Guardian

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Restoration Advisory Board Meeting Planned for April 16, 2025

The Travis Air Force Base (AFB) Environmental Restoration Program (ERP) is pleased to announce the next Travis AFB Restoration Advisory Board (RAB) meeting will be held on April 16, 2025, at 7:00 p.m. Please note that April 16 is a Wednesday, which is a departure from past meeting days.

The RAB meeting will start with general introductions and a review of the meeting agenda. This will be followed by updates on the ongoing environmental investigations and restoration activities across Travis AFB, including some of the topics presented in this newsletter. Representatives from the U.S. Environmental Protection Agency, California Department of Toxic Substances Control, and San Francisco Bay Regional Water Quality Control Board will provide regulatory agency updates. The RAB meeting will conclude with a public question-and-answer session on any aspect of our ERP.

Travis AFB In-Person RAB Meeting
Wednesday, April 16, 2025; 7:00 p.m.
3690 Hilborn Road, Fairfield, CA 94534
NO RSVP REQUIRED

As always, everyone from the community is welcome to attend. We encourage you to bring a friend who is interested in environmental cleanup activities at Travis AFB or who may be interested in joining the RAB. Please feel free to arrive a little early and catch up with other RAB members and our project staff. Light refreshments will be provided.

For more information, please contact Travis AFB ERP project staff at (707) 424-2812 or enviropa@us.af.mil.

We look forward to seeing you in April!

Central Groundwater Treatment Plant

The Travis AFB ERP is a leader in efficient and effective groundwater remediation and has even received the prestigious Secretary of Defense Environmental Award for Installations. In this and coming newsletters, we will highlight the groundwater treatment plants at Travis AFB. In this issue, we focus on the Central Groundwater Treatment Plant (CGWTP) and the changes over the years that have been implemented to adapt to the variable nature of remediation.

The CGWTP is located along Hangar Avenue, just east of the KC-46 Hangar 14 and just west of the Travis AFB Fire Department. Treatment plant operations began in May 1995 with the treatment of groundwater extracted from two extraction wells located in the 200 ramp near the air traffic control tower. By 2001, the CGWTP had been configured to include extracted groundwater from three additional extraction wells located near the new KC-46 hangar in the 300 ramp, and another 24 extraction wells throughout the western part of the Base.

Location of the Central Groundwater Treatment Plant within Travis AFB (click on image to enlarge). (Image credit: Jacobs)

The CGWTP was designed to treat up to 300 gallons per minute of groundwater flow through the system. At this time, treatment included two stages: the incoming groundwater would first go through a high-intensity, ultraviolet chamber to destroy the most highly concentrated contaminants, and following that, the process water would travel through multiple sets of granular activated carbon (GAC) vessels to filter out the remaining contaminants. Once treated, the water was discharged to a nearby storm drain that would ultimately end up in Union Creek in the southern portion of the base.

Entrance to the Central Groundwater Treatment Plant.
Two groundwater holding tanks are shown, with the large treated water holding tank (back left) and neighboring fire station (back right) shown as well. (Photo credit: Doug Berwick, Jacobs)

Over the years, many extraction wells saw contaminant concentrations decrease to the point where continued extraction from these locations would no longer be efficient or as effective as other remediation methods. As a result, the amount of groundwater being sent to the CGWTP for treatment began to decline as final-stage remedies were implemented in several areas in lieu of groundwater extraction.

By 2010, the number of extraction wells feeding into the CGWTP had dropped from 29 to just four. The average flow rate entering the CGWTP was down to approximately 30 to 40 gallons per minute, only one-tenth of what the plant had been designed to treat. Incoming contaminant concentrations had not only decreased, but the volume of incoming groundwater had been drastically reduced. For this reason, the energy-intensive ultraviolet oxidation system was taken offline in 2010, leaving only passive GAC filtration for treatment.

Since January 1996, the CGWTP has treated over 638 million gallons of groundwater and removed nearly 3,000 pounds of contaminant mass.

Currently, only four extraction wells associated with the CGWTP continue to operate. Throughout its operational history, the CGWTP has undergone two control system upgrades, piping and control realignment due to construction of the new KC-46 hangar, a change in its discharge location after construction of the fire station, and access route realignment due to installation, operation, and eventual closure of security gates along Hangar Avenue that allow access to Inner Perimeter Road. The CGWTP has had to adapt many times over the years, but it remains a steady presence as it continues its progress toward complete groundwater remediation at Travis AFB.

Site FT004 Bioreactor Trench Technology Demonstration Implementation and Results

A bioreactor trench system was installed as part of a technology demonstration at groundwater Site FT004 (Fire Protection Area #3) in 1996. The objective of the technology demonstration was to evaluate whether the distribution of total organic carbon (TOC) generated by emulsified vegetable oil (EVO) injections could be improved. The distribution of TOC generated by the EVO injections is important to the environmental cleanup of the chlorinated solvent contamination in groundwater at Travis AFB. Naturally occurring bacteria in the subsurface use oxygen to help degrade the TOC. The depletion of the oxygen allows other naturally occurring bacteria that thrive in anaerobic (low to no free oxygen) conditions to help degrade the chlorinated solvents into safe end products. Improving the distribution of the TOC is important at Travis AFB because the soil beneath the base has a high clay content, making it more difficult to inject EVO into the ground and for the generated TOC to spread out into the soil to support the chlorinated solvent degradation process.

The bioreactor trench system at Site FT004 consists of four bioreactor trenches, six extraction wells, and 24 injection wells (Figure 1) and operates as a groundwater recirculation cell (Figure 2). The bioreactor trenches are located along the southern and eastern portion of the contaminated groundwater plume and were constructed by removing soil to 4 feet below the groundwater contact. The trenches were then backfilled with a mixture of gravel, mulch, and iron pyrite sands. The mulch, along with the EVO, is a TOC source. To complement the biological process, iron pyrite breaks down the chlorinated solvents without the bacteria. Figures 3 through 5 illustrate the excavation and construction of the bioreactor trenches.

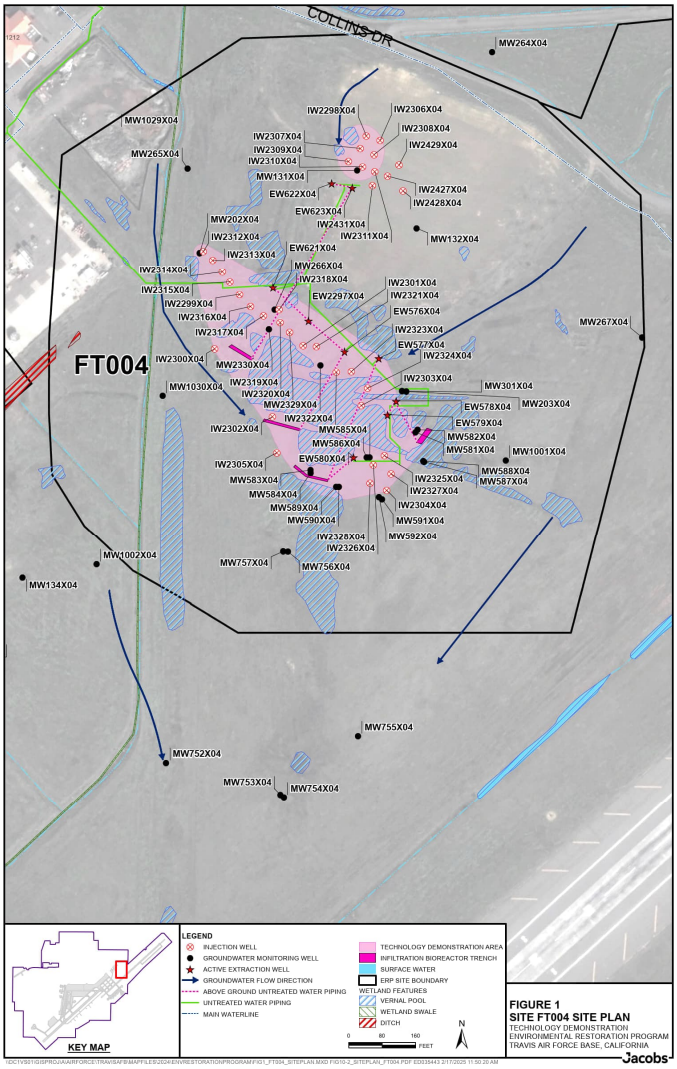


Figure 1. Layout of Site FT004 and the bioreactor trench system (click on image to enlarge). (Image credit: Jacobs)

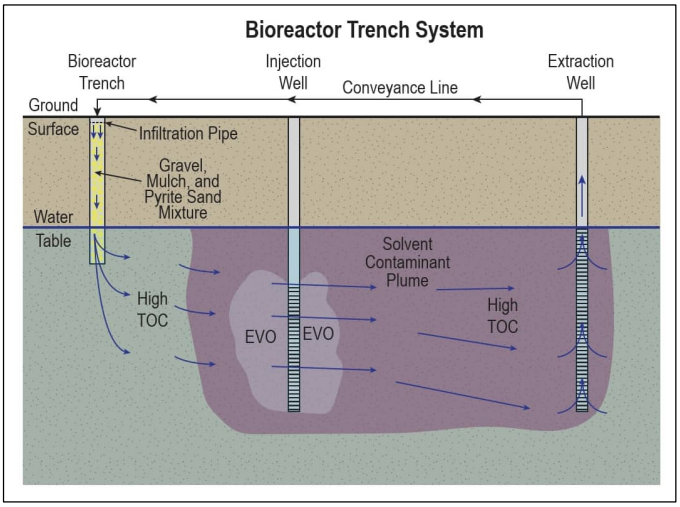


Figure 2. Site FT004 bioreactor trench system schematic (click on image to enlarge). (Image credit: Jacobs)

Figure 3. Photo of the excavation of a bioreactor trench. (Photo credit: Jacobs)

Figure 4. Photo of a fully excavated bioreactor trench. (Photo credit: Jacobs)

Figure 5. Photo of the bioreactor trench backfilled with the gravel, mulch, and pyrite sand mixture. (Photo credit: Jacobs)

The trenches are 3 feet wide and range from approximately 40 to 85 feet long. On the northeastern side of the plume is a line of extraction wells that runs from northwest to southeast. Figure 6 illustrates the installation of an extraction well vault. A line of 24 injection wells were then installed between the bioreactor trenches on the southern side of the plume and the extraction wells on the northeastern side of the plume.

Figure 6. Photo of the installation of the concrete vault for an extraction well. (Photo credit: Jacobs)

EVO was then injected into the line of injection wells creating a zone of EVO- and TOC-enriched groundwater within the contaminated groundwater plume. When the extraction wells were activated, the amended groundwater around the injection wells was pulled toward the extraction wells, thereby amending more of the chlorinated solvent plume (Figure 2). This mixture of chlorinated solvent and high TOC groundwater was then extracted from the subsurface and conveyed to the top of the bioreactor trenches, where the groundwater infiltrates to the bottom of the trenches and then flows back into the subsurface. The chlorinated solvent degradation process described above occurs within the bioreactor trenches and then continues in the subsurface as the infiltrated groundwater flows toward the injection well and then eventually back to the extraction wells. The extraction wells create a depression in the groundwater table within the technology demonstration area sufficient to overcome the predominantly southern groundwater flow at the site. This large recirculation loop extends the area of high TOC groundwater and supports the bacteria population across the entire solvent groundwater plume.

The bioreactor trench system has been very effective in distributing the TOC, which has resulted in significant trichloroethylene (TCE) concentration decreases; TCE is the primary chemical of concern in the solvent groundwater plume. Between the construction of the bioreactor trench system in 2015 (Figure 7) and 2023 (Figure 8), the area of the groundwater plume with TCE concentrations that exceed cleanup levels has been reduced by 96 percent. Also, analytical results indicate that the TCE concentrations in the groundwater plume continue to show a decreasing trend, and that the bioreactor trench system is doing its job successfully.

Due to the demonstrated effectiveness of the bioreactor trench system, Travis AFB plans to formally incorporate the bioreactor trench system into the groundwater remedy at this site through an amendment to the Groundwater Record of Decision (ROD). Community input on the proposed change to the groundwater remedy will be solicited during the ROD amendment process. As part of this process, the Air Force will request input from the community regarding changes to the groundwater remedy described in the Proposed Plan. The Proposed Plan will be emailed to the newsletter mailing list and posted on the ERP website for public review and comment.

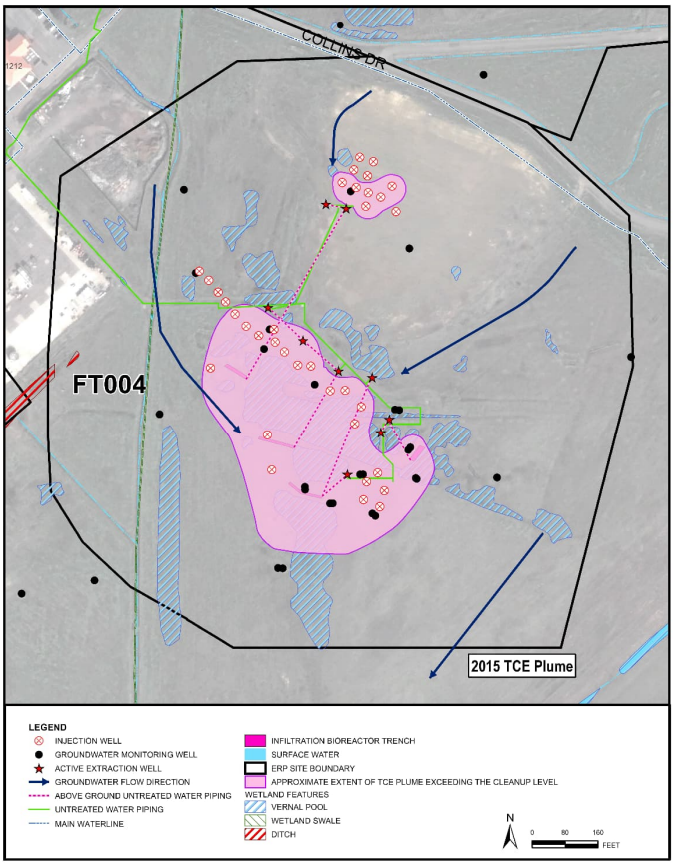


Figure 7. 2015 TCE Plume Exceeding the Cleanup Level (click on image to enlarge). (Image credit: Jacobs)

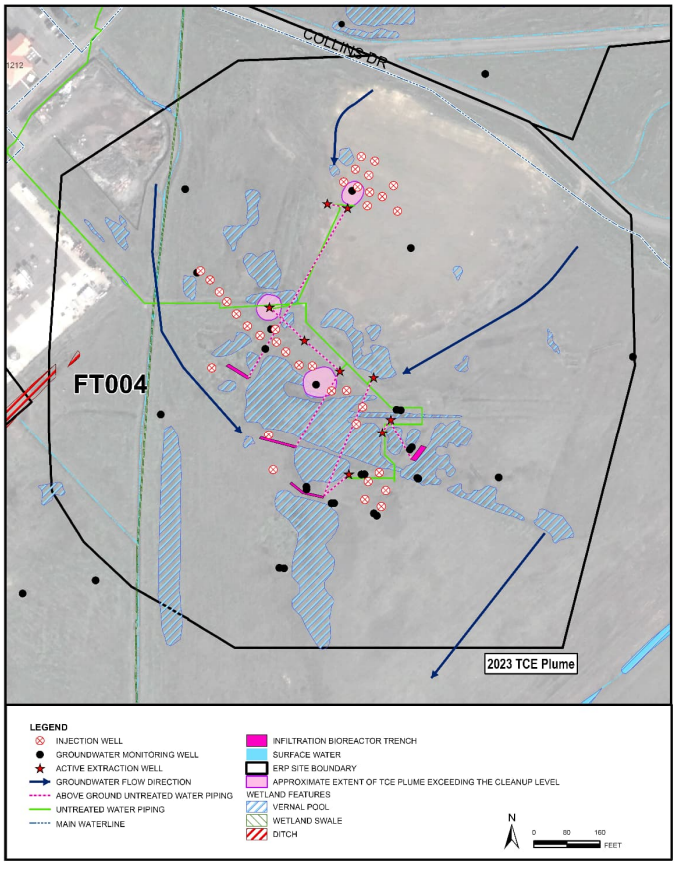
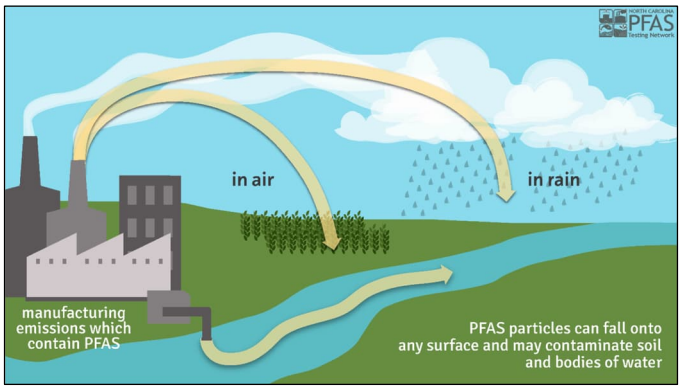


Figure 8. 2023 TCE Plume Exceeding the Cleanup Level (click on image to enlarge). (Image credit: Jacobs)

Phase I RI for AFFF Areas – Project Update

The Aqueous Film-Forming Foam (AFFF) Phase I Remedial Investigation (RI) project has entered the data evaluation and reporting phase. The objective of the Phase I RI is to delineate concentrations of per- and polyfluoroalkyl substances (PFAS) constituents associated with the previous use or release of AFFF in soil, groundwater, surface water, and sediment, and provide a better understanding of their presence in the environment. The RI was initiated in July 2020. Scoping and planning document preparation was conducted over the first year to identify sampling locations for each media followed by three field events to collect site data from 2021 to 2024. To date, the RI has completed installation of 109 monitoring wells, advancement of 99 soil borings, collection of 535 groundwater samples, collection of 20 surface water/sediment sample locations, and installation/sampling of eight lysimeters to support site characterization.

Following field sampling activities, samples are submitted to an accredited laboratory for analysis. The resulting data are then validated and reviewed for quality and usability. All project data are brought into the project database and visualized using the project geographical information system and other assessment tools. Scientists and engineers use the project data to continue developing the collective understanding of the conceptual site model (CSM). A CSM is an iterative representation or understanding of a site that incorporates all available site information to help teams visualize and interpret site information. The CSM is dynamic, meaning that it continues to change as more data are collected and integrated. The project team is currently working to further develop the CSM to report all project activities, the site status and understanding, and provide recommendations in the upcoming RI Report. The RI Report is targeted for submittal to regulatory agency stakeholders for review and input in summer 2025.



Example of a generalized conceptual site model illustrating PFAS emissions from a manufacturing facility. (Image credit: North Carolina PFAS Testing Network)

The project team has worked hard to communicate and coordinate across all project phases, which has aided in the success of this project to date.

PFAS Destruction

By Darren Kraabel, Remedy Scientific, Inc.

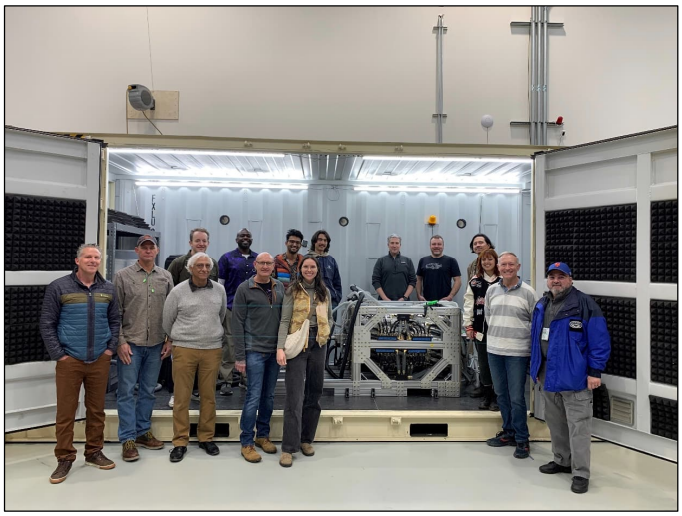
Restoration Teams from Travis and Beale AFBs recently travelled to Remedy Scientific, Inc. (Remedy) in Alameda, California, for a demonstration of a potential new tool to remove PFAS from the environment. PFAS, commonly referred to as "forever chemicals" due to their resistance to chemical breakdown, are a class of synthesized compounds used globally in a wide variety of applications, including stain and fire resistance fabrics/materials, non-stick coatings, and firefighting foams. The Air Force used PFAS-containing firefighting foams for decades to protect service members, equipment, and infrastructure particularly as related to aircraft accidents. The Air Force has been working with several technology developers over the past few years to identify solutions that remove these harmful compounds from water. Now, the focus is expanded to identify solutions that remove PFAS from soil, which often serves as a source of water contamination.

Remedy has developed an innovative approach to destroy PFAS in soil by harnessing high-energy mechanical forces of ball milling, a process that uses grinding stainless or chrome steel balls to break down materials into fine powders. The general idea of ball milling has been around for decades and particularly used in the mining industry. However, the technology has not been used to destroy PFAS chemical bonds… until now. During the physical process of grinding, the mechanical forces disrupt the strong chemical carbon-fluorine bonds that make PFAS notoriously resistant to degradation. This environmentally friendly solution destroys PFAS in soil without producing harmful emissions or hazardous byproducts.

Often new innovative technologies are difficult to scale to commercially viable size. However, Remedy overcomes this challenge by using proprietary software and advanced sensing to make the PFAS destruction process far more efficient. In just over a year, Remedy's continuous optimization approach has been scaled up from lab experiments to an industrial-sized ball mill.

"Remedy's mission is to bring contaminated land back online," according to CEO Randol Aikin. "Destroying PFAS at impacted sites is difficult due to the inherent complexity of soil. This complexity calls for smarter, adaptive systems designed to optimize the process by responding to varying soil constituents, making it both more effective and efficient. As a startup, our goal is to bring new technologies to the table to tackle the vast backlog of contaminated sites across the country – and do it fast. And none of that would be possible without the collaboration we've enjoyed with the Restoration Teams at Travis and Beale."

Future field demonstrations of this technology may occur at Travis and/or Beale AFB as part of the U.S. Department of Defense's certification program for environmental remediation technologies. For more information, visit www.remedyscientific.com.



Travis and Beale AFB Restoration Management teams, along with staff from Remedy Scientific, around Remedy's PFAS Soil Remediation System in Alameda, California. The system is specifically designed to fit into an off-the-shelf shipping container for easy modularization and deployment to the field. (Photo credit: Remedy Scientific)

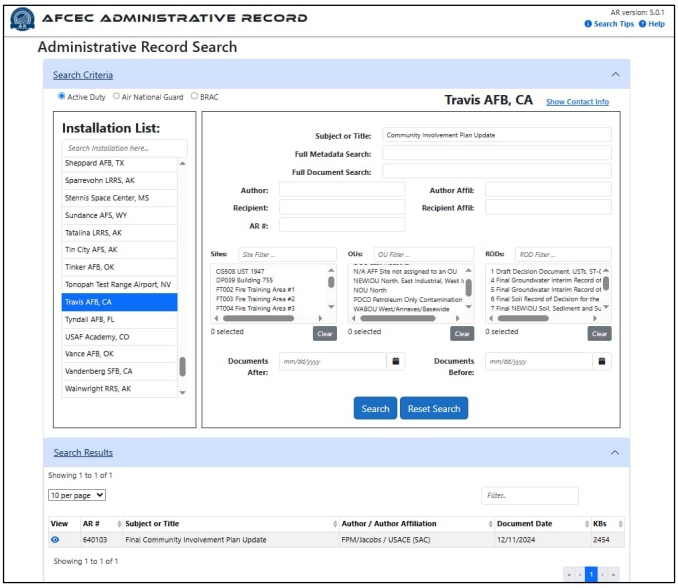
Community Involvement Plan Available to the Public

Travis AFB ERP recently updated its Community Involvement Plan (CIP), and it is now available to the public. CIPs are a requirement of the Comprehensive Environmental Response, Compensation, and Liability Act, otherwise known as CERCLA or Superfund. These documents serve to solicit public participation in the decision-making process regarding remedial actions and remediation-related documents. This update allows for continued communication with interested parties and also designates centralized points of contact for the public to express concerns about the cleanup program.

The last CIP for Travis AFB ERP was completed in 2006. This updated CIP covers program changes since that time, including information about ongoing cleanup efforts across the base, sites identified

since the last update, and emerging contaminants such as PFAS or "forever chemicals." The current CIP identifies community concerns such as status of drinking water, protection of vernal pools and the species that live in them, and pollution/exposure to contaminants that may cause long-term health effects. The document describes mechanisms available for communicating with the public regarding those issues. The CIP also summarizes the purpose and operational procedures of the Travis AFB ERP RAB, requirements for RAB membership, and general RAB member responsibilities.

This CIP update was made available to RAB members for review in spring 2024 before finalizing the document. To view the latest CIP update, please visit the online Administrative Record at https://ar.cce.af.mil. Click the **Continue to site** link at the bottom of the home page. This takes you to a search page for all available Air Force Administrative Records. Once on the search page, first click the button marked **Active Duty** in the upper left of the screen. Then, scroll down the list of active Air Force installations on the left side of the screen and click **Travis AFB**. To access the CIP, type **Community Involvement Plan Update** in the box asking for **Subject or Title** then click the blue **Search** button. The document should now be listed under **Search Results** and can be viewed by clicking on the blue icon that looks like an eye, located to the left of the document title.



The online Administrative Record entry for the Travis AFB CIP at https://ar.cce.af.mil.

Restoration Advisory Board Tours and Meetings

Community members are cordially invited to attend the public RAB meetings and tours. Meetings are held annually on the third Wednesday in April at 3690 Hilborn Road, Fairfield, California. The next RAB meeting is scheduled for Wednesday, April 16, 2025, at 7:00 p.m. You are welcome to arrive early to socialize with fellow RAB members, community members, and the project team. Light refreshments will also be provided. We look forward to seeing you there!

If you are interested in finding out more about the Travis AFB RAB, wish to be included on the email mailing list, or want to inquire about becoming a RAB member, let us know:

enviropa@us.af.mil

(707) 424-2812

For more information about Travis AFB's Environmental Restoration Program, contact us:

Remedial Program Manager
(707) 424-2812

Public Affairs Officer
(707) 424-2011

Or visit:

https://www.travis.af.mil/Information/Environment/