



**2002 Annual Monitoring Report
Biological Baseline Studies and
Follow-up Monitoring
Former Fort Ord
Monterey, California**

Prepared for

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1325 J Street
Sacramento, California 95814-2922

MACTEC Engineering and Consulting Project No. 55074 00171


Thomas Graham
Staff Environmental Scientist


Michael Johnson
Senior Project Environmental Scientist

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Engineering and Consulting, Inc.
90 Digital Drive
Novato, CA 94949 - (415) 883-0112

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DISTRIBUTION

1.0 INTRODUCTION

In support of habitat management and monitoring requirements presented in the *Installation-Wide Multispecies Habitat Management Plan for Former Fort Ord, California* (HMP; USACE, 1997a), biological resources are monitored after ordnance and explosive (OE) removal, or after lead, chemical or groundwater remediation activities have been completed. The HMP identifies flora species, fauna species, and habitats of concern within the Former Fort Ord installation. The HMP also specifies mitigation measures to monitor the regeneration of these species and habitats following OE removal or the completion of lead, chemical and groundwater remediation projects. Follow-up monitoring is required for a period of five years following baseline monitoring to document the effects of OE removal or lead, chemical and groundwater remediation projects on flora and fauna.

Since the inception of the OE removal program, the United States Department of the Army (Army) has elected to augment the monitoring program, where feasible, to include the collection of baseline data prior to OE removal. Baseline data has been collected to provide information on pre-existing species composition and distribution of sensitive annual herbaceous plant species, referred to herein as HMP annual species (USACE, 1997a).

Base closure and reuse activities conducted at Former Fort Ord are required to follow specific protocols approved by the United States Fish and Wildlife Service (USFWS), as detailed in the Biological and Conference Opinion (BO) on the Closure and Reuse of Fort Ord, Monterey County, California (USFWS, 1999). Base closure and reuse activities are also identified in memoranda (Willison, 1998), requesting reinitiation of formal consultation with USFWS pursuant to Section 7 of the Endangered Species Act of 1973, as amended. The 1999 BO identifies additional species and habitats of concern, that were not addressed in an earlier BO (USFWS, 97), which could potentially be impacted during remediation, predisposal, and reuse activities; specifies mitigation measures that include establishing existing conditions and monitoring the regeneration of species and habitat following remediation, predisposal, and reuse activities.

This report was prepared to address the Army and USFWS habitat monitoring requirements, as identified in the HMP and the BO, for sites where OE removal or lead, chemical, and groundwater remediation has taken place. As data accumulates for these sites, the methods used to minimize adverse effects on HMP species may be refined.

1.1 Habitats and Species Considered for Habitat Monitoring

HMP habitats of concern occurring within OE removal or lead, chemical, and groundwater remediation sites on the Former Fort Ord include central maritime chaparral and wetland habitats. These habitats possess many of the special status plants and animals identified in the HMP.

Baseline and follow-up surveys are conducted to characterize the composition of central maritime chaparral in terms of flora species composition and dominance, the location and extent of HMP annual species, and to characterize the location and extent of special status animals within OE removal or chemical and lead remediation sites. Groundwater remediation sites are also surveyed to characterize the location and extent of HMP annual species potentially disturbed during remedial activities.

Similarly, baseline and follow-up surveys in wetland habitats such as vernal pools and ponds (waterbodies) are conducted to characterize percent vegetative cover and occurrence of special status fauna. Environmental parameters such as surface area, water depth, pH, and turbidity are also recorded monthly during the rainy season for each waterbody.

Follow-up monitoring in these habitats is required to document community regeneration, which is an HMP success criteria parameter. Success criteria for central maritime chaparral habitat is defined in the HMP as “restored habitat will consist of naturally regenerating maritime chaparral that is managed using controlled burning and other techniques that maximize habitat value for HMP species.” The success criteria for HMP annual species states that “if after five monitoring years, population sizes are observed to vary over time within a range that includes annual populations similar in size to those estimated for these species in 1992.” The success criterion for restored or regenerated wetlands is defined in the HMP as “affected wetlands are of the same acreage and provide the same functions as before clearing of ordnance.” The HMP also states affected waterbodies must support healthy populations of California linderiella, California tiger salamander, or California red-legged frogs upon completion of restoration activities if the affected waterbody supported these species.

Through an examination of Former Fort Ord aerial photographs and field observations, three successional stages of central maritime chaparral habitat have been identified that could be divided by fires or other disturbances. These stages include mature chaparral, intermediate-age chaparral, and disturbed chaparral. Mature chaparral is composed of fully mature to senescent stands of shrubs that are estimated to be greater than fifteen years in age, and are generally between six and fifteen feet in height. Mature stands have little open ground with little or no herbaceous plant cover. Intermediate-age stands are estimated to be five to fifteen years in age, and generally range from three to six feet in height. Intermediate-age stands generally exhibit more open ground and herbaceous plant cover, and include a diverse species composition. Disturbed chaparral habitat includes areas that were subject to regular disturbance. This habitat type is generally located in range fans with cleared rows along firing lines interspersed with patches of chaparral species. Disturbed stands are typically transitional in species composition and range from intermediate-age chaparral and mature chaparral.

HMP species associated with terrestrial OE removal and lead, chemical and groundwater remediation sites are identified in Table 1. They include sand gilia (*Gilia tenuiflora arenaria*), Monterey spineflower (*Chorizanthe p. pungens*), Contra Costa goldfields (*Lasthenia conjugens*), coast wallflower (*Erysimum ammophilum*), Seaside bird’s-beak (*Cordylanthus rigidus littoralis*), Toro manzanita (*Arctostaphylos montereyensis*), Monterey ceanothus (*Ceanothus cuneatus rigidus*), Hooker’s manzanita (*Arctostaphylos h. hookeri*), Eastwood’s goldenbush (*Ericameria fasciculata*), sandmat manzanita (*Arctostaphylos pumila*), and California black legless lizard (*Anniella pulchra nigra*).

HMP species in Table 1 associated with wetlands include California red-legged frog (*Rana aurora draytoni*), California tiger salamander (*Ambystoma californiense*), and California linderiella (*Linderiella occidentalis*). Although California linderiella is not currently state or federally listed, surveys are being continued to monitor the health of this wetland species following cleanup activities. Additional species of concern associated with wetland habitats, and having the potential to occur at the Former Fort Ord, were identified in the Wetland Restoration Plan for Unexploded Ordnance Removal Activities at Former Fort Ord (WRP) (USACE, 1997b): they include southwestern pond turtle (*Clemmys marmorata pallida*) and tricolored blackbird (*Agelaius tricolor*).

1.2 Previous Baseline Studies and Monitoring at OE Removal Sites 1994-2001

As stated above, the HMP requires that central maritime chaparral, HMP annual species, and waterbodies be monitored for a period of five years upon the completion of remedial activities. Baseline and follow-up surveys are conducted to characterize the composition of flora species composition and dominance, the location and extent of HMP annual species, and to characterize the location and extent of special status animals at OE, lead, chemical and groundwater remediation sites.

Plate 1 illustrates locations, dating through 2001, where previous baseline studies and monitoring have been conducted at OE removal and lead, chemical, and groundwater remediation sites. All of these sites are in areas proposed to become habitat reserves that will support either central maritime chaparral and/or wetland habitats known to contain, or potentially contain, HMP species.

1.3 2002 Monitoring and Surveys

Plate 2 shows locations of 2002 monitoring activities. Table 2 summarizes monitoring activities conducted at OE removal and groundwater, lead, and chemical remediation sites from 1994 through 2002. Monitoring and survey activities conducted in 2002 include:

- Follow-up monitoring at four terrestrial OE removal sites (OE-10A, OE-10B, OE-19 monitoring conducted by BLM, OE-11 monitoring conducted by MACTEC).
- HMP annual species surveys at five terrestrial OE removal sites (OE-10A, OE-10B, and OE-19 conducted by BLM, OE-9 and OE-11 conducted by MACTEC).
- Surveys for the HMP annual species Contra Costa goldfields at OE removal sites (OE-10B at Machine Gun Flats (MGF), and in the mima mounds (undulating terrain consisting of small mounds with hydrologically interconnected depressions) grassland southeast of MGF conducted by MACTEC).
- Monitoring at groundwater remediation sites for HMP annual plant species (University of California Natural Reserve System (UC/NRS) - Fort Ord Natural Reserve (FONR) conducted by MACTEC).
- Baseline monitoring for exotic species at one terrestrial OE removal site (OE-11 monitoring conducted by MACTEC).
- Follow-up monitoring at two waterbodies (Waterbody 42 and Machine Gun Flats monitoring conducted by MACTEC).

1.3.1 Central Maritime Chaparral Monitoring

Central maritime chaparral monitoring was conducted by MACTEC and BLM biologists. BLM conducted follow-up central maritime chaparral monitoring at OE removal Sites OE-10A, OE-10B, and OE-19. MACTEC conducted follow-up central maritime chaparral monitoring at OE-11. Flora evaluations at these sites are described based upon the vegetation removal method used at the site (burned or manually clipped).

OE-10A has undergone several episodes of vegetation clearance between 1995 and 1998. In 1995, OE-10A was partially burned. The OE sampling and removal grids that were not burned in 1995 were

manually clipped from 1995 through 1997. During 1997, a majority of OE-10A was burned again, including the clipped grids.

Portions of OE-10B were burned or manually clipped in 1997. OE-11 was not burned due to safety reasons, but was manually clipped in 1997. OE-19 was burned in 1995.

1.3.2 HMP Annual Species Surveys – Monterey Spineflower, Sand Gilia, Seaside Bird’s-Beak, Contra Costa Goldfields

BLM conducted surveys for the population size and location of sand gilia and Monterey spineflower in May at OE-10A, OE-10B, and OE-19. BLM conducted surveys for Seaside bird’s-beak at these sites in October. MACTEC conducted surveys for the population size and locations of sand gilia and Monterey spineflower in May at OE-9 and OE-11. Surveys for Seaside bird’s-beak were conducted at these sites in July. HMP annual surveys conducted in 2002 at OE-9 represent baseline data for these species presented in the Army’s Annual Monitoring Report. Follow-up HMP annual surveys were conducted at OE-10A, OE-10B, OE-11, and OE-19. The federal, State, and California Native Plant Society (CNSP) listing status for these species are included in Table 1.

1.3.3 UC/NRS FONR Groundwater Remediation Sites

In May 2002, follow-up monitoring was conducted at groundwater remediation sites within the UC/NRS FONR for the presence of HMP annual species. The wells at UC/NRS FONR are used for groundwater monitoring. Surveys of HMP annual species were conducted along identified monitoring well access routes and at existing monitoring well sites.

1.3.4 Contra Costa Goldfields Surveys

HMP annual surveys for Contra Costa goldfields were conducted in May 2002. The effect of OE removal on Contra Costa goldfields is considered in a USFWS BO (*USFWS, 1999*). To date, this species has been located in two discrete locations in OE-10B; one is along the western edge of the vernal pool at Machine Gun Flats (MGF), the other in the mima mounds (undulating terrain consisting of small mounds with hydrologically interconnected depressions) grassland southeast of MGF. These two occurrences were first monitored in 1998 and 1999 to collect information prior to OE removal activities at OE-10B.

Contra Costa goldfields on Former Fort Ord occur adjacent to, or in the vernal waterbodies of grassland habitats that generally exhibit mima mound topography. The BO identifies mitigation measures (in addition to those presented in the HMP) to be implemented during OE removal in areas where Contra Costa goldfields occur. These measures are presented in a consultation letter from the Directorate of Environmental Natural Resources (DENR) to USFWS dated November 11, 1998 (*Willison, 1998*).

1.3.5 Exotic Species

Baseline exotic (non-native) species surveys were conducted in 2002 to identify the locations of exotic species on OE-11. Exotic species surveys included jubata grass (*Cortaderia jubata*), hottentot fig (*Carpobrotus edulis*), and cut-leaved fireweed (*Erechtites glomerata*).

Exotic species that were observed during the line-intercept and quadrat sampling in chaparral and wetland habitats are noted on the tables and figures for OE-10A, OE-10B, OE-19, Waterbody 42 and Machine Gun Flats.

1.3.6 Wetland Monitoring

From January through May 2002, follow-up wetland monitoring was conducted at approximately one-month intervals at Waterbody 42 and MGF as specified in the HMP. New waterbodies were not identified for baseline monitoring data in 2002.

Follow-up data collected at Waterbody 42 and MGF included characterization of wetland vegetation, assessing the potential occurrence of wetland-associated special-status fauna identified in the HMP, and collecting data on the physical characteristics and parameters of each seasonal waterbody. Surveys were conducted according to protocol identified in the HMP and follow-up monitoring requirements identified in the Wetland Restoration Plan for Unexploded Ordnance Removal Activities at Former Fort Ord (WRP) (USACE, 1997b).

1.4 Future Activities on Habitat Reserve Lands

In recent years, baseline surveys were conducted in areas supporting maritime chaparral and HMP annual species that would be disturbed during OE removal or lead and chemical remediation activities. The surveys characterize habitat and establish baseline conditions in these areas. Baseline surveys were conducted at the following OE removal, lead, and chemical remediation sites:

- in 1996 at OE-16
- in 1997 for Site 39 Multiple Range Area (MRA) West
- in 1999 for Site 39 Ranges 18 and 19 and MRA North
- in 2000 for Site 39 Ranges 21, 24, 25, and 26
- in 2001 for Site 39 Ranges 43-48

Remediation has not been initiated at these ranges and, therefore, no additional monitoring or evaluation has been conducted.

2.0 METHODS

Methods used to collect data on HMP species and habitat in the 2002 monitoring year are described in Protocol for Conducting Vegetation Sampling at Fort Ord in Compliance with the Installation-Wide Multispecies Habitat Management Plan (HMP Sampling Protocol) (USACE, 1995a). Reports from previous monitoring years (USACE, 1994, 1995b, 1996a, 1996b, 1997b, 1998, 1999, 2000, 2001) and the WRP (USACE, 1997a) were reviewed and the survey methods described were implemented to maintain consistency in sampling.

The survey methods used depends on whether the habitat is central maritime chaparral or wetland. Survey methods for terrestrial monitoring include: 1) line-intercept sampling along permanent transects to characterize central maritime chaparral shrub cover; 2) quadrat sampling in areas with a high percentage of herbaceous vegetation (areas visually estimated to have greater than 20 percent cover), and 3) visual surveys in suitable habitat to map the distribution of HMP annual species. Monitoring methods at wetland sites include wetland vegetation sampling (vegetative cover by species), special status wildlife surveys, and the collection of physical and hydrological data.

Chaparral and wetland sites monitored in 2002 are shown on Plate 2. All biological monitoring conducted in the MRA was accomplished with an OE specialist escort.

2.1 Central Maritime Chaparral Monitoring

During 2002, MACTEC and BLM conducted follow-up central maritime chaparral monitoring at four terrestrial OE removal sites. BLM conducted follow-up central maritime chaparral monitoring at OE removal Sites OE-10A, OE-10B, and OE-19 between April and June 2002. MACTEC conducted follow-up central maritime chaparral monitoring at OE-11 in May 2002. The survey methods used for central maritime chaparral monitoring, line-intercept sampling and quadrat sampling, are discussed below in sections 2.1.1 and 2.1.2.

2.1.1 Line-Intercept Sampling Methods

Line-intercept sampling is conducted to determine flora species composition and cover in central maritime chaparral habitat. Shrub composition, cover, and abundance were sampled along the length of a measuring tape that was extended above, below, or through the woody canopy. Intercept distance for each species was recorded separately to include foliar overlap. Additional species observed within 10 meters of the transect were also recorded. Intercept distances of each species were combined; this total was divided by the length of the transect and multiplied by 100 to obtain individual species percent cover. Cumulative intercept distances for cover types (i.e., shrubs, bare ground, and vegetated ground) were combined, divided by the total length of transects sampled, and multiplied by 100 to provide a numerical estimate of cover by species or cover type for each OE site.

Sample size for each variation of central maritime chaparral habitat type (or seral stage, i.e. disturbed, intermediate-age, or mature) was determined by calculating the cumulative total cover for the dominant and/or HMP species if present. The total was graphed versus a running total of the combined transect length. An adequate sample size was considered reached when, after including additional transect data with the combined data, there was a change of less than 10 percent in total cover.

Transect locations for follow-up monitoring were located using Global Positioning System (GPS) equipment and are indicated on Plates 3 through 6. In most cases at follow-up monitoring sites, pre-established transect endpoints had been removed during OE sampling. At these locations, new transect endpoints were installed. Four- or five-foot, lightweight t-posts were installed at transect endpoints and photographs were taken to record the location and condition of the sampling transect. Transect numbers were marked on aluminum tags that were attached to both endpoints. Most transects were 50 meters (approximately 164 feet) in length. In some cases, transect length was limited by tall, impenetrable brush or OE concerns.

2.1.2 **Quadrat Sampling Methods**

Quadrat sampling was used to characterize the herbaceous component of central maritime chaparral habitat. Quadrat sampling was conducted along transects with greater than 20 percent (visually estimated) cover contributed by herbaceous plant species. Quadrat sampling was conducted along the line intercept tape at 10-meter intervals; transects were placed at 0.25-meter square quadrats; starting at 10-meter intervals alternating from the right to left side of the transect. Plant species present within each quadrat were identified, percent cover was estimated for each species, and data were recorded.

2.1.3 **Line-Intercept and Quadrat Sampling Site Locations**

OE-10A: BLM conducted line-intercept sampling at sixteen transects (Transects 1 through 3, 5 through 13, and 16 through 19) located at this site. Supplemental quadrat sampling for common herbaceous species was conducted along eleven transects where the overall cover by herbaceous species exceeded 20 percent. Data was not collected from Transects 4, 14, and 15, which were not used in this evaluation; previous reports (*USACE, 1998*) identified Transects 4, 14 and 15, as occurring in “transitional grids” and considered them as more accurately representing a transitional area between coast live oak woodland and central maritime chaparral. Transect locations are identified in Plate 3.

OE-10B: BLM conducted line-intercept sampling at twelve transects located at this site. Ten transects (Transects 1, 6 through 9, 10-2 and 11 through 15) are located in burned areas. Supplemental quadrat sampling for common herbaceous species was conducted along two transects, Transects 7 and 15, where the overall cover by herbaceous species exceeded 20 percent. Two transects (Transects 2 and 12) are located in clipped areas. Supplemental quadrat sampling for common herbaceous species was not conducted along transects located in clipped grids because herbaceous vegetation did not exceed 20 percent at these transects. Data was not collected from Transects 3 through 5 for this evaluation as these transects are located in undisturbed areas. Transect locations are identified in Plate 4.

OE-11: MACTEC conducted line-intercept sampling at five transects (Transects 1 through 3, 5, and 8) located at this site. Supplemental quadrat sampling for common herbaceous species was conducted along three transects where the overall cover by herbaceous vegetation exceeded 20 percent. Sampling was not conducted along Transects 4, 6, and 7. Transects 4 and 7 are located in undisturbed areas and Transect 6 is located outside the boundary of OE-11. Transect locations are identified in Plate 5.

OE-19: BLM conducted line intercept sampling at eight transects (Transects 1 through 8) located at this site. Supplemental quadrat sampling for common herbaceous species was conducted along Transect 3. Transect locations are identified in Plate 6.

2.2 HMP Annual Species Surveys – Monterey Spineflower, Sand Gilia, Seaside Bird's-Beak, Contra Costa Goldfields

Visual HMP annual surveys are conducted at monitoring sites to verify the continued presence of previously recorded locations or to identify new ones. Prior to conducting visual surveys for HMP annual species, aerial photographs or maps showing previously recorded locations were reviewed to identify suitable or potential habitat. HMP annual surveys are conducted by inspecting areas of known or potential habitat by walking species-specific habitats at approximately 25-foot intervals. The location of observed HMP annual species was recorded using GPS.

2.2.1 OE Sites

HMP annual species surveys were conducted at five terrestrial OE removal sites in 2002. Surveys were conducted by BLM at OE-10A, OE-10B, and OE-19, and by MACTEC at OE-9 and OE-11. Population boundaries for HMP annual species were mapped using GPS. These sites and survey results are indicated on Plates 3 through 7.

Estimates for the number of individuals of sand gilia, Seaside birdsbeak, and most locations of Monterey spineflower were based upon direct counts. At locations supporting relatively large numbers or high densities of Monterey spineflower, estimates of spineflower numbers were based upon direct counts of representative sample areas. These sample counts were then used to estimate the number of Monterey spineflower individuals throughout a given location.

Population estimates for HMP annuals on OE sites are assigned as follows:

- Small populations are estimated to contain between 1 – 100 individuals per acre
- Medium populations are estimated to contain between 101 – 500 individuals per acre
- Large populations are estimated to contain over 500 individuals per acre

2.2.2 UC/NRS FONR Groundwater Remediation Sites

Population totals for sand gilia and Monterey spineflower on UC/NRS FONR are obtained by direct counts. Activities conducted within UC/NRS FONR property are required to follow specific protocols that were approved by the USFWS as detailed in the BO (*USFWS, 1999*) and memoranda (*Willison, 1998*). MACTEC conducted follow-up surveys in April 2002 for Monterey spineflower and sand gilia at the UC/NRS FONR in accordance with the BO (*USFWS, 1999*).

An access route along existing roads within the UC/NRS property was identified to allow access to existing wells and UCSC student study sites. These roads are currently in use by MACTEC, Marina Water District, and University of Santa Cruz (UCSC) staff. Surveys were conducted at existing well sites and along approved well access routes. Areas supporting sand gilia and Monterey spineflower were identified and flagged. Population totals within each identified area were totaled by direct counts. Populations were hand mapped in the field using landmarks on aerial photographs. Populations were later delineated using GPS.

2.2.3 Contra Costa Goldfields Surveys

In May 2002, MACTEC also conducted visual surveys of Contra Costa goldfields at OE-10B. The two occurrences of Contra Costa goldfields occur along the western edge of the vernal pool at Machine Gun Flats (MGF), the other in the mima mounds grassland southeast of MGF.

Sampling methods for Contra Costa goldfields involve conducting visual surveys by systematically walking grassland habitats where this species might occur. During this time, particular attention is given to topographically low areas that contain species associated with the presence of Contra Costa goldfields. Areas supporting Contra Costa goldfields were identified and flagged. Population densities for Contra Costa goldfields are obtained by direct counts or by sub-sampling large populations and calculating densities on a per acre basis. Sub-sampling of larger sub-populations involves using a random quadrat method to estimate population size. Quadrats measuring 0.25-meter square are randomly placed in each sub-population area and Contra Costa Goldfield individuals are counted. The number of quadrats utilized varies depending on the size of the sub-population. In general, 10 to 20 percent of the area in each sub-population was sampled. Population estimates are then calculated for each sub-population based upon the sampled density observed and the area of sub-population. Populations were later delineated using GPS.

2.3 Exotic Species

MACTEC conducted follow up monitoring surveys on OE-11 to identify the locations of the exotic (non-native) plant species jubata grass, hottentot fig, and cut-leaved fireweed. Observed species were mapped by GPS and observations identifying population size, extent and nature of infestation were recorded.

2.4 Wetland Monitoring

Annual follow-up wetland monitoring is being conducted in order to evaluate whether OE removal activities have affected baseline conditions previously observed at waterbodies. The WRP (*USACE, 1997b*) identifies the level of effort for monitoring depending on the degree of disturbance that occurred during OE removal. The physical characteristics of waterbodies are recorded during faunal surveys to identify factors that could potentially affect the continuing presence or absence of special-status fauna, including: California linderiella, other fairy shrimp species, California tiger salamander, California red-legged frog, tricolored blackbird, and southwestern pond turtle. Fauna and vegetation follow-up monitoring surveys were conducted at Waterbody 42 and MGF during the year 2002.

The special-status faunal surveys were conducted at Waterbody 42 and MGF during five monthly monitoring events between January and May. Vegetation surveys at Waterbody 42 and MGF were conducted in May. Methods used to collect baseline and follow-up data on special-status fauna, physical parameters and wetland vegetation were developed in accordance with guidelines specified in the HMP and WRP, and are described briefly in the sections below.

2.4.1 Wetland Vegetation Sampling

Wetland vegetation sampling was conducted at Waterbody 42 and MGF during the May monitoring event. Wetland vegetation sampling focused on characterizing wetland-influenced vegetation and transitional herbaceous species.

Sampling was conducted via a modified quadrant-transect method used for central maritime chaparral surveys (*USACE, 1995a*). The modification of the sampling protocol is specified within the HMP and the current methodology is the interval between quadrats. The original protocols were developed for

vegetation sampling in chaparral habitat, where the vegetation tended to be mono-typic. Quadrat transects for wetland habitats monitored in 2002 were placed every ten feet to capture abrupt vegetation changes, including intermittent patches of bare ground and open water.

Nine survey transects were established at the MGF wetland site based on size and variability of habitat. Two survey transects were established at Waterbody 42 based upon the limited size and flora variability at the project site. Transect lengths ranged from 50 to 241 feet. The number, location, and length of each selected transect was chosen to provide a representative cross-section of the transitional and emergent habitats at each waterbody. Five-foot, lightweight t-posts were installed at the start and endpoints of each sampled transect. For identification purposes, the top of the each t-post was spray painted orange and labeled with a numbered, aluminum tag. Photographs were taken to record the vegetative condition at each of the waterbodies throughout the survey period. Transect start and endpoint locations were mapped using GPS data collected during baseline studies. Sampling was conducted along each transect by placing a 0.25-meter square quadrat at the starting point and at 10-foot intervals, alternating from right to left. Plant species present within the quadrat were identified, percent cover was estimated for each species, and compositional data were recorded.

The WRP states that the monitoring period of wetlands is based upon the assumption that performance functions of a wetland will be successfully achieved within 5 years of disturbance activities. The WRP also states that at least three monitoring events are required within the five-year period after OE disturbance activities have been completed. The requirement for additional follow-up monitoring is based on the results of monitoring surveys.

2.4.2 Fauna

Wildlife monitoring for 2002 was conducted at Waterbody 42 and MGF from January through May, 2002. The monitoring included surveys for wildlife species identified in the HMP and other potentially occurring special-status species identified in the WRP. Vertebrate species observed during fauna surveys were recorded in field logs. Wildlife surveys were conducted to determine the presence/absence of California linderiella, California tiger salamander, California red-legged frog, tricolored blackbird, and southwestern pond turtle.

Fairy shrimp (*Linderiella* sp.)

Surveys for California linderiella and other potentially present vernal pool crustaceans were conducted during the January and February monthly site visits at Waterbody 42. No invertebrate surveys were conducted at this site from March through June due to the absence of standing water. Surveys for California linderiella and other fairy shrimp were conducted during monthly site visits at MGF from January through April. Surveys for California linderiella were not conducted at MGF in May and June due to reduced ponding at this site.

To assess the presence/absence of California linderiella and other fairy shrimp species, representative portions of each waterbody were sampled using a dipnet. Fairy shrimp were examined with a field-magnifying lens to identify genus. Samples were collected systematically from each waterbody until habitat was adequately represented. When fairy shrimp were observed, their relative abundance was estimated by collecting between 10 and 20 samples from each waterbody (depending on the size and complexity of each waterbody). The number of linderiella in each sample was totaled and the relative abundance was defined as follows:

- Low abundance: 1 to 10 linderiella

- Moderate abundance: 11 to 100 linderiella
- High abundance: 101 to 300 linderiella
- Very high abundance: more than 300 linderiella.

California tiger salamander (*Ambystoma californiense*)

California tiger salamanders (CTS) are commonly associated with grasslands in rolling terrain or foothills that contain suitable underground retreats such as burrows of the California ground squirrel (*Spermophilus beecheyi*) and Botta's pocket gopher (*Thomomys bottae*). CTS have been found, however, in areas with no apparent underground retreats. In these areas CTS may utilize cracks in the ground or may burrow into loose soil, or seek refuge in and under rotting logs or fallen branches. In captivity CTS have been observed to readily burrow into loose substrate such as decomposed oak leaves. Breeding ponds are typically vernal pools or other small, temporary waters that fill during winter rains and are dry by mid-summer. CTS can utilize artificial impoundments (farm ponds), even permanent ones, if they do not contain fish or bullfrogs (*Rana catesbeiana*).

Surveys to determine the presence/absence of CTS at Waterbody 42 and MGF were conducted by searching for physical evidence of the species during monthly site surveys from January through May, 2002. Surveys for CTS at Waterbody 42 were limited to upland surveys from March through May due to the absence of water at this site.

To assess the presence/absence of CTS, representative portions of each waterbody were sampled using a dip-net, and samples were examined for the presence of CTS larvae. Dip-net samples were collected systematically from each waterbody until habitat was adequately represented. In addition to the dipnet surveys for larvae, upland habitat was surveyed for the presence of adult CTS. Upland surveys consisted of walking transects from the edge of the waterbody into upland habitat and looking underneath downed tree branches and rocks, in burrow entrances, and soil fissures under tree canopies where there were suitable upland refugia.

California red-legged frog (*Rana aurora draytonii*)

The California red-legged frog (CRF), a federally listed Threatened species, can be encountered in and around freshwater within permanent to semi-permanent water bodies such as springs, and creeks as well as naturally or artificially created ponds containing thick emergent vegetation such as bullrush (*Scirpus* sp.), or cattails (*Typha* sp.). CRF require fresh water of at least two feet in depth with suitable emergent vegetation to provide escape cover from predators, to allow for thermo-regulation during summer months, and to allow for metamorphosis of the young. CRF may move up to one mile away from their resident drainages at the onset of the first winter rains, and have been known to move away from creeks and into riparian woodlands and adjacent grasslands.

Surveys to determine the presence/absence of CRF at Waterbody 42 and MGF were conducted by searching for physical evidence of this species during monthly site surveys at from January through May, 2002. Dipnet surveys for CRF at Pool 42 were not conducted from March through May due to the absence of water at this site during this period of time.

To assess the presence/absence of CRF, representative portions of each waterbody were sampled using a dipnet, and samples were examined for presence of CRF tadpoles. Samples were collected systematically from each waterbody until the habitat was adequately represented. In addition to the dipnet surveys for tadpoles, the presence/absence of adult CRF was conducted on the perimeter of each waterbody. Habitat

features such as duration of ponding, presence of submergent and emergent vegetation, and adequate upland estivation habitat were noted.

Tricolored blackbird (*Agelaius tricolor*) and southwestern pond turtle (*Clemmys marmorata*)

Tricolored blackbirds (TCB), a Species of Concern in California, are commonly found throughout the Central Valley and in coastal districts from Sonoma County and south. TCB are typically found near fresh water, preferably in emergent wetland with tall, dense cattails or tules, but also in thickets of willow, blackberry, wild rose, and tall herbs. TCB's are a summer resident in northeastern California and feed primarily on seeds in grassland and cropland habitats. Dense breeding colonies of up to 500 TCB's have been known to be vulnerable to massive nest destruction by mammalian and avian predators, including Swainson's hawks and other buteo's.

The southwestern pond turtle (SWPT), listed by the state as a Species of Special Concern, originally inhabited many of the Pacific drainage basins in California (*Stebbins, 1985*). Primary habits for SWPT include permanent water sources such as ponds, streams and rivers. SWPT is often seen basking on logs, mud banks or mats of vegetation, although wild populations are wary and individuals will often plunge for cover after detecting movement from a considerable distance. Although it is an aquatic species, it can move across land in response to fluctuating water level, an apparent adaptation to the variable rainfall and unpredictable flows that occur in many coastal California drainage basins (*Rathbun, et al. 1992*). In addition, SWPT can over-winter on land and water or remain active in the winter, depending on environmental conditions (*Jennings and Hayes, 1994*).

Visual surveys to determine the presence/absence of TCB and SWPT were conducted by searching for nesting or physical evidence of either species during monthly site surveys conducted at Waterbody 42 and MGF.

2.4.3 Physical Characteristics

Physical data were collected at two waterbodies, MGF and Waterbody 42, in order to characterize the functions and values of these seasonal wetlands. The degree of disturbance at these waterbodies was not significant enough to require the collection of physical data as identified in Table 3 of the WRP. Table 3 indicates waterbodies where OE removal activities have resulted in excavations greater than four feet or have been identified as having soil conditions other than a thick deep clay horizon, requiring hydrological monitoring. Although not specifically required in the WRP, physical data was collected at Waterbody 42 and MGF in order to assess the waterbodies functions and values. Data collected at Waterbody 42 and MGF included: pH measurements, maximum water depth, duration of ponding, and the surface area of each seasonal waterbody. Disturbance to the wetland habitat during data collection was minimized by restricting the amount of wading in each waterbody to what was necessary for dipnet sampling and measurements of physical characteristics. Physical data was recorded at MGF monthly during January through May, and at Waterbody 42 in January and February. Data was not measured at MGF in May and June due to the limited size of the waterbody. Data was not collected at Waterbody 42 from March to June due to the absence of water.

Measurements of pH were collected during each monthly monitoring event at all three waterbodies. A portable pH field meter was calibrated prior to each field monitoring visit. pH measurements were collected prior to other survey activities that could affect data accuracy (e.g., gathering depth measurements, vegetation sampling, and/or dipnetting). Measurements were taken no sooner than 24 hours after a storm event, as required by protocol indicated in the WRP.

Maximum water depth was measured during each monitoring event by locating the center or deepest portion of the waterbody until the apparent maximum depth was located. The depth was measured by placing a staff gauge into the deepest portion of each monitored waterbody. The depth was then recorded on field forms.

The area of ponding at both waterbodies was determined by measuring the perimeter of the area of ponding using a GPS unit. Ponding measurements were taken at MGF during four monthly monitoring events. The area of ponding was not measured at MGF in May and June due to the limited size of the waterbody. The area of ponding at Waterbody 42 was not measured from March through June due to the absence of water.

Ponding observed during monitoring events was recorded and is presented in the Results section of this report. The duration of ponding was not recorded at MGF during the 2002 follow-up monitoring surveys, as ponding occurred after the final survey date. Starting in May, ponding at MGF was limited to the “Bullfrog Pond” area within the western portion of MGF.

3.0 RESULTS

This section presents survey data collected during 2002 monitoring activities. The results are presented according to the types of monitoring conducted: central maritime chaparral, HMP annual species and Contra Costa goldfields, as well as exotic species and wetlands.

3.1 Central Maritime Chaparral Habitat Monitoring

The results of the line-intercept and quadrat sampling of central maritime chaparral habitat are summarized below. Results of chaparral vegetation sampling are presented in terms of dominant and/or HMP shrub species. Tables 3 through 11 provide the percent cover by transect for line intercept and quadrat sampling for each species observed at the OE sites monitored in 2002. Figure 1 is a representative photograph of central maritime chaparral habitat sampled during 2002 transect and quadrat sampling. Figures 2 through 9 provide the percent cover by shrub species for line-intercept sampling and average coverage by herbaceous species for quadrat sampling for each of the OE sites monitored in 2002.

3.1.1 OE Sites

OE-10A: Results of the line-intercept sampling for OE-10A are presented in Table 3 and Figure 2. OE-10A has undergone several episodes of vegetation clearance between 1995 and 1998. OE-10A was partially burned in 1995. OE sampling and removal grids not burned were manually clipped from 1995 through 1997. In 1997, the majority of OE-10A was burned again, including areas previously identified as clipped grids.

Dominant shrub species (contributing greater than 4 percent absolute cover) observed during sampling include: rush rose (*Helianthemum scoparium*) at 20.52 percent, shaggy-barked manzanita (*Arctostaphylos t. tomentosa*) at 10.83 percent, chamise (*Adenostoma fasciculatum*) at 8.61 percent, dwarf ceanothus (*Ceanothus dentatus*) at 6.38 percent, and Toro manzanita at 4.49 percent. Bare ground was estimated at 6.80 percent. HMP shrub species encountered at OE-10A and their respective cover are as follows: Toro manzanita at 4.49 percent, Hooker's manzanita at 3.19 percent, Monterey ceanothus at 2.42 percent, and Eastwood's goldenbrush at 0.20 percent. Exotic species encountered at OE-10A and their estimated cover included hottentot fig at 2.54 percent. Of the 23 species encountered, 22 are native.

Results of quadrat sampling for OE-10A are presented in Table 4 and Figure 3. Cover contributed by herbaceous vegetation at OE-10A was estimated using line-intercept sampling to be approximately 33.64 percent. The dominant herbaceous species (individually contributing greater than 2 percent cover) observed during sampling include: rush rose at 12.39 percent, smooth cat's-ear (*Hypochaeris glabra*) at 12.24 percent, fescue (*Vulpia* sp.) at 11.50 percent, cut-leaved fireweed at 10.2 percent, silvery hair-grass (*Aira caryophyllea*) at 5.19 percent, shaggy-barked manzanita at 5.14 percent, California filago (*Filago californica*) at 4.03 percent, coyote brush (*Baccharis pillularis*) at 3.88 percent, and Toro manzanita at 3.75 percent. An unidentified moss species provided an estimated 27.39 percent of the overall cover in quadrat squares at this site. Shrub and perennial species provided an estimated 123.2 percent of the overall cover in quadrat squares at this site. Exotic species encountered at OE-10A and their estimated covers included: smooth cat's-ear at 12.24 percent, silvery hair-grass at 5.19 percent, cut-leaved fireweed at 2.74 percent, six-week fescue (*Vulpia bromoides*) at 2.32 percent, rat-tail fescue (*Vulpia myuros*) at 0.83 percent, ripgut grass (*Bromus diandrus*) at 0.74 percent, scarlet pimpernel (*Anagallis arvensis*) at 0.13 percent, weedy cudweed (*Gnaphalium lueto-album*) at 0.10 percent, little quaking grass (*Briza minor*) at 0.04 percent, and prickly sow-thistle (*Sonchus asper*) at 0.04 percent. Of the 57 herbaceous species encountered during quadrat sampling, 47 are native.

A discussion of the 2002 central maritime chaparral monitoring results as compared to the 1994 baseline data for OE-10A is provided in Section 4 of this report. Data analysis for this site is based upon the burn clearance method used in 1997.

OE-10B: Results of line-intercept sampling for burned areas at OE-10B are presented in Table 5 and Figure 4. Portions of OE-10B were burned or manually clipped in 1997.

Dominant shrub species (contributing greater than 4 percent absolute cover) observed during line-intercept sampling in burned areas include: rush rose at 30.50 percent, dwarf ceanothus at 19.58 percent, shaggy-barked manzanita at 18.40 percent, Monterey ceanothus at 10.46 percent, black sage (*Salvia mellifera*) at 5.83 percent, deerweed (*Lotus scoparius*) at 4.71 percent, and chamise at 4.82 percent. HMP shrub species encountered at OE-10B and their respective cover in burned areas are as follows: Monterey ceanothus at 10.46 percent, Hooker's manzanita at 0.34 percent, Toro manzanita at 0.23 percent, and Eastwood's goldenbush at 0.06 percent. Bare ground was estimated at 7.39 percent cover. Cover contributed by herbaceous vegetation was estimated to be 20.30 percent. Exotic shrub or perennial species were not encountered at burned areas in OE-10B.

Results of quadrat sampling for burned areas in OE-10B are presented in Table 6 and Figure 5. Dominant herbaceous species (individually contributing greater than 2 percent cover) include: rush rose at 19.64 percent, Monterey ceanothus at 14.09 percent, fescue at 12.17 percent, silvery hair-grass at 10.95 percent, smooth cat's-ear at 8.59 percent, scarlet pimpernel at 7.83 percent, dwarf ceanothus at 6.94 percent, coyote brush at 5.56 percent, small tarweed (*Madia exigua*) at 5.44 percent, California plantain (*Plantago erecta*) at 4.56 percent, western bracken (*Pteridium aquilium*) at 4.29 percent, an bedstraw (*Gallium* sp.) at 4.05 percent, sticky monkey flower at 3.89 percent, soft chess (*Bromus hordeaceus*) at 3.61 percent, wedge-leaved horkelia (*Horkelia c. cuneata*) at 3.61 percent, black sage at 3.10 percent, California coffeeberry (*Rhamnus californica*) at 2.86 percent, poison oak (*Toxicodendron diversilobum*) at 2.78 percent, chamise at 2.62 percent, hooked navarretia (*Navarretia hamata*) at 2.46 percent, sedge (*Carex* sp.) at 2.38 percent, Hooker's manzanita at 2.22 percent, and cut-leaved fireweed at 2.22 percent. It should be noted that an unidentified moss species provided approximately 15.91 percent of the vegetative cover in quadrats at this site. Exotic species encountered at OE-10A and their estimated covers included: silvery hair-grass at 10.95 percent, smooth cat's-ear at 8.59 percent, scarlet pimpernel at 7.83 percent, soft chess at 3.61 percent, cut-leaved fireweed at 2.22 percent, little quaking grass at 1.17 percent, and pampas grass at 0.28 percent. Of the 51 herbaceous species encountered, 44 are native.

Results of line-intercept sampling for clipped areas at OE-10B are presented in Table 7 and Figure 6. Dominant shrub species (contributing greater than 4 percent absolute cover) observed during sampling in clipped areas include: shaggy-barked manzanita at 47.75 percent and Toro manzanita at 35.38 percent. HMP shrub species encountered at OE-10B and their respective cover in clipped areas include: Toro manzanita at 35.38 percent and Hooker's manzanita at 1.20 percent. Bare ground was estimated to be 18.22 percent cover. Cover contributed by herbaceous vegetation was estimated at 4.66 percent. Exotic shrub and perennial species were not encountered at clipped areas in OE-10B.

A discussion of the 2002 central maritime chaparral monitoring results as compared to the 1996 baseline data for OE-10B is provided in Section 4 of this report. Data analysis for this site includes separate discussion for the burned areas and clipped areas of the site.

OE-11: Results of line-intercept sampling for OE-11 are presented in Table 8 and Figure 7. OE-11 was manually clipped of vegetation in 1997. The cleared vegetation was piled in parallel rows approximately three to five feet high and six to ten feet wide at the site. No burning has been conducted on OE-11.

Dominant shrub species (contributing greater than 4 percent absolute cover) observed during sampling include: chamise at 21.56 percent, sticky monkey flower at 14.40 percent, shaggy-barked manzanita at 10.73 percent, and Toro manzanita at 6.13 percent. HMP shrub species sampled at OE-11 and their respective cover include Toro manzanita at 6.13 percent, and Monterey ceanothus at 1.06 percent. Bare ground was estimated at 12.94 percent. Cover contributed by herbaceous vegetation was estimated at 19.36 percent. Cover contributed by dead vegetation was 12.24 percent. Exotic species encountered at OE-11 and their estimated cover included weedy cudweed at 0.95 percent and cut-leaved fireweed at 0.60 percent. Of the 17 shrub and perennial species encountered, 15 are native.

Results of quadrat sampling for OE-11 are presented in Table 9 and Figure 8. Cover contributed by herbaceous vegetation at OE-11 was estimated using line-intercept sampling at approximately 19.36 percent. Dominant herbaceous species (individually contributing greater than 2 percent cover) observed during sampling include: chamise at 12.83 percent, shaggy-barked manzanita at 8.61 percent, sticky monkey flower at 7.44 percent, silvery hair-grass at 6.94 percent, rush rose at 5.56 percent, purple needlegrass (*Nallsella pulchra*) at 4.44 percent, golden yarrow (*Eriophyllum confertiflorum*) at 4.06 percent, deerweed at 3.50 percent, and six-week fescue at 2.22 percent. Exotic species encountered at OE-11 and their estimated covers included: silvery hair-grass at 6.94 percent, six-week fescue at 2.22 percent, cut-leaved fireweed at 2.00 percent, weedy cudweed at 1.17 percent, smooth cat's-ear at 0.39 percent, and scarlet pimpernel at 0.56 percent. Of the 18 herbaceous species encountered during quadrat sampling, 12 are native.

A discussion of the 2002 central maritime chaparral monitoring results as compared to the 1996 baseline data for OE-11 is provided in Section 4 of this report. Data analysis for this site is based upon the clipped clearance method used in 1997.

OE-19: Results of line-intercept sampling for OE-19 are presented in Table 10 and Figure 9. OE-19 was burned in 1995.

Dominant shrub species (contributing greater than 4 percent absolute cover) observed during sampling include: shaggy-barked manzanita at 48.88 percent, rush rose at 14.79 percent, chamise at 13.75 percent, dwarf ceanothus at 8.22 percent, Monterey ceanothus at 6.41 percent, and sticky monkey flower at 4.68 percent. HMP shrub species encountered at OE-19 and their respective cover include Monterey ceanothus at 6.41 percent and Toro manzanita at 0.08 percent. Coast live oak was estimated at 8.06 percent and bare ground was estimated at 7.79 percent. Cover contributed by herbaceous vegetation was estimated at 10.72 percent. Exotic species encountered at OE-19 and their estimated covers included hottentot fig at 0.48 percent. Of the 19 shrub and perennial species encountered, 18 were native.

Results of quadrat sampling for OE-19 are presented in Table 11 and Figure 10. Cover contributed by herbaceous vegetation at OE-19 was estimated using line-intercept sampling at approximately 10.72 percent. Dominant herbaceous species (individually contributing greater than 2 percent cover) observed during sampling include: shaggy-barked manzanita at 32.25 percent, chamise at 22.33 percent, rush rose at 20.83 percent, and black sage at 7.75 percent. It should be noted that an unidentified moss species provided approximately 10.17 percent of the vegetative cover in quadrats at this site. Coast live oak provided approximately 3.75 percent coverage. Exotic species encountered at OE-19 and their estimated cover included smooth cat's-ear at 1.08 percent. Of the 19 herbaceous species encountered during quadrat sampling, 18 are native.

A discussion of the 2002 central maritime chaparral monitoring results compared to the 1994 baseline data for OE-19 is provided in Section 4 of this report. Data analysis for this site is based upon the burn clearance method used in 1995.

3.2 HMP Annual Species Surveys – Monterey Spineflower, Sand Gilia, Seaside Bird’s-Beak, Contra Costa Goldfields

MACTEC conducted focused visual surveys for HMP annual species at OE-9, OE-11, and at the UC/NRS-FONR. MACTEC also conducted visual surveys for Contra Costa goldfields populations at OE-10B. Focused visual surveys for HMP annual species were conducted by the BLM at OE-10A, OE-10B, and OE-19. The following sections summarize results of HMP annual species monitoring at these locations.

3.2.1 OE Site Sites

OE-9: Plate 7 illustrates the location and size of HMP annual species populations for Monterey spineflower at this site. One small population of approximately 90 Monterey spineflower individuals was observed in the southwestern portion of the site. Several other small populations, totaling approximately 500 individuals are located just south of the site.

OE-10A: Plate 3 illustrates the location and size of HMP annual species populations for sand gilia and Monterey spineflower at this site. Two large populations (between 501 – 50,000 individuals), one medium population (between 101 – 500 individuals), and nine small populations (less than 100 individuals) of Monterey spineflower were observed in the southern and central portions of this site. One large population, one medium population, and five small populations of sand gilia were also observed on OE-10A. Seaside bird’s-beak was not observed at this site.

A discussion of the 2002 HMP annual species monitoring results as compared to the 1994 baseline data for OE-10A is provided in Section 4 of this report.

OE-10B: Plate 4 illustrates the location and size of HMP annual species populations for Seaside bird’s-beak, sand gilia, and Monterey spineflower at this site. Two large population, three medium, and ten small populations of Seaside bird’s-beak were observed on OE-10B. One large population, two medium populations, and six small populations of sand gilia were observed in the southern portion of OE-10B. One large population, two medium populations, and two small populations of Monterey spineflower were observed on the southern portion of this site.

Discussions of the 2002 HMP annual species monitoring results as compared to the previous monitoring years and the 1994 baseline data for OE-10B is provided in Section 4 of this report.

OE-11: Plate 5 illustrates the extent of follow-up monitoring surveys conducted for HMP annual species at this site. No HMP annual species were observed at this site in 2002.

OE-19: Plate 6 displays the extent of follow-up monitoring surveys conducted for HMP annual species at this site. One small population of Monterey spineflower was observed on the northern boundary of the site.

3.2.2 UC/NRS FONR Groundwater Remediation Sites

Plate 8 illustrates the location and spatial extent of sand gilia and Monterey spineflower populations present at groundwater monitoring wells and along access routes at the UC/NRS-FONR. Surveys were conducted at all groundwater monitoring well sites and along approximately 5.7 miles of identified access routes. Coverage by sand gilia populations is approximately 3,038 linear feet with an estimated population of 575 individuals. This is a notable decrease from the recorded population of 4,643 sand gilia individuals at this site during 2001. Coverage by Monterey spineflower populations is approximately

3,968 linear feet with an estimated population of 14,084 individuals. The 2001 Monterey spineflower population had approximately 15,451 individuals.

3.2.3 Contra Costa Goldfields Surveys

Plates 9 and 10 display the size and extent of Contra Costa goldfields populations at MGF, and the mima mounds at OE-10B. The population at MGF was observed to comprise approximately 6,257 individuals in areas totaling approximately 692 square feet. The population at the mima mounds comprises approximately 235,945 individuals in areas totaling approximately 4,068 square feet.

In general, the plants that were observed were associated with topographically low-lying habitat, transitional between areas dominated by obligate wetland species and those dominated by upland species. Both sites exhibited an uneven mounded topography with intervening low areas that impound water for varying lengths of time. The mima mound area had much more pronounced elevational differences between saturated and upland areas than the population at MGF. In general goldfields observed at the mima mound area were observed to be more associated with obligate wetland species than the population at MGF.

3.3 Exotic Species

The results of the OE-11 survey for jubata grass, hottentot fig, and cut-leaved fireweed are presented on Plate 5. Two populations of jubata grass were observed: a large population (30 adults, 30 intermediates, and 70 juveniles) within a highly disturbed erosion area on the southern portion of OE-11, and smaller population of 12 juvenile and intermediate individuals along an erosion area on the western border of the project site. Large hottentot fig mats were observed in the northeastern portion of OE-11. Cut-leaved fireweed was not observed at this site.

3.4 Wetland Monitoring

A summary of wetland survey dates and the type of survey conducted at Waterbody 42 and MGF is presented in Table 12. Results of the wetland monitoring are discussed below.

3.4.1 Wetland Vegetation Sampling

Wetland vegetation sampling was conducted on 11 transects located at wetland monitoring sites at Waterbody 42 and MGF in 2002. Transects ranged from 50 to 241 feet in length. Transect lengths, number of quadrats and total area sampled on each transect are summarized in Table 13. The relative percent cover by species for each waterbody is summarized in Tables 14 and 15. Plates 11 and 12 indicate transects and the photo point for each waterbody. Figures 11 and 12 provide the percent cover by species for Waterbody 42 and MGF, respectively, which were surveyed in May 2002. Figures 13 and 14 are photographic examples of Waterbody 42 and MGF in 2002. Figure 15 is a photographic example of line-intercept and quadrat sampling activities in waterbodies. Plant species observed during 2002 wetland monitoring surveys are listed in Table 16.

Waterbody 42

Species composition and estimated percent cover at Waterbody 42 are presented in Table 14 and Figure 11. Plate 11 illustrates the transect locations surveyed at Waterbody 42 in 2002. Twenty-four plant species were recorded at Waterbody 42. Dominant plant species, present at greater than 10 percent of the combined average cover, include: silvery hair-grass, smooth cat's ear, and blue-eyed grass (*Sisyrinchium bellum*). Coast tarweed (*Hemizonia c. corymbosa*), coast eryngo (*Eryngium armatum*),

rat-tail fescue, brown-headed rush (*Juncus phaeocephalus*), small quaking grass, and California oatgrass (*Danthonia californica*) were present between 2.8 and 8.2 percent of the combined average cover. Most other plant species totaled 1 percent or less of the combined average percent cover. Exotic species encountered at Waterbody 42 and their estimated covers included: silvery hair-grass at 17.94 percent, smooth cat's-ear at 11.59 percent, rat-tail fescue at 5.38 percent, small quaking grass at 3.75 percent, scarlet pimpernel at 1.95 percent, slender wild oat (*Avena barbata*) at 1.51 percent, cut-leaf plantain (*Plantago coronopus*) at 0.31 percent, and common sow-thistle (*Sonchus oleraceus*) at 0.13 percent. Of the 24 species observed during sampling, 16 were determined to be native.

Machine Gun Flats

Species composition and estimated percent cover at MGF are presented in Table 15 and Figure 12. Plate 12 displays transect locations associated with this waterbody. Forty-seven plant species were recorded at MGF. The dominant plant species, present at greater than 10 percent of the combined average cover is an unknown rush species (*Juncus* sp.). Pale spike-rush (*Eleocharis a. acicularis*), saltgrass (*Distichlis spicata*), coast eryngo, California oatgrass, smooth cat's ear, salt rush (*Juncus lesueurii*), brown-headed rush (*Juncus phaeocephalus*), beardless ryegrass (*Leymus triticoides*), rabbitfoot grass (*Polypogon monspeliensis*), silvery hair-grass, and needle spike-rush (*Eleocharis a. acicularis*) were present between 3.4 and 9.9 percent of the combined average cover. The remaining plant species were totaled 1 percent or less of the combined average cover. Exotic species encountered at MGF and their estimated covers included: smooth cat's-ear at 6.73 percent, rabbitfoot grass at 4.47 percent, silvery hair-grass at 3.99 percent, South American conyza (*Conyza bonariensis*) at 2.99 percent, rat-tail fescue at 2.8 percent, common sow-thistle at 1.96 percent, Carolina geranium at 1.92 percent, common cudweed at 1.65 percent, small quaking grass at 1.58 percent, ripgut grass at 1.57 percent, cut-leaved plantain at 1.43 percent, cut-leaved fireweed at 1.12 percent, prickly sow-thistle at 0.86 percent, long-beaked filaree (*Erodium botrys*) at 0.70 percent, Italian ryegrass (*Lolium multiflorum*) at 0.43 percent, greenstem filaree (*Erodium moschatum*) at 0.39 percent, poison hemlock (*Conium maculatum*) at 0.31 percent, curly dock (*Rumex crispus*) at 0.27 percent, scarlet pimpernel at 0.13 percent, redstem filaree (*Erodium cicutarium*) at 0.06 percent, and slender wild-oat at 0.02 percent. Of the 47 species observed during sampling, 26 were determined to be native.

3.4.2 Fauna

California linderiella were observed during wetland monitoring at Waterbody 42 and MGF. Table 17 presents a summary of California linderiella data collected each month at Waterbody 42 and MGF during 2002 follow-up monitoring events. No fairy shrimp species listed as threatened or endangered were observed at these sites during the 2002 surveys. Table 18 presents the list of special-status vertebrate species observed at wetland monitoring sites.

Fairy Shrimp

Immature fairy shrimp were observed in Waterbody 42 and MGF during January in very high numbers: over 1,000 immature individuals were observed in more than 20 dipnet samples. The density of immature individuals observed at Waterbody 42 dropped from very high to high (approximately 250 individuals) in February, as water temperatures increased and water levels receded. Subsequent linderiella surveys were not conducted at Waterbody 42 due to the absence of water.

Immature fairy shrimp were present in very high numbers at MGF in the January and February monitoring (over 1,000 individuals). No linderiella individuals were observed at MGF during subsequent surveys. Table 17 presents a summary of California linderiella data collected each month during 2002 at Waterbody 42 and MGF.

California tiger salamander/California red-legged frog

CTS and CRF were not observed during follow-up monitoring at Waterbody 42 and MGF in 2002. Pacific treefrog (*Hyla regilla*) adults and larvae were observed in both waterbodies. Bullfrogs, both tadpoles and adults, were observed in abundance in MGF, most notably in Bullfrog Pond. Table 18 presents the list of special-status species observed at Waterbody 42 and MGF monitoring sites in 2002. Vertebrate fauna observed during the surveys is presented in Table 19.

Southwestern pond turtle/tricolored blackbird

SWPT and TRB were not observed at Waterbody 42 and MGF during 2002 monitoring events. Table 18 presents the list of special-status species observed at wetland monitoring sites in 2002. Other vertebrate fauna observed during the surveys is listed in Table 19.

3.4.3 Physical Characteristics

The physical parameters measured monthly in each of the waterbodies during the 2002 Wetland Monitoring activities include water depth, area of ponding, and pH level. The maximum area of ponding (0.07 acres) and water depth (7 inches) at Waterbody 42 was observed in January. Waterbody 42 dried out between the second and third wetland surveys. Measurements for turbidity at Waterbody 42 ranged from 10.8 to 12, a relatively low reading that is likely due to the sites remote, tree-shaded location.

MGF exhibited ponded water from the time of the initial site visit in January through the May site visit. The maximum area of ponding (3.24 acres) was observed in January while the maximum water depth (24 inches) of ponding occurred in February at MGF. Measurements for pH ranged from 6.8 to 7.2, while measurements for turbidity ranged from 75.2 to 180 at MGF. This relatively high turbidity reading at MGF is possibly attributable to a flock of Canadian geese observed foraging within the wetland during February and March, and a significant human influence (dogs, hikers, etc.) around this waterbody.

The area of ponding and water depth at MGF was significantly reduced between the second and third wetland monitoring events. Beginning in April, ponding was limited to a deep pool located on the western edge of MGF (bullfrog pond). A summary of physical parameters at Waterbody 42 and MGF is presented in Table 20.

4.0 DISCUSSION

HMP habitats of concern within OE removal or lead, chemical, and groundwater remediation sites on the Former Fort Ord, include central maritime chaparral and wetland habitats. These habitats possess many of the special status plants and animals identified in the HMP. The success criteria for habitats of concern and special-status species are defined in the HMP. This section identifies which OE removal, lead, chemical, and groundwater remediation sites have or have not met the success criteria defined in the HMP.

4.1 Central Maritime Chaparral Habitat Monitoring

As stated earlier, success criteria for central maritime chaparral habitat is defined in the HMP as “restored habitat will consist of naturally regenerating maritime chaparral that is managed using controlled burning and other techniques that maximize habitat value for HMP species.”

4.1.1 OE Sites

OE-10A: The data collected in 2002 by BLM represents the sixth year of follow-up monitoring at this site. Baseline surveys were conducted for this site in 1994. OE-10A underwent several episodes of vegetation clearance between 1995 and 1998. OE-10A was partially burned in 1995; the OE sampling and removal grids not burned, were manually clipped beginning in 1995 and through 1997. The majority of OE-10A was burned again in 1997, including clipped areas. Transect data collected at this site is now analyzed as a burned area. The data collected in 2002 represents the second year that all of OE-10A was analyzed as a burn area. Figure 16 presents the overall coverage provided by chaparral species observed during line-intercept sampling in 1999 through 2002.

Overall coverage provided by flora species observed during line-intercept sampling for OE-10A is presented in Table 3 and Figure 2. The overall cover provided by chaparral shrub and perennial species has steadily grown since 2000. Chaparral shrub and perennial species provided 47 percent of the overall cover in 1999; however, this may not be representative of vegetative recovery of the site due to the limited number of transects sampled in 1999 (5 transects). Chaparral shrub and perennial species provided 70 percent of the overall cover in 2000, 62 percent in 2001, and 78 percent in 2002. The 1994 baseline survey shows that shrub and perennial species provided approximately 21 percent of the overall cover in seral (semi-disturbed) chaparral and approximately 89 percent of the overall cover in mature chaparral.

The cover provided by HMP seed reproducers such as Toro manzanita, Hooker’s manzanita, and Monterey ceanothus remains consistent with survey data obtained since the 2000 follow-up survey. The cover provided by HMP seed producers provided approximately 8 percent cover in 2000, 8 percent cover in 2001, and 10 cover percent in 2002. The 1994 baseline survey shows that HMP seed producers accounted for approximately 33 percent of the overall cover in mature chaparral. Toro and Hooker’s manzanita were not recorded in seral chaparral in the 1994 baseline survey of this site. Monterey ceanothus accounted for less than 1 percent of the overall cover in seral chaparral.

Bare ground was approximately 7 percent at this site compared to approximately 22 percent in the 1994 baseline survey. The cover provided by exotic species such as hottentot fig accounted for approximately 3 percent of the overall cover at this site in 2002. Exotic species were not observed as occurring at this site during the 1994 baseline survey.

Flora species recorded during quadrat sampling at this site are presented in Table 4 and Figure 3. Vegetative ground cover remained virtually unchanged in 2001 (32 percent) as compared to 2002 (34 percent). It should be noted that quadrat sampling was greater in 2002 (11 transects) as compared to 2001 (3 transects). Accordingly, herbaceous species diversity was greater in 2002 than in 2001. In 2001, 32 species were identified during quadrat sampling as compared to 51 species identified in 2002.

With the exception of high cover provided by herbaceous species, this site appears to be regenerating to baseline conditions, based upon the continued increase in the proportion of cover provided by chaparral shrub and perennial species. The cover provided by herbaceous species has remained high (over 30 percent) during sampling events held during 2000 through 2002 but is expected to drop as the cover provided by chaparral shrub and perennial species increases. In the 1994 baseline survey, herbaceous species provided 46 percent of the cover in seral chaparral at this site. Herbaceous species were not observed in mature chaparral at this site in the 1994 baseline survey. While 2002 represents the sixth year of follow-up monitoring at OE-10A, it represents the fifth year of follow-up monitoring that has occurred since the 1997 burn at this site. Thus, as required by the HMP, five years of follow-up monitoring has occurred at this site and future follow-up monitoring is not needed to identify the regeneration of species and species diversity at this site.

OE-10B: Data collected in 2002 represents the fifth year of follow-up monitoring on OE-10B. Baseline surveys for this site were conducted in 1996. Portions of OE-10B were burned or manually clipped in 1997. Figure 17 presents the overall coverage provided by chaparral species in burned areas that were observed during line-intercept sampling of burned areas of OE-10B in 1999, 2000, 2001, and 2002. Figure 18 presents the overall coverage provided by chaparral species in clipped areas that were observed during line-intercept sampling of clipped areas in 1999 through 2002. Figure 19 compares the coverage provided by chaparral shrub species recorded during line-intercept sampling for burned and clipped areas of OE-10B. This site is the only OE site where both burned and clipped vegetation occurred; and it represents the only site where a comparison of clipped and burned vegetation is available. Data available for other sites represent either burned or clipped data for that site.

Overall cover provided by flora species recorded during line-intercept sampling in burned areas at this site is presented in Table 5 and Figure 4. In 2002, cover by chaparral shrub and perennial species remained consistent (107 percent) with that observed in 2001 (105 percent) and the 1996 baseline survey (103 percent). The overall coverage by the HMP shrub species, Toro manzanita, remains low at this site. Toro manzanita provided less than one percent of the overall cover in the 2002, 2000, and 1999 follow-up survey as compared approximately 41 percent in the 1996 baseline survey. The low cover provided by Toro manzanita could be the result of the high cover provided by the perennial species rush rose at this site. Rush rose provided approximately 31 percent of the overall cover in 2002, 34 percent in 2001, 28 percent in 2000, and 24 percent in 1999. Rush rose was not observed at this site in the 1996 baseline survey. Vegetated cover remains high at this site. Vegetated cover was approximately 20 percent in the 2001 and 2002 follow-up surveys as compared to 2 percent in the 1996 baseline survey. The percentage of bare ground was low in the 2001 (nine percent) and 2002 (seven percent) follow-up surveys as compared to 15 percent identified in the 1996 baseline survey. Exotic species were not observed during follow-up surveys in burned areas at this site.

Flora species recorded during quadrat sampling in burned areas are presented in Table 6 and Figure 5. In 2002, herbaceous species cover was 20 percent, unchanged from the 2001 survey. Chaparral shrub species comprised approximately 70 percent of the cover noted during the 2002 quadrat sampling at this site compared to 43 percent of the cover in 2001 and 29 percent in 1998. Quadrat sampling was not performed at this site in 1999 and 2000.

With two notable exceptions, the low overall cover provided by Toro manzanita (less than one percent) and the high cover provide by rush rose (approximately 31 percent), the composition and cover of chaparral shrub and perennial species in burned areas appears consistent with baseline conditions recorded at this site. The seed source for rush rose at this site remains unknown. The overall cover provided by chaparral shrub and perennial species was virtually the same in the in the 2001 and 2002 follow-up surveys (105 and 107 percent respectively) as compared to the 1996 baseline survey (103 percent).

Results of line-intercept sampling for clipped areas at OE-10B are presented in Table 7 and Figure 6. Figure 18 presents the overall percent cover provided by chaparral species observed during line-intercept sampling for clipped areas of OE Site 10B in 1999 through 2002. The cover provided by chaparral scrub and perennial species in clipped grids showed notable increases from 1998 to 2000 and has remained fairly consistent since 2000. Chaparral shrub and perennial species provided approximately 48 percent of the overall cover at clipped grids in 1998, 86 percent of the cover in 1999, 94 percent in 2000, 99 percent in 2001, and 93 percent in 2002. Chaparral shrub and perennial species accounted for approximately 115 percent of the overall cover at this site in the 1996 baseline survey. Cover is dominated by two taller shrub species, Toro manzanita and shaggy-barked manzanita, which accounted for 83 percent of the overall cover in clipped areas at this site. The high percentage of cover provided by these two species may be the result of the limited vegetation clearance that was performed at this site. The percentage of bare ground in clipped grids is consistent with baseline conditions observed at this site. Bare ground was approximately 18 percent in 2002 as compared to 16 percent in the 1996 baseline conditions. Herbaceous species account for approximately five percent of the combined cover in clipped grids 1n 2002. Herbaceous species accounted for two percent of the overall cover in the 1996 baseline survey at this site.

Analysis of clipped areas is limited due to the small number of transects (2) located in clipped areas. Species diversity was found to be much lower in clipped areas than in burned areas of this site; however, the low diversity of species in clipped areas is consistent with expectations as allelopathic chemicals in the soil and the physical and shade barrier presented by duff and chipped material could prevent germination of some seed species. Based upon the low overall cover provided by chaparral shrub species, 93 percent in 2002 as compared to 115 percent in the 1996 baseline survey, clipped areas at OE-10B are not consistent with baseline conditions for central maritime chaparral habitat. It should be noted that analysis of clipped areas is limited by the small number of transects (two) located in clipped areas.

As noted previously, vegetation in burned areas at this site appears to be regenerating to baseline conditions while vegetation in clipped areas is not regenerating to baseline conditions. Based upon the limited data used to conduct analysis in clipped areas, corrective measures are not recommended to make vegetative conditions in clipped areas consistent with baseline conditions. As required by the HMP, five years of follow-up monitoring has occurred at this site. Thus, future follow-up monitoring is not needed to identify the regeneration of species and species diversity at this site.

OE-11: This is the fifth year of follow-up monitoring conducted at this site. Baseline data for this site was collected in 1996. In 1997, vegetation at OE-11 was manually clipped in preparation for OE removal. Cleared vegetation was piled in parallel rows approximately 3 to 5 feet high and 6 to 10 feet wide. Figure 20 presents the overall percent cover provided by chaparral species observed during line-intercept sampling for OE-11 in 1999 through 2002.

The overall cover provided by chaparral shrub and perennial species notably grew between 1998 and 2000 but has shown little variation since 2000. The cover provided by chaparral shrub and perennial species was 62 percent in 2002, 63 percent in 2001, 67 percent in 2000, 41 percent in 1999, and 30 percent in 1998. The 1996 baseline survey shows that shrub and perennial species provided approximately 117 percent of the overall cover at this site. Chaparral shrub species such as chamise provided approximately 22 percent and shaggy-barked manzanita provided approximately 8 percent in 2002. The 1996 baseline survey shows that chamise provided 48 percent and shaggy-barked manzanita provided approximately 30 percent of the overall cover at this site. The cover provided by Toro manzanita remains low (6 percent) at this site. Toro manzanita provided approximately 26 percent of the overall cover at this site in the 1996 baseline survey. The drop in the cover provided by Toro manzanita can be attributed to the percent of cover in Transects 3 and 5. Toro manzanita provided approximately three percent of the cover at Transect 3 in 2002 compared to approximately 28 percent in the 1996 baseline survey. Toro manzanita has not been observed at Transect 5 between 1998 and 2002 as compared to approximately 32 percent in the 1996 baseline survey.

The cover provided by brush piles dropped notably (15 percent in 2001 at compared to 7 percent in 2002) in sampling data at this site. Bare ground remains high at this site. Bare ground comprised 19 in of the cover as this site in 2002 as compared to 11 percent in the 1996 baseline survey.

Herbaceous species recorded during quadrat sampling at OE-11 are presented in Table 9 and Figure 8. The cover provided by herbaceous species increased from 13 percent in 2001 to 19 percent in 2002. Herbaceous species diversity at this site has steadily dropped since the 1999. Eighteen herbaceous species were identified in 2002 as compared to 56 herbaceous species in 1999, and 21 herbaceous species in 2000. Only 10 herbaceous species were identified in 2001; however, herbaceous surveys were only conducted on one transect in 2001.

The overall percent cover at OE Site 11 is not consistent with baseline conditions for central maritime chaparral habitat. The overall cover provided by chaparral shrub and perennial species at this site remains low at this site (62 percent of the overall cover at this site as compared to 116 percent in the 1996 baseline survey). The overall vegetated cover provided by annual species remains high at this site (19 percent of the overall cover in 2002 as compared to 4 percent in the 1996 baseline study). It should be noted that the cover provided by brush piles has steadily decreased from 18 percent in 1998 to 7 percent in 2002. The physical and shade barriers presented by brush piles may have inhibited the recovery of germinating seed species at this site. No corrective measures are recommended for this site as the continued decrease in the physical and shade barriers provided by brush piles could allow for an increase in the overall cover provided by chaparral shrub and perennial species at this site. As required by the HMP, five years of follow-up monitoring has occurred at this site; thus, future follow-up monitoring is not needed to identify the regeneration of species and species diversity at this site.

OE-19: Data collected in 2002 represents the fifth year of follow-up data collected for OE-19. Baseline data was collected for this site in 1994. OE-19 was burned in 1995 and sampled for OE between 1995 and 1998. Limited vegetation clearance was performed on stump-sprouting species at this site. Unburned branches and large stems of species such as chamise and shaggy-barked manzanita were manually clipped. Figure 21 presents the overall coverage provided by chaparral species observed during line-intercept sampling for OE-19 in 1999 through 2002.

Overall coverage provided by chaparral shrub and perennial species recorded during line-intercept sampling at this site is presented in Table 10 and Figure 9. The coverage provided by chaparral shrub and perennial species is consistent with data obtained in the 1994 baseline survey. Chaparral shrub and perennial species provided approximately 117 percent of the overall cover in 2002 as compared to approximately 96 percent in the 1994 baseline survey. It should be noted that the overall cover provided

by chaparral shrub and perennial species was significantly high in 1999. The overall cover provided approximately 108 percent in 1998 and notably rose to approximately 168 percent in 1999. It then dropped to approximately 137 percent in 2000 and 106 percent in 2001. The notable changes in the overall coverage provided by chaparral shrub and perennial species can be accounted for by sizable changes in the cover provided by shaggy-barked manzanita. The cover provided by shaggy-barked manzanita rose from approximately 39 percent in 1998 to approximately 67 percent in 1999 and then dropped to approximately 28 percent in 2000. It is undetermined as to the reason for changes in the cover provided by shaggy-barked manzanita at this site.

Herbaceous species recorded during quadrat sampling at OE-19 are presented in Table 11 and Figure 10. The cover noted by chaparral shrub and perennial species during quadrat sampling is high at this site. Chaparral shrub and perennial species accounted for approximately 92 percent of the vegetative cover in quadrat sampling.

Regeneration of this site appears to be approaching baseline conditions. The cover provided by chaparral and perennial species varied greatly but remained high at this site. As required by the HMP, five years of follow-up monitoring has occurred at this site; thus, future follow-up monitoring is not needed to identify the regeneration of species and species diversity at this site.

4.2 HMP Annual Species Surveys - Monterey Spineflower, Sand Gilia, Seaside Bird's-Beak, Contra Costa Goldfields

HMP species associated with OE removal, lead, chemical and groundwater remediation sites include: sand gilia, Monterey spineflower, Contra Costa goldfields, coast wallflower, Seaside bird's-beak, Toro manzanita, Hooker's manzanita, sandmat manzanita, Monterey ceanothus, Hooker's manzanita, Eastwood's goldenbush, and California black legless lizard. The success criteria for HMP annual species states that "if after five monitoring years, population sizes are observed to vary over time within a range that includes annual populations similar in size to those estimated for these species in 1992' restoration for these species will be considered successful.

4.2.1 OE Sites

OE-9: Surveys in 2002 represent the baseline study of HMP annual species at this site. A small population (less than 100 individuals) of Monterey spineflower was found in the southwest corner of this site. The size and location of HMP annual species populations observed in 2002 is illustrated on Plate 7.

Moreover, one small and two medium (101-500 individuals) populations are located just outside of the south boundary of this site. As stated earlier, 2002 represents the baseline study for these species at this site. Consistent with HMP monitoring requirements, HMP annual species follow-up surveys will commence upon completion of OE removal activities at this site.

OE-10A: Surveys in 2002 represent the fifth year of follow-up monitoring for HMP annual species at this site. The HMP annual species baseline survey for this site was conducted in 1997. The size and location of HMP annual species populations observed in 2002 is illustrated on Plate 3.

The size and locations of Monterey spineflower and sand gilia in 2002 populations are consistent with those observed in 2001. Follow-up surveys in 2001 and 2002 show a marked increase in the size of both Monterey spineflower and sand gilia population estimates over previous surveys. The increase in population size could be attributed to an increase in survey efforts beginning in 2001.

Two large (over 5,000 individuals), one medium (501-5,000 individuals), and nine small (less than 500) populations of Monterey spineflower was observed at this site in 2001 and 2002. One large and three small populations of Monterey spineflower were observed at this site in 2000. Monterey spineflower (population size not recorded) were observed along a sandy road in the central portion of the site during the 1997 baseline survey at this site.

One large and six small populations of sand gilia were observed at this site in 2002. One large, one medium, and six small populations of sand gilia were observed at this site in 2001. One large and one small population of sand gilia were observed at this site in 2000. Two small populations of sand gilia were observed at this site in 2000. The 1997 baseline survey indicated that the population size of sand gilia was less than 250. Sand gilia was not found at one spot previously identified as having sand gilia. The location of this site is included for reference and serves as an indicator on the fluctuations in the location and population size of sand gilia at this site.

Seaside bird's-beak was not observed at this site during the baseline or subsequent follow-up surveys at this site.

HMP annual species at site OE-10A appear to meet the success criteria as defined in the HMP. Self-sustaining populations of HMP annual species are present at this site. The population size of Monterey spineflower and sand gilia are larger and more numerous than those observed in the 1997 baseline survey for this site. As required by the HMP, five years of follow-up HMP annual species monitoring has occurred at this site; thus, future follow-up monitoring is not needed to identify the locations and populations sizes of HMP annual species at this site.

OE-10B: Surveys in 2002 represent the fifth year of follow-up monitoring for HMP annual species at this site. The HMP annual baseline survey for this site was conducted in 1996. The size and location of HMP annual populations observed in 2002 is illustrated on Plate 4.

The size and locations of Monterey spineflower and sand gilia in 2002 populations are consistent with those observed in 2001. Follow-up surveys in 2001 and 2002 show a marked increase in the size of both Monterey spineflower and sand gilia population estimates over previous surveys. The increase in population size could be attributed to an increase in survey efforts beginning in 2001.

Two large, one medium, and nine small populations of Monterey spineflower are scattered throughout the southern portion of this site in 2002 and 2001. Two large and three small populations were observed at this site in 2000. The 1996 baseline data indicates that Monterey spineflower occurred at a low density throughout this site.

One large, two medium, and six small populations of sand gilia were observed at this site in 2002 and 2001. Ten small populations of sand gilia were observed at this site in 2000. Two small populations of sand gilia were observed at this site in 1999. In the 1996 baseline survey, the sand gilia population occurred in a small, single population (37 individuals).

There was an increase in the number of populations of Seaside bird's-beak observed in 2002 as compared to the number of populations of Seaside bird's-beak observed in 2001. Two large, four medium, and eleven small populations of Seaside bird's-beak were also identified at this site in 2002. One large, two medium, and four small populations of Seaside bird's-beak were observed at this site in 2000. The size of the Seaside bird's-beak range was estimated to consist of hundreds to thousands of individuals in the 1996 baseline survey for this site. Seaside bird's-beak was not found at four spots previously identified as having Seaside bird's-beak. The location of these sites are included for reference purpose and serve as an indicator on the fluctuations in the location and population size of Seaside bird's-beak at this site.

HMP annual species at site OE-10B appear to meet the success criteria as defined in the HMP. Self-sustaining populations of HMP annual species are present at this site. The population size of Seaside bird's-beak, Monterey spineflower and sand gilia are larger and more numerous than those observed in the 1996 baseline survey for this site. It should be noted that observations by BLM at this site have identified two areas where erosion along former roads have impacted HMP annual species. As required by the HMP, five years of follow-up HMP annual species monitoring has occurred at this site; thus, future follow-up monitoring is not needed to identify the locations and populations sizes of HMP annual species at this site.

OE-11: Surveys in 2002 represent the fourth year of follow-up monitoring for HMP annual species at this site. The HMP annual baseline survey for this site was conducted in 1996.

The population size of HMP annual species is consistent those documented as occurring in the 1996 baseline survey of this site. Self-sustaining populations of two HMP annual species, Monterey spineflower and sand gilia, were not observed to occur during 1996 baseline survey at this site. Monterey spineflower and sand gilia were not observed at this site in 2000, 2001, and 2002 follow-up surveys. One individual of Seaside bird's-beak was observed at this site during the 1996 baseline survey. Further monitoring is required to monitor the population size and location of HMP annual species at this site pursuant to the monitoring requirements identified in the HMP

OE-19: The 2002 data represents the fifth year of follow-up monitoring for HMP annual species at this site. The HMP annual baseline survey for this site was conducted in 1994. HMP annual populations observed in 2002 is illustrated on Plate 6.

A small population (less than 100) was located just outside of the site's northwestern boundary in 2002. This small population was identified in the 2000 survey but not in the 2001 survey. HMP annual species were not observed at this site the 1994 baseline survey.

The population size of HMP annual species is consistent those documented as occurring in the 1994 baseline survey of this site. As required by the HMP, five years of follow-up HMP annual species monitoring has occurred at this site; thus, future follow-up monitoring is not needed to identify the locations and populations sizes of HMP annual species at this site.

4.2.2 UC/NRS FONR Groundwater Remediation Sites

Surveys conducted at the UC/NRS FONR in 2002 for sand gilia and Monterey spineflower comprise the third year of monitoring activities. HMP annual baseline surveys for this site were conducted in 1998. The size and location of HMP annual populations is illustrated on Plate 8.

Populations of sand gilia were significantly lower in 2002 as compared to 2001. The low population of this species may be attributed to low levels of precipitation at the FONR in the 2002. Precipitation at the UC/NRS FONR was notably low in 2002. Precipitation at the UC/NRS FONR was at 76 percent of the 50-year normal for the Monterey areas as compared to 103 percent in 2001. December 2001 was the only month with significant precipitation in the 2002 rain year for Monterey. Over six inches of precipitation were noted in December. Monthly precipitation averages fell to below two inches from January through April. Monthly precipitation comparisons for rainfall years 2001 and 2002 as compared to the 50-year norm are presented in Table 21 and Figure 22. The bloom period for sand gilia ranges from April through June. It is suspected sand gilia was more abundant in early April but dropped rapidly due to low precipitation observed in the 2002 rain year. Informal telephone conversations with Dr. Laurel Fox (Biology Professor) at the University of California, Santa Cruz, indicate that sand gilia population levels are greatly influenced by precipitation fluctuations.

Populations of Monterey spineflower and sand gilia are located along access roads and adjacent to groundwater monitoring wells. The Army implemented a series of mitigation measures to reduce the impacts of groundwater well drilling activities to adjacent habitat. These mitigation measures include:

- Limiting groundwater well construction activities to the dry season to avoid impacts to HMP annual species during growth and flowering periods and to avoid potential erosion
- The use of a DENR approved biologist to identify the least damaging access routes, work zones, equipment and material stockpile
- The placement of flagging/fencing around potential spineflower/sand gilia habitat with instructions to well drillers to avoid flagged/fenced off areas
- Windrowing of the top two inches of soil around the well site if impacts to potential Monterey spineflower and sand gilia habitat were unavoidable.

HMP annual species do not appear to be greatly influenced by vehicle access at the UC/NRS FONR. The notably low population size of sand gilia at the UC/NRS FONR is believed to be the result of markedly low levels of precipitation between January and April. Further monitoring of HMP annual species is required to monitor the recovery of HMP annual species at this site pursuant to monitoring requirements identified in the HMP.

4.2.3 Contra Costa Goldfields Surveys

Surveys in 2002 represent the third year of follow-up monitoring for Contra Costa goldfields at the MGF and mima mound sites. The Contra Costa goldfields baseline surveys were conducted in 1998 and 1999 at these two sites. The density and location of Contra Costs goldfields in MFG is illustrated on Plate 9. The density and location of Contra Costs goldfields in the mima mounds is illustrated on Plate 10.

The estimated populations of Contra Costa goldfields at MGF in 2002 is consistent with the 1999 baseline survey and are notably reduced as compared to populations identified in the 2000 survey. Populations in 2002 are estimated to contain 6,000 individuals at MFG as compared to 14,000 individuals in the 2000 survey. In the baseline surveys at MGF, the Contra Costa goldfields population was estimated to contain 6,500 in 1999.

Populations of Contra Costa goldfields were noticeably greater at the mima mound site as compared to the 1999 baseline survey and the 2000 follow-up survey. Contra Costa populations in 2002 are estimated to contain approximately 236,000 individuals at the mima mound site as compared to an estimated 148,000 individuals in the 2000 survey. In the 1999 baseline survey, Contra Costa goldfields population was estimated to be approximately 50,000 at the mima mound site.

Contra Costa goldfields populations observed at OE-10B was restricted to low-lying areas at MFG and the mima mound area. Plant density was visibly greater at the mima mound site than at MFG. This population difference may be attributed to the differences in rainfall totals and the duration of water ponding at the two sites. Changes in population in the year-to-year totals for Contra Costa goldfields will be recorded and compared with reported basewide fluctuations for those same years. Pursuant to HMP monitoring requirements, further monitoring is required to monitor the population size and location of Contra Costa goldfields at these two sites.

4.3 Exotic Species

OE-11 represents a potential seed source for these species and produces a potential of colonization of disturbed habitat within and adjacent to the project area by jubata grass and hottentot fig. In addition, wildlife species spread non-native, exotic species through their use of these species as a food source or on their bodies as the transit through areas containing exotic species. Non native species should be managed to reduce the potential for regeneration of these species after OE clearance and other remedial habitat disturbance activities have been completed within the surrounding area.

The California Exotic Pest Plant Council (CalEPPC) considers Jubata grass and hottentot fig as extremely invasive and were placed on CalPECC's List A-1; List A-1 is defined as Most Invasive Wildland Plants. Both species are colonizers of bare and disturbed ground and compete with native vegetation. Cut-leaved fireweed is listed on CalPECC's List A-2; List A-2 is defined as Wildland pest plant of lesser invasiveness. Cut-leaved fireweed propagates quickly after fire disturbance.

4.4 Wetland Monitoring

HMP and WRP species associated with wetlands include: California red-legged frog, California tiger salamander, California linderiella, southwestern pond turtle, and tricolored blackbirds. The HMP also states affected waterbodies must support healthy populations of California linderiella, California tiger salamander, or California red-legged frogs upon completion of restoration activities if the affected waterbody supported these species.

Fairy shrimp

The data collected at Waterbody 42 and MGF represents the third year of follow-up monitoring for vegetation and fairy shrimp at these waterbodies.

California linderiella were observed during follow-up monitoring conducted at Waterbody 42 and MGF. The relative abundance of fairy shrimp at Waterbody 42 during the 1998 baseline monitoring survey ranged from moderate abundance (11 to 100 individuals) in January 1998 to a low abundance (1 to 10 individuals) in February 1998. Relative abundance of immature individuals was very high, with over 1,000 immature individuals observed in January 2002 as compared to three California linderiella individuals observed in January 2001. It should be noted that immature individuals found at Waterbody 42 are assumed to be California linderiella based upon data from baseline and follow-up monitoring surveys at Waterbody 42. Immature individuals of vernal pool shrimp are not identifiable to a species.

Surveys for fairy shrimp did not occur at Waterbody 42 after February 2002 due to the absence of water. Precipitation levels of the 2002 rain year are at 76 percent of the 50-year norm for the Monterey area. Figure 22 and Table 21 display precipitation levels in Monterey during November through May of the 2002 rain year. Less than two inches of precipitation occurred in February 2002 and less than one and one-half inches of precipitation occurred in March 2002.

Fluctuations in the abundance and presence of fairy shrimp are attributed to variations of natural conditions at the waterbody, including precipitation timing and totals, temperature, and pH. Additionally, as water levels shrunk and temperatures increased, mosquito larvae numbers rose dramatically.

Linderiella were previously observed in MGF during the 1998 baseline monitoring event. The relative abundance during the 1998 baseline survey ranged from high abundance (101 to 300 individuals) in January 1998 to a moderate abundance (11 to 100 individuals) in February 1998. Relative abundance of vernal pool shrimp at MFG was very high (over 1,000 individuals) in January and February 2002

compared to baseline surveys (greater than 300 individuals) conducted in 1998. Relative abundance of vernal pool shrimp was very high, with over 1,000 immature individuals observed in January 2002. The density of California linderiella was very high (over 1,000 mature individuals) in February 2002. It should be noted that the immature individuals found at MGF in January 2002 are assumed to be California linderiella based upon data from the follow-up monitoring survey conducted in February, 2002. Immature individuals of vernal pool shrimp are not identifiable to a species.

Fairy shrimp were not observed at MGF during monitoring conducted from March through May 2002. The absence of fairy shrimp at MGF can be attributed to the decrease in the area of ponding and water depth at MGF. Precipitation levels of the 2002 rain year are at 76 percent of the 50-year norm for the Monterey area. Less than two inches of precipitation occurred in February 2002 and less than one and one-half inches of precipitation occurred in March 2002.

OE removal activities at OE-10B did not appear to have affected abundance of linderiella at MGF. The high abundance of fairy shrimp has been observed at waterbodies once OE removal activities have been completed.

California tiger salamander

The data collected at Waterbody 42 and MGF represents the third year of follow-up monitoring for CTS at these waterbodies. CTS's were not recorded as occurring at these waterbodies during baseline surveys. CTS's, both adults and juveniles, were observed at Waterbody 42 in 2000, the year following OE removal activities. CTS's have not been detected at MGF during follow-up monitoring. CTS's were not observed during follow-up monitoring surveys conducted at Waterbody 42 or at MGF in 2002.

California red-legged frog

The data collected at Waterbody 42 and MGF represents the third year of follow-up monitoring for CRF at these waterbodies. They were not observed during baseline or subsequent follow-up monitoring surveys conducted at these sites.

Waterbody 42 and MGF provides minimally suitable habitat for CRF. The lack of flowing water and suitable dispersal areas would likely rule out their presence, with the exception of winter storms, during which they may be able to move into the area. The absence of CRF in MGF may be attributable to the presence of large numbers of bullfrogs in the area. Adult bullfrogs are opportunistic feeders whose prey items include fish, salamanders, and other frogs. An area in the western portion of MGF, measuring approximately 0.02 acres, is substantially deeper than the rest of the waterbody. This area has also been observed to retain water throughout a majority of the year (7 to 8 months), and has allowed the bullfrog to persist as other frogs perish when waters dry up.

Tricolored blackbird

The data collected at Waterbody 42 and MGF represents the second year of follow-up monitoring for TRB's at these waterbodies. TRB's were not observed at this site in the 2000 baseline survey or subsequent follow-up surveys.

Southwestern pond turtles

The data collected at Waterbody 42 and MGF represents the second year of follow-up monitoring for SWPT's at these waterbodies. SWPT's were not observed at this site in the 2000 baseline survey or subsequent follow-up surveys.

4.5 Anticipated Future Monitoring

Pursuant to HMP monitoring and success criteria requirements, habitat monitoring activities recommended for the 2003 annual monitoring report include:

- Final annual HMP annual species surveys at UC/NRS-FONR, and OE-11.
- Follow-up monitoring of Contra Costa Goldfields populations at OE-10B.
- Final wetland monitoring at waterbodies 42 and MGF.
- If OE removal occurs, follow-up chaparral monitoring at OE-9, OE-16, MRA North and West, and Ranges 43 - 48.
- If OE removal activities occur, annual HMP annual species surveys at OE-9, MRA North, MRA West, and Ranges 43 - 48
- Follow-up wetland monitoring at waterbodies 43, 44, and 53 if OE removal occurs. Follow-up monitoring at waterbody 52 if remediation is complete.

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