IMPACT ASSESSMENT METHODOLOGY FOR HABITAT AND RARE SPECIES AT FONR AND SURVEY RESULTS FOR 2005 GROUNDWATER REMEDIATION AT OU-1 FRITZSCHE ARMY AIRFIELD FIRE DRILL AREA FORMER FORT ORD, CALIFORNIA

Prepared for

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Sacramento District
1325 J Street
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GROUNDWATER REMEDIATION AT OU-1
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LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS

ACL	aquifer cleanup level
BRAC	Base Realignment and Closure
CalEPA	California Environmental Protection Agency
Cal-IPC	California Invasive Plant Council
CDFA	California Department of Food and Agriculture
CDFG	California Department of Fish and Game
COC	contaminant of concern
EM	environmental monitor
FDA	Fire Drill Area
FONR	Fort Ord Natural Reserve
FPRI	Fixed-price Remediation with Insurance
GAC	granular activated carbon
GIS	geographic information system
GPS	global positioning system
GWETS	groundwater extraction and treatment system
HGL	HydroGeoLogic, Inc.
HLA	Harding Lawson Associates
HMP	Habitat Management Plan
LTM	long-term monitoring
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 at Santa Cruz
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Services
VOC	volatile organic compound

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1.0 INTRODUCTION

HydroGeoLogic, Inc. (HGL) is executing Delivery Order CM01 entitled "Fixed-price Remediation with Insurance (FPRI) Delivery Order for Operable Unit (OU)-1, Former Fort Ord, California" for the U.S. Army Corps of Engineers (USACE)-Sacramento District under Contract Number DACA45-03-D-0029. This contract is administered through the USACE-Omaha District) and was initiated in December 2003. The objectives of this FPRI effort are the same as those of the Record of Decision (ROD) signed in July of 1995 by the Army, U.S. Environmental Protection Agency (USEPA), and the California Environmental Protection Agency (CalEPA). The primary remediation objectives specified in the ROD are 1) to attain hydraulic control and containment of contaminated groundwater and 2) to extract and treat groundwater exceeding aquifer cleanup levels (ACLs). The project has the additional constraint that activities undertaken to achieve the OU-1 cleanup 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) between 1962 and 1985 resulted in release of contaminants to soils and groundwater. Although 10 separate volatile organic compounds (VOCs) have been identified as a contaminant 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 June 2005. The area surrounding the OU-1 contaminant plume is part of the University of California Natural Reserve System (UCNRS) designated as the FONR.

1.1 IMPACT ASSESSMENT/SURVEY OBJECTIVES

The objectives of the 2005 impact assessment and survey were to: 1) identify the locations and estimate the population at each location for Monterey Spineflower and Sand gilia within the remediation project area of OU-1 within the FONR; 2) to map Monterey Spineflower and Sand gilia population locations (so that project activities could avoid or minimize working in those areas to the extent possible); 3) to develop impact methodology to assess the impacts of future project construction activities in FONR; and, 4) to assess and report impacts from the 2005 project activities.

1.2 SITE DESCRIPTION

Fort Ord was established in 1917 as a military training base for infantry troops. The former Fort Ord is located near Monterey Bay 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.

In January 1991, the Secretary of Defense announced the downsizing/closure of the base. In August 1994, portions of the property were transferred to the University of California and the 605-acre FONR was established in June 1996.

The FONR area potentially impacted by the construction of OU-1 remediation facilities is approximately 130 acres in the southwestern corner of the former Fritzsche Army Airfield, west of Imjin Road and north of Reservation Road. The dominant habitats in this area include coast live oak woodland, maritime chaparral, and annual grassland. The history of the use at this site is presented in the Draft Operable Unit 1 Project Management Plan, Fritzsche Army Airfield Fire Drill Area, Former Fort Ord, California (HGL, 2004). The maritime chaparral is a rare habitat endemic to the Monterey Bay region and largely dependent on the former Fort Ord land for survival.

Several federally-protected rare, threatened or endangered (RTE) plant species are present within the FONR, including the endangered Sand gilia (*Gilia tenuiflora ssp. arenaria*) and the threatened Monterey Spineflower (*Chorizanthe pungens var. pungens*). Several plant and animal species of concern (SOC) are also present in the FONR. Plant species of concern include coast wallflower, Eastwood's *ericameria*, Monterey *ceanothus*, Sandmat manzanita, and Toro manzanita. The California black legless lizard and the Monterey ornate shrew are animal SOCs.

The northern boundary of OU-1 is adjacent to a large expanse of 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. The spread of invasive species into newly disturbed areas could result in population declines of the federally-listed plants, especially Sand gilia, which is less tolerant of plant cover than the Monterey Spineflower

1.3 SITE ACTIVITY SUMMARY

The HGL FPRI contract was awarded in December 2003. During 2005, field activity consisted of the following actions:

- Installing two piezometers (MW-OU1-46-AD2 and PZ-OU1-10-A1);
- Drilling and abandoning of two soil boring (SB-OU1-60-A and SB-OU1-46A1);
- Conducting three pumping tests;
- Conducting step-drawdown tests at four previously existing wells along the northwest Boundary Road;

- Routine sampling of existing wells as part of the quarterly groundwater long-term monitoring (LTM) program; and
- Performing one geophysical resistivity survey along the northwest Boundary Road.

The 2005 soil boring and well construction locations are shown on Figure 1.3 along with the previously existing wells installed by HGL and others. Project planning for field activities was conducted in cooperation with U.S. Fish and Wildlife Service (USFWS) (via the Fort Ord Base Realignment and Closure [BRAC] Office) and the University of California Santa Cruz (UCSC) FONR stewards.

Site activities within the FONR that were conducted as part of the HGL FPRI remediation, and the subsequent impact prevention and mitigation measures, are described in the following sections.

1.3.1 2005 Site Activities

Site activities included driving vehicles on designated roads, drilling soil borings, pumping water from existing wells, installing new wells and piezometers, and quarterly well sampling. The 2005 activities were conducted in locations devoid of known Monterey Spineflower of Sand gilia populations. Direct or potential impacts to known rare plant populations were thus limited to those associated with vehicle travel across existing roadways while gaining access to the work sites. The Biological Opinion (1-8-01-F-70R) did not consider driving on access roads during the dry-season to have a deleterious impact to Sand gilia or Monterey Spineflower.

1.3.2 Impact Prevention/Mitigation Measures

Activities in the FONR have been limited to those that are essential to the completion of the remediation goals for the project. The remedial design and construction as well as remedial actions are being planned and conducted 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 remedial action(s) includes:

- 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 [HLA], 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)
- Guidance and direction from UCNRS staff
- Former Fort Ord Habitat Management Plan (HMP) (U.S. Army, 1997)

In order to avoid or minimize impact to the FONR during ecologically sensitive periods (e.g., the rainy season, typically ranging between November and April), construction will be scheduled at other times insofar as possible within the overall project constraints. Additional specific

mitigation measures that have been taken to date and that will continue as standard procedure are described in the following sections.

1.3.2.1 Pre-construction Surveys

In order to minimize potential impacts from remediation activities, biological surveys were conducted in 2004 and 2005 for those portions of the FONR that were thought most likely to be impacted by the groundwater extraction and treatment system (GWETS). The plant populations surveyed were mapped and considered by the design team when selecting locations for new wells, piezometers, pipeline routes, and treatment/recharge facilities. The results of those surveys (conducted by CH2M Hill staff) were presented in Appendix A of the Draft Remedial System Modification Plan, Operable Unit 1, Fritzsche Army Airfield Fire Drill Area, Former Fort Ord (HGL, 2004a) for the 2004 survey and in the 2005 Monterey Spineflower and Sand Gilia Survey Results Fort Ord Operable Unit 1, Former Fort Ord, California (CH2M Hill, 2005). Plant populations identified in similar surveys conducted by UCNRS staff or others (intermittently since 1998) were also reviewed.

1.3.2.2 Impact Avoidance

The locations of plant populations identified in the biological surveys conducted by HGL/CH2M Hill and others were considered in selecting locations for the monitoring wells installed by HGL in 2004 and 2005. This information has been, and will continue to be used to select well and facility locations that avoid Monterey Spineflower and Sand gilia populations. The draft design of the GWETS, for example, was able to avoid excavation in each of the Sand gilia and Monterey Spineflower populations identified in the 2004 Baseline Survey (HGL, 2004a).

No new wells were constructed within any of the population boundaries identified in the 2004 or 2005 surveys. In one instance, a proposed well location was re-located approximately 1,000 feet from its original location because of potential impact to Monterey Spineflower and Sand gilia populations. Fewer than 10 percent of the Sand gilia or Spineflower populations in the HGL 2004 and 2005 surveys lie within 50 feet of current or proposed construction activity or access route. A species population was included in that 10 percent estimate if part of its boundary fell within the 50-foot window; for many populations, the overwhelming majority of the area lies greater than 50 feet away from the proposed disturbance.

Although the final design of the remediation groundwater treatment system is still evolving, it is expected that facilities can be located and pipelines routed so that the overwhelming majority of surveyed Monterey Spineflower and Sand gilia populations will be avoided.

1.3.2.3 Proactive Construction Techniques to Minimize Impacts

The construction effort has adopted a range of techniques, actions, and policies that minimize or prevent environmental damage. The following rules have been implemented for past activities and will govern future site construction activity:

- Where construction is required in the vicinity of known populations of protected species, the sensitive areas will be identified in advance by emplacing small flags or temporary

fencing to delineate the boundary of the area to be avoided. Construction personnel will keep out of exclusion areas thus marked on the ground or evident on aerial photos.

- Stay in or on designated routes, locations, corridors or work areas whenever possible.
- Drive on existing roadways whenever possible.
- Use approved access roads only. Close and lock all entrance and exit gates. The contractor supervisor will log in and out for his or her group.
- Implement protective measure(s) to protect wildlife. For example, open trenches may trap wildlife. Therefore, the general practice will be to dig, place, test connections, and cover sections of trench in the same workday. Inspect trenches and surface well locations prior to work and provide escape ramps for wildlife as needed.
- Carefully remove from harm's way any RTE SOC wildlife if encountered during field activities. Species will be carefully removed and deposited on the ground surface as near to their original location as possible but outside the work area. Each encounter with a California black legless lizard or tiger salamander will be documented on a form provided by the HGL Field Supervisor and submitted to the Fort Ord BRAC Office.
- Inform the on-site environmental monitor (EM) and the HGL field supervisor if a species of concern is found in a designated work area. Follow the instructions of the on-site EM and the HGL field supervisor as to how to address this situation.
- Do not litter. Remove trash from the job site on a daily basis.
- No pets or hunting are allowed.
- No fires are allowed. Report any smoke or open flame immediately to the subcontracting supervisor and to the HGL field supervisor. Keep fire fighting equipment in good operating order and readily available.
- Smoke only in approved areas or in vehicles. Do not drop cigarette butts on the ground to put out.
- Do not feed or disturb wildlife. Report mountain lion (or other dangerous animal) sightings immediately to the subcontracting supervisor, to the HGL field supervisor and to the on-site EM.
- Clean up and report any hazardous material spills immediately. Note that no hazardous material use is anticipated. Spills would most likely be the result of equipment malfunction, such as a ruptured hydraulic line.
- Keep fluid spill containment and clean up materials readily available.
- Do not discharge water or drill cuttings into unapproved areas. Drill cuttings will be placed in bins for transport to the off-site disposal facility.
- Keep equipment either in approved work areas or travel corridors, or in approved staging and storage areas.
- Do not stage, park, or move vehicles or equipment within drip lines of oak trees, except at those trees authorized for removal.
- Do not grade within drip lines of oaks not slated for removal. If project activities necessitate the removal of standing dead trees, these will be removed to an adjacent offsite area.

- Keep vehicle speeds to a minimum (< 10 miles per hour) in the FONR.
- All flagging and/or temporary fencing installed during construction will be removed shortly after project completion.

1.3.2.4 Field Environmental Monitor

The BRAC Office will approve biologists who will act as EMs during the field activities on the FONR. The role of the environmental monitors is to make sure that field personnel follow the environmental mitigation guidelines discussed below, and to assure that protected species will not be harmed by project activity. These EMs will conduct the majority of field compliance monitoring tasks under the supervision of the BRAC Office.

The EMs will have the authority to stop project work on the FONR if non-compliance with environmental regulations or non-compliance with environmental mitigation measures occurs. In such case, the EMs will then notify BRAC and the HGL field supervisor regarding corrective actions needed to return the project to environmental compliance. The EMs will:

- Assist in identifying and clearly delineating the least damaging access routes, turn-around locations, work zones, pipeline trench corridors and equipment/material staging areas. The EMs will be consulted prior to changing designated routes, locations, corridors or areas.
- Monitor onsite work as necessary to assure environmental mitigation measures are implemented, and to advise on resolution of unanticipated environmental issues as they arise.
- Instruct the field personnel how and where to place cut vegetation that is cleared for new drill pads, access roadways and pipeline trenches.
- Advise construction crews on how best to avoid adverse impacts to environmental resources.
- Notify and coordinate with BRAC and with the HGL field supervisor in the event of non-compliance with environmental regulations or mitigation efforts, and will stop Project work if necessary.
- Provide advice regarding interim surface erosion control measures as needed.

1.3.2.5 Worker Training

The worker environmental awareness training program provides an overview of:

- the sensitive biological resources in the project area,
- environmental laws and penalties,
- general environmentally-protective work practices,
- the responsibilities of project personnel and monitors, and
- of who to contact in case an environmentally-related situation arises, or if a field worker has an environmentally-related question.

Each worker is given a handout that summarizes environmental issues at the site relative to the construction program and undergoes an orientation session before starting work at the site. The handout includes photographs, descriptions of each of the plant or animal species of concern and a contact list with phone numbers to facilitate communication in the event of questions. The handout also summarizes the work procedures to be followed to minimize impacts.

1.3.2.6 Recharge Method to Mitigate Impact

Three options for recharge of treated water were considered for the draft remediation design: spray irrigation (current practice), use of injection wells, and infiltration through a seepage trench. All three are technically feasible at the site.

Recharge through seepage trenches was selected as the preferred method for returning treated water to the A-Aquifer. In contrast to the existing method of spray irrigation, seepage trenches will not support growth of undesirable weeds (i.e., ice plant) nor provide a water source for wildlife. According to UCSC personnel, deer feeding on ice plant at the existing spray irrigation site have helped to spread ice plant across a greater area within the FONR (Fusari, 2005). The grassland area to the northeast of the principal Monterey Spineflower and Sand gilia habitat provides ample space for construction of recharge facilities and enables HGL to locate the necessary new facilities outside the most important FONR habitat.

1.4 FUTURE ACTIVITIES

Additional remediation activities necessary to continue cleanup of groundwater at OU-1 include the following activities.

1.4.1 Ongoing Groundwater Remediation

The OU-1 groundwater remediation system currently consists of two extraction wells (EX-OU1-17-A and EX-OU1-18-A) and a granular activated carbon (GAC) treatment system. These wells and the treatment units are sampled bi-monthly and the treatment system is inspected weekly. Carbon is replaced in the GAC units on an as-needed schedule in response to the effluent quality sample data. The treated effluent is recharged to the groundwater through a spray irrigation system within the FDA area. Treated groundwater COC concentrations in the source area and the extraction system capture zone have been steadily decreasing over the years.

1.4.2 Groundwater Long-term Monitoring Events

Many of the 72 existing wells and piezometers are included in the LTM program to track groundwater quality. Sampling within the LTM program is conducted quarterly, although individual wells may be sampled on a quarterly, semi-annual, or annual frequency. Table 1.1 lists the current sampling frequency for each well.

1.4.3 Near-term New Construction

Six new extraction wells and five additional monitoring wells are planned for construction along the northwest Boundary Road to prevent plume migration across the former Fort Ord geographic

boundary. A new treatment plant is planned for construction in the grassland area northeast of the main FONR Monterey Spineflower and Sand gilia habitat. Treated effluent from the new treatment plant will be returned to the groundwater through infiltration trenches constructed to the northeast of the new treatment plant site and parallel to the northwest Boundary Road. The planned location of these wells and facilities are shown in Figure 1.4.

Additional information on the proposed northwest Boundary Road construction is presented in the Draft Work Plan, Hydraulic Control Pilot Project, Operable Unit 1, Fritzsche Army Airfield Fire Drill Area Former Fort Ord, California (HGL, 2005). Construction is expected to begin in February 2006 and be completed in mid-April 2006. Although the proposed construction period is within the rainy/blooming season for the protected plant species, the project location is at the northwest edge of the FONR and field surveys indicate that the presence of protected plant species is minimal. Discussions with UCSC FONR stewards verified that construction activity in this area and during this period would be acceptable for minimizing potential habitat and species impacts (Fusari, 2005).

1.4.4 Future Construction

Additional construction within the FONR may be required in the future to complete the construction of the GWETS to achieve the ROD cleanup goals. The design for this effort is currently in progress. The schedule for this action will be determined in consultation with the UCSC FONR staff.

2.0 OVERVIEW OF 2005 RARE PLANT SURVEY RESULTS

Rare plant surveys were conducted in May 2005 to identify the locations of two federally listed plant species. Habitat assessments to monitor invasive species were performed in June 2005. This section provides an overview of the results of those surveys. Complete results and detailed discussion are provided in the Monterey Spineflower and Sand Gilia Survey Results Fort Ord Operable Unit 1, Former Fort Ord, California. (CH2M Hill, 2005).

Before initiating the surveys, known populations of Sand gilia and Monterey Spineflower were examined in the field with Sean Mc Stay, the FONR Steward, to determine the flowering status and ensure proper identification of both species. The timing of the survey May 2005 was determined to be approximately two weeks past the peak blooming period for Sand gilia. It was determined that populations of Sand gilia would likely still be identifiable in the field, but that individual counts could be significantly reduced compared to the number of plants present earlier in the season.

CH2M Hill staff performed the surveys (under subcontract to HGL) to map the geographical extent and to estimate the size of Sand gilia and Monterey Spineflower populations within designated areas. Individual Sand gilia plants and small populations of Monterey Spineflower were mapped as global positioning system (GPS) points and the number of plants was enumerated for each mapped population. Rare plant locations and vegetation monitoring plots were mapped in the field using a Trimble GeoXT GPS. The survey boundaries were identified on a georeferenced background aerial image, which was also used for navigation during the surveys.

Large populations of Sand gilia and Monterey Spineflower were mapped as GPS polygons. Polygon boundaries were mapped based on the both the maximum distribution of Monterey Spineflower at a given location and the density of the plants as determined by areal cover estimates.

Individual plant counts were made for all Sand gilia populations, but counts of Monterey Spineflower were determined only for small sub-populations (i.e., comprising five or fewer easily distinguished individual plants). Density estimates were made for large populations of Monterey Spineflower based on percent absolute cover classes; Very Sparse (corresponding to an absolute cover of less than three percent), Sparse (3-25 percent), Medium (26-75 percent), Medium High (76-97 percent), or Very High (>97-100 percent). This percent cover classification method was recommended for use by Dr. Maggie Fusari, Director of UCSC Natural Reserve Program. GPS data was then exported to a geographic information system (GIS) database and mapped on high resolution aerial photograph base maps.

2.1 SAND GILIA

Sand gilia were observed at 102 locations during the May 2005 survey. Population size estimates ranged from single isolated individual plants up to approximately 100 plants, with an average of 5 plants per population (see Figures 1 – 9 of the Draft Results of the 2005 Monterey Spineflower and Sand Gilia Surveys [CH2M Hill, 2005]). Mapped areas consisted of 29 polygons with between 4 and 100 plants, and 73 GPS points with 1 to 8 plants per point. Only 16 locations had populations of 10 or more Sand gilia and only 2 of those exceeded 25 plants (50 were seen at

location G004 and 100 at G008). Most locations (66 out of 102; or approximately two-thirds) had fewer than 5 plants.

Sand gilia was found in open sandy areas and along access roads in the coast live oak woodland and maritime chaparral habitats, but was not observed in areas with dense woody vegetation or high cover of non-native annual grasses. Sand gilia was typically found growing in large open areas with coarse, sandy soil and relatively sparse vegetative cover in the coast live oak woodland habitat. In the maritime chaparral habitat, Sand gilia was primarily observed in openings and at the edges of manzanita shrubs in sandy coarse soils. All observed populations were found in areas that also contained Monterey Spineflower. Common associated species include filaree (*Erodium spp.*), sandmat (*Cardionema ramosissimum*), annual fescue, rip-gut brome, trefoil (*Lotus sp.*), and occasionally sandmat manzanita, but total plant cover associated with Sand gilia observations was generally low.

2.2 MONTEREY SPINEFLOWER

A total of 203 sub-populations of Monterey Spineflower were observed within the survey area. Approximately 36 percent (74 out of 203) of these were small populations (ranging from 1 to 5 individuals) that could be easily counted. Approximately half of the small populations (39 out of 73) contained only a single plant. Small populations were mapped as GPS points and direct plant counts were made for these populations. The remaining 128 locations were larger populations that were mapped as polygons.

Plant density estimates in the polygon areas were typically very sparse (less than 3 percent absolute cover) to sparse (3-25 percent absolute cover). Approximately 90 percent of the polygon areas (182 of the 203 populations) fell in these two categories. Very sparse populations outnumbered sparse populations by 2:1 (60 percent of the total versus 30 percent). Note that all of the populations with individual counts are also included by definition in the "very sparse" category. The remaining polygons were medium density (absolute cover between 25 and 75 percent) with a single high-density (75-97 percent absolute cover) population at polygon S100.

Monterey Spineflower was observed in all habitat types 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 found 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 micro-sites around the perimeter of shrubs, small areas of disturbance, and along existing access roads, but was also observed in grassy areas near the Armstrong Ranch fence. Common associated species include stork's bill geranium (*Erodium botrys*), sandmat, annual fescue, rip-gut brome, and catchfly (*Silene gallica*). 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.

2.3 HABITAT AND INVASIVE SPECIES

Habitat and invasive species monitoring was conducted in June 2005 at 25 reference monitoring plots. Total vegetative cover observed in the monitoring plots ranged from 46 to 90 percent with

average cover approximately 70 percent. Total annual grass cover was at approximately 16 percent with a range in total cover from 0 to 45 percent.

Italian thistle (*Carduus pycnocephalus*) was the only California Department of Food and Agriculture (CDFA) listed noxious weed species observed in the monitoring plots. This species was found only in monitoring plot P25, with an estimated five percent cover. Italian thistle has a "C" ranking on the CDFA noxious weed list, indicating that it requires State-endorsed holding action and eradication only when found in a nursery. An additional 9 invasive species, listed by California Invasive Plant Council (Cal-IPC), were observed in 23 of the 25 monitoring plots, as follows:

- Red brome was the only high ranked species and was observed in 4 plots with cover ranging from 1 to 10 percent.
- Medium ranked species observed were:
  - Rip-gut brome was observed in 18 plots with estimated cover between 1 and 40 percent
  - Wild oat was observed in 8 plots with cover between 1 and 24 percent
  - Sheep sorrel (*Rumex acetosella*) was observed in eight plots with cover between one and 10 percent.
- The remaining 5 low ranking species were:
  - Stork's bill geranium (*Erodium botrys*), observed in 13 plots with cover between one and 40 percent
  - Annual fescue was observed in 12 plots with cover between 1 and 15 percent
  - silver hairgrass (*Aira caryophyllea*) was observed in 8 plots with cover ranging from 1 to 10 percent
  - Soft chess was observed in 4 plots with cover between 1 and 24 percent
  - Red-stem filaree (*Erodium cicutarium*) was observed in 1 plot with an estimated relative cover of 2 percent.

Cut-leaved plantain (*Plantago coronopus*) is not listed by the CDFA or Cal-IPC, but is considered to be an invasive species in the FONR, was observed in 18 of the plots with cover between one and 20 percent.

Cape (German) ivy (*Delairea odorata*) was observed within Area A during the rare plant surveys, but was not encountered in any of the monitoring plots. Cape ivy has a severe ecological impact on ecosystems, plant and animal communities, and vegetation structure, and is therefore ranked high on the Cal-IPC list of invasive non-native species.

The northern boundary of OU-1 is adjacent to a large expanse of non-native grassland and non-native grasses and weedy forbs (herbaceous plants) are already present throughout much of OU-1. Transmission of non-native grasses into OU-1 is accelerated by the prevailing winds, which blow the seeds from the annual grassland habitat north of the FONR to the south and into the OU-1 area (Fusari, 2004). The spread of invasive species, especially non-native grasses, into

newly disturbed areas could result in population declines of the federally-listed plants, Sand gilia in particular, as it is less tolerant of plant cover than the Monterey Spineflower.

A Biological Information Report (HLA, 1998) for activities within the FONR considered invasion by non-native plant species such as ice plant (*Carpobrotus edulis*) and rip-gut brome among the principle threats to the long term survival of both Sand gilia and Monterey Spineflower. Ice plant was noted to be of particular concern because it forms dense, continuous mats of vegetation with few or no open spaces, and once established can spread rapidly by vegetative means. This species was not observed in any of the monitoring plots or survey areas in 2005.

2.4 SPECIAL STATUS WILDLIFE SPECIES

Several California coast horned lizards were observed in scattered locations throughout OU-1 during the 2005 surveys. This species is a federal and California state species of concern. The frequency of these incidental sightings suggests that the California coast horned lizard may be fairly common within OU-1. Several active dens of American badger (*Taxidea taxus*), also a California state SOC, were observed during the surveys.

3.0 IMPACT ASSESSMENT METHODS

This section describes the monitoring and evaluation procedures that will be used to evaluate the potential effects of groundwater remediation activities in the FONR on the rare plants and natural habitat at the site. Monitoring methods and impact thresholds for Sand gilia (*Gilia tenuiflora ssp. arenaria*), Monterey Spineflower (*Chorizanthe pungens var. pungens*), and invasive species are provided, followed by a discussion of proposed restoration activities.

Twenty-five monitoring plots were established during the 2005 Rare Plant Survey to provide quantitative data on the rare species in areas in which pipeline construction will occur (referred to as impact plots) and to allow comparison of these data to plots located in unimpacted areas (referred to as reference plots). Because most of the impacts from construction of the remedial system will occur adjacent to the roadway, thirteen of the impact plots are located next to the main access road. Seven "off-road reference" plots were located in areas that would not be subject to disturbance from access routes but that otherwise provide habitat comparable to that in potential work areas. Five plots were installed adjacent to access roads that are not expected to be used, and these are referred to as "roadway reference" plots.

The configuration and location of the remedial system pipeline within the existing roadway required the use of narrow plots, rather than the larger square plots used currently by FONR for annual rare plant monitoring. Figure 1.4 shows the locations of those reference plots in the vicinity of the proposed Hydraulic Control Pilot Project (Plots 21 – 25). The remaining plot locations are shown on Figures 1 through 9, contained in Appendix C of the Monterey Spineflower and Sand Gilia Survey Results Fort Ord Operable Unit 1, Former Fort Ord, California. (CH2M Hill, 2005), provided under a separate cover.

In each of the monitoring plots, Monterey Spineflower density was recorded using the plant cover categories corresponding to an absolute cover of plants in a given area: Very Sparse (less than 3 percent), Sparse (3-25 percent), Medium (26-75 percent), Medium High (76-97 percent), or Very High (>97-100 percent). These categories are based on monitoring protocols established by FONR for tracking this species. Sand gilia plants were individually counted in each reference plot.

The remedial system layout was designed to minimize direct impacts to rare plant patches (i.e., mapped polygons) to the maximum extent possible. Therefore, very few Sand gilia and Monterey Spineflower patches (as mapped during 2004 and 2005 spatial extent surveys) may potentially be directly impacted. Only two of the twenty-five plots (one reference plot and one impact plot) contained Sand gilia. Because data on direct impacts to Sand gilia are limited because of the limited number of patches observed and the avoidance of those areas when locating remedial facilities, the monitoring system was designed primarily to determine if indirect impacts to the species will have occurred over the post-construction three-year monitoring period. Indirect impacts (e.g., suitable habitat alteration) to rare plant patches located nearby the construction areas potentially could occur due to invasion of noxious weeds or non-native grass species (referred to collectively as invasive species). Alternatively, if the disturbed areas remain sparsely vegetated, and weed encroachment does not occur, it is also possible that

disturbance related to remediation activities may create new suitable habitat for the colonization of new patches.

3.1 IMPACT ASSESSMENT METHOD FOR SAND GILIA AND MONTEREY SPINEFLOWER

In accordance with the HMP (U.S. Army, 1997), HGL will perform annual monitoring of Monterey Spineflower and Sand gilia in each of the 25 monitoring plot locations for three successive years after construction of the remedial system. Annual rare plant monitoring will be conducted during the spring when rare plants are in bloom and, therefore, most readily identifiable. In each of the monitoring plots, Monterey Spineflower density will be determined based on areal cover within the plot and the total number of Sand gilia plants will be determined by individual counts as was done during the baseline studies.

One objective of the remediation project is to avoid rare plants to the maximum degree possible. Because these plants persist over time as seed bank, the exact location of a patch moves from year to year. Therefore, in addition to monitoring at plot locations, pre-disturbance surveys will be conducted for Sand gilia and Monterey Spineflower in the spring before construction commences along the main pipeline road in July, where the majority of site disturbance will occur. Any new locations of Sand gilia and Monterey Spineflower patches observed during the surveys will be avoided to the maximum extent possible during work activities.

3.1.1 Sand Gilia Direct Impact

Due to the population dynamics of Sand gilia described above, an impact threshold based on individual plant numbers for Sand gilia is not proposed; however these data will be collected during monitoring. The significance criteria to determine whether an impact to Sand gilia has occurred will be based on the presence or absence of the species in the reference plots.

Seven reference plots were located within or very close to Sand gilia patches (based on 2004 and 2005 rare plant data). If Sand gilia are found in the two impact monitoring plots (P-1 and P-15; populations of four and five, respectively) where they were detected in 2005, it will be presumed that no direct impact to Sand gilia has occurred as a result of construction. If Sand gilia are absent from the reference plots it will be presumed that no direct impact has occurred as a result of construction.

If Sand gilia is not detected in the two impact plots but is present in the reference plots over the three-year monitoring period, it will be assumed that a direct impact to Sand gilia has occurred. The impact will be discussed with the resource agencies, including the California Department of Fish and Game (CDFG) and the USFWS and FONR staff, to determine the significance of the impact relative to the number of populations and plants within FONR and evaluate if the loss will adversely affect the species or violate provisions of the Biological Opinions.

Monitoring methods to detect indirect impacts (e.g., suitable habitat alteration) to Sand gilia are described in Section 3.2 as part of the noxious weed and non-native grass monitoring program.

3.1.2 Monterey Spineflower Direct Impact

Monterey Spineflower is less responsive to micro-habitat variation and is more abundant within OU-1; therefore, a trend analysis of plant density counts in this species can be performed. Monterey Spineflower was detected in 22 of the 25 monitoring plots. Annual monitoring within established plots will be performed for three years post-installation of the remedial system. Density categories for Monterey Spineflower will be estimated from visual observations in accordance with protocols established during the 2005 monitoring.

The results of density categories (in terms of average percent change) within impact plots will be compared to reference plot findings. If there is a substantial difference in plant density between reference populations and impact populations (beyond the difference that may exist between these two baseline data), it will be assumed that a direct impact to Monterey Spineflower has occurred. The definition of substantial difference (direct impact) in plant density is a greater than two category decline in density (e.g., from medium high to sparse) in the 2005 Impact Plots.

Monitoring methods to detect indirect impacts (e.g., suitable habitat alteration) to Monterey Spineflower are described in Section 3.2.

3.2 HABITAT AND INVASIVE SPECIES MONITORING

The term invasive species is used herein to refer to both non-native grasses (believed to be the primary threat), and other species that may be considered noxious weeds by the resource or other agencies. Both Sand gilia and Monterey Spineflower require sandy substrates that are sparsely vegetated. In portions of the FONR, and in some areas within OU-1 in which disturbance has occurred, suitable Sand gilia and Monterey Spineflower habitat has been colonized by non-native grass species or other forbs, making the habitat unsuitable for Sand gilia and Monterey Spineflower.

Construction-related impacts may increase the potential for or accelerate the rate of invasive species encroachment and indirect impacts to the two rare plant species. Thus, a decrease in plant number or density, or loss of the plant patch may occur. The monitoring plots established for the Sand gilia species counts and Monterey Spineflower density estimates will also be used to determine whether invasive species are colonizing potentially suitable rare plant habitat. Monitoring methods are described below.

Monitoring of invasive species encroachment will be performed in a semi-qualitative manner in the 25 permanent monitoring plots that were established in 2005. Data on invasive plant species will be collected when the majority of the species are in flower or otherwise readily identifiable. Visual estimates of the total absolute percent cover for each plant species rooted within the 1-meter x 2-meter meter plots will be recorded. The percentage of bare ground and litter will also be noted. Photographs will also be taken as a visual record of each plot.

The proposed decision steps to determine if weed control actions are necessary are similar to that for rare plants, except that action will be triggered by population increases rather than decreases. For the purpose of evaluation of invasive plant impacts, only those non-native species that are considered to be a threat to the rare plants would be included in the impact analysis.

Similar to the rare plant monitoring, average absolute percent cover data from the impact plots will be compared to data collected in reference plots. Plant cover data for the individual reference plots is presented for reference in Table 3.1. If there is an increase of less than 30 percent in the total cover of invasive plant species in the impact area plots as compared to reference plots, the indirect impact to the habitat and rare plants would be considered less than significant and no weed control activity would be required.

At the end of the three-year monitoring period, if the total cover of invasive species in impact plots is more than 30 percent higher than the cover values of the invasive species in reference plots and Monterey Spineflower has declined by one or more categories in a majority of the impact plots, then remedial action would be required. However, if the reference plots show similar increases in invasive species, then no weed control or other actions would be required.

4.0 CONCLUSIONS

Remediation activities in 2005 were limited to installation of two additional piezometers, two soil borings that were abandoned, quarterly sampling of wells as part of the LTM program (Table 1.1), one non-invasive geophysical survey along a part of the northwest Boundary Road adjacent to the grassland area, and performance of three pumping tests at existing wells. One additional field activity was completed in mid-November. During this activity water was pumped in step-drawdown tests from four existing monitoring wells along the northwest Boundary Road and discharged to the ground after treatment via a perforated pipe temporarily placed on the ground surface in the same manner as the previously completed pumping tests described in Section 1.4.5. Unlike the pumping tests, these activities lasted only three to six hours at each well.

Each of the 2005 activities were conducted at locations devoid of known Monterey Spineflower or Sand gilia populations. Direct or potential impacts to known populations were thus limited to those associated with vehicle travel across existing roadways while gaining access to the work sites. The Biological Opinions did not consider driving on access roads during the dry-season to have a deleterious impact to Sand gilia or Monterey Spineflower, due to the habitat requirements of these species (seral species adapted to periodic disturbance and shifting sands) (HLA, 1998). The pumping test conducted at MW-OU1-57-A was conducted in March 2005; however, the location of this well (on the northwest Boundary Road) allowed the activity to proceed with negligible potential habitat impact. The current procedures and measures have been effective in protecting the existing FONR habitat and rare plant species.

Even with the protective measures outlined herein, complete avoidance of all the populations within OU-1 is not practical given the large number of populations present and their broad distribution throughout the OU-1 area. With the implementation of the mitigation measures outlined in the Natural Resource Protection Plan (Appendix B, HGL, 2004a), in Section 1.3.2 of this document, and in the Biological Information Report (HLA, 1998), remediation impacts are not expected to result in the decline of Sand gilia or Monterey Spineflower populations; however, the loss of some individual plants within impacted populations may occur.

5.0 RECOMMENDATIONS

In the event that remedial action impacts lead to implementing restoration actions in response to a decline in either Sand gilia or Monterey Spineflower or a significant increase in invasive plant species, a Restoration Plan would be presented to BRAC and FONR staff for review. Adjustments would also be made as needed to assure compliance with the March 30, 1999, Biological Opinion. The specific restoration action(s) would be described in detail in that plan but are expected to generally proceed as described below. Refinements of these general actions to address site-specific conditions would be made as part of the restoration mobilization effort.

If the primary cause of population decline appeared to be competition from invasive species, then weed control or other approved actions would be undertaken at the sites included in the Restoration Plan. Weed control actions may include any of the following:

- Application of herbicide, such as "Fusillade" or another monocot-specific herbicide that may be effective against weeds and safe for Sand gilia and Monterey Spineflower.
- Hand removal of weeds.
- Implementation of other approved weed removal actions.

Environmental monitoring would continue for a minimum of one year to measure the success of the weed removal effort and the species response. Proposed weed control efforts would be documented in the annual environmental survey reports. Results from initial weed control efforts would determine the need for further restoration action(s).

If direct impacts resulted in a species decline, then direct measures to replant Sand gilia and Monterey Spineflower would be undertaken. Replanting would be coordinated with BRAC and FONR, and other agencies as appropriate. Seed bank or seed that is hand collected from thriving populations will be used to grow new plants under either greenhouse or field conditions. However, direct seeding may also be used, if deemed appropriate. Environmental monitoring would continue for two years after seeding or planting to evaluate the success of the restoration effort.

Recommendations for SOC protection during 2006 activities are:

- Continue current construction policies and mitigation measures described in Section 1.4.5.
- Finalize (through consultation with UCSC, BRAC, and USFWS/CDFG staff as appropriate) the impact assessment methods and restoration criteria presented in Section 3.0 by 01 March 2006;
- Continue co-ordination efforts with UCSC FONR staff to identify timing and location of monitoring and construction activities;
- Select 2006 rare plant survey and impact monitoring locations based on design of remedial system for remainder of FONR area affected by OU-1 groundwater plume;

- Revise location(s) of reference plots for pre-construction survey as needed to correspond to the design of overall remedial system.

6.0 REFERENCES

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