2009 FONR IMPACT ASSESSMENT AND HABITAT AND RARE PLANT SPECIES SURVEY RESULTS FRITZSCHE ARMY AIRFIELD FIRE DRILL AREA FORMER FORT ORD, CALIFORNIA

Prepared for:

U.S. Army Corps of Engineers
Sacramento District
1325 J Street
Sacramento, CA 95814-2922

Contract No. DACA45-03-D-0029
Delivery Order CM01

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December 2009

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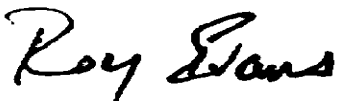

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TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS

ACL	aquifer cleanup level
COC	contaminant of concern
DD&A	Denise Duffy and Associates, Inc.
FDA	Fire Drill Area
FONR	Fort Ord Natural Reserve
GAC	granular activated carbon
GIS	geographic information system
GPS	global positioning system
GWETS	groundwater extraction and treatment system
HGL	HydroGeoLogic, Inc.
LTM	long-term monitoring
NWTS	Northwest Treatment System
OU	operable unit
ROD	Record of Decision
RTE	rare, threatened, or endangered
SOC	species of concern
TCE	trichloroethene
UCNRS	University of California Natural Reserve System
UCSC	University of California – Santa Cruz
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service

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1.0 INTRODUCTION

HydroGeoLogic, Inc. (HGL) was contracted by the U.S. Army Corps of Engineers (USACE)-Sacramento District to conduct a Fixed-Price Remediation with Insurance scope of work for Operable Unit (OU)-1 at the former U.S. Army Post Fort Ord located in Monterey County, California. This work was contracted in December 2003 by the USACE-Omaha District, under Contract Number DACA45-03-D-0029, and was administered through the USACE-Sacramento District. The objectives of this effort are the same as those of the Record of Decision (ROD) signed in July 1995 by the U.S. Army, U.S. Environmental Protection Agency (USEPA), and the California Environmental Protection Agency (U.S. Army, 1995).

The primary remediation objectives specified in the ROD are as follows:

- Establish hydraulic control and contain contaminated groundwater.
- Extract and treat groundwater exceeding aquifer cleanup levels (ACL).

Activities undertaken to achieve the OU-1 cleanup must adequately protect and maintain the critical habitat and protected species found within the Fort Ord Natural Reserve (FONR).

Figure 1.1 illustrates the location of Former Fort Ord and the OU-1 source area. Activities conducted at the former Fort Ord Fritzsche Army Airfield Fire Drill Area (FDA) (i.e., OU-1 source area) between 1962 and 1985 resulted in contaminants being released to soils and groundwater. Although 10 volatile organic compounds were identified as contaminants of concern (COC) in groundwater underlying the FDA, trichloroethene (TCE) is the contaminant that is detected at the highest concentrations and across the greatest extent of the affected aquifer. Thus far, data show that the TCE plume "footprint" encompasses that of the other nine COCs. Figure 1.2 shows the estimated extent of the TCE plume in September 2009. The area surrounding the OU-1 contaminant plume is part of the University of California Natural Reserve System (UCNRS) designated as the FONR. The FONR is managed by staff at the University of California – Santa Cruz (UCSC).

The U.S. Army consulted with the U.S Fish and Wildlife Service (USFWS) in 1998 to assess what effects groundwater investigation and remediation activities might have on two protected planted species within the FONR. These species were the sand gilia (*Gilia tenuiflora ssp. arenaria*) and the Monterey spineflower (*Chorizanthe pungens var. pungens*). The Biological and Conference Opinion was issued on March 30, 1999. The Army consulted again in 2002 and 2007 to address impacts to Monterey spineflower Critical Habitat and the California tiger salamander (*Ambystoma californiense*). Various mitigation measures were identified as a result of these consultations and are implemented before, during, and after work within the FONR.

Intermittent biological surveys within the OU-1 area have been undertaken since 1998. Specifically, these include:

- Harding Lawson Associates (1998)
- HGL (annual biological surveys using subcontractor CH2M Hill in 2004 and 2005 [HGL, 2004a Appendix A; CH2M Hill, 2005] and subcontractor Denise Duffy and Associates, Inc [DD&A] from 2006 through 2008 [HGL, 2007a, 2008, 2009])

These surveys focused on mapping the extent and population of federally protected rare, threatened, or endangered (RTE) plant species within the FONR, including the endangered sand gilia and the threatened Monterey spineflower.

This document presents the results of the 2009 rare plant survey and discusses the potential impact to date on those plants associated with the OU-1 remediation activities conducted since 2004. The 2009 rare plant survey was conducted by DD&A under subcontract to HGL. The following are also included in this report:

- A description of the FONR site and overview of past activities,
- Descriptions of the actions taken and site management protocols implemented to minimize adverse impacts to the FONR habitat,
- A summary of the site activities conducted by HGL during 2009 and planned future activities, and
- Results of the 2009 rare plant survey and interim impact assessment.

The following sections address these topics.

1.1 SITE DESCRIPTION

Fort Ord was established in 1917 as a military training base for infantry troops. In January 1991, the Secretary of Defense announced the closure of the base. In August 1994, portions of the property were transferred to the UCSC and the FONR was established in June 1996. Additional information regarding past land use at this site is presented in the Final Operable Unit 1 Project Management Plan, Fritzsche Army Airfield Fire Drill Area, Former Fort Ord, California (HGL, 2004b).

The former Fort Ord is located near Monterey Bay, which is located approximately 80 miles south of San Francisco. The base consists of approximately 28,000 acres near the cities of Seaside, Sand City, Monterey, Del Rey Oaks, and Marina. Monterey Bay marks the western boundary of the former Fort Ord. Toro Regional Park borders the base to the southeast, and land use to the east is primarily agricultural.

OU-1 occupies approximately 590 acres of the FONR in the southwestern corner of the former Fritzsche Army Airfield, west of Imjin Road and north of Reservation Road. The dominant habitats found in OU-1 include coast live oak woodland, maritime chaparral, and annual grassland. The dominant habitats within the FONR are coast live oak woodland, coastal scrub, maritime chaparral and annual grassland. The maritime chaparral is considered a rare habitat by

the California Department of Fish and Game. The former Fort Ord area contains large areas of maritime chaparral habitat.

Several federally protected RTE species are known or suspected to be present within the FONR. These include the endangered sand gilia, the threatened Monterey spineflower, and the threatened California tiger salamander. Several plant and animal species of concern (SOC) are also present in the FONR. Other plant SOC include coast wallflower (*Erysimum ammophilum*), Eastwood's ericameria (*Ericameria fasciculata*), Monterey ceanothus (*Ceanothus cuneatus* var. *rigidus*), Sandmat manzanita (*Arctostaphylos pumila*), and Toro manzanita (*A. montereyensis*). The California black legless lizard (*Anniella pulchra nigra*), California coast horned lizard (*Phrynosoma coronatum*), and the Monterey ornate shrew (*Sorex ornatus salarius*) are animal SOC.

The northern boundary of OU-1 is adjacent to a large expanse of privately owned, non-native grassland. Transmission of non-native grass species into OU-1 is accelerated by the prevailing winds, which blow the seeds south and into the OU-1 area (Fusari, 2004). Non-native grasses and weedy forbs are already present throughout much of the OU-1 area. Significant expansion of the non-native grasses could result in population declines of federally listed plants.

Sand gilia appears to be less tolerant of competing plant cover than the Monterey spineflower. This hypothesis is based on the observation that numerous small Monterey spineflower populations were identified within the dense grassland habitat bordering the main FONR habitat to the east and north or on the roadways bordering this grassland in the initial 1998 survey. Subsequent rare plant surveys conducted between 2004 and 2007 also observed Monterey spineflower in this region. Sand gilia was not observed in these areas in any of those surveys.

Although sand gilia was not detected in the dense grassland border areas during the 1998 – 2007 surveys, sand gilia populations were observed in 2007 within a small "island" of grassland species within the more extensive oak woodland habitat near the OU-1 plume source area (i.e., the former FDA; see Figure A3.4 in the 2007 FONR Impact Report Appendix A [HGL, 2008]). The small open area in which the sand gilia population was observed is bordered by grasses that are surrounded by oak woodland and understory habitat. Several Monterey spineflower populations also were observed thriving within dense patches of non-native grasses in the same vicinity. This occurrence suggests that both rare plant species may occur in the presence of non-native grasses within more supportive habitat. This region was not surveyed in 2009 because it has been more than three years since construction activities were completed.

1.2 OVERVIEW OF OPERABLE UNIT-1 REMEDIATION ACTIVITIES WITHIN THE FORT ORD NATURAL RESERVE

Numerous wells and soil borings were constructed within the FONR as part of the investigative effort to define the extent of environmental contamination or to remediate that contamination. Table 1.1 lists the wells that have been installed within the OU-1 portion of the FONR. Table 1.2 lists the abandoned wells and the soil borings that were drilled within the FONR portion of OU-1 between 2004 and 2006 without constructing a well. Figure 1.3 illustrates the OU-1 well and soil boring locations. No new wells or soil borings have been constructed by HGL within the FONR since 2007.

1.3 SITE ACTIVITY SUMMARY

In 1987, about 4,000 cubic yards of contaminated soils were excavated and replaced with clean fill. The OU-1 ROD (U.S. Army, 1995) stated that the contaminated soils at the FDA were remediated. The ROD also defined groundwater extraction and treatment as the selected remedial action for OU-1 groundwater. A groundwater extraction and treatment system (GWETS) was constructed in 1988 to remediate TCE and other related groundwater contaminants. The 1988 GWETS consisted of extraction wells EW-OU1-17-A and EW-OU1-18-A and was located slightly downgradient of the FDA. Extracted groundwater was transported through pipelines to a treatment unit located at the former FDA and passed through vessels containing granular activated carbon (GAC). The treated effluent was spray-irrigated in the southern portion of the FDA.

Despite a steady overall decline in contaminant levels within the groundwater capture zone of the 1988 GWETS, COCs were subsequently detected at concentrations above ACLs in groundwater downgradient from the extraction zone. Additional wells installed between 1997 and 2001 (MW-OU1-21-A through MW-OU1-46-A) revealed that TCE exceeded the ACL as far as 2,100 feet downgradient from the existing capture zone. Groundwater modeling showed that contaminated groundwater north and west of extraction well EW-OU1-17A is not captured by the extraction system (AHTNA, 2003).

The HGL remediation contract was awarded in December 2003 and a draft design to expand the original GWETS was presented in the Draft Remedial System Modification Plan (HGL, 2004a). New wells were installed and aquifer testing began in 2004 and continued through 2007. The draft GWETS expansion design was adjusted as new data from the well installation and aquifer testing were processed; the final design was issued in the three-volume Final Engineering Design Report in 2006 (HGL, 2006a, 2006b, and 2006c). Figure 1.4 illustrates the layout and components of the completed OU-1 groundwater remediation project within the FONR.

Construction of the first component of the GWETS expansion, the Hydraulic Control Pilot Project (HGL, 2006d), was initiated and completed in 2006. The remainder of the GWETS expansion (the FONR system) was constructed from July through September 2007. These construction activities are described in detail in the Final Hydraulic Control Pilot Project Construction Report (HGL, 2007b) and the Draft FONR System Construction Report (HGL, 2008). Additional details concerning the GWETS expansion and a summary of OU-1 site activities conducted during 2007 relating to habitat monitoring and impacts are provided in the 2007 FONR Impact Assessment and Habitat and Rare Plant Survey Results (HGL, 2008).

During 2009, the only activities conducted by HGL within the FONR habitat area involved collecting performance monitoring samples from the northwest treatment system (NWTS) (samples taken from eight extraction wells and the treatment plant) and collecting samples from the wells comprising the OU-1 groundwater long-term monitoring (LTM) network. These activities used only light vehicles (pickup trucks or sedans) that traveled only on established roadways. The following sections describe the 2009 sampling activities and the 2009 rare plant survey.

1.3.1 2009 Rare Plant and Habitat Surveys

Surveys for sand gilia and Monterey spineflower were conducted by DD&A on May 1, 2009. The timing of the survey was intended to correspond with the peak blooming period (late April to early May), which was established through communications with UCSC natural resource staff and by observing a known occurrence of sand gilia in the vicinity of FONR. A survey was conducted along the five roadways and access routes where construction occurred within the last three years and included 15 well sites. Figure 1.5 shows the areas surveyed. Section 2.0 of this report presents an overview of the biological survey results, and Appendix A includes a detailed description.

1.3.2 2009 Sampling Activities

No drilling, construction, or aquifer testing activities were conducted by HGL within OU-1 during 2009. Groundwater samples were collected during 2009 from many of the existing wells within the FONR as part of the OU-1 groundwater LTM program. As the remediation effort progresses, the number of wells included in the network decreases and the monitoring frequency diminishes. In the past, wells included in the LTM network typically have been sampled quarterly, semiannually, or annually and the NWTS performance monitoring samples have been collected bimonthly. The quarterly sampling usually occurs in March, June, September, and December of each year. During 2009 the LTM sampling program was modified to semi-annual and annual only. Thus, LTM samples were collected in March and September. The performance monitoring sample frequency also was modified and those samples will be collected quarterly going forward. NWTS samples during 2009 were collected from the treatment system and operating extraction wells during January, March, July, September, and December. Table 1.3 summarizes the 2009 sampling events conducted at each of the OU-1 wells.

Previous results from the groundwater quality monitoring program showed that cleanup targets within the capture zone of the original GWETS extraction wells (Figure 1.4) were achieved during 2005. Groundwater pumping and treatment from the existing GWETS area was suspended in February 2006 as part of the rebound evaluation. A rebound evaluation to assess if the improved groundwater quality could be sustained without additional remediation was completed during 2007. The Draft Rebound Evaluation Report (HGL, 2007c) was submitted for regulatory review and it was agreed that the groundwater sampling frequency in this region can be greatly reduced. Sampling from selected groundwater monitoring wells in this region will continue for some wells, though at a reduced frequency.

Groundwater levels are measured quarterly at most wells within the OU-1 LTM network. These measurements are taken either concurrently with or within a few days of sample collection.

1.4 IMPACT PREVENTION AND MITIGATION MEASURES

Activities conducted within the FONR are strictly limited to those that are essential to achieving the remediation goals for the project. The remedial design and construction as well as the ongoing operation of the remedial system have been and will continue to be consistent with the various biological opinions and guidance regarding mitigation measures to reduce and avoid impacts to RTE SOC on the project site. Guidance for the remedial design and action(s) includes the following:

- The March 30, 1999, Biological and Conference Opinion on the Closure and Reuse of Fort Ord, Monterey County, California (1-8-99-F/C-39R) (USFWS, 1999) and supporting documentation, such as Enclosure 2 to the request for consultation (Harding Lawson Associates, 1998)
- The October 22, 2002, Biological Opinion on the Closure and Reuse of Fort Ord, Monterey County, California, as it affects Monterey spineflower Critical Habitat, (1-8-01-F-70R) (USFWS, 2002)
- The March 14, 2005, Biological Opinion on the Cleanup and Reuse of Former Fort Ord, Monterey County, California, as it affects California Tiger Salamander and Critical Habitat for Contra Costa Goldfields (1-8-04-F-25R) (USFWS, 2005)
- The June 1, 2007, Amendment to Biological Opinion 1-8-04-F-25R, Cleanup and Reuse of Former Fort Ord, Monterey County, California, as it affects California Tiger Salamander and Critical Habitat for Contra Costa Goldfields (1-8-04-F-25R) (USFWS, 2007)
- Guidance and direction from UCNRS staff
- Former Fort Ord Habitat Management Plan (U.S. Army, 1997)

To avoid or minimize impact to the FONR during ecologically sensitive periods (i.e., the rainy season, typically ranging between November and April), construction was scheduled at other times insofar as possible within the overall project constraints. The final FONR system construction, for example, began in July 2007 and was completed in September 2007 before the seasonal rains began.

In addition to compliance with the above guidance, HGL subcontracted with UCSC to implement weed control measures at selected locations within the OU-1 portion of the FONR during 2007. This subcontract was renewed in 2008 and again for 2009 and the weed control program was continued. UCSC staff began weed control treatments on March 24, 2009, and continued through August 11, 2009. UCSC staff also surveyed well sites to identify the composition of the plant population in the immediate vicinity of the wells. UCSC prepared a report that describes and summarizes their efforts regarding weed control and plant surveys; the report is included as Appendix B. The objectives of the weed control activities are:

- Cut down or remove undesirable vegetation from areas disturbed by OU-1 construction activities during 2004 through 2006 before such vegetation released seeds into the environment.
- Prevent or reduce the expansion of non-native plants into areas disturbed by construction related to OU-1 activities during the 2004 through 2006 period.
- Prevent the occurrence of unacceptable impacts to the Monterey spineflower and sand gilia populations within that portion of the FONR affected by OU-1 remediation activities.

Figure 1.6 illustrates the locations where weed control measures were performed. Weed control consisted of cutting the weeds using manual methods (hand pulling, clipping) and mechanical (such as powered string trimmers or similar, easily portable equipment) during 2009 (Appendix

B). During 2008, only hand tools were used for weed control. Herbicides or similar poisons have not been used as part of this effort in any year. Disposing of cut weeds depended on both the plant species and the timing of the weed cutting episode. Cut weeds were left on the ground if there was no danger that the seeds would germinate and sprout after cutting; otherwise, the cut weeds were bagged and removed from the site for proper disposal. The species subject to weed control included plant species that are listed as a noxious weed by the California Department of Food and Agriculture, included on invasive plant lists maintained by the California Invasive Plant Council, or considered to be a problematic species by the UCSC FONR natural resource staff.

1.5 FUTURE ACTIVITIES

Currently planned, potential or recommended activities for 2010 include the following:

- Continue operating the NWTS and FONR systems.
- Continue sampling groundwater quality at selected existing wells.
- Continue weed control treatments through UCSC staff.
- Discontinue rare plant monitoring until remediation is complete and the remediation facilities (wells and treatment plant) are demolished. Consider expansion of the OU-1 groundwater extraction system to include pumping from existing monitoring well IW-OU1-10-A (see below for more detail about this proposal).

If implemented, the proposed expansion of the groundwater extraction system will convert monitoring well IW-OU1-10-A to an extraction well. The conversion will include installing a pump and flow control equipment in well IW-OU1-10-A and extending the existing underground transmission pipeline and electrical power from MW-OU1-87-A to IW-OU1-10-A along existing roadways. Groundwater pumped from IW-OU1-10-A will be treated at the existing NWTS plant. This proposed conversion will significantly accelerate the completion of the OU-1 remediation effort and thereby hasten the end of the routine groundwater monitoring activities within the FONR. No new areas will be disturbed as part of the proposed system expansion and neither Monterey spineflower nor sand gilia have been observed in previous surveys along the proposed pipeline route. Therefore, no impacts to rare plants are anticipated and rare plant monitoring along the pipeline route will not be conducted in 2010.

No new wells within OU-1 at the FONR are planned at this time. As the remediation progresses, the number of wells that are included in the sampling program and/or the number of samples collected will be reduced. The eight extraction wells (nine extraction wells if or when IW-OU1-10-A is brought online) and the NWTS facility will be sampled either quarterly or semi-annually. To date, sampling has been suspended at 46 OU-1 monitoring wells. Of the remaining 39 monitoring wells, five wells will be sampled quarterly, 22 wells semi-annually, and 10 wells annually. Two wells are sampled on a five-year cycle. The frequency of groundwater level measurements also has been reduced. Water levels in 2010 will be monitored at 40 wells on a semi-annual basis (March and September) and quarterly at 17 wells (June and December). Groundwater level measurements have been suspended at the remaining wells.

Upon attainment and verification of the groundwater cleanup targets established in the ROD, the monitoring wells and treatment facilities will be abandoned. The timetable for this milestone is not yet established.

2.0 OVERVIEW OF 2009 RARE PLANT SURVEY RESULTS

The objectives of the 2009 rare plant survey and habitat inventory were to accomplish the following:

- Identify locations and estimate rare plant populations for Monterey spineflower and sand gilia at each site where construction for the remediation system (including well installation) took place since 2006.
- Map Monterey spineflower and sand gilia populations for comparison to past surveys and to facilitate planning if future construction or maintenance activities are needed (no such activities are currently planned).

The rare plant survey was conducted along the five roadways and access routes where construction occurred within the last three years and included 13 well sites within OU-1. This section presents a summary of the key findings from those surveys. Appendix A presents the complete survey report.

Surveys for sand gilia and Monterey spineflower were conducted by a DD&A biologist and a DD&A global positioning system (GPS) technician on May 1, 2009. The survey was timed to coincide with the peak blooming period insofar as possible. The peak blooming period was determined through communications with UCSC FONR natural resource management staff and by observing a known occurrence of sand gilia in the vicinity of FONR.

Each of the rare plant surveys was conducted along existing or proposed roadways and access routes. In the absence of rare plants, the width of the survey area was approximately 10 feet beyond the edge of the roadway on either side. If a rare plant was identified, the survey in that area was extended to the boundary of the population encountered.

2.1 RARE PLANT SURVEY METHODS

Large areas of Monterey spineflower and sand gilia were mapped as polygons, using a Trimble Pathfinder ProXH GPS unit. Smaller plant groups and individuals were mapped as points with attributes to identify the number of individuals at each location.

Individual counts were made for all sand gilia populations whether they were mapped using points (population less than 10) or polygons (population greater than 10). However, Monterey spineflower were only counted as individuals when groups of less than five were mapped. Monterey spineflower mapped as polygons were characterized according to the percent of cover. The categories ranged from very sparse (corresponding to an absolute cover of less than 3 percent), sparse (3 to 25 percent), medium low (26 to 50 percent), medium (51 to 76 percent), and medium high (76 to 97 percent) to very high (greater than 97 to 100 percent). GPS data were exported to shapefile format for use in a Geographic Information System (GIS) (ESRI ArcGIS) and mapped on high-resolution aerial photography. These maps are presented in Appendix A (Figures A3.1 and A3.2).

2.2 SAND GILIA SURVEY RESULTS

Sand gilia was not observed or mapped in any of the locations within the five survey areas and 13 well sites surveyed for rare plants. Sand gilia was not detected at these survey locations in either the 1998 or the 2004 pre-construction surveys. Consequently, the absence of sand gilia in the 2009 rare plant survey is believed to be caused by natural variation in rainfall and climate factors. Sand gilia occurrences are discussed in more detail in Section 3.1 and Sections 4.2 through 4.4.

2.3 MONTEREY SPINEFLOWER SURVEY RESULTS

A total of 42 populations (16 polygons and 26 points) of Monterey spineflower were mapped along the five rare plant survey areas and 13 well sites within the FONR (Table A3.1 and Figures A3.1 through A3.2 in Appendix A). The occurrences of Monterey spineflower in the 2009 and previous post-construction rare plant surveys suggest a possible temporary or long-term beneficial impact of ground disturbance associated with construction activity relative to the Monterey spineflower population. This issue is discussed in more detail in Section 3.2 and Sections 4.1, 4.3, and 4.4.

A total of 42 individual plants were identified at the 26 mapped GIS points. Because Monterey spineflower population size estimates are not as easily quantified as the sand gilia populations, individual Monterey spineflower plants were not counted within the GIS polygons. Populations of Monterey spineflower were estimated as a percentage of the overall ground cover using visual estimation. Of the 16 populations of Monterey spineflower that were mapped as polygons, the results are as follows:

- Two populations had a medium high cover class (76 to 97 percent cover),
- Three populations had a medium cover class (51 to 76 percent cover),
- Two populations had a medium low cover class (26 to 50 percent), and
- Nine populations had a sparse cover class (3 to 25 percent).

None of the Monterey spineflower populations observed and mapped exceeded the medium high cover class.

Plant density estimates in the polygon areas were typically sparse cover. Approximately 56 percent (9 of the 16 populations) fell into this category.

Monterey spineflower was observed in each of the habitat types at the site and was usually restricted to open sandy areas with sparse vegetative cover. In the live oak woodland and maritime chaparral habitats, this species was often observed along access roads and other disturbed areas such as existing well locations, and in naturally occurring sandy or grassy open areas.

In the annual grassland habitat, Monterey spineflower was most often restricted to relatively open areas around the perimeter of shrubs, small areas of disturbance, and along existing access roads. Common associated species include stork's bill geranium (*Erodium botrys*), sand mat (*Cardionema ramosissimum*), fescue (*Vulpia* sp.), rip-gut brome (*Bromus diandrus*), and catchfly

(*Silene gallica*). Monterey spineflower populations were observed in areas with sparse to moderately abundant non-native annual grass cover, suggesting that this species may be somewhat more tolerant of annual grass cover than sand gilia.

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3.0 IMPACT ASSESSMENT

Data collected during the 2009 rare plant survey were evaluated in conjunction with other observations to identify impacts to the FONR habitat resulting from OU-1 activities. This annual impact assessment represents current conditions only and will be considered along with future data in the overall impact assessment to be conducted upon completion of the OU-1 remedial action.

3.1 SAND GILIA

No sand gilia populations were observed during the 2008 or 2009 survey versus 12 locations where sand gilia was evident in 2007. The difference is attributed to the combined effect of several potential factors:

- The amount of surveyed locations decreased from 15 sites in 2007 compared to five sites in 2008 and 2009.
- Spring rainfall totals have varied considerably and declined dramatically since the unusually wet 2006 period. According to the National Weather Service Climatological Station for Monterey, the spring (March, April, and May) rainfall total for 2006 was 12.63 inches, while the rainfall total for spring of 2007 was 2.31 inches. In 2008, the spring rainfall total was only 0.79 inches. In 2009, the spring rainfall was 3.54 inches.
- Sand gilia populations at DD&A reference sites also were relatively low indicating that the conditions during the 2009 sand gilia growing season were not optimal.

Sand gilia was observed earlier (in 2005) at Site 4 in the vicinity of well MW-OU1-51-A. Sand gilia had also been observed (in 2006) at two of the five sites surveyed in 2008: at Site 6 (at the western extreme of a potential route to well MW-OU1-86-A) and at Site 9 (around the well site at MW-OU1-59-A).

At Site 4, the sand gilia population in 2005 was observed the year after the roadway and well MW-OU1-51-A were constructed and there have been no other construction activities in that area since 2004. The proposed well location for MW-OU1-86-A (within the Site 6 survey area) was relocated more than 140 feet to the east of the sand gilia population observed in 2006; consequently, no construction or monitoring activities (other than foot traffic during the plant surveys) have been conducted in the sand gilia population area during the 2004 – 2009 period. Well MW-OU1-59-A was also constructed in 2004 and there has been only light vehicle traffic (for quarterly groundwater monitoring) since then.

In summary, sand gilia has been previously detected during the post-construction period at Sites 4 and 9 and the potential well location/access road at Site 6 was re-routed to avoid the rare plant populations observed in the pre-construction survey. Consequently, the absence of sand gilia in the 2009 rare plant survey is believed to be caused by natural variation in rainfall and climate factors.

3.2 MONTEREY SPINEFLOWER

Overlap between the OU-1 construction zones and populations of Monterey spineflower observed in the 2009 and previous surveys were limited, as described below:

- IW-OU1-74-A was constructed in the summer of 2006 to the west of small, very sparse populations that were observed in 2005 and 2006 (absent in 2004). The 1998 survey also showed the presence of Monterey spineflower in this area. The 2007 survey showed that the boundary of the very sparse population area had expanded to include the well site. The pipeline constructed to that well passed adjacent to or along the edge of the population. In 2008, Monterey spineflower was again observed in approximately the same area but the population density improved to sparse. During the 2009 survey, the polygon that was identified in 2008 had divided into two smaller polygons one categorized as sparse and the other increased to medium low.
- An access road leads from the main northwest–southeast roadway bordering the FONR habitat (segment 3 in Figure 1.5) to the closely spaced wells MW-OU1-46-A (constructed in 2001), MW-OU1-46-AD (constructed in 2004), and PZ-OU1-46-AD2 (constructed in 2005). In this area, recent surveys have shown the following:
  - Monterey spineflower populations (very sparse) were observed in the central segment of this road (Site 4 in Figure 1.5) in 2004 and 2006. The 2006 survey showed the boundary of the very sparse population extended along the full distance from the junction with the northwest–southeast road.
  - The 2007 survey showed a very sparse Monterey spineflower population along a much smaller segment of this roadway to the east of the MW-OU1-46-AD well cluster and a slightly larger population to the west. The pipelines to extraction well MW-OU1-46-AD and injection wells IW-OU1-73-A and IW-OU1-74-A were constructed down the approximate center of this road to minimize impact to the spineflower population.
  - In 2008, Monterey spineflower showed dramatically increased numbers as populations and/or individual plants were observed along approximately one-half of the roadway between the eastern grasslands and well site IW-OU1-74-A (Figure A3.2). In addition, the observed population densities increased to sparse (populations #34, #35, #38 and #39 in Figure A3.2 in Appendix A) and medium low (populations #36 and #37 in Figure A3.2 in Appendix A). Finally, 20 individual plant clusters ranging from one to three plants each were observed in the same segment (Site 4).
  - In 2009, the elongated polygon (#27) has remained approximately the same size but has increased to medium cover (51 – 76 percent) from sparse. Polygon #28 has also increased to medium (from medium low). Four additional polygons (#33, #41, #40, and #39) have remained categorized as sparse. Nine individual plant clusters ranging from one to three plants were observed in 2009. Between 2008 and 2009, there appeared to be a general reduction of individual plant clusters (from 14 to 9) in this region, particularly near the intersection with the northwest-southeast road.
- Two small populations (one very sparse and one sparse) were observed in the 2007 survey in the vicinity of monitoring well MW-OU1-83-A (constructed in 2006). One population was nearby to the northwest and the other population was more distant to the southeast. The 2004 and 2005 surveys also showed a similar presence of the southeast

population. The northeast population observed in 2007 was not found in the previous surveys although two other populations of very limited extent were noted in the general vicinity in the 2004 survey. These populations were also present in 2008 and the population density for the very sparse population increased to sparse. In 2009, the population to the northeast increased to medium high. However, the population to the west, which was previously a polygon, has been reduced to four discrete clusters of one to three plants. No disturbance was made to this area in 2007 – 2009 other than light vehicle (pickup truck or sport utility vehicle) or foot traffic as part of groundwater sample collection.

- A small, medium density population was observed along the north access road to well site EW-OU1-71-A (constructed in 2006; Figure A3.2 in Appendix A) during the 2007 survey. Monterey spineflower had not been observed at this location in the three previous surveys before the well was constructed in 2006 (surveys in 1998, 2004 and 2005). In 2008, the location of this population (#42) shifted to the southwest and encompassed the well site although the density decreased by one category to sparse. In 2009, there was no indication of this population.
- The extraction well pipeline along the northwest–southeast roadway passed through the edge of, or adjacent to, a number of Monterey spineflower populations located along this roadway in the segment between the NWTS facility and the intersection with the access road to MW-OU1-46-AD. These populations were identified as very sparse, sparse, or limited to a single plant and were confined to narrow bands along the edge of the roadway. Annual surveys showed that the number of these populations observed in any given year between 2004 and 2007 ranged from one to seven. In all cases, these populations were found at the edge of the grassland habitat, and the UCSC FONR natural resource management staff indicated that these populations are of marginal value to the overall FONR population (HGL, 2006b). This segment was not surveyed in 2008 because of the proximity to the eastern grassland and the marginal value of the habitat. In 2009, this area was surveyed but no populations were identified.

Maximum plant population densities increased in 2009 compared to 2008 although the majority of populations were categorized as sparse in both years. In 2008 the greatest plant density was Medium (two populations) but in 2009 there were two medium high populations and three Medium. At the opposite end of the spectrum, two observations of sparse and very sparse populations in 2008 at Site 7 were not observed during the 2009 survey. One population (sparse) observed at Site 6 in 2008 was also not observed in 2009. Overall, the Monterey spineflower polygons decreased in total area from 4,609 square feet in 2008 to 2,388 square feet in 2009. However, the large number of sparse and very sparse populations in both years means that a small decrease in the number plants can greatly affect the overall polygon area. The differences observed between the two years are sufficiently distinct to determine if they are significant.

Relatively abundant Monterey spineflower populations do not seem as equally affected by the same constraints as sand gilia. Previous rare plant surveys conducted by DD&A also indicate that populations of Monterey spineflower were often observed in areas with sparse to moderately abundant non-native annual grass cover, suggesting that this species may be somewhat more tolerant of annual grass cover than sand gilia.

In summary, the potential conflicts with rare plants in the FONR System project area are minimal—less than 600 feet out of a total pipeline distance of approximately 3,300 feet. The majority of that 600-foot total represents marginal value populations of very sparse density located at the edge of roadways adjacent to the grassland habitat that borders the FONR to the east and north.

3.3 EROSION

HGL staff conducted visual reconnaissance surveys to detect erosion resulting from construction activity along the roadways used to access the construction areas and the monitoring well network. These erosion surveys are conducted routinely during the quarterly groundwater monitoring events and on occasion during routine system maintenance. Significant erosion was not observed on the FONR roadways during 2009.

4.0 CONCLUSIONS

Construction efforts were undertaken by HGL during the 2004 through 2007 time period to remediate contaminated groundwater within the OU-1 portion of the FONR. Construction included:

- Drilling soil borings;
- Constructing extraction, injection, and monitoring wells;
- Installing water conveyance pipelines;
- Installing infiltration trenches; and
- Constructing a groundwater treatment facility.

Figure 4.1 illustrates the areas in which construction occurred during 2004 through 2007. For 2010, it is likely that IW-OU1-10-A will be converted from a monitoring well to an extraction well. The cost-effectiveness of that conversion will be determined early in 2010. If implemented, the conversion will include installing a pump in well MW-OU1-10-A and extending the underground transmission pipeline and electrical power from MW-OU1-87-A to IW-OU1-10-A along existing roadways. No new areas will be disturbed.

A critical concern throughout the project has been the protection of the rare plant species within the FONR. To that end, direct impacts (i.e., construction activity within the footprint of known populations of Monterey spineflower or sand gilia) have been minimized by using pre-construction surveys to delineate population locations. The results of the surveys were used to adjust the location of remediation facilities to avoid previously identified areas wherever possible. This strategy enabled the construction activity to avoid direct impact except in the handful of cases described below.

UCSC staff responsible for managing the FONR expressed significant concern that construction activities could alter the habitat and indirectly impact rare plant species. Clearing existing, native vegetation to enable equipment access for well or pipeline construction may have provided a pathway for non-native, invasive plant species from the surrounding areas to encroach farther into the FONR. The UCSC concern is that such encroachment may result in declining rare plant populations as the non-native newcomers out-compete the existing plants and come to dominate the overall species distribution. To address this concern, HGL has conducted annual rare plant surveys from 2004 through 2009 (through subcontractors) and conducted habitat surveys in 2006 and 2007. In addition, HGL has contributed funding to support weed control efforts by UCSC in 2007, 2008, and 2009.

To date, the above efforts and the proactive construction management techniques employed throughout the construction effort to mitigate impacts appear to have been successful in minimizing the impact to rare plant populations. Table 4.1 summarizes the rare plant populations observed at the well sites for those wells constructed during 2004 and thereafter. The data from Table 4.1 are discussed in detail below.

4.1 OPERABLE UNIT 1 GROUNDWATER EXTRACTION AND TREATMENT SUMMARY EXPANSION IMPACTS ON MONTEREY SPINEFLOWER

Forty-six new OU-1 wells were constructed within the FONR between 2004 and 2006. Previously existing Monterey spineflower populations were identified at only 12 of these locations. At eight of these 12 locations, however, the wells were constructed along the roadways bordering the adjacent grasslands to the north and east, and the habitat/rare plant populations are considered of marginal value (HGL, 2006b). HGL discussed the proposed well locations with UCSC management staff before well construction began to confirm that the potential disruption of these plant populations was an acceptable approach and would not present a significant impact. These eight well locations were:

EW-OU1-49-A	PZ-OU1-49-A1	MW-OU1-56-A	MW-OU1-57-A
EW-OU1-60-A	MW-OU1-61-A	MW-OU1-65-A	EW-OU1-66-A

As shown in Table 4.1, most of these wells were not surveyed in 2008 and none were included in 2009 because they are located along the edge of the grasslands on the either northwest or eastern borders of the FONR. Monterey spineflower was not detected at these locations in the 2004, 2005, 2006, 2007, or 2008 surveys (not all sites were included in 2004; see Table 4.1). Consequently, it is not possible to conclude that the absence of these marginal populations since their detection in 1998 is the result of the construction activity. Natural variables, including precipitation factors, may be responsible for the lack of detected populations in recent years. In either case, these populations are of marginal value given that they are present within the edge of the grassland habitat.

The remaining four wells with a construction footprint that overlapped the pre-construction population boundary were as follows:

- MW-OU1-46-AD and PZ-OU1-46-AD2. These wells were located within the boundary of a narrow, north-south oriented Monterey spineflower population identified in 1998 (Figure 4.2). Monterey spineflower was not observed at the well site in the 2005 – 2007 surveys. The plant population also was not observed at this location during the 2004 pre-construction survey. The 2006 survey did show the presence of a very sparse Monterey spineflower population (#70 in the 2006 survey) that extended approximately 200 feet along the access road to these wells and terminated approximately 20 feet to the east of the well sites. Given the scale of the maps available, it is possible that one or both of the wells are located outside the plant population boundary observed in 1998. In 2008, however, this population boundary (#34 in this 2008 survey; Figure A3.1 in Appendix A) shifted to the west and overlapped the MW-OU1-46-AD well site and a single plant was observed at PZ-OU1-46-AD2. In addition, the population density in 2008 improved to sparse. In 2009, the boundaries of this population area slightly retreated from MW-OU1-46-A but the population density increased to medium. These occurrences in both wet (2006) and dry (2008) spring rainfall patterns, support the assertion that there have not been any significant negative impacts to the rare plant population at this location.
- EW-OU1-53-A and IW-OU1-01-A. Neither of these wells were surveyed in 2008 or 2009 because they were constructed in 2004—and 2007 was the end of the three-year survey window. In both cases, the results of the rare plant surveys from 2004 – 2007

were the same. Monterey spineflower was detected in 1998 but not in 2004. Although absent in 2005, Monterey spineflower was present two and three years after well construction (observed at both locations in the 2006 and 2007 rare plant surveys). The data suggest that the well construction activity did not significantly impact the rare plant population.

At five well locations, Monterey spineflower was identified in one or more post-construction surveys between 2005 and 2007, although that species was not detected in either the 1998 or 2004 surveys. These wells were EW-OU1-54-A, IW-OU1-05-A, IW-OU1-24-A, MW-OU1-59-A, and IW-OU1-74-A. Only the latter well was included in the 2008 and 2009 survey area and Monterey spineflower was again present in two populations: one on either side of the well. In addition, the population density at one of the two locations improved from sparse in 2008 to medium low in 2009. Both years were improved as compared with the very sparse classification observed in 2007. These occurrences suggest a possible temporary or long-term beneficial impact of ground disturbance associated with construction activity relative to the Monterey spineflower population.

4.2 OPERABLE UNIT 1 GROUNDWATER EXTRACTION AND TREATMENT EXPANSION IMPACTS ON SAND GILIA

Sand gilia was not detected at any of the well sites shown in Table 4.1 during the 1998 or 2004 rare plant surveys. In the absence of any previously known populations, it is concluded that the construction activity did not adversely affect the sand gilia population. Further support for this conclusion is found in the 2006 survey results at well MW-OU1-59-A, constructed in 2004. Although absent in previous surveys, the 2006 survey team encountered a population of 13 sand gilia plants surrounding the well site. The decrease in spring rainfall in 2007 (less than 25 percent of that which occurred in 2006) may have negatively affected sand gilia in 2007. This area was not surveyed in 2008 or 2009 because three years had passed since the well was constructed.

4.3 PRE-2004 OPERABLE UNIT 1 CONSTRUCTION VERSUS RARE PLANT OCCURRENCES

Twenty OU-1 wells (counting MW-OU1-24-A and replacement well MW-OU1-24-AR as one well) were installed by previous investigators between 1985 and 1997, and one well was installed along the northwest boundary of the FONR in 1976. As these wells pre-date the earliest available survey results in 1998, it is unknown whether rare plants were present before the wells were constructed. These 21 wells have each been included in at least one of the rare plant surveys from 1998 through 2007. As shown in Table 4.2, Monterey spineflower has been detected in 15 of these 21 wells in one or more of those surveys. Except for MW-OU1-46-A, the wells shown in Table 4.2 are located outside the areas included in the 2009 rare plant survey. Monterey spineflower was observed in 2009 at the MW-OU1-46-A well site as part of the sparse population stretching along much of the access road to the well site (population #34 as discussed previously in Section 4.1). The following paragraphs summarize the results of previous surveys.

If wells MW-B-10-A, MW-OU1-07-A, and MW-OU1-12-A are discounted as not representative, then Monterey spineflower has been detected at 15 of 18 well sites at least once since construction was completed. These wells are not representative because well MW-B-10-A is

located in the grassland at the northern edge of the FONR, and wells MW-OU1-07-A and MW-OU1-12-A are located within the footprint of the former FDA and subject to far more disturbance than simple well construction and follow-up sampling. Even with the most conservative possible assumption that Monterey spineflower was present at all 18 sites before construction, this high percentage (83 percent) of post-construction occurrences suggests that well construction does not significantly affect the population's sustainability.

An additional 17 wells were constructed between 1998 and 2001. Monterey spineflower was present at nine of these sites in the 1998 rare plant survey. This suggests that the assumption in the preceding paragraph that this species was present at all 18 sites is too high and therefore the 83 percent figure calculated for the recurrence of Monterey spineflower may be low. At six of the nine sites, Monterey spineflower was present in one or more of the surveys conducted between 2004 and 2007. Of the remaining three sites, MW-OU1-44-A was not surveyed after 1998 because it was not anywhere near the 2004 – 2007 construction footprint and is thus not useful for this assessment. The other two were sampled once (MW-OU1-25-A in 2004) or twice (MW-OU1-40-A in 2004 and 2005). Thus, Monterey spineflower was detected at least once in six of the eight sites (75 percent) even with limited post-construction surveys. In addition, Monterey spineflower was detected in the 2006 and 2007 surveys at MW-OU1-30-A even though it was absent in both the 1998 and 2004 surveys.

For sand gilia, the results are similar to those described above (Table 4.2). Of the 21 wells installed before the initial 1998 plant survey, sand gilia was detected at nine locations in one or more of the rare plant surveys. During the 2004 rare plant survey, which covered a larger area than the more focused surveys that followed, sand gilia was observed at 90 locations in comparison to 209 locations for Monterey spineflower. This equals a 43 percent sand gilia to spineflower ratio. The 2005 survey covered somewhat less area overall but included areas in the northwest part of the OU-1 plume that were not included in the 2004 effort. Nonetheless, the results were quite similar to the 2004 survey—102 occurrences of sand gilia in comparison to 215 instances of Monterey spineflower (a ratio of 2.15 to 1). For the 18 relevant well sites installed before 1998, the nine subsequent sand gilia occurrences compare with 15 subsequent Monterey spineflower occurrences (a ratio of 1.67 to 1. Thus, the presence of sand gilia at nine of the 18 relevant locations for the pre-1998 wells is quite reasonable and does not show any adverse impact related to well construction.

Sand gilia was present at five of the 17 additional well sites constructed after 1998. Wells MW-OU1-36-A and MW-OU1-37-A are located within the footprint of the former FDA and MW-OU1-45-A is located at the edge of the grassland on the northern edge of the FONR. Excluding these non-representative sites, sand gilia was detected in the 1998 survey at five of the 14 well locations; this frequency of occurrence is similar to that observed for the group of wells constructed before 1998 (nine detections at 18 locations). The ratio of sand gilia detections to Monterey spineflower detections for these 14 well locations is also similar to that for the pre-1998 group—1.80 to 1 in comparison to 1.67 to 1. In two of these five locations, sand gilia was subsequently detected in at least one of the 2004 – 2007 surveys. One location (MW-OU1-44-A) was not included in any subsequent survey because it was not anywhere near the 2004 – 2007 construction footprint. Sand gilia was not detected in subsequent surveys at the other two

wells (the 2004 survey at MW-OU1-38-A and the 2004, 2006, and 2007 surveys at PZ-OU1-14-A).

4.4 SUMMARY

Data from the annual post-construction rare plant surveys for the expansion of the OU-1 groundwater remediation system was compared with the 1998 and 2004 pre-construction rare plant survey data to assess construction impacts on the FONR rare plant populations (Monterey spineflower and sand gilia). The results of that comparison indicate that the construction activity has not had significant adverse effects on those populations. The supporting observations for this conclusion were described in the preceding paragraphs and are summarized below:

- Neither Monterey spineflower nor sand gilia was detected in the 2004 pre-construction rare plant survey at any of the locations where wells were subsequently constructed. The absence of these plants before construction began is viewed as one indication of the lack of construction impact.
- During planning discussions that occurred before well construction began, the UCSC FONR management staff characterized the 1998 rare plant survey as representing a "great year" for Monterey spineflower and sand gilia (UCSC, 2006). Nonetheless, sand gilia was not detected in 1998 at any of the well sites where construction occurred during the 2004 – 2007 period. Monterey spineflower was detected in 1998 at only 12 of the 46 locations where wells were subsequently constructed between 2004 and 2007:
  - At eight of these 12 locations, the well sites were located at the edge of the grassland in areas already impacted by invasive species and outside the critical FONR habitat; potential construction impacts to these areas are not considered significant.
  - Two wells (MW-OU1-46-AD and PZ-OU1-46-AD2) were located within approximately 25 feet of one another and possibly overlapped with a Monterey spineflower population. Although that plant was not detected in subsequent surveys at the well sites in 2005 through 2007, the 2008 survey showed that a sparse Monterey spineflower population (#34; see Section 4.1) overlapped the MW-OU1-46-AD well site and a single plant was observed at PZ-OU1-46-AD2. In 2009, the population near MW-OU1046-AD had receded slightly but still overlapped and had increased to medium population density. However, no individual plant cluster was identified near PZ-OU1-46-AD2. While not conclusive, this occurrence combined with the uncertainty regarding the boundary of the plant population in 1998 relative to the well locations suggests there have not been any long-term negative impacts to the rare plant population.
  - At the other two well sites (EW-OU1-53-A and IW-OU1-01-A); Monterey spineflower was detected in both the 2005 and 2006 surveys.
- The wells and access roads constructed as part of the expansion of the OU-1 groundwater remediation were constructed between 2004 and 2006. At five of the 2004 – 2006 well locations, Monterey spineflower was identified in one or more post-construction surveys between 2005 and 2007 although that species was not detected in either the 1998 or 2004 pre-construction surveys. These wells are EW-OU1-54-A, IW-OU1-05-A, IW-OU1-24-A, MW-OU1-59-A and IW-OU1-74-A (Table 4.1). Only well IW-OU1-74-A is located within the 2009 survey area and Monterey spineflower and

Monterey spineflower was detected with an increased population density (medium low) relative to 2007 (very sparse) and 2008 (sparse) (Section 4.1). These occurrences suggest a possible temporary and/or long-term beneficial impact from ground disturbance associated with construction activity relative to the rare plant population.

- For 15 of the 18 wells constructed before 1998 in relevant FONR locations, Monterey spineflower was detected in one or more subsequent rare plant surveys. This represents a minimum recurrence rate of 83 percent under the most conservative possible assumption that this species was present at all 18 sites before construction began. Similarly, sand gilia was detected at nine of the 18 wells sites detected in one or more subsequent rare plant surveys. The frequency of occurrence for sand gilia relative to Monterey spineflower in subsequent surveys suggests that well construction activities resulted in no adverse impact to the sand gilia population.
- For those wells constructed between 1998 and 2001, Monterey spineflower was detected in 1998 at eight sites included in subsequent surveys and recurred at least once in six of those sites during the 2004 – 2007 surveys. In addition, this species was detected in 2006 and 2007 at well MW-OU1-30-A although it was not identified in 1998. Only one of these wells was located within the 2009 survey area. The Monterey spineflower was detected in 2008 (MW-OU1-46-A, Table 4.2) for the first time subsequent to 1998 and in 2009, the population density increased from very sparse to medium.
- Sand gilia in this group of wells was observed at four locations included in subsequent surveys and recurred at two locations in previous surveys.

Weed control efforts were initiated through the UCSC in 2007 and continued in 2008 and 2009 as a preventive measure (Section 1.4 and Appendix B). Visual observations of the extent of the weed populations were made by UCSC field staff in regard to the effectiveness of the weed control program during 2009. These observations indicated that the weed control program had a major impact in reducing the number of invasive plants and, importantly, removing a large portion of the invasive weed seed source for 2010 (see Appendix B). This positive assessment of the effectiveness of the weed control program provides support for a continuation of these efforts in 2010.

5.0 RECOMMENDATIONS

This section presents the status of the OU-1 rare plant survey program and recommendations concerning 2010 rare plant monitoring.

Six years of annual rare plant monitoring have shown that the 2004 – 2007 construction activities associated with the expansion of the OU-1 groundwater remediation program have not significantly affected rare plant populations within the FONR. As discussed in Section 4.0, the population data during six years of rare plant monitoring do not show definable negative impacts. At some well sites, Monterey spineflower have been observed only after the disturbance created by well construction.

As shown in Figure 4.1, there has been no construction activity over the last three years in the southern part of OU-1 within the FONR. Consequently, the HGL rare plant sampling program was suspended in this region in 2007. Selected areas in the northern half of the FONR were suspended for the same reason.

The last construction effort within the FONR occurred in 2007, but was limited to trenching within existing roadways that border the adjacent grasslands to the north and east of the FONR. The trenching activity was performed to install the water transmission pipelines that connected the extraction wells to the treatment system and conveyed the treated water to recharge locations. These roadway areas represent marginal habitat for Monterey spineflower and sand gilia. Although isolated patches of the Monterey spineflower are sometimes encountered in this area (sand gilia has not been detected), the predominant pre-construction population is bare earth with occasional weeds and invasive grasses. The last construction activity within undisturbed habitat occurred during the summer of 2006.

Two years have passed since the 2007 construction of the extraction and treated water pipelines in the northeastern portion of the FONR (Figure 4.1). The pipeline routes connecting the NWTS to the FONR infiltration trenches and to well MW-OU1-87-A are in the roadway bordering the eastern grasslands. The few rare plant populations sporadically observed along this route (CH2M Hill 2004, 2005; HGL 2007a, 2008, 2009) are considered by UCSC to be of marginal value (HGL, 2006b) because of the impact of the adjacent grasslands. Consequently, HGL recommends that the third year of post-construction rare plant survey in this region required by the Habitat Management Plan be omitted.

The pipeline branches to extraction well EW-OU1-72-A, monitoring well EW-OU1-71-A, and extraction well MW-OU1-85-A extend a few hundred feet westward (Figure 4.1) into potentially more valuable habitat. However, rare plants were not detected in these areas in either the 1998 or 2004 pre-construction surveys. A sparse population of Monterey spineflower was observed in 2008 in the vicinity of EW-OU1-71-A but no other rare plant occurrences have been documented in the surveys conducted annually from 2005 through 2009. The current year survey completes the three-year post-construction monitoring period for these wells. Given the absence of rare plants in the pre-construction surveys and the proximity to the eastern grassland, HGL recommends that the 2010 survey, which would be triggered by the pipeline construction in 2007, be omitted.

The final branch of the 2007 pipeline was constructed along the access route to wells MW-OU1-46-AD, MW-OU1-84-A, IW-OU1-73-A, and IW-OU1-74-A (Figure 4.1). The access road to these wells was constructed in 2006. Well MW-OU1-46-AD was constructed in 2004 at a location adjacent to well MW-OU1-46-A and used the same access route that had been created when the latter well was installed in 2001. Thus, the impacts of habitat clearing for the initial portion of this pipeline route have been monitored for six years (from 2004 through 2009). The results are summarized as follows:

- Sand gilia was not detected in any pre- or post-construction survey.
- Monterey spineflower was present in both the 1998 and 2004 pre-construction surveys.
- Monterey spineflower was not detected in 2005 but was found in every year from 2006 through 2009 with greatest areal extent and population densities occurring in the last two years.

The survey results were similar for the individual wells MW-OU1-46-AD, MW-OU1-84-A, IW-OU1-73-A, and IW-OU1-74-A) along the access route extended westward from MW-OU1-46-AD in 2006:

- Rare plants were not detected during the pre-construction surveys at these well sites except for MW-OU1-46-AD (Monterey spineflower was present in 1998 but absent in 2004).
- Monterey spineflower was:
    - absent at MW-OU1-46-AD from 2005 – 2007 but observed in 2008 and 2009,
    - absent at MW-OU1-84-A from 2005 – 2007 but observed in 2008 and 2009,
    - absent at IW-OU1-74-A in 2005 and 2006 but observed from 2007 through 2009, and
    - absent at IW-OU1-73-A from 2005 – 2009.
- Monterey spineflower was found along portions of the 2006 access road extension in every year from 2007 through 2009.

Both the three-year post-construction well monitoring and the six-year monitoring of the original access road constructed in 2001 show that post-construction Monterey spineflower populations have approximately equaled or exceeded the pre-construction populations. Consequently, HGL recommends that the 2010 survey of this region, which would be triggered by the pipeline construction in 2007, be omitted.

The proposed pipeline extension of approximately 500 feet to IW-OU1-10-A (Figure 5.1) would be identical in scope to the previously conducted activities described above. No new areas would be cleared and the work would be conducted in accordance with the previously established procedures and environmental monitoring that were used in constructing the current system. Given the absence of impacts observed in the previous construction efforts of this nature, HGL recommends that the three-year post-construction rare plant monitoring specified in the 1999 Biological and Conference Opinion be waived.

Taken together, the above recommendations mean that rare plant monitoring will be discontinued until remediation is complete and the remediation facilities (wells and treatment plant) are demolished.

HGL further recommends continuing the weed control program in 2010. The areas in which weed control will be implemented (Figure 1.6) and the methodology used will be the same as employed in 2008 and 2009.

In addition, the following actions will be taken during routine operations to minimize habitat impacts:

- Minimize roadway traffic during quarterly groundwater sampling activities to the extent practical.
- Reduce the sampling frequency from the groundwater monitoring well network to minimize road traffic wherever such reductions can be made consistent with remediation and performance monitoring objectives for the OU-1 cleanup. This action requires regulatory stakeholder approval.

The results of the 2010 weed control activities will be described in the 2010 Annual FONR OU-1 Impact Report.

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