1999 Annual Monitoring Report
Former Fort Ord
Monterey County, California

Prepared for

U.S. Department of the Army
Sacramento District Corps of Engineers
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December 2, 1999

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1.0 INTRODUCTION

To maintain compliance with habitat management and monitoring requirements presented in the *Installation-Wide Multi-Species Habitat Management Plan for Former Fort Ord, California* (HMP; *USACE, 1997a*), biological resources are monitored after ordnance and explosive (OE) removal activities have been completed. The HMP identifies species and habitats of concern on the installation and specifies mitigation measures to monitor the successful regeneration of species and habitat following removal of OE. Monitoring includes conducting follow-up monitoring for a period of 5 years following OE removal to document habitat conditions following remediation.

Since the inception of the OE removal program the Army has elected to augment the monitoring program, where feasible to include the collection of baseline data prior to OE removal. Baseline data have been collected to provide additional information on pre-existing species composition and distribution of herbaceous annual sensitive species. Additionally, base closure and reuse activities conducted on the former Fort Ord are required to follow specific protocols approved by 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, 99*) and 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 BO identifies additional species and habitats of concern not addressed in the April 11, 1997 biological and conference opinion that could potentially be impacted during remediation, predisposal, and reuse activities. The BO also outlines mitigation measures intended to document conditions and monitor the successful regeneration of species and habitat following remediation, predisposal, and reuse activities.

This report was prepared to address the Army's habitat monitoring requirements as identified in the HMP and BO for OE removal and groundwater remediation. As data accumulate for groundwater and OE remedial sites, these data may be used to refine methods to minimize adverse effects on HMP species.

1.1 Habitats and Species Considered for Habitat Monitoring

Sensitive habitats occurring on OE removal and groundwater remediation sites include central maritime chaparral and wetland habitats. These communities provide habitat for many of the special-status plants and animals identified in the HMP. Baseline and follow-up surveys are conducted on OE removal sites to characterize central maritime chaparral in terms of shrub species composition and cover dominance, and to characterize the location and extent of special status animal and herbaceous plant populations. Surveys are conducted on groundwater remediation sites to characterize the location and extent of HMP herbaceous species potentially disturbed during remedial activities. Similarly, surveys in vernal pools and ponds (waterbodies) are conducted to characterize percent vegetative cover, occurrence of special-status animals, and environmental parameters such as surface area, water depth, pH, and turbidity. Follow-up monitoring in these habitats is required to document community regeneration in order to meet HMP success criteria. Success criteria for central maritime chaparral are 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." Success criteria for herbaceous HMP species are defined that if after 5 years, population sizes and densities are observed to vary over time within a range similar to that estimated for these species in 1992, the effort will be considered successful. The success of restored or regenerated wetlands affected by OE removal will be gauged by comparing the

functioning value of the habitat defined in terms of the percentage of native species and occurrence of special-status species before and after remediation.

HMP species associated with terrestrial OE removal and groundwater remediation sites are identified on Table 1 and 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*), Monterey 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 associated with wetlands include California red-legged frog (*Rana aurora draytoni*), California tiger salamander (*Ambystoma californiense*), and California linderiella (*Linderiella occidentalis*). Although California linderiella currently is not state or federally listed, surveys are being continued in the event other listed species are encountered, and because the HMP retains monitoring requirements for this species. Additional species of concern were identified in the *Wetland Restoration Plan for Unexploded Ordnance Removal Activities at Former Fort Ord* (WRP) (*USACE, 1997b*) as being associated with wetland habitat and having the potential to occur at former Fort Ord including southwestern pond turtle (*Clemmys marmorata pallida*) and tricolored blackbird (*Agelaius tricolor*).

1.2 Previous Baseline Studies and Monitoring at Unexploded Ordnance Removal Sites 1994-1998

The locations of OE removal and groundwater remediation sites where baseline studies and monitoring have been conducted to date are shown on Plate 1. All of these sites are in areas proposed to become habitat reserves and either support maritime chaparral and/or wetland habitats known to contain or potentially containing HMP species. Table 2 summarizes monitoring activities conducted at OE sites from 1994 through 1999.

1.3 1999 Vegetation Monitoring and Surveys

Monitoring activities conducted in 1999 include baseline and follow-up sampling at several terrestrial OE removal and wetland sites and characterization of HMP annuals at the University of California Natural Reserve System North Reserve on Former Fort Ord (UC/NRS). HLA and Bureau of Land Management (BLM) conducted terrestrial monitoring at 7 OE removal sites. This report also includes chaparral monitoring data collected for 2 OE removal sites in 1998 by the Directorate of Environmental and Natural Resources (DENR). HMP herbaceous species surveys were conducted at 3 OE sites including seasonally wet habitat supporting Contra Costa goldfields. At the UC/NRS the size and extent of HMP annual plant populations along roads utilized for groundwater sampling were estimated. Baseline wetland monitoring was conducted at 6 waterbodies and follow-up monitoring was conducted at 5.

1.3.1 Central Maritime Chaparral Monitoring

Chaparral monitoring was conducted by BLM and HLA. BLM conducted follow-up monitoring at OE sites 10A, 10B and 19 and HLA conducted follow-up monitoring at OE Sites 11, 48, and 53. This report also presents monitoring data collected at OE Sites 19 and 48 in 1998 by the DENR resource specialist that were not received in time for inclusion in the 1998 report. Additionally, HLA conducted baseline chaparral surveys in the 1999 Chaparral Monitoring Polygon located in the Multiple Range Area (MRA). This site is located in the northwestern portion of the MRA and is situated in habitat reserve lands south and east of a fire break (blueline) that was established at the interface between development and habitat reserve lands. The south and eastern edge of

this area is an artificial line placed 1,200 feet away from the blueline boundary. This site borders the 1997 Chaparral Monitoring Polygon to the south.

1.3.2 HMP Annuals

Surveys for HMP herbaceous (annual) species were conducted at OE sites 11, 48, and at Contra Costa goldfields populations on OE 10B. 1999 is the first year of baseline data for this species presented in the Army's Annual Monitoring Report. A brief introduction and description is warranted for Contra Costa goldfields.

Contra Costa goldfields is a federally listed as endangered spring annual member of the sunflower family (Asteraceae). The species grows 4 to 12 inches tall and produces flowers March through June. The flowers are found in terminal yellow heads with phyllaries one-third to one-half fused. The partially fused phyllaries and the lack of a pappus distinguish this species from other lasthenia species that occur in similar habitats.

Habitat for Contra Costa goldfields consists of vernal pools in open grassy areas of woodland and valley grassland communities. Historically, this species grew in vernal pool habitats in Alameda, Contra Costa, Mendocino, Santa Barbara, Santa Clara, Napa, and Solano counties, California. Currently, the species is known from a total of 13 populations in Alameda, Contra Costa, Napa, and Solano counties (*62 FR 33373)*. To date, this species is known from four populations on former Fort Ord land. Two of these populations occur on OE Site 10B, one along the western edge of the vernal pool at Machine Gun Flats (MGF), the other in a "mima mound" grassland south southeast of MGF. These two populations were monitored in 1998 and 1999 to collect information prior to OE removal activities at OE Site 10B.

The effects of OE removal on Contra Costa goldfields is considered in the most recent revision of the BO (*USFWS, 1999*). Contra Costa goldfields on the former Fort Ord occur adjacent to and in vernal waterbodies in grassland habitat that generally exhibits mima mound topography (undulating terrain consisting of small mounds with hydrologically interconnected depressions). 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 DENR to USFWS dated November 11, 1998 (*Willison, 1998*).

Measures related to monitoring include identifying potential threats to the populations and collection of population information that identifies the number of individuals, area of occupied habitat, percent total vegetation cover and associated and dominant plant species. Populations will be monitored for up to five years to assess the effects of OE removal on the populations as related to baseline conditions and accounting for yearly fluctuations in population sizes.

1.3.3 UC/NRS

Baseline surveys for herbaceous HMP species were conducted at groundwater remediation sites at the UC/NRS North Reserve in April 1999. Baseline surveys for herbaceous HMP species were conducted along identified access routes. Access routes were identified based on existing and proposed well locations. The wells at UC/NRS North Reserve are primarily used for groundwater monitoring.

1.3.4 Wetland Monitoring

Wetland monitoring was conducted at approximately one-month intervals from January through May 1999. These waterbodies include numbers 1, 2, 17, 46, 47, 48, 49, 50, 51, Mudhen Lake East (MHLE) and Mudhen Lake West (MHLW).

Six waterbodies were identified as requiring baseline monitoring and five waterbodies were identified as requiring follow-up monitoring. Baseline monitoring was conducted at Waterbodies 46 through 51. Follow-up monitoring was conducted at Waterbodies 1, 2,

17, Mudhen lake East (MHLE), and Mudhen lake West (MHLW). Baseline and follow-up data collected included characterizing wetland vegetation, assessing the potential occurrence of wetland-associated special-status fauna identified in the HMP, and collecting data on the physical characteristics of each waterbody. Surveys were conducted according to protocol established in the HMP and follow-up monitoring requirements identified in the WRP (*USACE, 1997b*).

1.3.5 Future Activities on Habitat Reserve Lands

Monitoring activities initiated in 1999 for Site 39 Lead Remediation activities at Range 18 included baseline surveys in areas supporting maritime chaparral and herbaceous HMP species. Surveys were conducted to characterize habitat and establish baseline conditions in areas that will be disturbed during lead removal activities. Remediation has not yet been conducted, and therefore no additional monitoring or evaluation has been conducted.

Monitoring has been initiated for pipeline expansion activities for Operating Unit 2 (OU2) groundwater treatment plant. Activities conducted to date include a site walk to evaluate a proposed route. Location of the proposed pipeline route was established based on the proposed locations of extraction wells and refined to address habitat issues between well locations. No work, other than planning, has been conducted to date.

2.0 METHODS

Methods used to collect data on HMP species and habitat in the 1999 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, 1997c, 1998*) and the WRP (*USACE, 1997b*) were reviewed to maintain consistency in sampling methods. Methods for terrestrial monitoring include line-intercept sampling along permanent transects to characterize chaparral shrub cover, quadrat sampling in areas with a high percentage of herbaceous vegetation (areas visually estimated with greater than 20 percent cover), and focused surveys in suitable habitat to map the distribution of herbaceous HMP plant species. Monitoring activities at wetland sites included conducting wetland vegetation sampling (cover by species), special-status wildlife surveys, and collecting physical and hydrological data. Chaparral and wetland sites addressed during the 1999 biological monitoring surveys are shown on Plate 2. Biological monitoring work accomplished in the MRA was accomplished with escort by an OE specialist.

2.1 Central Maritime Chaparral

HLA and BLM conducted chaparral monitoring at 6 OE removal sites and one site in the MRA located in habitat reserve areas. Baseline line-intercept data was collected in central maritime chaparral habitat at the 1999 Chaparral Monitoring Polygon in the MRA between July and October 1999. Follow-up data was collected at OE Sites 10A, 10B and OE 19 between April and September 1999 by BLM. Transect data for OE sites 11, 48 and 53 was collected between July and October 1999. Data collected in 1998 for OE sites 19 and 48 were not received in time for inclusion in the 1998 Annual Monitoring Report (*USACE*, 1998) but are included in this report. Plates 3 through 9 display sampling transect locations at chaparral monitoring sites. Methods specific to each OE site are described below:

OE Site 10A: OE Site 10A was burned in 1995 and 1998 to facilitate OE removal actions. Remaining vegetation was cleared from the site using a combination of manual cutting on steep topography and in areas where unburned stems hampered OE removal and mechanical means (brush hog) in more level areas. Follow-up monitoring data were collected for chaparral shrub and herbaceous species by BLM at 5 of the 19 transects (1, 2, 5, 6, and 11) originally established on OE Site 10A (*USACE, 1996a*).

OE Site 10B: BLM conducted follow-up monitoring along 10 transects at OE Site 10B. These transects were evaluated based on vegetation removal method (burned and/or hand cut) as described in the 1998 Annual Monitoring Report (*USACE, 1998*) with one difference: burned areas with and without OE sampling were not evaluated separately as no significant differences between these two treatments were observed. Transects in burned areas used in the evaluation include 1, 6, 7, 8, 9, 10-2, 11, and 14. Transects in clipped sample grids include 2 and 12. Data collected from transects in undisturbed areas (Transects 3 and 4) were not used in the evaluation. Herbaceous monitoring was not conducted along transects in either burned or clipped areas because herbaceous species comprised less than 20 percent of the overall cover.

OE Site 11: Follow-up monitoring data were collected for chaparral shrub and herbaceous species along five (Transects 1, 2, 3, 5, and 8) of the original seven transects (*USACE, 1996a*). Vegetation along transects 4 and 7 were not disturbed by OE removal activities. Transect 8 was established in 1998 to sample cleared vegetation adjacent to transects 4 and 7. Transect 6 is located outside the boundary of OE Site 11. Consequently, as during 1998 monitoring no data were collected along Transects 4, 6, and 7.

OE Site 19: The site was burned and sampled for OE in 1995. Additional OE removal actions that involved manual cutting of the recovering vegetation were conducted between 1995 and 1998. The DENR resource specialist conducted follow-up monitoring along 8 transects located in sample grids at this site in November 1998. BLM conducted follow-up monitoring for chaparral shrub species along 6 transects during May and June 1999. Herbaceous sampling was not conducted along transects in 1998 or 1999 as cover contributed by herbaceous species was estimated to be less than 20 percent. Data collected in both 1998 and 1999 monitoring years are presented in this report.

OE Site 48: Four baseline transects were established by the DENR resource specialist in April 1998 in future OE sampling grids. Follow-up monitoring data were collected for chaparral shrub and herbaceous species by HLA in July 1999 along three transects (Transects 1, 3, and 4) where OE sampling had occurred. Follow-up sampling was not conducted along Transect 2 since no vegetation clearance or sampling had occurred in the area.

OE Site 53: Five OE sampling grids were cleared on OE Site 53 in 1998. Two of these supported central maritime chaparral habitat. HLA performed follow-up monitoring for chaparral shrub and herbaceous species at these two locations in October 1999.

1999 Chaparral Monitoring Polygon: A total of 38 baseline transects were placed in the 1999 Chaparral Monitoring Polygon. The site was evaluated to identify variations in chaparral seral stages. Examination of aerial photographs and field surveys revealed three associations, or successional stages, in the chaparral that could be separated by fire or disturbance history. These stages included mature chaparral, intermediate-age chaparral, and disturbed chaparral. Mature chaparral is composed of fully mature to senescent stands of shrubs that are of an estimated age greater than 15 years and are generally between 6 and 15 feet in height. Mature stands have very little open ground and almost no herbaceous layer. Intermediate-age stands are estimated to be 5 to 15 years old and generally range from 3 to 6 feet in height. Intermediate-age stands generally exhibit more open ground and herbaceous plant cover and generally include a more diverse species composition. Disturbed chaparral as defined in this report is generally located in range fans that have cleared rows in firing lines that are interspersed with strips of chaparral. Disturbed stands were observed to be transitional in species composition and cover between intermediate-age chaparral and mature chaparral. Disturbed chaparral habitat is defined as areas that were subject to regular disturbance (i.e. along firing lines in Range 18 and Range 19). Eighteen transects were established in mature chaparral, 6 transects in intermediate-age chaparral, and 14 in disturbed chaparral to represent each seral stage. Sampling for herbaceous species was not conducted in the 1999 Chaparral Monitoring Polygon as no areas displaying greater than 20 percent cover by herbaceous plant species were observed.

2.1.1 Line-Intercept Sampling

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 noted. Intercept distances of each species were combined and this total was divided by the length of the transect and multiplied by 100 to obtain percent cover. Cumulative intercept distances for all cover types (i.e., shrubs, bare ground, and vegetated ground) were combined and 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 or successional stage.

Sample size for each variation of chaparral habitat type (or seral stage, i.e. disturbed, intermediate-age, or mature) was established by accumulating a running total of cover for the dominant and/or HMP species if present. This total was graphed versus a running total of the combined transect length. An adequate sample size was considered reached when incorporating

additional transects to the combined data effects a change of less than 10 percent in cover.

Transect locations, for baseline and follow-up sampling at all but OE site 19, were located using Global Positioning System (GPS) equipment. Transect locations are indicated on Plates 3 through 9. Four- or five-foot, lightweight t-posts were installed at endpoints and photographs were taken to record 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. In most cases at follow-up monitoring sites, old transect endpoints had been removed during OE sampling. At these locations, new transect endpoints were installed.

2.1.2 Quadrat Sampling

Quadrat sampling was used to characterize the herbaceous component of chaparral habitat. Quadrat sampling was conducted along transects that contained 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. Sampling was conducted along the transects by placing a 0.25-meter square quadrat at the starting point and at 10-meter intervals alternating from the right to left side of the transect. Plant species present within the quadrat were identified, percent cover was estimated for each species, and data were recorded.

At OE Site 10A, BLM conducted a modified version of the method described above. BLM assigned a cover class based upon the estimated percentage of cover by each species in a sampled quadrat. Cover classes used by BLM are defined as follows: a = 0-1 percent, b = 2-5 percent, c = 6-25 percent, d = 26-50 percent, e = 51-75 percent, f = 76-95 percent, g = 96-100 percent. For analysis purposes, these classes were assigned a value based on the highest percentage for that class, i.e. a = 1, b = 5, c = 25, d = 50, e = 75, f = 96, f = 100. Percent cover for each species were combined, then the total was divided by the total number of quadrats along sampling transects and multiplied by 100 to obtain an average percent cover. This percentage was reassigned a cover class based on the initial class percent ranges.

2.2 Herbaceous Species Surveys

Surveys for HMP herbaceous (annual) species were conducted at OE sites 10B, 11, 48, and at the UC/NRS. HLA conducted surveys at OE sites 11, 48, UC/NRS North Reserve, and at Contra Costa goldfields populations on OE 10B.

Surveys were conducted at monitoring sites to either relocate previously recorded populations or to identify new ones. Prior to conducting surveys for annual HMP species, aerial photographs or maps showing previously recorded populations were reviewed to identify suitable or potential habitat. Surveys were conducted by inspecting areas of known or potential habitat by walking transects of opportunity at approximately 25-foot intervals. Observed populations were located using GPS.

2.2.1 OE Removal Sites

HLA biologists conducted surveys for annual HMP species at OE sites 11 and 48. The initial survey effort revealed that the flowering season of sand gilia had passed and that surveys at the 1999 Chaparral Monitoring Polygon would not be productive. Surveys in this location will be conducted during the flowering season of sand gilia in spring 2000.

2.2.2 Contra Costa Goldfields

Populations of Contra Costa goldfields monitored in spring 1999 included the two known locations on OE Site 10B, one at MGF and the other at the "mima mound area". Monitoring was conducted at these locations June 17 and 30. Suitable habitat in these areas was surveyed to potentially identify previously unknown outlying aggregations and to establish the boundary of known populations. Methods used to monitor populations of Contra Costa goldfields included techniques to delineate the

area of occupied habitat, identify the number of individual plants and estimate percent vegetative cover by dominants and associates.

Surveys over the grassland habitat for outlying populations at both locations involved systematically walking across the area. Areas surveyed included portions of the grassland that contained wetland indicator species with contributing cover estimated to be greater than 25 percent. Particular scrutiny was given to topographically low areas that displayed species associated with areas supporting Contra Costa goldfields.

Occupied habitat areas were surveyed using GPS. Occupied habitat at both of the locations was subdivided into several smaller sub-populations. Outer edges of goldfields sub-population boundaries were delineated with flagging. Sub-populations and outlying individuals were located using GPS.

Population sizes were estimated by direct counts and or by sub-sampling larger populations and calculating densities on a per acre basis. Direct counts were accomplished by subdividing sub-populations into parallel "lanes", where applicable, each approximately 10-feet wide and marked by two measuring tapes. Goldfields individuals observed in the lanes were tallied. Sampling of larger sub-populations was done using a random quadrat method to estimate density. Quadrats measuring 0.25-meter square were randomly placed in each sub-population area and goldfields individuals were counted. The number of quadrats utilized varied depending on the size of the sub-population. Between 7 and 45 quadrats were used in each sub-population during sampling. In general, 10 to 20 percent of the area in each sub-population was sampled. Population estimates were then calculated for each sub-population using the sampled density.

Species composition in habitat occupied by Contra Costa goldfields was inventoried and cover by dominants was visually estimated. Species generally found in close association with the goldfields were noted.

2.2.3 UC/NRS

Surveys for HMP annual species were conducted at UC/NRS in accordance with the most recent biological opinion (*USFWS, 1999*) regarding activities included in the ongoing remedial investigations at UC/NRS located at the former Fritzsche Airfield.

HLA implemented mitigation measures to address potential impacts to HMP species associated with quarterly groundwater monitoring, well development, and other activities associated with groundwater remediation at UC/NRS North Reserve. Activities conducted within UC/NRS property have to follow specific protocols that were approved by USFWS as detailed in the BO (*USFWS, 1999*) and memoranda referenced in section 1.0.

The following is a list of activities conducted to fulfill the intent of the BO.

- A route along existing roads within the UC/NRS property was identified to allow HLA staff access to existing wells and potential areas of future well development. These roads are currently in use by HLA staff to conduct quarterly groundwater monitoring and other associated groundwater remediation activities. These roads are also currently in use by agencies such as the Marina Water District and University of California Santa Cruz (UCSC).

- Surveys were conducted in April 1999 for sand gilia and Monterey spineflower along the identified route. Areas supporting sand gilia and Monterey spineflower were identified and flagged. Population totals were then estimated within each identified area by direct counts.

- Populations were located using landmarks on aerial photographs and hand mapped. Populations were later delineated using GPS.

2.3 Wetland Monitoring

Baseline wetland monitoring was conducted at six waterbodies: 46, 47, 48, 49, 50, and 51. Follow-up monitoring was conducted at five waterbodies: 1, 2, 17, MHLE, and MHLW. Baseline monitoring was conducted to collect baseline data on wetland-associated special-status fauna identified in the HMP, wetland vegetation, and physical characteristics prior to OE removal activities. Follow-up monitoring was conducted to evaluate whether OE removal activities affected baseline conditions previously observed at these waterbodies. The WRP (*USACE, 1997b*) identifies level of effort for monitoring depending on the degree of disturbance sustained during OE removal. According to protocols identified in the WRP, disturbance associated with OE removal at these waterbodies was not significant enough to warrant follow-up monitoring of the physical characteristics of these waterbodies. However, measurements were taken during wildlife surveys at waterbodies 1 and 2 to identify factors that could potentially affect the continuing presence or absence of special-status fauna, specifically California linderiella and potentially other fairy shrimp species.

Surveys for special-status fauna and physical characteristics were conducted during five monitoring events between January and June. Vegetation surveys at baseline and follow-up waterbodies were conducted May through November. Methods used to gather baseline and follow-up data on special-status fauna, physical characteristics and wetland vegetation were developed in accordance with guidelines specified in the HMP and WRP and are described briefly in the sections below.

2.3.1 Wetland Vegetation Sampling

Wetland vegetation sampling was conducted at eleven waterbodies. Sampling was conducted at the baseline waterbodies during the May monitoring event. Additional sampling was conducted at waterbodies 47 and 49 in June. Sampling at the follow-up waterbodies was conducted in June, with additional transect sampling at MHLE and MHLW conducted in September and November. Wetland vegetation sampling focused on characterizing emergent and transitional herbaceous species.

Sampling was conducted using a modified quadrat method following HMP Sampling Protocol (*USACE, 1995a*). The primary modification of the sampling protocol presented in the above referenced document is the interval between quadrats. The original protocols were developed for vegetation sampling in chaparral habitat. Due to high variability of herbaceous species composition and cover over short distances in wetland habitats monitored in 1999, most quadrats were placed at shorter intervals (ranging from 10 to 20 feet instead of every 10 meters) to capture abrupt vegetation changes, including intermittent patches of bare ground and open water that were evident in the field.

Monitoring transects were established at waterbodies 1, 2, 17, 46, 47, 48, 49, 50, 51, MHLE, and MHLW. One to four transects were established at each waterbody based on size and variability of habitat. Transect length ranged from 52 to 316 feet. The number, location, and length of transects were selected to provide data representative of the transitional and emergent habitats at each site. Five-foot lightweight t-posts were installed at endpoints and photographs were taken to record location and condition of the sampling transect. Transect endpoint locations were mapped using a GPS unit. Sampling was conducted along each transect by placing a 0.25-meter square quadrat at the starting point and at 10 to 20-foot intervals alternating from the right to left side of the transect. Plant species present within the quadrat were identified, percent cover was estimated for each species, and data were recorded.

2.3.2 Fauna

Wildlife monitoring was conducted at all eleven waterbodies, and included surveys for wildlife species identified in the HMP and other potentially occurring special-status species identified in the WRP. All vertebrate species observed during wildlife surveys were recorded in field logs.

Surveys for California linderiella and other fairy shrimp species were conducted at waterbodies 47, 48, and 49 once each month in January, February, March, and April. Surveys were not conducted at waterbodies 46, 50, 51, 1, and 2 during the January event because of the absence of water, but were conducted during the February, March, and April monitoring events. Fairy shrimp surveys were not required at MHLE, MHLW, and Waterbody 17 during follow-up monitoring because no fairy shrimp had been observed during baseline surveys at these sites. Surveys were conducted to determine presence/absence; in addition, when fairy shrimp were observed their relative abundance was estimated. To assess the presence/absence of California linderiella and other fairy shrimp, representative portions of each waterbody were sampled using a dipnet and samples were examined for presence of fairy shrimp species. Specimens were examined with a field-magnifying lens to identify genus. Samples were collected systematically from each waterbody until habitat was adequately represented. To estimate relative abundance, 20 or 40 samples were collected from throughout each waterbody (depending on waterbody size) and the total number of linderiella in all 20 (or 40) samples tallied. 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.

Surveys to determine presence/absence of California tiger salamander were conducted in March, April, and May at each waterbody except MHLE and MHLW. MHLE and MHLW were not surveyed for California tiger salamander because they were not observed at either waterbody during baseline surveys and, there is a lack of suitable habitat due to the presence of large populations of bullfrogs at both waterbodies, which will prey on tiger salamander larvae. To assess the presence/absence of California tiger salamander, representative portions of each waterbody were sampled using a dipnet and samples were examined for presence of California tiger salamander larvae. Samples were collected systematically from each waterbody until habitat was adequately represented. Waterbodies 46 and 50 were not sampled with a dipnet during the May monitoring event because of a lack of water. During the May survey, upland habitat was surveyed for the presence of adult California tiger salamander. Upland surveys consisted of walking transects from the edge of the waterbody into upland habitat and looking underneath downed tree branches and rocks, and in burrow entrances and soil fissures under tree canopies where there were suitable upland refugia.

Surveys to determine the presence/absence of suitable habitat for California red-legged frog were conducted during all visits (January through May). Habitat features such as duration of ponding and presence of submergent and emergent vegetation and adequate upland estivation habitat were noted. Surveys to assess the presence/absence of adult California red-legged frog were conducted by slowly walking the perimeter of each waterbody, and moving back and forth between open water and wetland vegetation at the edge of the waterbody looking for evidence of adult frogs.

Surveys to determine the presence/absence of tricolored blackbird and southwestern pond turtle were conducted during the May survey. Surveys consisted of walking the perimeter each waterbody looking for evidence of either species.

2.3.3 Physical Characteristics

Physical data was collected at all six baseline waterbodies (46 through 51). The degree of disturbance was not significant enough to require the collection of physical data at the follow-up waterbodies as identified in Table 3 of the WRP. Table 3 indicates that only those waterbodies in which OE removal activities have resulted in excavations greater than 4 feet deep or have been identified as having soil

conditions other than a thick deep clay horizon are required to have hydrological monitoring. Although not specifically required in the WRP, physical data were collected at waterbodies 1 and 2. Physical data collected at waterbodies 1, 2, 46, 47, 48, 49, 50, and 51 included pH and turbidity measurements, water depth, duration of ponding, and the surface area of each waterbody. Disturbance to the wetland habitat was minimized by restricting the amount of wading in each waterbody to only what was necessary for dipnet sampling and measurements of physical characteristics.

Turbidity and pH measurements were collected prior to other survey activities that could affect data accuracy (e.g., gathering depth measurements, vegetation sampling, and/or dipnetting). Turbidity was measured using a portable turbidimeter, and pH was measured using a portable field pH meter. Both the pH meter and turbidimeter were calibrated daily prior to data collection. Turbidity and pH were collected during the wildlife surveys, no sooner than 24 hours after a storm event, as required by protocol indicated in the WRP. Turbidity and pH were collected once at waterbodies 1, 2, 46, and 51, twice at Waterbody 50, and three times at waterbodies 47, 48, and 49. Additional turbidity and pH monitoring was not conducted owing to weather-related conditions and in some cases, lack of water.

Maximum water depth was measured during each monitoring event. The area of maximum depth was estimated by wading toward the center of the waterbody until the apparent maximum depth was found. The distance between the water surface and the bottom of the waterbody was measured and noted.

The area of ponding was measured during the first four monitoring events (January, February, March, and April). The perimeter of the area of ponding was delineated using 12-inch wooden stakes. Waterbodies 47 through 49 were measured and staked during the January monitoring event. Waterbodies 46, 50, and 51 were not measured and staked until the February monitoring event due to the absence of water in January. These stakes were used as a reference for standardizing measurement of area during future monitoring events. During the March monitoring event the area of waterbodies 1, 2, and 46-51 were measured using GPS. The area of Waterbody 17 was measured using GPS in June. MHLE and MHLW were measured using GPS in November. Because GPS measurements at waterbodies 17, MHLE, and MHLW were not recorded at the maximum extent of ponding, the edge of these waterbodies were located based on extent of wetland vegetation and the estimated mean high water mark.

The duration of ponding at the waterbodies was not recorded during the 1999 baseline surveys as many retained water past the final survey date. However, ponding observed during monitoring events was recorded and is presented in the results section of this report.

3.0 RESULTS

The following section presents data collected during monitoring in 1998 and 1999.

3.1 Central Chaparral Habitat Monitoring

Results of line-intercept and quadrat sampling of central maritime chaparral habitat are presented below. Results of chaparral vegetation sampling are presented in terms of dominant and or HMP species. Tables 3 through 18 present data collected at OE monitoring sites. Figures 1 through 6 photographically depict typical habitat sampled during monitoring events. Figures 7 through 19 graphically display vegetative cover by species. Non-native plant species are indicated in Tables 3 through 18 and Figures 7 through 19 by an asterisk.

3.1.1 OE Site 10A

Results of line-intercept sampling for OE Site 10A are presented in Table 3. These results are graphically presented in Figure 7. Dominant shrub species (contributing greater than 4 percent absolute cover) observed during sampling include Toro manzanita at 4.31 percent cover, shaggy-barked manzanita (*Arctostaphylos tomentosa*) at 8.43 percent cover and rush rose (*Helianthemum scoparium*) at 7.31 percent cover. Bare ground was estimated to be 53.4 percent cover. Cover contributed by herbaceous vegetation was estimated to be 26.97 percent with an additional 6.43 percent being contributed by cut-leaved fireweed (*Erechtites glomerata*) and 0.98 percent contributed by hottentot fig (*Carpobrotus edulis*). HMP species encountered at OE Site 10A and their respective cover are as follows: Toro manzanita (4.31 percent), Monterey ceanothus (2.18 percent cover), and Eastwood's goldenbush (0.11 percent cover). Herbaceous cover classes identified for species observed during quadrat sampling are presented in Table 4. Quadrat sampling provides an estimated average overall cover class of between 26 and 50 percent.

3.1.2 OE Site 10B

Results of line-intercept sampling are presented in Table 5 (clipped areas), and Table 6 (burned areas). These results are graphically presented in Figure 8 (clipped areas) and Figure 9 (burned areas). Dominant shrub species (contributing greater than 4 percent absolute cover) observed during sampling in clipped areas include Toro manzanita at 38.35 percent cover, Hooker's manzanita at 20.24 percent cover, and shaggy-barked manzanita at 17.05 percent cover. HMP species encountered at OE Site 10B and their respective cover in clipped areas are as follows: Toro manzanita (38.35 percent cover), and Hooker's manzanita (20.24 percent cover). Herbaceous cover in clipped areas is estimated to be 0.4 percent.

Dominant shrub species (contributing greater than 4 percent absolute cover) observed during sampling in burned areas include rush rose at 23.62 percent cover, shaggy-barked manzanita at 19.11 percent cover, and dwarf ceanothus (*Ceanothus dentatus*) and Carmel ceanothus (*Ceanothus griseus*) at a combined cover of approximately 14 percent cover. HMP species observed in burned areas and their respective cover are as follows Toro manzanita (0.51 percent cover), Monterey ceanothus (2.07 percent cover), and Eastwood's goldenbush (0.03 percent cover). Herbaceous cover in burned areas is estimated to be approximately 14 percent in burned grids with additional cover being contributed by cut-leaved fireweed (0.06 percent).

3.1.3 OE Site 11

Cover by species estimated from line-intercept sampling are presented in Table 7 and displayed graphically in Figure 10. Composition and cover contributed by herbaceous species is presented in Table 8 and graphically represented in Figure 11. Dominant shrub species (contributing greater than 4 percent absolute cover) observed during sampling at OE Site 11

include chamise at 13.9 percent cover, sticky monkey flower at 10.54 percent cover, Toro manzanita at 7.07 percent cover and shaggy-barked manzanita at 5.4 percent cover. HMP shrub species sampled at OE Site 11 and their respective cover are as follows: Toro manzanita (7.07 percent cover), and Monterey ceanothus (0.46 percent cover).

Cover contributed by herbaceous vegetation at OE Site 11 was estimated using line-intercept sampling to be approximately 44 percent. Dominant herbaceous species (individually contributing greater than 2 percent cover) were observed to include silvery hair-grass (*Aira caryophyllea*) at 15.85 percent cover, leafy bent-grass (*Agrostis pallens*) at 3.65 percent cover, small quaking grass (*Briza minor*) at 2.4 percent cover, cut-leaved fireweed at 2.53 percent cover, and climbing bedstraw (*Galium porrigens*) at 2.89 percent cover. Of the 47 herbaceous species observed during sampling, 28 of these are native.

3.1.4 OE Site 19

Results for line intercept sampling at OE Site 19 are presented in Tables 9 and 10. Table 9 presents sampling data collected in 1998 and Table 10 presents data from 1999 sampling. Sampling results for both years are graphically represented together in Figure 12.

In 1998, dominant shrub cover (contributing greater than 4 percent absolute cover) was contributed by shaggy-barked manzanita at 39.46 percent cover, rush rose at 27.57 percent cover, deerweed at 16.3 percent cover, chamise at 8.41 percent cover, and coast live oak (*Quercus a. agrifolia*) at 4.73 percent cover. HMP shrub species sampled in 1998 and their respective cover are as follows: Toro manzanita (0.05 percent cover) Hooker's manzanita (0.24 percent cover), and Monterey ceanothus (2.05 percent cover).

In 1999, the same shrubs provided dominant vegetative cover but some showed significant increases. Shrub species that display increases in cover from 1998 to 1999 include shaggy-barked manzanita (increased to 66.57 percent cover), rush rose (increased to 37.61 percent cover), and deerweed (increased to 34.74 percent cover). Bare ground (increased from 9.3 to 19.44 percent cover) and vegetated ground (increased from 5.19 to 7.53 percent cover) also increased from 1998 to 1999. HMP shrub species sampled at OE Site 19 in 1999 and their cover are as follows: Toro manzanita (0.36 percent cover), and Monterey ceanothus (3.35 percent cover).

3.1.5 OE Site 48

Results for line-intercept sampling at OE Site 48 are presented in Tables 11 and 12. These data are displayed graphically in Figure 13. Table 11 represents data collected from 4 sample grid locations in 1998. Table 12 represents data collected from three of these sample grids where vegetation had been cleared. Species composition and cover contributed by herbaceous species in 1999 are presented in Table 13 and graphically presented in Figure 14.

Dominant shrub species (contributing greater than 4 percent absolute cover) estimated during baseline sampling include shaggy-barked manzanita at 38.23 percent cover, chamise at 28.29 percent cover, Toro manzanita at 11.39 percent cover and Monterey ceanothus at 5.89 percent cover. HMP shrub species sampled at OE Site 48 in 1998 and their respective cover are as follows: Toro manzanita (11.39 percent cover), and Monterey ceanothus (5.89 percent cover). Bare and vegetated ground were estimated to contribute 10 and 7 percent cover, respectively.

Follow-up sampling data (as expected) indicate a significant drop in shrub cover and increase in cover by bare ground and herbaceous vegetation as a result of vegetation clearance. Dominant shrub cover (greater than 4 percent absolute cover) was contributed by shaggy-barked manzanita at 21.12 percent cover, and chamise at 8.94 percent cover. Bare and vegetated ground were estimated to contribute 39 and 35 percent cover, respectively.

Cover contributed by herbaceous vegetation at OE Site 48 was estimated using line-intercept

sampling to be approximately 35 percent. Dominant herbaceous species (individually contributing greater than 2 percent cover) as estimated by quadrat sampling were observed to include cut-leaved fireweed at 17.8 percent cover, silvery hair-grass (*Aira caryophyllea*) at 16.5 percent cover, rat-tail fescue (*Vulpia myuros*) at 5.6 percent cover. Of the 28 herbaceous species observed during sampling 15 of these are native.

3.1.6 OE Site 53

Results for line-intercept sampling at OE Site 53 are presented in Table 14. These data are displayed graphically in Figure 15. Composition and cover contributed by herbaceous species are presented in Table 15 and graphically represented in Figure 16.

Shrub dominants (contributing greater than 4 percent absolute cover) include coast live oak at 17.38 percent cover, blue blossom (*Ceanothus thyrsiflorus)* at 11.3 percent cover, coyote brush (*Baccharis pilularis*) at 8.17 percent cover and yerba santa (*Eriodictyon californicum*) at 8.29 percent cover. No HMP shrub species were observed along sampling transects at OE Site 53. Bare and vegetated ground were estimated to contribute 15 and 63 percent cover, respectively.

Absolute cover contributed by herbaceous vegetation at OE Site 53 is estimated using line-intercept sampling data to be approximately 63 percent. Dominant herbaceous species (individually contributing greater than 2 percent cover) were observed to include Cryptantha species (*Cryptantha* sp.) at 10 percent cover, soft chess (*Bromus hordeaceus*) at 4.38 percent cover, rat-tail fescue at 4.29 percent cover, wedge-leaved horkelia (*Horkelia c. cuneata*) at 2.83 percent cover, bull thistle (*Cirsium vulgare*) at 2.5 percent cover, and silvery hair-grass at 2.08 percent cover. Of the 19 herbaceous species observed during sampling, 11 of these are native.

3.1.7 1999 Chaparral Monitoring Polygon

The 1999 data represent baseline conditions at the 1999 Chaparral Monitoring Polygon. Plate 9 indicates transect locations and seral stages. The site is approximately 372 acres with mature chaparral occupying 232 acres, intermediate-age chaparral occupying 81 acres and disturbed chaparral occupying 59 acres. Results of sampling conducted in mature, intermediate-age and disturbed chaparral habitat are presented below.

Mature Chaparral

Species composition and estimated cover in mature chaparral habitat is presented in Table 16 and graphically in Figure 17. Dominant shrub species (contributing greater than 4 percent absolute cover) observed during sampling in mature chaparral include shaggy-barked manzanita at 57.2 percent cover, sandmat manzanita at 16.73 percent cover, chamise at 9.27 percent cover, black sage (*Salvia mellifera*) at 5.15 percent cover, and poison oak (*Toxicodendron diversilobum*) at 4.0 percent cover. HMP shrub species and their cover observed in mature chaparral include sandmat manzanita (16.73 percent cover) and Monterey ceanothus (3.16 percent cover). Bare and vegetated ground occupy 7.09 and 3.39 percent cover, respectively.

Intermediate-Age Chaparral

Species composition and estimated cover in intermediate-age chaparral habitat is presented in Table 17 and graphically in Figure 18. Dominant shrub species (contributing greater than 4 percent absolute cover) observed during sampling in intermediate-age chaparral include shaggy-barked manzanita at 15.0 percent cover, sandmat manzanita at 46.24 percent cover, chamise at 10.01 percent and Monterey ceanothus at 5.92 percent cover. HMP shrub species and their cover observed in mature chaparral include sandmat manzanita (46.24 percent cover) and Monterey ceanothus (5.92 percent cover). Bare and vegetated ground occupy 19.88 and 2.69 percent cover, respectively.

Disturbed Chaparral

Species composition and estimated cover in disturbed chaparral habitat is presented in Table 18 and graphically in Figure 19. Dominant shrub species (contributing greater than 4 percent absolute cover) observed during sampling in disturbed chaparral include shaggy-barked manzanita at 54.24 percent cover, chamise at 19.71 percent cover, sandmat manzanita at 14.62 percent cover, poison oak at 8.84 percent cover, black sage at 4.86 percent cover, and sticky monkey flower at 4.31 percent cover. HMP shrub species and their cover observed in disturbed chaparral include sandmat manzanita (14.62 percent cover), Monterey ceanothus (1.63 percent cover) and Eastwood's goldenbush at 0.12 percent cover. Bare and vegetated ground occupy 6.98 and 4.82 percent cover, respectively.

3.2 Herbaceous Species Monitoring

Herbaceous sampling was conducted at OE sites 11 and 48, the UC/NRS and at Contra Costa goldfields populations at OE 10B. No annual HMP species were observed at OE sites 11 and 48. However, several populations of diffuse spineflower (*Chorizanthe diffusa*) were observed along roads and in sample grids at both sites. The following sections summarize results of annual HMP monitoring at Contra Costa goldfields population locations and UC/NRS.

3.2.1 Contra Costa Goldfields

Plates 10 and 11 display the size and extent of Contra Costa goldfields populations at MGF and the mima mounds at OE Site 10B. Figures 20 through 22 photographically depict representative individuals from Machine Gun Flats at OE Site 10B. The population at MGF was observed to comprise approximately 6,426 individuals in an area of approximately 1,400 square feet. The population at the mima mounds comprises approximately 50, 609 individuals in an area of approximately 4,733 square feet.

Plants were generally observed associated with topographically low-lying habitat transitional between areas that were dominated by obligate wetland species and areas 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 did the population at MGF. In general goldfields observed at the mima mound area were found associated with more obligate wetland species than the population at MFG.

Machine Gun Flats

The Contra Costa goldfields population at MGF was observed to be associated with wet meadow/vernal pool species typical of the habitat on former Fort Ord. Plant species observed to be closely associated with Contra Costa goldfields included coyote thistle (*Eryngium vaseyi*), brown-headed rush (*Juncus phaeocephalus*), annual hair-grass (*Deschampsia danthonioides*), maritime beard-grass (*Polypogon maritimus*), smooth lasthenia (*Lasthenia glaberrima*), cut-leaved plantain (*Plantago coronopus*), Hickman's popcornflower (*Plagiobothrys chorisianus hickmanii*) and dwarf brodiaea (*Brodiaea terrestris*). Other species observed but not as closely associated included, slender woolly-heads (*Psilocarphus tenellus*), silvery hair-grass, small quaking grass (*Briza minor*), annual fescues (*Vulpia* spp.), soft chess, clovers (*Trifolium* spp), grass poly (*Lythrum hyssopifolium*), smooth cat's ear (*Hypochaeris glabra*) and coast tarweed (*Hemizonia corymbosa*).

Overall vegetative cover (absolute) in goldfields populations at MGF was estimated to be greater than 100 percent. The ranges of cover contributed by Contra Costa goldfields and dominant associates in addition to their wetland indicator status (*Reed, 1988*) are indicated below:

Associate	Range of Cover	Wetland Indicator Status
Contra Costa goldfields	2 to 10 percent	FACW

coyote thistle	5 to 20 percent	FACW
brown-headed rush	5 to 10 percent	FACW
annual hair-grass	10 to 20 percent	FACW
maritime beard-grass	2 to 10 percent	OBL
smooth lasthenia	5 to 20 percent	FACW
cut-leaved plantain	5 to 20 percent	FAC
Hickman's popcornflower	5 to 20 percent	OBL
Dwarf brodiaea	2 to 5 percent	NI

Wetland indicator categories are defined as:
OBL- Obligate wetland species estimated to be found in wetlands 99 percent of the time
FACW- Facultative wetland species estimated to be found in wetlands 67 to 99 percent of the time
FAC- Facultative wetland species estimated to be found in wetlands as often as not found in wetlands (34 to 66 percent of the time)
NI- Not included in the national list of indicator species

Mima Mounds

The Contra Costa goldfields population at the mima mounds was observed to also be associated with vernal pool species. Dominant plant species observed closely associated with Contra Costa goldfields included needle spikerush (*Eleocharis acicularis*), pale spikerush (*Eleocharis macrostachya*), common toad rush (*Juncus b. bufonius*), brown-headed rush, annual hair-grass, maritime beard-grass, Mediterranean barley (*Hordeum marinum gussonianum*), smooth lasthenia, Howell's quillrush (*Isoetes howellii*), Hickman's popcornflower and dwarf brodiaea. Other species observed but not as closely associated included, thyme-leaf pogogyne (*Pogogyne serpylloides*), slender woolly-heads, silvery hair-grass, small quaking grass, Italian ryegrass (*Lolium multiflorum*), annual fescues, soft chess, clovers, grass poly, smooth cat's ear and coast tarweed.

Overall vegetative cover in goldfields populations at the mima mounds was estimated to be approximately 50 percent. This relatively low cover estimate is attributed to the observation that the bottoms of many of the waterbodies supporting sub-populations were largely unvegetated and contained only widely scattered species. However, some of these waterbodies were densely vegetated throughout. Cover differences in these waterbodies is likely attributable to duration of ponding. Areas that ponded longer and rapidly dried in the spring would have less vegetative cover than areas with shorter periods of ponding. The ranges of relative cover and contributed by Contra Costa goldfields and dominant associates in addition to their wetland indicator status are indicated below:

Associate	Range of Cover	Wetland Indicator Status
Contra Costa goldfields	2 to 5 percent	FACW
Needle spike-rush	5 to 20 percent	OBL
pale spike-rush	2 to 5 percent	OBL
common toad rush	2 to 5 percent	FACW
brown-headed rush	5 to 10 percent	FACW
annual hair-grass	20 to 50 percent	FACW
maritime beard-grass	2 to 10 percent	OBL
Mediterranean barley	5 to 20 percent	FAC
Howell's quillrush	5 to 20 percent	OBL

smooth lasthenia	5 to 20 percent	FACW
Hickman's popcornflower	5 to 20 percent	OBL
dwarf brodiaea	2 to 5 percent	NI

3.2.2 UC/NRS

Plate 12 displays the general size and extent of sand gilia and Monterey spineflower populations along access routes at the UC/NRS North Reserve. Surveys were conducted along approximately 5.5 miles of identified access routes. Coverage by sand gilia populations is approximately 3,520 linear feet with an estimated population total of 2,954 individuals. Coverage by Monterey spineflower populations is approximately 6,720 linear feet with an estimated population total of 10,192 individuals.

3.3 Wetland Monitoring

A summary of wetland survey dates is presented in Table 19. Results of the wetland monitoring are discussed below.

3.3.1 Wetland Vegetation Sampling

A total of eighteen transects were placed at ten wetland monitoring sites in 1999. Transects ranged in length from 52 to 316 feet long. Transect lengths, number of quadrats and total area sampled on each transect are summarized in Table 20. The relative percent cover by species for each waterbody is summarized in Tables 21 through 30. Plates 13 through 21 indicate transect and photo point locations and the maximum measured boundary of each waterbody. Figures 23 through 32 present graphic representations of the species composition at each waterbody sampled during the 1999 monitoring period. Non-native plant species are indicated in Tables 21 through 30 and Figures 23 through 32 by an asterisk. Figures 33 through 43 photographically depict typical habitat sampled during monitoring events. Plant species observed during 1999 wetland monitoring are listed in Table 31.

Waterbodies 1 and 2

Species composition and estimated cover at waterbodies 1 and 2 are presented in Table 21 and graphically in Figure 23. One transect was established at Waterbody 1 to characterize both waterbodies 1 and 2 because of their small size, relative proximity, and the similarity of vegetative cover types. The two waterbodies are hydrologically connected with overflow from Waterbody 1 draining into Waterbody 2. Dominant plant species observed along this connection include brown-headed rush, needle spike-rush, western bent-grass (*Agrostis exarata*), and cut-leaved fireweed. Twenty-four plant species were recorded at Waterbody 1. Dominant plant species, present at greater than 10 percent of the combined average cover, included pale spike-rush, brown-headed rush, and subterranean clover (*Trifolium subterraneum*). Meadow barley (*Hordeum brachyantherum*), common toad rush, Italian ryegrass (*Lolium multiflorum*), cut-leaved plantain, and Nuttall's fescue (*Vulpia microstachys*) were present between 2.1 and 5.7 percent of the combined average cover. Most other plant species were present at 1 percent or less of the combined average cover. Of the 24 species observed during sampling 12 of these are native.

Waterbody 17

Species composition and estimated cover at Waterbody 17 are presented in Table 22 and graphically in Figure 24. Thirty-two plant species were recorded at Waterbody 17. Dominant plant species, present at greater than 10 percent of the combined average cover, included broad-leaved cattail (*Typha latifolia*). Red-rooting cyperus (*Cyperus erythrorhizos*), pale spike-rush, common toad rush, Pacific rush (*Juncus effusus*), spreading rush (*Juncus patens*), brown-headed rush, cut-leaved plantain, red willow (*Salix laevigata*), and prairie bulrush (*Scirpus robustus*) were present between 2.2 and 9.7 percent of the combined average cover. Most other plant species were present at 1 percent or less of the combined average cover. Of the 31 species observed during sampling 18 of these are native.

Waterbody 46
Species composition and estimated cover at Waterbody 46 are presented in Table 23 and graphically in Figure 25. Twenty plant species were recorded at Waterbody 46. Dominant plant species, present at greater than 10 percent of the combined average cover, included pale spike-rush and Mediterranean ditch grass (*Polypogon maritimus*). Small quaking grass (*Briza minor*), cut-leaved fireweed, common cudweed (*Gnaphalium luteo-album*), bugle hedge nettle (*Stachys a. ajugoides*), and western vervain (*Verbena lasiostachys*) were present between 2.1 and 3.6 percent of the combined average cover. Most other plant species were present at 1 percent or less of the combined average cover. Of the 20 species observed during sampling 11 of these are native.

Waterbody 47
Species composition and estimated cover at Waterbody 47 are presented in Table 24 and graphically in Figure 26. Fifty-two plant species were recorded at Waterbody 47. Dominant plant species, present at greater than 10 percent of the combined average cover, included Santa Barbara sedge (*Carex barbarae*). Common cudweed, lowland cudweed (*Gnaphalium palustre*), Baltic rush (*Juncus balticus*), salt rush (*Juncus lesueurii*), and willow dock (*Rumex salicifolius*) were present between 2.2 and 6.5 percent of the combined average cover. Most of the other plant species were present at 1 percent or less of the combined average cover. Of the 52 species observed during sampling 33 of these are native.

Waterbody 48
Species composition and estimated cover at Waterbody 48 are presented in Table 25 and graphically in Figure27. Twenty-two plant species were recorded at Waterbody 48. No plants were present at greater than 10 percent of the combined average cover. Dominant plant species, present between 1.5 and 4.4 percent of the combined average cover, included common toad rush, brown-headed rush, pale spike-rush, and Hickman's popcornflower. Most of the other plants were present at 1 percent or less of the combined average cover. Of the 22 species observed during sampling 18 of these are native.

Waterbody 49
Species composition and estimated cover at Waterbody 49 are presented in Table 26 and graphically in Figure 28. Twenty-three plant species were recorded at Waterbody 49. Dominant plant species, present at greater than 10 percent of the combined average cover, included needle spike-rush and pale spike-rush. Cotton-batting plant (*Gnaphalium stramineum*), Howell's quillrush, and Baltic rush were present between 1.5 and 9.6 percent of the combined average cover. Most of the other species were present at 1 percent or less of the combined average cover. Of the 23 species observed during sampling 15 of these are native.

Waterbody 50
Species composition and estimated cover at Waterbody 50 are presented in Table 27 and graphically in Figure 29. Thirty plant species were recorded at Waterbody 50. Dominant plant species, present at greater than 10 percent of the combined average cover, included pale spike-rush, brown-headed rush, and beardless ryegrass (*Leymus triticoides*). Small quaking grass, annual hair-grass, needle spike-rush, common cudweed, and smooth lasthenia *(Lasthenia glaberrima*) were present between 1.8 and 5.0 percent of the combined average cover. Most of the other species were present at 1 percent or less of the combined average cover. Of the 30 species observed during sampling 17 of these are native.

Waterbody 51
Species composition and estimated cover at Waterbody 51 are presented in Table 28 and graphically in Figure 30. Four plant species were recorded at Waterbody 51. Dominant plant species, present at greater than 10 percent of the combined average cover, included pale spike-rush, brown-headed rush, and beardless ryegrass. Small quaking grass was present at 5.0 percent of the combined average cover. Of the 4 species observed during sampling 3 of these are native.

MHLW
Species composition and estimated cover at Mudhen Lake East are presented in Table 29 and graphically in Figure 31. Thirty-two plant

species were recorded at Mudhen Lake East. Dominant plant species, present at greater than 10 percent of the combined average cover, included pale spike-rush, brown-headed rush, and swamp knotweed (*Polygonum amphibeum emersum*). Slender wild oat (*Avena barbata*), red-rooting cyperus, salt rush, and cut-leaved plantain were present between 2.1 and 5.6 percent of the combined average cover. Most of the other species were present at 1 percent or less of the combined average cover. Of the 31 species observed during sampling 19 of these are native.

MHLW

Species composition and estimated cover at Mudhen Lake West are presented in Table 30 and graphically in Figure 32. Thirty-two plant species were recorded at Mudhen Lake West. Dominant plant species, present at greater than 10 percent of the combined average cover, included pale spike-rush and swamp knotweed. Ripgut grass (*Bromus diandrus*), coyote brush, lowland cudweed, Chinese pusley (*Heliotropium curassavicum*), beardless ryegrass, and cut-leaved plantain were present between 2.0 and 8.8 percent of the combined average cover. Most of the other species were present at 1 percent or less of the combined average cover. Of the 33 species observed during sampling 22 of these are native.

3.3.2 Fauna

California linderiella were observed during follow-up monitoring at Waterbody 1 and baseline surveys at Waterbody 49. No fairy shrimp species listed as threatened or endangered were observed during 1999 surveys. California linderiella were observed in Waterbody 1 in February, March and April. Linderiella had been previously observed in Waterbody 1 during surveys in 1994, 1995, and 1996. Recorded abundance of California linderiella in Waterbody 1 was moderate (11 to 100 individuals) during the March follow-up monitoring event. Recorded abundance was low (1 to 10 individuals) during the February and April follow-up monitoring events. California linderiella were observed in low abundance in Waterbody 49 during the February baseline survey. Table 32 presents a summary of California linderiella data collected in 1999.

California tiger salamander and California red-legged frog were not observed during baseline surveys at waterbodies 46 through 51. In addition, California tiger salamander and California red-legged frog were not observed during follow-up monitoring at waterbodies 1, 2, 17, MHLE, and MHLW. Pacific treefrog (*Hyla regilla*) adults and larvae were observed in all waterbodies except Mudhen Lakes East and West. Adult bullfrogs were observed in abundance in Mudhen lakes East and West.

Southwestern pond turtle and tricolored blackbird were not observed at any of the waterbodies during baseline and follow-up monitoring. Other vertebrate fauna observed during the surveys are listed in Table 33.

3.3.3 Physical Characteristics

The physical parameters measured during the 1999 wetland monitoring include water depth, area of ponding, turbidity, and pH, and are summarized in Table 34. The maximum water depth and area of ponding were observed in March and April, with very little change recorded between these 2 monitoring events. Turbidity measurements were lowest in January for waterbodies 48 and 49. Turbidity measurements for Waterbody 47 showed a turbidity reading of 5 in January and a reading of 3 in April. Waterbodies 1, 2, and 51 showed high turbidity and waterbodies 46, 47, 48, 49, and 50 were notably clear. Measurements for pH ranged from 6.28 at Waterbody 2 to 8.15 at Waterbody 48.

Waterbodies 47, 48, 49, and 51 ponded water from the time of the first survey in January through the last site visit in May. Waterbody 46 ponded water from the time of the second survey in February through the time of the fourth survey in April. Waterbody 50 ponded water from the first survey in January through the fourth site visit in April, with small isolated pockets of water observed during the May site visit. Additionally, waterbodies 1 and 2 ponded

water from the second survey in February through the last site visits in May.

4.0 DISCUSSION

4.1 Central Maritime Chaparral Habitat Monitoring

OE Site 10A. The data collected in 1999 represents the third year of follow-up monitoring at this site. Baseline surveys for this site were conducted in 1994. The majority of OE Site 10A had been burned in 1995 and 1998 to facilitate OE removal. Remaining vegetation and partially burned stems were further removed using a brush hog on relatively flat areas and hand cutting in areas that were too steep to allow for mechanical removal.

Recovering vegetation is now primarily limited to herbaceous and regenerating burl-sprouting species. Herbaceous vegetation contributes over 33 percent of the cover on the site. Shrubs and semi-woody plant species contribute less than 40 percent of the estimated cover. Qualitatively, vegetation on this site appears to be recovering as expected considering the disturbance history. Cover contributed by seed reproducing and early seral species (such as Toro manzanita, *Ceanothus* spp., rush rose, and pitcher sage (*Lepechinia calycina*)) are indicative of what would be expected in the early seral stages of community regeneration. However, the limited number of transects sampled in 1999 may not be representative of vegetation recovery over the entire site. The high cover of cut-leaved fireweed could interfere with the establishment and growth of early-stage seral herbaceous species.

OE Site 10B. This represents the second year of follow-up monitoring on OE Site 10B. Baseline surveys for this site were completed in 1996. A portion of OE Site 10B burned and an additional portion was manually cleared in 1997. Vegetative cover on OE Site 10B varied depending on disturbance type. As described earlier, data from OE Site 10B was evaluated based on vegetation clearance method: burning versus manual cutting (clipped). Taller shrubs left standing following manual cutting dominate vegetative cover in clipped areas. Vegetative cover in burned areas is contributed by regenerating stump-sprouting species such as shaggy-barked manzanita and chamise (*Adenostoma fasciculatum*) but also have greater percent cover by rush rose, deer weed (*Lotus scoparius*), and herbaceous vegetation. Qualitatively, burned areas display a greater species diversity than clipped areas; but burned areas exhibited lower overall cover by shrub species and a corresponding increase in bare ground and vegetative cover. This data is consistent with expectations but analysis of data for clipped areas is limited by the small number of transects (2) sampled in 1999. Expected differences between burned and clipped areas would include the inhibitory effects on germination and regeneration from residual allelopathic chemicals in the soil and the physical barrier presented by layers of duff and chipped material on the soil surface. These effects are not a factor in burned areas.

OE Site 11. This is the second year of follow-up monitoring conducted at this site. Baseline data for this site was collected in 1996. OE Site 11 was manually cleared of vegetation in 1997 to facilitate OE removal. Cleared vegetation was piled in parallel rows approximately 3 to 5 feet high and 6 to 10 feet wide. Shrub cover is returning slowly and a large portion of the cover is contributed by sticky monkey flower (*Mimulus aurantiacus*) (10.54 percent) and herbaceous vegetation (44.48 percent). These results are consistent with expected inhibitory effects from alleopathy, duff and chipped material. It should also be noted that recovery on this site is inhibited by space occupied and shading from piled brush.

OE Site 19. This report presents result for line intercept sampling at OE Site 19 from 1998 (first year of follow-up monitoring) and 1999 (second year of follow-up monitoring). Baseline data for this site was collected in 1994. OE Site 19 was burned in 1995 and sampled for OE between 1995 and 1998. Limited clearing by hand clipping was performed on unburned

branches and large stems from stump sprouting species. This site appears to be regenerating well with high species diversity, good representation of early seral species and low cover by undesirable weed species. The comparative graph presented in Figure 12 displays rapid regeneration of stump-sprouting species with some representation by HMP seed producing species. However, the 1999 follow-up data was collected along only 6 of the 8 transects sampled in 1998 and may not be representative of overall site conditions.

OE Site 48. The 1999 monitoring data is the first year of follow-up monitoring conducted at OE Site 48. Baseline conditions are represented by the 1998 data set. In late 1998, 100 by 200-foot sample grids were mechanically cleared of vegetation to facilitate OE sampling. At OE Site 48 shrub cover contributed by stump-sprouting species is increasing slowly. In low-lying relatively mesic areas, a large portion of the cover is contributed by herbaceous vegetation. As expected, follow-up sampling data indicate a significant drop in shrub cover and increase in cover by bare ground and herbaceous vegetation. It is too early to formulate predictions regarding regeneration on the site. Data collected during subsequent follow-up monitoring events may be useful in evaluating the effect of this vegetation clearance method.

OE Site 53. Data collected in 1999 represent the first year of follow-up monitoring conducted following clearance activities at this site. In 1998, 100 by 200-foot sample grids were mechanically cleared of vegetation to facilitate OE sampling. At OE Site 53 shrub cover contributed by stump-sprouting species is increasing slowly. Herbaceous vegetation provides a significant amount of cover. This site has a species composition that marginally qualifies it as chaparral. Species commonly found in central maritime chaparral such as chamise, and rush rose are not present. The high cover contributed by coast live oak and creeping snowberry (*Symphoricarpos mollis*) indicate this habitat may be transitional between chaparral and coast live oak woodland.

1999 Chaparral Monitoring Polygon. The 1999 data represent baseline conditions in chaparral habitat at this site. Three shrub species, shaggy-barked manzanita, sandmat manzanita, and chamise dominate mature and disturbed chaparral habitat over the majority of the central and western portion of the 1999 Chaparral Monitoring Polygon. In many places this area supports dense brush composed of only shaggy-barked manzanita and chamise. The eastern portion of the site displayed a higher species diversity and more bare ground.

Plate 9 indicates the seral stages designated following review of aerial photographs and ground surveys. This representation is intended to provide an approximation of areal coverage by these stages and should be taken as a broad interpretation. Some ground truthing of these stages was limited due to potential OE hazards. A few generalizations can be made based on field observations. In undisturbed habitat, species diversity increases as distance from the blueline toward the center of the MRA increases. Additionally, chaparral habitat was observed to have greater species diversity and appeared younger (less time since the last burn) along the eastern third of the site. Both these observations can likely be attributed to frequency of ordnance related fire events in this area.

4.2 Herbaceous Species Monitoring

Populations of Contra Costa goldfields on former Fort Ord were observed to be somewhat reduced in size (estimated to be 20 to 30 percent smaller) compared to locations of the population boundary placed in 1998. The number of individuals estimated to be in the populations was significantly greater than counts performed in 1998. Population numbers in 1998 were estimated to range between 500 to 1,500 individuals. In 1999, the population at MGF is estimated at approximately 6,000 and at the mima mounds at 50,000. This difference may be attributable to differences in rainfall totals and water duration in ponded areas. Optimal conditions may not be provided by high rainfall

or a long rainy season, but rather a more moderate rainfall season.

Overall, the two populations at OE Site 10B displayed similar habitat preferences and associated species. Observed variations between the two populations involve differences between dominant associates and duration of standing water in low-lying areas. The population at MGF was generally observed to be associated with low-lying areas that supported mostly facultative wetland species. In contrast the population at the mima mounds was generally observed to be associated with similar facultative wetland species, but with a species composition augmented with additional obligate species.

Surveys conducted at UC/NRS Northern Reserve for sand gilia and Monterey spineflower comprise the first year of monitoring activity. Future monitoring will be conducted to assess what effect if any groundwater remediation activities, specifically vehicle traffic along the access routes, have on these species. Changes in population totals from year to year will be tracked and compared with reported basewide population fluctuations for those same years.

4.3 Wetland Monitoring

The findings presented here represent the first year of wetland monitoring at waterbodies 46, 47, 48, 49, 50, and 51. Complete baseline data was collected at these waterbodies. Follow-up monitoring at MHLE, MHLW, and waterbodies 1, 2 and 17 is considered the final year of follow-up monitoring.

Significant sedimentation was observed at MHLW and Waterbody 17. Sedimentation at MHLW resulting from erosion off ridges to the north, which resulted from a wildfire in 1997 and heavy rainfall in 1998, apparently modified the wetland boundary. Similarly, sedimentation in Waterbody 17 possibly resulting from construction of Turn 11 at Laguna Seca Raceway may also have modified the waterbody boundaries. As a result, the estimated wetland edge depicted in Plates 14 and 21 reflect current conditions and may not be comparative to conditions identified during baseline sampling in 1994.

California linderiella were observed during follow-up monitoring in Waterbody 1 and baseline surveys at Waterbody 49. Linderiella in Waterbody 49 represent baseline conditions that may be used for future comparison if OE removal activities warrant follow-up monitoring.

Linderiella were previously observed in Waterbody 1 during the 1994, 1995, and 1996 monitoring events. Relative abundance during these previous surveys has ranged from low to high. Fluctuations in abundance are most likely attributable to variations of natural conditions at the waterbody, including precipitation timing and totals, temperature and pH. Changes in abundance are not likely attributable to OE removal activities at OE site 14A because OE removal activities did not occur close enough to affect this waterbody.

Linderiella were not observed at Waterbody 2 during the 1999 surveys. They were observed in this waterbody during the 1994, 1995, and 1996 surveys. The reasons why linderiella were not observed during the 1999 surveys are unknown but are most likely attributable to variations of natural conditions at the waterbody, including precipitation timing and totals, temperature and pH. Fairy shrimp eggs hatch only when the required environmental cues in their aquatic habitat are established (*USACE, 1996b*). The absence of observed linderiella at Waterbody 2 during the 1999 surveys is not likely attributable to OE removal activities because OE removal activities at OE site 14A did not occur close enough to affect this waterbody.

California tiger salamander were not observed during baseline surveys at waterbodies 46 through 51, or during follow-up monitoring at waterbodies 1, 2, 17, MHLE, and MHLW. California tiger salamander had been previously observed in waterbodies 1, 47, 50, and 51 as reported in the *1992 Flora and Fauna Baseline Study of Fort Ord, California* (*USACE, 1992*). Although no tiger salamander were observed during baseline surveys at waterbodies 47, 50, and 51, suitable habitat exists for this species.

OE removal activities have not occurred in or adjacent to these waterbodies which could have affected habitat suitability. Although no tiger salamander were observed during follow-up monitoring at Waterbody 1, suitable habitat exists. OE activities at OE Site 14A were not conducted in or adjacent to Waterbody 1 and did not affect the natural conditions of this waterbody. It is possible that tiger salamander found previously at these waterbodies migrated to waterbodies not surveyed in 1999. Migrations to and from breeding ponds may occasionally exceed 1000 meters (*California Department of Fish and Game, 1988*).

Many of the waterbodies occurring at Former Fort Ord provide suitable habitat for California red-legged frog, and it is possible that red-legged frog may occur, however they were not observed during previous surveys or at any of the waterbodies surveyed in 1999.

4.4 Anticipated Future Activities

Habitat monitoring items to be performed and included in the year 2000 annual monitoring report include:

- Baseline chaparral monitoring at a proposed burn polygon south of the 1999 Chaparral Monitoring Polygon
- Follow-up chaparral monitoring at OE sites 10A, 10B, 11, 19, 48, and 53
- Annual HMP surveys in the 1997 Chaparral Monitoring Polygon
- Annual HMP surveys in the 1999 Chaparral Monitoring Polygon
- Annual HMP surveys at OE 10A, 10B, 11, 19, 48, and 53
- An analysis of existing and potential extent of noxious weed species in OE sites
- Follow-up wetland monitoring at waterbodies 43, 44, MGF and 40A
- Follow-up monitoring of Contra Costa goldfields populations following OE removal
- Habitat Characterization for lead remediation sites in the MRA
- Activities associated with groundwater remediation including construction of a pipeline for OU2 and monitoring HMP annuals along access roads at UC/NRS.

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