75% Basis of Design Report

Landscape Restoration for the Chevron San Luis Obispo Tank Farm

JANUARY 2009

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DISCLAIMER

WSP Environment & Energy, LLC, with the assistance of Padre Associates, Inc. and graphic support from Avocet Environmental, Inc., has prepared this *Basis of Design Report* for use by Chevron EMC. Results and conclusions presented in this report are based upon information available in the public domain (*e.g.,* published literature, previous consultants' reports, various on-line resources) and upon the WSP/Padre technical team's on-site reconnaissance, data collection, and analyses by standard methods. Waters of the U.S., including wetlands (waters/wetlands) boundaries presented in this report are described in reports prepared by the WSP/Padre Technical Team (2008a). Waters/wetlands boundaries have been approved verbally by Mr. Bruce Henderson (U.S. Army Corps of Engineers, Los Angeles District). Results and conclusions presented herein represent the best professional judgment of WSP Environment & Energy and Padre Associates technical staff. In this context, surveying/boundary locations of waters/wetlands and the geographic extent of rare plant populations documented by Padre Associates are assumed to be true and correct.

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EXECUTIVE SUMMARY

In July of 2007, WSP Environment & Energy, LLC was asked by Chevron Environmental Management Company to assist Padre Associates, Inc. with several tasks supporting remediation, restoration, and site development at the San Luis Obispo Tank Farm in San Luis Obispo County, California (hereafter "SLO Tank Farm"). These tasks included (1) identification of the federal waters/wetlands on the project site, (2) development of a hydrogeomorphic functional assessment for slope, riverine and depressional waters/wetlands, (3) preparation of a botanical resources inventory and report, and (4) development of restoration alternatives for the San Luis Obispo Tank Farm (hereafter "SLO Tank Farm") Project Site. This report builds upon the fourth task by presenting a landscape-level design at the 75% level of completion for the waters/wetlands, adjacent terrestrial ecosystems (*i.e.*, uplands), and native special status plant and animal populations impacted by the proposed remediation, site development, and landscape restoration at the SLO Tank Farm Project Site.

This *San Luis Obispo Landscape Restoration Report* provides a restoration scenario for the North Marsh/Tank Farm Creek slope/riverine complex, portions of the East Fork of San Luis Obispo Creek, vernal depressions, adjacent non-native grasslands, and riparian communities on the SLO Tank Farm. It is has been developed in conjunction with a detailed hydrologic analysis comprehensive storm water management plan for the site. This report presents a 75% restoration design describing a suite of activities that will increase waters/wetlands ecosystem functions and develop a native and diverse landscape.

The SLO Tank Farm Landscape Restoration Project avoids impacts to existing waters of the U.S., including wetlands where possible, mitigating impacts when it is not possible to avoid them, and compensating in the form of restoration (targeting regional reference) in line with the new national guidance on mitigation sequencing. Impacts to waters/wetlands due to remediation efforts are expected on 26.06 acres; impacts to waters/wetlands due to development efforts are expected on 1.16 acres; self-mitigating restoration of degraded wetlands is proposed on an additional 11.33 acres. As described in this document, the proposed restoration of waters/wetlands will occur on an estimated total of 45.67 acres, representing a 1.7:1 area-to-area metric. The design is particularly faithful to the joint 2008 U.S. Army Corps of Engineers and U.S. Environmental Protection Agency mitigation standards that reaffirm the mitigation sequence of avoid, minimize, and mitigate (compensate).

In addition, the SLO Tank Farm Landscape Restoration Project avoids impacts to the existing habitats of species of conservation concern where possible, mitigating impacts when it is not possible to avoid them, and compensating in the form of restoration of area occupied, number of populations, increase in habitat support functioning, or some combination of all three where possible. A total of 8.02 acres of Cambria morning glory (*Calystegia subacaulis* ssp. *episcopalism*) will be impacted due to remediation and development activities. An additional 0.14 acres of Cambria morning glory will have self-mitigating restoration impacts. Similarly, 5.69 acres (plus 1.49 acres of self-mitigating restoration impacts) of San Luis Obispo owl's clover (*Castilleja densiflora* spp. *obispoensis*) will be impacted, 9.67 acres (plus 4.89 acres of self-mitigating restoration impacts) of Congdon's tar plant (*Centromadia parryi* ssp. *condgonii*); 0.04 acres of San Luis Obispo serpentine dudleya habitat; 0.02 acres of self-mitigating restoration impacts to Hoover's button-celery (*Eryngium aristulatum* var. *hooveri*); 10.87 acres

of purple needlegrass (*Nassella pulchra*), and nine individual California walnut trees (*Juglans california* var. *californica*) will be impacted through remediation, development and restoration. Restoration of special status plant species' habitats is expected to result in a ≥1:1 area metric ratio of restored to impacted habitat for all vascular plant species of conservation concern. Vernal pool fairy shrimp (*Branchinecta lynchi*) habitats will be avoided where possible and impacts minimized when unavoidable. Nearly 12 acres of vernal pool and swale wetland mosaic wetland habitats will be created to compensate for unavoidable impacts to this federally endangered invertebrate.

The landscape-scale restoration design is a unified effort to restore native plant and animal populations, communities and habitats in the remediated industrial landscape of the SLO Tank Farm. It balances the objectives of restoration and responsible environmental stewardship with the mandates for protecting public safety and property specified in the *San Luis Obispo Waterway Management Plan*. The restoration design includes use of locally adapted plant stock, and when possible, use of propagules obtained from the project site and adjacent landscapes. A monitoring and adaptive management program, to be developed at a future date, will be implemented to ensure success of the restoration efforts.

I. INTRODUCTION AND OBJECTIVES

In July of 2007, WSP Environment & Energy (hereafter "WSP") was asked by Chevron Environmental Management Company (hereafter "Chevron EMC") to assist Padre Associates, Inc. (hereafter "Padre") with several tasks supporting remediation, restoration, and site development at the San Luis Obispo Tank Farm in San Luis Obispo County, California (hereafter "SLO Tank Farm"). These tasks included (1) identification and mapping the geographic extent of federal waters/wetlands on the SLO Tank Farm Project Site, (2) development of a hydrogeomorphic (HGM) functional assessment for riverine waters/wetlands in the San Luis Obispo region, (3) preparation of a botanical resources inventory and report, and (4) development of a 75% level design for the landscape restoration following site remediation and development. The fourth task, restoration design, is presented in this document, and has been prepared in support of an conceptual plan prepared in 2007 (WSP 2007b). A new task requested of WSP by Padre in early 2008 was the development of a comprehensive, landscape-level restoration design at the 75% level of completion for waters/wetlands and adjacent uplands impacted by the proposed remediation and site development at the SLO Tank Farm. In this report, we describe a landscape-scale restoration scenario for the North Marsh/Tank Farm Creek slope/riverine complex, portions of the East Fork of San Luis Obispo Creek, vernal depressions, and the adjacent degraded grassland and riparian communities.

In this basis of design report, WSP presents a restoration plan at the 75% level of completion for the SLO Tank Farm landscape, focusing on three main tasks.

Specifically, we have:

1. Conducted a thorough database and literature review to determine historic and current reference conditions for native plant communities as well as waters/wetland ecosystems in the San Luis Obispo region,

2. Identified reference conditions to the extent possible (Padre & WSP 2008b),

3. Prepared a restoration design to the 75% level of completion based upon a suite of activities that would achieve measurable increases in waters/wetlands ecosystem functioning at least proportional to, or in some cases in excess of, negative effects from remediation and development activities.

This design integrates a landscape approach to restoration of waters/wetlands and surrounding terrestrial habitats (*i.e.,* uplands), particularly those important to vascular plant species of conservation concern. In addition, the restoration design has been developed to complement alteration of the exiting site drainage infrastructure to manage more effectively storm water up to and including the 100-year 24-hour storm. Tank Farm Creek, for example, not only is an important ecological resource, but also it is crucial to effective regional flood water management (San Luis Obispo City & County 2003).

Implementation of the landscape restoration design for SLO Tank Farm will result in an increase in the hydrologic, biogeochemical, plant community and faunal support habitat functioning of all

waters of the U.S., including wetlands (hereafter "waters/wetlands") on the Project Site, in addition to a compensatory area mitigation ratio of 1.7:1 for unavoidable impacts (Table 1). A total of 45.67 acres of waters/wetlands will be restored on the SLO Tank Farm, maintaining particular fidelity to the joint 2008 U.S. Army Corps of Engineers (hereafter "Corps") and U.S. Environmental Protection Agency (hereafter "EPA") mitigation standards that reaffirm the mitigation sequence of avoid, minimize, and mitigate (compensate).

The SLO Tank Farm Landscape Restoration Project avoids impacts to the existing habitats of species of conservation concern where possible, mitigating impacts when it is not possible to avoid them, and compensating in the form of restoration of area occupied, number of populations, increase in habitat support functioning, or some combination of all three where possible. Restoration of special status plant species habitats is expected to result in a ≥1:1 area metric ratio of restored to impacted habitat for all vascular plant species of conservation concern (Table 1). Vernal pool fairy shrimp (*Branchinecta lynchi*) habitats will be avoided where possible and impacts minimized when unavoidable. The restoration, therefore, will result in 11.88 acres of vernal pool and swale wetland mosaic wetland habitats created to compensate for unavoidable impacts to this federally endangered invertebrate (Table 1).

The remainder of this document is organized to introduce the natural features of the SLO Tank Farm (remaining Section I); provide an overview to the rationale and regulatory framework supporting the landscape-scale restoration design (Section II); describe specific details of the restoration design and indicate proposed restoration measures specific to waters/wetlands (Section III), uplands (Section IV), vascular plant species of conservation concern (Section V), vernal pool fairy shrimp (Section VI); and, the construction details at present (Section VIII). The penultimate section (Section VIII) summarizes the changes in ecosystem functions with the implementation of the restoration design, while the final discussion (Section IX) provides a summary of the regulatory, design, and construction features of this *75% Basis of Design Report.*

A. Overview of Site Characteristics

1. Current and Historic Land Uses

The SLO Tank Farm is located immediately south of the city of San Luis Obispo, in San Luis Obispo County, California (Figure 1). It abuts the East Fork of San Luis Obispo Creek, which is an infrequently intermittent to perennial tributary to the "traditionally navigable waters" of the Pacific Ocean. SLO Tank Farm is not within the designated "Coastal Zone" in San Luis Obispo County as designated by the California Public Resources Code Division 20 §§30000 – 30012.

The SLO Tank Farm is owned by the Union Oil Company of California and managed by Chevron EMC. Storage facilities and supporting infrastructure were constructed in 1910 to serve as the tidewater accumulation point for the petroleum pipeline from the San Joaquin Valley. The Tank Farm facility was withdrawn slowly from Union Oil operations during the later decades of the twentieth century, and by the late 1990s, it was formally decommissioned (Avocet Environmental 2007).

With the exception of a small office building and parking lot complex recently vacated (formerly the local headquarters for Chevron San Luis Obispo operations), the SLO Tank Farm Project Site primarily is open space (Figure 2). For the past several decades, the Tank Farm lands have been leased for cattle grazing for the purposes of fire and weed controls. An historic quarry is located in the northeast corner of the site, often referred to as "Flower Mound." Adjacent land uses include the San Luis Obispo County Regional Airport to the south, and light commercial and industrial developments, agricultural and pastoral land with scattered residences, and a trailer park to the east.

At the SLO Tank Farm, topography, hydrologic processes, soils, and vegetation have been altered significantly through plowing and disking, catastrophic fire, grazing of domestic livestock, construction and removal of oil storage tanks and their surrounding berms, stream channelization, construction of water and oil management and containment systems, and several other anthropogenic alterations. Currently, most of the SLO Tank Farm site is dominated by non-native species of forbs and grasses. However, native scrub/shrub and forested plant communities occur in wet depressions or within riparian corridors associated with East Fork of San Luis Obispo Creek and its tributaries. Waters of the U.S., including wetlands, in the forms of riverine, depressional, and small slope ecosystems are prominent features throughout the SLO Tank Farm (Padre & WSP 2008a). Many of the waters/wetlands on the property are associated with natural features such as swales, small riverine channel systems, or depressions. However, many depressional and slope wetlands are associated with human-made depressions that remain after the decommissioning of oil storage facilities or after various mining or domestic livestock management operations.

2. Geomorphology and Landscape Context

The SLO Tank Farm is located in a geologically complex and seismically active region in the central coast of California (Figure 2). The underlying geologic structure was formed during millions of years of folding and faulting as the Pacific plate moved north along the North American plate. Geologic structure in this landscape is oriented primarily in a northwesterly direction within the Coast Range.

The SLO Tank Farm is positioned at the west end of the San Luis Valley, a northwest-trending, alluvium-filled basin Alluvial deposits filling the valley comprise the primary groundwater reservoir serving the San Luis Obispo area. They reach a maximum thickness of 150 feet south of the SLO Tank Farm. At the SLO Tank Farm, the alluvium thickness ranges from zero at the northwest corner where the Franciscan Formation is exposed (*i.e.*, at the Flower Mound), to more than 100 feet in the southwest corner. The upper 20 feet of alluvium generally consists of silts and lean clays with moderate to high plasticity. Lenticular interbeds of fine-grained silty sand, and poorly-graded and well-graded sands and gravels predominate below a depth of 20 feet (EGI 2002).

The northern portion of the Project Site is characterized by a slope/riverine wetland complex that serves as the headwaters of a small, unnamed tributary (locally known as "Tank Farm Creek") of the East Fork of San Luis Obispo Creek. This tributary has been mostly disconnected from the East Fork of San Luis Obispo Creek due to historic road construction, water and oil management

operations, and ranching activities. Prior to construction of the tank farm facility in 1910, Tank Farm Creek ran unimpeded from its headwaters in the hills to the northeast to its confluence with the East Fork of San Luis Obispo Creek. Since that time, development (including of the SLO Tank Farm and three east-west roads) has interrupted the tributary and degraded both its hydrologic and ecologic functions.

3. Climate

The San Luis Obispo area has a mild, Mediterranean climate with warm, dry summers and wetter, cooler winters. Average maximum temperature (by month) ranges from 63 °F in January to 79.5 °F in September. Average minimum temperatures range between 41.6 °F in January] and 53 °F in August (Station No. 047851-4) (Western Region Climate Center [WRCC] 2007). In this coastal area, the majority of precipitation comes as rainfall during the winter months (November through April). Average annual precipitation is 23.45 inches (WRCC 2007).

B. Hydrology

Hydrology on the SLO Tank Farm has been described previously by EDAW (1999), England & Associates (EAI) (2001), Jenesis (2003), Rincon Associates (2003-2004), and in recent detail by Padre & WSP (2008a). A comprehensive hydrologic analysis has been completed recently by Avocet Environmental, Inc. (2008) to support remediation and restoration activities.

Three principal watersheds are associated with the SLO Tank Farm. They encompass approximately 811 acres on and off the 333-acre property. Watersheds are defined by points of interest, or design points, selected in the *Hydrology Study*. The largest overall watershed (A) is the area tributary to the point where Tank Farm Creek exits the SLO Tank Farm site (Figure 3). A much smaller watershed (B) contributes flow to an old control structure that discharges into the East Fork of San Luis Obispo Creek. The last principal watershed (C) is the collection of isolated catchments (*i.e.*, no hydraulic connection to the surrounding creek systems exists) within property boundary.

Approximately 11 acres of minor watersheds, included in the above total and referred to as Watershed D in Figure 3, are not considered further in this study. Figure 3 also illustrates the spatial arrangement of the watersheds and defines important components that are the subject of further discussion below.

1. The North Marsh/Tank Farm Creek System (Tank Farm Creek Watershed)

The North Marsh/Tank Farm Creek system occupies the western portions of the SLO Tank Farm, both north and south of Tank Farm Road (Figure 3). The total watershed is 637 acres; of which 160 are onsite and 477 are offsite. Approximately 75 acres are predominately paved, and the balance is a combination of disturbed and natural open land. Over three-quarters of the catchment contributing flow to the North Marsh/Tank Farm Creek system is offsite, and the vast majority of that acreage is located north of the northern SLO Tank Farm property boundary.

Most storm water enters the SLO Tank Farm across the north property line via either the East or West Forks of Tank Farm Creek (Figure 4). Although some flow across the north property line is by sheet flow, storm flow is directed quickly to one of the two forks of Tank Farm Creek. The West Fork of Tank Farm Creek is the more significant drainage, as it serves a larger area than the East Fork, including the urbanized areas to the north. The East Fork captures run-off from the southeastern portion of the South Hills and the eastern part of the SLO Tank Farm, including Reservoir 4 and the Flower Mound. The forks meet at a point adjacent to the former operations area (Figure 4), forming the main Tank Farm Creek channel. A small portion of total run-on to the North Marsh/Tank Farm Creek System enters the site from the west.

Tank Farm Creek, including its upstream forks, is nominally isolated from the North Marsh by a low berm. Storm water is directed to a pair of 48-inch diameter round culverts that convey the water under Tank Farm Road. Once these culverts are flowing full the rising backwater tops the berm and spills into the North Marsh. Alternatively, the North Marsh receives flow from a relatively small catchment north of Tank Farm Road that is conveyed under Tank Farm Road to via twin 6-foot wide by 4-foot high concrete box culverts. South of Tank Farm Road Tank Farm Creek runs adjacent to the western property line, while discharge from the North Marsh travels along a parallel auxiliary channel. Tank Farm Creek exits the site at a concrete headwall that has a 36-inch diameter outlet raised approximately six inches above the flow invert. The auxiliary channel joins Tank Farm Creek immediately upgradient of the headwall, but is initially separated by a low berm approximately 18-inches above the channel invert.

The analysis provided in the hydrology study (Avocet 2008) concludes that the system manages storm water poorly in its current configuration. Any precipitation event greater than the 10-year storm produces uncontrolled overtopping at the headwall (as much as 50 acre-feet), and exacerbates flooding of the adjacent properties. This results, primarily, from inefficient storm water routing and the ineffective use of the potential storage capacity in the North Marsh and discharge capacity at the headwall.

2. Isolated Catchments and Depressional Wetlands

Nearly 140 acres on the SLO Tank Farm that are isolated catchments. That is, currently no regular hydraulic connections among these catchments exist (refer to Figure 3) and the surrounding watersheds. Limited connectivity exists, however, between certain sub-catchments. By their nature, the sub-catchments form a series of depressional wetlands (Figure 3, see also Figure 2). These wetland features are either man-made or relatively natural concave features that pond water for long (*e.g.,* 7-30 days) or very long (*e.g.,* > 30 days) durations. They typically receive water from direct precipitation, or in some instances, through discharges that emanate from the immediately adjacent sub-catchments.

As noted previously, the upper strata of soil on the site are typically silts and clays with moderate to high plasticity. Soils within the SLO Tank Farm depressional wetlands are often highly compacted as a consequence of grazing and trampling by domestic livestock, machinery operation, construction activities, historic operations, or similar activities. Consequently, they tend to pond water for long or very long durations.

The geographic extent of these depressions is usually defined by the extent of long duration ponding, which is easily mapped during the wet season (refer to Figure 2). At times, and in addition to ponding, long duration saturation of soils to the surface was observed by the WSP/Padre technical team members. Saturation usually occurred in the large slope wetlands associated with the North Marsh/Tank Farm Creek complex, in smaller slope features, or in depressions that had been ponded for long duration but that were drying out as a result of evapotranspiration.

3. Onsite Watershed Tributary to the East Fork of San Luis Obispo Creek

Approximately 19 acres of the southernmost portion of the site is tributary to an outlet structure that discharges into the East Fork of San Luis Obispo Creek (Figure 3). The area contributes an insignificant portion of the total flow that occurs in the creek. Further, neither remediation nor development is expected to occur there. It is notable, however, since it contains meanders of the East Fork of San Luis Obispo Creek that were isolated when a large containment berm was erected along the creek's north bank. It is believed that restoring communication between these meanders and the creek proper will provide a net waters/wetlands improvement.

C. Soils

The Natural Resources Conservation Service (NRCS) Soil Survey of San Luis Obispo County identifies and describes soils within the SLO Tank Farm project site as consisting of the Xererts-Xerolls-Urban land complex with 0-15 percent slopes (Figure 5) (Soil Survey Staff 2004). These soils have some hydric inclusions. The WSP/Padre team confirmed the presence of the NRCS mapped soils unit on the SLO Tank Farm site.

The Xererts component of the Xererts-Xerolls-Urban land unit as mapped by NRCS makes up approximately 30 percent of this map unit. Xererts formed from weathered sedimentary rocks. Xererts soils are deep and well drained, with little available water to a depth of 60 inches. The Xererts component is neither flooded nor ponded, and there is no zone of water saturation within 72 inches of the soil surface. This soil does not meet the hydric criteria. Also, the Xererts component of the Xererts-Xerolls-Urban land complex includes Cropley or Diablo soils. Cropley soils are clays that occur on alluvial fans and plains. These soils form in alluvium weathered from sedimentary rocks, and typically are very dark gray to black in the top 32 inches.

The Xerolls component comprises up 30 percent of the Xererts-Xerolls-Urban land map unit. Xerolls form from alluvium and/or residual materials derived from weathered sedimentary rock. This soil type is deep and well drained, with little available water to a depth of 60 inches. The Xerolls component is neither flooded nor ponded, and there is no zone of water saturation within 72 inches. This soil does not meet the hydric criteria. Urban land makes up 20 percent of the Xererts-Xerolls-Urban land map unit.

For waters/wetlands areas on the SLO Tank Farm site, the WSP/Padre team determined the presence of hydric soils consistent with criteria articulated in the *1987 Manual* (Environmental Laboratory 1987), current regulatory guidance, *Field Indicators of Hydric Soils in the United States, Version 6.0, Hydric Soils of the United States* (NRCS 2006), and information provided in

the *Arid West Regional Supplement* (Environmental Laboratory 2008). Details of hydric soil features are found in Padre & WSP (2008a).

D. Plant Communities

Vegetation on the SLO Tank Farm Project Site has been described by EDAW (1999), Jenesis (2003), Rincon Associates (2003-2004), and in recent detail by Padre & WSP (2008c) The focus of the older reports has been the description of the waters/wetlands. Padre & WSP (2008c) provide an extensive discussion of vegetation at the site currently, including a less comprehensive description of waters/wetlands features that also is included in this report.

1. Background

The flora and vegetation of California's central coastal regions is diverse and structurally complex, reflecting the diverse topography, geology, climate, and soil types of the region. As discussed in other relevant floras (*e.g.*, Matthews 1997; Smith 1998; Barbour, Keeler-Wolf, and Schoenherr 2007), plant communities in this biogeographic region consequently range from wet temperate forests (*e.g.*, coast redwood [*Sequoia sempervirons*]) to the desert-like moonscapes of the ultramafic regions of interior San Benito County. Many rare as well as local endemics are known from all of the major plant communities along the central coast.

Major vegetation types in the Monterey-San Luis Obispo-Santa Barbara central coast region include oak woodlands and forests (Pavlik *et al.* 1991, Allen-Diaz, Standiford, and Jackson 2007), coniferous forests (Barbour 2007, Minnich 2007), annual and perennial bunchgrasslands (Bartolome *et al.* 2007), chaparral (Keeley & Davis 2007), sage scrub (Rundel 2007), coastal prairie (Ford & Hayes 2007), beach and dune vegetation (Pickart & Barbour 2007); marine, estuarine, riverine, lacustrine, and palustrine wetland systems (Cowardin *et al.* 1979; Ferren, Fiedler & Leidy 1996; Grewell, Callaway & Ferren 2007; Solomeshch, Barbour & Holland 2007). Not all of these vegetation types are present on the SLO Tank Farm site today, and those that do exist (*e.g.*, grassland, willow riparian scrub shrub) are highly degraded in large part through a century of intensive and extensive land uses.

Grassland areas within the region that are not frequently disturbed are characterized by a native perennial bunch grassland community type often supporting an occasional tree or shrub (*e.g.,* Mexican elderberry [*Sambucus mexicana*]). Widespread grassland species, both native and non-native, found in the SLO Tank Farm Project Site include ripgut brome (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), purple needlegrass (*Nassella pulchra*), tarweed (*Deinandra congesta* ssp. *luzulifolia, Deinandra fasciculata,* and *Centromadia parryi* ssp. *congdonii*), San Luis Obispo owl's clover (*Castilleja densiflora* ssp. *obispoensis*), and sweet fennel (*Foeniculum vulgare*). Exotics occurring in the most intensively disturbed areas within the uplands include some species listed above as well as yellow star-thistle (*Centaurea solstitalis*), tocalote (*Centaurea melitensis*), mayweed (*Anthemis cotula*), wild oats (*Avena barbata*), annual fescue (*Vulpia myuros* var. *hirsuta*), Italian ryegrass (*Lolium multiflorum*), black mustard (*Brassica nigra*), and wild radish (*Raphanus sativus*).

Shrublands include a wide variety of vegetation types in central coastal California, including a suite of chaparral types (*e.g.*, chamise-dominated [*Adenostoma fasciculatum*], manzanita-dominated [*Arctostaphylos* spp.], coyote bush-dominated [*Baccharis pilularis*]; deerbrush-dominated [*Ceonothus* spp.], and oak-dominated [*Quercus* spp.]); California sagebrush-dominated [*Artemisia californica*]; black-sage-dominated [*Salvia mellifera*], among others). Only a small proportion of the SLO Tank Farm site supports any shrublands at present. Additional information regarding shrub-dominated vegetation in California can be found in Barbour, Keeler-Wolf, & Schoenherr (2007).

Plant communities along the streams of the central coast of California support a dynamic complement of native trees and other woody species, many of which can and do occur outside of the riparian corridor (*i.e.*, vegetation adjacent to, and influenced by, the presence of moving water). Perhaps the most conspicuous feature of the mature, native riparian vegetation within the southern portion of California's central coast is the dominance of large coast live oaks (*Quercus agrifolia*), western sycamore (*Platanus racemosa*), and Fremont cottonwood (*Populus fremontii*). Stands of live oak range in density from woodland or savannah (wherein individual tree canopies do not interdigitate) to forest (*i.e.*, tree canopies overlap). These live oak stands occur along stream terraces in the upper and middle reaches of moderately-sized riverine systems. The riparian overstory is mixed, typically with arroyo willow (*Salix lasiolepis*), Fremont cottonwood, red willow (*Salix laevigata*), and California walnut (*Juglans californica* var. *californica*) dominant in many riverine systems in the central and southern portions of the State, particularly in the perennial reaches, such as at the East Fork of San Luis Obispo Creek on the SLO Tank Farm.

The understory of the riverine systems of the biogeographic region of central coastal California supports a mix of native and nonnative plant species. Understory shrubs occurring on creek banks include coyote brush and California sage where the canopy is open, and blackberries (California blackberry [*Rubus ursinus*] and Himalayan blackberry [*Rubus discolor*]) in both sun and shade. Herbaceous species occurring in the riparian corridor include mugwort (*Artemisia douglasiana*), poison hemlock (*Conium maculatum*), smilo grass (*Piptatherum miliaceum*), wild oats (*Avena* spp.), and Italian thistle (*Carduus pycnocephalus*).

In the less disturbed stream reaches in this geographic region, typically higher in the watershed than the SLO Tank Farm, large live oaks are joined by western sycamore as dominants, particularly immediately adjacent to the stream channel. In addition to these tree species, the riparian plant communities consist of a small suite of native shrubs and vines found in the understory. Poison oak (*Toxicodendron diversiloba*) is ubiquitous, as is California blackberry. Less common, but still frequently occurring in the shrub layer, are several species of gooseberry (*Ribes* spp.) and honeysuckle (*Lonicera* spp.). These taxa are critically important food sources for the native fauna, providing a varied and abundant source of berries throughout much of the year. In the low elevation coastal plain, willows and California walnut are prominent in the riparian ecosystems.

Invasion by exotic species is a significant concern in California. Many ecosystems, particularly waters/wetlands in the region, are now completely devoid of a native complement of vascular plants. Instead, a large suite of exotic Eurasian weeds (*e.g., Bromus diandrus, Carduus*

pycnocephalus, *Melilotus officinale, Piptatherum miliaceum, Sonchus oleraceus*), ornamental escapes (*e.g., Delairea odorata, Tropaeoleum majus, Vinca major, Eucalyptus globulus*), or a various planted ornamentals, dominate many plant communities across California's landscapes.

2. Plant Communities at the SLO Tank Farm

Eight plant communities are found currently at the SLO Tank Farm Project Site (Figure 6). These include three upland communities of non-native annual grassland, serpentine bunchgrass grassland, central (Lucian) coastal scrub. Additionally, five waters/wetland communities are present, including palustrine persistent emergent vernal freshwater marsh, palustrine persistent emergent vernal swale/pool, palustrine nonpersistent emergent vernal swale/pool mosaic, palustrine scrub-shrub broad-leaf deciduous valley stream-bank wetland, palustrine scrub-shrub broad-leaf deciduous valley stream-bank wetland and palustrine forested broad-leaf deciduous valley stream-bank wetland. Additionally, two habitats not classified by Holland (1986) or Ferren, Fiedler, and Leidy (1996), but that support some vascular plants include a serpentinite rock outcrop that has been quarried extensively, and a ruderal class within developed portions of the site where non-native weeds have established around buildings, in asphalt cracks, and in similar heavily disturbed areas. A thorough discussion of these plant communities is found in Padre & WSP (2008c).

3. Vascular Plants of the SLO Tank Farm

One hundred fifty-two (152) vascular plant species have been identified within the property boundaries of the SLO Tank Farm. This listing combines previous field surveys (EDAW 1999, Jenesis 2003, Rincon 2003-2004) as well as recent surveys by the Padre & WSP project team (Padre 2007; Padre & WSP 2008c). A complete list of plant species identified at the SLO Tank Farm is provided in Padre & WSP (2008c), with plant nomenclature following Hickman (1993), with the exception of the Cyperaceae, which follows the *Flora of North America*, Volume 23 (FNA 2002).

Forty-nine percent (49%; 74 taxa) of recorded vascular plant species are native taxa, while 51% (78 taxa) are non-native (primarily naturalized) species commonly represented in the California flora. The percentage of non-native taxa on the SLO Tank Farm is more than twice what has been calculated for the State as a whole (approximately 20% [Randal, Rejmánek &Hunter (1998) as cited in Bossard and Randall (2007)]), reflecting a relatively high level of site disturbance associated with past oil operations, maintenance, and abandonment, and past and present cattle grazing.

4. Plant Species of Conservation Concern

Six special status species and a dominant native grass, purple needlegrass that is declining state-wide, are found at the SLO Tank Farm Project Site (Table 1, Figure 7). Thus, seven species on the SLO Tank Farm Project Site are of concern to the conservation community (Padre & WSP 2008c). None of these species are protected under the federal Endangered Species Act of 1973, as amended, nor under the California Endangered Species Act. Rather, they have been identified by the California Native Plant Society as species in decline, and are therefore acknowledged

under the California Environmental Quality Act as significant biological resources at the SLO Tank Farm.

E. Fauna

Fauna on the SLO Tank Farm Project Site has been described in varying detail by Entrix (1998), Rincon (2003-2004), and Padre in the *Project Execution Plan* (Padre 2007). This report is an extensive presentation of the site, as well as the proposed project activities, including remediation and development. It contains a thorough description of the regional and local fauna, and provides an extensive discussion of fauna at the site currently. A less comprehensive description of fauna is included below.

Detection methods for animals using the SLO Tank Farm included direct observation with binoculars; examination and identification of tracks, scats, burrows/diggings, and carcasses/ skeletal remains; and, identification of vocalizations (calls and songs). Surveys by Padre technical staff have been supplemented with previously published wildlife reports, regional and local species distribution references, and consultation with the U.S. Fish & Wildlife Service (hereafter "USFWS") and the California Department of Fish & Game (hereafter "CDFG") to determine which species occur or potentially occur on the SLO Tank Farm. The following is an overview of the major groups of fauna relevant to the landscape restoration.

1. Invertebrates

Invertebrate surveys have focused on aquatic species. Initial aquatic water column and benthic invertebrate studies resulted in the observation of invertebrates typical of non-flowing seasonally ponded habitats (Rincon 2003-2004). Following the initial study, a vernal pool fairy shrimp dry season survey resulted in the positive identification of vernal pool fairy shrimp (*Branchinecta lynchi*) in several locations within the site (Rincon 200-2004). Vernal pool fairy shrimp are found throughout the SLO Tank Farm in many of the vernal depressions and swales (Padre 2007) (Figure 6).

2. Fish

Fish species observed by Rincon (2003-2004) and Padre (2007) include common carp (*Cyprinus carpio*) and mosquito fish (*Gambusia affinis*) in the western marsh area, and threespine stickleback (*Gasterosteus aculeatus*) in the creek/riparian areas. The south-central California coast steelhead (*Oncorhynchus mykiss irideus*) has been documented in the East Fork of San Luis Obispo Creek (Padre 2008).

3. Amphibians

Western toad (*Bufo boreas*), pacific treefrog (*Hyla regilla*), and adult bullfrogs (*Rana catesbeiana*) were observed primarily in the seasonally flooded areas of the site. However, bullfrogs also were observed in the creek /riparian areas (Entrix 1998, Rincon 2003-2004).

4. Reptiles

The annual grassland and mixed riparian areas of the SLO Tank Farm site provide the most favorable habitats for reptiles. Species observed include western fence lizard (*Sceloporus occidentalis*) and garter snake (*Thamnophis* sp.) in the upland areas and western pond turtle (*Clemmys marmorata*) in the creek/riparian habitat within and adjacent to Acacia Creek and the East Fork of San Luis Obispo Creek (Entrix 1998, Padre 2007).

5. Birds

Quantitative survey techniques were conducted by Entrix (1998) to determine avian species present at four observation stations representing general habitat types present at the SLO Tank Farm. Species observed included killdeer (*Charadrius vociferous*), song sparrow (*Melospiza melodia*), red-winged blackbird (*Agelaius phoenicius*), American kestrel (*Falco sparvarius*), mourning dove (*Zenaida macroura*), cliff swallow (*Hirundo rustica*), cinnamon teal (*Anas cyanoptera*), mallard (*Anas platyrhynchos*), great-tailed grackle (*Quiscalus mexicanus*), spotted sandpiper (*Actitis macularia*), Cooper's hawk (*Accipiter cooperi*), sharp shinned hawk (*Accipiter striatus*), and downy woodpecker (*Picoides pubescens*) (Entrix 1998). In addition, golden eagle (*Aquila chrysaetos*), northern harrier (*Circus cyaneus*), western burrowing owl (*Athene cunicularia hypugaea*), great-horned owl (*Bubo virginianus*), California horned lark (*Eremophila alpestris actia*), and loggerhead shrike (*Lanius ludovicianus*) were observed within the SLO Tank Farm during field surveys conducted by Padre in spring/summer 2007.

6. Mammals

Mammals typically are mobile and may spend time in several different habitats across the landscape. Thus surveys by Padre biologists to identify the resident mammals were not restricted or defined by specific sample areas. Daytime and nighttime surveys resulted in the observation of scat, tracks, and direct observation of live individuals. Small, medium and large mammals observed include western harvest mouse (*Reithrodontomys megalotis*), California vole (*Microtus californicus*), Botta's pocket gopher (*Thomomys bottae*), California ground squirrel (*Spermophilus beecheyi*), black-tailed hare (*Lepus californicus*), Audubon's cottontail (*Sylvilagus audubonii*), striped skunk (*Mephitus mephitus*), raccoon (*Procyon lotor*), muskrat (*Ondatra zibetheca*), Virginia opossum (*Didelphis virginiana*), coyote (*Canis latrans*) and black-tailed deer (*Odoocoileus hemionus columbianus*) (Entrix 1998, Padre 2007).

7. Wildlife of Conservation Concern

At least seven species known to use the SLO Tank Farm site are protected by federal, state, and/or local statutes (Padre 2007). These species include the vernal pool fairy shrimp (Figure 8), western pond turtle, western burrowing owl, tricolored black bird, California horned lark, loggerhead shrike, the south central California coast steelhead and various wide-ranging raptors. For a complete description, refer to Padre (2007).

F. Extent of Jurisdictional Waters of the U.S., Including Wetlands

The WSP/Padre field team delineated one hundred three (103) polygons on the SLO Tank Farm (Figures 9 and 10, Appendix A). In addition to the delineation, the WSP/Padre field team classified the waters/wetlands consistent with the hydrogeomorphic classes described by Brinson (1993) and Brinson *et al.* (1995). On the SLO Tank Farm, we observed and mapped riverine, depressional and slope waters/wetlands (Figure 11).

Mr. Bruce Henderson of the Corps Los Angeles District worked in the field with the WSP/Padre technical team on June 9, 2008. Mr. Henderson determined that, of the 103 waters/wetlands polygons mapped by the WSP/Padre team, 38 are wetlands *per se* and under federal CWA jurisdiction. Their combined area is 49.0 acres (Appendix A). Another six (6) polygons are so-called "other waters" of the U.S. Their combined total area is 3.9 acres (Appendix A). Therefore, the total area of waters/wetlands under federal CWA jurisdiction at the SLO Tank Farm site is 52.9 acres.

Forty-four (44) mapped polygons on the SLO Tank Farm are not under federal CWA jurisdiction because they are isolated depressional features that (a) have no connection with or adjacency to traditionally navigable waters, and/or (b) have no significant nexus with interstate commerce, or maintenance of the physical, biological, or chemical integrity of downstream waters (Figures 9 and 10). However, in all instances, these wetland features support special status species that are protected at federal and/or state levels of jurisdiction (refer to Figures 7 and 8). Total area of the waters/wetlands not under federal CWA jurisdiction but which do support special status species is 15.8 acres (Appendix A). Finally, fifteen (15) wet depressional features mapped on the SLO Tank Farm site do not support any special status species. Their combined total area is 3.4 acres (Figure 9 and Appendix A).

II. Landscape Restoration Design Overview

A. Guiding Principles

Ten principals guided the development of this *75% Basis of Design Report*. These were articulated by and vetted through many sources, including recommendations from Chevron EMC management and technical staff, members of the Surface Evaluation, Remediation and Restoration Team (hereafter "SERRT"), and consulting scientists from Padre, Avocet, and WSP. Guidance from pertinent federal, California state, and local regulations and policies regarding requirements for site remediation, restoration of waters/wetlands, and management of habitats for species of conservation concern, *etc*. has been incorporated in the design.

The ten principals are:

1. Give due diligence to federal, state and local regulatory requirements (*i.e.,* avoid, minimize, then mitigate).
2. Aim for no net loss of wetland area and/or function and no net loss of rare plant and animal habitat area.
3. If mitigation is required, aim for an on-site, in-kind approach, and to the extent possible, restore historic site conditions and key ecological processes.
4. Base the restoration design on attainable regional reference conditions including attainable range and density targets for rare plant and animal populations.
5. Aim to restore the native hydrological, biogeochemical, plant community, and faunal support/habitat functioning of riverine, depressional, and upland ecosystems.
6. Integrate the form and function of the natural and the constructed landscapes.
7. Maintain and/or improve habitat for rare/endangered/threatened species of concern, and increase area of suitable habitat, if possible.
8. Restore hydrological connectivity within the landscape.
9. Use knowledge of historic conditions to restore a more natural topography for the landscape at the site.
10. To the extent possible, integrate human uses and educational opportunities into restored environments.

B. U.S. Army Corps and EPA Guidance on Wetlands Compensatory Mitigation

Particular to waters/wetlands, the Corps along with the EPA issued new standards to improve wetland restoration and protection policies (Federal Register, April 2008). The new "wetlands compensatory mitigation standards" were offered to promote the use of best available science, promote innovative approaches to the "no net loss of area and/or function" national policy, and to focus on the results of restoration and protection.

Relevant to the SLO Tank Farm Landscape Restoration Project, these new Corps/EPA mitigation standards reaffirm the mitigation sequence of avoid, minimize, and mitigate (compensate). The SLO Tank Farm Landscape Restoration Project avoids impacts to existing waters/wetlands where possible, mitigating impacts when it is not possible to avoid them, and compensating in the form of restoration (targeting regional reference) in line with the new guidance on mitigation

sequencing. Impacts to waters/wetlands due to remediation efforts are expected on 26.06 acres; impacts to waters/wetlands due to development efforts are expected on 1.16 acres (refer to Table 1); self-mitigating restoration of degraded wetlands is proposed on an additional 11.33 acres As described in this basis of design report, the proposed restoration of waters/wetlands will occur on a total of 45.67 acres, representing a 1.7:1 area-to-area metric (Table 1).

C. Landscape Restoration Design Framework

This restoration design is centered on the following major activities:

1. Earthwork, including mass and fine grading, including installation of microtopographic features (*e.g.*, large wood structures, mounds, depressions, habitat logs),
2. Planting and seeding,
3. Irrigation,
4. Weed control, and
5. Maintenance, monitoring and adaptive management

Design rationale for implementation of each technique is described in the following text. Sequence of the construction implementation is offered in Section VII.

1. Earthwork

At the SLO Tank Farm, natural landforms and transitions among them are significantly degraded as a result of historic land uses. These landforms will be further degraded by proposed remediation efforts. However, at completion, these project-related disturbances, including restoration, must at least maintain, and ideally improve upon, existing hydrologic functions. Therefore, as part of the remediation and restoration efforts, SLO Tank Farm earthwork has been designed to use both mass and fine grading techniques to re-create or mimic (where possible), natural features and transitions within the landscape (Appendices B through I). Specifically, grading can restore site conditions to natural forms and functioning, targeting the (re)establishment of important hydrologic processes and the partial structure of faunal habitats (*e.g.,* landscape hydrologic connectivity and creation of smooth transitions within and among wetland classes and adjacent upland habitats). Additionally, mass grading (specifically clearing, grubbing and stripping) is effective at removing weeds rapidly through elimination of standing biomass and surficial weed seed banks. Mass grading also helps prepare the soil surface as favorable planting environment. In addition, fine grading at the SLO Tank Farm is designed to focus on the creation of habitats for threatened and endangered plant and animal species (*e.g.*, vernal pool fairy shrimp, Congdon's tarplant).

a. Restored Channel Systems

(i) Tank Farm Creek

(a) The Channel and Floodplain System

Figures 2-4 illustrate the principal channels and contributing watersheds of the site in its existing condition. Drawings Appendix B (Sheets 1-3) and Appendix C (Sheets 1-2), in contrast, summarizes the changes that are proposed to occur in the channels and watersheds due to remediation, development, and restoration. Envelop One provides a CD with these 75% construction drawings at a 1:50 scale.

With particular respect to the Tank Farm Creek channel system, Appendices C and D show channel alignments, longitudinal slopes, and typical cross sections by reach. The new arrangement of Tank Farm Creek is intended to address the poor hydrologic function that results from its existing configuration. The East and West forks are now routed into the North Marsh. The dual round culverts are abandoned, and weir is installed in the box culverts forcing water to pond in the North Marsh, thereby reducing the magnitude of the peak flow for a given precipitation event and delaying its arrival at the site discharge point (the headwall). Tank Farm Creek is relocated to follow the course of the former auxiliary channel (away from the property line), and a low-flow outlet is provided in the headwall so that it releases water in a controlled manner earlier in a storm, further reducing demand on the limited storage capacity south of Tank Farm Road.

The longitudinal and cross-sectional geometries shown in Appendices C and D were developed by Avocet and WSP to ensure adequate flow capacity in the Tank Farm Creek channel system to convey storm water from precipitation events up to the 10-year 24-hour storm, and to retain the 100-year flood. Consequently, for storms that produce up to 4.7 inches in 24 hours, the system will function in a riverine fashion, with little to no flooding of the adjacent land. In addition, cross-sectional geometries and microtopographic features for all reaches within the Tank Farm Creek channel system were designed to (a) reduce the kinetic energy of floodwaters, (b) spread water over the floodplain surfaces during large storm events and maximize water contact with wetlands, and (c) provide a diversity of surfaces within the channel/floodplain system for establishment of native plant communities. Also included in Appendix D (Sheets 2-5) are rendings depicting plant community development at four cross-sections ten years post restoration.

(b) Storage Features and Function

It is likely that flood storage did not occur on the pre-development site. However, given the significant changes that have occurred within the watershed, particularly construction of important transportation corridors such as Tank Farm Road, it is impossible to recover the original hydrologic and ecologic function of Tank Farm Creek exactly. In fact, the current site exacerbates floods that result from downstream alterations of Tank Farm Creek.

Key tenets of modern storm water management include the guarantee of public safety, preservation of property, and protection of habitat. As such, flood storage is an inescapable reality for the existing and post-remediation site conditions. Our goal, however, has been to balance the needs for public safety, maintaining protected habitats that have established themselves on the SLO Tank Farm, and restoring (to the degree practical) as much of the original riverine function of Tank Farm Creek as possible.

The proposed restoration design, presented in this report and shown in detail in Appendices B-E, is our best effort to satisfy those storm water requirements. The modified channels pass storms up to the 10-year precipitation event in a riverine manner with some ponding in the North Marsh and support of depressional and slope wetland features. Larger storm events engage the increased storage capacity of the entire site. More importantly, uncontrolled discharges over the headwall are prevented, improving public safety.

(ii) Recapture of East Fork SLO Creek Meanders

In the southeastern portion of the SLO Tank Farm site, specifically in two areas adjacent to the East Fork of San Luis Obispo Creek, two creek meanders were cut off from the main channel system by levee construction. Thalweg elevations of these cut-off meanders is consistently approximately three (3) feet above the thalweg elevation of the East Fork of San Luis Obispo Creek as that channel passes the upstream portion of the cut-off meander. Currently, although plant communities within the meanders are heavily grazed and degraded, the fundamental geometry of the meanders is intact. It is therefore a relatively simple matter to remove the upstream and downstream earthen "plugs" that separate the meanders from the East Fork San Luis Obispo Creek channel system, and thus re-engage them. Appendix B (Sheet 3) shows the mass and fine grading approach that the Padre & WSP/Avocet design team has chosen to recapture the two meanders. Sill elevations shown are set to engage East fork San Luis Obispo Creek flows into the meanders early and often. That is, sill elevations are set at 40% of the maximum stage elevation of the annual return flood. To protect civil structures (*e.g.,* bridge abutments, instrument landing strip [ILS] structures), grading, slope hardening with rip-rap, and installation of some log deflection structures is recommended.

(a) Installation of Microtopographic Features, Including Mounds, Swales, Depressions and Large Wood and Log Structures

Prior to grazing, clearing, industrial uses and water management in California, a suite of microtopographic features (*e.g.*, including linked and isolated depressions, swales, large wood structures, log jams, windthrow mounds, and standing dead trees) were an integral part of both terrestrial and aquatic ecosystems (Mount 1995). Throughout the California Central Coast, these microtopographic features form on and within active channel systems and on the adjacent flood plains and associated stream terraces. They are integral and long lasting structural features that provide important surfaces and microtopographic relief that support many biogeochemical, plant community and faunal support/habitat ecosystem functions (NWSTC 2001, 2004). For example, mounds, swales, depressions and log structures create hydraulic roughness (*i.e.,* increased Manning's *n*), which slows water flow and dissipates the kinetic energy of floodwaters. Large wood structures also can be used to spread water and promote maximum contact with flood plain surfaces and associated plant and microbial communities. In landscape restorations, mounds, swales, depressions, and log structures can be placed strategically to direct or deflect flood waters away from natural or civil structures including upland habitats, roadways, bridges, *etc.* It is now common throughout the United States and elsewhere (*e.g.*, Australia) to use a suite of microtopographic features to create hydraulic and structural complexity within restored stream reaches (Abbe and Montgomery 1996, Brooks *et al*. 2001, Brummer *et al.* 2006, Montgomery 2006, Montgomery & Abbe 2006). Such complexity has been shown to provide habitat for a

diverse array of plant species and for aquatic invertebrates and vertebrates, including fish (Abbe and Montgomery 1996, Crook and Robertson 1999). At the SLO Tank Farm, the Padre & WSP technical team has placed large wood and log structures on flood plain surfaces to create microtopographic variation that includes abrupt gradients in elevation, soil texture and site water balance (Appendix E, Sheets 1-3). These features of the restored SLO Tank Farm landscape allow for restoration of biogeochemical functioning, high plant diversity, and a variety of faunal habitats.

(b) Soil Ripping and Lofting

After mass and fine grading as discussed, and prior to planting, finish grade soils will be ripped and lofted to a depth of approximately twelve (12) inches using either a tractor- or dozer- drawn set of hydraulic gang rippers and a box or gang disc. The goal of the ripping and lofting operation is to decrease soil compaction, increase soil aeration porosity, and improve conditions for planting. Passes for the ripping and lofting should be made at right angles to each other. No ripping or lofting should occur on soil surfaces intentionally compacted to encourage ponding of water (*e.g.*, depression bottoms) or amended to encourage colonization of species of conservation concern. No ripping or lofting zones will be clearly marked in the field.

(c) Site Stabilization/Interim Sediment and Erosion Control Systems

After ripping and lofting of finish grades, interim sediment and erosion control systems will be installed on SLO Tank Farm restoration areas. A suite of best management practices (hereafter "BMPs") and techniques will be used. These are summarized in Appendix F (Sheets 1-4) of the construction drawing set. BMP's include installation of rock aprons to protect high energy storm water outfall locations, degradable geotextile (*e.g.,* coir cloth) covers on high energy or highly erosive slopes or river meanders, lifts of sterile straw, hydroseeding with native plant mixes and tackifier, coir rolls and sediment traps, *etc*.

2. Planting & Seeding

Restoration planting will be conducted to maintain fidelity to native plant community structure and composition at the SLO Tank Farm. A native plant nursery will be established to provide planting stock suited to the restoration site and to better control planting schedules and logistics. Seed collecting will be conducted on-site, and off-site as necessary, to assist in reestablishment of suite of locally adapted native plants. Importantly, restoring native plants will increase the detrital pool that has degenerated due to livestock grazing. Further, native plant community restoration improves hydrologic and biogeochemical functioning on the site and provides habitat for native fauna. Specifically, restoration of a native plant community will provide complex vertical and horizontal structure within the landscape. Lastly, establishment of native plants will lead to exclusion of non-native and invasive weeds which are pervasive in California grassland landscapes. Because the SLO Tank Farm restoration effort will be at a large scale, planting will be conducted in phases that will allow for important, shade-tolerant species to be installed after initial plantings have been conducted in certain plant communities. For example, in the palustrine forest II community type, shade-tolerant species (e.g., elk clover [*Aralia californica*], hedge nettle [*Stachys bullata*], and western sword fern [*Polystichum munitum*]) will be planted

after the canopies of the tree and shrub layers (Fremont cottonwood, Western sycamore, coffee berry, toyon, and arroyo willow close (or nearly so). The 75% restoration planting design and plan is provided in Figure 12 and Appendices G and H. Envelop One provides a CD with these 75% construction drawings at a 1:50 scale. Typical nursery stock installation details are provided in Appendix I.

3. *Weed Management Systems*

Many highly aggressive, non-native plant species are present at the SLO Tank Farm Project Site (*e.g.,* Italian thistle, poison hemlock). Such species not only degrade the native plant community functions, but also threaten the long- and short-term success of the restoration project. Therefore, an integrated weed/pest management strategy is necessary as part of the overall restoration effort. Before, during and after establishment of restored riparian/wetland ecosystem area and functioning, management of weeds/invasive species will be a high priority. Implementation of weed management systems must address (i) re-emergence of weeds from on-site seed banks, (ii) establishment of existing populations of weeds not removed in the initial clearing effort, and (iii) colonization of restored area from off-site exotic seed sources. Weed control efforts will be adapted as needed using an integrated program that includes initial clearing, grubbing and stripping, mowing, hand weeding, weed-whacking, and re-planting or inter-planting additional plants as necessary, and use of herbicides as necessary. Weed control will be required as part of the construction, monitoring, maintenance, and adaptive management activities planned for the project.

An integrated weed strategy that has been successful in waters/wetlands restoration project elsewhere includes seven parts. They are:

a. Clearing, grubbing, stripping and mass grading to remove weeds and weed propagules,

b. Installing nursery stock at high planting densities to promote competitive exclusion of weed species by native plants, rapid establishment of shade, targeted or limited understory growth,

c. Installing native plant species with high survival potential and rapid growth rates that will exclude other species,

d. Hand weeding and weed whacking to remove invasive species prior to their reproduction,

e. Use of herbicides registered by the EPA for use in waters/wetlands, only if necessary,

f. Adaptive management techniques such as rest/rotation grazing by livestock and a controlled burn program. A detailed grazing plan, potentially coupled with a controlled burning plan, for the SLO Tank Farm landscape to control early emergence of noxious non-native grasses (specifically *Avena barbata, Bromus diandrus, B. madritensis*) and forbs (specifically *Brassica nigra, Malva parviflora*) will be developed in early 2009.

g. Particular species of non-native noxious weedy plant species will be targeted for immediate removal if or when they are documented on the restoration site. These species include, ***but are not limited to***, the following: giant reed (*Arundo donax*), slender oats (*Avena barbata*), smotherweed (*Bassia hyssopifolia*), Sahara mustard (*Brassica tournefortii*), ripgut brome (*Bromus diandrus*), red brome (*Bromus madritensis*), lens-podded hoary cress (*Cardaria chalepensis*), white top (*Cardaria draba*), Italian thistle (*Carduus pycnocephalus*), purple starthistle (*Centaurea calciptrapa*), tocolote (*Centaurea melitensis*), yellow starthistle (*Centaurea solstitialis*), poison hemlock (*Conium maculatum*), jubata grass (*Cortaderia jubata*), artichoke thistle (*Cynara cardunculus*), Cape ivy (*Delairea odorata*), perennial veldt grass (*Ehrharta calycina*), panic veldt grass (*Ehrharta erecta*), Tasmanian blue gum (*Eucalyptus globulus*), leafy spurge (*Euphorbia esula*), fennel (*Foeniculum vulgare*), French broom (*Genista monspessulana*), English ivy (*Hedera helix*), perennial pepperweed (*Lepidium latifolium*), purple loosestrife (*Lythrum salicaria*), myoporum (*Myoporum laetum*), fountain grass (*Pennisetum setaceum*), Harding grass (*Phalaris aquatica*), castor bean (*Ricinus communis*), Spanish broom (*Spartium junceum*), medusahead (*Taeniatherum caput-medusa*), all tamarisk species (*Tamarix ramosissima, T. chinensis, T. gallica*, T. *parviflora*), and periwinkle (*Vinca major*). Methods of weed control will be species-specific, as recommended and detailed by Bossard, Randall and Hoshovsky (2000). Specific treatments for control of these species and others will be provided in the monitoring plan to be prepared in early 2009.

4. Maintenance, Monitoring and Adaptive Management

Chevron EMC will be required to prepare and submit a final monitoring plan to federal, state, and local regulatory agencies prior to issuance of required permits and initiation of construction. To ensure that the landscape restoration at the SLO Tank Farm is a success, and that appropriate adaptive management/contingency measures are used, the Project Site will be monitored for baseline (*e.g.*, "time zero") conditions at the end of remediation, construction, and planting efforts. To ensure success, Chevron monitoring teams will visit the site at least twice yearly for ten years to observe conditions and recommend adaptive management and contingency measures. Monitoring reports will be prepared and submitted to federal, state, and local regulatory agencies in five years over a ten-year period (*e.g.*, following baseline conditions, reports will be prepared in years 1, 3, 5, 7, 10). This *Basis of Design Report* establishes success criteria via the use of project targets and project standards. The project targets and standards for the SLO Tank Farm landscape restoration are organized in four functional categories -- hydrology, biogeochemistry, native plant community, and faunal support/habitat.

The final monitoring plan (to be developed in early 2009) includes methods to quantify and document each project target and project standard and to identify criteria for success as well as first line contingency measures and adaptive management approaches. Monitoring protocols include combinations of photo points, topographic or shape surveys of channel systems' geometry and microtopographic features, characterizations of the stability of log structures, soil and/or sediment profiles, selected water quality measurements, invertebrate and wildlife fauna surveys, assessment of survivorship, vegetation cover, structure, composition, vigor, *etc*. In the event that project targets, standards and/or success criteria are not met, an adaptive management

strategy with contingency measures will have been established and refined in the final monitoring plan.

D. Sediment and Erosion Control Systems

All remediation and restoration construction activities at the SLO Tank Farm must adhere to the Storm Water Pollution and Prevention Plan (SWPP) and Temporary Erosion and Sediment Control (TESC) plans (refer to Appendix F). Specific erosion control and best management practices for remediation are described in the *Remedial Action Plan*. Draft TESC plans for pre-construction, during construction, and post construction conditions are included as part of this *75% Basis of Design Report* as discussed previously and in Part C of this Section (III) (Appendix F). The SWPPP document will be prepared in early 2009 and submitted by Chevron EMC to state and local regulatory agencies pursuant to applications for relevant permits.

Remediation and restoration construction activities will be initiated and completed during over two to three dry seasons (May to November). The first step in the construction efforts will be to install all safety, traffic flow control, and sediment and erosion control systems according to the site-specific Health and Safety, traffic safety, and SWPP and TESC plans. As introduced above, the TESC plan for this project anticipates a dynamic remediation and restoration construction environment where several sites or zones may be open and in operation simultaneously. The final plans will be structured and designed to move with and adapt to extant remediation, grading and planting efforts. Consequently, sediment and erosion control systems at the SLO Tank Farm are designed to be monitored continuously and maintained and adapted to construction activities as they occur within and among logical operating zones or sectors within the SLO Tank Farm. Upon completion of seasonal or final remediation and /or grading activities (*e.g.*, lay back slopes, create microdepressions, create wind throw and wood mounds, install deflection log jams, *etc.*), interim or final sediment and erosion control systems will be installed, monitored, and maintained consistent with the SWPP and TESC plans.

III. FINAL (75%) WATERS/WETLAND ECOSYSTEM DESIGN

A. General Description and Restoration Design Rationale

As introduced above, the WSP/Padre/Avocet team has designed the ecosystem restoration design for riverine, depressional, and slope waters/wetland ecosystems in Tank Farm Creek and the East Fork of San Luis Obispo Creek, and the surrounding landscape to a 75% level of completion. This design allows for a 1.7:1 acreage mitigation ratio for unavoidable impacts to waters/wetlands as a result of the anticipated remediation and development activities. Equally (if not more) important, our restoration design will increase the functioning of the hydrologic, biogeochemical, native plant community, and faunal support/habitat ecosystem functions identified at the SLO Tank Farm Site (WSP 2007a, Padre & WSP 2008b).

This 75% design addresses the restoration of the tank farm landscape after (or in concert with) the remediation of contaminated sediments extant on the site. Because the remediation efforts will occur across the SLO Tank Farm in both uplands and waters/wetlands, the WSP/Padre team has taken a landscape approach with a strong focus on use of historical and regional reference systems to focus the restoration design. Specifically, individual elements of the design, such as restoration of riverine waters/wetlands, vernal pool/swale mosaics, and special status species' habitats are introduced and addressed as individual components of the restoration and then integrated with other design elements to present a landscape-scale treatment of the restoration. Details of the landscape restoration approach are provided in the following text, paying close attention to the regulatory requirements and context of the proposed restoration project.

As detailed in the Section I.A. of this report and in the recent delineation report for the SLO Tank Farm (Padre & WSP 2008a), the Tank Farm Creek/North Marsh ecosystem and associated waters/wetlands in the SLO Tank Farm landscape are structurally and functionally degraded. Therefore, this design focuses on restoration of the structure and functioning of (a) the Tank Farm Creek system north and south of Tank Farm Road, and (b) many depressional wetlands and depression/swale mosaics throughout the project area. Incorporated within the reference system that we developed for this project (Padre & WSP 2008b), a series of topographic maps dating from 1900 (Figure 13) illustrate that the two main features of the landscape – *i.e.*, that the Tank Farm Creek/North Marsh ecosystem historically was an unnamed tributary of San Luis Obispo Creek. Natural and anthropogenic depressions and swales (slopes) features existing in the context of the San Luis Obispo and Tank Farm Creek alluvial systems would have existed, but at a scale that exceeds that of the standard 1:25000 USGS topographic quadrangle of Figure 13.

However, historic photos and maps show that construction of Tank Farm Road and oil storage infrastructure led to re-routing of the creek channel system, impoundment of reaches north and south of Tank Farm Road, and significant sedimentation of channel reaches, especially north of Tank Farm Road. Additional site activities, including cattle grazing, grading and leveling, road construction, and the construction of various culverts and pipes along the length of the Tank Farm Creek tributary contributed to fragmentation of the longitudinal and cross-sectional connections within the Tank Farm Creek channel system, decreases in faunal habitat patch sizes and contiguity, and degradation of plant community and faunal support ecosystem structure and functioning.

B. Project Targets, Project Standards and Success Criteria for Restoration of Riverine and Riverine-Slope Complex Waters/Wetlands Ecosystems in the SLO Tank Farm Landscape

The suite of waters/wetlands restoration activities proposed in this *Basis of Design Report* is targeted specifically for implementation in (a) riverine ecosystems in the north and southwestern portions of the Project Site, and the East Fork of San Luis Obispo Creek, and (b) restoration of depression and swale features distributed throughout the landscape and within Reservoirs 3 and 7, and in four of the smaller reservoirs in the northwest portion of the site. This landscape-scale restoration is depicted in Figure 12 and Appendices B through H. Details of riverine ecosystem restoration are discussed separately from depression/swale mosaics in the context of vernal pool fairy shrimp habitat restoration (see also Section VI).

Specific project targets, project standards and associated success criteria (*i.e.*, field indicators/measurements showing achievement of project standards) have been developed separately for the waters/wetland ecosystem restoration portion of the landscape scale restoration project. The proposed riverine and riverine/slope restoration design places emphasis on the following five project targets keyed to the four suites of ecosystem functions performed by waters/wetlands ecosystems (*i.e.,* hydrology, biogeochemistry, native plant community maintenance, and faunal support/habitat). Appendices J through L offers a comprehensive tabular summary of project targets, project standards, success criteria, and first line contingency measures and/or adaptive management for the three separate elements of the landscape restoration – *i.e.*, North Marsh-Tank Farm and East Fork San Luis Obispo Creeks; terrestrial (uplands)/rare plants; and, vernal pool fairy shrimp habitats.

Project Target I. – Hydrology: ***To the extent possible in current landscape contexts and considering current site potential(s), restore a riverine ecosystem with structure and functioning similar to intact reference system conditions.***

Project Standard 1 - Establish and maintain a restored Tank Farm/Northwest Creek channel system with water conveyance, energy dissipation, and storage structure and functioning as reflected in the design grades offered in the Construction Drawings (Appendices B through E).

Success Criteria

1. By end of monitoring period, bankfull width within ranges for given reaches:
    a) Northwest Creek Reach 1 and 2: 50-60 ft
    b) Northwest Creek Reach 3: 10-12 ft
    c) Tank Farm Creek Reach 1: 55-65 ft
    d) Tank Farm Creek Reach 2: 30-38 ft
2. Bankfull depth within range of 1-2 ft for all reaches by end of monitoring period
3. Mean longitudinal channel slope is between 0.5% and 1.0% for all reaches by end of monitoring period

Project Standard 2 - Reconnect two abandoned oxbows/secondary channels in the southeastern portion of the SLO Tank Farm site to the East Fork of San Luis Obispo Creek in a manner that engages flows into and through the oxbows at creek stages approximately 40% of the maximum height of the stage of the annual return flood.

Success Criteria

1. Oxbow/secondary channels are reconnected to East Fork, SLO
2. Creek/oxbow/secondary channels engage at approximately 40% of the maximum stage height of the annual return flood

Project Standard 3 - Following remediation measures within the footprint of Reservoir 3, create a complex of shallow vernal depression and swale wetland mosaics that are linked hydrologically, at least seasonally during high water events.

Success Criteria

Constructed microtopographic features remain structurally stable along short and long axes throughout the life of the monitoring period, *i.e.*, maintain design cross sectional geometry as measured along long and short axes.

Project Standard 4 - Construct small and medium scale vernal depression and swale wetland mosaics in the areas proximate to Reservoirs 5 and 7.

Success Criteria

Constructed microtopographic features remain structurally stable along short and long axes throughout the life of the monitoring period, *i.e.*, maintain design cross sectional geometry as measured along long and short axes.

Project Standard 5 - Install and maintain a suite of microtopographic features that include large wood structures, mounds, depressions, and single logs on the flood plain throughout the restored SLO Tank Farm landscape and as shown in the Construction Drawings (Appendices B through E). As possible, link small and medium scale vernal depressions and swales to one another and/or to adjacent riverine ecosystem.

Success Criteria

Construct and maintain microtopographic features. Features will remain structurally stable along short and long axes throughout the life of the monitoring period, *i.e.*, maintain design cross sectional geometry as measured along long and short axes.

Project Target II. – Biogeochemistry - *To the extent possible in the restored landscape, establish and maintain water contact with flood plain and waters/wetlands surfaces.*

Project Standard 1 – Maintain design grades to allow water contact with flood plain and waters/wetlands surfaces.

Success Criteria

No net decrease in flood plain and waters/wetlands area subject to flooding, inundation or ponding.

Project Target III – Biogeochemistry: *To the extent possible in the restored landscape, manage water routing, conveyance, and storage to maintain low kinetic energy in floodwaters and short and long duration residence time of waters on flood plain and waters/wetlands surfaces.*

Project Standard 1– Maintain design routing, conveyance, and storage features in the restored landscape.

Success Criteria

1. Minimal erosion and/or sedimentation within the main water conveyance and storage features.
2. Short duration (7-30 days) and long duration (>30 days) water storage in > 50% of design depressional features in most (*i.e.*, >50%) years.

Project Target IV -- Plant Community: *Establish and maintain diverse native plant community throughout the SLO Tank Farm restoration areas using a combination of live cuttings, nursery stock, and seeds genetically adapted to the project site.*

Project Standard 1– Restored plant community types develop into a plant community of viable, self-sustaining populations of native species that resist invasion by exotic plant species, in the absence of prolonged drought or non-natural perturbations that have the potential to reset plant community development.

Success Criteria

1. *Survivorship of nursery stock in forested and scrub-shrub community types*: Survivorship between 70-80% by year five of the monitoring period.
2. *Survivorship of nursery stock in herbaceous community types*: Survivorship between 70-80% by year five of the monitoring period.
3. *Percent cover of native tree species in riparian forest communities*: Native tree cover ranges between 70 - 80% by the end of year 10 (end of monitoring period).
4. *Percent cover of native tree species in riparian scrub-shrub communities*: Greater than or equal to 10% but less than 75% by the end of year 10 (end of monitoring period).
5. *Percent cover of native tree species in riparian herbaceous communities*: Native tree cover greater than 0% but less than 10% by the end of year 10 (end of monitoring period).
6. *Percent cover of native shrub species in riparian forest communities*: Native shrub cover greater than or equal to 10% but less than 75% by the end of year 10 (end of monitoring period).

7. *Percent cover of native shrub species in riparian scrub-shrub communities*: Native shrub cover ranges between 70 - 80% by the end of year 10 (end of monitoring period).
8. *Percent cover of native shrub species in riparian herbaceous communities*: Native shrub cover greater than 0% but less than 10% by the end of year 10 (end of monitoring period).
9. *Percent litter/detritus in all plant community types*: Greater than or equal to 65% of vegetation plots support autochonthonous litter by the end of year 10 (end of monitoring period).
10. *Vigor of planted stock*: Greater than or equal to 80% of vegetation plots assessed qualitatively as "good" or "excellent" at end of monitoring period by the end of year 10 (end of monitoring period).

Project Target V -- Faunal Support/Habitat: *Increase vertical and horizontal complexity for native faunal species within the restored waters/wetlands ecosystem and its buffers.*

Project Standard 1– Restored community types develop into a plant community of viable, self-sustaining populations of native species that resist invasion by exotic plant species and that support a suite of vertebrate species typical of reference standard conditions - specifically, characteristic of the central coast of California.

Success Criteria

1. *Vegetative strata*: *Forest communities* - Average of greater than or equal to three strata in vegetation plots (*i.e.*, trees, shrubs, herbs, with sapling/seedling and/or vines as additional stratum) by end of year 10 (end of monitoring period).
2. *Vegetative strata*: *Scrub-shrub communities* - Average of greater than or equal to two strata in vegetation plots (*i.e.*, shrubs, herbs, with sapling/seedling and/or vines as additional stratum) by the end of year 10 (end of monitoring period).
3. *Vegetative strata*: *Herbaceous communitie*s – Average of two or fewer strata in vegetation plots by end of year 10 (end of monitoring period).
4. *Canopy cover*: Greater than 80% cover in forested and scrub-shrub communities by the end of year 10 (end of monitoring period).
5. *Increase Plant Community Patch Size*: Canopy coverage by plant communities dominated by native species ranges between 70-80% within the 100 foot buffer for the restored creek channel system by the end of year 10 (end of monitoring period).
6. *Increase Habitat Patch Contiguity*: Establish and maintain the design number of unbroken connections among habitat patches throughout the restored SLO Tank Farm landscape by the end of year 10 (end of monitoring period).

IV. FINAL (75%) TERRESTRIAL ECOSYSTEMS DESIGN

As introduced, the terrestrial restoration (upland) design for the SLO Tank Farm has been prepared to a 75% level of completion. This terrestrial ecosystems design provides greater than 1:1 acreage (or better) mitigation for unavoidable impacts to serpentine bunchgrass grassland and for the rare plant species (*i.e.*, Cambria morning glory and San Luis Obispo owl's clover) as a result of the anticipated remediation and development activities. This ecosystem restoration design can be expected to increase the functioning of the native plant community and faunal support/habitat ecosystem functions identified at the SLO Tank Farm (Padre & WSP 2008b). The restoration scenario for terrestrial and special status species also is depicted in Figure 14. Project targets, standards and success criteria are presented below. Construction sequencing is discussed in Section VII.

A. General Description and Design Rationale

Currently, California annual grassland communities dominate the majority of the upland areas at the SLO Tank Farm Project Site. Approximately 218.6 acres are composed of a sparse to at times dense cover of various non-native, annual grasses (*e.g.*, wild oats, ripgut grass), often interspersed with native and non-native forbs. Following remediation activities, four upland plant communities, phreatophytic woodland, phreatophytic savannah, coastal sage chaparral, and forb fields, will be restored within the disturbed upland areas at the Project Site (Figure 14). The following is a brief description of each of these upland plant communities. Appendix H contains complete list of plant species within each plant community type, including density (number per acre) and area of each plant community type to be planted.

1. Phreatophytic Woodland

Phreatophytic woodlands consist of a relatively dense distribution of deeply rooted trees and shrubs that obtain a significant portion of the water they need to survive from the water table. Approximately four acres of phreatophytic woodland habitat will be restored throughout the SLO Tank Farm Project Site. This plant community will consist of a combination of trees and shrubs (*i.e.,* California buckeye [*Aesculus californica*], coast live oak [*Quercus agrifolia*], toyon (*Heteromeles arbutifolia*) coyote bush [*Baccharis pilularis*], golden yarrow [*Eriophyllum confertiflorum*], *etc.*) with a variety of native forbs, grasses, and vines in the understory.

2. Mixed Hardwood/Forb Field [1]

The mix hardwood/forb field will consist primarily of native forbs (*i.e.*, California poppy [*Eschscholzia californica*], tidy tips [*Layia platyglossa*], goldfields [*Lasthenia*], lupines [*Lupinus*], *etc.*) and selected native grasses (*i.e.*, purple needlegrass [*Nasella pulchra*], California fescue [*Festuca californica*], *etc.*) with trees such as coast live oak and California buckeye

[1] A recent publication by Minnich (2008), presents compelling evidence that current non-native annual grasslands of the Coast Ranges existed in pre-European times as extensive forb fields, not perennial bunch grasslands. The Padre & WSP team reviewed Minnich (2008) during the development of the design, and has decided to accept Minnich's thesis; the upland habitats therefore reflect this historical re-interpretation.

planted in scattered locations. Plant species of conservation concern to be restored in this community include Cambria morning glory (*Calystegia subacaulis* ssp. *episcopalis*) and San Luis Obispo owl's clover (*Castilleja densiflora* ssp. *obispoensis*). Approximately 27 acres of mixed hardwood/forb field habitat will be restored throughout the SLO Tank Farm Project Site.

3. Coastal Sage Chaparral

The coastal sage chaparral communities will be comprised of a combination of woody chaparral species (*i.e.,* chamise [*Adenostoma fasciculatum*], California coffeeberry [*Rhamnus californica*], *etc.*) and drought-deciduous sage scrub species (*i.e.*, California sagebrush [*Artemisia californica*], golden yarrow, *etc.*). In addition, a variety of native grass and forb species will be scattered throughout this plant community. Coastal sage chaparral habitat will be restored within approximately 10.9 acres at the SLO Tank Farm Project Site.

4. Forb Field

Emerging theories regarding California's pre-european landscape suggests that, rather than extensive bunch grasslands, extensive forb fields occupied the open slopes and foothills of the Coast Ranges and Sierra Nevada (Minnich 2008). Therefore, this *Basis of Design Report* calls for the restoration of extensive forb fields with selected native grasses in the uplands. Native perennial bunch grasses (*i.e*., purple needlegrass, California fescue, pine bluegrass [*Poa secunda* ssp. *secunda*], meadow barley [*Hordeum brachyantherum* ssp. *brachyantherum*], *etc.*) will be planted and seeded in subdominant abundance along with a diversity of native forbs (*i.e.,* California poppy, Botta's clarkia [*Clarkia bottae*], tidy tips [*Layia platyglossa*], goldfields [*Lasthenia*], lupines [*Lupinus*], and a variety of other species). Plant species of conservation concern to be restored in this community include Cambria morning glory and San Luis Obispo owl's clover. Approximately 45.2 acres of forb field habitat will be restored throughout the SLO Tank Farm Project Site.

B. Project Targets, Project Standards and Success Criteria for Landscape-Level Design for Upland Ecosystems

Project targets, standards and success criteria for the terrestrial habitats have been incorporated into those developed for the rare plant mitigation and restoration plan. Therefore, to avoid redundancy, project targets, standards, and success criteria for upland plant communities are articulated in the following Section V (see also Appendix K for a tabular summary).

V. Draft (75%) Mitigation/Restoration Plan for Vascular Plant Species of Special Concern

The proposed design for mitigation/restoration of vascular plant species of special concern for the SLO Tank Farm has been prepared to a 75% level of completion. This rare plant mitigation/restoration design provides on-site 1:1 acreage (or better) mitigation for unavoidable impacts to rare plant species and plant species of special concern (*i.e.,* Cambria morning glory, Congdon's tarplant, San Luis Obispo owl's clover, Hoover's button-celery, purple needlegrass grassland, and California walnut) as a result of anticipated remediation and development activities. Restoration of the SLO Tank Farm will impact additional rare plant populations; however, these impacts are, in most cases, temporary and considered self-mitigating as restoration of the site will greatly enhance the existing habitat and increase ecosystem functions at the SLO Tank Farm site. Detailed descriptions of each rare plant species, seed/propagule collection strategies, and propagation recommendations are outlined in the Botanical Resources Report (Padre & WSP 2008c).

A. General Description and Design Rationale

Six special-status vascular plant species and one dominant grass species, purple needle grass, are found at the SLO Tank Farm Project Site (Table 2). None of these species are protected under the federal Endangered Species Act of 1973, as amended, nor under the California Endangered Species Act. Rather, they have been identified by the California Native Plant Society (CNPS) as rare, threatened, and endangered in California and elsewhere (List 1B) or are considered to have a limited distribution in the State (List 4.2). They are therefore acknowledged under the California Environmental Quality Act as significant biological resources at the SLO Tank Farm (Padre & WSP 2008c).

The presence, relative density, and geographic distribution of Cambria morning glory, San Luis Obispo owl's clover, Congdon's tarplant, San Luis Obispo serpentine dudleya, and Hoover's button-celery were surveyed from May until July, 2008 (Padre & WSP 2008c). A rough estimate of the range of population density was obtained for each rare plant species (*i.e.,* either for every population occurrence or for a minimum of 100 sampling points). The resulting frequency of rare plant individuals per sample plot was used to guide the average densities of patch populations of the above mentioned rare plant species for outplanting. The geographic distribution of purple needlegrass and several stands of southern California walnut were surveyed and mapped in April 2008. Restoration areas for special-status plant species are depicted on Figure 14 and a complete list of plant species within each plant community, including density (number per acre) and area of each species planted is contained in Appendix H.

Impacts to rare plant species and purple needlegrass grassland will occur as a result of excavation and backfilling activities within remediation areas, existing reservoirs, and borrow areas as well as along access routes, within staging/stockpile areas, and various clean-up sites. Furthermore, Chevron proposes to develop portions of the SLO Tank Farm upon completion of the remediation activities. The following text provides an overview of the estimated extent of impacts to rare plants and sensitive habitat areas as a result of project implementation. A summary of the impacts associated with each of the project components (*i.e.,* remediation,

development, and restoration) is provided in Table 1. It is important to note that impacts to rare plants were estimated based on surveys conducted in 2003 and 2008. Given that several of the rare plants species present at the SLO Tank Farm (*i.e.,* Congdon's tarplant and San Luis Obispo owl's clover) are annual species and total number of individuals is variable each year, it is anticipated that these rare plant populations will display some deviation in number and geographic extent during subsequent growing seasons.

B. Design Considerations and Techniques for Mitigation/Restoration of Vascular Plant Species of Conservation Concern

To restore special status (rare) plant species populations, a combination of seed distribution and planting techniques will be employed. A native plant nursery will be established for the project to propagate and provide access to plants suited to the restoration site. Rare plant seed/propagules will be collected from specified on-site collection locations (Figure 15) prior to construction/remediation. This collected plant material is estimated to begin propagation from 18 to 24 months prior to initiation of restoration activities (*i.e.*, seed distribution and outplanting) to allow sufficient time for collection, and propagation of collected materials. In addition, all rare plants can be salvaged from impact areas prior to implementation of each phase of the project. Biennial and perennial species salvaged from construction/remediation areas will be transplanted directly to the native plant nursery.

Patch populations for Cambria morning glory, San Luis Obispo owl's clover, Congdon's tarplant, and Hoover's button-celery will be established in appropriate habitat types following mass grading. Seed mix and/or nursery stock will be installed in the fall/winter months to take advantage of the rainy season, dormancy of foliage, and rooting period to ensure optimum survival. Planting densities and target densities for rare plant patch populations, included in the planting take-offs in Appendix H, are based on average relative density surveys conducted in 2008. They reflect anticipated growth of population numbers by the end of the monitoring period. To monitor population success and refine target densities for different rare plant species, on-site control sites will be established in rare plant populations unaffected by construction/ remediation activities where possible. Vital rates in restored mitigation populations will be compared to those from on-site control sites. Restoration specifics for each special status plant species at the SLO Tank Farm are discussed in detail below.

1. Cambria Morning Glory

At the SLO Tank Farm, Cambria morning glory is widespread, primarily across the non-native grassland and serpentine bunchgrassland. Approximately 8.2 acres of Cambria morning glory habitat will be impacted by remediation, development, and self-mitigating restoration activities. Based on relative density surveys conducted in spring 2008, most populations of Cambria morning glory support an average of 5 individuals in 100 cm^2 sample plots (Padre & WSP 2008c). Therefore, at the end of the 10-year monitoring period, the target average density of restored Cambria morning glory patch populations is expected to average approximately 25 to 50 individuals per square meter.

Restoration techniques for Cambria morning glory populations will include the following tasks:

a. Establish eight to 15 Cambria morning glory patch populations within the forb fields and mixed hardwood forest forb field plant communities, ranging in size from approximately 0.5-acre to approximately 1.0-acre or greater depending on available space. Total area of all established patch populations will equal approximately 8.2 acres.
b. Distribute Cambria morning glory seed as a component of the forb fields and mixed hardwood forest forb fields seed mix in all patch populations.
c. Plant Cambria morning glory nursery stock in all patch populations at an average density of two Cambria morning glory individuals per square meter.

2. *San Luis Obispo Owl's Clover*

Much like the Cambria morning glory, San Luis Obispo owl's clover is widespread in the non-native grassland plant communities throughout SLO Tank Farm. It is a hemiparasitic annual species partially dependent upon a host (*i.e.,* purple needle grass, pine bluegrass, salt grass [*Distichlis spicata*], *etc.*) for its germination, establishment, and to obtain nutrients. Due to its hemiparasitic habit and expected low transplant success rate, San Luis Obispo owl's clover restoration efforts will include seed distribution as well as planting of nursery stock. Approximately 7.2 acres of San Luis Obispo owl's clover habitat will be impacted by remediation, development, and self-mitigating restoration activities. Relative density surveys concluded that over 80% of the populations surveyed in 2008 had five or less individuals in 100 cm^2 sample plots (Padre & WSP 2008c). Therefore, at the end of the ten year monitoring period the target average density of restored Cambria morning glory patch populations will be approximately 20 (+/- 10) individuals per square meter. Restoration techniques for San Luis Obispo owl's clover populations will include the following:

a. Establish up to 15 San Luis Obispo owl's clover patch populations within the forb fields and mixed hardwood forest forb field plant communities, ranging in size from approximately 0.5-acre to approximately 1.0-acre or greater depending on available space. Total area of all established patch populations will equal approximately 7.2 acres.
b. Distribute San Luis Obispo owl's clover as a component of the forb fields and mixed hardwood forest forb field seed mix in all patch populations.
c. Plant San Luis Obispo owl's clover nursery stock in all patch populations at an average density of two San Luis Obispo owl's clover individuals per square meter.

3. *Congdon's Tarplant*

Congdon's tarplant is the most widespread of all rare plant species at the SLO Tank Farm. It occurs within vernal swale/pool habitat, on the margins of vernal marsh habitat, and rarely in palustrine scrub-shrub habitat. Approximately 11.88 acres of Congdon's tarplant habitat will be impacted by remediation and development. Approximately 4.89 acres of Congdon's tarplant habitat will be impacted through restoration activities.

Despite its widespread distribution, the majority of the Congdon's tarplant populations surveyed had one individual in 100 cm^2 sample plots (Padre & WSP 2008c). Therefore, at the end of the 10-year monitoring period the target average density of Congdon's tarplant patch populations will be 1 individual per square meter.

Congdon's tarplant populations will be restored within 11.88 acres of palustrine non-persistent emergent vernal depression and palustrine non-persistent vernal swale habitats created within the upland ecosystems and remediated reservoirs at the Project Site. All impacts due to remediation and development activities (9.67 acres) will be restored in-kind at a 1.2:1 ratio. Impacts to Congdon's tarplant habitat due to restoration activities on approximately 9.67 acres are considered self-mitigating as restoration of the site will greatly enhance the existing habitat and increase ecosystem functions. Furthermore, Congdon's tarplant is extremely abundant throughout the SLO Tank Farm site, as additional impacts due to restoration activities will not impact significantly the Congdon's tarplant populations within the SLO Tank Farm landscape.

Restoration techniques for Congdon's tarplant populations will include the following:

a. Establish patch populations of Congdon's tarplant in all of the palustrine non-persistent emergent vernal depression and palustrine non-persistent vernal swale habitats constructed during restoration.
b. Distribute Congdon's tarplant seed as a component of the palustrine non-persistent emergent vernal depression and palustrine non-persistent vernal swale seed mix in all patch populations.
c. Plant Congdon's tarplant nursery stock in all patch populations at an average density of one Congdon's tarplant individual per square meter.

4. San Luis Obispo Serpentine Dudleya

San Luis Obispo serpentine dudleya is the most restricted rare plant species at SLO Tank Farm. It occupies only 0.04-acre, being restricted to the serpentinite rock outcrop in the northeastern corner of the site (Flower Mound). Only a few occurrences were documented, and typically only two individuals were found in 100 cm^2 sample plots (Padre & WSP 2008c).

The entire 0.04-acre occurrence of San Luis Obispo serpentine dudleya will be impacted by remediation and development activities. Due to lack of suitable habitat in the remaining portions of SLO Tank Farm and the low survival rate of transplanted individuals, all San Luis Obispo serpentine dudleya at the SLO Tank Farm Project Site will be salvaged and donated to an accredited botanic garden (*e.g.*, Santa Barbara Botanical Garden, Rancho Santa Ana Botanic Garden, University of California, Berkeley, Botanic Garden).

5. Hoover's Button-Celery

Several small populations of Hoover's button-celery occur within vernal pool habitats at the SLO Tank Farm. All Hoover's button-celery populations will be avoided during remediation and development activities; however, 0.02-acre of Hoover's button-celery habitat will be impacted

during restoration activities. Based on relative density surveys, this species occurs as one or a few individuals in 100 cm^2 sample plots (Padre & WSP 2008c). Therefore, at the end of the 10-year monitoring period the target average density of Hoover's button-celery patch populations will range between two and 10 individuals per square meter.

Restoration techniques for Hoover's button-celery populations will include the following:

a. Establish up to five Hoover's button-celery patch populations, averaging 200 square feet in size, within the palustrine non-persistent emergent vernal depression habitat constructed during restoration of the SLO Tank Farm Project Site.
b. Include Hoover's button-celery in the palustrine non-persistent emergent vernal depression seed mix and distribution in appropriate patch populations.
c. Plant Hoover's button-celery nursery stock in all patch populations at an average density of two individuals per square meter.

6. *Purple Needlegrass Grassland*

At the SLO Tank Farm, purple needlegrass ranges from a dominant, to co-dominant, to sub-dominant species in the grassland habitats in the northeastern portion of the site, and in smaller populations near Tank Farm Road (Padre & WSP 2008c). Approximately 10.8 acres of purple needlegrass grassland will be impacted by remediation, development, and restoration activities. However, purple needlegrass will be a component of all the terrestrial ecosystems restored at the SLO Tank Farm, along with a suite of other native grass species.

Restoration techniques for purple needlegrass will include the following:

a. Include purple needlegrass as a primary component of all seed mixes in all upland ecosystems restored across the SLO Tank Farm landscape.
b. Plant purple needlegrass nursery stock (*i.e.*, plugs) in naturally occurring densities throughout the upland ecosystems.

7. *California Walnut (*Juglans californica *var.* californica*) Woodland*

Several stands of southern California walnut consisting of mature, mostly multi-stemmed specimens were mapped along the East Fork of San Luis Obispo Creek (Padre & WSP 2008c). Nine (9) individuals will be impacted negatively due to the restoration activities. However, California walnut woodland will be restored/enhanced in several locations along the East Fork of San Luis Obispo Creek and Tank Farm Creek in the mixed broadleaved deciduous forest and the California walnut woodland habitats (Figure 14).

Restoration techniques for California walnut will include the planting of California walnut nursery stock throughout the mixed broadleaved deciduous forest and the California walnut woodland habitats.

C. Project Targets, Project Standards and Success Criteria for Vascular Plant Species of Special Concern

The following specific project standards and associated success criteria (*i.e.*, field indicators/measurements) have been developed for the rare plant habitat restoration (see also Appendix K).

Project Target I -- Plant Community: *Establish and maintain diverse native plant community throughout the restored SLO Tank Farm restoration areas using a combination of live cuttings, nursery stock, and seeds that are genetically adapted to the Project Site.*

Project Standard 1– Restored plant community types develop along predicted successional pathways and are composed of viable, self-sustaining populations of native species as designed that resist invasion by exotic plant species.

Success Criteria

1. *Survivorship of nursery stock in herbaceous community types*: Greater than or equal to 80% for the first five years of monitoring.
2. *Percent cover of native tree species in woodland* communities: Greater than or equal to 75% by the end of year 10 (end of monitoring period)
3. *Percent cover of native tree species in forb field* communities: Greater than or equal to 10% but less than 20% by the end of year 10 (end of monitoring period)
4. *Percent cover of native shrub species in woodland communities*: Greater than or equal to 10% but less than 75% by the end of year 10 (end of monitoring period)
5. *Percent cover of native shrub species in scrub-shrub communities*: Greater than or equal to 75% by the end of year 10 (end of monitoring period)
6. *Percent cover of native herbaceous species in woodland and forb field communities*: Greater than or equal to 90% by the end of year 10 (end of monitoring period)
7. *Vigor of planted stock*: Greater than or equal to 80% of vegetation plots assessed qualitatively as "good" or "excellent" at end of monitoring period by the end of year 10 (end of monitoring period).

Project Target II -- Plant Community: *Establish self-sustaining populations of the seven rare plant species of conservation concern on the SLO Tank Farm.*

Project Standard 1– Establish populations of Cambria morning glory, San Luis Obispo's owl's clover, Congdon's tarplant, San Luis Obispo serpentine Dudleya, Hoover's button-celery, purple needlegrass, and California walnut establish populations across the SLO Tank Farm that are self-sustaining over the life of the monitoring period.

Success Criteria

1. *Survivorship.* Greater than or equal to 90% survival of rare herbaceous and tree species the first five years of monitoring.

2. *Reproduction*: Seedling recruitment and establishment must occur at 1:1 replacement values or greater within each patch population by the end of the ten year monitoring effort.

Project Target III -- Plant Community: *Establish rare plant populations in the range of densities determin-ed as reference standard.*

Project Standard 1– At minimum, maintain or increase the total number of rare plant population numbers.

Success Criteria

1. Number of rare plant populations for each species of conservation concern does not fall below 5% of the target number during two consecutive monitoring years, nor below 2% of the target number by the end of the monitoring period.
2. Determine the cause of grade failure(s) and apply corrective action, e.g., hydroseed to stabilize slopes, remove non-native weeds, change irrigation routine, modify grazing regime, institute controlled burn program.

Project Standard 2 – At minimum, maintain or increase population densities of rare plant populations at design levels.

Success Criteria

1. Density of rare plant populations for each species of conservation concern does not fall below 5% of the target density during two consecutive monitoring years, nor below 2% of the target density by the end of the monitoring period
2. Determine the cause of grade failure(s) and apply corrective action, *e.g.*, hydroseed to stabilize slopes, remove non-native weeds, change irrigation routine, modify grazing regime, institute controlled burn program.

Project Target IV -- Faunal Support/Habitat: *Increase vertical and horizontal complexity for native faunal species within the restored terrestrial (uplands) plant community types.*

Project Standard 1– Restored community types develop along predicted successional pathways and are composed of viable, self-sustaining populations of native species as designed that resist invasion by exotic plant species and that support a suite of vertebrate and invertebrate species (pollinators and fruit dispersers) that are potential flower visitors characteristic of the central coast of California.

Success Criteria

1. *Vegetative strata*: Woodland and mixed hardwood forest forb fields communities - Average of greater than or equal to three strata in vegetation plots (*i.e.*, trees, shrubs, herbs, with sapling/seedling and/or vines as additional stratum) by end of year 10 (end of monitoring period).

2. *Vegetative strata*: Herbaceous communities – Average of two or fewer strata in vegetation plots by end of year 10 (end of monitoring period).
3. *Canopy cover*: Greater than 80% cover by two or three strata in woodland/forested communities by the end of year 10 (end of monitoring period).
4. In vegetation plots for rare plant populations, seed set is documented in more than greater than or equal to 75% of the individuals
5. *Reproduction*: Seedling recruitment of rare plant species is documented and can be shown to replace planted stock at a 1:1 replacement ratio or better.

VI. DRAFT (75%) MITIGATION/RESTORATION PLAN FOR VERNAL POOL FAIRY SHRIMP HABITAT DESIGN

A. General Description and Design Rationale

The proposed design for mitigation/restoration of vernal pool fairy shrimp (VPFS) habitat at the SLO Tank Farm has been prepared to a 75% level of completion. This mitigation/restoration design provides greater than 1:1 acreage mitigation for unavoidable impacts to VPFS habitat as a result of the anticipated remediation and restoration activities. Based on aquatic water column and benthic invertebrate studies and a VPFS dry season survey conducted by Rincon Consultants, Inc. (2003-2004), VPFS are currently found in approximately 31.8 acres of vernal swale and vernal pool habitat throughout the SLO Tank Farm Project Site (refer to Figure 8). Impacts to approximately 10.3 acres of VPFS habitat will occur as a result of remediation activities and restoration of the SLO Tank Farm.

Impacts to VPFS habitat will be mitigated within the 11.88 acres of palustrine non-persistent emergent vernal depression and palustrine non-persistent vernal swale habitats created within the upland ecosystems and remediated reservoirs at the SLO Tank Farm. Restoration areas for VPFS are depicted on Figure 14. The restoration scenario for VPFS habitat, following completion of the remediation activities, is described below.

B. Design Considerations and Techniques for Mitigation/Restoration of Vernal Pool Fairy Shrimp Habitat

To create depressions (*i.e.,* vernal pool and swale mosaics) that provide suitable habitat for VPFS, control site (control) pools will be identified on-site during pre-construction surveys. To establish baseline data for construction of vernal pools, Chevron EMC or its consultants will conduct vegetation surveys (absolute and relative cover) using transects with point intercept and square meter quadrats (De Weese 1998) in a representative number of vernal pool habitats that will be impacted by project activities and in control pools that will not be impacted. Plant species with 20% relative cover or greater, their indigenous status and relative cover of hydrophytics, and the number of vernal pool endemic (VPEs) species present per pool will be recorded in this survey effort (De Weese 1998). Additionally, area of pool bottoms and slope of side walls will be recorded to provide design parameters that will mimic hydrologic depth, surface area, and inundation period. Photo-documentation of pools to be impacted during pre-construction surveys and establishment of photo-documentation stations at control pools will also be conducted.

To restore vernal pool fairy shrimp in the graded depressions, inoculum will be applied. A variety of techniques and best available technology will be used to collect inoculum from pools at the SLO Tank Farm prior to remediation including, but not limited to, the use of low ground pressure equipment (*i.e.,* trackhoe, mini-excavator, *etc.*) and various hand tools (*i.e.,* shovels, trowels, *etc*.). To salvage inoculum from remediation areas, Chevron EMC or its consultants will remove the upper most two to five inches of the soil from the vernal pools that will be impacted during a construction/remediation phase. Inoculum will be stockpiled in linear rows approximately three feet in height. The stockpiles will be covered with temporary tents to prevent sun exposure and excessive heating of the soil. If it is necessary to cover inoculum

stockpiles, a perforated non-plastic material (*i.e.*, woven polyethylene) will be used to allow adequate ventilation to prevent the occurrence of pathogenic fungi. Inoculum will not be stored for longer than one year to avoid adverse effects to the establishment of vegetation.

As necessary, additional inoculum will be collected from "donor" pools (*e.g.,* on-site pools not impacted by project activities) and applied in the graded depressions. If additional inoculum is determined to be necessary to supplement inoculum salvaged from impacted depressions, no more than ten percent (10%) of the inoculum present in any non-impacted donor depression shall be removed to minimize any adverse effects to the donor pool (see City of San Diego [2008]). When collecting inoculum from donor pools, material will be collected from randomly placed one meter quadrats and care will be taken to avoid areas dominated by non-native plant species (*i.e.*, rabbits foot grass [*Polypogon monspeliensis*], Italian ryegrass, *etc.*) (Ferren and Hubbard 1998). Hand tools (*i.e.*, shovels, trowels, rakes, *etc.*) will be used to remove the first two inches of soil from the donor pools. Whenever possible, salvage personnel will use a trowel to pry up intact chunks of soil, rather than loosening the soil by raking and shoveling, collection techniques that can damage the cysts (*cf.* City of San Diego [2008]).

To construct pools that provide suitable habitat for VPFS, depressions will be excavated and graded to maintain fidelity with control VPFS habitat, to create smooth transitions to the surrounding landscape and to establish landscape hydrologic linkages among vernal depressions, swales and/or to adjacent riverine ecosystems. Each depression's side slopes and pool bottoms will be shaped to mimic hydrologic depth, surface area, and inundation period observed in control pool conditions. To optimize conditions for VPFS, depth of constructed pools/swales will average 20 cm (eight inches) with a maximum depth of 120 cm (48 inches) as recommended by Sutter and Francisco (1998). In areas where constructed pools are located on top of backfilled and/or capped reservoirs where infiltration is undesirable, the surface of the pool will be made impervious to pond water through placement of two geo-textile pads with a liner or compaction and placement of bentonite below the topsoil layer.

Finally, to promote VPFS colonization in excavated depressions, the stockpiled inoculum will be spread across the newly graded pools/swales and similar wetland mosaics. Inoculum will be raked into the substrate and the soil compacted with a roller or sheep's foot. The planting plan will incorporate distribution of seeds of native vernal pool species (*i.e*., palustrine non-persistent emergent vernal depression and vernal swale seed mix) in the treated substrates prior to compaction, as recommended by Ferren and Hubbard (1998) (see Appendix H, Sheets 3 & 4). In addition, native nursery stock from the palustrine non-persistent emergent vernal depression and vernal swale planting palettes will be installed in depressions following compaction of the soil.

C. Project Targets, Project Standards and Success Criteria for Vernal Pool Fairy Shrimp Habitat

Hydrological, biogeochemical, plant and faunal support/habitat project standards and associated success criteria developed for the microtopographic features, specifically vernal depressions/swales wetland mosaics that serve as VPFS habitat are presented in Section III (and Appendix J). In addition, project targets and standards specific to VPFS, including field indicators/measurements, have been developed for the VPFS habitat mitigation/restoration

component of the landscape restoration at the SLO Tank Farm. These VPFS performance standards are based on the USFWS *Specific Habitat Mitigation and Monitoring Guidelines for Vernal Pools (Guidelines)* as described in De Weese (1998). The *Guidelines'* performance standards are based upon establishing control sites and primarily comparing the hydrology and vegetation of constructed pools to control pools to evaluate performance. Project targets and standards specific to VPFS are presented in tabular form in Appendix L and below.

Project Target I - Faunal Support/Habitat: *Construct self-sustaining vernal depressions and swales that provide ecosystem functions similar to those of naturally occurring vernal depression and swale wetland mosaics (i.e., wetland hydrology, biogeochemistry, plant community, and habitat for special-status invertebrate fauna and plant species, etc.), and that support vernal pool endemics (VPEs), including VPFS.*

***Project Standard 1*:** Construct vernal depression and swale mosaics according to design specifications so as to create a site-wide complex of shallow vernal depressions and swales that are linked hydrologically, at least seasonally during high water events.

Success Criteria

1. Maximum depth of inundation of constructed pools must be within range of reference pools and the longest period of inundation not greater than 125% of a set of "control pools" that will serve as a comparison to the structure of the constructed depressions.
2. Absolute cover and relative cover by vernal pool endemic (VPEs) in each constructed pool shall be no less than the minimum recorded in the control pools over any two year monitoring period. Data will be compared to that from the control data set, and not depart >75% from the control data.
3. Each constructed pool will support no fewer than the lowest number of (VPEs) recorded in control pools for more than two consecutive years
4. (VPEs) shared by both the impact and control pools shall be as vigorous and reproductively active in the constructed pools as in the control pools.
5. By the final year of monitoring (year 10), any (VPEs) that are dominant (relative cover of at least 20%) in at least 30% of the control pools shall be present as a dominant species in all of the constructed pools.

VII. FIRST APPROXIMATION CONSTRUCTION SEQUENCING

The following text provides a general description of the sequence of construction activities that will be required to implement the restoration design as described in this report.

A. Pre-Construction Activities

1. Review and implement health and safety protocols for the pre-construction interval.

2. Collect seed on-site and/or in proximity to the project site to assist in reestablishment of a suite of locally adapted native plants.

   a. Collect all rare plant seed/propagules from specified collection locations (*cf.* Figure 12) and propagate plant material between 18 months and two years prior to restoration activities (*i.e.*, seed distribution and outplanting) to allow sufficient time for collection, and propagation of collected materials.

   b. Salvage all rare plants from impact areas prior to implementation of each phase of the project and transplant biennial and perennial species to the native plant nursery.

3. Begin collection and stockpiling of large wood.

B. Site Preparation – Immediately Before Construction

1. Review and implement health and safety protocols for the "immediately before construction" interval

2. Install barrier fencing along the perimeter of the disturbance areas to protect wetland, riparian, and rare plant habitats located adjacent to the work areas.

3. Instruct all personnel to avoid or restrict activities in areas delimited by fencing.

4. Conduct a pre-activity training session/orientation for operators and workers that will highlight special-status species (*e.g.*, vernal pool fairy shrimp, rare plant species, *etc.*) that occur or have the potential to occur in the SLO Tank Farm Project Site. Explain measures being implemented to avoid and/or minimize impacts during remediation and restoration activities.

5. Install sediment and erosion control systems consistent with the SWPP and TESC plans.

C. Earthwork

1. Review and implement health and safety protocols for the earthwork phase of construction.

2. Collect topsoil (inoculum for vernal pool fairy shrimp) by removing the upper 2 to 5 inches of the soil profile from vernal pools that will be impacted during remediation or restoration phases.

    a. Collect this soil inoculum when landscape is dry to avoid damaging or destroying VPFS cysts.
    b. As possible, this work will be done by hand.

3. Inoculum from each pool will be stockpiled separately in linear rows approximately 3 feet in height. Stockpiles will be covered with temporary tents and if necessary, covered with a perforated non-plastic material (*i.e.*, woven polyethylene).

4. Grade North Marsh and the system of channels (Tank Farm Creek), swales, and depressions south of Tank Farm Road to create smooth transitions to the surrounding landscape (Appendices B, C, and D).

5. Establish the channel system including main and secondary channels, depressions and slope riverine proximal wetlands north and south of Tank Farm Road Appendices B, C, and D).

6. Establish landscape hydrologic linkages among vernal depressions and swales and/or to adjacent riverine ecosystems via fine grading and directed time.

7. Construct and link microtopographic depressions within the flood prone area of the new channel system (Appendix E).

8. Grade to remove berms and reconnect East Fork SLO Creek and old oxbows (Appendix B).

9. Grade upland areas as needed to restore site design to natural form and function, creating smooth transitions between wetland classes and with upland habitat.

10. Within the flood plain and upland landscape and in the vicinity of Reservoirs 5 and 7 (Appendix B, Sheet 2), grade small and medium scale vernal depressions and swales. Ensure impervious surface to pond water (*e.g.,* compaction*,* placement of bentonite below topsoil layer). As possible, create smooth transitions from the swales and depressions to the surrounding landscape.

11. Construct small scale vernal depressions and swales outside of the flood prone area but within the forb fields, woodlands, and mixed hardwood forest forb field areas to be restored at the Project Site (Appendices B and E).

12. Focus grading to create habitat for threatened and endangered plant and animal species (*e.g.*, vernal pool fairy shrimp). Excavate depression side slopes and pool bottoms to mimic surfaces within impacted and reference pools. When possible, grade to create smooth transitions to the surrounding landscape.

13. Focus mechanical disturbance in order to remove weeds, as possible, from the restoration area.

14. Stockpile downed woody debris and shrubs/trees (*i.e.*, willows, coyote brush, *etc.*) removed as a result of remediation/grading activities to be used as wildlife habitat within restored upland areas.

15. Stockpile serpentine rock removed from the northeastern corner of the SLO Tank Farm Project Site to be used as wildlife habitat within restored upland areas.

D. Log Structures

1. Construct single and multiple log deflection structures at and below the ordinary high water mark where designed in areas north and south of Tank Farm Road (Appendix E).

2. Install large wood structures (including single logs, piles of logs, and wood mounds) on and beneath the floodplain and upland landscapes in areas North and South of Tank Farm Road (Appendix E).

3. Along East Fork of San Luis Obispo Creek, install log sills at upstream and downstream confluence between oxbow and the creek proper to allows water to flow to the oxbow during moderate and higher flows (Appendix E).

4. Install deflection log structures on outer bends along oxbow in East Fork of San Luis Obispo Creek.

5. Construct large wood structures (*e.g.,* wood mounds, windfall mounds) on and beneath the soil surface within the depressions and swales and adjacent upland landscape where designed (Appendix E).

6. In depressions or swales situated on the remediated tanks, install large wood structures (including single logs and piles of logs) on (not beneath) the soil surface in constructed vernal pools and swales. Do not install logs subsurface, and do not breach subsurface barriers (Appendix E).

E. Irrigation, Planting, Seeding and Spreading of Inoculum

1. Following mass grading, remove and/or control weeds mechanically and by hand, as necessary.

2. Establish irrigation system and controls.

3. Lay out (stake) planting plan (Appendix G).

4. Install native nursery stock and/or distribute appropriate seed mix according to planting plan using a suite of plant community types suited to microsite conditions and with fidelity to reference system conditions (Appendices G, H & I).

5. Apply seed mix and/or plant nursery stock in the fall/winter months to take advantage of the rainy season, dormancy of foliage, and rooting period to ensure optimum survival.

6. Throughout the restoration areas north and south of Tank Farm Road, install native plant species seed mix on all disturbed graded areas.

7. Within vernal pools, spread inoculum collected or stockpiled during grading activities or collected from "donor pools" across the newly graded pools/swales, rake inoculum into the substrate, and compact soil with a roller or sheep's foot.

8. Within vernal pools, install native seed mix of vernal pool species (*i.e.,* palustrine non-persistent emergent vernal depression and vernal swale seed mix) to the treated substrates prior to soil compaction.

9. Establish patch populations for Cambria morning glory, San Luis Obispo owl's clover, Congdon's tarplant, and Hoover's button-celery in appropriate habitat types per planting specifications.

10. Initiation irrigation of planted nursery stock.

11. Place organic mulch around each container plant to provide an additional source of nutrients, enhance soil moisture content, and reduce competition.

12. Mulch entire planted/seeded area with sterile straw (Appendices H and I).

F. Weed Control and Management

1. Implement weed management program that includes mowing, hand weeding, and re-planting and/or interplanting additional plants as necessary. No herbicides shall be used to eliminate non-native vegetation within vernal pool/swale habitat.

2. If necessary, managed grazing may be an option to keep invasive plant species under control with approval from the applicable local, state, and federal agencies.

G. Fauna

1. Place and/or stockpile woody debris and shrubs/trees (*i.e.*, oaks, willows, *etc.*) removed during remediation/grading activities in natural clumps in selected upland habitat areas to provide immediate habitat for wildlife.

2. Place serpentine rock stockpiled during remediation/grading activities in selected upland habitat areas to provide immediate habitat for wildlife (Appendix E).

3. Install raptor perches in select upland locations within forb fields, phreatophytic woodlands, and mixed hardwood forb fields habitats. Perches should be placed at least 150 feet (50 m) apart, at least 300 feet (100 m) from the edge of wetland habitat, with their horizontal axis pointing east-west to avoid instability due to wind direction and changing visibility due to sun and moonlight (Appendix E).

H. Monitoring Maintenance and Adaptive Management

1. Assume establishment of baseline conditions following construction activities ("time zero"), and then a five-year monitoring effort within a ten-year monitoring interval (*i.e.,* Time zero plus Years 1, 3, 5, 7, 10).

2. Conduct two site visits per year, minimum: wet and dry season. During each site visit characterize hydrologic, biogeochemical, plant community and faunal support/habitat conditions. Conduct survival surveys to determine percent mortality of each planted species in each planting area, and botanical surveys (*i.e.,* line-intercept surveys) to document the increase in the expected number and proportion of native species over time.

3. Install two water level staff gauges (one deep, one shallow, where 70% of the pool bottom is lower) in a subset of the constructed and reference pools. Monitoring devices will be continuous real-time a data loggers and pressure transducers.

4. Document depth, area, and duration of inundation in each pool.

5. Monitor invertebrate and amphibian richness and densities. Monitor bird species richness, densities, and resource utilization annually in all constructed and reference pools.

6. Monitor pools for human disturbance, soil erosion, water-runoff pollutants, and wildlife mortality.

7. Conduct annual spring vegetation surveys (absolute and relative cover) using transects with point intercept and square meter quadrats in all constructed pools/swales and in reference pools. Record plant species with 20% relative cover or greater, indicate status and relative cover of hydrophytics, and determine the number of vernal pool endemic (VPEs) species present per pool.

8. Prepare monitoring reports (Years 1, 3, 5, 7, and 10) due by December 15. Recommend any necessary maintenance and or adaptive management measures. Reports will include identification of plant species within the restoration areas, survival rates, visual estimation of percent cover of vegetation, average height by species of trees and shrubs, number of trees and/or shrubs replaced and/or in need of replacement, overview of exotic plant controls, methods used to assess these parameters, and recommendations for any necessary maintenance and or adaptive management measures. Photographs from designated stations also will be included within the reports to visually document restoration progress.

9. Implement maintenance and adaptive management measures, including weed control (*i.e.,* mowing, hand weeding, and re-planting and/or interplanting additional plants, *etc*.) and re-application of mulch around plantings, as necessary.

10. Conduct weed removal activities at least twice annually during the spring/summer season, as needed, through the 10-year restoration period.

VIII. CHANGES IN ECOSYSTEM FUNCTIONS FOLLOWING RESTORATION

The proposed restoration scenario was assessed and compared using HGM models for each wetland class developed in the *Operational Draft Guidebook to Assessment of Riverine, Slope and Depressional Waters/Wetlands Functions at the Chevron Tank Farm, San Luis Obispo, California* (WSP 2007b, Padre & WSP 2008a). The HGM approach facilitates the assessment of restoration impacts to ecosystem functioning by considering processes within four types of functions: (1) hydrologic, (2) biogeochemical, (3) plant community and (4) faunal support/habitat functions. HGM models score variables on a scale between 0.0 and 1.0 to identify the relative level of ecosystem functioning. Reference standard sites (*i.e.*, typically pristine or historic conditions) yield "Functional Capacity Indices" (hereafter "FCIs") of 1.0, while highly degraded waters/ wetlands typically yield FCIs of 0.0 (*i.e.*, unrecoverable loss of ecosystem function). Comparisons between current (existing) conditions on the site and conditions expected five years after restoration were made for each scenario. Existing conditions for ecosystem functions and results for each wetland class that will be affected by the proposed restoration are described below.

Factors affecting the ability of waters/wetlands to perform ecosystem functions include, but are not limited, to the following:

1. Lack of hydrologic connections across the landscape,
2. Degradation from historical industrial land use,
3. Grazing intensity,
4. Historic modifications to which straightened the stream channels,
5. Non-native species,
6. Urbanization in surrounding landscape,
7. Soil compaction, and
8. Construction of berms, *etc.*

A more detailed discussion of the ecosystem functions on the SLO Tank Farm Project Site is provided below for each restoration area. Scoring of environmental variables was conducted as a desk-top exercise given the preliminary nature of the restoration -- *i.e.,* the restoration design has not yet been implemented; therefore, scoring is based upon what can be expected with the restoration implemented as designed. Scoring of the HGM variables will be repeated after the restoration is built, and reported with each year's monitoring effort.

A. North Marsh/ Tank Farm Creek

Under current conditions, North Marsh/Tank Farm Creek is a degraded waters/wetlands system. North Marsh/Tank Farm Creek currently is functioning poorly as a riverine wetland, but moderately well as an artificial slope wetland. Using the HGM models, we assessed the North Marsh as a riverine-slope complex wetland under current conditions, and we assessed the North Marsh as a riverine wetland under projected conditions following restoration (Table 3). As a

slope wetland, the marsh is performing at low to moderate levels for all functions, scoring between 0.17 and 0.37, meaning that it is performing functions at a level between approximately 17% and 37% of the reference standard condition. The effects of restoring this marsh to a riverine ecosystem are discussed in detail below.

1. Hydrologic Functions

Energy Dissipation. ***Energy Dissipation*** is defined as *the transformation and/or reduction of the kinetic energy of water as a function of the roughness of the landscape and channel morphology, and vegetation.*

The North Marsh received a low score (0.17) (Table 3; Figure 16a) for existing conditions because the original riverine channel with natural hydrologic roughness does not exist currently. However, grading an informal channel with associated flood plain, installation of large wood, establishment of complex microtopography, and a diverse native plant community including trees will lead to an increase in this function to a projected score of 0.70 after five years (Δ + 0.53) (Table 3; Figure 16).

Surface & Subsurface Storage of Water. ***Surface & Subsurface Storage of Water*** is defined as *the presence of soil and/or geologic materials within the creek ecosystem, including the hyporheic zone, that have physical characteristics suitable for detention, retention, and transmission of water.*

The North Marsh received a relatively low score (0.37) (Table 3; Figure 16a) for existing conditions because the original riverine channel and associated hyporheic zone have been filled, drained, and degraded by petrochemical inputs as a result of the Tank Farm and ranching activities. However, this function is recoverable with the proposed remediation to remove petrochemicals and restoration through establishment of a sinuous channel that is hydrologically linked to depressions and swales, installation of large wood above and below ground, and development of a native plant community with complex vertical structure. This function is projected to increase to a functional index score of 0.58 after five years (Δ + 0.21).

Landscape Hydrologic Connections. ***Landscape Hydrologic Connections*** is defined as *the maintenance of the natural hydraulic connectivity among source areas of surface and subsurface flow to riverine waters/wetlands and other down gradient waters/wetlands.*

The North Marsh received a score of 0.31 (Table 3; Figure 16), which translates to a functioning of roughly one third of the reference condition. This hydrologic function received this 0.31 score because the upgradient landscape connection is degraded through ditching associated with ranching, as well as the berming activities associated with the tank farm operations. The downgradient connection is culverted under and interrupted by Tank Farm Road. This function is only modestly recoverable with the proposed restoration, with a projected score of 0.58 after five years (Δ + 0.27), because the Tank Farm Road cannot be removed or altered to the benefit of this variable.

2. Biogeochemical Functions

Cycling of Elements & Compounds. ***Cycling of Elements & Compounds*** is defined as *the short- and long- term transformation of elements and compounds through abiotic and biotic processes that convert chemical species (e.g., nutrients and metals) from one form, or valence, to another.*

The North Marsh received a low score of 0.17 (Table 3; Figure 16a) for existing conditions because the original riverine channel and associated hyporheic zone have been filled, drained, and degraded by petrochemical inputs as a result of the Tank Farm operations and ranching activities. However, this function is recoverable to a projected score of 0.66 after five years (Δ + 0.49) with the proposed restoration due to the construction of increased microtopographic variation, installation of large wood and establishment of a diverse plant community.

Removal of Imported Elements & Compounds. ***Removal of Imported Elements & Compounds*** is defined as *the removal of imported nutrients, contaminants, and other elements and compounds in surface and groundwater*.

The North Marsh received a low score of 0.19 (Table 3; Figure 16a) for existing conditions because the original riverine channel, hyporheic zone, and associated roughness features (*e.g.,* boulders, woody debris, *etc.*) have been removed, filled, drained and degraded as a result of the Tank Farm operations, and ranching and road building activities. Through re-establishment of a channel associated with a complex floodplain characterized by diverse native plant communities and linked microdepressions that retain and detain water, this function is recoverable with the proposed restoration. The projected score for this function is 0.57 after five years (Δ + 0.38).

Retention and Detention of Particulates. ***Retention and Detention of Particulates*** is defined as *the deposition and retention of inorganic and organic particulates (>0.45μm) from the water column, primarily through physical processes.*

The North Marsh received a low score of 0.17 (Table 3; Figure 16a) for existing conditions because the original riverine channel, hyporheic zone, and associated roughness features (*e.g.*, boulders, woody debris, *etc.*) have been removed, filled, drained and degraded as a result of the Tank Farm, ranching and road-building activities. However, this function is recoverable with the proposed restoration, with a projected score of 0.64, or nearly two-thirds of the reference condition after five years (Δ + 0.47).

Organic Matter Export. ***Organic Matter Export*** is defined as *the export of dissolved and particulate organic carbon from a wetland.*

The North Marsh received a low score of 0.16 (Table 3; Figure 16a) for existing conditions because this slope-riverine complex does not transport organic matter at the same level as an undisturbed riverine wetland. That is, the export of organic carbon is much less, all things being equal, in a slope wetland than in a flowing water (riverine) system. However, this function is recoverable with the proposed restoration, with a projected score of 0.66 after five years (Δ + 0.50).

3. Native Plant Functions

Characteristic Plant Communities. ***Characteristic Plant Communities*** is defined as *the physical characteristics and ecological processes that maintain the indigenous living plant biomass*.

The North Marsh received a score of 0.23 (Table 3; Figure 16a) for existing conditions because while it does support native plant species, it does not support native plants characteristic of central California Coast riverine ecosystems. However, this function is recoverable with the proposed restoration, with a projected score of 0.81 after five years (Δ + 0.58). The site may be expected to achieve a reference condition (1.0) after a longer period of time.

Characteristic Detrital Biomass. ***Characteristic Detrital Biomass*** is defined as *the process of production, accumulation, and dispersal of dead plant biomass of all sizes.*

The North Marsh received a low score of 0.10 (Table 3; Figure 16a) for existing conditions because of heavy grazing by cattle that occurs throughout the North Marsh, and the fact that the current plant community does not develop a detrital biomass characteristic of a riverine and associated riparian wetlands. However, this function is recoverable with the proposed restoration, with a projected score of 0.67 after five years (Δ + 0.57), and possible reference standard functioning after a longer time (*i.e.*, 10 years or more).

4. Faunal Support Habitat Functions

Spatial Structure of Habitat. ***Spatial Structure of Habitat*** is defined as *the capacity of waters/ wetlands to support native animal populations and guilds through the heterogeneity of structure of vegetative communities.*

The North Marsh received a low score of 0.25 (Table 3; Figure 16a) for existing conditions because (a) heavy grazing by cattle occurs throughout the North Marsh, and (b) the current plant community has not developed a vertical (or horizontal) structure characteristic of a riverine and associated riparian wetlands. However, this function is recoverable with the proposed restoration, with a projected score of 0.70 after five years (Δ + 0.45), and possible reference standard functioning after 10 years or more.

Habitat Interspersion & Connectivity. ***Habitat Interspersion & Connectivit***y is defined as *the capacity of waters/wetlands to permit aquatic, semi-aquatic, and terrestrial organisms to enter and leave a riverine ecosystem via large, contiguous plant communities to meet life history requirements.*

The North Marsh received a moderately low score of 0.32 (Table 3; Figure 16a) for existing conditions because the characteristic physical complexity of a riverine and associated riparian community is not present nor is it juxtaposed in a mosaic of perennial forb fields, grasslands, vernal swales and depressions characteristic of the south central Coast Ranges. Additionally, heavy grazing by cattle that occurs throughout the North Marsh and Tank Farm Road restricts virtually all movement from the landscape south of the marsh. However, this function is

recoverable with the proposed restoration, with a projected score of 0.32 after five years (Δ + 0), largely through the restoration of the riverine vegetative structure and adjacent plant communities. This variable does not change in any direction primarily because of the presence of Tank Farm Road, which is a significant barrier to animal dispersion and habitat connectivity.

Distribution & Abundance of Vertebrates. ***Distribution & Abundance of Vertebrates*** is defined as *the capacity of waters/wetlands to maintain characteristic density and spatial distribution of invertebrates (aquatic, semi-aquatic and terrestrial).* However, the WSP/Padre team did not attempted to score these functions because the team do not have the assessment tools at this time.

Distribution & Abundance of Invertebrates. ***Distribution & Abundance of Invertebrate***s is defined as *the capacity of waters/ wetlands to maintain the density and spatial distribution of invertebrates (aquatic, semi-aquatic and terrestrial).* However, the WSP/Padre team did not attempted to score these functions because the team do not have the assessment tools at this time.

B. Riverine Waters/Wetlands - East Fork, San Luis Obispo Creek

1. Hydrologic Functions

Energy Dissipation. ***Energy Dissipation*** is defined as *the transformation and/or reduction of the kinetic energy of water as a function of the roughness of the landscape and channel morphology, and vegetation.*

Riverine waters/wetland systems along the East Fork of San Luis Obispo Creek are providing a moderate level of function for this variable (score of 0.36) (Table 4; Figure 16b) under existing conditions. This function is expected to increase within 5 years following restoration to a projected score of 0.66 (Δ + 0.30). Increased hydrologic connectivity with the surrounding landscape and construction of connected microdepressions and swales within and adjacent to the flood plain are primary drivers for this increase in functioning.

Surface & Subsurface Storage and Exchange of Water. ***Surface & Subsurface Storage*** and Exchange of Water is defined as *the presence of soil and/or geologic features within the creek ecosystem, including the hyporheic zone, that have physical characteristics suitable for detention, retention, and transmission of water.*

Under existing conditions the riverine wetlands along the East Fork of San Luis Obispo Creek received a sore of 0.28 (Table 4; Figure 16b), which is approximately one-quarter of reference site functioning. Incised, straightened channels disconnected from their flood plain have poor capacity for water storage and exchange. This function is recoverable with the proposed restoration, with a projected score of 0.58 after five years (Δ + 0.30).

Landscape Hydrologic Connections. ***Landscape Hydrologic Connections*** is defined as *the maintenance of the natural hydraulic connectivity among source areas of surface and subsurface flow to riverine waters/wetlands and other down gradient waters/wetlands.*

Riverine waters/wetlands along the East Fork of San Luis Obispo Creek received a moderate score of 0.32 (Table 4; Figure 16b). This hydrologic function received a 0.32 score because the upgradient landscape connection is degraded through ditching associated with ranching, as well as the berming activities associated with the Tank Farm operations. The down gradient connection is both culverted under, and interrupted by, Tank Farm Road. This function is modestly recoverable with the proposed restoration, to a projected score of 0.63 after five years (Δ + 0.31), because the Tank Farm Road cannot be removed or altered to the benefit of this variable.

2. Biogeochemical Functions

Cycling of Elements & Compounds. ***Cycling of Elements & Compounds*** is defined as *the short- and long- term transformation of elements and compounds through abiotic and biotic processes that convert chemical species (*e.g.*, nutrients and metals) from one form, or valence, to another.*

Riverine waters/wetlands along the East Fork of San Luis Obispo Creek received a moderate score of 0.29 (Table 4; Figure 16b) under existing conditions. This function is recoverable with the proposed restoration to a projected score of 0.68 after five years (Δ + 0.39). Increased connectivity of water with the surface through construction of a network of microdepressions and swales within and adjacent to the flood plain drives this increase in functioning.

Removal of Imported Elements & Compounds. ***Removal of Imported Elements & Compounds*** is defined as *the removal of imported nutrients, contaminants, and other elements and compounds from surface and groundwater*.

Riverine waters/wetlands along the East Fork of San Luis Obispo Creek received a moderate score of 0.37 (Table 4; Figure 16b) for existing conditions. Grading and installation of log structures within the channel, hyporheic zone, and associated depressions and swales in and adjacent to the flood plain will increase functioning within the riverine system. This function is recoverable with the proposed restoration to a projected score of 0.66 after five years (Δ + 0.29).

Retention and Detention of Particulates. ***Retention and Detention of Particulates*** is defined as *the deposition and retention of inorganic and organic particulates (>0.45μm) from the water column, primarily through physical processes.*

The riverine ecosystem along the East Fork of San Luis Obispo Creek received a moderate score of 0.32 (Table 4; Figure 16b) for existing conditions. The original riverine channel, hyporheic zone, and associated roughness features (*e.g.*, depressions, swales, *etc.*) have been filled, drained and degraded as a result of the Tank Farm operations, ranching and road-building activities. This function is recoverable with the proposed restoration, to a projected score of 0.59 (Δ + 0.27), after five years.

Organic Matter Export. ***Organic Matter Export*** is defined as *the export of dissolved and particulate organic carbon from a wetland.*

The riverine ecosystem along the East Fork of San Luis Obispo Creek received a moderate score of 0.33 (Table 4; Figure 16b). Through restoration of the native plant community and hydrologic connectivity across the landscape, this function is recoverable with the proposed restoration to a projected score of 0.73 (Δ + 0.40) after five years.

3. Native Plant Functions

Characteristic Plant Communities. ***Characteristic Plant Communities*** is defined as *the physical characteristics and ecological processes that maintain the indigenous living plant biomass*.

The riverine wetland ecosystem along the East Fork of San Luis Obispo Creek received a score of 0.28 (Table 4; Figure 16b) for existing conditions because, while it does support native plant species, it is not dominated in all strata by native plants characteristic of central California coast riverine and riparian ecosystems. However, this function is recoverable with the proposed restoration, to a projected score of 0.83 after five years (Δ + 0.55). It may be expected to achieve a reference condition (1.0) after a longer period of time.

Characteristic Detrital System. ***Characteristic Detrital System*** is defined as *the process of production, accumulation, and dispersal of dead plant biomass of all sizes.*

Riverine wetlands along the East Fork of San Luis Obispo Creek received a moderately low score of 0.20 (Table 4; Figure 16b) for existing conditions because (a) heavy grazing by cattle occurs throughout the SLO Tank Farm Project Site, and (b) the current plant community has not developed a detrital biomass characteristic of a riverine and associated riparian waters/wetlands. However, this function is recoverable with implementation of the proposed restoration, with a projected score of 0.67 after five years (Δ + 0.47), and possible reference standard functioning after 10 years or more.

4. Faunal Support Habitat Functions

Spatial Structure of Habitat. ***Spatial Structure of Habitat*** is defined as *the capacity of waters/ wetlands to support animal populations and guilds through the heterogeneity of structure of vegetative communities.*

Riverine wetlands along the East Fork of San Luis Obispo Creek received a moderate score of 0.43 (Table 4; Figure 16b) for existing conditions. Heavy grazing, lack of natural transitions within the landscape, and the fact that the current plant community does not develop a vertical (or horizontal) structure characteristic of a riverine system and associated riparian wetlands explains the moderate score of this ecosystem function. This function is recoverable with the proposed restoration, with a projected score of 0.64 after five years (Δ + 0.21), and possible reference standard functioning after 10 years or more.

Habitat Interspersion & Connectivity. ***Habitat Interspersion & Connectivity*** is defined as *the capacity of waters/wetlands to permit aquatic, semi-aquatic, and terrestrial organisms*

to enter and leave a riverine ecosystem via large, contiguous plant communities to meet life history requirements.

The riverine wetland ecosystem along the East Fork of San Luis Obispo Creek received a moderately score of 0.42 (Table 4; Figure 16b) for existing conditions because the characteristic physical complexity of a riverine and associated riparian community is not present, nor is it juxtaposed in a mosaic of perennial grasslands, vernal swales and depressions characteristic of the south central Coast Ranges. Additionally, heavy grazing by cattle throughout the SLO Tank Farm Project Site further disrupts this function. However, this ecosystem function is recoverable with the proposed restoration, with a projected score of 0.58 after five years (Δ + 0.16), largely through the restoration of the riverine vegetative structure and the adjacent plant communities.

Distribution & Abundance of Vertebrates. Distribution & Abundance of Vertebrates is defined as *the capacity of waters/wetlands to maintain characteristic density and spatial distribution of invertebrates (aquatic, semi-aquatic and terrestrial).* However, the WSP/Padre team did not attempted to score these functions because the team do not have the assessment tools at this time.

Distribution & Abundance of Invertebrates. Distribution & Abundance of Invertebrates is defined as *the capacity of waters/ wetlands to maintain the density and spatial distribution of invertebrates (aquatic, semi-aquatic and terrestrial).* However, the WSP/Padre team did not attempted to score these functions because the team do not have the assessment tools at this time.

C. Depressional Waters/Wetlands

WSP recognizes that most of the depressional wetlands currently in existence on the SLO Tank Farm are an artifact of past land uses, site degradation, and conversion of portions of the SLO Tank Farm site to industrial uses. For example, seasonally inundated, ponded and saturated pools are a feature of the industrial landscape of the decommissioned Tank Farm. Such features are not historically significant part of the central coast domain and thus few native reference depressional waters/wetlands exist in the landscape. Therefore, in order to assess ecosystem functioning in the depressional waters/wetlands that do exist at the SLO Tank Farm, we used our best professional judgment to adapt an existing HGM model developed for vernal pool wetlands in the California Central Valley domain (LC Lee & Associates 1997). The draft HGM model for depressional wetlands at SLO Tank Farm was completed in December 2007 (WSP 2007).

1. Hydrologic Functions

Surface & Subsurface Water Storage and Exchange. ***Surface & Subsurface Water Storage and Exchange*** is defined as *the retention and/or circulation of surface and shallow subsurface and groundwater in the depression.*

Under current conditions, depressional wetlands at the SLO Tank Farm Project Site are scored at 0.29 for this function (Table 5; Figure 16c). Alterations to topography, placement of berms, degradation by petrochemicals, and intense grazing pressure have resulted in degradation of the

soil profile integrity, hydrologic connections (outlets), and buffer conditions for most of the depressions. Due to creation of the proposed complex system of interconnected depressions and swales set within the terrestrial communities, this variable will increase following restoration to a projected score of 0.53 (Δ + 0.24).

Landscape Hydrologic Connections. ***Landscape Hydrologic Connections*** is defined as *the hydrologic connectivity of contributing areas to flow through depressions and slope waters/wetlands, and to other downgradient waters/wetlands.*

The importance of Landscape Hydrologic Connections in the SLO Tank Farm landscape was recognized after the Draft HGM Model runs for depressional wetlands were completed for this *75% Design Report* effort, and therefore this function was not scored formally at that time. Under existing conditions, depressional wetlands occur primarily as an artifact of industrial and agricultural uses and are relatively isolated. Depressional wetlands in this landscape are not well connected through surface and shallow subsurface flow as relic berms surrounding excavated, man-made depressions result in hydrologic isolation of many of the individual depressional features across the site. The proposed restoration will establish a complex network of interconnected swales, depressions, and riverine features. Computing a rough index for this function, with the implementation of the restoration project, the landscape hydrologic connectioins function will increase from an existing 0.50 to 0.75 (Δ + 0.25) (Table 5; Figure 16c).

2. Biogeochemical Functions

Cycling of Elements & Compounds. ***Cycling of Elements & Compounds*** refers to *the abiotic and biotic processes that change elements and convert compounds (*e.g., *nutrients, metals) from one form or valence to another.*

Depressional wetlands at the SLO Tank Farm Project Site received a low score of 0.19 (Table 5; Figure 16c) for existing conditions. However, this function is expected to increase within five years following the proposed restoration, to a projected score of 0.63 (Δ + 0.44). Improved landscape contiguity through increased buffer condition and an increase in area of high quality habitat patches drive this increase in function.

Retention and Detention of Particulates. ***Retention and Detention of Particulates*** is defined as *the delay, retardation, or prevention of movement of inorganic and organic particulates (>0.45 μm) from the water column, primarily through physical processes.*

Depressional wetlands at the SLO Tank Farm Project Site received a score of 0.28 (Table 5; Figure 16c) for existing conditions due to intense grazing, buffer condition and contiguity. This function is expected to be recoverable under the proposed restoration to a projected score of 0.63 after five years (Δ + 0.35).

3. Plant Functions

Characteristic Plant Communities. ***Characteristic Plant Communities*** is defined as *the physical characteristics and ecological processes that maintain the indigenous living plant biomass*.

Depressional waters/wetlands perform this function moderately, receiving a score of 0.38. Proposed restoration is designed to replace lost functional capacity and to create a complex network of interconnected depressions and swales with native plant communities. This function is projected to increase significantly following restoration to a projected 0.68 (Δ + 0.38) (Table 5; Figure 16c).

Characteristic Detrital System. ***Characteristic Detrital System*** is defined as *the process of production, accumulation, and dispersal of dead plant biomass of all sizes.*

Depressional wetlands at the SLO Tank Farm Project Site received a low score of 0.15 (Table 5; Figure 16c) under existing conditions because of heavy grazing by cattle that occurs through the site and the fact that current plant community does not develop a robust detrital biomass However, this function is recoverable with the proposed restoration, with a projected score of 0.67 after five years (Δ + 0.45). Recovery to reference standard functioning is possible after 10 years or more.

4. Faunal Support Habitat Functions

Spatial Structure of Habitat. ***Spatial Structure of Habitat*** is defined as *the capacity of waters/ wetlands to support animal populations and guilds through the heterogeneity of structure of vegetative communities.*

Depressional wetlands received a score of 0.22 (Table 5; Figure 16c) under existing conditions due to lack of connectivity between wetlands and between wetland and surrounding upland habitat. This function is recoverable with the proposed restoration, with a projected score of 0.75 after five years (Δ + 0.53) with greater recovery expected after 10 years or more.

Distribution & Abundance of Vertebrates. Distribution & Abundance of Vertebrates is defined as *the capacity of waters/wetlands to maintain characteristic density and spatial distribution of invertebrates (aquatic, semi-aquatic and terrestrial).* However, the WSP/Padre team did not attempted to score these functions because the team do not have the assessment tools at this time.

Distribution & Abundance of Invertebrates. Distribution & Abundance of Invertebrates is defined as *the capacity of waters/wetlands to maintain the density and spatial distribution of invertebrates (aquatic, semi-aquatic and terrestrial).* However, the WSP/Padre team did not attempted to score these functions because the team do not have the assessment tools at this time.

IX. CONCLUSIONS

The proposed landscape restoration project consists of restoring the North Marsh/Tank Farm Creek slope-riverine complex waters/wetlands and the East Fork of San Luis Obispo Creek to their historic state as riverine waters/wetlands ecosystems. The former system will be restored to sinuous channel with adjacent riverine/riparian ecosystem. The latter will be restored by a significant reestablishment of the fluvial hydrologic connections on and across the SLO Tank Farm Project Site. The landscape scale restoration is expected to result in significant increases in hydrologic, biogeochemical, plant community and faunal support/habitat ecosystem functions in both riverine features on the SLO Tank Farm. In addition, under this scenario, the North Marsh/Tank Farm Creek will be reconnected hydrologically to the downstream waters through restoration in the southwest portion of the site. The flow path for discharge from the northwest portion of SLO Tank Farm will be restored and connected to the restored main channel of Tank Farm Creek. In addition to the riverine restoration plans, vernal depression and swale waters/wetlands mosaics will be restored across the property to compensate for the loss of depressional wetland area and ecosystem function.

Net gains in all 13 waters/wetlands riverine functions are expected for the North Marsh/Tank Farm Creek slope wetland and its associated riverine wetland systems. Net gains in eight of the nine depressional waters/wetlands functions also are expected as a result of this restoration effort. A minor decrease in the hydrology function surface and subsurface storage and exchange of water may be anticipated, but this result likely represents a purposefully shift in HGM wetland class (*i.e.,* slope to riverine).

The Padre/WSP team focused on restoring the waters/wetlands ecosystem functions of closed rather than open depressions, in large part because of the seemingly higher functioning habit for the native invertebrate community. Therefore, the proposed landscape scale restoration (including restoration of the North Marsh to a riverine water/wetland, restoration of associated riverine wetlands in the southwest, and restoration of some depressional features) has the likely outcome of increasing the waters/wetlands ecosystem functions of the former Tank Farm Creek, its flood plain, and the surrounding landscape, including presently degraded upland woodlands and forb fields.

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TABLES

Table 1. Estimated Impacts and Proposed Mitigation for Waters/Wetlands and Special-Status Species Associated with Each Project Component.

Impacted Elements	Remediation Impacts	Development Impacts	Restoration Impacts[1]	Total Impacts[2]	Proposed Mitigation	Net Effect of Restoration at Year 10
Waters of the U.S. including wetlands	26.06 ac	1.16 ac	11.33 ac.	27.22 ac	Restore 45.67 acres of impacted and degraded waters/ wetlands	• Waters/wetlands area restored at 1.7:1 ratio • Net gains in ecoysystem functioning over all classes of functions
Vernal pool fairy shrimp habitat (*Branchinecta lynchi*)	8.46 ac.	0	1.88 ac	8.46 ac	Creation of 11.88 acres of vernal pool and vernal swale habitat	Habitat restored at 1.4:1 ratio
Cambria morning glory (*Calystegia subacaulis* ssp. *episcopalis*)	2.45 ac	5.57 ac	0.14 ac	8.02 ac	• Included in seed mix for patch populations within terrestrial forb field habitats (8.2 acres) • 7,695 one gal. container plantings in patch populations	Species restored at 1:1 ratio
San Luis Obispo owl's clover (*Castilleja densiflora* ssp. *obispoensis*)	5.69 ac	0	1.49 ac	5.69 ac	• Included in seed mix for patch populations within terrestrial forb field habitats (7.2 acres) • 7,085 one gal. container plantings in patch populations	Species restored at 1.3:1 ratio
Congdon's tarplant (*Centromadia parryi* ssp. *congdonii)*	9.67 ac	0	4.89 ac	9.67 ac	• Included in seed mix for vernal pool/swale habitats (11.88 acres) • 8,090 one gal. container plantings in vernal pool/ swale habitats	• Species restored at 1.2:1 ratio • Impacts to Congdon's tarplant habitat due to restoration activities are considered self-mitigating due to overall increase in ecosystem function.
San Luis Obispo serpentine dudleya (*Dudleya abramsii* ssp. *bettinae*)	0.04 ac	0	0	0.04 ac	Donate all plant material to accredited botanical garden	No net loss of San Luis Obispo serpentine dudleya

[1] Note: Restoration impacts are self-mitigating and are therefore not included in the calculation of total impacts.

[2] Note: Total impacts = Remediation Impacts + Development Impacts. Assume Restoration Impacts are self-mitigating.

Table-1

Table 1. Estimated Impacts and Proposed Mitigation for Waters/Wetlands and Special-Status Species Associated with Each Project Component *(continued)*.

Species	Remediation Impacts	Development Impacts	Restoration Impacts[1]	Total Impacts[2]	Proposed Mitigation	Net Effect of Restoration at Year 10
Hoover's button-celery (*Eryngium aristulatum* var. *hooveri*)	0	0	0.02 ac	0	108 one gal. container plantings distributed throughout 0.04-acre of vernal pool/swale habitat	Species restored at 2:1 ratio
Purple Needlegrass (*Nassella pulchra*)	6.73 ac.	4.14 ac.	0	10.87 ac	• Included in seed mix for all terrestrial habitats (>11 acres) • 6,506 one gal. container plantings	Species restored at >1:1 ratio
California walnut (*Juglans californica* var. *californica*)	0 trees	0 trees	9 trees	9 trees	865 one gal. container plantings distributed throughout riparian habitats	Species restored at >95:1 ratio

[1] Note: Restoration impacts are self-mitigating and are therefore not included in the calculation of total impacts.

[2] Note: Total impacts = Remediation Impacts + Development Impacts. Assume Restoration Impacts are self-mitigating.

Table 2. Plant Species of Conservation Concern and Their Protected Status at the SLO Tank Farm Project Site, San Luis Obispo, California (CNPS 2008).

Scientific Name	Common Name	Protected Status
Calystegia subacaulis ssp. *episcopalis*	Cambria morning glory	CNPS 1B.2*
Castilleja densiflora ssp. *obispoensis*	San Luis Obispo owl's clover	CNPS 1B.2
Centromadia parryi ssp. *congdonii*	Congdon's tarplant	CNPS 1B.2
Dudleya abramsii ssp. *bettinae*	San Luis Obispo serpentine dudleya	CNPS 1B.2
Eryngium aristulatum var. *hooveri*	Hoover's button-celery	CNPS 1B.1
Juglans californica	Southern California walnut	CNPS 4.2
Nassella pulchra	Purple Needlegrass	CNDDB**

*CNPS = California Native Plant Society
1B = *Plants rare, threatened, or endangered in California and elsewhere*
4 = *Plants with limited distribution (Watch List)*
0.1 = *seriously endangered in California*
0.2 = *fairly endangered in California*
**CNDDB = California Natural Diversity Database "special community"

Table-2

Slope-Riverine North Marsh Complex Landscape Restoration

Project: Chevron San Luis Obispo Tank Farm
Location: North Marsh / SLO Tank Farm north & south of Tank Farm Road
Hydrogeomorphic Type: Slope -Riverine Complex Wetland
Name: Landscape Restoration **Date:** 12/04/08
Comments: PLF & JP 75%

KEY: DOES THIS WETLAND PERFORM [FUNCTION]?
"-" Wetland performance of function is negative with respect to the reference
"0" Wetland performance of function is neutral with respect to the reference
"+" Wetland performance of function is positive with respect to the reference
"N/A" Wetland does not perform the function
0-1 Scaling 0.0=low degree of function, 1.0=high degree of function
Y = Yes N = No

CHEVRON SAN LUIS OBISPO TANK FARM
LANDSCAPE LEVEL HYDROGEOMORPHIC WATERS/WETLANDS FUNCTIONAL ASSESSMENT WORKSHEET

				HYDROLOGY			BIOGEOCHEMISTRY				PLANT COMMUNITY		FAUNAL SUPPORT / HABITAT			
				Energy Dissipation	Surface & Subsurface Storage & Exchange of Water	Landscape Hydrologic Connections	Cycling of Elements & Compounds	Removal of Imported Elements & Compounds	Particulate Detention	Organic Matter Export	Characteristic Plant Communities	Characteristic Detrital Biomass	Spatial Structure of Habitat	Habitat Interspersion & Connectivity	Distribution & Abundance of Vertebrates	Distribution & Abundance of Invertebrates
Reference Sites	1	Do Reference Sites Perform Function?	(Y/N) scale?	(Y) 1.0	(Y) 1.0	(Y) 1.0	(Y) 1.0	(Y) 1.0	(Y) 1.0	(Y) 1.0	(Y) 1.0	(Y) 1.0	(Y) 1.0	(Y) 1.0	(Y) 1.0	(Y) 1.0
Initial Project Site	2	Does Site Perform Function?	(Y/N) scale?	(Y) 0.17	(Y) 0.37	(Y) 0.31	(Y) 0.17	(Y) 0.19	(Y) 0.17	(Y) 0.16	(Y) 0.23	(Y) 0.10	(Y) 0.25	(Y) 0.32	–	–
Conditions Prior to Restoration	3	What is functional status relative to the Target Reference Condition? Rows 2 vs 1	(-,0,+,N/A) change in scale	-0.83	-0.63	-0.69	-0.83	-0.81	-0.83	-0.84	-0.77	-0.9	-0.75	-0.68	–	–
Existing Site Conditions w/ Remediation & Restoration	4	Does Site Perform Function?	(Y/N) scale	(Y) 0.7	(Y) 0.58	(Y) 0.58	(Y) 0.66	(Y) 0.57	(Y) 0.64	(Y) 0.66	(Y) 0.81	(Y) 0.67	(Y) 0.7	(Y) 0.32	–	–
(Time = Plus 5 Years After Initial Restoration)	5	What is the functional status relative to the Target Reference Condition? Rows 4 vs 1	(-,0,+,N/A) change in scale	-0.3	-0.42	-0.42	-0.34	-0.43	-0.36	-0.34	-0.19	-0.33	-0.3	-0.68	–	–
	6	What is the functional status relative to the Initial Project Site Condition? Rows 4 vs 2	(-,0,+,N/A) change in scale	0.53	0.21	0.27	0.49	0.38	0.47	0.50	0.58	0.57	0.45	0	–	–
Overall Restoration Effectiveness	7	As proposed, does the Restoration result in a net loss or a net gain in function at Year 5?	G=Gain 0=Neutral L=Loss	G	G	G	G	G	G	G	G	G	G	0	–	–

Table 3

East Fork, San Luis Obispo Creek Landscape Restoration

Project: Chevron San Luis Obispo Tank Farm
Location: East Fork, SLO Creek / SLO Tank Farm south of Tank Farm Road
Hydrogeomorphic Type: Riverine Wetland
Name: Landscape Restoration **Date:** 12/04/2008
Comments: PLF & JP 75%

KEY: DOES THIS WETLAND PERFORM [FUNCTION]?
"-" Wetland performance of function is negative with respect to the reference
"0" Wetland performance of function is neutral with respect to the reference
"+" Wetland performance of function is positive with respect to the reference
"N/A" Wetland does not perform the function
0-1 Scaling 0.0=low degree of function, 1.0=high degree of function
Y = Yes N = No

CHEVRON SAN LUIS OBISPO TANK FARM
LANDSCAPE LEVEL HYDROGEOMORPHIC WATERS/WETLANDS FUNCTIONAL ASSESSMENT WORKSHEET

				HYDROLOGY			BIOGEOCHEMISTRY				PLANT COMMUNITY		FAUNAL SUPPORT / HABITAT			
				Energy Dissipation	Surface & Subsurface Storage & Exchange of Water	Landscape Hydrologic Connections	Cycling of Elements & Compounds	Removal of Imported Elements & Compounds	Particulate Detention	Organic Matter Export	Characteristic Plant Communities	Characteristic Detrital Biomass	Spatial Structure of Habitat	Habitat Interspersion & Connectivity	Distribution & Abundance of Vertebrates	Distribution & Abundance of Invertebrates
Reference Sites	1	Do Reference Sites Perform Function?	(Y/N) scale?	(Y) 1.0	(Y) 1.0	(Y) 1.0	(Y) 1.0	(Y) 1.0	(Y) 1.0	(Y) 1.0	(Y) 1.0	(Y) 1.0	(Y) 1.0	(Y) 1.0	(Y) 1.0	(Y) 1.0
Initial Project Site	2	Does Site Perform Function?	(Y/N) scale?	(Y) 0.36	(Y) 0.28	(Y) 0.32	(Y) 0.29	(Y) 0.37	(Y) 0.32	(Y) 0.33	(Y) 0.28	(Y) 0.20	(Y) 0.43	(Y) 0.42	–	–
Conditions Prior to Restoration	3	What is functional status relative to the Target Reference Condition? Rows 2 vs 1	(-,0,+,N/A) change in scale	-0.64	-0.72	-0.68	-0.71	-0.63	-0.68	-0.67	-0.72	-0.8	-0.57	-0.58	–	–
Existing Site Conditions w/ Remediation & Restoration	4	Does Site Perform Function?	(Y/N) scale	(Y) 0.66	(Y) 0.58	(Y) 0.63	(Y) 0.68	(Y) 0.66	(Y) 0.59	(Y) 0.73	(Y) 0.83	(Y) 0.67	(Y) 0.64	(Y) 0.58	–	–
(Time = Plus 5 Years After Initial Restoration)	5	What is the functional status relative to the Target Reference Condition? Rows 4 vs 1	(-,0,+,N/A) change in scale	-0.34	-0.42	-0.37	-0.32	-0.34	-0.41	-0.27	-0.17	-0.33	-0.36	-0.42	–	–
	6	What is the functional status relative to the Initial Project Site Condition? Rows 4 vs 2	(-,0,+,N/A) change in scale	0.30	0.30	0.31	0.39	0.29	0.27	0.40	0.55	0.47	0.21	0.16	–	–
Overall Restoration Effectiveness	7	As proposed, does the Restoration result in a net loss or a net gain in function at Year 5?	G=Gain 0=Neutral L=Loss	G	G	G	G	G	G	G	G	G	G	G	–	–

Table 4

Depressional Wetlands Site Wide Landscape Restoration

Project: Chevron San Luis Obispo Tank Farm
Location: Depressional Wetlands Site Wide
Hydrogeomorphic Type: Depressional Wetland
Name: Depression Site Wide Landscape Restoration **Date:** 12/04/2008
Comments: LCL, PLF & AKK 75%

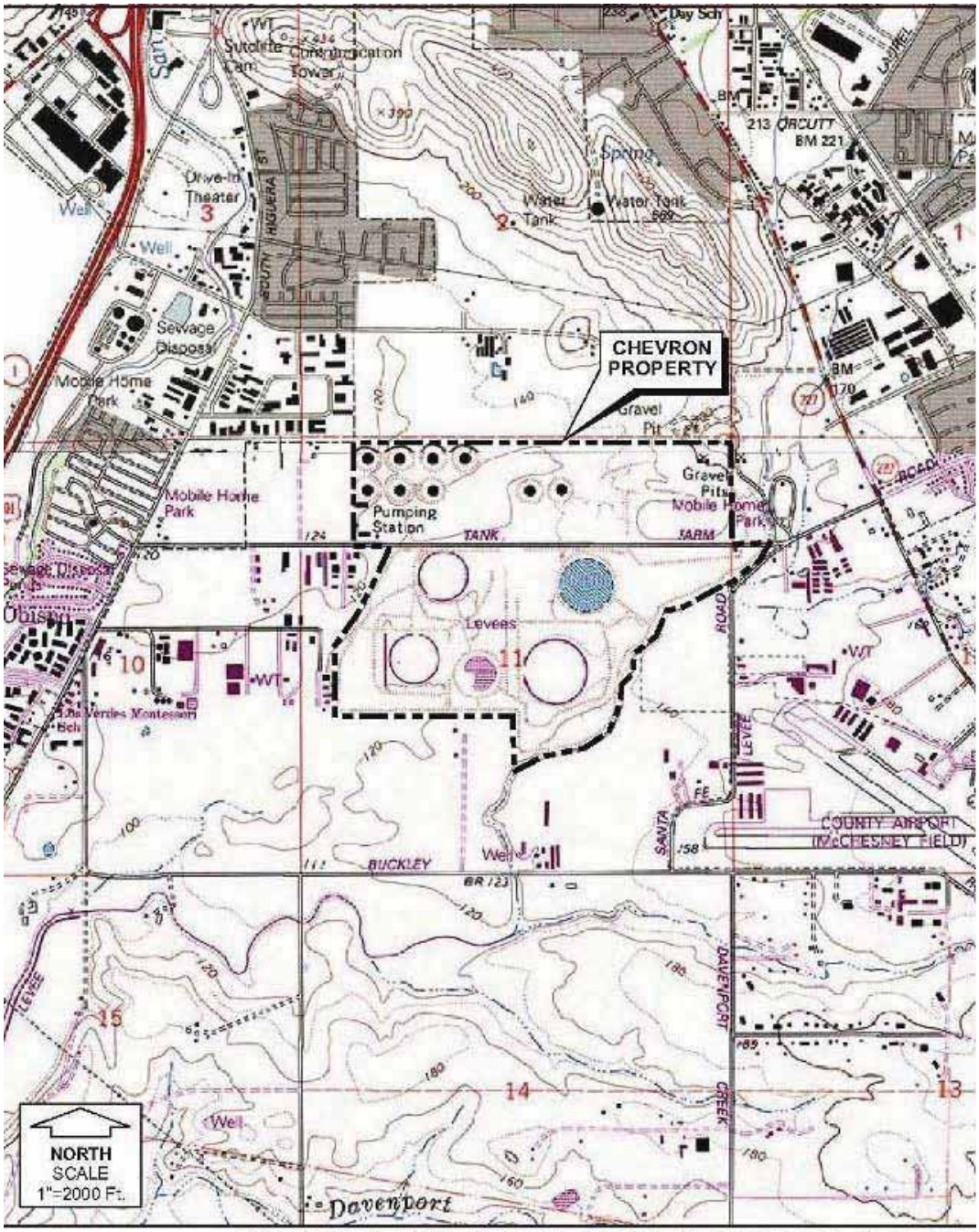
KEY: DOES THIS WETLAND PERFORM [FUNCTION]?
"-" Wetland performance of function is negative with respect to the reference
"0" Wetland performance of function is neutral with respect to the reference
"+" Wetland performance of function is positive with respect to the reference
"N/A" Wetland does not perform the function
0-1 Scaling 0.0=low degree of function, 1.0=high degree of function
Y = Yes N = No

CHEVRON SAN LUIS OBISPO TANK FARM
LEVEL I HYDROGEOMORPHIC WATERS/WETLANDS FUNCTIONAL ASSESSMENT WORKSHEET

				HYDROLOGY		BIOGEOCHEMISTRY		PLANT COMMUNITY		FAUNAL SUPPORT / HABITAT		
				Surface & Subsurface Storage & Exchange of Water	Landscape Hydrologic Connections	Cycling of Elements & Compounds	Retention & Detention of Particulates	Characteristic Plant Communities	Characteristic Detrital System	Spatial Structure of Habitat	Distribution & Abundance of Vertebrates	Distribution & Abundance of Invertebrates
Reference Sites	1	Do Reference Sites Perform Function?	(Y/N) scale?	(Y) 1.0	(Y) 1.0	(Y) 1.0	(Y) 1.0	(Y) 1.0	(Y) 1.0	(Y) 1.0	(Y) 1.0	(Y) 1.0
Initial Project Site	2	Does Site Perform Function?	(Y/N) scale?	(Y) 0.29	(Y) 0.50	(Y) 0.19	(Y) 0.28	(Y) 0.38	(Y) 0.150	(Y) 0.22	(Y)	(Y)
Conditions Prior to Restoration	3	What is functional status relative to the Target Reference Condition? Rows 2 vs 1	(-,0,+,N/A) change in scale	-0.71	-0.50	-0.81	-0.72	-0.62	-0.85	-0.78	-	-
Existing Site Conditions w/ Remediation & Restoration	4	Does Site Perform Function?	(Y/N) scale	(Y) 0.53	(Y) 0.75	(Y) 0.63	(Y) 0.63	(Y) 0.68	(Y) 0.67	(Y) 0.75	(Y)	(Y)
(Time = Plus 5 Years After Initial Restoration)	5	What is the functional status relative to the Target Reference Condition? Rows 4 vs 1	(-,0,+,N/A) change in scale	-0.48	-0.25	-0.38	-0.38	-0.25	-0.33	-0.25	-	-
	6	What is the functional status relative to the Initial Project Site Condition? Rows 4 vs 2	(-,0,+,N/A) change in scale	0.24	0.25	0.44	0.35	0.38	0.45	0.53	-	-
Overall Restoration Effectiveness	7	As proposed, does the Restoration result in a net loss or a net gain in function at Year 5?	G=Gain 0=Neutral L=Loss	G	G	G	G	G	G	G	-	-

Table 5

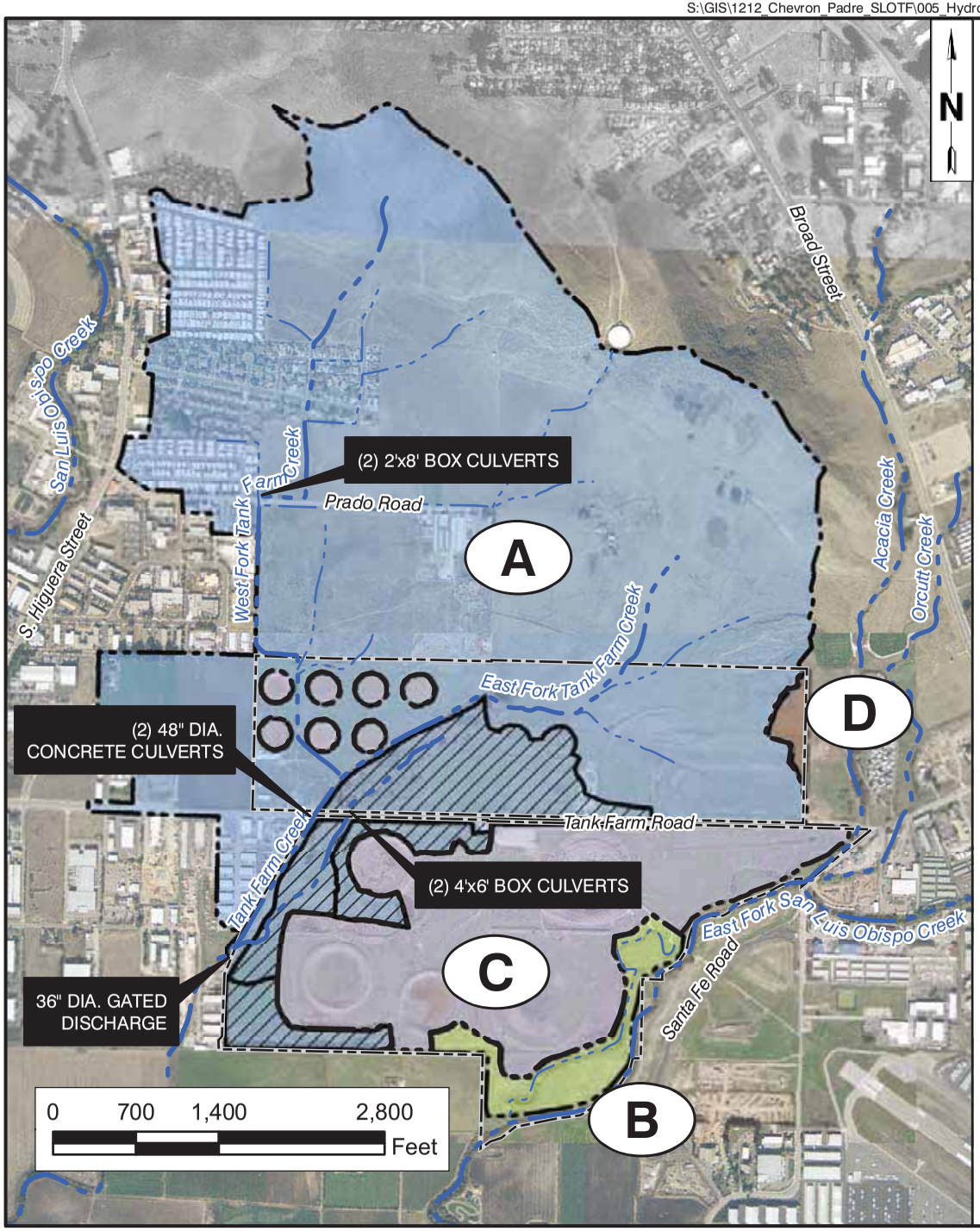
FIGURES



CHEVRON SLO TANK FARM PROJECT SITE LOCATION
SAN LUIS OBISPO, CALIFORNIA
(FROM PADRE ASSOCIATES, INC 2007)
FIGURE - 1

AERIAL IMAGE OF CHEVRON SLO TANK FARM PROJECT SITE
(FLIGHT DATE 2-4-08)
FIGURE - 2

S:\GIS\1212_Chevron_Padre_SLOTF\005_Hydrology_Study\ArcMapDocuments\013_1212.005_Watersheds_Overview_Existing_Conditions.mxd, 11/18/08



WATERSHED ID	ONSITE (ac)	OFFSITE (ac)	TOTAL (ac)
WATERSHED A TANK FARM CREEK WATERSHED	160.1	476.5	636.6
WATERSHED B ONSITE TRIBUTARY TO THE EAST FORK OF SAN LUIS OBISPO CREEK	19.1	0.0	19.1
WATERSHED C ONSITE HYDROLICALLY ISOLATED DEPRESSIONS	139.1	0.8	139.9
WATERSHED D ONSITE AREA TO THE EAST WHICH DRAINS OFFSITE	4.0	0.0	4.0
OTHER OTHER MINOR OFFSITE DRAINAGE	11.0	0.0	11.0
TOTAL	333.3	477.3	810.6

NOTES:

1) DIAGONAL HATCHED AREAS ARE TRIBUTARY TO THE NORTH MARSH AND AUXILIARY TANK FARM CREEK AND ARE NOT ENGAGED IMMEDIATELY DURING A STORM,

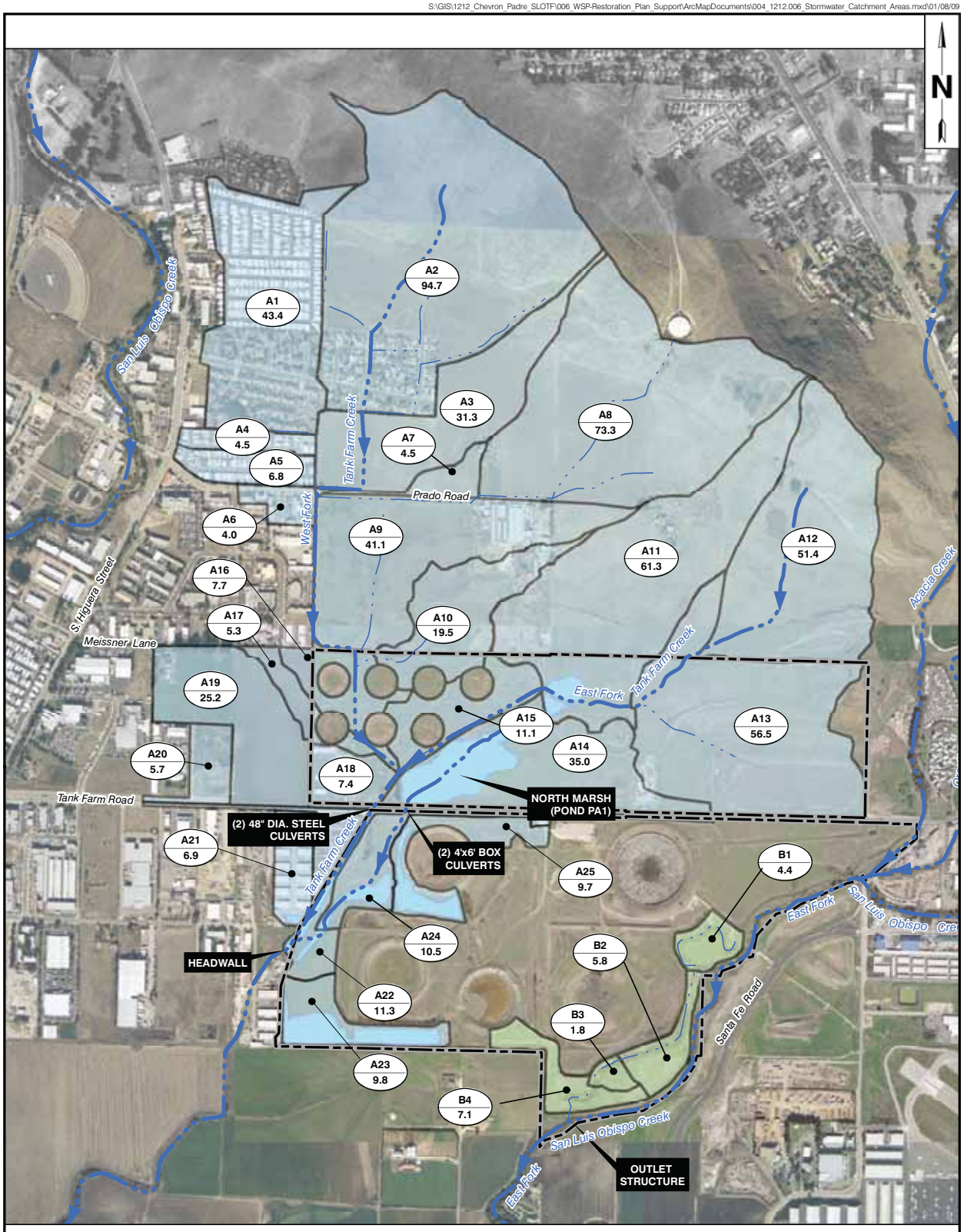
FIGURE 3

WATERSHEDS OVERVIEW EXISTING CONDITIONS

HYDROLOGY STUDY
SAN LUIS OBISPO TANK FARM
PREPARED FOR
CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA

AVOCET ENVIRONMENTAL, INC.

S:\GIS\1212_Chevron_Padre_SLOTF\006_WSP-Restoration_Plan_Support\ArcMapDocuments\004_1212.006_Stormwater_Catchment_Areas.mxd\01/08/09



LEGEND

- PRIMARY CREEK
- SECONDARY CREEK
- SITE PROPERTY BOUNDARY
- WATERSHED B
- EXISTING HYDROLOGIC CATCHMENT A
- EXISTING POND

A4 — SUBCATCHMENT I.D.
4.5 — SUBCATCHMENT AREA (ACRES)

0 400 800 1,600 FEET

FIGURE 4

STORM WATER CATCHMENT AREAS

SAN LUIS OBISPO TANK FARM
SAN LUIS OBISPO, CA

PREPARED FOR

CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA

AVOCET ENVIRONMENTAL, INC.

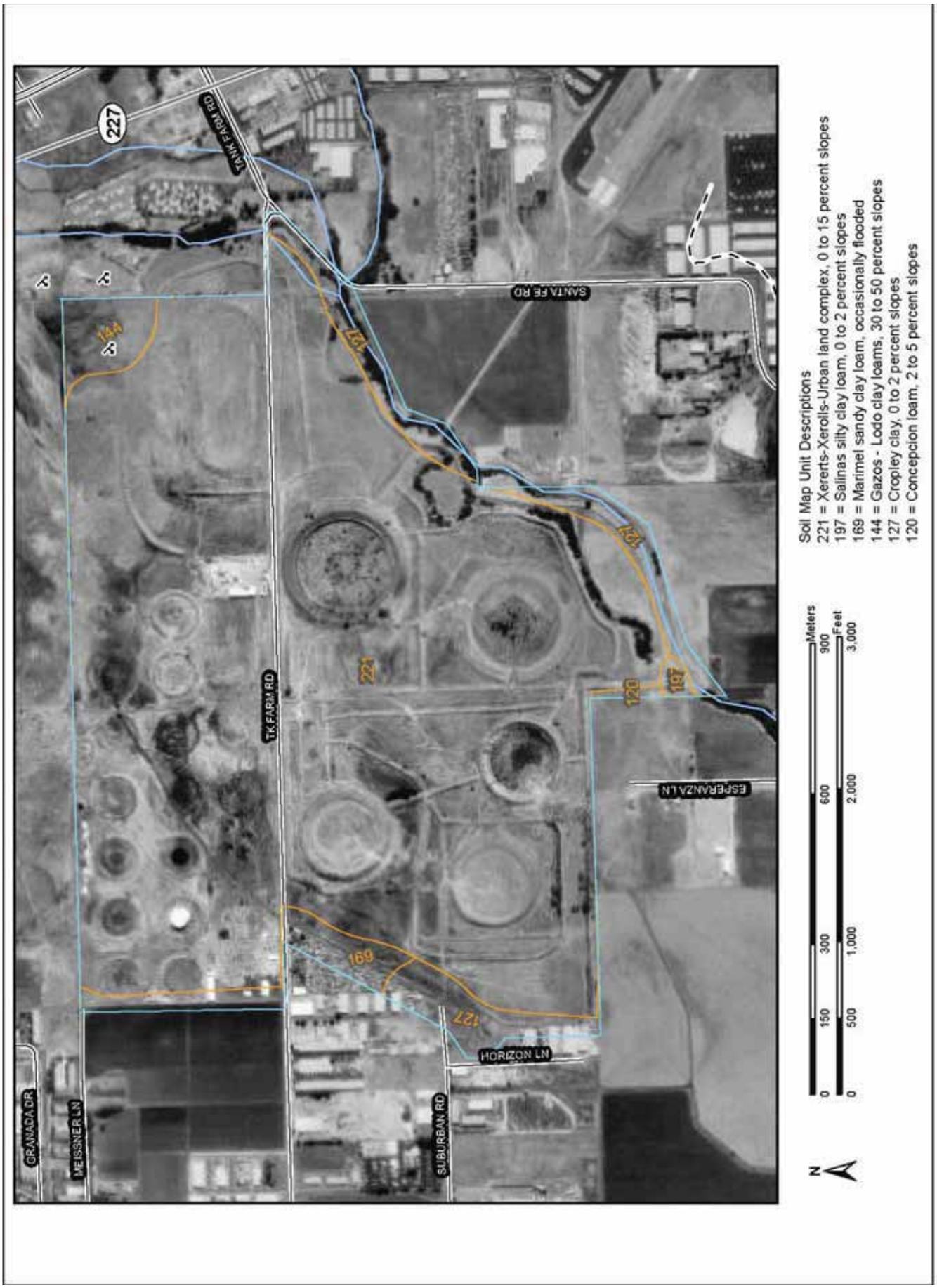


Figure 5
Mapped Soils for the San Luis Obispo Tank Farm Project Site (NRCS 2004)

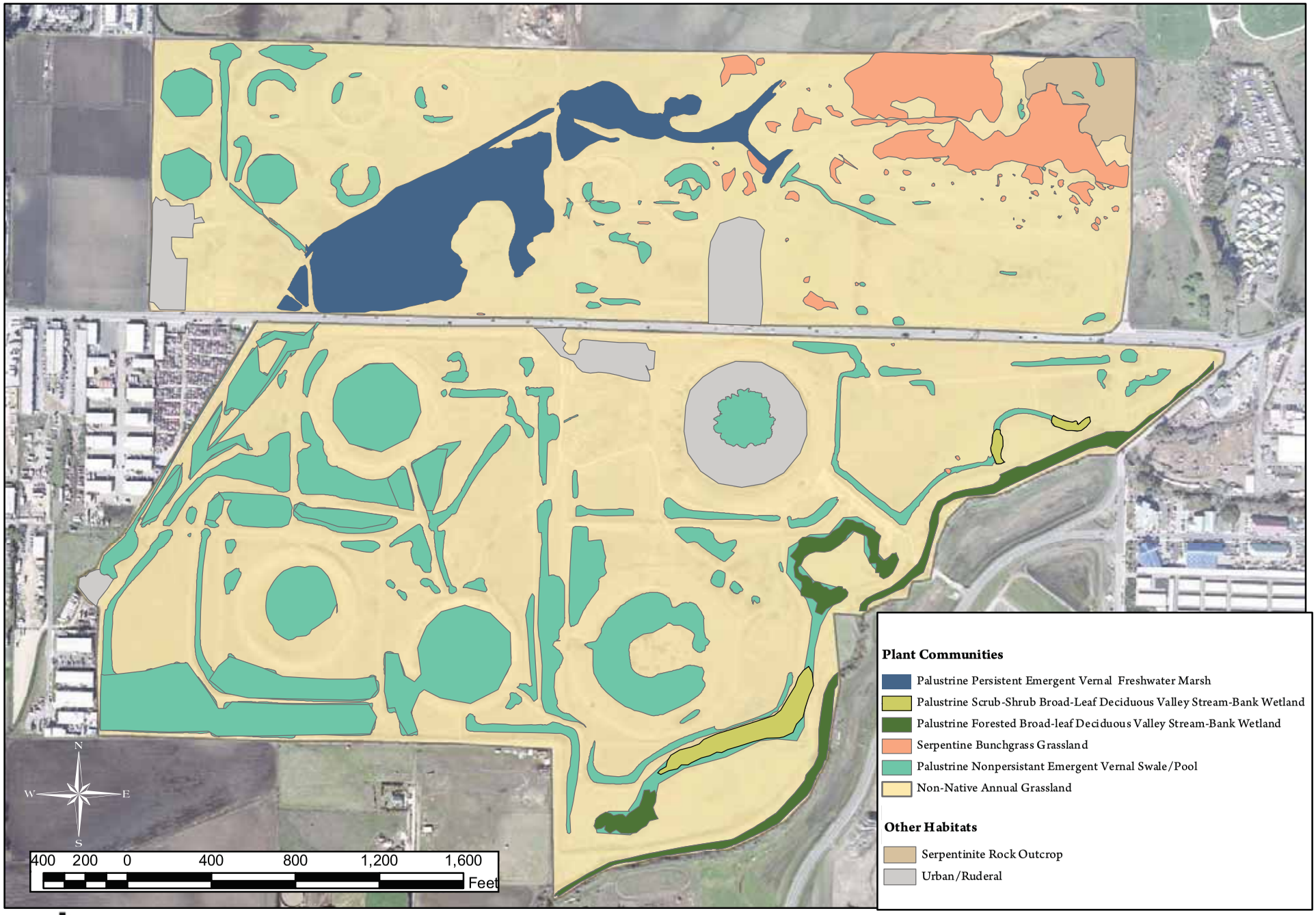


Figure 6

Plant Communities of the San Luis Obispo Tank Farm

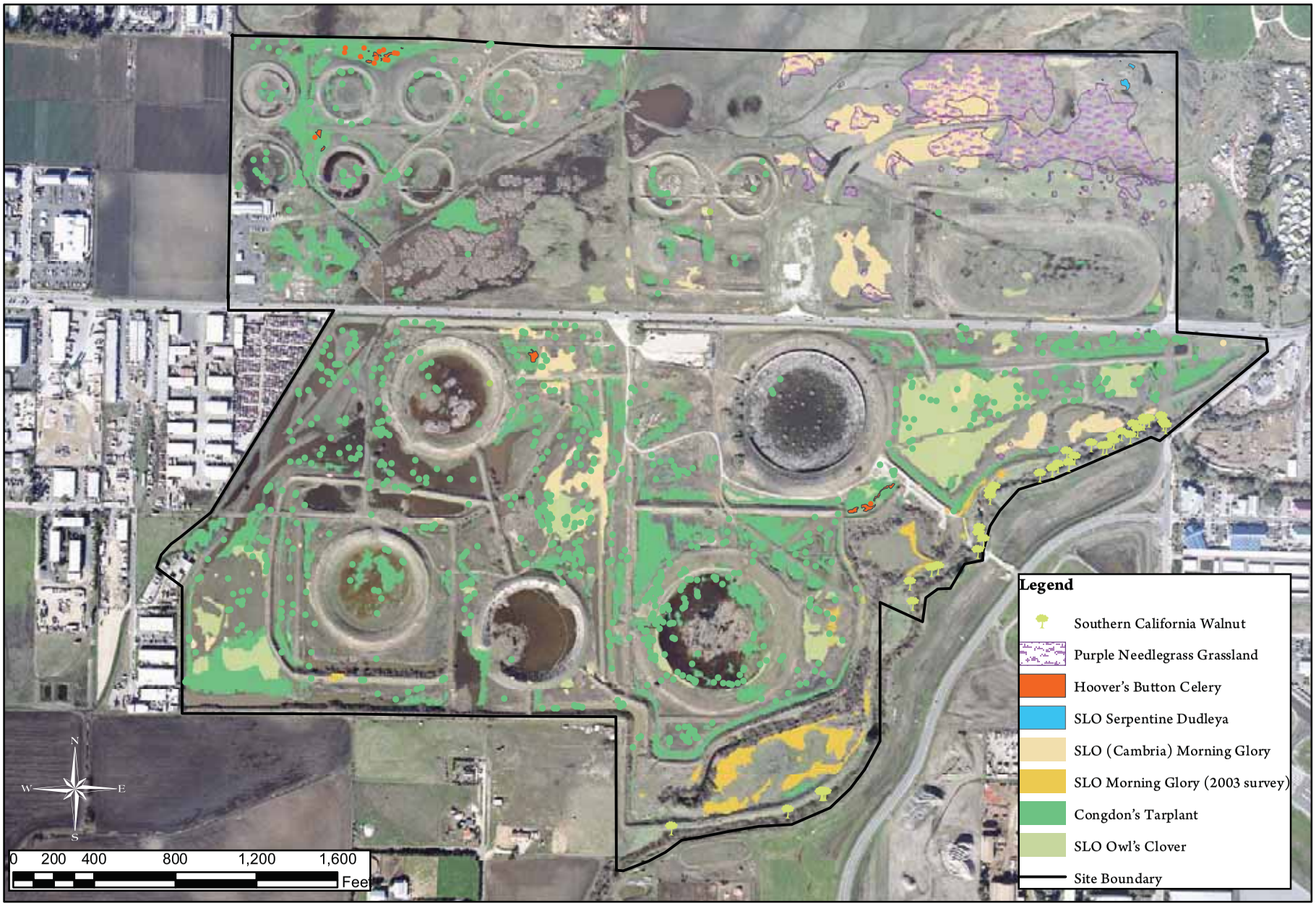
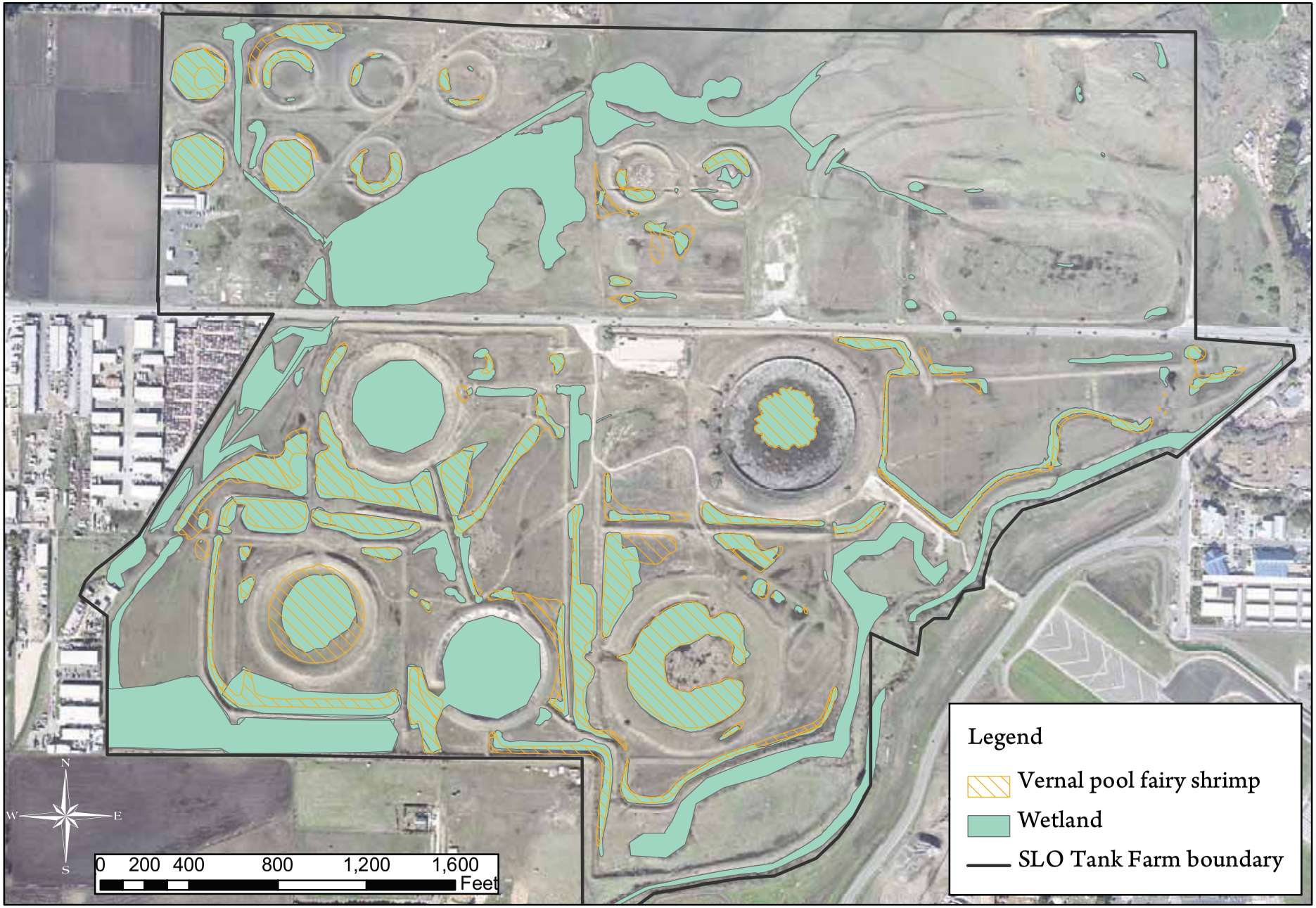


Figure 7
Geographic Distribution of Rare Plant Species at the San Luis Obispo Tank Farm

Chevron EMC- San Luis Obispo Tank Farm Restoration and Re-development Project



padre associates, inc. ENGINEERS, GEOLOGISTS & ENVIRONMENTAL SCIENTISTS
WSP

Chevron EMC- San Luis Obispo Tank Farm Restoration and Re-development Project

Figure 8
Vernal pool fairy shrimp habitat identified within SLO Tank Farm property.

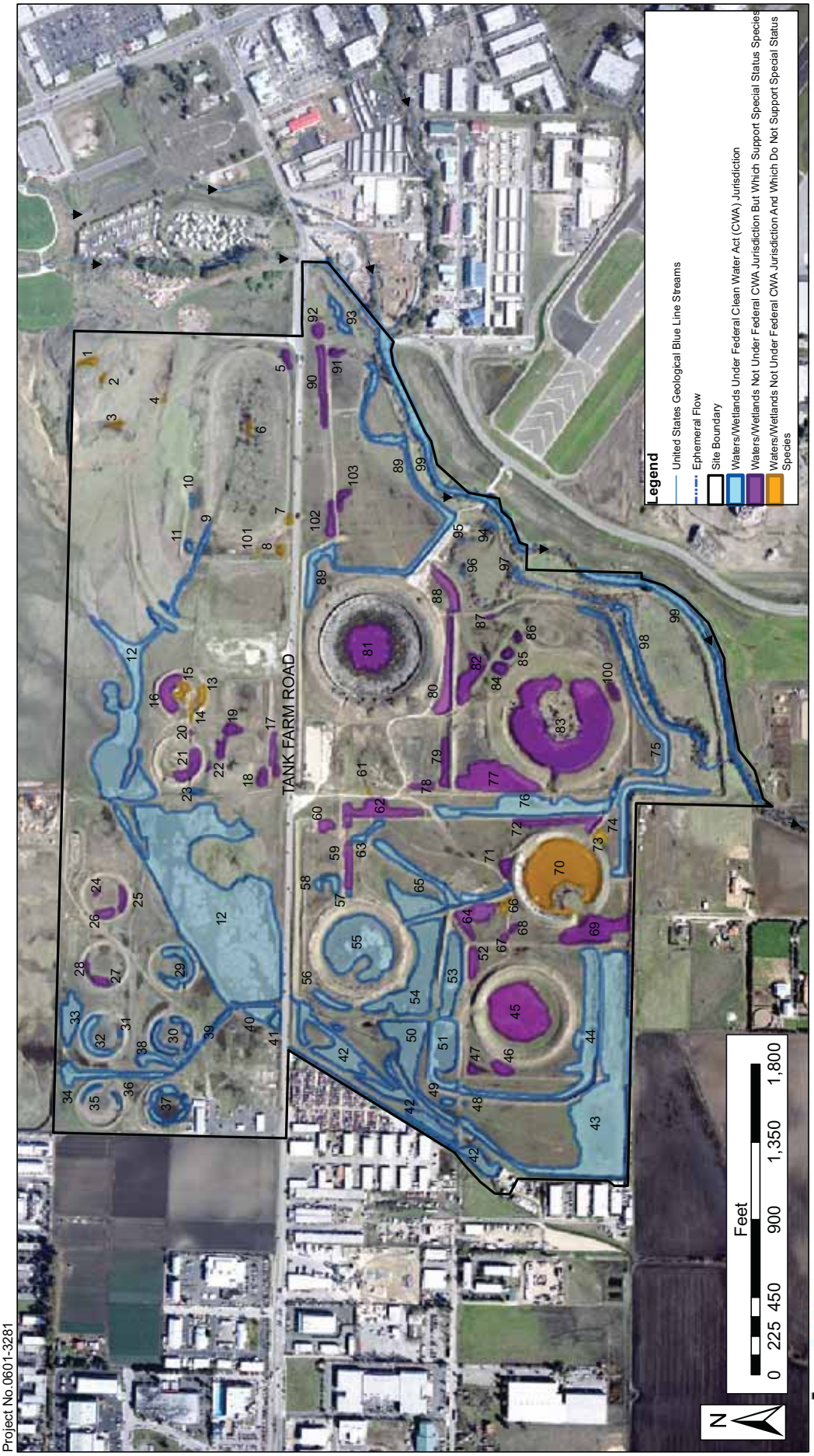


Figure 9

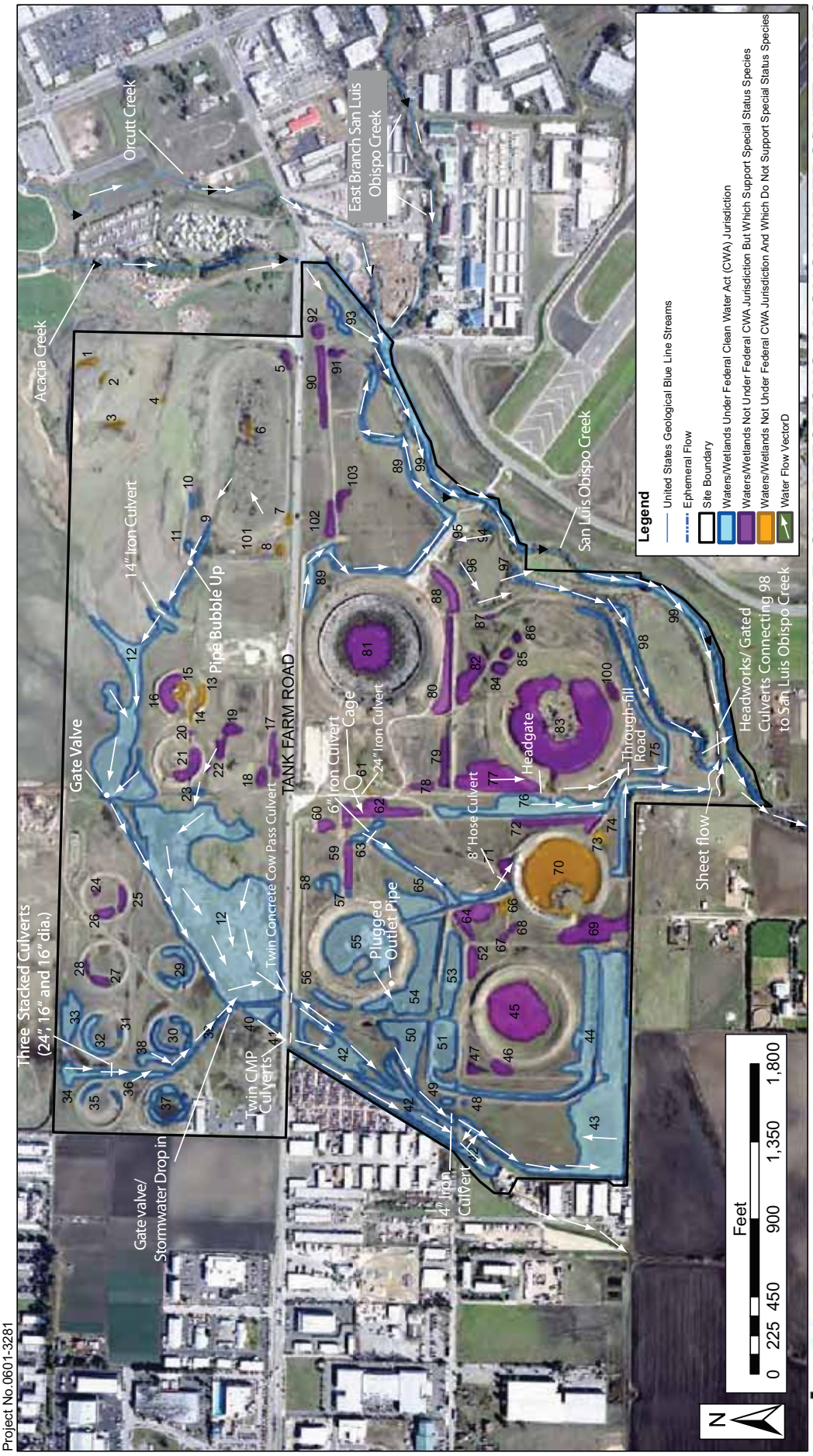
Waters of the US Including Wetlands
SLO Tank Farm, San Luis Obispo, CA

December 2008
Project No.0601-3281

padre associates, inc. PLANNERS, ENGINEERS, & ENVIRONMENTAL SCIENTISTS

WSP

Chevron EMC – San Luis Obispo Tank Farm Restoration and Re-development Project



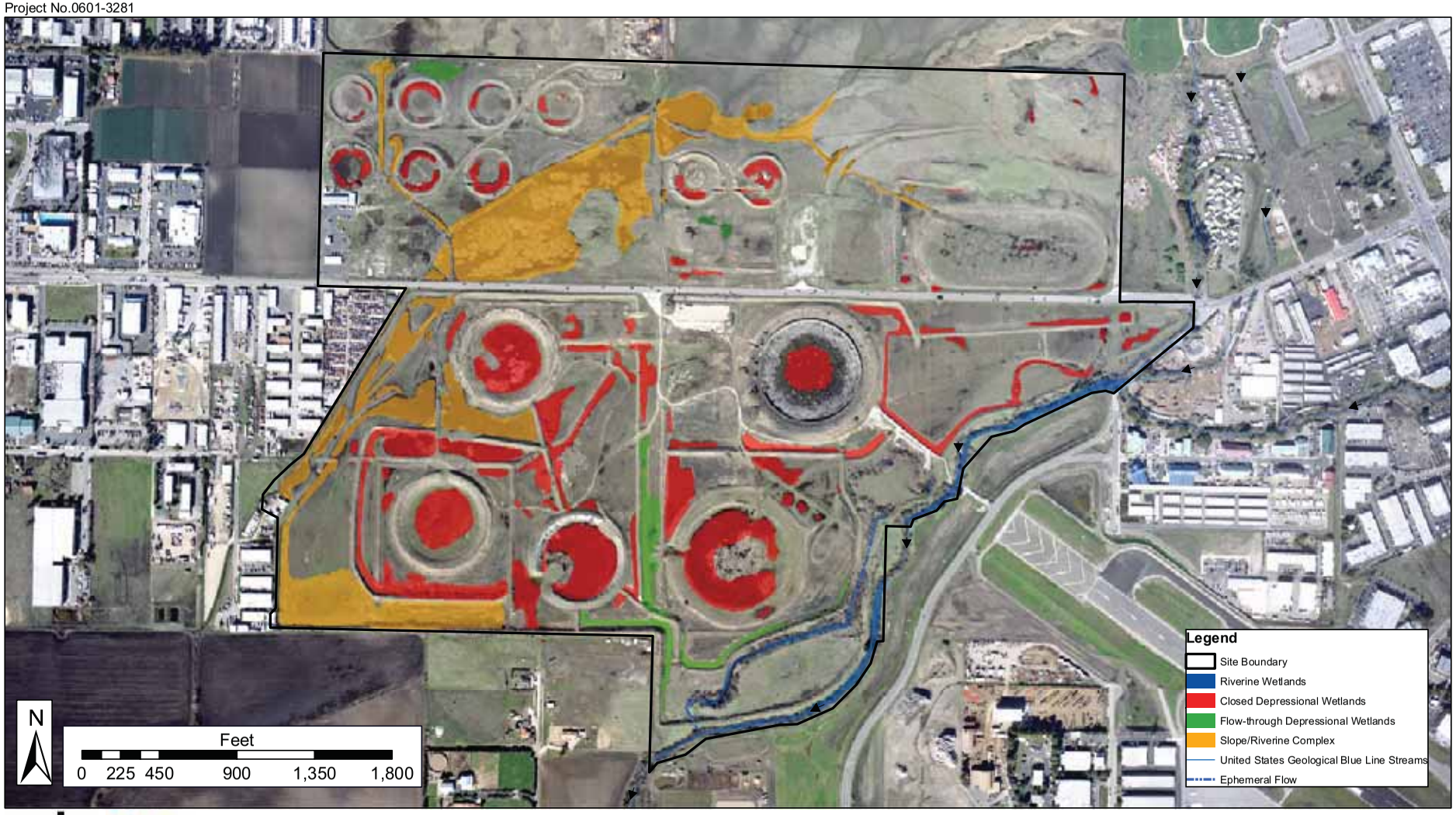
WATER FLOW DIRECTIONS AMONG WATERS/WETLANDS
SLO TANK FARM, SAN LUIS OBISPO, CA
FIGURE 10

December 2008
Project No.0601-3281

padre associates, inc. WSP

Chevron EMC – San Luis Obispo Tank Farm Restoration and Re-development Project

December 2008
Project No.0601-3281



padre associates, inc. ENGINEERS, GEOLOGISTS & ENVIRONMENTAL SCIENTISTS
WSP

Figure 11

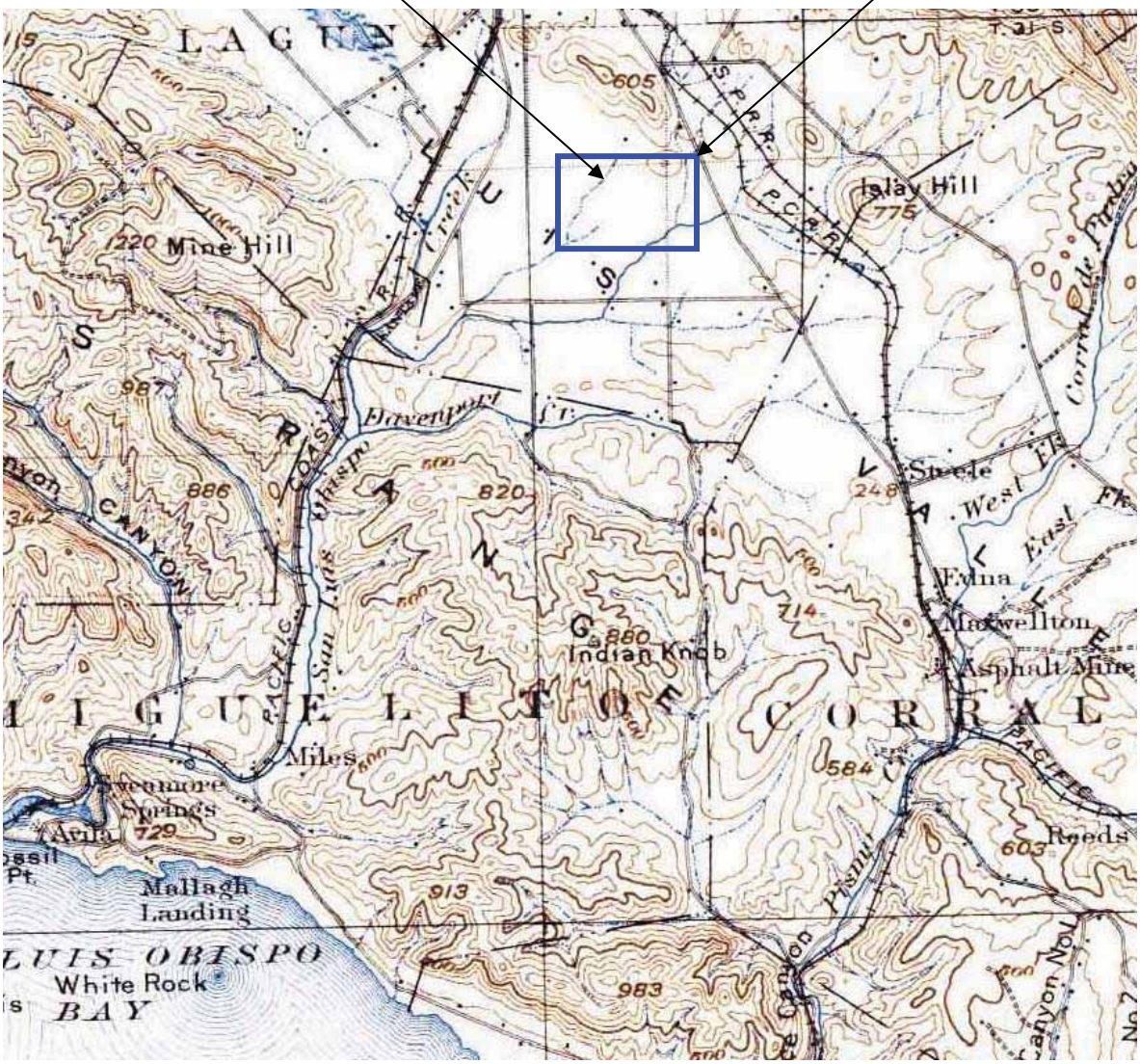
HGM Wetland Classes (Following Brinson et al., 1995)

Chevron EMC – San Luis Obispo Tank Farm Restoration and Re-development Project

N
STORMWATER OUTFALL/STILLING POND
TANK FARM ROAD
FIGURE 12
PLANTING PLAN (75%)
PREPARED FOR
CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA
WSP
padre associates, inc.
ENGINEERS, GEOLOGISTS & ENVIRONMENTAL SCIENTISTS
0 250 500 1,000 FEET
APPROXIMATE SCALE
LEGEND
Project Boundary
Stormwater Outfall/Stilling Pond
Terrestrial Forest Phreatophytic Woodland 4.02 Acres
Terrestrial Phreatophytic Forest Forb Field 26.97 Acres
Terrestrial Coastal Sage Chaparral 10.87 Acres
Terrestrial Forb Field 45.22 Acres
Palustrine Forest I - Mixed Broadleaf Deciduous Forest 9.56 Acres
Palustrine Forest II - Willow Sycamore Forest 7.63 Acres
Palustrine Forest III - CA Walnut Woodland 5.80 Acres
Palustrine Forest IV - Live Oak Riparian Woodland 3.20 Acres
Palustrine Scrub Shrub - Mixed Riparian Scrub Shrub 4.20 Acres
Palustrine Persistent Emergent - Mixed Bulrush 2.35 Acres
Palustrine Persistent Emergent - Riverine Perennial 1.05 Acres
Palustrine Non-Persistent Emergent - Vernal Depression 10.27 Acres
Palustrine Non-Persistent Emergent - Vernal Swale 1.61 Acres
S:\GIS\1212_Chevron_Padre_SLOTF\011_1212.005_Planting_Plan_no_numbers.mxd\12/01/08

Unnamed Tributary of San Luis Obispo Creek

Approximate Location of the Project Site



1900 SAN LUIS OBISPO TOBPGRAPHIC QUADRANGLE

FIGURE 13

NOTE: Blue box illustrates the unnamed tributary at the Chevron SLO Tank Farm Project Site impounded by the construction. of Tank Farm Road. The North Marsh exists currently at the approximate location of this tributary.

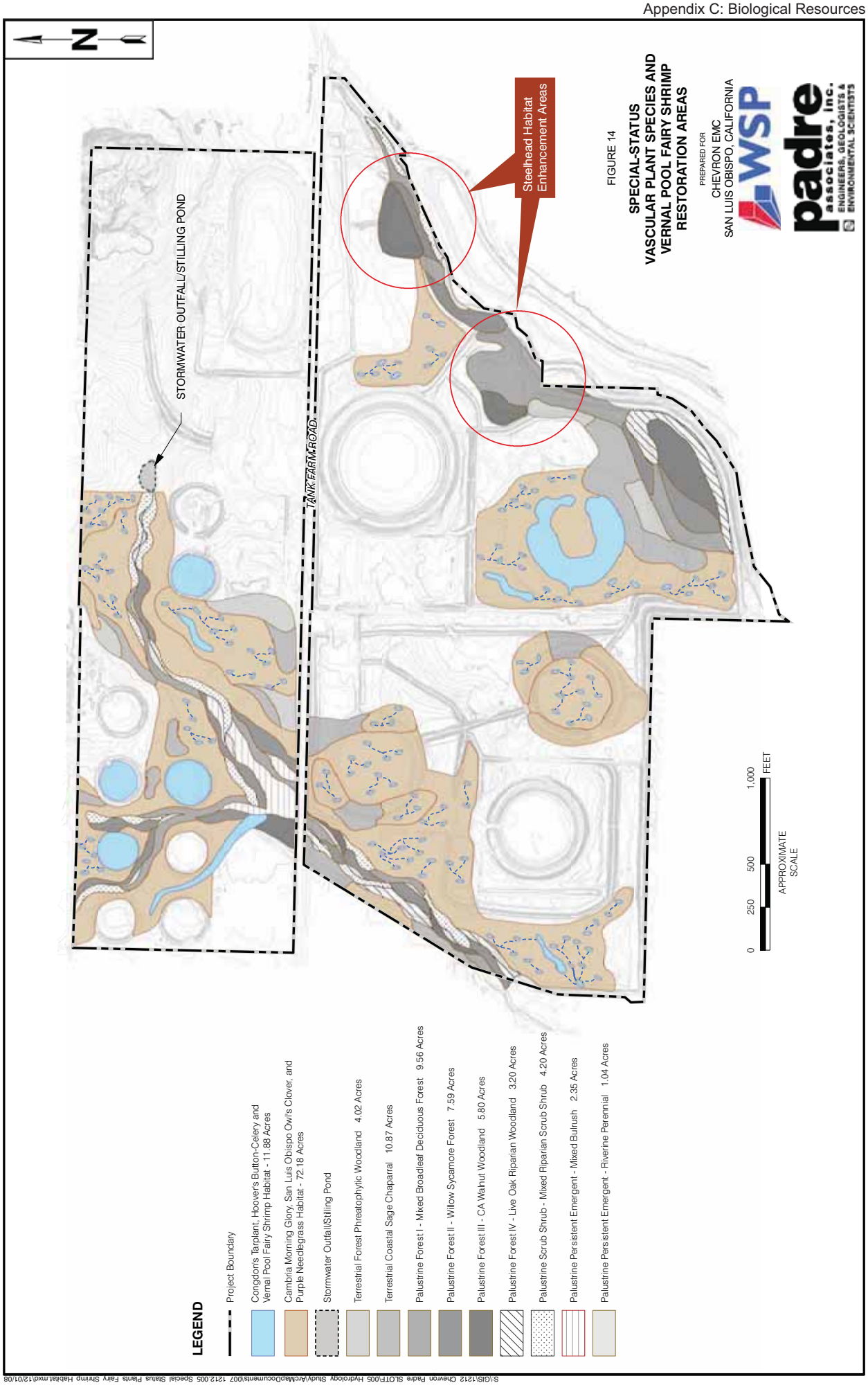


FIGURE 14
SPECIAL-STATUS VASCULAR PLANT SPECIES AND VERNAL POOL FAIRY SHRIMP RESTORATION AREAS
PREPARED FOR
CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA

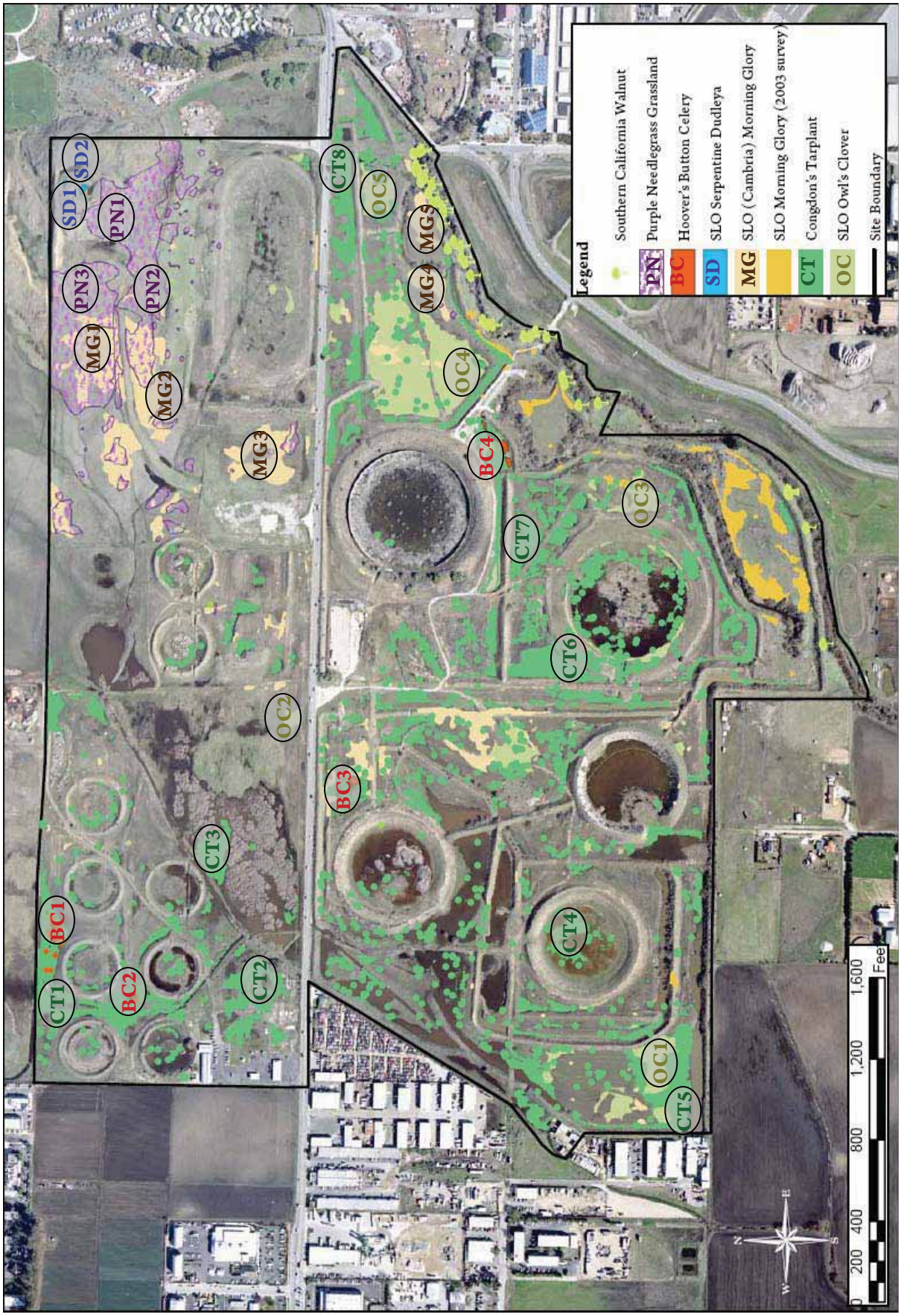
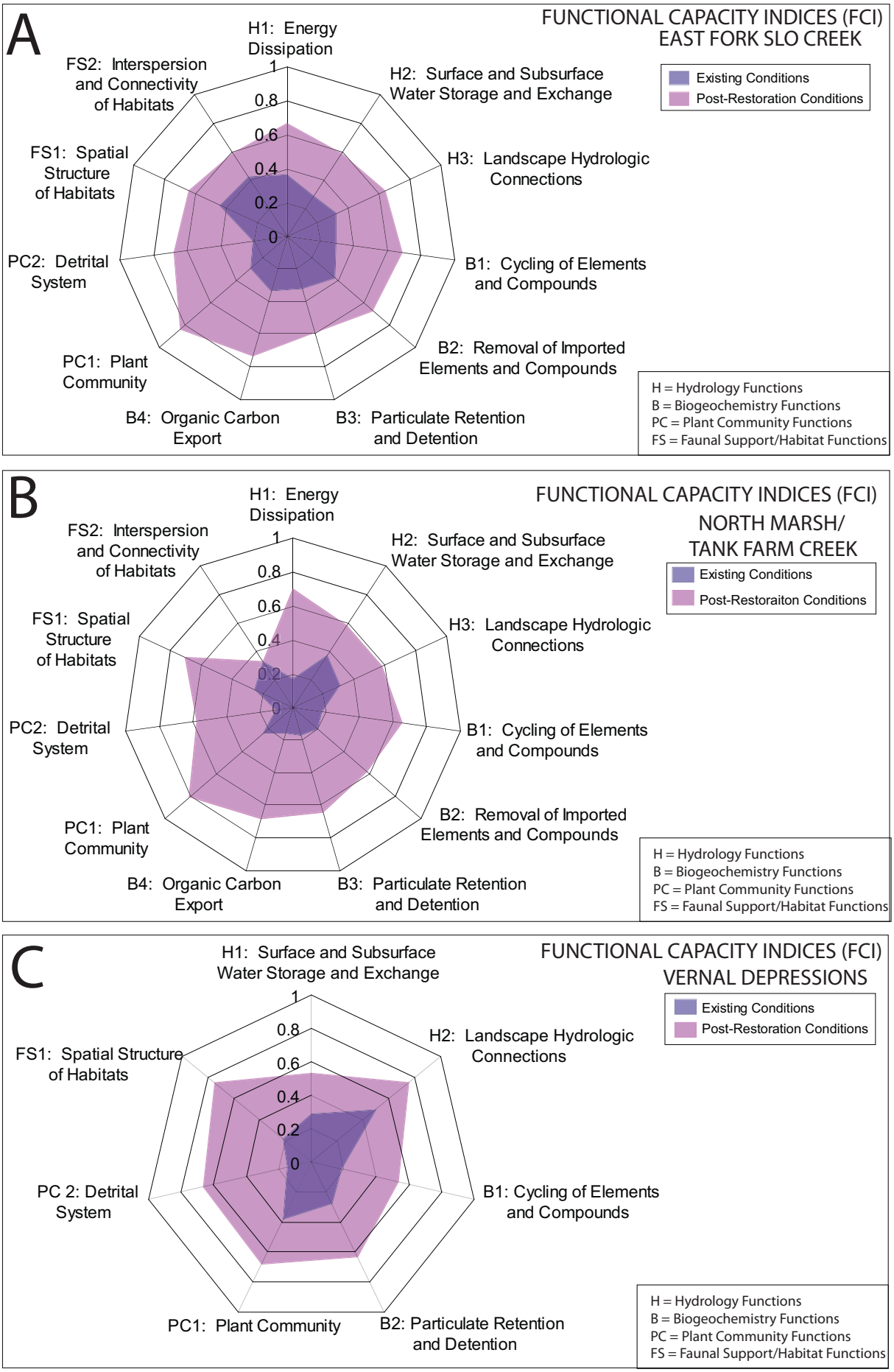


Figure 15: Proposed collection locations for protected vascular plants at the San Luis Obispo Tank Farm.

FIGURE 16. Functional capacity indices for SLO Tank Farm Restoration



APPENDIX A

Summary of the Distribution of Waters of the U.S. Including Wetlands and Other Wetland Features at the Chevron Tank Farm, San Luis Obispo, California

APPENDIX A. Summary of the Distribution of Waters of the U.S. Including Wetlands and Other Wetland Features at the Chevron Tank Farm, San Luis Obispo, California.

		Waters/Wetlands HGM*[1] Class			***Waters/Wetlands Jurisdiction***				***Special-status Species***					
Wetland Number	***Area (acres)***	Slope/Riverine Complex	Depression	Riverine	Federal Clean Water Act (CWA)	Federal "Other" Waters" of the U.S.	Not Under Federal CWA Jurisdiction And Which Do Not Support Special Status Species	Not Under Federal CWA Jurisdiction But Which Do Support Special Status Species	Vernal Pool Fairy Shrimp	Congdon's tarplant	Hoover's button-celery	SLO morning-glory	Purple needlegrass	South-Central California Coast Steelhead
1	0.07		X				X							
2	0.02		X				X							
3	0.04		X				X							
4	0.01		X				X							
5	0.07		X					X		X	X			
6	0.02		X				X							
7	0.04		X				X							
8	0.04		X				X							
9	0.30	X			X									
10	0.02	X			X									
11	0.05	X			X									
12	16.33	X			X					X				
13	0.09		X				X							
14	0.03		X				X							
15	0.11		X				X							
16	0.33		X					X	X	X				

Appendix A-2

Appendix A. Cont'd.

Wetland Number	Area (acres)	Waters/Wetlands HGM*[1] Class			Waters/Wetlands Jurisdiction				Special-status Species					
		Slope/Riverine Complex	Depression	Riverine	Federal Clean Water Act (CWA)	Federal "Other" Waters" of the U.S.	Not Under Federal CWA Jurisdiction And Which Do Not Support Special Status Species	Not Under Federal CWA Jurisdiction But Which Do Support Special Status Species	Vernal Pool Fairy Shrimp	Congdon's tarplant	Hoover's button-celery	SLO morning-glory	Purple needlegrass	South-Central California Coast Steelhead
17	0.14		X					X	X	X				
18	0.09		X					X	X	X				
19	0.21		X					X		X				
20	0.00		X					X						
21	0.23		X					X	X	X				
22	0.01		X					X	X	X				
23	0.04	X			X				X	X				
24	0.01		X					X		X				
25	0.07		X					X	X	X				
26	0.09		X					X	X	X				
27	0.08		X					X		X				
28	0.02		X					X		X				
29	0.44		X		X				X	X				
30	0.44		X		X				X	X				
31	0.01		X		X									
32	0.34		X		X				X	X				
33	0.53		X		X				X	X	X			
34	0.64	X			X					X				

Appendix A-3

Appendix A. Cont'd.

Wetland Number	Area (acres)	Waters/Wetlands HGM*[1] Class			Waters/Wetlands Jurisdiction				Special-status Species					
		Slope/Riverine Complex	Depression	Riverine	Federal Clean Water Act (CWA)	Federal "Other" Waters" of the U.S.	Not Under Federal CWA Jurisdiction And Which Do Not Support Special Status Species	Not Under Federal CWA Jurisdiction But Which Do Support Special Status Species	Vernal Pool Fairy Shrimp	Congdon's tarplant	Hoover's button-celery	SLO morning-glory	Purple needlegrass	South-Central California Coast Steelhead
35	0.05		X		X				X	X				
36	0.03		X		X				X	X				
37	0.40		X		X				X	X				
38	0.21	X			X				X	X				
39	0.22	X			X				X	X	X			
40	0.27	X			X									
41	0.12	X			X									
42	2.99	X			X					X		X		
43	6.92	X			X					X		X		
44	2.35		X		X				X	X		X		
45	2.03		X					X	X	X				
46	0.14		X					X	X	X				
47	0.06		X					X	X	X				
48	0.00		X		X				X					
49	0.07		X		X				X					
50	1.52	X			X				X	X				
51	1.21		X		X				X	X				
52	0.18		X					X	X	X				

Appendix A-4

Appendix A. Cont'd.

Wetland Number	Area (acres)	Waters/Wetlands HGM*[1] Class			Waters/Wetlands Jurisdiction				Special-status Species					
		Slope/Riverine Complex	Depression	Riverine	Federal Clean Water Act (CWA)	Federal "Other" Waters" of the U.S.	Not Under Federal CWA Jurisdiction And Which Do Not Support Special Status Species	Not Under Federal CWA Jurisdiction But Which Do Support Special Status Species	Vernal Pool Fairy Shrimp	Congdon's tarplant	Hoover's button-celery	SLO morning-glory	Purple needlegrass	South-Central California Coast Steelhead
53	0.98		X		X				X	X				
54	2.17	X			X				X	X				
55	2.59		X		X					X				
56	0.22		X		X				X	X				
57	0.01		X		X				X					
58	0.21		X		X				X	X	X	X		
59	0.23		X					X		X		X		
60	0.09		X					X	X	X				
61	0.01		X				X							
62	0.64		X					X		X				
63	0.67		X		X				X	X				
64	0.44		X					X		X				
65	1.64		X		X				X					
66	0.07		X				X							
67	0.03		X					X	X	X				
68	0.03		X					X	X	X				
69	0.90		X					X	X	X				
70	2.76		X				X							

Appendix A-5

Appendix A. Cont'd.

Wetland Number	Area (acres)	Waters/Wetlands HGM*[1] Class			Waters/Wetlands Jurisdiction				Special-status Species					
		Slope/Riverine Complex	Depression	Riverine	Federal Clean Water Act (CWA)	Federal "Other" Waters" of the U.S.	Not Under Federal CWA Jurisdiction And Which Do Not Support Special Status Species	Not Under Federal CWA Jurisdiction But Which Do Support Special Status Species	Vernal Pool Fairy Shrimp	Congdon's tarplant	Hoover's button-celery	SLO morning-glory	Purple needlegrass	South-Central California Coast Steelhead
71	0.10		X					X	X	X				
72	0.38		X					X	X	X				
73	0.08		X				X							
74	0.88		X		X				X	X				
75	0.75		X		X				X	X				
76	1.83		X		X				X	X		X		
77	1.27		X					X	X	X				
78	0.07		X					X	X	X				
79	0.21		X					X	X	X				
80	0.47		X					X	X	X				
81	1.36		X					X		X				
82	0.49		X					X	X	X				
83	4.24		X					X	X	X				
84	0.10		X					X	X	X				
85	0.05		X					X		X				
86	0.02		X					X	X	X				
87	0.01		X					X		X				
88	0.27		X					X	X	X	X			

Appendix A-6

Appendix A. Cont'd.

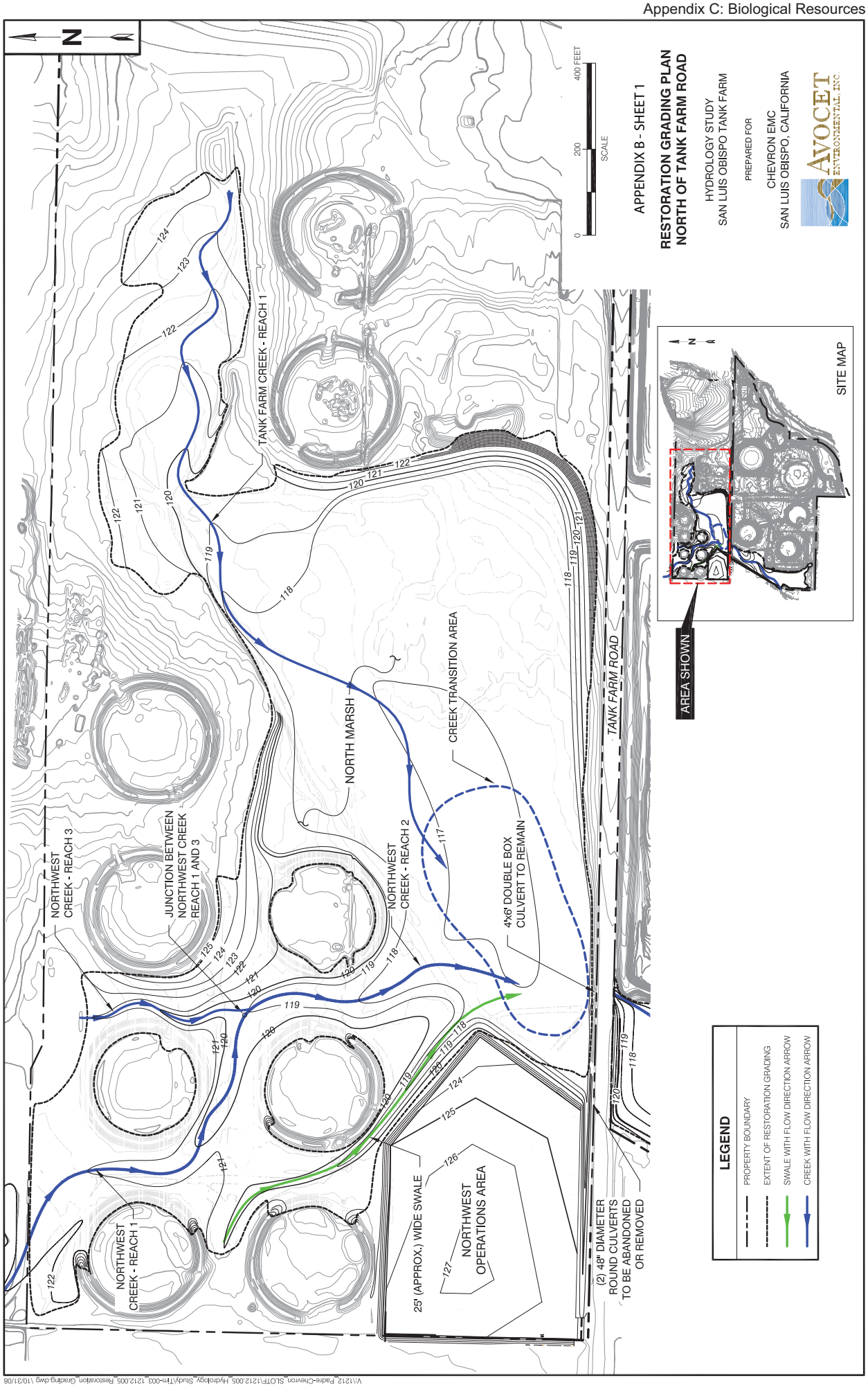
Wetland Number	Area (acres)	Waters/Wetlands HGM*[1] Class			Waters/Wetlands Jurisdiction				Special-status Species					
		Slope/Riverine Complex	Depression	Riverine	Federal Clean Water Act (CWA)	Federal "Other" Waters" of the U.S.	Not Under Federal CWA Jurisdiction And Which Do Not Support Special Status Species	Not Under Federal CWA Jurisdiction But Which Do Support Special Status Species	Vernal Pool Fairy Shrimp	Congdon's tarplant	Hoover's button-celery	SLO morning-glory	Purple needlegrass	South-Central California Coast Steelhead
89	1.81		X		X				X	X				
90	0.31		X					X		X				
91	0.06		X					X		X				
92	0.09		X					X	X	X				
93	0.21		X		X				X	X				
94	0.02			X		X								
95	0.00			X		X								
96	0.01			X		X								
97	0.04			X		X								
98	0.64			X		X								
99	3.18		X	X		X								X
100	0.05		X					X		X				
101	0.01		X				X							
102	0.15		X					X						
103	0.09		X					X						
Total acres:	**72.2**	**31.8**	**36.5**	**3.9**	**49.0**	**3.9**	**3.4**	**15.8**	**31.1**	**63.8**	**1.3**	**14.5**	**0.0**	**3.2**

*[1] Hydrogeomorphic (HGM) Class (following Brinson 1993)

Appendix A-7

APPENDIX B

Grading Plan (75%)
(Sheets B-1, B-2, and B-3)
SLO Tank Farm Landscape Restoration Design



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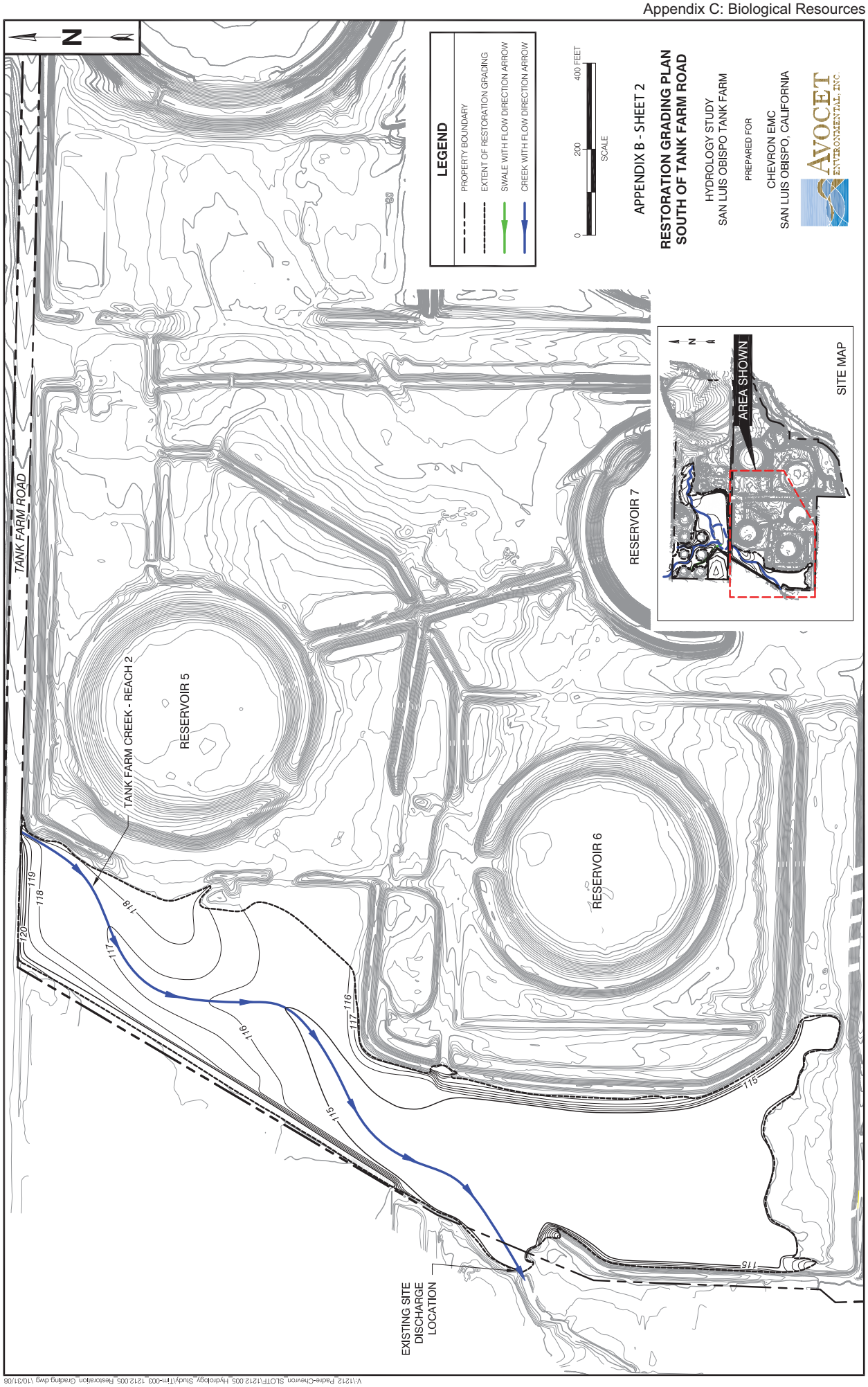

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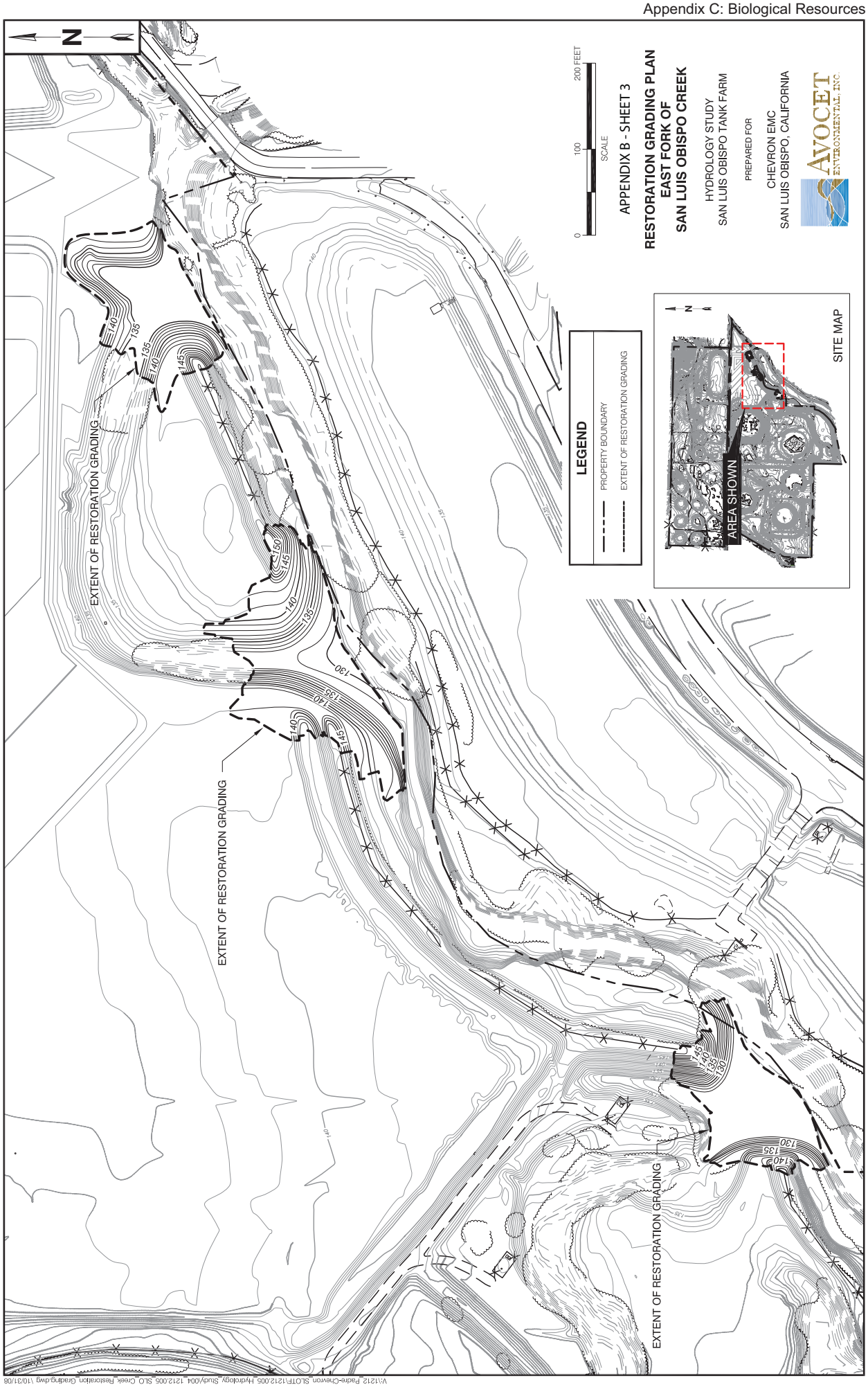

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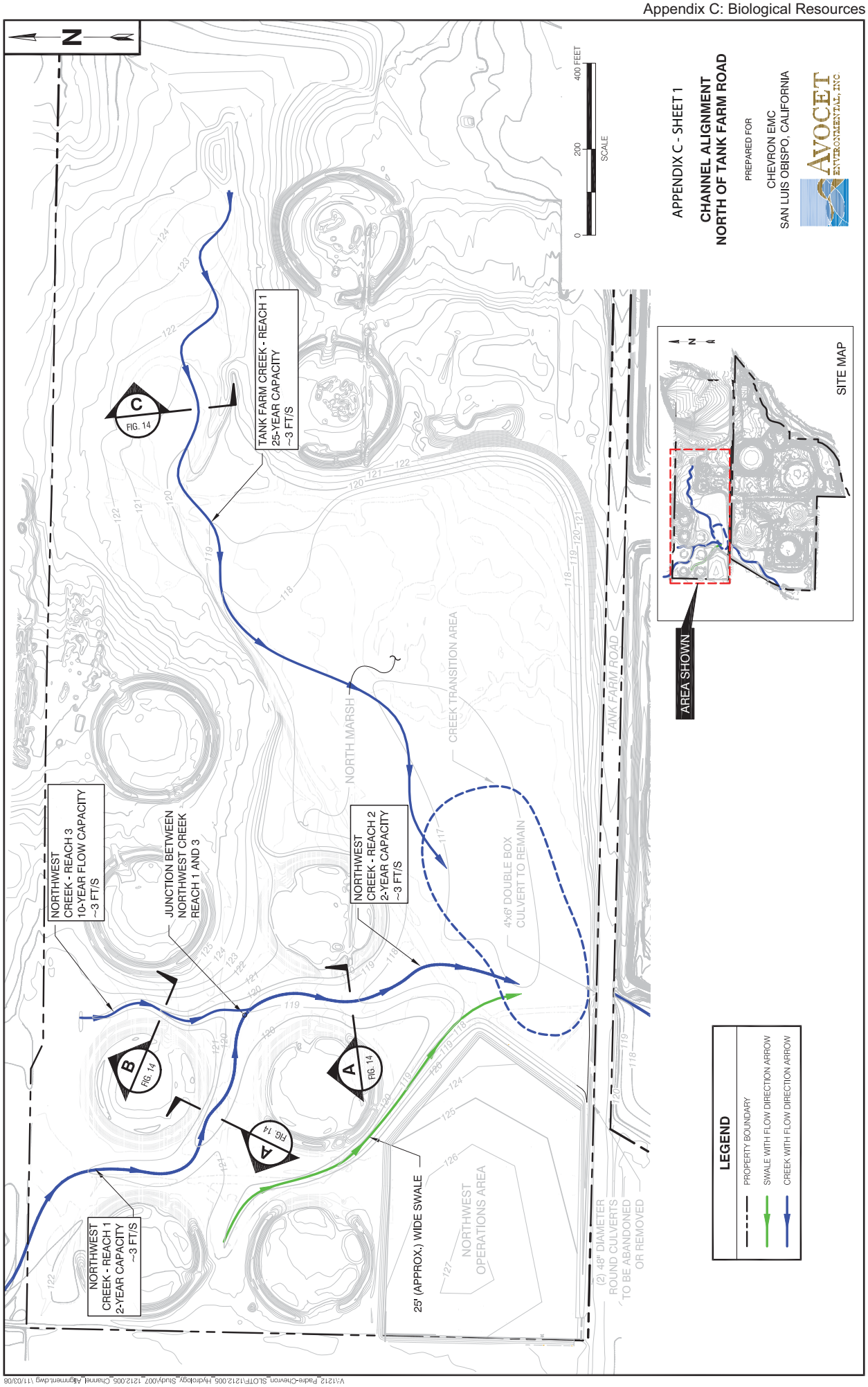
APPENDIX C

North Marsh-Tank Farm Creek Channel Alignment Construction Drawings
SLO Tank Farm Landscape Restoration Design



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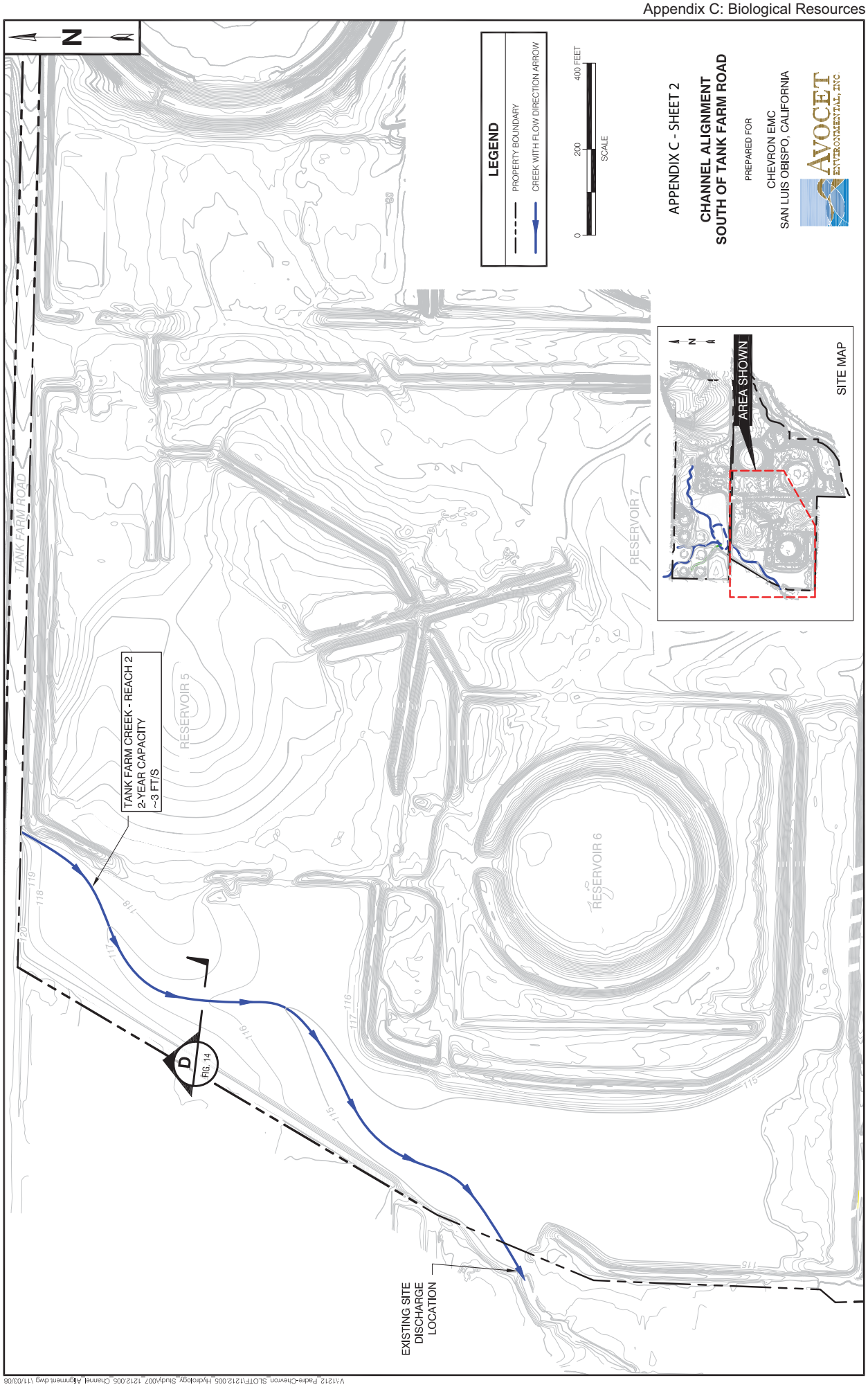

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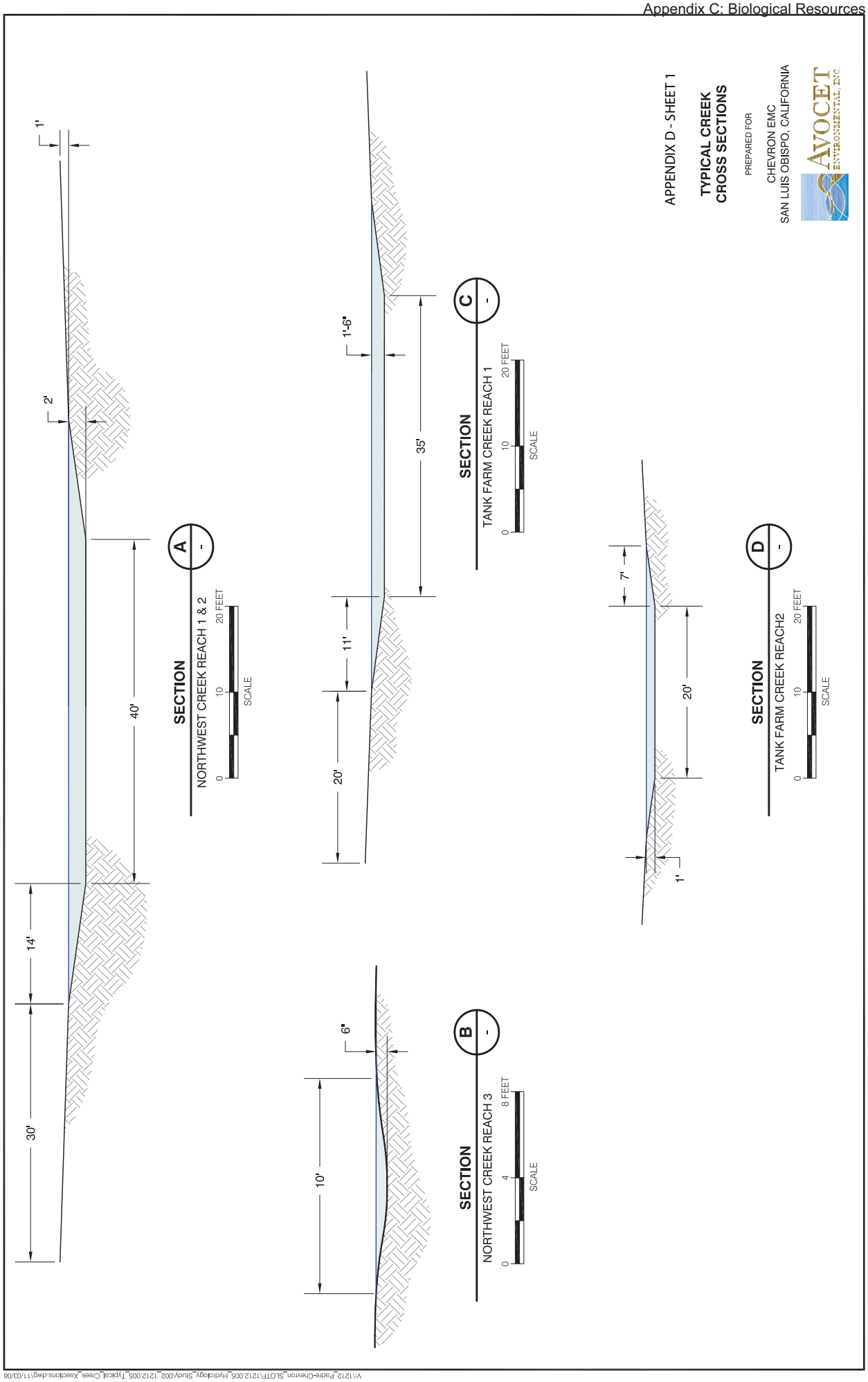
APPENDIX D

North Marsh-Tank Farm Creek Channel Cross Section Construction Drawings
SLO Tank Farm Landscape Restoration Design



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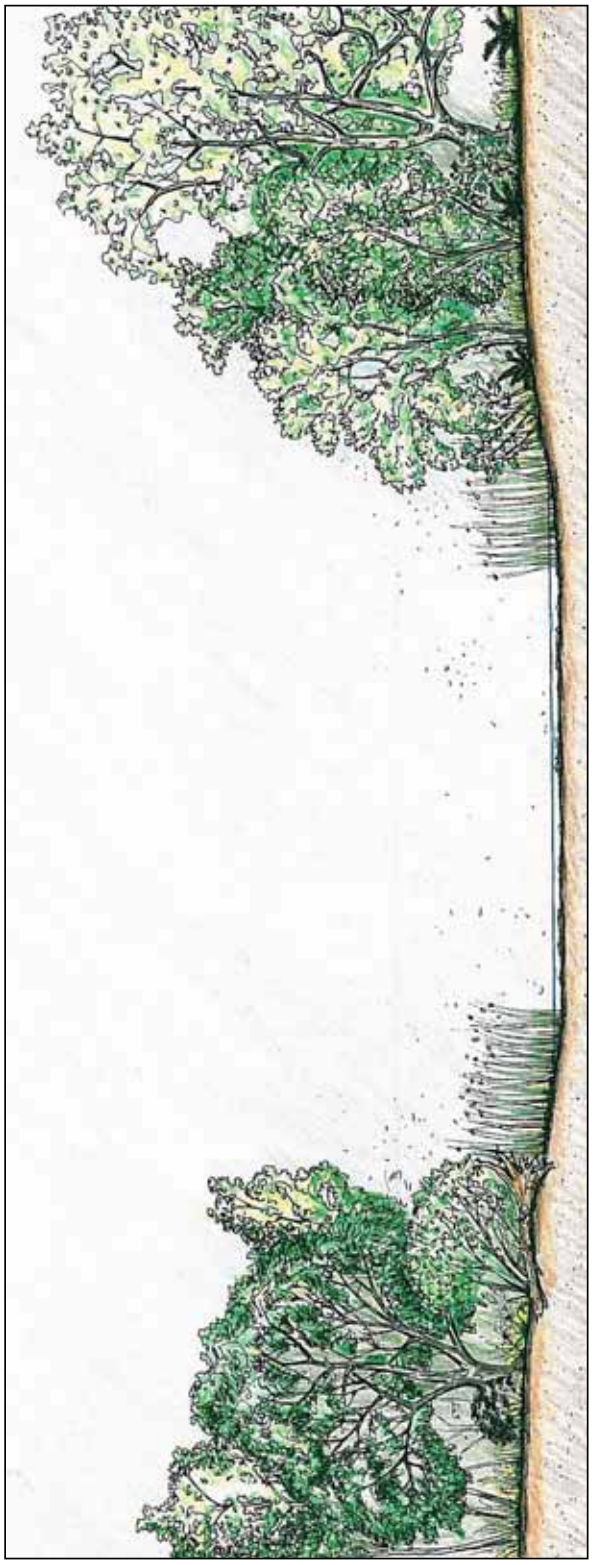
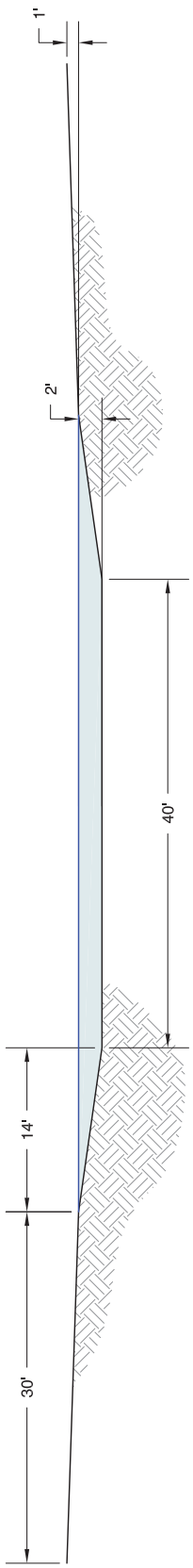




APPENDIX D - SHEET 2

TYPICAL CREEK CROSS SECTION
SECTION A

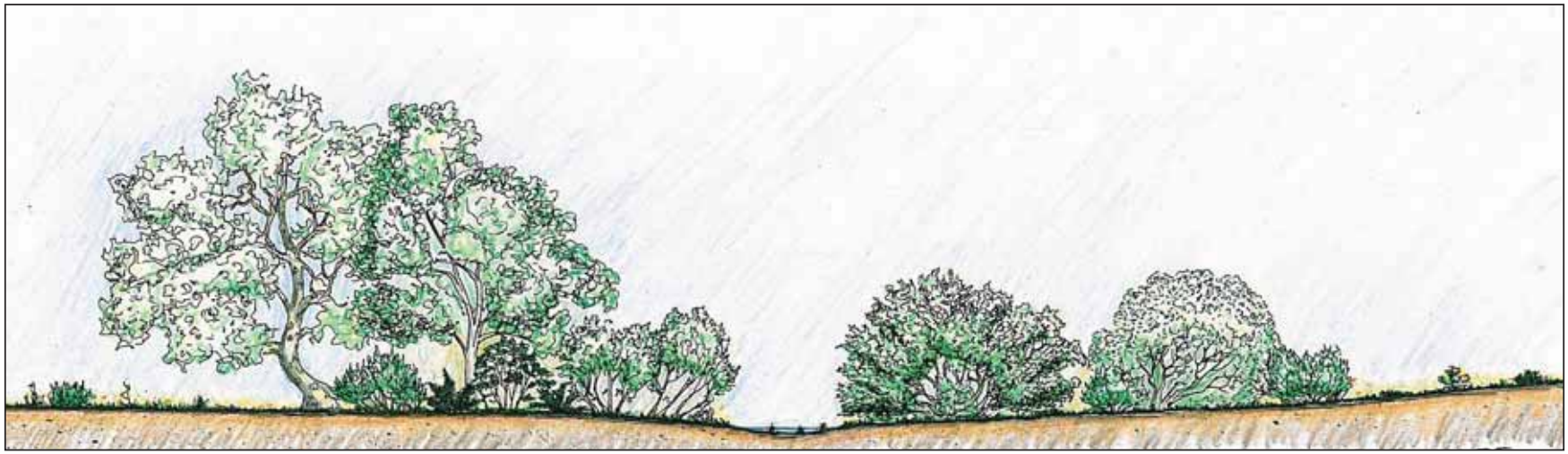
PREPARED FOR

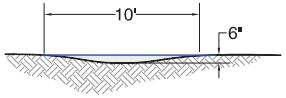
CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA

SECTION
NORTHWEST CREEK REACH 1 & 2

A
-

0 10 20 FEET
SCALE





SECTION B
NORTHWEST CREEK REACH 3 -

0 4 8 FEET
SCALE

APPENDIX D - SHEET 3

TYPICAL CREEK CROSS SECTION
SECTION B

PREPARED FOR

CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA

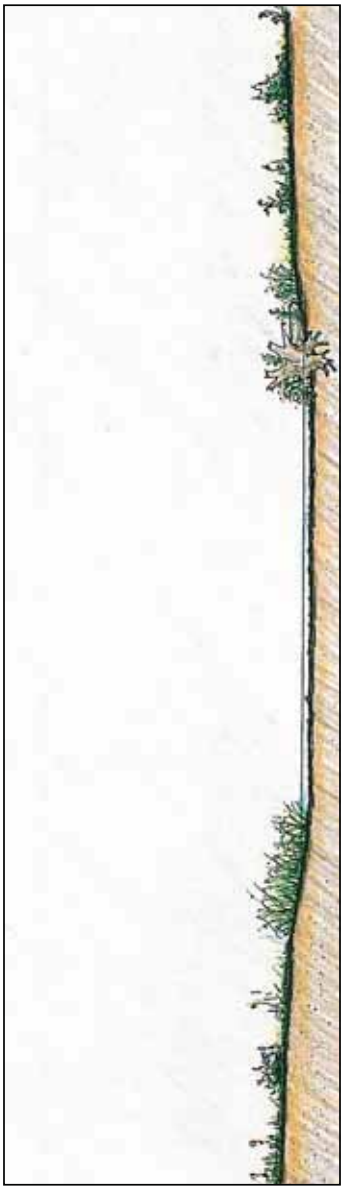
WSP

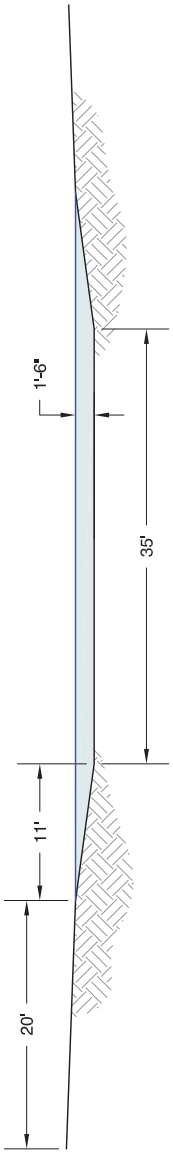
APPENDIX D - SHEET 4

TYPICAL CREEK CROSS SECTION
SECTION C

PREPARED FOR

CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA

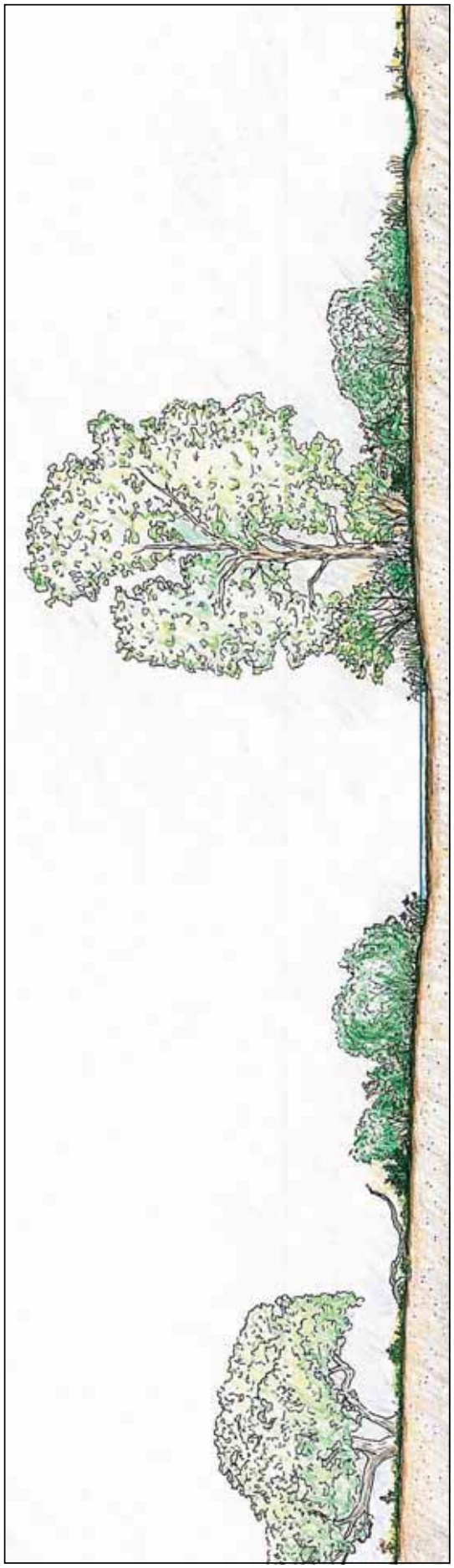


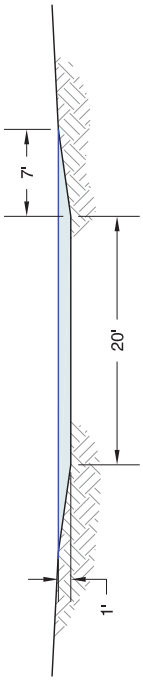


SECTION
TANK FARM CREEK REACH 1

C
-

0 10 20 FEET
SCALE





SECTION D -
TANK FARM CREEK REACH2

0 10 20 FEET
SCALE

APPENDIX D - SHEET 5

TYPICAL CREEK CROSS SECTION
SECTION D

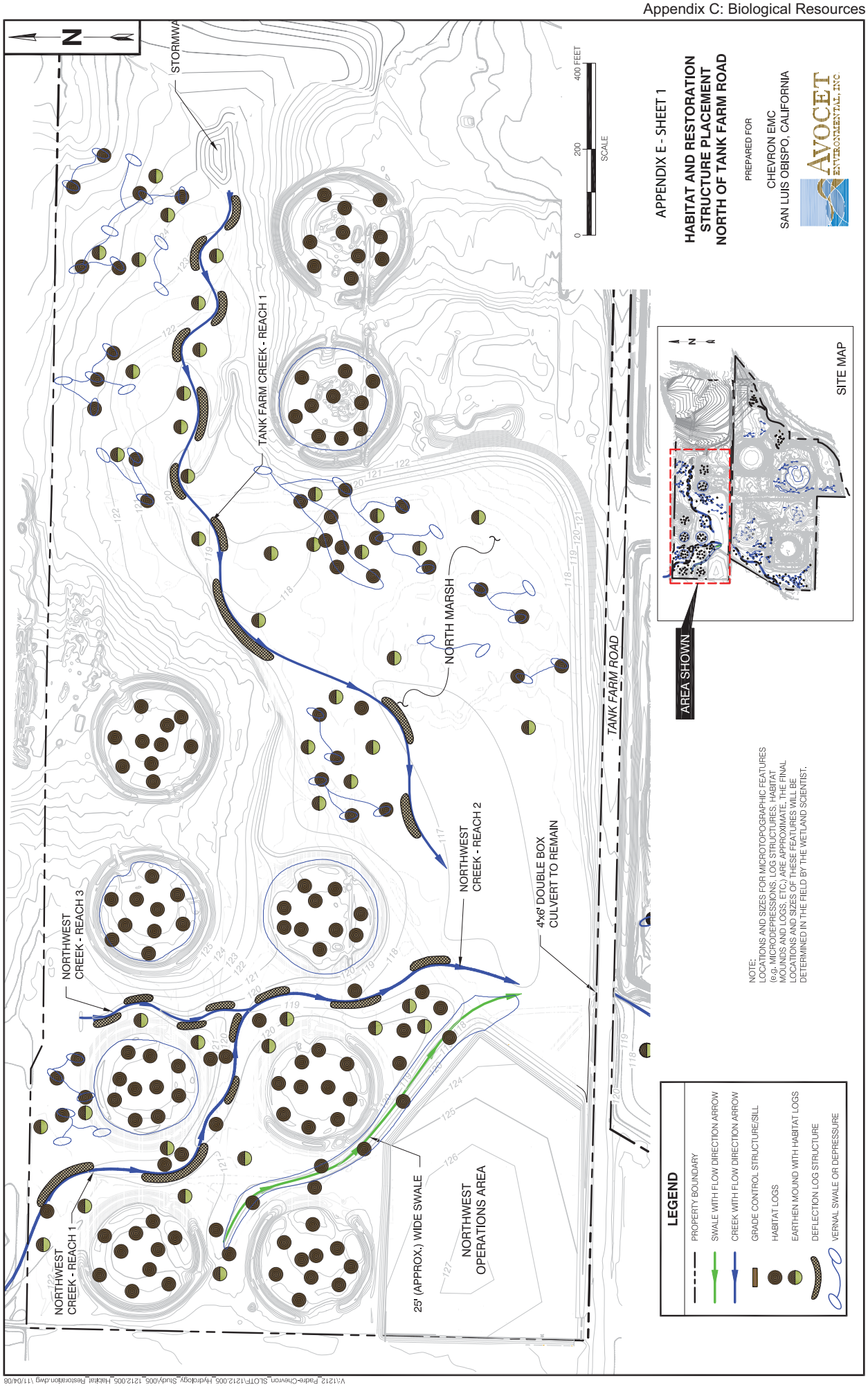
PREPARED FOR

CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA

WSP

APPENDIX E

Habitat and Restoration Structures Construction Drawings
SLO Tank Farm Landscape Restoration Design



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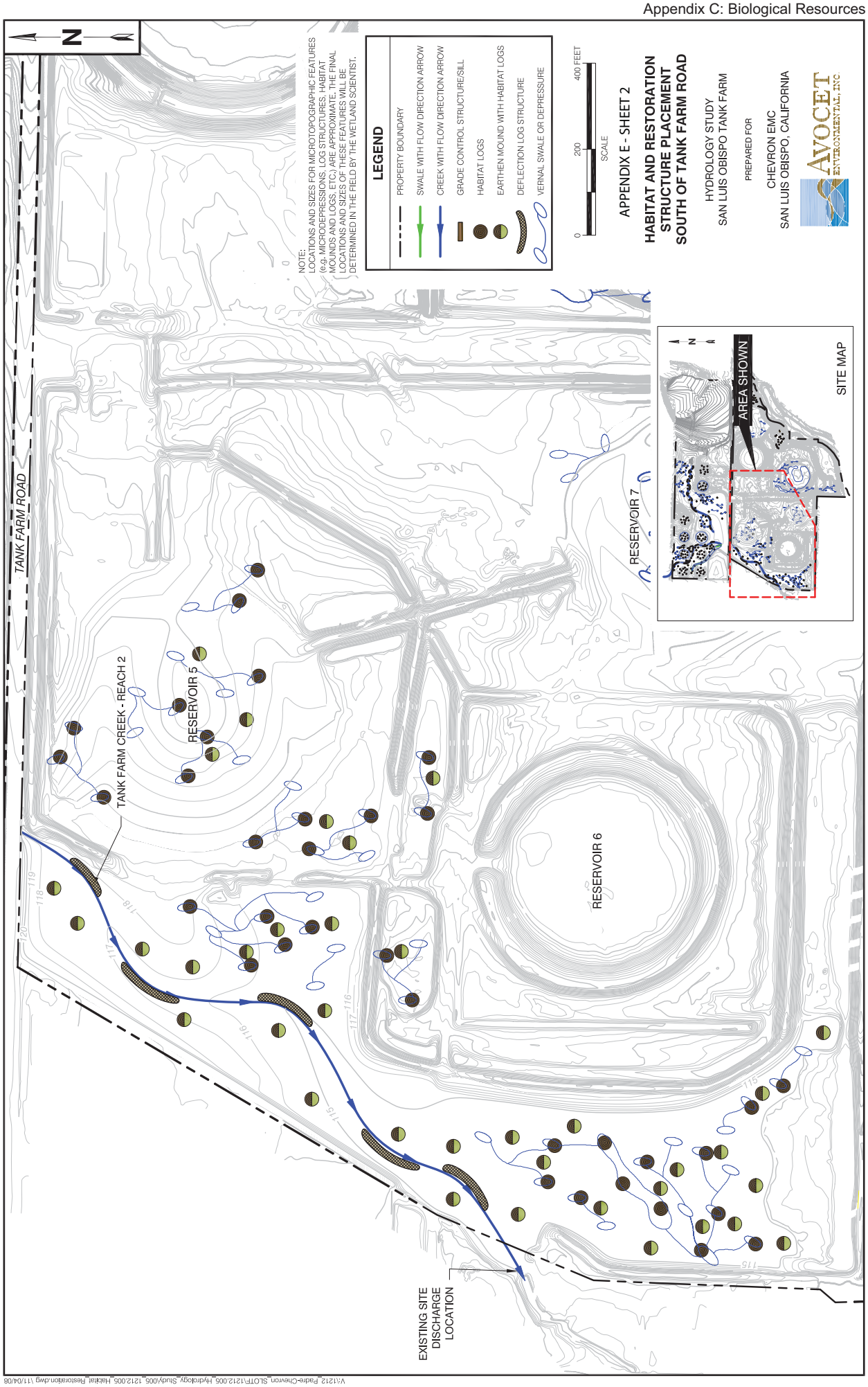
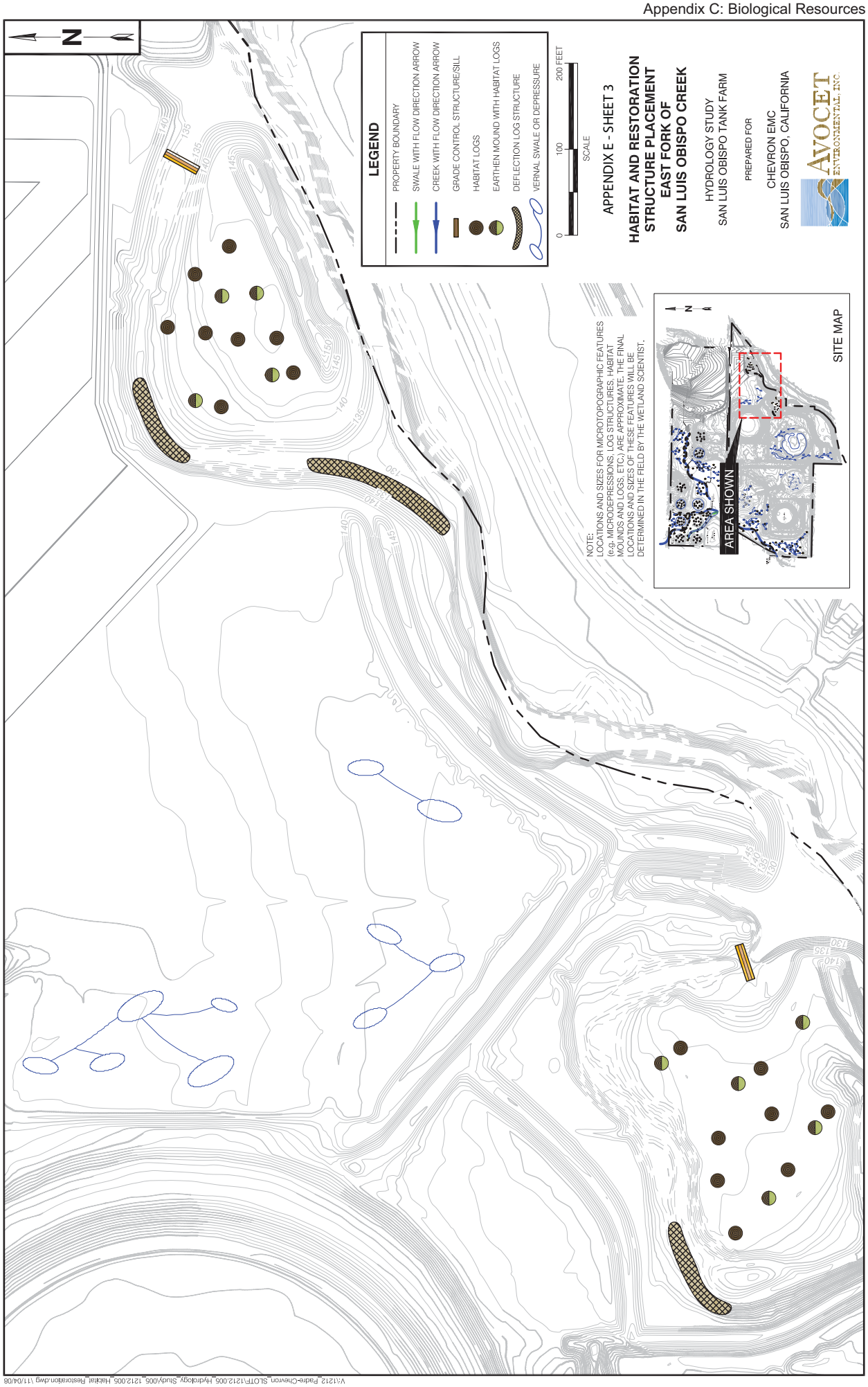

N
TANK FARM ROAD
TANK FARM CREEK - REACH 2
RESERVOIR 5
RESERVOIR 6
RESERVOIR 7
EXISTING SITE DISCHARGE LOCATION
NOTE:
LOCATIONS AND SIZES FOR MICROTOPOGRAPHIC FEATURES (e.g. MICRODEPRESSIONS, LOG STRUCTURES, HABITAT MOUNDS AND LOGS, ETC.) ARE APPROXIMATE. THE FINAL LOCATIONS AND SIZES OF THESE FEATURES WILL BE DETERMINED IN THE FIELD BY THE WETLAND SCIENTIST.
LEGEND
PROPERTY BOUNDARY
SWALE WITH FLOW DIRECTION ARROW
CREEK WITH FLOW DIRECTION ARROW
GRADE CONTROL STRUCTURE/SILL
HABITAT LOGS
EARTHEN MOUND WITH HABITAT LOGS
DEFLECTION LOG STRUCTURE
VERNAL SWALE OR DEPRESSURE
0
200
400 FEET
SCALE
APPENDIX E - SHEET 2
HABITAT AND RESTORATION STRUCTURE PLACEMENT SOUTH OF TANK FARM ROAD
HYDROLOGY STUDY
SAN LUIS OBISPO TANK FARM
PREPARED FOR
CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA
AVOCET ENVIRONMENTAL, INC.
AREA SHOWN
SITE MAP


N
LEGEND
PROPERTY BOUNDARY
SWALE WITH FLOW DIRECTION ARROW
CREEK WITH FLOW DIRECTION ARROW
GRADE CONTROL STRUCTURE/SILL
HABITAT LOGS
EARTHEN MOUND WITH HABITAT LOGS
DEFLECTION LOG STRUCTURE
VERNAL SWALE OR DEPRESSURE
0
100
200 FEET
SCALE
APPENDIX E - SHEET 3
HABITAT AND RESTORATION STRUCTURE PLACEMENT EAST FORK OF SAN LUIS OBISPO CREEK
HYDROLOGY STUDY
SAN LUIS OBISPO TANK FARM
PREPARED FOR
CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA
AVOCET ENVIRONMENTAL, INC.
NOTE:
LOCATIONS AND SIZES FOR MICROTOPOGRAPHIC FEATURES (e.g. MICRODEPRESSIONS, LOG STRUCTURES, HABITAT MOUNDS AND LOGS, ETC.) ARE APPROXIMATE. THE FINAL LOCATIONS AND SIZES OF THESE FEATURES WILL BE DETERMINED IN THE FIELD BY THE WETLAND SCIENTIST.
AREA SHOWN
SITE MAP
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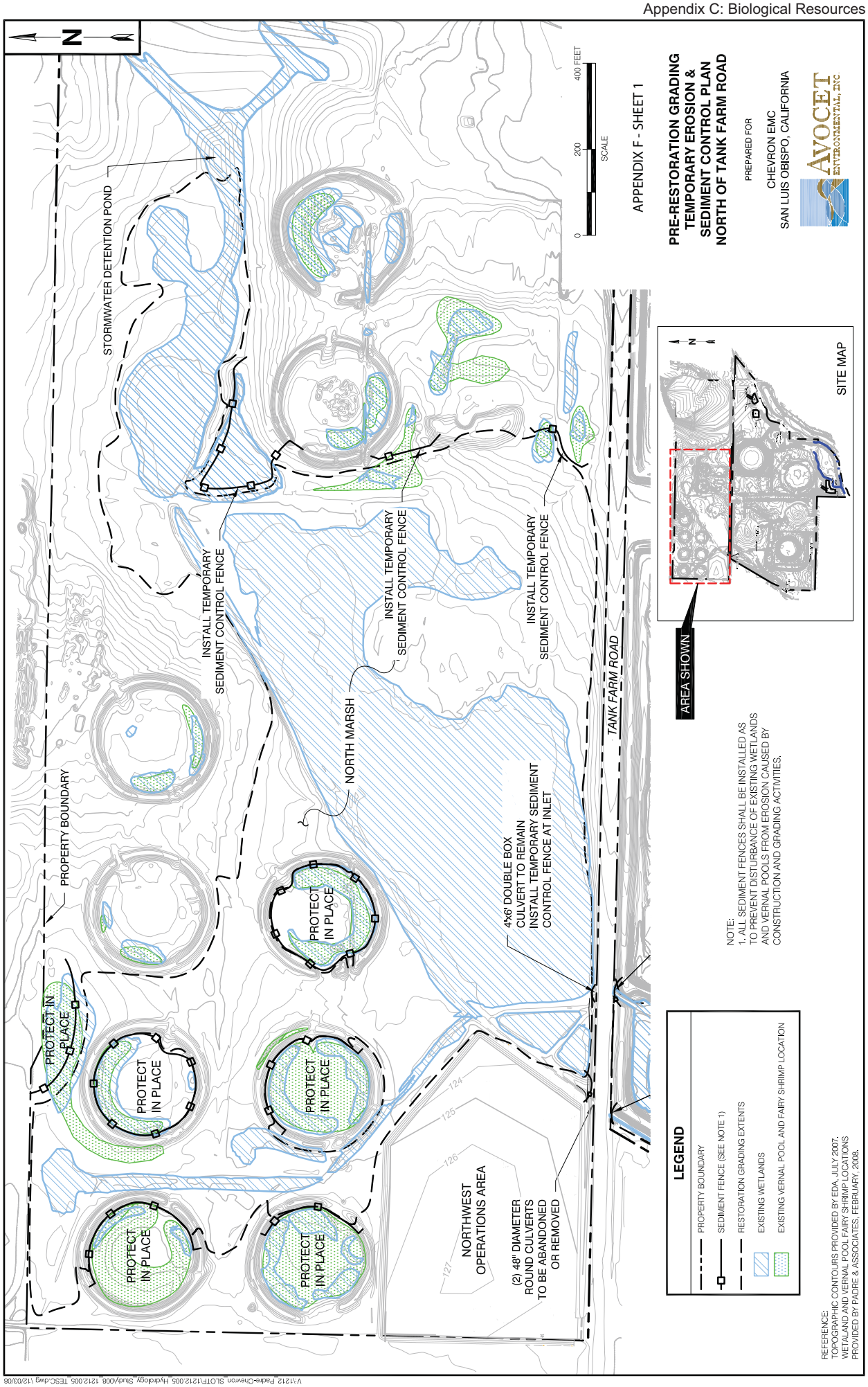
APPENDIX F

Pre-Restoration Grading
Temporary Erosion & Sediment Control Plan
SLO Tank Farm Landscape


N
STORMWATER DETENTION POND
PROPERTY BOUNDARY
INSTALL TEMPORARY SEDIMENT CONTROL FENCE
INSTALL TEMPORARY SEDIMENT CONTROL FENCE
INSTALL TEMPORARY SEDIMENT CONTROL FENCE
NORTH MARSH
PROTECT IN PLACE
PROTECT IN PLACE
PROTECT IN PLACE
PROTECT IN PLACE
PROTECT IN PLACE
PROTECT IN PLACE
4'x6' DOUBLE BOX CULVERT TO REMAIN
INSTALL TEMPORARY SEDIMENT CONTROL FENCE AT INLET
TANK FARM ROAD
NORTHWEST OPERATIONS AREA
(2) 48" DIAMETER ROUND CULVERTS TO BE ABANDONED OR REMOVED
127
126
125
124
0
200
400 FEET
SCALE
APPENDIX F - SHEET 1
PRE-RESTORATION GRADING
TEMPORARY EROSION &
SEDIMENT CONTROL PLAN
NORTH OF TANK FARM ROAD
PREPARED FOR
CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA
AVOCET
ENVIRONMENTAL, INC.
AREA SHOWN
SITE MAP
NOTE:
1. ALL SEDIMENT FENCES SHALL BE INSTALLED AS TO PREVENT DISTURBANCE OF EXISTING WETLANDS AND VERNAL POOLS FROM EROSION CAUSED BY CONSTRUCTION AND GRADING ACTIVITIES.
LEGEND
PROPERTY BOUNDARY
SEDIMENT FENCE (SEE NOTE 1)
RESTORATION GRADING EXTENTS
EXISTING WETLANDS
EXISTING VERNAL POOL AND FAIRY SHRIMP LOCATION
REFERENCE:
TOPOGRAPHIC CONTOURS PROVIDED BY EDA, JULY 2007.
WETLAND AND VERNAL POOL FAIRY SHRIMP LOCATIONS PROVIDED BY PADRE & ASSOCIATES, FEBRUARY, 2008.
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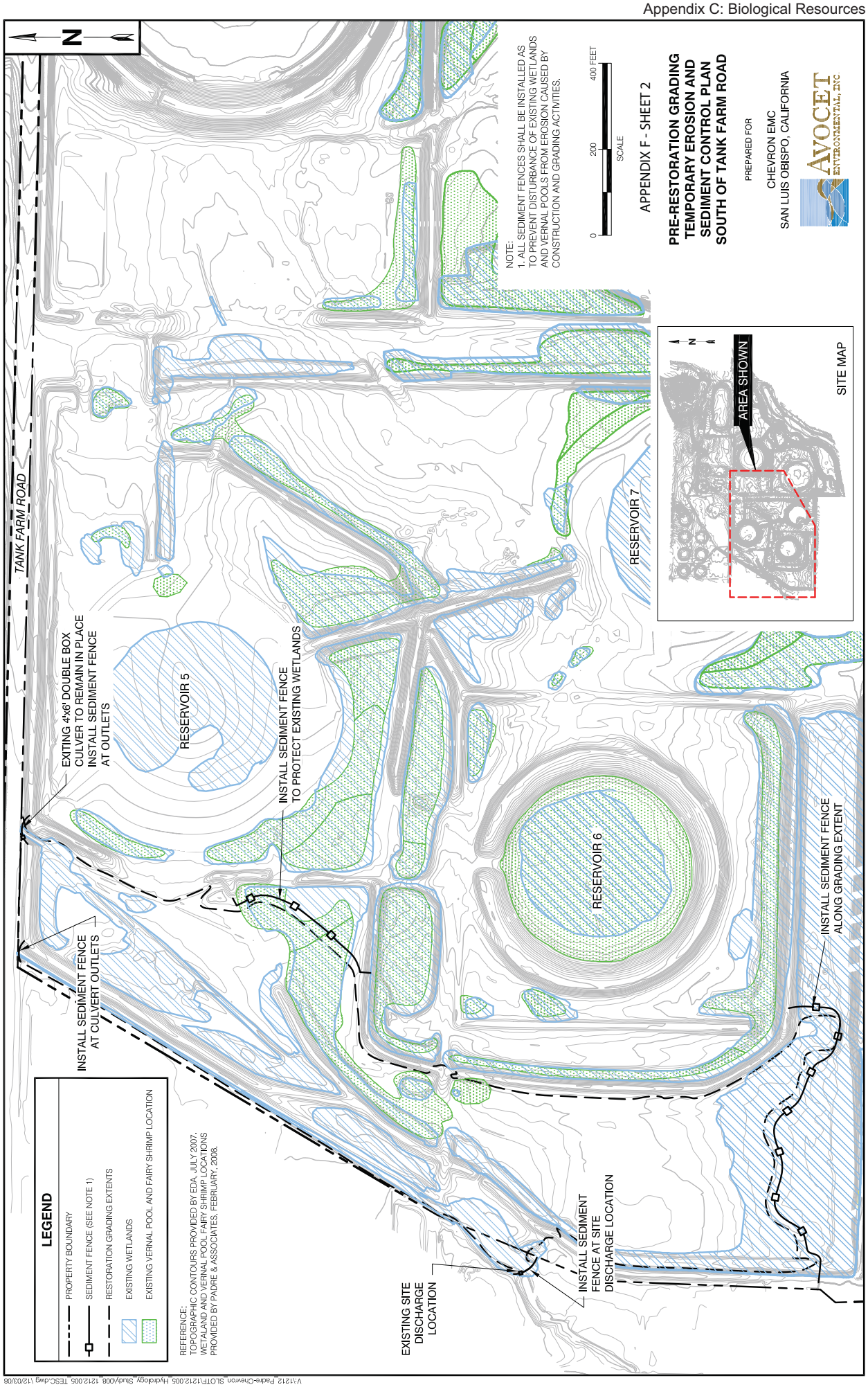
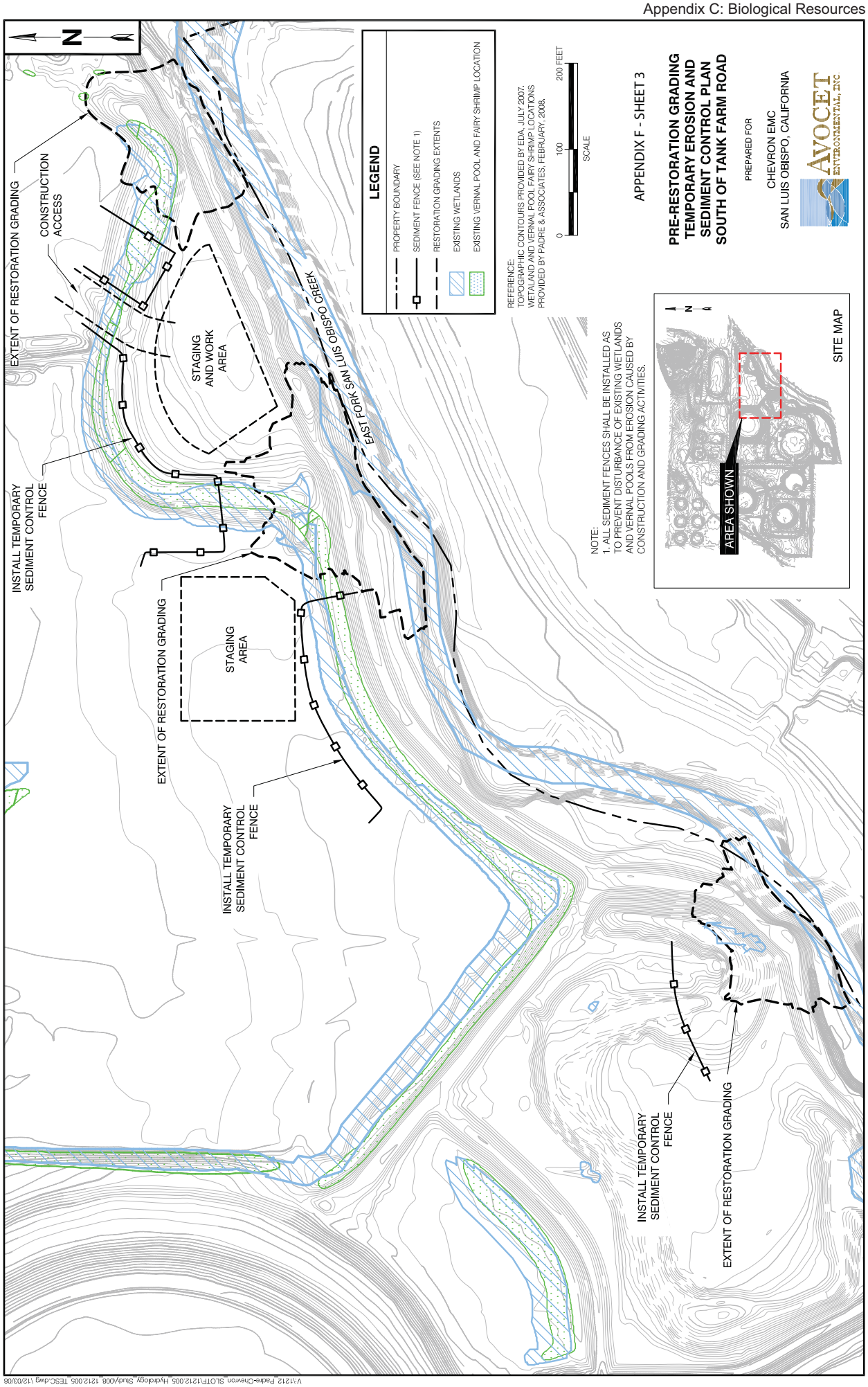
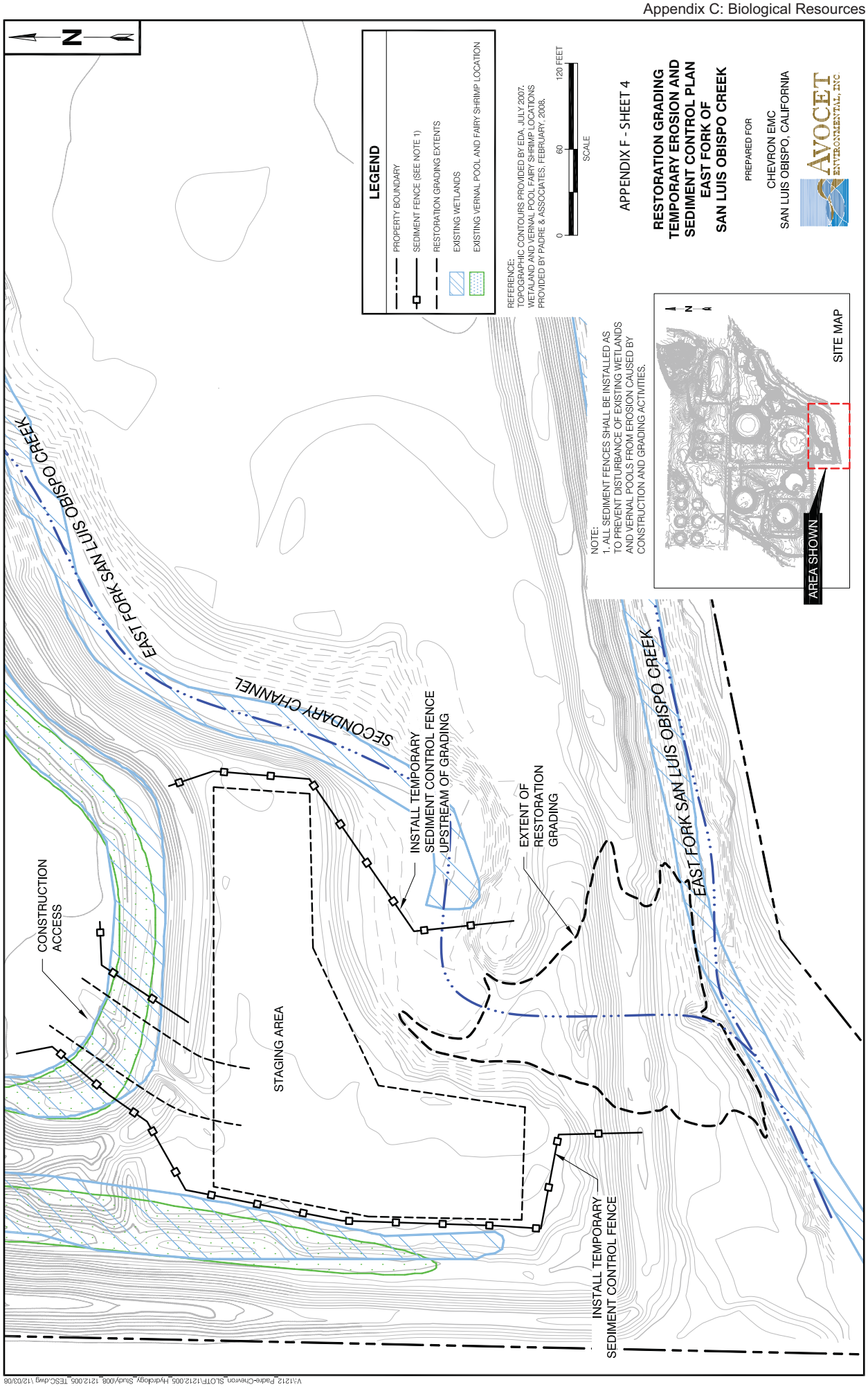

N
TANK FARM ROAD
EXITING 4'x6' DOUBLE BOX CULVER TO REMAIN IN PLACE INSTALL SEDIMENT FENCE AT OUTLETS
RESERVOIR 5
INSTALL SEDIMENT FENCE TO PROTECT EXISTING WETLANDS
RESERVOIR 6
RESERVOIR 7
INSTALL SEDIMENT FENCE AT CULVERT OUTLETS
INSTALL SEDIMENT FENCE ALONG GRADING EXTENT
INSTALL SEDIMENT FENCE AT SITE DISCHARGE LOCATION
EXISTING SITE DISCHARGE LOCATION
LEGEND
PROPERTY BOUNDARY
SEDIMENT FENCE (SEE NOTE 1)
RESTORATION GRADING EXTENTS
EXISTING WETLANDS
EXISTING VERNAL POOL AND FAIRY SHRIMP LOCATION
REFERENCE:
TOPOGRAPHIC CONTOURS PROVIDED BY EDA, JULY 2007.
WETALAND AND VERNAL POOL FAIRY SHRIMP LOCATIONS PROVIDED BY PADRE & ASSOCIATES, FEBRUARY, 2008.
NOTE:
1. ALL SEDIMENT FENCES SHALL BE INSTALLED AS TO PREVENT DISTURBANCE OF EXISTING WETLANDS AND VERNAL POOLS FROM EROSION CAUSED BY CONSTRUCTION AND GRADING ACTIVITIES.
0
200
400 FEET
SCALE
APPENDIX F - SHEET 2
PRE-RESTORATION GRADING TEMPORARY EROSION AND SEDIMENT CONTROL PLAN SOUTH OF TANK FARM ROAD
PREPARED FOR
CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA
AVOCET ENVIRONMENTAL, INC.
AREA SHOWN
SITE MAP
V:\1212_Padre-Chevron_SLO\F\1212.005_Hydrology_Study\008_1212.005_TESC.dwg \12/03/08


N
EXTENT OF RESTORATION GRADING
CONSTRUCTION ACCESS
INSTALL TEMPORARY SEDIMENT CONTROL FENCE
STAGING AND WORK AREA
EAST FORK SAN LUIS OBISPO CREEK
EXTENT OF RESTORATION GRADING
STAGING AREA
INSTALL TEMPORARY SEDIMENT CONTROL FENCE
INSTALL TEMPORARY SEDIMENT CONTROL FENCE
EXTENT OF RESTORATION GRADING
LEGEND
PROPERTY BOUNDARY
SEDIMENT FENCE (SEE NOTE 1)
RESTORATION GRADING EXTENTS
EXISTING WETLANDS
EXISTING VERNAL POOL AND FAIRY SHRIMP LOCATION
REFERENCE:
TOPOGRAPHIC CONTOURS PROVIDED BY EDA, JULY 2007.
WETALAND AND VERNAL POOL FAIRY SHRIMP LOCATIONS
PROVIDED BY PADRE & ASSOCIATES, FEBRUARY, 2008.
0
100
200 FEET
SCALE
NOTE:
1. ALL SEDIMENT FENCES SHALL BE INSTALLED AS TO PREVENT DISTURBANCE OF EXISTING WETLANDS AND VERNAL POOLS FROM EROSION CAUSED BY CONSTRUCTION AND GRADING ACTIVITIES.
N
AREA SHOWN
SITE MAP
APPENDIX F - SHEET 3
PRE-RESTORATION GRADING
TEMPORARY EROSION AND
SEDIMENT CONTROL PLAN
SOUTH OF TANK FARM ROAD
PREPARED FOR
CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA
AVOCET
ENVIRONMENTAL, INC.
V:\1212_Padre-Chevron_SLOTF\1212.005_Hydrology_Study\008_1212.005_TESC.dwg \12/03/08



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APPENDIX G

Plant Community Types for the SLO Tank Farm Landscape Restoration Design

APPENDIX G
PLANTING PLAN (75%)
PREPARED FOR
CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA
WSP
padre associates, inc.
ENGINEERS, GEOLOGISTS & ENVIRONMENTAL SCIENTISTS
STORMWATER OUTFALL/STILLING POND
TANK FARM ROAD
0 250 500 1,000 FEET
APPROXIMATE SCALE
LEGEND
Project Boundary
Stormwater Outfall/Stilling Pond
Terrestrial Forest Phreatophytic Woodland 4.02 Acres
Terrestrial Phreatophytic Forest Forb Field 26.97 Acres
Terrestrial Coastal Sage Chaparral 10.87 Acres
Terrestrial Forb Field 45.22 Acres
Palustrine Forest I - Mixed Broadleaf Deciduous Forest 9.56 Acres
Palustrine Forest II - Willow Sycamore Forest 7.63 Acres
Palustrine Forest III - CA Walnut Woodland 5.80 Acres
Palustrine Forest IV - Live Oak Riparian Woodland 3.20 Acres
Palustrine Scrub Shrub - Mixed Riparian Scrub Shrub 4.20 Acres
Palustrine Persistent Emergent - Mixed Bulrush 2.35 Acres
Palustrine Persistent Emergent - Riverine Perennial 1.05 Acres
Palustrine Non-Persistent Emergent - Vernal Depression 10.27 Acres
Palustrine Non-Persistent Emergent - Vernal Swale 1.61 Acres
91 Planting Area Number (see Appendix H for Acreage)
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Appendix G
Planting Polygon Communities and Acreages

Area Numbers	Plant Type	Acres
1	Terrestrial Phreatophytic Forest Forb Field	1.24
2	Palustrine Scrub Shrub Mixed Riparian Scrub Shrub	0.50
3	Palustrine Persistent Emergent Riverine Perennial	0.02
4	Palustrine Scrub Shrub Mixed Riparian Scrub Shrub	0.41
5	Palustrine Persistent Emergent Riverine Perennial	0.04
6	Palustrine Persistent Emergent Riverine Perennial	0.05
7	Palustrine Forest II Willow Sycamore Forest	0.41
8	Palustrine Forest I Mixed Broadleaf Deciduous Forest	0.65
9	Palustrine Persistent Emergent Riverine Perennial	0.04
10	Palustrine Scrub Shrub Mixed Riparian Scrub Shrub	0.15
11	Palustrine Persistent Emergent Riverine Perennial	0.14
12	Terrestrial Phreatophytic Forest Forb Field	0.36
13	Terrestrial Phreatophytic Woodland	0.46
14	Terrestrial Coastal Sage Chaparral	0.56
15	Palustrine Scrub Shrub Mixed Riparian Scrub Shrub	0.63
16	Terrestrial Phreatophytic Forest Forb Field	4.97
17	Terrestrial Phreatophytic Woodland	1.42
18	Terrestrial Coastal Sage Chaparral	0.73
19	Terrestrial Coastal Sage Chaparral	0.38
20	Terrestrial Phreatophytic Woodland	0.66
21	Palustrine Forest II Willow Sycamore Forest	0.74
22	Palustrine Persistent Emergent Mixed Bulrush	0.25
23	Terrestrial Coastal Sage Chaparral	0.39
24	Terrestrial Coastal Sage Chaparral	0.26
25	Terrestrial Phreatophytic Forest Forb Field	0.15
26	Terrestrial Coastal Sage Chaparral	0.20
27	Palustrine Scrub Shrub Mixed Riparian Scrub Shrub	0.33
28	Palustrine Forest II Willow Sycamore Forest	0.92
29	Palustrine Forest I Mixed Broadleaf Deciduous Forest	0.01
30	Palustrine Forest II Willow Sycamore Forest	0.01
31	Palustrine Scrub Shrub Mixed Riparian Scrub Shrub	0.31
32	Palustrine Persistent Emergent Riverine Perennial	0.08
33	Palustrine Forest I Mixed Broadleaf Deciduous Forest	1.22
34	Palustrine Persistent Emergent Riverine Perennial	0.06
35	Palustrine Forest II Willow Sycamore Forest	0.33
36	Palustrine Scrub Shrub Mixed Riparian Scrub Shrub	0.35
37	Palustrine Forest II Willow Sycamore Forest	0.69
38	Palustrine Persistent Emergent Riverine Perennial	0.10
39	Palustrine Forest I Mixed Broadleaf Deciduous Forest	0.54
40	Palustrine Persistent Emergent Mixed Bulrush	0.30
41	Palustrine Persistent Emergent Mixed Bulrush	1.80
42	Palustrine Forest III CA Walnut Woodland	0.67
43	Terrestrial Coastal Sage Chaparral	0.79

44	Palustrine Forest IV Live Oak Riparian Woodland	0.21
45	Palustrine Forest I Mixed Broadleaf Deciduous Forest	0.24
46	Palustrine Persistent Emergent Riverine Perennial	0.17
47	Palustrine Forest III CA Walnut Woodland	0.19
48	Palustrine Forest II Willow Sycamore Forest	0.16
49	Palustrine Scrub Shrub Mixed Riparian Scrub Shrub	0.24
50	Palustrine Forest II Willow Sycamore Forest	0.27
51	Palustrine Scrub Shrub Mixed Riparian Scrub Shrub	0.25
52	Palustrine Forest I Mixed Broadleaf Deciduous Forest	0.30
53	Palustrine Persistent Emergent Riverine Perennial	0.05
54	Palustrine Forest II Willow Sycamore Forest	0.37
55	Palustrine Forest IV Live Oak Riparian Woodland	0.62
56	Terrestrial Phreatophytic Forest Forb Field	0.68
57	Terrestrial Coastal Sage Chaparral	0.50
58	Palustrine Forest III CA Walnut Woodland	0.25
59	Palustrine Persistent Emergent Riverine Perennial	0.06
60	Palustrine Scrub Shrub Mixed Riparian Scrub Shrub	0.43
61	Palustrine Forest IV Live Oak Riparian Woodland	0.44
62	Palustrine Forest II Willow Sycamore Forest	0.37
63	Palustrine Forest I Mixed Broadleaf Deciduous Forest	0.20
64	Terrestrial Phreatophytic Forest Forb Field	1.06
65	Terrestrial Coastal Sage Chaparral	0.78
66	Terrestrial Phreatophytic Forest Forb Field	0.93
67	Terrestrial Coastal Sage Chaparral	1.10
68	Terrestrial Phreatophytic Forest Forb Field	0.90
69	Terrestrial Phreatophytic Forest Forb Field	1.21
70	Terrestrial Coastal Sage Chaparral	0.78
71	Terrestrial Phreatophytic Forest Forb Field	3.1
72	Terrestrial Phreatophytic Forest Forb Field	12.36
73	Terrestrial Coastal Sage Chaparral	4.40
74	Terrestrial Phreatophytic Woodland	0.86
75	Palustrine Forest I Mixed Broadleaf Deciduous Forest	1.44
76	Palustrine Forest II Willow Sycamore Forest	1.14
77	Palustrine Forest III CA Walnut Woodland	2.23
78	Palustrine Forest IV Live Oak Riparian Woodland	1.93
79	Palustrine Forest II Willow Sycamore Forest	0.53
80	Palustrine Forest I Mixed Broadleaf Deciduous Forest	4.18
81	Palustrine Forest II Willow Sycamore Forest	0.14
82	Terrestrial Phreatophytic Woodland	0.62
83	Palustrine Forest III CA Walnut Woodland	0.74
84	Palustrine Forest II Willow Sycamore Forest	1.01
85	Palustrine Persistent Emergent Riverine Perennial	0.22
86	Palustrine Forest I Mixed Broadleaf Deciduous Forest	0.32
87	Palustrine Scrub Shrub Mixed Riparian Scrub Shrub	0.28
88	Palustrine Forest II Willow Sycamore Forest	0.55
89	Palustrine Forest III CA Walnut Woodland	1.72
90	Palustrine Forest I Mixed Broadleaf Deciduous Forest	0.44
91	Palustrine Scrub Shrub Mixed Riparian Scrub Shrub	0.29

Appendix G-3

APPENDIX H

Planting Take-Offs for the SLO Tank Farm Landscape Restoration Design

Terrestrial I -Phreatophytic Woodland (Ter I - PW)

5 Polygons, 4.02 acres

Species	Density (# per acre)	On Center Spacing (ft)	Material	Area (acres)	Unit Total
Trees					
Aesculus californica	16	50, clumped	1 gal. pot	4.02	64
Platanus racemosa	16	50, clumped	1 gal. pot	4.02	64
Quercus agrifolia	16	50, clumped	1 gal. pot	4.02	64
Shrubs					
Baccharis pilularis	70	25	1 gal. pot	4.02	281
Eriophyllum confertifolium	70	25	1 gal. pot	4.02	281
Ribes sanguineum var. *glutinosum*	70	25	1 gal. pot	4.02	281
Symphoricarpos mollis	38	30	1 gal. pot	4.02	153
Vines					
Marah fabaceus	27	40	1 gal. pot	4.02	109
Graminoids					
Native grassland/wildflower seed mix	*53.5 lbs/acre*		seed		215 lbs
Bromus carinatus	10	65	1 gal. pot	4.02	40
Chlorogalum pomeridianum	9	70	1 gal. pot	4.02	36
Juncus patens	48	30	1 gal. pot	4.02	193
Nassella pulchra	48	30	1 gal. pot	4.02	193
Forbs					
Artemisia douglasiana	70	25	1 gal. pot	4.02	281
Scrophularia californica	70	25	1 gal. pot	4.02	281

Terrestrial II - Phreatophytic Forest Forb Field (Ter II - PFF)

11 Polygons, 27.74 acres

Species	Density (# per acre)	On Center Spacing (ft)	Material	Area (acres)	Unit Total
Trees					
Aesculus californica	8	75, clumped	1 gal. pot	27.74	222
Platanus racemosa	8	75, clumped	1 gal. pot	27.74	222
Quercus agrifolia	70	25, clumped	1 gal. pot	27.74	1,942
Shrubs					
Sambucus mexicana	48	30	1 gal. pot	27.74	1,332
Graminoids					
Native grassland/wildflower seed mix	*53.5 lbs/acre*		seed		1,484 lbs
Bromus carinatus	10	65	1 gal. pot	27.74	277
Calamagrostis koelerioides	70	25	1 gal. pot	27.74	1,942
Chlorogalum pomeridianum	10	65	1 gal. pot	27.74	277
Festuca californica	70	25	1 gal. pot	27.74	1,942
Hordeum brachyantherum spp. brachyantherum	70	25	1 gal. pot	27.74	1,942
Leymus triticoides	56	28	1 gal. pot	27.74	1,553
Nassella pulchra	76	24	1 gal. pot	27.74	2,108
Poa secunda ssp. secunda	56	28	1 gal. pot	27.74	1,553
Sisyrhynchium bellum	10	65	1 gal. pot	27.74	277
Forbs					
Calystegia subacaulis ssp. *episopalis*	70	25, clumped	1 gal. pot	27.74	1,942
Castilleja densiflora ssp. *obispoensis*	48	30	1 gal. pot	27.74	1,332

Terrestrial III - Coastal Sage Chapparal (Ter III - CSC)

12 Polygons, 10.88 acres

Species	Density (# per acre)	On Center Spacing (ft)	Material	Area (acres)	Unit Total
Shrubs					
Artemisia californica	1,031	6.5	1 gal. pot	10.88	11,217
Baccharis pilularis	436	10	1 gal. pot	10.88	4,744
Eriogonum fasciculatum	303	12	1 gal. pot	10.88	3,297
Eriophyllum confertifolium	222	14	1 gal. pot	10.88	2,415
Lotus scoparius	134	18	1 gal. pot	10.88	1,458
Mimulus aurantiacus	194	15	1 gal. pot	10.88	2,111
Rhamnus californica	70	25	1 gal. pot	10.88	762
Salivia mellifera	109	20	1 gal. pot	10.88	1,186
Sambucus mexicana	10	65	1 gal. pot	10.88	109
Graminoids					
Coastal sage scrub seed mix	*53.5 lbs/acre*		seed		582 lbs
Bromus carinatus	10	65	1 gal. pot	10.88	109
Chlorogalum pomeridianum	10	65	1 gal. pot	10.88	109
Festuca californica	10	65	1 gal. pot	10.88	109
Nassella pulchra	70	25	1 gal. pot	10.88	762

Terrestrial IV - Forb Field (Ter IV - PBG)

45.30 acres

Species	Density (# per acre)	On Center Spacing (ft)	Material	Area (acres)	Unit Total
Graminoids					
Native grassland/wildflower seed mix	*53.5 lbs/acre*		seed		2,423 lbs
Bromus carinatus	10	65	1 gal. pot	45.3	453
Calamagrostis koelerioides	70	25	1 gal. pot	45.3	3,171
Chlorogalum pomeridianum	10	65	1 gal. pot	45.3	453
Danthonia californica	70	25	1 gal. pot	45.3	3,171
Festuca californica	70	25	1 gal. pot	45.3	3,171
Hordeum brachyantherum spp. brachyantherum	70	25	1 gal. pot	45.3	3,171
Koeleria macrantha	70	25	1 gal. pot	45.3	3,171
Leymus triticoides	33	40	1 gal. pot	45.3	1,495
Nassella pulchra	76	24	1 gal. pot	45.3	3,443
Poa secunda ssp. secunda	36	35	1 gal. pot	45.3	1,631
Sisyrhynchium bellum	10	65	1 gal. pot	45.3	453
Forbs					
Achillea millifolium	10	65	1 gal. pot	45.3	453
Aesclepias acicularis	25	42	1 gal. pot	45.3	1,133
Calystegia subacaulis ssp. *episopalis*	127	18.5	1 gal. pot	45.3	5,753
Castilleja densiflora ssp. *obispoensis*	127	18.5, clumped	1 gal. pot	45.3	5,753
Clarkia bottae	25	42	1 gal. pot	45.3	1,133
Eschscholzia californica	25	42	1 gal. pot	45.3	1,133

APPENDIX H - SHEET 1

PLANT COMMUNITY TAKE-OFFS (75%)- TERRESTRIAL COMMUNITIES

PREPARED FOR

CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA

Palustrine Forest I - Mixed Broadleaved Deciduous Forest (PFI - MBDF)

11 polygons, 9.56 acres

Species	Density (# per acre)	On Center Spacing (ft)	Material	Area (acres)	Total
Trees					
Juglans californica var. californica	48	30	1 gal. pot	9.56	459
Platanus racemosa	70	25	1 gal. pot	9.56	669
Populus fremontii	48	30	1 gal. pot	9.56	459
Salix laevigata	48	30, clumped	1 gal. pot	9.56	459
Shrubs					
Heteromeles arbutifolia	36	35	1 gal. pot	9.56	344
Rhamnus californica	26	41	1 gal. pot	9.56	249
Ribes speciosum	25	42, clumped	1 gal. pot	9.56	239
Salix lasiolepis	25	42, clumped	1 gal. pot	9.56	239
Vines					
Clematis ligusticifolia	10	65	1 gal. pot	9.56	96
Graminoids					
Carex spissa	90	22	1 gal. pot	9.56	860
Juncus balticus	104	20.5	1 gal. pot	9.56	994
Juncus effusus var. *pacificus*	99	21	1 gal. pot	9.56	946
Scirpus microcarpus	121	19	1 gal. pot	9.56	1,157
Forbs					
Helenium puberulum	90	22	1 gal. pot	9.56	860
Hoita orbicularis	104	20.5	1 gal. pot	9.56	994
Oenanthe sarmentosa	104	20.5	1 gal. pot	9.56	994
Stachys bullata	99	21	1 gal. pot	9.56	946

Palustrine Forest II - Willow Sycamore Forest (PF II - WSF)

15 polygons, 7.59 acres

Species	Density (# per acre)	On Center Spacing (ft)	Material	Area (acres)	Total
Trees					
Platanus racemosa	50	29.5	1 gal. pot	7.59	380
Populus fremontii	60	27	1 gal. pot	7.59	455
Salix laevigata	48	30, clumped	1 gal. pot	7.59	364
Shrubs and Vines					
Heteromeles arbutifolia	36	35	1 gal. pot	7.59	273
Rhamnus californica	26	41	1 gal. pot	7.59	197
Salix lasiolepis	25	42, clumped	1 gal. pot	7.59	190
Vines					
Calystegia macrostegia ssp. intermedia	12	60	1 gal. pot	7.59	91
Clematis ligusticifolia	10	65	1 gal. pot	7.59	76
Graminoids					
Carex spissa	90	22	1 gal. pot	7.59	683
Juncus effusus var. *pacificus*	99	21	1 gal. pot	7.59	751
Scirpus microcarpus	121	19	1 gal. pot	7.59	918
Herbs					
Aster chilensis	90	22	1 gal. pot	7.59	683
Euthamia occidentalis	104	20.5	1 gal. pot	7.59	789
Oenanthe sarmentosa	104	20.5	1 gal. pot	7.59	789
Scrophularia californica	40	33	1 gal. pot	7.59	304
Stachys bullata	99	21	1 gal. pot	7.59	751
Forbs, Ferns, and Fern Allies					
Polystichum munitum	40	33	1 gal. pot	7.59	304

Palustrine Forest III - California Walnut Woodland (PF III - CWW)

6 polygons, 5.80 acres

Species	Density (#/ per acre)	On Center Spacing (ft)	Material	Area (acres)	Total
Trees					
Juglans californica var. californica	70	25	1 gal. pot	5.8	406
Quercus agrifolia	70	25	1 gal. pot	5.8	406
Shrubs					
Heteromeles arbutifolia	36	35	1 gal. pot	5.8	209
Rhamnus californica	26	41	1 gal. pot	5.8	151
Ribes speciosum	26	41	1 gal. pot	5.8	151
Rosa californica	60	27	1 gal. pot	5.8	348
Salix lasiolepis	104	20.5	1 gal. pot	5.8	603
Symphoricarpos mollis	90	22	1 gal. pot	5.8	522
Vines					
Lonicera hispidula var. vacillans	12	60	1 gal. pot	5.8	70
Graminoids					
Native grassland/wildflower seed mix	*53.5 lbs/acre*		seed		310 lbs.
Bromus carinatus	40	30	1 gal. pot	5.8	232
Juncus patens	25	42	1 gal. pot	5.8	145
Leymus triticoides	40	30	1 gal. pot	5.8	232
Forbs, Ferns, and Fern Allies					
Helenium puberulum	90	22	1 gal. pot	5.8	522
Stachys bullata	99	21	1 gal. pot	5.8	574
Polystichum munitum	48	30	1 gal. pot	5.8	278

Palustrine Forest IV - Live Oak Riparian Woodland (PF IV - LORW)

4 polygons, 3.20 acres

Species	Density (# per acre)	On Center Spacing (ft)	Material	Area (acres)	Total
Trees					
Acer macrophylla	70	25	1 gal. pot	3.2	224
Quercus agrifolia	70	25	1 gal. pot	3.2	224
Shrubs					
Heteromeles arbutifolia	36	35	1 gal. pot	3.2	115
Ribes speciosum	26	41	1 gal. pot	3.2	83
Rosa californica	60	27	1 gal. pot	3.2	192
Symphoricarpos mollis	90	22	1 gal. pot	3.2	288
Vines					
Calystegia macrostegia ssp. intermedia	20	47	1 gal. pot	3.2	64
Lonicera hispidula var. vacillans	12	60	1 gal. pot	3.2	38
Graminoids					
Native grassland/wildflower seed mix	*53.5 lbs/acre*		seed	3.2	171 lbs.
Bromus carinatus	40	30	1 gal. pot	3.2	128
Chlorogalum pomeridianum var. *divaricatum*	38	34	1 gal. pot	3.2	122
Elymus glaucus	40	30	1 gal. pot	3.2	128
Iris douglasiana	38	34	1 gal. pot	3.2	122

APPENDIX H - SHEET 2

PLANT COMMUNITY TAKE-OFFS (75%)- PALUSTRINE FOREST COMMUNITIES

PREPARED FOR

CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA

Palustrine Scrub-Shrub I - Mixed Riparian Scrub-Shrub (PSS II - MRSS)

12 polygons, 4.25 acres

Species	Density (# per acre)	On Center Spacing (ft)	Material	Area (acres)	Total
Shrubs					
Salix lasiolepis	104	20.5	1 gal. pot	4.25	442
Ribes speciosum	26	41	1 gal. pot	4.25	111
Sambucus racemosa var. *racemosa*	60	27	1 gal. pot	4.25	255
Vines					
Clematis ligusticifolia	20	47	1 gal. pot	4.25	85
Lonicera hispidula var. vacillans	12	60	1 gal. pot	4.25	51
Graminoids					
Iris douglasiana	38	34	1 gal. pot	4.25	162
Juncus patens	25	42	1 gal. pot	4.25	106
Forbs					
Artemisia douglasiana	194	15	1 gal. pot	4.25	825
Helenium puberulum	134	18	1 gal. pot	4.25	570
Oenanthe sarmentosa	194	15	1 gal. pot	4.25	825
Scrophularia californica	151	17	1 gal. pot	4.25	642
Ferns and Fern Allies					
Athyrium felix-femina	56	28	1 gal. pot	4.25	238
Polystichum munitum	34	36	1 gal. pot	4.25	145

Palustrine Persistent Emergent I - Mixed Bulrush (PPE I- MB)

3 polygons, 2.35 acres

Species	Density (# per acre)	On Center Spacing (ft)	Material	Area (acres)	Total
Graminoids					
Bolboschoenus robustus	681	8, clumped	1 gal. pot	2.35	1,600
Eleocharis macrostachya	1210	6, clumped	1 gal. pot	2.35	2,844
Schoenoplectus acutus var. occidentalis	1742	5	1 gal. pot	2.35	4,094
Schoenoplectus californica	1210	6, clumped	1 gal. pot	2.35	2,844
Forbs					
Helenium puberulum	104	20.5	1 gal. pot	2.35	244

Palustrine Persistent Emergent II - Riverine Perennial (PPE II- RP)

12 polygons, 1.05 acres

Species	Density (# per acre)	On Center Spacing (ft)	Material	Area (acres)	Total
Graminoids					
Juncus balticus	1742	5	1 gal. pot	1.05	1,829
Juncus effusus var. *pacificus*	1210	6, clumped	1 gal. pot	1.05	1,271
Scirpus microcarpus	681	8, clumped	1 gal. pot	1.05	715
Forbs					
Helenium puberulum	134	18	1 gal. pot	1.05	141
Hoita orbicularis	104	20.5	1 gal. pot	1.05	109
Potentilla anserina var. *pacifica*	681	8	1 gal. pot	1.05	715
Solanum douglasii	104	20.5	1 gal. pot	1.05	109
Stachys bullata	99	21	1 gal. pot	1.05	104

Palustrine Non-Persistent Emergent I - Vernal Pool (PNPEI - VRS)

10.27 acres

Species	Density (# per acre)	On Center Spacing (ft)	Material	Area (acres)	Total
Graminoids					
Eleocharis acicularis var. acicularis	4840	3	1 gal. pot	10.27	49,707
Juncus phaeocephalus	1210	6, clumped	1 gal. pot	10.27	12,427
Juncus tenuis	681	8	1 gal. pot	10.27	6,994
Juncus xiphioides	436	10, clumped	1 gal. pot	10.27	4,478
Forbs					
Blennospermum nana	0.1 lb/ac		seed	10.27	1.03 lbs.
Centromadia parryi ssp. *congdonii*	681	8	1 gal. pot	10.27	6,994
Downingia bicornuta	0.1 lb/ac		seed	10.27	1.03 lbs.
Downingia concolor	0.1 lb/ac		seed	10.27	1.03 lbs.
Eryngium aristulatum var. hooveri	2,723	4, clumped	1 gal. pot	0.02	54
Lasthenia fremontii	0.1 lb/ac		seed	10.27	1.03 lbs.
Lasthenia glabrata ssp. glabrata	0.1 lb/ac		seed	10.27	1.03 lbs.
Limnanthes douglasii ssp. douglasii	0.1 lb/ac		seed	10.27	1.03 lbs.
Plantago erecta	0.1 lb/ac		seed	10.27	1.03 lbs.
Psilocarphus brevissimus var. brevissimus	0.1 lb/ac		seed	10.27	1.03 lbs.

Palustrine Non-Persistent Emergent II - Vernal Swale (PNPEI - VS)

1.61 acres

Species	Density (# per acre)	On Center Spacing (ft)	Material	Area (acres)	Total
Graminoids					
Horedeum brachyantherum spp. brachyantherum	1742	5	1 gal. pot	1.61	2,805
Forbs					
Centromadia parryi ssp. *congdonii*	681	8	1 gal. pot	1.61	1,096
Downingia concolor	0.1 lb/ac		seed	1.61	0.16 lb
Eleocharis acicularis var. acicularis	4840	3	1 gal. pot	1.61	7,792
Eryngium aristulatum var. hooveri	2,723	4, clumped	1 gal. pot	0.02	54
Lasthenia glabrata ssp. glabrata	0.1 lb/ac		seed	1.61	0.16 lb
Layia fremontii	0.1 lb/ac		seed	1.61	0.16 lb
Limnanthes douglasii ssp. douglasii	0.1 lb/ac		seed	1.61	0.16 lb
Plantago erecta	0.1 lb/ac		seed	1.61	0.16 lb
Psilocarphus brevissimus var. brevissimus	0.1 lb/ac		seed	1.61	0.16 lb

APPENDIX H - SHEET 3

PLANT COMMUNITY TAKE-OFFS (75%): SCRUB-SHRUB AND EMERGENT COMMUNITIES

PREPARED FOR

CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA

CHEVRON EMC- SLO TANK FARM SITE
CALIFORNIA NATIVE GRASS & WILDFLOWER MIX

This is a mixture of annual and perennial wildflowers, and native perennial grasses are native to many zones of California, including the San Luis Obispo region. This specific mix may be used for as a portion of a native grassland or shrub mix. Irrigation will prolong bloom.

SPECIES- FORBS	COMMON NAME	BULK #'s/ACRE	MIN % PLS*
Bloomeria crocea	Golden Stars	0.50	70
Calochortus clavatus	Club haired mariposa lilly	0.50	50
Camissonia californica	California Primrose	0.25	80
Castilleja exserta	Owl's Clover	0.50	25
Clarkia amoena semi-dwarf	Farewell-to-Spring	1.00	80
Clarkia bottae	Showy clarkia	1.00	80
Collinsia heterophylla	Chinese Houses	1.00	85
Dichelostemma capitatum	Blue Dicks	0.50	80
Eriophyllum confertiflorum	Golden Yarrow	2.00	25
Eschscholzia californica	California Poppy	2.00	85
Lasthenia glabrata	GoldFields	1.50	85
Layia platyglossa	Tidy Tips	1.00	60
Lupinus bicolor	Dove lupine	3.00	80
Lupinus nanus	Sky Lupine	2.00	85
Lupinus succulentus	Arroyo Lupine	3.00	90
Mentzelia lindleyii	Lindley's Blazing Star	0.25	70
Nemophila menziesii	Baby Blue Eyes	1.00	75
Phacelia grandiflora	Big Flower Phacelia	0.50	70
Sisyrinchium bellum	Blue-eyed grass	1.00	60
		22.50	
NATIVE GRASSES:			
Bromus carinatus	California brome	4.00	60
Hordeum brachyantherum	Meadow barley	5.00	60
Koeleria macrantha	Junegrass	4.00	50
Leymus triticoides	Creeping wildrye	5.00	50
Nassella pulchra	Purple needlegrass	8.00	50
Poa secunda	Pine bluegrass	2.00	50
Vulpia microstachys	Small fescue	5.00	50
		33.00	

* MIN % PLS (Pure Live Seed) = Seed Purity x Germination Rate

Seeding rate: 55.50 lbs per acre
Height: 18-36 inches
Emergence: 15-21 days
Establishment: 120 days to 80% cover after emergence

COASTAL SAGE SCRUB MIX- CHEVRON EMC- TANK FARM SITE- SLO

This mix is specifically designed for native scrub restoration on this San Luis Obispo site. It is a blend of grasses, flowers and shrubs for revegetation of soil and slopes with plant types that belong here. There is a quick start grass to protect soil and allow slower perennials to provide their permanent cover in the years to come. Designed as a non-irrigated mix, irrigation will foster establishment and prolong the blooming period.

SPECIES	COMMON NAME	BULK #'s/ACRE	MIN % PLS*
Artemesia californica	California Sagebrush	2.00	10
Baccharis pilularis	Coyote bush	2.00	2
Camissonia californica	California Primrose	1.00	40
Collinsia heterophylla	Chinese Houses	2.00	85
Eriogonum fasciculatum	California Buckwheat	12.00	10
Eriophyllum confertiflorum	Golden Yarrow	3.00	25
Lasthenia glabrata	Goldfields	2.00	85
Lotus scoparius	Deerweed	8.00	85
Lupinus succulentus	Arroyo Lupine	4.00	90
Mimulus aurantiacus	Monkeyflower	2.00	2
Phacelia ramossisima	Branching phacelia	1.50	75
Rhamnus californica	Coffeeberry	1.50	20
Salvia mellifera	Black Sage	2.00	40
Sambucas mexicanum	Elderberry	2.00	60
Sisyrinchium bellum	Blue-eyed Grass	2.00	80
Vulpia microstachys	Small Fescue	6.00	85
		53.00	

* MIN % PLS (Pure Live Seed) = Seed Purity x Germination Rate

Seed: 53 lbs per acre
Height: 12-54 inches
Emergence: 10-20 days
Establishment: 50-70 days to 90% cover after emergence

APPENDIX H - SHEET 4

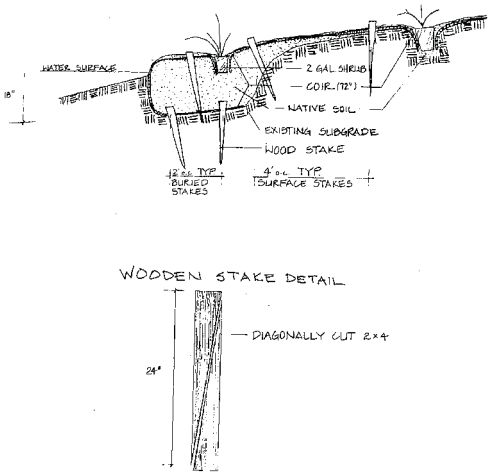
PLANT COMMUNITY TAKE-OFFS (75%): SEED MIXES

PREPARED FOR

CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA

APPENDIX I

Planting and Sediment & Erosion Control Typicals



COIR - SHRUB PLANTING DETAIL (1)
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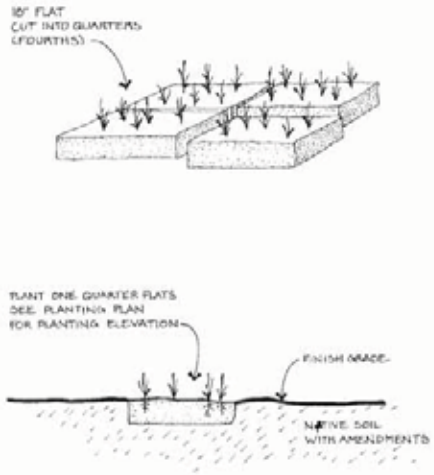

FLAT PLANTING DETAIL (2)
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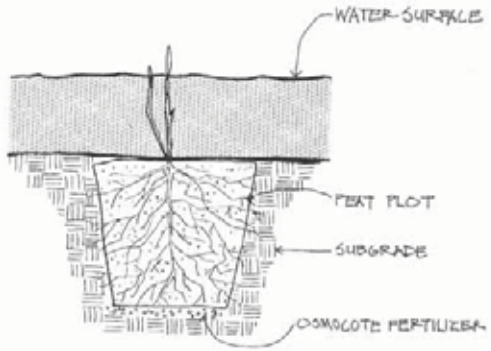

GRASSES, MARSH GRASSES
& EMERGENT MARSH PLANTING DETAIL (3)
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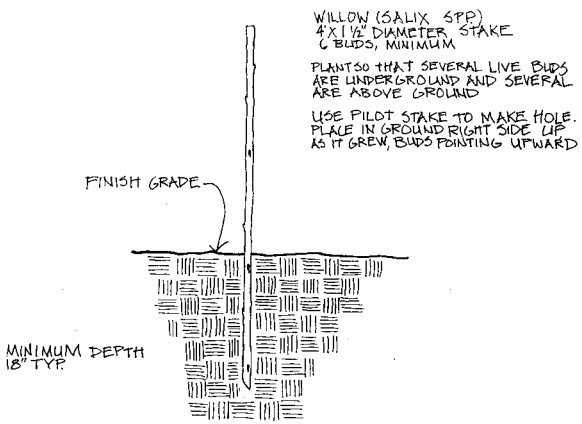

LIVE STAKE (CUTTING) DETAIL (4)
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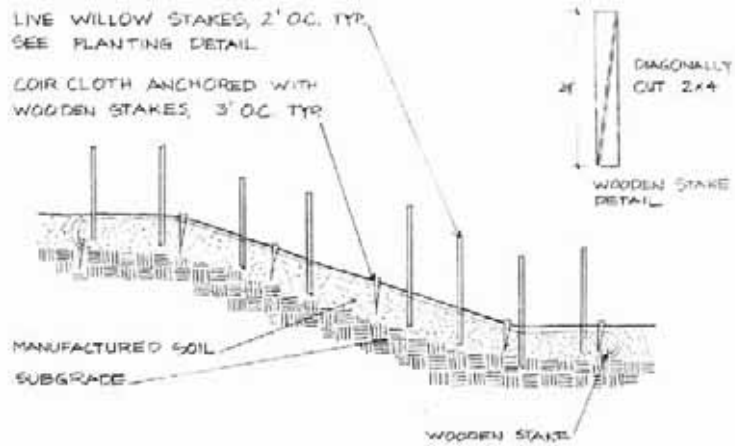

BIOENGINEERING DETAIL, 3:1 SLOPE TYP. (5)

APPENDIX I - SHEET 1

TYPICAL PLANTING DETAILS

PREPARED FOR

CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA

WSP

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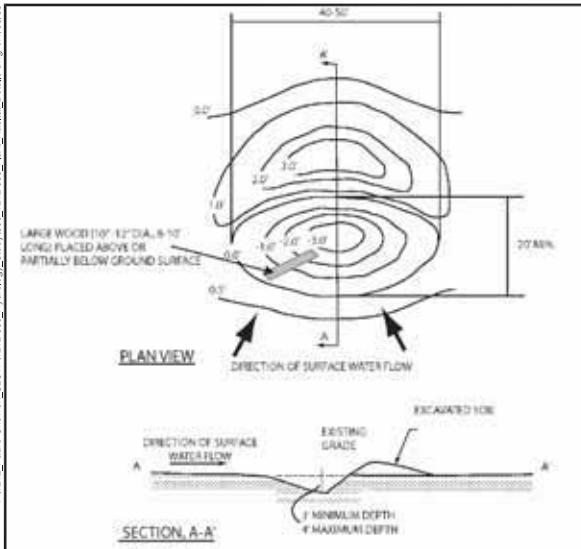
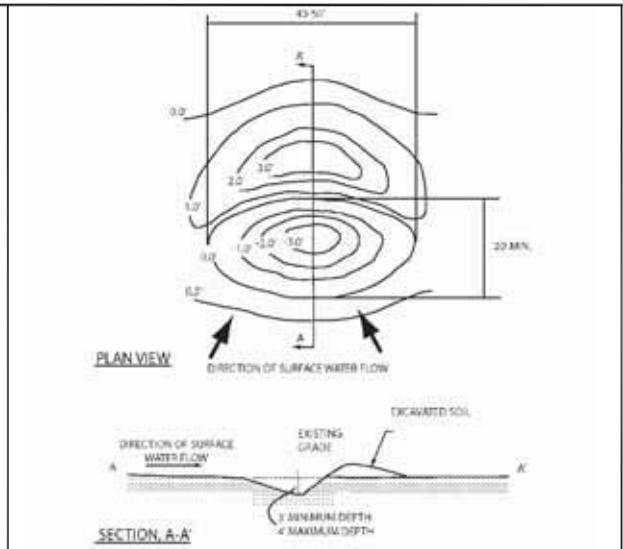


MICRODEPRESSION WITH BERM / WITH LARGE WOOD 6
Not to scale



MICRODEPRESSION WITH BERM / NO LARGE WOOD 7
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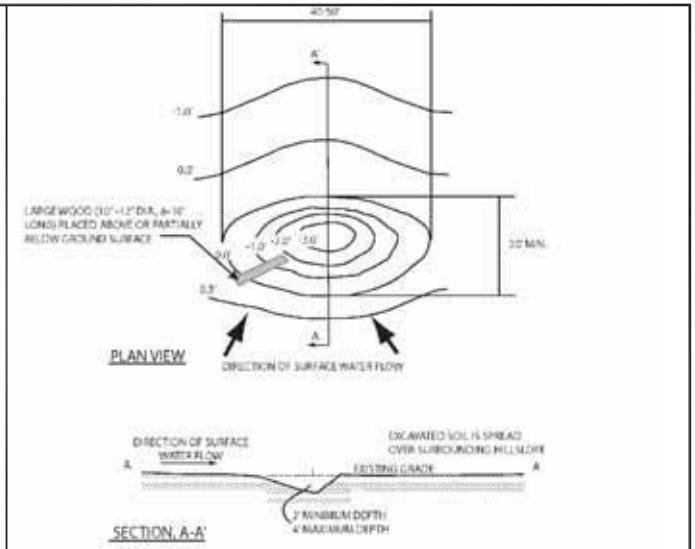

MICRODEPRESSION WITHOUT BERM / WITH LARGE WOOD 8
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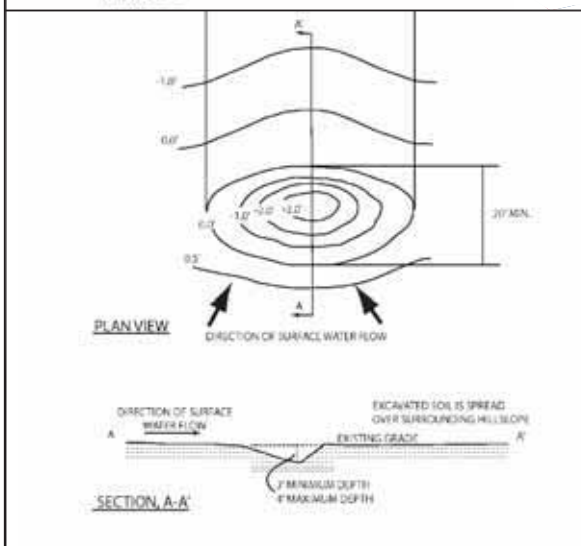

MICRODEPRESSION WITHOUT BERM / NO LARGE WOOD 9
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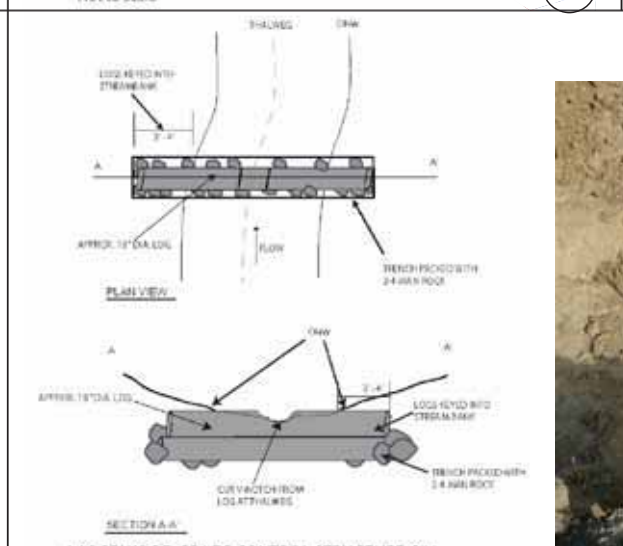

LARGE WOOD GRADE CONTROL STRUCTURE/SILL
PLAN VIEW 10
Not to Scale

APPENDIX I - SHEET 2

TYPICAL MICRODEPRESSION AND SILL DETAILS

PREPARED FOR

CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA

WSP

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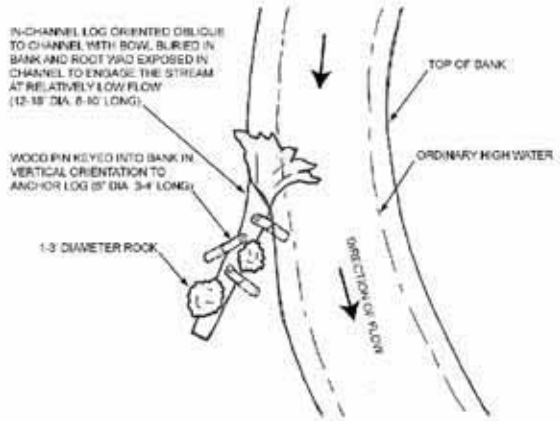
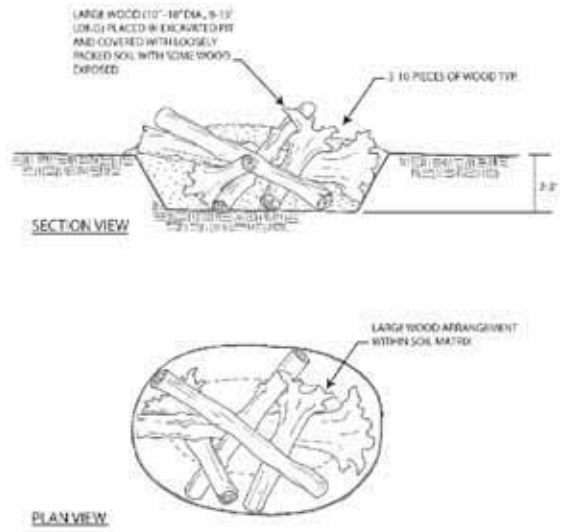


TYPICAL IN-CHANNEL DEFLECTION LOG PLACEMENT
PLAN VIEW
Not to Scale
11



WOOD MOUND
Not to scale
12

APPENDIX I - SHEET 3

TYPICAL IN-CHANNEL DEFLECTION LOG STRUCTURE AND WOOD MOUND DETAILS

PREPARED FOR

CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA

WSP

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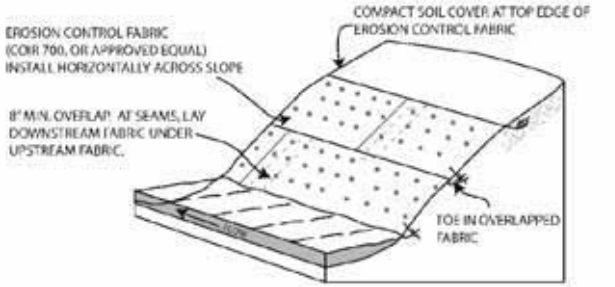
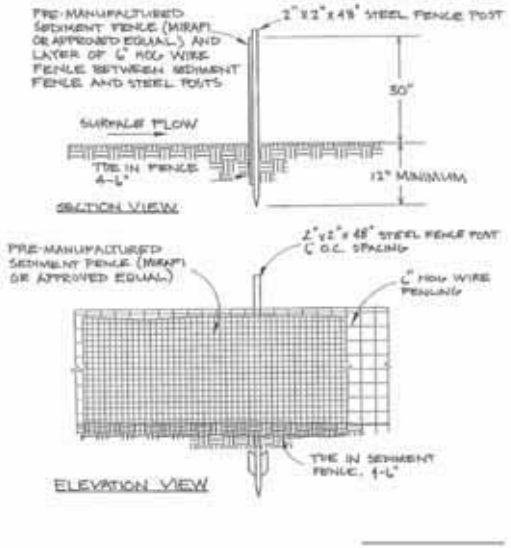


NOTES:
1. SLOPE SURFACE SHOULD BE FREE OF CLODS, STICKS, ROCKS, AND GRASS.
2. LAY EROSION CONTROL FABRIC LOOSELY AND STAKE TO MAINTAIN DIRECT CONTACT WITH THE SOIL. DO NOT STRETCH THE FABRIC.
3. INSTALL 2"X2"X24" LONG STAKES AT 4' O.C. PROVIDE STAKES ON ALL OVERLAPPING AREAS AND EXTEND STAKES 2-3' ABOVE THE SURFACE OF THE FABRIC.

EROSION CONTROL FABRIC INSTALLATION (STREAMBANK) 13

Not to Scale



HEAVY DUTY SEDIMENT FENCE 14

Not to Scale

APPENDIX I - SHEET 4

TYPICAL TEMPORARY EROSION CONTROL STRUCTURE DETAILS

PREPARED FOR

CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA

WSP

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APPENDIX J

Summary of Project Targets, Project Standards, Success Criteria, and Contingency Measures for the Slope-Riverine North Marsh/Tank Farm Creek and East Fork, San Luis Obispo Creek SLO Tank Farm Landscape Restoration

Appendix J. Summary of Project Targets, Project Standards, Success Critieria, and Contingency Measures for the SLO Tank Farm Slope-Riverine North Marsh/Tank Farm Creek Complex and East Fork, San Luis Obispo Creek Landscape Restoration

Functional Group	Project Targets	Project Standards/ Implementation Procedures	Success Criteria	Recommended Contingency Measures
Hydrology	**1. To the extent possible in current landscape contexts and considering current site potential(s), restore a riverine ecosystem with structure and functioning similar to intact reference system conditions.**	Establish and maintain a restored Tank Farm Creek channel system with water conveyance, energy dissipation, and storage structure and functioning as reflected in the design grades offered in the Construction Drawings	By end of monitoring period, bankfull width within ranges for given reaches: a) Northwest Creek Reach 1 and 2: 50-60 ft b) Northwest Creek Reach 3: 10-12 ft c) Tank Farm Creek Reach 1: 55-65 ft d) Tank Farm Creek Reach 2: 30-38 ft Bankfull depth within range of 1-2 ft. by end of monitoring period Mean longitudinal slope ranges from 0.5 and 1.0 % by end of monitoring period	Re-enter restoration site and re-grade banks to conform to original design criteria in construction drawings
		Reconnect two abandoned oxbows/secondary channels in the southeastern portion of the SLO Tank Farm site to the East Fork SLO Creek in a manner that engages flows into and through the oxbows at creek stages approximately 40% of the maximum height of the stage of the annual return flood	Oxbow/secondary channels are reconnected to East Fork, SLO Creek Oxbow/secondary channels engage between approximately 40% of the maximum height of the stage of the annual return flood	If channels fill with sediment from upgradient sources, re-enter restoration site and remove fill and return grade to design specifications
		Following remediation measures within the footprint of Reservoir 3, create a complex of shallow vernal depressions and swales that are	Constructed microtopographic features remain structurally stable along short and long axes throughout the life of the	If microtopographic features fill with sediment from upgradient sources, re-enter restoration site and

		linked hydrologically, at least seasonally during high water events	monitoring period, *i.e.*, maintain design cross sectional geometry as measured along long and short axes.	remove fill and return grade to design specifications. If microtopographic features scour deep beyond range of design criteria, re-enter restoration site and fill microtopography to return grade to design specifications
		Construct small and medium scale vernal depressions and swales in the areas proximate to Reservoirs 5 and 7	Constructed microtopographic features remain structurally stable along short and long axes throughout the life of the monitoring period, *i.e.*, maintain design cross sectional geometry as measured along long and short axes.	
		Install and maintain a suite of microtopographic features that include large wood structures, mounds, depressions, and single logs on the flood plain throughout the restored SLO Tank Farm landscape and as shown in the Construction Drawings. As possible, link small and medium scale vernal depressions and swales to one another and/or to adjacent riverine ecosystem.	Constructed microtopographic features remain structurally stable along short and long axes throughout the life of the monitoring period, *i.e.*, maintain design cross sectional geometry as measured along long and short axes.	
Biogeochemistry	**2. To the extent possible in the restored landscape, establish and maintain water contact with flood plain and waters/wetland surfaces.**	Maintain design grades to allow contact with flood plain and waters/wetlands surfaces.	No net decrease in flood plain and waters/wetland area subject to flooding, inundation or ponding.	
	3. To the extent possible in the restored landscape, manage water routing, conveyance, and storage to maintain low kinetic energy in flood waters and short and long duration residence time of waters on flood plain and waters/wetlands surfaces.	Maintain design routing, conveyance and storage features in the restored landscape.	Minimal erosion and/or sedimentation within the main water conveyance and storage features. Short duration (7-30 days) and long duration (>30 days) water storage in > 50% of design depressional features in most	

			(*i.e.*, > 50%) years.	
Native Plant Communities	**4. Establish and maintain diverse native plant community throughout the SLO Tank Farm restoration areas using a combination of live cuttings, nursery stock, and seeds genetically adapted to the project site.**	Restored plant community types develop into a plant community of viable, self-sustaining populations of native species that resist invasion by exotic plant species, in the absence of prolonged drought or non-natural perturbations that have the potential to reset plant community development.	Survivorship of nursery stock in forested and scrub-shrub community types: Survivorship between 70-80% by year five of the monitoring period. Survivorship of nursery stock in herbaceous community types: Survivorship between 70-80% by year five of the monitoring period. Percent cover of native tree species in riparian forest communities: Native tree cover ranges between 70 - 80% by the end of year 10 (end of monitoring period). Percent cover of native tree species in riparian scrub-shrub communities: Greater than or equal to 10% but less than 75% by the end of year 10 (end of monitoring period). Percent cover of native tree species in riparian herbaceous communities: Native tree cover ranges greater 0 but less than 10% by the end of year 10 (end of monitoring period). Percent cover of native shrub species in riparian forest communities: Native shrub species cover greater than or equal to 10% but less than 75%	Replant dead stock according to planting plan/construction drawings and specifications

			by the end of year 10 (end of monitoring period). Percent cover of native shrub species in riparian scrub-shrub communities: Native tree cover ranges between 70 and 80% by the end of year 10 (end of monitoring period). Percent cover of native shrub species in riparian herbaceous communities: Native shrub cover ranges greater than 0 but less than 10% by the end of year 10 (end of monitoring period). Percent litter/detritius in all plant community types: Greater than or equal to 65% of vegetation plots support autochonthonous litter by the end of year 10 (end of monitoring period). Vigor of planted stock: Greater than or equal to 80% of vegetation plots assessed qualitatively as "good" or "excellent" at end of monitoring period by the end of year 10 (end of monitoring period).	
Faunal Support/Habitat	**5. Increase vertical and horizontal complexity for native faunal species within the restored waters/wetlands ecosystem and its buffers.**	Restored community types develop along predicted successional pathways and are composed of viable, self-sustaining populations of native species that resist invasion by exotic plant species and that support a suite of vertebrate species typical of	Vegetative strata: Forest communities: Average of greater than or equal to three strata in vegetation plots (*i.e.*, trees, shrubs, herbs, with sapling/seedling and/or vines as additional stratum) by end of year 10 (end of monitoring	Determine cause of stalled plant community development and apply corrective measure, *e.g.,* remove non-native species and replant according to planting plan

		reference standard conditions - specifically, characteristic of the central coast of California.	period). Vegetative strata: Scrub-shrub communities: Average of greater than or equal to two strata in vegetation plots (*i.e.*, shrubs, herbs, with sapling/ seedling and/or vines as additional stratum) by the end of year 10 (end of monitoring period). Vegetative strata: Herbaceous communities: Average of two or fewer strata in vegetation plots by end of year 10 (end of monitoring period). Canopy cover: Greater than 80% cover in forested and scrub-shrub communities by the end of year 10 (end of monitoring period). Increase Plant Community Patch Size: Canopy coverage by native species ranges between 70-80% within in the 100 foot buffer for the restored creek channel system by the end of year 10 (end of monitoring period). Increase Habitat Patch Contiguity: Establish and maintain the design number of unbroken connections among habitat patches throughout the restored SLO Tank Farm landscape by the end of year 10 (end of monitoring period).	

APPENDIX K

Summary of Project Targets, Project Standards, Success Criteria, and Contingency Measures for the Uplands Ecosystems (Including Rare Plant Habitat) of the SLO Tank Farm Landscape Restoration

Appendix K. Summary of Project Targets, Project Standards, Success Critieria, and Contingency Measures for the Uplands (Including Rare Plant Habitats) SLO Tank Farm Landscape Restoration.

Functional Group	Project Targets	Project Standards/ Implementation Procedures	Success Criteria	Recommended Contingency Measures
Native Plant Communities	**1. Establish and maintain diverse native plant community throughout the restored SLO Tank Farm restoration areas using a combination of live cuttings, nursery stock, and seeds that are genetically adapted to the project site.**	Restored plant community types develop along predicted successsional pathways and are composed of viable, self-sustaining populations of native species as designed that resist invasion by exotic plant species.	Survivorship of nursery stock in herbaceous community types: Greater than or equal to 80% for the first five years of monitoring. Percent cover of native tree species in woodland communities: Greater than or equal to 75% by the end of year 10 (end of monitoring period) Percent cover of native tree species in forb field communities: Greater than or equal to 10% but less than 20% by the end of year 10 (end of monitoring period) Percent cover of native shrub species in woodland communities: Greater than or equal to 10% but less than 75% by the end of year 10 (end of monitoring period) Percent cover of native shrub species in scrub-shrub communities: Greater than or equal to 75% by the end of year 10 (end of monitoring period) Percent cover of native herbaceous species in woodland	Determine the cause of grade failure(s) and apply corrective action, *e.g.*, hydroseed to stabilize slopes, remove non-native weeds, change irrigation routine, modify grazing regime, institute controlled burn program

			and forb field communities: Greater than or equal to 90% by the end of year 10 (end of monitoring period) Vigor of planted stock: Greater than or equal to 80% of vegetation plots assessed qualitatively as "good" or "excellent" at end of monitoring period by the end of year 10 (end of monitoring period).	
	2. Establish self-sustaining populations of the seven rare plant species of conservation concern on the SLO Tank Farm.	Cambria morning glory, San Luis Obispo's owl's clover, Congdon's tarplant, San Luis Obispo serpentine Dudley, Hoover's button-celery, purple needlegrass, and California walnut establish populations across the SLO Tank Farm that are self-sustaining over the life of the monitoring period.	Survivorship. Greater than or equal to 90% survival of rare herbaceous and tree species by year 5. Reproduction: Seedling recruitment and establishment must occur at 1:1 replacement values or greater within each patch population by the end of the ten year monitoring effort.	Determine the cause of grade failure(s) and apply corrective action, *e.g.*, hydroseed to stabilize slopes, remove non-native weeds, change irrigation routine, modify grazing regime, institute controlled burn program
	3. Establish rare plant populations in the range of densities determined as reference standard	At minimum, maintain or increase the total number of rare plant population numbers.	Number of rare plant populations for each species of conservation concern does not fall below 5% of the target number during two consecutive monitoring years, nor below 2% of the target number by the end of the monitoring period	Determine the cause of grade failure(s) and apply corrective action, *e.g.*, hydroseed to stabilize slopes, remove non-native weeds, change irrigation routine, modify grazing regime, institute controlled burn program
		At minimum, maintain or increase population densities of rare plant populations at design levels.	Density of rare plant populations for each species of conservation concern does not fall below 5% of the target density during two consecutive monitoring years, nor below 2%	Determine the cause of grade failure(s) and apply corrective action, *e.g.*, hydroseed to stabilize slopes, remove non-native weeds, change irrigation

			of the target density by the end of the monitoring period	routine, modify grazing regime, institute controlled burn program
Faunal Support/Habitat	**4. Increase vertical and horizontal complexity for native faunal species within the restored terrestrial (uplands) plant community types**	Restored community types develop along predicted successional pathways and are composed of viable, self-sustaining populations of native species as designed that resist invasion by exotic plant species and that support a suite of vertebrate and invertebrate species (pollinators and fruit dispersers) that are potential flower visitors characteristic of the central coast of California.	Vegetative strata: Woodland and mixed hardwood forest forb field communities - Average of greater than or equal to three strata in vegetation plots (*i.e.*, trees, shrubs, herbs, with sapling/seedling and/or vines as additional stratum) by end of year 10 (end of monitoring period). Vegetative strata: Herbaceous communities – Average of two or fewer strata in vegetation plots by end of year 10 (end of monitoring period). Canopy cover: Greater than 80% cover by two or three strata in forest/woodland communities by the end of year 10 (end of monitoring period). In vegetation plots for rare plant populations, seed set is documented in more than greater than or equal to 75% of the individuals Reproduction: Seedling recruitment of rare plant species id documented and can be shown to replace planted stock at a 1:1 replacement ratio or better.	Determine the cause of grade failure(s) and apply corrective action, *e.g.*, hydroseed to stabilize slopes, remove non-native weeds, change irrigation routine, modify grazing regime, institute controlled burn program

APPENDIX L

Summary of Project Targets, Project Standards, Success Criteria, and Contingency Measures for the Vernal Depression and Swale Wetland Mosaic Complexes (Including Vernal Pool Fairy Shrimp [VPFS] Habitat) of the SLO Tank Farm Landscape Restoration

Appendix L. Summary of Project Targets, Project Standards, Success Critieria, and Contingency Measures for the Vernal Pool Endemics (VPEs) in the Vernal Depression and Swale Wetland Mosaic Complexes for the SLO Tank Farm Landscape Restoration.

Functional Group	Project Targets	Project Standards/ Implementation Procedures	Success Criteria	Recommended Contingency Measures
Faunal Support/Habitat	**1.** *Construct self-sustaining vernal depressions and swales that provide ecosystem functions similar to those of naturally occurring vernal depression and swale wetland mosaics (i.e., wetland hydrology, biogeo-chemistry, plant community, and habitat for special-status invertebrate fauna and plant species, etc., and that support vernal pool endemics (VPEs), including vernal pool fairy shrimp (VPFS).*	Construct vernal depression and swale mosaics according to design specifications so as to create a site-wide complex of shallow vernal depressions and swales that are linked hydrologically, at least seasonally during high water events.	Maximum depth of inundation of constructed pools must be within range of control pools and the longest period of inundation not greater than 125% of control pools. Absolute cover and relative cover by vernal pool endemic (VPEs) in each constructed pool shall be no less than the minimum recorded in the reference pools for any two year period. Each constructed pool must support no fewer than the lowest number of VPEs recorded in control pools. VPEs shared by both the impact and control pools shall be as vigorous and reproductively active in the constructed pools as in the control pools. By the final year of monitoring (year 10), any VPEs that are dominant (relative cover of at least 20%) in at least 30% of the control pools shall be present as a dominant species in all of the constructed pools.	Determine why native fauna are absent and apply corrective measure, *e.g.*, water chemistry, water residence time, remove non-native species and replant according to planting plan, *etc.*