Draft

Souza II Restoration Project
Restoration Management Plan

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Acronyms and Abbreviations

APN	Assessor's Parcel Number
BMPs	best management practices
Cal-IPC	California Invasive Plant Council
CDFG	California Department of Fish and Game
Conservancy	East Contra Costa County Habitat Conservancy
Corps	U.S. Army Corps of Engineers
CWA	Clean Water Act
District	East Bay Regional Park District
dS/m	deci-Siemens per meter
ED	ephemeral drainages
GPS	global positioning system
HCP/NCCP Plan	East Contra Costa County Habitat Conservation Plan/Natural Community Conservation Plan
MMP	Mitigation and Monitoring Plan
PMP	Preserve Management Plan
RMP	Restoration Management Plan
RPW	relatively permanent water
TNW	traditionally navigable waterway
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

Souza II Restoration Project

Restoration Management Plan

Introduction

The East Contra Costa County Habitat Conservancy (Conservancy), in partnership with the East Bay Regional Park District (District), will implement a wetland and habitat restoration project for the Souza II parcel (Figure 1). The Souza II parcel is being acquired by the District with support from the Conservancy. The Souza II acquisition and the restoration project were initiated as a component of the East Contra Costa County Habitat Conservation Plan/Natural Community Conservation Plan (HCP/NCCP or Plan: Jones and Stokes 2006). This Plan provides regional conservation and development guidelines to protect natural resources while improving and streamlining the permit process for endangered species and wetland regulations. A critical component of the HCP/NCCP is the implementation of the conservation strategy, which provides for the creation of a preserve system that will protect land for the benefit of covered species, natural communities, biological diversity, and ecosystem function and compensate for habitat loss by restoring or creating specific habitats and land cover types.

This *Restoration Management Plan* (RMP) describes the site conditions, restoration goals and objectives, restoration techniques, HCP/NCCP compliance elements, short-term management, and restoration-related monitoring actions for a 94-acre portion (project area) of the Souza II parcel (Figure 1). The restoration project proposed for the project area addresses specific restoration- and enhancement-related objectives of the HCP/NCCP conservation strategy for alkali wetlands, seasonal wetlands, ponds, and grasslands. This RMP also describes the species covered for incidental take under the HCP/NCCP (i.e., covered species) that rely on these habitat types and will benefit from the restoration actions.

This RMP will be a component of a larger *Preserve Management Plan* (PMP) that is being developed for several parcels in the Byron Hills area, including the Souza II parcel. This larger plan, called the Byron Hills PMP, will document past and ongoing land management activities on the entire Souza II parcel, describe permitted and prohibited uses of the parcel, and prescribe short-term and long-term management actions that will be used to fulfill preserve-wide biological goals and objectives.

This RMP also provides the necessary elements of a Mitigation and Monitoring Plan (MMP) as required by the U.S. Army Corps of Engineers (Corps) for authorization to fill waters of the United States pursuant to Section 404 of the Clean Water Act (CWA).

Permitting Requirements

The following permits and authorizations will be necessary prior to initiation of restoration activities in the project area:

- A Streambed Alteration Agreement from the State of California, Department of Fish and Game.
- A permit to fill waters of the United States, pursuant to Section 404 of the Clean Water Act, from the U.S. Army Corps of Engineers.
- A water quality certification, pursuant to Section 401 of the Clean Water Act, from the Central Valley Regional Water Quality Control Board.
- A Stormwater Pollution Prevention Plan (SWPPP) to be prepared by the Contractor, approved by East Bay Regional Park District and submitted to the State Water Resources Control Board.
- A grading permit from the Contra Costa County Department of Conservation and Development, if required.
- A permit from the Contra Costa County Health Services Department, Environmental Health Division, to remove and cap the existing well, if required.

Responsible Parties

Site Manager and Property Owner:
East Bay Regional Park District
2950 Peralta Oaks Court
Oakland, CA 94605-0381
Project Contact: Brad Olson

Partner (Restoration and Monitoring):
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Project Contact: John Kopchik

Site Conditions

Site Location

The 190.56-acre Souza II parcel is located in eastern Contra Costa County (Figure 1), approximately three miles from the town of Byron. On the Byron Hot Springs 7.5-minute U.S. Geological Survey (USGS) quadrangle, it lies in Transverse 1, Range 3 East, Section 21 (Assessor's Parcel Number [APN] #001-011-040). The parcel is near the Byron Airport, and is bisected by Vasco Road. A small portion of the parcel lies on the west side of Vasco Road and is connected to the remainder of the parcel by a small tunnel under Vasco Road. The parcel can be accessed from Armstrong Road via Byron Hot Springs Road.

Regional Setting

The Souza II parcel is located on the eastern edge of the Diablo Range near the San Joaquin and Contra Costa counties border, approximately three miles from the town of Byron (Figure 1). The entire parcel is designated as a high acquisition priority in the HCP/NCCP in Acquisition Analysis Zone 5a (see Figure 5-2 in the HCP/NCCP).

The parcel is situated between two existing park/open space areas - Byron Airport's Habitat Management Lands (adjacent to the Souza II parcel, just to the east), and the Los Vaqueros Watershed Lands (approximately two miles to the west). Private properties in the immediate vicinity are mainly large holdings (approximately 80 to 2,000 acres in size) dominated by annual grasslands, only a few of which have been improved with homesteads and structures.

The parcel is located at the proximal end of a large alluvial fan complex that flanks the eastern side of the Coast Ranges. The parcel is in the Brushy Creek Watershed, at the southeastern corner of the HCP/NCCP planning area. Brushy Creek Watershed drains eastward from the Byron Hills to the Clifton Court Forebay, a reservoir along the San Joaquin River.

Historical Context

Cattle ranching was the primary historical land use on the parcel and surrounding area. Based on a historical ecology analysis prepared by Grossinger and Askevold (2008), the parcel was historically a diffuse, seasonally flooded drainage system with alkali wetlands, perhaps vernal pool/swale features, and a discontinuous channel. The parcel probably had a high degree of topographic variability with shallow channels or sloughs and perhaps larger bodies of persistent surface water. It appears that this system was converted to a relatively straight artificial channel in the early 20th Century, presumably to improve drainage characteristics (Grossinger and Askevold 2008).

An archaeological survey and evaluation of the parcel revealed that it belonged to the Armstrong family, ranchers and dairy farmers, during the early 20th century (Pacific Legacy, Inc. 2009). The cultural resources analysis focused on the project area (i.e., that portion of the parcel that will be impacted by the proposed restoration activities). Three historic archaeological sites were identified during the survey: two drainage ditches and a concrete structure associated with the slaughter of livestock. The cultural resources report concludes that the drainage ditches are not eligible for the California Register of Historic Places, and the resource associated with the concrete structure will be avoided during restoration activity. Additional details regarding cultural resources are provided in the report (Pacific Legacy, Inc. 2009).

Access

The parcel is readily accessible due to its nearly flat topography and short vegetation. There are cattle fences and gates, in good to fair condition, throughout the property. Portions of the parcel are not suitable for vehicular use, namely the southern hilly portion. Several areas fenced for cattle have gates that allow access.

Soils

ICF Jones & Stokes conducted a soil suitability assessment for the project area in February, 2009, to evaluate the general suitability of the soils for restoration, creation, and enhancement of target habitat types, and to identify any soil-based constraints that may affect the success of proposed habitat creation, restoration, and enhancement efforts (ICF Jones & Stokes 2009a). This assessment is provided as Appendix A. Based on the soil analysis, the existing onsite soils are appropriate for the designed restoration activities. A description of soils is detailed in the soils report and is summarized below.

The moderately to gently sloping alluvial fan deposits that comprise most of the project area consist of unconsolidated gravel, sand, silt, and clay. Soils in the project area include Altamont Clay, 15–30% slopes, Fontana Altamont Complex, San Ysidro Loam, and Solano Loam (Figure 3). Soils formed from the fan deposits are mapped primarily as San Ysidro loam, with a few small areas of strongly alkaline Solano loam mapped near the eastern boundary along Armstrong Road. The San Ysidro loam and Solano loam soils have very similar morphologies and commonly occur in association with one another on fan deposits along the eastern side of Coast Ranges. Both soils are deep and typically moderately well to somewhat poorly drained Alfisols characterized by loamy surface textures and fine-textured, slowly permeable subsurface horizons with high illuvial clay content (Welch 1977 in ICF Jones & Stokes 2009a). The main difference between the two soil types is that the fine-textured, illuvial subsurface horizons in the San Ysidro loam soil have relatively low exchangeable sodium content (<15%) (horizons referred to collectively as an argillic horizon), while the fine-textured, illuvial subsurface horizons in the

Solano loam soil contain high concentrations of exchangeable sodium (>15%) (horizons referred to collectively as a natric horizon). The Solano loam subsoil is also typically characterized by alkaline pH values (7.4–9.0) and high salinity (>8 deci-Siemens per meter [dS/m]).

The strongly alkaline Solano loam soil map unit that occupies a small portion of the project area typically occurs only in the lowest and most poorly drained landscape positions (i.e., basins and basin rims), and is distinguished from the non-alkaline Solano loam map unit that occurs outside the project area in that it contains substantial inclusions of soils that have very high concentrations of sodium and carbonate in the surface and near surface horizons. The concentration of sodium and carbonate salts near the surface is the result of capillary rise from shallow or perched groundwater water tables. Sodium and carbonate salts derived from the marine parent material accumulate near the surface as water evaporates and is transpired by plants, and is continually replenished by capillary rise from the underlying water table. The resulting high pH and salinity can substantially affect plant nutrient water availability, while high concentrations of exchangeable sodium can disperse surface soil structure and cause extended periods of surface ponding. Most areas affected by these high pH, salinity, and exchangeable sodium conditions are unvegetated (i.e., often referred to as "alkali scalds") or are dominated by halophytic wetland plants that are physiologically adapted for growth in saturated and saline-sodic soil conditions.

Soils formed from the residual marine bedrock in the more steeply sloping portions of the project area are mapped as Altamont clay (Figure 2). The Altamont clay soil is a well drained Vertisol characterized by clay-textures throughout, pronounced surface cracking caused by shrink-swell activity, and alluvial accumulations of carbonates in the subsurface horizons (Welch 1977 in ICF Jones & Stokes 2009a).

Vegetation/Land Cover

The project area currently contains six land cover types: grassland (92.25 acres), ephemeral drainage (0.096 acre), intermittent stream (0.187 acre), riverine seasonal wetlands (0.538 acres), depressional seasonal wetlands (0.641 acres), and pond (0.31 acre). (Figure 4).

Non-native and/or naturalized plant species dominate the grassland in the project area. Dominant grasses are wild oats (*Avena* spp.), brome grasses (*Bromus* spp.) and annual fescues (*Vulpia* spp.). Patches of potentially noxious milk thistle (*Silybum marianum*), the largest of which is 25.43 acres in size, are interspersed throughout the grassland, particularly in the southern hills. Groundcover in the annual grassland is generally 90–100%, with less cover occurring only on unpaved roads and cattle crossings.

The intermittent stream in the project area is characterized by a shallow gradient, with one main channel that appears to have been artificially straightened in the past. The channel is very incised on the western two-thirds of the property; the

banks are vegetated with saltgrass (*Distichlis spicata*) in some areas and unvegetated in areas where channel incision and cattle utilization is high. The remaining eastern portion of the intermittent stream is less incised with lower, gradual banks and is typically more vegetated.

Two ephemeral drainages are present in the project area; both are located north of the unnamed tributary to Brush Creek. These features do not support wetland plant species but exhibit sporadic water flow and are directly connected to depressional seasonal wetlands on the site. Both of these features capture runoff from Vasco Road and adjacent lands and convey water onto the study area, influencing the hydrology of depressional seasonal wetlands in the project area. One of the drainages appear to have been artificially created or artificially maintained in the past, as evidenced by relict cast-off alongside this feature in the form of a low lip or berm observed during the wetland delineation in February, 2008.

The seasonal wetlands in the project area include depressional and riverine wetlands. Several depressional seasonal wetlands are located in the northern portion of the study area, adjacent to the unnamed tributary to Brushy Creek. The vegetation within depressional seasonal wetlands is dominated by hydrophytic plant species including Italian ryegrass (*Lolium multiflorum*), common blennosperma (*Blennosperma nanum*), Mediterranean barley (*Hordeum marinum* ssp. *gussonianum*) and saltgrass. The riverine seasonal wetlands in the project area also occur in association with and directly abutting the tributary to Brushy Creek. Portions of these wetlands were dominated almost exclusively by saltgrass with some bulrush (*Schoenoplectus americanus*) present.

One seasonal pond is present in the project area. It appears to be formed by water collecting behind a berm between the project area and Armstrong Road. It appears that the seasonal pond does not remain inundated for extended periods of time, as evidenced by the absence of any perennial emergent plant species (e.g., cattails) that would otherwise have become established.

Covered Species Habitat Value

Based on field surveys and habitat distribution models in the HCP/NCCP, existing habitats in the project area are capable of supporting the following species covered in the HCP/NCCP: San Joaquin kit fox, western burrowing owl, Swainson's hawk, golden eagle, California red-legged frog, California tiger salamander, listed vernal pool crustaceans, and brittlescale (suitable habitat is also available for other covered plant species, but brittlescale was the only species found).

The project area supports suitable denning, foraging, and dispersing habitat for San Joaquin kit fox. California ground squirrels and their burrow complexes are abundant on the parcel, particularly in the central-eastern portion of the property. Kit fox have been observed periodically in the vicinity of the Bryon Airport over the past 30 years (Stromberg and Ford 2003).

The entire project area is potential breeding habitat for burrowing owl, and two were observed onsite in 2008. The ground squirrel burrows are present throughout the property, and burrowing owls often take over vacated ground squirrel burrows.

The annual grasslands also provide suitable foraging habitat for Swainson's hawk and golden eagle. There are no potential nest trees for these species in the project area, or on the entire parcel.

One pond in the project area appears capable of retaining water for the minimum of 10 weeks required for successful California tiger salamander reproduction. The annual grassland habitats and associated ground squirrel burrows provide abundant upland habitat for this species. California tiger salamander is known to occur on the adjacent Byron Airport Habitat Management Lands.

Potential breeding habitat for California red-legged frog is present on the western half of the tributary to Brushy Creek, where there are patches of ponded water with emergent vegetation such as cattails (*Typha*) and (*Scirpus*). The annual grassland habitats and associated ground squirrel burrows on the parcel provide abundant upland habitat for this species. California red-legged frogs are known to occur on the adjacent Byron Airport Habitat Management Lands.

Seasonal wetlands outside of the tributary channel have potential to support vernal pool fairy shrimp, vernal pool tadpole shrimp, and midvalley fairy shrimp, although none were observed during the February or October 2008 site visits (no focused surveys for these species have been conducted). Vernal pool fairy shrimp are known to occur on the adjacent Byron Airport Habitat Management Lands. The entire Souza II parcel is within the area designated by the U.S. Fish and Wildlife Service (USFWS) as critical habitat for vernal pool fairy shrimp (U.S. Fish and Wildlife Service 2006).

The project area supports a population of one covered plant species, brittlescale (*Atriplex depressa*). Approximately 100 individuals of this species were observed in October, 2008 along the channel bank. Appendix B provides a map showing the location at which brittlescale was observed in 2008.

The project area also provides potentially suitable habitat for seven additional covered plant species: adobe navarretia (*Navarretia nigelliformis* ssp. *nigelliformis*), big tarplant (*Blepharizonia plumose*), Brewer's dwarf flax (*Hesperolinon breweri*), Diablo heliantella (*Heliantella castanea*), recurved larkspur (*Delphinium recurvatum*), round-leaved filaree (*California macrophylla*), San Joaquin spearscale (*Atriplex joaquiniana*), and showy madia (*Madia radiata*). However, these species currently have a low potential for occurrence in the project area due to past heavy grazing and none were observed during the detailed botanical surveys conducted in October, 2008 and April, 2009. The potential for these species may improve in the future with the proposed restoration.

Topography and Hydrology

The project area is relatively flat, ranging in elevation from approximately 75 feet in its lowlands to 200 feet in the gently sloping hills and ridges to the south. A tributary of Brushy Creek bisects the project area, flowing from west to east for approximately 2,700 linear feet.

The tributary flows eastward from the project area under Armstrong Road to the adjacent Byron Airport Habitat Management Lands. It then converges with Brushy Creek east of the parcel, which eventually reaches the Clifton Court Forebay.

The project area is located in the Lower Sacramento River watershed, within the San Joaquin Delta hydrologic unit (HUC 18040003). Average annual precipitation within the study area region is approximately 15 inches (Western Regional Climate Center 2008).

An unnamed intermittent tributary to Brushy Creek with seasonally continuous flow is the dominant hydrological feature in the study area. This intermittent stream is a relatively permanent water (RPW) that flows into Brushy Creek in southeastern Contra Costa County and then into Italian Slough, which flows into the Old River on the northern end of Clifton Court Forebay. The Old River flows into the San Joaquin River at approximately river mile 24. The Old River is the closest traditionally navigable waterway (TNW) to the study area.

The primary water source for some of the depressional wetland features (W-6, W-12, W-17, and W-18) appears to be water flowing through the ephemeral drainages, ED1 & 2, in the northern part of the Souza II parcel. The remaining depressional wetlands appear to capture surface flow across the parcel.

Water Quality

The project area has been heavily grazed, resulting in highly eroded stream banks, sedimentation, and reduced water quality. During a site visit on February 26, 2008, ICF Jones & Stokes biologists noted that the water in the existing pond was highly turbid, in part due to unrestricted access by grazing animals.

Jurisdictional Areas

ICF Jones & Stokes (2009b) conducted a delineation of waters of the United States, including wetlands, for the project area (Appendix C). In summary, a total of 1.78 acres, including 1.18 acres of potential jurisdictional wetlands and 0.60 acre of potential other waters of the United States, were delineated in the project area. Table 1 summarizes the type of features in the project area and the preliminary jurisdictional status of each.

Table 1. Summary of Existing Wetlands and Other Waters in the Souza II Study Area

Feature Type	Area (acres)	Jurisdictional Status[a]
Seasonal Wetlands		
Depressional wetlands	0.64	Potential jurisdictional wetland
Riverine wetlands	0.54	Potential jurisdictional wetland
Total Seasonal Wetlands	1.18	
Other Waters		
Intermittent Stream	0.19	Potential jurisdictional water
Ephemeral Drainage	0.10	Potential jurisdictional water
Seasonal Pond	0.31	Potential jurisdictional water
Total Other Waters	0.60	
Total Potential Jurisdictional Wetlands and Other Waters	**1.78**	

[a] Preliminary jurisdictional status pending verification by the Corps Sacramento District.

Aquatic Functions

The tributary to Brushy Creek is a linear and incised channel throughout the project area. The banks are mostly unvegetated or vegetated with non-native plant species or saltgrass. The tributary was channelized sometime in the early 20th Century and has deeply eroded to be steeply incised on the western two-thirds of the property. Wetlands adjacent to the tributary are heavily grazed and are of low to moderate quality. As a result of the lack of vegetation and the linear and incised nature of the channel, the onsite wetlands have low function in terms of water filtration, sediment storage, and flood retention.

Restoration

Restored Wetlands and Other Waters

The restoration will focus on the northern portion of the parcel (Figure 5) that includes the degraded tributary to Brushy Creek, which is currently incised and isolated from its flood plain. The banks of the Brushy Creek tributary will be stabilized and additional seasonal wetlands will be restored in association with the tributary. Channel banks will be sloped in a manner to promote onsite flooding, and the berms north and south of the tributary will be removed to increase tributary connectivity with the adjacent wetlands and floodplain. Rock weirs will be installed in the tributary to increase structural diversity and provide ponding for California red-legged frog. Additionally, a 0.18-acre pond will be created south of the channel to provide breeding habitat for California tiger salamander. The pond may also provide aquatic habitat for California red-legged frog, although it will not necessarily hold water for a sufficient period to support a breeding California red-legged frog subpopulation. An existing dirt road will be retired, restored to wetland habitat in the wetland portions (this will include

removal of a culvert from the Brushy Creek tributary), and seeded with native grasses in the upland portions. Additionally, separate from the restoration project, a milk thistle infestation will be removed from the upland grassland area and replanted with native grasses (initial treatment was performed in April 2009; necessary follow-up measures will be identified in the PMP). The restored acreage and total acreage in the project area following restoration for wetland and other waters are summarized in Table 2 and Table 3.

Table 2. Table 2. Wetland and Pond Impacts and Creation[1]

Land Cover	**Existing Acres**	**Permanent Impacts (filled)**	**Temporary Impacts (returned to wetland)**	**Restoration and Creation Acres**	**Total After Restoration**	**Net Increase**
Wetland[2]	1.18	0.20	0.48	8.50	9.48	8.30
Pond	0.31	0.00	0.00	0.18	0.49	0.18
Total	1.49	0.20	0.48	8.68	9.97	8.48

[1] All impacts to aquatic land covers in this table are based on wetlands and waters as delineated in the wetland delination report attached to this project description and represent impacts to waters of the U.S.
[2] Wetland impacts include impacts to both depressional and riverine wetlands as described in the wetland delineation report attached to this project description.

Table 3. Stream Impacts and Creation

Existing		**Permanent Impacts**		**Temporary Impacts**		**Restored/ Created**		**Total After Restoration**		**Net Increase**	
Length (Feet)	Area (Acres)[1]	Length (Feet)	Area (Acres)	Length (Feet)	Area (Acres)	Length (Feet)	Area (Acres)	Length (Feet)	Area (Acres)	Length (Feet)	Area (Acres)
4784	0.8	367	0.03	2429	0.5	3508	0.6	7925	1.4	3141	0.6

[1] Acreages are based on an average width of 5 feet from the stream centerline for a total width of 10 feet for the intermittent reaches and an average width of 2 feet from the channel centerline for a total width of 4 feet for the ephemeral drainages.

Restored Habitat Aquatic Functions and Values

The aquatic functions and values of wetlands and other waters of the United States will be significantly enhanced through implementation of this RMP. The natural hydraulic function of the tributary to Brushy Creek will be restored by

reconnecting it to its flood plain. Creation and restoration of wetlands in the project area will increase water filtration, sediment storage, and flood retention. The restoration will also increase the functions and value of the onsite wetlands as wildlife habitat, including habitat for the federally listed California red-legged frog, the state and federally-listed California tiger salamander and the federally listed vernal pool fairy shrimp and longhorn fairy shrimp, as well as the HCP/NCCP covered species, midvalley fairy shrimp.

Restoration Goals and Objectives

[Note to reader: This section is still under revision; fairy shrimp goals are under development.]

The restoration goals and objectives for the project area are based upon the biological goals and objectives established for the HCP/NCCP (Table 5-1 of the HCP/NCCP). Biological goals and objectives relevant to restoration on the Souza II site are provided in Table 3, below. Table 3 also defines the site-specific restoration objectives for the Souza II site, based upon each relevant HCP/NCCP objective. The HCP/NCCP objectives describe the desired outcome for the HCP/NCCP as a whole, whereas the site-specific restoration objectives describe the desired restoration outcome for the Souza II site. Table 4 also lists the Covered Species that may be benefitted, and restoration measures that will be implemented to achieve each of the site-specific restoration objectives. Performance criteria for each of these objectives are described in the Monitoring section of this RMP.

Table 4. HCP/NCCP Biological Goals and Objectives, Site Specific-Restoration Objectives and Site-Specific Restoration Measures

HCP/NCCP Goals and Objectives	Souza II Site-Specific Restoration Objectives	Covered Species Benefitted	Site-Specific Restoration Measures
Wetlands (and Other Aquatic) Biological Goals and Objectives			
Goal 2: Maintain and enhance hydrogeomorphic and ecological function of wetlands and ponds to promote covered species, native biological diversity, and habitat heterogeneity.			
Objective 2.1. Maintain or increase native emergent vegetation where appropriate.	SO-1: Increase the abundance and distribution of native emergent vegetation in the project area.	California red-legged frog	Create and restore wetlands onsite. Establish native emergent vegetation where appropriate in created and restored wetlands.
Objective 2.2. Reduce sediment deposition and transport where appropriate.	SO-2: Reduce erosion along the tributary to Brushy Creek.	California red-legged frog	Stabilize (lay back and revegetate) the banks in selected areas along the tributary. Increase channel sinuosity. Install in-stream rock weirs to catch and store sediment.
Objective 2.3. Maintain or increase wetland and pond capacity and water duration as appropriate.	SO-3: Increase wetland and pond capacity and water duration in the project area.	California red-legged frog	Install in-stream rock weirs to pool water. Increase channel sinuosity. Increase wetland capacity by increasing seasonal wetland acreage in the project area. Create a 0.3-acre pond.
Objective 2.4. Maintain or increase flows to and connectivity among wetlands and wetland complexes as appropriate	SO-4: Hydrologically reconnect the Brushy Creek tributary with its floodplain and adjacent wetland complex.	California red-legged frog, vernal pool fairy shrimp, vernal pool tadpole shrimp, midvalley fairy shrimp, brittlescale	Remove berms on either side of the tributary. Connect the tributary with its restored seasonal wetland complexes to the north and south. Remove road crossing and culvert across Brushy Creek tributary.
Objective 2.6. Eliminate or reduce exotic plants	SO-5: Reduce non-native plant species in the project area wetlands.	Brittlescale Possibly: big tarplant recurved larkspur round-leaved filaree, showy madia, adobe navarretia, Brewer's dwarf flax, Diablo heliantella, San Joaquin spearscale	Vegetate newly restored areas with native species and implement invasive plant control during the maintenance period.

HCP/NCCP Goals and Objectives	Souza II Site-Specific Restoration Objectives	Covered Species Benefitted	Site-Specific Restoration Measures
Goal 3: Restore wetlands and create ponds in Preserve System to compensate for permanent loss of these habitats.			
Objective 3.3. Restore seasonal wetlands in-kind at a ratio of 2:1 of wetted acres (estimated to be 118 acres of seasonal wetland complex with the maximum urban development area)	SO-6: Restore 8.5 acres of seasonal wetlands in the project area.	Vernal pool fairy shrimp, vernal pool tadpole shrimp, brittlescale Possibly: big tarplant recurved larkspur round-leaved filaree, showy madia, adobe navarretia, Brewer's dwarf flax, Diablo heliantella, San Joaquin spearscale	Grade areas north and south of the tributary and plant with seasonal wetland plant species, to restore additional seasonal wetland acreage onsite.
Objective 3.4. Create ponds in-kind at a ratio of 1:1 (estimated to be 8 acres with the maximum urban development area) to support California tiger salamander, California red-legged frog, and/or western pond turtle.	SO-7: Create 0.18 acres of pond habitat in the project area capable of supporting California tiger salamander.	California tiger salamander, California red-legged frog	Create a 0.18-acre pond
Goal 4: Restore wetlands and create ponds in the Preserve System to contribute to recovery of covered species.			
Objective 4.3. Restore 20 wetted acres of seasonal wetlands	See SO-6. The project will partially satisfy compensation requirements and partially satisfy recovery requirements, depending upon the mix of funding sources used for the project.		
Objective 4.4. Create 8 acres of ponds to support California tiger salamander, California red-legged, and/or western pond turtle	See SO-7. The project will partially satisfy compensation requirements and partially satisfy recovery requirements, depending upon the mix of funding sources used for the project.		

HCP/NCCP Goals and Objectives	Souza II Site-Specific Restoration Objectives	Covered Species Benefitted	Site-Specific Restoration Measures
Goal 8: Compensate for loss of occupied covered shrimp habitat.			
Objective 8.2. Restore suitable habitat within the Preserve System at a ratio of 2:1 or dedicate an equivalent number of mitigation bank credits.	SO-8: Restore 8.5 acres of suitable habitat for vernal pool fairy shrimp and vernal pool tadpole shrimp	Vernal pool fairy shrimp, longhorn fairy shrimp, midvalley fairy shrimp	Create seasonal depressions that will hold water for sufficient duration to sustain vernal pool fairy shrimp, longhorn fairy shrimp, and midvalley fairy shrimp. Import soil with potential innoculum from a seasonal depression on an adjacent site to an onsite seasonal depression.
Grassland Biological Goals and Objectives			
Goal 11: Enhance grassland to promote native biological diversity and habitat heterogeneity			
Objective 11.3. Reduce the biomass, cover, and extent of exotic plants (i.e., non-native invasive plants) in the Preserve System.	SO-9: Eliminate milk thistle from the project area.	San Joaquin kit fox, western burrowing owl, golden eagle, Swainson's hawk, California tiger salamander, California red-legged frog, brittlescale. Possibly: big tarplant recurved larkspur round-leaved filaree, showy madia, adobe navarretia, Brewer's dwarf flax, Diablo heliantella, San Joaquin spearscale	Implement physical removal of milk thistle (*Silybum marianum*).
Goal 18: Enhance populations of grassland-dependent covered plants			
Objective 18.1: Increase population size and distribution of grassland-dependent covered plants, where feasible and biologically desirable.	SO-10: Increase the population size and distribution of brittlescale (*Atriplex depressa*) in the project area, if feasible.	Brittlescale	Experimentally introduce brittlescale onto the site.
Streams and Riparian Woodland/Scrub Biological Goals and Objectives			
Goal 30: Maintain and enhance instream aquatic habitat for covered species and native fish			
Objective 30.4. Reduce sediment input and downstream sediment transport and deposition, where appropriate	See SO-2		

HCP/NCCP Goals and Objectives	Souza II Site-Specific Restoration Objectives	Covered Species Benefitted	Site-Specific Restoration Measures
Objective 30.5. Maintain and enhance instream structural diversity, where appropriate	SO-11: Enhance structural diversity by creating in-stream pools in the Brushy Creek tributary.	California red-legged frog	Install in-stream rock weirs.

Overview of Construction Specifications

Below please find a summary of the technical specifications for constructing the project. Please consult the Souza II restoration Project Plans and Specifications for details.

Grading and Soil Treatment

The restoration areas will be constructed to meet finish grade as shown on the plan drawings (Appendix D), +/– 0.1 foot. The top two inches of soil and organic material will be stripped from all the areas to be graded or filled. The stripped material will be spread out in the spoils areas adjacent to the work sites, as shown on the plan drawings (Appendix D) and covered with a minimum of 1.5 feet of spoils material.

To construct the pond berm, onsite fill material will be used as shown on the plan drawings, in 6-inch maximum lifts, and compacted to 90% relative density. After final grading of the pond has been completed, the pond bottom will be loosened to a depth of 12 to 18 inches below finish grade using a dozer with an attached flared-end shank of the type used in agricultural operations. A sufficient number of shanks or a sufficient number of passes will be made through the soil so that the shank(s) pass through the soil between 3 and 4 feet apart. Once the soil has been loosened in successive parallel passes in one direction, additional passes will be made at a 60 to 120 degree angle to the alignment of the first series of passes using the same equipment. Following soil loosening, the pond bottom will be compacted to 90% relative.

Upon completion of grading, the existing road bed will be loosened, as shown on the drawings, to a depth of 12 inches below existing grade. The Contractor will loosen the soil using a dozer with an attached flared-end shank of the type used in agricultural operations. A sufficient number of passes will be made through the soil so that the shanks pass through the soil between 3 and 4 feet apart. The contractor will remove or break-up rocks or lumps greater than 2.5-inches in greatest dimension remaining on the surface after achieving finish grade.

Soil Disposal

The contractor will dispose of excess onsite material in spoils areas adjacent to the work areas, as shown on the plan drawings (Appendix D). The spoils material will be placed in 6" maximum lifts and compacted to 85% maximum compaction.

In-Stream Structures, Matting, and Filter Fabric

J-hook boulder weirs, boulder cross-weirs, and boulder clusters will be placed in the locations shown on the plan drawings (Appendix D). Minor adjustments to the locations and grades of the boulder weirs may be made in the field, at the direction of the District. The stream boulders will be 30 to 36 inches in size, clean, hard, durable, and rounded in shape, free of fractures.

A geomembrane vertical barrier will be installed in the pond berm to prevent burrowing animals from burrowing through the berm and casuing leaks. The membrane will be placed a minimum of one-foot below the elevation of the pond bottom and anchored with geotextile pins, with washers, installed on 1-foot centers. The terminal end of the membrane will be keyed a minimum of one-foot into the existing slope. If more than one continuous sheet of material is used, adjacent sheets will be overlapped by a minimum of one-foot.

A turf reinforcement mat will be installed in the pond spillway to prevent erosion. 6-inch wide by 12-inch deep key trenches at the upper and lower ends of the spillway will be used to anchor the ends of the mat. Longitudinal trenches 4-inches wide by 4-inches deep will be excavated along the sides of the spillway to anchor the edges of the mat. Following installation, the mat will be covered with soil and vegetated.

Planting and Seeding

Nature and Source of Propagules

Three approaches will be used to vegetate the restoration site. In approach number one, seed has been collected from native species on the Souza II parcel and other local sites in the same watershed as the Souza II parcel. The Watershed Nursery will grow these seeds to provide plants for the onsite restoration. Two of these species, brittlescale (*Atriplex depressa*) and San Joaquin spearscale (*Atriplex joaquniana*), are difficult to grow in a nursery, and will be seeded directly onsite following the restoration. Additionally, the Watershed Nursery has collected saltgrass plugs from the project area and is currently growing them to provide stock for the restoration. The species, propagule type, and quantities are shown on the plan drawings (Appendix D). A total of approximately 15,000 plants will be grown offsite and planted. The District will also identify salvage locations along the channel bank, and plant

material, to consist primarily of brittlescale plants and/or seeds, will be salvaged from these locations.

In approach number two, native seed will be obtained from local sources and supplied by Pacific Coast Seed. These native seeds will be used to supplement the plugs in the wetland and grassland areas surrounding the wetlands. In approach number three, sterile seed will be obtained by the contractor to provide erosion protection in staging, spoils and other areas disturbed as a consequence of the project.

Planting Plan

The species to be planted in each planting zone are specified in Table 5. After final grading has been completed, the planting areas and other disturbed areas (i.e., equipment access routes) will be disked as shown on the plan drawings (Appendix D) to a depth of 12 inches, to prepare the areas for hydroseeding and planting. Following disking, the native grass seed mix will be broadcasted in the upland/grassland and channel bank planting zones. Sterile grassland seed mix will be planted in the spoils disposal areas, equipment access routes and other areas disturbed by construction activities. The wetland seed mix will be broadcasted into seasonal wetland, wetland transition, and emergent wetland planting zones, as shown on the plan drawings (Appendix D). All seed will be broadcasted by hand using a rotary-type spreader. The seeded areas will be dragged using a chain, or other implement, to mix the seed into the top layer of the disked soil. Mulch and tackifier will then be applied over the seeded areas. All seeding and hydromulching will be completed before plant installation.

Container plant installation will not begin until the rainy season has begun (after October 15) and enough rain has fallen to saturate the soils in the planting zones. Planting has also been timed to minimize the change in climate experienced by the plants (the plants will be cultivated in Richmond, which has much milder summers than Byron but a more similar fall and winter climate). The plants will be installed according to the locations, species percentages, and quantities indicated on the plan drawings (Appendix D [note Appendix is undergoing inor revision to indicate the contractor will be resposnbile for acquiring sterile seed for soil disposal and other disturbance areas]). Planting locations may be modified at the discretion of the District, if large rocks, tree roots, or other underground obstructions are encountered that interfere with plant installation.

Container planting holes will be excavated to twice the width and 1.5 times the depth of the container, as shown on the plan drawing. After the holes have been excavated, the inside surfaces of the holes will be scarified to enable root penetration. Plug planting material will be delivered in one gallon containers. Container plants will be removed from the container with the root ball intact. After removing the plants from containers, each side of the root ball will be scarified to prevent a root-bound condition. Matted roots on the side of the root ball will be longitudinally sliced 1/8 to 1/4 inch deep at least once per side. Matted roots on the bottom of the root ball will be sliced to 1/4 inch deep. The root ball will be inserted into the planting hole without bending or damaging the

roots. Plants will be set plumb and braced in position until backfill material has been placed and tamped solidly around the root ball. Planting holes will be backfilled with native material. Stones, sticks, or other materials greater than 2 inches in dimension will be removed from the backfill soil material and discarded. The container plant root ball will be placed so that the top is ½ inch above finished grade after settling. For plug plantings, the root ball will be at finished grade after settling.

Table 5. Plant Species by Planting Zone

Planting Zone	Common Name	Latin Name
Seasonal wetland	Saltgrass	*Distichlis spicata*
	Spikerush	*Eleocharis macrostachya*
	Heliotrope	*Heliotropum curassavicum*
	Baltic rush	*Juncus balticus*
	Rush	*Juncus* sp.
	Iris-leaved rush	*Juncus xiphioides*
	White hedge nettle	*Stychys albens*
	Wetland seed mix	
Wetland Transition	Narrow-leaved milkweed	*Asclepias fascicularis*
	Saltgrass	*Distichlis spicata*
	Alkali heath	*Frankenia salina*
	Heliotrope	*Heliotropium curassavicum*
	Baltic rush	*Juncus balticus*
	Rush	*Juncus* sp.
	Iris-leaved rush	*Juncus xiphioides*
	Alkali mallow	*Malvella leprosa*
	Wetland seed mix	
Emergent wetland margin	Spikerush	*Eleocharis macrostachya*
	Baltic rush	*Juncus balticus*
	Iris-leaved rush	*Juncus xiphioides*
	Wetland seed mix	
Channel bank	Brittlescale	*Atriplex depressa*
	Native grass mix	
Upland/grassland	Native grass mix	
Spoils Disposal Sites/Staging Areas/Construction Impact Areas	Sterile grass mix	
Boulder cluster	Baltic rush	Juncus balticus
J-hook boulder weir	Baltic rush	Juncus balticus
Boulder cross weir	Baltic rush	Juncus balticus

Avoidance and Minimization Measures

Measures will be implemented to avoid and minimize impacts to HCP/NCCP Covered Species and their habitat, and to wetlands during restoration related activities. Some of these measures are conditions of the HCP/NCCP, while others are required to comply with other laws and regulations, as described below.

Covered Species Avoidance and Minimization Measures

Section 6.4.3 of the HCP/NCCP provides measures for avoiding and minimizing project related impacts to Covered Species. The species-level planning surveys, preconstruction surveys, and construction monitoring requirements necessary in order to implement impact avoidance and minimization are summarized in Table 6-1 of the HCP/NCCP. The proposed restoration activities will take place in suitable habitat for two of the species listed in Table 6-1 of the HCP/NCCP: San Joaquin kit fox and western burrowing owl. The required preconstruction surveys, avoidance and minimization measures, and construction monitoring for these two species are described below.

San Joaquin Kit Fox

The entire project area, except for the developed portion, is within the range and suitable habitat for San Joaquin kit fox. Therefore, all required avoidance and minimization measures specified in the HCP/NCCP must be followed for this species. The following sections copy the required measures from the HCP/NCCP (pages 6-37, 6-38).

Preconstruction Surveys

Prior to any ground disturbance related to covered activities, a USFWS/CDFG–approved biologist will conduct a preconstruction survey in areas identified in the planning surveys as supporting suitable breeding or denning habitat for San Joaquin kit fox. The surveys will establish the presence or absence of San Joaquin kit foxes and/or suitable dens and evaluate use by kit foxes in accordance with USFWS survey guidelines (U.S. Fish and Wildlife Service 1999).

Preconstruction surveys will be conducted within 30 days of ground disturbance. On the Souza II parcel where the activity is proposed, the biologist will survey the proposed disturbance footprint and a 250-foot radius from the perimeter of the proposed footprint to identify San Joaquin kit foxes and/or suitable dens. Adjacent parcels under different land ownership will not be surveyed. The status of all dens will be determined and mapped. Written results of preconstruction surveys will be submitted to USFWS within 5 working days after survey

completion and before the start of ground disturbance. Concurrence is not required prior to initiation of covered activities.

If San Joaquin kit foxes and/or suitable dens are identified in the survey area, avoidance and mitigation measures described below will be implemented.

Avoidance and Minimization Requirements

- If a San Joaquin kit fox den is discovered in the proposed development footprint, the den will be monitored for 3 days by a USFWS/CDFG–approved biologist using a tracking medium or an infrared beam camera to determine if the den is currently being used.
- Unoccupied dens should be destroyed immediately to prevent subsequent use.
- If a natal or pupping den is found, USFWS and CDFG will be notified immediately. The den will not be destroyed until the pups and adults have vacated and then only after further consultation with USFWS and CDFG.
- If kit fox activity is observed at the den during the initial monitoring period, the den will be monitored for an additional 5 consecutive days from the time of the first observation to allow any resident animals to move to another den while den use is actively discouraged. For dens other than natal or pupping dens, use of the den can be discouraged by partially plugging the entrance with soil such that any resident animal can easily escape. Once the den is determined to be unoccupied it may be excavated under the direction of the biologist. Alternatively, if the animal is still present after 5 or more consecutive days of plugging and monitoring, the den may have to be excavated when, in the judgment of a biologist, it is temporarily vacant (i.e., during the animal's normal foraging activities).

Construction Monitoring

If dens are identified in the survey area outside the proposed disturbance footprint, exclusion zones around each den entrance or cluster of entrances will be demarcated. The configuration of exclusion zones should be circular, with a radius measured outward from the den entrance(s). No covered activities will occur within the exclusion zones. Exclusion zone radii for potential dens will be at least 50 feet and will be demarcated with four to five flagged stakes. Exclusion zone radii for known dens will be at least 100 feet and will be demarcated with staking and flagging that encircles each den or cluster of dens but does not prevent access to the den by kit fox.

Western Burrowing Owl

Preconstruction Surveys

Prior to any ground disturbance related to covered activities, a USFWS/CDFG approved biologist will conduct a preconstruction survey in areas identified in the

planning surveys as having potential burrowing owl habitat. The surveys will establish the presence or absence of western burrowing owl and/or habitat features and evaluate use by owls in accordance with CDFG survey guidelines (California Department of Fish and Game 1993).

On the Souza II parcel where the activity is proposed, the biologist will survey the proposed disturbance footprint and a 500-foot radius from the perimeter of the proposed footprint to identify burrows and owls. Adjacent parcels under different land ownership will not be surveyed. Surveys should take place near sunrise or sunset in accordance with CDFG guidelines. All burrows or burrowing owls will be identified and mapped. Surveys will take place no more than 30 days prior to construction. During the breeding season (February 1– August 31), surveys will document whether burrowing owls are nesting in or directly adjacent to disturbance areas. During the nonbreeding season (September 1–January 31), surveys will document whether burrowing owls are using habitat in or directly adjacent to any disturbance area. Survey results will be valid only for the season (breeding or nonbreeding) during which the survey is conducted.

Avoidance and Minimization, and Construction Monitoring

If burrowing owls are found during the breeding season (February 1–August 31), the project proponent will avoid all nest sites that could be disturbed by project construction during the remainder of the breeding season or while the nest is occupied by adults or young. Avoidance will include establishment of a non-disturbance buffer zone (described below). Construction may occur during the breeding season if a qualified biologist monitors the nest and determines that the birds have not begun egg-laying and incubation or that the juveniles from the occupied burrows have fledged. During the nonbreeding season (September 1–January 31), the project proponent should avoid the owls and the burrows they are using, if possible. Avoidance will include the establishment of a buffer zone (described below).

If occupied burrows for burrowing owls are not avoided, passive relocation will be implemented. Owls should be excluded from burrows in the immediate impact zone and within a 160-foot buffer zone by installing one-way doors in burrow entrances. These doors should be in place for 48 hours prior to excavation. The project area should be monitored daily for 1 week to confirm that the owl has abandoned the burrow. Whenever possible, burrows should be excavated using hand tools and refilled to prevent reoccupation (California Department of Fish and Game 1995). Plastic tubing or a similar structure should be inserted in the tunnels during excavation to maintain an escape route for any owls inside the burrow.

Wetlands and Water Quality Avoidance and Minimization Measures

Sections 404 and 401 of the Clean Water Act require minimization of impacts to wetlands and water quality. Additionally, section 6.4.2 of the HCP/NCCP includes measures to wetlands, ponds, and streams. The following measures will be implemented to protect wetlands outside the restoration area, and to ensure against adverse water quality effects that could otherwise result from restoration related activities.

- All materials that are potential construction pollutants from the contractor's operations will be stored in a lawful manner. The contractor will not fuel, service or make repairs to any equipment or vehicles within 100-feet of the top of bank draining into the stream or the stream itself, as delineated in the plans and marked in the field by the district.
- The contractor will develop and implement a pollutant containment plan that will include a minimum the following best management practices (BMPs)

    1. Identification and protection of all drainage swales, creeks, and streams at or near the construction site and the appropriate measures to prevent sediment and pollutants from entering them.
    2. Proper storage of potential pollutants.
    3. Proper containment and cleanup procedures for accidental spills. Adequate materials for proper containment and cleanup shall be stored at the site.
    4. Proper waste disposal methods.
    5. Development of designated and contained washout areas for concrete.
    6. Off-site vehicle wash and designated on-site refueling area with spill containment in a bermed area only if it is necessary to fuel equipment on-site.
    7. The dewatering of excavated areas is allowed to be discharged into the adjacent creek. Creek bank erosion and flowline siltation shall be prevented by installing filter fabric at points of discharge. This operation plan shall be in accordance with the BMPs.
    8. Clearing and grubbing limits will be laid out with lathe stakes 5 days prior to beginning site clearing.
    9. Where equipment access routes are required, the sequence of construction activities shall be coordinated to only allow equipment access prior to preparation of soils. Upon completion of soil preparation activities, no further vehicular traffic will be allowed other than equipment required for planting (e.g., truck mounted auger). If equipment access should become necessary, the access route shall be disked and fine graded again prior to seeding to eliminate any resulting soil compaction.

Short-Term Maintenance

Short-term maintenance measures are those that will be implemented until the restoration project is successfully completed. The project will be deemed successfully completed when the performance criteria defined in this RMP have been met. Maintenance activities will occur on the property on both an as-needed and routine basis. In general, maintenance could include irrigation, plant replacement, exotic plant control, repair/replacement of fencing and gates, fire hazard reduction, debris removal, and road crossings and culvert cleaning. Some of these activities are described in greater detail below.

Irrigation

All container plants and cuttings will be irrigated with water from a truck immediately following installation. If precipitation conditions require, the contractor charged with restoration construction will conduct irrigation (truck watering) for four weeks following planting. Planting will be timed to coincide with the rainy season, and no further irrigation is anticipated. However, if it is determined through monitoring that irrigation is necessary, irrigation will be implemented as described in the Adaptive Management section, below.

Native Plant Species

Establishment of native species will be monitored for the first five years. Depending on the successful establishment of new species and level of invasive species encroachment, native plants may need to be salvaged and revegetated on an annual basis. Plants will be harvested locally from within the watershed.

Invasive Species Control

Grading in the restoration area could result in the spread of non-native plant species, specifically milk thistle (*Silybum marianum*) and yellow star thistle (*Centaurea solstitialis*). Infestations of invasive and noxious plants can adversely affect habitat values. Occurrences of such weedy species will be controlled by some combination of manual removal, short-term grazing, or herbicide application. Any herbicides to be used will be labeled by the U.S. Environmental Protection Agency for use in or near aquatic environments. Herbicide application methods will be limited to the most target specific approaches practicable. Additional methods to control non-native plant species and other weeds could include mowing and hand-pulling.

Control of pests will be in accordance with the District's pest management policies and practices. Other sites in the District park system with milk thistle infestations have been managed with small applications of Milestone herbicide on mature stands, which is broad-leaf selective and will not kill grasses.

Monitoring

Monitoring and adaptive management are essential components of restoration and habitat management in order to ensure that the restoration goals and objectives are met. Performance criteria indicate whether restoration is progressing as intended and how the project may be altered or redesigned to better achieve project goals. Adaptive management is the process of integrating the results of performance monitoring into ongoing management decisions. The performance criteria, monitoring methods and adaptive management procedures for the Souza II restoration are described below.

Performance Criteria

[Note to reader: This section is still under development. Fairy shrimp goals are under development. Target values in Table 6 may be revised.]

Performance monitoring will determine whether the site-specific restoration objectives are being met for the site. Table 6 provides the performance criteria for each site-specific restoration objective. Table 7 provides performance criteria related to restoration plantings. Thresholds by which to evaluate the success of restoration plantings will be based on survivorship and health of individual plants during the three years following implementation, as listed in Table 6. If performance criteria are not met during the specified time period, then adaptive management actions will be triggered and annual monitoring will continue until performance criteria are met.

Table 6. Site Specific Restoration Objectives and Performance Criteria

Souza II Site-Specific Restoration Objectives	Performance Criteria
Wetlands (and other Aquatic)	
SO-1: Increase the abundance and distribution of native emergent vegetation onsite.	See Table 6.
SO-2: Reduce erosion along the tributary to Brushy Creek.	Qualitative assessment including photo-documentation before and annually for five years after restoration activity determines that erosion along the Brushy Creek tributary onsite has been reduced.
SO-3: Increase wetland and pond capacity and water duration onsite.	Wetland acreage onsite has increased by 8.3 acres and pond acreage onsite has increased by 0.18 acres by five years following the restoration construction.
SO-4: Hydrologically reconnect the tributary to Brushy Creek with its floodplain and adjacent wetland complex.	Qualitative assessment based on photo-documentation before and annually for five years after restoration activity determines that the Brushy Creek tributary is hydrologically connected with its floodplain and adjacent wetland complexes.
SO-5: Reduce non-native plant species in the onsite wetlands.	See Table 6.

Souza II Site-Specific Restoration Objectives	Performance Criteria
SO-6: Restore 8.5 acres of seasonal wetlands onsite.	8.5 acres seasonal wetlands have been restored and met the performance criteria provided in Table 5.
SO-7: Increase acreage of pond habitat onsite capable of supporting California tiger salamander.	The depth and duration of inundation at the newly created pond is not significantly different than the reference pools (at $\alpha \leq 0.05$ or 95% confidence) over a five-year monitoring period.
SO-8: Restore 8.5 acres of suitable habitat for vernal pool fairy shrimp and vernal pool tadpole shrimp	N/A (experimental—no performance criteria).
Grassland	
SO-9: Eliminate milk thistle from the project area.	No milk thistle is present five years after restoration.
SO-10: Increase the population size and distribution of brittlescale (*Atriplex depressa*) to the project area, if feasible.	N/A (experimental—no performance criteria).
Streams and Riparian Woodland/Scrub	
SO-11: Enhance structural diversity by creating in-stream pools in the Brushy Creek tributary.	Qualitative assessment based photo-documentation before and annually for five years after restoration activity determines that pools have formed behind rock weirs along the Brushy Creek tributary.

Table 7. Performance Criteria for Restoration Plantings

Performance Period (years)	Performance Indicators	Target Value
1	Percent of plants surviving	At least 75% survival in Good or Fair condition
2 (and subsequent years if necessary)		At least 70% survival in Good or Fair condition
3–5	Total absolute cover of native wetland vegetation	At least 60% cover
1–5	Total absolute cover of non-native invasive species*	No more than 5% cover

* Nonnative species = California Invasive Plant Council (Cal-IPC) with a level "high" rating, and any other species determined to threaten successful restoration of the native plant communities onsite (California Invasive Plant Council 2006).

Monitoring Methods

[Note to reader: This section is still under revision; methods described below may be revised.]

The following methods will be used to determine whether the performance criteria are being met.

Vegetation Monitoring

Vegetation monitoring will be performed in the restored areas to determine whether restoration objectives #SO-1, SO-5, and SO-6 have been met. Vegetation monitoring will occur during the early to mid spring, after or during the end of the rainy season. The actual timing may be adjusted slightly to coincide with optimal blooming conditions for the plantings.

During years one through three, performance criteria will be measured in ten 30-meter-long belt transects. Plant survival and health will be measured in the area within about 5 meters on either side of the transect line. The end points of each transect will be permanently marked using a metal T-post or other method approved by the District. Transect end points will also be recorded with a sub-meter precision global positioning system (GPS) unit.

The condition (vigor) of surviving plants will be evaluated on the basis of leaf color and size, as well as the presence of browse damage, disease symptoms and insect infestation, using the following qualifiers.

- Good Condition—Most or all leaves show healthy color and size, and/or <25% of plant's aboveground growth is affected by browse damage, disease or insect infestation.
- Fair Condition—Most leaves show healthy color and size, and/or 25–75% of plant's aboveground growth is affected by browse damage, disease or insect infestation.
- Poor Condition—Few or some leaves show healthy color and size, and/or more than >75% of plant's aboveground growth is affected by browse damage, disease or insect infestation.

Percent absolute cover will be measured for non-native species during years one through eight, and for native species during years four through eight. For the purpose of this RMP, non-native species are defined as species on the Cal-IPC List (California Invasive Plant Council 2006).

Percent absolute cover will be measured in 40 1-meter-square quadrats, randomly located along the ten 30-meter long transects (four quadrats per transect). Each year the quadrat locations along the line will be randomly chosen utilizing a random number table to identify 40 start points along the transects. The quadrat will be aligned such that one corner of the quadrat touches the transect and the quadrat lies to the northwest of that point.

During monitoring of plant survival and health, a monitor will count and visually estimate the health of the individual plantings in each quadrat. During monitoring of vegetative cover, a monitor will estimate the percentage of absolute cover of wetland vegetation and of each wetland plant species located in the quadrat. This could include other species than those planted, if such become

established. Although data on cover of individual species will not be used as performance criteria, this information could be used to inform adaptive management decisions and to illustrate the success of the project.

After the target values are met for restoration plantings, monitoring will measure and evaluate native wetland vegetative cover annually for five years. If after five years, the target values detailed in Table 5 for vegetative cover and abundance are met each year, then monitoring will cease and the project will be considered successful. If performance criteria are not met each year, then adaptive management decisions will be made as described below. Monitoring will continue until the criteria are met for five consecutive years.

Erosion

Erosion monitoring will be implemented to determine whether site-specific restoration objective #SO-2 is being met. Photo stations will be established prior to the onset of the restoration construction. Each station will be placed at a location where erosional problems have been identified along the Brushy Creek tributary. A baseline assessment will be prepared prior to onset of construction, to include photographs and a written description of the conditions at each station. Photographs and written descriptions from each station will then be prepared annually at approximately the same time of year, after the rainy season. The written descriptions will compare each station with conditions from the previous year in terms of bank stability or degree of erosion. At the end of five years, a determination will be made as to whether the restoration has successfully resulted in reduced erosion along the Brushy Creek tributary.

Wetland Acreage

The wetland and pond acreage onsite will be monitored to determine whether restoration objective #SO-3 is being met. A habitat map will be prepared at year 5, and the acreage of each habitat type will be calculated. These acreages will be compared with the baseline habitat map and the differences in acreages between baseline and year 5 for each habitat type will be calculated.

Hydrologic Connectivity

Hydrologic connectivity between the Brushy Creek tributary and adjacent wetlands will be monitored to determine whether restoration objective #SO-4 is being met. Photo stations will be established prior to the onset of the restoration construction, and placed at locations where hydrologic connectivity between Brushy Creek tributary and adjacent wetlands will be improved. A baseline assessment will be prepared prior to onset of construction, to include photographs and a written description of the conditions at each station. Photographs and written descriptions from each station will then be prepared annually, within a week of a major storm event. The written descriptions will compare each station

with conditions from the previous year in terms of hydrologic connectivity. At the end of five years, a determination will be made as to whether the restoration has successfully resulted in hydrologic connectivity between Brushy Creek tributary and restored seasonal wetlands.

Depth and Duration of Inundation

The depth and duration of inundation for the created pond will be monitored to determine whether restoration objective #SO-7 is being met. Reference ponds known to support California tiger salamander will be established on the adjacent Byron Airport's Habitat Management Lands. The depth of ponding in the created and reference ponds will be measured by installing at least one staff gauge in the lowest elevation in each wetland. The gauge elevations will be surveyed so that water depths can be accurately estimated for all other portions of the pools and swales using known bottom elevations. The lateral extent of inundation will also be estimated based on visual observation and recorded on standardized site base maps. Hydrographs for each created wetland will be compared with hydrographs for reference wetlands on an annual basis and for the entire 5-year monitoring period.

If the first five years of monitoring are characterized by abnormally dry conditions, an assessment will be conducted that compares the observed hydrological responses of each wetland to various rainfall events during the 5-year period. These rainfall/response relationships will be projected to more normal rainfall years. If the assessment suggests that created the created pool will respond in normal rainfall years in the same pattern as reference wetlands, then the performance criterion will be considered satisfied. If not, then monitoring will continue until the created pond sustains three consecutive years of hydrology that meet the performance criterion.

Milk Thistle

Milk thistle will be monitored in the project area to determine whether restoration objective SO-9 is being met. A survey for milk thistle and other invasive plants will be conducted annually in late spring. All milk thistle found in the project area will be mapped, and population numbers will be estimated. SO-9 will be considered successfully met if no milk thistle plants are present at the year 5 following restoration construction.

In-Stream Pools

The creation of in-stream pools in the Brushy Creek tributary will be monitored to determine whether restoration objective SO-11 is being met. Photo stations will be established prior to the onset of the restoration construction, and placed at locations where rock weirs are to be installed in the Brushy Creek tributary. A baseline assessment will be prepared prior to onset of construction, to include

photographs and a written description of the conditions at each station in terms of the in-channel structure diversity and pooling. Photographs and written descriptions from each station will then be prepared annually, during the rainy season. The written descriptions will compare each station with conditions from the previous year in terms of in-stream structural diversity and pooling of water. At the end of five years, a determination will be made as to whether the restoration has successfully resulted in increased in-channel structural diversity and creation of pooled areas within the Brushy Creek tributary.

Monitoring Schedule

Monitoring will be conducted in accordance with the schedule provided in Table 7.

Table 8. Monitoring Schedule

Type of Monitoring	Years[a]	Time Period
Vegetation: % survival	1–2	Early to mid spring, after or during the end of the rainy season
Vegetation: % cover planted species	3–5	Early to mid spring, after or during the end of the rainy season
Vegetation: % cover invasive species	1–5	Early to mid spring, after or during the end of the rainy season
Erosion	0–5	Late spring or early summer, after the rainy season
Wetland acreage	0[b], 5	Early to mid spring, after or during the end of the rainy season
Hydrologic connectivity	0–5	Within a week of a major storm event
Depth and duration of inundation	1–5	Rainy season
Milk thistle	0–5	Late spring
In-stream pools	0–5	Rainy season

[a] Year 0 is baseline, prior to restoration construction.
[b] Year 0 (baseline) for wetland acreage is the 2009 wetland delineation.

Adaptive Management

If performance criteria are not met within the specified timeframes, adaptive measures will be implemented to meet these criteria. Examples of adaptive measures would be installation of additional plantings or erosion control structures/devices if erosion and bank stability criteria are not being met, or deepening ponds if they do not hold water for a sufficient duration.

If the wetland fails to meet annual vegetation performance criteria, then additional planting of the same species and/or a shift in the planting palette will occur. As adaptive management proceeds, the efficacy and/or appropriateness of the monitoring methods and performance criteria will be evaluated. If necessary, new methods or criteria may be proposed and utilized. Additional truck irrigation may also be supplied if deemed necessary.

Additionally, adaptive management of the project area may include evaluating whether hydrological conditions and other ecological process are adequate to support the wetland vegetation as designed. If such conditions are not present for parts of the project area, based on new data and/or continued failure to meet the performance criteria, then managers may decide to reduce the final size of the wetland area counted toward the HCP/NCCP requirements.

Reporting

The monitoring results and adaptive management measures implemented each year will be provided in the annual HCP/NCCP monitoring report as required under Chapter 7 of the HCP/NCCP. Additionally, annual reports will be provided to the Corps to demonstrate compliance with conditions associated with the Corps' authorization under Nationwide Permit 27.

Completion of Corps Restoration Responsibilities

Corps Notification

Following completion of the restoration activities onsite, the contractor responsible for implementing the restoration will prepare as-built record drawings to document the grading and plant installation. The District will notify the Corps that restoration construction is complete and provide the Corps with copies of the as-built plans within 90 days after completion.

The District will inform the Corps when the performance criteria outlined in Table 5 of this RMP have been met.

Corps Confirmation

The Corps restoration responsibilities will be deemed complete when the Corps has provided written confirmation that conditions of the NWP 27 authorization, and performance criteria outlined in Table 5 of this RMP, have been met.

Long-Term Management

Long-term management is the management of the restored lands that will take place after the restoration project has met its performance criteria. Long-term preserve management is dictated by the management guidelines in Conservation Measure 1-2 (Chapter 5) of the HCP/NCCP and the site specific prescriptions that will be outlined in a Preserve Management Plan. A PMP is currently being prepared for the Souza II property and several other properties in the Byron Hills area.

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Appendix A

Soils Report

ICF Jones & Stokes
an ICF International Company

Memorandum

Date: February 23, 2009

To: John Kopchik, East Contra Costa County Habitat Conservancy

From: Kevin MacKay, Lead Designer

Kate Bode, Plant Ecologist

Scott Frazier, Certified Professional Soil Scientist

Subject: **Souza II Project Area Soil Suitability Assessment**

This memorandum summarizes the results of an onsite soil suitability assessment conducted at the Souza II Project Area (project area), located in eastern Contra Costa County, California, in December 2008. The project area has been identified by the Contra Costa County HCP implementation team as a candidate location for the enhancement of existing intermittent stream habitat and the creation of adjacent alkali/riverine wetlands, the creation of a California red-legged frog breeding pond, and the restoration and/or creation of two types of depressional wetland habitat (alkali flats/pools and seasonal freshwater marsh). The objectives of the soil suitability assessment were to evaluate the general suitability of soils located onsite for the restoration, creation, and enhancement of the target habitat types, and to identify any soil-based constraints that may affect the success of proposed habitat creation, restoration, or enhancement efforts.

Methods

Prior to conducting the onsite soil suitability assessment, I reviewed a detailed topographic map of the project area and available maps and documents describing the regional physiograpgy, geology, and soil survey mapping for the project vicinity (Welch 1977; Wagner et al. 1991). The onsite soil assessment was conducted on December 22, 2008, during which time a total of eight soil test pits were excavated in proposed habitat enhancement, restoration, and creation areas to depths ranging from 36 inches to 75 inches below ground surface. One test pit was excavated near Vasco Road at the proposed location of a seasonal freshwater marsh (test pit TP-1), two were excavated at the proposed locations of two alkali/riverine wetlands (test pits TP-2 and TP-3), another at the proposed location of a red-legged frog breeding pond (test pit TP-4), one at the proposed location of wetland swale (test pit TP-5), and three in a large area proposed for alkali wetland creation (test pits TP-6, 7, and 8). The basic morphologic properties of soils observed in each test pit were recorded, and grab samples were collected from select soil horizons and sent to a laboratory for analysis of particle size distribution, pH, electrical conductivity (i.e., salinity), and sodium adsorption ratio (SAR) (a measure of exchangeable sodium on the soils cation exchange complex).

Two grab samples were also collected from the surface soil horizons of two alkali wetlands located on the county airport property just east of Armstrong Road (Exhibit A) and sent to the laboratory for analysis of

pH, salinity, and SAR. One sample was collected from an unvegetated alkali wetland with salt deposits on the surface (Alkali Wetland 1), and the other was taken from a vegetated alkali wetland with no salt deposits on the surface (Alkali Wetland 2). The pH, salinity, and SAR values of these "reference site soils" were compared to those measured for soils in the project area to help determine their suitability for alkali wetland creation/restoration.

Results and Discussion

Local Geomorphology, Geology, and Soil Survey Mapping

The project area is situated on the proximal end of the large alluvial fan complex that flanks eastern side of the Coast Ranges. The moderately to gently sloping alluvial fan deposits that comprise most of the project area consist of unconsolidated gravel, sand, silt, and clay. The more steeply sloping hillslopes that exist along the northern, southern, and eastern fringes of the project area are underlain by sedimentary bedrock of the Panoche and Moreno Formations (marine sandstone, siltstone, and shale) (Wagner et al. 1991).

Soils formed from the fan deposits are mapped primarily as San Ysidro loam, with a few small areas of strongly alkaline Solano loam mapped near the eastern boundary along Armstrong Road (Exhibit A). The San Ysidro loam and Solano loam soils have very similar morphologies and commonly occur in association with one another on fan deposits along the eastern side of Coast Ranges. Both soils are deep and typically moderately well to somewhat poorly drained Alfisols characterized by loamy surface textures and fine-textured, slowly permeable subsurface horizons with high illuvial clay content (Welch 1977). The main difference between the two soil types is that the fine-textured, illuvial subsurface horizons in the San Ysidro loam soil have relatively low exchangeable sodium content (<15%) (horizons referred to collectively as an argillic horizon), while the fine-textured, illuvial subsurface horizons in the Solano loam soil contain high concentrations of exchangeable sodium (>15%) (horizons referred to collectively as a natric horizon). The Solano loam subsoil is also typically characterized by alkaline pH values (7.4-9.0) and high salinity (>8dS/m).

The strongly alkaline Solano loam soil map unit that occupies a small portion of the project area typically occurs only in the lowest and most poorly drained landscape positions (i.e., basins and basin rims), and is distinguished from the non-alkaline Solano loam map unit that occurs outside the project area in that it contains substantial inclusions of soils that have very high concentrations of sodium and carbonate in the surface and near surface horizons. The concentration of sodium and carbonate salts near the surface is the result of capillary rise from shallow or perched groundwater water tables. Sodium and carbonate salts derived from the marine parent material accumulate near the surface as water evaporates and is transpired by plants, and is continually replenished by capillary rise from the underlying water table. The resulting high pH and salinity can substantially affect plant nutrient water availability, while high concentrations of exchangeable sodium can disperse surface soil structure and cause extended periods of surface ponding. Most areas affected by these high pH, salinity, and exchangeable sodium conditions are unvegetated (i.e., often referred to as "alkali scalds") or are dominated by halophytic wetland plants that are physiologically adapted for growth in saturated and saline-sodic soil conditions.

Soils formed from the residual marine bedrock in the more steeply sloping portions of project area are

mapped as Altamont clay (Exhibit A). The Altamont clay soil is a well drained Vertisol characterized by clay-textures throughout, pronounced surface cracking caused by shrink-swell actvivity, and illuvial accumulations of carbonates in the subsurface horizons (Welch 1977).

Onsite Soil Suitability Assessment

The soil profile morphology and laboratory data for each of the eight test pits excavated in the project area and the two alkali wetland reference sites located on the county airport property are summarized below, along with a brief assessment of the suitability of the soil from each test pit location for creation/restoration of the target habitat types.

Reference Alkali Wetland Sites

The surface soil at both alkali wetland sample locations consisted of strongly alkaline, saline-sodic fine sandy loam. Electrical conductivity, pH, and SAR were measurably higher in the sample collected from the largely unvegetated alkali wetland with salt deposits on the surface (Alkali Wetland 2) than in the sample collected from the vegetated alkali wetland without surface salt deposits (Alkali wetland 2). A small amount of surface water ponding was observed at the Alkali Wetland 1 site during sampling. Given the relatively coarse texture and unsaturated condition of the soil at this location, the ponding appears to be the result of surface sealing caused by the high exchangeable sodium content (i.e., high SAR).

Table 1. Laboratory results for topsoil at alkali wetland reference sites

Sample ID	pH	Electrical conductivity (dS/m)	SAR
Alkali Wetland 1	9.0 (strongly alkaline)	11.4 (saline)	88.84 (sodic)
Alkali Wetland 2	8.2 (moderately alkaline)	14.6 (saline)	55.52 (sodic)

Test Pit TP-1. Proposed Seasonal Marsh Creation Site

Test pit TP-1 was excavated to a depth of approximately 36 inches in an area where soils are mapped as San Ysidro loam (Exhibit A). The portion of the soil profile observed in the test pit excavation appears to fit that of the San Ysidro loam soil fairly well. Two loam and clay loam A horizons extend to depth of approximately 19 inches, and are underlain by a clay-textured argillic horizon1 that extends to a depth of greater than 36 inches (i.e., past bottom of excavation).

The soil observed at test pit TP-1 is well to moderately well drained, due primarily to slope gradient and position. However, the subsurface, clay-textured argillic horizon (Bt horizon) is very slowly permeable and is moderately well suited to supporting seasonal wetland hydrology. In most San Ysidro loam soil profiles, the clay-textured argillic horizon gives way to a more coarse-textured and permeable alluvial

1 Zone of illuvial clay accumulation

parent material at depths between 40 and 60 inches, so care should be taken not to overexcavate and or spoil the clayey argillic material when excavating the footprint of the proposed seasonal marsh.

Table 2. Test Pit TP-1 Morphology and Laboratory Results (San Ysidro loam)

Horizon	Depth (inches)	Texture (est. %clay)	Color - Structure	Redox Features	Sample ID
A1	0-6	loam (28%)	10YR3/2 – blocky	none	TP-1 (A)
A2	6-19	clay loam (34%)	10YR3/2 – blocky	none	TP-1 (B, C)
Bt	19-36+	clay (42%)	10YR3/1 - massive	none	TP-1 (D)

Notes:
Test pit excavated on gentle hillslope adjacent to Vasco Road culvert outlet and associated, human-made drainage channel; no groundwater was encountered at time of excavation

Horizon Designations:
Lower case "t" indicates accumulation of illuvial clay

Laboratory Analyses and Results:
1. Sample TP-1 (C): (A20-N) – particle size distribution
   Results: 37% clay, 27% silt, 36% sand/ Texture = clay loam

Test Pits TP-2 and TP-3. Alkali/Riverine Wetland Creation Sites

Test pits TP-2 and TP-3 were excavated to depths of approximately 62 and 42 inches, respectively, on a gently sloping alluvial plain located on the north side of the intermittent stream channel that bisects the project area. Soils at both locations are mapped as San Ysidro loam (Exhibit A). The morphology and chemistry of the soil profile observed at test pit TP-2 resembles that of the Solano loam soil, consisting of two loam and clay loam A horizons underlain by a clay loam natric horizon that has an alkaline pH, high salinity, and a high concentration of exchangeable sodium. The morphology and chemistry of the soil profile observed at test pit TP-3 more closely resembles that of the San Ysidro loam soil, consisting of two loam and clay loam A horizons underlain by a clay and clay loam textured argillic horizon that lacks the high exchangeable sodium, pH, and salinity characteristic of the Solano loam subsoil (Tables 3 and 4).

Soils at both locations appear to be moderately well drained (redox features noted near the bottom of test pit TP-3 appear to relict). However, the clay-textured argillic and natric horizons observed in both test pits is typically very slowly permeable and is therefore moderately well suited to supporting seasonal wetland hydrology. It should be noted, however, that in most Solano and San Ysidro loam soil profiles, the clay-textured argillic and natric horizons often give way to more coarse-textured and permeable alluvial parent material at depths between 40 and 60 inches, so care should be taken not to overexcavate and or spoil the clayey argillic and natric horizon material when excavating the footprint of the proposed alkali/riverine wetlands. The invert of intermittent stream channel is positioned a foot or more below the surface of clayey argillic horizon observed in test pits TP-2 and TP-3, suggesting that the argillic horizon is not acting as a geologic control for the adjacent intermittent stream channel.

The surface and near surface soils observed at test pits TP-2 and TP-3 lack high the alkaline pH values, high salinity, and high exchangeable concentrations that are characteristic of the surface soils in nearby alkali wetlands nearby alkali wetlands (Tables 1, 3, and 4). As such, it's my interpretation that the soils in

the vicinity of test pits TP-2 and TP-3 are not well suited to alkali wetland creation. Although the subsurface natric and argillic horizons observed in these soils are sufficient to support seasonal wetland hydrology, the exchangeable sodium concentrations in the surface and near surface horizons are too low to disperse soil structure and cause surface sealing/ponding, and the salinity and pH are probably also too low to favor dominance by halophytic wetland plants. In addition, test pits TP-2 and TP-3 are situated on a sloping, well drained alluvial fan and not a low-lying, poorly drained basin where alkali wetlands occur naturally in the vicinity of the project area. As such, it's unlikely that importing saline-sodic topsoil from an offsite location would be effective in creating high quality, self-sustaining alkali wetlands in the vicinity of TP-2 and TP-3.

Table 3. Morphology and Laboratory Results for Test Pit TP-2 (Solano loam)

Horizon	Depth (inches)	Texture (est. %clay)	Color - Structure	Redox Features	Sample ID
A1	0-5	loam (14%)	10YR4/6 – blocky	none	TP-2 (A)
A2	5-14	clay loam (28%)	10YR3/3 – prismatic	none	TP-2 (B)
Btn1	14-23	clay loam (34%)	110YR3/3 – blocky	none	none
Btn2	23-52	clay loam (38%)	10YR4/6 – massive	none	TP-2 (C)
BC/C	52-62+	clay loam (30%)	7.5YR4/6 - massive	none	TP-2 (D)

Notes:
Test pit excavated in nearly level area adjacent to intermittent stream channel; bottom of test pit excavation extends approximately 16 inches below invert of adjacent stream channel (measured using clinometer); no groundwater was encountered at time of excavation

Horizon Designations:
Lower case "t" indicates accumulation of alluvial clay; lower case "n" indicates accumulation of sodium salts

Laboratory Analyses:
1. Sample TP-2 (A): (A02) – Agricultural Suitability
   Results: pH=6.3 / EC = 0.5 dS m^{-1} / SAR = 2.34
2. Sample TP-2 (B): (A02) – Agricultural Suitability
   Results: pH=7.0 / EC = 1.8 dS m^{-1} / SAR = 11.27
3. Sample TP-2 (C): (A02 and A20-N) - Agricultural Suitability
   Results: pH=7.6 / EC = 9.9 dS m^{-1} / SAR = 18.30 / clay = 37%, silt = 26%, sand = 37% texture = clay loam

Table 4. Morphology and Laboratory Results for Test Pit TP-3 (San Ysidro loam)

Horizon	Depth (inches)	Texture (est. %clay)	Color - Structure	Redox Features	Sample ID
A1	0-3	loam (22%)	10YR3/2 – blocky	none	TP-3 (A)
A2	3-8	clay loam (30%)	10YR3/2 - blocky	none	TP-3 (B)
Bt	8-20	clay (48%)	10YR3/2 – prismatic	none	TP-3 (C)
Btck	20-42+	clay (52%)	10YR3/3 - massive	Few Mn-x & Fe-x	TP-3 (D)

Notes:
Test pit was excavated on nearly level plain near Armstrong Road and intermittent stream channel; bottom of test pit excavation extends approximately 12 inches below invert of adjacent stream channel (measured using clinometer); no groundwater was encountered at time of excavation

Horizon Designations:
Lower case "t" indicates accumulation of illuvial clay; lower case "n" indicates accumulation of sodium

salts; lower case "k" indicates the accumulation of carbonates, and lower case "c" indicates that the carbonates are present in part as cemented concretions and nodules; Mn-x indicates presence of manganese concentrations; Fe-x indicates presence of iron concentrations

Laboratory Analyses:

1. TP-3 (A): (A02) – Agricultural suitability
   Results: pH= 6.2 / EC = 1.1 dS m^{-1} / SAR = 1.65
2. TP-3 (B): (A02) – Agricultural suitability
   Results: pH=6.5 / EC = 0.8 dS m^{-1} / SAR = 1.59
3. TP-3 (C): (A02 and A20-N) - Agricultural suitability and particle size distribution
   Results: pH=7.4 / EC = 0.5 dS m^{-1} / SAR = 4.07 / clay = 43%, silt = 21%, sand = 36% / texture = clay

Test Pit TP-4. California Reds-Legged Frog Pond Creation Site

Test pit TP-4 was excavated to a depth of approximately 75 inches on a nearly level alluvial plain where soils are mapped as San Ysidro loam (Exhibit A). The portion of the soil profile observed in the test pit excavation appears to match that of the San Ysidro loam soil fairly well. A loam A horizon extends to depth of approximately 7 inches, and is underlain by a series of clay loam Bt horizons (referred to collectively as an argillic horizon) that extends to a depth of approximately 46 inches (Table 5).

The soil observed at test pit TP-4 appears to be well drained (redox features noted at depth appear to be relict), due primarily to slope gradient and position. However, the subsurface argillic horizon (Bt horizons) is very slowly permeable and is moderately well suited to supporting seasonal wetland/pond hydrology. It should be noted that in this test pit, as well as in most San Ysidro loam soil profiles, the clay-textured argillic horizon gives way to a more coarse-textured and permeable alluvial parent material at depths between 40 and 60 inches, so care should be taken not to overexcavate and or spoil the clayey argillic material when excavating the footprint of the proposed California red-legged frog breeding pond.

Table 5. Test Pit TP-4 Morphology and Laboratory Results (San Ysidro loam)

Horizon	Depth (inches)	Texture (est. %clay)	Color - Structure	Redox Features	Sample ID
A	0-7	loam (26%)	10YR3/2 – blocky	few Fe-x	none
Bt1	7-20	clay loam (36%)	10YR3/2 – prismatic	none	TP-4 (A)
Bt2	20-31	clay loam (37%)	10YR3/3 - prismatic	none	none
Btck	31-46	clay loam (40%)	10YR5/4 – massive	none	TP-4 (B)
BC	46-75+	clay loam (32%)	10YR5/4 – massive	many Fe-x and Mn-x	TP-4 (C)

Notes:
Test pit excavated on nearly level alluvial plain located south of intermittent stream channel that bisects project area; no groundwater was encountered at time of excavation

Horizon Designations:
Lower case "t" indicates accumulation of illuvial clay; lower case "k" indicates the accumulation of carbonates, and lower case "c" indicates that the carbonates are present in part as cemented concretions and nodules

Laboratory Analyses:

1. TP-2 (B): (A20-N) – particle size analysis
   Results: clay = 35%, silt = 28%, sand = 37%, texture = clay loam

Test Pit TP-5. Seasonal Wetland Swale Creation Site

Test pit TP-5 was excavated to a depth of approximately 46 inches on moderately sloping alluvial plain located on the south side of the intermittent stream channel that bisects the project area where soils are mapped as San Ysidro loam (Exhibit A). The soil profile observed at test pit TP-5 resembles that of the San Ysidro loam soil fairly well, consisting of a loam topsoil horizon underlain by a clay loam argillic horizon (Bt horizons) (Table 6).

The soil observed at test pit TP-5 appears to be moderately well drained. However, the clay-textured argillic horizon is typically very slowly permeable and is moderately well suited to supporting seasonal wetland hydrology. It should be noted, however, that in most San Ysidro loam soil profiles, the clay-textured argillic horizon typically gives way to more coarse-textured and permeable alluvial parent material at depths between 40 and 60 inches, so care should be taken not to overexcavate and or spoil the clayey argillic horizon material when excavating the footprint of the proposed seasonal wetland swale.

Table 6. Test Pit TP-5 Soil Morphology and Laboratory Results (San Ysidro loam)

Horizon	Depth (inches)	Texture (est. %clay)	Color - Structure	Redox Features	Sample ID
A	0-14	loam (18%)	10YR3/2 – blocky	none	TP-5 (A)
Bt1	14-28	clay loam (30%)	10YR3/3 - blocky	none	none
Bt2	28-46+	clay loam (36%)	10YR 4/4– blocky	none	TP-5 (B)

Notes:
Test pit excavated on gently sloping alluvial plain located south of intermittent stream channel that bisects project area; no groundwater was encountered at time of excavation

Horizon Designations:
Lower case “t” indicates accumulation of illuvial clay

Laboratory Analyses:
None

Test Pits TP-6, TP-7, and TP-8. Alkali Wetland Creation/Restoration Sites

Test pits TP-6, TP-7, and TP-8 were excavated to depths of approximately 39, 41, and 46 inches, respectively, on a moderately sloping to nearly level alluvial plain located on the south side of the intermittent stream channel that bisects the project area. The soils at test pits TP-6 and TP-8 are mapped as San Ysidro loam, while test pit TP-7 is included in a strongly alkali Solano loam soil map unit centered on the eastern side of Armstrong Road (Exhibit A). In both instances, the soil survey mapping appears to be accurate. The soil profiles observed at test pits TP-6 and TP-8 are characteristic of the San Ysidro loam soil, consisting of a loamy topsoil underlain by a clay loam argillic horizon (Tables 7 and 9), while the soil profile observed at test pit TP-7 is characteristic of the Solano loam soil, consisting of a loamy topsoil

underlain by a clay loam natric horizon with high exchangeable sodium, strongly alkaline pH, and high salinity (Table 8).

The soil profiles observed at test pits TP-6 and TP-8 appear to be moderately well drained (redox features noted in test pit TP-8 appear to be relict), while the soil at test pit TP-8, which is situated on a lower landscape position, appears to be somewhat poorly drained (redox features noted appear to be contemporary). At all three locations, the clay loam argillic and natric horizons are very slowly permeable and are moderately well suited to supporting seasonal wetland hydrology. It should be noted, however, that in most Solano and San Ysidro loam soil profiles, the clay-textured argillic and natric horizons give way to more coarse-textured and permeable alluvial parent material at depths between 40 and 60 inches, so care should be taken not to overexcavate and or spoil the clayey argillic and natric horizon material when excavating the footprint of constructed wetlands.

The topsoil at test pits TP-6 and TP-7 lack the high pH values, high salinity, and high exchangeable sodium concentrations characteristic of surface soils collected from nearby alkali wetlands (Tables 1, 7, and 8). As such, it's my interpretation that the soils in the area sampled by test pits TP-6, TP-7, and TP-8 are not well suited to alkali wetland creation. Although the subsurface natric and argillic horizons observed at these locations are sufficient to support seasonal wetland hydrology, the exchangeable sodium concentrations in surface and near surface horizons are too low to disperse soil structure and cause surface sealing/ponding, and salinity and pH are probably also too low to favor dominance by halophytic wetland plants. In addition, much of the area sampled by these three test pits is sloping and moderately well drained, and is not situated in a low-lying, poorly drained landscape position where alkali wetlands occur naturally in the vicinity of the project area. As such, it's unlikely that importing saline-sodic topsoil from an offsite location would be effective in creating high quality, self-sustaining alkali wetlands. The small, nearly level area in the immediate vicinity of test pit TP-7 is the only portion of the project area that is even marginally suitable for alkali wetland creation.

Table 7. Test Pit TP-6 Soil Morphology and Laboratory Results (San Ysidro loam)

Horizon	Depth (inches)	Texture (est. %clay)	Color - Structure	Redox Features	Sample ID
A	0-8	Loam (28%)	10YR3/2 – blocky	none	TP-6 (A)
Bt	8-27	clay loam (32%)	10YR4/2 – prismatic	none	TP-6 (B)
Btk	27-39+	clay loam (38%)	10yR4/2 – massive	none	TP-6 (C)

Notes:
Test pit excavated on gently sloping alluvial plain on south side of intermittent stream channel; no groundwater was encountered at time of excavation

Horizon Designations:
Lower case "t" indicates accumulation of illuvial clay (i.e., argillic horizon); lower case "k" indicates the accumulation of carbonates

Laboratory Analyses:
1. TP-2 (A): (A02) – Agricultural Suitability (pH, salinity, SAR)
   Results: pH= 6.7 / EC = 0.7 dS m^{-1} / SAR = 1.04
2. TP-2 (B): (A02) – Agricultural Suitability (pH, salinity, SAR)
   Results: pH= 6.8 / EC = 0.5 dS m^{-1} / SAR = 1.81
3. TP-2 (C): (A02 and A20-N) - Agricultural Suitability (pH, salinity, SAR) and particle size analysis
   Results: pH= 8.0 / EC = 1.1 dS m^{-1} / SAR = 5.77 / clay = 35%, silt = 33%, sand = 32%, texture = clay loam

Table 8. Test Pit TP-7 Soil Morphology and Laboratory Results (Solano loam)

Horizon	Depth (inches)	Texture (est. %clay)	Color - Structure	Redox Features	Sample ID
A	0-6	Loam (22%)	10YR3/2 – blocky	few Fe-x and Mn-x	TP-7 (A)
Bt1	6-20	clay loam (32%)	10YR4/2 - prismatic	few Fe-x and Mn-x	TP-7 (B)
Btn2	20-41	clay loam (40%)	7.5YR4/4 – massive	none	TP-7 (C)

Notes:
Test pit excavated in nearly level alluvial plain south of intermittent stream channel; no groundwater was encountered at time of excavation

Horizon Designations:
Lower case "t" indicates accumulation of illuvial clay; lower case "n" indicates accumulation of sodium salts; Mn-x indicates presence of manganese concentrations; Fe-x indicates presence of iron concentrations

Laboratory Analyses:
1. TP-2 (A): (A02) – Agricultural Suitability (pH, salinity, SAR)
   Results: pH= 6.5 / EC = 4.0 dS m-1 / SAR = 9.24
2. TP-2 (B): (A02) – Agricultural Suitability (pH, salinity, SAR)
   Results: pH= 8.2 / EC = 0.5 dS m-1 / SAR = 7.92
3. TP-2 (C): (A02 and A20-N) - Agricultural Suitability (pH, salinity, SAR) and particle size analysis
   Results: pH= 8.6 / EC = 6.5 dS m-1 / SAR = 29.91 / clay = 37%, silt = 35%, sand = 28%, texture = clay loam

Table 9. Test Pit TP-8 Soil Morphology and Laboratory Results (San Ysidro loam)

Horizon	Depth (inches)	Texture (est. %clay)	Color - Structure	Redox Features	Sample ID
A1	0-5	loam (20%)	10YR3/2 - blocky	none	TP-8 (A)
A2	5-17	loam (26%)	10YR4/3 – blocky	few Fe-x and Mn-x	TP-8 (B)
Bt	17-36	clay loam (36%)	10YR4/4 - massive	none	TP-8 (C)

Notes:
Test pit excavated on moderately sloping alluvial plain located south of intermittent stream channel; no groundwater was encountered at time of excavation

Horizon Designations:
Lower case "t" indicates accumulation of illuvial clay; Mn-x indicates presence of manganese concentrations; Fe-x indicates presence of iron concentrations

Laboratory Analyses:
None

References Cited

Wagner, D.L., E.J. Bortugno, and R.D. McJunkin. 1991. Geologic map of the San Francisco-San Jose Quadrangle, California, 1:250,000. California Department of Conservation, Division of Mines and Geology. Sacramento, CA.

Welch, L.E. 1977. Soil Survey of Contra Costa County, CA. U.S. Department of Agriculture Soil Conservation Service, In Cooperation with the University of Califonrnia Agriculatural Experiment Station. Davis, CA.

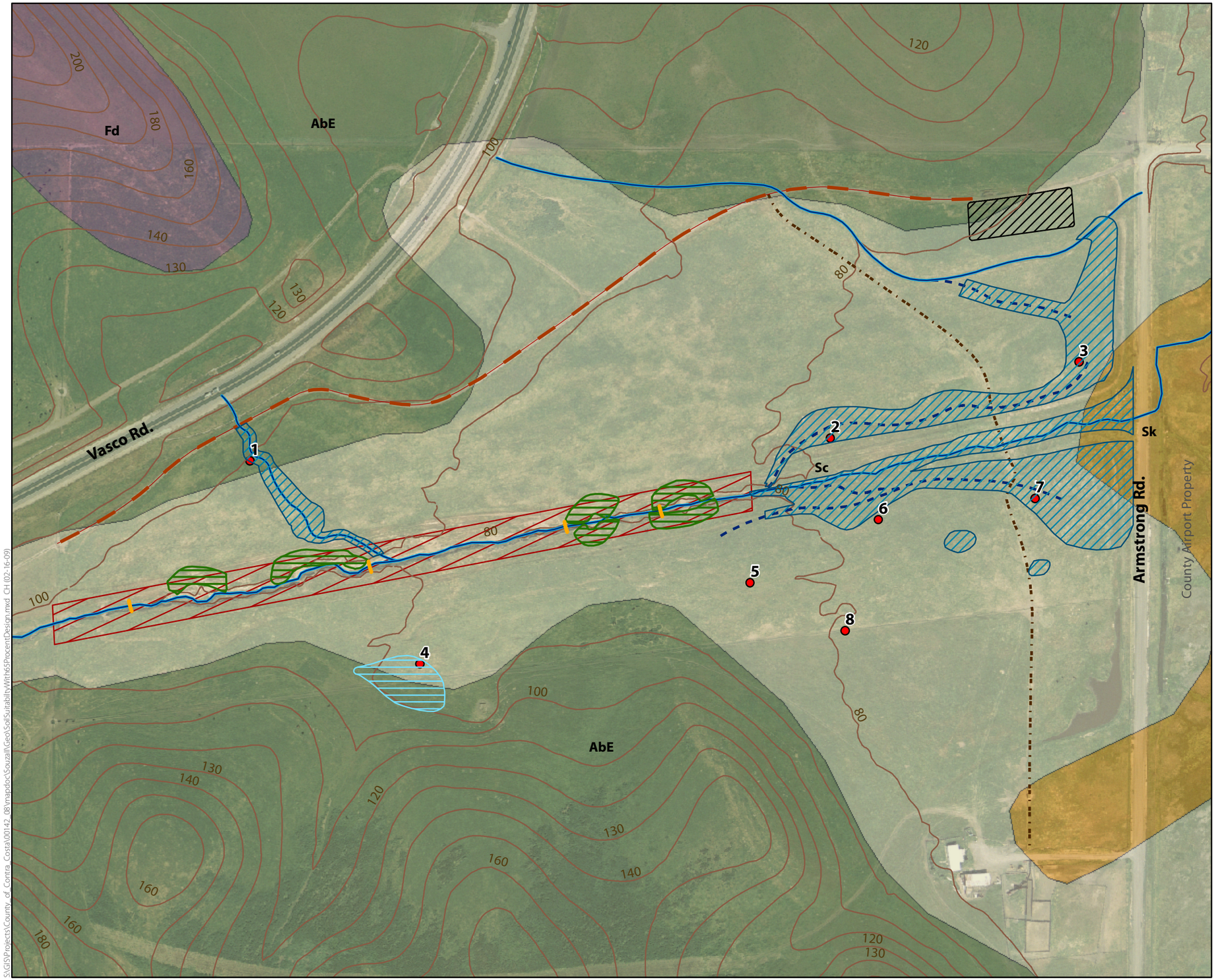

Exhibit A
Soil Suitability Assessment
Souza II Project Area
Contra Costa County, California
January 6, 2009

Soil Test Pit

Soil Map Unit Index

- **AbE** Altamont Clay 15 to 30 Percent Slopes
- **Fd** Fontana-Altamont Complex
- **Sc** San Ysidro Loam
- **Sk** Solano Loam, Strongly Alkali

Source: SSURGO Soil Data, Natural Resource Conservation Service Downloaded 10/5/2006

10ft Contour

Restoration Features

Phase I
- Boulder Weir
- Bank Layback and Revegetate
- Pond
- Seasonal Wetland
- Existing Stream
- Proposed Stream

Phase II
- Channel Restoration

Phase III
- Staging Area
- Trail

Note: Fieldwork completed on December 22, 2008

N

0 200 400
Feet

ICF Jones & Stokes
an ICF International Company

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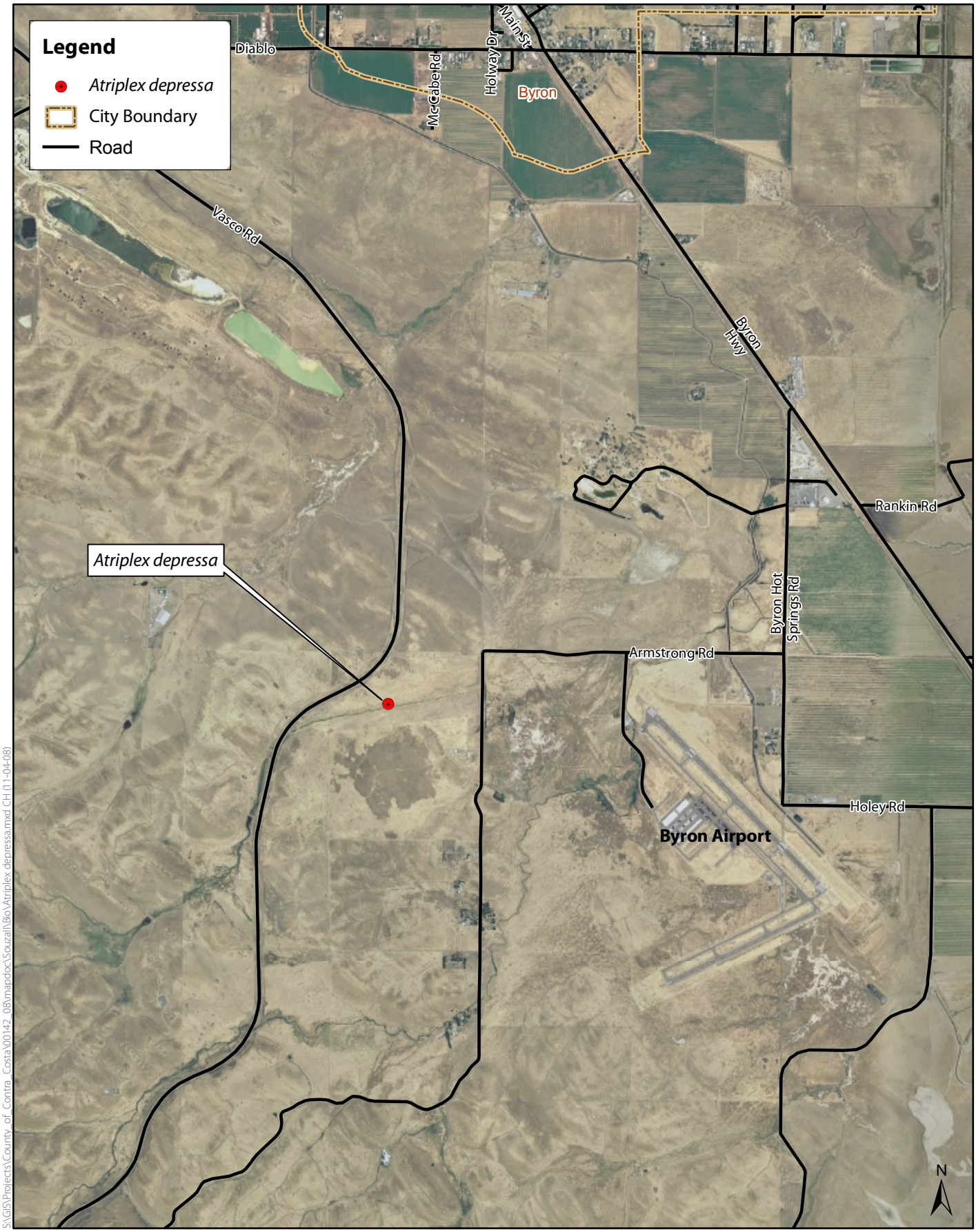
Appendix B

Brittlescale Location Map



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0 500 1,000 Meters

Atriplex depressa Occurrence

Appendix C

Wetland Delineation

(attached separately)

Appendix D

Restoration Plan Drawings

(attached separately)