# 2.8 Remedial Action Objectives

Remedial action objectives (RAOs) provide a general description of what the cleanup will accomplish. These goals typically serve as the design basis for the remedial alternatives, which are presented in the next section.

The RAOs for groundwater at Travis AFB provide for protection of human health and include the following:

- Restrict human ingestion and direct dermal contact with contaminated groundwater and reduce concentrations of COCs in groundwater to restore designated beneficial uses. Refer to Table 2.8-1.
- Restrict inhalation of COCs that are volatilizing from groundwater into indoor air until those levels do not pose unacceptable risk to human health. Refer to Table 2.8-2.
- Prevent or minimize further migration of the contaminant plume that is above the cleanup levels referenced in Table 2.8-1.
- Prevent or minimize further migration of contaminants from the portions of the plumes with the highest concentrations of dissolved groundwater contaminants resulting from the dissolution of residual DNAPLs to hydraulically downgradient portions of plumes. Includes cleanup of groundwater, to the extent practicable, within the highest concentration portions of the Site SS015, SS016, SD036, SD037, and DP039 contaminant plumes followed by natural attenuation at Sites SS015, SD036, SD037, and DP039; and hydraulic control and removal at Site SS016.
- Remove Stoddard solvent, containing dissolved COCs, floating on the groundwater table at Site SD034 and potentially impacting designated beneficial uses to the maximum extent practicable.

Cleanup levels to achieve the RAOs of restoring designated beneficial uses of groundwater are provided in Table 2.8-1. Groundwater concentrations that will trigger implementation of LUCs and mitigation measures for vapor intrusion are provided in Table 2.8-2.

**TABLE 2.8-1**
Groundwater Cleanup Levels for Direct Contact
*Groundwater Record of Decision, Travis Air Force Base, California*

| Chemical of Concern[a] | Direct Contact Cleanup Level[b] (µg/L) | Basis for Groundwater Cleanup Level[c,d] |
|---|---|---|
| TCE | 5 | Federal Primary MCL |
| cis-1,2-DCE | 6 | California Primary MCL |
| Vinyl chloride | 0.5 | California Primary MCL |
| 1,2-DCA | 0.5 | Federal Primary MCL |
| Chloroform | 100 | Federal Primary MCL |
| Bromodichloromethane | 100 | Federal Primary MCL |
| 1,1-DCE | 6 | California Primary MCL |
| 1,4-DCB | 5 | California Primary MCL |
| Benzene | 1 | California Primary MCL |
| Chlorobenzene | 70 | California Primary MCL |
| 1,2-Dichloropropane | 5 | Federal Primary MCL |
| Alpha-chlordane | 0.1 | California Primary MCL |
| Heptachlor | 0.01 | California Primary MCL |
| Heptachlor epoxide | 0.01 | California Primary MCL |
| PCE | 5 | Federal Primary MCL |
| Toluene | 150 | California Primary MCL |
| Carbon tetrachloride | 0.5 | California Primary MCL |
| Methylene chloride | 5 | Federal Primary MCL |
| 1,1,1-TCA | 200 | California Primary MCL |
| 1,1,2-TCA | 5 | California Primary MCL |
| MTBE | 13 | California Primary MCL |
| TPH-D | NA[e] | NA[e] |
| TPH-G | NA[e] | NA[e] |
| Aldrin | 0.004 | EPA Risk-based RSL[f] |
| Acetone | 12,000 | EPA Risk-based RSL[f] |
| Naphthalene | 0.14 | EPA Risk-based RSL[f] |
| Chloromethane | 190 | EPA Risk-based RSL[f] |

[a] COCs listed in the NEWIOU and WABOU Groundwater IRODs prior to implementing IRAs. Nickel was initially identified as a COC, but in 2002 was demonstrated as leaching from the stainless steel well casings used in some monitoring well construction and not representative of groundwater contamination. Similarly, bis(2-ethylhexyl)phthalate was initially identified as a COC, but in 2002 was recognized as a field and/or laboratory artifact and not representative of groundwater contamination. Accordingly, nickel and bis(2-ethylhexyl)phthalate are not listed as COCs.

[b] Groundwater cleanup level is the lesser of the federal MCL or State of California MCL.

[c] EPA Federal Primary MCL. Source: EPA, 2012.

[d] State of California Primary MCL. Source: State Water Board, 2011.

[e] If residual TPH is present after RAOs are achieved, then those sites will be transferred from the CERCLA program to the POCO program.

[f] EPA Region 9 Tapwater Regional Screening Level. Source: EPA, 2012.

**TABLE 2.8-2**
Groundwater Concentrations Requiring Vapor Intrusion Land Use Controls and Mitigation Measures
*Groundwater Record of Decision, Travis Air Force Base, California*

| Chemical of Concern | Groundwater Concentrations Requiring Vapor Intrusion Land Use Controls and Mitigation Measures (µg/L)[a] | |
|---|---|---|
| | Industrial Exposure | Residential Exposure |
| TCE | 57 | 26 |
| cis-1,2-DCE | 6,800 | 4,800 |
| Vinyl chloride | 14 | 4.1 |
| 1,2-DCA | 57 | 34 |
| Chloroform | 20 | 12 |
| Bromodichloromethane | 51 | 30 |
| 1,1-DCE | 5,500 | 3,900 |
| 1,4-DCB | 95 | 56 |
| Benzene | 48 | 29 |
| Chlorobenzene | 12,000 | 8,600 |
| 1,2-Dichloropropane | 75 | 45 |
| PCE | 490 | 350 |
| Toluene | 600,000 | 430,000 |
| Carbon tetrachloride | 13 | 7.9 |
| Methylene chloride | 72,000 | 43,000 |
| 1,1,1-TCA | 250,000 | 180,000 |
| Aldrin | NA[b] | NA[b] |
| Acetone | 16,000,000 | 12,000,000 |
| Naphthalene | 120 | 69 |
| Chloromethane | 5,020 | 3,600 |

[a] Risk-based groundwater concentration protective of the indoor air pathway for industrial use and hypothetical residential land use exposure scenarios. Source: *Vapor Intrusion Assessment Update* (CH2M HILL, 2013a). Risk-based groundwater concentrations were calculated using a target ELCR of $1 \times 10^{-6}$ and unit risk factors and reference concentrations based on the EPA hierarchy for human health toxicity values for Superfund risk assessments and AF guidance on selection of toxicity values for risk. Sources: *Vapor Intrusion Assessment Update* (CH2M HILL, 2013a) and *Vapor Intrusion Assessment Work Plan* (CH2M HILL, 2008c). The vapor intrusion assessment developed indoor air cleanup levels for all VOCs detected in groundwater at Travis AFB from August 2006 through June 2007. The groundwater COC 1,1,2-TCA was not detected in groundwater at Travis AFB over this time period; therefore, no groundwater cleanup level protective of the indoor air pathway was developed for 1,1,2-TCA (CH2M HILL, 2008c).

[b] NA = not applicable. Aldrin is a nonvolatile pesticide. Vapor intrusion is not an exposure pathway for this COC.

# 2.9 Description of Alternatives

A total of seven (7) groundwater remedial alternatives for groundwater at Travis AFB were developed in the final FFS (CH2M HILL, 2011a). As technologies or remedy components may not be appropriate for each site, only applicable alternatives were developed and evaluated for each site. For example, at Site LF004, the following three (3) alternatives were developed and evaluated: Alternative 1 – No Further Action, Alternative 2 – MNA, and Alternative 3 – GET (continuing the IRA). The alternatives are summarized in Table 2.9-1 (by alternative) and Table 2.9-2 (by site).

The overall cleanup strategy described in the ROD for Travis AFB groundwater is to transition from the current interim actions to final remedies. This transition includes incorporating successfully performing components of the existing interim actions, incorporation of successful treatment demonstrations, actions based on the results of supporting studies, and actions following GSR practices. Summaries of the Travis AFB groundwater sites, interim remedies, remedial alternatives, and the rationale for the transition from the interim remedies are provided in Tables 2.9-1 and 2.9-2.

Following placement on the NPL in 1989, Travis AFB followed the requirements of CERCLA to investigate site contamination and design and implement appropriate measures. Travis AFB successfully implemented the six (6)-step CERCLA process of (1) PA/SI, (2) RI, (3) FS, (4) remedy selection, (5) RD/RA, and (6) performance monitoring and five-year reviews. The process was modified at the remedy selection step to take an interim approach to groundwater remediation, but otherwise all the requirements of CERCLA were followed throughout the process.

Travis AFB began evaluations of potential groundwater remedial technologies with the development of two (2) CERCLA FSs, including the final NEWIOU FS Report (Radian, 1996b) and the final WABOU FS Report (CH2M HILL, 1998a). Two (2) basic approaches to Travis AFB groundwater remediation resulted from the evaluations conducted in these feasibility studies: GET and MNA assessments. These interim remediation technologies were then implemented at each site, either singly or in combination, in accordance with the NEWIOU Groundwater IROD (Travis AFB, 1998) and the WABOU Groundwater IROD (Travis AFB, 1999). The performance of the interim remedy selected for each site has been monitored and evaluated during the period of interim remediation since the late 1990s.

As the period of interim remediation using GET and MNA assessment concluded, Travis AFB developed the FFS to re-evaluate remediation technologies that had matured since the initial FSs were finalized in 1996 and 1998 (CH2M HILL, 2011a). Three (3) basic remedy transitions resulted from the evaluations conducted in the FFS:

1. Continue the interim remedy.
2. Modify the interim remedy.
3. Discontinue the interim remedy and implement one (1) or more different technologies.

Included in the CERCLA FS criteria evaluations, the FFS re-evaluations included consideration of the following factors:

- Past completion of the CERCLA process at Travis AFB
- The long-term performance of GET systems implemented under the IRODs

- The results of long-term MNA assessments implemented under the IRODs
- Ongoing optimizations of GET systems
- The performance of in situ treatment demonstrations began in 2008 (i.e., ERD treatment using bioreactors and EVO injections)
- The results of supplemental studies (e.g., phytoremediation treatability study, aerobic chlorinated cometabolism enzymes study)
- Preference for GSR practices (e.g., using solar-powered GET systems)

Accordingly, the FFS assembled seven (7) remedial alternatives from technology processes that best satisfied the CERCLA FS threshold and primary balancing evaluation criteria and represented the most reasonable value for the money.

## 2.9.1 Description of Remedy Components

Summary descriptions of the main components of each remedial alternative are provided in Table 2.9-1. Site-specific listings of IRAs, remedial alternatives, and the remedy transition rationale are provided in Table 2.9-2. Each alternative is described in more detail, including common elements and distinguishing features and expected outcomes, in the following sections.

**TABLE 2.9-1**
Summary of Remedial Alternatives
*Groundwater Record of Decision, Travis Air Force Base, California*

| Remedial Alternative | Alternative Description | Sites Evaluated |
|---|---|---|
| 1. No Further Action | The No Further Action alternative serves as a baseline for comparison with the other remedial alternatives. No further actions, including no LUC provisions, will occur to remediate or manage COCs in groundwater. | All sites |
| 2. MNA | Naturally occurring physical, chemical, and biological processes remediate COCs in groundwater. Operation of existing IRA GET systems is discontinued. LUCs will restrict groundwater access and use and residential and industrial land uses. Groundwater-to-indoor-air LUCs will be enforced in areas overlying plumes that exceed groundwater-to-indoor-air RBCs. | FT004, FT005, LF006, Subarea LF007B, Subarea LF007D, LF008, SS015, ST027B, SS029, SS030, SD031, SD033, SS035, SD043 |
| 3. GET | Extraction and ex situ treatment of COCs in groundwater with LGAC and hydraulic containment of plumes using GET systems. Water will be discharged to the stormwater drainage system. LUCs will restrict groundwater access and use and residential and industrial land uses. Groundwater-to-indoor-air LUCs will be enforced in areas overlying plumes that exceed groundwater-to-indoor-air RBCs. | FT004, FT005, Subarea LF007C, LF008, SS016, SS029, SS030, SD031, SD033, SD034, SD036, SD037, DP039, SD043 |
| 4. Bioreactor and GET | Treatment of COCs in groundwater with an in situ bioreactor and extraction and ex situ treatment with a GET system. An in situ bioreactor installed within a source zone will facilitate ERD treatment processes to anaerobically degrade chlorinated VOCs. Groundwater within the hydraulically downgradient portions of the plume will be extracted and treated ex situ with LGAC. Treated water will be discharged to the stormwater drainage system. LUCs will restrict groundwater access and use and residential and industrial land uses. Groundwater-to-indoor-air LUCs will be enforced in areas overlying plumes that exceed groundwater-to-indoor-air RBCs. | SS016 |

**TABLE 2.9-1**
Summary of Remedial Alternatives
*Groundwater Record of Decision, Travis Air Force Base, California*

| Remedial Alternative | Alternative Description | Sites Evaluated |
|---|---|---|
| 5. EVO and EA | In situ source zone treatment with EVO and EA within the hydraulically downgradient portion of the plume. An edible oil substrate (i.e., EVO) will be injected into the higher concentration source zone of the plume to facilitate ERD treatment processes to anaerobically degrade chlorinated VOCs. Naturally occurring physical, chemical, and biological processes will remediate COCs in downgradient groundwater, which will be enhanced by the reduced influx of contaminants from the treated source zone. LUCs will restrict groundwater access and use and residential and industrial land uses. Groundwater-to-indoor-air LUCs will be enforced in areas overlying plumes that exceed groundwater-to-indoor-air RBCs. | SS015, SD036, SD037 |
| 6. Bioreactor, Phytoremediation, EVO PRB, and EA | In situ treatment of COCs in the higher concentration source zone of groundwater with a bioreactor, phytoremediation, and an injected EVO PRB to facilitate biological processes and EA within the remainder of the downgradient plume. A grove of engineer-planted eucalyptus trees will supplement source zone treatment by the hydraulically upgradient bioreactor as the plume flows beneath the trees. A PRB of injected edible vegetable oil across the leading edge of the source area (i.e., a biobarrier) will continue to treat the portion of the aquifer downgradient of the bioreactor and zone of phytoremediation. Naturally occurring physical, chemical, and biological processes will remediate COCs in downgradient groundwater, which will be enhanced by the reduced influx of contaminants from the treated source zone. LUCs will restrict groundwater access and use and residential and industrial land uses. Groundwater-to-indoor-air LUCs will be enforced in areas overlying plumes that exceed groundwater-to-indoor-air RBCs. | DP039 |
| 7. Passive Skimming and EA | Passive skimming to remove the continuing source of groundwater contamination and EA. Stoddard solvent, containing dissolved COCs, floating on the groundwater table will be physically removed using passive skimmers and recycled. Removal of the continuing source and naturally occurring physical, chemical, and biological processes will remediate COCs in groundwater. LUCs will restrict groundwater access and use and residential and industrial land uses. | SD034 |

Note:

For each of the listed remedies, except Alternative 1 – No Further Action, O&M groundwater monitoring will be conducted during the period of LTO to assess whether the remedy is performing as intended. The O&M monitoring will be conducted until groundwater cleanup levels have been achieved. After the O&M data indicate that groundwater cleanup levels have been achieved, then LTM will be conducted for an additional 2 years to verify that the concentrations of contaminants have been permanently reduced to cleanup levels or below.

**TABLE 2.9-2**
Summary of Sites and Remedial Alternatives
*Groundwater Record of Decision, Travis Air Force Base, California*

| Site | Remedy Transition | | Summary of Remedy Transition Rationale |
|---|---|---|---|
| | Interim Remedial Action[a] | Remedial Alternative[b] | |
| FT004 | GET and MNA Assessment | 2 – MNA | Alternative 2 – MNA best satisfied the threshold and primary balancing criteria evaluated in the FFS and represents the most reasonable value for the money. Costs are proportional to the effectiveness of the remedy by achieving long-term effectiveness and permanence within a reasonable time (35 years). The main factors considered in the FFS criteria evaluations included the following: the monitoring well components of MNA have already been implemented, the processes of natural attenuation have been demonstrated to be effective at remediating the entirety of the site plume, and the capital costs for the MNA monitoring well network have already been incurred.<br><br>Implementation of ROD Alternative 2 – MNA follows approximately a decade of successful interim GET system operation within the higher concentration portion of the plume combined with MNA Assessment in the lower concentration portion of the plume located hydraulically downgradient of the GET system. The GET system part of the IRA has been shut down for a contaminant rebound study since 2010. Plume concentrations under long-term GET operation had declined at an ever decreasing rate and had become cost-ineffective. Natural attenuation processes have since been evaluated for the entirety of the plume (CH2M HILL, 2010b). Assessments of MNA during the period of interim remediation and during the period of the rebound study indicate that natural physical, chemical, and biological processes are viable for remediation of the entire plume under the site conditions (refer to Section 2.2.5.1). |
| FT005 | GET | 3 – GET | Alternative 3 – GET best satisfied the threshold and primary balancing criteria evaluated in the FFS and represents the most reasonable value for the money. Costs are proportional to the effectiveness of the remedy by achieving long-term effectiveness and permanence within a reasonable time (10 years). The main factors considered in the FFS criteria evaluations included the following: the GET remedy components have already been implemented, GET has been demonstrated to be effective at remediating the site plume, and the GET system capital costs have already been incurred. Off-base EPA-approved vendor treatment of contaminant-laden LGAC will also satisfy the statutory preference for treatment.<br><br>Implementation of ROD Alternative 3 – GET at Site FT005 represents a continuation of approximately a decade of successful interim GET system operation (refer to Section 2.2.5.2). |

**TABLE 2.9-2**
Summary of Sites and Remedial Alternatives
*Groundwater Record of Decision, Travis Air Force Base, California*

| Site | Remedy Transition | | Summary of Remedy Transition Rationale |
|---|---|---|---|
| | Interim Remedial Action[a] | Remedial Alternative[b] | |
| LF006 | MNA | 2 – MNA | Alternative 2 – MNA best satisfied the threshold and primary balancing criteria evaluated in the FFS and represents the most reasonable value for the money. Costs are proportional to the effectiveness of the remedy by achieving long-term effectiveness and permanence within a reasonable time (5 years). The main factors considered in the FFS criteria evaluations included the following: the monitoring well components of MNA have already been implemented, the processes of natural attenuation have been demonstrated to be effective at remediating the entirety of the site plume, and the capital costs for the MNA monitoring well network have already been incurred.<br>Implementation of ROD Alternative 2 – MNA at Site LF006 is a continuation of approximately a decade of successful MNA during the period of interim remediation (refer to Section 2.2.5.3). |
| Subarea LF007B | MNA Assessment | 2 – MNA | Alternative 2 – MNA best satisfied the threshold and primary balancing criteria evaluated in the FFS and represents the most reasonable value for the money. Costs are proportional to the effectiveness of the remedy by achieving long-term effectiveness and permanence within a reasonable time (0 years). Cleanup levels were achieved during the period of interim remediation. The main factors considered in the FFS criteria evaluations included the following: the monitoring well components of MNA have already been implemented, the processes of natural attenuation have been demonstrated to be effective at remediating the entirety of the subarea plume, and the capital costs for the MNA monitoring well network have already been incurred.<br>Implementation of ROD Alternative 2 – MNA at Site LF007B represents a transition from approximately a decade of successful MNA Assessment (CH2M HILL, 2010b) (refer to Section 2.2.5.4). |

**TABLE 2.9-2**
Summary of Sites and Remedial Alternatives
*Groundwater Record of Decision, Travis Air Force Base, California*

| Site | Remedy Transition | | Summary of Remedy Transition Rationale |
|---|---|---|---|
| | Interim Remedial Action[a] | Remedial Alternative[b] | |
| Subarea LF007C | GET | 3 – GET | Alternative 3 – GET best satisfied the threshold and primary balancing criteria evaluated in the FFS and represents the most reasonable value for the money. Costs are proportional to the effectiveness of the remedy by achieving long-term effectiveness and permanence within a reasonable time (26 years). The main factor considered in the FFS criteria evaluations is that GET system remedy components have already been mostly implemented. Interim GET system optimization will be conducted during 2013 to increase groundwater pumping rates, improve hydraulic capture, and achieve a higher rate of contaminant mass removal. Following the completion of optimization activities, the GET system capital costs will be largely incurred. Off-base EPA-approved vendor treatment of contaminant-laden LGAC will also satisfy the statutory preference for treatment. The use of solar-powered groundwater extraction pumps and beneficial reuse of treated groundwater in the on-base Duck Pond provides aspects of GSR.<br>Implementation of ROD Alternative 3 – GET at Subarea LF007C represents a continuation of approximately a decade of interim GET system operation (refer to Section 2.2.2.1). |
| Subarea LF007D | MNA Assessment | 2 – MNA | Alternative 2 – MNA best satisfied the threshold and primary balancing criteria evaluated in the FFS and represents the most reasonable value for the money. Costs are proportional to the effectiveness of the remedy by achieving long-term effectiveness and permanence within a reasonable time (23 to 49 years). The main factors considered in the FFS criteria evaluations included the following: the monitoring well components of MNA have already been implemented, the processes of natural attenuation have been demonstrated to be effective at remediating the entirety of the site plume, and the capital costs for the MNA monitoring well network have already been incurred.<br>Implementation of ROD Alternative 2 – MNA at Subarea LF007D represents a transition from approximately a decade of successful MNA Assessment (refer to Section 2.2.5.5). |

**TABLE 2.9-2**
Summary of Sites and Remedial Alternatives
*Groundwater Record of Decision, Travis Air Force Base, California*

| Site | Remedy Transition | | Summary of Remedy Transition Rationale |
|---|---|---|---|
| | Interim Remedial Action[a] | Remedial Alternative[b] | |
| LF008 | GET | 2 – MNA | Alternative 2 – MNA best satisfied the threshold and primary balancing criteria evaluated in the FFS and represents the most reasonable value for the money. Costs are proportional to the effectiveness of the remedy by achieving long-term effectiveness and permanence within a reasonable time (100 to 110 years). The main factors considered in the FFS criteria evaluations included the following: the monitoring well components of MNA have already been implemented, the processes of MNA will be effective because the site plume has been demonstrated to be stable or contracting, and the capital costs for the MNA monitoring well network have already been incurred.<br><br>Implementation of ROD Alternative 2 – MNA at Site LF008 represents a transition from approximately a decade of partially effective interim GET system operation. Pesticide contaminant concentrations were stable over the period of active GET. Therefore, the interim GET system was shut down for a contaminant rebound study in 2008. After approximately 7.5 years following shutdown of the GET system, no significant change in contaminant concentrations was observed. Filtered and non-filtered sample data indicated that residual pesticide contaminants are strongly sorbed to soil particles and not dissolved in the groundwater. Therefore, MNA is a viable remedy for the entirety of the site under these conditions (refer to Section 2.2.5.6). |
| SS015 | MNA Assessment | 5 – EVO and EA | Alternative 5 – EVO and EA best satisfied the threshold and primary balancing criteria evaluated in the FFS and represents the most reasonable value for the money. Costs are proportional to the effectiveness of the remedy by achieving long-term effectiveness and permanence within a reasonable time (70 years). The main factors considered in the FFS criteria evaluations included the following: the EVO injection well components of the remedy have already been mostly implemented during the ERD treatment demonstration, and the EA monitoring well components have already been implemented; the effectiveness of ERD treatment via EVO injection to address residual DNAPL principal threat wastes and the higher concentration portion of the plume have been successfully demonstrated; the processes of natural attenuation are assessed as likely to be effective at remediating the lower concentration portion of the plume when combined with the EVO injection component (refer to Section 2.2.5.7); and the capital costs of EVO injection wells and EA monitoring wells have already been largely incurred. Use of EVO injection to facilitate ERD under Alternative 5 will also satisfy the statutory preference for treatment. Use of food-grade EVO to facilitate in situ ERD treatment processes provides an aspect of GSR. |

**TABLE 2.9-2**
Summary of Sites and Remedial Alternatives
*Groundwater Record of Decision, Travis Air Force Base, California*

| Site | Remedy Transition | | Summary of Remedy Transition Rationale |
|---|---|---|---|
| | Interim Remedial Action[a] | Remedial Alternative[b] | |
| | | | Implementation of ROD Alternative 5 – EVO and EA at Site SS015 represents a transition from approximately a decade of an ultimately unsuccessful MNA Assessment for the entirety of the site plume (refer to Section 2.2.5.7) to a more effective strategy of active ERD treatment within the highest concentration portion of the plume taken in combination with natural attenuation processes in the lower concentration portion of the plume. ERD treatment using EVO injection has been demonstrated to be effective at remediating the highest concentration portion of the plume (refer to Section 2.2.3.2). Natural attenuation processes within the lower concentration portion of the plume will be more effective after the ongoing source of contamination is greatly reduced by the ERD treatment component of the remedy (refer to Section 2.2.5.7). |
| SS016 | GET | 4 – Bioreactor and GET | Alternative 4 – Bioreactor and GET at Site SS016 best satisfied the threshold and primary balancing criteria evaluated in the FFS and represents the most reasonable value for the money. Costs are proportional to the effectiveness of the remedy by achieving long-term effectiveness and permanence within a reasonable time (62 years). The main factors considered in the FFS criteria evaluations included the following: the bioreactor and GET system components of the Site SS016 remedy have already been implemented within an area of restricted access and ongoing military flightline operations, ERD treatment via a bioreactor was successfully demonstrated as being effective for addressing the residual DNAPL principal threat wastes and the highest concentration portions of the Site SS016 plume, GET system operation has been demonstrated to be effective at remediating the remainder of the higher concentration plume, and the capital costs for both the bioreactor and GET system components of the remedy have already been largely incurred. Use of an in situ bioreactor under Alternative 4 will satisfy the statutory preference for treatment. Off-base EPA-approved vendor treatment of contaminant-laden LGAC will also satisfy the statutory preference for treatment. Use of organic mulch to facilitate in situ ERD treatment processes in the bioreactor provides an aspect of GSR.<br><br>Implementation of ROD Alternative 4 at Site SS016 follows approximately a decade of interim GET system operation. Operation of the GET system within the highest concentration portion of the plume had become increasingly cost-ineffective as contaminant concentrations were being reduced at an ever-decreasing rate. As a result, the GET system within this portion of the plume was shut down in 2010 for a successful ERD treatment demonstration via the bioreactor (refer to Section 2.2.3.1). The remainder of the GET system remained in operation and continues to operate successfully (refer to Section 2.2.2.2). |

**TABLE 2.9-2**
Summary of Sites and Remedial Alternatives
*Groundwater Record of Decision, Travis Air Force Base, California*

| Site | Remedy Transition | | Summary of Remedy Transition Rationale |
|---|---|---|---|
| | Interim Remedial Action[a] | Remedial Alternative[b] | |
| ST027B | MNA[c] | 2 – MNA | Alternative 2 – MNA best satisfied the threshold and primary balancing criteria evaluated in the FFS and represents the most reasonable value for the money. Costs are proportional to the effectiveness of the remedy by achieving long-term effectiveness and permanence within a reasonable time (50 years). The main factors considered in the FFS criteria evaluations included the following: the monitoring well components of MNA have already been implemented, the processes of natural attenuation have been demonstrated to be effective at remediating the site plume, and the capital costs for the MNA monitoring well network have already been incurred.<br><br>Implementation of ROD Alternative 2 – MNA at Site ST027B represents a transition from MNA as the POCO program presumptive remedy for the site and a period of MNA assessment after CERCLA contaminants were detected in 1999. Site ST027B was not included in the NEWIOU Groundwater IROD, and MNA Assessment was not formally selected as the interim remedy. However, long-term groundwater monitoring of the site was conducted under the Travis AFB GSAP. The data were obtained by the GSAP monitoring support using natural attenuation processes to remediate the plume (refer to Section 2.2.5.8). |
| SS029 | GET | 3 – GET | Alternative 3 – GET at Site SS029 best satisfied the threshold and primary balancing criteria evaluated in the FFS and represents the most reasonable value for the money. Costs are proportional to the effectiveness of the remedy by achieving long-term effectiveness and permanence within a reasonable time (62 years). The main factors considered in the FFS criteria evaluations included the following: the components of the Site SS029 GET system have already been implemented within an area of restricted access and ongoing military flightline operations, long-term interim GET system operation has been demonstrated to be effective at remediating the combined Site SS016 and SS029 plumes and preventing plume migration, and the capital costs for the Site SS029 GET system have already been incurred. Off-base EPA-approved vendor treatment of contaminant-laden LGAC will also satisfy the statutory preference for treatment.<br><br>Implementation of ROD Alternative 3 – GET at Site SS029 represents a transition from approximately a decade of successful interim GET system operation (refer to Section 2.2.1).<br><br>The contaminant plume at Site SS029 includes contaminants migrating to the site from the hydraulically upgradient Site SS016 plume. |

**TABLE 2.9-2**
Summary of Sites and Remedial Alternatives
*Groundwater Record of Decision, Travis Air Force Base, California*

| Site | Remedy Transition | | Summary of Remedy Transition Rationale |
|---|---|---|---|
| | Interim Remedial Action[a] | Remedial Alternative[b] | |
| SS030 | GET | 3 – GET | Alternative 3 – GET best satisfied the threshold and primary balancing criteria evaluated in the FFS and represents the most reasonable value for the money. Costs are proportional to the effectiveness of the remedy by achieving long-term effectiveness and permanence within a reasonable time (22 years). The main factor considered in the FFS criteria evaluations was that the GET remedy components have already been implemented and have been demonstrated to be effective at remediating the site plume. Optimization of the interim GET system will be conducted during 2013 by installing an additional extraction well to improve hydraulic capture. Following this optimization measure, the GET system capital costs will have already been incurred. Off-base EPA-approved vendor treatment of contaminant-laden LGAC will also satisfy the statutory preference for treatment.<br><br>Implementation of ROD Alternative 3 – GET at Site SS030 represents a transition from approximately a decade of successful interim GET system operation (refer to Section 2.2.1). |
| SD031 | GET and MNA Assessment | 2 – MNA | Alternative 2 – MNA best satisfied the threshold and primary balancing criteria evaluated in the FFS and represents the most reasonable value for the money. Costs are proportional to the effectiveness of the remedy by achieving long-term effectiveness and permanence within a reasonable time (15 years). The main factors considered in the FFS criteria evaluations included the following: the monitoring well components of MNA have already been implemented, the processes of natural attenuation have been demonstrated to be effective at remediating the site plume, and the capital costs have already been incurred.<br><br>Implementation of ROD Alternative 2 – MNA at Site SD031 follows approximately a decade of successful interim GET system operation within the higher concentration portion of the plume combined with MNA Assessment in the lower concentration portion of the plume located hydraulically downgradient of the GET system. The GET system part of the IRA has been shut down for a contaminant rebound study since 2010. Plume concentrations under long-term interim GET operation had declined at an ever-decreasing rate and had become cost-ineffective. Natural attenuation processes have since been evaluated for the entirety of the plume (CH2M HILL, 2010b). Assessments of MNA during the period of interim remediation and during the period of the rebound study indicate that natural physical, chemical, and biological processes are viable for remediation of the entire plume under the site conditions (refer to Section 2.2.5.1). |

**TABLE 2.9-2**
Summary of Sites and Remedial Alternatives
*Groundwater Record of Decision, Travis Air Force Base, California*

| Site | Remedy Transition | | Summary of Remedy Transition Rationale |
|---|---|---|---|
| | Interim Remedial Action[a] | Remedial Alternative[b] | |
| SD033[a] | GET and MNA Assessment[d] | 2 – MNA | Alternative 2 – MNA best satisfied the threshold and primary balancing criteria evaluated in the FFS and represents the most reasonable value for the money. Costs are proportional to the effectiveness of the remedy by achieving long-term effectiveness and permanence within a reasonable time (60 years, as a component of the overall WIOU plume). The main factors considered in the FFS criteria evaluations included the following: the monitoring well components of MNA have already been implemented, the processes of natural attenuation have been demonstrated to be effective at remediating the site plume, and the capital costs have already been incurred.<br><br>Implementation of ROD Alternative 2 – MNA at Site SD033 follows approximately a decade of successful interim GET system operation within the higher concentration portion of the plume combined with MNA Assessment in the lower concentration portion of the plume located hydraulically downgradient of the GET system. The GET system part of the IRA has been shut down for a contaminant rebound study since 2010. Plume concentrations under long-term GET operation had declined at an ever-decreasing rate and had become cost-ineffective. Natural attenuation processes have since been evaluated for the entirety of the WIOU plume, including Site SD033 (CH2M HILL, 2010b). Assessments of MNA during the period of interim remediation and during the period of the rebound study indicate that natural physical, chemical, and biological processes are viable for remediation of the entire plume under the site conditions (refer to Section 2.2.5.9). |
| SD034[a] | GET (coordinated with Site SD037) with Free Product Removal[d] | 7 – Passive Skimming and EA | Alternative 7 – Passive Skimming and EA best satisfied the threshold and primary balancing criteria evaluated in the FFS and represents the most reasonable value for the money. Costs are proportional to the effectiveness of the remedy by achieving long-term effectiveness and permanence within a reasonable time (60 years, as a component of the overall WIOU plume). The main factors considered in the FFS criteria evaluations included the following: the passive skimming and monitoring well components of the remedy have already been implemented, the processes of passive skimming and natural attenuation have been demonstrated to be effective at removing the residual LNAPL principal threat waste (i.e., free-phase Stoddard solvent containing dissolved COCs) and remediating the dissolved site plume, and the capital costs of passive skimming and monitoring have already been incurred. |

**TABLE 2.9-2**
Summary of Sites and Remedial Alternatives
*Groundwater Record of Decision, Travis Air Force Base, California*

| Site | Remedy Transition | | Summary of Remedy Transition Rationale |
|---|---|---|---|
| | Interim Remedial Action[a] | Remedial Alternative[b] | |
| | | | Implementation of ROD Alternative 7 – Passive Skimming and EA at Site SD034 follows approximately a decade of successful passive skimming of free-phase Stoddard solvent and interim GET system operation within the higher concentration portion of the plume, combined with MNA Assessment in the lower concentration portion of the plume located hydraulically downgradient of the passive skimming and GET systems (as part of the WIOU plume). Passive skimming has removed Stoddard solvent (containing dissolved COCs) to the degree that it is only intermittently measured, and the GET system component of the IRA has been shut down for a contaminant rebound study since 2010. Plume concentrations under long-term GET operation had declined at an ever-decreasing rate and had become cost-ineffective. Natural attenuation processes have since been evaluated for the entirety of the WIOU plume, including Site SD034 (CH2M HILL, 2010b). Assessments of MNA during the period of interim remediation and during the period of the rebound study indicate that natural physical, chemical, and biological processes are viable for plume remediation under the site conditions (refer to Section 2.2.5.9). |
| SS035[a] | GET and MNA Assessment[d] | 2 – MNA | Alternative 2 – MNA best satisfied the threshold and primary balancing criteria evaluated in the FFS and represents the most reasonable value for the money. Costs are proportional to the effectiveness of the remedy by achieving long-term effectiveness and permanence within a reasonable time (60 years, as a component of the overall WIOU plume). The main factors considered in the FFS criteria evaluations included the following: the monitoring well components of MNA have already been implemented, the processes of natural attenuation have been demonstrated to be effective at remediating the site plume, and the capital costs have already been incurred.<br><br>Implementation of ROD Alternative 2 – MNA at Site SS035 follows approximately a decade of successful interim GET system operation within the higher concentration portion of the WIOU plume, including Site SS035, combined with MNA Assessment in the lower concentration portion of the plume located hydraulically downgradient of the GET system. The GET system part of the IRA has been shut down for a contaminant rebound study since 2010. Plume concentrations under long-term GET operation had declined at an ever-decreasing rate and had become cost-ineffective. Natural attenuation processes have since been evaluated for the entirety of the WIOU plume, including Site SD034 (CH2M HILL, 2010b). Assessments of MNA during the period of interim remediation and during the period of the rebound study indicate that natural physical, chemical, and biological processes are viable for remediation of the entire plume under the site conditions (refer to Section 2.2.5.9). |

**TABLE 2.9-2**
Summary of Sites and Remedial Alternatives
*Groundwater Record of Decision, Travis Air Force Base, California*

| Site | Remedy Transition | | Summary of Remedy Transition Rationale |
|---|---|---|---|
| | Interim Remedial Action[a] | Remedial Alternative[b] | |
| SD036[a] | GET and MNA Assessment[d] | 5 – EVO and EA | Alternative 5 – EVO and EA best satisfied the threshold and primary balancing criteria evaluated in the FFS and represents the most reasonable value for the money. Costs are proportional to the effectiveness of the remedy by achieving long-term effectiveness and permanence within a reasonable time (60 years, as a component of the overall WIOU plume). The main factors considered in the FFS criteria evaluations included the following: the EVO injection component of the remedy has already been mostly implemented during the ERD treatment demonstration, the EA monitoring well components have already been implemented, ERD treatment via EVO injection to address the residual DNAPL principal threat wastes and the higher concentration portion of the plume has been successfully demonstrated (refer to Section 2.2.3.2), the processes of natural attenuation have been demonstrated to be effective at remediating the lower concentration portion of the plume (refer to Section 2.2.5.9), and the capital costs of EVO injection wells and EA monitoring wells have already been largely incurred. Use of EVO injection to facilitate ERD under Alternative 5 will also satisfy the statutory preference for treatment. Use of food-grade EVO to facilitate in situ ERD treatment processes provides an aspect of GSR.<br><br>Implementation of ROD Alternative 5 – EVO and EA at Site SS036 follows approximately a decade of successful interim GET system operation within the higher concentration portion of the WIOU plume combined with MNA Assessment in the lower concentration portion of the plume located hydraulically downgradient of the GET system. Operation of the interim GET system within the highest concentration portion of the plume had become increasingly cost-ineffective as contaminant concentrations were being reduced at an ever-decreasing rate. As a result, the GET system component of the IRA has been shut down for an ERD treatment demonstration and contaminant rebound study since 2010. Natural attenuation processes have since been evaluated for the entirety of the WIOU plume, including Site SD036 (CH2M HILL, 2010b). Assessments of MNA during the period of interim remediation and during the period of the rebound study indicate that natural physical, chemical, and biological processes are viable for remediating the lower concentration portions of the WIOU plume, including the Site SD036 plume component (refer to Section 2.2.5.9). |

**TABLE 2.9-2**
Summary of Sites and Remedial Alternatives
*Groundwater Record of Decision, Travis Air Force Base, California*

| Site | Remedy Transition | | Summary of Remedy Transition Rationale |
|---|---|---|---|
| | Interim Remedial Action[a] | Remedial Alternative[b] | |
| SD037[a] | GET and MNA Assessment[d] | 5 – EVO and EA | Alternative 5 – EVO and EA best satisfied the threshold and primary balancing criteria evaluated in the FFS and represents the most reasonable value for the money. Costs are proportional to the effectiveness of the remedy by achieving long-term effectiveness and permanence within a reasonable time (60 years, as a component of the overall WIOU plume). The main factors considered in the FFS criteria evaluations included the following: the EVO injection well components of the remedy have already been mostly implemented during the ERD treatment demonstration, the EA monitoring well components have already been implemented, ERD treatment via EVO injection to address the principal threat wastes and the higher concentration portion of the plume has been successfully demonstrated (refer to Section 2.2.3.2), the processes of natural attenuation have been demonstrated to be effective at remediating the lower concentration portion of the plume (refer to Section 2.2.5.9), and the capital costs of EVO injection wells and EA monitoring wells have already been largely incurred. Use of EVO injection to facilitate ERD under Alternative 5 will also satisfy the statutory preference for treatment. Use of food-grade EVO to facilitate in situ ERD treatment processes provides an aspect of GSR.<br><br>Implementation of ROD Alternative 5 – EVO and EA at Site SS037 follows approximately a decade of successful interim GET system operation within the higher concentration portion of the WIOU plume combined with MNA Assessment in the lower concentration portion of the plume located hydraulically downgradient of the GET system. Operation of the interim GET system within the highest concentration portion of the plume had become increasingly cost-ineffective as contaminant concentrations were being reduced at an ever-decreasing rate. As a result, the GET system component of the IRA has been shut down for an ERD treatment demonstration and contaminant rebound study since 2010. Natural attenuation processes have since been evaluated for the entirety of the WIOU plume, including Site SD037 (CH2M HILL, 2010b). Assessments of MNA during the period of interim remediation and during the period of the rebound study indicate that natural physical, chemical, and biological processes are viable for remediating the lower concentration portions of the WIOU plume, including the Site SD037 plume component (refer to Section 2.2.5.9). |

**TABLE 2.9-2**
Summary of Sites and Remedial Alternatives
*Groundwater Record of Decision, Travis Air Force Base, California*

| Site | Remedy Transition | | Summary of Remedy Transition Rationale |
|---|---|---|---|
| | Interim Remedial Action[a] | Remedial Alternative[b] | |
| DP039 | GET and MNA Assessment | 6 – Bioreactor, Phytoremediation, EVO PRB, and EA | Alternative 6 – Bioreactor, Phytoremediation, EVO PRB, and EA best satisfied the threshold and primary balancing criteria evaluated in the FFS and represents the most reasonable value for the money. Costs are proportional to the effectiveness of the remedy by achieving long-term effectiveness and permanence within a reasonable time (58 years). The main factors considered in the FFS criteria evaluations included the following: the bioreactor, phytoremediation, EVO PRB, and EA monitoring well components have already been implemented during the period of interim remediation; ERD treatment via bioreactor and EVO PRB have been successfully demonstrated as being effective in treating the residual DNAPL principal threat wastes and the higher concentration portions of the plume; biological treatment via phytoremediation has been successfully demonstrated as being effective in treating a portion of the higher concentration plume; and the processes of natural attenuation were assessed as likely to be effective at remediating the lower concentration portion of the plume when combined with the bioreactor, phytoremediation, and EVO PRB remedy components. The capital costs of the bioreactor, area of phytoremediation, EVO PRB, and EA monitoring wells have already been largely incurred. Use of a bioreactor and EVO injection to facilitate ERD and biological treatment using phytoremediation will satisfy the statutory preference for treatment. Use of food-grade EVO and planted trees will provide aspects of GSR.<br><br>Implementation of ROD Alternative 6 at Site DP039 follows approximately a decade of successful interim GET system operation combined with an assessment of MNA in the lower concentration portion of the plume. A successful phytoremediation treatability study was conducted within the higher concentration portion of the site plume located hydraulically downgradient of the GET system. The assessment of MNA was conducted in the lower concentration portion of the plume located hydraulically downgradient of the GET system and area of phytoremediation.<br><br>Operation of the GET system within the highest concentration portion of the plume had become increasingly cost-ineffective as contaminant concentrations were being reduced at an ever-decreasing rate. As a result, the GET system component of the IRA was shut down in 2008 for a successful ERD treatment demonstration via the bioreactor. Another successful ERD treatment demonstration via an EVO PRB began in 2010 (refer to Section 2.2.3.2). Successful biological treatment using phytoremediation had been ongoing since 1998 (refer to Section 2.2.4).The assessment of MNA during the period of interim remediation indicated that natural physical, chemical, and biological processes alone were not adequate for remediation of the plume, and additional measures were needed to further reduce the influx of contamination from the higher concentration portions of the plume (i.e., using the bioreactor, area of phytoremediation, and EVO PRB) (refer to Section 2.2.5.10). |

**TABLE 2.9-2**
Summary of Sites and Remedial Alternatives
*Groundwater Record of Decision, Travis Air Force Base, California*

| Site | Remedy Transition | | Summary of Remedy Transition Rationale |
|---|---|---|---|
| | Interim Remedial Action[a] | Remedial Alternative[b] | |
| | | | Use of organic mulch to facilitate in situ ERD treatment processes in the bioreactor provides an aspect of GSR. Use of a solar-powered pump to provide groundwater to the bioreactor provides another aspect of GSR. Also, use of planted trees for in situ biological treatment and food-grade EVO to facilitate in situ ERD treatment processes within the PRB provide additional aspects of GSR. |
| SS041 | GET | 1 – NFA | Alternative 1 – NFA best satisfied the threshold and primary balancing criteria evaluated in the FFS and represents the most reasonable value for the money. Costs are proportional to the effectiveness of the remedy by achieving long-term effectiveness and permanence within a reasonable time (0 years). Cleanup levels were achieved during the period of interim remediation. The main factors considered in the FFS criteria evaluations included the following: groundwater cleanup levels have already been achieved by the interim GET system, and Site SS041 is currently in No Further Remedial Action Plan status under a consensus statement signed by representatives of the AF and regulatory agencies (Travis AFB, 2005). |
| SD043 | GET[d] | 2 – MNA | Alternative 2 – MNA best satisfied the threshold and primary balancing criteria evaluated in the FFS and represents the most reasonable value for the money. Costs are proportional to the effectiveness of the remedy by achieving long-term effectiveness and permanence within a reasonable time (60 years, as a component of the overall WIOU plume). The main factor considered in the FFS criteria evaluations was that site groundwater cleanup levels have already been achieved by the interim GET system, although groundwater concentrations will continue to be monitored by the GRIP under Alternative 2 – MNA to provide verification of the plume concentrations. |

[a] IRAs were developed in the final NEWIOU FS Report (Radian, 1996b) or final WABOU FS Report (CH2M HILL, 1998a) and were then implemented in accordance with the final NEWIOU Groundwater IROD (Travis AFB, 1998) or final WABOU Groundwater IROD (Travis AFB, 1999).

[b] Remedial alternatives were developed in the final FFS (CH2M HILL, 2011a) and were made available for public review and comment in the final *Proposed Plan for Groundwater Cleanup* (Travis AFB, 2012b).

[c] Formerly managed under the POCO program as a site with only petroleum fuels contamination.

[d] Component site of WIOU collection of site plumes.

## 2.9.2 Common Elements and Distinguishing Features of Each Alternative

This section provides a summary of the elements common to each alternative and features that distinguish one (1) alternative from another. Summaries of the common elements and distinguishing features for each of the alternatives considered at Sites FT004, FT005, LF006, LF007 (Subareas LF007B, LF007C, and LF007D), LF008, SS015, SS016, ST027B, SS029, SS030, SD031, SD033, SD034, SS035, SD036, SD037, DP039, and SD043 are provided in Tables 2.9-3 through 2.9-22.

All of the remedial alternatives, except Alternative 1 – No Further Action, have the common element of LUCs. Alternative 1 has no common elements or distinguishing features. The key distinguishing feature between Alternatives 2 through 7 is treatment. Alternatives 3 through 6 include treatment, with Alternatives 3 and 4 including ex situ treatment and Alternatives 4, 5, and 6 including in situ ERD treatment. Alternatives 3 and 4 include groundwater extraction with ex situ treatment using LGAC and discharge to the stormwater drainage system. Alternatives 5 and 6 both include in situ ERD treatment using EVO injection. Alternatives 4 and 6 both include in situ ERD treatment with bioreactors. Alternative 6 also includes in situ biological treatment using phytoremediation.

Passive skimming to remove free-phase Stoddard solvent is the distinguishing feature of Alternative 7. At Site SD034, Alternative 7 includes the physical removal of Stoddard solvent, containing dissolved COCs, floating on the groundwater table and the treatment or recycling of recovered product by an off-base EPA-approved vendor. Stoddard solvent is present only at Site SD034.

Alternatives 2, 5, and 7 use natural physical, chemical, and biological processes to remediate COCs in groundwater. Alternative 2 includes MNA that was successfully demonstrated by long-term interim MNA assessments, positive results of contaminant rebound studies, and positive results of an aerobic chlorinated cometabolism enzyme study. In addition to treatment or passive skimming, Alternatives 5 and 7 include EA, which will remediate COCs in downgradient groundwater by the reduced influx of contaminants from the treated portions of the higher concentration plumes.

**TABLE 2.9-3**
Common Elements and Distinguishing Features – Site FT004
*Groundwater Record of Decision, Travis Air Force Base, California*

| Element | Alternative | |
|---|---|---|
| | **2-MNA** | **3-GET*** |
| Key ARARs associated with alternative | Refer to Tables B-1, B-2, and B-3. | Refer to Tables B-1, B-2, and B-3. |
| Long-term reliability of remedy | Reliable. Natural attenuation processes successfully demonstrated during period of MNA assessment (refer to Section 2.2.5). | Existing GET system operated successfully during period of interim remediation but became increasingly cost-ineffective as concentrations decreased (refer to Section 2.2.2). |
| Quantity of untreated waste and treatment residuals to be disposed of off-site or managed on-site in a containment system and the degree of hazard remaining in such material | None | 600 to 800 pounds per year of spent carbon from the NGWTP is currently recycled by an off-base vendor. Low hazard. |
| Estimated time for design and construction (years) | 0.5 | 0.5 |
| Estimated time to reach remediation goals (years) | 35 | 35 |
| Estimated capital cost ($) | 0 | 0 |
| Estimated annual O&M cost ($) | 2,703 | 4,088 |
| Estimated total O&M present worth ($) | 59,641 | 90,200 |
| Estimated periodic costs present worth ($) | 0 | 73,337 |
| Estimated total cost present worth ($) | 59,641 | 163,538 |
| Discount rate (percent) | 2.7 | 2.7 |
| Number of years over which cost is projected | 35 | 35 |
| Use of presumptive remedies and/or innovative technologies | No | Yes – GET (presumptive) |

* Existing IRA includes GET combined with MNA assessment.

Note:

ARAR = applicable or relevant and appropriate requirement

**TABLE 2.9-4**
Common Elements and Distinguishing Features – Site FT005
*Groundwater Record of Decision, Travis Air Force Base, California*

| Element | Alternative | |
|---|---|---|
| | **2-MNA** | **3-GET*** |
| Key ARARs associated with alternative | Refer to Tables B-1, B-2, and B-3. | Refer to Tables B-1, B-2, and B-3. |
| Long-term reliability of remedy | Reliable. Natural attenuation processes successfully demonstrated at similar sites during period of MNA assessment (refer to Section 2.2.5). | Reliable. Existing GET system operated successfully during period of interim remediation (refer to Section 2.2.2). |
| Quantity of untreated waste and treatment residuals to be disposed of off-site or managed on-site in a containment system and the degree of hazard remaining in such material | None | Approximately 12,000 pounds per year of spent carbon from the SBBGWTP is currently recycled by an off-base vendor. Low hazard. |
| Estimated time for design and construction (years) | 0.5 | 0.5 |
| Estimated time to reach remediation goals (years) | 43 | 10 |
| Estimated capital cost ($) | 0 | 0 |
| Estimated annual O&M cost ($) | 4,024 | 2,596 |
| Estimated total O&M present worth ($) | 101,633 | 41,239 |
| Estimated periodic costs present worth ($) | 0 | 53,034 |
| Estimated total cost present worth ($) | 101,633 | 94,273 |
| Discount rate (percent) | 2.7 | 2.7 |
| Number of years over which cost is projected | 43 | 21 |
| Use of presumptive remedies and/or innovative technologies | No | Yes – GET (presumptive) |

* Existing IRA is GET for the entirety of the plume.

**TABLE 2.9-5**
Common Elements and Distinguishing Features – Site LF006
*Groundwater Record of Decision, Travis Air Force Base, California*

| Element | Alternative |
|---|---|
| | **2-MNA*** |
| Key ARARs associated with alternative | Refer to Tables B-1, B-2, and B-3. |
| Long-term reliability of remedy | Reliable. Natural attenuation processes successfully demonstrated during period of interim remediation using MNA (refer to Section 2.2.5). |
| Quantity of untreated waste and treatment residuals to be disposed of off-site or managed on-site in a containment system and the degree of hazard remaining in such material | None |
| Estimated time for design and construction (years) | 0.5 |
| Estimated time to reach remediation goals (years) | 5 |
| Estimated capital cost ($) | 0 |
| Estimated annual O&M cost ($) | 2,451 |
| Estimated total O&M present worth ($) | 11,909 |
| Estimated periodic costs present worth ($) | 0 |
| Estimated total cost present worth ($) | 11,909 |
| Discount rate (percent) | 1.6 |
| Number of years over which cost is projected | 5 |
| Use of presumptive remedies and/or innovative technologies | No |

* Existing IRA.

**TABLE 2.9-6**
Common Elements and Distinguishing Features – Subarea LF007B
*Groundwater Record of Decision, Travis Air Force Base, California*

| Element | Alternative |
|---|---|
| | **2-MNA[a]** |
| Key ARARs associated with alternative | Refer to Tables B-1, B-2, and B-3. |
| Long-term reliability of remedy | Reliable. Natural attenuation processes successfully demonstrated during period of MNA assessment (refer to Section 2.2.5). |
| Quantity of untreated waste and treatment residuals to be disposed of off-site or managed on-site in a containment system and the degree of hazard remaining in such material | None |
| Estimated time for design and construction (years) | 0.5 |
| Estimated time to reach remediation goals (years) | 0[b] |
| Estimated capital cost ($) | 0 |
| Estimated annual O&M cost ($) | 817 |
| Estimated total O&M present worth ($) | 0 |
| Estimated periodic costs present worth ($) | 0 |
| Estimated total cost present worth ($) | 0 |
| Discount rate (percent) | 0 |
| Number of years over which cost is projected | 0 |
| Use of presumptive remedies and/or innovative technologies | No |

[a] Existing IRA is MNA assessment.
[b] Cleanup levels achieved during period of interim remediation.

**TABLE 2.9-7**
Common Elements and Distinguishing Features – Subarea LF007C
*Groundwater Record of Decision, Travis Air Force Base, California*

| Element | Alternative |
|---|---|
| | **3-GET*** |
| Key ARARs associated with alternative | Refer to Tables B-1, B-2, and B-3. |
| Long-term reliability of remedy | Reliable. Existing GET system operated successfully during period of interim remediation, but required optimization to improve performance (refer to Section 2.2.2). |
| Quantity of untreated waste and treatment residuals to be disposed of off-site or managed on-site in a containment system and the degree of hazard remaining in such material | 600 to 800 pounds per year of spent carbon from the NGWTP is currently recycled by an off-base vendor. Low hazard. |
| Estimated time for design and construction (years) | 0.5 |
| Estimated time to reach remediation goals (years) | 26 |
| Estimated capital cost ($) | 48,706 |
| Estimated annual O&M cost ($) | 15,258 |
| Estimated total O&M present worth ($) | 311,227 |
| Estimated periodic costs present worth ($) | 36,288 |
| Estimated closeout cost present worth ($) | 36,173 |
| Estimated total cost present worth ($) | 432,334 |
| Discount rate (percent) | 2.7 |
| Number of years over which cost is projected | 26 |
| Use of presumptive remedies and/or innovative technologies | Yes – GET (presumptive) |

* Existing IRA is GET for the entirety of the on-base and off-base portions of the plume.

**TABLE 2.9-8**
Common Elements and Distinguishing Features – Subarea LF007D
*Groundwater Record of Decision, Travis Air Force Base, California*

| Element | Alternative |
|---|---|
| | **2-MNA[a]** |
| Key ARARs associated with alternative | Refer to Tables B-1, B-2, and B-3. |
| Long-term reliability of remedy | Reliable. Natural attenuation processes successfully demonstrated during period of MNA assessment (refer to Section 2.2.5). |
| Quantity of untreated waste and treatment residuals to be disposed of off-site or managed on-site in a containment system and the degree of hazard remaining in such material | None |
| Estimated time for design and construction (years) | 0.5 |
| Estimated time to reach remediation goals (years) | 23 to 49[b] |
| Estimated capital cost ($) | 0 |
| Estimated annual O&M cost ($) | 1,069 |
| Estimated total O&M present worth ($) | 18,139 |
| Estimated periodic costs present worth ($) | 0 |
| Estimated total cost present worth ($) | 18,139 |
| Discount rate (percent) | 2.7 |
| Number of years over which cost is projected | 23 |
| Use of presumptive remedies and/or innovative technologies | No |

[a] Existing IRA is MNA assessment.
[b] Revised from the FFS (CH2M HILL, 2011a) value of greater than 100 years after re-evaluation of contaminant-specific degradation rates. The basis for this revision is provided in the *2012 Groundwater Sampling and Analysis Program Technical Memorandum* (CH2M HILL, 2012g).

**TABLE 2.9-9**
Common Elements and Distinguishing Features – Site LF008
*Groundwater Record of Decision, Travis Air Force Base, California*

| Element | Alternative | |
|---|---|---|
| | **2-MNA** | **3-GET[a]** |
| Key ARARs associated with alternative | Refer to Tables B-1, B-2, and B-3. | Refer to Tables B-1, B-2, and B-3. |
| Long-term reliability of remedy | Reliable. Natural attenuation processes successfully demonstrated during period of interim remediation (refer to Section 2.2.5). | Existing GET system operated successfully during period of interim remediation but was demonstrated to be ineffective for the residual pesticides contamination sorbed to soil particles (refer to Section 2.2.2). |
| Quantity of untreated waste and treatment residuals to be disposed of off-site or managed on-site in a containment system and the degree of hazard remaining in such material | None | Approximately 20,000 pounds per year of spent carbon from the CGWTP is currently recycled by an off-base vendor. Low hazard. |
| Estimated time for design and construction (years) | 0.5 | 0.5 |
| Estimated time to reach remediation goals (years) | 100 to 110[b] | 100 to 110[b] |
| Estimated capital cost ($) | 0 | 0 |
| Estimated annual O&M cost ($) | 2,264 | 519 |
| Estimated total O&M present worth ($) | 46,182 | 10,587 |
| Estimated periodic costs present worth ($) | 0 | 24,959 |
| Estimated total cost present worth ($) | 46,182 | 35,545 |
| Discount rate (percent) | 2.7 | 2.7 |
| Number of years over which cost is projected | 30 | 30 |
| Use of presumptive remedies and/or innovative technologies | No | Yes – GET (presumptive) |

[a] Existing IRA is GET for the entirety of the plume.
[b] Remediation time governed by total concentration of organochlorine pesticides in unfiltered groundwater samples. Cleanup levels are already achieved in filtered groundwater samples.

**TABLE 2.9-10**
Common Elements and Distinguishing Features – Site SS015
*Groundwater Record of Decision, Travis Air Force Base, California*

| Element | Alternative | |
|---|---|---|
| | **2-MNA[a]** | **5-EVO and EA** |
| Key ARARs associated with alternative | Refer to Tables B-1, B-2, and B-3. | Refer to Tables B-1, B-2, and B-3. |
| Long-term reliability of remedy | Not reliable. Natural attenuation processes alone were not successfully demonstrated during period of MNA assessment (refer to Section 2.2.5). | Reliable. In situ ERD treatment using EVO injection was successfully demonstrated during the period of interim remediation (refer to Section 2.2.3.2). Natural attenuation processes successfully demonstrated at similar sites during period of MNA assessment (refer to Section 2.2.5). |
| Quantity of untreated waste and treatment residuals to be disposed of off-site or managed on-site in a containment system and the degree of hazard remaining in such material | None | None |
| Estimated time for design and construction (years) | 0.5 | 0.5 |
| Estimated time to reach remediation goals (years) | -[b] | 70 |
| Estimated capital cost ($) | 0 | 136,971 |
| Estimated annual O&M cost ($) | 2,703 | 1,635 |
| Estimated total O&M present worth ($) | 55,137 | 33,344 |
| Estimated periodic costs present worth ($) | 0 | 188,159 |
| Estimated total cost present worth ($) | 55,137 | 358,474 |
| Discount rate (percent) | 2.7 | 2.7 |
| Number of years over which cost is projected | 30 | 30 |
| Use of presumptive remedies and/or innovative technologies | No | Yes – in situ ERD (innovative) |

[a] Existing IRA is MNA assessment.
[b] MNA demonstrated to be ineffective during the period of interim remediation. Groundwater contaminant concentrations were increasing in some site monitoring wells, and a remediation time could not be estimated.

**TABLE 2.9-11**
Common Elements and Distinguishing Features – Site SS016
*Groundwater Record of Decision, Travis Air Force Base, California*

| Element | Alternative | |
|---|---|---|
| | **3-GET[a]** | **4-Bioreactor and GET** |
| Key ARARs associated with alternative | Refer to Tables B-1, B-2, and B-3. | Refer to Tables B-1, B-2, and B-3. |
| Long-term reliability of remedy | Existing GET system operated successfully during period of interim remediation. However, GET within the higher concentration portion of the plume became increasingly ineffective as concentrations were reduced at an ever decreasing rate (refer to Section 2.2.2). | Reliable. In situ ERD treatment using a bioreactor was successfully demonstrated during the period of interim remediation (refer to Section 2.2.3.1). Existing GET system component operated successfully during period of interim remediation. |
| Quantity of untreated waste and treatment residuals to be disposed of off-site or managed on-site in a containment system and the degree of hazard remaining in such material | Approximately 20,000 pounds per year of spent carbon from the CGWTP is currently recycled by an off-base vendor. Low hazard. | Approximately 20,000 pounds per year of spent carbon from the CGWTP is currently recycled by an off-base vendor. Low hazard. |
| Estimated time for design and construction (years) | 0.5 | 0.5 |
| Estimated time to reach remediation goals (years) | > 100[b] | 62 |
| Estimated capital cost ($) | 0 | 306,116 |
| Estimated annual O&M cost ($) | 34,517 | 35,928 |
| Estimated total O&M present worth ($) | 704,077 | 732,860 |
| Estimated periodic costs present worth ($) | 57,641 | 93,194 |
| Estimated total cost present worth ($) | 761,718 | 1,116,162 |
| Discount rate (percent) | 2.7 | 2.7 |
| Number of years over which cost is projected | 30 | 30 |
| Use of presumptive remedies and/or innovative technologies | Yes – GET (presumptive) | Yes – GET (presumptive) and in situ ERD (innovative) |

[a] Existing IRA is GET.
[b] The probable presence of DNAPL results in an extended and indeterminate remediation time.

**TABLE 2.9-12**
Common Elements and Distinguishing Features – Site ST027B
*Groundwater Record of Decision, Travis Air Force Base, California*

| | **Alternative** |
|---|---|
| **Element** | **2-MNA*** |
| Key ARARs associated with alternative | Refer to Tables B-1, B-2, and B-3. |
| Long-term reliability of remedy | Reliable. Natural attenuation processes successfully demonstrated during period of MNA assessment (refer to Section 2.2.5). |
| Quantity of untreated waste and treatment residuals to be disposed of off-site or managed on-site in a containment system and the degree of hazard remaining in such material | None |
| Estimated time for design and construction (years) | 0.5 |
| Estimated time to reach remediation goals (years) | 50 |
| Estimated capital cost ($) | 0 |
| Estimated annual O&M cost ($) | 2,451 |
| Estimated total O&M present worth ($) | 49,996 |
| Estimated periodic costs present worth ($) | 0 |
| Estimated total cost present worth ($) | 49,996 |
| Discount rate (percent) | 2.7 |
| Number of years over which cost is projected | 30 |
| Use of presumptive remedies and/or innovative technologies | No |

* Existing IRA is MNA assessment.

**TABLE 2.9-13**
Common Elements and Distinguishing Features – Site SS029
*Groundwater Record of Decision, Travis Air Force Base, California*

| Element | Alternative |
|---|---|
| | **3-GET**[a] |
| Key ARARs associated with alternative | Refer to Tables B-1, B-2, and B-3. |
| Long-term reliability of remedy | Reliable. Existing GET system operated successfully during period of interim remediation (refer to Section 2.2.2). |
| Quantity of untreated waste and treatment residuals to be disposed of off-site or managed on-site in a containment system and the degree of hazard remaining in such material | Approximately 12,000 pounds per year of spent carbon from the SBBGWTP is currently recycled by an off-base vendor. Low hazard. |
| Estimated time for design and construction (years) | 0.5 |
| Estimated time to reach remediation goals (years) | 62[b] |
| Estimated capital cost ($) | 0 |
| Estimated annual O&M cost ($) | 13,835 |
| Estimated total O&M present worth ($) | 282,210 |
| Estimated periodic costs present worth ($) | 57,640 |
| Estimated total cost present worth ($) | 339,851 |
| Discount rate (percent) | 2.7 |
| Number of years over which cost is projected | 30 |
| Use of presumptive remedies and/or innovative technologies | Yes – GET (presumptive) |

[a] Existing IRA is GET for the entirety of the plume.
[b] Remediation time is affected by interactions with the hydraulically upgradient Site SS016 plume.

**TABLE 2.9-14**
Common Elements and Distinguishing Features – Site SS030
*Groundwater Record of Decision, Travis Air Force Base, California*

| Element | Alternative |
|---|---|
| | **3-GET*** |
| Key ARARs associated with alternative | Refer to Tables B-1, B-2, and B-3. |
| Long-term reliability of remedy | Reliable. GET system operated successfully during period of interim remediation, but required optimization to improve performance (refer to Section 2.2.2). |
| Quantity of untreated waste and treatment residuals to be disposed of off-site or managed on-site in a containment system and the degree of hazard remaining in such material | Approximately 12,000 pounds per year of spent carbon from the SBBGWTP is currently recycled by an off-base vendor. Low hazard. |
| Estimated time for design and construction (years) | 0.5 |
| Estimated time to reach remediation goals (years) | 22 |
| Estimated capital cost ($) | 17,532 |
| Estimated annual O&M cost ($) | 13,835 |
| Estimated total O&M present worth ($) | 227,351 |
| Estimated periodic costs present worth ($) | 49,507 |
| Estimated total cost present worth ($) | 294,390 |
| Discount rate (percent) | 2.7 |
| Number of years over which cost is projected | 22 |
| Use of presumptive remedies and/or innovative technologies | Yes – GET (presumptive) |

* Existing IRA is GET for the entirety of the plume.

**TABLE 2.9-15**
Common Elements and Distinguishing Features – Site SD031
*Groundwater Record of Decision, Travis Air Force Base, California*

| Element | Alternative | |
|---|---|---|
| | **2-MNA** | **3-GET*** |
| Key ARARs associated with alternative | Refer to Tables B-1, B-2, and B-3. | Refer to Tables B-1, B-2, and B-3. |
| Long-term reliability of remedy | Reliable. Natural attenuation processes successfully demonstrated during period of MNA assessment (refer to Section 2.2.5). | Existing GET system operated successfully during period of interim remediation but became increasingly cost-ineffective as concentrations decreased (refer to Section 2.2.2). |
| Quantity of untreated waste and treatment residuals to be disposed of off-site or managed on-site in a containment system and the degree of hazard remaining in such material | None | 600 to 800 pounds per year of spent carbon from the NGWTP is currently recycled by an off-base vendor. Low hazard. |
| Estimated time for design and construction (years) | 0.5 | 0.5 |
| Estimated time to reach remediation goals (years) | 15 | 15 |
| Estimated capital cost ($) | 0 | 0 |
| Estimated annual O&M cost ($) | 2,451 | 2,970 |
| Estimated total O&M present worth ($) | 30,480 | 26,447 |
| Estimated periodic costs present worth ($) | 0 | 15,656 |
| Estimated total cost present worth ($) | 30,480 | 42,103 |
| Discount rate (percent) | 2.45 | 2.2 |
| Number of years over which cost is projected | 15 | 15 |
| Use of presumptive remedies and/or innovative technologies | No | Yes – GET (presumptive) |

* Existing IRA.

**TABLE 2.9-16**
Common Elements and Distinguishing Features – Site SD033
*Groundwater Record of Decision, Travis Air Force Base, California*

| Element | Alternative | |
|---|---|---|
| | **2-MNA** | **3-GET[a]** |
| Key ARARs associated with alternative | Refer to Tables B-1, B-2, and B-3. | Refer to Tables B-1, B-2, and B-3. |
| Long-term reliability of remedy | Reliable. Natural attenuation processes successfully demonstrated during period of MNA assessment (refer to Section 2.2.5). | Existing GET system operated successfully during period of interim remediation but became increasingly ineffective as concentrations decreased (refer to Section 2.2.2). |
| Quantity of untreated waste and treatment residuals to be disposed of off-site or managed on-site in a containment system and the degree of hazard remaining in such material | None | Approximately 20,000 pounds per year of spent carbon from the CGWTP is currently recycled by an off-base vendor. Low hazard. |
| Estimated time for design and construction (years) | 0.5 | 0.5 |
| Estimated time to reach remediation goals (years) | 60[b] | 91[b] |
| Estimated capital cost ($) | 0[c] | 0[c] |
| Estimated annual O&M cost ($) | 2,063 | 2,409 |
| Estimated total O&M present worth ($) | 42,082 | 49,140 |
| Estimated periodic costs present worth ($) | 0 | 16,638 |
| Estimated total cost present worth ($) | 42,082 | 65,778 |
| Discount rate (percent) | 2.7 | 2.7 |
| Number of years over which cost is projected | 30 | 30 |
| Use of presumptive remedies and/or innovative technologies | No | Yes – GET (presumptive) |

[a] Existing IRA is a combination of GET and MNA assessment.

[b] Site SD033 is a component site within the overall WIOU plume. The remediation time is based on the entirety of the WIOU plume achieving cleanup levels, including the commingled plumes that originated from Sites SD033, SD034, SS035, SD036, SD037, and SD043.

[c] Capital costs for the Site SD033 GET system and monitoring well network have already been incurred.

**TABLE 2.9-17**
Common Elements and Distinguishing Features – Site SD034
*Groundwater Record of Decision, Travis Air Force Base, California*

| Element | Alternative | |
|---|---|---|
| | **3-GET** [a] | **7-Passive Skimming and EA** |
| Key ARARs associated with alternative | Refer to Tables B-1, B-2, and B-3. | Refer to Tables B-1, B-2, and B-3. |
| Long-term reliability of remedy | Existing GET operated successfully during period of interim remediation but became increasingly ineffective as concentrations decreased (refer to Section 2.2.2). | Reliable. Existing passive skimming system operated successfully during period of interim remediation (refer to Section 2.2.2). Natural attenuation processes successfully demonstrated during period of MNA assessment (refer to Section 2.2.5). |
| Quantity of untreated waste and treatment residuals to be disposed of off-site or managed on-site in a containment system and the degree of hazard remaining in such material | Approximately 0.5 gallon of Stoddard solvent, containing dissolved COCs, removed annually. Low hazard. | Approximately 0.5 gallon of Stoddard solvent, containing dissolved COCs, removed annually. Low hazard. |
| Estimated time for design and construction (years) | 0.5 | 0.5 |
| Estimated time to reach remediation goals (years) | 91[b] | 60[b] |
| Estimated capital cost ($) | 0[c] | 0[c] |
| Estimated annual O&M cost ($) | 4,114 | 3,655 |
| Estimated total O&M present worth ($) | 83,924 | 80,639 |
| Estimated periodic costs present worth ($) | 24,363 | 0 |
| Estimated total cost present worth ($) | 108,288 | 80,639 |
| Discount rate (percent) | 2.7 | 2.7 |
| Number of years over which cost is projected | 30 | 30 |
| Use of presumptive remedies and/or innovative technologies | Yes – GET (presumptive) | No |

[a] Existing IRA is a combination of GET, passive skimming, and MNA assessment.

[b] Site SD034 is a component site within the overall WIOU plume. The remediation time is based on the entirety of the WIOU plume achieving cleanup levels, including the commingled plumes that originated from Sites SD033, SD034, SS035, SD036, SD037, and SD043.

[c] Capital costs for the Site SD034 GET system, passive skimming, and monitoring well network have already been incurred.

**TABLE 2.9-18**
Common Elements and Distinguishing Features – Site SS035
*Groundwater Record of Decision, Travis Air Force Base, California*

| Element | Alternative |
|---|---|
| | **2-MNA[a]** |
| Key ARARs associated with alternative | Refer to Tables B-1, B-2, and B-3. |
| Long-term reliability of remedy | Reliable. Natural attenuation processes successfully demonstrated during period of MNA assessment (refer to Section 2.2.5). |
| Quantity of untreated waste and treatment residuals to be disposed of off-site or managed on-site in a containment system and the degree of hazard remaining in such material | None |
| Estimated time for design and construction (years) | 0 |
| Estimated time to reach remediation goals (years) | 60[b] |
| Estimated capital cost ($) | 0[c] |
| Estimated annual O&M cost ($) | 1,320[c] |
| Estimated total O&M present worth ($) | 2,537[c] |
| Estimated periodic costs ($) | 0[c] |
| Estimated total cost present worth ($) | 2,537[c] |
| Discount rate (percent) | 2.7[c] |
| Number of years over which cost is projected | 2[c] |
| Use of presumptive remedies and/or innovative technologies | No |

[a] Existing IRA is MNA assessment.

[b] Site SS035 is a component site within the overall WIOU plume. The remediation time is based on the entirety of the WIOU plume achieving cleanup levels, including the commingled plumes that originated from Sites SD033, SD034, SS035, SD036, SD037, and SD043.

[c] Site SS035 has achieved cleanup levels, and 2 years of monitoring will be completed prior to evaluating the site for closure.

**TABLE 2.9-19**
Common Elements and Distinguishing Features – Site SD036
*Groundwater Record of Decision, Travis Air Force Base, California*

| Element | Alternative | |
|---|---|---|
| | 3-GET[a] | 5-EVO and EA |
| Key ARARs associated with alternative | Refer to Tables B-1, B-2, and B-3. | Refer to Tables B-1, B-2, and B-3. |
| Long-term reliability of remedy | Existing GET system operated successfully during period of interim remediation. However, GET within the higher concentration portion of the plume became increasingly ineffective as concentrations were reduced at an ever decreasing rate (refer to Section 2.2.2). | Reliable. In situ ERD treatment using EVO injection was successfully demonstrated during the period of interim remediation (refer to Section 2.2.3.2). Natural attenuation processes successfully demonstrated during period of MNA assessment (refer to Section 2.2.5). |
| Quantity of untreated waste and treatment residuals to be disposed of off-site or managed on-site in a containment system and the degree of hazard remaining in such material | Approximately 20,000 pounds per year of spent carbon from the CGWTP is currently recycled by an off-base vendor. Low hazard. | None |
| Estimated time for design and construction (years) | 0.5 | 0.5 |
| Estimated time to reach remediation goals (years) | 91[b] | 60[b] |
| Estimated capital cost ($) | 0[c] | 254,210 |
| Estimated annual O&M cost ($) | 3,979 | 1,635 |
| Estimated total O&M present worth ($) | 81,165 | 33,344 |
| Estimated periodic costs present worth ($) | 18,940 | 472,321 |
| Estimated total cost present worth ($) | 100,106 | 759,875 |
| Discount rate (percent) | 2.7 | 2.7 |
| Number of years over which cost is projected | 30 | 30 |
| Use of presumptive remedies and/or innovative technologies | Yes – GET (presumptive) | Yes – in situ ERD (innovative) |

[a] Existing IRA is a combination of GET and MNA assessment.

[b] Site SD036 is a component site within the overall WIOU plume. The remediation time is based on the entirety of the WIOU plume achieving cleanup levels, including the commingled plumes that originated from Sites SD033, SD034, SS035, SD036, SD037, and SD043.

[c] Capital costs for the Site SD036 GET system and monitoring well network have already been incurred.

**TABLE 2.9-20**
Common Elements and Distinguishing Features – Site SD037
*Groundwater Record of Decision, Travis Air Force Base, California*

| Element | Alternative | |
|---|---|---|
| | **3-GET[a]** | **5-EVO and EA** |
| Key ARARs associated with alternative | Refer to Tables B-1, B-2, and B-3. | Refer to Tables B-1, B-2, and B-3. |
| Long-term reliability of remedy | Existing GET system operated successfully during period of interim remediation. However, GET within the higher concentration portion of the plume became increasingly ineffective as concentrations were reduced at an ever decreasing rate (refer to Section 2.2.2). | Reliable. In situ ERD treatment using EVO injection was successfully demonstrated during the period of interim remediation (refer to Section 2.2.3.2). Natural attenuation processes successfully demonstrated during period of MNA assessment (refer to Section 2.2.5). |
| Quantity of untreated waste and treatment residuals to be disposed of off-site or managed on-site in a containment system and the degree of hazard remaining in such material | Approximately 20,000 pounds per year of spent carbon from the CGWTP is currently recycled by an off-base vendor. Low hazard. | None |
| Estimated time for design and construction (years) | 0.5 | 0.5 |
| Estimated time to reach remediation goals (years) | 91[b] | 60[b] |
| Estimated capital cost ($) | 0[c] | 400,749 |
| Estimated annual O&M cost ($) | 9,032 | 1,635 |
| Estimated total O&M present worth ($) | 184,237 | 33,344 |
| Estimated periodic costs present worth ($) | 91,513 | 864,487 |
| Estimated total cost present worth ($) | 275,751 | 1,298,581 |
| Discount rate (percent) | 2.7 | 2.7 |
| Number of years over which cost is projected | 30 | 30 |
| Use of presumptive remedies and/or innovative technologies | Yes – GET (presumptive) | Yes – in situ ERD (innovative) |

[a] Existing IRA is a combination of GET and MNA assessment.

[b] Site SD037 is a component site within the overall WIOU plume. The remediation time is based on the entirety of the WIOU plume achieving cleanup levels, including the commingled plumes that originated from Sites SD033, SD034, SS035, SD036, SD037, and SD043.

[c] Capital costs for the Site SD037 GET system and monitoring well network have already been incurred.

**TABLE 2.9-21**
Common Elements and Distinguishing Features – Site DP039
*Groundwater Record of Decision, Travis Air Force Base, California*

| | Alternative | |
|---|---|---|
| **Element** | **3-GET[a]** | **6-Bioreactor, Phytoremediation, EVO PRB, and EA** |
| Key ARARs associated with alternative | Refer to Tables B-1, B-2, and B-3. | Refer to Tables B-1, B-2, and B-3. |
| Long-term reliability of remedy | Existing GET system operated successfully during period of interim remediation. However, GET within the higher concentration portion of the plume became increasingly ineffective as concentrations were reduced at an ever decreasing rate (refer to Section 2.2.2). | Reliable. In situ ERD treatment using a bioreactor and EVO PRB was successfully demonstrated during the period of interim remediation (refer to Sections 2.2.3.1 and 2.2.3.2). The phytoremediation component was also successfully demonstrated during the period of interim remediation (refer to Section 2.2.4). Natural attenuation processes successfully demonstrated during period of MNA assessment (refer to Section 2.2.5). |
| Quantity of untreated waste and treatment residuals to be disposed of off-site or managed on-site in a containment system and the degree of hazard remaining in such material | Approximately 20,000 pounds per year of spent carbon from the CGWTP is currently recycled by an off-base vendor. Low hazard. | None |
| Estimated time for design and construction (years) | 0.5 | 0.5 |
| Estimated time to reach remediation goals (years) | 70 | 58 |
| Estimated capital cost ($) | 0[b] | 291,678 |
| Estimated annual O&M cost ($) | 2,039 | 2,629 |
| Estimated total O&M present worth ($) | 41,592 | 53,627 |
| Estimated periodic costs present worth ($) | 32,088 | 832,312 |
| Estimated total cost present worth ($) | 73,680 | 1,177,618 |
| Discount rate (percent) | 2.7 | 2.7 |
| Number of years over which cost is projected | 30 | 30 |
| Use of presumptive remedies and/or innovative technologies | Yes – GET (presumptive) | Yes – in situ bioreactor, biological treatment using planted trees, and solar-powered pumps (innovative) |

[a] Existing IRA is a combination of GET and MNA.
[b] Capital costs for the Site DP039 GET system have already been incurred.

**TABLE 2.9-22**
Common Elements and Distinguishing Features – Site SD043
*Groundwater Record of Decision, Travis Air Force Base, California*

| Element | Alternative | |
|---|---|---|
| | **2-MNA** | **3-GET[a]** |
| Key ARARs associated with alternative | Refer to Tables B-1, B-2, and B-3. | Refer to Tables B-1, B-2, and B-3. |
| Long-term reliability of remedy | Reliable. Natural attenuation processes successfully demonstrated during period of MNA assessment (refer to Section 2.2.5). | Reliable. GET system operated successfully during period of interim remediation (refer to Section 2.2.2). |
| Quantity of untreated waste and treatment residuals to be disposed of off-site or managed on-site in a containment system and the degree of hazard remaining in such material | None | Approximately 20,000 pounds per year of spent carbon from the CGWTP is currently recycled by an off-base vendor. Low hazard. |
| Estimated time for design and construction (years) | 0.5 | 0.5 |
| Estimated time to reach remediation goals (years) | 60[b] | 91[b] |
| Estimated capital cost ($) | 0[c] | 0[c] |
| Estimated annual O&M cost ($) | 1,288 | 1,461 |
| Estimated total O&M present worth ($) | 26,273 | 29,802 |
| Estimated periodic costs present worth ($) | 0 | 8,319 |
| Estimated total cost present worth ($) | 26,273 | 38,121 |
| Discount rate (percent) | 2.7 | 2.7 |
| Number of years over which cost is projected | 30 | 30 |
| Use of presumptive remedies and/or innovative technologies | No | Yes – GET (presumptive) |

[a] Existing IRA is a combination of GET and MNA assessment.

[b] Site SD043 is a component site within the overall WIOU plume. The remediation time is based on the entirety of the WIOU plume achieving cleanup levels, including the commingled plumes that originated from Sites SD033, SD034, SS035, SD036, SD037, and SD043.

[c] Capital costs for the Site SD043 GET system and monitoring well network have already been incurred.

## 2.9.3 Expected Outcome of Each Alternative

Tables 2.9-23 through 2.9-42 provide summaries of the expected outcomes of the alternatives considered for each site.

**TABLE 2.9-23**
Expected Outcomes of Each Alternative – Site FT004
*Groundwater Record of Decision, Travis Air Force Base, California*

| | Alternative | |
|---|---|---|
| **Element** | **2-MNA** | **3-GET*** |
| Available uses of land upon achieving cleanup levels | Unrestricted | Unrestricted |
| Time frame to achieve available land use (years) | 35 | 35 |
| Available uses of groundwater upon achieving cleanup levels | Drinking water | Drinking water |
| Time frame to achieve available groundwater use (years) | 35 | 35 |
| Other impacts or benefits associated with alternative | Lower energy requirements and less GHG emission compared with GET system. | Uses existing IRA GET system infrastructure. |

* Existing IRA is a combination of GET and MNA assessment.

**TABLE 2.9-24**
Expected Outcomes of Each Alternative – Site FT005
*Groundwater Record of Decision, Travis Air Force Base, California*

| | Alternative | |
|---|---|---|
| **Element** | **2-MNA** | **3-GET*** |
| Available uses of land upon achieving cleanup levels | Unrestricted | Unrestricted |
| Time frame to achieve available land use (years) | 43 | 10 |
| Available uses of groundwater upon achieving cleanup levels | Drinking water | Drinking water |
| Time frame to achieve available groundwater use (years) | 43 | 10 |
| Other impacts or benefits associated with alternative | Lower energy requirements and less GHG emission compared with GET system. | Uses existing IRA GET system infrastructure. |

* Existing IRA is GET for the entirety of the plume.

**TABLE 2.9-25**
Expected Outcomes of Each Alternative – Site LF006
*Groundwater Record of Decision, Travis Air Force Base, California*

| | Alternative |
|---|---|
| **Element** | **2-MNA*** |
| Available uses of land upon achieving cleanup levels | Unrestricted |
| Time frame to achieve available land use (years) | 5 |
| Available uses of groundwater upon achieving cleanup levels | Drinking water |
| Time frame to achieve available groundwater use (years) | 5 |
| Other impacts or benefits associated with alternative | Minimal GHG generation. |

* Existing IRA is MNA for the entirety of the plume.

**TABLE 2.9-26**
Expected Outcomes of Each Alternative – Subarea LF007B
*Groundwater Record of Decision, Travis Air Force Base, California*

| | Alternative |
|---|---|
| **Element** | **2-MNA[a]** |
| Available uses of land upon achieving cleanup levels | Unrestricted |
| Time frame to achieve available land use (years) | 0[b] |
| Available uses of groundwater upon achieving cleanup levels | Drinking water |
| Time frame to achieve available groundwater use (years) | 0[b] |
| Other impacts or benefits associated with alternative | Minimal GHG generation. |

[a] Existing IRA is MNA assessment for the entirety of the plume.
[b] Current contaminant concentrations do not exceed cleanup levels.

**TABLE 2.9-27**
Expected Outcomes of Each Alternative – Subarea LF007C
*Groundwater Record of Decision, Travis Air Force Base, California*

| | Alternative |
|---|---|
| **Element** | **3-GET*** |
| Available uses of land upon achieving cleanup levels | Unrestricted |
| Time frame to achieve available land use (years) | 26 |
| Available uses of groundwater upon achieving cleanup levels | Drinking water |
| Time frame to achieve available groundwater use (years) | 26 |
| Other impacts or benefits associated with alternative | Uses existing IRA GET system infrastructure.<br>Incorporates GSR by using solar-powered pumps. Lower energy requirements and less GHG emission compared with a typical GET system. |

* Existing IRA is GET for the entirety of the plume.

**TABLE 2.9-28**
Expected Outcomes of Each Alternative – Subarea LF007D
*Groundwater Record of Decision, Travis Air Force Base, California*

| Element | Alternative |
|---|---|
| | 2-MNA[a] |
| Available uses of land upon achieving cleanup levels | Unrestricted |
| Time frame to achieve available land use (years) | 23 to 49[b] |
| Available uses of groundwater upon achieving cleanup levels | Drinking water |
| Time frame to achieve available groundwater use (years) | 23 to 49[b] |
| Other impacts or benefits associated with alternative | Minimal GHG generation. |

[a] Existing IRA is MNA assessment for the entirety of the plume.
[b] Revised from the FFS (CH2M HILL, 2011a) value of greater than 100 years after re-evaluation of contaminant-specific degradation rates (CH2M HILL, 2012g).

**TABLE 2.9-29**
Expected Outcomes of Each Alternative – Site LF008
*Groundwater Record of Decision, Travis Air Force Base, California*

| Element | Alternative | |
|---|---|---|
| | 2-MNA | 3-GET* |
| Available uses of land upon achieving cleanup levels | Unrestricted | Unrestricted |
| Time frame to achieve available land use (years) | > 100 | 100 to 110 |
| Available uses of groundwater upon achieving cleanup levels | Drinking water | Drinking water |
| Time frame to achieve available groundwater use (years) | > 100 | 100 to 110 |
| Other impacts or benefits associated with alternative | Lower energy requirements and less GHG emission compared with GET system. | Uses existing IRA GET system infrastructure. |

* Existing IRA is GET for the entirety of the plume.

**TABLE 2.9-30**
Expected Outcomes of Each Alternative – Site SS015
*Groundwater Record of Decision, Travis Air Force Base, California*

| | Alternative | |
|---|---|---|
| **Element** | **2-MNA[a]** | **5-EVO and EA** |
| Available uses of land upon achieving cleanup levels | Unrestricted | Unrestricted |
| Time frame to achieve available land use (years) | -[b] | 70 |
| Available uses of groundwater upon achieving cleanup levels | Drinking water | Drinking water |
| Time frame to achieve available groundwater use (years) | -[b] | 70 |
| Other impacts or benefits associated with alternative | Minimal GHG generation. | Incorporates GSR by using low-energy in situ bioremediation via EVO to facilitate ERD. |

[a] Existing IRA is MNA assessment for the entirety of the plume.
[b] MNA not effective without enhancement. Groundwater contaminant concentrations are increasing.

**TABLE 2.9-31**
Expected Outcomes of Each Alternative – Site SS016
*Groundwater Record of Decision, Travis Air Force Base, California*

| | Alternative | |
|---|---|---|
| **Element** | **3-GET*** | **4-Bioreactor and GET** |
| Available uses of land upon achieving cleanup levels | Unrestricted | Unrestricted |
| Time frame to achieve available land use (years) | > 100 | 62 |
| Available uses of groundwater upon achieving cleanup levels | Drinking water | Drinking water |
| Time frame to achieve available groundwater use (years) | > 100 | 62 |
| Other impacts or benefits associated with alternative | Uses existing IRA GET system infrastructure. | Incorporates GSR by using low-energy in situ bioremediation via a bioreactor to facilitate ERD.<br>Replaces energy-intensive OSA 2-Phase extraction and ThOX vapor treatment. |

* Existing IRA is GET for the entirety of the plume.

**TABLE 2.9-32**
Expected Outcomes of Each Alternative – Site ST027B
*Groundwater Record of Decision, Travis Air Force Base, California*

| | Alternative |
|---|---|
| **Element** | **2-MNA*** |
| Available uses of land upon achieving cleanup levels | Unrestricted |
| Time frame to achieve available land use (years) | 50 |
| Available uses of groundwater upon achieving cleanup levels | Drinking water |
| Time frame to achieve available groundwater use (years) | 50 |
| Other impacts or benefits associated with alternative | Minimal GHG generation. |

* Existing IRA is MNA assessment for the entirety of the plume.

**TABLE 2.9-33**
Expected Outcomes of Each Alternative – Site SS029
*Groundwater Record of Decision, Travis Air Force Base, California*

| | Alternative |
|---|---|
| **Element** | **3-GET*** |
| Available uses of land upon achieving cleanup levels | Unrestricted |
| Time frame to achieve available land use (years) | 62 |
| Available uses of groundwater upon achieving cleanup levels | Drinking water |
| Time frame to achieve available groundwater use (years) | 62 |
| Other impacts or benefits associated with alternative | Uses existing IRA GET system infrastructure and includes solar-powered pumps. |

* Existing IRA is GET for the entirety of the plume.

**TABLE 2.9-34**
Expected Outcomes of Each Alternative – Site SS030
*Groundwater Record of Decision, Travis Air Force Base, California*

| | Alternative |
|---|---|
| **Element** | **3-GET*** |
| Available uses of land upon achieving cleanup levels | Unrestricted |
| Time frame to achieve available land use (years) | 22 |
| Available uses of groundwater upon achieving cleanup levels | Drinking water |
| Time frame to achieve available groundwater use (years) | 22 |
| Other impacts or benefits associated with alternative | Uses existing IRA GET system infrastructure. |

* Existing IRA is GET for the entirety of the plume.

**TABLE 2.9-35**
Expected Outcomes of Each Alternative – Site SD031
*Groundwater Record of Decision, Travis Air Force Base, California*

| | Alternative | |
|---|---|---|
| **Element** | **2-MNA** | **3-GET*** |
| Available uses of land upon achieving cleanup levels | Unrestricted | Unrestricted |
| Time frame to achieve available land use (years) | 15 | 15 |
| Available uses of groundwater upon achieving cleanup levels | Drinking water | Drinking water |
| Time frame to achieve available groundwater use (years) | 15 | 15 |
| Other impacts or benefits associated with alternative | Lower energy requirements and less GHG emission compared with GET system. | Uses existing IRA GET system infrastructure. |

* Existing IRA is a combination of GET and MNA assessment.

**TABLE 2.9-36**
Expected Outcomes of Each Alternative – Site SD033
*Groundwater Record of Decision, Travis Air Force Base, California*

| | Alternative | |
|---|---|---|
| **Element** | **2-MNA** | **3-GET[a]** |
| Available uses of land upon achieving cleanup levels | Unrestricted | Unrestricted |
| Time frame to achieve available land use (years) | 60[b] | 91[b] |
| Available uses of groundwater upon achieving cleanup levels | Drinking water | Drinking water |
| Time frame to achieve available groundwater use (years) | 60[b] | 91[b] |
| Other impacts or benefits associated with alternative | Lower energy requirements and less GHG emission compared with GET system. | Uses existing IRA GET system infrastructure. |

[a] Existing IRA is a combination of GET and MNA assessment.
[b] Site SD033 is a component site within the overall WIOU plume. The remediation time is based on the entirety of the WIOU plume achieving cleanup levels, including the commingled plumes that originated from Sites SD033, SD034, SS035, SD036, SD037, and SD043.

**TABLE 2.9-37**
Expected Outcomes of Each Alternative – Site SD034
*Groundwater Record of Decision, Travis Air Force Base, California*

| | Alternative | |
|---|---|---|
| **Element** | **3-GET[a]** | **7-Passive Skimming and EA** |
| Available uses of land upon achieving cleanup levels | Unrestricted | Unrestricted |
| Time frame to achieve available land use (years) | 91[b] | 60[b] |
| Available uses of groundwater upon achieving cleanup levels | Drinking water | Drinking water |
| Time frame to achieve available groundwater use (years) | 91[b] | 60[b] |
| Other impacts or benefits associated with alternative | Uses existing IRA GET system infrastructure. | Lower energy requirements and less GHG emission compared with the IRA GET system. |

[a] Existing IRA is a combination of GET, passive skimming, and MNA assessment.
[b] Site SD034 is a component site within the overall WIOU plume. The remediation time is based on the entirety of the WIOU plume achieving cleanup levels, including the commingled plumes that originated from Sites SD033, SD034, SS035, SD036, SD037, and SD043.

**TABLE 2.9-38**
Expected Outcomes of Each Alternative – Site SS035
*Groundwater Record of Decision, Travis Air Force Base, California*

| | Alternative |
|---|---|
| **Element** | **2-MNA[a]** |
| Available uses of land upon achieving cleanup levels | Unrestricted |
| Time frame to achieve available land use (years) | 60[b] |
| Available uses of groundwater upon achieving cleanup levels | Drinking water |
| Time frame to achieve available groundwater use (years) | 60[b] |
| Other impacts or benefits associated with alternative | Minimal GHG generation. |

[a] Existing IRA is MNA assessment for the entirety of the plume.
[b] Site SS035 is a component site within the overall WIOU plume. The remediation time is based on the entirety of the WIOU plume achieving cleanup levels, including the commingled plumes that originated from Sites SD033, SD034, SS035, SD036, SD037, and SD043.

**TABLE 2.9-39**
Expected Outcomes of Each Alternative – Site SD036
*Groundwater Record of Decision, Travis Air Force Base, California*

| Element | Alternative | |
|---|---|---|
| | **3-GET[a]** | **5-EVO and EA** |
| Available uses of land upon achieving cleanup levels | Unrestricted | Unrestricted |
| Time frame to achieve available land use (years) | 91[b] | 60[b] |
| Available uses of groundwater upon achieving cleanup levels | Drinking water | Drinking water |
| Time frame to achieve available groundwater use (years) | 91[b] | 60[b] |
| Other impacts or benefits associated with alternative | Uses existing IRA GET system infrastructure. | Incorporates GSR by using low-energy in situ bioremediation via EVO to facilitate ERD. Lower energy requirements and less GHG emission compared with the IRA GET system. |

[a] Existing IRA is a combination of GET and MNA assessment.
[b] Site SD036 is a component site within the overall WIOU plume. The remediation time is based on the entirety of the WIOU plume achieving cleanup levels, including the commingled plumes that originated from Sites SD033, SD034, SS035, SD036, SD037, and SD043.

**TABLE 2.9-40**
Expected Outcomes of Each Alternative – Site SD037
*Groundwater Record of Decision, Travis Air Force Base, California*

| Element | Alternative | |
|---|---|---|
| | **3-GET[a]** | **5-EVO and EA** |
| Available uses of land upon achieving cleanup levels | Unrestricted | Unrestricted |
| Time frame to achieve available land use (years) | 91[b] | 60[b] |
| Available uses of groundwater upon achieving cleanup levels | Drinking water | Drinking water |
| Time frame to achieve available groundwater use (years) | 91[b] | 60[b] |
| Other impacts or benefits associated with alternative | Uses existing IRA GET system infrastructure. | Incorporates GSR by using low energy in situ bioremediation via EVO to facilitate ERD. Lower energy requirements and less GHG emission compared with GET system. |

[a] Existing IRA is a combination of GET and MNA assessment.
[b] Site SD037 is a component site within the overall WIOU plume. The remediation time is based on the entirety of the WIOU plume achieving cleanup levels, including the commingled plumes that originated from Sites SD033, SD034, SS035, SD036, SD037, and SD043.

**TABLE 2.9-41**
Expected Outcomes of Each Alternative – Site DP039
*Groundwater Record of Decision, Travis Air Force Base, California*

| | Alternative | |
|---|---|---|
| **Element** | **3-GET*** | **6-Bioreactor, Phytoremediation, EVO PRB, and EA** |
| Available uses of land upon achieving cleanup levels | Unrestricted | Unrestricted |
| Time frame to achieve available land use (years) | 70 | 58 |
| Available uses of groundwater upon achieving cleanup levels | Drinking water | Drinking water |
| Time frame to achieve available groundwater use (years) | 70 | 58 |
| Other impacts or benefits associated with alternative | Uses existing IRA GET system infrastructure. | Incorporates multiple GSR components, including a solar-powered groundwater pump to supply a bioreactor, an existing area of planted trees, and an EVO PRB. |

* Existing IRA is a combination of GET and MNA assessment.

**TABLE 2.9-42**
Expected Outcomes of Each Alternative – Site SD043
*Groundwater Record of Decision, Travis Air Force Base, California*

| | Alternative | |
|---|---|---|
| **Element** | **2-MNA** | **3-GET[a]** |
| Available uses of land upon achieving cleanup levels | Unrestricted | Unrestricted |
| Time frame to achieve available land use (years) | 60[b] | 91[b] |
| Available uses of groundwater upon achieving cleanup levels | Drinking water | Drinking water |
| Time frame to achieve available groundwater use (years) | 60[b] | 91[b] |
| Other impacts or benefits associated with alternative | Minimal GHG generation. | Uses existing IRA GET system infrastructure. |

[a] Existing IRA is a combination of GET and MNA assessment.
[b] Site SD043 is a component site within the overall WIOU plume. The remediation time is based on the entirety of the WIOU plume achieving cleanup levels, including the commingled plumes that originated from Sites SD033, SD034, SS035, SD036, SD037, and SD043.