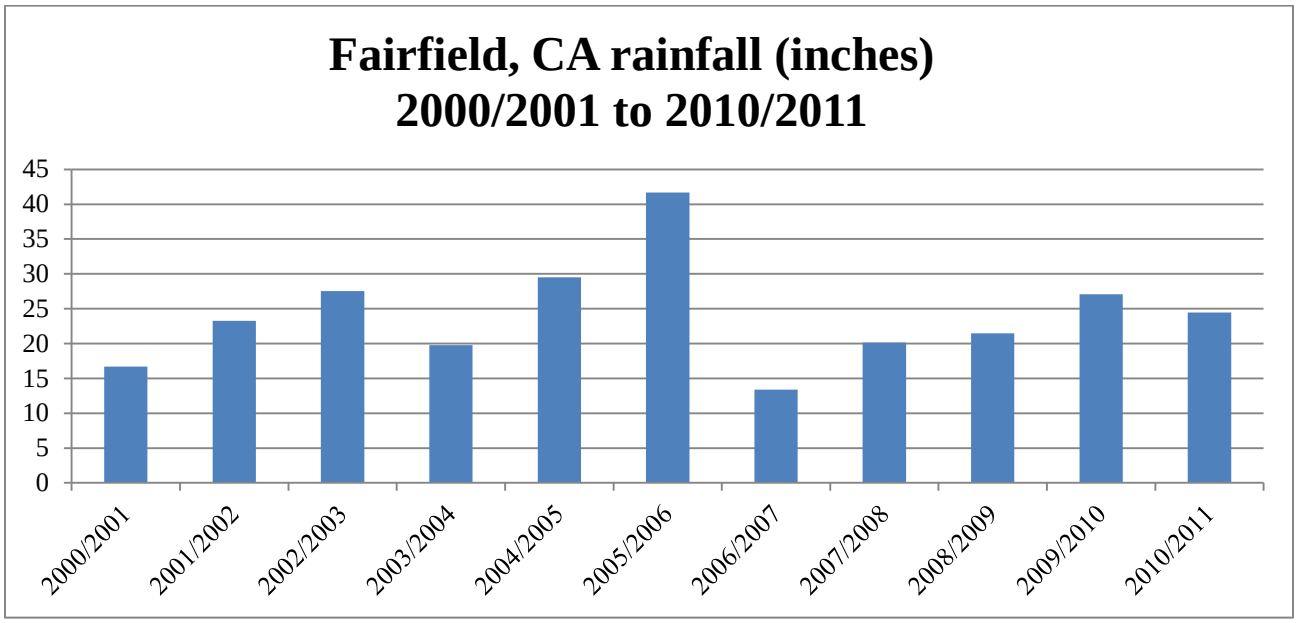

Figure 4-1: Annual (July-June) rainfall in inches for Fairfield, California, 2000/2001 to 2010/2011 (Western Regional Climate Center, www.wrcc.dri.edu, accessed February 2017).

4.2 Land-use history

Land-use history can have significant impacts on current vegetation species composition, structure, and productivity. In particular, previous cultivation is linked to the absence of native perennial bunchgrasses and native annual forbs in California grasslands (Bartolome et al. 2007).

Prior to the construction of the military facility in the early 1940s, the land on which Travis AFB is now located was used for sheep and cattle grazing (Dingler 2002; Goerke-Shrode 2007). Several of the soil series found at Travis are also suitable for crop agriculture, including some soil series designated as high quality farmland (Bates 1977; NRCS Web Soil Survey,

accessed June 2016), suggesting that at least some areas of Travis may have been cultivated in the 19th and early 20th century. Information on specific locations that have been cultivated, if available, may prove useful in prioritizing future grassland restoration activities.

4.3 Topography, hydrology, soils, and infrastructure

Travis' grazing area is predominantly flat or gently sloped (Travis AFB 2016). Other than a small area within Pasture 7, slopes do not exceed 10% (Figure 4-2). Elevations at Travis range from 15 feet in the southwest corner of the Base to 140 feet along the Base's northern boundary (Travis AFB 2016).

Union Creek, flowing in two branches along Travis' southwest boundary, provides the primary watershed drainage for the Base (Travis AFB 2016). Currently, there is no livestock grazing in the vicinity of Union Creek, although USAF staff have indicated interest in the possibility of using livestock to manage riparian vegetation for BASH purposes (Lauren Wilson and Penn Craig, pers. comm., January 2016; Travis AFB 2016, 66; see Appendix B for discussion of this proposal).

Six soil series, as mapped by the USDA Natural Resources Conservation Service (NRCS), occur in the grazing pastures at Travis (Table 4-2; Figure 4-3). These soil series have no associated NRCS range vegetation production data, perhaps because the soil series are considered primarily agricultural rather than range sites (i.e., they have a "higher" potential use than range). Erosion hazard is for the most part rated as slight for the Travis grazing area soils (Bates 1977). Erosion is a moderate hazard for the San Ysidro and San Benito components of the Altamont-San Ysidro-San Benito complex with 2-9% slopes, which together compose only 35% of the soil complex (Bates 1977). See Appendix H for acreage of soil series within each pasture.

Table 4-2: Total acreage and erosion hazard rating for soil series within Travis AFB grazing pastures (Bates 1977; NRCS 2016).

Soil series	Code	Acres	Erosion hazard
Altamont-San Ysidro-San Benito complex, 2-9% slopes	AlC	155	slight to moderate
Antioch-San Ysidro complex, 0-2 % slopes	AoA	100	slight
Antioch-San Ysidro complex, thick surface, 0-2 % slopes	AsA	82	slight
San Ysidro sandy loam, 0-2 % slopes	SeA	11	slight
Omni clay loam	Om	9	slight
Clear Lake clay, 0-2 % slopes	CeA	3	none

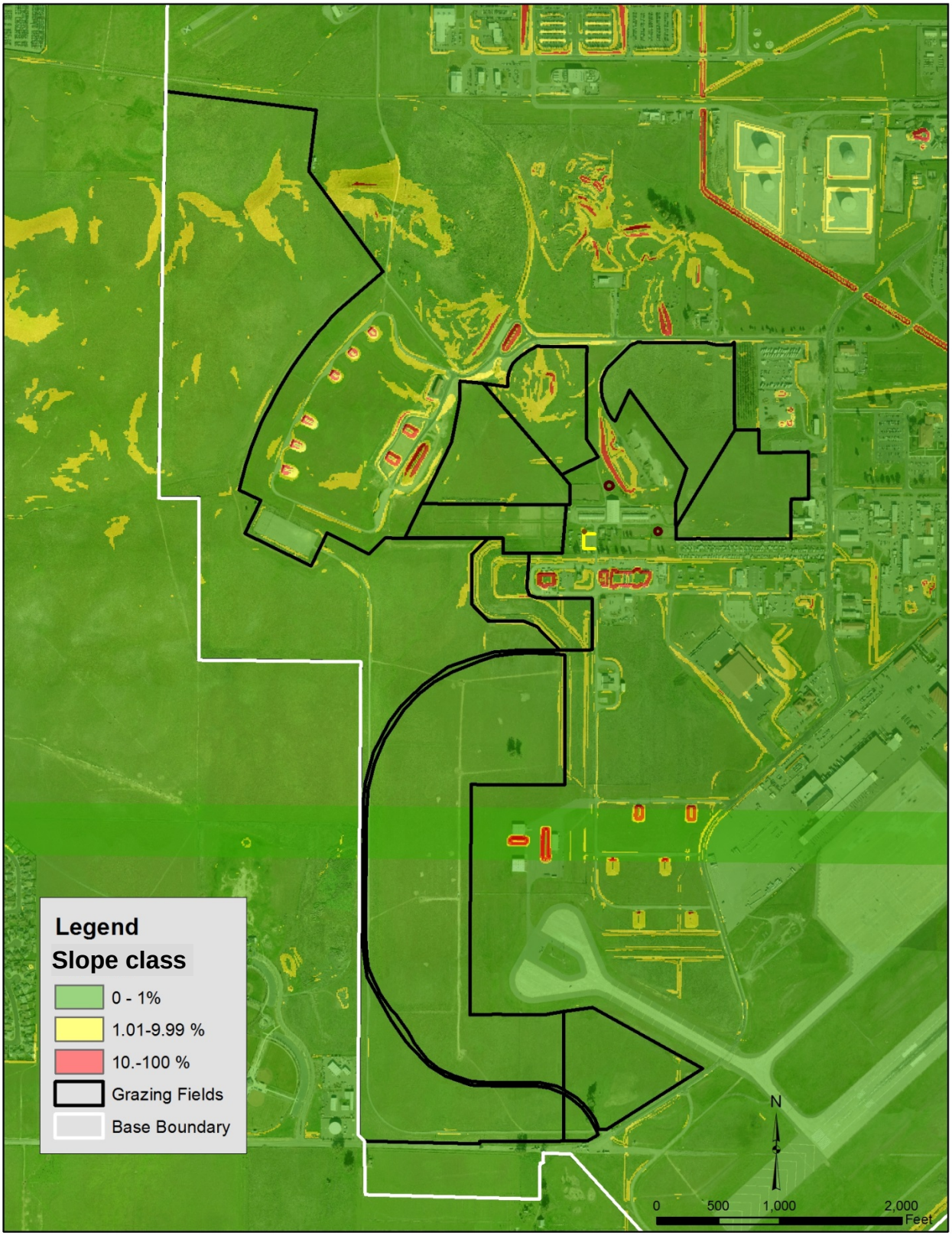

Figure 4-2: Travis AFB grazing pasture area slope classes; map produced by Behdad Sanai, Travis AFB.

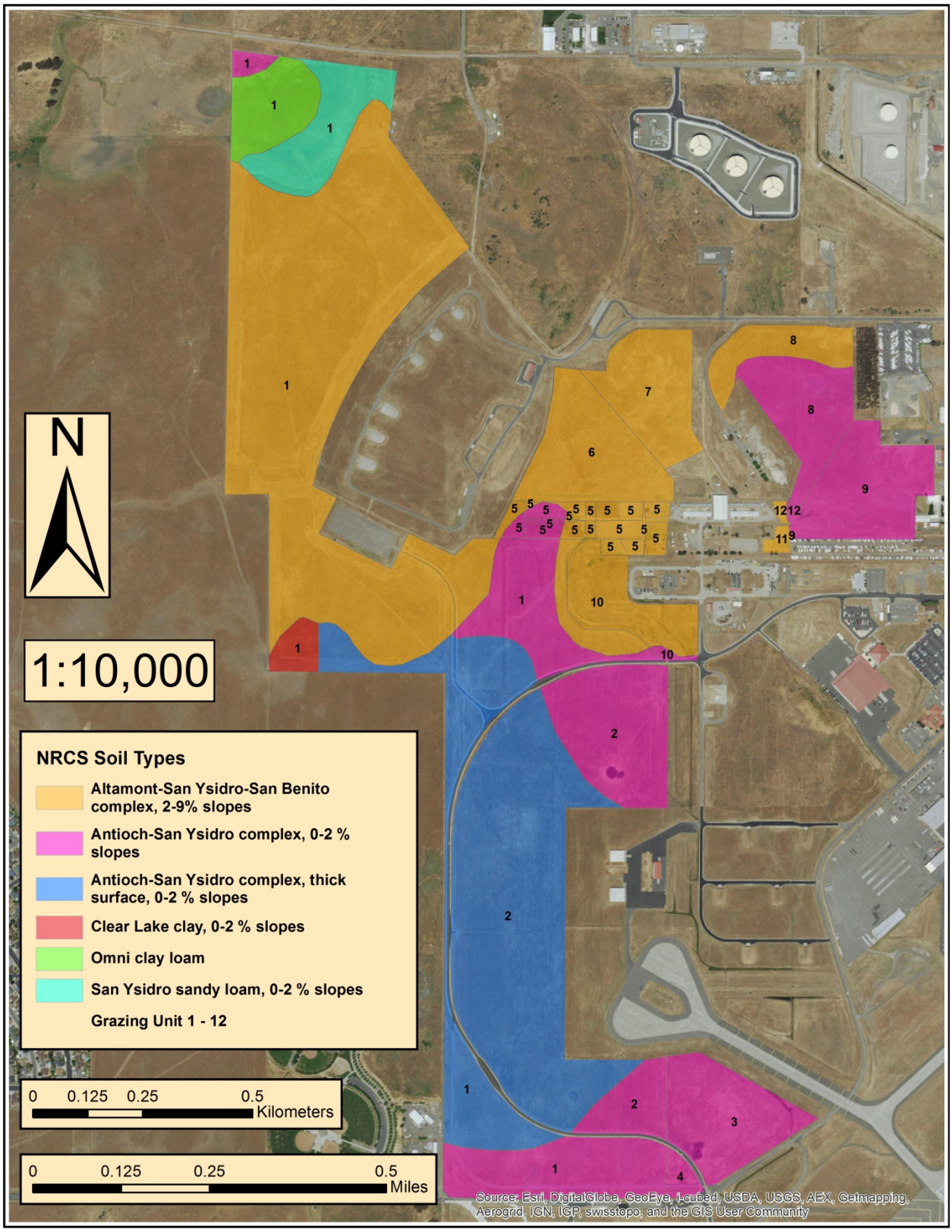

Figure 4-3: Soil series within Travis AFB grazing pastures; data from NRCS (2016); map produced by Paul Block, CEMML.

Travis' cattle grazing area infrastructure comprises the usual cattle guards, fencing, gates, and water troughs (Figure 2-1; Barry et al. 2016). There is a cattle guard on W Street west of its intersection with Cordelia Avenue and another cattle guard on W Street just north of Peterson Road. Pasture 4 serves as a corral. Cattle lessee Bill Traylor states that under the terms of the lease, he, as grazing lessee, is responsible for repairing livestock fences in the cattle pastures (Pastures 1-4; Pers. comm., February and August 2016).

Interior fencing within the Base, much of it installed for military rather than livestock purposes, is in varying degrees of repair; there may be opportunities to cross-fence large pastures, which can improve livestock distribution (George et al. 2007), or to create new grazing areas by using pre-existing fences if they are in adequate condition. Pasture 1 is the largest pasture and may benefit from being divided into 2 or more smaller pastures. There is a pre-existing cross-fence near the munitions area (Bunkers B-958, etc.) in Pasture 1 that could serve to bisect the pasture (Figure 2-1), although the fence may no longer be in repairable condition. If it is not usable, the Travis Natural Resources Manager may wish to consider installing a new cross-fence in that general location. In addition, 2 short cross-fences separating the central and south sections of Pasture 1 at the narrow strip of Pasture 1 between the Base boundary fence and W Street could help improve livestock distribution. Isolating the central section of Pasture 1 with these two cross-fences would also allow cattle to be held in the drier central section when the north and south sections of Pasture 1 are water-logged. Installing cross-fencing typically involves the development of water sources for those new pastures without access to water.

Currently, the Travis cattle pastures have three water troughs (Figure 2-1; Bill Traylor, pers. comm., August 2016): one is located in Pasture 1 near the gate at the intersection of W Street and Munitions Access Road; two adjacent troughs, a large and a small one, are located in Pasture 2 near its W Street gate.

As of fall 2016, tubs of mineral supplement have been placed near troughs in Pastures 1 and 2 (Figure 2-1). Having multiple livestock attractants like water and mineral supplement next to each other means that the adjacent area is likely to receive concentrated livestock use. If the Travis Natural Resources Manager wants to limit impact in any one area, and, especially if a more uniform distribution of grazing is desired, I recommend placing mineral supplements away from water supplies and in strategic locations chosen to optimize distribution.

Wildlife often drink from or bathe in livestock troughs and can drown in the troughs; this hazard can be minimized by installing small escape ramps, a standard addition to livestock watering systems. These escape ramps provide wildlife with access to additional water sources while minimizing drowning hazard and also improve livestock performance by reducing water contamination (NRCS 2014). Ramps are easy to build (e.g., NRCS 2014), or pre-fabricated ramps can be purchased. The Travis cattle-grazing lease currently in effect recommends the use of escape ramps for all troughs (DAF 2003-2012; Appendix D, D52). Bats frequently use livestock troughs in arid areas and are more likely to use troughs that are larger (~6 feet in diameter), surrounded by limited vegetation, and filled with water rather than emptier (Jackrel and Matlack 2010).

Pastures 5-13 are horse pastures used by the Travis Equestrian Center (Figures 4-4 and 4-5). Pastures 6, 7, and 8/9 are conventional horse pastures. Pasture 5 comprises 15 small turnouts and is considered a sacrifice area. Pastures 11-13 are small enclosures also used as turnouts. Total turnout sacrifice area is 10 acres (Table 2-1). Pasture 10 is not currently used by the Equestrian Center (see below for further details).

The Equestrian Center is responsible for maintaining infrastructure in the horse-grazing pastures. The Equestrian Center also pays for water provision and for weed abatement in the horse pasture area. Water is provided in all stalls, and all turnouts in Pastures 5, 11, and 12 have water. Pastures 6, 7, and 8/9 each have a water trough fed by a hose from the horse barns (Kristine Moyer, pers. comm., September 2016).

Currently, the Equestrian Center can house a maximum of 60 horses. Although the number of horses fluctuates from month to month, the Equestrian Center generally operates close to capacity. Primary feeding of all horses takes place in the stalls. Consequently, grazing in the pastures is believed to be incidental (Kristine Moyer, pers. comm., September 2016). Horses may on occasion be fed hay in the Pasture 5 turnouts, but this is usually considered a "snack," not primary feeding, and no feeding is permitted in the other horse pastures (Kristine Moyer, pers. comm., September 2016; Travis AFB 2011). Horses are not ridden in the pastures.

Year-round, no more than 30 horses at a time are permitted in the horse pastures. A horse can be in a pasture for up to 12 hours, primarily for exercise. After a maximum of 12 hours, horses in the pastures are returned to their stalls, and the horses previously in the barns are put in the pastures for the next 12 hours. Pasture 6 holds 10-11 horses; Pasture 7 holds 5 horses; and Pasture 8/9 (currently a single pasture; see below) holds 17 horses (Kristine Moyer, pers. comm., September 2016). Some horses are only placed in the turnouts (Pastures 5, 11-13), and others remain in their stalls.

Pasture 8/9 currently has no cross-fencing. A cross-fence will be installed along the boundary between the two pastures indicated on the pasture map (Figure 4-4) to allow work on remediation wells in Pasture 9 to proceed without interference from the horses. After the well work is complete, the Equestrian Center plans to maintain Pastures 8 and 9 as separate pastures (Kristine Moyer, pers. comm., September 2016).

Pasture 10 has not been used previously by the Equestrian Center. The Equestrian Center has been informed that it has the right to use the pasture but does not do so currently because the pasture contains a drainage canal with an open grate system that presents a potential hazard to horses. Also, the southeast end of the pasture has a hill with a low fence, a combination that could allow horses to escape. Options that Travis staff are considering to remedy the problem include using Pasture 10 for 4-H animals or fencing off the problem areas (Sonja Hunt, pers. comm., November 2016).

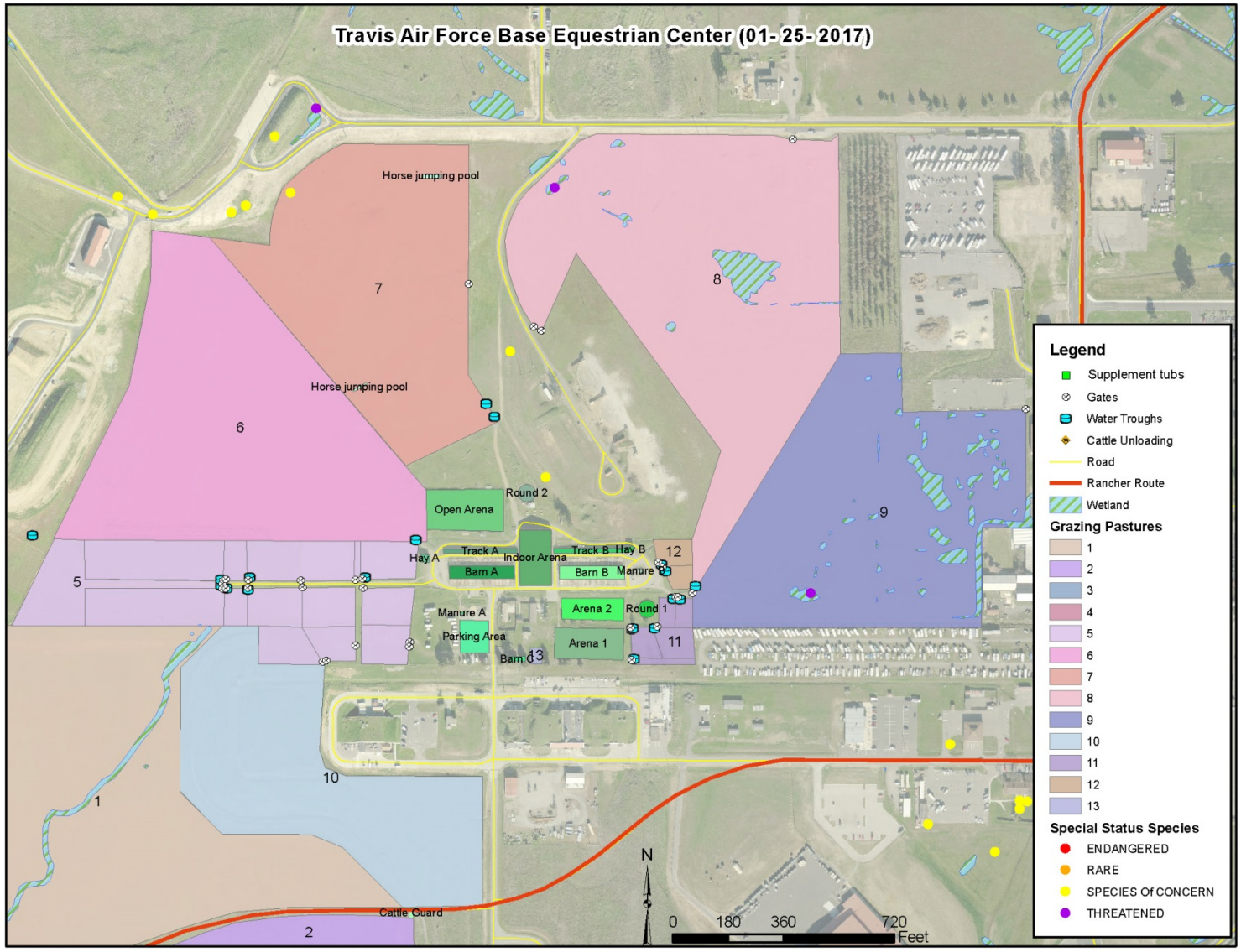

Figure 4-4: Travis AFB pastures 5-13 used by the Travis Equestrian Center as horse pastures and turnouts; map produced by Behdad Sanai, Travis AFB.

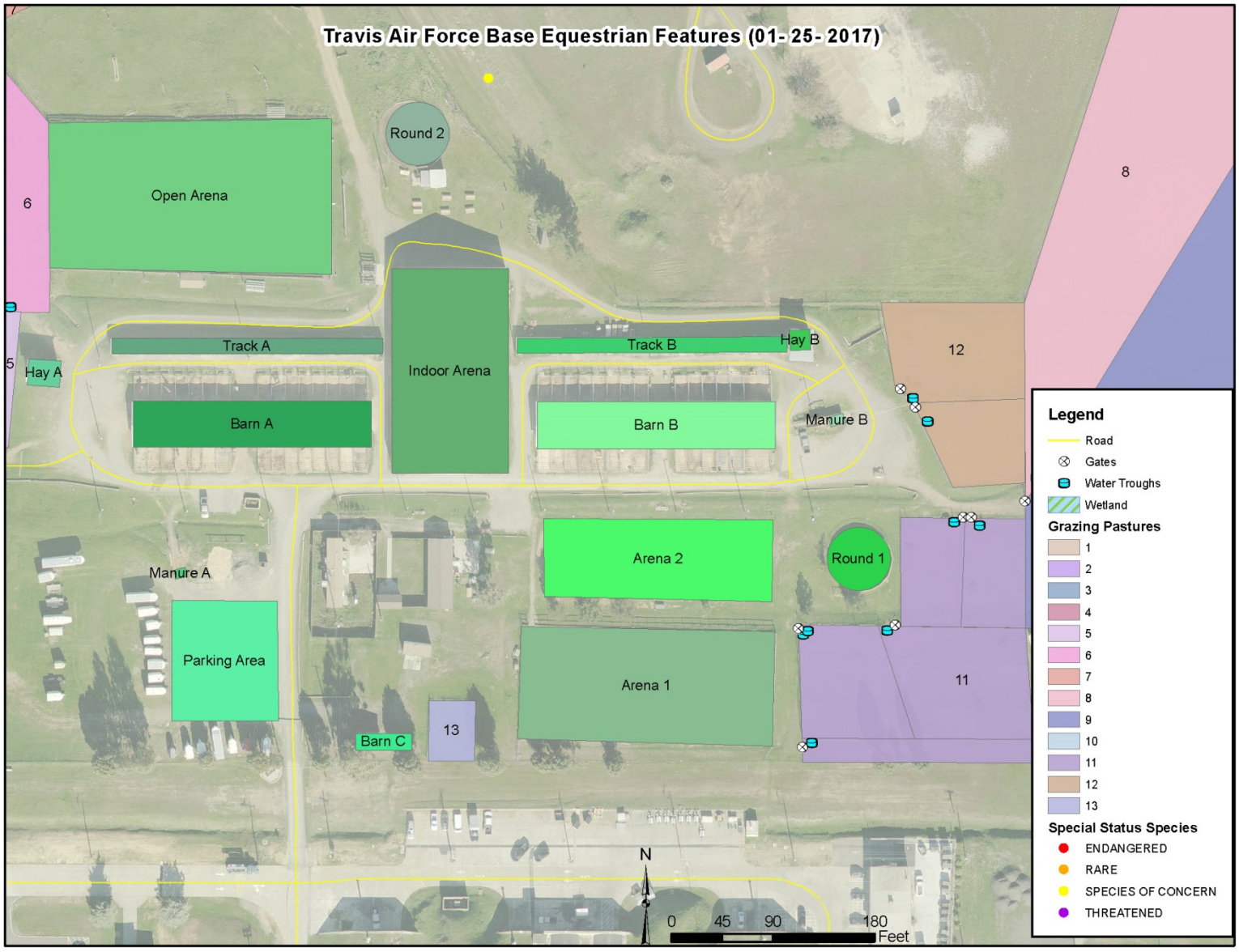

Figure 4-5: Travis AFB Equestrian Center barn, arena, and track features; map produced by Behdad Sanai, Travis AFB.

As noted in Section 2.0, the INRMP states that Travis' horse facilities are operating at maximum capacity and that plans are in progress to increase stabling capacity (Travis AFB 2016, 97). As an increase in horse numbers will almost certainly result in increased use of the horse pastures or interest in additional horse pastures, I recommend that the Travis Natural Resources Manager consult with the Equestrian Center management regarding their expansion plans and how increased horse numbers might affect use of the horse pastures.

4.4 Vegetation types

The primary vegetation type of Travis' grazing pastures is Valley grassland, also known as California annual grassland. California's Valley grassland type is found in the Central Valley, the foothills surrounding the Central Valley, including the central and southern Coast Ranges, and parts of the Transverse and Peninsula Ranges (Bartolome et al. 2007). Non-native annual grasses and forbs have dominated this grassland type for many decades, and in most areas, native plants make up only a very small percentage of the total cover. Despite this, numerous native plant species remain, generally at very low density, and can make up a significant proportion of the species richness (number of species). The majority of these native species are likely to be annual forbs.

Valley grassland exhibits considerable spatial and temporal variation at many scales. Annual rainfall amount and pattern, temperatures during the growing season, variation in soil chemistry and texture, topographic diversity, and land-use history, among other variables, largely determine plant species composition, biomass production, and dominance relationships. Management activities such as livestock grazing generally do not cause spatially or temporally consistent changes in grassland community composition at the landscape level (Jackson and Bartolome 2002). Livestock grazing is a useful tool for reducing grassland fuel loads, for reducing vegetative biomass, especially of non-native grasses, which can benefit many native plant and animal species (see Section 4.5), for altering vegetation structure, which can help achieve Bird/Wildlife Aircraft Strike Hazard (BASH) program goals, and, when carefully planned and implemented, for controlling some rangeland invasive plant species.

Within the Valley grassland, several smaller specialized habitat types can occur that make a significant contribution to Valley grassland native biodiversity (Bartolome et al. 2014). The vernal pools that occur at Travis are one such specialized habitat. The Travis INRMP identifies the Base's vernal pool systems as Northern claypan vernal pools and vernal swales (Travis AFB 2016). See Section 4.5 for further details on vernal pools.

Riparian vegetation occurs along Union Creek, but as noted above, this area is not grazed by livestock (Travis AFB 2016). Union Creek riparian vegetation comprises some small patches of willow (*Salix* spp.), coyote brush (*Baccharis pilularis*), native and non-native herbaceous species, including the invasive perennial pepperweed (*Lepidium latifolium*; see Appendix B), and native emergent vegetation such as common cattail (*Typha latifolia*) and tule (*Schoenoplectus* (*Scirpus*) *acutus* var. *occidentalis*; CH2MHILL 2006; Travis AFB 2016, 28).

4.5 Sensitive biological resources and grazing effects

Vernal pool ecosystems

Vernal pools form in small depressions that are underlain by impervious layers of clay or cemented hardpans; Travis' vernal pools are of the claypan type. Winter rain collects in the depression and forms a pool; as spring progresses, the pool begins to dry and during the summer is typically bone-dry. Depending on the time of year, vernal pools are too wet for most upland plants or too dry for wetland plants, making survival difficult for most plant species but resulting in numerous endemic taxa: plants and animals that have evolved to tolerate the harsh and changing conditions of vernal pools (Bartolome et al. 2014). A highly specialized suite of plants has evolved that can tolerate both the aquatic and drought phases of the vernal pool cycle (Solomeshch et al. 2007). They typically germinate and begin to grow underwater, but their adult life generally occurs in much drier conditions. Endemic vernal pool tadpole and fairy shrimp species, several of which are federally listed, must also cope with desiccation for part of the year or longer. The federally listed California tiger salamander (*Ambystoma californiense*) and other amphibians also use vernal pools.

In addition to these endemic species, vernal pools provide "safe space" for many other native plants that are largely responsible for vernal pool spring wildflower displays. The inhospitable growing conditions make it difficult for non-native grasses and forbs to flourish so native species do not have to compete with them for resources to such an extent. Unfortunately, certain non-native plant species threaten vernal pools, despite their harsh growing conditions. Although most non-native species cannot grow in a vernal pool while it is wet, they can hug the boundary of a pool as it dries, competing with native wildflowers on the edges and increasing the evapotranspiration rate for the pool water, which shortens pool inundation period. This has likely contributed to localized losses of native fauna and flora in Central Valley vernal pools (Marty 2005). Livestock grazing has been shown to protect native plant and animal biodiversity in vernal pool ecosystems in part by reducing non-native plants' competition and evapotranspiration (Marty 2015; Travis AFB 2016). A recent US Fish and Wildlife Service report on an endangered vernal pool species (USFWS 2013, 18) explicitly states "Moderate grazing may be a necessary tool to maintain the species diversity of the natural vernal pool ecosystem," citing Marty (2005). An additional challenge facing vernal pool species is that most historic vernal pools across the state have been lost to urban and agricultural development (Solomeshch et al. 2007).

Hydrology of vernal pool complexes is an essential consideration in their management. Depth, surface area, and duration of pool inundation affect habitat suitability and quality for many vernal pool plant and animal species (Collinge 1999; CH2MHILL 2005). Vernal pool hydrology is determined by annual rainfall amount and timing and by local topography, with surface flow from the surrounding landscape filling pools (CH2MHILL 2006).

Vernal pools and swales occur throughout Travis' grazing area, with over 600 identified base-wide (Travis AFB 2016, 28). The Base's vernal pools, some of which were restored in 1999, have been extensively monitored over the last two decades (e.g., BioSystems Analysis 1994; Collinge 1999; Gerhardt and Collinge 2003; CH2MHILL 2005, 2006; Collinge et al. 2013,

ICF International 2013; see 2016 Travis INRMP Section 5.6 for full list of publications) in part because they contain federally listed plant and animal species and are also an ecosystem under threat. The Travis INRMP lists the native plant species in Table 4-3 as occurring in Travis vernal pools (Travis AFB 2016, 28-29, 44).

Table 4-3: Native plant species occurring in Travis AFB vernal pools (Travis AFB 2016, 28-29, 44). CNPS rank from the California Native Plant Society's Inventory of Rare and Endangered Plants (CNPS 2016).

Common name	Scientific name	Legal status	CNPS rank
Pacific meadow foxtail	*Alopecurus* sp.		
alkali milk vetch	*Astragalus tener* var. *tener*		1B.2
annual hairgrass	*Deschampsia danthonioides*		
downingia	*Downingia* spp.		
spike rush	*Eleocharis macrostachya*		
coyote thistle	*Eryngium* spp.		
San Joaquin spearscale	*Extriplex* (*Atriplex*) *joaquinana*		1B.2
meadow barley	*Hordeum brachyantherum*		
goldfields	*Lasthenia* spp.		
Contra Costa goldfields	*Lasthenia conjugens*	federally endangered	1B.1
flowering quillwort	*Lilaea scilloides*		
popcorn flower	*Plagiobothrys* spp.		
Oregon woolly marbles	*Psilocarphus oregonus*		
round woolly marbles	*Psilocarphus tenellus*		

Three federally listed invertebrate and vertebrate animal species have been found in vernal pools at Travis: vernal pool fairy shrimp (*Branchinecta lynchi*; federally threatened), vernal pool tadpole shrimp (*Lepidurus packardi*; federally endangered), and California tiger salamander (federally threatened; Travis AFB 2016). See below for further details.

Contra Costa goldfields

An annual forb in the Asteraceae family, Contra Costa goldfields (*Lasthenia conjugens*) is found primarily in central coastal California (CNPS 2016). Contra Costa goldfields blooms from March through June (CNPS 2016). Potential threats to the species include development, agricultural conversion, hydrological alteration, intensive grazing practices, livestock trampling,

and competition from non-native plants ((LSA Associates, Inc. 2012b; USFWS 2013; CNPS 2016).

The U.S. Fish and Wildlife Service (USFWS) in its most recent 5-year review of Contra Costa goldfields explicitly states that "insufficient grazing" and "lack of grazing" present a threat to the species. Cattle preferentially eat non-native grasses. Consequently, cattle grazing reduces the non-native grasses' competitive impacts, the amount of their thatch, and evapotranspiration. Reduction of evapotranspiration results in longer vernal pool inundation periods (USFWS 2013). Experiments in Alameda County demonstrated that Contra Costa goldfields were more abundant in seasonally grazed areas than in comparison ungrazed exclosures (USFWS 2013). In addition, the review describes Contra Costa goldfields populations in several counties that are increasing with well-managed livestock grazing programs. Heavy grazing, in contrast, is cited as a threat to the species. The USFWS appears to consider moderate grazing an appropriate and even necessary tool for controlling the negative effects of non-native grasses (USFWS 2013). Moderate grazing has been be defined as livestock use that removes 50-75% of the forage each year, leaving 500-1,000 pounds per acre of residual dry matter still on the ground immediately prior to fall rains (Barry et al. 2011, 23). See Bartolome et al. (2006) for photographs of California annual grassland under light, moderate, and heavy livestock grazing regimes.

Alkali milkvetch

An annual forb in the Fabaceae family, alkali milkvetch (*Astragalus tener* var. *tener*) is found in central California (LSA Associates, Inc. 2012a). The species blooms from March through June (CNPS, Rare Plant Program 2016). Potential threats to alkali milk vetch are development, agricultural conversion, and competition from exotic plants (CNPS, Rare Plant Program 2016). Livestock are unlikely to eat the plant as many *Astragalus* species are toxic to livestock, including horses and cattle (DiTomaso and Healy 2007; Forero et al. 2010); the species may possibly be threatened by livestock trampling (CNPS, Rare Plant Program 2016). Cattle and horses typically select grasses over forbs (Larson et al. 2015) and may, therefore, influence the competitive relationship between non-native annual grasses and native forbs in favor of the natives. The USFWS in their vernal pool recovery plan observe that all 10 populations of alkali milkvetch in areas grazed by livestock are rated as in good or excellent condition, and that livestock grazing may be necessary to reduce competition from non-native plants (USFWS 2005). The plan also notes that alkali milkvetch appears to benefit from temporary surface disturbance, suggesting that livestock disturbance of the soil surface may not harm the species to a significant degree.

San Joaquin spearscale

An annual forb in the Chenopodiaceae family, San Joaquin spearscale, also known as San Joaquin saltbush (*Extriplex (Atriplex*) *joaquiniana*), has a range limited to the western side of the Central Valley and small inner Coast Range valleys. There is minimal information about its ecology (East CCC HCP/NCCP 2006a). San Joaquin spearscale flowers between April and October. *Extriplex* species are relatively tolerant of disturbance but may be intolerant of fire

(LSA Associates, Inc. 2004; Silveira 2000). Potential threats to the San Joaquin spearscale include overgrazing, development, intensive agriculture, and competition from exotic plants (CNPS, Rare Plant Program 2016; Little and Gerlach 2009; East CCC HCP/NCCP 2006a), although Little and Gerlach (2009) note that the species has a long-lived seedbank that germinates in response to soil disturbance and that the species can co-exist in grassland dominated by non-native annual plants.

Cattle and horses typically select grasses over forbs (Larson et al. 2015) and may, therefore, influence the competitive relationship between non-native annual grasses and native forbs in favor of the native forbs. A researcher who surveyed San Joaquin spearscale in 5 cattle-grazed sites for 10 years suggests that moderate livestock grazing appears best for San Joaquin spearscale but that occasional rest from grazing is fine. She notes that harsh soil conditions in alkali grasslands, where San Joaquin spearscale typically occurs, appear to control annual grasses to the extent that competition in ungrazed conditions is not overwhelming for a few years, but that San Joaquin spearscale recruitment then declines drastically after several years without grazing; at the other extreme, San Joaquin spearscale recruitment decreases or ends in areas that are grazed to almost barren conditions. She further recommends that because cattle "tend to congregate in barren areas causing greater impact to these microhabitats than the adjacent grassland or alkali grassland . . . that should be taken into account in stocking rates" (Susan Bainbridge, pers. comm. 2011).

Vernal pool branchiopods

Vernal pools at Travis AFB contain two federally listed branchiopods: vernal pool fairy shrimp (*Branchinecta lynchi*; federally threatened) and vernal pool tadpole shrimp (*Lepidurus packardi*; federally endangered). Livestock grazing may help maintain the necessary hydrological conditions for reproduction of these two California vernal pool branchiopods, which require several weeks to mature (USFWS 2007a and b). A Sacramento County grazing exclosure study demonstrated that, after 9 years without livestock grazing, vernal pools took up to 2 weeks longer to fill and dried 1-2 weeks earlier on average than comparison grazed pools (Marty 2015). As noted above, livestock reduce non-native cover, which in turn reduces evapotranspiration, resulting in longer vernal pool inundation periods. In addition, Marty (2015) suggests that non-native plant thatch build-up in ungrazed pools increases soil organic matter and consequently soil water-holding capacity; as a result, the surrounding soil holds more water in an ungrazed vernal pool, and less is retained in the vernal pool itself, reducing inundation period. In its most recent 5-year reviews for both vernal pool fairy and tadpole shrimp, the USFWS states that cessation of grazing is a threat to the species, while noting that overgrazing that modifies vernal pools by increasing sedimentation and nutrient inputs is also likely to be a threat; livestock trampling may also crush shrimp cysts (USFWS 2007a and b).

California tiger salamander

The federally threated California tiger salamander (CTS; *Ambystoma californiense*) also occurs on Travis AFB, breeding in vernal pools and ponds and summering in small mammal

burrows or soil cracks in upland grassland (Ford et al. 2013). The Castle Terrace Preserve is the only area on Base in which CTS are known to breed (Jaymee Marty, pers. comm., September 2016).

As with the branchiopods, livestock grazing may help maintain the necessary hydrological conditions for completion of CTS' aquatic phase, estimated to last 70 to 90 days (Marty 2005; Marty 2015); longer vernal pool inundation periods can produce significantly more metamorphosing CTS juveniles (Ford et al. 2013). CTS are more commonly found in turbid vernal pools than in pools with clear water, probably because muddy water helps them avoid predation; livestock use of vernal pools can increase turbidity (Ford et al. 2013). Livestock grazing can also reduce habitat for predacious aquatic hexapods (Bobzien and DiDonato 2007).

In addition, livestock grazing can improve upland habitat conditions for California ground squirrels (*Otospermophilus beecheyi*), whose burrows CTS occupy, and help maintain the short grassland that CTS requires for travel between upland summer refugia and breeding ponds (Barry et al. 2015). Ford et al. (2013, 16, 42) recommend not removing livestock grazing from extensive grassland areas for more than a year and state that, in general, managing grazing for residual dry matter (RDM) based on the recommendations of Bartolome et al. (2006) is "compatible with healthy populations" of CTS (see sections 6.0 and 9.1 for more details on RDM) . Ford et al. (2013) provide a useful review of rangeland management for CTS.

Other species of concern

The Travis INRMP lists three other special status species that are known to occur on Base (Travis AFB 2016, INRMP Table 5-A, 32-33). Table 4-4 summarizes possible grazing effects on these species.

Table 4-4: Possible grazing effects on special status species known to occur at Travis AFB.

Species	Special status (Travis AFB 2016)	Habitat/ occurrence (Zeiner et al. 1988-1990)	Potential effects of livestock grazing and associated impacts	Grazing impact assessment
Agelaius tricolor (tricolored blackbird)	Federal Bird of Conservation Concern; State candidate for listing	Forages in cropland, grassland, and along pond edges; nests near fresh water, often emergent wetlands.	Generally breeds in freshwater marshes and agricultural fields (TBWG 2009); grazing vegetation to < 15 cm can improve foraging habitat (TBWG 2009); livestock grazing can eliminate breeding colonies located in mustard stands (Meese 2016).	Heavy grazing in mustard-dominated breeding areas likely negative; grazing probably beneficial in foraging areas.

Species	Special status (Travis AFB 2016)	Habitat/ occurrence (Zeiner et al. 1988-1990)	Potential effects of livestock grazing and associated impacts	Grazing impact assessment
Athene cunicularia ssp. *hypugea* (western burrowing owl)	Federal Bird of Conservation Concern; State Species of Special Concern	Dry grassland and desert.	Burrowing owls often require short grass for foraging; often associated with grazed areas; livestock grazing may enhance burrowing owl foraging and nesting habitat (Kantrud and Kologiski 1982; Lantz et al. 2004); burrowing owl nests lined with livestock manure may have higher success rate (Dechant et al. 2002)	Grazing beneficial if not excessive.
Buteo swainsoni (Swainson's hawk)	Federal Bird of Conservation Concern; State Threatened	Forages in grassland, cropland; nests in riparian areas.	Nests strongly associated with riparian vegetation; grasslands provide foraging habitat only: grazing may increase visibility of prey by reducing cover (Woodbridge 1998); in Central Valley, Swainson's hawk strongly associated with grazed grasslands (Swolgaard et al. 2008).	Grazing beneficial if not excessive.

4.6 Cultural resources

Cultural resources can be affected by the activities of livestock, including trampling and rubbing/scratching behavior. If livestock are likely to congregate in a location (e.g., because water or shade are available), fencing the site to exclude livestock is a reliable method of protecting cultural resources from livestock impacts. If a cultural resource site is not located in an area of concentrated livestock activity, livestock use of the area can often be managed so as to prevent damage to the cultural resource. Best management practices can be implemented, such as locating livestock-holding areas (e.g., corrals) and livestock water sources and placing mineral supplements or supplemental feed away from cultural resource sites. For such practices to be successful, communication between the Base's Natural Resources Manager, Cultural Resources Manager, and grazing lessee is essential.

The INRMP states that all of Travis AFB has been surveyed, and no listing-eligible archaeological sites or resources were found (Travis AFB 2016). If listing-eligible archaeological sites or resources are located in the future, potential impacts of livestock grazing on the sites/resources should be assessed, and management actions implemented to minimize or eliminate grazing impacts.

5.0 Invasive plants

Controlling invasive plants has proven to be one of the greatest challenges facing California rangeland managers and restoration practitioners (Stromberg et al. 2007). A detailed

weed management strategy is beyond the scope of this grazing management plan; rather, I present brief overviews of common management methods for the primary rangeland invasive plant species of concern at Travis. H.T. Harvey & Associates (2014) recently prepared a weed management plan for Travis AFB, which identified yellow starthistle and medusahead as the primary invasive plants in the Travis grazing area. In addition, purple starthistle (*Centaurea calcitrapa*) occurs in the cattle and horse pastures (Solano RCD 2016). Additional rangeland weeds mapped as occurring on Base but not in the grazing areas are addressed in Appendix B (H.T. Harvey & Associates 2014).

Preventing new infestations is generally acknowledged as the most cost-effective method of managing invasive species (Lodge et al. 2006; NISC 2016), and the Travis weed management plan recommends important prevention best management practices, including some related to livestock operations (H.T. Harvey & Associates 2014). Invasive plant management tools available to rangeland managers include livestock grazing; however, a single weed management tool typically does not result in successful control (DiTomaso et al. 2007). To increase the likelihood of successful long-term control, weed management experts recommend combining several weed management methods, tailored to situation-specific goals, constraints, and opportunities (DiTomaso et al. 2007; NISC 2016). A weed management plan should include a well-designed monitoring component that evaluates treatment effectiveness and assesses any unintended consequences, such as increased erosion or impact on non-target species.

The cattle-grazing lease currently in effect at Travis contains a provision requiring that, "at his own cost and expense, the lessee will participate in a noxious weed control program" ((DAF 2003-2012; Appendix D, D43, D51). Exactly how this provision was to be implemented is not clearly stated in the lease, and it is not clear that the provision has ever been implemented or enforced. Although weed control perhaps requires more detailed planning and management than this lease provision is likely to generate, including the lessee in weed control activities makes sense, especially if the lessee's livestock are to be employed in the control activities or if the livestock operation will be affected by the control activities, as may happen with prescribed burns or herbicide application.

Using livestock to control invasive plants often requires prescription grazing, which is the application of specified livestock grazing actions to accomplish specific vegetation management goals. Grazing intensity, animal distribution, and grazing period are often rather different from standard, light to moderate intensity grazing, and livestock performance may be significantly reduced. Consequently, finding a lessee willing to implement a grazing prescription can prove difficult and may require reduced grazing fees or even payment to the livestock operator. Furthermore, intensive grazing, sometimes necessary for successful weed control, can have undesirable consequences. Concentrated hoof impacts and greatly reduced vegetative cover (i.e., reduced residual dry matter) could result in increased soil erosion, and greater area of bare ground may allow other weed species to thrive. In addition, intensive grazing may significantly impact desirable species in the weed-infested area.

Those caveats noted, prescription grazing can work well in controlling some weed species (DiTomaso et al. 2007). An essential planning factor is that prescription grazing has to be timed to the target species' phenology. Grazing must occur when weeds are most vulnerable

to defoliation; poorly timed grazing can actually benefit target species (Huntsinger et al. 2007). Timing prescription grazing to avoid vulnerable periods for desirable plants may also be necessary. Another consideration is the effect of prescription grazing on stocking rate. Forage consumed as part of a grazing prescription should be considered when making stocking rate decisions, although Animal Unit Months (see Section 6) in weed-infested areas may differ from standard calculations. A weed management plan should address these important issues.

In developing a weed management plan for an area that is grazed, if herbicide use is being contemplated, it is important to account for the fact that some herbicides have restrictions for use in rangelands, and treated areas may have to be excluded from livestock grazing for weeks or even an entire season, depending on the herbicide. Although this trade-off may be well worth making in order to control a weed, the restriction on livestock use should be planned for, in consultation with the grazing lessee.

Finally, I recommend that Travis consider developing an early detection-rapid response program to find and eradicate incipient infestations of new invasive species or satellite populations of resident invasives. Invasive species experts consider such programs to be key for successful invasives management, in part because they allow for the possibility of immediate eradication at the stage when the invasive is at low numbers and occupies a small area (DiTomaso et al. 2007; NISC 2016). An early detection-rapid response program may also reduce long-term invasive control costs (Lodge et al. 2006). The National Invasive Species Council, of which the Department of Defense is a founding member, recently released a management plan that emphasizes early detection and rapid response as an essential strategy for reducing the adverse impacts of invasive species and lays out the action plan for implementing a national early detection-rapid response program over the next two years (NISC 2016).

Early detection-rapid response programs often rely upon reports from users of an area. Educational signs around corrals and at gates could briefly describe the weed, preferably with a photograph, and ask users to take a georeferenced photo of the plant if possible and send it to the Travis AFB Natural Resources Manager. Reports should be acted upon as soon as possible. For example, according to the Travis weed management plan, barbed goatgrass (*Aegilops triuncialis*) has not been documented in the grazing area, but the Castle Terrace Housing area of the Base has moderate to heavy barbed goat grass cover (H.T. Harvey & Associates 2014). Because goatgrass is such a noxious and invasive rangeland weed but may not yet be present in grazed areas of Travis, an early detection-rapid response program focused on goatgrass could be an effective weed control technique for the Travis grazing pastures.

5.1 Yellow starthistle

Yellow starthistle (*Centaurea solstitialis*; Asteraceae family) is one of the worst rangeland weeds in California, occupying over 3 million hectares of California grasslands and continuing to spread (Bossard and Randall 2007). Travis' infestation of yellow starthistle likely reduces habitat values for many species, reduces forage for both wildlife and livestock, and may increase BASH risks by attracting certain seed-eating bird species (DiTomaso et al. 2006; RMAT 2000). It often forms monocultures, displacing native species, and as a deep-rooted

summer annual, can deplete soil moisture and alter a site's hydrology (Gerlach 2004). Yellow starthistle infestation also lowers recreational and other human use values (DiTomaso et al. 2006). Several methods of control, including prescribed burning, livestock grazing, herbicide application, and biological control by insects, can help control, if not eliminate, yellow starthistle (DiTomaso et al. 2007). Because horses occur on the Base, it is important to note that yellow starthistle is toxic to horses. DiTomaso et al. (2006) is a useful general reference on control of yellow starthistle.

According to the Travis weed management plan, yellow starthistle occurs throughout the grazing area at about 1-5% cover; however, yellow starthistle is at lower cover in the grazing area than in other areas on the Base in which it occurs, suggesting that current cattle grazing management is already providing some measure of control (H.T. Harvey & Associates 2014). Yellow starthistle occurs in the horse pastures but is not as widespread as purple starthistle (*C. calcitrapa*; see below); horse trampling likely provides some control of yellow starthistle. According to Equestrian Center staff, no horse toxicity problems with yellow starthistle have occurred. Equestrian Center staff try to control the starthistles manually because they are not permitted to use herbicides (Kristine Moyer, pers. comm., September 2016). Because the Equestrian Center could serve as a source for the spread of both starthistle species to other areas of the Base, the Travis Natural Resources Manager may consider assisting the Equestrian Center with weed control.

Grazing prescriptions must be carefully designed because grazing yellow starthistle at the wrong phenological stage can actually benefit the plant (Huntsinger et al. 2007). Bossard et al. (2000) report that intensive grazing of yellow starthistle by sheep, goats, or cattle before the spiny stage but after bolting can reduce biomass and seed production. A recent study found that prescribed cattle grazing from January through May failed to reduce yellow starthistle cover, probably because the grazing season did not extend into summer when yellow starthistle is most vulnerable to grazing (Davy et al. 2015). In years with significant late spring rainfall, Davy et al. (2015) recommend that grazing should, if possible, be continued into the summer to maintain control of yellow starthistle. The cattle lessee, Bill Traylor, states that he generally removes his livestock from the Base in May (Pers. comm., February and August 2016), which may limit the impact of grazing on yellow starthistle. The Travis Natural Resources Manager may wish to ask the lessee to keep his cattle longer into the summer in pastures with significant yellow starthistle, especially in years with late spring rainfall.

Alternatively, bringing goats into the yellow starthistle-infested areas during the summer may provide better control, especially once the weed has entered the spiny stage. Goat grazing has proved successful in controlling yellow starthistle experimentally (Thomsen et al. 1993; Goehring et al. 2010) and in management situations (DiTomaso et al. 2006). Unlike cattle or sheep, goats will eat yellow starthistle in the spiny stage and so can be deployed later in the season; goats can also be corralled within small areas by electric fencing and watered with a mobile water source. As a result, a mixed goat and cattle or sheep strategy may afford greater control than cattle or sheep alone. On the downside, goat rental can be expensive (goat herd owners are typically paid to graze their animals), goats are vulnerable to predators, and their impact on non-target plant species may be undesirable (DiTomaso et al. 2006). Furthermore, because they are often fenced into small areas and will eat a wide variety of plants, goats can

remove most of the plant cover in an area; unless carefully managed, they may increase erosion on slopes or creek banks. Such considerations should be addressed in the weed management plan and monitored for if goat grazing is implemented.

Other control methods such as burning and herbicide application can provide good control. DiTomaso et al. (2007) describe a successful long-term control program using a prescribed burn in the first year, followed by a second-year clopyralid treatment. Bossard et al. (2000) recommend burning after native species have dispersed their seeds but before yellow starthistle produces viable seed in the summer months. DiTomaso et al. (2013) provide detailed recommendations about herbicide use for yellow starthistle control.

5.2 Medusahead

The annual grass medusahead (*Elymus* (*Taeniatherum*) *caput-medusae*; Poaceae family) is a noxious rangeland weed, increasing across California and the western U.S. (DiTomaso and Healy 2007). Medusahead and yellow starthistle are the two most common invasives in the Valley grassland (DiTomaso et al. 2007). Medusahead can form dense stands and persistent thatch layers that displace native species and reduce forage values and wildlife habitat (DiTomaso et al. 2013). Its awns can injure grazing animals, and its thatch layer can increase fuel for wildfire (DiTomaso and Healy 2007). Kyser et al. (2014) is a useful general manual on medusahead control. According to the Travis weed management plan, medusahead occurs throughout the grazing area at about 5-25% cover, although there are a few patches at higher cover (H.T. Harvey & Associates 2014).

In a recent meta-analysis of 22 medusahead control studies, herbicide with subsequent reseeding proved the most effective treatment method, and glyphosate the most effective herbicide (James et al. 2015). James et al. (2015) suggested that burning may be similarly effective but could not locate a sufficient quantity of long-term studies to test this hypothesis. In the Central Valley, two consecutive annual burns when medusahead has begun to head out but before it has dropped seed can nearly eliminate a medusahead infestation (DiTomaso et al. 2013). In the meta-analysis, sheep and cattle grazing appeared to be moderately effective, but the control effect was strongly dependent on grazing timing and intensity, which can be difficult to implement (James et al. 2015; Davy et al. 2015; Brownsey et al. 2016). Although livestock typically avoid medusahead as it matures, DiTomaso et al. (2007) reported that high intensity grazing by sheep in April and May can reduce medusahead cover significantly. A recent University of California Agriculture and Natural Resources publication provides clear descriptions of the susceptible growth stages and the approximate timing for grazing to control medusahead successfully; a very short, 2 to 3 week period, typically from early April to May is the optimal period to achieve control of medusahead with livestock grazing (Brownsey et al. 2016). Cattle lessee Bill Traylor stated that his cattle will only graze on the medusahead in Pasture 2 very early in the season when the grass is green but will not eat it once it has begun to dry (Pers. comm., August 2016). Where feasible, mowing can also be an effective method of control, if timed to coincide with medusahead's vulnerable growth stage, an approximately 5 week period, typically lasting from late April to early June (Brownsey et al. 2016).

5.3 Purple starthistle

Cattle lessee Bill Traylor noted that a thistle was the main weed problem he observed in Travis' cattle-grazing area, especially where the Base decommissioned an old roadway near the western fence of south section of Pasture 1 (Pers. comm., February and August 2016). During a Travis site visit in October 2016, I visited the location and saw the infestation he described. The weed is purple starthistle (*Centaurea calcitrapa*; Asteraceae family), and a recent Travis weed control report confirms this (Solano RCD 2016). Purple starthistle is also widespread in the horse pastures. As noted above, Equestrian Center staff try to control the starthistles manually because they are not permitted to use herbicides (Kristine Moyer, pers. comm., September 2016). To a greater extent even than yellow starthistle, purple starthistle has rigid spines that deter grazing by livestock, injure animals, and generally degrade habitat and recreational values (DiTomaso et al. 2013).

Livestock grazing is not an effective control as grazing animals generally avoid purple starthistle. Livestock can actually encourage the weed by grazing on more palatable plants surrounding purple starthistle that would otherwise compete with it. Burning is not effective, and while mowing can reduce seed production, purple starthistle can resprout from root crowns (DiTomaso et al. 2013).

Manual removal can control small infestations, although this method must be undertaken multiple times a year for several consecutive years. Herbicide application can also control purple starthistle, although some of the effective herbicides are not registered for use in California (DiTomaso et al. 2013).

6.0 Grazing capacity assessment

A primary task of a grazing management plan is to determine the number of grazing animals that the area under evaluation can support on a sustainable basis, that is, without long-term adverse impacts to the natural resource base (e.g., soil, vegetation). Range managers call this number "grazing capacity". Grazing capacity may be defined more formally as the maximum number of animals in a defined area that will produce a target level of production without ecosystem deterioration over a defined period, usually a long time (Heady and Child 1994). With the grazing capacity determined, a stocking rate can then be decided upon; stocking rate is the actual number of animals in a defined area during a specific period, usually a grazing season (Heady and Child 1994).

Grazing capacity expressed as a single, sustainable stocking rate seems a simple concept: "how much grazing can be sustained". In practice, the concept becomes discouragingly complex both in theory and application and has a long history of problems when applied to dry rangelands. The concept of a single, sustainable stocking rate has been questioned for dry rangelands in general (Heitschmidt and Stuth 1991) and is regarded as of little value for Mediterranean annual-type range like the Valley grassland (George et al. 2001). Although long-term averages can be determined, they are of little value under the extreme fluctuations in

production caused by California's highly variable annual weather patterns. Therefore, grazing capacity estimates provide a useful starting point for setting annual stocking rates and provide a general guide around which stocking rates can be adjusted. Stocking rates themselves, however, must be adjustable in response to variations in forage production and the timing of actual use.

It is important to realize that setting a stocking rate in California requires retrospective rather than prospective consideration. Annual forage production in California cannot be reliably predicted until February, by which time it is generally too late for a livestock operator to reduce herd size; livestock decisions for the following spring are typically made in the fall of the previous year. This is an inescapable fact of range management in California.

A solution to the difficulty lies in evaluating stocking rates for the coming grazing season based on residual dry matter (RDM) remaining from the previous grazing season (Bartolome et al. 2006). Based on many years of research in California rangelands, RDM at levels appropriate for a site has been shown to protect soil from the erosive force of rain and wind and to limit nutrient losses from the soil; in areas, such as Travis AFB, with more than 15 inches of annual rainfall, appropriate RDM levels can also maximize rangeland biomass production and can influence plant species composition in some instances (Bartolome et al. 2006).

When RDM in the fall meets the minimum targets, then the stocking rate suggested by the grazing capacity estimate is appropriate for the following year's grazing season. If RDM has fallen below the minimum targets, as can happen, for example, in a drought year because of the difficulty of predicting forage production before the start of the grazing season, the stocking rate for the following year's grazing season should be reduced. The reduced stocking rate is likely to ensure that RDM minimum targets are achieved for that grazing season. In other words, livestock use to below RDM minimums may occasionally occur but only within a single season, which is unlikely to result in long-term damage to the range resource. Of course, in extreme drought years when forage production fails, the grazing season may have to be curtailed (see Section 7). Stocking rate decisions are generally considered the most important of all grazing management decisions (Holechek et al. 2011) and should therefore be supervised by an experienced range manager.

6.1 Methods used for determining grazing capacity

Production of available forage to support livestock varies based on an array of interacting environmental factors including weather, substrate, accessibility, and vegetation composition. Production plot clipping is a vegetation sampling technique used for making direct estimates of forage production and RDM for a particular site. While plot clipping is likely to provide the most accurate production estimates for a given area, it requires clipping multiple plots over multiple years to capture sufficient variation in production. To estimate grazing capacity on the grazing pastures at Travis AFB, I initially used the Scorecard method, developed by University of California rangeland scientists (McDougald et al. 1991; Standiford et al. 1999).

Two other commonly used indirect methods of estimating forage production are the Range site method and the Ecological site method. Both methods rely on vegetation production

estimates for different soil series under two to three rainfall scenarios (average, below average, and above average) developed by the USDA Natural Resources Conservation Service (NRCS) and its predecessor, the USDA Soil Conservation Service (SCS). Unfortunately, rangeland production estimates for the soil series in Travis' pastures are not available from the NRCS Web Soil Survey (accessed June 2016) or from the SCS' *Soil Survey of Solano County* (Bates 1977).

A management plan for the nearby Jepson Prairie Preserve (Witham 2009, 35) includes a formula[3] for coarse rangeland production estimates for Solano County soil series based on the *Soil Survey of Solano County*'s Animal Unit Month[4] (AUM) per acre values for dryfarmed pasture that has been ploughed or disked, drill-seeded with legumes and palatable annual grass or perennial grass, and fertilized (Bates 1977, 58-59, 63). The resulting AUM per acre estimates are much higher than the estimates presented below, especially if the Jepson estimates are assumed to include an RDM allowance. See further discussion below.

The Scorecard method is an alternative that estimates grazing capacity values based on a combination of average annual precipitation, slope, and woody cover (McDougald et al. 1991). Although it does not use soil series to estimate forage values, the Scorecard method produces reasonably accurate forage estimates in lieu of clipping production plots over several years (see Section 9.2 for recommendations about production plots at Travis).

For areas like Travis with average annual rainfall between 10 and 40 inches, McDougald et al. (1991) provides AUM values for four classes of canopy cover and four slope classes. All the Travis pastures fall within a single category: canopy cover between 0-25% and slope less than 10%. The estimated grazing capacity value for this category is two AUMs per acre. Incorporating McDougald et al. (1991)'s RDM allowance for that category of 400 lbs per acre results in a vegetation production estimate of 2,400 lbs per acre for all the Travis pastures.

From this production estimate, an RDM allowance and a summer RDM loss estimate were then subtracted to determine forage available for livestock. The University of California Agriculture and Natural Resources (UC ANR) recommended minimum RDM target was subtracted for the slope class of the pastures (all pastures <10% so 500 lbs per acre; Bartolome et al. 2006).

Decomposition of RDM in California over the summer months prior to sampling of RDM in early October has been estimated to average about 7% per month (Frost et al. 2005; Bartolome et al. 2006). At Travis, cattle are removed by June 30 so three months' (July through September) RDM decomposition has to be accounted for. The Travis horse pastures are grazed year-round, which may affect RDM decomposition rates, but how and to what extent are not known; the Travis Natural Resources Manager should adjust for this unknown as data from RDM sampling of the horse pastures accumulate.

[3] Based on unpublished data, Witham (2009, 35) estimates that rangeland is about 80% as productive as dryfarmed pasture in a normal rainfall year.

[4] An Animal Unit Month (AUM) is the standard unit used for grazing capacity and stocking rate. Please see Appendix A for further explanation.

For each pasture, the available forage estimate was then multiplied by the pasture's acreage to determine total available forage in that pasture. Finally, total available forage for each pasture was converted into AUMs for each pasture (Table 6-1). Note that AUMs were not calculated for the horse turnouts (Pastures 5, 11-13) as they are considered sacrifice areas without RDM targets. Please see Appendix A for complete details on the calculations.

Table 6-1: Estimated grazing capacity in Animal Unit Months (AUM) for Travis Pastures 1-4 and 6-10 based on Scorecard method (McDougald et al. 1991; Standiford et al. 1999).

TAFB Pasture	Size (acres)	Livestock type	RDM target (lbs/acre)	Summer RDM losses (lbs/acre)	AUMs	AUM per acre
Pasture 1	178	cattle	500	120	316.8	1.8
Pasture 2	81	cattle	500	120	144.2	1.8
Pasture 3	15	cattle	500	120	26.7	1.8
Pasture 4	2	cattle	500	120	3.6	1.8
Total AUMs for cattle pastures					**491**	
Pasture 6	16	horse	500	120	28.5	1.8
Pasture 7	13	horse	500	120	23.1	1.8
Pasture 8	19	horse	500	120	33.8	1.8
Pasture 9	15	horse	500	120	26.7	1.8
Pasture 10	11	horse	500	120	19.6	1.8
Total AUMs for horse pastures					**132**	

The 2000 report by the Range Management Assistance Team (RMAT 2000) provides "allowable annual AUM stocking limits" (Table 6-2) that are significantly lower than the AUMs determined using the Scorecard method (Table 6-1); the RMAT report states that these AUM stocking limits come from a 1989 grazing plan but provides no information about the way in which the values were calculated, other than to note that Travis was using an RDM target of 400 lbs per acre at the time. Although the current pastures do not appear to correspond closely with the grazing management units (GMU) of the RMAT report, the report's AUM per acre values (overall average of 1.1 AUM per acre) are approximately half the Scorecard-derived pasture values, with the exception of GMU 9 (Tables 6-1 and 6-2).

Additional information useful for determining an accurate grazing capacity for the Travis pastures came from cattle lessee Bill Traylor, who stated that, in a normal year, he can stock 50 cow-calf pairs on Pastures 1 and 2 from approximately November 15 to July 1, a 7.5 month grazing season (Pers. comm., August 2016). This is equivalent to 375 AUMs or just over 1.4 AUM per acre, higher than the 1989 grazing capacity AUM per acre values but lower than the Scorecard-derived AUM per acre estimates. Traylor went on to note that there is often adequate forage for the cow herd to continue grazing into the fall, which suggests that, in a normal to good rainfall year, significant amounts of forage may be left unconsumed at the end of the grazing period in the summer. Table 6-3 provides the estimated grazing capacity based on this recent actual use.

Table 6-2: Grazing capacity in Animal Unit Months (AUM) for Travis Grazing management units (GMU) 1-10 from the 2000 Range Management Assistance Team report (RMAT 2000).

TAFB Grazing management unit	Size (acres)	Livestock type	AUMs	AUM per acre
GMU 1	88.7	cattle	100	1.1
GMU 2	82	cattle	100	1.2
GMU 3	61.5	cattle	55	0.9
GMU 4	192.8	cattle	190	1.0
GMU 5	13.2	horse	15	1.1
GMU 6	36.6	horse	35	1.0
GMU 7	16.2	horse	15	0.9
GMU 8	7.8	horse	6	0.8
GMU 9	1.4	horse	3	2.1
GMU 10	71.6	horse	90	1.3

AUM per acre estimates for Solano County soils made using the formula[3] in the Jepson Prairie Preserve management plan (Witham 2009) are considerably higher than estimates from the Scorecard method, the RMAT report, or recent actual use. Table 6-4 lists the Jepson AUM per acre estimates for the soil types that occur in Travis' grazed areas. Given the uncertainty about accurate production values for Travis rangeland, the Jepson estimates seem too high to act on, at least until some Travis-specific production data have been collected.

Because of the differences between the Scorecard method, the RMAT report, and the recent actual AUMs grazed, a prudent course of action would be to set an initial stocking rate based on the recent actual use, namely, using an average of 1.4 AUM per acre as the starting point for the first year following implementation of this grazing management plan (Table 6-3). Again, please see Appendix A for complete details on the calculations.

Because this course of action is based on conflicting production data, I recommend monthly visual inspections of the pastures during the grazing season in the first year this plan is implemented, preferably with the lessee in attendance to discuss forage quantity and prospects for the rest of the season. These visual inspections should broadly assess whether forage is adequate for allowed AUMs. Livestock distribution throughout the pastures should also be informally evaluated to determine whether some areas are undergrazed, which could account for some of the disparity in estimated AUM values. If undergrazed areas are evident, livestock attractants such as mineral supplements or additional water could be located in these areas to even out distribution (George et al. 2007).

Table 6-3: Estimated grazing capacity in Animal Unit Months (AUM) for Travis Pastures 1-4 and 6-10 based on recent actual use value of 1.4 AUM per acre in Pastures 1 and 2.

TAFB Pasture	Size (acres)	Livestock type	RDM target (lbs/acre)	Summer RDM losses (lbs/acre)	AUMs	AUM per acre
Pasture 1	178	cattle	500	120	245.6	1.4
Pasture 2	81	cattle	500	120	111.8	1.4
Pasture 3	15	cattle	500	120	20.7	1.4
Pasture 4	2	cattle	500	120	2.8	1.4
Total AUMs for cattle pastures					**381**	
Pasture 6	16	horse	500	120	22.1	1.4
Pasture 7	13	horse	500	120	17.9	1.4
Pasture 8	19	horse	500	120	26.2	1.4
Pasture 9	15	horse	500	120	20.7	1.4
Pasture 10	11	horse	500	120	15.2	1.4
Total AUMs for horse pastures					**102**	

Table 6-4: Animal Unit Month (AUM) per acre estimates for soil series occurring in Travis AFB grazing pastures (Bates 1977; NRCS 2016), based on Witham's formula (2009, 35).

Soil series	Acres	AUM per acre
Altamont-San Ysidro-San Benito complex, 2-9% slopes	155	3.2
Antioch-San Ysidro complex, 0-2 % slopes	100	2.4
Antioch-San Ysidro complex, thick surface, 0-2 % slopes	82	2.8
San Ysidro sandy loam, 0-2 % slopes	11	2.4
Omni clay loam	9	1.2
Clear Lake clay, 0-2 % slopes	3	no data

If available forage does appear to be greater than 1.4 AUM per acre in a normal rainfall year, the Natural Resources Manager could consider increasing stocking rates towards the Scorecard method AUM per acre values. If this decision is taken, I recommend exercising caution. Lessee should be informed that stocking rates are provisional, and that flexibility with animal numbers may be necessary. For the first year using Scorecard values, I again recommend monthly visual inspections of the pastures during the grazing season, preferably with the lessee in attendance to discuss forage quantity and prospects for the rest of the season. Thereafter, if the AUM values appear reasonable and the fall RDM targets are typically achieved, stocking rates for the following season can continue to be set using the Scorecard AUM values.

Because of the uncertainty surrounding the accuracy of the vegetation production values, I recommend that annual direct measurement of production at Travis begin as soon as possible. The Range Management Assistance Team also recommended Travis measure production in their

2000 report (RMAT 2000, 9). Section 9.2 and Appendix C describe the recommended method to determine site-specific production values.

Regardless of which set of AUM values appears to be the most accurate, below- or above-average rainfall years will require forage evaluation at least once during the grazing season (e.g., in February; see recommendation 8.5), until adequate understanding of the full variation in Travis' forage production is developed, either by experience or by monitoring production plots over multiple years (see Section 9.2). Once production values for normal, below-, and above-average rainfall years are known for Travis' pastures, they should be incorporated into a revised grazing management plan and revised grazing land use regulations and used to inform subsequent stocking rate decisions.

7.0 Contingencies for low forage years

As described in Section 6, a key to controlling over-stocking is to build in an RDM-based rolling stocking rate that allows for variations due to weather-induced differences but prevents successive years of over-use. In extreme drought years, however, when forage production fails, the Natural Resources Manager may decide that the grazing season has to be curtailed to protect Travis' rangeland resources; provision should be made for the emergency cessation of grazing in Base grazing leases.

With the advent of climate change, extreme drought years and multiyear droughts may become more frequent in California (Polley et al. 2013; Chaplin-Kramer and George 2013), which will significantly affect livestock grazing management. Deliberately planning for such events in cooperation with the grazing lessee is highly recommended. Drought contingencies that grazing operators may implement include moving livestock to other pastures, reducing overall herd size, early weaning, and supplemental feeding (McDougald et al. 2001).

8.0 Grazing management recommendations

8.1 The Travis AFB grazing lease agreement should include specific stocking rate recommendations that allow for adjustments based on residual dry matter (RDM) and other evaluations, monthly reporting requirements, RDM targets, animal management specifications, and contingencies for low forage years. For the most part, such details are already clearly laid out in the 2016 Travis grazing land use regulations (GLUR; see Appendix E).

8.2 For the initial grazing season following implementation of this grazing management plan, I recommend that Travis AFB establish the stocking rate at 381 AUMs for the cattle pastures (Pastures 1-4) and 102 AUMs for the horse pastures (Pastures 6-10). See Table 6-3 for pasture-specific AUMs. The potential cattle grazing season extends from November 1 through June 30, with use of specific pastures at the discretion of the lessee. The horse grazing season is year-round. During the initial year, I recommend that the Travis Natural Resources Manager make

monthly visual inspections of the pastures, preferably with the lessee in attendance to discuss forage quantity and prospects for the rest of the season; these visual inspections should broadly assess whether forage is adequate for allowed AUMs

8.3 Owing to the limited site-specific forage production data available for Travis' grazing pastures, I recommend that Travis AFB consider collecting annual production data for the pastures over several years (see Section 9.2 and Appendix C). Such data should prove useful in setting appropriate stocking rates at Travis.

8.4 I recommend that Travis AFB map RDM in each pasture every fall, prior to the onset of germinating rains (generally undertaken in early October; see Section 9.2 and Appendix C). If RDM minimum targets are not achieved for that season over a significant area of the pasture, the stocking rate for the following year should be adjusted and the season shortened for those pastures that did not meet RDM targets. Minimum RDM targets for Travis cattle and horse pastures are currently defined as 500 lbs per acre. Horse turnouts (Pastures 5 and 11-13) are considered sacrifice areas without RDM targets.

8.5 In years when rainfall is running significantly below average, I recommend that Travis AFB re-evaluate forage production projections, animal numbers, and levels of utilization in mid-February. Following the February evaluation, modification of livestock use may be necessary. The lessee should be informed and participate in fall RDM evaluations and in any February evaluations.

8.6 I recommend that Travis AFB require the lessee to provide monthly AUM and animal number reports and then confirm these reports with occasional compliance monitoring (see Section 9.0).

8.7 No grazing prescriptions for the reported special status species currently appear necessary. Grazing in mustard-dominated tricolored blackbird nesting sites should be avoided. Given the limited data underpinning the production estimates, I recommend that the Travis Natural Resources Manager evaluate forage production, livestock use, and RDM in relation to the needs of special status species.

8.8 Supplemental feeding of livestock should be restricted to mineral and limited protein supplements. Salt and mineral licks and other supplements should be placed no less than ¼ mile away from any vernal pools, riparian areas, or similar sensitive natural resources, unless there are specific management reasons for placing them nearer, as determined by the Travis Natural Resources Manager. In addition, livestock attractants should be placed to encourage more uniform distribution of livestock grazing; RDM mapping should prove useful in determining where attractants should be located (see Section 9.0).

8.9 Information on specific areas on Base that have been cultivated may prove useful in prioritizing future grassland restoration activities (see Section 4.2).

8.10 To improve livestock distribution, evaluate the potential for dividing Pasture 1 into 2 smaller pastures, using the pre-existing cross-fence near the munitions area (Bunkers B-958, etc.)

in Pasture 1 (see Section 4.3). If the cross-fence is not usable, the Travis Natural Resources Manager could consider installing a new cross-fence in that general location. In addition, a short cross-fence separating the central and southern portions of Pasture 1 at the narrow strip of Pasture 1 between the Base boundary fence and W Street could help improve livestock management. Installing cross-fencing typically involves the development of water sources for those new pastures without access to water.

8.11 I recommend that Travis AFB consider developing an early detection-rapid response program to find and eradicate incipient infestations of new invasive species or satellite populations of resident invasives. Preventing spread of barbed goatgrass from the Castle Terrace Housing area into other areas of the Base should be an initial goal.

8.12 Travis' horse facilities are operating at maximum capacity, and the Equestrian Center plans to increase stabling capacity (Travis AFB 2016, 97). As an increase in horse numbers will almost certainly result in increased use of the horse pastures or interest in additional horse pastures, I recommend that the Travis Natural Resources Manager consult with the Equestrian Center management regarding their expansion plans and how increased horse numbers might affect use of the horse pastures.

8.13 I recommend Travis implement an adaptive management process in situations when the optimal management activity to achieve a particular management goal is not obvious. The adaptive management process entails setting clear goals, implementing management activities, monitoring management and control areas, analyzing monitoring data to determine if management activities have achieved the goals, and then using the monitoring data to decide on next management steps (see Section 9.3). Effectiveness monitoring protocols, including those for analysis and reporting, should be designed to meet the needs of the adaptive management process.

Table 8.1 links these grazing management recommendations to the Travis AFB grazing program goals and objectives listed in Section 3.

Table 8-1: Recommended grazing management actions linked to Travis AFB grazing program goals and objectives from Table 3-1.

Goal	Objectives	Recommended actions
1. Protect and enhance vernal pool ecosystem functions and processes.	1.1 Graze vernal pool ecosystem to maintain or increase inundation periods within vernal pools to support vernal pool native plants and animals. 1.2 Maintain residual dry matter (RDM) at recommended levels.	8.1) detailed lease provisions; 8.2) recommended AUMs and grazing season; 8.4) RDM mapping; 8.5) drought year re-evaluations in February; 8.7) determine vegetation production and horse pasture RDM values in relation to special status species; 8.8) placement of livestock

Goal	Objectives	Recommended actions
		attractants to protect natural resources and enhance livestock distribution; 8.10) consider dividing Pasture 1 into 2 smaller pastures to enhance livestock distribution; 8.11) early detection-rapid response program to eradicate new invasive plants; 8.12) consult regarding Equestrian Center expansion plans; 8.13) use adaptive management process to improve management effectiveness.
2. Protect and provide a conservation benefit for federal and state listed species, state species of concern, and other at-risk species, including rare rangelands plants.	2.1 Implement Objectives 4.1, 4.2, 4.3, and 5.1 below. General – in grasslands, move towards a habitat mosaic to support multiple special status species (and their prey) with varying requirements (grazed, lightly/rotationally grazed, ungrazed).	8.1) detailed lease provisions; 8.2) recommended AUMs and grazing season; 8.4) RDM mapping; 8.5) drought year re-evaluations in February; 8.7) determine vegetation production and horse pasture RDM values in relation to special status species; 8.8) placement of livestock attractants to protect natural resources and enhance livestock distribution; 8.10) consider dividing Pasture 1 into 2 smaller pastures to enhance livestock distribution; 8.11) early detection-rapid response program to eradicate new invasive plants; 8.12) consult regarding Equestrian Center expansion plans; 8.13) use adaptive management process to improve management effectiveness.

Goal	Objectives	Recommended actions
3. Maintain and improve rangeland ecosystem functions and processes	3.4 Maintain residual dry matter (RDM) at recommended levels to minimize soil erosion. 3.5 Reduce cover of widespread invasive plant species.	8.1) detailed lease provisions; 8.2) recommended AUMs and grazing season; 8.3) determine site-specific vegetation production; 8.4) RDM mapping; 8.8) placement of livestock attractants to protect natural resources and enhance livestock distribution; 8.10) consider dividing Pasture 1 into 2 smaller pastures to enhance livestock distribution; 8.11) early detection-rapid response program to eradicate new invasive plants; 8.12) consult regarding Equestrian Center expansion plans; 8.13) use adaptive management process to improve management effectiveness.
4. Maintain or increase populations of native rangeland plants that contribute to floral and faunal biological diversity.	4.1 Maintain or reduce cover of widespread invasive species medusahead (*Elymus caput-medusae*). 4.2 Reduce cover of widespread invasive species yellow starthistle (*Centaurea solstitialis*). 4.3 Eliminate incipient populations of new invasive species, such as barbed goatgrass (*Aegilops triuncialis*), by implementing a rapid response protocol. 4.4 Monitor native species richness in grazed pastures.	8.1) detailed lease provisions; 8.2) recommended AUMs and grazing season; 8.3) determine site-specific vegetation production; 8.4) RDM mapping; 8.9) determine historic cultivation patterns for restoration planning; 8.11) early detection-rapid response program to eradicate new invasive plants; 8.12) consult regarding Equestrian Center expansion plans; 8.13) use adaptive management process to improve management effectiveness.

Goal	Objectives	Recommended actions
5. Manage and improve rangeland vegetation to provide high quality livestock forage on a sustainable basis to maintain benefits received from livestock grazing leases.	5.1 Eliminate known populations of barbed goatgrass within five years, an invasive species unpalatable to livestock. 5.2 Implement Objectives 4.1, 4.2.	8.1) detailed lease provisions; 8.2) recommended AUMs and grazing season; 8.3) determine site-specific vegetation production; 8.4) RDM mapping; 8.5) drought year re-evaluations in February; 8.8) placement of livestock attractants to protect natural resources and enhance livestock distribution; 8.10) consider dividing Pasture 1 into 2 smaller pastures to enhance livestock distribution; 8.11) early detection-rapid response program to eradicate new invasive plants; 8.12) consult regarding Equestrian Center expansion plans; 8.13) use adaptive management process to improve management effectiveness.
6. Meet Bird/Wildlife Aircraft Strike Hazard (BASH) requirements and implement land management measures that discourage use by wildlife.	6.1 Maintain vegetation height between 7-14 inches. 6.2 Limit forb (wildflower) abundance. 6.3 Limit patches of bare ground. 6.4 Limit edge effects. 6.5 Reduce cover of widespread invasive species yellow starthistle.	8.1) detailed lease provisions; 8.2) recommended AUMs and grazing season; 8.3) determine site-specific vegetation production; 8.4) RDM mapping; 8.5) drought year re-evaluations in February; 8.8) placement of livestock attractants to protect natural resources and enhance livestock distribution; 8.10) consider dividing Pasture 1 into 2 smaller pastures to enhance livestock distribution; 8.13) use adaptive management process to improve management effectiveness.

Goal	Objectives	Recommended actions
7. Reduce wildland fire risk and its potential effects on base facilities and natural resources.	7.1 Reduce fine herbaceous fuels through managed livestock grazing.	8.1) detailed lease provisions; 8.2) recommended AUMs and grazing season; 8.3) determine site-specific vegetation production; 8.4) RDM mapping; 8.8) placement of livestock attractants to protect natural resources and enhance livestock distribution; 8.10) consider dividing Pasture 1 into 2 smaller pastures to enhance livestock distribution.
8. Ensure no net loss in the capability of Travis grazing program lands to support the military mission of the installation.	8.1 Maintain fencing integrity to avoid livestock in sensitive military areas. 8.2 Remove livestock carcasses from pastures within 24 hours to reduce BASH risks. 8.3 Ensure ranching practices are flexible, and ranchers are available within 24 hours' notice if livestock needs to be moved for mission priorities.	8.1) detailed lease provisions.
9. Ensure compliance with applicable federal and state laws and regulations related to natural resource protection.	9.1 Conduct grazing compliance surveys monthly to verify grazing lease and grazing land use regulations are properly implemented. 9.2 Comply with Base Regulations.	8.6) monthly AUM reports from lessee and periodic compliance checks.

9.0 Monitoring and adaptive management

Grazing monitoring accomplishes two objectives: 1) compliance monitoring determines if an action complies with expectations or regulations; and 2) effectiveness monitoring determines if management actions are achieving the desired results (Bush 2006). The data from a properly designed monitoring program provide guidance both for compliance and effectiveness and are used to improve management practices (a continuous process called adaptive management). A good monitoring program efficiently produces at minimum cost the information required to accomplish stated goals. See Appendix C for detailed discussion of recommended monitoring methods.

In general, I recommend that the Natural Resources Manager discuss monitoring methods and results with the grazing lessee because the lessee's familiarity with and insights about the grazing area and the livestock operation may provide useful guidance in the implementation of effective monitoring methods and the interpretation of monitoring results and consequent feasible management actions.

9.1 Compliance monitoring, including RDM monitoring

Compliance monitoring requires information about the number of animals, timing of grazing, distribution of grazing, and the intensity of grazing:

1) Number of animals: Livestock can be counted as they are brought on to the property. The counts should be supervised by Travis range staff, and thus bringing animals on requires prior notification by the lessee. These counts can be supplemented by monthly reports from the lessee.

2) The presence of animals (timing and distribution of grazing) on a property can be documented by regular surveys by responsible range personnel. Again, this information can also be provided by monthly reports from the lessee.

3) The distribution and intensity of grazing can be adequately monitored through assessment of residual dry matter (RDM). RDM monitoring is considered the most common and important compliance monitoring method on grazed California rangelands (Bush 2006).

Guidelines for minimum RDM targets have been developed by University of California researchers that apply to most of the state's grasslands and savannahs (Bartolome et al. 2006; see Section 6 above). Traditionally, the standard method for monitoring RDM requires the establishment of several permanent monitoring locations in a grazed site. In each location, RDM is determined in early fall before the onset of germinating rain (typically late September to early October) by any of a variety of methods including (Bartolome et al. 2006; Bush 2006; Guenther and Hayes 2008):

- clipping biomass in small plots and weighing the clipped biomass;
- visual estimation of RDM in comparison to photo guides;
- the comparative yield method that combines clipping a small number of plots and visually estimating RDM based on those clipped plots; or
- the RDM mapping technique, developed and implemented in California more recently, an innovation that allows for a clearer picture of the spatial distribution of RDM.

RDM mapping is easy to learn and often requires less time to complete than the traditional permanent plot-based method, while still producing robust information. Sites with too little or too much RDM can be quickly identified, and solutions based on manipulating livestock distribution may also be more easily developed. RDM mapping requires developing RDM classes (e.g., 0-600 lbs per acre, 600-1,000 lbs per acre, etc.) and, with a paper map or GPS unit

in-hand, mapping RDM classes based on visual estimation of fairly large areas. Visual estimates are calibrated during the mapping process by clipping and weighing RDM from small, representative plots. Annual time-series of RDM class maps can then be evaluated for areas requiring management attention.

RDM mapping is the RDM monitoring technique that I recommend Travis adopt for the cattle pastures. The Range Management Assistance Team recommended Travis use this technique in their 2000 report (RMAT 2000, 9). The traditional plot-based techniques described above would also be suitable RDM monitoring methods for the cattle pastures. For the horse pastures, which have low and highly spatially variable RDM levels (pers. obs., October 2016), a more intensive, plot-based method may be necessary to provide the appropriate level of accuracy. Plot-based sampling may also be appropriate if a pasture falls below its RDM target over multiple years, or if a dispute with the lessee arises over compliance. Bartolome et al. (2006), Bush (2006), and Guenther and Hayes (2008) provide useful information on implementing an RDM monitoring program; the first two are available online. See also Appendix C.

Once the annual RDM data are collected and analyzed, I recommend that the Travis Natural Resources Manager review the RDM results with the grazing lessee and also with the point of contact for the Equestrian Center. Discussion about the year's RDM levels in relation to Travis RDM targets should inform planning for the coming grazing season for all participants.

The minimum RDM targets recommended by UC ANR researchers are general guidelines, and, as Bartolome et al. (2006) state in their publication, managers may wish to develop site-specific RDM targets for multiple reasons, such as unusual site conditions or management goals that focus on listed species' habitat requirements, weed control, or herbaceous fuel load reduction. Consequently, this plan's recommendation of a minimum RDM target of 500 lbs per acre may need to be adjusted as RDM monitoring data are collected, and as the Natural Resources Manager evaluates whether management goals are being achieved at this level of RDM.

9.2 Effectiveness monitoring for management actions

Effectiveness monitoring is usually more complex and expensive than compliance monitoring and requires longer-term data collection. Effectiveness monitoring is tied to specific grazing management goals which at Travis might include: a) protecting vernal pool habitat and maintaining desired pool inundation periods; b) enhancing habitat for wildlife species of concern, c), meeting Bird/Wildlife Aircraft Strike Hazard (BASH) standards, and d) controlling invasive species. The general approach to effectiveness monitoring is to establish permanent plot locations and measure critical response variables. Plots can be located in areas representative of vegetation types and in areas of special concern such as native plant-dominated areas, areas with grazing-affected listed species, and sites with invasive species. Establishing comparison control plots (locations in which management is not applied but which are as similar as possible to the areas under management) is necessary to evaluate the effects of management activities such as livestock grazing as compared to those changes that are driven by annual

weather or other factors. Appendix C describes in more detail monitoring methods that could be implemented at Travis.

As noted in Section 6, estimates of grazing capacity for Travis' grazing pastures are coarse because site-specific information about Travis' rangeland production is limited. I recommend that the Natural Resources Manager undertake direct measurement of production in the grazing pastures. The Range Management Assistance Team similarly suggested Travis measure production in their 2000 report (RMAT 2000, 9). In addition, determining range production values and appropriate stocking rates for some of the proposed new grazing areas (see Appendix B) may prove difficult using indirect methods because their soils have been significantly disturbed. Direct measurement of these proposed new areas may be the only way to develop accurate production estimates. This is typically accomplished by clipping biomass within a small quadrat at peak standing biomass in an ungrazed plot, then drying and weighing it (Bush 2006; Becchetti et al. 2016). Because production on California annual grasslands is highly variable, both in space and time (Bartolome et al. 2007), direct measurement should entail multiple plots located within each pasture and sampled over a series of years that encompass the range of annual rainfall amount and pattern, to the extent possible (Bush 2006). See Appendix C for further details of production plot sampling.

For monitoring of Contra Costa goldfields populations, the USFWS' most recent review recommends the following monitoring protocol developed by LSA Associates for a Solano County population assessment: "mapping parcel boundaries and measuring *L. conjugens* density within quadrats along a wide belt transect is recommended for repeatable and statistically valid estimates of *L. conjugens* cover among sites and across years" (USFWS 2013, 26). If this monitoring method is deployed in both grazed and ungrazed areas at Travis, useful information on the benefits and impacts of livestock grazing could be developed (Solomeshch et al. 2007).

9.3 Adaptive management approach

In general, an important reason for monitoring in complex and dynamic ecosystems such as Valley grassland and vernal pools is the essential role monitoring plays in adaptive management. Adaptive management of natural resources is the continuous process of developing a response dataset that is adequate for testing the effectiveness of management actions, then analyzing that dataset, and using the analysis to refine specific management goals and actions (Reever-Morghan et al. 2006). An adaptive management process can be a powerful tool for creating data-based feedback that improves management outcomes and long-term ecosystem conditions.

The crux of adaptive management is to monitor both areas under management and comparison control areas. A control area is a location in which management is not applied but which is as similar as possible to the managed area; one does, however, monitor using the same methods employed in the managed area. Control plots allow the manager to compare what happens in the managed area with what happens in the control area, which helps to differentiate between those changes caused by annual weather for example and those that are the result of management. Generally, a quasi-experimental design is desirable, with multiple management and

control plots (replication), as well as randomized location of plots and randomized assignment of treatment(s) to plots if feasible. Monitoring data must be analyzed and, importantly, the resulting analysis must be fed back into the management decision-making process.

An adaptive management process can be fairly easy to implement as, in many ways, it follows regular management protocols. An example might be the control of the invasive species yellow starthistle (YST). First, the managers must understand the extent of the YST infestation (e.g., conduct a baseline survey). Then, managers must develop YST management goals and objectives, evaluate the feasible YST treatment options, and develop a monitoring program that will cost-effectively determine whether the implemented treatment activities are achieving the management goals. Generally, incorporating input from other stakeholders (e.g., livestock lessees and other departments with responsibilities for the property) during the goal-setting process will increase the success of the process. After this planning process has finished, the selected YST treatment activities (e.g., prescription goat grazing, herbicide application, etc.) should be implemented followed by monitoring of both the treated YST areas and some YST-infested control areas that have not been treated[5] but are otherwise as similar as possible to the treated areas. Comparing monitoring data from the treatment and control areas should give managers information about whether the treatment has worked effectively (for example, if the goat-grazed areas have 10% YST cover the next year while the control areas have 60% YST cover, that suggests that the goat grazing has reduced the YST infestation). Managers should discuss the monitoring analysis and, based on how well the treatment activities have achieved management goals, decide whether to continue those treatments or try a different YST treatment method. Monitoring, analysis, and management discussion of treatment effectiveness and future activities should continue until management goals are fully achieved. In some instances, management goals may need to be altered based on monitoring information; for example, permanent eradication of YST may not be an achievable goal and so a new goal of long-term reduction to low levels of YST may need to be substituted for the original goal.

In general, effectiveness monitoring protocols, including those for analysis and reporting, should be designed to meet the needs of the adaptive management process. Monitoring reports should explicitly address the issue of whether management activities have achieved management goals and, if not, recommend changes to management activities that the monitoring analysis suggests could improve the effectiveness of the activities.

One potential adaptive management process could evaluate RDM targets at Travis. Although RDM estimates (see Sections 6 and 9.1) are typically compared to a minimum target to minimize soil erosion and optimize forage production, a <u>maximum</u> RDM target may also be important, depending on management goals. Maximum RDM targets may be necessary to meet wildlife habitat requirements (e.g., those of burrowing owl (*Athene cunicularia* ssp. *hypugaea*) and California tiger salamander), to control invasive species, or to minimize fuel loading. I know of no published maximum RDM guidelines or even research projects to develop such guidelines. Determining whether a site needs a maximum RDM target is likely to require site- and/or species-specific evaluation. Conducting modest adaptive management experiments at

[5] Note that in some circumstances, untreated areas of invasive species can serve as a source for re-infestation of treated areas. Care should be taken when siting the control plots.

Travis may provide some useful site-specific information on appropriate RDM targets, which can then feed back into management activities.

10.0 References

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Appendix A: Vegetation production estimates and Animal Unit Month calculations

A1. Calculating Animal Unit Month values for the Travis grazing pastures

As described in Section 6 of the grazing management plan, to determine grazing capacity on the 9 pastures of the current Travis grazing area, I initially employed the Scorecard method, developed by University of California rangeland scientists (McDougald et al. 1991; Standiford et al. 1999). The Scorecard method estimates grazing capacity values based on a combination of average annual precipitation, slope, and woody cover (McDougald et al. 1991).

For areas like Travis with average annual rainfall between 10 and 40 inches, McDougald et al. (1991) provides Animal Unit Month (AUM – see below for further explanation) values for four classes of canopy cover and four slope classes (Table A-1). All the Travis pastures fall within a single category: canopy cover between 0-25% and slope less than 10%. The estimated grazing capacity value for this category is two AUMs per acre (upper red circle in Table A-1), which is equivalent to 2,000 lbs per acre of available forage (see AUM explanation below). Incorporating McDougald et al. (1991)'s residual dry matter (RDM) allowance of 400 lbs per acre for that canopy cover and slope class category (lower red circle in Table A-1) results in a vegetation production estimate of 2,400 lbs per acre for all Travis pastures.

Table A-1: Scorecard AUM values from McDougald et al. (1991).

Central Coast and Central Valley Foothills Zone (10" to 40" precipitation)

	Slope Classes (percent)			
Canopy Cover (percent)	< 10%	10%-25%	25%-40%	> 40%
	AUM/acre			
0% to 25%	2.0	0.8	0.5	0.3
25% to 50%	1.5	0.6	0.4	0.2
50% to 75%	1.0	0.4	0.3	0.1
75% to 100%	0.5	0.2	0.2	0.1
	RDM lb/acre			
	400	600	800	800

From this production estimate of 2,400 lbs per acre, an RDM allowance and a summer RDM loss estimate were then subtracted to determine forage available for livestock. Guidelines for minimum RDM targets have been developed by University of California researchers that apply to much of the state's grasslands and savannahs and are widely accepted and implemented throughout the state (Bartolome et al. 2006). RDM levels are measured in early fall before the onset of germinating rain (typically late September to early October). Table A-2 provides the RDM minimum targets by percent slope for open grasslands such as those found at Travis.

The lease currently in force for the Travis cattle pastures contains two conflicting RDM minimum targets (DAF 2003-2012; Appendix D). The 2003 lease's land use regulations state that on average at least 600 lbs per acre of residual dry matter should remain at the end of the

grazing season (Appendix D, D33-D34), while Section 8.0 of the Travis AFB Integrated Natural Resources Management Plan (INRMP) from that period, which is attached to the lease as an exhibit and "imposes certain obligations on the lessee", states:

> To insure adequate maintenance of the soil organic layer, 400 pounds per acre of the annual forage production will be allowed to return to the soil as mulch. Accordingly, grazing will cease on the leased area when . . . the accessible forage has been utilized to . . . an average forage residue of 400 pounds per acre (Appendix D, D43).

The latter value was chosen by Travis staff based on University of California research from the early 1980s (RMAT 2000). In both instances, RDM is described as the biomass remaining at the *end of the grazing season*, which per the land use regulations is June 30 and per Section 8.0 of the INRMP from the period is May 1. Accounting for RDM decomposition over the summer months (see below for details), these minimum targets would leave approximately 480 and 280 lbs per acre of RDM, respectively, by early October, the period at which RDM is assessed. The 2000 report by the Range Management Assistance Team (RMAT 2000, 10) recommended an RDM minimum target of 800 lbs per acre at the end of the grazing season (May 1 at the time of the report, RMAT 2000, 12), which would leave approximately 550 lbs per acre by early October. This last value is close to the University of California Agriculture and Natural Resources (UC ANR) recommended minimum RDM target of 500 lbs per acre (Table A-2; Bartolome et al. 2006). As noted above, the UC ANR RDM guidelines are widely accepted and used throughout the state and so I used these RDM minimum targets in calculating the AUMs for Travis. Five hundred lbs per acre RDM was subtracted for the slope class of Travis' pastures (all <10%; Table A-2; Bartolome et al. 2006).

Table A-2: University of California Agriculture and Natural Resources recommended minimum RDM targets for open annual grassland (Bartolome et al. 2006).

0-10 % slope	10-20 % slope	20-40 % slope	>40 % slope
500 lbs/acre	600 lbs/acre	700 lbs/acre	800 lbs/acre

Decomposition of RDM in California over the summer months prior to sampling of RDM in early October has been estimated to average about 7% per month (Frost et al. 2005; Bartolome et al. 2006). At Travis, cattle are removed by June 30 so three months' (July through September) RDM decomposition has to be accounted for. The Travis horse pastures are grazed year-round, which may affect RDM decomposition rates, but how and to what extent are not known. For each pasture, the available forage estimate was then multiplied by the pasture's acreage to determine total available forage in that pasture. Finally, total available forage for each pasture was then converted into AUMs for each pasture (Table A-3). Note that AUMs were not calculated for the horse turnouts (Pastures 5, 11-13), as they are considered sacrifice areas without RDM targets.

As detailed in Section 6 of the grazing management plan, the 2000 report by the Range Management Assistance Team (RMAT 2000) provided AUM per acre values that are significantly lower than the AUMs calculated via the Scorecard method (Tables A-3 and A-4). Although the numbering system for the current pastures does not appear to correspond closely with that of the grazing management units (GMU) in the RMAT report, the report's AUM per

acre GMU values (overall average of 1.1 AUM per acre) are approximately half the Scorecard-derived pasture values, with the exception of GMU 9 (Tables A-3 and A-4).

Additional information useful for determining an accurate grazing capacity for the Travis pastures came from cattle lessee Bill Traylor, who stated that, in a normal year, he can stock 50 cow-calf pairs on Pastures 1 and 2 (259 acres combined) from approximately November 15 to July 1, a 7.5 month grazing season (Pers. comm., August 2016). This is equivalent to 375 AUMs or just over 1.4 AUM per acre, higher than the Range Management Assistance Team's grazing capacity AUM per acre values but lower than the Scorecard-derived AUM per acre estimates.

Because of the differences between the Scorecard method, the RMAT report, and the recent actual AUMs grazed, a prudent course of action would be to set an initial stocking rate based on the recent actual use, namely, using 1.4 AUM per acre as the starting point for the first year following implementation of this grazing management plan. As noted above, current[1] Travis cattle lease land use regulations require that on average at least 600 lbs per acre of residual dry matter should remain at the end of the grazing season (DAF 2003-2012; Appendix D, D33-D34). Assuming this RDM target has been met during the current lease period[2], that implies that there is approximately 2,000 lbs per acre[3] of vegetation production in Travis Pastures 1 and 2 (1,400 lbs per acre consumed over the course of the grazing season with 600 lbs per acre remaining at the end of the grazing season). Using this "recent actual use" production estimate and following the process described above, I then calculated AUMs for Travis Pastures 1-4 and 6-10 (Table A-5).

Animal Unit Month (AUM)

An Animal Unit Month (AUM) is the standard measurement unit used for describing grazing capacity and stocking rates (Heady and Child 1994; Bush 2006). An AUM is defined as the amount of forage required by 1 Animal Unit for 1 month. An Animal Unit is defined as 1 mature, 1,000 lbs cow, which by definition eats 1,000 lbs of California annual range forage per month. Other kinds and classes of grazing animals (including wildlife) are calculated as a percentage of an Animal Unit; for example, a horse is 1.25 of an Animal Unit. Reported Animal Unit equivalents (AUE) for different classes of cattle and for different livestock species can vary somewhat, but the following AUEs are commonly used in California (Heady and Child 1994; Bush 2006):

- 0.2 AUM: one mature sheep, grazing for one month;
- 0.6 AUM: one yearling bovine, grazing for one month; one weaned calf less than 1 year old (stocker), grazing for one month;

[1] Note that these land use regulations are part of the 2003 lease (Appendix D). Updated grazing land use regulations were drafted in 2016 and are likely to be incorporated into a new lease for 2017/2018 (see Section 2.0 of the Grazing management plan and Appendix E). RDM values in these new regulations are likely to follow UC ANR guidelines.
[2] Note that no RDM monitoring and reporting has occurred at Travis in recent years so compliance with the lease's RDM targets is unknown (Lauren Wilson, pers. comm., September 2016).
[3] More precisely, the vegetation production estimate based on recent actual use is 2,048 lbs per acre. I chose to round down to 2,000 lbs per acre, both to generate conservative estimates and because AUM calculations are rough estimates and using values that appear highly precise can be misleading.

- 1.0 AUM: one mature cow with or without unweaned calf not more than six months old, grazing for one month;
- 1.25 AUM: one mature horse, grazing for one month; and
- 1.25-1.5 AUM: one bovine bull more than 2 years old, grazing for one month.

Current cattle lease AUMs

As a historical note, the 2003 cattle lease currently in force provides for use of grazing management units (GMU) 1 and 4, with a combined area of approximately 280 acres (Table A4; DAF 2003-2012; Appendix D, D16). Using the estimates in the 2000 Range Management Assistance Team report, these 2 units provide 290 AUMs, with a 400 lbs per acre minimum RDM target[4], and AUM per acre values of 1.1 for GMU 1 and 1.0 for GMU 4 (Table A4; RMAT 2000).

Using the recent actual use value of approximately 1.4 AUM per acre and accounting for a 500 lbs per acre minimum RDM target and summer RDM decomposition loss (see calculation details above), estimated grazing capacity for grazing management units 1 and 4 totals 389 AUMs (Table A-6). Because current Pastures 1, 2, 3, and 4 are nearly equivalent to GMUs 1 and 4 (they are essentially the same location with about 4 acres removed for a new road), the recalculated estimated grazing capacity for Travis' cattle GMUs under the 2003 lease and this plan's estimated grazing capacity for the cattle pastures are very close (389 and 381 AUMs respectively; Tables A-6 and A-5).

The estimated AUMs used during the 2015/2016 grazing season in the leased area, based on lessee Bill Traylor's annual report of cattle numbers, total 326 (Appendix G). This is somewhat below estimated grazing capacity; however, Mr. Traylor stated that production was fairly poor that year (Pers. comm., February 2016).

[4] The Range Management Assistance Team recommended that Travis adopt an 800 lbs per acre minimum RDM target in their report but used AUM estimates from a 1989 grazing management plan, which appears to have used the lower RDM target (RMAT 2000, 6-11).

Table A-3: Estimated grazing capacity in Animal Unit Months (AUM) for Travis Pastures 1-4 and 6-10, based on Scorecard method (McDougald et al. 1991; Standiford et al. 1999).

TAFB Pasture	Size (acres)	Livestock type	Production (lbs/acre)	Minimum RDM (lbs/acre)	Summer RDM losses (lbs/acre)	Available forage (lbs/acre)	Total available forage (lbs)	AUMs	AUMs/acre
Pasture 1	178	cattle	2,400	500	120	1,780	316,840	316.8	1.8
Pasture 2	81	cattle	2,400	500	120	1,780	144,180	144.2	1.8
Pasture 3	15	cattle	2,400	500	120	1,780	26,700	26.7	1.8
Pasture 4	2	cattle	2,400	500	120	1,780	3,560	3.6	1.8
Pasture 6	16	horse	2,400	500	120	1,780	28,480	28.5	1.8
Pasture 7	13	horse	2,400	500	120	1,780	23,140	23.1	1.8
Pasture 8	19	horse	2,400	500	120	1,780	33,820	33.8	1.8
Pasture 9	15	horse	2,400	500	120	1,780	26,700	26.7	1.8
Pasture 10	11	horse	2,400	500	120	1,780	19,580	19.6	1.8
Totals for cattle (Pastures 1-4)	276						491,280	491	
Totals for horse (Pastures 6-10)	74						131,720	132	
Overall totals	350						623,000	623	

Table A-4: Grazing capacity in Animal Unit Months (AUM) for Travis Grazing management units (GMU) 1-10 from the 2000 Range Management Assistance Team report (RMAT 2000).

TAFB Grazing management unit	Size (acres)	Livestock type	Minimum RDM (lbs/acre)	AUMs	AUMs/acre
GMU 1	88.7	cattle	400	100	1.1
GMU 2	82	cattle	400	100	1.2
GMU 3	61.5	cattle	400	55	0.9
GMU 4	192.8	cattle	400	190	1.0
GMU 5	13.2	horse	400	15	1.1
GMU 6	36.6	horse	400	35	1.0
GMU 7	16.2	horse	400	15	0.9
GMU 8	7.8	horse	400	6	0.8
GMU 9	1.4	horse	400	3	2.1
GMU 10	71.6	horse	400	90	1.3
Average AUM/acre					1.1
Totals for cattle (GMU 1-4)	425			445	
Totals for horse (GMU 5-10)	146.8			164	
Overall totals	571.8			609	

Table A-5: Estimated grazing capacity in Animal Unit Months (AUM) for Travis Pastures 1-4 and 6-10, based on recent actual use value of 1.4 AUM per acre in Pastures 1 and 2.

TAFB Pasture	Size (acres)	Livestock type	Production (lbs/acre)	Minimum RDM (lbs/acre)	Summer RDM losses (lbs/acre)	Available forage (lbs/acre)	Total available forage (lbs)	AUMs	AUMs/acre
Pasture 1	178	cattle	2,000	500	120	1,380	245,640	245.6	1.4
Pasture 2	81	cattle	2,000	500	120	1,380	111,780	111.8	1.4
Pasture 3	15	cattle	2,000	500	120	1,380	20,700	20.7	1.4
Pasture 4	2	cattle	2,000	500	120	1,380	2,760	2.8	1.4
Pasture 6	16	horse	2,000	500	120	1,380	22,080	22.1	1.4
Pasture 7	13	horse	2,000	500	120	1,380	17,940	17.9	1.4
Pasture 8	19	horse	2,000	500	120	1,380	26,220	26.2	1.4
Pasture 9	15	horse	2,000	500	120	1,380	20,700	20.7	1.4
Pasture 10	11	horse	2,000	500	120	1,380	15,180	15.2	1.4
Totals for cattle (Pastures 1-4)	276						380,880	381	
Totals for horse (Pastures 6-10)	74						102,120	102	
Overall totals	350						483,000	483	

Table A-6: Estimated grazing capacity in Animal Unit Months (AUM) for Travis grazing management units (GMU) 1 and 4, available under the 2003 lease (DAF 2003-2012; Appendix D), based on recent actual use value of 1.4 AUM per acre.

TAFB GMU	Size (acres)	Livestock type	Production (lbs)/acre	Minimum RDM (lbs)/acre	Summer RDM losses (lbs)/acre	Available forage (lbs)/acre	Total available forage (lbs)	AUMs	AUMs/acre
GMU 1	88.7	cattle	2,000	500	120	1,380	122,406	122.4	1.4
GMU 4	192.8	cattle	2,000	500	120	1,380	266,064	266.1	1.4
Overall totals	281.5						388,470	389	

A2. References

URLs correct as of June 2016.

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Personal communication

Bill Traylor, cattle lessee, Travis AFB, February and August 2016.

Lauren Wilson, Regional Biologist, Travis Installation Support Team, September 2016.

Appendix B: Sites at Travis AFB with potential for being added to the grazing program

B1. Introduction

At least as long ago as the mid-1980s, Travis AFB natural resources staff have been interested in expanding the Travis AFB grazing program to include various ungrazed areas on the Base, both to achieve management goals such as weed control and habitat improvement and to reduce costs associated with mowing for military mission purposes such as fire hazard reduction and the Bird/Wildlife Aircraft Strike Hazard (BASH) program (Travis AFB 1983). During his evaluation of Travis grazing program in 1982, Dr. Mel George of UC Davis recommended adding several ungrazed areas to the grazing program (Travis AFB 1983). The 2000 report by the Range Management Assistance Team similarly recommended that the Travis grazing program incorporate ungrazed rangeland areas of the Base (RMAT 2000, 7, 24).

Currently, there are several areas of the Base that appear to have potential for incorporation into the Travis AFB grazing program (Table B-1 and Figure B-1):

1. the Castle Terrace housing area;
2. the closed landfill site in the northeastern corner of the Base;
3. the "three tanks" site, north of the horse pastures;
4. the Cordelia Avenue site, south of the horse pastures;
5. the South Airfield group of sites, including the disused concrete basins site and areas along Union Creek;
6. the Contra Costa goldfields site at the southwest end of the flightline.

In addition, the Aero Club site immediately north of Pasture 1 has already been approved for fence installation, and livestock grazing will likely begin in the 2017/2018 grazing season (see ManTech 2016 for further details).

Estimating grazing capacity for these proposed sites involves additional uncertainty to the already uncertain task of determining grazing capacity at Travis because several of the proposed sites have undergone extensive soil disturbance over the years. Consequently, normal vegetative production for those soil series may not occur on the highly disturbed sites. This is probably especially true for the disused concrete basins site in the South Airfield area. Also, the abundance of multiple weeds in some of the proposed areas, especially the South Airfield, is also likely to reduce grazing capacity until the weeds are controlled. As a coarse guide to grazing capacity for the proposed sites, I calculated Animal Unit Months (AUM) using the "recent actual use" method employed in the grazing management plan, with an assumption of 1.4 AUM per acre and a minimum residual dry matter (RDM) target of 500 lbs per acre (see Section 6 of the

grazing management plan and Appendix A for full details). Table B-1 provides the grazing capacity estimates for each site.

The estimated total AUMs for the proposed sites are more than twice the AUMs available in the current Travis cattle pastures (795 and 381, respectively). Even if the AUMs for the proposed sites are overestimated, they nonetheless represent a considerable potential increase in the size of the Travis grazing program.

Table B-1: Estimated grazing capacity in Animal Unit Months (AUM) for Travis AFB sites with potential for incorporation into the grazing program, based on recent actual use value of 1.4 AUM per acre and minimum residual dry matter (RDM) target of 500 lbs per acre.

Site	Estimated size (acres)	AUMs
Castle Terrace housing area	57	79
Old landfill site	75	103
"Three tanks" site	124	171
Cordelia Avenue site	39	54
South Airfield area	268	370
Contra Costa goldfields site at southwestern end of flightline	13	18
Total:	**576**	**795**

At least two of these sites were likely grazed previously as part of Travis' grazing program: the "three tanks" site and the Cordelia Avenue site (see Grazing management units map on page D40 of Appendix D; DAF 2003-2012). However, many of these sites have no livestock grazing infrastructure, especially the fences and fixed water sources generally necessary for cattle grazing (Barry et al. 2016). In addition, some of the areas include remediation sites that may require further study to confirm that they are suitable for livestock grazing (see Section B5; Travis AFB 2015).

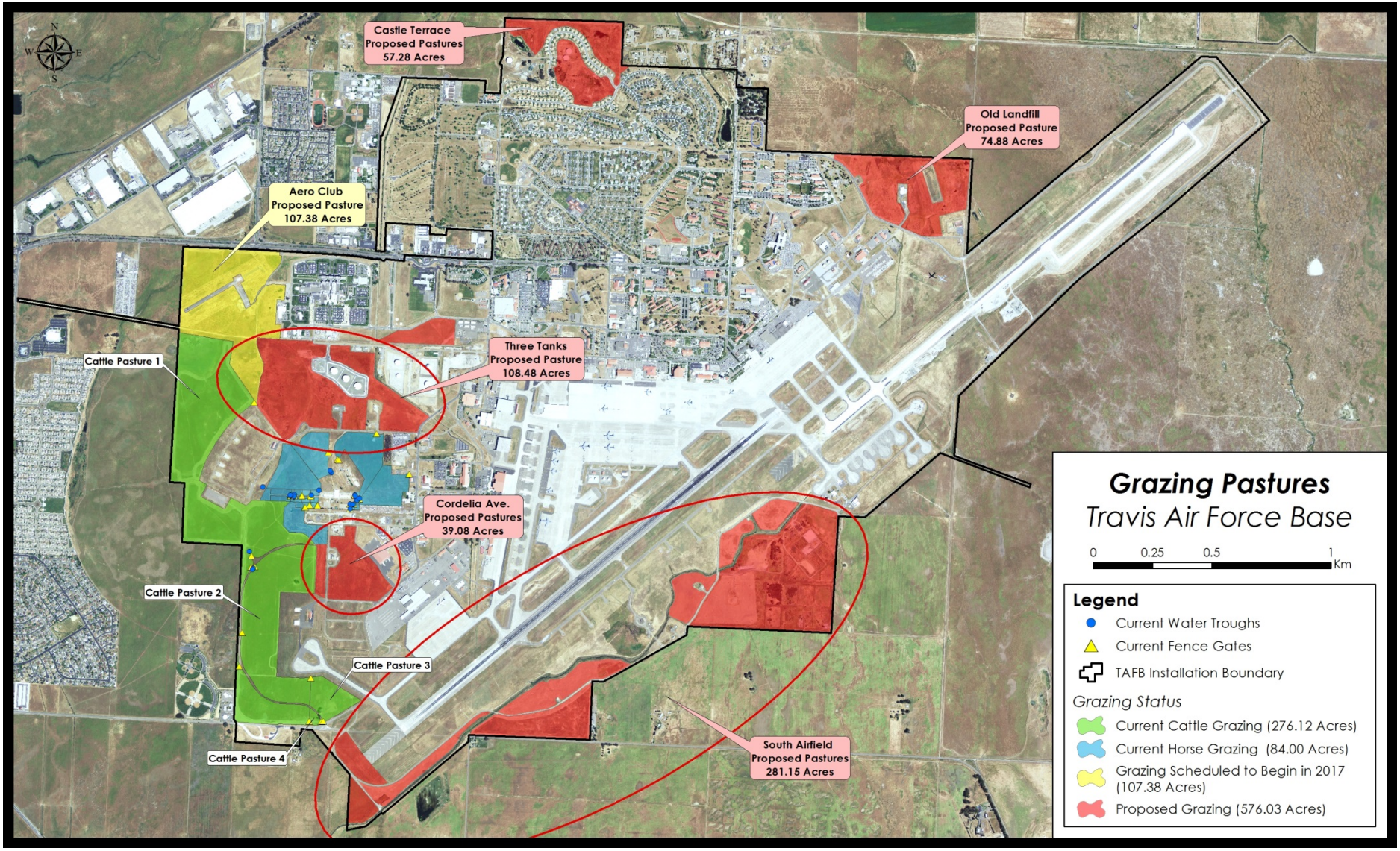

Figure B-1: Areas proposed for adding to Travis AFB grazing program; map courtesy of Morgan Ball, ManTech SRS Technologies, Inc.

B2. Grazing management goals for proposed grazing sites

All the goals from Section 3 of the grazing management plan are also appropriate for the proposed grazing sites. Several of the proposed grazing sites have specific focal goals provided by Travis AFB natural resources staff, detailed in Table B-2.

Table B-2: Travis AFB focal grazing management goals for proposed grazing sites.

Goal	Justification	Objectives
Proposed site: Castle Terrace housing area		
Maintain suitable habitat required to support federally listed California tiger salamander (CTS; *Ambystoma californiense*), vernal pool fairy shrimp (*Branchinecta lynchi*), and Contra Costa goldfields (*Lasthenia conjugens*) in the Castle Terrace Housing Wetlands and Open Space Preserve.	ESA 16 USC 1533 Section 4.(a)(B)(i) requirement to provide conservation benefit for listed species to achieve exemption from critical habitat; Support of State Wildlife Action Plan and state wildlife laws; Supports conservation value of rangelands; INRMP objectives A.3.3, A.3.4, C.1.1, C.2.1, D.3.1, D.3.2, E.1.2.	Implement properly managed livestock grazing to: -increase the number of ground squirrel burrows, important summer habitat for CTS, by maintaining vegetation height below 8 inches; -maintain/encourage CTS migration by maintaining rangeland at recommended minimum residual dry matter (RDM) targets; -increase the inundation period of vernal pools to support breeding vernal pool fairy shrimp (18-147 days, average 40) by decreasing non-native annual grass cover near vernal pools before, during, and after the wet season.

Goal	Justification	Objectives
Establish self-sustaining populations of native rangeland plants that outcompete non-native species; manage and improve rangeland vegetation to provide high quality livestock forage on a sustainable basis to maintain benefits received from livestock grazing leases.	Provides for the conservation and rehabilitation of natural resources and sustains the long-term ecological integrity of the resource base and the ecosystem services it provides; per Sikes Act (16 USC 670a Section 101 (a)(3)(A)(i)) and DoDI4715.03 (4.a.); INRMP objectives C.1.1, C.2.1, C.3.2, C.3.3, E.1.1, E.1.2, E.1.3.	Implement properly management livestock grazing to reduce cover of widespread invasive species medusahead (*Elymus caput-medusae*), yellow starthistle (*Centaurea solstitialis*), and black mustard (*Brassica nigra*) to less than 10% by 2019. Eliminate incipient populations of new invasive species, such as barbed goatgrass (*Aegilops triuncialis*).
Proposed site: Old landfill site		
Reduce current Bird/Wildlife Aircraft Strike Hazard (BASH) conditions.	INRMP objectives A.2.3, C.3.3, E.1.3.	Implement properly managed livestock grazing to: -reduce cover of yellow starthistle; -reduce vegetative perches for birds.
Enhance upland California tiger salamander habitat.	ESA 16 USC 1533 Section 4.(a)(B)(i) requirement to provide conservation benefit for listed species to achieve exemption from critical habitat; Support of State Wildlife Action Plan and state wildlife laws; Supports conservation value of rangelands; INRMP objectives A.3.3, A.3.4, C.1.1, C.2.1, D.3.1, D.3.2, E.1.2.	Implement properly managed livestock grazing to: -increase the number of ground squirrel burrows, important summer habitat for CTS; -maintain/encourage CTS migration by maintaining rangeland at recommended minimum residual dry matter (RDM) targets.

Goal	Justification	Objectives
Protect and enhance vernal pool ecosystem functions and processes.	ESA (16 USC 1531-1544) listed fauna protection (no listed flora), Clean Water Act jurisdictional water protection; INRMP objectives A.3.3, A.3.4, C.1.1, C.2.1, D.3.1, D.3.2, E.1.2.	Graze vernal pool ecosystem to maintain or increase inundation periods. Graze vernal pool ecosystem to maintain native species richness. Maintain residual dry matter (RDM) at recommended levels.
Proposed site: Union Creek sites of South Airfield area		
Reduce risk of Bird/Wildlife Aircraft Strike Hazard (BASH)	INRMP objectives A.2.3, C.3.3, E.1.3.	Implement properly management livestock grazing to: -reduce yellow starthistle to no more than 20% cover to limit use and attraction of rangelands to birds; -reduce shrub presence to limit cover for black-tailed jackrabbits (*Lepus californicus*).
Maintain current upland habitat suitability for California tiger salamander.	ESA 16 USC 1533 Section 4.(a)(B)(i) requirement to provide conservation benefit for listed species to achieve exemption from critical habitat; Support of State Wildlife Action Plan and state wildlife laws; Supports conservation value of rangelands; INRMP objectives A.3.3, A.3.4, C.1.1, C.2.1, D.3.1, D.3.2, E.1.2.	Implement properly managed livestock grazing to maintain/encourage CTS migration by maintaining rangeland at recommended minimum residual dry matter (RDM) targets.

Goal	Justification	Objectives
Proposed site: Contra Costa goldfields site at southwestern end of flightline		
Maintain Contra Costa goldfields population.	ESA 16 USC 1533 Section 4.(a)(B)(i) requirement to provide conservation benefit for listed species to achieve exemption from critical habitat; Support of State Wildlife Action Plan and state wildlife laws; Supports conservation value of rangelands; INRMP objectives A.3.3, A.3.4, C.1.1, C.2.1, D.3.1, D.3.2, E.1.2.	If feasible for this site, implement properly managed livestock grazing to increase the inundation period of vernal pools to support Contra Costa goldfield population.
Protect and enhance vernal pool ecosystem functions and processes.	ESA (16 USC 1531-1544) listed fauna protection (no listed flora), Clean Water Act jurisdictional water protection; INRMP objectives A.3.3, A.3.4, C.1.1, C.2.1, D.3.1, D.3.2, E.1.2.	Maintain residual dry matter (RDM) at recommended levels.

B3. Livestock considerations for proposed grazing sites

Deciding what species of livestock to employ in any particular area is based on considerations of the rangeland vegetation each species eats in relation to management goals and forage availability, of the site's topography, of the site's existing infrastructure, and of revenue needs. Cattle prefer to eat grass rather than forbs or shrubs; sheep eat both grass and forbs and can eat shrubs; goats eat shrubs, forbs, grass, and have a wide tolerance for plants that are toxic or too thorny/spiny for other ungulates; horses primarily eat grass and can crop vegetation very close to the ground (Larson et al. 2015). Although not a major consideration at Travis AFB with its generally flat topography, livestock species use the landscape differently, with sheep and goats generally able to use steeper terrain than cattle. Stockers (young, weaned cows) may be more willing to scale slopes than adult cows, especially those that are pregnant and/or lactating.

Sheep and goats are typically herded and fenced in with mobile, often electric, fencing so they can be spatially and temporally controlled much more easily than cattle and horses. In addition, their water needs can often be met by mobile water sources. Sheep and goat operators are likely to be concerned about predators, including domestic dogs from nearby houses. Sheep and goats typically require a herder onsite with them at all times, and herding dogs may also be a necessary component of a sheep operation. Cattle and horses as heavier animals can have an impact on soil stability and creek banks (large numbers of smaller ungulates can also cause soil erosion). Cattle, in particular, are attracted to riparian areas, which can result in undesirable impacts. Sheep can be kept away from riparian areas, and goats tend to avoid water. Bedding locations for sheep can also be a concern and generally should be moved every few days to avoid damage to range resources. Finally, cattle and sheep operators typically pay for the use of grazing land, whereas goat herd owners frequently charge land managers for employing their goats to control vegetation.

In the pastures at Travis that are currently cattle-grazed and that have suitable fencing and water infrastructure, cattle are likely to continue to be the best choice. A cattle lease generates revenue, cattle do not require constant supervision, and cattle help Travis AFB achieve several natural resource management goals: reduction in grassland fuel loads; control of non-native, naturalized annual grasses that compete with native forbs; and control of some invasive rangeland weeds such as medusahead (*Elymus caput-medusae*) and yellow starthistle (*Centaurea solstitialis*). Similarly, in Travis' vernal pool areas, cattle are likely to be the appropriate choice. Cattle grazing has been shown in several studies to increase native vernal pool plant and animal populations, in part by controlling non-native annual grasses, which reduces the competitive burden on native plants and reduces evapotranspiration of vernal pool water (Marty 2005; Marty 2015).

The horse pastures at Travis can continue to be grazed by horses for many of the above reasons that cattle are suitable. Horse grazing may provide conservation benefits similar to those provided by cattle, but there is only anecdotal evidence to support this hypothesis. Horses tend to crop vegetation shorter than cattle, which could result in undesirable impacts to soil and vegetation, but wildlife habitat values of very short vegetation can be positive depending on the wildlife species (e.g., Barry et al. 2015). There is also limited research suggesting horses may cause greater soil compaction than other livestock (Larson et al. 2015). Properly managed grazing should minimize this impact.

In contrast, for many of the sites proposed for grazing, lack of fencing and water and, in some cases, the small size of the area make sheep or possibly goats the preferable choice. The cost of fencing and water supply suitable for cattle could probably not be justified solely by the revenue generated by these small pastures, at least in the short-term; sheep operations come with their own mobile infrastructure and would likely generate revenue. Native forbs are not known to be abundant on most of these proposed sites so sheep preference for forbs should not present a problem in that regard.

For the "three tanks" site, which does contain a population of the federally endangered forb Contra Costa goldfields (*Lasthenia conjugens*), sheep could graze prior to the goldfields' flowering period, May through June (CNPS 2016), which may reduce competition with non-

native annual grasses to some degree. In light of the endangered forb population, another option could be to install infrastructure to allow cattle grazing, which is likely to benefit the population (see Section 4.5 of the grazing management plan).

The Contra Costa goldfields site at the southwest end of the flightline may not be suitable for grazing at all due to its proximity to the runway. Certainly, cattle infrastructure is unlikely to be acceptable so close to the flightline; temporary sheep fencing might be acceptable. Although the U.S. Fish and Wildlife Service noted in its most recent 5-year review of Contra Costa goldfields that a population in Marin County appears to be doing well under sheep-grazing (USFWS 2013, 10), monitoring would be essential to minimize any negative impacts of sheep grazing on the Travis populations.

Some of the invasive plant species in the Castle Terrace housing area have the potential to be controlled with livestock (Wilson 2015); sheep may be the best option here as well. The areas to be grazed are small and would likely only have livestock present for a short period. Current infrastructure is insufficient for cattle. Because of housing surrounding the Castle Terrace grazing site, care would need to be taken in protecting livestock from domestic dogs and in selecting an operator with staff who could interact positively with residents. Sheep would likely control fuel loads and invasive species well; as noted above, their impact on vernal pool forbs in the area would need to be monitored. Horses have also been proposed for the Castle Terrace area (Wilson 2015); it is not clear that infrastructure is adequate, but if it were, horses may work on this site, although they would not control yellow starthistle as it is toxic to horses. Goats may also work, although their impact on vernal pool ecosystems is unknown. Goat operators would likely charge for their services.

For the remediation areas such as the closed landfill, the possibility of allowing grazing animals that do not enter the human food chain to graze in these areas has been suggested (Lauren Wilson, pers. comm., May 2016). Horses are a potential candidate as they generally do not end up in the human food chain in the US; infrastructure at the site may not be currently suitable for horses, however. Some goat herds maintained for vegetation control may also not enter the human food chain, but this would have to be certified by the goat operator. If the landfill area is determined to be safe for livestock that enter the human food chain, sheep would probably be the initial choice because there is inadequate fencing and water infrastructure for cattle, although the area is probably large enough to serve as a small cattle pasture.

Along Union Creek, the coarse riparian vegetation could be controlled by goat grazing. Goats are commonly used to control woody and coarse vegetation on steep banks of creeks. Goat operators would likely charge for their services. The concrete basins area of the South Airfield sites was used by tricolored blackbirds in 2016 (Jaymee Marty, pers. com., September 2016) so livestock grazing in this area during the nesting season should be avoided (see Section 4.5 of the grazing management plan).

B4. Invasive plant considerations for proposed grazing sites

H.T. Harvey & Associates (2014) recently prepared a weed management plan covering the entire Travis AFB. In addition, the Solano County Resource Conservation District (RCD) has mapped five areas of the Base for weeds and, in 2015, initiated fairly small-scale control activities for four species, primarily in the Castle Terrace Housing area (Solano RCD 2016). Rangeland weeds occurring in Travis' grazing pastures are addressed in the body of the Grazing management plan. Additional rangeland weeds mapped as occurring on Base but not primarily in the grazing areas are addressed below.

In developing a weed management plan for an area that is grazed, if herbicide use is being contemplated, it is important to account for the fact that some herbicides have restrictions for use in rangelands, and treated areas may have to be excluded from grazing for weeks or even an entire season, depending on the herbicide. Although this trade-off may be well worth making in order to control a weed, the restriction on livestock use should be planned for, in consultation with the grazing lessee.

Barbed goatgrass

Barbed goatgrass (*Aegilops triuncialis*; Poaceae family) is an invasive grass that is spreading rapidly in California's rangelands. It forms monocultural stands that reduce species diversity, habitat values, and forage for livestock and wildlife (Davy et al. 2008). Like medusahead, it forms a thatch layer that is slow to decompose and can inhibit germination of other plants. Its awns can injure livestock. According to the Travis weed management plan, barbed goatgrass occurs in the Castle Terrace Housing area at moderate to high levels of cover, 5-50% (H.T. Harvey & Associates 2014). In 2015 and 2016, the Solano RCD used mowing to control the Castle Terrace goatgrass population (Solano RCD 2016).

Control of goatgrass is typically achieved with prescribed fire or with herbicides because this annual grass species is mostly unpalatable to livestock (Davy et al. 2008). Brownsey et al. (2016) describe the growth stages during which goatgrass is likely to be vulnerable to grazing but do not currently recommend grazing as a control method. A goatgrass seed is often twinned with a smaller seed that is inhibited from germinating by its larger sibling seed. This second, smaller seed tends to germinate the year after its larger twin. Consequently, several studies have recommended that multiple burns, ideally two consecutive annual burns, are needed for effective control of goatgrass because a single burn is unlikely to kill the smaller seeds remaining in the soil that then germinate the following season (DiTomaso et al. 2001, Hopkinson et al. 1999). A recent report by Marty et al. (2015), however, suggests that in years with high biomass production and therefore high fuel loading, a prescribed fire will likely burn hot enough to kill most of the seeds and achieve control for several years after the burn. Goatgrass seedheads remain on the plant later into the summer than seedheads of most other annual grassland species. Therefore, an appropriately timed burn can kill goatgrass seeds aboveground but not affect more desirable forage and/or native species seeds that have already shattered and entered the soil. Marty et al. (2015) burned in June and saw not only reduced goatgrass germination and cover for 6-7 years but also an increase in native species richness in the first year. DiTomaso et al. (2001)

note that goatgrass phenology varies "dramatically depending on seasonal climatic conditions" so burns may work best from May to July, depending on goatgrass phenology in the burn year.

Herbicide application can also successfully control goatgrass. A study in Lake County found that application of fluazifop in early May resulted in excellent control of goatgrass (Aigner and Woerly 2011). In addition, carefully timed mowing can reduce goatgrass seed production. Mowing must occur after flowering but before seeds fully develop (Aigner and Woerly 2011; DiTomaso et al. 2013; Brownsey et al. 2016). Goatgrass recovers from early mowing, and mowing late in the season can spread goatgrass seeds (DiTomaso et al. 2013). A recent University of California Agriculture and Natural Resources publication provides clear descriptions of the susceptible growth stages and the approximate timing for mowing to control goatgrass successfully; a five week period typically from May to early June affords the greatest likelihood of successful control (Brownsey et al. 2016).

Black mustard

Dense stands of black mustard (*Brassica nigra*; Brassicaceae family), which grows up to 6 feet tall, can occupy large areas and outcompete other species, including native plants. It accomplishes this both by shading out smaller-statured species and by producing allelopathic compounds that inhibit germination and growth of other species (Bell and Muller 1973; DiTomaso and Healy 2007). Black mustard also matures early and so may reduce soil water availability to other plants (Cal-IPC 2004). Furthermore, black mustard produces a large and persistent (50+ years) seedbank so multi-year treatments are necessary to reduce populations of the weed (DiTomaso and Healy 2007). According to the Travis weed management plan, black mustard occurs at 5-25% cover in the Castle Terrace Housing area, in the Aero Club, and in the flightline area, and at 25-50% cover in the South Airfield areas around Union Creek (H.T. Harvey & Associates 2014).

Control of black mustard has proven difficult to accomplish in California grasslands. Burning usually results in increased black mustard cover (DiTomaso and Healy 2007). Anecdotally, cattle reduce cover of black mustard by trampling, and sheep can completely strip mustard of all foliage (pers. obs.), though whether these are effective controls in the long-term is unknown (DiTomaso et al. 2013). Toxicity problems in livestock can occur if animals are confined to areas that contain only black mustard, or if they eat large quantities of black mustard seed (DiTomaso et al. 2013). Several herbicides can provide effective control of black mustard, although some are not approved for use in California, and many also affect other broadleaf plant species (DiTomaso et al. 2013).

DiTomaso and Healy (2007) note that annual removal of black mustard before seeds mature can eventually deplete the seedbank. This technique was employed on San Clemente Island by a group from San Diego State University (Soil Ecology and Research Group 2003). In areas without sensitive native species, their treatment included application of 2% glyphosphate solution and removal of flowers and seedheads with string trimmers; in areas with sensitive species, only the mechanical treatment was used. Sites were then planted with native seedlings. Such manual control methods are labor-intensive and likely to be expensive to implement.

It is important to note that tricolored blackbird (*Agelaius tricolor*), a special status species known to occur at Travis, nests in black mustard patches, and, therefore, control of black mustard can negatively affect this bird. Livestock grazing can eliminate tricolored blackbird breeding colonies located in mustard stands (Meese 2016).

Italian thistle

Italian thistle (*Carduus pycnocephalus*; Asteraceae family) can form monocultural stands and crowd out desirable species. As with other thistles, their spines discourage livestock grazing and wildlife and recreational use of infested areas (DiTomaso et al. 2013). According to the Travis weed management plan, Italian thistle occurs at 1-5% cover in the Castle Terrace Housing area and at 5-25% cover in the South Airfield areas around Union Creek (H.T. Harvey & Associates 2014).

Control options include manual removal of small plants and cutting or mowing large plants (DiTomaso and Healy 2007). Mowing can reduce seed production but typically must be repeated several times during the bolting period, as plants within a patch do not bolt simultaneously (DiTomaso et al. 2013). Cattle and horses typically avoid grazing on Italian thistle. Sheep will eat the rosette, and goats will eat the whole flowering plant and so can provide control. Prescribed burning in grassland may not burn hot enough to kill the root crown of Italian thistle. Many herbicides provide effective control, although several are not approved for use in California, and many also affect other plant species (DiTomaso et al. 2013).

Fennel

Fennel (*Foeniculum vulgare*; Apiaceae family) is a tall perennial that can reproduce rapidly and form monocultural stands in annual grassland and other vegetation communities in California (Bossard et al. 2000; Bell et al. 2008). According to the Travis weed management plan, fennel occurs at 5-25% cover in the flightline area and the South Airfield areas around Union Creek, and in small patches elsewhere on Base (H.T. Harvey & Associates 2014). The Solano RCD mapped about 8 acres of fennel in the “three tanks” area (Solano RCD 2016). They also mapped about 6 acres of fennel in the old landfill site and noted significant fennel infestation in the South Airfield areas around Union Creek (Solano RCD 2016).

There is limited published research on control of fennel (Bell et al. 2008). Livestock grazing in infested areas can spread fennel seed into uninfested areas and is typically an ineffective control (Bossard et al. 2000; DiTomaso et al. 2013). Bell et al. (2008) evaluated several variations of herbicidal control and concluded that for large infestations of fennel, broadcast application, rather than spot spraying, of several combinations of triclopyr and glyphosate was the most effective method (typically >90% control after 1 year), with negligible injury to the native species, purple needlegrass (*Stipa pulchra*); both herbicides affect other broadleaf plant species, however (DiTomaso et al. 2013). Fall burning with 2 years of subsequent herbicide application to new foliage during the growth period can also control large

fennel stands (DiTomaso and Healy 2007). Gwinn (2009) investigated control of small fennel infestations and found that chopping each plant close to the base and then immediately spraying it with glyphosate was almost as effective (96% control) as digging plants out and considerably less expensive than digging.

Perennial pepperweed

Perennial pepperweed (*Lepidium latifolium*; Brassicaceae family) can dominate over large areas and displace desired species (DiTomaso et al. 2013). Once established, it is difficult to control, producing abundant seed and resprouting from root fragments. According to the Travis weed management plan, perennial pepperweed occurs at 5-25% cover in the flightline area and at 25-50% cover in the South Airfield areas around Union Creek (H.T. Harvey & Associates 2014). The Solano RCD mapped the species in the Aero Club, the old landfill site, the Castle Terrace Housing area, the "three tanks" area, and the South Airfield areas around Union Creek (Solano RCD 2016).

Control options include inundation for several months (Bossard 2000). Cattle, sheep, and goat grazing may temporarily reduce populations (DiTomaso et al. 2013). Mechanical control, such as hand-pulling and mowing, is ineffective because the weed can resprout from small segments of rootstock left in the soil (Bossard 2000), although combined mowing at bolting or flower bud stages and herbicide treatment thereafter can be successful (DiTomaso et al. 2013). Prescribed burning also fails to provide adequate control (Bossard 2000). Several herbicides can effectively control perennial pepperweed, although not all are approved for use in California, and most will also affect other plant species (DiTomaso et al. 2013).

Bristly oxtongue

Another weedy member of the sunflower family, bristly oxtongue (*Helminthothec*a (*Picris*) *echioides*; Asteraceae family) can form dense stands in grasslands and crowd out other more desirable species. It occupies a 5 acre patch in the northeast corner of the Aero Club (Solano RCD 2016).

There is very little information available about control of this species (DiTomaso et al. 2013). Hand pulling and other forms of mechanical control, including mowing offer some level of control. Prescribed burning may also be effective, especially after the common annual grasses have dried but before bristly oxtongue has produced seed (DiTomaso et al. 2013). Herbicides effective on other members of the sunflower family are likely to control bristly oxtongue, especially those that are effective on yellow starthistle (DiTomaso et al. 2013).

B5. Special considerations for livestock grazing on the remediation sites

As noted above, some of the areas proposed for grazing include remediation sites that may require further study to confirm that they are suitable (Travis AFB 2015):

- The closed landfill site in the northeastern corner of the Base

The most recent report on the status of the remediation sites (Travis AFB 2015) provides the following information about this site[1]:

> LF007 is a closed municipal landfill in the northeast corner of the base that was active from the1950s to 1974. LF007E was located in the vicinity of the former Defense Property Disposal Office and had polychlorinated biphenyl contamination in surface soil that extended beyond the base boundary. Appendix B documents the cleanup of PCB-contaminated soil in Area E.
> . . . several groundwater Chemicals of Concern - COCs (benzene; 1,4-dichlorobenzene; chlorobenzene, etc.), but none of these COCs have been detected after years of monitoring under the Groundwater Sampling and Analysis Program. Therefore, the groundwater COC concentrations are below cleanup levels, and LF007B has no plume dimensions. The Travis AFB Groundwater ROD selected Alternative 2 (Monitored Natural Attenuation) to address the residual dissolved solvent contamination. The progress that MNA has made in reducing COC mass and concentrations is reported in annual Groundwater Remedial Implementation Status Reports-GRISRs.
> LF007 Area C (LF007C) is located near the northern NOU boundary in a low, swampy area and contains a solvent plume that extends beyond the base boundary . . . The Travis AFB Groundwater ROD selected Alternative 3 (Groundwater Extraction and Treatment-GET) to address the residual dissolved solvent contamination. The progress that GET has made in reducing COC mass and concentrations is reported in annual GRISRs.
> LF007 Area D (LF007D) is located east of Building 1365 and has a groundwater plume that is limited to one small area in the vicinity of MW261x07. The COCs in this plume consist of benzene, chlorobenzene, and 1,4-dichlorobenzene. The concentrations of benzene and 1,4- dichlorobenzene still exceed their cleanup levels. The Travis AFB Groundwater ROD selected Alternative 2 (Monitored Natural Attenuation) to address the residual dissolved solvent contamination. The progress that MNA has made in reducing COC mass and concentrations is reported in annual GRISRs.
> Travis AFB also does not allow unauthorized soil disturbance and relocation activities at LF007 and periodically inspects and actively monitors the CAMU to ensure that its integrity and function remain intact.
> There are no groundwater COCs at LF007B that exceed their cleanup standards, but LUCs are still in place to ensure that groundwater is not used for potable purposes.

In addition, Travis AFB staff note that the northeast and east sections of the landfill site have exposed debris that may not be suitable for grazing because of potential physical hazards (Mark Smith, email to Lauren Wilson, February 3, 2016). UC Davis livestock expert Dan Macon, who visited the Base in February 2016, was of the opinion that sheep and goats would probably not be endangered by the exposed debris in the landfill site, and that even cattle could probably graze

[1] Please see Travis AFB (2015) for complete details, further references, and a list of acronyms used in this quotation.

the site safely[2]. He recommended that young animals, i.e., lambs, kids, calves, and stockers, not be grazed on the site as they might be attracted to the debris and explore the crevices therein, endangering themselves in the process (Pers. comm., February 2016). He further recommended that vegetation and water from the landfill site be tested for toxins if the site is to be grazed.

- The disused concrete basins site and sites along Union Creek in the South Airfield area

The most recent report[1] on the status of the remediation sites (Travis AFB 2015) provides the following information about these sites:

> FT005 is in the southeastern part of Travis AFB and consists of the former Fire Training Area #4, an unoccupied 30-acre open field that was used to train fire fighters from about 1962 to 1987. From 1962 to the early 1970's, waste fuels, oils, and solvents were burned on open ground. From the early 1970's to when Fire Training Area #4 was closed, only waste fuels were burned. These activities contaminated the groundwater with chlorinated solvents, mainly 1,2-dichloroethane (DCA). The maximum 1,2-DCA concentration in the groundwater at FT005 is 5.8 parts per billion (ppb). The federal and State of California drinking water standard for 1,2-DCA is 0.5 ppb. The Travis AFB Groundwater ROD selected Alternative 3 (Groundwater Extraction and Treatment-GET) to address the residual dissolved solvent contamination. The progress that GET has made in reducing COC mass and concentrations is reported in annual GRISRs.

In addition, Travis AFB staff further note for this area:

> ERP Site FT005 should only have groundwater contamination, however, emerging contaminants from the use of AFFF (Aqueous Film Forming Foam) may be in the area (pending investigations that should start this year); closed ERP Sites OT010 and WP017, that although they don't pose any risk from chemicals, are uneven terrain, concrete ponds (used by the old sewer system) and have been used to store soils used in various 60 CEP construction projects (not managed by us). The EOD range is in this area and just to the north of the EOD range is concrete pipe storage. Another potential hazard to livestock. ERP Site SS014 is close by in the leftmost region, but doesn't pose a threat to grazing (Mark Smith, email to Lauren Wilson, February 3, 2016).

- "Three tanks" site

Travis AFB staff note of this area that:

> The area in the upper left, around the new tank farm, has some heavy metals and maybe some Polycyclic Aromatic Hydrocarbons-PAHs remaining in the surface at our ERP Site LF044 (Mark Smith, email to Lauren Wilson, February 3, 2016).

The most recent report[1] on the status of the remediation sites (Travis AFB 2015) provides the following information about this site:

[2] Current cattle lessee, Bill Traylor, also stated that he did not think that the debris piles would be a problem for cattle grazing (Lauren Wilson, pers. comm., January 2017).

Landfill X (LF044) is not a landfill; it comprises approximately 25 acres and is located within Grazing Management Unit (GMU)-2, a 126-acre parcel of land that had been used to graze horses. The soil COCs are attributed to the asphalt and other construction debris that had been stockpiled onsite.
Chemicals of Concern (COCs) detected in surface soils include benzo(a)anthracene, benzo(a)pyrene, and dibenz(a,h)anthracene. These COCs are also chemicals of ecological concern (COECs) together with benzo(k)fluoranthene, fluoranthene, and pyrene. COCs detected in subsurface soils include benzo(a)anthracene, benzo(a)pyrene, and dibenz(a,h)anthracene, benzo(k)fluoranthene. These COCs are also subsurface COECs together with anthracene, acenaphthene, benzo(b)fluoranthene, benzo(g,h,i)perylene, chrysene, fluoranthene, indeno(1,2,3-c,d)pyrene, phenanthrene, bis(2-ethlhexyl)phthalate, cadmium, lead, and silver.
Section 5.3.6 of the WABOU Soil ROD states that Alternative S2 (Land Use and Access Restrictions) is the selected remedial action for this site. The selected remedy requires the installation of a fence around the contaminated area and the training/stockpile area and the construction of a protective berm within the fenced area. The purpose of the berm is to provide environmental protection by preventing soil COCs from flowing during rain events into nearby vernal pools. The Air Force is to restrict residential development and unauthorized disturbance and relocation of soil at this site.

Possible precautionary management actions

Provided with the above information about the remediation sites, UC Davis livestock expert Dan Macon spoke with colleagues from the California Animal Health and Food Safety Laboratory (CAHFS) at UC Davis about possible concerns regarding livestock use of these sites. He reported back that his CAHFS colleagues "felt the potential risk was extremely low," and he provided the following suggestions based on his colleagues' recommendations (Pers. comm., August 2016):

1. The grazing contractor should have access to a "clean" water source and should have the ability/equipment to haul water to the livestock.

2. While forage plants do not seem to accumulate the chemicals in question, it would probably be a good idea to test the forage from areas where heavy metals were present. This should be done during the growing season.

3. In the interest of caution, they thought it would be prudent for any animal that died on the project to be sent to the CAHFS lab for a necropsy. This could be a condition of the contract, and it would probably be appropriate for it to be done at Air Force expense. A necropsy for a sheep or goat is $120/head at the moment.

4. An addition possibility would be for the Air Force to purchase 5 animals at market prices at the end of the first grazing season and for these animals to be harvested and necropsied. That said, this might be a red flag to some contractors. Personally, the idea that I'd get paid for the animals and get information back that would help me refine my

herd health program would be attractive (beyond the toxicity issues, the necropsy could show nutritional status and other herd health issues).

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Appendix C: Recommended vegetation monitoring methods

C1. Introduction

Appendix C describes the following vegetation monitoring methods that Travis AFB may wish to consider using to monitor the Travis grazing area, following management activities:

- Photo points,
- Frequency plots,
- Residual dry matter (RDM) monitoring and mapping,
- Relevé plots, and
- Line-point transects.

I refer to several publications, most available online, that provide greater detail on the implementation of these monitoring methods.

Estimating time required to complete a plot using the various methods is inexact because plots vary in complexity and personnel vary in expertise. Note that the estimated times provided do not include travel time to plot nor time spent establishing a new plot or re-locating a pre-existing plot. Based on experience with UC Berkeley Range Lab field crews, a frequency plot of the design described below takes two crew members (one person sampling the quadrats, the other recording the data) about 20 minutes to complete. RDM monitoring and mapping time depends too greatly on the topography, size, RDM variability, vehicular accessibility, etc. of an individual site to generalize with confidence, but in good conditions, an experienced crew of two can cover several hundred acres in a day. A $100m^2$ relevé plot takes one experienced field crew member, if armed with a local species list, about 30-60 minutes to complete. A 50-100 point line-point transect takes two crew members (one person reading the transect, the other recording the data) 30-60 minutes to complete.

C2. Recommended vegetation monitoring methods

Table C-1 lists the recommended vegetation monitoring methods, broadly ranked from least to most expensive, the kind of information that the method provides, and the goals that each method is best suited to meet. By matching goals with appropriate methods, a suitable monitoring methodology can be developed.

Table C-1: Recommended rangeland vegetation monitoring methods.

Sampling method	Data generated	Typical goals
Permanent photo points	Visual evidence of large changes in biomass and species composition	Independent check on plant changes indicated by quantitative data; changes in abundance for some invasive species; public presentations
Frequency plots	Presence/absence of species of interest	Broad changes in species abundance, estimates of species richness
Residual dry matter (RDM) sampling	Dry weight of above ground biomass	Monitoring distribution and intensity of grazing; compliance with minimum (and potentially maximum) RDM targets
Cover: relevé plot	Small-scale cover, including rare species; species richness, including rare species	Presence of rare plants; localized changes in species composition, richness, and relative abundance
Cover: line-point transects	Cover of dominant species especially; species richness	Changes in species composition, abundance; estimates of species richness; functional group analysis; effect of management

Photo points

Permanent (i.e., at a GPS-ed location with a fixed azimuth and a fixed field of view) photo points retaken every year can be an inexpensive but broadly effective method of monitoring for large changes in vegetation, e.g., cover of invasive plants, coyote brush invasion. They can also serve as useful indexes of annual herbaceous production and of residual dry matter (RDM).

Frequency plots

Travis AFB is likely to find frequency monitoring a time-effective method of monitoring broad changes in abundance of native or invasive species of interest, following some management action (e.g., for native species, cattle grazing to reduce competition with non-native grasses; for invasive plants, control with herbicides or goat grazing). The frequency plot method is "useful for monitoring vegetation changes over time at the same locations or for comparisons of different locations" (Despain et al. 1991) and can provide this information at relatively low cost. Despain et al. (1991, 7) define frequency as:

> the number of times a plant species is present within a given number of sample quadrats of uniform size placed repeatedly across a stand of vegetation . . . It is generally

expressed as a percentage of total placements and reflects the probability of encountering a particular species at any location within the stand.

Average frequency values can be followed from year to year and provide an index of a species' density and dispersion (Despain et al. 1991).

Although frequency plot specifics can vary based on monitoring needs, a frequency plot may, for example, comprise a 10 meter transect with 20 quadrats arranged on alternating sides of the transect. Within each quadrat, the field crew determines whether any individual of the species under consideration is rooted within the quadrat. The resulting metric is the species' frequency of occurrence in the 20 quadrats of the plot (for example, if yellow starthistle occurred in 15 of 20 quadrats along a transect, its frequency for that plot is 0.75).

Quadrat size has a significant effect on frequency values (Despain et al. 1991) and so must be carefully selected. Frequency sampling works best when a species' frequency values fall between 20% and 80% (Despain et al. 1991) so quadrat size must be selected to provide values that fall within that range. Typically, larger-sized quadrats will include sparsely distributed species but will result in almost 100% frequencies for common species, reducing one's ability to detect change in common species; smaller quadrats solve this problem but can miss sparsely distributed species (Despain et al. 1991). Because frequency varies based on species size, abundance, and distribution in the plot area, it is necessary to determine in the field which quadrat size is most suitable. A recommended technique is initially to employ nested quadrats of 5x5 cm, 10x10 cm, 25x25 cm, and 50x50 cm and then determine which quadrat size is most appropriate for the situation.

Frequency plots should be randomly located within the management and control areas, and the azimuth of the frequency transect should be randomly selected (even if the range of acceptable azimuths is constrained to keep the transect within the area of interest). I recommend permanently marking the beginning of frequency transect (either with a stake or rebar[1] or taking a sub-meter GPS reading), recording the azimuth of the transect, and taking two photographs of each frequency plot, the first from the start of the frequency transect to the end of the transect and the second in the reverse direction.

RDM monitoring and mapping

The distribution and intensity of grazing can be monitored through assessment of residual dry matter (RDM). Traditionally, the standard method for monitoring RDM requires the establishment of several permanent monitoring locations in a grazed site. In each location, RDM is determined in early fall, before the onset of germinating rain, through the use of photo guides or the comparative yield method. See Bartolome et al. 2006, Bush 2006, and Guenther and Hayes 2008 for descriptions of RDM monitoring techniques.

Within the last decade, the RDM mapping technique has been developed and implemented in California, an innovation that allows for a clearer picture of the spatial

[1] If a stake or a rebar is used, care must be taken in vernal pool areas not to damage pool claypan or other vernal pool natural resources.

distribution of RDM (Harris et al. 2002; Guenther and Hayes 2008). RDM mapping is easy to learn and often requires less time to complete than the traditional permanent plot-based method, while still producing robust information. Sites with too little or too much RDM can be quickly identified, and solutions based on manipulating animal distribution may also be more easily developed. Annual time-series of RDM maps can be assessed for areas requiring management attention. In the county adjacent to Solano County, Contra Costa Water District has successfully implemented RDM mapping at Los Vaqueros Reservoir.

RDM mapping requires developing a few, broad RDM classes (e.g., 0-500 lbs/acre, 500-1000 lbs/acre, >1000 lbs/acre etc.) based on management goals and RDM targets, and then mapping these RDM classes using visual estimation of fairly large areas (up to several hectares), with either a paper map or GPS in-hand. Visual estimations are calibrated during the mapping process by clipping and weighing RDM from small, representative plots (e.g., a 25cm x 25cm quadrat). Photographs are taken of large representative areas of RDM classes and of the calibration plots prior to clipping.

As noted in the main plan, RDM levels in the Travis horse pastures are generally fairly low and also highly spatially variable over short distances (Figure C-1; pers. obs., October 2016). Accurately describing RDM levels in these areas will likely require a more intensive, plot-based method. A transect with sampling quadrats on alternating sides, similar to the frequency plot described above, should work well. Because the horse pastures are small, two 30-meter transects with a RDM quadrat clipped every 6 meters (5 quadrats per transect) may prove sufficient, although their adequacy should be confirmed in the field. Measurement of bare ground may also be necessary. Ocular estimates of bare ground within each quadrat should be recorded, and large areas of bare ground within each horse pasture mapped.

Vegetation production plots

If direct measurement of vegetative production is necessary, sampling biomass from ungrazed plots at peak standing biomass is the usual technique. This is typically accomplished by clipping biomass within a small quadrat (e.g., 1x1 foot or 0.25x0.25 meter square-frame) at peak standing biomass (at the end of rapid spring growth) in an ungrazed plot, then oven or air drying it, weighing it, and converting the biomass weight/quadrat size to lbs/acre (Bush 2006; Becchetti et al. 2016). Because production on California annual grasslands is highly variable, both in space and time (Bartolome et al. 2007), several plots should be placed within each pasture to capture different production capabilities (generally based on soil type and topography; see Figures 4-2 and 4-3 in the main plan) and sampled over a series of years that encompasses the range of annual rainfall amount and pattern, to the extent possible (Bush 2006).



Figure C-1: Travis AFB horse Pasture 7, October 3, 2016; RDM levels are generally low and highly spatially variable over short distances.

In pastures that are grazed, exclosure plots can be difficult to protect from livestock. A reliable design for protective wire cages is the "Kosco cage", made out of four 48-inch, heavy-gauge, woven wire panels that should be cut 3 feet long at the base and 18 inches long at the top (so the cage is essentially 1 meter square at the base). The four panels are wired together to form a pyramidal shape, open at the top. The cage is then anchored to the ground via one 12-18 inch wooden stake per panel, pounded into the ground, with a nail hammered in near the top of the stake that is bent and then turned down to hook over the bottom wires of the center of each panel.

Exclosure cages typically strike cattle as perfect scratching posts and so are often knocked over in the course of a grazing season. The Kosco cage design tends not to be very appealing to scratch against because the cages flex and are angled in at the top so cattle typically leave them alone. Over many years, the UC Berkeley Range Lab has only had a few toppled over, although the cages certainly get a bit bashed up

Relevé plots

To monitor native species richness in native species-rich sites with rare plant populations, for example in vernal pools, Travis may wish to establish permanent relevé plots (e.g., a 5m x 20m rectangular plot, which gives a100-meter^2 plot). Relevé plots should be sited within a single, continuous vegetation type. The field crew visually estimates cover of all species occurring in the relevé. The relevé plot method generates data on rare species, including broad changes in abundance, is time- and labor-efficient, and is likely to provide data robust enough for adaptive management needs, although the ocular estimates of cover are not generally adequate for research. It is a technique used by the California Native Plant Society for classifying vegetation and so could allow for comparisons between Travis monitoring data and alliances described in the *Manual of California Vegetation* (Sawyer et al. 2009).

The relevé plot method provides data on a site's species richness including any uncommon species, while the line-point transect method, described below, delivers reliable cover values for the site's dominant species. The UC Berkeley Range Lab has developed a hybrid relevé/line-point transect technique, designed to collect species composition and abundance information in adequate detail at reasonable cost. The technique involves establishing: 1) a permanent 100-meter^2 relevé plot to provide data on plant diversity and capture rare plant species, and 2) four 25-meter, 50-point line-point transects radiating from the corners of the relevé plot to provide data on dominant species cover. The relevé is a 5m by 20m rectangular plot; all species within the relevé are listed with an ocular estimation of cover for each species. Along the line-point transects, field crew record the first species hit every half meter. Again, relevé plots should be sited within a single, continuous vegetation type; if including line-point transects in the plot, be sure the transects also fall within the single, continuous vegetation type. Photographs of the relevé plot and the line point transects should be taken (in both directions along each transect).

Line-point transects

Line-point transects work well to monitor changes in cover of a dominant species, including native or invasive plants in areas where they are abundant. Line-point transects would also be useful for monitoring cover of native forbs in areas that have abundant cover of multiple forb species. This method is generally more time-consuming than frequency plots but results in more precise estimates of abundance.

For monitoring purposes, a potential design could be a 25m transect with points taken every 50cm for 50 points total or a 50m transect with points taken every 50cm for 100 points total, depending on the size of the area of interest and the degree of precision desired (increasing the number of points within a given area increases precision of cover estimates). Typically, line-point transects would be sited within a single, continuous vegetation type. Transects should be randomly located within the area of interest, and the azimuth of the transect should be randomly selected (even if the range of acceptable azimuths is constrained). I recommend permanently marking the beginning of the transect (either with a stake or rebar[1] or taking a sub-meter GPS reading), recording the azimuth of the transect, and taking photographs of the line-point transects in both directions along each transect.

C3. Determining adequate sample size

A basic question that should be addressed in developing an adaptive management monitoring program is how many samples or plots are necessary to test management hypotheses (in other words, is the management activity affecting the attribute of interest in the way and to the extent that the manager wants). The answer depends on two sets of factors:
1) manager-determined factors:

a) the maximum acceptable probability of committing a Type I error (rejecting a true null hypothesis, commonly set at $\alpha = 0.05$ for scientific research but often 0.1 or larger for monitoring), and

b) the maximum acceptable probability of committing a Type II error (accepting a false null hypothesis, commonly set at $\beta = 0.2$);

and 2) underlying ecological characteristics of the population, community, or ecosystem being managed:

a) the size of the difference between means for the groups (managed, control) being compared (smaller differences require more samples), and

b) the size of the variance (larger variance requires more samples) (Crawley 2002, 131).

Power analysis uses these manager-determined factors and ecosystem characteristics to calculate the sample size necessary to test hypotheses or to calculate the power of a study given a pre-set sample size. Power is the probability that a study will correctly reject the hypothesis of no difference between groups (the null hypothesis) when the hypothesis genuinely is false

(Crawley 2002, 131). Examples of null hypotheses might be that there is no difference in native forb species richness or in cover[2] of yellow starthistle between grazed and ungrazed sites.

In determining necessary sample size, 0.8 is a commonly set level of power (power is 1 – the maximum acceptable probability of committing a Type II error; Crawley 2002, 131). Power analyses are useful because they can show whether adding a few extra monitoring plots would increase power to sufficient levels (e.g., 0.8). Conversely, power analyses can show that, given underlying ecosystem means and variation, a huge number of plots would be necessary to reach 0.8 power.

It is important to note that a power analysis requires data on system means and variance so a pilot round of management activity and monitoring is necessary before determining final sample size. In addition, interannual fluctuations in averages and level of variability mean that the results of a power analysis are guidelines only. For example, in a very dry year, species richness could fall to such low numbers in management and control groups that a 0.8 power level is not attained even with the sample sizes suggested by the power analysis, especially if the pilot data are limited, as they are likely to be.

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Appendix D: Travis cattle-grazing lease and supplemental agreements, numbers 1-6, 2003-2016

Appendix D comprises the Department of the Air Force lease for livestock grazing on Travis Air Force Base; lease no. DACA05-1-04-500, and supplemental agreements numbers 1-6, in effect from 2003-2016, and currently in force under a "holdover" arrangement (see Grazing management plan, section 2).

To aid in the use of this appendix, the table of contents below provides Appendix D page numbers for the lease, the supplemental agreements, and exhibits.

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Lease Exhibit "B" – Land use regulations D30
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SUPPLEMENTAL AGREEMENT No. 6
TO
LEASE No. DACA05-1-04-500
TRAVIS AIR FORCE BASE
Solano County, California

DACA05-1-04-500 is made and entered into by and between the Secretary of the Air Force, hereinafter designated as the Secretary, Mr. Tony R. Martin and Mr. Billy G. Traylor doing business as J/V Angus, 844 Walnut Lane Winters, California 95694, hereinafter referred to as the lessee.

WHEREAS, Mr. Tony R. Martin wishes to assign his full interests in said lease at Travis Air Force Base to Mr. Billy G. Traylor, doing business as J/V Angus; and

WHEREAS, Travis Air Force Base has a mission need for the leased area for the 2012 and 2013 grazing season; and

NOW THEREFORE IT IS HEREBY AGREED AS FOLLOWS:

1) Mr. Tony R. Martin does hereby acknowledge his full assignment of said lease to Mr. Billy G. Traylor, doing business as J/V Angus, hereinafter designated as "lessee".

2) Lessee does hereby agree to perform all of Mr. Tony R. Martin's obligations required under the terms of said lease as of the date of signature by the Real Estate Division's Contracting Officer of this Supplemental Agreement No. 6, and lessee to be solely liable for said performance, and lessee further agrees that his name and address as stated above shall be in the granting clause and Condition No. 3, NOTICES, of the lease as appropriate.

3) The Air Force and the Lessee have agreed to suspend the grazing to facilitate the construction of a Bypass Road in the grazing area of Grazing Management Unit (GMU) 4.

4) The 2012 – 2013 grazing season shall be from 1 April 2013 to 30 June 2013 (3 Months). The rental and Animal Unit Month (AUM) will be reduced to reflect the missed grazing season of June 2012 and 1 November 2012 thru 31 March 2013.

5) In accordance with Condition 11 (Rental Adjustment), Condition 2 (Consideration) is hereby modified to read "One Thousand Three Hundred Twenty Four and 00/100 Dollars ($1,324.00)".

----------NO PARTICULARS FOLLOW----------

All other provisions and conditions thereof, including any previous modifications thereto, shall remain binding and in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand by direction of the Secretary of the Air Force this 30th day of July 2012.

Reviewed as to form
and content.

By: _____
Sharon Caine
Chief, Real Estate Division
U.S. Army Engineer District
Sacramento

This Supplemental Agreement NO.6, to Lease No. DACA05-1-04-500 is hereby executed by the lessee this 17th day of July 2012.

Date: 7-17-12

By: _____
Billy G. Traylor
J/V Angus

Date: 7/17/12

By: _____
Tony R. Martin
J/V Angus

SUPPLEMENTAL AGREEMENT No. 5
TO
LEASE No. DACA05-1-04-500
TRAVIS AIR FORCE BASE
Solano County, California

DACA05-1-04-500 is made and entered into by and between the Secretary of the Air Force, hereinafter designated as the Secretary, and Tony R. Martin and Billy G. Traylor doing business as J/V Angus, a Joint venture, P.O. Box 688, Winters, California 95694, hereinafter referred to as the lessee, is modified in the following particulars:

1) The Air Force and the Lessee desire to extend said Lease on the same terms and conditions contained therein. Condition No. 1 (Term), is hereby modified so that the termination date reads "September 29, 2016".

2) In accordance with Condition 11 (Rental Adjustment), Condition 2 (Consideration) is hereby modified to read "Five Thousand Two Hundred Ninety Seven and 00/100 Dollars ($5,297.00)".

3) Exhibit "A" is hereby replaced with Exhibit "A-1" modifying the number of acres in the lease to 243.68.

All other provisions and conditions thereof, including any previous modifications thereto, shall remain binding and in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand by direction of the Secretary of the Air Force this 15th day of September 2011.

Reviewed as to form
and content.

By: Sharon Caine
Sharon Caine
Chief, Real Estate Division
U.S. Army Engineer District
Sacramento

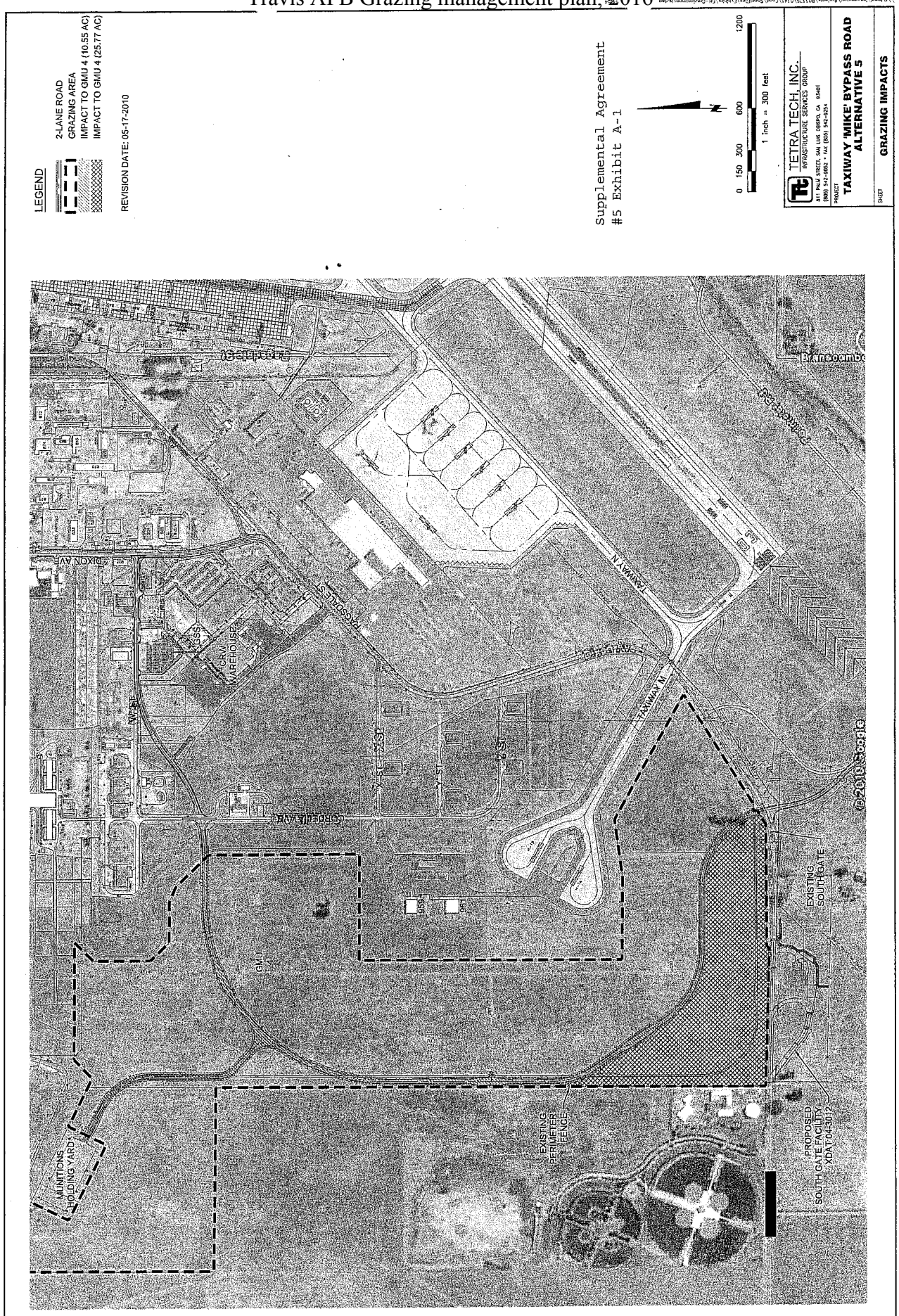
This Supplemental Agreement NO.5, to Lease No. DACA05-1-04-500 is hereby executed by the lessee this 15th day of September 2011.

Date: 09-01-11

By: T R Martin
Tony Martin
J/V Angus, a Joint Venture

Date: 09-01-11

By: Billy G Traylor
Billy G. Traylor
J/V Angus, a Joint Venture


LEGEND
2-LANE ROAD
GRAZING AREA
IMPACT TO GMU 4 (10.55 AC)
IMPACT TO GMU 4 (25.77 AC)
REVISION DATE: 05-17-2010
Supplemental Agreement
#5 Exhibit A-1
0 150 300 600 1200
1 inch = 300 feet
TETRA TECH, INC.
INFRASTRUCTURE SERVICES GROUP
811 PALM STREET, SAN LUIS OBISPO, CA 93401
(805) 542-9002 • FAX (805) 542-9254
PROJECT
TAXIWAY 'MIKE' BYPASS ROAD
ALTERNATIVE 5
SHEET
GRAZING IMPACTS
DIXON AVE
CRW WAREHOUSE
TAXIWAY N
TAXIWAY M
GMU 4
EXISTING SOUTH GATE
EXISTING PERIMETER FENCE
PROPOSED SOUTH GATE FACILITY XDAT 04-3012
MUNITIONS HOLDING YARD
©2010 Google

SUPPLEMENTAL AGREEMENT No. 4
TO
LEASE No. DACA05-1-04-500
TRAVIS AIR FORCE BASE
Solano County, California

This Supplemental Agreement No. 4, to Lease No. DACA05-1-04-500 is made and entered into by and between the Secretary of the Air Force, hereinafter designated as the Secretary, and Tony R. Martin and Billy G. Traylor doing business as J/V Angus, a Joint Venture, ~~204 Railroad Avenue~~, Winters, California 95694, hereinafter referred to as the lessee.
P.O. Box 688

The Air Force and the Lessee desire to extend said Lease on the same terms and conditions contained therein. Condition No. 1 (Term), is hereby modified so that the termination date reads "September 30, 2011".

Said lease is modified in the preceding particular only, and all other provisions and conditions thereof, including any previous modifications thereto, shall remain binding and in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand by direction of the Secretary of the Air Force this 7th day of September 2010.

Reviewed as to form and content.

By: Sharon Caine
Sharon Caine
Chief, Real Estate Division
U.S. Army Engineer District
Sacramento

SUPPLEMENTAL AGREEMENT No. 4
LEASE No. DACA05-1-04-500
TRAVIS AIR FORCE BASE, CALIFORNIA

This Supplemental Agreement No. 4 to Lease No. DACA05-1-04-500 is hereby executed by the lessee this 15 TH. **day of** SEPTEMBER **2010.**

Date: _____ **By:** Tony R Martin
Tony R. Martin
J/V Angus, a Joint Venture

Date: 09-15-10 **By:** Billy G Traylor
Billy G. Traylor
J/V Angus, a Joint Venture

SUPPLEMENTAL AGREEMENT No. 3
TO
LEASE No. DACA05-1-04-500
TRAVIS AIR FORCE BASE
SOLANO COUNTY, CALIFORNIA

THIS Supplemental Agreement No. 3, to Lease No. DACA05-1-04-500 is made and entered into by and between the Secretary of the Air Force herein after designated as the Secretary, and TONY R. MARTIN and BILLY G. TRAYLOR doing business as J/V ANGUS, a Joint Venture, 204 Railroad Avenue, Winters, California 95694, herein after designated as the Lessee.

The Air Force and the Lessee desire to extend Lease No. DACA05-1-04-500 on the same terms and conditions. Condition No. 1, term, is hereby modified so that the termination date reads "September 30, 2010".

Said lease is modified in the preceding particular only, and all other provisions and conditions thereof shall remain binding and in full force and effect.

IN WITNESS WHEREOF I have hereunto set my hand by direction of the Secretary of the Air Force this 30th day of September 2009.

Reviewed as to Form and Content

Attorney

BY: Sharon Caine
SHARON CAINE
Chief, Real Estate Division
U.S. Army Engineer District,
Sacramento

09-29-09
Bill Traylor

Supplemental Agreement No. 3
Lease DACA05-1-04-500

THIS SUPPLEMENTAL AGREEMENT NO. 3 to lease DACA05-1-04-500 is also executed by the following individuals:

DATE: 9/29/09

BY: Tony R. Martin
TONY R. MARTIN
J/V Angus, a Joint Venture

DATE: 09/29/09

BY: Billy G Traylor
BILLY G. TRAYLOR
J/V Angus, a Joint Venture

SUPPLEMENTAL AGREEMENT No. 2
TO
LEASE No. DACA05-1-04-500
TRAVIS AIR FORCE BASE
SOLANO COUNTY, CALIFORNIA

THIS Supplemental Agreement No. 2, is made and entered into by and between the Secretary of the Air Force; TONY GARICA JR., doing business as the Valley Cattle Company, Post Office Box 761, Winters, California 95694; and TONY R. MARTIN and BILLY G. TRAYLOR doing business as J/V ANGUS, a Joint Venture, 204 Railroad Avenue, Winters, California 95694,

WITNESSETH THAT:

WHEREAS, Lease No. DACA05-1-04-500 was executed between the Secretary of the Air Force and TONY GARCIA JR., lessee, hereinafter referred to as "Mr. Garcia", for a lease term of approximately five years ending 30 September 2008; and

WHEREAS, Mr. Garcia wishes to assign his full interests in said lease at Travis Air Force Base to Tony R. Martin and Billy G. Traylor, doing business as J/V Angus; and

NOW THEREFORE IT IS HEREBY AGREED AS FOLLOWS:

1. Mr. Garcia does hereby acknowledge his full assignment of said lease to Tony R. Martin and Billy G. Traylor, doing business as J/V Angus, hereinafter designated as "lessee".

2. Lessee does hereby agree to perform all of Mr. Garcia's obligations required under the terms of said lease as of the date of signature by the Real Estate Division's Contracting Officer of this Supplemental Agreement No. 2, and lessee to be held jointly and severally liable for said performance, and lessee further agrees that its name and address as first stated above shall hereby be in the granting clause and Condition No. 3, NOTICES, of the lease as appropriate.

----------NO PARTICULARS FOLLOW----------

Supplemental Agreement No. 2
Lease DACA05-1-04-500

Said lease is modified in the preceding particulars only, and all other provisions and conditions thereof shall remain binding and in full force and effect.

IN WITNESS WHEREOF I have hereunto set my hand by direction of the Secretary of the Air Force this 5 day of October, 2007.

BY: Sharon Cane
SHARON CANE
Chief, Real Estate Division
U.S. Army Engineer District, Sacramento

Reviewed as to Form and Content:
Attorney

THIS SUPPLEMENTAL AGREEMENT NO. 2 to lease DACA05-1-04-500 is also executed by the following individuals:

DATE: 9/29/07

BY: Tony Garcia
TONY GARCIA JR.
Valley Cattle Company

DATE: 9/29/07

BY: T. R. Martin
TONY R. MARTIN
J/V Angus, a Joint Venture

DATE: 09-29-07

BY: Billy G Traylor
BILLY G. TRAYLOR
J/V Angus, a Joint Venture

SUPPLEMENTAL AGREEMENT No. 1
TO
DEPARTMENT OF THE AIR FORCE
LEASE No. DACA05-1-04-500
TRAVIS AIR FORCE BASE, CALIFORNIA

By this Supplemental Agreement No. 1, made and entered into by and between the Secretary of the Air Force and Mr. Tony Garcia Jr. Post Office Box 761, Winters, California 95694-0761, hereinafter referred to as the lessee,

WITNESSETH THAT:

WHEREAS, the water trough owned by the United States had become unserviceable, and had to be replaced; and

WHEREAS, the lessee replaced the water tough with a trough of a superior quality to that of the government-owned trough when the government-owned trough was in new condition, and the trough is acceptable to the Secretary; and

WHEREAS, the Secretary is interested in maintaining a water trough on the premises for the purpose of future livestock grazing; and

WHEREAS, the lessee is willing to leave the water trough on the premises upon the termination of the lease; and

WHEREAS, there was a grassland fire on the premises which required access to the premises to put out the fire, and in the process of putting out the fire damaged a substantial portion of the fence, and the damage to the fence was beyond those repairs required of the lessee by terms of the lease; and

WHEREAS, the Air Force informed the lessee that it would not be able to repair the fence prior to the beginning of the grazing season, which would delay the lessee in placing cattle on the property.

NOW THEREFORE, it is mutually agreed that for the consideration stated herein, Lease No. DACA05-1-04-500 is modified in the following particulars:

SUPPLEMENTAL AGREEMENT No. 1
LEASE No. DACA05-1-04-500
TRAVIS AIR FORCE BASE, CALIFORNIA

1. The water trough placed by the lessee shall become the property of the United States upon execution of this Supplemental Agreement.

2. The fence repairs are satisfactory to the United States, and the lessee shall be reimbursed for his actual costs for repairing the fence.

3. Reimbursement shall be in the form of either: (a) a credit applied toward rental or other payments due under the terms and conditions of the lease; (b) a refund from previously paid cash rental for the current grazing season; or (c) a combination thereof; as determined by the District Engineer.

Said lease is modified in the preceding particulars only, and all other provisions and conditions thereof, including any previous modifications thereto, shall remain binding and in full force and effect.

----------No Conditions Follow----------

SUPPLEMENTAL AGREEMENT No. 1
LEASE No. DACA05-1-04-500
TRAVIS AIR FORCE BASE, CALIFORNIA

IN WITNESS WHEREOF, I have hereunto set my hand by authority of The Secretary of the Air Force this 27th day of April 2007.

Sharon Caine

Sharon Caine
Chief, Real Estate Division
U.S. Army Engineer District, Sacramento

This Supplemental Agreement No. 1 to Lease No. DACA05-1-04-500 is hereby executed by the lessee this 23 day of April 2007.

By: Tony Garcia Jr.

Lessee sign here
Mr. Tony Garcia Jr.,
Post Office Box 761, Winters,
California 95694-0761

DEPARTMENT OF THE AIR FORCE
LEASE
FOR LIVESTOCK GRAZING
ON
TRAVIS AIR FORCE BASE

SOLANO COUNTY, CALIFORNIA

Lease No. DACA05-1-04-500

THIS LEASE, made between the Secretary of the Air Force, hereinafter designated as Secretary, and TONY GARCIA Jr., doing business as the Valley Cattle Company, Post Office Box 761 Winters, Ca 95694, hereinafter designated as lessee.

WITNESSETH:

That the Secretary, by virtue of the authority contained in Title 10, United States Code, Section 2667, having determined that the property hereby leased is not excess property as defined by Section 3 of the Federal Property and Administrative Act of 1949, as amended (40 U.S.C. 472), is not for this time needed for public use, and the leasing thereof will be advantageous to the United States and in the public interest, hereby leases to the lessee the property hereinafter identified on Exhibit "A" as Grazing Management Unit (GMU) numbers 1 and 4, hereinafter referred to as the premises, containing approximately 280 acres, for livestock grazing purposes only; and that this lease is granted subject to the provisions of Appendix J, *Land Use Regulations*, of the Integrated Natural Resources Management Plan (INRMP) dated September 2003 identified as Exhibit "B," and Section 8 of the INRMP, identified as Exhibit C. Exhibits "A," "B" and "C" are attached hereto and made a part hereof. This lease is subject to the following terms and conditions:

1. TERM

Said premises is hereby leased for a term of approximately 5 years beginning upon execution by the representative of the Secretary of the Air Force, and ending September 30, 2008, but revocable at will by the Secretary.

2. CONSIDERATION

a. The lessee shall pay rental in advance to the United States in the amount of SIX THOUSAND ONE HUNDRED FOUR AND 100/DOLLARS ($6,104.00) per annum; payable on 1 November of each

REMIS ENTRY
BY: Salam Enoka
Date: Mar. 4, 05

lease year. Compensation shall be made payable to: FAO-USAED, SACRAMENTO and forwarded by the lessee direct to the District Engineer, U.S. Army Engineer District, Sacramento, ATTN: CESPK-RM-FC, 1325 J Street, Sacramento, California 95814-2922.

b. The lessee shall also pay to the United States on demand any sum that may have to be expended after the expiration, revocation, or termination of this lease in restoring the said premises to the condition required by the lease Condition on Restoration.

c. All rent and other payments due under the terms of this lease must be paid on or before the date they are due in order to avoid the mandatory sanctions imposed by the Debt Collection Act of 1982, (31 U.S.C. Section 3717). This statute requires the imposition of an interest charge for the late payment of debts owed to the United States; an administrative charge to cover the costs of processing and handling delinquent debts; and the assessment of an additional penalty charge on any portion of a debt that is more than 90 days past due. The provisions of the statute will be implemented as follows:

(1) The United States will impose an interest charge, the amount to be determined by law or regulation, on late payment of rent. Interest will accrue from the due date. An administrative charge to cover the cost of processing and handling each late payment will also be imposed.

(2) In addition to the charges set forth above, the United States will impose a penalty charge of six percent (6%) per annum on any payment or portion thereof more than ninety (90) days past due. The penalty shall accrue from the date of delinquency and will continue to accrue until the debt is paid in full.

(3) All payments received will be applied first to any accumulated interest, administrative, and penalty charges, and then to any unpaid rental or other payment balance. Interest will not accrue on any administrative or late payment penalty charge.

3. NOTICES

All correspondence and notices to be given pursuant to this lease shall be addressed, if to the lessee, to Mr. Tony Garcia Jr., Post Office Box 761, Winters, California 95694-0761; and if to the United States, to the District Engineer, U.S. Army Engineer District, Sacramento, ATTN: CESPK-RE-MM, 1325 J Street, Sacramento, California 95814-2922, or as may from time to time otherwise be directed by the parties. Notice shall be deemed to have been duly given if and when enclosed in a properly sealed envelope, or wrapper, addressed as aforesaid, and deposited, postage prepaid (or, if mailed by the United States, deposited under its franking privilege) in a post office regularly maintained by the United States Postal Service.

4. AUTHORIZED REPRESENTATIVES

Except as otherwise specifically provided, any reference herein to "Secretary", "District Engineer", "said officer", "Installation Commander", and "lessee" shall include their successors and duly authorized representatives.

5. SUPERVISION BY THE INSTALLATION COMMANDER

The lessee's use and occupation of the said premises shall be subject to the general supervision and approval of the Installation Commander, Travis Air Force Base, hereinafter designated as said officer, and to such rules and regulations regarding ingress, egress, safety, sanitation and security as may be prescribed by the said officer from time to time; provided, such rules and regulations do not unnecessarily interfere with the lessee's use of the said premises.

6. APPLICABLE LAWS AND REGULATIONS

The lessee shall comply with all applicable Federal, state, county and municipal laws, ordinances and regulations wherein the said premises is located.

7. CONDITION OF PREMISES

The lessee has inspected the said premises, knows its condition, and understands that the same is leased without any representation or warranties whatsoever and without obligation on the part of the United States to make any alterations, repairs or

additions thereto.

8. TRANSFERS AND ASSIGNMENTS

Without prior written approval of the District Engineer, U.S. Army Engineer District, Sacramento, hereinafter designated as District Engineer, the lessee shall neither transfer nor assign this lease, nor sublet the said premises or any part thereof, nor grant any interest, privilege or license whatsoever in connection with this lease. Failure to comply with this condition shall constitute a noncompliance for which the lease may be revoked immediately by the District Engineer.

9. COST OF UTILITIES

The lessee shall pay the cost, as determined by the said officer, of producing and/or supplying any utilities and other services furnished by the United States or through United States-owned facilities for the use of the lessee, including the lessee's proportionate share of the cost of operation and maintenance of the United States-owned facilities by which such utilities or services are produced or supplied. The United States shall be under no obligation to furnish utilities or services. Payment shall be made in the manner prescribed by the said officer.

10. PROTECTION OF PERSONAL PROPERTY

Subject to the limitations of the lease Condition on Restoration herein with respect to restoration, the lessee shall at all times exercise due diligence in the protection of all United States personal property used or occupied by the lessee under this lease against damage or destruction and shall maintain such property in good order and condition by and at the expense of the lessee. Any personal property of the United States damaged or destroyed by the lessee incident to the exercise of the privileges granted herein shall be promptly repaired or replaced by the lessee to a condition satisfactory to the District Engineer, or at the election of the District Engineer, reimbursement made therefor by the lessee in an amount necessary to restore or replace the property to a condition satisfactory to the District Engineer.

11. RENTAL ADJUSTMENT

In the event the United States revokes this lease or in any other manner materially reduces the leased area or materially affects its use by the lessee prior to the expiration date, an equitable adjustment in the rental paid or to be paid under this lease shall be made. Such adjustment of rent shall be evidenced by a written supplemental agreement, executed by the District Engineer; PROVIDED, HOWEVER, that none of the provisions of this condition shall apply in the event of revocation because of noncompliance by the lessee with any of the terms and conditions of this lease.

12. RIGHT TO ENTER

a. In addition to the rights reserved in the Land Use Regulations, the right is hereby reserved to the United States, its officers, agents, and employees, to enter upon the said premises at any time for the purpose of inspection and inventory and when otherwise deemed necessary for the protection of the interest of the United States; to perform any work necessary for flood control operations or other authorized project purposes and to flood the said premises whenever necessary. The lessee shall have no claim for damages of any character on account thereof against the United States or any officer, agent, or employee thereof.

b. The lessee hereby agrees to make no claim under flood insurance issued under any United States program for loss to any property of the lessee located on the said premises which arises from or is incident to the flooding of the said premises by the United States.

13. INDEMNITY

a. The lessee agrees to assume all risks of loss, damage to property, or personal injury or death to persons by reason of or incident attributable or incident to the use of the said premises or activities conducted under this lease. The lessee expressly waives all claims against the United States for any such loss, damage, personal injury, or death caused by or occurring as a consequence of use of the said premises by the lessee, or the conduct of activities, or the performance of responsibilities under this lease by the lessee. The lessee further agrees to indemnify and hold harmless the United States and its officers, agents, and employees, from and against all suits, claims, demands or actions, liabilities, judgements, costs and attorneys'

fees arising out of, or in any manner predicated upon, personal injury, death, or property damage resulting from, related to, caused by, or arising out of the use of the said premises by the lessee. The United States will give the lessee notice of any claim against it covered by this indemnity as soon after learning of such claim as practicable.

b. The lessee shall indemnify and hold harmless the United States from any costs, expenses, liabilities, fines, or penalties resulting from discharges, releases, emissions, spills, storage, disposal, or any other action by the lessee giving rise to United States liability, civil or criminal, or responsibility under Federal, state, or local environmental laws.

c. Subparagraphs "a" and "b" of this condition and the obligations of the lessee hereunder shall survive the expiration or termination of the lease and any conveyance of the said premises. The lessee's obligations hereunder shall apply whenever the United States incurs costs or liabilities for the lessee's actions giving rise to liability under this condition.

14. INSURANCE

a. At the commencement of this lease, the lessee shall obtain, from an approved insurance company(ies), comprehensive liability insurance. The insurance shall provide an amount not less than a combined single limit of ***FIVE HUNDRED THOUSAND AND NO/100 DOLLARS ($500,000.00)***, for any number of persons or claims arising from any one incident with respect to bodily injuries or death resulting therefrom, property damage, or both, suffered or alleged to have been suffered by any person or persons resulting from the operations under the terms of this lease.

b. The liability insurance policy shall insure against contractual liability specified in the Condition on Indemnity herein. The policy shall name the United States as an insured party. Each policy shall be reasonably satisfactory to the United States in all respects and will provide that any losses shall be payable, notwithstanding any act or failure to act, or negligence of the lessee, the United States, or any other person. The insurer will have no right of subrogation against the United States. Under no circumstances will the lessee be entitled to assign to any third party rights of action that it may have against the United States arising out of this lease.

c. The lessee shall require that its insurance company(ies) provide the District Engineer ***thirty (30) days*** written notice of any cancellation or change in such insurance. The District Engineer may require closure of any or all of the said premises

during any period for which the lessee does not have the required insurance coverage. The lessee shall require their insurance company(ies) to furnish the District Engineer a copy of the policy(ies), or if acceptable to the District Engineer, certificates of insurance

15. RESTORATION

On or before the expiration of this lease or its termination by the lessee, the lessee shall vacate the said premises, remove the property of the lessee therefrom, and restore the said premises to as good order and condition as that existing upon the date of commencement of the term of this lease, damages beyond the control of the lessee and due to fair wear and tear excepted. If, however, this lease is terminated in accordance with the Condition on Termination by the lessee hereof, or revoked, the lessee shall vacate the said premises, remove the property of the lessee therefrom, and restore the said premises to the aforesaid condition within such time as the District Engineer may designate. If the lessee shall fail or neglect to remove the property of the lessee and so restore the said premises, then, at the option of District Engineer, the property of the lessee shall either become the property of the United States without compensation therefor, or the District Engineer may cause the property to be removed and said premises so to be restored at the expense of the lessee, and no claim for damages against the United States or its officers or agents shall be created by or made on account of such removal and restoration work. The Lessee shall also pay the United States on demand any sum that may be expended by the United States after the expiration, revocation or termination of this lease in restoring the premises.

16. NON-DISCRIMINATION

The lessee shall not discriminate against any person or persons or exclude them from participation in the lessee's operations, programs or activities conducted on the said premises, because of race, color, religion, sex, age, handicap or national origin.

17. SUBJECT TO GRANTS IN REAL PROPERTY

This lease is subject to all existing and future issuances of leases, easements, licenses, and permits on the said premises. In the event that future grants for the aforesaid purposes

materially affect the lessee's use of the said premises, an equitable adjustment will be made in the rental paid or to be paid under this lease.

18. SUBJECT TO MINERAL INTERESTS

This lease is subject to all outstanding mineral interests. As to United States-owned mineral interests, it is understood that they may be included in present or future mineral leases issued by the Bureau of Land Management (BLM). The Secretary will provide lease stipulations to BLM for inclusion in said mineral leases, which stipulations are designed to protect the said premises from activities that would interfere with the lessee's operations or would be contrary to local law.

19. TERMINATION BY THE LESSEE

a. This lease may be terminated by the lessee at any time by giving at least sixty (60) days notice thereof, in writing, to the District Engineer. In the case of such termination, no refund by the United States of any rental previously paid shall be made and payment in full of all rent becoming due during the period of notice will be required. If the effective date of termination is not at least sixty (60) days prior to the annual rental due date the lessee shall be required to pay the rental for the period or term shown in the Condition on Consideration hereof. In the event the effective date of termination occurs after the start of the grazing season as specified in the Land Use Regulations, any rent due for the balance of the annual term, or the rental due for the remaining term if the lease is for less than one year, shall be due and payable on or before the date of such termination.

b. If the lessee exercises the right to terminate this lease as provided for herein, the lessee shall be ineligible to bid on the said premises until after the ending date specified in the granting clause of this lease; however, the District Engineer reserves the right to waive the ineligibility if he determines such waiver would be in the interest of the United States.

20. PROHIBITED USES

In addition to the requirements specified in the Land Use Regulations hereof, the lessee shall not:

a. construct or place any permanent or temporary structure, improvement, or advertising sign or permit such construction or placement without prior written approval of the District Engineer;

b. commit or permit any unlawful acts, activities, or nuisances upon said property;

c. cut timber;

d. conduct mining operations, or remove sand, gravel, or kindred substances from the ground; or

e. in any manner substantially change the contour of the said premises, except as may be authorized by the District Engineer.

21. CONSERVATION PAYMENTS

The lessee agrees that he will not accept any federal cost-sharing payments for soil conservation practices required by the lease which will result in a duplicate payment for such practices.

22. DISPUTES

a. Except as provided in the Contract Disputes Act of 1978 (41 U.S.C. 601-613) (the Act), all disputes arising under or relating to this lease shall be resolved under this condition and the provisions of the Act.

b. "Claim," as used in this condition, means a written demand or written assertion by the lessee seeking, as a matter of right, the payment of money in a sum certain, the adjustment of interpretation of lease terms, or other relief arising under or relating to this lease. A claim arising under this lease, unlike a claim relating to this lease, is a claim that can be resolved under a lease condition that provides for the relief sought by the lessee. However, a written demand or written assertion by the lessee seeking the payment of money exceeding $100,000 is not a claim under the Act until certified as required by subparagraph "d" of this condition. The routine request for rental payment that is not in dispute is not a claim under the Act. The request may be converted to a claim under the Act, by this condition, if it is disputed either as to liability or amount or is not acted upon in a reasonable time.

c. (1) A claim by the lessee shall be made in writing and submitted to the District Engineer for a written decision. A claim by the United States against the lessee shall be subject to a written decision by the District Engineer.

(2) For lessee claims exceeding $100,000, the lessee shall submit with the claim a certification that:

(i) the claim is made in good faith;

(ii) supporting data are accurate and complete to the best of the lessee's knowledge and belief; and

(iii) the amount requested accurately reflects the amount for which the lessee believes the United States is liable.

(3) If the lessee is an individual, the certificate shall be executed by that individual. If the lessee is not an individual, the certification shall be executed by:

(i) a senior company official in charge at the lessee's location involved; or

(ii) an officer or general partner of the lessee having overall responsibility of the conduct of the lessee's affairs.

d. For lessee claims of $100,000 or less, the District Engineer must, if requested in writing by the lessee, render a decision within 60 days of the request. For lessee certified claims over $100,000, the District Engineer must, within 60 days, decide the claim or notify the lessee of the date by which the decision will be made.

e. The District Engineer's decision shall be final unless the lessee appeals or files a suit as provided in the Act.

f. At the time a claim by the lessee is submitted to the District Engineer or a claim by the United States is presented to the lessee, the parties, by mutual consent, may agree to use alternative means of dispute resolution. When using alternate dispute resolution procedures, any claim, regardless of amount, shall be accompanied by the certification described in subparagraph "c" of this condition and executed in accordance with either subparagraph "c (3)" of this condition.

g. The United States shall pay interest on the amount found due and unpaid by the United States from (1) the date the District Engineer received the claim (properly certified if required), or (2) the date payment otherwise would be due, if that date is later, until the date of payment. Simple interest on claims shall be paid at the rate, fixed by the Secretary of the Treasury, as provided in the Act, which is applicable to the period during which the District Engineer receives the claim and then at the rate applicable for each six-month period as fixed by the Secretary of the Treasury during the pendency of the claim. Rental amounts due to the United States by the lessee will have

interest and penalties as set out in the Condition on Consideration herein.

h. The lessee shall proceed diligently with performance of the lease, pending final resolution of any request for relief, claim, appeal, or action arising under the lease, and comply with any decision of the District Engineer.

23. ENVIRONMENTAL PROTECTION

a. Within the limits of their respective legal powers, the parties to this lease shall protect the said premises against pollution of its air, ground, and water which is incident to the lessee's use and occupation of said premises. The lessee shall comply with existing and future issuances of any laws, regulations, conditions, or instructions affecting the activity hereby authorized which are issued by any Federal, state, interstate or local governmental agency having jurisdiction to abate or prevent pollution.

b. The lessee shall not discharge waste or effluent from the said premises in such a manner that the discharge will contaminate streams or other bodies of water or otherwise become a public nuisance.

c. The disposal on said premises of any materials classified by law or regulation as "toxic", "hazardous", or "restricted" is prohibited.

24. HISTORIC PRESERVATION

The lessee shall not knowingly remove or distorb, or cause or permit to be removed or disturbed, any known historical, archeological, architectural or other cultural artifacts, relics, remains, or objects of antiquity. In the event such items are discovered on the premises, the lessee shall immediately notify the said officer and protect the site and the material from further disturbance until said officer gives clearance to proceed.

25. SOIL AND WATER CONSERVATION

The lessee shall maintain, in a manner satisfactory to the District Engineer, all soil and water conservation structures that may be in existence upon the said premises at the beginning of or that may be constructed by the lessee during the term of this lease, and the lessee shall take appropriate measures to prevent or control soil erosion within the premises. Any soil erosion occurring outside the said premises resulting from the activities of the lessee shall be corrected by the lessee as

directed in writing by the District Engineer.

26. TAXES

The lessee shall pay to the proper authority all taxes, assessments, or similar charges imposed by the state or its political subdivisions upon the United States or the lessee with respect to or upon said premises. In the event any taxes, assessments, or similar charges are imposed with the consent of Congress upon said premises (as opposed to a leasehold interest of the lessee therein), this lease shall be renegotiated so as to accomplish an equitable reduction in the rental provided for in the Condition on Consideration herein.

27. COVENANT AGAINST CONTINGENT FEES

The lessee warrants that no person or selling agency has been employed or retained to solicit or secure this lease upon an agreement or understanding for a commission, percentage, brokerage or contingent fees, excepting bona fide employees or established commercial or selling agencies maintained by the lessee for the purpose of securing business. For breach or violation of this warranty, the United States shall have the right to annul this lease without liability or, in its discretion, to require the lessee to pay, in addition to the lease rental or consideration, the full amount of such commission, percentage, brokerage or contingent fee.

28. OFFICIALS NOT TO BENEFIT

No Member of or Delegate to Congress or Resident Commissioner shall be admitted to any share or part of this lease or to any benefits to arise therefrom. However, nothing herein contained shall be construed to extend to any incorporated company if this lease is for the general benefit of such corporation or company.

29. SEVERAL LESSEES

If more than one lessee is named in this lease, the obligations of said lessees herein named shall be joint and several obligations.

30. MODIFICATIONS

This lease contains the entire agreement between the parties hereto, and no modifications of this agreement, or waiver, or consent hereunder shall be valid unless the same be in writing, signed by the parties to be bound or by a duly authorized representative and this provision shall apply to this condition as well as other conditions of this lease.

31. DISCLAIMER

This lease is effective only insofar as the rights of the United States in the said premises are concerned. The lessee shall obtain any permit or license that may be required by Federal, state or local statute in connection with the use of the said premises.

32. WORK IN LIEU OF CASH RENT

As otherwise provided for in Section 9(a)(1) of Appendix J, *Land Use Regulations*, of the INRMP (Exhibit B, and Section 8.4.3 of the INRMP (Exhibit C), the lessee shall, upon request by the District Engineer, negotiate to perform items of work in lieu of payment of cash rent, which support the Air Force's agricultural leasing objectives. Examples of such work include, but are not limited to, the construction of new fencing, gates, and cattle guards; development of water supplies; control of noxious weeds; and range seeding and fertilization. The identification of such work, the cost for performance thereof, and the payment schedule therefor shall be contained in a separate negotiated written supplemental agreement between the lessee and the District Engineer prior to commencement of each project. The lessee shall be compensated in an amount not to exceed the lessee's actual cost for performance of the specified work or the amount specified in the supplemental agreement, whichever is less. Compensation allowed by the United States may be in the form of credit applied toward future rent, a cash refund from previously paid rent, or a combination thereof.

33. REVOCATION

Any breach by the lessee of any condition of this lease including the Land Use Regulations, or the falsification of reports required herein, or the failure to complete the work as specified and scheduled by supplemental agreement is sufficient grounds for revocation of this lease by the United States.

34. LIMITS OF RESPONSIBILITY

All references in this lease to the responsibilities and obligations of the lessee apply only to those activities related to the rights granted in this lease, or which are incidental to the lessee's use and occupation of the said premises, and over which the lessee would normally exercise control in exercising the rights granted in this lease.

35. ANTI-DEFICIENCY ACT NOTICE

The obligation of the United States to perform, pay or

reimburse any money under this lease is subject to the availability of appropriated funds, and nothing in this lease shall be interpreted to require obligations or payments by the United States in violation of the Anti-Deficiency Act, Public Law 97-258.

THIS LEASE is not subject to Title 10, United States Code, Section 2662, as amended.

IN WITNESS WHEREOF I have hereunto set my hand by direction of the Secretary of the Air Force this 14 day of Oct, 2004

Brian L. Miller

BRIAN L. MILLER
Colonel, USAF
Deputy Director, Installations & Mission Support

THIS LEASE is also executed by the lessee this 17 day of Dec, 2004

Larry Garcia Jr.

LAND USE REGULATIONS

GRAZING LEASE
GRAZING MANAGEMENT UNITS 1 & 4
TRAVIS AIR FORCE BASE, CALIFORNIA
2003-2008

SECTION 1 - PURPOSE

The purpose of these Land Use Regulations is to ensure that all grazing activities are conducted in a manner consistent with national policy intended to: (a) provide for the multiple-use of the said premises for military purposes, domestic livestock grazing, public recreation, water conservation, and wildlife habitat; and (b) to preserve and enhance the natural resources.

SECTION 2 - DEFINITIONS

The following definitions shall apply for the purposes of this lease:

a. *Commander*: shall mean the Commander, 60th Support Group, Travis Air Force Base, California, and his authorized representatives.

b. *District Engineer*: shall mean the District Engineer, U.S. Army Engineer District, Sacramento, and his authorized representatives.

c. *Animal Unit Month (AUM)*:

(1) *0.65 AUM* - one bovine weighing less than 600 pounds upon entry to the said premises and grazing for one month. Calves born during the grazing season are excluded from this definition.

(2) *1.0 AUM* - one bovine weighing 600 pounds or more upon entry to the said premises and grazing for one month; one cow with unweaned calf not more than two months of age upon entry to the said premises and grazing for one month.

SECTION 3 - COORDINATION

a. The said premises is subject to multiple-use and is managed by the United States in a manner which gives consideration to all demands for use of the land and water resources consistent with the military mission, conservation, and environmental concerns.

b. The primary use of the said premises is for military activities.

The lessee's use of the said premises is subordinate to military requirements, and all of the lessee's operations shall be conducted in a manner that will not interfere with or disrupt military activities.

c. The lessee, or his representative, shall closely coordinate grazing operations with the Commander. When livestock are grazing on the said premises, the lessee shall: contact the Commander at least once every other week in order to maintain adequate coordination between military uses and the lessee's operation; upon request, attend occasional meetings which may be called for the purpose of discussing the lessee's operation; and be available to correct emergency situations associated with the lease. The lessee shall provide the Commander with current emergency telephone number(s) where the lessee may be contacted on a 24-hour basis.

d. The route of ingress and egress for livestock transport through the installation to the said premises shall be designated by the Commander. Transportation of livestock on the installation shall be by vehicle only. Herding of livestock outside the said premises is prohibited without the consent of the Commander.

SECTION 4 - EXCLUSIONS

The United States reserves the following rights and the lessee shall have no claim of any character on account thereof against the United States or any officer, agent or employee thereof; provided, however, that if the United States exercises any of the rights reserved herein and the District Engineer determines that such action adversely affects the lessee's use of the said premises, the lessee shall, unless otherwise stated in the rights reserved herein, be entitled to a rental adjustment in accordance with Condition No. 11 of the lease.

a. The right to permit use of the said premises by the general public for outdoor recreational purposes.

b. The right to conduct, or to permit others to conduct, range management studies, conservation programs, firebreak maintenance, fire control, fire prevention, pest and weed control programs, and the maintenance of firebreaks up to 100 feet wide around Grazing Management Unit boundaries on the said premises.

c. The right to control burn in any area when such burning is necessary to support military operations or wildlife habitat improvement projects conducted on the said premises. The Commander shall provide the lessee a minimum of 72 hours advance notice of all burning to support military operations. The District Engineer shall provide the lessee a minimum of 30 days advance notice of burning for wildlife habitat improvement.

d. The right to require the lessee to remove and withhold all

livestock from any designated area within the said premises when the District Engineer has determined that such areas are required for military purposes; provided, however, that the lessee shall receive a minimum of 72 hours advance notice of such requirements and shall be allowed sufficient time to remove the livestock. No reduction in rent will be allowed for such movement of livestock. The lessee shall hold the United States harmless for any weight loss in livestock or inconvenience incurred pursuant to this condition.

e. The lessee is prohibited from using or permitting the use of any and all existing livestock exclosures maintained by, or with the permission of, the United States for wildlife, forestry, weather station, bivouac and other purposes. Livestock straying therein shall be immediately removed and fences repaired by the lessee. The United States reserves the right to erect additional livestock exclosures. The District Engineer shall notify the lessee at least 30 days prior to the construction of any exclosure more than one-quarter (0.25) acre in area.

f. The lessee shall not construct, erect, modify or dismantle any object on the said premises without prior written approval of the District Engineer.

g. The lessee shall not use United States buildings, water wells, or other facilities not specifically provided to support livestock grazing without the prior written approval of the District Engineer.

SECTION 5 - AUTHORIZED USE

Unless otherwise authorized in writing by the District Engineer, use of the said premises is limited to the grazing of cattle.

SECTION 6 - AVAILABILITY OF WATER

Water for livestock is provided by the United States to the best of its ability to each of the Grazing Management Unit (GMU). The United States does not, however, guarantee that water will be available at all times at all locations and the lessee shall have no claim of any character on account thereof against the United States or any officer, agent, or employee thereof. The lessee may also use any naturally occurring streams and ponds.

SECTION 7 - RANGE AND LIVESTOCK MANAGEMENT

a. General. It is the expressed intent of the United States that the land shall be utilized in accordance with proper range management practices consistent with concurrent multiple purpose use. The lessee is expected to be familiar with and to conduct grazing operations in

accordance with the usual, customary, and accepted practices of grazing on annual grasslands. In particular, the lessee must conduct his grazing operation in a manner that gives full consideration to the significant variation in the availability of forage that can occur from year to year and within a grazing season due to the amount and distribution of precipitation. The protection of the soil and its vegetative cover from deterioration by erosion, overgrazing, wildfire, noxious weed infestation, or other causes is part of proper range management.

b. *Forage Availability.* The United States does not guarantee or imply in any manner that the said premises will have sufficient forage to sustain livestock grazing during any portion or all of the specified grazing season. Except as provided for in Section 7, paragraphs *d(1)* and *f(1)* of these Land Use Regulations, the lessee is not entitled to any reduction in annual rent due to insufficient forage to support livestock grazing during any portion or all of the specified grazing season.

c. *Grazing Season.* The grazing season shall be from *1 November to 30 June* of each lease year; however, the grazing season may be modified in accordance with the following provisions:

(1) the District Engineer may *curtail* the grazing season when, in his opinion, accessible forage has been utilized to the extent where further grazing would be detrimental to the land or vegetative resources; and

(2) the District Engineer may *extend* the grazing season when, in his opinion, sufficient forage exists to sustain additional grazing and the lessee has submitted a *written* request to the District Engineer for an extension of the grazing season. Extending the grazing season is permissive only and nothing herein shall be construed as obligating the District Engineer to extend the grazing season regardless of the availability of forage.

d. *Carrying Capacity.* The *nominal carrying capacity*[1] of the said premises is *280 animal unit months* (AUM) during each lease year. The nominal carrying capacity for each GMU is as follows: GMU No. 1=90 AUM, GMU No. 4=190 AUM (Refer to Exhibit "A" for the location of each GMU.) Notwithstanding the stated nominal carrying capacity, the availability of forage and the general condition of the range shall determine the number of animal unit months permitted during each grazing season. It is the United States' objective to manage livestock grazing on the annual rangelands so that there is on average at least *600 pounds per acre of residual dry matter*[2] (excluding noxious weed species) remaining at the

1. The nominal carrying capacity is the TOTAL number of animal unit months of grazing that the lessee can reasonably expect to obtain during a typical grazing season.

2. Residual dry matter is the amount of dry plant material resulting from vegetation produced during one growing season, which remains on the ground prior to the onset of rains which initiate germination for

end of each grazing season; therefore, the nominal carrying capacity may be modified by the District Engineer as follows:

(1) The nominal carrying capacity may be reduced prior to the beginning of any grazing season by notifying the lessee of such reduction in writing not later than 1 August of the calendar year in which the affected grazing season commences. In such event, the annual rent for that year shall be computed by multiplying the reduced carrying capacity expressed in AUM's by the *AUM Rate*[3].

(2) An increase in the nominal carrying capacity may be authorized upon written request by the lessee, provided adequate forage is available. *Permission in writing must be granted by the District Engineer prior to the lessee exceeding the nominal carrying capacity. Additional rent shall be due when the nominal carrying capacity is exceeded.* The additional rent shall be computed by subtracting the nominal carrying capacity from the total number of AUM's utilized during the grazing season, and multiplying the difference by the AUM Rate. Additional rent shall be due and payable upon written demand by the District Engineer, provided that the lessee is notified at least 10 days prior to the date payment is required. Increasing the nominal carrying capacity is permissive only and nothing herein shall be construed as obligating the District Engineer to increase the nominal carrying capacity regardless of the availability of forage.

e. *Stocking Density*. The number of head of livestock grazing on the said premises may be reduced at any time during the grazing season if the District Engineer determines such reduction is necessary to prevent damage to rangeland or riparian resources. Livestock removals may be temporary with the period of time designated by the District Engineer. The lessee shall be notified in writing by the District Engineer if the removal of livestock is necessary. Livestock shall be removed by the date specified by the District Engineer; provided, however, that the lessee shall be permitted a minimum of 10 calendar days to remove livestock.

f. *Adjustments to Rent.*

(1) If the District Engineer determines that as the result of complying with written instructions from the District Engineer: (i) the total number of livestock permitted on the said premises during the grazing season was insufficient for the lessee to obtain the nominal carrying capacity of *200 AUM's* (or a reduction thereto made in accordance

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the succeeding growing season.

3. The *AUM Rate* is determined by divding the annual rent, as set forth in Condition No. 2 of this lease, by the nominal carrying capacity specified in Section 7, paragraph d, of these Land Use Regulations.

with Section 7, paragraph *d(1)* hereof) by the end of the grazing season; or (2) based on the usual and customary grazing practices for annual grasslands, the grazing season was not of sufficient length to permit the lessee to obtain the nominal carrying capacity of *200 AUM's* (or a reduction thereto made in accordance with Section 7, paragraph d(1) hereof) by the end of the grazing season, the lessee shall be entitled to a rental rebate. The amount of the rebate shall be determined by multiplying the number of AUM's that could not be obtained by the end of the grazing season, as the result of complying with written instructions from the District Engineer, by the AUM Rate. This determination is not dependent on whether or not the lessee had livestock available to utilize all of the permitted AUM's.

(2) The determination of the amount of any rebate and its payment shall be made after the end of the affected grazing season. The rebate may be in the form of either a refund from previously paid rent, credit applied toward future rent, or a combination thereof. The District Engineer shall determine the method of rebate. The lessee shall have no claim of any character against the United States or any officer, agent or employee thereof for any cost or expense incurred for complying with instructions issued by District Engineer pursuant to the provisions of Section 7 hereof. Nothing herein shall be construed as abrogating the responsibility of the lessee to pay rent as specified in Condition No. 3 of the lease.

(3) If the lessee exceeds the nominal carrying capacity (or any adjustments thereto made in accordance with the Section 7, paragraphs *d(1)* or *d(2)* hereof) without approval by the District Engineer, the ***lessee shall owe additional rent*** computed by multiplying those AUM's in excess of the nominal carrying capacity (or any adjustments thereto made in accordance with the Section 7, paragraph *d(1)* or *d(2)* hereof) by the AUM Rate, and then by 1.25. The additional rent shall be due and payable upon written demand by the District Engineer. Payment of additional rent for unauthorized grazing does not abrogate the District Engineer's right to revoke the lease.

g. ***Distribution of Livestock.*** The lessee shall make every effort to maintain a distribution of livestock over the said premises which will achieve uniform range utilization, minimize sacrifice areas, and reduce the overall fire hazard; therefore, unless otherwise directed in writing by the District Engineer, the lessee shall insure that:

(1) salt blocks and feed supplements are distributed throughout the said premises and moved as necessary to promote an optimal distribution of livestock; and

(2) salt blocks and feed supplements are not placed in close proximity to any watering source or surfaced road.

h. ***Supplemental Feeding.*** Feeding of protein, salt, minerals, or trace additives whether singly or in combination shall be allowed to

supplement the animals' daily food requirements only. Feeding of grains, hay, silage, or similar feeds which constitute a major portion of the animals' total daily food requirement shall not be allowed. Short-term emergency feeding may be permitted in lieu of hardship or temporary removal of the animals only with the prior written permission of the District Engineer.

i. Animal Health. The lessee shall comply with all federal, state, and local animal health laws and regulations with respect to livestock grazing on the said premises and, upon request, shall furnish written evidence to that effect to the Commander. In accordance with Air Force Regulation 163-5 the District Engineer reserves the right to impose quarantine, immunization, or other health requirements deemed necessary to prevent or control zoonotic diseases.

j. Dead Livestock. The lessee shall remove dead livestock from the installation within 24 hours of detection by the lessee or notification by the Commander or District Engineer.

k. Livestock Identification. If the lessee claims two weight classes for cattle (see Section 2, paragraph "c", herein) on monthly AUM reports (see Section 8, paragraph "a(4)", herein), one weight class will be identified with an ear tag. The District Engineer may approve alternative identification methods.

l. Working of Livestock. The lessee shall notify the Commander at least 48 hours in advance of working (branding, sorting, weaning, etc.) livestock on the said premises. The Commander is authorized to invite other lessees and adjacent ranchers to be present at the time such work is being done for the purpose of reclaiming stray livestock. If a dispute arises concerning ownership, the matter shall be submitted to the District Engineer for resolution.

m. Stray Livestock. It is the lessee's responsibility to confine his livestock to the said premises and to facilitate the removal of strays coming from adjoining leases or private lands. The lessee shall determine how the strays exited or entered the leased area and initiate corrective action in accordance with Section 9, herein.

SECTION 8 - LIVESTOCK REPORTING REQUIREMENTS

a. The United States reserves the right to verify the numbers and weights of livestock brought on to and removed from the said premises; therefore, the lessee shall provide:

(1) Notification. Notify the Commander at least 48 hours prior to placing livestock on, or removing livestock from, the said premises.

(2) *Weight Certificates.* If claiming 0.65 AUM for some or all cattle (see Section 2, paragraph "c", herein) on monthly AUM reports (see Section 8, paragraph "a(4)", herein), insure all arriving cattle shipments for which 0.65 AUM are to be claimed are accompanied by properly completed weight certificates, said certificates to be made available for inspection by the Commander or District Engineer at the time of livestock delivery to the said premises. The District Engineer reserves the right to waive the requirement for weight certificates as stated in Section 8, paragraphs "a(2)", "a(3)", and "a(4)", herein, and to accept alternative methods of weight verification. Livestock weight is calculated on the basis of the average weight per head, excluding unweaned calves, for all livestock on the said premises.

(3) *Documents.* Make available for inspection upon request by the Commander or District Engineer pertinent documents including, but not limited to, weight certificates, health certificates, brand inspection reports, and shipping documents.

(4) *Reports.* A report is required for each month of the grazing season which enumerates the number animal unit months utilized during the month. ***Each report shall be submitted not later than the seventh day following the end of the month for which the report is for.*** A separate report is required for each class (bovine, equine, ovine) of livestock utilizing the said premises and for each GMU identified in Section 7, paragraph "d", herein. This report is required even if there are no livestock on the said premises during the grazing season. The report form, which specifies the method for computing AUM's, will be provided by the District Engineer. Additionally, ***weight certificates*** for cattle placed on the said premises during the month, for which 0.65 AUM's are claimed, must accompany the report ***submitted to the District Engineer.*** In the absence of weight certificates (or an alternative weight verification approved by District Engineer), each bovine will be considered as weighing a minimum of 600 pounds upon entry to the said premises for the purpose of computing the AUM utilization. The report is to be sealed in an envelope, addressed to the parties identified in this paragraph, and ***deposited postage prepaid*** in a postal facility regularly maintained by the United States Postal Service or an alternate carrier if approved by the District Engineer. A copy of the completed form shall be mailed to the following addressees:

District Engineer U S Army Engineer District, Sacramento ATTN: CESPK-RE-MM 1325 J Street Sacramento, CA 95814-2922	Commander 60 CES/CEV ATTN Mr. Holmes 411 Airman Drive Building 570 Travis Air Force Base, CA 94535-2656

b. Failure of the lessee to comply with the foregoing provisions of Section 8 hereof shall constitute sufficient justification for the District Engineer to order all livestock to be gathered and counted. In lieu of assigning all cattle a minimum weight classification of 600

pounds, as provided for in Section 8, paragraph "a(4)", herein, the lessee may elect to have all cattle weighed and assigned a weight classification based on the results of the weighing. All costs associated with gathering, counting, and weighing, including costs incurred by the United States, shall be paid by the lessee who shall have no claim of any character on account thereof against the United States or any officer, agent, or employee thereof. The provisions of this paragraph do not abrogate the District Engineer's option to revoke the lease.

SECTION 9 - MAINTENANCE

a. The ***lessee***, at his ***own cost and expense***, shall:

(1) during the grazing season, perform routine maintenance and repair (except as stated in Section 9, paragraph "b", herein) to maintain in a livestock-tight condition those fences and gates whose function is for the confinement of livestock to the said premises; except that, this condition shall not apply if District Engineer determines such fences and gates have deteriorated to the point of unserviceability;

(2) drain, clean, and refill watering troughs at least every other year or as directed by the Commander, and maintain float valves in an operating condition;

(3) during the grazing season, perform emergency repairs to fences and gates on the said premises that have been damaged or destroyed by accidents, vandalism, or the forces of nature. Such repairs may be temporary but must be sufficient to confine livestock to the said premises. Unless otherwise directed by the Commander or District Engineer, repairs must be completed within 48 hours after notification by the District Engineer that repairs are needed. Failure of the lessee to perform repairs as directed by the Commander or District Engineer is sufficient cause for the District Engineer to require removal of livestock from the said premises until repairs are completed. The District Engineer may elect to negotiate a supplemental agreement in accordance with ***Condition No. 32*** of the lease for the permanent repair or replacement of damaged or destroyed fences or gates. Reasonable costs and expenses, as determined by the District Engineer, incurred by the lessee for performing emergency repairs may be included in the supplemental agreement; and

(4) insure proper clean-up of all areas used by his personnel and will dispose of refuse and debris generated as a result of various lease activities conducted on the said premises to the satisfaction of the Commander.

b. The United States shall repair facilities damaged by activities of the United States, its contractors or employees, and fire fighting activities.

e. The United States shall maintain chain-link security fencing and gates.

d. The lessee shall obtain written approval from the Commander prior to using any pesticides on the said premises. As used herein, the term "pesticides" includes herbicides, insecticides, fungicides, and rodenticides but does not include products commonly known as medicines.

SECTION 10 - EMPLOYEE CONDUCT

The lessee shall be responsible for the conduct of lessee's employees, agents, representatives and invitees when on the said premises, and shall inform each of them concerning laws, rules, and regulations applicable to the said premises (e.g., vehicle travel, security, safety, hunting, and fishing).

SECTION 11 - INTEGRATED NATURAL RESOURCE MANAGEMENT PLAN

The lessee understands and agrees that the lessee's actions shall be consistent with the terms of the Travis AFB Integrated Natural Resource Management Plan (INRMP) and all applicable Air Force instructions concerning natural resource management. Moreover, the INRMP Section 8.0 Grazing Management Plan imposes certain obligations on the lessee and those obligations are described in these Land Use Regulations. Section 8.0 is included as Exhibit "C". The United States shall make available to the lessee the entire Travis AFB INRMP and any applicable Air Force instructions.

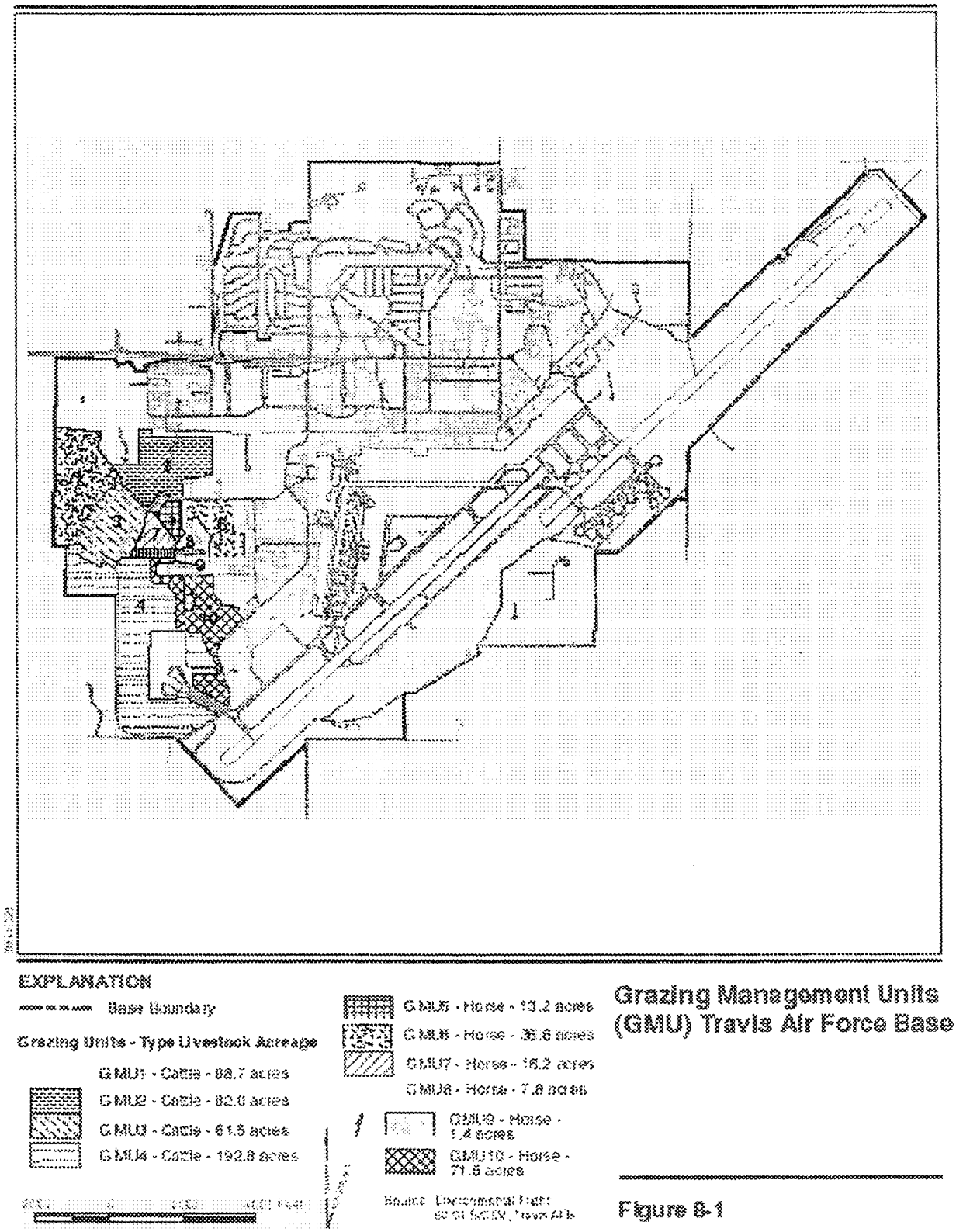
EXPLANATION
Base Boundary
Grazing Units - Type Livestock Acreage
GMU1 - Cattle - 88.7 acres
GMU2 - Cattle - 82.0 acres
GMU3 - Cattle - 61.5 acres
GMU4 - Cattle - 192.8 acres
GMU5 - Horse - 13.2 acres
GMU6 - Horse - 36.6 acres
GMU7 - Horse - 16.2 acres
GMU8 - Horse - 7.8 acres
GMU9 - Horse - 1.4 acres
GMU10 - Horse - 71.5 acres
Source: Environmental Flight
Grazing Management Units (GMU) Travis Air Force Base

Figure 8-1

- **Animal Unit (AU)** - One bovine weighing more than 600 pounds. One horse is equal to 1-1/2 animal units. Five weaned sheep.

- **Animal Unit Month (AUM)** - One animal unit grazing for 30 days.

- **Lessee** - Any person or group using the grazing lands on Travis AFB for the grazing or exercising of any animals.

Primary use. The primary use of Travis AFB is for military activities. Any grazing operation on the base is secondary and subject to military requirements. Consequently, the lessee is expected to conduct operations in a manner that will not, at any time, interfere with the military use. In the event that military requirements so demand, the lessee will, upon 24-hour notice from the Management Agronomist, gather, move, and hold livestock in specified areas within the leased premises. If adequate forage does not exist on the remaining area, livestock will be removed from the base.

Lessee Coordination. The lessee or his representative will maintain biweekly contact with the Management Agronomist, Travis AFB, or his authorized representative when livestock are on the base. In addition, the lessee or his representative will be available any time of the day or night to correct emergency situations involving livestock, such as livestock on roadways outside the leased area. Accordingly, the lessee will provide the Management Agronomist with current emergency telephone numbers.

The lessee will submit under penalty of perjury, by the 10th day of each month, a certificate that lists the number of AUMs grazed during the previous month. The certificate, to be provided by the District Engineer or the Management Agronomist, specifies the method of computing the average AUM. The form will be made out in duplicate and sent to the following addressees:

- **Commander**, 60 CES/CEV, Attn: Management Agronomist, 580 Hickman Avenue, Building 246, Travis AFB, California 94535-5498

- **Department of the Army**, USACE, Sacramento District, Attn: CESPK-RE-MS, 1325 J Street, Sacramento, California 95814-2922

Ingress and egress. Route of ingress and egress for livestock through the base to the leased area will be designated by the Management Agronomist. Transport of livestock to and from the base will be by vehicle only. The herding of animals outside the leased areas is prohibited without the consent of the Management Agronomist.

Type of Livestock. The use of the leased areas will be limited to the following types of livestock: GMUs 1, 5, 6, 7, 8, 9, and 10 for cattle or horses, and GMUs 2, 3, and 4 for cattle only.

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Grazing Season. The primary grazing season will be from October 1 to May 1. The grazing season for GMU 6 is mid-March (depending on rainfall) to October 31.

Grazing Capacity. The availability of adequate forage and the general condition of the range, as determined by the Management Agronomist, will govern the intensity of grazing by the lessee. The types of plants recommended in grazing areas are listed in Table 6-1.

Table 6-1. Common Desirable and Undesirable Plants in the Grazing Pastures, Travis AFB, CA

Common Name	Scientific Name
	Desirable
Annual fescue	*Festuca megalura*
Blue lupin	*Lupinus bicolor*
Broad-leaf filaree	*Erodium botrys*
Burr clover	*Medicago polymorpha*
Foxtail barley	*Hordeum jubatum*
Italian ryegrass	*Lolium multiflorum*
Red stem filaree	*Erodium cicutarium*
Ripgut grass	*Bromus diandrus*
Rose clover	*Trifolium hirtum*
Soft chess brome	*Bromus hordeaceus*
Subterranean clover	*Trifolium subterranean*
Wild oats	*Avena fatua*
	Undesirable
Medusahead	*Taeniatherum caput-medusae*
Milk Thistle	*Silybum marianum*
Yellow star thistle	*Centaurea solstitialis*

Source: Travis Air Force Base, 1998

The Management Agronomist reserves the right to reduce the number of allowable AUMs in any lease year. Therefore, if the lessee is prevented from achieving the target utilization rate during a lease year as a result of compliance with written instructions from the Management Agronomist requiring a reduction in allowable AUMs, the lessee will be entitled to a rebate in the rental fee. Said rebate will be determined by dividing the annual rental rate by the target AUM rate and then multiplying by the number of AUMs not attained.

The Management Agronomist may allow an increase in the grazing capacity provided adequate forage exists. Generally, this determination will be made 1 week before livestock are to be removed from said leased area. Written permission to exceed the AUM grazing capacity must be granted to the lessee by the Management Agronomist. The lessee hereby agrees to pay for each additional AUM at the rate determined by dividing the annual rental rate by the target AUM rate and then multiplying by the excess number of AUMs.

The lessee will make every effort to obtain optimum distribution of livestock over the leased area, to obtain uniform range utilization, to minimize "sacrifice"

(overgrazed) areas, and to reduce the overall fire hazard. Accordingly, salt blocks will not be situated within 1/4 mile of watering areas and will be distributed uniformly throughout the remaining leased area.

It is the express concern of the government that the range not be overgrazed and that a layer of living or dead vegetation as mulch be maintained to protect the soil from erosion while enhancing seedling establishment and growing conditions for forage plants. To insure adequate maintenance of the soil organic layer, 400 pounds per acre of the annual forage production will be allowed to return to the soil as mulch. Accordingly, grazing will cease on the leased area when, in the opinion of the Management Agronomist, the accessible forage has been utilized to an average height of 3 inches or an average forage residue of 400 pounds per acre.

Dead animals. The lessee will dispose of any dead animals by removing them from the area within 24 hours of notification by the Management Agronomist.

Noxious weed control. At his own cost and expense, the lessee will participate in a noxious weed control program. The Solano County Agricultural Office does not have an established weed control program or standards for weed control (pers. comm., Joe Mraz, 2000). However, it is recommended that the lessee consult with the County Agricultural Commissioner's Office at 501 Texas Street, Fairfield, California, 94533, (707) 421-7465, for guidance on weed control. The lessee will obtain written approval from the Management Agronomist prior to using any pesticide on the leased premises. As used herein, the term "pesticide" includes herbicides, insecticides, fungicides, and rodenticides, but does not include products commonly known as medicines. If this work is not done by the lessee, the Air Force will do the work and bill the lessee.

A noxious weed is an invasive exotic plant which is able to proliferate and aggressively alter or displace indigenous biological communities (California Native Plant Society, 1996). Some examples of noxious weeds include: yellow star thistle (*Centaurea solstitialis*), purple loosestrife (*Lythrum salicaria*), leafy spurge (*Euphorbia esula*), spotted knapweed (*Centaurea maculosa*), and musk thistle (*Carduus nutans*), all of which occur in California (Article 1.1. Noxious Weeds Management, Chapter 1 of Food and Agriculture Code, 1999). At present, star thistle, is the only noxious weed present on Travis AFB, and its control is being managed by the grounds maintenance contractor (Holmes, 2000).

A copy of the CNPS policy on invasive exotic plants, adopted September 1996, is provided as a reference in Appendix G. Also provided in Appendix G is a copy of the Executive Order on Invasive Species and a copy of the Federal Interagency Memorandum of Understanding (MOU) on Noxious Weeds, Bureau of Land Management, California.

Fences and gates. The lessee will repair and maintain, in a livestock-tight condition, all fences that separate the leased premises from adjoining government or nongovernment property. Gates will not be installed along the base boundary without the express written consent of the Management

Agronomist. In the event that boundary gates are approved, they will be installed at the cost and expense of the lessee and will be locked at all times, with a key being furnished to the Management Agronomist. All materials used in the maintenance of said fence and construction of said gates will become the property of the government and will not be removed by the lessee.

Credits and refunds. For work performed by the lessee, the amount of credit or refund to be allowed by the government will be the lessee's cost or the amount shown in the Work Schedule (WS), whichever is lower. The term "work" implies all labor, equipment, and materials. The Management Agronomist reserves the right to modify, add, or delete items of work on the WS as may be in the best interest of the government. The District Engineer or the Management Agronomist will negotiate with the lessee for the accomplishment of additional work or modification of scheduled work. The lessee will notify and coordinate with the Management Agronomist prior to beginning all work projects. The lessee will not accept any federal cost-sharing payments for soil conservation practices required by the lease that will result in duplicate payment for such practices.

Ordnance area. Entry into the ordnance area, otherwise known as "A Bunker" (GMU 3), will be by escort only. Prior to the placement of or checking on livestock in the bunker area, the lessee or his representative will make arrangements with the Management Agronomist 24 hours prior to arrival. Roadways within "A Bunker" (Facilities 980-996) will be cleared of animal residue six times per grazing season by the lessee at the direction of the Air Force, at no cost to the government.

Earth-Covered Explosives Storage Structures. GMUs that contain earth-covered explosives storage structures may be temporarily removed from grazing in the event that structural repairs to the facility require the removal of the soil cover and the native cover has not regenerated by the start of the grazing season. Should this happen, the carrying capacity of the lease will be reduced, as will the rental fee for that year. The removal period will not exceed 1 year. GMUs 3 and 10 contain such structures.

Compliance with other AFB regulations. The lessee and all people in his employ will adhere to posted speed limits and traffic control signs, restricted (off limits) areas, and Travis AFB natural resources regulations. The lessee will also insure proper clean-up of areas used by his personnel and will dispose of all refuse and debris generated at his temporary work sites.

8.4 PROGRAMS

The grasslands in Northern California are composed of cool-season annual plants, both grasses and broadleaf. All plants in the pasture grow from seeds, and the percent cover of each plant changes every year. Usually, annual plants germinate after the first 1/2 to 1 inch of rainfall. If the fall rains occur while the weather is still warm (early fall), plants will grow rather rapidly early in their life. However, if adequate rainfall occurs after the onset of cool weather, growth during the fall and winter season will be rather slow. These grasslands remain in

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this slow but green growth period until mid-February to mid-March when the temperature rises. This period of time, from the first fall rains until warm weather arrives in the spring, is called the Inadequate Green Season. The end of the Inadequate Green Season is followed by the Adequate Green Season, which is characterized by warm spring temperatures, accompanied by additional spring rainfall. This season ends when the forage begins to dry out for lack of soil moisture. The Adequate Green Season is followed by the Inadequate Dry Season, which lasts from sometime in May or the first of June until the fall rains occur. The cycle then repeats.

Productivity during the inadequate green season is usually rather low, amounting to 500 pounds of dry matter per acre or less. During the adequate green season, productivity can be quite high, on the order of 1,000 or more pounds of dry matter per acre, depending on the amount of rainfall and the length of the adequate green season. The forage that is left at the end of the adequate green season can be grazed as dry forage throughout the summer. The quality of this feed is lower, but it is a good source of energy. Frequently, livestock grazed on dry feed during the inadequate green season need a protein supplement to maintain an adequate level of nutrition. Protein levels of this forage that were quite adequate during the adequate green season will decrease during the course of the dry season, reaching protein levels of less than 6 percent (Travis Air Force Base, 1996).

Among the plants common in the grazing pastures, there are both desirable and undesirable species (see Table 8-1).

8.4.1 Grazing Management Units

There are ten identified GMUs on the base (see Figure 8-1). Table 8-2 provides information on the size of each unit, its capacity for grazing, and the type of livestock that it supports.

Table 8-2. Acreage, Maximum Grazing Capacity, and Type of Livestock for Each Grazing Management Unit, Travis AFB, California

GMU	Acreage	Grazing Capacity (AUM)	Type of Livestock
1	88.7	100	Cattle
2	82.0	100	Cattle
3	61.5	55	Cattle
4	192.8	190	Cattle
5	13.2	15	Horse
6	36.6	35	Horse
7	16.2	15	Horse
8	7.8	6	Horse
9	1.4	3	Horse
10	71.6	90	Horse

Note: The grazing capacity is a target figure only and can be adjusted up or down on a yearly basis, depending on the amount of winter rain and the forage growth for that year.
AUM = animal unit month
GMU = Grazing Management Unit

Source: Travis Air Force Base, 1996

8.4.2 Land Use Capability Class For Grazing Areas

Capability classes are designated to indicate how the land should be used and to identify limitations that affect the choices for practical use. Capability classes for soil are shown in Table 8-3. Class II, III, and IV soils are identified on the base and occur in the grazing area.

Table 8-3. Capability Classes for Soil

Soil Class	Description
Class I	Few limitations that restrict use
Class II	Some limitations that reduce the choice of plants or require moderate conservation practices
Class III	Severe limitations that reduce the choice of plants, require special conservation practices, or both
Class IV	Very severe limitations that reduce the choice of plants, require very careful management, or both
Class V	Not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife habitat (none in Solano County)
Class VI	Severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture, range, woodland, or wildlife habitat
Class VII	Very severe limitations that make them unsuited to cultivation and restrict their use largely to grazing, woodland, or wildlife habitat
Class VIII	Limitations that preclude their use for commercial planting and restrict their use to recreation, wildlife, water supply, or aesthetic purposes

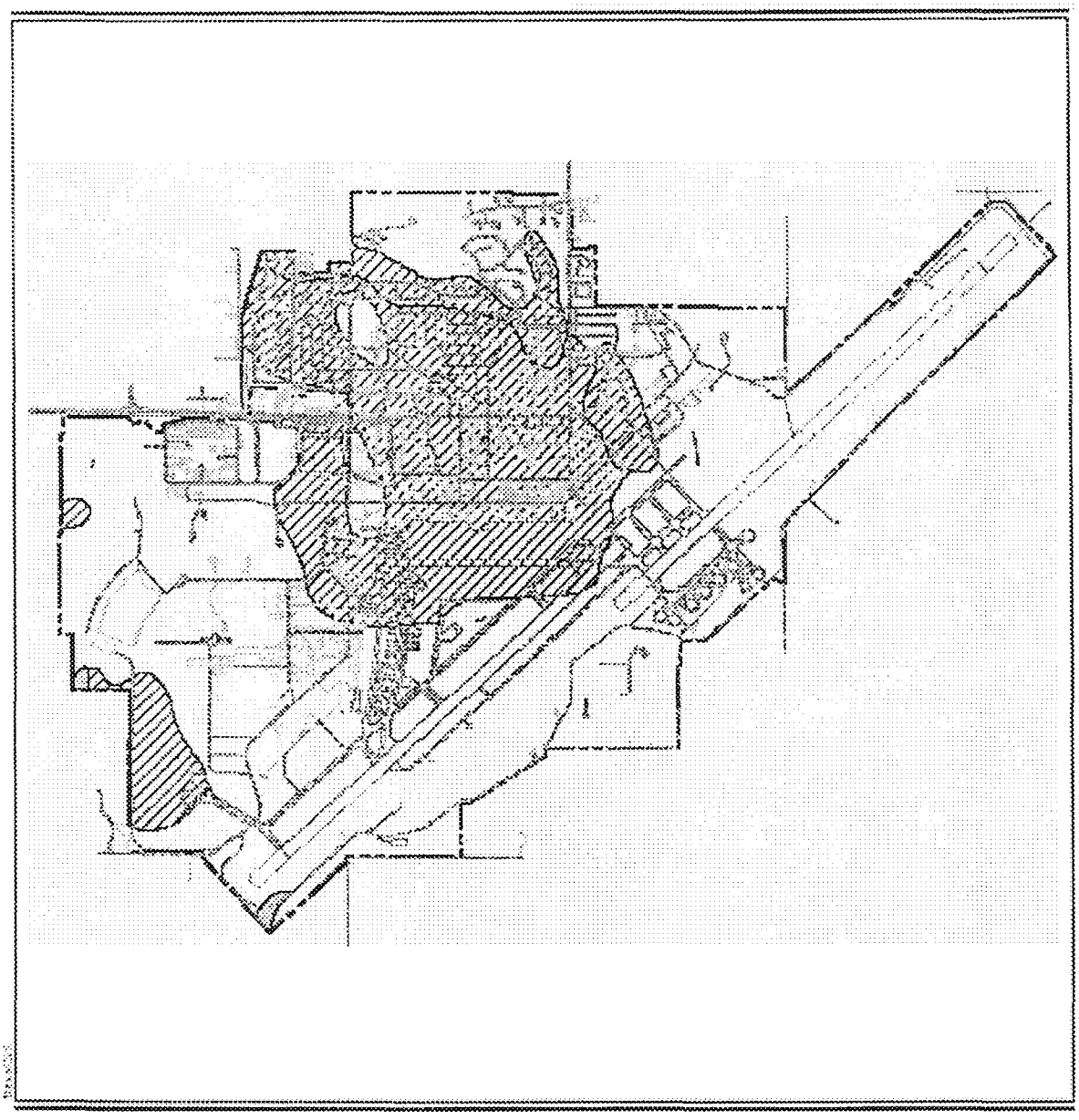
Source: Soil Survey of Solano County, Department of Agriculture, May 1997.

8.4.3 Bird-Air Strike Hazard Program

A portion of the lands used for grazing is near the end of one of the runways. Grazing this area reduces the available habitat for bird species; consequently, there is a small positive effect on the Travis AFB BASH program.

8.4.4 Cropland Management

Prime Farmlands and Farmlands of Statewide Importance. There are approximately 1,578 acres of prime farmlands and farmlands of statewide importance on Travis AFB. Of these, about 25 acres are prime farmlands and about 1,553 acres are lands of statewide importance. Only about 150 acres are in undeveloped areas (Figure 8-2). Prime farmlands are lands best suited for producing food, feed, forage, fiber, and oilseed crops. Prime farmlands should also be available for other uses, such as cropland, pastureland, rangeland, forest land, or other land but not urban built up land or water. Prime farmlands have



EXPLANATION

Base Boundary

Prime Farmland (0 acres)

Farmland of Statewide Importance - (1963 acres)

Prime Farmlands and Farmlands of Statewide Importance, Travis Air Force Base

Figure 8-2

the soil quality, growing season, and moisture supply needed to produce sustained high yields of economic crops. These farmlands should also meet certain soil criteria, which is provided in the NRCS farmland inventory (Important Farmlands Reference Binder, 1981, NRCS, Dixon Office, California) (Appendix H).

Farmlands of statewide importance are land other than prime farmland that have a good combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. These farmlands should also be available for other uses such as cropland, pastureland, rangeland, forest land, or other land, but not urban built-up land or water. These farmlands should meet specific soil criteria, which is listed in the NRCS farmland inventory in Appendix E.

As these lands are in safety zones for aircraft or explosives storage, they will likely remain available for agriculture.

8.5 IMPLEMENTATION

8.5.1 Monitoring

Grazing System. The system used at Travis AFB was developed by the University of California, Davis, Cooperative Extension. This involves dividing the year into the following three seasons: Inadequate Green Season, Adequate Green Season, and Inadequate Dry Season (see Section 8.3). Cattle and horse grazing are managed differently. The cattle lands are grazed during the Adequate and Inadequate Green Seasons, with supplemental feeding during the Inadequate Green Season. There is no grazing during the Inadequate Dry Season. The GMUs utilized for horse pastures are used on a rotational basis, being grazed only during the Adequate Green Season and the Inadequate Dry Season, with no grazing occurring in the Inadequate Green Season. This rotation system is used to ensure equal and proper utilization of all areas. Supplemental feeding of horses is required at all times (Travis Air Force Base, 1998).

Readiness/Utilization Standards. On all grazed lands, there must be at least 400 pounds of forage cover per acre before grazing can begin. This means that grazing can usually start in October (during the Inadequate Green Season) as long as there is supplemental feeding. These lands are grazed until May 1, when grazing is stopped at the beginning of the Inadequate Dry Season. The remaining stubble is 2-3 inches in height. On all lands, if the forage falls below or does not reach 400 pounds per acre, grazing must stop or is not allowed to begin (Travis Air Force Base, 1998).

Each GMU will be visually monitored biweekly for forage utilization during the growing season. The location of the monitoring points will be random each time there is to be an inspection. If these visual inspections indicate any problems, such as low forage utilization, soil sampling will be conducted to locate possible problems and to determine possible soil amendment needs (pers. comm., Bob Holmes, Travis Air Force Base, 2000). Each GMU will have from 3 to 10 1-square-foot sites that are checked at each inspection, depending on GMU size.

These inspections will be utilization checks and will be completed by the base Management Agronomist.

Present conditions of annual grasslands at Travis AFB can be described, although the trend of each forage plant cannot. The only trend that can be monitored is an increase or decrease in undesirable plants on the base. This trend of species mix will be followed as an indicator of grazing management success. If the frequency of undesirable species increases, controlled burning, mowing, and other management actions will be implemented. Burns will occur no more than once every 3 years, and mowing will be done as necessary. The base Fire Department will conduct the burning.

Noxious weed control. Travis has one weed considered to be noxious: the yellow star thistle. Control measures for these weeds will follow the system discussed within the Grazing Land Use Regulations.

8.5.2 Improvements

8.5.2.1 Fencing.

Fencing is defined as enclosing or dividing an area of land with a suitable permanent structure that acts as a barrier to livestock, big game, or people. This does not include electric or other temporary fences. It is used to exclude livestock or big game from areas that should be protected from grazing; subdivide grazing land to permit use of grazing systems; protect new seedlings and plantings from grazing; and regulate access to areas by people. It should be used on any area where livestock or big game control or exclusion is needed, or where access by people is to be regulated.

Woven Wire Fences. The minimum height of the woven wire with three barbed wires will be 42 inches. Finished fences will fit the following description: a finished fence will have a strand of barbed wire 1 inch above the ground line, with the woven wire starting 1 inch above that and extending upward for 39 inches. On top of the woven wire will be 2 equally spaced strands of barbed wire with the top strand 2 inches below the top of the post.

Barbed Wire Fenced. A 5-strand fence is minimum. The completed fence will be a minimum of 39 inches in height to a maximum of 50 inches and will contain five equally spaced wire strands. Suspension fences are acceptable if they meet minimum specifications. Smooth, or "barbless," wire may be used under special circumstances if such wire will accomplish the purpose of the fence.

Materials

- **Woven Wire Minimums.** The top and bottom wire in woven wire will be 11 gauge (U.S. Wire Gauge) or heavier, and line and stay wires will be 14-1/2 gauge or heavier.

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- **Minimum Wire Specifications.** 12-1/2-gauge galvanized barbed wire or, under special circumstances, smooth, or "barbless," wire, of double strand or equivalent strength. No. 9-gauge, "barbless," single-strand wire will meet minimum specifications for special fencing jobs. Smooth "barbless" wire fences are to be adequately constructed with sufficient use of stays. Stays are to be no more than 10 feet apart.

- **Wooden Posts.** Wooden posts having acceptable durability are cedar, juniper, osage orange, catalpa, black locust, and redwood. All other wooden posts will be treated with an acceptable commercial preservative. Peeler cores will not be used.

- **Line Posts.** The minimum width will be 3 inches, and the minimum length will be 6 feet. Line posts for suspension fences will have minimum diameters of 4 inches. Unless soil or ground conditions prohibit, all line posts will be set to a minim of 18 inches into the ground.

- **Corner and Brace Posts.** The minimum diameter will be 6 inches, and the minimum length will be 6-1/2 feet. Corner and brace posts for suspension fences will be at least 8 inches in diameter and a minimum of 7 feet in length. The posts will be set to a minimum of 2-1/2 feet in the ground for regular fences and set to a minimum depth of 3 feet for suspension fences.

- **Steel Posts.** All steel posts will have an anchor plate. Lengths of posts will be sufficient to facilitate construction of a fence at least 42 inches high. Steel posts will be driven into the ground to a depth that puts the top of the anchor plate even with the surface of the soil, as a minimum.

- **Bracing Wire.** Bracing wire will be composed of two complete loops of No. 9-gauge smooth wire, or 2 complete loops of double-strand barbed wire.

- **Staples.** Staples used to fasten fence wire to wooden posts will be No. 9-gauge galvanized wire with minimum lengths of 1-1/2 inches for soft woods and 1 inch for close-grained hardwoods.

- **Finished Fences.** Finished fences will have the posts no more than 12 feet apart and a brace post every 300 feet. Additional posts will be used any time there is a ground deflection of 20 degrees or more.

8.5.2.2 Gate and Cattle Guards.

Gates should be a minimum of 10 feet wide to a maximum of 16 feet wide when open, based on the width of the road. They should be galvanized steel or aluminum pipe with a diameter of 2-1/2 inches, with support posts having a

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minimum of 3 feet anchored in the ground. The finished height of gate will match that of the finished fence, and upon completion, it will be of such quality and construction that it will have a usable life of at least 10 years. The finished gate will be capable of excluding sheep and cattle. Cattle guards will be equal to Power River's™ U-54 or U-80 guards with end wings or newer equivalents.

8.5.2.3 Water Troughs.

Water troughs should be constructed of 14-gauge steel with tapered sides and ends, electrically welded, and galvanized. They should have a minimum of one drain plug and one fill plug and be placed on one or more concrete pads or three or more wooden supports of sufficient size and strength to insure the trough remains upright and level. The location and size of troughs will be based on the size of the pasture and the number of animals to be served. Water is available on site (pers. comm., Bob Holmes, 2000).

8.5.2.4 Nonstructural.

The only nonstructural improvement is that of noxious weed and star thistle control. This is entirely the responsibility of the lessee and will be accomplished at his own expense. Star thistle control can be best accomplished through periodic mowing of the pastures with large infestations. The key objective is to prevent the star thistle plant from setting seed. During the spring, the star thistle plant is a low-growing rosette that may not be obvious until later in the year. As the late spring progresses into early summer, star thistle produces a conspicuous yellow flower. Once the flowers appear, the pasture should be mowed, and all the flowers should be cut off the plant. A cutting height of 4 inches should remove most of these flower heads, preventing them from setting seed and placing a new batch of seed into the ground. Because the star thistle seeds germinate at different times through the spring and summer, it will be necessary to clip them more than once because there will be plants of several ages present. Furthermore, those that are clipped early may produce flowers a second time. Therefore, it may be necessary to clip two or three times each year. Because the star thistle seeds remain viable in the soil for many years, it is necessary to mow for several consecutive years (Travis Air Force Base, 1996). This is still only a control method, as the star thistle will never be completely eliminated. Lessee's noncompliance with weed control measures will result in completion of the work by the Air Force, and charge to the lessee for these services.

8.5.3 Workplan/Budget

Each year, a budget developed from a work plan is submitted for the following fiscal year's (FY's) work to be accomplished. The work plan indicates necessary work and is dynamic as a result of infrastructure condition and priority of the required work. The priority is based on which work will best benefit the grazing program through increased productivity or management of the grazed lands. The cost of each year's work is difficult to estimate because of the rapid change of material costs. It is intended that the lessee will accomplish the work in lieu of payment of lease fees. This method requires the lessee to submit a materials

and labor cost bid to the USACE for review and work authorization following a cost negotiation. These combined factors make cost estimation very difficult.

The work plan for FY 2001 and 2002 specifies repair or replacement of 3,000 feet of field fence each year.

The following is a list of recommended additional work elements that may be specified in the work plan for the lease holder to accomplish:

- Lease holder will be familiar with Subsection 4.5.5, Special-Status Species (plants and animals) of Chapter 4.0, Natural Environment, of the Travis AFB INRMP.

- Lease holder will be familiar with Chapter 8.0, Grazing Management Plan of the Travis AFB INRMP. Lease holder will follow the instructions described under the following topics: Lessee coordination, Ingress and Egress, Type of Livestock, Grazing Season, Grazing Capacity, Fences and Gates, Credits and Refunds, Ordnance Area, Earth-Covered Explosive Storage Structures, Compliance with other Air Force Regulations, and all information contained under Subsections 8.4, Programs, and 8.5, Implementation.

- The lease holder will inspect water troughs periodically to ensure there are no leaks. Water troughs should be provided with wildlife escape ramps. The escape ramp should be a simple device constructed of a 2-foot by 4-foot piece of wood, and placed in the water trough by means of a wire in such a way that the wood is free-floating to enable fallen wildlife to escape (pers. comm., Craig Nathe, Rangeland Management Specialist, Natural Resources, 30 CES/ CEVPN, Vandenberg AFB, California, 2000).

- The lease holder will take measures to discourage stock trails to water troughs, which will lead to soil compaction, by distributing water troughs throughout the grazing area. Lease holder will monitor grazing units once per month for any intensive use leading to stock trails, particularly along the fence lines. If there is evidence of stock trails, lease holder will install cross fencing to discourage stock trails along the fence line. Installation of cross fencing will be coordinated with the Management Agronomist prior to installation.

- Lease holder will carefully inspect the water in the troughs, once every 2 weeks. If there is noticeable algae growth in the troughs, a copper tubing (approximately 2 feet), may be placed in the trough to inhibit algal growth (pers. comm., Craig Nathe, Rangeland Management Specialist, Natural Resources, 30 CES/CEVPN, Vandenberg AFB, California, 2000)

- Lease holder will assist the Management Agronomist in photodocumentation of the grazing land each season to facilitate trend analysis of grazing lands. Before livestock are released into each of the grazing units, lease holder will take a photograph of the pasture land and "key areas." A similar photograph will be taken at the end of the grazing season, after all the livestock have been removed from a grazing unit. The particulars of the photodocumentation (e.g., number, "key areas" to be photographed, angle of photography, number of copies) will be coordinated with the Management Agronomist prior to the onset of the grazing season

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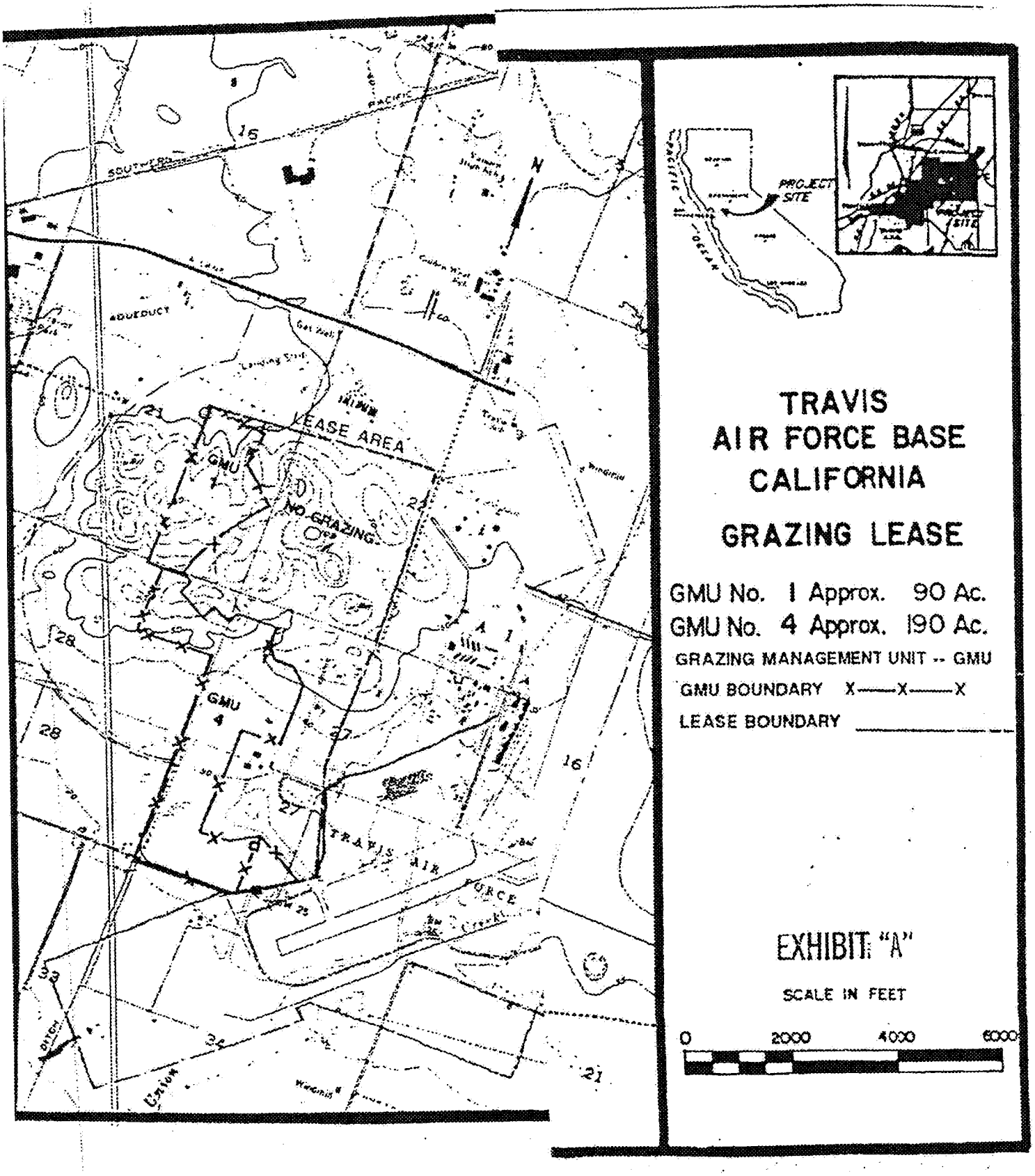
LEASE AREA
GMU 1
NO GRAZING
GMU 4
TRAVIS AIR FORCE BASE
AQUEDUCT
PROJECT SITE
TRAVIS
AIR FORCE
BASE
CALIFORNIA
GRAZING LEASE
GMU No. 1 Approx. 90 Ac.
GMU No. 4 Approx. 190 Ac.
GRAZING MANAGEMENT UNIT -- GMU
GMU BOUNDARY X——X——X
LEASE BOUNDARY
EXHIBIT "A"
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EXHIBIT "C" TO LEASE DACA05-1-04-500
TRAVIS AIR FORCE BASE, CALIFORNIA

8.0 GRAZING MANAGEMENT PLAN

8.1 INTRODUCTION

In early 1977, it was determined that grazing lands would be leased on Travis AFB. The land set aside for grazing is necessary for the mandatory quantity-distance (QD) criteria buffer for explosives storage and handling facilities; consequently, it cannot be declared excess.

All lands utilized for grazing are on the west side of the base extending from the southwestern boundary to the boundary of the Aero Club in one continuous parcel (Figure 8-1). The grazed area is approximately 605 acres: 475 acres are outleased, and 130 acres are grazed under a use license by the Saddle Club. This acreage is divided into ten subunits called Grazing Management Units (GMUs).

8.2 ROLES AND RESPONSIBILITIES

The USACE, Sacramento District, was initially responsible for procedural guidance on leasing the grazing land; and they continue to monitor the lease and collect the rental fees. The Management Agronomist is responsible for setting stocking rates and for monitoring the health of the grazing allotments.

8.3 RELEVANT REGULATIONS

The lessee will comply with all federal, state, and local animal health laws and regulations with respect to livestock grazing on the leased premises. Upon request, the lessee will furnish written evidence of this compliance to the Management Agronomist.

Travis AFB has a set of Land Use Regulations (LURs) in place for the grazing areas. These LURs are intended to provide for multiple-purpose use of these lands for the base's mission, grazing by domestic livestock, wildlife habitat, and recreation. Adherence to the LURs, along with sound range management practices, will conserve and enhance the environment while providing economic returns to the lessee.

The protection of the range cover from damage or destruction by overgrazing, wildfire, erosion, noxious weed infestation, or other causes is considered part of sound range management. The right is reserved for others, as directed by the Management Agronomist, to conduct conservation programs, fire control and prevention (including maintenance of fire breaks), and weed control on the leased premises. No reduction in rental will accrue if the Air Force exercises its right to perform these activities. The following definitions will apply for the purpose of this agreement, notwithstanding any other commonly known definitions:

TECHNICAL SPECIFICATIONS FOR WOVEN WIRE FENCE

1. General. The following minimum specifications shall apply to the construction of woven wire fencing.

2. Materials. Only new domestic materials shall be used unless prior written approval from the said officer is obtained for the use of substitute materials.

a. Woven wire: Hinge-jointed, cooper bearing, galvanized, field fence, style 939-6-11 (9 horizontal bars, 39 inches in height, 9 gauge top and bottom wires, 11 gauge stays spaced 6 inches apart). Galvanizing must satisfy ASTM Class 1 standards.

b. Barbed wire: Two twisted strands of 12 gauge galvanized steel wire; 4-point barbs spaced not more than 5 inches apart. Galvanizing must satisfy ASTM Class 1 standards.

c. Line posts: Constructed of high carbon steel, Tee style, heavy-duty (1-3/8 x 1-3/8 inches, weight 1.33 pounds per foot). Anchor plate to be at least 1/8 inch thick, 17 square inches and riveted to post. Posts protected with heavy coat of paint. Posts shall be 6 feet in length.

3. Construction.

a. Woven and barbed wires and line posts shall be installed as illustrated in Figure 1.

b. All wire shall be stretched to proper tension and attached to the line posts with appropriate wire clips. The woven wire shall have clips on the top and bottom wires and at alternate wires in between.

c. All wire shall be wrapped around corner and end posts, spliced back on itself and stapled to the post with 1~ inch galvanized staples.

d. Corner and end posts and braced line posts shall be constructed in accordance with the accompanying technical specification for same.

e. Corner/end post assemblies shall be installed at all terminal points (e.g., gates, cattleguards) and wherever the fence line changes direction.

f. Braced line posts shall be installed at approximately 660-foot intervals as shown in figure 2 or 1320-foot as shown in figure 3. End posts shall be constructed in accordance with figure 4.

g. All low places in the fence shall be anchored with permanent and practical anchors. These anchors are to be of such strength that the fence wire crossing the depression shall remain the same height from the ground as on level surfaces. Additional wire shall be added to fill gaps created by ditches and gullies.

4. Site Preparation: All major modifications of the landscape such as removing trees or extensive cutting and filling must be coordinated with and have the approval of said commander.

in advance of beginning work.

6. Old Fencing Materials: The old fencing materials that are unserviceable shall be removed from the site by the lessee and disposed of at a location designated by the Commander, or and the direction of the Commander, the material shall be disposed at a State approved landfill.

----------NO MORE TECHICAL SPECIFICATIONS FOLLOW----------

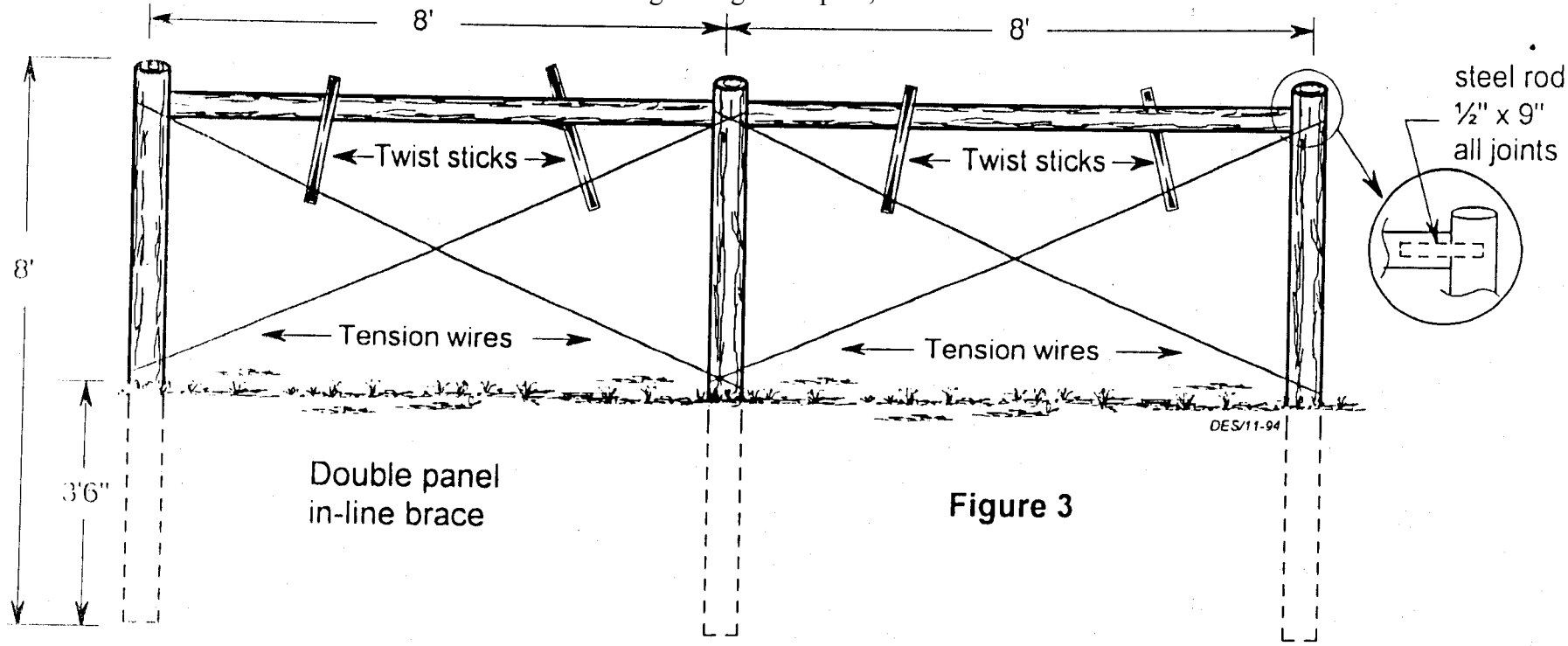


Figure 3

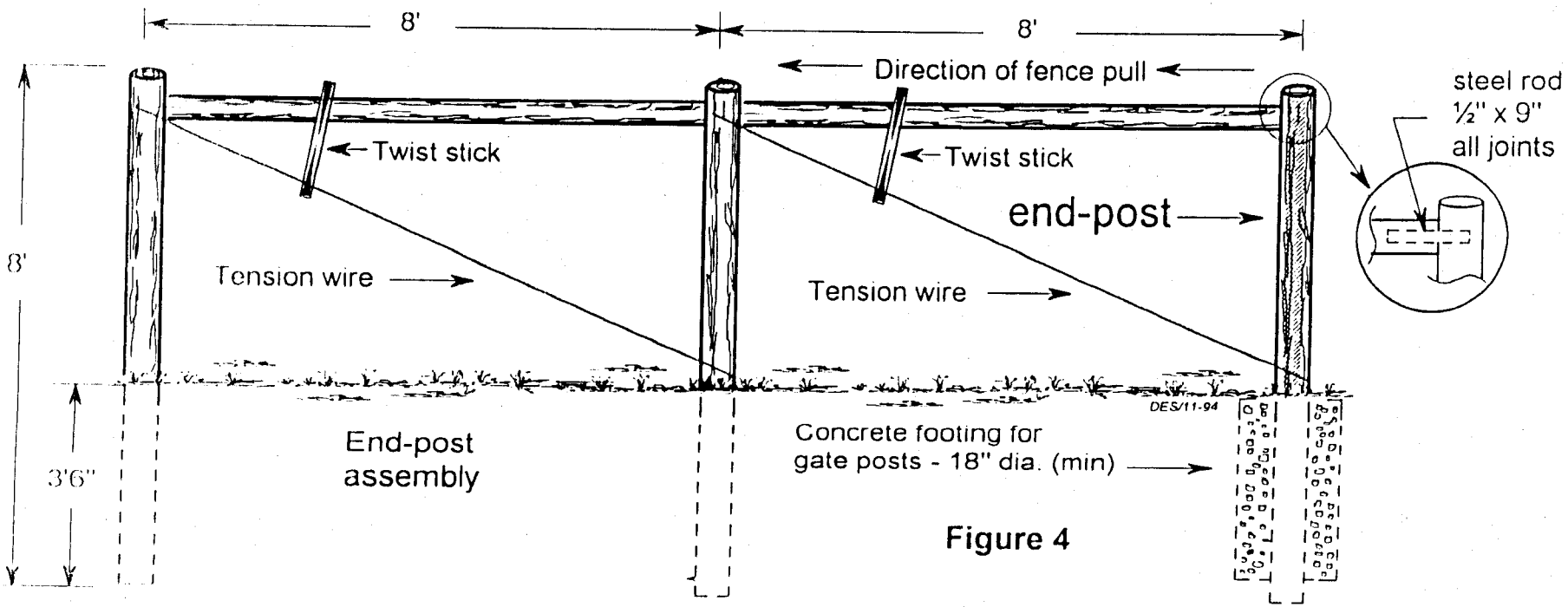


Figure 4

TECHNICAL SPECIFICATIONS
WOVEN WIRE FENCE

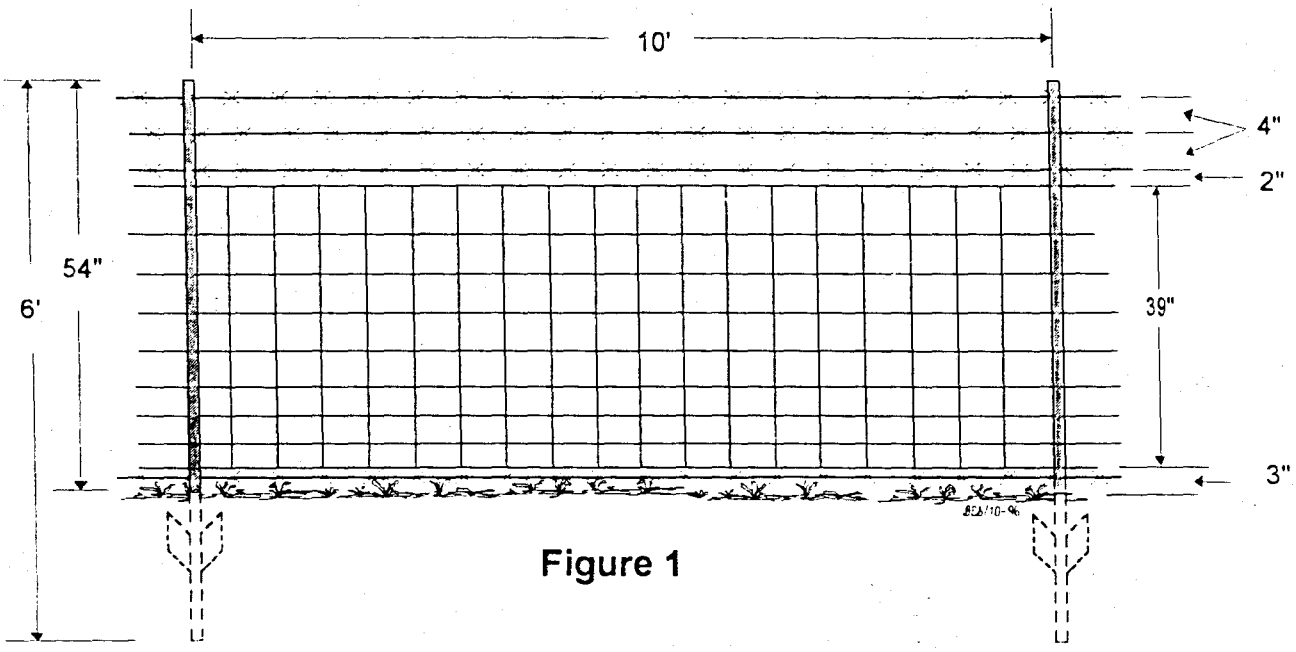


Figure 1

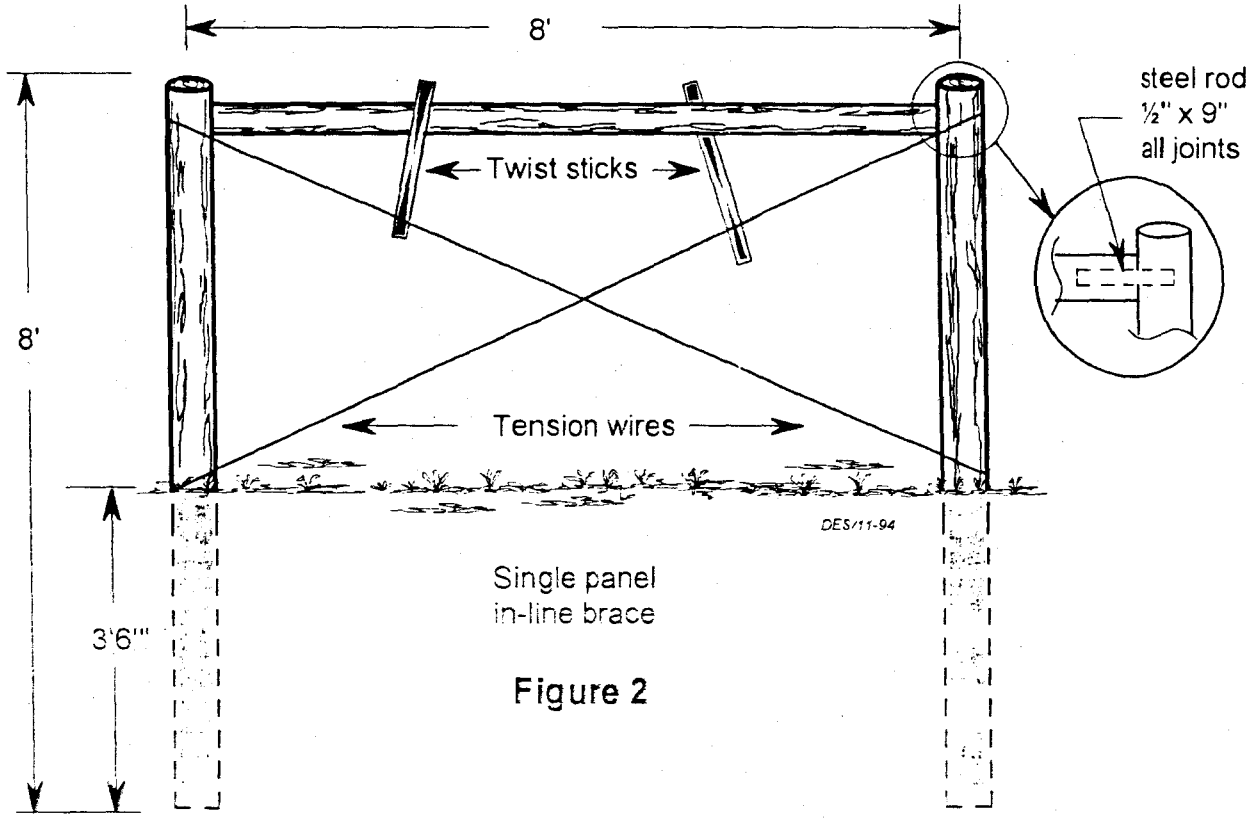
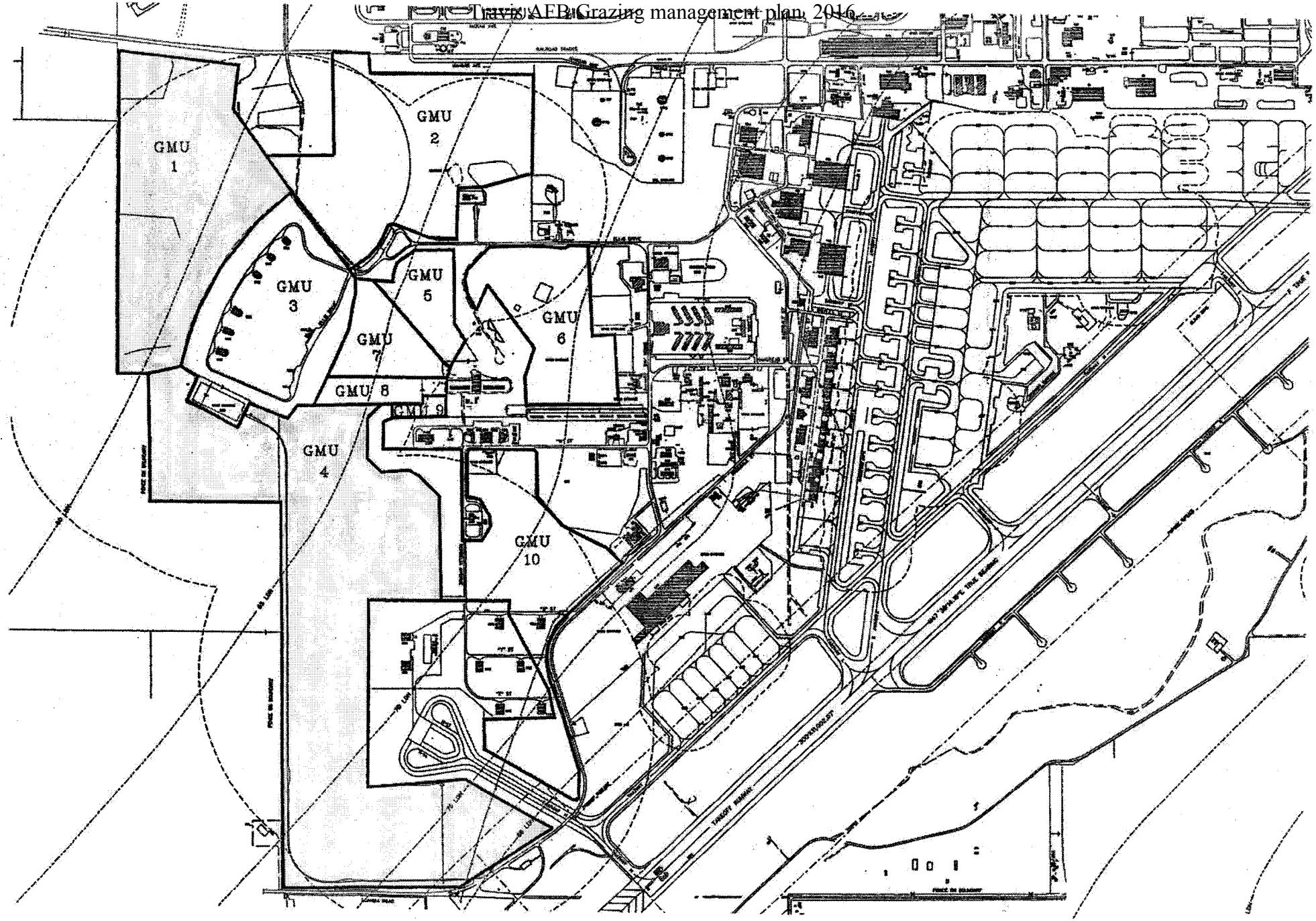


Figure 2


GMU 1
GMU 2
GMU 3
GMU 4
GMU 5
GMU 6
GMU 7
GMU 8
GMU 9
GMU 10

Appendix E: Travis Grazing Land Use Regulations, 2017 & 2016

Appendix E comprises the Grazing land use regulations (GLUR) for Travis Air Force Base, drafted in 2016 and revised in 2017. These GLURs will be appended to the 2017/2018 cattle grazing lease (see Grazing management plan, section 2).

GRAZING LAND USE REGULATIONS
Travis Air Force Base (AFB)
2017
FINAL 03/17/2017

Section 1. Grazing Land Use Regulations (GLUR), as required by AFI 32-7064 Section 10.2.4, are intended to provide guidance for multiple purpose use of military lands. Such purposes include military operations, domestic livestock grazing, wildlife habitat and other conservation values, and public recreation.

Section 2. Contact. The lessee[1] or her/his representative must maintain adequate contact, at least monthly, with the Natural Resources Manager (NRM) when livestock are on the installation. Each lessee shall submit contact information to the NRM upon signature of a grazing lease, on an annual basis, and when there are changes. In the event of an emergency involving livestock, the NRM must be able to contact the lessee at any time day or night by phone and e-mail. It is the lessee's responsibility to have in-place emergency procedures to control potential harm to property, the environment, and humans by livestock.

Section 3. Mission First. At Travis AFB, the primary use of military land is for activities directly associated with the Installation mission. Grazing operations on the Installation have been on-going for many years and have benefited the Installation with management of vernal pools, vegetative fuel load, and non-native species control.

a. The lessee is expected to conduct their operations in a manner which will not at any time interfere with military operations, which is the essential function at Travis AFB.
b. At any time there may be a directive to re-locate all livestock to a specific designated area or to be transported off the Installation. In the event that such a directive is given, the NRM will provide the lessee 24-hour notice. The lessee is expected to comply immediately.

Section 4. Routes. The lessee must consult, in writing, with the NRM on ingress and egress routes for transporting livestock on and off the Installation each year, if needed, to comply with Security Forces requirements. Approval from the NRM is required prior to deviating from any established ingress and egress routes. All livestock shall be transported through and off the Base by vehicle only; herding is prohibited outside of leased areas without prior NRM consent.

Section 5. Employee Conduct. The lessee and all associates are required to adhere to all Installations rules and regulations including speed limits, traffic control lights, signs, and restricted areas. All roads providing access to leased pastures are authorized for use.

Section 6. Sustainable Range Management. Sound range management includes the protection of range vegetation and soil from damage or destruction by heavy grazing, erosion, and noxious weed infestation and achieves goals outlined in the Travis Integrated Natural

[1] Lessee: Any person or group using rangelands on Travis AFB for the grazing or exercising of any livestock animals including cattle, sheep, goats, or horses.

Table 1						
Pasture[2]	**Acres**	**AUM**[34]	**Stocking Rate (AUM/ac)**	**Type of Livestock**	**Minimum RDM**[5] **(lbs/ac)**	**Maximum RDM (lbs/ac)**
Pasture 1	178	316.8	1.8	Cattle	500	900
Pasture 2	81	144.2	1.8	Cattle	500	900
Pasture 3	15	26.7	1.8	Cattle	500	900
Pasture 4	2	3.6	1.8	Cattle	500	900
Pasture 14*	107	148	1.4	Cattle	500	900
Totals	**383**	**639**				
Pasture 6	16	28.5	1.8	Horse	500	900
Pasture 7	13	23.1	1.8	Horse	500	900
Pasture 8	19	33.8	1.8	Horse	500	900
Pasture 9	15	26.7	1.8	Horse	500	900
Totals	**63**	**112**				
Pasture 10**	11	19.6	**1.8**	Cattle/Horse	500	900
Totals	**11**	**20**				
**Pasture 14 is new in 2017. Permits may not be in place for a 1 November 2017 start date. Lessee shall work closely with NRM to manage grazing once approved by NRM and will be subject to close monitoring and federal permits. See Section 6.b.iii and Section 9.* ***Pasture 10 has not been grazed for many years. Availability is subject to agreement between the Equestrian Center and Cattle Lessee. Area should be inspected closely before use – hazards exist.*						

[2] See Map on Page 9.

[3] The Scorecard method, developed by University of California rangeland scientists (McDougald et al. 1991; Standiford et al. 1999) was used to calculate AUMs. Two other commonly used methods of estimating forage production are the Range site method and the Ecological site method. Both methods use vegetation production estimates for different soil series under two to three rainfall scenarios (average, below average, and above average) developed by the USDA Natural Resources Conservation Service (NRCS) and its predecessor, the USDA Soil Conservation Service (SCS). Unfortunately, rangeland production estimates for the soil series in Travis' pastures are not available from the NRCS Web Soil Survey or from the SCS' Soil Survey of Solano County (Bates 1977). The Scorecard is an alternative method that estimates grazing capacity values based on a combination of average annual precipitation, slope, and woody cover (McDougald et al. 1991). All of the Travis pastures fall within a single category: canopy cover between 0-25% and slope less than 10% with annual rainfall between 10 and 40 inches. The estimated grazing capacity value for this category is 2 AUMs per acre. Adding McDougald et al. (1991)'s RDM allowance for that category of 400 lbs/acre results in a vegetation production estimate of 2,400 lbs/acre for all the Travis pastures.

[4] 1.0 Animal Unit (AU): Considered to be one mature cow of about 1,000 pounds (450 kg), either dry or with calf up to 6 months of age, or their equivalent, consuming about 26 pounds (12 kg) of forage/day on an oven-dry basis. 0.65 AU: one bovine weighing less than 600 pounds upon entry to the said premises and grazing for one month. Calves born during the grazing season are excluded from this definition and are included as a cow/calf pair (1 AU). 1.25 AU: one adult mature horse (approximately 1200 pounds). Animal Unit Month (AUM): One AU grazing for 30 days or the amount of oven-dry forage (forage demand) required by 1 AU for a standardized period of 30 animal-unit-days. Not synonymous with animal month. The term AUM is commonly used in three ways: (a) stocking rate, as in "X acres per AUM"; (b) forage allocations, as in "X AUMs in Allotment A"; (c) utilization, as in "X AUMs taken from Unit B." *Source: SRM 1998, Bush 2006*

[5] Residual dry matter (RDM) is a standard used by land management agencies for assessing the level of grazing use on annual rangeland. RDM is the old herbaceous plant material left standing or on the ground at the beginning of a new growing season. It indicates the combined effects of the previous season's forage production, breakdown over summer, and its consumption by grazing animals of all types. The standard assumes that the amount of RDM remaining in the fall, subject to site conditions and variations in weather, will influence subsequent plant species composition and forage production. *From: Bartolome et al. 2006. UCANR Publication # 8092.*

Resources Management Plan and Travis Grazing Management Plan (GMP) as required by AFI 32-7064 (Section 10.1.2). The NRM has responsibility for overseeing grazing. To ensure sound range management practices are employed, the following guidance is established:

a. Type of Livestock:
   i. All pastures may support cattle, sheep, goats, or horses. Livestock refers to any of these kinds of animals.

b. Grazing Regime: The grazing regime will be as follows although it may be adapted per the Travis GMP on an annual basis.
   i. Grazing Season: The cattle grazing season shall be from 01 November to 30 June. Horse pastures may be used year round.
   ii. Grazing Capacity: The authorized stocking rate[6] (Table 1) is **80 cows (cattle) on 383 acres for 8 months within pastures 1 – 4 and 14 and 9 horses on 63 acres for 12 months within pastures 6-9.** Pasture 10 may be available for cow or horse grazing when debris has been removed. Pastures 5, 11, 12, and 13 are horse turnouts. Pasture 14 has restrictions outlined below. The availability of forage and the general conditions of the range shall determine the number of AUMs permitted during each grazing season. The stated stocking rate and AUMs in Table 1 are rough estimates; lessees shall adhere to annual RDM targets in Table 1 as revised annually by the NRM.
   iii. Aero Club Pasture 14 Special Conditions: This pasture will be fenced in June 2017 and will be available for grazing once the applicable National Environmental Policy Act and Endangered Species Act Section 7 consultations have been completed. Pasture may not be ready for November 2017 grazing. The NRM will notify the Lessee when grazing can begin. The pasture includes a large population of endangered Contra Costa goldfields thus special grazing restrictions (timing, duration, intensity) may be warranted. A research study will take place using grazing exclosures to monitor impacts.
   iv. Residual Dry Matter Standard. The Air Force's objective is to manage livestock grazing on the annual rangelands to achieve **500 to 900 pound per acre** of residual dry matter (RDM) in October. RDM will be measured annually by the NRM, following University of California (UC) guidelines[7] (see Section 11 *Compliance*).
   v. Forage Availability. The Air Force does not guarantee or imply in any manner that the said premises will always have sufficient forage to sustain livestock grazing at 771 AUMs while achieving target RDM values during any portion or all of the specified grazing season. This is primarily due to the characteristic variability of California's Mediterranean climate. Forage production and availability fluctuate with abiotic factors including temperature, rainfall, and soil condition. Emergency

[6] Stocking Rate is the number of animal units per acre for a specified amount of time.

[7] Bartolome, James, William Frost, and Neil McDougald. 2006. Guidelines for Residual Dry Matter on Coastal and Foothill Rangelands in California. University of California Rangeland Monitoring Series Publication 8092. Available at: http://anrcatalog.ucanr.edu/pdf/8092.pdf.

curtailment of the grazing period may occur, upon the direction of the NRM or decision by the rancher if insufficient forage[8] is identified (Section 11 *Compliance*).

vi. Stocking Rate Adjustments: The NRM may reduce or extend the grazing season or increase or decrease the allowable use when conditions allow in consultation with the lessee. Adjustments to the grazing season or stocking rate are permissive only and nothing herein shall be constructed as obligating the NRM to change benchmarks outlined in these GLURs regardless of the availability of forage. If an AUM adjustment occurs as a result of reduction or extension of the grazing season, and any reduction in AUMs is due to abiotic drivers, annual rental fee may change as outlined in Section 7 *Adjustments to Rent*.

1. Allowable Stocking Rate Reduction. The allowable use may be reduced prior to the beginning of any grazing season or during the season by notifying the lessee of such reduction in writing. The annual rent for that year shall be computed per Section 8 *Adjustments to Rent*.
2. Stocking Rate Increase. The allowable stocking rate may be increased upon written request by the lessee, provided adequate forage is available to meet conservation goals (see Section 9 *Integrated Natural Resource Management*). Permission in writing must be granted by the NRM prior to the lessee exceeding the normal allowable use. Additional rent shall be due when use exceeds the normal stocking rate per Section 8 *Adjustments to Rent*.

vii. Livestock Distribution. Lessee shall optimize livestock distribution to minimize sacrifice areas and reduce overall fire hazard. Placement of livestock attractants (e.g. water, shade, salt blocks) shall be distributed to promote distribution and reduce gathering in sensitive wildlife areas (see Section 9 *Integrated Natural Resource Management*) or surfaced roadways. Placement of attractants shall be at least 200 meters (660 feet) from sensitive wildlife areas including vernal pools. Sheep bedding areas shall be used for less than 3 consecutive days and no more frequently than every 20 days.

viii. Supplemental Feeding. Feeding of protein, salt, minerals, or trace additives whether singly or in combination shall be allowed to supplement the animals' daily nutritional requirements. Feeding of grains, hay, silage, or similar feeds that constitute a major portion of the animals' total daily energy requirement shall not be allowed except by Equestrian Club members in horse turnout pastures or the horse stables. Short-term emergency feeding may be permitted in lieu of hardship or temporary removal of livestock, but only with the prior written permission of the NRM. Annual rental rates shall not be adjusted as lessee is expected to properly plan pasture forage use to avoid such emergency situations.

ix. Livestock Health. The lessee is obligated to comply with all federal, state, and local animal health laws and regulations with respect to livestock grazing on the leased premises, and upon request, shall furnish written evidence to this effect to the NRM (AFI32-110 Section 3.8). In accordance with Air Force Regulations, the

[8] Insufficient forage is defined here to mean available forage below 300 lbs/acre in horse pastures and below 500 lbs/acre in cattle pastures where continued grazing would be detrimental to resources (soil, water, vegetation, habitat value).

NRM reserves the right to impose quarantine, immunization, or other health requirements deemed necessary to prevent or control zoonotic diseases.

x. Livestock Identification. If the lessee claims two weight classes for cattle on monthly AUM reports (see Section 10 *Reporting Requirements*) one weight class will be identified with an ear tag or other visible marker.

xi. Working of Livestock. The lessee shall notify the NRM and Security Forces Squadron (Munitions) in advance of working (branding, sorting, weaning, etc.) livestock on the said premises. The NRM or lessee is authorized to invite other lessees and adjacent ranchers to be present at the time such work is being done for the purpose of reclaiming stray livestock.

xii. Stray Livestock. It is the lessee's responsibility to confine his or her livestock to the said premises and to facilitate the removal of strays coming from adjoining leases or private lands. The lessee shall determine how animals exited or entered the leased area and initiate corrective action immediately. Unconfined livestock have the potential to cause extensive damage to life and property due to pasture proximity to the active runway. Fences nearest the runway shall be checked weekly to ensure their sufficiency for containing livestock.

xiii. Dead Livestock: All dead livestock belonging to the lessee shall be properly removed and disposed of within 24-hours of initial discovery or notification by the NRM, and at the lessee's expense. No livestock remains shall be left that attract birds and wildlife, which pose a Bird Airstrike Hazard (BASH).

xiv. Predator / Pest Control: Any and all predator and pest control activities required to protect lessee property shall be discussed and approved by the NRM and Security Forces. Predator control activities are not expected; thus, if they are requested, adequate justification shall be provided. Ground squirrels and their burrows provide habitat for federally listed California tiger salamander and are important habitat features on the Installation (see Section 9 *Integrated Natural Resource Management*).

Section 7. Adjustments to Rent. Annual rent is computed by multiplying the AUMs expected per year with the AUM Rate. The AUM Rate is determined by the grazing lease for all pastures or supplemental agreements with the Force Support Squadron. Fees support lease compliance monitoring and other INRMP goals as determined by the NRM in accordance with AFI 32-7064 Section 10.7. Fee collection is required by AFI 32-7064 Section 10.2.2, AFI34-110 Section 3.8, and AFI32-9003 Section 5.1.2.

a. If the Lease/Real Property Agreement Administrator (LAA), in consultation with the NRM, determines that as the result of complying with written instructions from the NRM, (1) the total number of livestock permitted on the premises during the grazing season was insufficient for the lessee to obtain the stocking rate of 771 AUMs (or a reduction thereto made in accordance Section 6) by the end of the grazing season or (2) based on the usual and customary grazing practices for annual grasslands, the grazing season was not of sufficient length to permit the lessee to obtain the stocking rate of 771 AUMs (or a reduction thereto made in accordance Section 6) by the end of the grazing season, the lessee shall be entitled to a rental rebate. The amount of the rebate shall be determined by multiplying the number of AUMs grazed by the AUM rate and subtracting that from the amount paid.

b. The determination of the amount of any rebate and its payment shall be made after the end of the affected grazing season. The lessee shall have no claim of any

character against the United States or any officer, agent, or employee thereof for any cost or expense incurred for complying with instructions listed by LAA pursuant to the provisions of Section 6. Nothing herein shall be construed as abrogating the responsibilities of the lessee to pay rent as specified in these GLUR and Grazing Lease.

c. If the lessee exceeds the stocking rate with approval from the NRM and LAA, the lessee shall owe additional rent computed by multiplying those AUMs (in excess of the stocking rate or any adjustments thereto made in accordance with the Section 6) by the AUM Rate. If the lessee exceeds the stocking rate without approval by the NRM and LAA, the lessee shall owe additional rent computed by multiplying those AUMs (in excess of the stocking rate) by the AUM Rate plus a penalty as defined in the grazing lease.
d. Exceedance of stocking rate without approval by the NRM in two or more grazing seasons is grounds for cancellation of all future lease agreements.

Section 8. Maintenance. The lessee, at his or her own cost and expense, shall:

a. During the grazing season, perform routine maintenance and repair to maintain in a livestock-tight condition those fences and gates whose function is for the confinement of livestock to the said premises; except that, this condition shall not apply if the NRM determines such fences and gates have deteriorated to the point of unserviceability. Base boundary fences and gates are also excluded from this requirement. Upon termination of the lease all such property and materials becomes the property of the Government. All gates shall remain unlocked but secure.
b. During the grazing season, perform emergency repairs to fences and gates on the said premises that have been damaged or destroyed by accidents, vandalism, or forces of nature. Such repairs may be temporary but must be sufficient to confine livestock to the said premises. Repairs must be completed within 48 hours after notification or discovery. Failure of the lessee to perform repairs as directed is sufficient cause for the NRM to require removal of livestock from said premises until repairs are completed. The LAA may elect to negotiate a supplemental agreement for the permanent repair or replacement of damaged or destroyed fences or gates. Reasonable costs and expenses, as determined by the LAA and NRM incurred by the lessee for performing emergency repairs may be included in the supplemental agreement.
c. The United States shall repair facilities damaged by activities of the United States, its contractors or employees, and firefighting activities.
d. Insure proper clean-up of all areas used for livestock operation and dispose of refuse and debris generated as a result of various lease activities conducted on said premises to the satisfaction of the NRM.
e. Drain, clean, and refill watering troughs as needed or directed by the NRM.
f. Paved roadways within pastures shall be cleared of livestock residue four times per grazing season by the lessee or upon request.
g. Water for livestock is provided by the Air Force to the best of its ability in grazed pastures. The Air Force does not, however, guarantee that water will be available at all times at all locations and the lessee shall have no claim of any character on account thereof against the Air Force or any officer, agent, or employees thereof. Any water infrastructure needed for livestock that does not already occur on site, shall be the responsibility of the lessee. The lessee shall notify the NRM and the

Water System Maintenance Supervisor (Mr. James Medeiros (james.medeiros.11@us.af.mil, 707-424-3025) of any issues.

h. Maintain float valves in water troughs in an operating condition during the grazing season. All watering troughs that use the base water system shall include a backflow device.

i. If water features need to be moved or modified, contact the NRM to discuss and initiate proper permitting. The lessee may use any naturally occurring streams and ponds in their natural form only.

Section 9. Integrated Natural Resource Management: The lessee understands and agrees that the lessee's actions shall be consistent with the terms of the Sikes Act compliant Travis AFB Integrated Natural Resources Management Plan (INRMP) and Air Force Instructions 32-7064 which provide for functioning, sustainable ecological communities that integrate the interests and mission of the agencies charged with conservation, protection, and management in the public interest for the benefit of the military mission. Moreover, the Travis AFB Grazing Management Plan details sustainable grazing management practices and considerations with which all lessees are expected to comply. The NRM shall make these documents available at least 60 days prior to the grazing season on an annual basis.

a. Conservation Activities. At the discretion of the NRM, the Installation has the right to conduct conservation program activities which include, but are not limited to, fire control and prevention (including maintenance of 33 meter (100 foot) wide fire breaks) and chemical weed control on the leased premises. No reduction in rent will accrue if Travis AFB exercises its right to perform these activities. If prescribed fire activities or wildland fire occur, a reduction in rental may occur per Section 7 *Adjustments in Rent*.

a. Sensitive Wildlife Areas. Sensitive wildlife areas within pastures primarily include vernal pool wetlands. These are jurisdictional under the federal Clean Water Act (33 U.S.C. §1251–1387) and provide habitat and/or are occupied by species listed under the federal Endangered Species Act (ESA, 16 U.S.C. § 1531 et seq.). Use of such areas may be subject to an ESA Biological Opinion and special management provisions. No special provisions are currently identified though are expected for Pasture 14 and may change for other pastures with 72 hours' notice to lessees.

b. Noxious Weeds. The lessee is responsible for notifying the NRM of any new noxious weed populations observed by the lessee. If the lessee decides to eradicate un-wanted plant species on leased property by the application of herbicides, such action will require a written approval from the NRM in conjunction with the Installation Pest Management Coordinator (IPMC). Recent noxious weed information can be located in the Invasive Species Management Plan (15 September 2014). Lessee must have appropriate California herbicide application permits.

c. Medusahead & Forage Availability. Pasture 2 has high cover of medusahead, an annual invasive grass with limited palatability to cattle. Other pastures have significant cover of medusahead as well. Medusahead cover is likely to reduce available forage, livestock capacity, and livestock gains. Lessee and NRM shall try to work together to address this range productivity issue. Fire is a key tool that may limit pasture capacity in the year of burning.

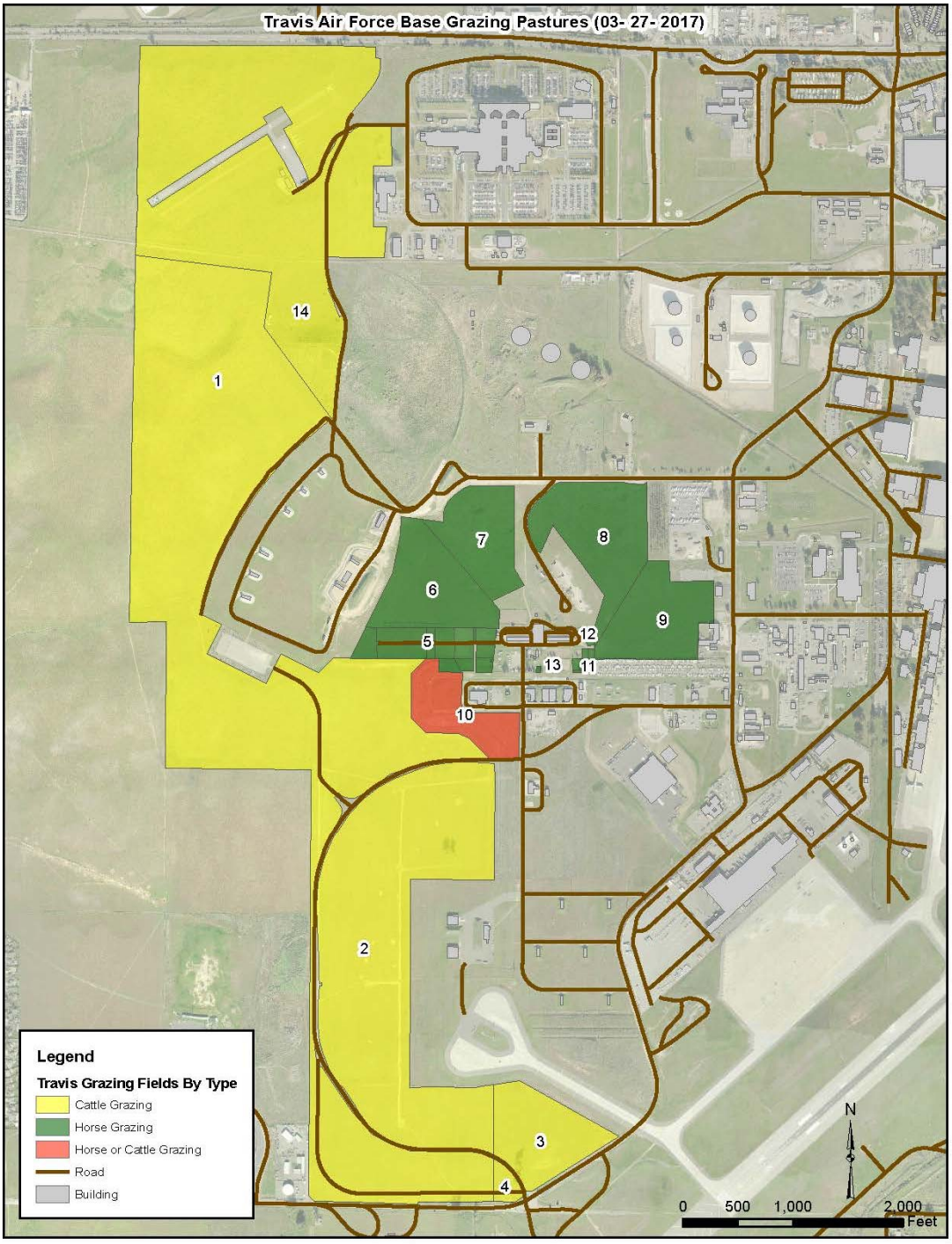
Section 10. Reporting Requirements.

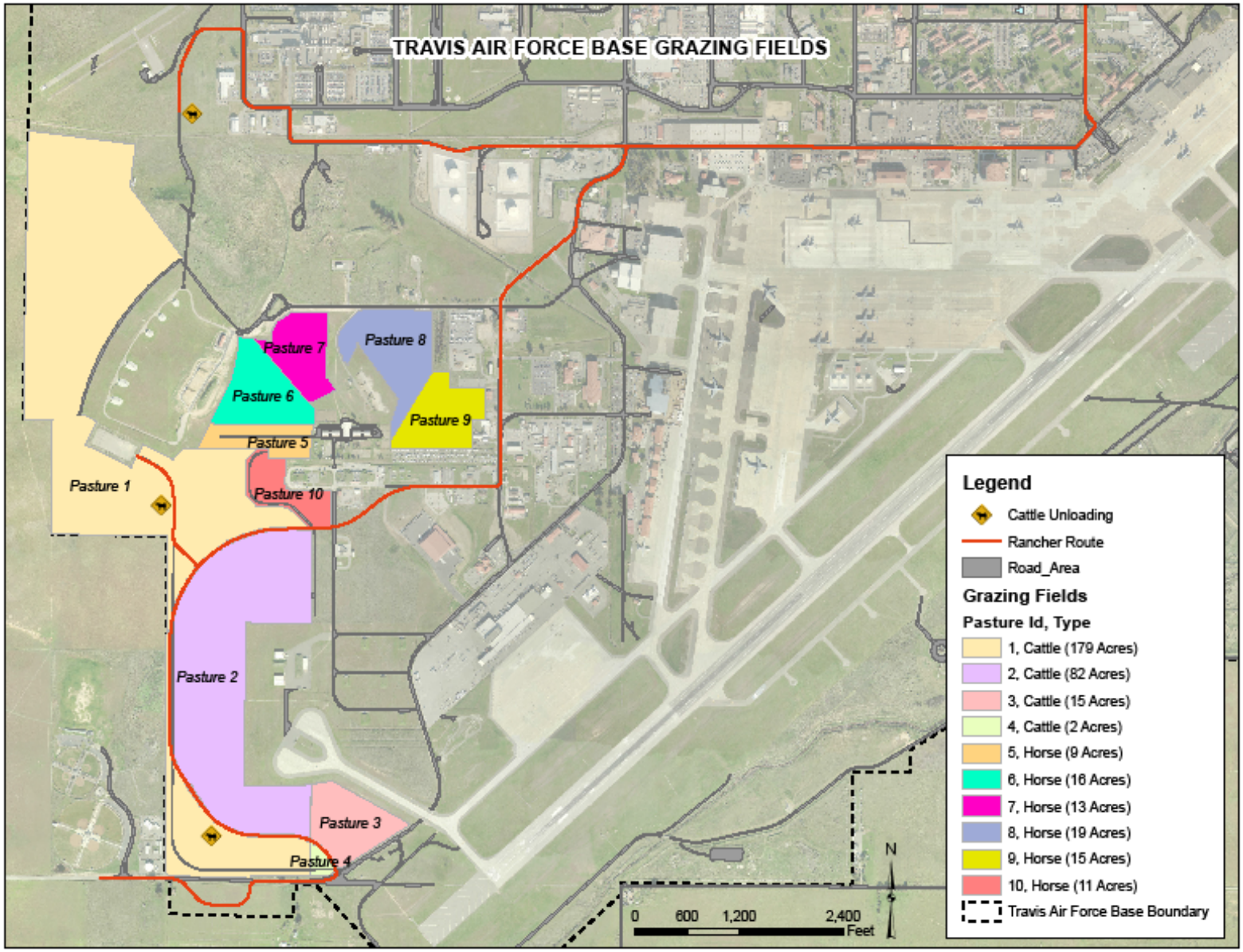
a. At the beginning of the grazing season, before 1 November, lessees shall submit an Annual Grazing Prescription Plan (Annual Plan). This plan shall be reviewed and revised as appropriate to receive approval by the NRM. The Annual Plan shall identify the predicted AUMs and the predicted pasture use schedule by month which are both subject to change based on forage availability; the arrival and departure dates of cattle; contingency plans for low forage availability measures taken to reduce water quality impacts; measures taken to reduce potential erosion issues; location of livestock attractants if any (e.g. mineral licks); any improvements planned for pasture infrastructure; and use of working dogs or horses.
b. The lessee is required to submit, under penalty of perjury, by the 10th day of each new month, a report enumerating the number of AUMs utilized during the previous month by pasture. This report is required even if there are no livestock on the premises starting 1 November until the last month's report states that all livestock have left Travis AFB for the season. The report shall specify how AUMs are computed. Report will be provided to the LAA and NRM via email.
c. Lessee shall notify the NRM and Security Forces Squadron prior to placing livestock on or removing livestock from Travis AFB.
d. Failure of lessee to comply with the reporting provisions in Section 10 shall constitute sufficient justification for the LAA, in consultation with the NRM, to order all livestock or horses to be gathered and counted. All resultant costs incurred by the Air Force, shall be paid by the lessee who shall have no claim of any character on account thereof against the Air Force or any officer, agent, or employee thereof.

Section 11. Compliance. Compliance with the GLUR shall be monitored by the NRM in conjunction with the Real Property Office and LAA by conducting monthly inspections. Additional monitoring, as outlined in the Grazing Management Plan, will ensure that sound range management practices outlined in these GLURs are a benefit to natural resources. Results of this monitoring will be integrated back into the GLURs and the Grazing Management Plan to provide adaptive management of the program.

a. Compliance Monitoring. All site visits conducted by the NRM shall be documented on the compliance checklist authorized under AFI 32-7064 Section 10.2.6. Copies of these reports shall be delivered to the Real Property Office, the LAA, and the lessee annually for final action and record keeping. If compliance issues are detected, reports shall be furnished to the lessee for immediate corrective action. Compliance checks will include a general inspection of pasture infrastructure, bare ground and soil erosion, number of livestock animals per pasture, grazing season compliance, and sufficient forage (RDM estimation).
b. Failure to Comply: Failure by a lessee to comply with the terms of this GLUR is grounds for immediate removal of livestock from Travis AFB pasture lands. The NRM shall document compliance violations and notify the lessee in writing. Lessee shall have 48 hours to correct compliance issues. If compliance is not achieved, lessee shall remove livestock from Travis AFB pastures. Return of livestock may occur only after documented violations have been corrected, the NRM has been notified in writing via a Corrective Action Report, and the NRM has confirmed corrective actions. If violations include RDM values below 300 pounds per acre, return during the current grazing season will not be possible. No rental rate adjustments will be granted. Failure to comply with the GLUR in two or more

grazing seasons is grounds for permanent termination of grazing rights on Travis AFB.




TRAVIS AIR FORCE BASE GRAZING FIELDS
Pasture 1
Pasture 2
Pasture 3
Pasture 4
Pasture 5
Pasture 6
Pasture 7
Pasture 8
Pasture 9
Pasture 10
Legend
Cattle Unloading
Rancher Route
Road_Area
Grazing Fields
Pasture Id, Type
1, Cattle (179 Acres)
2, Cattle (82 Acres)
3, Cattle (15 Acres)
4, Cattle (2 Acres)
5, Horse (9 Acres)
6, Horse (16 Acres)
7, Horse (13 Acres)
8, Horse (19 Acres)
9, Horse (15 Acres)
10, Horse (11 Acres)
Travis Air Force Base Boundary
N
0 600 1,200 2,400
Feet

GRAZING LAND USE REGULATIONS
Travis Air Force Base (AFB)
2016
FINAL 08/01/2016

Section 1. Grazing Land Use Regulations (GLUR), as required by AFI 32-7064 Section 10.2.4, are intended to provide guidance for multiple purpose use of military lands. Such purposes include military operations, domestic livestock grazing, wildlife habitat and other conservation values, and public recreation.

Section 2. Contact. The lessee[1] or her/his representative must maintain adequate contact, at least monthly, with the Natural Resources Manager (NRM) when livestock are on the installation. Each lessee shall submit contact information to the NRM upon signature of a grazing lease, on an annual basis, and when there are changes. In the event of an emergency involving livestock, the NRM must be able to contact the lessee at any time day or night by phone and e-mail. It is the lessee's responsibility to have in-place emergency procedures to control potential harm to property, the environment, and humans by livestock.

Section 3. Mission First. At Travis AFB, the primary use of military land is for activities directly associated with the Installation mission. Grazing operations on the Installation have been on-going for many years and have benefited the Installation with management of vernal pools, vegetative fuel load, and non-native species control.

a. The lessee is expected to conduct their operations in a manner which will not at any time interfere with military operations, which is the essential function at Travis AFB.
b. At any time there may be a directive to re-locate all livestock to a specific designated area or to be transported off the Installation. In the event that such a directive is given, the NRM will provide the lessee 24-hour notice. The lessee is expected to comply immediately.

Section 4. Routes. The lessee must consult, in writing, with the NRM on ingress and egress routes for transporting livestock on and off the Installation each year, if needed to comply with Security Forces requirements. Approval from the NRM is required prior to deviating from any established ingress and egress routes. All livestock shall be transported through and off the Base by vehicle only; herding is prohibited outside of leased areas without prior NRM consent.

Section 5. Employee Conduct. The lessee and all associates are required to adhere to all Installations rules and regulations including speed limits, traffic control lights, signs, and restricted areas. All roads providing access to leased pastures are authorized for use.

Section 6. Sustainable Range Management. Sound range management includes the protection of range vegetation and soil from damage or destruction by heavy grazing, erosion, and noxious weed infestation and achieves goals outlined in the Travis Integrated Natural

[1] Lessee: Any person or group using rangelands on Travis AFB for the grazing or exercising of any livestock animals including cattle, sheep, goats, or horses.

Table 1						
Pasture[2]	**Acres**	**AUM**[3][4]	**Stocking Rate (AUM/ac)**	**Type of Livestock**	**Minimum RDM**[5] **(lbs/ac)**	**Maximum RDM (lbs/ac)**
Pasture 1	179	340		Cattle	500	900
Pasture 2	82	156		Cattle	500	900
Pasture 3	15	29		Cattle	500	900
Pasture 4	2	4		Cattle	500	900
Totals	**278**	**529**	**1.9**	**Cattle**		
Pasture 5	9	19		Horse	300	900
Pasture 6	16	34		Horse	300	900
Pasture 7	13	27		Horse	300	900
Pasture 8	19	40		Horse	300	900
Pasture 9	15	31		Horse	300	900
Pasture 10	11	23		Cattle/Horse	300	900
Totals	**83**	**174**	**1.7**	**Horse**		

[2] See Map on Page 9.

[3] The Scorecard method, developed by University of California rangeland scientists (McDougald et al. 1991; Standiford et al. 1999) was used to calculate AUMs. Two other commonly used methods of estimating forage production are the Range site method and the Ecological site method. Both methods use vegetation production estimates for different soil series under two to three rainfall scenarios (average, below average, and above average) developed by the USDA Natural Resources Conservation Service (NRCS) and its predecessor, the USDA Soil Conservation Service (SCS). Unfortunately, rangeland production estimates for the soil series in Travis' pastures are not available from the NRCS Web Soil Survey or from the SCS' Soil Survey of Solano County (Bates 1977). The Scorecard is an alternative method that estimates grazing capacity values based on a combination of average annual precipitation, slope, and woody cover (McDougald et al. 1991). All of the Travis pastures fall within a single category: canopy cover between 0-25% and slope less than 10% with annual rainfall between 10 and 40 inches. The estimated grazing capacity value for this category is 2 AUMs per acre. Adding McDougald et al. (1991)'s RDM allowance for that category of 400 lbs/acre results in a vegetation production estimate of 2,400 lbs/acre for all the Travis pastures.

[4] 1.0 Animal Unit (AU): Considered to be one mature cow of about 1,000 pounds (450 kg), either dry or with calf up to 6 months of age, or their equivalent, consuming about 26 pounds (12 kg) of forage/day on an oven-dry basis. 0.65 AU: one bovine weighing less than 600 pounds upon entry to the said premises and grazing for one month. Calves born during the grazing season are excluded from this definition and are included as a cow/calf pair (1 AU). 1.25 AU: one adult mature horse (approximately 1200 pounds). Animal Unit Month (AUM): One AU grazing for 30 days or the amount of oven-dry forage (forage demand) required by 1 AU for a standardized period of 30 animal-unit-days. Not synonymous with animal month. The term AUM is commonly used in three ways: (a) stocking rate, as in "X acres per AUM"; (b) forage allocations, as in "X AUMs in Allotment A"; (c) utilization, as in "X AUMs taken from Unit B." *Source: SRM 1998, Bush 2006*

[5] Residual dry matter (RDM) is a standard used by land management agencies for assessing the level of grazing use on annual rangeland. RDM is the old herbaceous plant material left standing or on the ground at the beginning of a new growing season. It indicates the combined effects of the previous season's forage production, breakdown over summer, and its consumption by grazing animals of all types. The standard assumes that the amount of RDM remaining in the fall, subject to site conditions and variations in weather, will influence subsequent plant species composition and forage production. *From: Bartolome et al. 2006. UCANR Publication # 8092.*

Resources Management Plan and Travis Grazing Management Plan (GMP) as required by AFI 32-7064 (Section 10.1.2). The NRM has responsibility for overseeing grazing. To ensure sound range management practices are employed, the following guidance is established:

a. Type of Livestock:
   i. All pastures may support cattle, sheep, goats, or horses. Livestock refers to any of these kinds of animals.

b. Grazing Regime: The grazing regime will be as follows although it may be adapted per the Travis GMP on an annual basis.
   i. Grazing Season: The cattle grazing season shall be from 01 November to 30 June. Horse pastures may be used year round.
   ii. Grazing Capacity: The authorized stocking rate[6] (Table 1) is **66 cows (cattle) on 278 acres for 8 months within pastures 1-4 and 11.6 horses on 83 acres for 12 months within pastures 5-10.** The availability of forage and the general conditions of the range shall determine the number of AUMs permitted during each grazing season. The stated stocking rate and AUMs in Table 1 are rough estimates; lessees shall adhere to annual RDM targets in Table 1.
   iii. Residual Dry Matter Standard. The Air Force's objective is to manage livestock grazing on the annual rangelands to achieve **300 to 900 pound per acre** of residual dry matter (RDM) in October. RDM will be measured annually by the NRM, following University of California (UC) guidelines[7] (see Section 11 *Compliance*). Minimum RDM values of 300 pounds per acre for horse pastures are below UC guidelines; however, vernal pools appear to be functional and listed species continue to be present (recent surveys by J. Marty). Future surveys and research shall verify this RDM target is acceptable for vernal pool management.
   iv. Forage Availability. The Air Force does not guarantee or imply in any manner that the said premises will always have sufficient forage to sustain livestock grazing at 703 AUMs while achieving target RDM values during any portion or all of the specified grazing season. This is primarily due to the characteristic variability of California's Mediterranean climate. Forage production and availability fluctuate with abiotic factors including temperature, rainfall, and soil condition. Emergency curtailment of the grazing period may occur, upon the direction of the NRM or decision by the rancher if insufficient forage[8] is identified (Section 11 *Compliance*).
   v. Stocking Rate Adjustments: The NRM may reduce or extend the grazing season or increase or decrease the allowable use when conditions allow in consultation with the lessee. Adjustments to the grazing season or stocking rate are permissive only and nothing herein shall be constructed as obligating the NRM to change benchmarks outlined in these GLURs regardless of the availability of forage. If an AUM adjustment occurs as a result of reduction or extension of the grazing season, and any reduction in AUMs is due to abiotic drivers, annual rental fee may change as outlined in Section 7 *Adjustments to Rent*.

[6] Stocking Rate is the number of animal units per acre for a specified amount of time.

[7] Bartolome, James, William Frost, and Neil McDougald. 2006. Guidelines for Residual Dry Matter on Coastal and Foothill Rangelands in California. University of California Rangeland Monitoring Series Publication 8092. Available at: http://anrcatalog.ucanr.edu/pdf/8092.pdf.

[8] Insufficient forage is defined here to mean available forage below 300 lbs/acre in horse pastures and below 500 lbs/acre in cattle pastures where continued grazing would be detrimental to resources (soil, water, vegetation, habitat value).

1. Allowable Stocking Rate Reduction. The allowable use may be reduced prior to the beginning of any grazing season or during the season by notifying the lessee of such reduction in writing. The annual rent for that year shall be computed per Section 8 *Adjustments to Rent*.
2. Stocking Rate Increase. The allowable stocking rate may be increased upon written request by the lessee, provided adequate forage is available to meet conservation goals (see Section 9 *Integrated Natural Resource Management*). Permission in writing must be granted by the NRM prior to the lessee exceeding the normal allowable use. Additional rent shall be due when use exceeds the normal stocking rate per Section 8 *Adjustments to Rent*.

vi. Livestock Distribution. Lessee shall optimize livestock distribution to minimize sacrifice areas and reduce overall fire hazard. Placement of livestock attractants (e.g. water, shade, salt blocks) shall be distributed to promote distribution and reduce gathering in sensitive wildlife areas (see Section 9 *Integrated Natural Resource Management*) or surfaced roadways. Placement of attractants shall be at least 200 meters (660 feet) from sensitive wildlife areas including vernal pools. Sheep bedding areas shall be used for less than 3 consecutive days and no more frequently than every 20 days.

vii. Supplemental Feeding. Feeding of protein, salt, minerals, or trace additives whether singly or in combination shall be allowed to supplement the animals' daily nutritional requirements. Feeding of grains, hay, silage, or similar feeds that constitute a major portion of the animals' total daily energy requirement shall not be allowed except by the Equestrian Club lessee in Pasture 5 or the Horse Stables. Short-term emergency feeding may be permitted in lieu of hardship or temporary removal of livestock, but only with the prior written permission of the NRM. Annual rental rates shall not be adjusted as lessee is expected to properly plan pasture forage use to avoid such emergency situations.

viii. Livestock Health. The lessee is obligated to comply with all federal, state, and local animal health laws and regulations with respect to livestock grazing on the leased premises, and upon request, shall furnish written evidence to this effect to the NRM (AFI32-110 Section 3.8). In accordance with Air Force Regulations, the NRM reserves the right to impose quarantine, immunization, or other health requirements deemed necessary to prevent or control zoonotic diseases.

ix. Livestock Identification. If the lessee claims two weight classes for cattle on monthly AUM reports (see Section 10 *Reporting Requirements*) one weight class will be identified with an ear tag or other visible marker.

x. Working of Livestock. The lessee shall notify the NRM and Security Forces Squadron (Munitions) in advance of working (branding, sorting, weaning, etc.) livestock on the said premises. The NRM or lessee is authorized to invite other lessees and adjacent ranchers to be present at the time such work is being done for the purpose of reclaiming stray livestock.

xi. Stray Livestock. It is the lessee's responsibility to confine his or her livestock to the said premises and to facilitate the removal of strays coming from adjoining leases or private lands. The lessee shall determine how animals exited or entered the leased area and initiate corrective action immediately. Unconfined livestock have the potential to cause extensive damage to life and property due to pasture

proximity to the active runway. Fences nearest the runway shall be checked weekly to ensure their sufficiency for containing livestock.

xii. Dead Livestock: All dead livestock belonging to the lessee shall be properly removed and disposed of within 24-hours of initial discovery or notification by the NRM, and at the lessee's expense. No livestock remains shall be left that attract birds and wildlife, which pose a Bird Airstrike Hazard (BASH).

xiii. Predator / Pest Control: Any and all predator and pest control activities required to protect lessee property shall be discussed and approved by the NRM and Security Forces. Predator control activities are not expected; thus, if they are requested, adequate justification shall be provided. Ground squirrels and their burrows provide habitat for federally listed California tiger salamander and are important habitat features on the Installation (see Section 9 *Integrated Natural Resource Management*).

Section 7. Adjustments to Rent. Annual rent is computed by multiplying the AUMs expected per year with the AUM Rate. The AUM Rate is determined by the grazing lease for all pastures or supplemental agreements with the Force Support Squadron. Fees support lease compliance monitoring and other INRMP goals as determined by the NRM in accordance with AFI 32-7064 Section 10.7. Fee collection is required by AFI 32-7064 Section 10.2.2, AFI34-110 Section 3.8, and AFI32-9003 Section 5.1.2.

a. If the Lease/Real Property Agreement Administrator (LAA), in consultation with the NRM, determines that as the result of complying with written instructions from the NRM, (1) the total number of livestock permitted on the premises during the grazing season was insufficient for the lessee to obtain the stocking rate of 703 AUMs (or a reduction thereto made in accordance Section 6) by the end of the grazing season or (2) based on the usual and customary grazing practices for annual grasslands, the grazing season was not of sufficient length to permit the lessee to obtain the stocking rate of 703 AUMs (or a reduction thereto made in accordance Section 6) by the end of the grazing season, the lessee shall be entitled to a rental rebate. The amount of the rebate shall be determined by multiplying the number of AUMs grazed by the AUM rate and subtracting that from the amount paid.

b. The determination of the amount of any rebate and its payment shall be made after the end of the affected grazing season. The lessee shall have no claim of any character against the United States or any officer, agent, or employee thereof for any cost or expense incurred for complying with instructions listed by LAA pursuant to the provisions of Section 6. Nothing herein shall be construed as abrogating the responsibilities of the lessee to pay rent as specified in these GLUR and Grazing Lease.

c. If the lessee exceeds the stocking rate with approval from the NRM and LAA, the lessee shall owe additional rent computed by multiplying those AUMs (in excess of the stocking rate or any adjustments thereto made in accordance with the Section 6) by the AUM Rate. If the lessee exceeds the stocking rate without approval by the NRM and LAA, the lessee shall owe additional rent computed by multiplying those AUMs (in excess of the stocking rate) by the AUM Rate plus a penalty as defined in the grazing lease.

d. Exceedance of stocking rate without approval by the NRM in two or more grazing seasons is grounds for cancellation of all future lease agreements.

Section 8. Maintenance. The lessee, at his or her own cost and expense, shall:

a. During the grazing season, perform routine maintenance and repair to maintain in a livestock-tight condition those fences and gates whose function is for the confinement of livestock to the said premises; except that, this condition shall not apply if the NRM determines such fences and gates have deteriorated to the point of unserviceability. Base boundary fences and gates are also excluded from this requirement. Upon termination of the lease all such property and materials becomes the property of the Government. All gates shall remain unlocked but secure.

b. During the grazing season, perform emergency repairs to fences and gates on the said premises that have been damaged or destroyed by accidents, vandalism, or forces of nature. Such repairs may be temporary but must be sufficient to confine livestock to the said premises. Repairs must be completed within 48 hours after notification or discovery. Failure of the lessee to perform repairs as directed is sufficient cause for the NRM to require removal of livestock from said premises until repairs are completed. The LAA may elect to negotiate a supplemental agreement for the permanent repair or replacement of damaged or destroyed fences or gates. Reasonable costs and expenses, as determined by the LAA and NRM incurred by the lessee for performing emergency repairs may be included in the supplemental agreement.

c. The United States shall repair facilities damaged by activities of the United States, its contractors or employees, and firefighting activities.

d. Insure proper clean-up of all areas used for livestock operation and dispose of refuse and debris generated as a result of various lease activities conducted on said premises to the satisfaction of the NRM.

e. Drain, clean, and refill watering troughs as needed or directed by the NRM.

f. Paved roadways within pastures shall be cleared of livestock residue four times per grazing season by the lessee or upon request.

g. Water for livestock is provided by the Air Force to the best of its ability in grazed pastures. The Air Force does not, however, guarantee that water will be available at all times at all locations and the lessee shall have no claim of any character on account thereof against the Air Force or any officer, agent, or employees thereof. Any water infrastructure needed for livestock that does not already occur on site, shall be the responsibility of the lessee. The lessee shall notify the NRM and the Water System Maintenance Supervisor (Mr. James Medeiros (james.medeiros.11@us.af.mil, 707-424-3025) of any issues.

h. Maintain float valves in water troughs in an operating condition during the grazing season. All watering troughs that use the base water system shall include a backflow device.

i. If water features need to be moved or modified, contact the NRM to discuss and initiate proper permitting. The lessee may use any naturally occurring streams and ponds in their natural form only.

Section 9. Integrated Natural Resource Management: The lessee understands and agrees that the lessee's actions shall be consistent with the terms of the Sikes Act compliant Travis AFB Integrated Natural Resources Management Plan (INRMP) and Air Force Instructions 32-7064 which provide for functioning, sustainable ecological communities that integrate the interests and mission of the agencies charged with conservation, protection, and management in the public interest for the benefit of the military mission. Moreover, the

Travis AFB Grazing Management Plan details sustainable grazing management practices and considerations with which all lessees are expected to comply. The NRM shall make these documents available at least 60 days prior to the grazing season on an annual basis.

a. Conservation Activities. At the discretion of the NRM, the Installation has the right to conduct conservation program activities which include, but are not limited to, fire control and prevention (including maintenance of 33 meter (100 foot) wide fire breaks) and chemical weed control on the leased premises. No reduction in rent will accrue if Travis AFB exercises its right to perform these activities. If prescribed fire activities or wildland fire occur, a reduction in rental may occur per Section 7 *Adjustments in Rent*.

a. Sensitive Wildlife Areas. Sensitive wildlife areas within pastures primarily include vernal pool wetlands. These are jurisdictional under the federal Clean Water Act (33 U.S.C. §1251–1387) and provide habitat and/or are occupied by species listed under the federal Endangered Species Act (ESA, 16 U.S.C. § 1531 et seq.). Use of such areas may be subject to an ESA Biological Opinion and special management provisions. No special provisions are currently identified though this is subject to change with 72 hours' notice to lessees.

b. Noxious Weeds. The lessee is responsible for notifying the NRM of any new noxious weed populations observed by the lessee. If the lessee decides to eradicate un-wanted plant species on leased property by the application of herbicides, such action will require a written approval from the NRM in conjunction with the Installation Pest Management Coordinator (IPMC). Recent noxious weed information can be located in the Invasive Species Management Plan (15 September 2014).

Section 10. Reporting Requirements.

a. At the beginning of the grazing season, before 1 November, lessees shall submit an Annual Grazing Prescription Plan (Annual Plan). This plan shall be reviewed and revised as appropriate to receive approval by the NRM. The Annual Plan shall identify the predicted AUMs and the predicted pasture use schedule by month which are both subject to change based on forage availability; the arrival and departure dates of cattle; contingency plans for low forage availability measures taken to reduce water quality impacts; measures taken to reduce potential erosion issues; location of livestock attractants if any (e.g. mineral licks); any improvements planned for pasture infrastructure; and use of working dogs or horses.

b. The lessee is required to submit, under penalty of perjury, by the 10th day of each new month, a report enumerating the number of AUMs utilized during the previous month by pasture. This report is required even if there are no livestock on the premises starting 1 November until the last month's report states that all livestock have left Travis AFB for the season. The report shall specify how AUMs are computed. Report will be provided to the LAA and NRM via email.

c. Lessee shall notify the NRM and Security Forces Squadron prior to placing livestock on or removing livestock from Travis AFB.

d. Failure of lessee to comply with the reporting provisions in Section 10 shall constitute sufficient justification for the LAA, in consultation with the NRM, to order all livestock or horses to be gathered and counted. All resultant costs incurred

by the Air Force, shall be paid by the lessee who shall have no claim of any character on account thereof against the Air Force or any officer, agent, or employee thereof.

Section 11. Compliance. Compliance with the GLUR shall be monitored by the NRM in conjunction with the Real Property Office and LAA by conducting monthly inspections. Additional monitoring, as outlined in the Grazing Management Plan, will ensure that sound range management practices outlined in these GLURs are a benefit to natural resources. Results of this monitoring will be integrated back into the GLURs and the Grazing Management Plan to provide adaptive management of the program.

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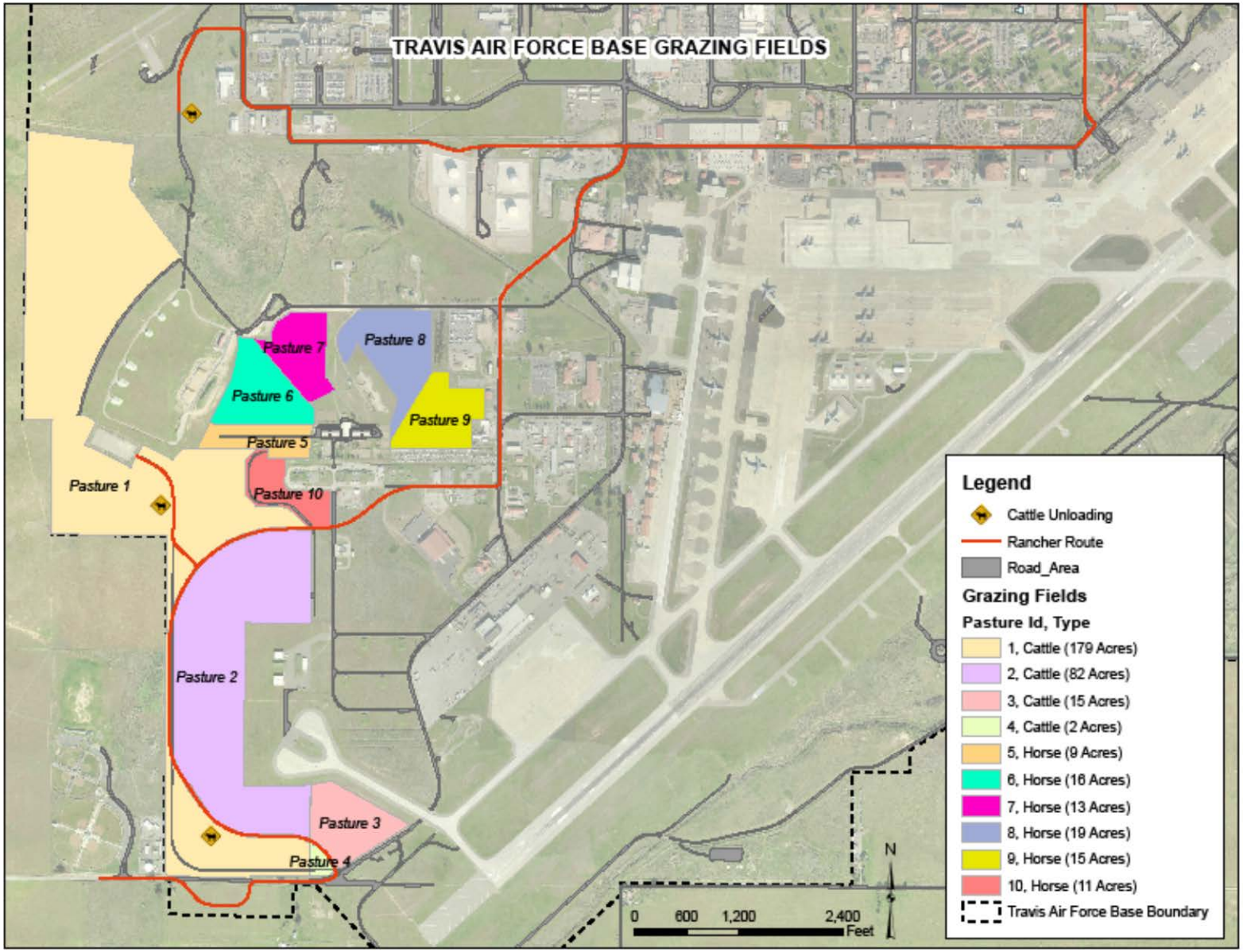
b. Failure to Comply: Failure by a lessee to comply with the terms of this GLUR is grounds for immediate removal of livestock from Travis AFB pasture lands. The NRM shall document compliance violations and notify the lessee in writing. Lessee shall have 48 hours to correct compliance issues. If compliance is not achieved, lessee shall remove livestock from Travis AFB pastures. Return of livestock may occur only after documented violations have been corrected, the NRM has been notified in writing via a Corrective Action Report, and the NRM has confirmed corrective actions. If violations include RDM values below 300 pounds per acre, return during the current grazing season will not be possible. No rental rate adjustments will be granted. Failure to comply with the GLUR in two or more grazing seasons is grounds for permanent termination of grazing rights on Travis AFB.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Pasture 9
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Rancher Route
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Pasture Id, Type
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9, Horse (15 Acres)
10, Horse (11 Acres)
Travis Air Force Base Boundary
N
0 600 1,200 2,400
Feet

FOUO ADDENDUM

Contact Information:

a. Natural Resource Manager: Mr. Penn Craig, 60 CES/CEIEC, Office 707-424-8354, Cell 707-631-7165, penn.craig@us.af.mil.
b. Rancher: Mr. William (Bill) Traylor, jvangus@att.net.;Home (530) 795-2161, Cell (530) 304-2811,
c. Recreation Management Programs: Ms. Sonja Hunt, 60 FSS/FSCO, 707-424-5049, sonja.hunt@us.af.mil.
d. Travis Equestrian Club: TBD.

Historical AUM Rates & Penalty Fees

The historical AUM Rate was determined by dividing the annual rent, as set forth in the original 2004 lease, by the 2004 carrying capacity. Original 2004 lease rates were $6,104 for 280 AUMs on unknown acreage or $21.80 per AUM.

Historically, if the lessee exceeded the carrying capacity without approval by the NRM and LAA, the lessee would owe additional rent computed by multiplying those AUMs (in excess of the stocking rate) by the sum of the AUM Rate plus $1.25.

Appendix F: Memorandum regarding license to operate an Equestrian Center at Travis AFB, 1996; and Travis Air Force Base Instruction 34-201 – Managing nonappropriated funds, Travis Equestrian Center, 2011

Appendix F comprises two documents pertaining to the Travis Equestrian Center. The first is a Department of the Air Force memorandum from 1996 determining that the Equestrian Center does not require a license to operate. The second is the 2011 Travis AFB Instruction that governs the operations of the Equestrian Center.

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR MOBILITY COMMAND (AMC)

CER
CE
info

Keep for policy

08 FEB 1996

MEMORANDUM FOR 60 SPTG/CC

FROM: HQ AMC/CEP
507 A Street
Scott AFB IL 62225-5022

SUBJECT: License for MWR to Operate an Equestrian Center at Travis AFB CA
(Your memo, 2 Jan 96)

1. We staffed the subject license to HQ AMC/JAQ for review and comments. The Command Legal Office determined a real estate license is not necessary for this action (memo attached). We faxed the license and attached memo to Air Force Real Estate (AFREA/MI) and they concur with the AMC/JAQ assessment.

2. Private use such as stabling and grazing of horses on Government property does not receive appropriated or nonappropriated support. Regardless of reimbursement to the Air Force for such uses, AFI 32-9003 paragraph 5.1.2 still does not require issuance of a real estate license either to the Riding Club or its Club members.

3. Recommend your base establish conditions of use of base property for equine recreation through local directives and agreements.

4. If the members of your staff have any questions, please have them call our POC, Frances Varner, at DSN 576-5043 ext 424.

Wm Randall Floyd

WM. RANDALL FLOYD, Lt Col, USAF
Actg Chief, Planning and Programming Division
Directorate of Civil Engineering

Attachment:
HQ AMC/JAQ Memo, 2 Feb 96

Post-it® Fax Note 7671	Date 9/2/96	# of pages ▶ 2
To Barbara White	From Frances Varner	
Co./Dept. 60SPTG/CERR	Co. HQ AMC/CEPE	
Phone # 837-4362	Phone # 576-5043 ext 424	
Fax # 837-2948	Fax # 576-3140	

TRAVISAFBI34-201

BY ORDER OF THE COMMANDER TRAVIS AIR FORCE BASE

TRAVIS AIR FORCE BASE INSTRUCTION 34-201

16 NOVEMBER 2011

MANAGING NONAPPROPRIATED FUNDS

TRAVIS EQUESTRIAN CENTER

COMPLIANCE WITH THIS PUBLICATION IS MANDATORY

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RELEASABILITY: There are no releasability restrictions on this publication.

OPR: 60 FSS/CD

Certified by: 60 FSS/CC (E. Jonelle Eychner, Maj, USAF)

Supersedes: SUP1 TO AIR FORCE INSTRUCTION 34-242

Pages: 10

This Operating Instruction (OI) implements Air Force Policy Direction (AFPD) 34-2, *Managing Nonappropriated Funds*. provides local governing policies and procedures for the Travis Equestrian Center (TEC), located on Travis Air Force Base. It is intended to set the guidelines and operating parameters of the TEC. All policies and procedures set forth in this OI will be strictly followed. Any member not following the policies and procedures outlined in this document will not be allowed to use the facility and their membership will be cancelled. The use of this facility is a privilege and not a right, and active membership involvement is vital to maintain the quality of the facilities for all. This instruction applies to all members authorized to reside at the TEC in compliance with compliance with Air Force Instruction (AFI) 34-262, *Services Programs and Use Eligibility*.

SUMMARY OF CHANGES

This document has been substantially revised and must be completely reviewed. Major changes include: this instruction has been re-written to incorporate new Travis Air Force Base (AFB) policies.

VIOLATIONS/COMPAINTS/DISCIPLINARY ACTIONS POLICY

The Travis Equestrian Center (TEC), located on Travis Air Force Base, is designed to foster a safe and positive environment for all members and their guests.

If a TEC member observes a violation of the instructions, the alleged violation and the name of the alleged violator(s) will be submitted in writing to the TEC Advisory Board President (ABP) by placing the complaint in the TEC Advisory Board (AB) box or handing it directly to an AB member. The TEC-AB members will then address and resolve the complaint. If the complaint cannot be resolved by the TEC-AB it will be forwarded to the 60th FSS/CC appointed liaison. If the proposed course of action is termination of the membership of the alleged violator, the final determination for immediate revocation of all membership privileges will be made by the 60th FSS/CC. Any damage to personal property caused by a member or a member's equine is the responsibility of the member for reimbursement.

REFERENCES

1.1. AFI 34-262, *Services and Use Eligibility,* and AFI 48-131, *Veterinary Health Services.*

CLUB MEMBER IDENTIFICATION AND PERSONAL INFORMATION POLICY

2.1 Club members (Regular and Associate) will provide evidence of eligibility to the TEC-AB for themselves and their authorized family members at the time of their application submittal.
2.2 If there is any change in a members status (ie., member separates or retires) or that of any family member, the sponsor will notify the TEC-AB immediately to determine continued Equestrian Center privileges.
2.3 To protect the personal information of all the members, at no time will any person or entity connected to the Travis Equestrian Center, be allowed to give out personal membership information without the written consent of the individual member.

EQUINE INDENTIFICATION POLICY

3.1 The Health Secretary will maintain a data sheet on each equine stabled at the Equestrian Center.
3.2 Each data sheet will include the owners name and address, home/work phone number, shot record and emergency care provider's name and phone number when applicable.
3.3 Each stall door will have the following information posted by the member (Information must remain current)
-Equine's name.
-Members name, home phone, work phone and cell phone number.
-Veterinarian's name and phone number.
-Emergency care provider's name and number, when applicable.

FORM OF MANGEMENT

4.1 The Travis Equestrian Center, located on Travis Air Force Base, is a business activity under the direction of the 60 FSS/CC. All policies and procedures are at their direction. Day-to-day business operations are handled by the 60th FSS/CC appointed liaison.
4.2 The TEC-AB, elected by the membership, and the 60th FSS/CC appointed liaison will work closely together to ensure the day-to-day operations meet the guidelines of the OI and all applicable Air Force Instructions (AFI's)

ADVISORY COMMITTEE

5.1 The TEC-AB will consist of a President, Vice President, Secretary/Resource Custodian, Health Secretary, Safety Officer, and two Workday Coordinators. Each Advisory Board

member will serve a one-year term. In the event that an individual cannot complete their term, the position may be temporarily filled by a member selected by the board until the next election.

5.2 Definitions of duties of Advisory Board members:

5.2.1 **President:** The President is the primary liaison between the entire membership and the 60th FSS/CC. Duties include, but are not limited to: ensuring a safe environment for all the members, ensuring OI compliance by the membership, and assisting with the resolution of problems or member complaints. The President chairs monthly membership meetings.

5.2.2 **Vice President:** The Vice President will assist the president in carrying out all duties and will act on the president's behalf in the absence of the president. The vice president will be the point of contact for all sub-committees to include Shows, clinics, and all arena scheduling. The Vice President will track all regular and associate membership and provide a roster of members on a bi-annual basis (twice yearly). The Vice President will assist other officers in ensuring all other actions and responsibilities are properly carried out.

5.2.3 **Health Secretary:** The Health Secretary is responsible for maintaining the health records on all equines stabled at the Travis Equestrian Center and for those associate members who bring their equine to the TEC. The health secretary maintains the stall waiting/request list, quarantine schedule and works with the vice president to update the regular membership roster. The Health Secretary works with 60th FSS/CC liaison at outdoor recreation by providing a billing summary on a monthly basis. The Health Secretary insures all shot clinics are scheduled and acts as the primary liaison between the Base Veterinarian and the Equestrian Center.

5.2.4 **Safety Officer:** The Safety Officer, along with the President and Vice President, will be responsible for the membership adherence to all safety guidelines set forth in the OI. The safety officer conducts periodic safety inspections of the Equestrian Center. The safety officer coordinates with the 60th FSS Safety and Environmental to insure compliance of fire and ground safety practices and will maintain records of all members qualified to operate Equestrian Center NAF equipment.

5.2.5 **Workday Coordinator** (one per barn): The workday coordinators work together and are responsible for coordination of workday projects needed to ensure the TEC grounds and facilities are properly maintained and in good working order. The workday coordinators provide the status of workday participation/non-participation on a monthly basis at the General membership meeting and pass the names of those not regularly participating during workdays to the President and the billing official. The workday coordinators provide the upcoming workday project(s) at the board meeting prior to the workday. The workday coordinators coordinate with the 60th FSS/CC liaison and the resource custodian for any material purchase or equipment rentals needed to perform workday projects.

5.3 Nominations for the Advisory Board members will be taken at the May membership meeting. Voting will be conducted at the June membership meeting. The AB will administer the election and tabulate the results. Ballots will be available two weeks prior to the June membership meeting. Those unable to attend the meeting and who desire to vote must submit their ballot to the board no later than 24 hours prior to the election.

TYPES OF MEMBERSHIP

6.1 **Regular Membership**: Extended to those personnel stabling equines at the Equestrian Center. Eligible members are defined in AFI 34-262.

6.2 **Associate Membership**: Extended to those who are eligible for regular membership but who do not have an equine stabled at the Equestrian Center. An Associate Member:
-May ride another member's equine with that member's permission
-May care for another member's equine with that members' permission
-May participate in facility activities
-May not be a member of the Advisory Committee
-May bring personal equine on Travis AFB
-Does not have voting privileges

MEMBERSHIP MEETINGS AND MEMBER WORKDAY POLICY

7.1 The Advisory Board will conduct the meeting and the Secretary will ensure and agenda is available at each meeting. Meeting minutes will be available for review at the next membership meeting.
7.2 Monthly membership meeting /workdays are scheduled for the first Saturday of each month from 0900-1400 (9 AM until 2 PM local time) unless otherwise indicated by the TEC-AB President. A yearly schedule will be posted by 30 July and updated as needed. The monthly membership meeting will be from 0900-1000. Meetings are normally held on the second weekend if the Friday or Monday before/after the first weekend is a federal holiday.
7.2.1 Members will not ride or work horses until after workday is done. 1000-1400 are the normal workday hours.
7.3 It is mandatory that every member attend a minimum of one meeting every quarter. Two quarters of missed meetings may result in the loss of membership. A valid written notice to the TEC-AB may excuse missing a meeting.
7.4 Membership participation is mandatory for workday unless prior coordination with the board is made. Failure to do so will result in a $50 per stall fee.
7.5 Make-up sessions must be completed prior to the 25th of each month due to outdoor recreation billing procedures. Coordinate the make-up session with the workday coordinators or a TEC-AB member prior to completing the session.
7.5.1 Each member will be required to perform a minimum of two work days or make-up sessions per calendar year to be considered an active member. TDYs and deployments over 30 days will be credited if accompanied by a copy of orders. Other extenuation situations, presented in writing, that prevent the member from complying will be considered by the TEC-AB.
7.6 A member who is TDY/Deployed in excess of 30 days will be excused from the workdays missed during the TDY/Deployed period. A copy of the orders must be provided to the workday coordinator as soon as possible. We strongly encourage the member's family to come to a meeting, as this is where you will get updated on information about the TEC.
7.7 Annual cleaning of both A and B barns will be accomplished during the June and July workdays. It will include but not be limited to the following:
-Pressure wash the outside/inside of barns
-Fixing fly spray nozzles and hoses (if needed)
-Cleaning light fixtures
-Cleaning gutters
-Leveling main barn aisles

SAFETY

8.1 All patrons associated with the TEC must follow all safety procedures when using the facilities and equipment of the TEC.
8.2 There will be no smoking on the Equestrian Center grounds except on the Clubhouse patio or within a personal vehicle. Butts will be disposed of in a proper receptacle.
8.3 Vehicles will not be parked in the fire lanes on either side of the indoor arena next to the stalls.
8.4 All equines must be handled on foot, i.e., equines may not be led or handled with a vehicle.
8.5 Equines will not run or walk loose except in authorized areas. Authorized areas include turnouts, pastures, round pens or arenas.
8.6 No riding in barns or aisle ways.
8.7 Stall fans must be unplugged when unattended.
8.8 Equines should not be tied to turnouts, paddock rails, arenas or stalls.
8.9 ASTM/SEI certified helmets are required for all riders 17 years old and under when mounted on an equine.
8.10 ASTM/SEI certified helmets are required for riders that are jumping. A protective vest is recommended by all riders jumping fences on the cross country course.
8.11 All members, family and visitors should wear, as a minimum, closed toe shoes at all times while handling equines at TEC.
8.12 Any safety hazard will be identified and reported to the Safety Officer or Board Member as soon as possible.
8.13 No extension cords may be used that are drapped over the top of stalls or through the rafters of the roof. The cord shall be the minimum length required for the purpose.

EQUINE HEALTH CARE REQUIREMENTS AND STANDARDS POLICY

9.1 All animals entering the TEC facility will adhere to AFI 48-131, *Veterinary Health Services.*

MEMBER COMPLIANCE WITH ESTABLISHED RULES

10.1 The Clubhouse is off limits to children 11 and under without the direct supervision of an adult.
10.2 Notify an AB member of any perceived neglect to an equine so they can make contact with the animal's owner to determine the next action.
10.3 Tack room, stall and paddock cleanliness is the responsibility of the assigned member. Areas in front of an individual's stall, paddock and assigned tack room will be kept clean and clear of weeds and debris. The surrounding areas of each individuals assigned stall and paddock will be kept clear of weeds and debris. Grass and weeds should be no more than 4in tall. This includes paddocks with ditches. Ditches will have no grass growing in the bottom and pipes should be free of dirt. Ditches at the end of an individual's assigned paddock will be kept clean and clear of weeds and debris.
10.3.1 On the 16th of each month, the TEC-AB will walk the facilities and write up any member not in compliance. A warning will be issued to any member that has been written up with a seven (7) day suspense to fix any write ups. Any further non-compliance my result in the loss of membership.

10.4 Stalls and paddocks must be cleaned on a daily basis. Clay and granite (as available) will be provided to maintain stalls and paddocks in a condition that allows water to drain and not form puddles.
10.5 Shavings/Straw/Stall Pellets must be used in the stall as bedding material. No other bedding material is permitted without approval from the AB. Shavings will be supplied by the 60th FSS via the liaison if available. However, due to the increasing expense, shavings will only be ordered approximately every eight (8) weeks or as deemed necessary. If shavings are unavailable, members are responsible for procuring shavings at owner's expense. Lack of shavings supplied by the TEC does not relieve the member of ensuring the stall has sufficient bedding material for their animal.
10.5.1 Shavings are assigned to the stalls and not the members.
10.6 Common area cleanliness is the responsibility of all the members. Aisle ways will be kept neat and orderly. Items will not be left unattended as to interfere with the movement of equines and/or personnel. Wheelbarrows must not be left in aisle ways or breezeways.
10.7 Large items will not be placed in the trashcans. Those items must be taken to the dumpster located at the entrance to the facility. Recyclables or hazardous materials are not allowed in either trash cans or dumpster. They must be disposed of properly off site. Recycle bins are provided. These containers must be emptied on a monthly basis.
10.8 Any member that is found to be in violation of this OI may have their membership revoked and be required to remove their horses from the facility within 30 days. Subsequent reapplication for membership will depend on the severity of the infraction.
10.8.1 Normally, for minor infractions (not cleaning stall, excessive weeds, etc) a verbal warning will be given.
10.8.2 If the minor infractions continue, a written warning will be issued.
10.8.3 If the condition continues, a second and final written warning will be issued.
10.8.4 Continued disregard will result in termination of membership and a ban from the TEC for a period of at least one (1) year.
10.8.5 Based on the severity of the infraction (theft, intentional harm or disregard) the AB will have the discretion to issue a written warning with the next step termination of membership, or immediate termination of membership with consultation of 60th FSS/CC and up to a permanent ban from TEC membership.
10.9 Members will ensure that any items damaged by their horse(s) are repaired or replaced.

GUEST USE OF THE EQUESTRIAN CENTER POLICY

11.1 A guest is person who has been invited by an authorized and active club member.
11.2 Based on evidence gathered by a member, the AB may recommend withdrawal of guest privileges of a member. Final approval authority for withdrawing guest privileges is the responsibility of the 60th FSS/CC or liaison.
11.3 Guest privileges must not be used to circumvent member eligibility and guest requirements outlined in AFI 34-262. Furthermore, guest privileges cannot be used to circumvent the prohibition of commercial activity for financial gain. Any member found blatantly disregarding these rules will have their membership revoked.
11.4 All guests that ride at TEC are required to sign a waiver and the TEC member is required to provide the waiver to the TEC-AB. Guests under 18 years old must have their parent/guardian's signature and comply with helmet requirements. The TEC member

sponsoring the guest is responsible for any damage (members or their property, equines or TEC property) caused by their guest.
11.4.1 Blank form are available in the Clubhouse.

STALL ASSIGNMENT POLICY

12.1 The stalls at the TEC are intended for recreational use and are not intended for commercial purposes, unless otherwise stated in this OI.
12.2 Under no circumstances will stalls be loaned out.
12.3 Continuous changing of equines by a member will be addressed by the TEC-AB President to insure that TEC and Travis AFB property are not being used for commercial purposes, such as buying and selling for purposes of profit or as a business endeavor.
12.4 Members removing equines from the TEC for more than 30 days must submit a Removal Notification. Permission to retain empty stalls must be processed through the AB. A stall will be considered abandoned with no notice of removal and over a 30-day period without an equine in the stall.
12.5 An application must be on file in order to be placed on the waiting list. Applicants will be prioritized and notified in the priority order designated in AFI34-262.
12.6 A member is initially allowed to stable one equine per family at the TEC. Members with more than one rider per family may request permission for additional stall space to stable additional equines. All requests for additional stall space will be in writing with sufficient justification to support the increase in authorization. Final determination for additional stall space will be made by the AB. All requests for additional stall space will be filed in the member's equine records.
12.7 If a new member PCSing to Travis AFB has more than one equine they can request additional authorizations in writing at the time of application submittal. Approval will be given based on the same criteria used for existing members.
12.8 If the waiting list becomes excessive in number (over ten) the AB will allocate stalls IAW AFI 34-262
12.9 The Health Secretary will notify members of stall assignment and quarantine dates. A member awaiting a stall assignment who has been notified that a stall is available is responsible for notifying the Health Secretary within 48 hours via phone call or email if the stall is no longer desired.
12.10 Stall fees are charged on the 1st of every month. Stall fees will not be pro rated; however, if the stall is occupied by the 25th of the month the member will be charged for that month. If the stall is occupied after the 25th of the month billing will begin the next month.
12.11 Upon stall assignment, the Health Secretary will inspect the stall/tack room with the member. The stall agreement and condition checklist will be filled out and signed by both parties. Any facility discrepancies will be annotated and turned into the AB. The tack room with corresponding number of the stall will be issued at the same time. Any appliances, furniture or mounted items must be removed prior to departure unless prior coordination is made with the incoming member.
12.12 A member will provide a 30-day written notice for turning in a stall to the Health Secretary. If such notice is not provided, the member will be charged for that 30-day notice period. A waiver can be submitted with sufficient justification. When turning in the stall it must be in equal condition as when received. Any damages other than fair wear and tear will be charged to the member and will be repaired at member's expense. The tack room must be

free of any debris with the floor swept; walls cleaned; channels clean from chaff and all the hinges and latches in good repair. Additionally, all walls, hayracks and feeders must be washed and disinfected. Stall floors cleaned and leveled and paddocks will be cleaned and graded to allow water to drain.
12.13 Changes to the configuration of the stalls need to be approved by the board.
12.13.1 All modifications need to be put in writing stating the reasons behind the suggested modification.
12.13.2 When turning in a stall it has to have feeder door, stall door and panels all in the correct place.
12.14 Basic modifications that can be made without prior board approval are as follows.
-Hot wire
-Wire fencing other than panels
-Kick boards at the ends of the stalls to keep shavings in
-Blanket racks on stall doors
-Hooks to hang halters
12.15 Requests to change your assigned stall will be directed to the AB. The person will be placed on a waiting list and available stall(s) will be assigned on a first come, first served basis. Changes to assigned stalls will also be based upon the waiting list.

QUARANTINE STALL POLICY

13.1 Equine(s) coming into quarantine are to be unloaded by the quarantine stall in the front parking area. They are to be kept in the quarantine stall, but may be exercised or turned out in the blue arena if not in use. Owner must be present while the horse is turned out in either area and remove their equine if others intend to ride.
13.2 Walls and floor must be cleaned with bleach/water and paddock must be leveled with DG and holes filled in. All shavings must be removed from the stall. If the quarantine stall has not been made ready for the next occupant within 48 hours of the member's equine being released from quarantine, a $50 service fee will be assessed. The AB member is the determining authority on whether the quarantine stall is ready for the next occupant.

MARES WITH FOAL/STALLIONS POLICY

14.1 Due to health and safety standards, foaling stalls are not available at the TEC. Allowing a mare to foal at the TEC will be at the owner's risk. At no time will the 60th FSS be held liable or responsible for any death or injury associated with foaling or keeping a foal in Travis AFB property.
14.2 A foal or mare must be permanently removed from the stall when the foal reaches six months of age. The mare and foal will be separated earlier if deemed necessary by the Base Veterinarian or other qualified large animal vet.
14.3 Mares with foals can be placed in a turnout at the owner's risk.
14.4 Stallion may not be brought onto the TEC grounds at any time other than a sanctioned event or with prior approval by the board. For clarification, a colt is considered a stallion when he becomes one year old.

ANIMALS OTHER THAN EQUINES AT THE EQUESTRIAN CENTER POLICY

15.1 Any animals belonging to the TEC members and on TEC grounds must be on a leash and under the direct control of the responsible individual. Members are responsible for picking up and disposing of any pet droppings.
15.2 The AB and the Base Veterinarian must approve animals other than dogs or equines being on the TEC grounds on a case-by-case basis in writing.

NON-MEMBER CARE PROVIDERS OR EQUINES POLICY

16.1 The health and welfare of the animals and members of the TEC are paramount. Non-member care providers are authorized during periodic and emergency situations only. A member must submit a signed waiver to the AB and the waiver must be on file. Unless otherwise determined by the TEC-AB, non-member care will include but not be limited to cleaning, feeding and daily turnout of the member's equine(s).
16.2 The number of days and reason for the non-member to serve as a care provider will be included in the written request. Any member will be denied requests for non-member care if such care is for commercial activity or financial gain. It is the responsibility of the military sponsor to insure authorized base access to non-members.
16.3 The period of care must be limited to times when the member is out of the local area, such as business or vacation trips or when temporary care is required due to illness or injury of the member. Approval will be granted in increments of 30 days.

LEASED EQUINES POLICY

17.1 An equine will not be leased by a member for use by or to accommodate individuals outside the member's family or the owner of the equine. Leases will not be used for business or commercial purposes. Equines leased by members will be for the exclusive use of the member/lessee and their authorized family members. Leased horses will be kept in the lessee's properly acquired stall.
17.2 Abuse of this provision of the OI will be grounds for immediate termination.

STALL CLEANING AND SHAVINGS DISPOSAL POLICY

18.1 In order to help maintain overall sanitation and the health and welfare of all equines at the TEC, all occupied stalls will be cleaned daily. There are no exceptions to this policy.
18.2 Members choosing to use mats in outdoor paddocks are responsible for proper cleaning and positioning of mats to prevent stagnant urine or water from collecting. Use of mats does not alleviate a member from the responsibility of maintaining their areas and all common areas IAW the OI
18.3 Soiled bedding will be disposed of properly.
18.4 Soiled bedding must be kept separate from trash and will only be placed into the manure bin. A manure bin is located at the end of each barn. No other trash may be placed in these bins. In the event a manure bin is full or inaccessible in one barn the bedding will be disposed of in the other manure bin.
18.5 Members must push back bedding to fill in the back of the bin. Bedding must not rise above the top of the sided of the bin.

PASTURE USE & DAY TURNOUT

19.1 Turnouts are to be shared by all the members and are available on a first come, first served basis. No one barn owns a turnout area.

19.2 Equines will be turned out in the turnouts and pastures at the owner's risk. At no time will the TEC or the 60th Force Support Squadron be held responsible or liable for any injuries suffered by equines or humans using these areas.
19.2.1 Horses that display overtly aggressive behavior to either other horses or humans will be removed from the open herd pastures for a minimum of three months, but up to one year; exact time will be decided by the TEC-AB based on the circumstances. After this time and if the behavior in question has been addressed, the member can petition the board for reinstatement. If that same horse again displays overtly aggressive behavior, they will be permanently barred from any open herd pastures and restricted to turnouts.
19.3 Overnight pasturing and turnout use is allowed. However, equines will be attended to every 24 hours.
19.4 Separating your equines by doubling them up with other member's equines is authorized. Any doubling of equines in turnouts must be with the written or verbal concurrence of all owners involved.
19.5 Equines may be fed in the turnouts. However, for health and sanitation reasons no food may be left in the turnout after an equine has been removed. Under no circumstances will equines be fed in the pasture.
19.6 When the outdoor and jump arenas are not being used for riding or lunging, they may be used for turnouts. However, the member must stay with the equine in direct sight. Equines must be brought in immediately when the arena is needed for riders or lunging. For health and sanitation reason equines will **not** be fed in the arenas.

ARENA SCHEDULING POLICY

20.1 The arenas and grounds of the Travis Equestrian Center, located on Travis Air Force Base, are intended for the use of all members.
20.2 If someone wishes to use the arena and associated grounds, a written request will be made for special activities to the TEC-AB. If given permission, the member sponsoring the event must ensure all base entry procedures are followed.
20.3 The Vice President will keep the calendar/schedule in the office updated and will post additional requests for use of the arena at least one month in advance.
20.4 Because of the varied disciplines and varied footing in the arenas, schedules for different activities (jumping, gymkhana, barrels, etc) will be established by the AB, as necessary, to ensure equal access for all members and disciplines.

NON-DOD AGENCY USE POLICY

21.1 The use of the club facilities by non-DOD agencies will be as joint functions with the Equestrian Center, with the approval of the Advisory Board and the Base Veterinarian.
21.2 Members wishing to sponsor an event will present a proposal to the TEC-AB Vice President. The Vice President will present the proposal at a general membership meeting at least one month in advance of the proposed event. If given permission, the member sponsoring the event must ensure all base entry procedures are followed.

FUND RAISING POLICY

22.1 Funds generated through fund raising activities by the membership will be handled IAW applicable AFI and 60th FSS directives.

PARKING OF PERSONAL TRAILERS AND VEHICLES POLICY

23.1 At no time will personal vehicles be stored on the Travis Equestrian Center grounds. Those found in violation will have their vehicle towed off-base and will be responsible for all charges incurred because of the towing and storage to another location.
23.2 A list of trailer owners will be maintained by the TEC-AB Secretary.
23.3 Members with assigned stalls may park one (1) horse trailer per stall. The horse trailers will be parked in the designated area only. Trailers used for equine support purposes may only be parked if space permits and must be removed within 48 hours of notification if additional space is needed for parking.
23.4 There will be no parking or driving in the immediate barn areas between barn and tack rooms or between the barns and indoor arena except for drop off/pick up of feed or tack items. These areas are designated "Fire Lanes". Vehicles will be moved to their proper location upon completion of all tasks.

LESSONS

24.1 Any member may give lessons for profit after the following requirements have been met.
24.1.1 Become a vendor with the 60th FSS. The 60th FSS requires a fee for giving lessons and making a profit.
24.1.2 Have proof of $25,000 liability insurance.
24.2 Any member's equine may be used for profit for giving lessons; the equine's owner must be a vendor with the 60th FSS.
24.3 The member must inform the TEC-AB that all proper paperwork has been filled out with the 60th FSS.

E. JONELLE EYCHNER, Maj, USAF
Commander, 60th Force Support Squadron

Appendix G: Travis AFB 2015/2016 annual grazing use report from cattle lessee, Bill Traylor

Appendix G contains the Travis AFB 2015/2016 annual grazing use report, dated August 1, 2016, from cattle lessee, Bill Traylor, both in its original format as submitted by Mr. Traylor and converted to approximate Animal Unit Months (Table G-1; see Appendix A for definition of AUM).

Table G-1: Approximate Animal Unit Months (AUMs) reported for the Travis AFB cattle lease 2015/2016 grazing season by cattle lessee, Bill Traylor.

Livestock	Start date	End date	AUMs for period
31 cows (1 AUM)	11/14/2015	4/19/2016	160.2
1 bull (1.25 AUM)	11/14/2015	4/19/2016	6.5
7 cows (1 AUM)	12/15/2015	4/19/2016	28.9
36 cows (1 AUM)	4/20/2016	5/25/2016	42.0
1 bull (1.25 AUM)	4/20/2016	5/25/2016	1.5
38 cows (1 AUM)	5/26/2016	7/16/2016	63.3
1 bull (1.25 AUM)	5/26/2016	7/16/2016	2.1
11 cows (1 AUM)	7/17/2016	7/18/2016	0.7
7 cows (1 AUM)	7/19/2016	7/23/2016	1.2
17 yearlings (0.6 AUM)	5/7/2016	7/3/2016	19.0
14 yearlings (0.6 AUM)	7/4/2016	7/4/2016	0.3
3 yearlings (0.6 AUM)	7/5/2016	7/11/2016	0.4
TOTAL AUMs for 2015/2016 grazing season:			326.1

Travis 2015 + 2016
J. V. Angus
8-1-16

11-14-15	31	cows to Travis + Bull
12-15-15	7	cows to Travis
	38	Total

4-19-16	2	cows from Travis #774 + 317
5-26-16	2	cows to Travis #774 + 317

5-7-16	17	2 yr. cows to Travis - East pasture	
7-3-16	3	2 yr. cows from Travis	
7-4-16	11	2 yr. " " "	17
7-11-16	3	cows from Travis "	

7-16-16	27	Bulls + Cows from Travis West Pasture
7-18-16	4	pairs " " "
7-23-16	7	cows
	Total 38	

Thanks
Bill Langston

Appendix H: Acreage of soil series within each pasture

Appendix H contains a table of the acreage of the soil series mapped within each of Travis AFB's grazing pastures. See Figure 4-3 in the main plan for a map displaying the soil series within each pasture. Soil series data from the USDA Natural Resources Conservation Service's Web Soil Survey (http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm), accessed June 2016.

Table H-1: Acreage of soil series in acres within each grazing pasture at Travis AFB; soil series data from the USDA NRCS's Web Soil Survey.

Pasture	Soil series	Soil code	Acreage of soil series within pasture (acres)	Livestock use
1	Altamont-San Ysidro-San Benito complex, 2-9% slopes	AlC	101.58	Cattle grazing
1	Antioch-San Ysidro complex, 0-2 % slopes	AoA	29.99	Cattle grazing
1	Antioch-San Ysidro complex, thick surface, 0-2 % slopes	AsA	24.51	Cattle grazing
1	San Ysidro sandy loam, 0-2 % slopes	SeA	11.44	Cattle grazing
1	Omni clay loam	Om	8.55	Cattle grazing
1	Clear Lake clay, 0-2 % slopes	CeA	2.78	Cattle grazing
2	Antioch-San Ysidro complex, thick surface, 0-2 % slopes	AsA	57.71	Cattle grazing
2	Antioch-San Ysidro complex, 0-2 % slopes	AoA	24.24	Cattle grazing
3	Antioch-San Ysidro complex, 0-2 % slopes	AoA	14.92	Cattle grazing
4	Antioch-San Ysidro complex, 0-2 % slopes	AoA	1.65	Cattle grazing
5	Altamont-San Ysidro-San Benito complex, 2-9% slopes	AlC	7.10	Sacrifice pasture
5	Antioch-San Ysidro complex, 0-2 % slopes	AoA	2.21	Sacrifice pasture

Pasture	Soil series	Soil code	Acreage of soil series within pasture (acres)	Livestock use
6	Altamont-San Ysidro-San Benito complex, 2-9% slopes	AlC	16.23	Horse pasture
7	Altamont-San Ysidro-San Benito complex, 2-9% slopes	AlC	12.91	Horse pasture
8	Antioch-San Ysidro complex, 0-2 % slopes	AoA	12.11	Horse pasture
8	Altamont-San Ysidro-San Benito complex, 2-9% slopes	AlC	7.09	Horse pasture
9	Antioch-San Ysidro complex, 0-2 % slopes	AoA	15.09	Horse pasture
9	Altamont-San Ysidro-San Benito complex, 2-9% slopes	AlC	0.02	Horse pasture
10	Altamont-San Ysidro-San Benito complex, 2-9% slopes	AlC	10.04	Horse pasture
10	Antioch-San Ysidro complex, 0-2 % slopes	AoA	0.46	Horse pasture
11	Altamont-San Ysidro-San Benito complex, 2-9% slopes	AlC	0.74	Sacrifice pasture
12	Altamont-San Ysidro-San Benito complex, 2-9% slopes	AlC	0.31	Sacrifice pasture
12	Antioch-San Ysidro complex, 0-2 % slopes	AoA	0.07	Sacrifice pasture

APPENDIX K

Permits and Consultations

APPENDIX K

Permits and Consultations

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Suite W-2605
Sacramento, California 95825-1846

In Reply Refer to:
08ESMF00-
2017-F-2294-3

JUN 0 1 2018

Brian L. Sassaman
60th Civil Engineer Squadron
Flight Chief, Installation Management
411 Airman Drive, Building 570
Travis Air Force Base, California 94535-2001

Subject: Programmatic Formal and Informal Consultation on the Proposed Effects of Activities Conducted at Travis Air Force Base on Six Federally Threatened and Endangered Species, Solano County, California

Dear Mr. Sassaman:

This letter is in response to your March 30, 2017, letter requesting initiation of formal and informal programmatic consultation with the U.S. Fish and Wildlife Service (Service) for the proposed Effects of Activities Conducted at Travis Air Force Base on Six Federally Threatened and Endangered Species, California (proposed projects/activities). The proposed projects include typical activities that will be authorized as a framework programmatic action. Your request, which included the March 2017 document titled *Programmatic Biological Assessment: Effects of Activities Conducted at Travis Air Force Base, California, on Six Federally Threatened and Endangered Species* (programmatic biological assessment) was received by the Service via email on March 30, 2017. However, the request and the programmatic biological assessment were insufficient to initiate consultation. On June 12, 2017, the Service requested additional information needed (2017-F-2294-1). On July 11, 2017, and May 01, 2018, the Service received emails from Travis Air Force Base (Travis AFB) providing the additional information requested. All of the necessary information was received and consultation commenced on May 01, 2018. This response is provided under the authority of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act), and in accordance with the implementing regulations pertaining to interagency cooperation (50 CFR 402).

The federal action that you requested consultation on is for typical activities which will be conducted over the next 5 years at Travis AFB and at its eight geographically separated units (GSUs) (see Figure 1 of the Enclosure). These activities are necessary for the functioning of the Base, and are divided into the following four core programs: Mission Operations; Infrastructure Support; Infrastructure Development; and Environmental Management. The programmatic biological assessment describes categories of activities related to construction of new facilities, operations and maintenance, flight-related activities, and restoration activities that will occur in accordance with these core programs.

The programmatic biological assessment presents an evaluation of the proposed project's effects on species federally-listed. At issue are the proposed project's effects on the federally-listed as threatened Central Valley population of the California tiger salamander (*Ambystoma californiense*) (California tiger salamander), vernal pool fairy shrimp (*Branchinecta lynchi*), Contra Costa goldfields

(*Lasthenia conjugens*); delta green ground beetle (*Elaphrus viridis*); as well as the federally-listed as endangered vernal pool tadpole shrimp (*Lepidurus packardi*), and the Conservancy fairy shrimp (*Branchinecta conservatio*) and critical habitat designated for these species.

The following sources of information were used to develop this programmatic biological opinion: (1) the programmatic biological assessment for the proposed projects; (2) Travis AFB's *Integrated Natural Resource Management Plan*, dated July 2016; (3) additional information provided by Travis AFB in a response letter dated July 11, 2017; (4) emails, phone conversations between representatives of the Service, Travis AFB, and consulting biologists; and (5) other information available to the Service.

Consultation History

March 30, 2017	The Service received a letter from Travis AFB requesting initiation of formal and informal programmatic consultation for the proposed projects.
June 12, 2017	The Service sent a letter to Travis AFB requesting additional information needed regarding the proposed projects potential affects to federally-listed species.
July 11, 2017	The Service received the information requested on June 12, 2017, from Travis AFB for the proposed projects.
March 16, 2018	The Service received a request from Travis AFB to add further information to the proposed project. This information provided acreages of "low, medium, and high value habitat suitability areas" for the federally-listed species covered in this consultation.
May 01, 2018	The Service received a request from Travis AFB to update Table 6: *Summary Effects Determination for Federally-Listed Species,* provided in the programmatic biological assessment.

Programmatic Section 7 Consultation Approach

The programmatic biological assessment submitted for routine activities conducted by Travis AFB analyzes proposed activities as a whole, for impacts to the six federally-listed species and their habitat. Based upon this analysis, Travis AFB proposes specific criteria within this document for proposed projects and activities that will have either have **no effect** (Level 1); **may affect, but is not likely to adversely affect** (Level 2); and **may affect and is likely to adversely affect** (Level 3), federally-listed species.

All projects meeting the consultation criteria defined under this framework, established by this programmatic consultation (Levels 2 and 3), will have individual abbreviated project-specific analysis completed by Travis AFB, following the *Covered Project Analysis Template* (consultation template) provided in the Enclosure, and explained in detail in Appendix B of the programmatic biological assessment. Specific habitat effect thresholds have been developed for the four federally-listed species known to occur on the main Base and its GSUs and is provided in Tables 1 and 2 of the Enclosure. Because there are no verified occurrences of either the Conservancy fairy shrimp or delta green ground beetle on Travis AFB or its GSUs; informal consultation for potential effects to Conservancy fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpole shrimp, will occur within 250 feet of known or potential habitat, and designated critical habitat for this species (See Tabs A, B and F of the programmatic biological assessment). Similarly, informal consultation

for potential effects to the delta green ground beetle and its potentially suitable habitat will be limited to projects conducted which may affect potentially suitable habitat, located ≤ 1 mile, from known occurrences or potential habitat, or is located within 250 feet of critical habitat designated for this species (See Tab C of the programmatic biological assessment). Informal consultation will occur on projects within medium (yellow) and some high (red) risk California tiger salamander areas (see Table 2-Level 2 activities included in the Enclosure).

For each project, Travis AFB will implement conservation measures pertinent to the project, in order to avoid or minimization potential effects to species and their habitat. Within this framework the following three possible effect levels are possible:

- The first level is "**no effect**" on any federally-listed species discussed in this document (Table 1-Level 1, and Table 2-Levels 1a and 1b of the Enclosure). Level 1 activities (no effect) will not require further analysis or reporting to the Service. It applies to all situations where none of the federally-listed species with the potential to occur on Travis AFB are likely to be present, within the proposed action area, or the nature of the activity itself will have no effect on federally-listed species and their habitat.

- The second level is "**may affect, not likely to adversely affect**" federally-listed species (Level 2 in Table 1 and 2 of the Enclosure). This level refers to those activities that are not likely to adversely affect federally-listed species, or their habitat. These effects on species are expected to be discountable, insignificant, or entirely beneficial. This level of effect will apply to all proposed projects where the implementation of avoidance and minimization measures (section 1.5 of the programmatic biological assessment), and species-specific measures (Tabs A-F of the programmatic biological assessment) will ensure project's activities are not likely to adversely affect a federally-listed species, or their habitat.

  Travis AFB will complete the consultation template for Level 2 projects. The completed consultation template and any other pertinent information will be mailed or emailed to the Service at least 30 days prior to project start date. The completed consultation template will be addressed to the Assistant Field Supervisor, Doug Weinrich at the Sacramento Fish and Wildlife Office (SFWO). The Service will respond within 14 days if we do not concur with the Base' determination, and will provide an explanation as to why the Service does not concur.Level 2 projects that meet the requirements described in this programmatic biological opinion will be appended on an annual basis, after the Service receives an annual report from Travis AFB requesting to have Level 2 projects that were completed the prior year appended to the biological opinion. Although no habitat compensation will be required for projects that fit these criteria; appropriate general minimization measures (*Conservation Measures* section), and species-specific avoidance measures (Tabs A-C, E and F of the programmatic biological assessment) will be implemented to avoid potential adverse effects to federally-listed species. Project effects located >100 feet from all wetlands will be summarized and retained by the Base, and will be submitted in the Level 2 annual report to the Service.

- The third level is "**may affect, likely to adversely affect**" federally-listed species (Level 3 in Tables 1 and 2 of the Enclosure), and their habitat. This level refers to proposed projects that are likely to directly or indirectly adversely affect the federally-listed species or their critical habitat present (Table 6 of the Enclosure). This level of effect will require formal consultation prior to project implementation, adhering to this programmatic framework, and will include a project-specific analysis following the consultation template. Travis AFB will

mail or email projects requested to be appended to this programmatic biological opinion to the Assistant Field Supervisor, Doug Weinrich at the SFWO. The Service will issue a biological opinion after all necessary information is received, which will include a project-specific incidental take statement (ITS), if it is determined that a project covered under this programmatic biological opinion is likely to adversely affect federally-listed species. The appended biological opinion will include a project-specific ITS; if take is reasonably certain to occur, and will also document any changes to species data (e.g., species occurrences) since issuance of this document. Before a biological opinion can be appended to this programmatic biological opinion, the Service will determine that: (1) the proposed project's activities are within the scope of the activities described in the programmatic biological assessment; (2) the potential effects of the proposed action are consistent with those analyzed in this programmatic biological opinion; and (3) the appropriate conservation measures will be implemented.

Activities that will have No Effect on the Species and Informal Consultation on Categorical Activities that May Affect but are Not Likely to Adversely Affect the Species

Background and Federally-listed Species

In their programmatic biological assessment, Travis AFB determined that many activities typically conducted on the Base and its eight GSU's will either not effect or are not likely to adversely affect the California tiger salamander, vernal pool fairy shrimp, vernal pool tadpole shrimp, Conservancy fairy shrimp, Contra Costa goldfields and the delta green ground beetle, and their critical habitat; Travis AFB requests our concurrence with the this determination. In addition, Travis AFB determined that certain activities proposed to occur on the Base and its eight GSU's are likely to adversely affect vernal pool fairy shrimp, vernal pool tadpole shrimp, California tiger salamander, and Contra Costa goldfields. These activities are evaluated in the programmatic biological opinion that follows. Activities which are not likely to adversely affect these federally-listed species or their habitat are described in the sections below and are summarized in Tables 1, 2, and 6.

Typical activities performed at Travis AFB that are likely to trigger section 7 consultation requirements are described in the sections below, and in the *Description of the Proposed Action* section included in the following biological opinion. Several guiding conservation principles apply to the implementation of all projects, regardless of habitat types and species, and are engrained in an ecosystem approach for the management of natural resources and the conservation of federally-listed species. As such, Travis AFB has developed, and will implement, general avoidance and minimization measures, and general conservation measures described below under *Conservation Measures.* In addition to these measures, species-specific conservation measures described in Tabs A-F of the programmatic biological assessment may apply to some projects and activities to avoid or minimize potential impacts. This will be determined during the project analysis conducted by Travis AFB's Natural Resource Management Team (60 CES/CEIE) following the consultation template, titled *Project Effects Analysis Report Template* (consultation template) provided in the Enclosure.

Conservancy Fairy Shrimp and its Critical Habitat

Surveys for special status invertebrates have not detected Conservancy fairy shrimp on Travis AFB (CH2M Hill 2006). However, nine occurrences of this species have been reported within 3 miles of Travis AFB, including seven locations on the Wilcox Ranch; located immediately southeast of the Base, California Natural Diversity Database (CNDDB) 2016). Limited habitat is present on Travis AFB for Conservancy fairy shrimp because it is most often found in large, deep, pools that typically remain ponded late into the spring (June). Critical habitat for Conservancy fairy shrimp occurs on the main Base at the South Gate; a triangular parcel south of Runway 03R/21L not within the

fenced boundary of the Base; and south of Runway 03R/21L (See Figure 3 of the Enclosure). In the Solano-Colusa Vernal Pool Region, Conservancy fairy shrimp are reported as occurring in Olcott Lake at Jepson Prairie about 6 miles east of Travis AFB. Presence of this species has been documented off-Base on the Muzzy Ranch and Wilcox Ranch (CNDDB 2015). In the Solano-Colusa region, Conservancy fairy shrimp populations are protected from development on some locations at the Jepson Prairie Preserve. Other occurrences of the species on private land in this region are threatened by development, particularly in the rapidly urbanizing areas of Fairfield and Vacaville (Service 2005).

Although Travis AFB does not believe the Conservancy fairy shrimp occurs on the Base or its eight GSUs, conservation measures and avoidance and minimization measures will be implemented to ensure this species and its habitat are not affected. Specifically, all projects occurring within 250 feet of known or potential Conservancy fairy shrimp habitat, will implement appropriate general minimization measures. See *Conservation Measures* section for general avoidance and minimization measures, and species-specific avoidance measures (Tab F of the programmatic biological assessment) to avoid potential adverse effects to the species and its habitat.

For each project area within designated critical habitat, Travis AFB will evaluate whether the physical and biological features (PBFs) of critical habitat for the Conservancy fairy shrimp are present, and may be adversely affected with project implementation which would require separate section 7 consultation for potential adverse effects to this species and its critical habitat (See Figure 4 of the Enclosure for a map of designated critical habitat). The PBFs considered to be essential to the conservation and survival of Conservancy fairy shrimp are: (1) topographic features characterized by mounds and swales and depressions within a matrix of surrounding uplands; (2) depressional features including isolated vernal pools with underlying restrictive layers that become inundated during winter rains and that continuously hold water for a minimum of 18 days in all but the driest years; (3) sources of food, expected to be detritus occurring in the pools; and (4) structure within the pool consisting of organic and inorganic materials that provide shelter (USFWS 2005).

Because the Conservancy fairy shrimp has not been identified on Travis AFB or its GSU's, activities proposed in the programmatic biological assessment are not expected to result in adverse effects to the species. However, Travis AFB routinely monitors the status of listed species on its properties and will continue to monitor for Conservancy fairy shrimp as necessary. If at any time this species is detected by surveys, Travis AFB will immediately contact the Service to initiate discussions on how best to proceed regarding the revised status of the species and whether proposed project activities may affect the species or its habitat.

Delta Green Ground Beetle and its Critical Habitat

The closest known population of the delta green ground beetle to Travis AFB is located about 1,500 feet off-Base in playa pools on the Wilcox Ranch, owned by the City of Fairfield and Solano County (adjacent to the eastern boundary of Travis AFB; CNDDB 2016). The delta green ground beetle has been recorded in a total of 18 playas on the eastern portion of the Wilcox Ranch. It is important to note that not all playas on the western Wilcox parcel have been surveyed for this species, and additional suitable habitat exists closer to Travis AFB. Other playa pools on private lands adjacent to Travis AFB have the potential to provide habitat for this species, but surveys have not been conducted or reported to CNDDB.

A habitat assessment on Travis AFB was conducted for the delta green ground beetle in 2012 by Dr. Richard Arnold, who found no evidence of appropriate habitat for this species. Dr. Jaymee Marty also conducted surveys for this species on the Base in 2016, as a follow up survey and reached the same conclusion: that no suitable habitat for the species was present. While appropriate habitat for the delta green ground beetle likely does not exist on the main Base at Travis AFB, critical habitat for the species was designated over lands owned by Travis AFB at the former Sacramento Northern Railroad Right-of-Way GSU. Additionally, because little is known about the ecology of the species including dispersal distances and upland habitat use, Travis AFB has established a 1-mile buffer around known and potential delta green ground beetle habitat. Projects within the 1-mile buffer will consider the delta green ground beetle in informal project consultation. The buffer for potential delta green ground beetle is based on buffers used for critical habitat around Olcott Lake and habitat polygons shown in the CNDDB for the species (See Figure C-1 in Tab C of the programmatic biological assessment). This is also based on the assumption that surveys of potential delta green ground beetle habitat on private lands adjacent to the Base have not been extensive. Because little is known about the life history, particularly dispersal distances of this species and use of upland habitat surrounding vernal pools, Travis AFB has determined that the larger buffer is warranted.

Travis AFB anticipates projects proposed within designated critical habitat for the delta green ground beetle and in areas within 1 mile of known habitat for this species, will have no effect or are not likely to adversely affect the species or its habitat (See Figure 4 for a map of designated critical habitat). However for projects proposed within designated critical habitat for the delta green ground beetle, Travis AFB will evaluate whether the PBFs of the critical habitat are present and may be adversely affected, requiring separate section 7 consultation for potential adverse effects to this species and its critical habitat. The PBFs considered essential to the conservation and survival of this species are: (1) vernal pools with their surrounding vegetation; and (2) land areas that surround and drain into these pools (USFWS 2005). If activities are proposed in designated critical habitat for the delta green ground beetle on Travis AFB GSU Former Sacramento Northern Railroad-Right-of-Way, separate section 7 consultation will be completed for the proposed project.

Because Travis AFB lacks suitable habitat for the delta green ground beetle, activities proposed in the programmatic biological assessment are not expected to result in effects to the species or its habitat. Travis AFB will conduct future surveys if new information comes to light that alters the scientific understanding of this species habitat requirements and changes the likelihood of its potential to occur on Base. At this time, Travis AFB does not believe the species exists on the Base, but will conduct future surveys if new information is found that changes the scientific understanding of the species' habitat requirements and changes the likelihood of its potential to occur on the Base.

California Tiger Salamander, Vernal Pool Fairy Shrimp, Vernal Pool Tadpole Shrimp, and Contra Costa Goldfields and their Critical Habitat

See the *Environmental Baseline* section in the following biological opinion for details on these species occurrences, and potential suitable habitat, including critical habitat for the California tiger salamander, vernal pool fairy shrimp, vernal pool tadpole shrimp, and Contra Costa goldfields for which Travis AFB has determined are not likely to be adversely effected by the activities described in this section.

Categorical Activities that will have No Effect on Federally-Listed Species and their Habitat

Travis AFB has determined that there will be **no effect on California tiger salamander or its habitat** on projects located within low (green) risk CTS areas. See Appendix A of the programmatic biological assessment for the CTS risk analysis and model used at Travis AFB. In the analysis,

Travis AFB designated and defined areas on the Base as either having a low, moderate or high potential for supporting CTS. For simplicity of interpreting the three levels for potential risk for CTS, the corresponding colors are used to describe these risk levels: green (low), yellow (medium) and red (high). A map of the green, yellow, and red risk areas are depicted in Figure 2 of the Enclosure. No effect projects will include activities completed between May 1 and October 15, occurring on paved or gravel surfaces and shoulders, and projects that utilize all equipment and leave excess soil on paved or gravel surfaces. Additionally, with the incorporation of avoidance and minimization measures Travis AFB has determined that there will be no effect on California tiger salamander or its habitat on projects: occurring on paved or gravel surfaces and shoulders in green or yellow risk CTS areas from October 16 – April 30, and/or projects having temporary and permanent disturbances in upland habitat in green risk CTS areas. See Table 2; Levels 1a, and 1b of the Enclosure for a list of the avoidance and minimization measures which will be implemented for these activities. No effect activities do not require consultation with the Service.

In addition, with the incorporation of avoidance and minimization measures, Travis AFB has determined that the following activities will have **no effect on the vernal pool fairy shrimp, vernal pool tadpole shrimp, Conservancy fairy shrimp, Contra Costa goldfields, and the delta green ground beetle or their habitat:** on projects that will occur on paved or gravel surfaces, and/or are within paved or graveled road shoulders; and/or work located >250 feet from a wetland (see Table 1; Level 1 of the Enclosure). As a conservation measure, Travis AFB will ensure that all equipment and excess soil will be contained on the project site and will stay on either paved or surfaces.

Mowing

Travis AFB has determined that mowing activities will provide beneficial effects to federally-listed species and their habitats when completed during the dry season (May 1 - October 15). Additionally, if mowing occurs in or near vernal pools, it will occur only when the soil is no longer saturated to ensure tracks are not left in or near wetlands. Mowing activities will avoid California tiger salamander breeding ponds during the spring and early summer months in efforts to avoid any effects to this species.

Mowing occurs in both landscaped areas and natural habitat throughout the Base on about 2,900 acres (Figure 8 of the Enclosure). Routine mowing occurs for safety and security reasons around the airfield munitions storage facilities, and along roadway shoulders. Vegetation is also mowed for habitat management in areas not grazed by cattle or horses, and for aesthetic purposes in planted turf areas and open spaces within the cantonment area. Mowing activities in grassland and vernal pool habitat is done to maintain vegetation height and thatch levels that are optimal for the federally-listed species. Mowing may occur as often as weekly in developed areas and around the flightline. In undeveloped areas, mowing occurs once or twice per year, depending on the time of year and the growth rate of vegetative material. This is accomplished with gasoline and diesel mowers (manual, ride-on, or commercial mowers), hedge trimmers, and weed whackers. Mowing in undeveloped areas generally commences in the spring once the soil is no longer saturated. Vegetation around the flightline is maintained between 7-14 inches, while vegetation around buildings and facilities, along roadways, and in landscaped areas is generally kept to $\leq$ 6 inches.

Grazing and Livestock Management

Travis AFB has determined that grazing activities will benefit federally-listed species and their habitats. The duration, intensity, and frequency of current and future seasonal grazing on Travis AFB is designed to improve habitat for federally-listed species occurring on the Base; promote native species; minimize soil erosion; reduce non-native plant species; reduce wildfire risk; and prevent the spread of undesirable plant species (Travis AFB 2016b). See the *Conservation Measures*

section below for general measures, and Tabs A-F for species-specific conservation measures that will be implemented during grazing to avoid potential effects to federally-listed species:

To prevent non-native plant species from becoming increasingly dominant in upland grassland areas, and in vernal pools, management in the form of grazing is necessary (Travis AFB 2017b). While grazing alone does not eradicate invasive species; it is effective in reducing infestation and slowing the spread of some undesirable species. Grazing is one of the most compatible long-term management tools for grassland habitat on the Base, because nearby infrastructure makes burning less practical and risks injury and damage to human health and property.

Travis AFB accommodates agricultural out-leasing as a major land use. Grazing currently occurs within designated fields, or Grazing Management Units (GMUs), located along the southwestern portion of the Base (see Figure 7 of the Enclosure). Both cattle and horse grazing occur within these areas from November - July for cattle and year round for horses. Table 7 of the programmatic biological assessment provides information on the current size of each GMU, its capacity for grazing (measured in animal unit months), and the type of livestock that it supports. Cattle grazing currently occurs on 425 acres and 75 acres are grazed by horses (Travis AFB 2016a).

In addition to the pastures currently being grazed on Travis AFB, the Base proposes to graze up to an additional 595 acres of land in areas that are either unmanaged or mowed, and where habitat degradation has been observed. All lands currently being grazed and lands proposed to be grazed are located on the west side of the Base, extending from the southwestern boundary to the boundary of the former Aero Club in one continuous parcel. Most of these areas do not have infrastructure currently to support livestock grazing, so improvements to fencing and development of water sources as described in the programmatic biological assessment will be required (See the *Description of the Proposed Action* section in the following programmatic biological opinion for proposed fence installation). Existing access roads within grazing units are maintained and the Base will not install new access roads within the grazing units. See section 4.4.3 of the programmatic biological assessment for a description of how grazing units will be developed and maintained for grazing purposes.

Aero Club Grazing Study

At the Aero Club Preserve, fencing and grazing infrastructure improvements were initiated in 2017, as part of another project, in order to facilitate livestock grazing within a 106-acre pasture. The grazing program at the Aero Club will be implemented as a management tool to enhance habitat for vernal pool species by controlling non-native species. Generally, livestock grazing at the Aero Club will occur from about October - July. The duration, intensity, and frequency of seasonal grazing will be managed to benefit federally-listed species; improve native habitat; sustain native vegetative cover; minimize soil erosion; and prevent the spread of invasive plants. Travis AFB will adopt sampling and monitoring methods for 3-7 years, which will allow for adaptive management by informing decisions about each year's grazing duration and intensity to maximize habitat improvements for federally-listed species. For further details, see the *Aero Club Grazing Study* proposed in section 4.4.3 of the programmatic biological assessment, pages 52-53. Site-specific management and monitoring plans are included in Travis AFB's Grazing Management Plan (Travis AFB 2016a).

Travis AFB will implement the following additional Avoidance and Minimization Measures for Livestock Grazing Practices, identified in their response letter dated, July 11, 2017, and in *Travis AFB's Grazing Management Plan, Revised February 2017:*

- Grazing compliance surveys will be conducted monthly to verify grazing lease and grazing

land use regulations (Travis AFB 2017c) are properly implemented;
- Minimum residual dry matter (RDM) level range of 500-900 pounds per acre by October of every year, through stocking rate manipulations and grazing season adjustments (shorter or longer seasons);
- Reduce invasive plant species over the next 5 years;
- Monitor and collect fall RDM data, followed by an annual meeting with the cattle lessee and equestrian center to review, discuss, and analyze results of past grazing practices for adaptive management; and
- Monitor and collect 2018 baseline vegetation composition data to inform management prescriptions for weed control.

Categorical Activities that May Affect but are Not Likely to Adversely Affect Federally-Listed Species and their Habitat

The following section describes activities that are not likely to adversely affect these species or their habitat. Also, see Level 2 activities in Tables 1 and 2 ("not likely" activities), and Table 6, for a list of "not likely" activity categories.

Travis AFB has determined, with the incorporation of the appropriate avoidance and minimization measures, the following activities are **not likely to adversely affect the California tiger salamander or its habitat:** projects having temporary disturbance of upland habitat in yellow risk CTS areas; and/or work limited to paved/gravel surfaces and shoulders in red risk CTS areas (Table 1-Level 2, with the appropriate conservation measures). Project effects located in upland habitat, having a disturbance of ≤1/4 acre in yellow risk CTS areas, will be summarized and retained by the Base, and will be submitted in an annual report to the Service. Although no habitat compensation will be required for projects that fit these criteria; appropriate general minimization measures (*Conservation Measures* section), and species-specific avoidance measures (Tab D of the Enclosure) will be implemented to avoid potential adverse effects to California tiger salamander and its habitat.

In addition, Travis AFB has determined, with the incorporation of the appropriate avoidance and minimization measures, the following activities are **not likely to adversely affect the vernal pool fairy shrimp, vernal pool tadpole shrimp, Conservancy fairy shrimp, Contra Costa goldfields, and the delta green ground beetle, or their habitat**: projects occurring outside wetlands, but within 250 feet of wetlands that meet any of the following criteria; the wetland is located higher in elevation than the work site; the wetland area is upstream of the project; a physical barrier to hydrological connectivity is present; shallow excavation; or other valid reasons why wetlands will not be affected (see Table 2-Level 2 activities).

Invasive Plant Species Management

The Travis AFB Invasive Species Management Plan (Travis AFB 2017b) was developed to address invasive species control which describes activities that are completed for the sole purpose of providing a conservation benefit to federally-listed species and their habitat. This plan identifies 11 invasive plant species that are of particular concern on Travis AFB that are known to occur in plant communities on the Base. Section 4.4.2 of the programmatic biological assessment lists the invasive plant species of particular concern at Travis AFB, and also lists weed species known to be prevalent in the region.

Prescribed Burns

Prescribed burn actions as proposed by Travis AFB, in general, are not likely to adversely affect federally-listed species and their habitat (requiring Level 2 consultation). Travis AFB anticipates prescribed fire will result in overall benefits to federally-listed species and their habitat. However on

a project by project basis, prescribed burns may require Level 3 consultation for potential adverse effects to the California tiger salamander, depending on which prescribed fire practices are employed. See the *Prescribed Burns* section under the *Proposed Action*, and potential adverse effects to the California tiger salamander described under the *Effects of the Action* section in the following programmatic biological opinion. Furthermore, in order to avoid potential adverse effects to Contra Costa goldfields, prescribed fires will not occur in occupied habitat when the vegetation is green (April – June), and will be scheduled after the federally-listed plant has senesced and seed dispersal is complete.

Burning of dry vernal pool habitat is expected to have a beneficial effect to vernal pool habitat by reducing viable seeds of non-native annual grasses still holding seeds; removing thatch; changing vegetation composition over the following one to three growing seasons, and benefiting native forbs within vernal pools (Marty 2015). Prescribed burning reduces competition from annual grasslands and broad-leaf weeds such as yellow-star thistle, which will be targeted by prescribed fires. Marty (2015) found that native plant cover and diversity were higher in burned vernal pools than unburned vernal pools and nonnative annual grass cover was significantly lower than in unburned plots for at least 3 years after treatment at the Jepson Prairie Preserve. They also monitored fire behavior in the vernal pools in this study and found that most fires did not carry into the vernal pool basin (Marty personal communication 2017).

Herbicide Treatment

Travis AFB anticipates that most herbicide application will have an overall benefit to federally-listed species and their habitat, due to complete avoidance and implementation of species-specific conservation measures. However, there may be some instances where full avoidance of federally-listed species and their habitat is not feasible, and potential insignificant or discountable affects may occur. Full avoidance will be achieved by designating 250 foot no access buffers around suitable species habitat. Mechanical methods will be used for the removal of invasive plant species within 20 feet of the mapped wetlands. Herbicide treatment will not be applied within 20 feet from the edge of mapped wetlands. See additional avoidance and minimization measures under the *Conservation Measures* section. Potential insignificant or discountable affects to federally-listed species and their habitat may occur if invasive plants are targeted within, or in close proximity, to these species and their habitat.

The *Invasive Species Management Plan - Treatment Options for Travis AFB Weed Species* developed for Travis AFB identifies targeted weeds and outlines control strategies for these species (Travis AFB 2017b). Specifically, Appendix B of the plan (pages B-12 to B-29), includes recommendations regarding the best timing and herbicide formulation for each weed species that will be followed if herbicide application occurs. Although, it is not known at this time which chemicals will be used; Travis AFB proposes to use any of the herbicides recommended for use in their referenced *2017 Invasive Species Management Plan*. Decisions on specific nontoxic surfactants and specific herbicides to be used will be made by personnel licensed/certified by the State of California in coordination with the Base's Natural Resource Management Team, and only those certified shall apply herbicides. Herbicides will be applied per their label and follow the additional minimization measures developed, as noted in an excerpt provided by Travis AFB from the Solano RCD's *Final Weed Report 2015-2016*.

Grassland Restoration

Habitat restoration treatments such as replanting or reseeding may be used in Travis AFB grasslands to promote native species and restore natural and habitat conditions. Reseeding or replanting using native species may occur if the Base determines that restoration treatments are required due to

invasion by problematic weed species or significant degradation of habitat value. The most common planting methods which may be used at Travis AFB are drill seeding and plug planting. See section 4.4.6 of the programmatic biological assessment for a list of native plant species that may be used and a description of these planting methods.

Hand pulling of non-native plants before restoration occurs may also be completed prior to restoration; although, manual removal methods are labor intensive and costly for large infestations and may not be feasible. Hand-pulling of seedlings has shown to be very effective at inhibiting new growth of some invasive species; however, a shovel or Pulaski will be used for removing well-established clumps of larger plants. Manual removal of invasive plants may be the most desirable weed control method for projects located in suitable habitat for federally-listed species.

The Service concurs with Travis AFB's determination that the projects and activities described in the section above (i.e., *Categorical Activities that May Affect but are Not Likely to Adversely Affect the Species*, and summarized in Tables 1, 2 (Level 2), and 6 may affect, but are not likely to adversely affect the California tiger salamander, vernal pool fairy shrimp, vernal pool tadpole shrimp, Conservancy fairy shrimp, Contra Costa goldfields, and the delta green ground beetle, or their habitat. If during the 5-year term of this programmatic action new information reveals effects of the proposed action may affect federally-listed species or their habitat in a manner or to an extent not previously considered Travis AFB will contact the Service to determine whether these determinations are still valid.

The remainder of this document provides our biological opinion on the effects of the proposed projects on the California tiger salamander, vernal pool fairy shrimp, vernal pool tadpole shrimp, Contra Costa goldfields, and their designated critical habitat.

BIOLOGICAL OPINION

This programmatic biological opinion provides the framework for species habitat compensation, conservation measures, species salvage and relocation efforts, avoidance and minimization measures.

Description of the Proposed Action

The following proposed action consists of typical activities performed by Travis AFB which are likely to require section 7 consultation requirements at Travis AFB Base and the GSUs managed by the Base. General conservation measures described below under *Conservation Measures* will be implemented for all applicable proposed projects described in this programmatic biological opinion. In addition, species-specific conservation measures are included in Tabs A, B, D and E of the programmatic biological assessment, and will be implemented for all applicable proposed projects. Project specific conservation measures will be selected from these lists of measures during the project analysis phase conducted by the Base, and following the consultation template provided in the Enclosure. Table 1-Level 3, and Table 6 provide a list of the proposed projects and activities which have the potential to adversely affect vernal pool fairy shrimp, vernal pool tadpole shrimp, California tiger salamander and Contra Costa goldfields, or their habitat. If both direct and indirect effects have been identified, only the higher level of effect is noted in this table.

The Air Force conducts numerous mission-related activities and operations on Travis AFB. For the purposes of this consultation only, the actions proposed by the Air Force consist of four core programs (Mission Operations, Infrastructure Support, Infrastructure Development, and Environmental Management), which occur throughout the Base and associated GSUs, and are likely

to adversely affect vernal pool fairy shrimp, vernal pool tadpole shrimp, California tiger salamander, and Contra Costa goldfields, or their habitat. The following paragraphs consist of a brief description of the four programs and describe categories of flight- related, construction, and maintenance activities that will occur in accordance to these core programs:

Mission Operations

Airfield and Flight Operations

Travis AFB hosts the 60th and 349th Air Mobility Wings (AMW). The 60th AMW is the largest air mobility organization within the Air Force (in terms of personnel), and supports maintaining and flying the C-5 Galaxy cargo aircraft, the KC-10 Extender refueling aircraft, and the C-17 Globemaster III cargo aircraft. In partnership with the 60th AMW, the 349th AMW, the largest reserve wing, also makes its home at Travis AFB with its four flying squadrons, three Aerial Port Squadrons, and three Aircraft Maintenance Squadrons.

The 60th AMW is responsible for strategic airlift and air refueling missions circling the globe. The unit's primary roles are to provide rapid, reliable airlift of American fighting forces anywhere on earth in support of national objectives, and to extend the reach of American and allied air power through mid-air refueling. The 60th AMW maintains a work force of approximately 5,800 active-duty military and more than 1,000 appropriated fund civilians and more than 400 non-appropriated fund civilians to support its global mission. In addition, more than 3,500 Reservists are assigned to the associated 349th AMW; combined with their active duty and civilian counterparts form a fully integrated Total Force team.

Travis AFB maintains two main runways; Runway 3R/21L and 3L/21R, which are both oriented northeast/southwest. Both runways are protected by a 2,000-foot wide primary surface in which development is prohibited. The primary surface of the two runways consumes about 1,036 acres of land. A new runway facility, the Assault Landing Zone (ALZ), was recently constructed parallel to 3R/21L on 58 acres. Other facilities supporting flight operations include associated taxiways, cargo ramps, hangars, and associated maintenance facilities.

Travis AFB supports about 42,000 annual total aircraft operations of which 41 percent occur at night, between 10:00 p.m. and 7:00 a.m. Many operations at Travis AFB are conducted by the military aircraft based at the installation, but a large number also include many transient military aircraft and contract commercial aircraft. Flight frequency is variable and future operation rates are subject to change based on mission need. As part of flight operations and other non-mission related flight activities including air shows, the Air Force may alter or expand existing facilities. In most cases, these activities will occur within previously disturbed or developed areas. To reactivate, operate, and maintain existing facilities at Travis AFB, the Air Force may demolish and/or remove existing equipment, fences, antenna towers, and power poles; install structures above and below ground such as subsurface communication lines and utilities, concrete pads for mounting equipment, new power poles and power lines, firebreaks, diesel-powered generators, security barriers, fences and lighting; and repave access roads.

Limited expansion of existing airfield operations and maintenance facilities is projected under the Air Force's Installation Development Plan, including a new War Reserve Material storage facility, Aerial Port facility renovation and new fencing around the airfield development area. About 783,285 square feet (ft^2) of facilities are scheduled for demolition within the developed area north of the flightline.

Security and Antiterrorism Operations

Security and antiterrorism operations primarily include law enforcement patrols and boundary evaluation. These operations include using vehicles to conduct the patrols, which typically traverse the Base via existing roads and trails; installing high-powered lights; and removing vegetation via mechanical removal (e.g. mowing, weed eating), or herbicide treatment to improve visibility at secure facilities, gates, and similar locations. Fence maintenance and repair is another crucial component of security and antiterrorism operations.

Other Military Training

Travis AFB military personnel may conduct field operations training for personnel on a routine basis. Training may consist of erecting temporary shelters (e.g., tents), staging of equipment and vehicles, and locating generators near the temporary training sites. Some of these activities will occur in upland areas.

Infrastructure Support

The general types of operations and maintenance projects that routinely occur on Travis AFB include: repair and maintenance of paved and unpaved roads and parking lots; maintenance and demolition of structures and buildings; maintenance, inspection, repair, and replacement of drinking water, wastewater, storm water, natural gas, and other compressed gas pipelines; fuel systems; installation of under- and above-ground utilities such as fiber-optic cables, conduits, power lines, and sensors and poles; landscaping and mowing; and maintenance and replacement of fences and signs.

Road and Bridge Construction and Maintenance

Road Maintenance

The Air Force maintains more than 76 miles of arterial roadways and 118 miles of secondary roadways that vary from one to four lanes in width. The average life span for most roads is anticipated to be 20 years before complete replacement. Travis AFB's 60 AMW Civil Engineer Squadron maintains roads annually after the rainy season. Repair activities may range from filling potholes to replacing road segments. Under most circumstances, replacement will require removal, grading, curb repair, placing new foundation and pavement, placing culverts, testing, sealing, painting, and installation of reflectors or other warning devices. Unpaved roads are used by security, operations, maintenance, and other personnel at all times of the year.

The Air Force performs unpaved road maintenance activities to make the roads usable by standard and four-wheel drive vehicles. These actions include, but are not limited to, installing and grading gravel material or shale to improve road stability and decrease washouts and weathering, installing drainage culverts where needed, filling holes, and repairing any areas where erosion has impacted the road. Recreational pathways for non-motorized vehicles and pedestrians occur throughout the Base in recreational areas as well as throughout Base housing. These paths are primarily comprised of decomposed granite or asphalt and are typically 4 to 6 feet wide. These paths are maintained during the dry season as needed to ensure they are safe for use. Maintenance activities include repairing and filling cracks on paved paths, smoothing and redistributing trail surface material for unpaved paths, and mowing as necessary.

Road paving and repair will generally disturb up to 25 feet from the paved road surface, which allows for equipment to access the area. The existing surface will be leveled and then base rock will be laid down up to 6 inches thick and then covered by up to 6 inches of asphalt or concrete. For gravel roads, the surface will be leveled and 2 to 4 inches of gravel will be laid down. The depth of

disturbance will be no more than 18 inches for paved roads and 12 inches for gravel roads. The heavy equipment used for construction may include scrapers, loaders, grinders, pavers, or rollers.

Bridge Construction and Maintenance
New bridges will be constructed throughout Travis AFB as needed. Materials such as rock, concrete, and sand will be used to upgrade the physical structure so that the bridges can support vehicles. Bridge construction may also include removal/excavation of sediments and bottom material. Bridge construction will typically involve the use of heavy equipment such as excavators, scrapers, loaders, dozers, backhoe, cranes, and dump trucks.

Existing bridges throughout Travis AFB will be repaired, maintained, or upgraded to existing safety standards as needed. Routine repair activities include the repair of footings to prevent future erosion, the installation of railings and support beams for structural support, the sealing of cracks, and the filling of potholes in roadways. Materials such as rock, concrete, and sand will be used to upgrade the physical structure so that the bridges can support vehicles. Bridge repairs may also include removal/excavation of sediments and bottom material and the use of an excavator and a dump truck.

Runway, Aircraft Ramps and Taxiway Repair and Maintenance
The existing concrete aircraft runways, parking ramps and taxiways on Travis AFB may become deteriorated over time to the point where there is an increased risk of foreign object damage to aircraft. As these areas are identified, Travis AFB will replace the existing concrete runway, taxiways and parking ramp and repave the asphalt shoulders as needed. The work typically consists of the removal of existing concrete and granular base, and placement of the new concrete layer. The concrete layer is placed over a drainage layer, which is placed over aggregate base layers and a lime-modified subgrade layer. The asphalt shoulders are then repaved with hot mix asphalt. Lastly, joint sealing and paint striping is completed. The cementitious material, aggregates, water and admixtures are placed in transit agitator trucks or mixer trucks and transported from a temporary concrete batch plant to the project site and unloaded into a paver machine. It is anticipated that between two to four 10 cubic yard mixer trucks will be needed for these types of activities (depending on contractor production rates).

Joint and Crack Sealing
Travis AFB runways, taxiways and ramps require routine maintenance and include repair and sealing of pavement joints and cracks. Joint and crack repair includes the removal of the existing joint, sandblasting or other means of cleaning the joint or crack and then resealing the joint with an appropriate sealant. The equipment used for this operation typically includes a 200-gallon capacity heated asphalt joint seal machine or equivalent.

Runway Rubber Removal
Twice per year, Travis AFB is required to remove the rubber that accumulates on the active runway surfaces. Rubber deposits are removed using specialized rubber removal equipment that uses high pressure water without additional chemicals. The water is recirculated within the equipment and all waste water and rubber debris is contained for proper disposal off- Base. During this activity, all equipment remains on paved surfaces at all times. Following rubber removal, the runway surface is typically restriped and any cracks are sealed.

Facility Maintenance and Demolition

Maintenance and Upgrade
Facilities will be repaired, upgraded, and maintained throughout Travis AFB. Most work will be located in the developed areas of the main Base, the flightline and housing areas. Facility repair or upgrades will generally occur in areas that are previously developed. Activities may include maintenance and upgrades to existing facilities, munitions storage structures, parking lots, storage sheds, concrete pads for utility boxes, sidewalks and communications structures. Each project will have a ground disturbance footprint of up to 1 acre. These activities may involve the use of heavy equipment including excavators, bulldozers, dump trucks, pavers, and scrapers.

Air Force recreational facilities such as running tracks and soccer and softball fields may require periodic maintenance to ensure the surfaces are safe for use and may include filling holes, replacing turf and minor ground leveling. The munitions bunkers on the Base have soil roofs that require periodic repair and/or replacement, in part due to ground squirrel activity. To replace the soil roofs, Travis AFB will remove the existing turf covering on a bunker (roughly 2,500 ft^2 each) and fill with soil at a minimum of 2 feet in thickness. The new soil roofs will consist of a smooth slope down to the base of each bunker and will be treated with lime. Grass will then be reestablished to stabilize the earthen cover. Repair of these structures may include filling cracks and holes in the earthen surfaces. Other repairs may include trenching through upland habitat to repair electrical system deficiencies and the placement of concrete pads for installation of associated service equipment.

Demolition
Travis AFB will remove degraded, unsafe, and/or unnecessary facilities. Removal of the facilities is necessary to minimize safety concerns, reduce maintenance costs, and/or provide land for new construction. Demolition activities will typically occur in the developed areas of the main Base, such as the flightline and housing areas. These activities may involve ground disturbance of up to 3 feet in depth, and may include removal of: existing facility structures; associated equipment and utilities; facility parking lots; and fencing. Activities may require use of heavy equipment including excavators, bulldozers and dump trucks.

Utility Installation, Maintenance, and Removal
Aboveground Utility Lines
Existing utilities will be replaced and maintained throughout the Base in support of Air Force's missions. Additionally as Travis AFB implements new missions, the installation of new utilities will likely be required. Most of the existing utilities are located in the developed areas of Travis AFB. Occasionally, there will be utilities installed in the undeveloped areas when expanding existing lines is needed. Utility poles on the Base are generally placed 180 to 250 feet apart. This generally allows for avoidance of wetlands during the installation and replacing of poles. Guy wires for pole stability are sometimes required, which are installed surrounding the pole using tie downs secured in concrete blocks (<5 ft^2).

Utilities will generally be installed within 25 feet of existing roads; however, some traverse open grassland areas. Pole installation will involve disturbance of a 100-foot diameter area. This will allow for heavy equipment to conduct the installation by digging down 6-10 feet to install the pole. A 24-inch truck mounted auger is typically used to excavate down to 6-10 feet and install the pole. A similar process is used to install guy wires (anchors) and guy poles. Typical equipment includes: pole trailers; line (bucket) trucks; and digger (pole) trucks.

Annual inspection will require access to utility poles, transformers and electrical equipment in undeveloped areas on Travis AFB. Typical equipment used to access these areas will involve disturbances of a 50-foot diameter area around the equipment. Access for typical annual equipment inspections is limited to the dry season, barring emergencies when life and death situations are presented due to electrical system malfunctions.

Underground Utility Lines
New and existing utilities including in-ground electrical; communication cables; pipes for below ground water; fuel; and sewer lines will be installed and maintained throughout the Base to support new workload, missions or an increased capacity of existing workloads. Most of the existing utilities are located in the developed areas of Travis AFB. Occasionally, there will be utilities installed in the undeveloped areas when expanding existing lines is needed. Utilities will generally be installed within 25 feet of existing roads, however some traverse open grassland areas. Trenching varies for different utilities. For electrical, the trench will be between 2-5 feet wide and 3-6 feet deep. The trench for cable and pipe placement will be between 2-5 inches wide and 3-4 feet deep. When installation of utilities involves directional drilling underground, a 6 x 6 x 6 foot entrance and exit pit is required for drill head access and removal. A trencher or backhoe will be used for these tasks. Soil will be backfilled into all trenches.

Underground electrical utility projects frequently include the installation, removal, or maintenance of pad-mounted electrical transformers that provide electrical service to structures on the Base. The concrete/fiberglass pads typically range from 3' x 3' x 6" to 10' x 12' x 12" (width x length x depth), and are typically located in close proximity to the structure they feed. Some electrical infrastructure/designs necessitate pad-mount transformer locations be located in upland grassland areas. Other typical electrical infrastructure include: pullboxes; junction boxes; switches; handholes; manholes; circuit breakers; etc.; all of which vary in size and require different installation methods. Occasionally, underground electrical lines experience faults, requiring access for immediate repairs. These repairs will require a minimum 4 x 4 x 4 foot entrance pit to perform repairs. More significant excavation may be required depending on the severity of the damage. All disturbed areas will be restored to its preconstruction state upon completion of the repairs.

Electrical manholes are occasionally dewatered in order to prevent underground electrical infrastructure damages, and to ensure safe working environments. Utility vault pumps will be constructed in accordance with the National Pollutant Discharge Elimination System Utility Vault Discharge Permit conditions. Depending on the time of year and location of the vault, discharges vary between a couple hundred gallons, to thousands of gallons.

Culverts and Drainage Ditches
New culverts will be installed at drainage crossings and high surface water flow areas throughout Travis AFB. Existing culverts and drainage ditches are mostly located in the developed areas of Travis AFB. Occasionally, there will be new culvert and drainage ditches constructed in the undeveloped areas when necessary. This will ensure surface water is adequately captured and contained to reduce potential flooding on the Base. Existing culverts will be upgraded or repaired at drainage crossings. This work will involve replacing existing culverts with larger ones, and may require minimal widening or deepening of current drainages. Soil , sediment, and vegetation will be excavated during culvert installations, which require an excavator, back hoe, and dump truck. New culverts and culvert repairs may also include constructing new concrete support structures at road culverts.

Landscape Maintenance

Landscape maintenance activities include planting, trimming and mowing, and the removal of turf, shrubs, and flowerbeds. Landscaped areas occur predominantly in the main cantonment and housing areas, at high visibility facilities, and in the vicinity of the airfield and flightline. The Air Force may remove existing vegetation and landscape areas associated with the construction of new facilities in areas not previously landscaped.

Fencing Installation, Maintenance, and Replacement

To enhance security and protect assets and resources, fences are erected throughout Travis AFB around buildings, facilities, and areas containing natural resources. Fences may also be used to contain livestock, prevent pedestrian access in natural areas, and to demarcate various areas. Currently, there are about 100 miles of existing fence, and the type (chain link, barbed wire, electric) and height of these fences vary based on its purpose. Fence installation, maintenance and replacement typically involves clearing brush, digging holes mechanically or by hand, and installing new poles and fencing. Maintenance schedules are highly variable and depend on the condition of the fence and the asset it is protecting.

Travis AFB repairs or replaces 5,000 to 10,000 feet of fencing each year. In addition, due to changing security requirements, the Base may install about 10 miles of new chain link fence over the next 5 years. Installation of fencing will require a 15-foot area to be mowed clear of all vegetation and area leveled. Equipment such as a tractor and truck with an auger that will access the area in the 15-foot work zone may be required. A 3-foot deep hole will be dug to install the support poles that are 1 foot in diameter. Support poles will be installed every 10 feet. If necessary to avoid wetlands, the poles can be extended out to 15 feet and concreted in. The chain-link fence will be constructed to a height of 7-8 feet with three strands of barbed wire placed on outriggers.

Infrastructure Development

Development Pattern

The existing development pattern provides a basic guidance for the future development of land resources and attempts to integrate future requirements with decisions made over the last 50 years. The development pattern attempts to balance the need to maintain a maximum capability for: the Base's mission; locating new facilities in economical and convenient locations; and for the conservation of federally-listed species and their habitat. Because flight operations are the primary mission of the Air Force at Travis AFB, the land use is a high priority in regards to future facility planning.

Future Development

Land use at Travis AFB is not expected to change significantly; however, hardscape development such as the addition of new parking lots, roads compacted gravel, and other hardscape surfaces is planned to occur. Additionally, there are multiple opportunities to make better use of space and consolidate functions efficiently. This is particularly true of the north flightline, which is considered the prime real estate of the installation. Over time, uses that do not require adjacency to the airfield will be moved off the flightline. The other major consolidation of land uses is in the southwest. Industrial uses that are currently scattered across the installation will be co-located in the future, forming a super-industrial district. This will reduce compatibility issues with other uses, and also create space on the flightline and in other areas.

Administrative uses will expand but functions will be concentrated together more densely. The current patchwork of multiple land uses will be phased out over time to create a more cohesive, campus-like environment. Recreational uses, which are currently spread out across the Base, will be

consolidated into a recreation campus in the northwest corner of the installation, providing easy access to and from accompanied housing.

Space is projected for additional recreational facilities that serve the Base population, including the addition of new soccer fields, community park development and the expansion of other outdoor recreation land use growth areas. These are generally located adjacent to housing and the dormitories in the urbanized portion of the cantonment area. Expansion of these recreational areas will entail increasing their acreage and incorporating landscaping and recreational equipment for children and adults.

Minor Construction Projects
New facilities will be constructed throughout Travis AFB. Development of new industrial, commercial, and residential facilities may include airfields; munitions storage facilities; communication structures; concrete pads; parking lots; storage yards; and detention basins. Most of the new facility construction will occur in developed areas of the main Base, such as the flightline or housing areas. New construction will be generally limited to designated development areas; although, new construction may occasionally involve minimal disturbance to undeveloped areas. Projects occurring in developed areas may cause disturbances down to 6 feet. Projects requiring excavation to 6 feet will use heavy equipment including excavators, bulldozers, dump trucks, pavers, and scrapers.

Environmental Management Programs
Environmental Restoration Program (ERP)
The ERP is a congressionally authorized Department of Defense (DOD) program for the identification, investigation and remediation of past DOD waste releases (prior to January 1, 1984). The ERP is designed to identify and correct problems arising from past releases of hazardous substances and petroleum products into the environment. Travis AFB is a National Priority List site; therefore, the Base is required to address ERP sites in a manner consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act, and the Resource Conservation and Recovery Act (RCRA). The Environmental Protection Agency (EPA) Region 9 is the lead regulatory agency for the investigation and cleanup of contaminated are as in coordination with the California Department of Toxic Substances Control (DTSC) and the California Regional Water Quality Control Board (RWQCB), San Francisco Bay Region.

Most of the installation's ERP sites have undergone clean-up actions and are closed, but 29 sites with land use controls (LUCs) remain. These sites are undergoing remediation and until closed will require special consideration to limit exposure to contaminants. Travis AFB has been involved in environmental cleanup for over 30 years. Currently, Travis has 10 contaminated soil sites with LUCs and 19 contaminated soil and/or groundwater sites also under LUCs. At each remaining restoration site, Travis AFB restricts the land use to industrial purposes only; prohibits on-Base water supply well construction and consumption of contaminated groundwater; and places constraints on soil excavation and other subsurface work where a worker might encounter contaminated groundwater or vapors. The 19 contaminated groundwater locations are primarily located near the flightline. Major soil clean-up actions were completed in 2003 and 2007. Efforts to clean up remaining sites are ongoing.

Site Investigations and Remediation Methods
A substantial amount of investigation has been completed to characterize the nature and extent of contamination and the potential response actions for each location. A typical methodology to

determine the type and extent of contamination at a site is the collection of soil samples from varying depths, depending on the specific site and the known historical contaminants present at the site. While some borings may be as shallow as 1 to 2 feet, some may exceed 50 feet. Soil samples may be collected with hand equipment (i.e., hand auger) or mechanical tools (i.e. air knifing, drill rigs with augers or direct push technology). Soil borings are generally made in areas surrounding the contaminated site to determine the extent of contamination. If groundwater contamination is being investigated, groundwater samples may be collected using a direct-push technology rig or a hollow-stem auger drill rig. Investigation groundwater samples are generally collected from depths of 15-40 feet. Drilling activities generally generate soil cuttings that are stored in soil bins or 55-gallon drums that placed in close proximity to where drilling activities occur.

While most of the ERP sites on Travis AFB have been cleaned up and closed, some sites may require further action. Remediation activities can include well installation (extraction, injection, and monitoring wells); redevelopment of existing wells; decommissioning of wells once they are no longer needed; soil excavation and backfill; hauling; soil capping; phytoremediation plantings; chemical or biological amendment injection to groundwater; single or multiphase extraction and aboveground treatment; in-ground permeable reactive barrier or barrier wall; air sparging; and thermal treatment. Most of these technologies require installation of access to monitoring wells for periodic monitoring of the treatment system. The nature and area of disturbance associated with each of these activities can vary greatly as indicated below:

- Well Installation involves utility clearance, drilling, construction of the well and surface completion, well development, and surveying of the well. Disturbances range from 10 ft^2 to less than 1 acre.
- Well Redevelopment of existing wells to optimize the performance of the wells. Disturbances range from 10 ft^2 to less than 1 acre.
  Well Decommissioning involves either pressure grouting or over drilling and grouting of the well. Disturbances range from 10 ft^2 to less than 1 acre.
  Soil Excavation involves removal of contaminated soil. Disturbances range from 10 ft^2 to several acres.
- Soil Capping involves covering contaminated soil with either a few feet of soil or a layer of concrete/asphalt to prevent contact with the contaminated material. This technique is often applied to former landfills, such as the former Landfill 2 on Travis AFB, where 94 acres were capped with 5 feet of clean soil. Disturbances range from 10 ft^2 to less than 1 acre.
  Phytoremediation involves the planting of trees in order to extract shallow contaminated groundwater. They also absorb contaminants and thereby cleanse the aquifer. The level of these effects will depend on the water uptake capacity of the plants and the size of the aquifer. Disturbances range from 0.25 to 2 acres.
- Chemical or Biological Amendment Injection involves injection of compounds into the subsurface either through the use of a direct-push rig or an injection well network. The injection array can be installed to concentrate on a source area or as a flow-through barrier with spacing ranging from 5 to 20-foot centers. Disturbances range from 100 ft^2 to 2 acres.
- Permeable Reactive Barrier Installation involves the installation of a narrow barrier generally 2-5 feet wide extending into groundwater containing a material that enhances treatment. The reactive material varies and may include, but is not limited to, iron filings, bark mulch, oxygen, emulsified vegetable oil, or ozone injection. Permeable Reactive Barrier remediation can also involve driving sheet piling into the surface or using direct-push rigs to create a grout curtain to direct the flow of groundwater though a localized barrier. Disturbances range from 100 to 3,000 feet.

- Multiphase Extraction or Sparging with Aboveground Treatment involves trenching and the installation of piping to connect 1 to 50 or so wells to an aboveground treatment system that consists of a concrete pad with the necessary treatment equipment. The area for trenching will range from 10 to 3,000 feet per trench. The treatment pad can range from 100-2,500 ft^2.
- Thermal Treatment involves installation of subsurface heating elements and thermal couples on 10 to 20-foot centers over the extent of the treatment zone. It includes installation of a multiphase extraction system with associated aboveground treatment system described above. The area for trenching will range from 10 to 3,000 feet. The treatment pad will range from 500 to 2,500 ft^2. During this treatment, the ground is heated to volatilize contaminants therein and the volatilized compounds are then vacuumed off, captured and removed.

ERP Site Maintenance and Groundwater Monitoring

Most sites also require regular operation and maintenance activities. The groundwater restoration extraction wells, conveyance pipelines, underground electrical systems, and groundwater treatment plants at Travis AFB are operated and maintained on a continuous basis throughout each year. The purpose of this activity is to maximize the run-time of the systems in order to remediate contaminated groundwater beneath the Base as efficiently as possible.

Groundwater wells are sampled throughout each year to monitor contaminant plume mobility, degradation, and potential for new releases. There are currently 962 groundwater wells, 385 of which are typically sampled each year. In addition to sampling, 665 of the wells associated with Travis AFB are typically monitored for depth-to-water at least annually to assess water table fluctuations and hydraulic gradients. Well sampling and water level measurements are generally conducted two times per year (in April/May and in October/November). However, sampling may be conducted on a smaller scale throughout the year. Additionally, surface water samples are typically collected in April/May from five locations along Union Creek, where the creek intersects groundwater plumes. The surface water sampling data is used to evaluate whether groundwater discharging to the creek is adversely affecting surface water quality.

Invasive Plant and Pest Management (Fauna)

The U.S. Department of Agriculture conducts the non-lethal removal of raptors under a permit from the Service's Migratory Bird Permit Office in support of the Travis AFB BASH Program (Travis AFB 2008). Bullfrogs (*Rana catesbeiana*) and non-native fish may require removal from ponds on the Base. These species will be removed using seine nets, traps, and other commonly used devices. Alternately, ponds on Travis AFB may be pumped dry to eliminate populations of bullfrogs and fish in order to improve habitat conditions for the California tiger salamander.

Common pest wildlife on Travis AFB includes turkeys, skunks, opossums and raccoons. Pests are removed on an as needed basis. Physical removal and relocation of these animals is done with HAVAHART live traps. Additionally, Macabee traps and Wilco Gopher Getter are used to remove pocket gophers. Manicured lawns, parade grounds, golf course greens and fairways, and athletic fields are treated for gopher removal. Ground squirrels are found nesting along ditch banks and in open fields. Squirrel control is allowed using Wilco Ground Squirrel Bait in areas greater than 1.3 miles from known California tiger salamander breeding ponds (Travis AFB 2016b). If control is required in areas within 1.3 miles of a breeding pond, the Natural Resources Manager will be contacted to develop a plan that minimizes the risk to federally-listed species and their habitat. Rats and mice infest Base buildings and housing areas and are controlled without use of chemicals by employing practices; such as, closing entryways, practicing good sanitation procedures, and using snap traps and glue boards. Food handling establishments and commissary warehouses are the main

concern.

Herbicide Application

Herbicide treatment is one method that will be used to control some invasive plant infestations. All herbicides used on Travis AFB are in accordance with Natural Resource Conservation Service's best management practices. In addition, the DOD must approve herbicides used at Travis AFB. Glyphosate (e.g., Roundup Pro®, Glyfos® Pro, Glypro™ Plus) is a nonselective, systemic herbicide that carries plant toxins to the roots, and may be the most effective method for extensive infestations in disturbed areas with little desirable vegetation. Effective control can also be achieved by using a broadleaf herbicide that does not harm grasses.

Application of Telar XP to a dry wetland is consistent with the Telar XP label which states that application is permissible to intermittently flooded low lying sites, seasonably dry flood plains, and areas between upland and lowland sites (Dupont 2011). Pepperweed is a target weed for this herbicide along with many non-native grasses, mustards, starthistles, and clovers depending on the application rate (DuPont 2011). According to the Weed Science Society of America's Herbicide Handbook, Telar XP has an average field half-life of 40 days, and this decreases with lower soil pH. The Telar XP label lists the replant interval for several common pasture grasses, which provides an idea on how long the pre-emergent qualities can last for some plants. These range from 1 month after application at low herbicide rates (0.5 ounce/acre), and up to 4-6 months at higher rates (2 ounces/acre). One study had 95 percent weed control for 2 years at rates of 0.75-1 ounce/acre. The Solano Resource Control District (RCD) has a current recommendation of 1.5 ounce/acre; thus, different application rates will be experimented at Travis AFB to best control pepperweed and avoid or minimize adverse effects to federally-listed species.

Federally-Listed Species Habitat Management

Sensitive species management uses an ecosystem approach because some areas contain more than one species, and also support multiple Base-related activities. The intent of sensitive species management activities is to enhance habitat for federally-listed species or contribute to scientific understanding of their life history and habitat requirements. Species surveys may be conducted by either a biologists holding a section 10(a)(1)(A) of the ESA permit or a biologist with equivalent training and experience to better understand the distribution of federally-listed species at the Base. These surveys may include wet-season sampling in wetlands for vernal pool fairy shrimp, vernal pool tadpole shrimp, and California tiger salamanders; dry-season sampling in wetlands for vernal pool crustaceans; and drift-net studies for the salamander. Prior to conducting these studies, a detailed work plan and qualifications of the biologists conducting the work will be sent to the Service for approval.

These management actions may include removing invasive plant species in and around vernal pools and other seasonal wetlands; installing new and maintaining existing protective fencing in suitable species habitat; collecting native seeds for restoration; and conducting species surveys. Two perennial ponds occur in the Castle Terrace Preserve and have the potential to provide breeding habitat for the California tiger salamander (with management intervention); although, they currently have very low habitat suitability due to the presence of predaceous non-native fishes and bullfrogs. Eradication of fishes and reduction of bullfrogs may transform these ponds into suitable breeding habitat for the California tiger salamander. Eradication will require that these ponds be drained completely and allowed to refill naturally. Pond draining will occur after August and before the start of the next rainy season, to more closely mimic the hydrology of suitable California tiger salamander breeding habitat (which dries out in late spring and summer). Before draining occurs, as a conservation measure, screens will be placed over the drain pipe or hose in order to exclude

potential California tiger salamanders. The drained water will be pumped into an area where erosion will not occur, and in an upland area that will not trigger emergence/movement of the salamander. Pond draining will be repeated once every 3-4 years to effectively reduce the risk of bullfrog reintroduction.

California Tiger Salamander Burrow Inspection and Relocation

For some activities, it may be necessary for a qualified wildlife biologist to inspect suitable burrows with a scope and possibly hand-excavate burrows during pre-construction surveys, or at other times as deemed necessary by Travis AFB and the Service for protection of federally-listed species. If any California tiger salamander are found during these excavation activities or encountered at other times on the Base and require relocation, the *CTS Relocation Plan* as describe in section 4.4.5 of the programmatic biological assessment, pages 55-57 will be followed.

Vernal Pool and Seasonal Wetland Restoration

Habitat restoration may be conducted in vernal pools and seasonal wetland habitat in the event that impacts result from projects or unforeseen activities. The goal of these restoration activities will be to restore impacted habitat to as close to pre-disturbance conditions as possible. Unavoidable wetlands will be surveyed prior to proposed projects, in order to characterize the preconstruction conditions. Existing vegetation and hydrology will be characterized in order to document a preconstruction condition with which to compare post-construction characteristics. The preconstruction conditions will be one of the factors used to determine restoration success.

Prior to grading within wetlands, the top 4-6 inches of topsoil will be removed from the surface and stored separately from all other spoil piles, including non-wetland topsoil, in order to maintain integrity of the soil composition and character. Wetland topsoil will be replaced in the same wetland it was taken from following backfill and grading. Restoration of wetland areas will commence as soon as is practicable following construction. Generally, monitoring of wetland areas for the success of restorative efforts will occur at a minimum of 2 years. For further detail, see section 4.4.6 of the programmatic biological assessment.

Fire Management

Fire Suppression

Emergency fire department actions will be conducted Base-wide and allow personnel to respond to emergency fires without delay. This will allow quick containment of any unexpected threat to human health, safety or the environment. These actions may require the use of excavators, bulldozers, dump trucks, and fire trucks. Because of the nature of these actions they will most likely be consulted on after an emergency action has occurred. Any emergency action that occurred and potentially impacted federally-listed species requires verbal or email notification to the Service within 24 hours and a follow-up request to the Service to append the incident to this programmatic biological opinion as soon as all information is available.

Firebreak Maintenance

A system of strategic roads and fire and fuel breaks are located throughout Travis AFB for fire control and management. Currently, there are about 10.5 miles of maintained firebreaks. Firebreaks are used to prevent or hinder the spread of fire and are usually blocks or linear strips of land, managed to maintain very low or no fuel loading. The width of a firebreak is site specific and dependent on the fuel type, asset being protected and risk of potential wildfire. Prior to 2013, all firebreaks on Travis AFB were disked to reduce fuel loading. Since 2013, the mowing of these areas has been included in the grounds maintenance contract. Firebreaks are maintained by mowing all vegetation within a 20 to 30-foot wide strip.

Certain areas of the Base including the southeast boundary and the location of the Tactical Airborne Communications and Maritime Operations Project are considered high wildfire risk with potential to impact the flying mission (Figure 8). In these areas, a disked firebreak may be installed along the Base boundary, and maintained to reduce the fire risk. This firebreak will be 20-feet wide, no more than 12 inches deep, and approximately 1.0 mile long (about 2.5 acres). Additionally, a 25-foot area surrounding the DASR radar site will be maintained as a vegetation free zone by removing all vegetation and soil down to a depth of 3 inches. The cleared area will be leveled and geotextile fabric will be placed for weed prevention. A 3-inch layer of rock will be placed on top of the geotextile fabric. Additionally, fire hazards and safety concerns within the Explosive Ordinance Disposal (EOD) range will be eliminated by removing the soil that comprises the existing berms within the EOD range, and dispersing it in the adjacent upland area. Gravel will be placed on top of the dispersed soil to provide weed control over and area of about 2.5 acres. Gravel will also be placed on about 1,400 feet of unimproved roadways (10-15 feet wide) within the EOD range to improve road conditions and access (Figure 8).

As part of wildfire suppression and fuels management activities, the Base uses access roads that are single-lane secondary dirt roads (10 to 15 feet wide) to access remote portions of the Base. These roads are used to break-up contiguous fuel loads and provide a line of defense to execute fire-fighting actions. These roads are maintained once a year, after the rainy-season. For certain fuel-reduction projects, mastication may be used. The result of the mastication is about a 6-inch mulch layer left in place on top of the soil. This mulch is left in place to limit the amount of invasive weeds that establish within the area and to assist in erosion control.

Prescribed Burns

On a project by project basis, prescribed burns may require Level 2 or Level 3 consultation for potential adverse effects to federally-listed species, depending on which prescribed fire practices are employed. Potential adverse impacts may occur from the installation of roads or fire breaks for protection of resources, or to define fire boundaries; although, Travis AFB anticipates prescribed fire to result in overall benefits to federally-listed species and their habitat.

Prescribed burns include the planned, controlled application of fire to vegetation to achieve a specific natural resource management objective on land areas selected in advance of that application. Prescribed fires conducted on Travis AFB will be ignited by qualified personnel in accordance with an approved site-specific burn plan as described in the *Travis AFB Wildland Fire Management Plan* (Travis AFB 2015). Prescribed burning operations will utilize existing manmade and natural fuel breaks as much as possible. Fuel breaks will be mowed in support of prescribed fire operations, and will not be disked or graded. Prescribed fire has not yet been conducted on Travis AFB, but may be considered.

Implementation of prescribed burns may occur within 23 proposed burn plots, covering about 985 acres of land along the perimeter of the installation (Figure 8). Prescribed burns may occur during the spring and early summer (April, May, June, and July). Typically, up to 40 acres will be burned at one time on the Base; large burn plots will be split into smaller sub-plots for safety and cost reasons. A typical prescribed fire in annual grasslands consumes 75 to 100 percent of fine fuels; therefore, reducing fire risk for at least one season post-burn; each plot may be burned up to once per year to reduce fine fuel loads for the upcoming fire season in summer and fall. Prescribed burning is one tool out of several vegetation management options and use of prescribed burning will not be maximized, but rather used only when it best meets ecological objectives for a particular area and time.

Conservation Measures

General Avoidance and Minimization Measures:

Travis AFB proposes to implement the following general avoidance and measures in order to avoid and/or minimize potential adverse effects to federally-listed species and their habitats over the next 5 years. *Species-Specific Conservation Measures* will also be implemented to avoid and/or minimize potential adverse impacts effects to the following federally-listed species, and are included in Tabs A, B, D and E of the programmatic biological assessment (Tab A - *Vernal Pool Fairy Shrimp*; Tab B - *Vernal Pool Tadpole Shrimp*; Tab D - *California Tiger Salamander*; and Tab E - *Contra Costa Goldfields.*

Monitoring and Surveying

MM-1. A Service-approved biologist will conduct preconstruction surveys of all ground disturbance areas within sensitive habitats to determine if any federally-listed species may be present prior to the start of construction. These surveys will be conducted prior to the start of construction activities in and around any sensitive habitat. If any federally-listed species are found during the preconstruction surveys, the Service-approved biologist will contact the Service to determine how to proceed. At least 10 business days prior to the onset of activities, Travis AFB will submit the name(s) and credentials of biologists who will conduct these preconstruction surveys if they have not previously received Service approval for similar surveys. See the *Biological Monitor Qualifications* section 1.4.3 of the programmatic biological assessment for the minimum experience and qualifications required to serve as a Service-approved biologist or a Natural Resource Monitor. No project activities will begin until Travis AFB has received written approval from the Service that the biologist(s) is qualified to conduct the work.

MM-2. A Service-approved biologist will monitor construction activities in or adjacent to sensitive habitats as required. The biologist will ensure compliance with all applicable avoidance and minimization measures required to protect federally-listed species and their habitats. If federally-listed species are found that are likely to be affected by work activities, the Service-approved biologist will have the authority to stop any aspect of the project that may result in unauthorized take of a federally-listed species. If the biologist exercises this authority, they must coordinate this with Travis 60 CES/CEIE who will notify the Service and the California Department of Fish and Wildlife by telephone within 1 working day and in writing within 5 working days.

MM-3. A Service-approved biologist will conduct environmental awareness training for all construction personnel working within and near sensitive habitat on the Base. Training will be provided at the start of work, and within 15 days of any new worker arrival. The program will consist of a briefing on environmental issues relative to the proposed project. The training program will include an overview of the legal status, biology, distribution, habitat needs, and compliance requirements for each federally-listed species that may occur in the project area. The presentation will also include a discussion of the legal protection for endangered species under the Act, including penalties for violations. A fact sheet conveying this information will be distributed to all personnel who enter the project site. Upon completion of the orientation, employees will sign a form stating that they attended the program and understand all avoidance and minimization measures. These forms will be maintained at Travis AFB and will be accessible to the appropriate resource agencies;

CTS-4. Construction activities will occur between 30 minutes after sunrise and 30 minutes before sunset unless otherwise specified in the proposed project description and analysis;

CTS-5. At the end of every work day, trenches, pits, and excavations shall be provided with escape ramps constructed of earth fill or wooden planks at a 3:1 slope. Before such trenches, pits, and excavations are filled, they will be thoroughly inspected for trapped wildlife;

Service Notification

MM-4. Travis AFB will track the areal extent and location of impacts resulting from projects covered under the programmatic biological opinion, and will submit an annual report to the Service

listing each project covered and summarizing effects to each federally-listed species and their habitat on a project by project basis. Travis AFB will submit an annual report to the Service by February 15 of each year, for the previous year (over the next 5-years), that documents the following information:

- Summary of projects covered under the programmatic biological opinion;
- Federally-listed species occurrences and potentially suitable habitat in each proposed project area; and
- A summation of the total effect, including beneficial effects and associated compensation, on listed species and their habitat for each proposed project.

Seasonal Avoidance Procedures

CTS-7. Seasonal Avoidance - **Wet-Season Procedures** (October 16 – April 30): Work will not be conducted in the rain. The Service-approved Biologist will monitor the weather forecast and authorize work when the forecast indicates a period of dry days (5 to 10 days of no rain) before starting the project. The Travis Environmental Office will document through email notification to the Service when work will commence. The weather forecast and hourly weather data for Travis AFB will be monitored and can be found by entering the zip code 94535 (Travis AFB) at http://www.weather.gov. A Service-approved biologist will be on-site for morning inspections before the start of work. Morning inspections consist of examination of all trenches, pits, excavations, equipment, California tiger salamander exclusionary barriers (if present), all suitable upland habitat including refugia habitat such as small woody debris, refuse, burrow entries, etc. will be properly inspected, and all other areas within the project site. In addition, the project work crew will be notified to maintain vigilance regarding potential California tiger salamander activity. If feasible, the work crew will participate in the morning inspection(s). Modifications to this timing may be approved on a case-by-case basis by the Service.

CTS-8. Seasonal Avoidance – **Dry-Season Procedures** during Rain/High Humidity Events (May 1 – October 15): Work will not be conducted if raining. The Service-approved biologist will check the National Weather Service by 6:00 AM on the day prior to a scheduled work day to see if there is a 50% or greater probability of rain forecasted overnight. If there is, then before work begins the next morning (after the rain event has stopped), the Service-approved biologist will conduct an even more extensive morning inspection. The inspection will include searching the work area and a wider perimeter of the area for presence of the species. In addition, the work crew will be notified to maintain vigilance regarding potential CTS activity. If feasible, the work crew will participate in the morning inspection(s). Modifications to this timing may be approved on a case-by-case basis by the Service. The weather forecast and hourly weather data for Travis AFB will be monitored at http://www.weather.gov.

CTS-9. If Dry-Season (May 1 – October 15) night time work is necessary, the following additional conservation measures shall be implemented:

- Work will only occur within paved areas (greater than 20 feet from uplands);
- A 6-inch high exclusionary barrier for California tiger salamander will surround the work area during work, with ingress/egress access being the only break in the barrier;
- A Service-approved biologist will be on-site during all night time work and will routinely monitor the exclusionary barrier and the project site; and
- Work will not be conducted at night time if there is a 50% or more chance of rain predicted overnight;

Buffers and Site Restoration

VP-1. No work will be conducted within 250 feet of federally-listed vernal pool species' habitat during the wet-season (October 16 – April 30); unless specifically approved by the Travis AFB

Natural Resource Management Team who must first field verify soil saturation, visual ponding, and expected surface disturbance. The Service will be notified of any off-pavement work within the designated 250 foot buffer.

MM-5. All vernal pools, drainages, and wetlands, if present, will have erosion control measures (straw waddles, silt fencing) installed where hydrological continuity exists between the construction activities and the wetland. A Service-approved biologist will determine whether erosion control measures should be utilized, weighing the potential for effects to federally-listed species. Construction boundaries within the buffer will be designated with fencing or other suitable means to ensure no equipment and/or construction workers access protected wetland resources.

Prescribed Burning

CCG. Prescribed fires will not occur in Contra Costa goldfields occupied habitat when the vegetation is green (April - June). Prescribed burns will be scheduled after Contra Costa goldfields plants have senesced and seed dispersal is complete.

Mowing

VP-2. Mowing will be completed in and around vernal pool habitat, after Contra Costa goldfields seeds set, but during the dry season (May 1 – October 15). Mowing conducted earlier in the season may be desirable to maintain appropriate conditions for vernal pool species including Contra Costa goldfields. If mowing occurs in or near vernal pools, it will occur only when the soil is no longer saturated to ensure tracks are not left in or near wetlands. The mower height will be set to avoid the flowering heads of sensitive vernal pool plant species. Populations of Contra Costa goldfields, and known California tiger salamander breeding ponds will be avoided during the spring and early summer months.

Herbicide Application

Herbicide application and invasive species management activities will comply with the Updated Invasive Plant Species Management Plan (note, changes to this plan are identified below. Travis AFB will implement additional buffers during herbicide application which were identified in their response letter dated, July 11, 2017; in an excerpt from the Solano RCD, titled *Invasive Plant Mapping and Management, 2016 Annual Activity Report*; and are also included below:

- Mechanical methods will be used for the removal of invasive plant species within 20 feet of the mapped wetlands. Herbicide treatment will not be applied within 20 feet from the edge of mapped wetlands, with the following exceptions: in areas where mechanical treatments within 20 feet of a wetland will not be effective in eliminating the infestation and herbicide application within this buffer is required when water is present in pools;
- Herbicide application will occur once pools are dry (May – June), allowing for a 4 to 6 month dry period;
- All mixing of herbicides will be conducted at least 150 feet from water and often off-Base;
- Herbicide applicators will prescribe and use only non-ionic surfactants near open water (i.e., TERGITOLTM 15-S surfactants);
- When spraying on roadsides, applicators will use a surfactant such as GROUNDED® that increases soil particle absorption and modulates droplet size to prevent soil mobility and decrease aerial drift to prevent movement of chemical into sensitive habitat areas; and
- Herbicides will be applied with a hand held backpack sprayer, targeted to hit only the pepperweed with a focused nozzle and careful application.

Minimization/Conservation Measures Proposed (Travis AFB's letter dated July 11, 2017):

1. Herbicides will only be administered by State Licensed Qualified Applicators;
2. The application of any pesticide, including herbicides will be conducted in accordance with approved Integrated Pest Management Plan, Updated Invasive Species Management Plan, and Integrated Natural Resources Management Plan which includes submission of monthly herbicide use reports, summarized in annual activity reports;
3. Herbicides will be applied according to the chemical manufacturer's instructions on the label, along with other applicable conservation measures. All mixing of herbicides will be conducted at least 150 feet from water.
4. Herbicide applicators will prescribe and use only non-ionic surfactants near open water. These surfactants are readily biodegradable and low in aquatic toxicity. An example is the TERGITOL™ 15-S surfactants by Dow; and
5. While spraying on roadsides, applicators will use a surfactant such as GROUNDED® that increases soil particle absorption and modulates droplet size to prevent soil mobility and decrease aerial drift; thus, preventing movement of chemical into sensitive habitat areas (primarily wetlands).

MM-6. All areas of upland ground disturbance or exposed soil will be reseeded with a native "weed-free" seed mix approved by the Travis AFB 60 CES/CEIE. Ground disturbance within vernal pools will require a restoration plan and 2 years of follow-up monitoring by a Service-approved biologist. Note, that direct impacts to wetlands require a Clean Water Act Section 404 permit issued by the U.S. Army Corps of Engineers and Section 401 permit from the State Regional Water Quality Control Board.

Additional Measures

MM-7. Off-road travel outside of the demarcated construction boundaries will be prohibited;

MM-8. Prior to initiation of construction activities, sensitive areas, such as vernal pools, wetlands, riparian areas, and potential habitat for federally-listed species (i.e., vernal pool fairy shrimp, tadpole shrimp, CTS, and Contra Costa goldfields), will be staked and flagged as exclusion zones where construction activities will not take place. Orange construction barrier fencing (or an appropriate alternative method) will designate exclusion zones where construction activities are prohibited. Flagging and fencing will be clearly marked as an "Environmentally Sensitive Area". The contractor will remove all fencing, stakes and flagging within 60 days of construction completion.

MM-9. Any worker that inadvertently kills or injures a federally-listed species, or finds one injured or trapped, will immediately report the incident to the on-site biologist. The biologist will inform the Travis AFB 60 CES/CEIE immediately, who will verbally notify the SFWO within 1 day, and will provide written notification of the incident within 5 days.

MM-10. Motor vehicles and equipment will only be fueled and serviced in designated service areas. All fueling and maintenance of vehicles and other equipment and staging areas will occur in a designated area with appropriate spill containment. Any newly established, project specific fueling and maintenance areas will be located at least 250 feet from any wetland/drainage habitat or water body. Prior to the onset of work, Travis AFB will ensure that a plan is in place that will allow for a prompt and effective response to any accidental spill. All workers will be informed of the importance of preventing spills and of the appropriate measures to take should a spill occur;

MM-11. During construction activities, all trash will be properly contained, removed from the work site daily, and disposed of properly. Following construction, all refuse and construction debris will be removed from work areas. All garbage and construction-related materials in construction areas will be removed immediately following project completion.

MM-12. Unless otherwise designated as part of a habitat restoration plan, all excess soil excavated during construction occurring near vernal pools and other wetlands will be removed and disposed of

outside the project area. Coordination with the Travis AFB 60 CES/CEIE and appropriate regulatory agencies is required prior to disposal of the excavated soil;
MM-13. The number of access routes, number and size of staging areas, and the total area of the activity will be limited to the minimum necessary to achieve the project goal. Routes and boundaries will be clearly demarcated, and these areas will avoid wetlands/drainage areas whenever feasible.
MM-14. All vehicle operators will follow the posted speed limit on paved roads and a 10-mile per hour speed limit on unpaved roads;
MM-15. No pets or non-military firearms will be allowed in the project area;
MM-17. No trenches will be left open at the end of the day; trenched areas will be compacted and restored to normal grade once the project is completed; and
MM-18. No work requiring vehicles/equipment will be done when the ground is soft enough where travel will cause depressions.

Furthermore, Travis AFB has agreed to limit the amount of disturbances that will occur in suitable habitats for the California tiger salamander, vernal pool fairy shrimp, vernal pool tadpole shrimp, and Contra Costa goldfields. See the *Effects of the Action* section below for specific acreage amounts that will not be exceeded annually, or over a 5-year period.

Compensation Measures
Travis AFB proposes the following habitat compensation for adverse effects to the California tiger salamander, vernal pool fairy shrimp, vernal pool tadpole shrimp, and Contra Costa goldfields, or their habitat (Table 3 below). These ratios are dependent on whether the proposed project results in adverse effects that are direct or indirect, and whether these adverse effects are temporary or permanent. Habitat compensation may be met by Travis AFB by purchasing habitat at a Service-approved Conservation Bank, or through the preservation and protection in perpetuity of high value habitat at an acquired site near the Base.

Table 3. Habitat Compensation Ratios for Direct and Indirect Effects to the California Tiger Salamander, Vernal Pool Fairy Shrimp, Vernal Pool Tadpole Shrimp, and Contra Costa Goldfields.

Species	Level of Effect		Compensation ratios
CTS Upland	Temporary		0.5:1 Preservation of Upland Habitat
	Permanent		2:1 Preservation of Upland Habitat
CTS Breeding	Direct		3:1 Preservation of CTS breeding habitat; and 2:1 (or 0.35 ac., whichever is greater) Creation of CTS breeding habitat
	Indirect		2:1 Preservation or creation of CTS breeding habitat
VPFS/VPTS*	Direct	High value	7:1 Preservation of existing VPFS/VPTS habitat
		Medium value	3:1 Preservation of existing VPFS/VPTS habitat
		Low value	1:1 Preservation of existing VPFS/VPTS
	Indirect		1:1 Preservation of existing VPFS/VPTS habitat
CCG**	Direct		7:1 Preservation of existing CCG habitat; and 2:1 Establish self-reproducing populations in protected habitat areas
	Indirect		1:1 Preservation of existing CCG habitat

*The compensation ratio may also be met by 6:1 or 2:1 preservation with a 1:1 creation component in the high and medium value conservation areas respectively.
**The restoration requirement may be met by establishing new CCG populations at a single-project mitigation site or by purchasing credits at an approved mitigation bank authorized to sell credits for this species in an amount equal to the 2:1 mitigation ratio.

Action Area

The action area is defined in 50 CFR § 402.02, as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." For the proposed project, the action area encompasses Travis AFB properties consisting of a main Base (Solano County) and

eight GSUs (Solano and Contra Costa counties). Travis AFB is situated on about 5,137 acres of fee-owned land with lesser interests (easements) on additional land surrounding the Base. The eight GSUs controlled by Travis AFB are the: Defense Fuel Supply Point Ozol (51.40 acres - fuel facility within the Carquinez Strait, Contra Costa County); Potrero Hills Annex (24.81 acres - former Nike missile site in the Potrero Hills, Solano County); Middle Runway Marker (1.86 acres - airfield infrastructure, Solano County); Outer Runway Marker (0.23 acre - airfield infrastructure, Solano County); Water Well 1 (1.75 acres - well facility, Solano County); Cypress Lakes Golf Course (207.52 acres - golf course facility, Solano County); and the Former Sacramento Northern Railroad Right-of-Way (70.00 acres - railroad right-of-way, Solano County).

Analytical Framework for the Jeopardy and Adverse Modification Analysis

Section 7(a)(2) of the Endangered Species Act requires that federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of the federally-listed species covered in this consultation. "Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR § 402.02).

The jeopardy analysis in this programmatic biological opinion considers the effects of the proposed federal action, and any cumulative effects, on the range-wide survival and recovery of federally-listed species. It relies on four components: (1) the *Status of the Species*, which describes the range-wide condition of the species, the factors responsible for that condition, and its survival and recovery needs; (2) the *Environmental Baseline*, which analyzes the condition of the species in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the species; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed federal action and the effects of any interrelated or interdependent activities on the species; and (4) the *Cumulative Effects*, which evaluates the effects of future, non-federal activities in the action area on the species.

The following analysis places an emphasis on using the range-wide survival and recovery needs of the California tiger salamander, vernal pool fairy shrimp, vernal pool tadpole shrimp, and Contra Costa goldfields, and the role of the action area in providing for those needs as the context for evaluating the significance of the effects of the proposed federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

Analytical Framework Adverse Modification

Section 7(a)(2) of the ESA requires that federal agencies insure that any action they authorize, fund, or carry out is not likely to destroy or to adversely modify designated critical habitat. A final rule revising the regulatory definition of "destruction or adverse modification" (DAM) was published on February 11, 2016 (81 FR 7214). The final rule became effective on March 14, 2016. The revised definition states:

> "Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features."

The DAM analysis in this programmatic biological opinion relies on four components: (1) the *Status of Critical Habitat*, which describes the range-wide condition of the critical habitat in terms of the key components (i.e., essential habitat features, primary constituent elements, or physical and biological features) that provide for the conservation of the listed species, the factors responsible for that condition, and the intended value of the critical habitat overall for the conservation/recovery of the listed species; (2) the *Environmental Baseline*, which analyzes the condition of the critical habitat in the action area, the factors responsible for that condition, and the value of the critical habitat in the action area for the conservation/recovery of the listed species; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated and interdependent activities on the key components of critical habitat that provide for the conservation of the listed species, and how those impacts are likely to influence the conservation value of the affected critical habitat; and (4) *Cumulative Effects*, which evaluate the effects of future non-Federal activities that are reasonably certain to occur in the action area on the key components of critical habitat that provide for the conservation of the listed species and how those impacts are likely to influence the conservation value of the affected critical habitat.

For purposes of making the DAM determination, the Service evaluates if the effects of the proposed federal action, taken together with cumulative effects, are likely to impair or preclude the capacity of critical habitat in the action area to serve its intended conservation function to an extent that appreciably diminishes the rangewide value of critical habitat for the conservation of the California tiger salamander, vernal pool fairy shrimp, vernal pool tadpole shrimp, and Contra Costa goldfields. The key to making that finding is understanding the value (i.e., the role) of the critical habitat in the action area for the conservation/recovery of these listed species based on the *Environmental Baseline* analysis.

Status of the Species

California Tiger Salamander
For the most recent comprehensive assessment of the California tiger salamander's range-wide status, please refer to the *California Tiger Salamander Central California Distinct Population Segment (Ambystoma californiense) 5-year Review: Summary and Evaluation* (Service 2014), and the *Recovery Plan for the Central California Distinct Population Segment of the California Tiger Salamander (Ambystoma californiense)*, signed June 06, 2017 (Service 2017). No change in the California tiger salamander's listing status was recommended in this 5-year review. Threats evaluated during that review and discussed in the final document have continued to act on the species since the 2014; 5-year review was finalized, with loss of habitat being the most significant effect. While there continue to be losses of California tiger salamander habitat throughout its range, to date no project has proposed a level of effects for which the Service has issued a biological opinion of jeopardy for this species.

Vernal Pool Fairy Shrimp
For the most recent comprehensive assessment of the vernal pool fairy shrimp's range-wide status, please refer to the *Vernal Pool Fairy Shrimp (Branchinecta lynchi) 5-year Review: Summary and Evaluation* (Service 2007a). No change in the species' listing status was recommended in this 5-year review. Threats evaluated during that review and discussed in the final document have continued to act on the species since the 2007 5-year review was finalized, with loss of habitat being the most significant effect. While there continue to be losses and fragmentation of vernal pool habitat throughout these species range, to date no project has proposed a level of effect for which the Service has issued a biological opinion of jeopardy for the species. The Service is in the process of finalizing its most current 5-year review for this species.

Vernal Pool Tadpole Shrimp

For the most recent comprehensive assessment of the vernal pool tadpole shrimp's range-wide status, please refer to the *Vernal Pool Tadpole Shrimp (Lepidurus packardi) 5-Year Review: Summary and Evaluation* (Service 2007a) for the current Status of the Species. No change in the species' listing status was recommended in this 5-year review. Threats evaluated during that review and discussed in the final document have continued to act on the species since the 2007 5-year review was finalized, with loss of habitat being the most significant effect. While there continue to be losses and fragmentation of vernal pool habitat throughout these species range, to date no project has proposed a level of effect for which the Service has issued a biological opinion of jeopardy for the species. The Service is in the process of finalizing its most current 5-year review for this species.

Contra Costa Goldfields

For the most recent comprehensive assessment of Contra Costa Goldfields' range-wide status, please refer to the *Contra Costa Goldfield (Lasthenia conjugens) 5-Year Review: Summary and Evaluation* (Service 2013) for the current Status of the Species. No change in the species' listing status was recommended in this 5-year review. Threats evaluated during that review and discussed in the final document have continued to act on the species since the 2013 5-year review was finalized, with loss of habitat being the most significant effect (See *Environmental Baseline* section below for further threats to the species). While there continue to be losses and fragmentation of vernal pool habitat throughout these species range, to date no project has proposed a level of effect for which the Service has issued a biological opinion of jeopardy for this species.

Environmental Baseline

Travis AFB is located about 62 feet above mean sea level, and is near the Carquinez Strait; a major break in the Coast Range that allows the ocean to moderate temperatures. The climate at Travis AFB is Mediterranean; with wet winters and dry summers, with a mean annual temperature of 68°F (mean monthly temperature ranges from 37°F in December to 89°F in August). Monthly mean relative humidity typically ranges from a low of 50% in June, to a high of 77% in January (https:\\weatherspark 2017).

Travis AFB's main development area is clustered on the west side of the airfield, which spans diagonally from southwest to northeast. The north side of the airfield is primarily used for airfield operations and maintenance, with some industrial and outdoor recreation areas. Currently at Travis AFB, there is a combination of administrative, community, open space, recreation, industrial, and airfield operations and maintenance uses. Industrial land uses are scattered across the Base, but are concentrated in the southwest. The perimeter of the installation is mostly characterized by open space except in the north, where accompanied housing is clustered closely together. Medical land uses are concentrated at the David Grant Medical Center along Air Base Parkway.

Seasonal wetlands and vernal pools located on the Base are known to support the California tiger salamander, vernal pool fairy shrimp, vernal pool tadpole shrimp, and Contra Costa goldfields. Terrestrial habitats at Travis AFB consists of annual grasslands (main vegetation community present), early successional ruderal, and riparian. The undeveloped upland annual grassland areas on the Base are known to support the California tiger salamander.

Travis AFB is located on a nearly level to gently rolling terrace; therefore, many pools are hydrologically connected. Wetlands, vernal pools, streams, drainages, and other aquatic resources, are scattered throughout Travis AFB. These aquatic resources include almost 6 miles of streams and ditches, 4 ponds, over 700 vernal pools and swales, and nearly 90 other seasonal wetland features.

The water restrictive layer in Northern claypan vernal pools, like the ones found on Travis AFB, is formed by a surface clay layer rather than a duripan type subsurface structure (Rains *et al.* 2008). Vernal pool hydrology is therefore controlled primarily by surface water runoff. Subsurface flows have limited importance in maintaining hydroperiods in vernal pools associated with the action area.

Seasonal wetland, annual grassland, riparian and marsh habitat in Union Creek surround the airfield on Travis AFB, and is actively managed to reduce its suitability to wildlife for aircraft safety reasons. Vegetation clearing in Union Creek along its bed and banks is conducted periodically to remove vegetation since mowing/cutting is difficult to accomplish because of the steepness of slopes along much of the drainage. Additionally, grassland and vernal pool vegetation along the runways and taxiways (up to a distance of 800 feet from their edge) are maintained at a height of 7 to 14 inches. All shrubs and brush within this zone are removed. Vegetation clearing occurs in the fall after the migratory bird nesting season has concluded, but prior to the first rains of the season. Vegetation is removed along the bed of Union Creek either by hand, using hand tools where the bed is inaccessible to heavy equipment, or with the use of an excavator to pull vegetation from the channel bottom. All material removed from Union Creek is placed directly in a truck and hauled off the Base at the end of each work day.

Travis AFB has mapped wetlands that may be considered habitat for some of the listed species across the Base and its GSUs. Much of the vernal pool grasslands on Travis AFB have been subject to extensive disturbance over at least the past century including: land leveling for past agricultural uses; grading for development and drainage improvements; paving and excavation to establish and improve roads and runways; installation of pipelines, wells, and other utilities; and other past and current land uses. The soil surface over most of the vernal pool grasslands has been modified by these activities, eliminating the natural mima mound topography normally present in the grasslands. However, in most if not all areas, the underlying claypan remains intact. In areas with the appropriate surface topography, water can pond at the soil surface in depressions creating a seasonal wetland feature with representative aquatic plant and animal species. Upland habitat surrounding vernal pools on Travis AFB is dominated by non-native annual grass and forb species, and the pools themselves support both native and non-native species (such as various bromes, ryegrass, medusahead and perennial pepperweed).

An extensive survey was conducted on the main Base in 2017, to categorize and quantify vernal pool habitat as either providing high, medium or low habitat conservation values for vernal pool species (See Figure 3). Emulating what was done for the jurisdictional area covered in the draft Solano County Multi-species Habitat Conservation Plan (Solano HCP); Travis AFB has surveyed and categorized habitat on the Base and its GSU's into three habitat conservation value categories (high, medium and low value conservation areas; see Figure 3). This methodology is based on a number of existing criteria including: (1) disturbance levels; (2) distribution of federally-listed species; (3) unique or uncommon habitat features; (4) proximity to existing and proposed Preserves/Reserves; (5) presence of physical barriers; (6) located in Core Recovery Areas and/or designated critical habitat; and (7) corridors and linkage areas. Based on this methodology, Travis AFB classified and mapped vernal pool conservation areas. Currently, there are 729 acres of high value vernal pool habitat, 920 acres of medium value vernal pool habitat, and 1,559 acres of low value vernal pool habitat located at Travis AFB (see map in Figure 3). Specific criteria used to categorize habitat conservation values as either high, medium, or low is provided below:

High Value Vernal Pool Conservation Areas; 729 acres present:

- Large blocks (greater than 100 acres) of vernal pool complexes and associated habitats with low to moderate levels of disturbance, and containing or potentially supporting federally-listed species;
- Unique or uncommon habitat features (such as large playa pools or lakes, alkali flats, and unique soil types) and areas with high concentrations of federally-listed species and biological diversity;
- Moderately to highly disturbed habitats, within and adjacent to, moderate to high quality vernal pool complexes that have a high potential for restoration and enhancement of vernal pools and associated habitats;
- Complexes that support isolated populations of extremely rare or range-limited species and/or core populations of Contra Costa goldfields regardless of size, level of disturbance or existence of barriers;
- Areas that may serve as corridors or linkages between other high value lands; and
- Areas designated in the Integrated Natural Resource Management Plan (INRMP) as on-Base Preserves.

Medium Value Vernal Pool Conservation Areas; 920 acres present:

- Watershed and buffer lands to High Value Conservation Areas;
- Areas that support (or may support) populations of more common and widespread listed species (e.g. vernal pool fairy shrimp);
- Sites of limited size that are isolated and/or subject to significant anthropogenic pressures, and the potential for restoration is limited.

Low Value Vernal Pool Conservation Areas; 1,559 acres present:

- Small, infill parcels surrounded by existing development;
- Little or no connectivity to medium or high value conservation areas;
- Areas with extensive soil disturbance that has impacted underlying claypan; and
- Areas that have been surveyed using appropriate protocols with no known records of federally-listed species.

Federally-Listed Species:

California Tiger Salamander and its Critical Habitat

Presence within the Action Area: Based on California tiger salamander occurrences reported by Travis AFB and documented on the California Natural Diversity Database (CNDDB), this species is known to breed in ponds and vernal pools located on the Base (See Figures 5 and 6 of the Enclosure; CNDDB 2017). Much of the grassland habitat on Travis AFB and on its GSUs provides suitable aestivation habitat for the California tiger salamander (Figure D-1 of the programmatic biological assessment). The presence of suitable habitat for the California tiger salamander, and documented occurrences suggests that the species is likely to persist on Travis AFB given current conditions. Documented California tiger salamander breeding habitat is concentrated in the Castle Terrace Preserve (former Burke Property) in the far northern portion of the Base (Marty 2016).

During relocation efforts conducted from May 31- July 20, 2017, 874 juvenile California tiger salamanders were documented originating and migrating from an off-Base breeding pond and onto the northeastern portion of the Base (Figures 5 and 6). Furthermore on January 29, 2014, an adult California tiger salamander was reported on CNDDB in the same area of the Base traveling west from private lands towards the interior of Travis AFB. This occurrence indicates that this area is a California tiger salamander migratory pathway, which encompasses Runway 21L, the Assault Landing Zone (ALZ), and portions of Perimeter Road (Base road). Additionally, on July 5 and July 8, 2015, two dead California tiger salamanders were found on the eastern portion of the Base.

These two individuals were most likely responding to either ponded water, as a result of a break in a water main near suitable upland habitat, humid weather conditions, or both. In the early morning hours of February 4, 2017, a California tiger salamander was observed crossing the ALZ (CNDDB 2015). All of these indicate that California tiger salamanders are aestivating and dispersing through the upland habitat on the eastern portion of the Base.

The California tiger salamander has also been observed in breeding ponds located at the Wilcox Ranch and Muzzy Ranch. Travis AFB is located within the 1.3 mile migration range for the California tiger salamander (CH2M Hill 2006, CNDDB 2016). Marty (2016) found CTS larvae in a stock pond located adjacent to the Base's northern boundary (property owned by the City of Fairfield and Solano County). As part of that same study, Marty used aerial photo interpretation and inspection of 2015-2016 hydrology to assess potential California tiger salamander breeding ponds on private property adjacent to Travis AFB, and determined that three ponds on the southern boundary of the Base have a high probability of providing breeding habitat (Figure D-1 of the programmatic biological assessment). Mantech (2016) conducted non-protocol level surveys on Travis AFB GSUs and found potential habitat for the California tiger salamander at the Former Sacramento Northern Railroad Right-of-Way, Outer Runway Marker, Middle Runway Marker, and Potrero Hills Landfill GSUs. Critical habitat is also designated for the California tiger salamander on a section of the Railroad Right-of-Way GSU, managed by Travis AFB (See Figure 4).

A set of tools developed by The Nature Conservancy, called the Resistance and Habitat Calculator Toolset (part of Gnarly Landscape Utilities), was used to create a map of landscape resistance for the California tiger salamander on Travis AFB (McRae et al. 2013). The following criteria were used to define areas as either having a high, medium or low (red, yellow, or green, respectively) risk potential for encountering a California tiger salamander: (1) relative habitat and resistance values were assigned to different landscapes (ranging from zero resistance to 100 for high resistance); (2) a migration distance of 1.3 miles from known breeding ponds was used for the species; and (3) known occurrences of the species. A map of these resistance values (green, yellow, or green CTS risk areas) is included in Figure 2. The methodology used is based on the migration distance of the species from known breeding sites, and is further described in Appendix A of the programmatic biological assessment. Currently within both developed and undeveloped areas at Travis AFB, there is a total of 2,546 acres in red risk, 507 acres in yellow risk, and 1,955 acres in green risk areas for encountering California tiger salamander. Based on habitat suitability mapping in undeveloped areas only, there are about 2,192 acres in the red risk areas, 279 acres in the yellow risk areas, and 1,096 acres in the green risk areas. See Appendix A of the programmatic biological assessment for a detailed description of risk areas developed for the California tiger salamander.

Current and Historical Distribution: Although the historical distribution of the California tiger salamander is not known in detail, their current distribution suggests that they may have been continuously distributed along the low-elevation grassland-oak woodland plant communities of the San Joaquin-Sacramento river valleys and foothills. The California tiger salamander occurs from on the Central Valley floor near sea level, up to a maximum elevation of roughly 3,940 feet in the Coast Ranges and 1,640 feet in the Sierra Nevada foothills (Shaffer et al. 1993; Shaffer et al. 2013).

Threats: Multiple factors have contributed to population declines of the California tiger salamander. The primary threats to this species are loss, degradation, and fragmentation of habitat as the result of human activities. Aquatic and upland habitat available to the species has been degraded and reduced in area through agricultural conversion, urbanization, road construction, and other projects. Further threats to the California tiger salamander include predation from, and competition with, invasive species; hybridization with nonnative barred tiger salamanders (*Ambystoma tigrinum*) (sometimes

referred to as *Ambystoma tigrinum mavortium*); mortality from road crossings; contaminants; and small mammal burrow control efforts. Additional threats include introduction of diseases such as ranaviruses and chytrid fungi, and also climate change (Service 2004, 2014). Furthermore, the species' low recruitment and high juvenile mortality makes it particularly susceptible to habitat loss, fragmentation, urbanization, and construction related harm and mortality.

Recovery Plan: In the *Recovery Plan for the Central California Distinct Population Segment of the California Tiger Salamander (Ambystoma californiense) June 06, 2017*, actions are identified to sufficiently reduce the threats to the species. The recovery objectives listed in the plan are to: secure self-sustaining populations of the California tiger salamander throughout the full range of the DPS, ensuring conservation of native genetic variability and diverse habitat types (e.g., across elevation and precipitation gradients); ameliorate or eliminate the threats that caused the species to be listed, and any future threats; and restore and conserve a healthy ecosystem supportive of the species. Specific actions needed to recover the California tiger salamander include the following: 1) maintain current distribution of species; 2) maintain native genetic structure across the species range; 3) minimize road mortality; 4) minimize potential for disease introduction; 5) minimize non-native predator populations; 6) ensure adaptive management and monitoring of habitat; and 7) conduct research.

The Service (2004) recognizes that livestock grazing is for the most part compatible with the continued successful use of rangelands by the California tiger salamander, provided the grazed areas do not also have intensive burrowing rodent control efforts. Grazing animals can be used as a tool to reduce invasive nonnative plant species; thus, improving habitat for the California tiger salamander. For example, taller grass, or grass with significant thatch build-up, may make dispersal difficult for migrating California tiger salamanders and have been associated with declines in ground squirrel populations (EDAW 2008; Ford et al. 2013).

Vernal Pool Fairy Shrimp and its Critical Habitat

Presence within the Action Area: In the Solano-Colusa Vernal Pool Region, vernal pool fairy shrimp are reported on the greater Jepson Prairie, which includes the Wilcox Ranch, as well as near Vacaville and Dixon in Solano County (CNDDB 2017) (Figures 5 and 6). Vernal pool fairy shrimp are known to occur on Travis AFB and much of the seasonal wetland habitat on the Base and their GSUs provide suitable habitat for the species (Figure A-1 of the programmatic biological assessment). The presence of suitable habitat for the species and documented occurrences suggests that the species is likely to persist on Travis AFB given current conditions. On Travis AFB there are 45 documented occurrences of vernal pool fairy shrimp. These occurrences are concentrated within the northern portion of the Base; though, a number of other occurrences are scattered throughout the center of the Base in natural vernal pools, as well as manmade seasonal wetland features (Marty 2016).

A 1993 survey of the vernal pools in the southwest part of Travis AFB identified adult vernal pool fairy shrimp and its cysts (eggs of this species). A subsequent survey by BioSystems Analysis, Inc. (1994) identified adult vernal pool fairy shrimp on the Base. Base-wide surveys conducted by EcoAnalysts, Inc. (2006) from 2004 to 2006 identified vernal pool fairy shrimp at several locations, mostly on the western side of the Base. During these protocol-level surveys, vernal pool fairy shrimp were identified in a total of eight locations on the Base. Most vernal pool fairy shrimp occurrences were on the western side of the Base. Two large populations of adult vernal pool fairy shrimp have been observed in a roadside pool, and a drainage ditch along the abandoned railroad tracks on the northern side of Hangar Avenue and the eastern side of Union Creek. Additionally, low numbers of adult vernal pool fairy shrimp have been observed in the following locations: five vernal pools west of Union Creek; in a wet depression along the railroad right-of-way at Meridian

Road; in one pool north of the Runway 03R/21L; and in vernal pools along the Railroad Right-of-Way GSU north of the Base.

Protocol-level surveys of the vernal pool habitat around the former Aero Club conducted by ICF International from 2011-2013 found no vernal pool fairy shrimp (ICF International 2011, 2013). Marty (2016) conducted surveys of 142 wetlands during the 2015-2016 wet season and recorded 16 pools with vernal pool fairy shrimp and 1 pool with a close relative, the midvalley fairy shrimp (*B. mesovallensis*). Mantech (2016) conducted non-protocol level surveys of the Travis AFB GSUs and found potential habitat for this species at the Former Sacramento Northern Railroad Right-of-Way, Outer Runway Marker, Middle Runway Marker, and Point Ozol. Critical habitat is designated for vernal pool fairy shrimp on the Travis AFB main Base at the South Gate; a triangular parcel south of Runway 03R/21L (not within the fenced boundary of the Base); and at the Western Railroad Right-of-Way as well as the Potrero Hills Landfill GSU (Figure 4).

Current and Historical Distribution: Vernal pool fairy shrimp are known to occur in a wide range of vernal pool habitats in the southern and Central Valley areas of California, and in two vernal pool habitats within the "Agate Desert" area of Jackson County, Oregon. It is likely the historical distribution of this species coincides with the historical distribution of vernal pools in California's Central Valley and southern Oregon. Holland (1998) estimated that about 4,000,000 acres of vernal pool habitat existed in the Central Valley prior to the widespread agricultural development that began in the mid-1800s. He found that although the current and historical distribution of vernal pools is similar, vernal pools are now far more fragmented and isolated from each other than during historical times and currently occupy only about 25 percent of their former land area (Holland 1998). The current distribution of the vernal pool fairy shrimp in the Central Valley may be similar to its historical distribution in extent, but remaining populations are now considerably more fragmented and isolated than in pre-agricultural times.

Threats: The primary threats to the species are habitat loss and fragmentation due to urban development on the private property where the species occurs, agricultural conversion, altered hydrology, nonnative invasive species, inadequate regulatory mechanisms, exclusion of grazing in areas where grazing has been a historically occurred, and inappropriate grazing regimes (overgrazing or undergrazing) (Service 2005).

Recovery Plan: The *Recovery Plan for Vernal Pool Ecosystems for Vernal Pool Ecosystems of California and Southern Oregon* identifies conservation actions (divided into five categories) to sufficiently reduce the threats to the species (Service 2005). These categories are to continue to provide: regulatory and legal protections; education and outreach; research; conservation planning and habitat protection; and species-specific management and monitoring for the species.

Venal Pool Tadpole Shrimp and its Critical Habitat

Presence within the Action Area: Vernal pool tadpole shrimp are known to be present in much of the undeveloped areas surrounding Travis AFB. The CNDDB includes multiple reports of the species within 0.50 mile surrounding the Base (Figures 5 and 6; CNDDB 2016). Some observations include those at Wilcox Ranch adjacent to the Base, Muzzy Conservation Bank, North Suisun Conservation Bank, and the Burke Ranch Conservation Bank.

Despite numerous protocol-level and non-protocol-level sampling efforts over the past 20 years, vernal pool tadpole shrimp have not been found on the main Base; although, this species has been found on the Northern Railroad Right-of-Way GSU, located just off the main Base near the Meridian Gate on the eastern boundary (Figure B-1 of the programmatic biological assessment).

During 2004-2005 surveys conducted by EcoAnalysts, this species was observed at eight locations along the Northern Railroad Right-of-Way GSU. In 1994, Biosystems found vernal pool tadpole shrimp in one pool located about 40 feet from the Base's perimeter fence, near the Meridian Gate on the eastern Base boundary (Biosystems 1994). Mantech (2016) conducted non-protocol level surveys of the Travis AFB GSUs. These surveys indicate that suitable habitat for vernal pool tadpole shrimp likely exists at the following GSU's: Former Sacramento Northern Railroad Right of Way; Outer Runway Marker; Middle Runway Marker; and the Defense Fuel Supply Point Ozol. Critical Habitat is designated for vernal pool tadpole shrimp on Travis AFB at the South Gate; a triangular parcel south of Runway 03R/21L (not within the fenced boundary of the Base); the Western Railroad Right-of-Way; and the Potrero Hills Landfill GSU (Figure 4).

Current and Historical Distribution: Historically, about 4,000,000 acres of vernal pool habitat existed in the Central Valley during pre-agricultural time, and vernal pool tadpole shrimp were probably distributed over most of these vernal pool habitats. However, surveys in southern portions of California have never revealed vernal pool tadpole shrimp populations, and the species probably did not occur historically outside of the Central Valley and Central Coast regions (Service 2005). Currently vernal pool tadpole shrimp are distributed across the Central Valley of California and in the San Francisco Bay area. The species' distribution has been greatly reduced from historical times as a result of widespread destruction and degradation of its vernal pool habitat. Vernal pool habitats in the Central Valley now represent only about 25 percent of their former area, and remaining habitats are considerably more fragmented and isolated than during historical times (Holland 1998). Vernal pool tadpole shrimp are uncommon even where vernal pool habitats occur. In 1998, Helm found vernal pool tadpole shrimp in only 17 percent of vernal pools sampled.

Threats: The primary threats to the species are habitat loss and fragmentation due to urban development on private property where vernal pool tadpole shrimp occur in Alameda County. Additional threats to this species are: habitat conversions for agriculture; altered hydrology; competition with nonnative invasive species; inadequate regulatory mechanisms; exclusion of grazing in areas where grazing has historically occurred; and inappropriate grazing regimes (overgrazing or undergrazing) (Service 2005).

Recovery Plan: The *Recovery Plan for Vernal Pool Ecosystems for Vernal Pool Ecosystems of California and Southern Oregon, 2005* states that although conservation efforts have been implemented for vernal pool ecosystems in general; very few actions have been taken specifically to benefit vernal pool tadpole shrimp (Service 2005).

Contra Costa Goldfields and its Critical Habitat

Presence within the Action Area: Rare plant surveys conducted by Biosystems (1994) counted 36 separate occurrences of Contra Costas goldfields on Travis AFB, concentrated on the western portion of the Base. The majority of plants (33 of 36 plants) are located at the former Aero Club and in the grazing areas south of the Aero Club. The remaining occurrences are found in the southwestern corner of the Base along Perimeter Road at the end of the runway (CH2M Hill 2006).

Contra Costa goldfields distribution on Travis AFB included pools within the Aero Club area. In 1999, the Service issued a biological opinion following the loss of individual Contra Costa goldfields, and damage to its habitat in 1997 at the Aero Club and Civil Engineering Training Yard, and to mitigate impacts related to the Castle Terrace Housing project (referred to then as the Burke Property) (Service 1999). The biological opinion required the restoration and/or creation of on-site and off-site habitat for Contra Costa goldfields, as well as the purchase of credits at a vernal pool conservation bank. The resulting Contra Costa goldfields habitat restoration and compensation

entailed the creation of 256 vernal pools around the Aero Club (Collinge 1999). Additionally, Travis AFB has restored and is permanently protecting 0.2 acre of potential Contra Costa goldfields habitat on the main Base. During 2005 surveys and restoration project data collection, Contra Costa goldfields were documented in 43% of reference pools within the Aero Club, and in 39% of created pools (CH2M Hill 2005).

In total, 462 occurrences have been recorded for Contra Costa goldfields on Travis AFB over the years. In 2016, a total of 62 pools on Travis AFB were occupied, of which 80% of those occurrences were within the Aero Club (Marty 2017; Figures E-1 and E-2 of the programmatic biological assessment). The species has also been found in pools totaling about 28 acres, all on the western portion of the Base. Critical habitat is designated for Contra Costa goldfields on the main Base at: the South Gate; a triangular parcel south of Runway 03R/21L; and at the West Railroad Right-of-Way extending to Walters Road (Figure 4 of the Enclosure).

Current and Historical Distribution: Of the 32 historical occurrences of Contra Costa goldfields recorded between 1884 and 2003 that are documented on the CNDDB (2005), 22 are likely extant. Contra Costa goldfields occurred historically in seven vernal pool regions: Central Coast, Lake-Napa, Livermore, Mendocino, Santa Barbara, Santa Rosa, and Solano-Colusa (Service 2005; Keeler-Wolf et.al. 1998). In addition, several historical occurrences in Contra Costa County are outside of the defined vernal pool regions (Keeler-Wolf et al. 1998, CNDDB 2003). The species presumably remains in all of the vernal pool regions where it occurred historically, except for the Santa Barbara Vernal Pool Region. The greatest concentration of Contra Costa this species occurs is in the Solano-Colusa Vernal Pool Region on area located east of Fairfield, Solano County. This location contains 10 occurrences that are presumed extant, plus 1 that may be extirpated (Service 2005).

Threats: Current threats to Contra Costa goldfields include loss of habitat due to conversions for residential development, agriculture and vineyards, inappropriate grazing practices, and expansions drainage channels, landfill and highways. Some projects, such as proposed highways, may disturb habitat on Travis AFB as well as in the Fairfield area (Service 2005). Threats due to conversions to vineyards are also continuing. The largest Napa County occurrence of this plant, at Soscol Ridge is imminently threatened by vineyard conversion (Service 2005) (Figures 5 and 6; CNDDB 2017). Additionally, competition from invasive plant species, improper or lack of grazing regimes, climate change/drought, intensive grazing and lack of grazing are significant threats to this species (Service 2005). Heavy grazing is cited as a threat to Contra Costa goldfields occurring at Pacific Commons Preserve in Alameda County, and for four occurrences in Solano County, including the Gentry property (CNDDB 2012). Additionally, lack of grazing is cited as a threat for this plant species at Soscol Ridge in Napa County (CNDDB 2012). Both lack of grazing and excessive grazing may cause an increase in organic matter in the habitat that can eliminate the natural vernal pool invertebrate community and promote opportunistic and invasive nonnative plant species (Service 2013).

Recovery Plan: The *Recovery Plan for Vernal Pool Ecosystems for Vernal Pool Ecosystems of California and Southern Oregon 2005* provides recovery criteria that either directly or implicitly address three of the listing factors noted in the final rule to list the species: destruction, modification, or curtailment of habitat or range; inadequacy of existing regulatory mechanisms; and other man-made or natural factors affecting its continued existence (Service 2005). The overutilization for commercial, recreational, scientific, or education purposes, and disease or predation, were not included as threats in the listing rule and are not addressed in the Recovery Plan for Contra Costa goldfields. Since the Recovery Plan for this species has only recently begun to be implemented, species surveys and

monitoring efforts that will provide data to evaluate progress towards recovery have not yet occurred (Service 2005).

Effects of the Action

Activities described in the *Description of the Proposed Action* section may result in direct and indirect; permanent and temporary effects to federally-listed species and their habitat occurring at Travis AFB and the eight GSUs owned/managed by the Base (Table D-1 of the Enclosure). Each project proposed for coverage under the programmatic biological opinion was analyzed for the level of effect it may have on each of the federally-listed species and their habitat found on Travis AFB and its GSUs. For the California tiger salamander in particular, Travis AFB has divided the Base lands into three risk categories for encountering the California tiger salamander: green, yellow, and red (Figure 2). See the *Environmental Baseline* section for a summary, and Appendix A of the programmatic biological assessment for an expanded discussion of these risk categories and the methodology used to develop them. A combination of the California tiger salamander risk categories, federally-listed species habitat evaluations, and implementation of the proposed conservation measures and activities proposed are used to determine possible effect levels to federally-listed species and their habitat.

Measures described in the *Conservation Measures* section, and additional species-specific measures included in Tabs A, B, D and E of the programmatic biological assessment will be implemented to minimize or avoid potential adverse effects to the California tiger salamander, vernal pool fairy shrimp, vernal pool tadpole shrimp, and Contra Costa goldfields or their habitat. Furthermore, the following strategies will be followed during project development and implementation: 1) the project footprint will be reduced to the minimum area needed; 2) project boundaries will be clearly demarcated prior to work; 3) worker education programs to recognize and report federally-listed species will be conducted; 4) a Service-approved biologist will be on-site during project activities that have potential to result in take; 5) a relocation plan for any California tiger salamanders found will be implemented; 6) when feasible disturbed sites will be restored and revegetated with a native weed-free seed mix and/or native plant species; 7) if mowing is implemented in suitable habitat for federally-listed species, it will be occur during the dry-season; 8) if herbicide are used, it will only be applied using non-ionic surfactants when near water; and 9) if prescribed burning occurs, it will be timed to occur after Contra Costa goldfields has senesced and seed dispersal (March – June; Ornduff 1966, Service 2005) is complete.

Additionally, habitat enhancement and restoration projects at Travis AFB may adversely affect individual California tiger salamander, vernal pool fairy shrimp, vernal pool tadpole shrimp, and Contra Costa goldfields, or temporarily affect their habitat as described in the *Ground Disturbance and Construction* section below. However, the long-term benefits of restoration and conservation are anticipated to provide these federally-listed species with protection and managed habitat in perpetuity; improve habitat quality and suitability; increase species population size; increase extent of protected habitat; and increase connectivity for species between occupied areas.

The habitat compensation ratios proposed by Travis AFB included in this section for projects adversely affecting either the California tiger salamander, vernal pool fairy shrimp, vernal pool tadpole shrimp, or Contra Costa goldfields were informed by the Solano HCP (SCWA 2012). However, some of the compensation ratios proposed by Travis AFB are scaled to reflect the Air Force's commitment to conserving listed species on the Base and its GSU's through the implementation of the INRMP. Through this natural resource management process, the Air Force funds management, monitoring and research activities that benefit listed species and ultimately

contribute to their recovery. The habitat compensation ratios proposed by Travis AFB in this section are dependent on the quality of the existing habitat which will be affected by proposed projects.

Habitat compensation ratios for the vernal pool fairy shrimp and the vernal pool tadpole shrimp are based on the mitigation ratios developed in the Solano HCP (SCWA 2012). Travis AFB's compensation ratios are centered on habitat preservation, with an additional 1:1 preservation component for projects indirectly effecting either medium or high value vernal pool conservation habitat. The Air Force believes that preservation of vernal pool habitat is a more suitable compensation measure than creation of habitat, which is often done in areas with existing species habitat and may have negative effects to species that use the upland habitat where the wetlands are created (e.g. California tiger salamander) and the watershed in general. Additionally, increasing wetland acreage through wetland creation in mitigation banks and other preserved properties near Travis AFB runways may increase the bird aircraft strike hazard.

Effects to the California Tiger Salamander

Travis AFB has determined that the following list of activities described below and in the *Description of the Proposed Action* section, have the potential to result in temporary and permanent adverse effects to the California tiger salamander and its habitat: airfield and flight operations; security and antiterrorism operations; road maintenance; bridge construction and maintenance; runway, taxiway and ramp repair; facility maintenance and upgrade; demolition; above and under -ground utility lines; culverts and drainage ditches; fence installation, maintenance and replacement; minor construction projects; ERP site investigations and remediation methods; ERP site operations and maintenance; ERP groundwater monitoring; invasive and pest species removal; California tiger salamander burrow and inspection and relocation; wetland restoration; fire suppression; firebreak maintenance; and prescribed fire (Table 6, and Table D-1 of Tab D). The effects analysis for the California tiger salamander is primarily based on the location of the proposed projects, relative to known species observations and/or proximity to breeding habitat for the species (Figure 2).

Ground Disturbance and Construction/Demolition

Ground disturbance and construction activities described in the *Description of the Proposed Action* section may result in temporary or permanent loss of water bodies utilized by the California tiger salamander for breeding and maturation of tadpoles to metamorphs, as well as loss of upland habitat used for aestivation, dispersal, and foraging. Additionally, suitable small mammal burrows or soil cracks (potential aestivation habitat) within construction footprints may contain the California tiger salamander, which are likely to be entombed and killed as burrows and soil cracks are destroyed during grading and ground compaction activities.

The California tiger salamander may be killed or injured from accidental trampling by workers from foot traffic and operation of construction equipment during construction activities. Construction activities may result in harassment from noise, vibration, and night-lighting and may disrupt their natural behaviors causing them to leave their upland refugia and increase their exposure to desiccation and predation. California tiger salamanders may also become trapped in open excavations or construction trenches, making them vulnerable to desiccation, starvation, and predation. Implementation of proper conservation measures and species-specific conservation measures will avoid or minimize habitat alteration and destruction and loss of individuals, including reducing construction footprints (See the *Conservation Measures* section above and species-specific measures listed in Tab D of the programmatic biological assessment).

Ground disturbing activities may cause alterations in hydrology that result in converting a vernal pool to a perennial pond, increasing the likelihood of the pond being colonized by predators and hybrids; thus, exposing California tiger salamanders to increased harassment and mortality from predators and possibly lead to their extirpation from a breeding site. In efforts to avoid these potential adverse effects to the species and its habitat, seasonal breeding sites will not be converted to perennial water bodies, and will not create new perennial ponds in the vicinity of species occurrences. Implementing ongoing actions to keep perennial water bodies free of predatory invasive species may result in overall benefits to the California tiger salamander and its habitat.

Temporary adverse effects to the California tiger salamander and its habitat may result from vernal pool and seasonal wetland restoration projects from associated grading, excavation, disking, trenching, or other types of direct ground disturbances. Monitoring of restoration sites will be monitored for success of restorative efforts for a minimum of 2 years. In general, restoration projects conducted at Travis AFB are expected to have overall benefits to the California tiger salamander by restoring their destroyed or altered habitat, and by enhancing existing habitat. In addition, while most of the ERP sites on Travis AFB have been cleaned up and closed, some sites may require further action and operations and maintenance. See the *Description of the Proposed Action* section for specific activities, including ground disturbing activities, which may adversely affect the California tiger salamander and its habitat.

California Tiger Salamander Relocation Activities
Preconstruction surveys and relocation of California tiger salamanders may reduce injury or mortality within proposed project footprints; however, death and injury of individuals can result at the time of relocation efforts or later subsequent to their release. Although survivorship for relocated California tiger salamanders has not been determined; survivorship of relocated wildlife, in general, is lower because of intraspecific competition; lack of familiarity with the new location including breeding sites; feeding and sheltering habitats; increased risk of contracting disease in a foreign environment; and the risk of predation. Furthermore, improper handling; containment; lack of disease prevention measures; or improper transport of individuals can occur during relocation activities. In order to reduce or prevent these potential adverse effects from occurring, a Service-approved biologist with experience handling this species will conduct these activities. Additionally, the Service-approved biologists will follow *Travis AFB's CTS Relocation Plan*, and will limit the duration of handling and ensure that all California tiger salamanders are released in a timely manner, in order to further reduce potential adverse effects to the species.

Airfield and Flight Operations - Roads, Runways and Other Impediments to Dispersal
Projects that involve roads and highways can result in vehicle caused mortality of individual California tiger salamanders, and can cause habitat fragmentation. Injury and mortality occur when California tiger salamanders cross roads, runways, or other impermeable surfaces during dispersal and migration, as individuals are either unable to avoid being run over or desiccate before successfully passing. Species mortality may increase as a result of road widening projects, or placement of curbs at road edges. Mortality may also increase at constructed barriers within medians, and along roadways which can impede species movement; resulting in individuals being more vulnerable to vehicle and aircraft strikes, predation, and desiccation. Roads and other development, and highly cultivated areas can also indirectly affect the California tiger salamander by functioning as a partial or complete barrier to the species attempting to migrate through. Where interchange of the California tiger salamander between sites is overall beneficial to a population, the retrofitting of barriers to allow for passage (e.g., rounded curbs, ramps for curbs, etc.) and the installation of culverts, tunnels, bridges, and other crossings, specifically designed to facilitate safe wildlife passage under or across roads can minimize direct mortality from vehicle strikes, and

increase habitat connectivity and genetic exchange.

Exposure to Contaminants
The construction of buildings and roadways, repair and use of roadways, and the use of agricultural chemicals next to suitable aquatic and upland habitat for the California tiger salamander can expose the species to chemical contaminants. Substances used in road building materials or to recondition roads or for agricultural purposes can drift or wash off into nearby habitat. Vehicles may leak hazardous substances such as motor oil and antifreeze. Vehicle exhaust emissions can include hazardous substances which may concentrate in soils and in the air along roads (Trombulak and Frissell 2000), and include organic pollutants (*i.e.* dioxins, polychlorinated biphenyls) (Benfenati *et al.* 1992). A variety of substances can be introduced during accidental spills of materials.

Spills can also result from small containers falling off vehicles, or from accidents resulting in whole loads being spilled. Large spills may be partially or completely mitigated by clean-up efforts, depending on the substance. The California tiger salamander can also be exposed to contaminants through inhalation, dermal contact and absorption, direct ingestion of contaminated soil or plants, or consumption of contaminated prey. Exposure to contaminants may cause short-term affects or lead to long-term morbidity. Contaminants may also adversely affect the California tiger salamander's prey diversity and abundance, and diminish the local carrying capacity for the species. Implementation of Conservation Measures related to managing stormwater runoff, fueling, storage of hazardous materials, having a spill containment plan in place, and informing project personnel of the importance of these measures will reduce the potential for adverse effects from contaminants during project construction. However, most of these measures will not eliminate the effects of contaminants from ongoing use of roads and other infrastructure, and from agricultural practices.

Invasive Plants and Pest Management Programs
Herbicide Treatment
Herbicides will be applied per their label, and will also follow additional minimization measures developed, as noted in Solano RCD's *Final Weed Report 2015-2016* (Solano RCD 2015-2016). Changes to the Solano RCD's *Final Weed Report 2015-2016* by Travis AFB are noted in the *Conservation Measures - Herbicide Application* section. These conservation measures were developed to avoid all effects to federally-listed species and their habitat. However, Travis AFB anticipates some instances where full avoidance is not feasible and potential activities may result in adverse effects to the California tiger salamander its habitat.

Potential adverse effects may occur for projects where mechanical treatments within 20 feet of a wetland is not effective at eliminating the non-native plant infestation, and herbicide application inside this buffer is required, while water is present in potential California tiger salamander breeding sites. Such a scenario is also likely at the Aero Club where vernal pools are so numerous; it is not feasible to completely avoid the pools. Spot, directed spray with a backpack sprayer will be used in order to minimize potential adverse effects to this species and its habitat. The use of Telar XP can have some residual soil activity/pre-emergent qualities, but the length of control depends on soil pH, rainfall after application, and rate of application (Solano RCD 2015-2016).

In areas where aquatic resources are present, only a glyphosate-based herbicide without toxic surfactants approved for use in aquatic environments will be used. To minimize potential adverse effects to this species from drift during treatments, chemicals will be applied using spot treatments with a backpack sprayer or truck mounted spray tank with hose. When applied in the summer and fall the herbicide is taken up more rapidly due to photosynthetic byproducts being transported into the root mass at a faster pace. However, applying herbicide in the spring before viable seed

maturation, and again in the fall during this intense photosynthetic process may be necessary to prevent regrowth.

Prescribed Burns

Burning of dry vernal pool habitat is expected to have an overall beneficial effect to California tiger salamander habitat. Prescribed burns may occur during the spring and early summer (April –July). On a project by project basis, prescribed burns may adversely affect the California tiger salamander and its habitat, depending on which prescribed fire practices are employed for protection of resources. Potential adverse impacts may occur from the installation of roads or fire breaks, or to define fire boundaries. Potential California tiger salamander aestivation habitat (small mammal burrows or soil cracks) within the construction footprint will likely be destroyed during installation of roads or fire breaks, as burrows are crushed or as inhabitants of burrows (including the California tiger salamander) are entombed.

Mosquito Abatement

Mosquito abatement agencies have introduced non-native western mosquitofish (*Gambusia affinis*) to wetlands on Travis AFB. Mosquitofish prey upon California tiger salamander developing embryos and larvae and can eliminate an entire cohort (Jennings and Hayes 1994). Additionally, both the California tiger salamander and mosquitofish feed on invertebrates and it is possible that large numbers of mosquitofish may out-compete the salamander larvae for food. However, in efforts to avoid adverse effects to the California tiger salamander, mosquitofish will not be added to known breeding sites for the federally-listed species.

Rodent Control

Rodent control programs can adversely affect California tiger salamander populations on Travis AFB by reducing or eliminating California ground squirrels and/or pocket gophers in or near suitable habitat for the salamander. This is especially true in areas defined as either red or yellow risk CTS areas at Travis AFB (see Appendix A of the programmatic biological assessment). The reduction or elimination of fossorial rodents can lead to eventual loss of suitable burrows that provide both aestivation habitat for the salamander and refugium for their upland prey. If suitable burrows are not available for the California tiger salamander, this species may seek suboptimal upland habitats which increases their exposure to predators, and can lead to desiccation and starvation. However, in efforts to avoid or minimize potential adverse effects to the California tiger salamander, application of pest control programs in yellow and red risk CTS areas will be avoided or reduced.

California Tiger Salamander - Habitat Compensation

Travis AFB anticipates that the majority of projects will result in temporary effects to suitable breeding and upland habitat, resulting from electrical utility system maintenance. All areas that are temporarily affected will be returned back to its preconstruction state upon completion of the proposed project. Activities most commonly producing temporary impacts are: pole replacements; vehicular access to electrical infrastructure; and underground electrical system maintenance. Permanent impacts will typically be the result of new service projects, in which a customer requires electrical service at a location not previously serviced. These activities will include the installation of new aboveground infrastructure such as utility poles and pad mounted transformers and switches. Most subsurface electrical installation (such as underground electrical conductors/conduits) projects will result in temporary effects to suitable breeding and upland habitat, as project sites will be returned to their preconstruction state upon completion.

Travis AFB will compensate for loss of California tiger salamander habitat (suitable upland habitat and aquatic breeding sites) with in-perpetuity preservation and/or restoration of habitat for the species (Table 3). Temporary loss of California tiger salamander upland habitat will be compensated at a habitat preservation ratio of 0.5:1 (area of habitat preserved to area of habitat impacted). Permanent effects to California tiger salamander upland habitat will be compensated at a habitat preservation ratio of 2:1. Direct effects to California tiger salamander breeding habitat will be compensated at a habitat preservation ratio of 3:1 and 2:1 creation (2:1 creation or 0.35 acre, whichever is greater) of California tiger salamander breeding habitat. Indirect effects to California tiger salamander breeding habitat will be compensated at a preservation or creation of 2:1.

Preservation and protection in perpetuity of high value habitat at an acquired site near the Base or by purchasing habitat at a Service-approved Conservation Bank, will allow for the permanent protection, long-term management, and enhancement of habitat for the California tiger salamander; thus, contributing to the recovery of the species. Travis AFB may coordinate with the Solano HCP process to meet habitat compensation requirements. Additionally, projects resulting in temporary effects to California tiger salamander habitat such as revegetation and restoration of project sites post-project will occur when feasible; thus, benefiting the species by improving habitat conditions. Restoration projects described in the *Description of the Proposed Action* section are expected to provide overall benefits to the California tiger salamander by restoring their destroyed or altered habitat, and by enhancing existing habitat. This compensation, combined with the implementation of additional conservation measures described in the *Conservation Measures* section above, and in Tab D of the programmatic biological assessment, are anticipated to offset the adverse effects of harm, resulting from project related habitat modification or loss.

Furthermore to avoid adverse effects to the California tiger salamander, Travis AFB will limit the amount of disturbances occurring in suitable habitat for the California tiger salamander. Specific acreage amounts for disturbance limits that will not be exceeded annually or over a 5-year period are provided below (Tab D of the programmatic biological assessment):

Permanent and Temporary Affects to California Tiger Salamander Habitat will not exceed the following:
Permanent effects to California tiger salamander habitat:

- Total habitat disturbances to yellow and red risk CTS habitat will not exceed 1% (24 acres) annually;
- Total cumulative habitat disturbances for all projects will not exceed 3% (68 acres) over the 5-year period;

Temporary effects to California tiger salamander habitat:

- Total temporary habitat disturbances for all projects will not exceed 2% (48 acres) annually; and
- Total cumulative habitat disturbances for all projects will not exceed 5% (123 acres) over the 5-year period.

The percentages above are based on suitable California tiger salamander upland habitat mapped at Travis AFB which consists of about 2,192 acres in red risk areas, 279 acres in the yellow risk areas, and 1,096 acres in the green risk areas. Because California tiger salamanders are unlikely to utilize habitat located within the green risk areas on Travis AFB, only affected habitat located within yellow and red risk areas (2,471 total acres) will be compensated for temporary and permanent effects to suitable upland habitat. Additionally, habitat quality will be determined and documented through threatened and endangered species surveys prior to project activities.

Effects to Vernal Pool Fairy Shrimp and Vernal Pool Tadpole Shrimp – Individuals

Travis AFB has determined that the following list of activities described below and in the *Description of the Proposed Action* section, have the potential to result in direct and indirect adverse effects to the vernal pool fairy shrimp and vernal pool tadpole shrimp, their cysts and their habitat: security and antiterrorism operations; road maintenance; runway, taxiway and ramp repair; facility maintenance and upgrade; demolition; above and under -ground utility lines; culverts and drainage ditches; fence installation, maintenance and replacement; minor construction projects; ERP site investigations and remediation methods; ERP site operations and maintenance; ERP groundwater monitoring; wetland restoration; fire suppression; and firebreak maintenance (Table 6, and Tables A-1 and B-1 of Tabs A and B respectively).

Temporary and permanent effects to these species may occur by displacement or burial, or the permanent loss of individuals and cysts through crushing by construction equipment and vehicles. Mortality or injury of individual vernal pool fairy shrimp and vernal pool tadpole shrimp is likely to occur from suitable or confirmed species habitat being altered hydrologically, by water depth, water quality, and/or water temperature. Restoration projects described in the *Description of the Proposed Action* section are expected to provide overall benefits to vernal pool fairy shrimp and vernal pool tadpole shrimp by restoring their destroyed or altered habitat, and by enhancing existing habitat. This compensation, combined with the implementation of additional conservation measures described in the *Conservation Measures* section above, and in Tabs A and B of the programmatic assessment, are anticipated to offset the adverse effects of harm, resulting from project related habitat modification or loss.

Ground Disturbance and Construction/ Demolition

Direct effects to vernal pool fairy shrimp and tadpole shrimp from ground disturbing activities may include damage and removal of suitable vernal pool habitat and other aquatic features, killing individuals and cysts of these species. Indirect effects to these species from ground disturbance in or near occupied habitat may result from alteration of surface hydrology that affects the hydro-period of pools and swales; leading to the eventual loss of suitable habitat and species occurrences. However, with most proposed projects, implementation of proper species-specific conservation measures will avoid or minimize habitat alteration and destruction, and/or the loss of vernal pool fairy shrimp and vernal pool tadpole shrimp and cysts.

Exposure to Contaminants

The construction of buildings and roadways, as well as the repair and use of roadways, and the use of agricultural chemicals next to vernal pools and other suitable wetlands can expose vernal pool fairy shrimp and tadpole shrimp to chemical contaminants. Substances used in road, building materials, and to recondition roads, or for agricultural purposes, can drift or wash off into nearby habitat. Vehicles may leak hazardous substances such as motor oil and antifreeze. See the above section *Effects to California Tiger Salamander - Exposure to Contaminants* for details regarding additional sources of potential contaminants which may also lead to potential affects to vernal pool fairy shrimp and vernal pool tadpole shrimp. Species-specific conservation measures and general measures will be implemented to avoid or minimize potential adverse effects to both of these species including: having a spill containment plan in place; stormwater runoff management plan; and a plan for fueling and storage of hazardous materials. However, most of these measures will not completely eliminate the potential adverse effects of contaminants from ongoing use of roads and other infrastructure, and from agricultural practices.

Invasive Plant Species Management
Herbicide Application
Travis AFB anticipates that any proposed projects that occur within 250 feet of known or potentially suitable habitat for these vernal pool crustaceans will implement the measures described in the *Conservation Measures* section, and species-specific measures in Tabs A and B to avoid or minimize disturbances and adverse effects to these vernal pool species (unless otherwise noted in the project effects analysis that will be sent to the Service prior to project implementation).

Adverse effects to vernal pool fairy shrimp and tadpole shrimp or their habitat may occur in instances where herbicides treatment within the 250 foot buffer is necessary for larger weed infestations, or where vernal pools are located close together. Any herbicide sprayed within the buffer, will only contain herbicides without toxic surfactants, approved for use in aquatic environments. Such a scenario is likely at the Aero Club where vernal pools are so numerous; it is not feasible to completely avoid the pools. Spot, directed spray with a backpack sprayer will be used to avoid or minimize potential effects to these vernal pool crustaceans. Because of the difficulty in quantifying take of individual vernal pool fairy shrimp and vernal pool tadpole shrimp, effects to these species are determined by the area of impact to suitable or occupied habitat.

Effects to Vernal Pool Fairy Shrimp and Vernal Pool Tadpole Shrimp - Habitat
The proposed activities also have the potential to result in temporary and permanent affects to vernal pool fairy shrimp and vernal pool tadpole shrimp through the destruction or removal of their habitat. Where feasible, both occupied and suitable habitat for these vernal pool crustaceans will be avoided; although, unforeseen situations may exist that prevent complete avoidance (i.e., emergency repairs to overhead or underground utilities).

Ground Disturbing Activities
Due to the relatively flat topography on most of Travis AFB, many vernal pools and other suitable wetland features are hydrologically connected; therefore, the aquatic habitat may be affected if trenching, boring, or significant ground disturbance or paving with impermeable surfaces occurs in areas between the aquatic features. These types of activities within a hydrologically connected area may alter the hydrologic flow of the pools, diminishing their ability to function adequately. Vernal pool fairy shrimp, vernal pool tadpole shrimp, and their cysts may be subject to injury or mortality by activities such as grading, excavation, disking, trenching, or other types of direct ground disturbance. Vernal pool fairy shrimp and vernal pool tadpole shrimp habitat may be subject to disturbance as a result of proposed projects, and by vehicle and equipment access to their associated project sites.

Ground disturbing activities in the watershed of vernal pools is expected to result in siltation when pools fill during the wet-season following construction. Construction activities may result in increased sedimentation transport into the habitat for these vernal pool crustaceans during periods of heavy rains. Siltation in pools supporting vernal pool fairy shrimp and vernal pool tadpole shrimp may result in decreased cyst viability, decreased hatching success, and decreased survivorship among early life history stages; thereby, reducing the number of mature adults in future wet-seasons.

The hydrologic regime (e.g., change in rates of surface flow) of vernal pools may be altered due to disturbance of the claypan layer or changing the slope or groundcover of the surrounding landscape. The biota of vernal pools and aquatic swales can change when the hydrologic regime is altered. Survival of aquatic organisms such as vernal pool fairy shrimp and vernal pool tadpole shrimp are directly linked to the water regime of their habitat (Zedler 1987). Therefore, construction near vernal pool areas is likely to result in the decline of local sub-populations of vernal pool organisms,

including vernal pool fairy shrimp and vernal pool tadpole shrimp. These activities can affect the amount and quality of water available to vernal pools and the surrounding areas which drain into the pools. Grading for roads may affect the water regime of vernal pool habitat, particularly when grading involves cutting into the substrata in or near these areas. Exposure of sub-surface layers of soil at road cuts may accelerate the loss of water from adjacent habitat by mass flow through networks of cracks, lenses of coarser material, animal burrows, or other macroscopic channels.

Many temporary wetlands on Travis AFB are manmade and are typically the result of water ponding next to a runway, taxiway, road or railroad in a toe drain. Many roadside localities in the cantonment area are occupied by vernal pool fairy shrimp and vernal pool tadpole shrimp; therefore when feasible, temporary wetland habitats that occur along roadways will be avoided during all aspects of proposed projects, reducing potential adverse effects to vernal pool fairy shrimp and vernal pool tadpole shrimp and their habitat. Access to sites for maintenance projects that are within seasonal wetland habitats will only occur during the dry season in order to minimize or avoid potential impacts to vernal pool fairy shrimp and vernal pool tadpole shrimp and their habitat. Where feasible, all equipment will be staged outside of the immediate vicinity of wetlands and will perform all project activities manually. When this is not feasible and it is necessary to encroach within the perimeter of any vernal pool, it will be accomplished by accessing existing non-sensitive habitat, and using boards or plates placed over the pool to distribute the weight of the equipment in order to reduce or avoid potential adverse effects.

Vernal Pool Fairy Shrimp and Vernal Pool Tadpole Shrimp - Habitat Compensation
Travis AFB will compensate for both direct and indirect adverse effects to suitable vernal pool fairy shrimp and tadpole shrimp habitat with in-perpetuity preservation of existing habitat for these species (See Table 3). Specifically, direct effects to high value vernal pool conservation habitat will be compensated at a 7:1 preservation ratio (area of vernal pool habitat preserved to area of vernal pool habitat effected); medium value vernal pool conservation habitat will be compensated at a 3:1 preservation ratio; and low value vernal pool conservation habitat will be compensated at a 1:1 preservation ratio. Alternatively within high and medium value vernal pool conservation areas, compensation may also be met by purchasing credits at a 6:1 or 2:1 preservation ratio with 1:1 ratio creation, respectively. Indirect effects to suitable vernal pool fairy shrimp and vernal pool tadpole shrimp habitat will be compensated at a 1:1 preservation ratio.

The purchase of habitat at a Service-approved Conservation Bank or the preservation and protection in perpetuity of high value vernal pool habitat near the Base will allow for the permanent protection, long-term management, and enhancement of the habitat for vernal pool fairy shrimp and vernal pool tadpole shrimp; thus, contributing to the recovery of these species. Additionally, Travis AFB may coordinate with the Solano HCP to meet compensation requirements. The conservation and compensation measures described above are anticipated to help offset adverse effects of harm resulting from project-related habitat modification or loss. Additionally, restoration projects will be implemented as described in the *Description of the Proposed Action* section, are expected to benefit vernal pool fairy shrimp and vernal pool tadpole shrimp in the long-term by restoring their destroyed or altered habitat, and by enhancing existing habitat.

Because vernal pool fairy shrimp have been found occurring in numerous locations on the Base, and much of the seasonal wetland habitat on the Base and at the GSUs provide suitable habitat for this species; Travis AFB has agreed to the following annual and cumulative disturbance limits to vernal pool fairy shrimp habitat (Tab A of the programmatic biological assessment):

Permanent and Temporary Affects to Vernal Pool Tadpole Shrimp Habitat will not exceed the following:
Direct affects to occupied habitat:

- Total habitat disturbances for all projects will not exceed 1% (0.08 acre) annually;
- Total cumulative habitat disturbances for all projects will not exceed 3% (0.27 acre) over the 5-year period;

Indirect affects to occupied habitat:

- Total habitat disturbances to hydrologically connected systems will not exceed 5% (0.44 acre) annually;
- Total cumulative habitat disturbances for all projects will not exceed 15% (1.33 acres) over the 5-year period.

Direct affects to potentially occupied habitat:

- Total habitat disturbances for all projects will not exceed 2% (1.6 acres) annually;
- Total cumulative habitat disturbances for all projects will not exceed 3% (2.4 acres) over the 5-year period;

Indirect affects to potentially occupied habitat:

- Total habitat disturbances for all projects will not exceed 5% (4.0 acres) annually;
- Total cumulative habitat disturbances for all projects will not exceed 10% (8.0 acres) over the 5-year period;

Permanent loss of occupied habitat:

- Total permanent loss of habitat will not exceed 0.5% (0.029 acre) annually; and
- Total cumulative permanent loss of habitat will not exceed 1.5% (0.06 acre) over the 5-year period.

The percentages provided above for limits in disturbances to vernal pool fairy shrimp habitat is based on a total of 8.9 acres of occupied vernal pool fairy shrimp habitat, and a total of 80 acres of potentially occupied habitat for the species. This area excludes the GSUs since a wetland delineation and species surveys have not yet been completed for those locations. Therefore, habitat and its quality will be determined and documented through existing and future threatened and endangered species surveys.

Vernal pool tadpole shrimp have not been found to occur on the main Base of Travis AFB despite numerous species focused surveys; therefore, annual and cumulative disturbance limits to vernal pool tadpole shrimp habitat have not been developed.

Effects to Contra Costa Goldfields

Travis AFB has determined that the following list of activities described below and in the *Description of the Proposed Action* section, have the potential to result in direct and indirect adverse effects to Contra Costa goldfields and their habitat: security and antiterrorism operations; road maintenance; runway, taxiway and ramp repair; facility maintenance and upgrade; demolition; above and under - ground utility lines; culverts and drainage ditches; fence installation, maintenance and replacement; minor construction projects; ERP site investigations and remediation methods; ERP site operations and maintenance; ERP groundwater monitoring; invasive species removal; wetland restoration; and fire suppression (Table 6, and Table E-1 and E-1 of Tab E).

Ground Disturbance and Construction/ Demolition

Direct effects to Contra Costa goldfields from ground disturbing activities and construction equipment may include damage, burial or displacement, and removal of individual plants and seeds; therefore, potentially leading to permanent loss. Indirect effects to the plant and its seeds from ground disturbance in or near occupied habitat may result in permanent loss of soil structure, soil

water-holding capacity, or loss of microhabitat features (Rains *et al.* 2008). Ground disturbance in occupied habitat may also fragment occurrences, which can lead to isolated individual plants and affect genetic variability within plant populations. Other indirect effects include alteration of surface hydrology that affects the hydro-period of pools and swales which may reduce germination and growth or promote the establishment of non-native invasive plant species. Contra Costa goldfield populations are likely to be adversely affected within vernal pools that are altered hydrologically by water depth, water quality, and or water temperature. The hydrologic regime (e.g., change in rates of surface flow) of the pools may be altered due to disturbance of the claypan layer or changing the slope or groundcover of the surrounding landscape. Therefore, construction within 250 feet of vernal pools occupied with Contra Costa goldfields is likely to result in the decline of local sub-populations of the plant.

Activities such as deep drilling, grading, excavation, disking, trenching, installation of equipment under ground, or other types of direct ground disturbance that perforate the claypan either within a pool basin or adjacent to a pool may cause the area to drain at a faster rate; therefore adversely affecting the hydrology of a pool. Due to the relatively flat topography on most of Travis AFB, many pools are hydrologically connected; thus, may be affected if ground disturbances occur in areas between pools. Construction activities within 250 feet of Contra Costa goldfields habitat may result in increased sedimentation transport into the plants habitat during periods of heavy rains. Siltation in pools supporting this species may result in decreased seed viability, decreased germination success, and decreased survivorship; thereby, reducing the number of flowering plants in future wet seasons.

All projects that occur within 250 feet of known or potential Contra Costa goldfields habitat, will implement the conservation measures to avoid or minimize disturbances and adverse effects to the species and its habitat when feasible. Furthermore, implementing proper conservation measures and species-specific conservation measures will avoid, or minimize, habitat alteration and destruction and loss of individual plants and their seeds. See the *Conservation Measures* section and species-specific measures listed in Tab E of the programmatic biological assessment.

Vernal Pool and Seasonal Wetland Restoration

Restoration projects described in the *Description of the Proposed Action* section may result in temporary adverse effects to Contra Costa goldfields and their habitat. Contra Costa goldfields may be subject to loss or injury of plants and its seeds by activities such as grading, excavation, disking, trenching, or other types of direct ground disturbances. To avoid or minimize potential adverse effects to Contra Costa goldfields and its habitat prior to grading within wetlands, the top 4-6 inches of topsoil will be removed from the surface and stored separately from all other spoil piles, including non-wetland topsoil, in order to maintain integrity of the soil composition and character. Wetland topsoil will be replaced in the same wetland it was taken from following backfill and grading. Generally, monitoring of wetland areas for the success of restorative efforts will occur for a minimum of 2 years. See section 4.4.6 of the programmatic biological assessment for further details on restoration activities. In general, restoration projects conducted at Travis AFB are expected to have overall long-term benefits to Contra Costa goldfields by restoring its destroyed or altered habitat, and by enhancing existing habitat.

In addition, while most of the ERP sites on Travis AFB have been treated and closed, some sites may require further action and operations and maintenance. See the *Description of the Proposed Action* section for specific activities, including ground disturbing activities which may adversely affect Contra Costa goldfields and its habitat.

Fire Suppression
Roads used to access remote portions of the Base as part of wildfire suppression and fuels management activities are maintained once a year, after the rainy season. As a result of wildfire suppression and fuels management activities, Contra Costa goldfields plants and seeds may be adversely affected by injury or mortality caused by grading, excavation, disking, or other types of direct ground disturbances. When feasible, implementing proper conservation measures and species-specific conservation measures will avoid, or minimize, habitat alteration and destruction and loss of individual plants and their seeds. See the *Conservation Measures* section and species-specific measures listed in Tab E of the programmatic biological assessment.

Herbicide Application
Travis AFB anticipates that any proposed projects that occur within 250 feet of known or potentially suitable habitat for Contra Costa goldfields will implement the measures described in the *Conservation Measures* section, and will follow additional species-specific measures in Tab E to avoid or minimize potential adverse effects to the species and it habitat (unless otherwise noted in the project effects analysis that will be sent to the Service prior to project implementation).

In most instances full avoidance of Contra Costa goldfields and its habitat will occur by designating 250 foot no access buffers; however, there may be some instances where affects to this species are unavoidable. Adverse effects to Contra Costa goldfields and its habitat may occur in instances where herbicides treatment within the 250 foot buffer is necessary for larger weed infestations, or where vernal pools are located close together. Any herbicide sprayed within the buffer will only contain herbicides without toxic surfactants, and be approved for use in aquatic environments. Such a scenario is likely at the Aero Club where vernal pools are so numerous; it is not feasible to completely avoid the pools. Spot, directed spray with a backpack sprayer will be used within the buffer in order to avoid or minimize potential effects to Contra Costa goldfields plants and its seeds or habitat.

One instance where full avoidance of this species and its habitat is likely not possible is a pilot study using Telar being planned to occur at Travis AFB. The pilot study will be conducted on pepperweed infested pools at the Aero Club that contain the related common *Lasthenia* plant species. Before and after vegetation data will be collected to determine whether adverse effects to the common species were avoided. If data shows that the related species was adversely affected, Travis AFB will request a Level 3 LAA consultation with appropriate conservation measures.

Because of the difficulty in quantifying take of individual Contra Costa goldfields, effects to this species is determined by the area of effect to suitable habitat. Because of the observed limited distribution of Contra Costa goldfields at Travis AFB, not all vernal pool habitats on the Base are considered suitable for the species. Current populations and vernal pools that have been documented to provide suitable habitat for the Contra Costa goldfields in the past are considered occupied habitat for this species (based on the presumption that the long-lived soil seedbank is still viable).

Effects to Contra Costa Goldfield - Habitat
The proposed activities have the potential to result in short-term temporary affects and permanent removal of Contra Costa goldfields habitat. Where feasible, both occupied and suitable habitat for this species will be avoided; although, unforeseen situations may exist that prevent complete avoidance (i.e., emergency repairs to overhead or underground utilities).

Contra Costa Goldfields - Habitat Compensation

Travis AFB will compensate for direct and indirect effects to Contra Costa goldfields habitat with in-perpetuity preservation and/or restoration of suitable habitat for this species (Table 3). Specifically, direct effects to Contra Costa goldfields habitat will be compensated at a 7:1 ratio through preservation of existing habitat, and will also compensate at a 2:1 creation ratio, establishing self-reproducing populations of Contra Costa goldfields in protected areas. Indirect effects to Contra Costa goldfields habitat will be compensated at a 1:1 ratio through preservation of existing habitat for this species.

The purchase of Contra Costa goldfields habitat at a Service-approved Conservation Bank or the preservation and creation, and protection in perpetuity of high value vernal pool habitat near the Base will allow for the permanent protection, long-term management, and enhancement of habitat for the recovery of the species. Additionally, Travis AFB may coordinate with the Solano HCP process to meet compensation requirements. The conservation and compensation measures described above are anticipated to help offset the adverse effects of harm resulting from project-related habitat modification or loss. Additionally, restoration projects proposed by Travis AFB are expected to benefit Contra Costa goldfields in the long-term by restoring its destroyed or altered habitat, and by enhancing existing habitat.

Furthermore, Travis AFB has agreed to the following disturbance limits to Contra Costa goldfields and its habitat (Tab E of the programmatic biological assessment):

Permanent and Temporary Affects to Contra Costa goldfield habitat will not exceed the following over the next 5 years:

Direct affects to occupied habitat:

- Total habitat disturbances for all projects will not exceed 0.5% (0.14 acre) annually;
- Total cumulative habitat disturbances for all projects will not exceed 1% (0.28 acre) over the 5-year period;

Indirect affects to occupied habitat:

- Total habitat disturbances to hydrologically connected systems will not exceed 5% (1.4 acres) annually;
- Total cumulative habitat disturbances for all projects will not exceed 10% (2.8 acres) over the 5-year period;

Permanent loss of occupied habitat:

- Total irretrievable loss of documented habitat will not exceed 0.25% (0.07 acre) annually; and
- Total cumulative irretrievable loss of documented habitat will not exceed 0.5% (0.14 acre) over a 5-year period.

The percentages above are based on a total of about 28 acres of species occupied vernal pool habitat including previously documented Contra Costa goldfields occurrences; which assumes that this species seedbank is still viable. Existing habitat and its quality will be determined and documented through present and future threatened and endangered species surveys.

Cumulative Effects

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area are considered in this programmatic biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section; they require separate consultation pursuant to section 7 of the Act.

Numerous non-federal activities continue to adversely affect vernal pool fairy shrimp, vernal pool tadpole shrimp, California tiger salamander, and Contra Costa goldfields in the action area, primarily through the damage or destruction of habitat for these species. In addition, the same activities that affect these federally-listed species also affect critical habitat for vernal pool fairy shrimp, vernal pool tadpole shrimp, California tiger salamander, and Contra Costa goldfields. Loss and degradation of habitat affecting these species with or without Service authorization continues as a result of urbanization; road construction and maintenance; utility right-of-way management; flood control projects that may not be funded, permitted, or constructed by a federal agency; and continuing conversion of rangelands to more intensive agricultural crops. Additionally, the California tiger salamander is also adversely affected by ground squirrel reduction, mosquito control, including the planting of non-native mosquito fish, and road-related mortality. However, much of the land surrounding Travis AFB is protected through deed restrictions or conservation easements, reducing some of these potential adverse effects. The portion of the Wilcox Ranch adjacent to the Base is owned by the City of Fairfield and Solano County, and is subject to deed restrictions that prohibit most kinds of development.

Access to sites within vernal pool fairy shrimp, vernal pool tadpole shrimp, California tiger salamander and Contra Costa goldfields habitat for proposed projects will continue to occur in the future, therefore continued short-term temporary disturbance to the affected vernal pools and other suitable wetland habitat will occur. However, proposed projects at these sites are relatively rare, and every attempt will be made to minimize and avoid disturbances to these species and their habitat.

Conclusion

Federally-Listed Species
After reviewing the current status of the vernal pool fairy shrimp, vernal pool tadpole shrimp, California tiger salamander, and Contra Costa goldfields, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that proposed projects which meet the qualifications for this programmatic biological opinion are not likely to jeopardize the continued existence of these species. Although critical habitat for these species will be affected, none will be destroyed or adversely modified by the projects that meet the qualifications of the programmatic biological opinion. This determination is based on the description of the proposed action that provides numerous measures and additional minimization measures that will be implemented to minimize adverse effects of future proposed projects on federally-listed species and their critical habitat. Implementing these conservation measures, including the standard habitat compensation ratios, ensures more occupied habitat will be conserved than affected. As a result, project-related effects to vernal pool fairy shrimp, vernal pool tadpole shrimp, California tiger salamander, and Contra Costa goldfields, and their habitat will not rise to the level of precluding recovery of these species or reducing the likelihood of their survival.

Critical Habitat
After reviewing the current status of designated critical habitat for vernal pool fairy shrimp, vernal pool tadpole shrimp, California tiger salamander, and Contra Costa goldfields; the environmental baseline for the action area; the effects of the proposed projects over the next 5-years at Travis AFB and its GSUs; and the cumulative effects, it is the Service's biological opinion that the Proposed Effects of Activities Conducted at Travis Air Force Base on Six Federally Threatened and Endangered Species, as proposed, is not likely to destroy or adversely modify designated critical habitat for these species. The Service reached this conclusion because proposed project-related effects to designated critical habitat, when added to the environmental baseline and analyzed in consideration of all potential cumulative effects, will not rise to the level of precluding the function

of these four federally-listed species' designated critical habitat to serve its intended conservation role for these species based on the following. The effects to critical habitat are small and discrete, relative to the entire area designated as critical habitat, and are not expected to appreciably diminish the value of the critical habitat or prevent it from sustaining its role in the conservation of vernal pool fairy shrimp, vernal pool tadpole shrimp, California tiger salamander, and Contra Costa goldfields.

PROGRAMMATIC INCIDENTAL TAKE STATEMENT

Section 9(a)(1) of the Act and federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened fish and wildlife species without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to a listed species by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. Harm is defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by impairing behavioral patterns including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with this Incidental Take Statement.

The measures described below are non-discretionary, and must be implemented by Travis AFB so that they become binding conditions of any grant, contract, or permit issued by Travis AFB as appropriate, in order for the exemption in section 7(o)(2) to apply. Travis AFB has a continuing duty to regulate the activity covered by this Incidental Take Statement. If Travis AFB: (1) fails to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit, contract, or grant document; and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, Travis AFB must report the progress of the action and its impact on the California tiger salamander, vernal pool fairy shrimp, vernal pool tadpole shrimp, and Contra Costa goldfields to the Service as specified in the incidental take statement (SO CFR §402.14(i)(3)).

Amount or Extent of Take

The specific amount or extent of incidental take of the California tiger salamander, vernal pool fairy shrimp, vernal pool tadpole shrimp, and Contra Costa goldfields unquantifiable at this time because this consultation has analyzed multiple proposed actions at a programmatic level. Travis AFB will submit individual projects to the Service for specific review and analysis by the Service. If appropriate, incidental take will be authorized upon appendage of the specific project to this programmatic biological opinion. No exemption from section 9 of the Act is granted in this programmatic biological opinion.

Effect of the Take

No incidental take is authorized by this programmatic biological opinion for the California tiger salamander, vernal pool fairy shrimp, vernal pool tadpole shrimp, and Contra Costa goldfields.

Reasonable and Prudent Measures

All necessary and appropriate measures to avoid or minimize effects on the California tiger salamander, vernal pool fairy shrimp, vernal pool tadpole shrimp, and Contra Costa goldfields, resulting from project implementation has been incorporated into this programmatic framework. Therefore, the Service believes the following reasonable and prudent measure is necessary and appropriate to minimize incidental take of the California tiger salamander, vernal pool fairy shrimp, vernal pool tadpole shrimp, and Contra Costa goldfields:

1. All conservation measures, as described in the programmatic biological assessment and restated here in the *Description of the Proposed Action* section of this programmatic biological opinion, shall be fully implemented and adhered to. Further, this reasonable and prudent measure shall be supplemented by the terms and conditions below.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, Travis AFB must ensure compliance with the following term and condition, which implement the reasonable and prudent measure described above. This term and condition is nondiscretionary.

1. Travis AFB shall include full implementation and adherence to the conservation measures proposed in the programmatic biological assessment and restated in this programmatic biological opinion as a condition of any permit issued for the proposed project.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on federally-listed species or critical habitat, to help implement recovery plans, or to develop information. The Service recommends the following actions:

Travis AFB should continue to work with the Service to assist us in meeting the goals for: 1) the vernal pool fairy shrimp, vernal pool tadpole shrimp, and Contra Costa goldfields as outlined in the *Recovery Plan for Vernal Pool Ecosystems for Vernal Pool Ecosystems of California and Southern Oregon* (Service 2005); and 2) the California tiger salamander as outlined in the *Recovery Plan for the Central California Distinct Population Segment of the California Tiger Salamander (Ambystoma californiense)*, signed June 06, 2017 (Service 2017).

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION - CLOSING STATEMENT

This concludes formal consultation on the actions described in this programmatic biological opinion for the Proposed Effects of Activities Conducted at Travis Air Force Base on Six Federally Threatened and Endangered Species. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if:

(a) If the amount or extent of taking specified in the incidental take statement is exceeded;
(b) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered;
(c) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the programmatic biological opinion; or
(d) If a new species is listed or critical habitat designated that may be affected by the identified action.

If you have any questions regarding this draft programmatic biological opinion, please contact Harry Kahler, Biologist (Harry_Kahler@fws.gov) at (916) 414-6577 or Doug Weinrich, Assistant Field Supervisor (Douglas_Weinrich@fws.gov) at (916) 414-6563.

Sincerely,

Jennifer M. Norris, Ph.D.
Field Supervisor

Enclosure

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Enclosure

(Figures 1 – 8; Tables 1, 2 & 6; & Project Effects Analysis Report Template were provided by Travis AFB in their Programmatic Biological Assessment, March 2018)

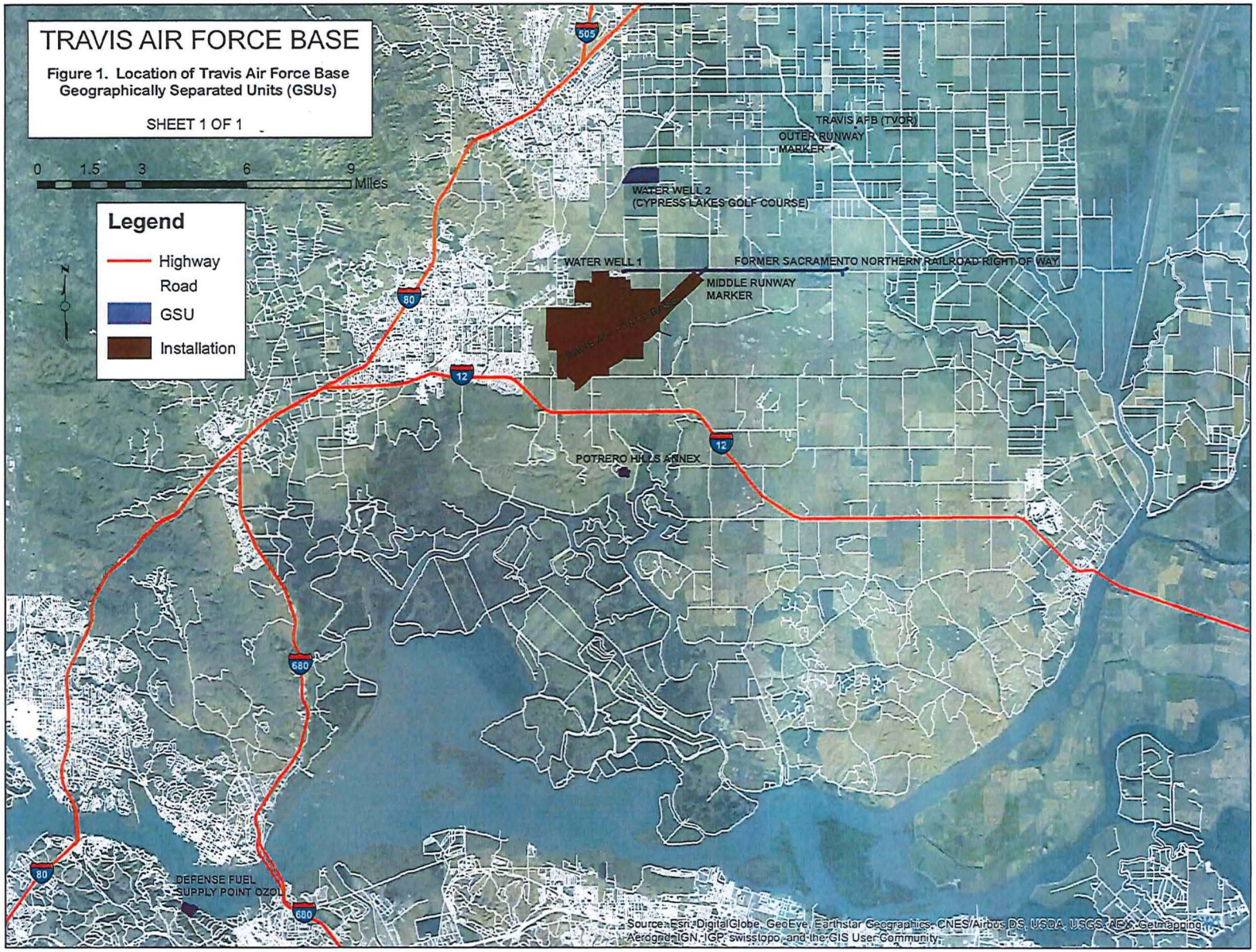
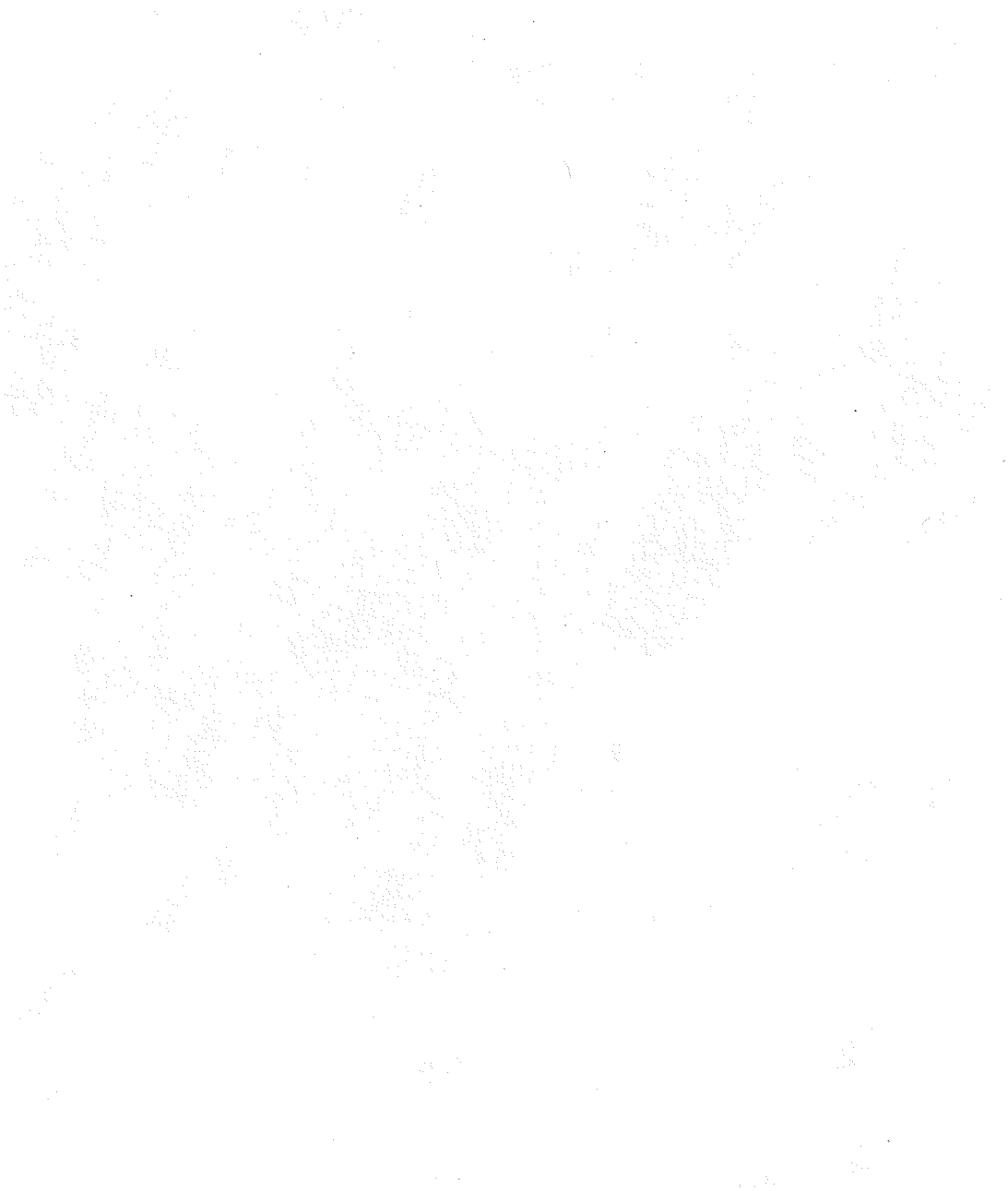
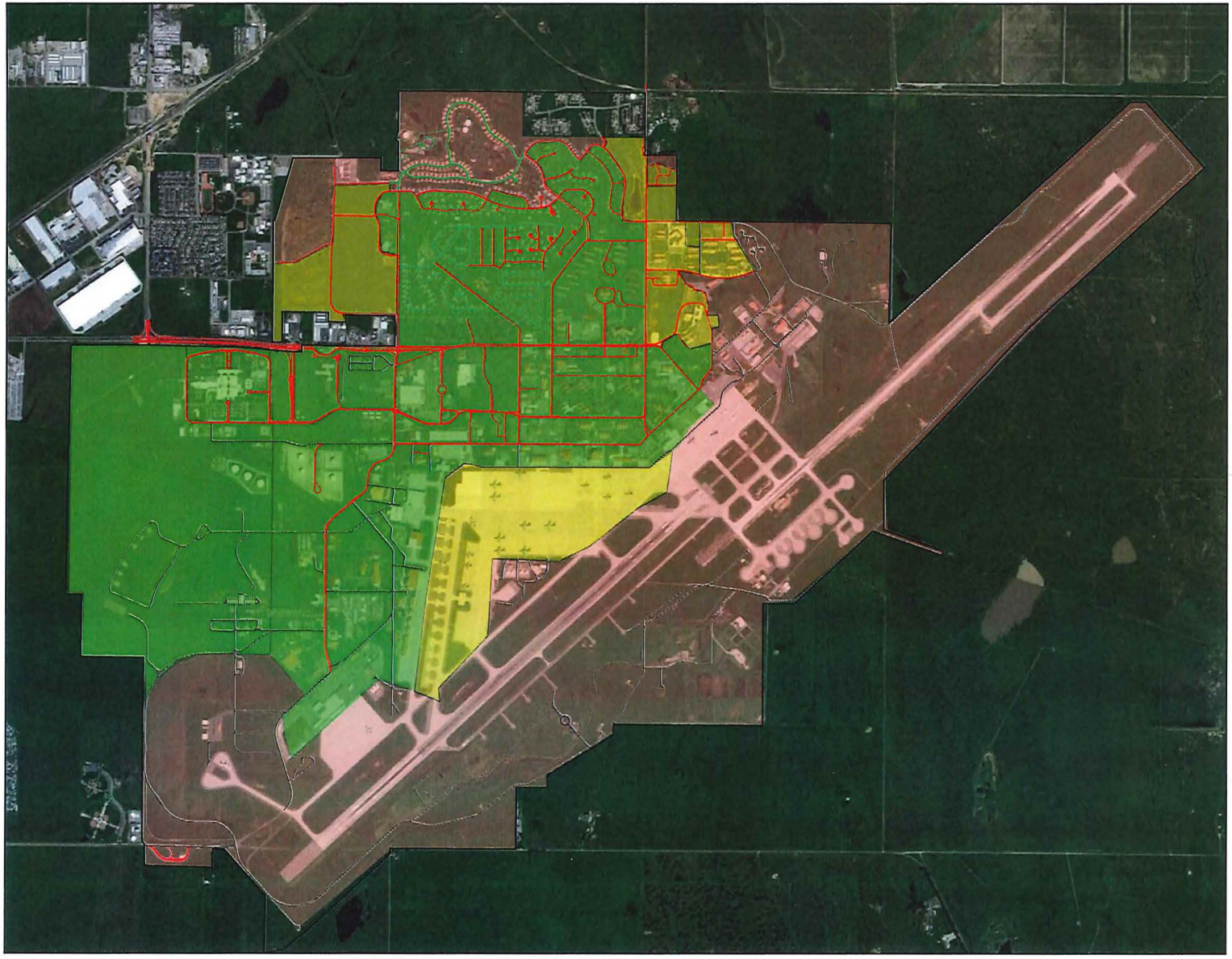


Figure 1. General location of Travis AFB and GSUs.



Programmatic Biological Assessment
Travis AFB, CA

Figure 2
CTS Risk Areas



Credits: ESRI 2017; TAFB 2018
risk mapping based on habitat resistance modeling conducted as part of TAFB PBA

Document Path: \\vmware-host\Shared Folders\Desktop\GIS\TAFB\PBA figures\PBA Figure 2 CTS Risk.mxd

Programmatic Biological Assessment
Travis AFB, CA

Figure 3
Vernal Pool Conservation Areas



Travis AFB Boundary and GSUs
2018_wetlands
VP Conservation Areas
High value (729 acres)
Medium value (920 acres)
Low value (1559 acres)

N

0 0.2 0.4 0.8 1.2 1.6
Kilometers

Credits: USDA 2016; TAFB 2017
habitat value mapping based on
Solano Co. HCP
mapping conducted as part of TAFB PBA

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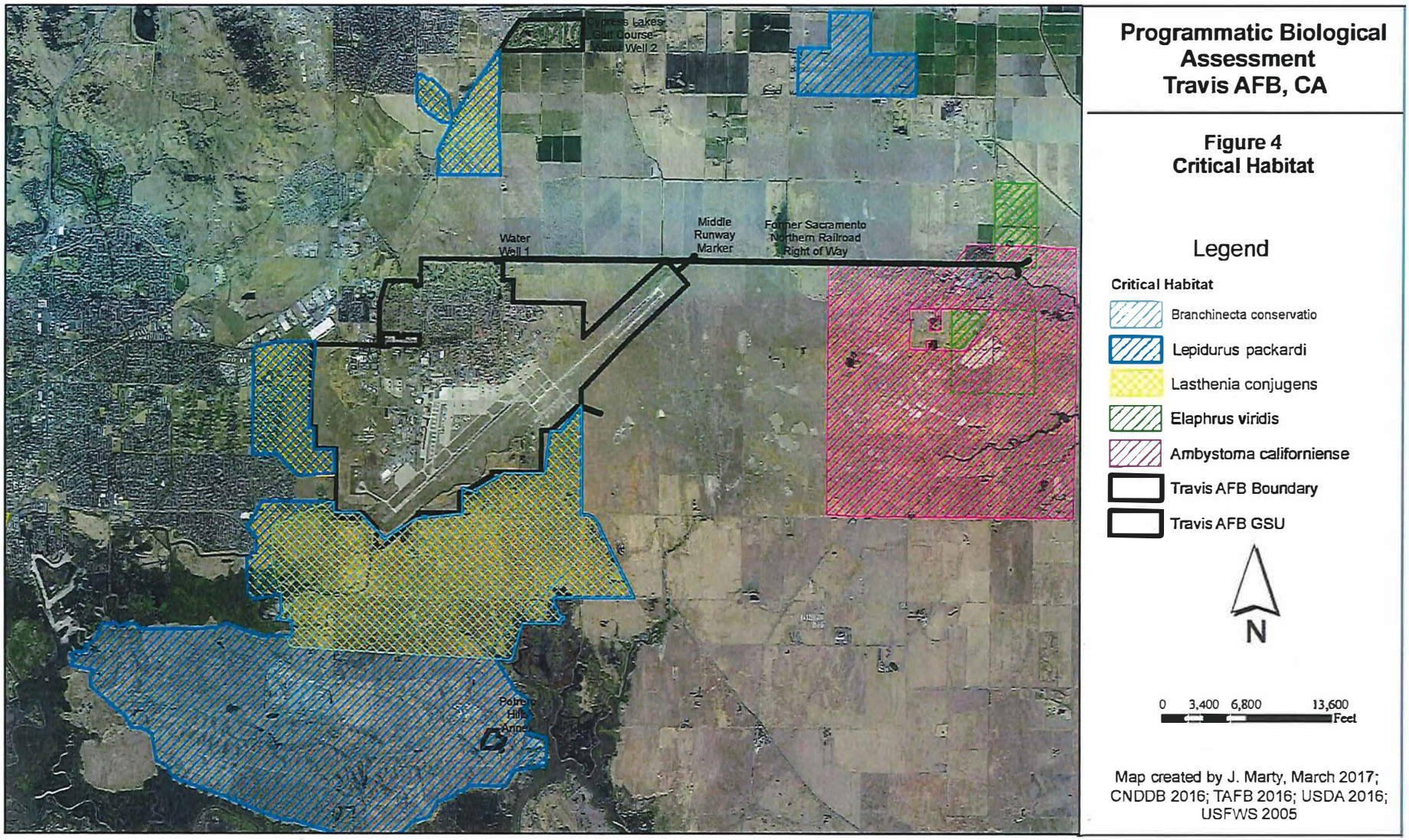

Figure 4. Critical Habitat.

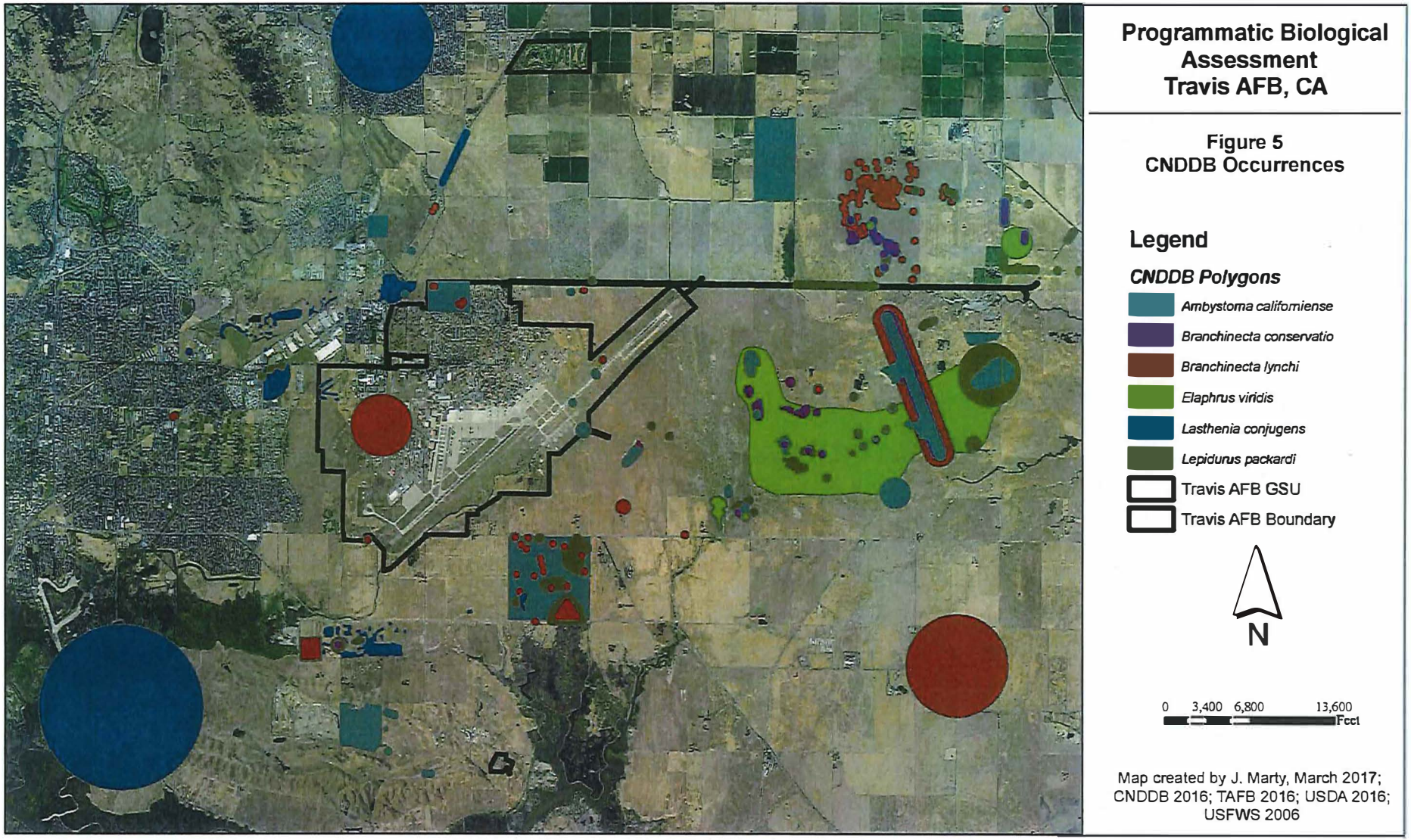

Figure 5. CNDDB Occurrences.

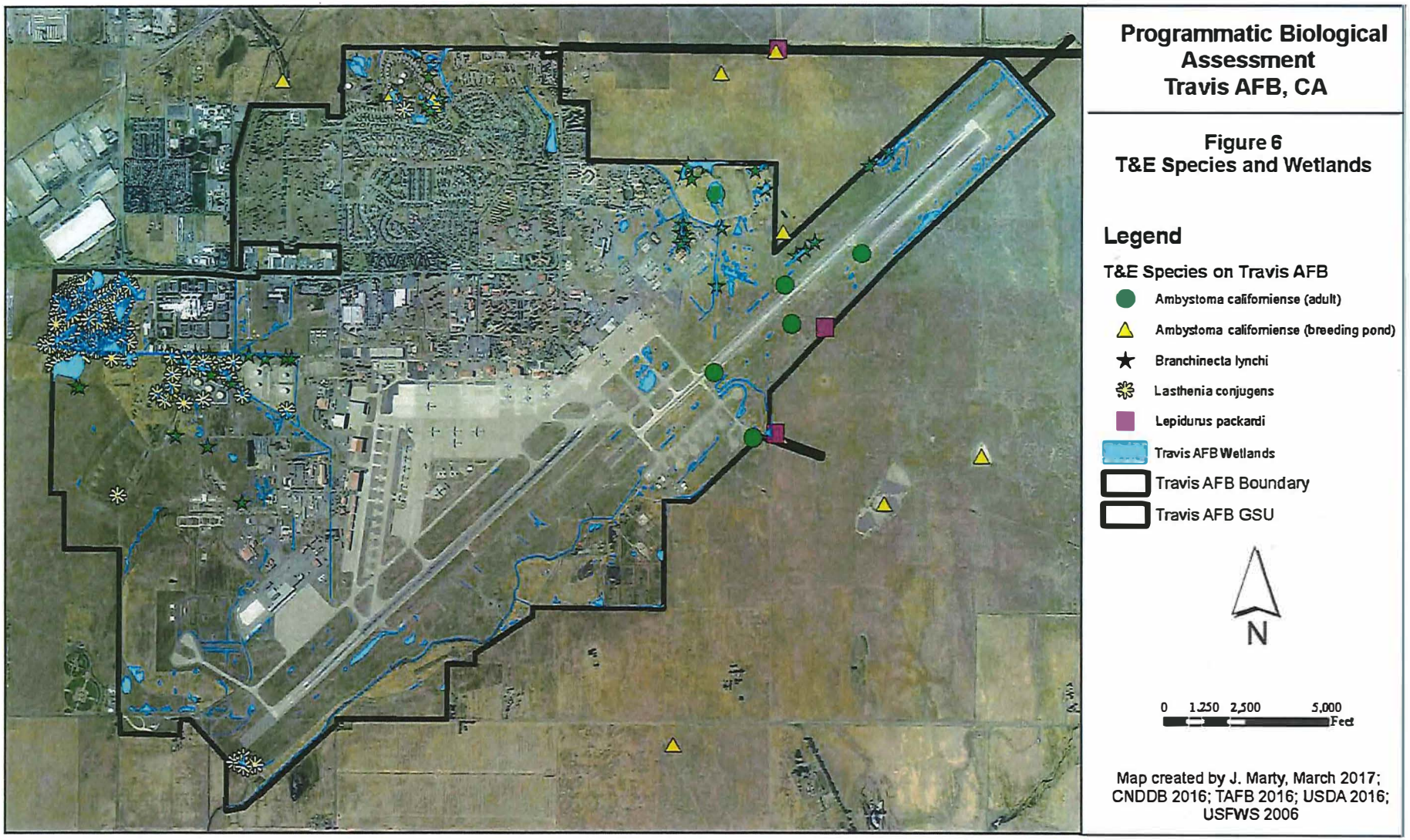

Figure 6. On-Site Species Occurrences.

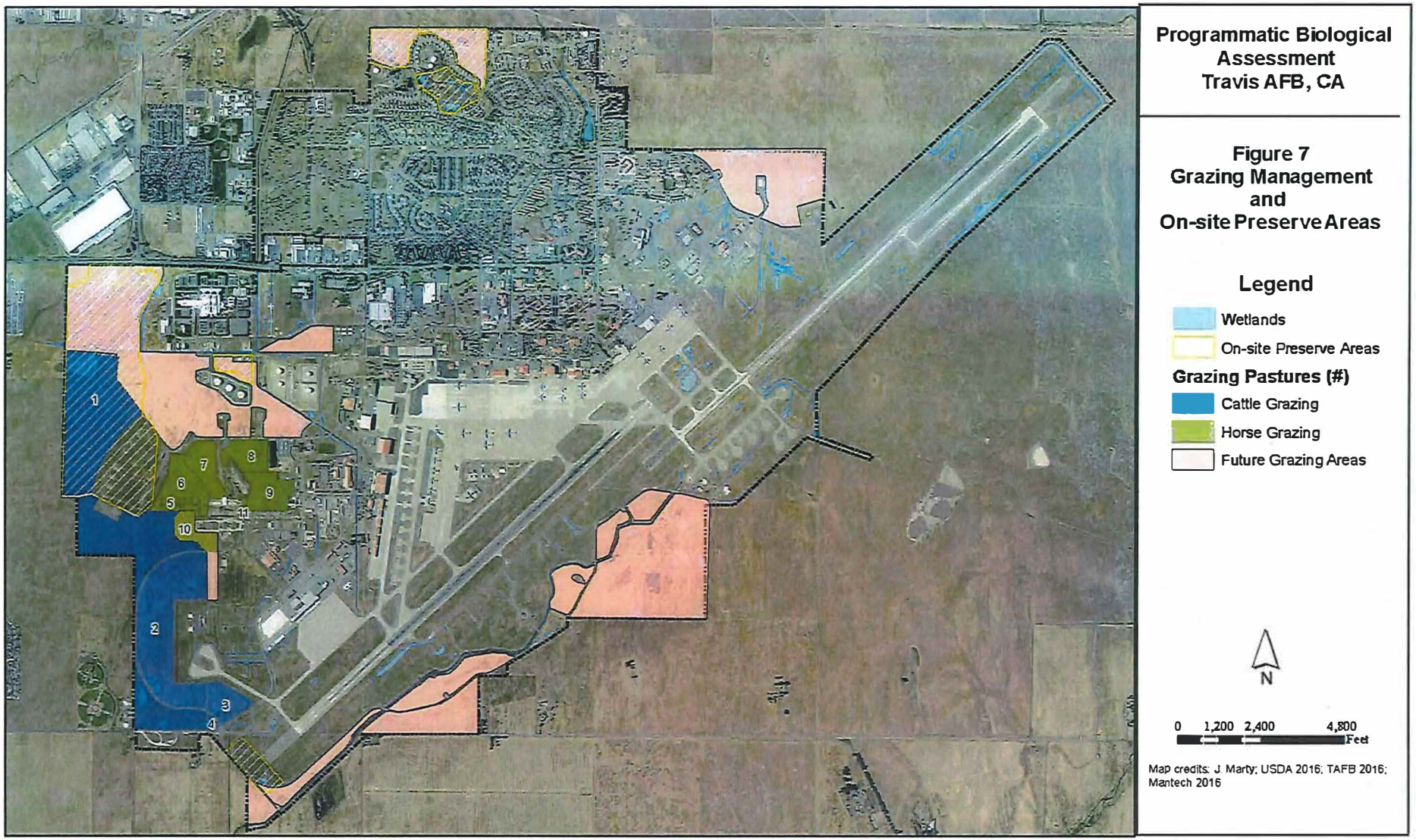

Figure 7. Grazing Management and Preserves.

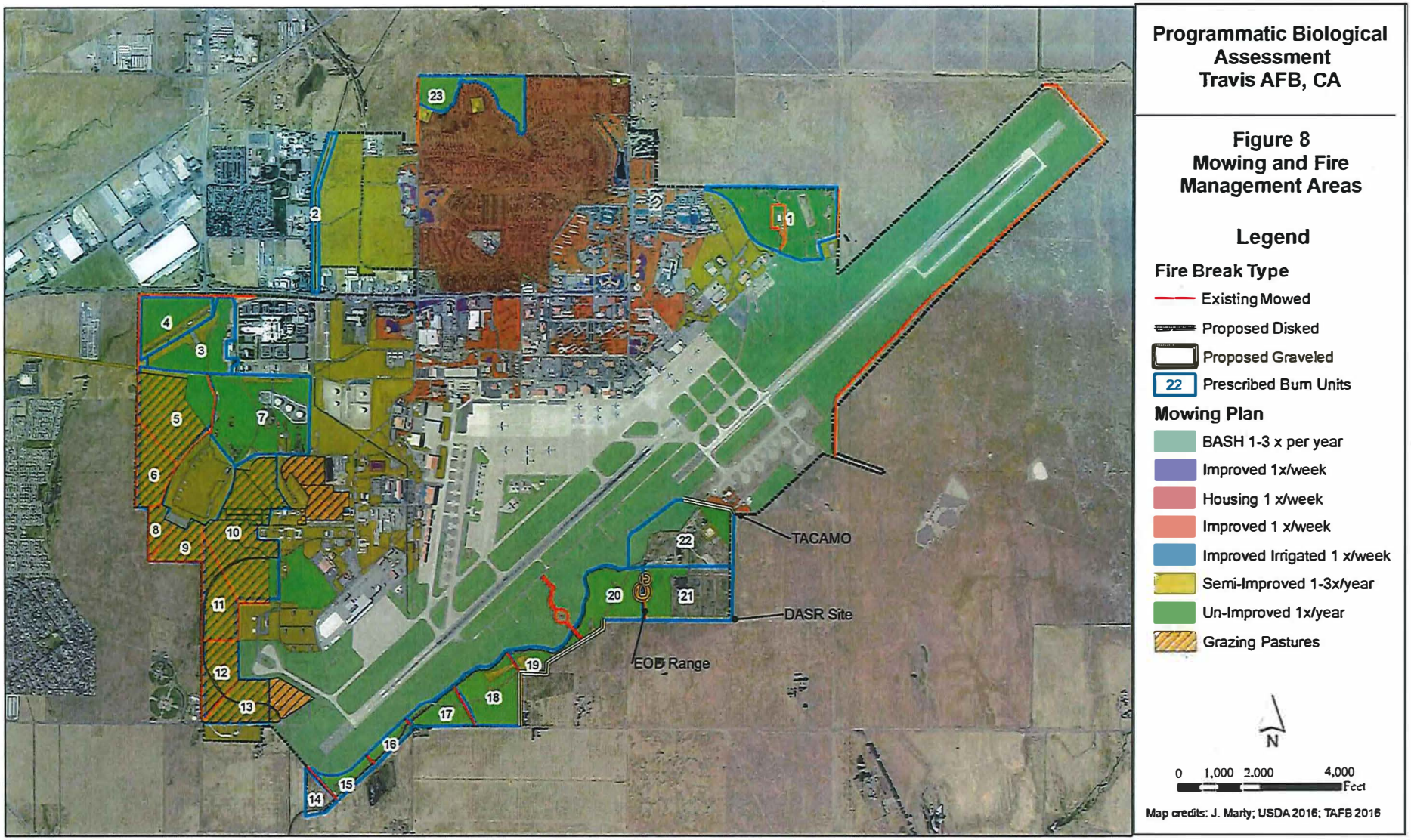

Figure 8. Fire Management and Mowing.

Table 1. Proposed Thresholds for Levels of Consultation for VPFS, VPTS, CFS, and CCG, and selected areas of the base for DGGB. See Figure C-1.

(*upland habitat is defined as land cover value 1; Appendix A)

Criteria	Level 1	Level 2	Level 3
	No Effect	**Not Likely to Adversely Affect**	**May Adversely Affect**
Proximity to Resources	• Work on paved/gravel surfaces; and/or • Work within paved/gravel road shoulders; and/or • Work > 250 feet from wetland	Work outside wetlands but within 250 feet of wetlands that meet the following criteria: • wetland is higher in elevation than the work site or, • wetland area is upstream of the project or, • a physical barrier to hydrological connectivity is present or, • shallow excavation; or • other reasons why wetlands are not impacted	Projects that will affect wetlands (directly or indirectly)
Submittal to USFWS	No submittal	• Project Analysis (template in Appendix B) sent >30 days prior to project start with two-week FWS response period • When project impacts are >100 ft from all wetlands then documents kept by base; submit in annual report	A Project Analysis including project description with maps following template in Appendix B.
Avoidance & Minimization Measures	All equipment and excess soil must stay on paved/gravel surfaces	• General Minimization Measures • Species-Specific Avoidance Measures • No habitat compensation required	• General Minimization Measures • Species-Specific Avoidance Measures • Habitat compensation and/or monitoring required

Table 2. Proposed Thresholds for Levels of Consultation for CTS (*upland habitat is defined as land cover value 1; Appendix A)

Criteria	Level 1a No Effect	Level 1b No Effect (With Conservation Measures)	Level 2 Not Likely to Adversely Affect	Level 3 May Adversely Affect
Project Impact on Resources	• Work limited to paved/gravel surfaces and shoulders; and • Work between 1 May and 15 Oct	• Work limited to paved/gravel surfaces and shoulders in Low Risk areas from 16 Oct to 31 Apr; and/or • Work limited to paved/gravel surfaces and shoulders in Medium Risk areas; and/or • *Temporary and permanent* disturbance of upland habitat* in Low risk areas	• Temporary disturbance of upland habitat* in Medium Risk areas; and/or • Work limited to paved/gravel surfaces and shoulders in High Risk areas (with appropriate CMs)	• Permanent disturbance of upland habitat in Medium and High Risk areas; and/or • Temporary ground disturbance of upland habitat* within High Risk Areas
Submittal to USFWS	No submittal	No submittal	• Project analysis (template in Appendix B) sent >30 days prior to project start with two-week FWS response period; and/or • When upland disturbance ≤1/4 acre in Medium Risk area then documents kept by base; submit in annual report	Project analysis following template in Appendix B.
Location	Low Risk	Low Risk (Some Medium)	Medium Risk (Some High)	Some Medium, all High Risk
Avoidance & Minimization Measures	All equipment and excess soil must stay on paved/gravel surfaces	• CTS awareness training by Service-approved Biologist for all crew members; and • All equipment/vehicles stay on paved surfaces from 16 Oct to 31 Apr; and • All open trenches >6" covered or escape ramp placed in trench/hole at end of every workday if cover not feasible; and • Approved Natural Resource Monitor must inspect equipment/work area for CTS before initial groundbreaking and after rain event	• General Minimization Measures • Species-Specific Avoidance Measures • No habitat compensation required	• General Minimization Measures • Species-Specific Avoidance Measures • Habitat compensation required when permanent impacts to uplands

Table 6. Summary Effects Determination for each T&E Species.

Travis AFB Projects and Activities	EFFECTS DETERMINATION					
	TAB A	TAB B	TAB C	TAB D	TAB E	TAB F
	VPFS	VPTS	CCG	CTS	DGGB	CFS
MISSION OPERATIONS						
Airfield and Flight Operations	NE	NE	NE	LAA	NE	NE
Security and Antiterrorism Operations	LAA	LAA	LAA	LAA	NLAA	NLAA
INFRASTRUCTURE SUPPORT						
Road Maintenance	LAA	LAA	LAA	LAA	NLAA	NE
Bridge Construction and maintenance	NLAA	NLAA	NE	LAA	NLAA	NE
Runway/taxiway/ramp repair	LAA	LAA	LAA	LAA	NE	NE
Runway/taxiway/ramp maintenance	NE	NE	NE	NLAA	NE	NE
Facility Maintenance and Upgrade	LAA	LAA	LAA	LAA	NLAA	NE
Demolition	LAA	LAA	LAA	LAA	NLAA	NE
Aboveground Utility Lines	LAA	LAA	LAA	LAA	NLAA	NE
Underground Utility Lines	LAA	LAA	LAA	LAA	NLAA	NE
Culverts and Drainage Ditches	LAA	LAA	LAA	LAA	NLAA	NE
Mowing	BE	BE	BE	BE	BE	BE
Tree Trimming and Removal	NE	NE	NE	NE	NE	NE
Fencing Installation, Maintenance, and Replacement	LAA	LAA	LAA	LAA	NLAA	NE
INFRASTUCTURE DEVELOPMENT						
Minor Construction Projects	LAA	LAA	LAA	LAA	NLAA	NE
Facility Maintenance and Upgrade	LAA	LAA	LAA	LAA	NLAA	NE
ENVIRONMENTAL MANAGEMENT PROGRAMS						
ERP Site investigations and Remediation Methods*	LAA	LAA	LAA	LAA	LAA	LAA
ERP Site Operations and Maintenance*	LAA	LAA	LAA	LAA	LAA	LAA
ERP Groundwater Monitoring*	LAA	LAA	LAA	LAA	LAA	LAA
Invasive and Pest Species Removal	NLAA	NLAA	LAA	LAA	NLAA	NE
Grazing and Livestock Management	BE	BE	BE	BE	BE	NE
Sensitive Species Habitat Management	NLAA	NLAA	NLAA	BE	NLAA	NLAA
CTS Burrow Inspection and Relocation	NE	NE	NE	LAA	NE	NE
Grassland Restoration	NLAA	NLAA	NLAA	NLAA	NE	NE
Wetland Restoration	LAA	LAA	LAA	LAA	NE	NE
Fire Suppression	LAA	LAA	LAA	LAA	NLAA	NE
Firebreak Maintenance	NLAA	NLAA	NLAA	LAA	NLAA	NE
Prescribed Fire	NLAA	NLAA	NLAA	LAA	NE	NE

NOTES:

LAA = Likely to Adversely Affect

NLAA = Not Likely to Adversely Affect

BE = Beneficial Effect

NE = No effect

*may include off-base activities

Refer to Project Description for a detailed explanation of the project or management programs. Refer to individual tabs for detailed determinations.

Date sent to FWS:

Project Title:

Project Proponent:

CEIE POC:

Location: *Should Briefly Describe Where on Travis AFB or GSU project is occurring*

Species impacted: *State which species are being analyzed*

Effects Assessment: *State whether this is NLAA/LAA*

Expected start date of project:

Project Description:

Describe in detail:

- Purpose and need for the project.
- Project site location including all work, staging and storage areas.
- Detailed narrative description of proposed project activity to include:
  - Description of work (soil disturbing or not, dimensions of disturbed area, depth of disturbance etc.)
  - Seasonal constraints of activity
  - Equipment needed to perform activity
  - Site ingress and egress plan
  - Other relevant information
- Show all of this on a map.

60 CES/CEIE Analysis:

Describe methods used for effects analysis including:

- Personnel and Methods used to determine effects (e.g. field methods, map analysis, expert consultation, etc.)
- Description of all potential or known listed species habitat within the project area including:
  - wetlands within 250 feet, if applicable
  - known occurrences of T&E species in Project Area including closest populations of all affected species
  - CTS upland habitat description and risk area location (Appendix A), if applicable
  - density and abundance of small mammal burrows in any uplands to be disturbed on the site
  - figures showing all applicable species and habitat information
- Describe how effects were considered for each species

Programmatic Biological Opinion Reference:

List the PBO Section and page number where the activity is described

Analysis of Effects:

Describe maximum expected disturbance area and how much of that is habitat (for each habitat type present) for the species (in acres).

Describe potential take (harm, harassment, etc.) that the activity may cause to the species present

Describe the impact if project not completed

Species-specific Minimization Measures which will NOT be implemented for this project:

Assumes all General measures (PBA section 1.5) will be implemented (if applicable)

Only list species-specific CMs that will not be implemented

Summary:

Summarize as follows:
"Travis AFB has determined that the proposed project should be considered and authorized for action because:

a.) the project fits within the scope of the actions described in the PBO,
b.) the effects analyzed are identical or similar to those that were analyzed in the PBO,
c.) sensitive time periods for listed species will be avoided to the extent practicable, and
d.) all pertinent minimization measures will be implemented.

We request concurrence from FWS within __ days *(14 days for NLAA and 30 days for LAA)* of the date of this document. This project will also be discussed and/or listed within our annual report."

Site Maps and Project Figures:

Note: Use as many or few maps as needed to cover the information presented above.

Figure 1: Overview of Project location on Base

Figure 2: Overall project site map, showing project details (disturbance footprint, ingress/egress routes, staging areas, etc.)

Figure 3: Species and habitat information (wetlands, 250-foot buffer, CTS breeding ponds, VPFS/VPTS/CCG point locations, CTS Risk area, etc.)

APPENDIX L

Abbreviations and Acronyms

GLOSSARY OF ABBREVIATIONS AND ACRONYMS

ac	acre
ACAM	Air Conformity Applicability Model
ACC	Air Combat Command
ae/ac	acid equivalent/acre
AFB	Air Force Base
AFCEC	Air Force Civil Engineer
AFCEC/CZOF	Air Force Wildland Fire Branch
AFFF	aqueous film-forming foam
AFI	Air Force Instruction
AFM	Air Force Manual
AFOSH	Air Force Occupational and Environmental Safety, Fire Protection, and Health
AFPD	Air Force Policy Directive
ai/ac	active ingredient/acre
AICUZ	Air Installation Compatible Use Zone
ALUC	Airport Land Use Commission
AMC	Air Mobility Command
AMMs	Avoidance and Minimization Measures
AMPA	aminomethylphosphonic acid
AMW	Air Mobility Wing
ANG	Air National Guard
APAP	Aquatic Pesticide Application Plan
APZ	Accident Potential Zone
AQMD	Air Quality Management District
ATV	All-Terrain Vehicle
AUM	animal unit month
BA	Biological Assessment
BAAQMD	Bay Area Air Quality Management District
BAER	Burned Area Emergency Response
BASH	Bird/wildlife Aircraft Strike Hazard
BCC	Birds of Conservation Concern, a list of the U.S. Fish and Wildlife Service
BE	beneficial effect
BEE	butoxyethyl ester
BGEPA	Bald and Golden Eagle Protection Act
BMPs	Best Management Practices
BO	Biological Opinion
BRC	biomass reduction capability
B.S.	Bachelor of Science
bw/day	bodyweight per day
CA	California
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
CAEAQ	California Almanac of Emissions and Air Quality
Cal-IPC	California Invasive Plant Council
CAMU	Corrective Action Management Unit
CARB	California Air Resources Board
CATEX	categorial exclusion
CES	Civil Engineering Squadron
CES/CEIEC	(60th) Civil Engineering Squadron Conservation Element

CCG	Contra Costa goldfields
CCR	California Code of Regulations
CDFA	California Department of Food and Agriculture
CDFG	California Department of Fish and Game
CDFW	California Department of Fish and Wildlife
CEIE	(60 CES) Environmental Element
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
CFS	Conservancy fairy shrimp
CH_4	Methane
CIRE	Center for Integrated Research on the Environment at University of Montana
CM	conservation measures
CNDDB	California Natural Diversity Database
CNEL	Community Noise Equivalent Level
CNPS	California Native Plant Society
CO_x	Carbon Oxides
CO	Carbon monoxide
CO_2	Carbon dioxide
CTS	California tiger salamander
CWA	Clean Water Act
CZ	Clear Zone
dB	Decibels
DGGB	delta green ground beetle
DNL	Day-Night Average A-Weighted Sound Level
DO	Dissolved oxygen
DoA	Detection of application
DoD	Department of Defense
DoDI	Department of Defense Instruction
DoDM	Department of Defense Manual
DOSH	(California) Division of Occupational Safety and Health
DPR	Department of Pesticide Regulation
DPS	Distinct Population Segment
EA	Environmental Assessment
EDRR	early detection rapid response
EIAP	Environmental Impact Analysis Process
EIS	Environmental Impact Statement
EO	Executive Order
EOD	Explosive Ordinance
EPA	Environmental Protection Agency
ERP	Environmental Restoration Program
ESA	Endangered Species Act
ESOHC	Environment, Safety and Occupational Health Council
ESQD	Explosive safety quantity-distance arcs
°F	degrees Fahrenheit
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FERNS	Fire Emergency Response Network System

FES	Fire and Emergency Services
FFA	Federal Facility Agreement
FONPA	Finding of No Practicable Alternative
FONSI	Finding of No Significant Impact
FPPA	Farmland Protection Policy Act
g	grams
gal	gallons
GHG	Greenhouse Gas
GIS	Geographic Information System
GLUR	Grazing Land Use Rules
GMP	Grazing Management Plan
GMR	grazing management recommendations
GMU	Grazing Management Units
GSU	Geographically Separate Unit
HAFZ	Hazards to Aircraft Flight Zone
HQ	Hazard Quotient
HUD	U.S. Department of Housing and Urban Development
HWMP	Hazardous Waste Management Plan
ICRMP	Integrated Cultural Resources Management Plan
ID	infestation density
IDP	Installation Development Plan
IICEP	Interagency/Intergovernmental Coordination for Environmental Planning
INRMP	Integrated Natural Resources Management Plan
IPMC	Installation Pest Management Coordinator
IPMP	Integrated Pest Management Plan
IPSMP	Invasive Plant Species Management Plan
ISMP	Invasive Species Management Plan
JLUS	Joint Land Use Study
lbs	pounds
L	liter
LAA	likely to adversely affect
LSI	landscape scale of infestation
LUC	land use controls
LUST	leaking underground storage tank
MAJCOM	Major Command
MBTA	Migratory Bird Treaty Act
MCL	Maximum Contaminant Level
MEC	Marty Ecological Consulting, Inc.
MFR	Memorandum for the Record
MFRI	mean fire return interval
mg/kg/bw	milligrams per kilogram of bodyweight
mg	milligrams
MGD	Million Gallons Per Day
MIST	minimum impact suppression techniques
MMRP	Military Munitions Response Program
MOU	Memorandum of Understanding
M.S.	Master of Science
N_2O	Nitrous Oxide
NA	not applicable
NAAQS	National Ambient Air Quality Standards
NE	no effect

NEI	National Emissions Inventory
NEPA	National Environmental Policy Act
NEUDA	Northeast Undeveloped Area
NFES	National Fire Equipment System
NFIRS	National Fire Incident Reporting System
NHPA	National Historic Preservation Act
NIMS	National Incident Management System
NLAA	not likely to adversely affect
NMFS	National Marine Fisheries Service, Part of the National Oceanic and Atmospheric Administration (NOAA)
NMVOC	Nonmethane volatile organic carbon
N_2O	Nitrous oxide
NOA	Notice of Availability
NO_x	Nitrogen Oxides
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NRM	(Travis AFB) Natural Resources Manager
NRMU	National Resources Management Unites
NWCG	National Wildfire Coordinating Group
O_3	Ozone
OHP	Office of Historic Preservation
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
OWA	oil/water separator
oz.	ounces
PA	Project Analysis under Travis's Programmatic Biological Opinion
PAH	polycyclic aromatic hydrocarbons
Pb	lead
PBA	Programmatic Biological Assessment
PBO	Programmatic Biological Opinion
PCBs	polychlorinated biphenyls
PCA	Pest Control Advisor
PFIRS	Prescribed Fire Information Reporting System
PFP	Prescribed Fire Plan
PGD	potential for ground disturbance
PM	particulate matter
PM2.5	particulate matter 1-5 microns in aerodynamic diameter
PM10	particulate matter less than or equal to 10 microns in aerodynamic diameter
PMC	Pest Management Coordinator
PMS	Publication Management System
POEA	polyethoxylated tallowamine
PPE	Personal Protective Equipment
ppm	parts per million
PSD	Prevention of Significant Deterioration
QAE	Qualified Assurance Evaluator
QAL/C	(California) Qualified Applicator License/Certificate
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RDM	residual dry matter

ROD	Record of Decision
ROI	Region of Influence
SAB	Service-approved Biologist
SDS	Safety Data Sheets
SERA	Syracuse Environmental Research Associates, Inc.
SGMA	Sustainable Groundwater Management Act
SHPO	State Historic Preservation Officer
SMOP	Synthetic Minor Operating Permit
SMP	Smoke Management Plan
SO	Solicitors Opinion
SO_x	Sulfur Oxides
SO_2	Sulfur dioxide
SRCD	Solano Resource Conservation District
SSC	Species of Special Concern, a list of the California Department of Fish and Wildlife
SVOC	semi-volatile organic compound
T	terrain
TACAMO	Tactical Airborne Communication and Maritime Operation
TAFB	Travis Air Force Base
TCE	Trichloroethene
TCP	3,5,6-trichloro-2-pyridinol
TEA	triethylamine acid
THPO	Tribal Historic Preservation Officer
TMDL	Total Maximum Daily Loads
TMRC	Theoretical Maximum Residue Contribution
TPH	total petroleum hydrocarbons
tpy	Tons per year
TS	target specificity
TSCA	Toxic Substance Control Act
USACE	United States Army Corps of Engineers
USAF	United States Air Force
USC	United States Code
USDA	United States Department of Agriculture
USDI	United States Department of Interior
USFWS	United States Fish and Wildlife Service
USSS	United States Forest Service
USGS	United States Geological Survey
UXO	Unexploded Ordnance
VPFS	Vernal Pool Fairy Shrimp
VPTS	Vernal Pool Tadpole Shrimp
VOC	Volatile Organic Compound
WFMP	Wildland Fire Management Plan
WFPC	Wildland Fire Program Coordinator
WoTUS	Waters of the United States
Yr.	year
Yrs.	years

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