Planning Level Delineation and Geospatial Characterization of Aquatic Resources for Otay Watershed, San Diego County, California

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Executive Summary

A planning level delineation of aquatic resources was performed within the Otay River Watershed, San Diego County, California. A planning level delineation is defined here as the identification of areas that meet the jurisdictional requirements under Section 404 of the *Clean Water Act* (Section 404), and the California Department of Fish and Game (CDFG) Section 1600 Code at a watershed scale. Although the delineation is accurate at the planning level, it is not specific to any one site. Thus, a planning level wetland delineation does not replace the need for a jurisdictional wetland delineation from the Corps of Engineers (COE) permitting program, or the CDFG Section 1600 requirements. In addition, the limits of COE jurisdiction may vary from the limits of other regulatory agencies as defined under state law or local ordinances (e.g. CDFG jurisdiction). For the purpose of this report the jurisdiction described refers to COE jurisdiction unless otherwise specified. As such, this report describes the baseline occurrence of aquatic resources that were observed in these watersheds at the time of the study during the period between March 2001 and January 2003.

The modification of standard delineation sampling protocols and the development of wetland ratings for Section 404 Regulatory purpose for the riparian vegetation map units allowed for a watershed scale delineation. The sampling protocols outlined in the Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987) and 33 CFR 328 were modified for use at the watershed scale. To delineate at this scale, we mapped geomorphic surfaces in the riparian zones representing several different flood return intervals, which were later interpreted for the limits of ordinary high water marks (OHWM) under 33 CFR 328. Individual vegetation units were sampled at 40 sites to develop a characterization of the indicators for both wetlands and other Waters of the United States (WoUS). Wetland decisions were determined by combining the field data for wetland criteria for each separate vegetation map unit with the distribution patterns of vegetation units within the geomorphic surfaces. By combining the wetland indicators with flood frequency information obtained from the geomorphic surface map, we made jurisdictional decisions regarding WoUS, including wetlands across the entire study area.

The vegetation units in the riparian areas were then rated for their probability of meeting the criteria as either wetland or non-wetland WoUS. These ratings resolved the issue that some vegetation units had repeatable characteristics that always meet the criteria of a WoUS, including wetlands, and others were so ecologically diverse that they were able to occur in various landscape positions. By combining field sampling and observations with distribution patterns analyzed within the GIS database, probabilities ratings intended for regulatory purposes were developed to accommodate all variations. Six categories of wetland ratings were assigned to each of the riparian vegetation units with ratings ranging from always regulated to upland or not regulated.

We delineated a total of 1,984 hectares (4,903 acres) of WoUS including wetlands in the riparian areas and 1,641 kilometers (1,020 miles) of ephemeral and intermittent streams as non-wetland WoUS on the watershed.

1. Introduction

1.1 Background

The U.S. Army Corps of Engineers, Los Angeles District (LA District) recently funded an effort to map the aquatic resources within the Otay watershed, San Diego County, California. This effort began by using vegetation coverages obtained from San Diego County. By combining onsite mapping efforts for vegetation and hydrogeomorphic surfaces with detailed field sampling, we were able to develop a large scale planning level wetland delineation for the watershed. Our report provides support to the LA District and others on aquatic resources and their regulatory status (under Section 404) that will be useful for the large scale future assessment of impacts to aquatic resources in the watershed. Specifically, it provides information necessary to identify and characterize regulated waters of the United States (WoUS) including wetlands, in the context of Section 404 permit review. Although jurisdictions may vary, this planning level delineation of aquatic resources provides a comprehensive mapping of aquatic resources regulated under California Department of Fish and Game's Section 1600 program.

This planning level delineation also supports in part the concurrent landscape level functional assessment for the watershed.[1] Because of the ecological breadth of these studies, no effort was made to distinguish between those areas that may or may not be isolated wetlands. Additionally, to establish whether an aquatic resource is an "isolated wetland" requires an effort that exceeds the intent and scope of this study. All jurisdictional limits under Section 404 for Waters of the U.S. including wetlands identified in this report will be made by the U.S. Army Corps of Engineers, Los Angeles District, Regulatory Branch.

1.2 Objectives

The overall objective of this project was to conduct a planning level delineation and geospatial characterization of aquatic resources in the Otay River Watershed under current conditions to provide a baseline for further evaluation. Following the delineation, a functional assessment of the ecosystems will be performed. In turn, the assessment will be used to evaluate the potential impacts of future development projects on the aquatic resources in the watersheds. A similar project has been completed for both the San Diego Creek Watershed (Smith 2000a), San Juan Creek and portions of the San Mateo River Watersheds (Smith 2000b) in Orange County and the San Jacinto and portions of the Santa Margarita Watersheds (Smith 2002) in Riverside County.

Five specific tasks were identified to meet the overall project objective. The first was to conduct a planning level identification of aquatic resources within

[1] Aquatic resources delineated in this study are intended to include those regulated under Section 404 of CWA and CDFG's 1600 program. The term aquatic resource is used to be inclusive of these regulated resources.

the boundaries of the Otay River Watershed through the interpretation of orthophoto quadrangles and stereoscopic aerial photography.

The second task was to verify the jurisdictional status and location of identified aquatic resources using sampling and global positioning system (GPS) techniques at a representative numbers of field locations.

The third task, to produce a planning level map of aquatic resources, including jurisdictional WoUS, which provided a tool for the visualization of these resources within an ArcGIS based geographical information system (GIS). These data were used for the fourth task, which was to develop a GIS database of riparian ecosystem and watershed characteristics.

The fifth and final task was to provide an aquatic resource characterization, including data regarding the occurrence of the resources as well as digital coverages to support a concurrent landscape level wetland functional assessment within the watersheds.

The overall purpose of this study is identification of aquatic resources in Otay River Watershed in San Diego County as part of the Special Area Management Plan (SAMP) currently underway in this region. The SAMPs are comprehensive aquatic resource planning efforts in the context of Section 404 of the Clean Water Act. The ultimate goal of the SAMP is to provide a management tool whereby a balance is reached between protection of aquatic resources and reasonable economic development. The U.S. Army Corps of Engineers, Los Angeles District, is leading the development of the SAMP in San Diego County, California. The aquatic resource delineation will be used as the basis for identifying the resources regulated under Section 404. Additional studies are currently underway to characterize the aquatic resources in terms of hydrological, habitat, and water quality functions. Other components of the SAMP include development of the SAMP tenets, the purpose and need statement, an analysis of alternatives, a watershed restoration plan, the preparation of a joint Environmental Impact Statement (EIS)/Environmental Impact Report, and finally the issuance of permits.

2. Study Area

Otay watershed encompasses 39,810 hectares (98,374 acres) approximately 10 miles south of downtown San Diego, California. Otay watershed includes communities such as City of Imperial Beach, City of Chula Vista, City of Coronado, and City of San Diego. The watershed is bounded by the crest of the San Ysidro Mountains on the south, Skyline Drive to the north, the Pacific Ocean to the west. (Figure 1)

Elevations range from sea level to 1,140 meters (3,740 ft) at Lyons Peak in the northeast corner of the watershed. Terrain includes rugged mountains, steep-walled canyons and gently sloping floodplains. The western half is located on a succession of marine terraces, or mesas, on the coastal plain that rises gradually from the Pacific Ocean. The central portion changes to relatively flat valleys with highly incised adjacent foothills. The eastern portion is exposed basement rock forming foothills with deeply incised canyons.

The major vegetation types include chaparral, coastal sage scrub, grassland, and riparian vegetation.

Figure 1. Study Area Site and Location Map

2.1 Climate

The regional climate in the Otay watershed is classified as Mediterranean, which is characterized by warm, dry summers, and mild, wet winters. Precipitation averages range from 25.4 cm. (10 in.) on the coast to 45.7 cm. (18 in.) in the eastern mountains and is primarily associated with low to moderate intensity storms in the winter and spring. Frosts are light and infrequent, with the growing season ranging from 345 to 360 days, depending on distance from the ocean. The average annual temperature is about 63 degrees F (17.22 C). The average daily high is 71 degrees F (21.67 C), and the low 53 degrees F (11.67 C).

The major influences on the regional climate of the Otay Watershed are the Eastern Pacific High, a strong persistent anticyclone, and the moderating effects of the cool Pacific Ocean (USACE 1998). During summer, the Eastern Pacific High dominates the Eastern Pacific Ocean, creating fair weather and producing a temperature inversion. Thermal low-pressure systems that typically develop over the inland deserts draw cool marine air onto the land, moderating the daytime temperatures. This marine air frequently condenses into fog and stratus clouds below the inversion layer during the evening but dissipates during the following day as the land heats up. Summer precipitation associated with tropical air masses is generally infrequent and light.

During winter and spring, polar storm systems pass through the region as the Eastern Pacific High weakens and shifts south. Most regional precipitation occurs during this period. Excessive rainfall can occur when the jet stream maintains a position over Southern California and carries multiple storms across the region. Moderate to major flooding events for this region typically occur from December to March and have been documented for the following years during the 20th century: 1906, 1916, 1921, 1927, 1937, 1938, 1969, 1978, 1980, 1983, 1993, 1995 and 1998. The worst flooding observed in the Otay Watershed occurred in 1916 when catastrophic flooding beyond the level of a 100-year flood burst the Otay Reservoir Dam, destroying all structures downstream and killing several people.

A strong east to northeastern wind, known as the “Santa Ana Winds”, makes its appearance throughout Southern California in the Fall and can occur at any time throughout the Winter months. These “Santa Ana Winds” carry warm dry air from the deserts to the coast, dramatically increasing temperatures and decreasing relative humidity levels. These factors, combined with potentially strong winds, create the perfect environment for fire to initiate and spread.

2.2 Regional Geology

The Otay River Watershed lies in the Peninsular Range Province that consists of an uplifted fault block that extends from the tip of Baja California northward to the San Jacinto Mountains and is approximately 80 miles in length and 45 miles in width within the United States. Jurassic Granites and Cretaceous and Tertiary sediments form the geology of the province within the Otay River Watershed (Figure 2). (California Department of Water Resources, 1967)

The basement rocks of the eastern mountains and foothills are Jurassic metamorphic and Cretaceous plutonic igneous rocks. Beginning in the late Cretaceous the Woodson Mountain Granodiorite intruded the Jurassic metamorphics. Along this contact are gabbros, diorites, and tonalities formed from the differentiated and cooled margin of the intruding granodiorite. Today this contact is approximately one mile east of Highway 94. Subsequent uplift and erosion late in the Cretaceous exposed these units. During the Tertiary a series of uplifts and coastal transgressions and regressions formed a thick package of marine and non-marine sediments creating the coastal plain in the west. The Pliocene San Diego Formation consists of fine to medium grained sandstones with abundant fossils of marine organisms. The cap rock of much of the coastal terraces is the coarse grained and highly cemented Pleistocene Linda Vista Formation, formed as glaciers forming elsewhere world-wide lowered sea level. The late Pleistocene Bay Point Formation formed during a rise in sea level that migrated into the coastal lowlands and major river valleys during glacial retreat. It consists of a poorly cemented fine sandstone that is found in the Otay River valley and coastal lowlands to the west. Recently, fluvial deposits have formed along the Otay River, Jamul and Dulzura Creeks and Proctor Valley. Recent colluvial deposits are also found throughout the high relief basement rocks, especially along the contact between Mesozoic and Cretaceous rocks.

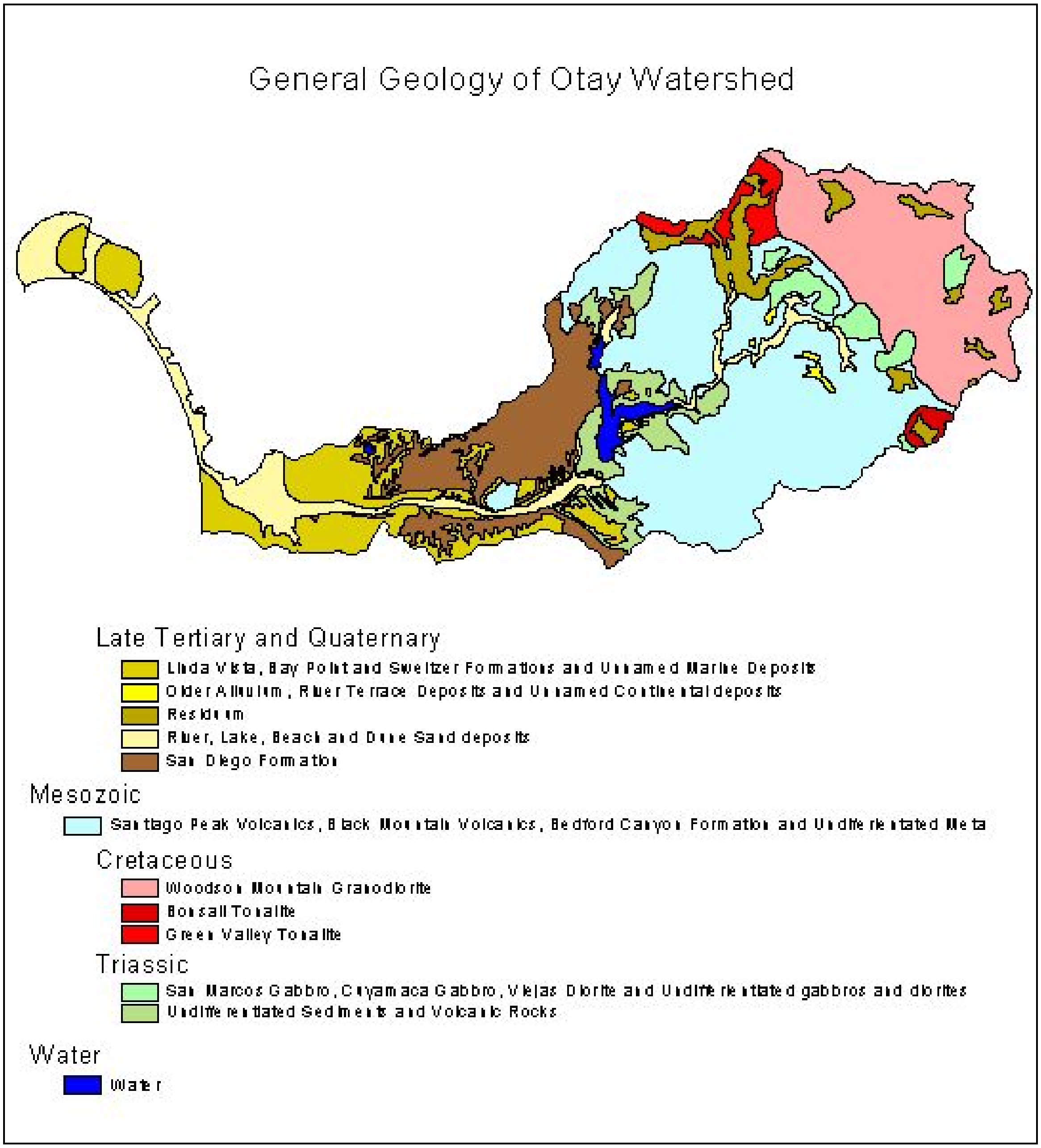

Figure 2. General Geology of Otay Watershed

2.3 Soils

The soils of primary interest for this study are those occurring in riparian areas and active floodplains. The majority of the floodplain soils are classified as Entisols and are poorly developed. The USDA soil survey (1973) for San Diego County describes the soils along the streambeds as somewhat excessively drained to poorly drained, nearly level to moderately sloping soils on alluvial fans and floodplains and in basins of the coastal plains. Floodplain soils are young in age and are mainly composed of silt loam and silty clay loam alluvial deposits. In terrace locations in the floodplain where fine silts and organic material have accumulated for years, the soils have developed horizons within the soil profile.

The floodplain is dominated by the Riverwash map unit (Rm), a listed hydric soil, is located in intermittent stream channels and in floodplains and is typically composed of sand, gravel and cobbles. (USDA 1973) This floodplain soil unit is composed of soil that has developed on coarse alluvium and is excessively drained and rapidly permeable. Other soil map units occurring in fluvial settings along riparian corridors in this area are Tujunga and Greenfield. (Table 1) These are located in many fluvial locations throughout the upper reaches of the watershed.

Outside of the floodplains are a variety of soil associations that are used to describe alluvial fans, slopes of both fine and cobbly materials, and other sand-stone, shale, metavolcanic, and sedimentary formations.

The digital soil maps for the study area were developed as a Soil Survey Geographic (SSURGO) data base coverage (Figure 3). SSURGO is a digitally generated soil map developed by the National Resource Conservation Service (NRCS). It is generated from the NRCS county Soil Surveys, which represent the most detailed soil mapping done by the NRCS. Mapping scales range from 1:12,000 to 1:63,360. The SSURGO database consists of delineated soil phases with roughly 25 physical and chemical soil properties recorded for each phase.

Table 1. Identified hydric and other associated soil unit descriptions	
Largest NRCS identified hydric soil unit	
Riverwash	Miscellaneous areas found in active stream channels, on floodplains, and adjacent to drainageways
Most common other soil units associated with fluvial surfaces	
Tujunga	Excessively drained soils formed in alluvium; found on alluvial fans and floodplains
Greenfield	Well drained soils formed in moderately coarse and coarse textured alluvium; found on alluvial fans and terraces

2.4 Topography

Elevations within the watershed range from just under 1,140 meters (3,740 ft) in the east to sea level in the west. The uplands to the east are cut by southwesterly trending canyons that open onto an alluvial plain. Along drainages on the alluvial plain are a series of fluvial terraces composed of coarse channel deposits. The alluvial plain thins to the west as marine deposits that are partially covered by younger alluvial fan deposits appear. The San Ysidro Mountains to the south have almost the same maximum elevation as the uplands to the east and are cut by north-south trending canyons that open onto the terraced alluvial plain.

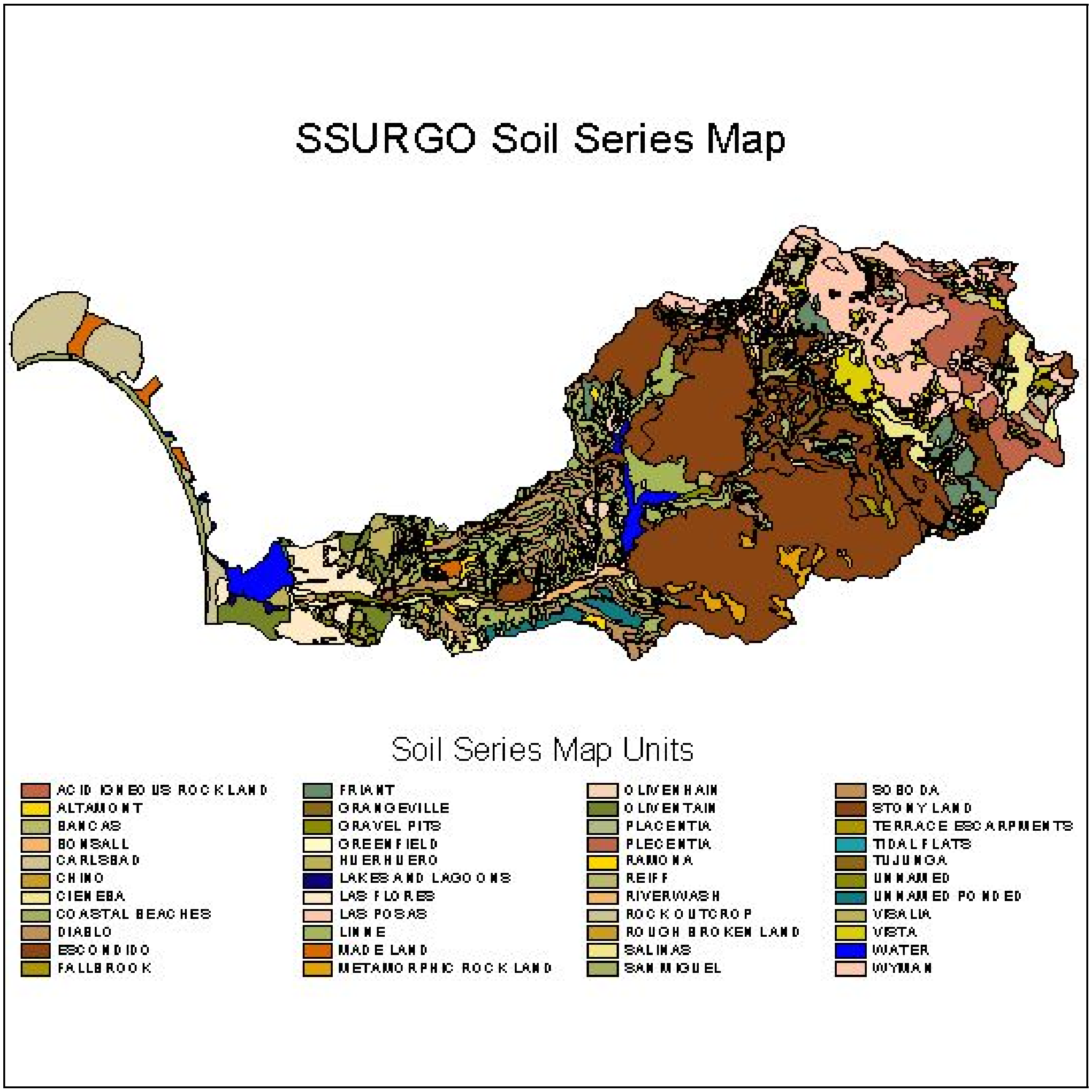

Figure 3. SSURGO Soil Series Map for Otay Watershed

2.5 Subwatersheds

The Otay Watershed encompasses only a portion of the San Diego eight-digit USGS Hydrologic Unit (USGS-HU). The San Diego USGS-HU has been divided using the State of California classification and database (California Department of Forestry and Fire Protection's Fire and Resource Assessment Program

[FRAP] 1999). In that classification, which we adopted (Table 2), FRAP provides a standard nested watershed delineation scheme using the State Water Resources Control Board numbering scheme. The hierarchy of watershed designations consists of six levels of increasing specificity: Hydrologic Region (HR), Hydrologic Unit (FRAP-HU), Hydrologic Area (HA), Hydrologic Sub-Area (HSA), Super Planning Watershed (SPWS), and Planning Watershed (PWS). Using this classification the USGS-HU was divided into six FRAP Hydrologic Units (FRAP-HU) including Otay Watershed that was further subdivided into nine HAS's (Figure 4).

The Otay Watershed drains predominately to the west and south-west ending in San Diego Bay, which opens into the Pacific Ocean. The main drainage is the Otay River with numerous tributaries arising in the surrounding uplands. Lower Otay, and Upper Otay reservoirs are the largest artificial impoundments within the watershed.

The larger HSA's are drained by the Otay River (Otay Valley) and Dulzura Creek (Hollenbeck and Savage). Smaller HSA's are drained by streams originating in the foothills immediately adjacent to the coastal plain. The upland HSA's include Lyon, Lee, northern Jamul, western Hollenbeck and Engineer Springs that drain predominately to the southwest. The elongate plain HSA's include Otay Valley and Coronado that have been artificially channelized in many urban locations. The foothill HSA's include Proctor, Savage, southern Jamul and eastern Hollenbeck that drain predominately south-southwest. These HSA's drain at some point into the Otay River.

Table 2. FRAP Hydrologic Unit (FRAP-HU and Hydrologic Sub-Area (HSA) name and size.)

Name	Hectares	Acres
Otay Watershed	39826.5	98413.5
Coronado	2255.6	5573.6
Engineer Springs	498.5	1231.7
Hollenbeck	12829.6	31702.5
Jamul	3151.8	7788.2
Lee	838.9	2072.9
Lyon	839.4	2074.1
Otay Valley	11993.6	29636.9
Proctor	3286.9	8122.1
Savage	4132.4	10211.4

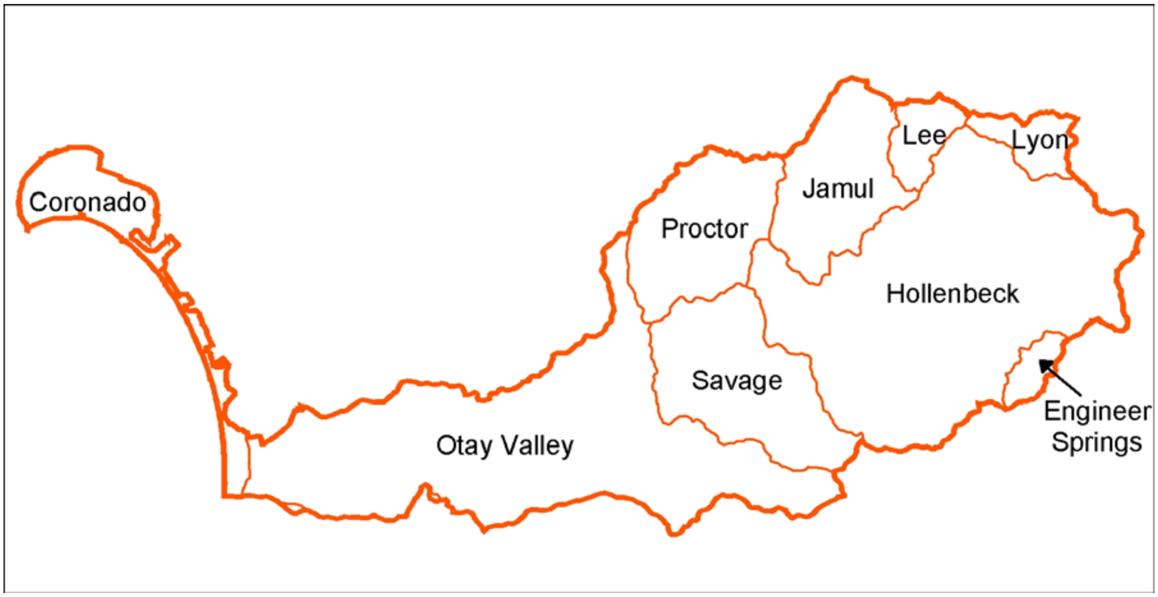

Figure 4. Hydrologic Sub-Areas for Otay Watershed.

2.6 Riparian Vegetation Communities

The riparian vegetation is one of the most dynamic vegetation communities within the watershed. The dramatic changes in vegetation patterns over short time scales are a result of periodic cycles of destruction and regrowth from flooding events and human disturbance. As a result of these disturbances, the ability of riparian vegetation to have “pure stands” or “climax” vegetation is limited in these dynamic environments. The natural events caused by periodic flooding can quickly change the distribution and species composition and reset the disturbance–recovery cycle. Additionally, land development within parts of some watersheds has modified the potential of the natural vegetation to reestablish itself after flooding events. These disturbances have modified watercourse directions, altered silt loads, and have affected areas such that they may retain water for longer or shorter periods than previously. Increased surface runoff from paved parking lots and other developed areas has resulted in impacts to willow forests and ponds.

3. Definitions

3.1 Riparian Ecosystems

Riparian areas, which typically border rivers and streams, link landscapes together by serving as corridors through which water, materials, and organisms move. In arid regions, riparian ecoystems are critical to maintaining regional biodiversity because they provide habitat for a disproportionately large number of species, despite their limited area. Riparian areas typically include a zone of frequent flooding (bank full), that is regulated under existing federal and state law, as well as a less frequently flooded transition zone between these areas and adjacent uplands (active floodplain to floodplain terrace). Although they contribute greatly to the habitat, hydrological, and biogeochemical functions performed by riparian areas, transition zones vary in their regulatory status: some portions are regulated as WoUS (including wetlands), while others are non-regulated uplands. In this planning level delineation and characterization, we identified all the units, rather than only the jurisdictional areas, because they constitute the functional riparian ecosystem.

3.2 Waters of the United States

Waters of the United States (WoUS) are regulated under Section 404 of the *Clean Water Act* (CWA). The areas delineated as WoUS in this study met the requirements outlined in the Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987), subsequent guidance from the Office of the Chief of Engineers (1992, 1995), and 33 CFR 329.11(a)(1-7). These areas include the following:

> "…1) all waters that are currently used, or were in the past, for interstate or foreign commerce, including all waters that are subject to the ebb or flow of the tide; 2) all interstate waters including interstate wetlands; 3) all other waters such as intrastate lakes, rivers, streams, (including intermittent streams), mud flats, sandbars, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds; 4) all impoundments of waters otherwise defined as waters of the United States; 5) tributaries of waters identified in numbers 1-4 above; 6) the territorial seas; and 7) wetlands adjacent to waters listed in 1-6 above."

All surface waters within the study area boundary were considered WoUS, including ephemeral and intermittent tributaries, intermittent streams, ponds, lakes, and reservoirs. Furthermore, there was an attempt made to include all other waters, regardless of whether they would be considered isolated or connected to navigable waters. Examples of these features would include small ponds and retention basins as well as seasonally wet areas outside of a riparian corridor.

Vernal Pool mapping was not included in this study due to the small size of the pools in relation to the mapping units used for the planning level delineation. However, vernal pools are an aquatic resource that will be evaluated as part of the SAMP. Several existing sources of vernal pool mapping will be used to complement this report and ensure that potential impacts to vernal pools are considered. In addition, since the planning level delineation does not take the place of a site-specific delineation, it gives the regulatory and wildlife agencies another opportunity to evaluate and determine jurisdiction for the resources.

3.3 Ordinary High Water Mark

The jurisdictional limits of streams are defined by using the "ordinary high water mark" (OHW). The OHW is defined at 33 CFR 328.3(e) as

> "... that line on the shore established by fluctuations of water and indicated by physical characteristics such as clear, natural lines impressed on the bank, shelving, changes in the character of the soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding area."

Additionally, seasonal wetlands, as described in the Corps of Engineers Wetland Delineation Manual, are where "... water in a depression (is) ... sufficiently persistent to exhibit an ordinary high-water mark or the presence of wetland characteristics."

The regulated waters under Section 404 of the CWA delineated in this study include ephemeral, intermittent, and perennial tributaries, which may or may not include riverine wetlands. The isolated depressions and parts of the riverine system were determined to be wetlands because they met the three parameter criteria. The intermittent stream and some portions of the perennial streams were treated as WoUS.

3.4 Wetlands

Wetlands are one of six types of special aquatic sites regulated as WoUS under Section 404 of CWA (40 CFR 230); sanctuaries and refuges, mud flats, vegetated shallows, coral reefs, and riffle and pool complexes make up the other types of special aquatic sites granted special consideration under Section 404(b)(1) Guidelines. Wetlands are defined as

"areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (33 CFR 328.3(b)).

The methodology for delineating the boundaries of jurisdictional wetlands, using hydrologic, hydrophytic vegetation, and hydric soil criteria, is outlined in the Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987).

Although “wetlands” are WoUS, throughout this report we will follow the common convention of distinguishing between wetlands and non-wetlands WoUS. The term “wetland” will refer to regulated WoUS that meet the hydrologic, hydrophytic vegetation, and hydric soils criteria outlined in the Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987). The term non-wetland WoUS will refer to non-wetland waters regulated under Section 404 of the CWA.

4 METHODS

4.1 Delineation of Aquatic Resources

Aquatic resources were identified using a high-precision, planning-level delineation approach, which is a modification of the sampling methods outlined in the Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987) and 33 CFR 328, that was applied at a watershed scale. The delineation approach allowed for the identification of different types of regulated wetlands and non-wetland WoUS over a large area. While the approach provided a high-quality map of jurisdictional WoUS suitable for use in project planning, the planning level delineation does not serve as a substitute for the on-site jurisdictional delineation conducted as part of the Section 404 permit review process.

4.2 Initial Identification of Aquatic Resources

Delineation geospatial databases were developed with an iterative process, combining both field and laboratory efforts. Aquatic resources were initially identified by interpretation of both Color Infra-Red Digital Orthoquadrangles (DOQ) obtained from the USGS and true color aerial photographs obtained from AirPhoto USA Inc. (taken March 2002) at a scale of 1:4800. Aquatic resources were delineated and characterized by vegetation and geomorphology in the field using the DOQ’s within a customized ArcView 3.2 geographic information system (GIS) on a Fujitsu 3500 Stylistic pen tablet computer. All mapping was at a scale of 1:4800, with a minimum mapping unit size of approximately 405 m^2 (0.1 ac). Using the GIS in the field allowed for viewing of support spatial databases (i.e. imagery, roads, contours, parcel information, etc) to better identify all potential aquatic resources.

The aerial photographs (taken Jan 02 2000) were obtained for the Otay River from the Lower Otay Reservoir Dam to the coast due to the temporal constraints of the USGS DOQ’s (Figure 5) and the lack of identifiable species signatures for the AirPhoto USA Inc. imagery due to the complexity of the vegetation communities and hydrogeomorphic floodplain units. After viewing aerial photographs for various parts of the year it was determined that a mid-winter 2000 photo would provide the most easily identifiable species signature. Because of limited access or suitable viewpoints for mapping, these aerial photographs were remotely interpreted using stereoscopic methods and later field verified for accuracy and precision. These delineated aerial photos were later scanned, registered, rectified, digitized and appended to the database delineated in the field.

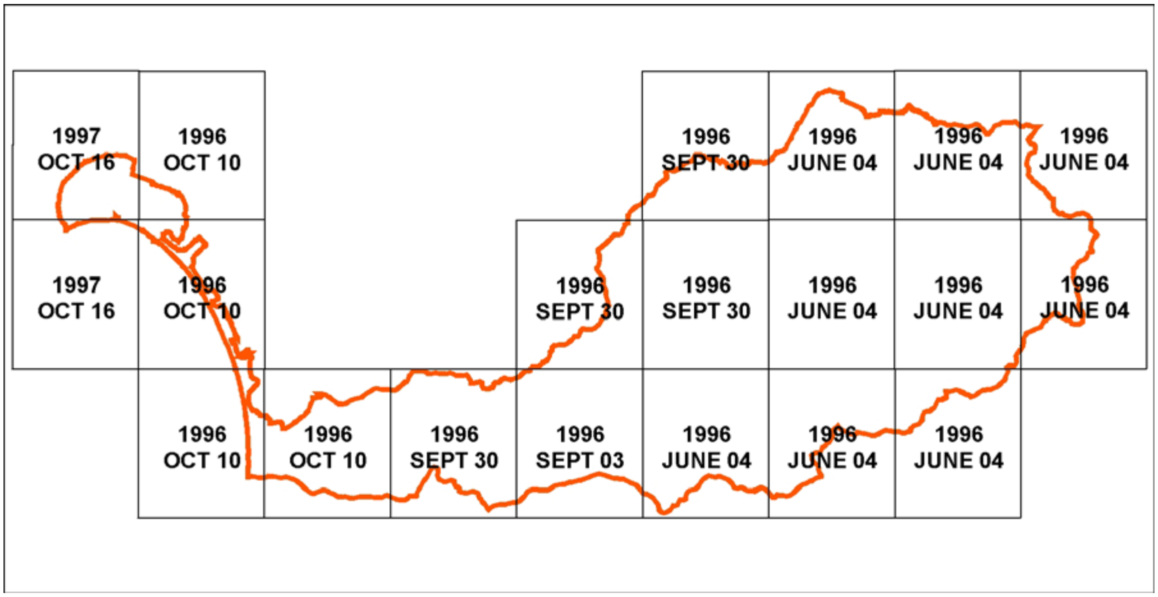

Figure 5. Dates aerial photography taken for USGS DOQ's

Vegetation map units were developed through a series of modification to the California natural community classification by Holland (1986). In previous SAMP efforts by CRREL in other watersheds in southern California, CRREL found that existing vegetation classifications lacked sensitivity for use in watershed scale wetland delineations mainly because the concepts of the existing map series concepts weren't refined enough for wetland delineation purposes. To meet the needs of identifying wetlands, we developed a classification that followed the hierarchical schemes of both Holland (1986) and Sawyer and Keeler-Wolf (1995) but split out additional units at the species level. In doing so, our classification shares the use of many of the same growth forms and dominant species but we have divided many of the existing map series into finer species level map units that also include native and non-native groupings. This approach allows for quick mapping of riparian vegetation using dominant species associated with wetlands in the watershed at a finer mapping scale. In Figure 6, an example of comparison depicting the level of detail associated with the Holland and the USACE growth and species level classifications is presented. A list of the riparian vegetation communities and other map unit types, the codes used to designate them, and other information is provided in Appendix 2.

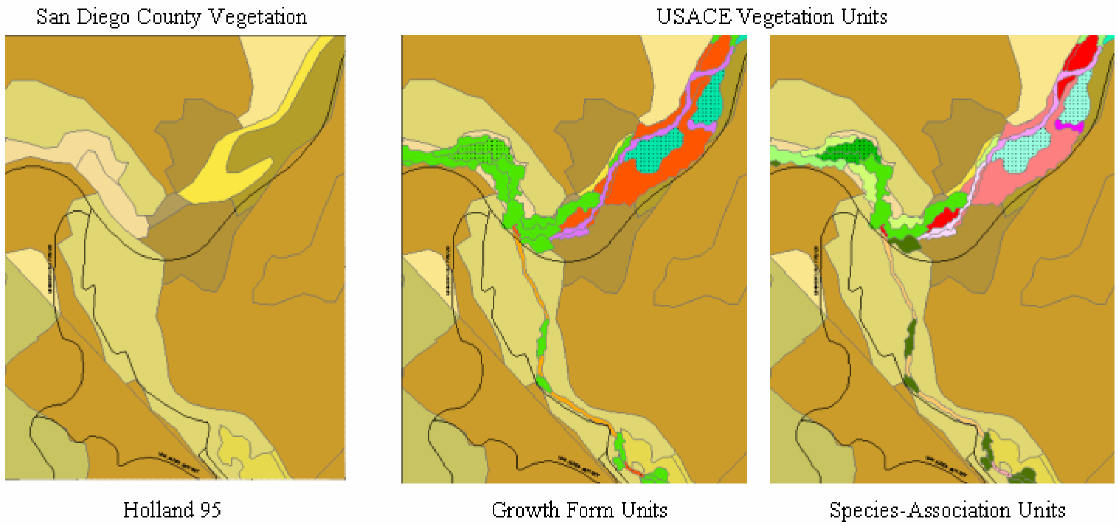

Figure 6. Comparison of vegetation classifications.

Hydrogeomorphic floodplain units were mapped for the purposes of indicating flood frequency for use in delineation purposes. Typically floodplain terraces develop on second, third order and greater Strahler stream types. First order streams typically lacked floodplain terraces since they are located on more vertical slopes, have smaller drainage areas, and are confined to bedrock channels that limit their ability to create floodplain terraces. In this study, the two floodplains map units identified in the field were the active and abandoned floodplain terraces (Figure 7). The active floodplain, in this study, contains the bankfull and the adjacent active floodplain terrace that contain features associated with frequent flooding. These features include high flow channels, unvegetated surfaces, bed and bank, and a break in slope. The abandoned floodplain terrace is above the active floodplain and contains features associated with infrequent flooding and seasonally wet areas. Potential regulated hydrologic features in this terrace are driven by infrequent over bank flooding, local precipitation, and occasional groundwater discharge within paleo channels and other depressional features. Often times there is a distinct change of vegetation community from the active to abandoned floodplain. The cross section in Figure 7 represents the ideal floodplain development, but in some instances one or more terraces may be lacking due to human influence, local soil conditions and geomorphology, or local precipitation patterns. In this study, areas identified as abandoned floodplain terraces , based on the above reasons, does not imply that it may not be jurisdictional.

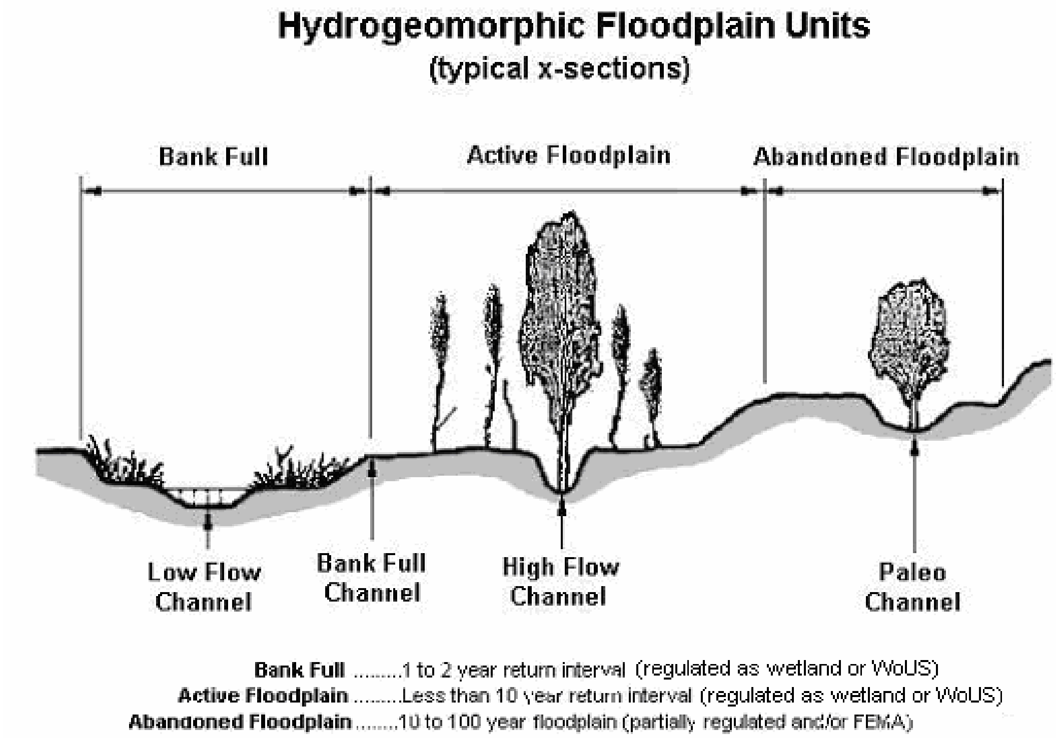

Figure 7. Typical Cross-Section Depicting Floodpain Units

The first order, ephemeral, and intermittent streams were initially identified and delineated by interpretation of the DOQ's remotely. In several instances, second and third order streams (terminology follows Stahler 1952, 1957) were also identified as a single blue line owing to their narrow width. These categories of streams, identified in this booklet as "ephemeral stream," are typically up to 10 feet wide and lack floodplain surfaces. Ephemeral streams were verified for accuracy and precision using the field GIS as potential aquatic resources were delineated. Vegetation associated with washes that lacked floodplain terraces were assigned a hydrogeomorphic floodplain code of "Non-Floodplain Riparian".

By using the Strahler stream order numbering classification (Figure 8), it is easy for investigators to identify potential terminal and ephemeral stream segments using mostly remote sensed methods. Typically all first and second order stream channels that have exposed bare channels, indicating bed and bank features necessary to be considered as OHW, are identified in the laboratory and verified separately in the field. If the channels are hidden by vegetation, we attempt to evaluate other exposed segments of the channels to make OHW decisions. Then in higher order stream segments (e.g., third and fourth order), in addition to the blue line identification of the main channel the other floodplain terraces are identified.

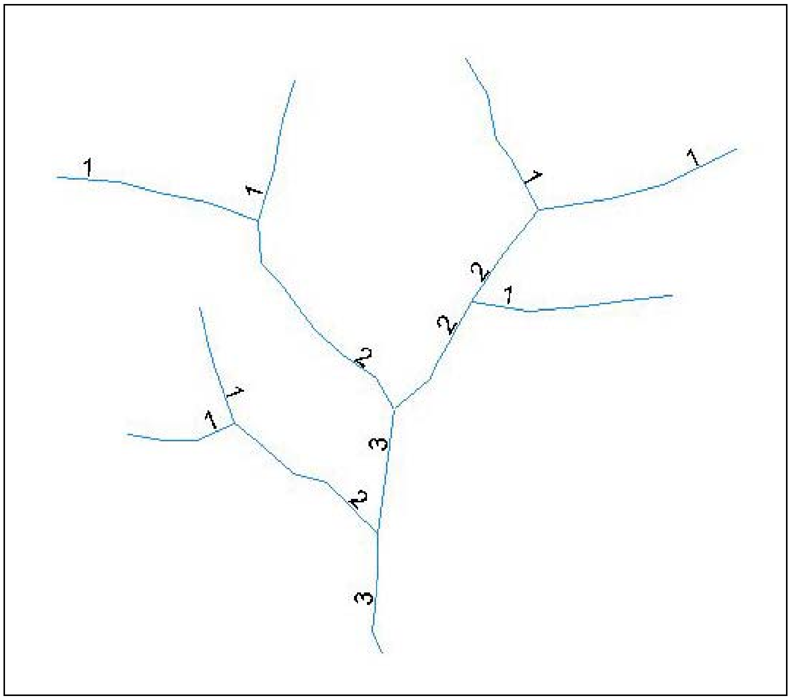

Figure 8. Example of Strahler stream orders

4.3 Field Verification

We sampled 40 sites in the field to verify the regulatory status of riparian vegetation communities identified on the riparian vegetation base map (Figure 9) (example sample point sheet in Appendix 3). Representative sample sites were selected based on the need to refine previously established Probability Rating for riparian vegetation units in southern California watersheds (Lichvar et al. 2003). The determination of whether a map unit type would meet the criteria to be considered regulated was determined by using criteria specified in the wetland delineation manual (Environmental Laboratory 1987) and physical features representing OHW extents. The 40 sample points were located in representative positions within various vegetation map units. At each sample point, the information necessary to complete a routine wetland delineation was collected for the purposes of evaluating the vegetation map units potential to be considered regulated. In addition, physical and biological information, including geomorphic surface (channel, active floodplain, and terrace), soil texture, plant species and abundance by stratum, adjacent land use/land cover, and cultural alterations was collected to help classify and

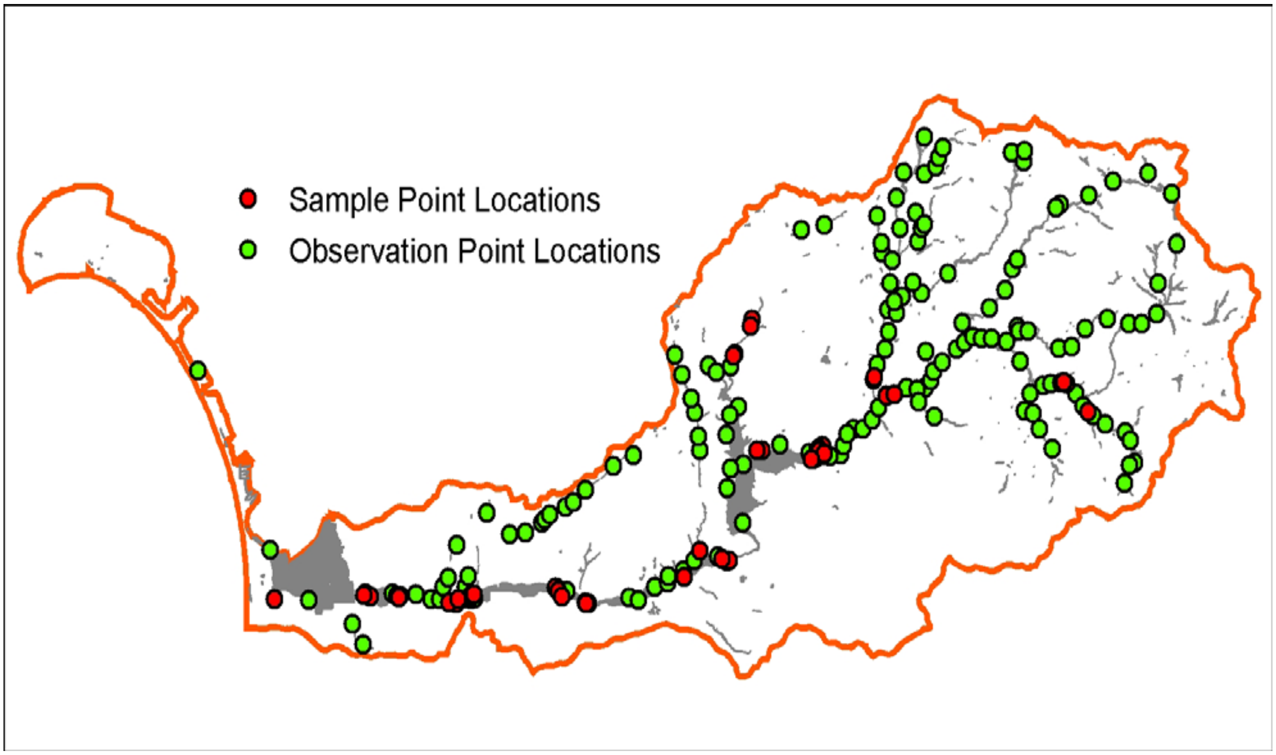

Figure 9. Locations of sample and observation points.

characterize vegetation communities and riparian reaches.

The data collected during field sampling were summarized to provide a description of the geomorphology, hydrology, soils, and vegetation of various vegetation community types. These data were used to modify the riparian vegetation and geomorphic surface base maps.

Additionally, other less rigorous samples intended for verification purposes were collected. This level of sampling is referred to as observation points. Over 164 observation points were collected to provide a verification of the quality of the field mapping effort (example observation point data sheet in Appendix 4). Data collected at observation points included simple yes or no responses for hydrophytic vegetation, hydric soils, disturbance and jurisdictional status, as well as a determination of the hydrology indicator and geomorphology based on the experience of the field investigators. Plant species recorded at sample points and presented in this report follow nomenclature in *The Jepson Manual* (Hickman 1993).

During the sampling process, all field digitized polygons and lab digitized "blue lines" were reviewed for correct placement and labeling. Boundaries and labels were corrected in the field, or coordinates were taken and edits were made later in the laboratory.

4.4 Final Map of Wetlands and Waters of the United States

For regulatory purposes (Section 404), the final map for WoUS was developed by assigning probability ratings to the riparian vegetation/hydrogeomorphic base map. These designations were made based on the results of the field verification and sampling that established the likelihood of its regulatory probability rating by evaluating the wetland and WoUS criteria for each unit for each type over the watershed area, the estimated frequency of the hydrology for each geomorphic surface, and its vegetation type. Furthermore, the regulatory probability designations (applying to Section 404 only) were evaluated using GIS software to compare their spatial distribution patterns with distributions of other types of designations, including watersheds, human disturbance, and geomorphic surfaces.

Most of the areas delineated as within the active floodplain (including the bankfull area), and first order ephemeral streams were found to be WoUS, and therefore are regulated under Section 404 of the CWA. The wetland status of vegetation types occurring in terrace geomorphic surfaces and along some of the first order streams varied, depending on a number of factors, and therefore could be placed in one of several Section 404 jurisdictional wetland categories (Table 3). Owing to the variability in both site conditions and patterns of occurrence for certain riparian vegetation types in terrace and first order stream positions with similar site conditions, probability ratings were adopted to determine the likelihood of wetlands or non-wetland WoUS occurring in both the floodplain and non-floodplain areas (Table 3).

Each riparian vegetation type within the three geomorphic surfaces (i.e. active floodplain, abandoned terrace, and non-floodplain riparian), hereafter referred to as floodplain riparian vegetation, was assigned a rating of 1 through 6 (Table 3). Also, the ratings in Table 3 are used for the non-riparian wetlands located outside the floodplain or riparian corridor, which are associated with first order streams and outlier positions, hereafter referred to as non-floodplain riparian vegetation. This allows for distinguishing the different hydrologic regimes associated with each major ecological setting. The ratings assigned to both the floodplain and non–floodplain riparian vegetation ratings are compared and shown in Appendix 5.

Table 3. Regulatory probability ratings assigned to riparian vegetation types.

Rating	Descriptions
1	Types meet the criteria for a wetland or WoUS 100% of the time
2	Types meet the criteria for a wetland or WoUS 67–98% of the time
3	Types meet the criteria for a wetland or WoUS 33–66% of the time.
4	Types meet the criteria for a wetland or WoUS 2–32% of the time (primarily uplands)
5	Types meet the criteria for a wetland or WoUS <2% of the time (primarily uplands)
6	Unregulated upland

Section 404 jurisdictional designations were assigned to each polygon and intermittent or ephemeral stream reach as follows. The bank full channel geomorphic surface meets the criteria for a jurisdictional wetland if it is vegetated with hydrophytes because the hydrology criteria have been met “in most years or [with a] greater than 50 percent probability.” Since these vegetated geomorphic surfaces met the hydrology criteria, the soils may be considered hydric as a result of long periods of flooding or ponding. However, when hydrophytic vegetation is absent, the polygon qualifies as a non-wetland WoUS based on the presence of a bed and bank or OHW.

Unlike the bank full channel geomorphic surface, the active floodplain geomorphic surface is result of the most recent geomorphically effective discharge that shapes (Lichvar and Wakeley 2004) the active part of the channel that is typically associated with a recurrence interval of 10 years or less (Williams 1978), and consequently, may not meet the hydrologic criteria required for a jurisdictional wetland (Section 404). The active floodplain surface however has many OHW mark indicators resulting from flow events that would be considered “ordinary”. Furthermore, because of the unevenly distributed precipitation patterns of the region, the active floodplain surfaces may be considered non-wetland WoUS because the irregular precipitation patterns do not support the hydrophytic nature of the vegetation or the development of the hydric soils. However, included within the active floodplain there were areas with groundwater discharge, etc. that met the criteria for a jurisdictional wetland. Also, occasional tributary channels bisecting the active floodplain and the terrace met the criteria for a non-wetland WoUS.

Terraces had the following types of regulated units: the lateral tributary, adjacent wetlands, and areas that receive over bank flooding or with adequate groundwater influence such that wetland features were developed. Adjacent wetlands that met all three criteria were usually located in the linear paleo channels. In the upper most reaches of the watershed, the first, second, and some third order streams were identified as WoUS based on the location of the OHW, i.e., bed and bank. Riparian vegetation communities associated with these locations were assigned probability ratings for non-floodplain riparian vegetation. These non-floodplain riparian wetlands also included isolated wetlands scattered throughout the watershed.

In summary, probability ratings can be interpreted two ways: 1) a rating describing the probability of whether a map unit may be regulated based on presence of wetland or OHW indicators that meets the criteria of these regulated types of aquatic resources and 2) the range of reliability of predicting whether a unit is regulated across the watershed as represented by the frequency statements associated with each rating (Table 3). For example, Cattail swamps always have the field indicators present to meet the criteria necessary to be considered a wetland, and they are consistent for those features at all sites across the watershed. A map unit with a high probability of having positive wetland indicators present and high level of predictability at all sites receives a Rating 1, always regulated and highly reliable. But, as in the case of the map unit Mulefat (*Baccharis salicifolia*) (a species with a FACW status) that occurs in various landscape positions with and without wetland indicators, the reliability factor is less. In abandoned floodplain terraces of the Otay watershed, we found that Mulefat occurs in both wetland and upland sites. Our ability to predict its probability of being regulated is almost 50:50. Therefore, we assigned it a Rating 3 that predicts 33-66% of the time it would be considered regulated. That rating implies that the map units with a Rating of 3 have a 50:50 chance of being regulated and therefore would required further site-specific investigations to gather data on indicators to determine if a particular site would be considered regulated. In the Mulefat example, with a Rating of 3 our watershed methodology has flagged Mulefat as having a moderate potential to be considered a wetland map unit type at the planning level. Additionally, if a site visit is done at a particular Mulefat map unit site and it is decided that the specific location isn't regulated, it can be deleted from the files; if the specific site is determined to be regulated, then the time needed to correct any boundaries of the wetland should be highly reduced. So precision in the watershed scale delineation method comes in several forms: 1) whether the potential regulated sites for planning purpose has been located, 2) whether the outline and attributes of the polygon are correct, and 3) whether the rating represents a reliable level of accurately in predicting the likelihood that a site is regulated.

5. Results And Discussion

5.1 Description of Vegetation Community Types

A total of 46 species-association types, including 8 unvegetated types such as Disturbed Sites and Dry Wash Channel, were identified during the field mapping phase of the delineation effort. Appendix 1 summarizes the species-association vegetation units by area and frequency of occurrence. Table 4 shows the species associated with six of the largest map units. Samples (40) were collected across 13 of the map units (Appendix 6).

As shown in Table 4, the largest mapped vegetation unit was Water Body__Freshwater Pond with 380 ha (940 acres). Relative to other map units, this unit is dominated by several large man made open water reservoirs. Aquatic or wetland vegetation is common along the edges of the shorelines of this type. Both *Typha latifolia* and *Scirpus californicus* can be mixed or a substantial inclusion within this map unit.

With 239 ha (592 acres) of coverage, the Trees/Woodland/Forest__*Quercus agrifolia* map unit was the second most extensive vegetation community found in the study area. This non-wetland indicator tree is associated with and located along most of the first and second order streams in the upper watershed. This type has a Regulatory Probability Rating of 6 or upland. However, this type is included here since it may be regulated by the State of California as a riparian type.

With 111 ha (274 acres) of coverage (Table 4), the Herbaceous_Non-Native_Common Weeds map unit was the third most extensive vegetation community found throughout the study area. This invasive community type is in response to many of the human disturbed areas scattered throughout the watershed. This type has a Regulatory Probability Rating of 6 or upland. Many of the floodplain terraces that were dry enough to be converted to agricultural use and later abandoned are dominated by this type. Soils associated within these sites were usually disturbed by grading or old abandoned agricultural activities.

The Trees/Woodland/Forest__*Salix lasiolepis* map unit was one of the most frequently encountered wetland vegetation types in the watershed. This type was mixed and had varied amounts of inclusions of *S. gooddingii*. The willow species has adapted and responded to disturbance very successfully in this watershed. Since they are well adapted to the geomorphic and hydrologic regimes and can reproduce both sexually and asexually, the have become a major vegetation type in most riparian areas. Most of the older stands were associated with abandoned floodplain terraces while the younger pole stands were more typically found in the active floodplain areas.

The common and highly adaptive Shrub Native__*Baccharis salicifolia* was the fifth most common type. Besides its occurrence as a specific community type (Shrub Native_*Baccharis salicifolia*), *Baccharis salicifolia* frequently occurred in several other community types. This vegetation unit is located mostly in the active floodplain but it is commonly found scattered throughout riparian corridors.

Table 4. Most common riparian vegetation units in study area.

Unit Name	**Hectare /Acres**	**Common Associates**
Water Body__Freshwater Pond	380 / 940	*Typha latifolia, Scirpus californicus, Salix gooddingii, Populus fremontii*
Trees/Woodland/Forest__*Quercus agrifolia*	239 / 592	*Toxicodendron diversilobum, Salvia mellifera, Ceanothus oliganthus, Heteromeles arbutifolia*
Herbaceous_Non-Native_Common Weeds	111 / 274	*Amsinkia tessellata, Marrubium vulgare, Rumex crispus, Urtica dioica*
Trees/Woodland/Forest__*Salix lasiolepis*	108 / 268	*Baccharis salicifolius, Salix gooddingii, Plantus racemosa, Populus fremontii*
Shrub Native__*Baccharis salicifolia*	102 / 251	*Brassica nigra, Tamarix ramossisma, Bromus spp., Salix lasiolepis, Populus fremontii*
Freshwater Marsh__*Scirpus acutus*	85 / 209	*Typha latifolia, Eleocharis machystachya, Cyperus eragrostis, Alima plantago-aquatica*

This common riparian shrub has the ability to respond to recent flood events by actively germinating on newly exposed soil or by layer caused by sediment loads that lay the shrubs over during larger events.

The most common aquatic community was Freshwater Marsh__*Scirpus acutus* that was located along the periphery of the large open water reservoirs. This type was located at the littoral edge where water fluctuated between low to high water stages. This type in most areas was poor in plant species diversity but provided excellent habitat for many other riparian animal species.

5.2 Hydrologic Settings and Their Influence on the Regulatory Status of Units

Three main types of hydrologic flows that characterized the riparian corridors in this area are as follows: a flood flow over floodplain terraces, precipitation combined with over bank flooding onto floodplain terraces, and groundwater discharge to seeps and springs. Field indicators for these three hydrology sources were assessed in the field for use in making jurisdictional decisions at various locations. Surface runoff and groundwater discharge to streambeds can provide for a perennial source of water in most years. In these types of settings with perennial flow, at least in the thalweg (low flow channel), the vegetated units typically always had positive indicators of all three parameters to meet the requirements of a jurisdictional wetland. However, the majority of riparian corridors did not have perennial water in the thalweg. Rather, the riparian corridors received intermittent flows during storm events.

We estimated that the bank full and active floodplains geomorphic surface fill with water during storms that occur at intervals of less than 10 years. The remainder of the floodplain is estimated to flood at various stages depending upon the storm severity until in certain events all of the floodplain is full. In larger events, greater than 10 years, the WoUS and wetland primary hydrology indicators of drift and silt material are scattered across some or all of the floodplain. Therefore we discovered that these indicators are not reliable for assessing jurisdictional wetland occurrence since they can be remnants of an infrequent but large event that scattered these indicators across most of the floodplain. Because of this issue, we relied on bed and bank features and geomorphic surfaces combined with certain vegetation units as field indicators for meeting regulatory criteria.

Over bank flooding, local precipitation, and occasional groundwater discharge provide the hydrology for wetlands within the paleo channels and other depressional features located in the abandoned floodplain terrace. For those seasonally wet areas in the terrace that have less than a 50 percent likelihood of having ponded or saturated soils in the upper part for at least 17 days (5 percent of the 345 to 360 day growing season in the valley floor and foothill regions) and do not meet the hydrology requirements for a jurisdictional wetlands were considered regulated because they met the definition of non-wetland WoUS with an ordinary high water mark. Most of the paleo channels located in the terrace geomorphic surface retain water for short periods; however they are frequently supplied water from tributaries entering the floodplain and meet the requirements of OHW criteria. The larger and slightly depressed zones are typically covered by Southern Arroyo and Gooddings willows, which may retain water for longer periods. The soils in these depressional sites typically have higher silt content, so consequently they can pond water for extended periods. In these depressional settings in the terrace, the soils typically met both COE and NRCS field indicators used to meet the hydric soil criteria.

Intermittent and ephemeral channels (bluelines) were considered regulated based on OHW criteria. These features all had evidence of bed and bank or confined flow channels. Included in the blueline coverage were both connected and isolated channels. Since a determination of isolated waters is beyond the scope of this study, all aquatic resources were included to provide a complete baseline of aquatic resources that occurred within this watershed at the time of the study. If a decision is needed on a particular water body's regulatory status, the Los Angeles District Regulatory office will make all final jurisdictional determinations.

5.3 Delineation Results: Aquatic Resources (including Waters of the United States)

Aquatic resources mapped by vegetation unit and geomorphic surface within the study area totaled 1,514 ha (3,744 acres) and included 1,641 km (1020 miles) of intermittent and ephemeral streams. Table 5 shows a summary of vegetation map units by rating and geomorphic surfaces. The Section 404 jurisdictional ratings for all riparian vegetation map units by geomorphic surface are provide in Appendices 7, 8, and 9.

Within the active floodplain, 36 riparian map units were considered jurisdictional (Rating 1) since these surfaces always met the hydrology criteria for WoUS. The most frequent and largest vegetation units found in the active floodplain are listed in Table 6.

Within the terrace, 568 ha (1,406 acres) were comprised of 16 vegetation communities with wetland ratings (Rating of 1, 2, 3, and 4). Of 28 riparian vegetation types located on the terrace geomorphic surface, 12 had either a low probability of being a regulated wetland under Section 404 or were designated as uplands (Table 5).

There were 79 ha (196 acres) among 15 riparian vegetation communities considered to be wetlands (Rating of 1, 2, 3, and 4) on non-floodplain surfaces (Table 5). In total, 27 vegetation units were mapped as non-floodplain riparian, 12 of which had a low probability of being regulated under Section 404, but may be regulated under CDFG 1600 program.

Table 5. Regulated decisions for each floodplain and non-floodplain riparian units in the wetland GIS coverage.		
Geomorphic Surface and Rating	**Number of Vegetation Types**	**Hectares (acres) or Kilometers (miles)**
Active floodplain (Rating 1)	36	867 ha (2,142 ac)
Abandoned Terrace		
Rating 1	3	399 ha (986 ac)
Rating 2	6	61 ha (152 ac)
Rating 3	3	48 ha (120 ac)
Rating 4	4	60 ha (148 ac)
Rating 5	1	38 ha (95 ac)
Rating 6	11	159 ha (393 ac)
Non-Floodplain Riparian		
Rating 1	3	13 ha (33 ac)
Rating 2	3	4 ha (10 ac)
Rating 3	4	19 ha (48 ac)
Rating 4	5	43 ha (106 ac)
Rating 5	3	12 ha (29 ac)
Rating 6	9	261 ha (645 ac)
Intermittent Streams (Rating 1)		1,641 km (1,020 mi)
Total of regulated wetlands and WoUS **(1-4)**		**1,514 ha (3,744 ac) 1,641 km (1,020 mi)**

Table 6. Largest and most frequent riparian vegetation types in the active floodplain.		
Type	**Frequency**	**Size (ha) / (ac)**
Water Body__Freshwater Pond	55	378 ha / 933 ac
Freshwater Marsh__*Scirpus acutus*	215	85 ha / 209 ac
Trees/Woodland/Forest, Native__*Salix lasiolepis*	77	62 ha / 152 ac
Shrub Native__*Baccharis salicifolia*	130	54 ha / 135 ac
Shrub, Non-Native__*Tamarix* spp.	34	52 ha / 128 ac
Shrub Native__*Salix lasiolepis*	59	48 ha / 120 ac
Alkali Marsh_Alkali Marsh	11	32 ha / 80 ac

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Appendix 1: Glossary

Abandoned Floodplain Terraces
Abandoned floodplain terraces are located above the bankfull and active floodplain. These alluvial terraces are surfaces that were formed when the river flowed at higher water and deposition levels than present (Graf 1988). In this study area there were variously dated alluvial surface, both Pleistocene and Holocene in age. Mapping efforts were restricted to the Holocene surfaces. These Holocene terraces occasionally flood in western riparian systems as a result of flooding or flash floods (Osterkamp and Friedman 2000). These less infrequent flood events inundate most or all of the bottomland features, including dry alluvial terraces. Most parts of the abandoned floodplain terrace are considered to be within the 100-year flood return interval or recognized by the Federal Emergency Management Agency (1995) (FEMA).

Active Floodplain Channel
The active floodplain channel is reported by Riggs (1985) as representing a 10-year recurrence event. Riggs and Harenberg (1976) calibrated the active floodplain surface using 10-year flood events at gauged sites in Owybee County, Idaho. Rosgen (1996), referred to this surface as the flood prone area, provided an on-site technique to establish the elevation/width for calculation of the entrenchment ratio. This field technique identifies surfaces that he cites as being associated with a less than 50-year return flood interval. In western riparian areas this surface is associated with less vegetation cover, recently deposited fluvial materials dominated by sandy surfaces, and high flow channels that frequently bisect the abandoned floodplain terrace.

Aquatic Resources
All waters and water habitats including lakes, ponds, streams, rivers and adjoining riparian areas that they affect, marshes, vernal pools, seeps, flats, and other wetlands.

Bankfull Channel
That part of the fluvial system that corresponds to the discharge that at which the channel maintenance is the most active, that is, the discharge at which moving sediment, forming or removing bars, forming or changing bends and meanders, and generally doing work that results in the average morphologic characteristics of channels (Dunne and Leoplold, 1978).

Channel
A natural stream or river, or an artificial feature such as a ditch or canal that exhibits features of bed and bank, and conveys water primarily unidirectional and down gradient.

Channel Type
Channel type refers to the Rosgen (1996) classification of streams, which is based on channel slope, sinuosity, entrenchment, width to depth ratios, and channel substrate.

Clean Water Act
The federal law establishes standards and procedures for limiting the discharge of fill and pollutants into jurisdictional waters of the United States.

Delineation
A determination of the boundaries of a wetland or other aquatic resources.

Ephemeral
Ephemeral streams are defined as streams in which flow is attributable only to surface water runoff in response to precipitation.

Floodplain (aka Flood plain)
The land adjacent to a stream or lake, built of alluvium and subject to repeated flooding.

Functional Assessment
The process by which the capacity of a wetland to perform a function is measured.

Geomorphic
A term referring to the shape of the land surface.

Geomorphic Unit
A delineated area within the fluvial corridor that shares similar hydrologic events and morphological features. The map unit is named according to the lowest ranked level from the vegetation classification system used in the study.

Geographical Information System (GIS) and Geospatial Data
GIS is a computer information system uses information that is spatially referenced to the Earth and allows the user to analyze and display these locational and spatial data. More specifically, GIS provides the capability to relate layers of different types of data for the same points. The spatially related data may be combined, analyzed, and mapped, within a coordinate system. For example, the most common depiction of spatial information is a map on which the location of any point could be given using latitude and longitude.

Intermittent Stream
Intermittent streams are defined as streams in which ground water maintained base flow occurs intermittently at different times of the year

Jurisdictional Wetlands
Areas that meet the soil, vegetation, and hydrologic criteria described in the " Corps of Engineers Wetlands Delineation Manual" (Environmental Laboratory 1987).

Ordinary High Water (OHW)
That line along the riparian corridor that is established by fluctuations of water and indicated by physical features that is persistent to the extent that an ordinary high water mark develops. The jurisdictional limits of “Waters of the United States” are identified using indicators of OHW.

Perennial Stream
Perennial streams are defined as streams in which base flow is maintained year round by groundwater

Riparian Vegetation
That vegetation that follows along the stream corridors associated with either active floodplains or groundwater associated with confined discharge areas. Typically dominated by several willow and wetland herbaceous species.

Stream Order
First order streams (i.e., the smallest mapped streams, or stream branches, without tributaries) discharge into second order streams (i.e., branches of streams receiving discharges from only first order streams). Lower order streams may discharge directly into a third order stream (i.e., larger branches of a stream receiving first and second order tributaries). In general, as stream orders increase, the width of the bankfull channel increases, and the size of the area supporting riparian vegetation increases.

Stream Type
Stream type refers to the Rosgen (1996) classification of streams that is based on channel slope, sinuosity, entrenchment, width to depth ratios, and channel substrate.

Section 404 Permit
The permit issued by the Corps under Section 404 of the Clean Water Act for authorizing the discharge of dredged or fill material into waters of the United States, including wetlands; also known as Corps permit, fill permit, Department of the Army permit, DA permit, individual permit, 404 permit.

Thalweg
The line characterizing the lowest, or deepest, points along the length of a channel or streambed or valley.

Valley Type
Valley type refers to the Rosgen (1996) classification of valleys, which is based on valley slope, width, and shape.

Vegetation (Plant) Community
Vegetation communities are stands of similar overstory species. Either a single species can dominate the stand or a mixture of species. These communities are described based upon the most dominant species using either ocular or plot data.

Vegetation Unit
A delineated area that shares similar kinds of vegetation. The map unit is named according to the lowest ranked level from the vegetation classification system used in the study.

Waters of the United States (WoUS)
Water bodies that are regulated under Section 404 of the Clean Water Act. It is the broadest category of regulated water bodies and includes wetlands along with non-wetland habitats, such as streams, rivers, lakes, ponds, bays, and oceans.

Watershed
A geographical area that drains to a major water body such as a river, lake, or creek, which is usually the water body for which the basin is named.

Wetland
Areas inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Appendix 2: Complete List of Map Units Used in the Study with Count and Area Totals

Map Unit	Count	Acres	Hectares
Alkali Marsh__Alkali Marsh	14	83.383	33.745
Artificial Structure__Constructed Wetlands	32	995.345	402..812
Artificial Structure__Disturbed Sites	49	103.331	41.817
Artificial Structure__Flood Control Structure	10	2.302	0.931
Artificial Structure__Lined Pond/Fountain	1	0.359	0.145
Artificial Structure__Retention Basin	75	42.2390	17.0930
Chaparral__*Baccharis sarathroides*	40	113.141	45.786
Chaparral__*Rhus integrefolia*	2	1.983	0.803
Chaparral__*Rhus ovata*	44	58.253	23.579
Freshwater Marsh__*Azolla filiculoides*	1	0.417	0.169
Freshwater Marsh__*Hydrilla verticillata*	2	0.118	0.048
Freshwater Marsh__*Juncus effussus*	14	14.049	5.688
Freshwater Marsh__*Scirpus acutus*	215	208.925	84.548
Freshwater Marsh__*Scirpus americanus*	8	7.345	2.973
Freshwater Marsh__*Scirpus microcarpus*	1	0.296	0.120
Freshwater Marsh__*Typha* spp.	57	41.314	16.722
Grassland, Native__*Polypogon* spp.	1	0.303	0.123
Grassland, Non-Native__*Arundo donax*	10	1.95	0.789
Grassland, Non-Native__*Bromus tectorum*	17	33.947	13.738
Grassland, Non-Native__*Cynodon plectostachyus*	1	0.77	0.311
Herbaceous Native__Riparian Dry (Dry Species)	11	8.666	3.507
Herbaceous Native__Riparian Moist (Moist Species)	14	18.514	7.493
Herbaceous Native__Riparian Wet (Wet Species)	4	3.204	1.297
Herbaceous Non-Native__Agricultural Weeds	2	52.127	21.095
Herbaceous Non-Native__Common Weeds	64	273.835	110.822
Juncus Meadow__*Juncus effusus*	4	1.399	0.567
Montane Forest__*Cupressus* sp.	10	4.925	1.993
Shrub Native__*Artemisia tridentata*	1	0.146	0.059
Shrub Native__*Baccharis salicifolia*	226	251.251	101.68
Shrub Native__*Eriogonum fasciculatum*	1	0.062	0.025
Shrub Native__*Iva hayesiana*	7	25.264	10.224
Shrub Native__*Salix goodingii*	28	54.669	22.124
Shrub Native__*Salix lasiolepis*	78	147.789	59.805
Shrub, Non-Native__*Nicotiana glauca*	1	1.519	0.615
Shrub, Non-Native__*Tamarix* spp.	69	196.98	79.717
Trees/Woodland/Forest, Native__*Platanus racemosa*	225	144.173	58.347
Trees/Woodland/Forest, Native__*Quercus agrifolia*	284	591.721	239.477
Trees/Woodland/Forest, Native__*Quercus engelmannii*	2	0.964	0.391
Trees/Woodland/Forest, Native__*Salix goodingii*	28	47.032	19.033
Trees/Woodland/Forest, Native__*Salix lasiolepis*	203	267.763	108.362
Trees/Woodland/Forest, Native__*Washingtonia filife*	1	0.62	0.251
Trees/Woodland/Forest, Non-Native__*Eucalyptus* spp.	68	59.751	24.18
Trees/Woodland/Forest, Non-Native__*Schinus molle*	7	4.799	1.942

Unvegetated__Dry Wash Channel	34	55.819	22.591
Water Body__Freshwater Pond	63	940.064	380.442
Water Body__Saltwater_Bay	4	42.037	17.011
Totals	2033	4904.863	1984.99

Appendix 3: Example Sample Data Sheet (Sample Point 16)

Project Name: otay_sps	Date:	Time:
Sample Point Number: 16	County: San Diego	State: CA
Investigators: Lichvar, Ericsson	Roll No:	Photo No:
Yes Do Normal Circumstances exist on the site?	UTM zone: 11	Datum: NAD83
No Is the site significantly disturbed (Atypical Situation)?	North: 3605551	
No Is the site a potential Problem Area?	West: 495410	

VEGETATION

No.	Scientific Name	Strata	Indicator Status	Percent Cover	Dominant Species
1	BACCHARIS VIMINEA	Shrub	FAC	3.00	No
2	SALIX GOODDINGII	Shrub	OBL	2.00	No
3	SALIX LASIOLEPIS	Shrub	FAC	40.00	Yes
4	TYPHA LATIFOLIA	Herb	OBL	65.00	Yes
5	JUNCUS ACUTUS	Herb	FAC	20.00	Yes
6	ELEOCHARIS MACROSTACHYA	Herb	OBL	10.00	No
7	SCIRPUS ACUTUS	Herb	OBL	5.00	No

Total Number of Species: 7 Total Dominants: 3
Percent of Dominants that are Wetland Species: 50/20: 100.00 FAC(minus)- applied: 100.00
Prevalence Index: 1.43 FAC Neutral: Yes

HYDROLOGY

Recorded Data:
- ____ Stream, Lake, or Tide Gauge
- ____ Aerial Photographs
- ____ Other
- X No Recorded Data Available

Field Observations:
- Depth of Surface Water: ________ (in.)
- Depth to Free Water in Pit: ________ (in.)
- Depth to Saturated Soil: ________ (in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ____ Inundated
- ____ Saturated in Upper 12 inches
- X Water Marks
- X Drift Lines
- ____ Sediment Deposits
- ____ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ____ Oxidized Root Channels in Upper 12 inches
- ____ Water-Stained Leaves
- ____ Local Soil Survey Data
- X FAC-Neutral Test
- ____ Other (Explain in Remarks)

SOILS

Map Unit Name:
(Series and Phase):
Taxonomy (Subgroup):

Drainage Class:
Field Observations
Confirm Mapped Type? No

Profile Description:

Depth (inches)	Hz	Matrix Color (Munsell Moist)	Texture, Concretions, Structure	Redox Feature Abundance/Contrast	Redox Color (Munsell Moist)
0-10		N2-2.5/	Sandy clay loam		

Hydric Soil Indicators:

____ Histosol
____ Histic Epipedon
____ Sulfidic Odor
____ Aquic Moisture Regime
____ Reducing Conditions
X Gleyed or Low-Chroma Colors

____ Concretions
____ High Organic Content in Surface Layer in Sandy Soils
____ Organic Streaking in Sandy Soils
____ Listed on Local Hydric Soils List
____ Listed on National Hydric Soils List
____ Organic Pan

NRCS Field Indicators: ____

____ Other (Explain in Remarks)

WETLAND DETERMINATION

Yes Hydrophytic Vegetation Present?
Yes Wetland Hydrology Present?
Yes Hydric Soils Present?

Yes Is this Sampling Point Within a Wetland?
No Is this Sampling Point a Waters of the US?
No Have the determination results been overridden by the user?

REMARKS

Wetland
X Yes
____ No

WoUS
____ Yes
X No

7 Species Richness
1.43 Prevalence Index

Categorical Variables

Veg code

__ Alkali Marsh__Alkali Marsh
__ Alkali Marsh__Distichlis spicata
__ Alkali Marsh__Typha spp.
__ Artificial Structure__Aquaduct
__ Artificial Structure__Constructed Wetlands
__ Artificial Structure__Disturbed Sites
__ Artificial Structure__Flood Control Structure
__ Artificial Structure__Lined Pond/Fountain
__ Artificial Structure__Pond
__ Artificial Structure__Retention Basin
__ Artificial Structure__Sewage Pond
__ Chaparral__Adenostoma sparsifolium
__ Chaparral__Arctostaphylos pungens
__ Chaparral__Arctostaphylos spp.
__ Chaparral__Baccharis sarathroides
__ Chaparral__Ceanothus tomentosus
__ Chaparral__Quercus berberidifolia
__ Chaparral__Rhus integrefolia
__ Chaparral__Rhus ovata
__ Chaparral__Rhus trilobata
__ Freshwater Marsh__Azolla filiculoides
__ Freshwater Marsh__Disturbed Wetland
__ Freshwater Marsh__Eleocharis spp.
__ Freshwater Marsh__Juncus effussus
__ Freshwater Marsh__Juncus mexicanus
[X] Freshwater Marsh__Scirpus acutus
__ Freshwater Marsh__Scirpus americanus
__ Freshwater Marsh__Scirpus microcarpus
__ Freshwater Marsh__Typha spp.
__ Grassland, Native__Leymus triticoides
__ Grassland, Native__Muhlenbergia rigens
__ Grassland, Native__Polypogon spp.
__ Grassland, Native__Sporobolus spp.
__ Grassland, Native__Stipa pulchra
__ Grassland, Non-Native__Agropyron repens
__ Grassland, Non-Native__Avena barbata
__ Grassland, Non-Native__Avena fatua
__ Grassland, Non-Native__Bromus diandrus
__ Grassland, Non-Native__Bromus rubens
__ Grassland, Non-Native__Bromus tectorum
__ Grassland, Non-Native__Cynodon plectostachyus
__ Grassland, Non-Native__Echinochloa muricata
__ Grassland, Non-Native__Hordeum leporinum
__ Grassland, Non-Native__Lolium perenne
__ Herbaceous Native__Riparian Dry (Dry Species)
__ Herbaceous Native__Riparian Moist (Moist Species)
__ Herbaceous Non-Native__Agricultural Weeds
__ Herbaceous Non-Native__Common Weeds
__ Juncus Meadow__Juncus effusus
__ Juncus Meadow__Juncus mexicanus
__ Montane Forest__Abies concolor
__ Montane Forest__Pinus coulteri
__ Montane Forest__Pinus jeffreyi
__ Montane Forest__Pinus ponderosa
__ Montane Forest__Pseudotsuga macrocarpa
__ Shrub Native__Artemisia nova
__ Shrub Native__Artemisia tridentata

Quantitative Variables

__	Woody Debris Cover %
__	Tree Cover %
45	Shrub Cover %
100	Herb Cover %
100	Total Cover %
__	Other Exotic %
10	Litter %
30	Silt %
20	Sand %
__	Gravel %
__	Gravel Size (cm)
__	Cobble %
__	Cobble Size (cm)
7	Species Richness
1.43	PI value

__ Shrub Native__Atriplex californica
__ Shrub Native__Atriplex canescens
__ Shrub Native__Baccharis pilularis
__ Shrub Native__Baccharis salicifolia
__ Shrub Native__Bebbia juncea
__ Shrub Native__Brickellia californica
__ Shrub Native__Chilopsis linearis
__ Shrub Native__Encelia farinosa
__ Shrub Native__Eriodictyon crassifolium
__ Shrub Native__Eriogonum fasciculatum
__ Shrub Native__Eriogonum wrightii
__ Shrub Native__Gutierrezia sarothrae
__ Shrub Native__Isocoma menziesii
__ Shrub Native__Juniperus californica
__ Shrub Native__Lepidospartum squamatum
__ Shrub Native__Salix exigua
__ Shrub Native__Salix goodingii
__ Shrub Native__Salix laevigata
__ Shrub Native__Salix lasiolepis
__ Shrub Native__Salix melanopsis
__ Shrub Native__Salvia mellifera
__ Shrub Native__Sambucus mexicana
__ Shrub Native__Senecio flaccidus
__ Shrub Native_Salix spp.
__ Shrub, Non-Native__Nicotiana glauca
__ Shrub, Non-Native__Olea europea
__ Shrub, Non-Native__Tamarix spp.
__ Trees/Woodland/Forest, Native__Alnus rhombifolia
__ Trees/Woodland/Forest, Native__Fraxinus dipetala
__ Trees/Woodland/Forest, Native__Fraxinus velutina
__ Trees/Woodland/Forest, Native__Platanus racemosa
__ Trees/Woodland/Forest, Native__Populus balsamifera
__ Trees/Woodland/Forest, Native__Populus fremontii
__ Trees/Woodland/Forest, Native__Quercus agrifolia
__ Trees/Woodland/Forest, Native__Quercus chrysolepis
__ Trees/Woodland/Forest, Native__Quercus engelmannii
__ Trees/Woodland/Forest, Native__Quercus kelloggii
__ Trees/Woodland/Forest, Native__Salix exigua
__ Trees/Woodland/Forest, Native__Salix goodingii
__ Trees/Woodland/Forest, Native__Salix laevigata
__ Trees/Woodland/Forest, Native__Salix lasiolepis
__ Trees/Woodland/Forest, Native__Salix spp.
__ Trees/Woodland/Forest, Native__Washingtonia filifera
__ Trees/Woodland/Forest, Non-Native__Eucalyptus spp.
__ Trees/Woodland/Forest, Non-Native__Schinus molle
__ Unvegetated__Dry Wash Channel
__ Water Body__Freshwater Pond
__ Water Body__Lake
__ Water Body__Pond
__ Water Body__Spring

Geo Pos
__ Bankfull stream channel
[X] Active floodplain
__ Terrace (abandoned floodplain)

Problematic
__ Hydrophytic Vegetation

__ Hydric soil
__ Hydrology

Disturbance Condition
__ Disturbed
[X] Natural

Hydrophytic Veg
[X] Yes
__ No

Hydric Soil
[X] Yes
__ No

Hydrology
[X] Yes
__ No

Appendix 4: Example Observation Data Sheet (Observation Point 18)

Project Name: Otay Observation Points	Date: 11/05/2002	Time:
Sample Point Number: 18	County:	State: CA
Investigators:	Roll No:	Photo No:
Yes Do Normal Circumstances exist on the site?	UTM zone: 11	Datum: NAD83
No Is the site significantly disturbed (Atypical Situation)?	North: 3605840	
No Is the site a potential Problem Area?	West: 496378	

VEGETATION

No.	Scientific Name	Strata	Indicator Status	Percent Cover	Dominant Species

Total Number of Species: 0 Total Dominants: 0

Percent of Dominants that are Wetland Species: 50/20: 0.00 FAC(minus)- applied: 0.00

Prevalence Index: 0.00 FAC Neutral:

HYDROLOGY

Recorded Data:

_____ Stream, Lake, or Tide Gauge
_____ Aerial Photographs
_____ Other
__X__ No Recorded Data Available

Field Observations:

Depth of Surface Water: ________ (in.)
Depth to Free Water in Pit: ________ (in.)
Depth to Saturated Soil: ________ (in.)

Wetland Hydrology Indicators:

Primary Indicators:

_____ Inundated
_____ Saturated in Upper 12 inches
_____ Water Marks
_____ Drift Lines
_____ Sediment Deposits
_____ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):

_____ Oxidized Root Channels in Upper 12 inches
_____ Water-Stained Leaves
_____ Local Soil Survey Data
_____ FAC-Neutral Test
_____ Other (Explain in Remarks)

SOILS

Map Unit Name:
(Series and Phase):
Taxonomy (Subgroup):

Drainage Class:
Field Observations
Confirm Mapped Type? No

Profile Description:

Depth (inches)	Hz	Matrix Color (Munsell Moist)	Texture, Concretions, Structure	Redox Feature Abundance/Contrast	Redox Color (Munsell Moist)

Hydric Soil Indicators:

____ Histosol
____ Histic Epipedon
____ Sulfidic Odor
____ Aquic Moisture Regime
____ Reducing Conditions
____ Gleyed or Low-Chroma Colors

____ Concretions
____ High Organic Content in Surface Layer in Sandy Soils
____ Organic Streaking in Sandy Soils
____ Listed on Local Hydric Soils List
____ Listed on National Hydric Soils List
____ Organic Pan

NRCS Field Indicators: ____

____ Other (Explain in Remarks)

WETLAND DETERMINATION

No Hydrophytic Vegetation Present?
No Wetland Hydrology Present?
No Hydric Soils Present?

No Is this Sampling Point Within a Wetland?
No Is this Sampling Point a Waters of the US?
No Have the determination results been overridden by the user?

REMARKS

Wetland

____ Yes
X No

WoUS

____ Yes
X No

0 Species Richness
0.00 Prevalence Index

Categorical Variables

Quantitative Variables

Hydric Vegetation
[X] Yes
__ No

Hydric Soils
__ Yes
[X] No

Indicators
[X] Yes
__ No

Disturbed
__ Yes
[X] No

WoUS
[X] Yes
__ No

Wetland
__ Yes
[X] No

Geomorphology
__ 0
__ 2
[X] 3

Appendix 5: Ratings for Non-Floodplain and Floodplain Riparian Vegetation

Map Unit	Non Floodplain Riparian Rating	Floodplain Riparian Rating
Alkali Marsh__Alkali Marsh	4	0
Artificial Structure__Constructed Wetlands	2	1
Artificial Structure__Disturbed Sites	5	5
Artificial Structure__Flood Control Structure	0	6
Artificial Structure__Retention Basin	1	1
Chaparral__*Baccharis sarathroides*	4	4
Chaparral__*Rhus integrefolia*	6	0
Chaparral__*Rhus ovata*	6	6
Freshwater Marsh__*Juncus effussus*	2	2
Freshwater Marsh__*Scirpus microcarpus*	2	0
Freshwater Marsh__*Typha* spp.	0	1
Grassland, Non-Native__*Arundo donax*	5	4
Grassland, Non-Native__*Bromus tectorum*	6	6
Grassland, Non-Native__*Cynodon plectostachyus*	0	6
Herbaceous Native__Riparian Dry (Dry Species)	0	6
Herbaceous Native__Riparian Moist (Moist Species)	0	2
Herbaceous Non-Native__Agricultural Weeds	0	6
Herbaceous Non-Native__Common Weeds	6	6
Juncus Meadow__*Juncus effusus*	4	3
Montane Forest__*Cupressus* sp.	6	0
Shrub Native__*Baccharis salicifolia*	4	3
Shrub Native__*Iva hayesiana*	0	3
Shrub Native__*Salix gooddingii*	0	2
Shrub Native__*Salix lasiolepis*	3	2
Shrub, Non-Native__*Nicotiana glauca*	0	6
Shrub, Non-Native__*Tamarix* spp.	5	4
Trees/Woodland/Forest, Native__*Platanus racemosa*	4	4
Trees/Woodland/Forest, Native__*Quercus agrifolia*	6	6
Trees/Woodland/Forest, Native__*Quercus engelmannii*	6	0
Trees/Woodland/Forest, Native__*Salix gooddingii*	3	2
Trees/Woodland/Forest, Native__*Salix lasiolepis*	3	2
Trees/Woodland/Forest, Native__*Washingtonia filife*	3	0
Trees/Woodland/Forest, Non-Native__*Eucalyptus* spp.	6	6
Trees/Woodland/Forest, Non-Native__*Schinus molle*	6	6
Unvegetated__Dry Wash Channel	1	0
Water Body__Freshwater Pond	1	0

“0” Indicates that it doesn’t occur in this setting.

Appendix 6: Map Units Observed and Sampled in Study

Map Unit	# Observed	# Sampled
Alkali Marsh__Alkali Marsh	1	1
Artificial Structure__Constructed Wetlands	2	0
Artificial Structure__Disturbed Sites	1	0
Artificial Structure__Retention Basin	1	0
Chaparral__*Baccharis sarathroides*	10	3
Chaparral__*Rhus ovata*	1	0
Freshwater Marsh__*Azolla filiculoides*	0	1
Freshwater Marsh__*Juncus effussus*	4	1
Freshwater Marsh__*Scirpus acutus*	9	6
Freshwater Marsh__*Typha* spp.	7	0
Grassland, Non-Native__*Arundo donax*	1	0
Herbaceous Native__Riparian Dry (Dry Species)	1	0
Herbaceous Native__Riparian Moist (Moist Species)	3	0
Herbaceous Native__Riparian Wet (Wet Species)	2	1
Herbaceous Non-Native__Common Weeds	7	0
Juncus Meadow__*Juncus effusus*	1	0
Shrub Native__*Baccharis salicifolia*	17	5
Shrub Native__*Iva hayesiana*	0	1
Shrub Native__*Salix gooddingii*	1	0
Shrub Native__*Salix lasiolepis*	8	3
Shrub, Non-Native__*Tamarix* spp.	6	3
Trees/Woodland/Forest, Native__*Platanus racemosa*	17	2
Trees/Woodland/Forest, Native__*Quercus agrifolia*	23	0
Trees/Woodland/Forest, Native__*Salix gooddingii*	7	1
Trees/Woodland/Forest, Native__*Salix lasiolepis*	11	9
Trees/Woodland/Forest, Non-Native__*Eucalyptus* spp.	6	0
Unvegetated__Dry Wash Channel	1	0
Water Body__Freshwater Pond	5	0
Totals	153	37

Appendix 7: Frequency and Area of Riparian Vegetation Community Types on the Terrace Geomorphic Surface

Wetland Rating	Riparian Vegetation Community Type	Frequency	Acres	Hectares
Rating 1	Artificial Structure__Constructed Wetlands	25	984.638	398.477
	Artificial Structure__Retention Basin	1	0.877	0.355
	Freshwater Marsh__*Typha* spp.	1	0.274	0.111
Rating 2	Freshwater Marsh__*Juncus effussus*	3	1.166	0.473
	Herbaceous Native__Riparian Moist (Moist Species)	6	14.275	5.777
	Shrub Native__*Salix gooddingii*	14	30.781	12.455
	Shrub Native__*Salix lasiolepis*	9	21.204	8.581
	Trees/Woodland/Forest, Native__*Salix gooddingii*	1	2.052	0.831
	Trees/Woodland/Forest, Native__*Salix lasiolepis*	87	82.292	33.304
Rating 3	Juncus Meadow__*Juncus effusus*	1	0.133	0.054
	Shrub Native__*Baccharis salicifolia*	51	95.029	38.458
	Shrub Native__*Iva hayesiana*	6	24.636	9.970
Rating 4	Chaparral__*Baccharis sarathroides*	26	87.380	35.361
	Grassland, Non-Native__*Arundo donax*	2	0.274	0.111
	Shrub, Non-Native__*Tamarix* spp.	15	40.215	16.275
	Trees/Woodland/Forest, Native__*Platanus racemosa*	48	20.471	8.286
Rating 5	Artificial Structure__Disturbed Sites	42	94.687	38.319
Rating 6	Artificial Structure__Flood Control Structure	8	1.341	0.542
	Chaparral__*Rhus ovata*	11	3.285	1.332
	Grassland, Non-Native__*Bromus tectorum*	5	28.478	11.525
	Grassland, Non-Native__Cynodon plectostachyus	1	0.770	0.311
	Herbaceous Native__Riparian Dry (Dry Species)	8	7.495	3.033
	Herbaceous Non-Native__Agricultural Weeds	2	52.127	21.095
	Herbaceous Non-Native__Common Weeds	36	251.631	101.835
	Shrub, Non-Native__*Nicotiana glauca*	1	1.519	0.615
	Trees/Woodland/Forest, Native__*Quercus agrifolia*	39	26.207	10.609
	Trees/Woodland/Forest, Non-Native__*Eucalyptus* spp.	29	19.402	7.852
	Trees/Woodland/Forest, Non-Native__*Schinus molle*	1	0.818	0.331
	Totals	479	1893.457	766.278

Appendix 8: Frequency and Area of Riparian Vegetation Community Types on Non-Floodplain Surfaces

Wetland Rating	Non-Riparian Vegetation Community Type	Frequency	Acres	Hectares
Rating 1	Artificial Structure__Retention Basin	59	25.52	10.327
	Unvegetated__Dry Wash Channel	1	0.327	0.132
	Water Body__Freshwater Pond	8	6.815	2.759
Rating 2	Artificial Structure__Constructed Wetlands	3	3.294	1.334
	Freshwater Marsh__*Juncus effussus*	5	6.756	2.735
	Freshwater Marsh__*Scirpus microcarpus*	1	0.296	0.120
Rating 3	Shrub Native__*Salix lasiolepis*	10	6.763	2.735
	Trees/Woodland/Forest, Native__*Salix gooddingii*	10	6.077	2.459
	Trees/Woodland/Forest, Native__*Salix lasiolepis*	39	33.478	13.547
	Trees/Woodland/Forest, Native__*Washingtonia filife*	1	0.620	0.251
Rating 4	Alkali Marsh__Alkali Marsh	3	3.788	1.533
	Chaparral__*Baccharis sarathroides*	5	7.276	2.944
	Juncus Meadow__*Juncus effusus*	3	1.266	0.513
	Shrub Native__*Baccharis salicifolia*	45	21.683	8.775
	Trees/Woodland/Forest, Native__*Platanus racemosa*	104	71.498	28.935
Rating 5	Artificial Structure__Disturbed Sites	1	0.104	0.042
	Grassland, Non-Native__*Arundo donax*	1	0.181	0.073
	Shrub, Non-Native__*Tamarix* spp.	20	28.514	11.539
Rating 6	Chaparral__*Rhus integrefolia*	2	1.983	0.803
	Chaparral__*Rhus ovata*	29	45.543	18.433
	Grassland, Non-Native__*Bromus tectorum*	1	0.186	0.075
	Herbaceous Non-Native__Common Weeds	3	8.265	3.345
	Montane Forest__*Cupressus* sp.	10	4.925	1.993
	Trees/Woodland/Forest, Native__*Quercus agrifolia*	225	547.566	221.605
	Trees/Woodland/Forest, Native__*Quercus engelmannii*	2	0.964	0.391
	Trees/Woodland/Forest, Non-Native__*Eucalyptus* spp.	34	31.996	12.948
	Trees/Woodland/Forest, Non-Native__*Schinus molle*	6	3.981	1.611
	Totals	631	869.665)	351.957

Appendix 9: Frequency and Area of Riparian Vegetation Community Types on the Active Floodplain Geomorphic Surface

Riparian Vegetation Community Type	Frequency	Acres	Hectares
Alkali Marsh__Alkali Marsh	11	79.595	32.212
Artificial Structure__Constructed Wetlands	4	7.413	3.001
Artificial Structure__Disturbed Sites	6	8.540	3.456
Artificial Structure__Flood Control Structure	2	0.961	0.389
Artificial Structure__Lined Pond/Fountain	1	0.359	0.145
Artificial Structure__Retention Basin	15	15.842	6.411
Chaparral__*Baccharis sarathroides*	9	18.485	7.481
Chaparral__*Rhus ovata*	4	9.425	3.814
Freshwater Marsh__*Azolla filiculoides*	1	0.417	0.169
Freshwater Marsh__*Hydrilla verticillata*	2	0.118	0.048
Freshwater Marsh__*Juncus effussus*	6	6.127	2.480
Freshwater Marsh__*Scirpus acutus*	215	208.925	84.548
Freshwater Marsh__*Scirpus americanus*	8	7.345	2.973
Freshwater Marsh__*Typha* spp.	56	41.040	16.611
Grassland, Native__*Polypogon* spp.	1	0.303	0.123
Grassland, Non-Native__*Arundo donax*	7	1.495	0.605
Grassland, Non-Native__*Bromus tectorum*	11	5.283	2.138
Herbaceous Native__Riparian Dry (Dry Species)	3	1.171	0.474
Herbaceous Native__Riparian Moist (Moist Species)	8	4.239	1.716
Herbaceous Native__Riparian Wet (Wet Species)	4	3.204	1.297
Herbaceous Non-Native__Common Weeds	25	13.939	5.642
Shrub Native__*Artemisia tridentata*	1	0.146	0.059
Shrub Native__*Baccharis salicifolia*	130	134.539	54.447
Shrub Native__*Eriogonum fasciculatum*	1	0.062	0.025
Shrub Native__*Iva hayesiana*	1	0.628	0.254
Shrub Native__*Salix goodingii*	14	23.888	9.669
Shrub Native__*Salix lasiolepis*	59	119.822	48.489
Shrub, Non-Native__*Tamarix* spp.	34	128.251	51.903
Trees/Woodland/Forest, Native__*Platanus racemosa*	73	52.204	21.126
Trees/Woodland/Forest, Native__*Quercus agrifolia*	20	17.948	7.263
Trees/Woodland/Forest, Native__*Salix gooddingii*	17	38.903	15.743
Trees/Woodland/Forest, Native__*Salix lasiolepis*	77	151.993	61.511
Trees/Woodland/Forest, Non-Native__*Eucalyptus* spp.	5	8.353	3.380
Unvegetated__Dry Wash Channel	33	55.492	22.459
Water Body__Freshwater Pond	55	933.249	377.683
Water Body__Saltwater-Bay	4	42.037	17.011
Totals	923	2141.741	866.755