URS, "Draft Hybrid Assessment of Riparian Condition for the Newhall Ranch Resource Management and Development Plan, Valencia, California" (October 10, 2008; 2008a)

DRAFT

HYBRID ASSESSMENT OF RIPARIAN CONDITION (HARC)

FOR THE

NEWHALL RANCH RESOURCE MANAGEMENT AND DEVELOPMENT PLAN

VALENCIA, CALIFORNIA

Prepared for:

Newhall Land and Farming Company

23823 Valencia Boulevard
Valencia, CA 91355

Prepared by:

URS
130 Robin Hill Road, Suite 100
Santa Barbara, California 93117
(805) 964-6010 ◆ Fax: (805) 964-0259

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AA	Assessment Area
ABL	Aquatic Bioassessment Laboratory
ACOE	U.S. Army Corps of Engineers
AW	Area-Weighted, as in AW-Score Units
CDFG	California Department of Fish and Game
Corps	U.S. Army Corps of Engineers
CRAM	California Rapid Assessment Method
CSBP	California Stream Bioassessment Procedure
DNST	Downstream
HARC	Hybrid Assessment of Riparian Condition
HFA	Hybrid Functional Assessment (term used for early drafts of HARC)
HGM	Hydrogeomorphic
IBI	Index of Biotic Integrity
LACDPW	Los Angeles County Department of Public Works
LEDPA	Least Environmentally Damaging Practicable Alternative
LLFA	Landscape Level Functional Assessment
LSAA	Lake and Streambed Alteration Agreement
LULC	Land Use Land Cover
NRMP	Natural River Management Plan
OHWM	Ordinary High Water Mark
RAM	Rapid Assessment Method
RMDP	Resource Management and Development Plan
SCR	Santa Clara River
SIP	Standard Individual Permit
TRIB	Tributary
UPST	Upstream
WoUS	Waters of the U.S.

The purpose of this assessment is to characterize and evaluate the condition of wetland and riparian habitats within the Newhall Ranch project area (Figure ES-1). A Hybrid Assessment of Riparian Condition (HARC) method was developed through consideration of three established wetland/riparian assessment methods adapted for use at the project site.

There are several advantages to applying this HARC method to the Newhall Ranch site.

- The HARC method is relatively rapid to perform in the field.
- The HARC is based upon established rapid and functional assessment methods.
- No reference condition work is required, although calibration work must be performed.
- The method is well adapted to the project site and the needs of the environmental review process.

The HARC was conducted on 57 homogeneous segments (stream reaches) across the study area, which included the Santa Clara River (SCR) and several tributaries north and south of the SCR. Wetland and riparian habitats within these reaches were classified as Perennial River, Perennial/Intermittent/Ephemeral Tributary, Riverine Persistent Emergent Alkali Marsh, Seep Palustrine Alkali Marsh, and Slope Palustrine Alkali Marsh. The HARC resulted in total scores ranging from 0.98 to 0.10, and was successful in capturing a range of wetland/riparian habitat quality across the project area.

The results of the HARC provide baseline data on the riparian condition of wetland/riparian habitats within Newhall Ranch. In addition, the impacts of the proposed Newhall Ranch Resource Management and Development Plan (RMDP) project and alternatives are evaluated.

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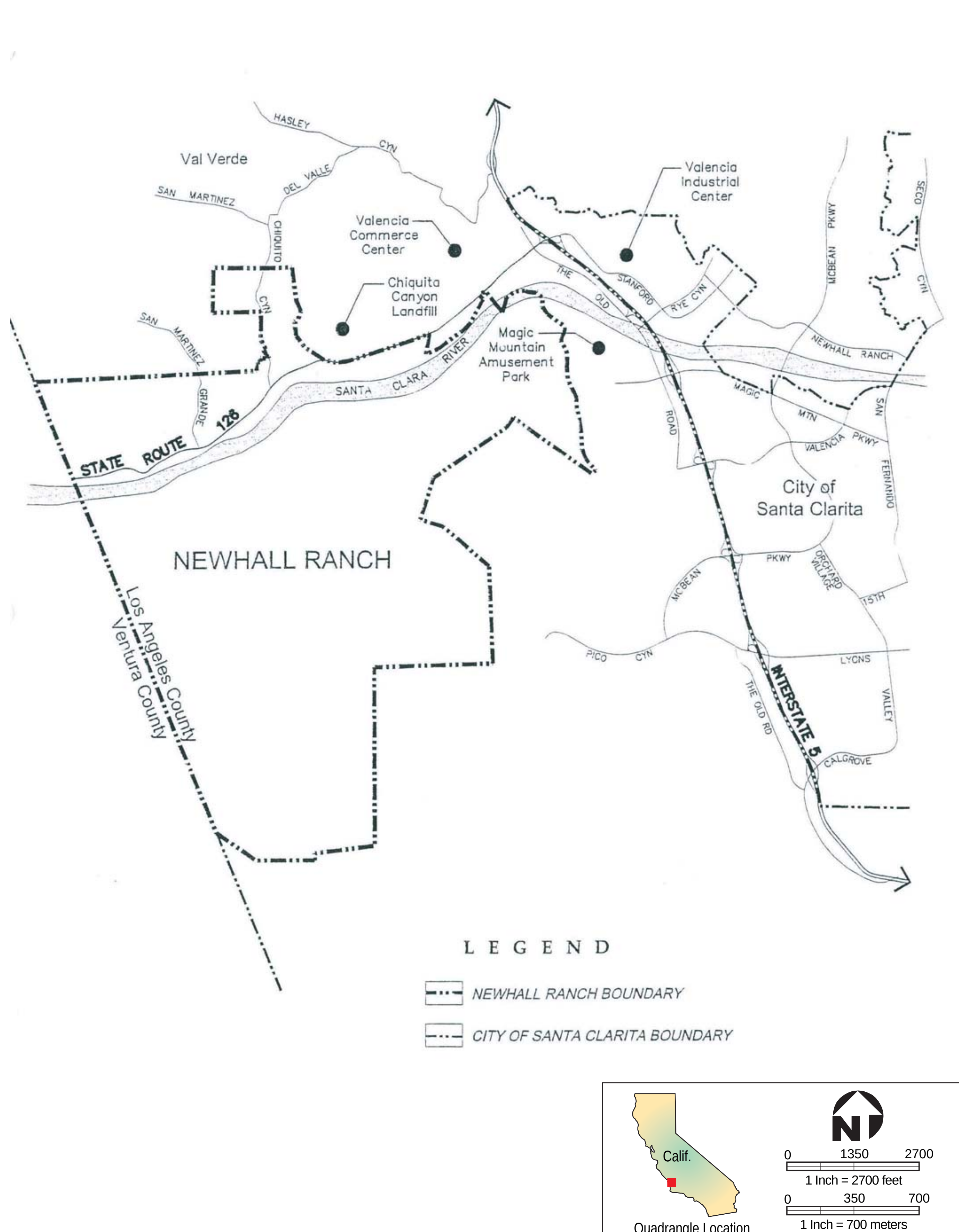


Newhall Ranch Project URS Corporation	**Source:** FORMA Dated: January 24, 2002	Figure ES-1. **NEWHALL RANCH LOCATION AND BOUNDARIES**	January 2005

The U.S. Army Corps of Engineers (Corps) requested the preparation of a Functional Assessment or Rapid Assessment Method (RAM) that would supplement the Draft EIS/EIR alternatives analysis for the proposed RMDP (RMDP; Corps 2004a). A detailed description of this analysis will be included in the Draft EIS/EIR, and is not discussed in this document. Several recent reports discuss the aquatic resources within and around the project area (URS 2003; PCR 2000b).

1.1 SPECIFIC PROJECT NEEDS

In the interest of time, budget, and the needs of the project, the Regulatory Division of the Corps (Los Angeles District) requested that the assessment of wetland and riparian aquatic resources take into account the following criteria:

- Although the Draft Santa Margarita River (SMR) and Draft Santa Barbara coastal streams hydrogeomorphic (HGM) models are theoretically usable in the Santa Clara River (SCR) watershed, either model would have to be adapted or modified to this system. The methods have not been tested; therefore, there is little validity to using the SMR or SB model in the SCR system.
- The HGM model traditionally used by the Corps is complex, and would require significant time, logistical, and financial resources at this time. Thus, a less rigorous semi -quantitative approach would be adequate for the Corps' purposes.
- The HGM approach involves complex equations difficult for the general public to adequately evaluate through the public review process; thus, this HARC approach is more straightforward than other methods.
- Rapid assessment methods (RAMs) are widely accepted and utilized by federal and state agencies; thus, a RAM is appropriate for evaluating the condition of wetland and riparian habitats at the project site.
- The California Rapid Assessment Method (CRAM), although quick to conduct with simplified analysis, is in draft form at the time of this study, and the current draft version is not considered intensive enough to adequately assess aquatic resources at the project site.
- There is a need for a "hybrid," or semi-quantitative approach for this situation. As no method exists that fits the project need, other methods will have to be modified to suit the needs of the project. This effort may include field testing and development of a project-specific method in coordination with the Corps.
- The method must be able to account for differences between the Santa Clara River mainstem, the onsite tributaries to the river, and non-riverine areas such as seep and slope wetlands.

- The method must be able to assess mitigation and avoidance sites, as well as potential impact areas. The method must result in scores that rate assessment areas both pre- and post-project.
- The method must be defensible and be based on functional assessment principles and/or other established rapid assessment methods.

2.1 APPLICATIONS OF WETLAND AND RIPARIAN ASSESSMENTS

Functional Assessments are often required to supplement Clean Water Act Section 404 permit applications when any of the following apply:

- The proposed project site is large.
- The aquatic resources present on site are perceived to be of high value.
- The Corps believes it is necessary to supplement the traditional alternatives analysis with an ecosystem-based assessment.

Functional assessments are used for classification of wetland and riparian habitats and evaluation of the functional condition of specific on-site aquatic resources (i.e., baseline assessment), potential impacts to these resources, and the functional "lift" through mitigation and/or restoration (Smith et al. 1995; Rheinhardt et al. 1997; Hauer and Smith 1998). Functional Assessments can also be used in the alternatives analysis and identification of the Least Environmentally Damaging Practicable Alternative (LEDPA; Section 404(b)(1) Guidelines, 40 CFR Part 230) required under Section 404 of the federal Clean Water Act (CWA).

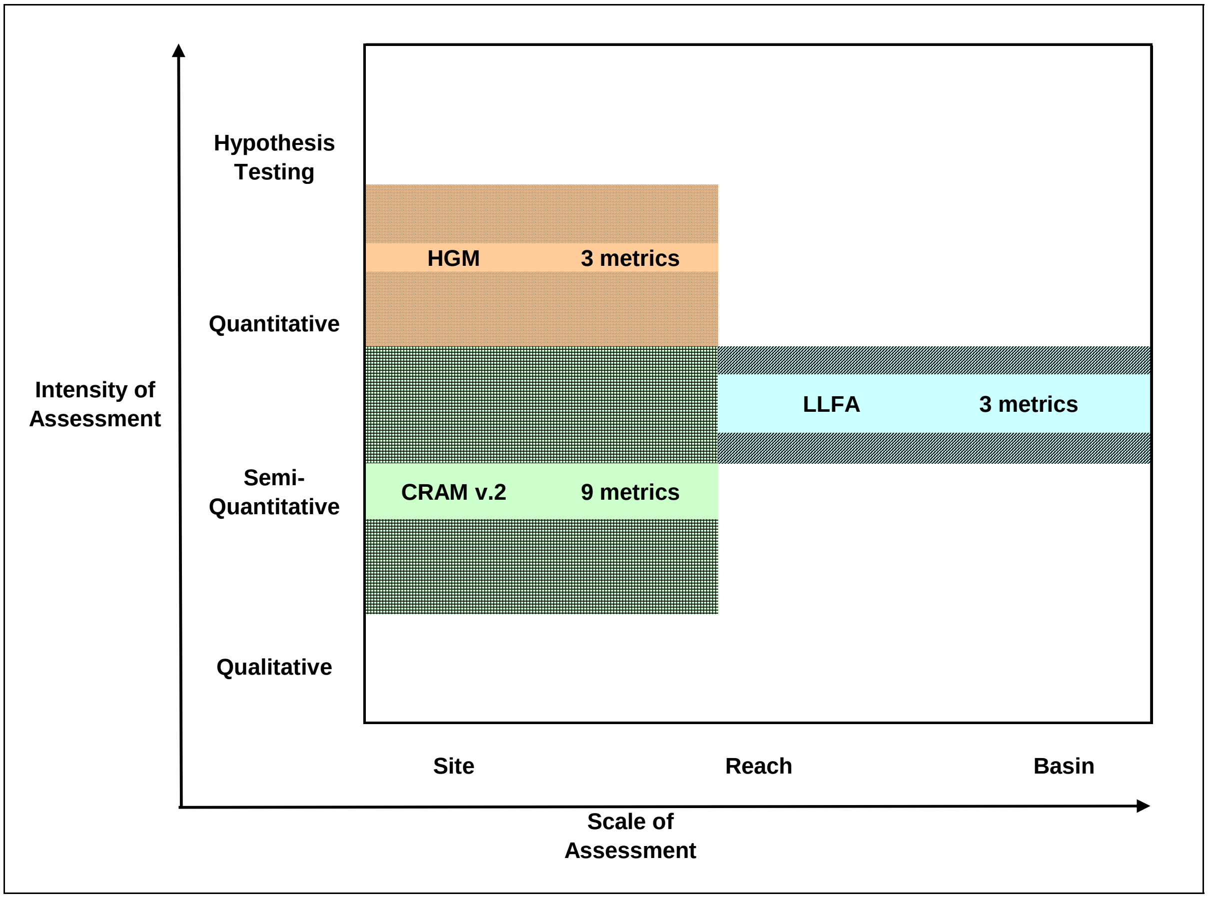
Methods for assessments of riparian and wetland ecosystems range from very complex and time intensive (e.g., HGM) to very rapid (e.g., CRAM). The scale of analysis varies among methods from the watershed scale (e.g., *Landscape Level Functional Assessment [LLFA]*) to a site-specific scale (e.g., *Index of Biotic Integrity [IBI]*).

Figure 2-1 shows the relationship between three of these methods along spatial and assessment intensity scales. The CRAM and HGM are site-based methods, and the LLFA covers the reach and drainage basin scales.

The CDFG operates the Aquatic Bioassessment Laboratory (ABL; see http://www.dfg.ca.gov/abl/index.asp). The goal of this group is to support the use of biology in California's water quality management, assessment, and enforcement programs. Specifically, the ABL uses a macroinvertebrate IBI method to conduct bioassessment of freshwater streams throughout California; the method developed by the ABL, the California Stream Bioassessment Procedure (CSBP), is currently the most widely used stream bioassessment method in California (see http://www.dfg.ca.gov/cabw/cabwhome.html).

Although the Corps has encouraged the use of HGM in the Section 404 context (Corps 1997), the HGM approach is rarely implemented due to time and budget constraints and the overall scientific complexity of the method. From a legal perspective, the Corps has the latitude to determine which method suits a given project (Kusler 2004a). Specifically, the Corps has broad discretion in selecting assessment methods, and is supported in their

FIGURE 2-1
COMPARISON BETWEEN THE THREE COMPONENTS OF HARC, ALONG AXES OF THE SCALE OF THE ASSESSMENT (X-AXIS), AS WELL AS THE INTENSITY OF FIELDWORK AND DATA ANALYSIS (Y-AXIS) REQUIRED (ADAPTED FROM SUTULA ET AL. 2006 AND R. DAN SMITH UNPUBLISHED)



information gathering and analyses by the legal presumption that their regulations and fact-finding activities are valid.

A variety of different assessment methods may be used to classify wetland resources on a project site. In the HGM approach, wetlands are divided into hydrogeomorphic classes determined by their geomorphic setting (e.g., within a river, adjacent to a lake, etc.) (Brinson, 1993); see Table 2-1. The Ferren classification system (Ferren et al. 1996) utilizes a modified Cowardin approach (Cowardin et al. 1979) and incorporates factors such as substrate types and water regimes. Both approaches are valid, and even combinations of these approaches have been used in Functional Assessment reports. For example, one report combines 'riverine' [HGM] plus 'palustrine emergent-persistent seasonally-saturated alkali marsh' [Ferren] to get "Riv-pam" ('persistent, emergent, alkali marsh in a riverine geomorphic setting'; PCR 2000a).

TABLE 2-1
HYDROGEOMORPHIC CLASSES OF WETLANDS SHOWING DOMINANT WATER SOURCE, HYDRODYNAMICS, AND EXAMPLES OF SUBCLASSES

Hydrogeomorphic Class (Geomorphic Setting)	Dominant Water Source	Dominant Hydrodynamic	Examples of Regional Subclass	
			Eastern U.S.A.	Western U.S.A.
Riverine	Flow from channel and/or subsurface hyporheic groundwater	Unidirectional, vertical, and horizontal	Bottomland hardwood forest	Alluvial, riparian floodplains
Depressional	Return flow from groundwater and interflow	Vertical	Prairie Potholes Marshes, Pools	California vernal pools
Slope	Through flow from groundwater	Unidirectional, horizontal	Fens	Alpine snowmelt fens
Mineral Soil Flats	Precipitation	Vertical	Wet pine flatwoods	Large playas
Organic Soil Flats	Precipitation	Vertical	Peat bogs	Peat bogs
Lacustrine Fringe	Inundation from lake	Bi-directional horizontal	Littoral zone marshes, Douglas Lake	Flathead Lake marshes
Estuarine Fringe	Inundation from estuary	Bi-directional horizontal	Chesapeake Bay marshes	San Francisco Bay marshes

Source: Brinson (1993).

Wetland functions are the physical and biological processes that occur in wetlands (Brinson 1993; Smith et al. 1995; Kusler 2004b-c, 2006). As shown in Table 2-2, functions may be categorized within three processes: hydrologic, biogeochemical, and habitat. For example, through the function "Short-term Storage of Surface Water," wetlands provide the following services to the natural environment:

- On-site services – replenishment of soil moisture, import/export of materials, conduit for organisms
- Downstream services – reduction of downstream peak discharge, maintain and improve water quality

2.2 ASSESSMENT INDICATORS

Assessment methods may be used to rate the quality of wetland habitats on a project site. As functions are difficult to measure directly, methods have been developed to assess that functions are occurring based on various indicators. These indicators, also referred to as metrics, provide component scores which can be mathematically combined to evaluate

TABLE 2-2
WETLAND FUNCTIONS AND THEIR VALUES

Functions Related to Hydrologic Processes	Benefits, Products, and Services Resulting from the Wetland Function	
Short-Term Storage of Surface Water: the temporary storage of surface water for short periods.	Onsite:	Replenish soil moisture, import/export materials, conduit for organisms.
	Offsite:	Reduce downstream peak discharge and volume and help maintain and improve water quality.
Long-Term Storage of Surface Water: the temporary storage of surface water for long periods.	Onsite:	Provide habitat and maintain physical and biogeochemical processes.
	Offsite:	Reduce dissolved and particulate loading and help maintain and improve surface water quality.
Storage of Subsurface Water: the storage of subsurface water.	Onsite:	Maintain biogeochemical processes.
	Offsite:	Recharge surficial aquifers and maintain baseflow and seasonal flow in streams.
Moderation of Groundwater Flow or Discharge: the moderation of groundwater flow or groundwater discharge.	Onsite:	Maintain habitat.
	Offsite:	Maintain groundwater storage, baseflow, seasonal flows, and surface water temperatures.
Dissipation of Energy: the reduction of energy in moving water at the land/water interface.	Onsite:	Contribute to nutrient capital of ecosystem.
	Offsite:	Reduced downstream particulate leading helps to maintain or improve surface water quality.
Functions Related to Biogeochemical Processes	**Benefits, Products, and Services Resulting from the Wetland Function**	
Cycling of Nutrients: the conversion of elements from one form to another through biotic and abiotic processes.	Onsite:	Contributes to nutrient capital of ecosystem.
	Offsite:	Reduced downstream particulate loading helps to maintain or improve surface water quality.
Removal of Elements and Compounds: the removal of nutrients, contaminants, or other elements and compounds on a short-term basis through burial, incorporation into biomass, or biochemical reactions.	Onsite:	Contributes to nutrient capital of ecosystem. Contaminants are removed, or rendered innocuous.
	Offsite:	Reduced downstream loading helps to maintain or improve surface water quality.
Retention of Particulates: the retention of organic and inorganic particulates on a short-term or long-term basis through physical processes.	Onsite:	Contributes to nutrient capital of ecosystem.
	Offsite:	Reduced downstream particulate loading helps to maintain or improve surface water quality.
Export of Organic Carbon: the export of dissolved or particulate organic carbon.	Onsite:	Enhances decomposition and mobilization of metals.
	Offsite:	Supports aquatic food webs and downstream biogeochemical processes.

TABLE 2-2 (CONTINUED)
WETLAND FUNCTIONS AND THEIR VALUES

Functions Related to Habitat	Benefits, Goods, and Services Resulting from the Wetland Function	
Maintenance of Plant and Animal Communities: the maintenance of plant and animal community that is characteristic with respect to species composition, abundance, and age structure.	Onsite:	Maintain habitat for plants and animals (e.g., endangered species and critical habitats), forest and agriculture products, and aesthetic, recreational, and educational opportunities.
	Offsite:	Maintain corridors between habitat islands and landscape/regional biodiversity.

Source: Hauer and Smith (1998).

wetland functions or attributes that contribute to function. The current condition of an assessment area would be assigned a metric score based on pre-determined scoring criteria. For example, for the metric “Surface Water Persistence” (Table A-9 from Appendix A; based on Lee et al. 1997), the following rating scale would be used:

- (Score = 1.00) Evidence of surface water ponding/storage on floodplain for greater than one day (intermittent). Substrate porosity is such that runoff persists; floodplain has complex microtopographic relief; or perennially flowing/saturated; or adjacent wetlands present.
- (Score = 0.75) Evidence of surface water ponding/storage on floodplain for greater than one day (intermittent). Floodplain has simple microtopographic relief (non-wetland floodplain).
- (Score = 0.50) Evidence of surface water ponding/storage for less than one day (ephemeral).
- (Score = 0.25) Assessment area provides no features for ponding/storing water. Variable is recoverable and sustainable through natural processes.
- (Score = 0.00) Assessment area provides no features for ponding/storing water. Variable is not recoverable and sustainable through natural processes under current conditions.

Individual metric scores are then summed or placed into an algorithm that represents a particular function. In the example above, the “Surface Water Persistence” metric is one of several metrics that comprise a specific hydrology function.

The hybrid method used in this study contains elements of the current draft version of CRAM (v. 5.0, September 2007), supplemented with components from the LLFA and HGM approaches. The goal is to retain the rapid nature of the CRAM approach while incorporating more intensive field metrics (HGM components) and landscape metrics (LLFA components).

See Section 3.6 for a discussion of the validity of combining metrics from different methods.

3.1 INTRODUCTION

3.1.1 Source Methods for the Hybrid Approach

The proposed HARC method is based on the following rapid assessment, integrity assessment, and functional assessment methods for wetland and riparian habitats (Collins et al. 2004, 2006; Smith 2003; Lee et al. 1997, 2001):

- *Draft California Rapid Assessment Method for Wetlands*. (CRAM) This method is currently being developed for use by various federal and state agencies.
- *Assessment of Riparian Ecosystem Integrity: San Jacinto and Upper Santa Margarita River Watersheds, Riverside County, California*. (Landscape Level Functional Assessment = LLFA) This method was developed for use in Special Area Management Plan (SAMP) projects that are ongoing in Orange, Riverside Counties, and San Diego Counties.
- *Peer Review Draft Guidebook to Hydrogeomorphic Functional Assessment of Riverine Waters/Wetlands in the Santa Margarita Watershed*. (Santa Margarita River HGM = SMR HGM) This HGM guidebook was developed for use in Southern California, and the model was based on data collected in San Diego County.
- *Draft Guidebook for Reference Based Assessment of the Functions of Riverine Waters/Wetlands Ecosystems in the South Coast Region of Santa Barbara County, California*. (Santa Barbara HGM = SB HGM) This HGM guidebook was developed for use in the small, coastal watersheds of Southern Santa Barbara County.

The HARC approach is a combination and slight modification of these three established types of assessment methods. The intent here was not to create a new method for assessing wetlands, but to use and adapt existing assessment methodology for the Corps' purpose in evaluating jurisdictional streams and wetlands within the Newhall Ranch project area.

3.1.2 Terminology

The terms used in this HARC are described below:

- **Function.** Refers to natural processes (Kusler 2004b) within wetlands, or the normal or characteristic activities that take place in wetland ecosystems, or "simply the things wetlands do" (Smith et al. 1995). Wetlands perform a wide variety of functions in a hierarchy from simple to complex as a result of their physical, chemical, and biological attributes (Smith et al. 1995). The purpose of this assessment is to quantitatively evaluate the quality of wetland and riparian habitat within the project area with respect to how effectively these resources perform selected functions.
- **Wetland Values.** Those services provided by wetlands that relate specifically to a human use, such as recreation, aesthetics, historic potential, education potential, and urban quality of life (text based on CWP 2007).
- **Condition.** Defined as its status, in terms of its natural structural and biological complexity, relative to the best possible condition for wetlands of the same class, at the time of the assessment.
- **Reach.** For the purpose of the HARC, the jurisdictional streams and wetlands in the project area have been divided into 57 homogeneous segments, called reaches. Each reach received scores based upon its physical and biological characteristics. Reach boundaries were determined in the field using a global positioning system (GPS), and then digitized into a GIS layer. Methods for identifying homogeneous reaches are discussed in Section 3.5.
- **Assessment Width (Meters).** For the purpose of this HARC, the assessment width equals the width of agency (CDFG) jurisdiction within a given reach, and is expected to be similar or greater to HGM's "flood-prone area." The GIS spatial database was used to accurately determine this value. Thus, most metrics evaluated riparian areas within and beyond the flood-prone area. Some metrics evaluate the buffer and land use adjacent to the assessment width.
- **Assessment Area (Square Meters).** The assessment area of a reach is equal to the area of agency jurisdiction within that reach. The GIS spatial database was used to accurately determine this value.
- **Plot.** A 10-meter x 50-meter study area located within a reach used for vegetation and soil data collection.
- **Metric.** Metrics are indicators of wetland function, and were evaluated quantitatively in this assessment. Every metric was scaled to have a value, or metric score, between 0 (degraded condition) and 1.0 (optimal condition). These metric scores were the basic components used to calculate the HARC scores. A total of 21 different metrics were measured, of which only 15 were used in the HARC analysis; for further details see

Appendix A. Not all metrics were used in calculating scores for each function (see Table 3-1). Individual metrics were modified for use in particular wetland functional types (e.g., riverine vs. slope wetlands) as shown in Appendix A, allowing for equal comparison among all reaches, and thus all wetland functional types, after completion of the assessment.

- **Attribute.** Attributes are the obvious, universal aspects of wetland condition. In concept, all wetlands everywhere share these attributes: buffer and landscape context, hydrology, physical structure, and biotic structure. Each of these attributes consists of a number of metrics (text from Collins et al. 2006).
- **Hybrid Assessment of Riparian Condition Total Score (HARC Total Score).** HARC scores are the numerical scores showing the quality of each reach, or the extent to which the reach exhibits certain wetland attributes. HARC scores were derived for three discreet attributes (hydrologic, biogeochemical, and habitat), and overall scores incorporating all measured metrics were also calculated.
- **Hybrid Assessment of Riparian Condition Area-Weighted Score (HARC AW-Score Unit).** Although the HARC score provides a means for comparing the quality of different stream reaches with respect to certain wetland attributes, it does not take into consideration the differing size of the reaches. In order to incorporate this variable, each HARC score was multiplied by the assessment area of the reach. The resulting product is termed the number of HARC AW-Score Units. It is this number that ultimately describes the value of a particular reach, and the number of AW-Score Units impacted vs. preserved will show the impacts of the proposed project and alternatives on wetland and riparian resources. Conceptually, the alternative with the fewest lost AW-Score Units would be the least environmentally damaging alternative. An alternative with a greater loss of HARC AW-Score Units, though, may be mitigated by producing AW-Score Units in another location within the project area through wetland/riparian restoration or creation. The cost and logistics of producing AW-Score Units in another location may or may not be practicable given the project site. See Section 5.0 for further consideration of this subject.

3.1.3 Reference Condition

The HGM method relies on defined reference conditions derived from sampled reference sites (referred to as reference domain in HGM). Reference sites provide data that is necessary for calibrating HGM models developed for various wetland classes. Reference standard sites consist of what Smith (2003) termed least culturally altered – "*those conditions that currently exist in a watershed or region and most closely reflect culturally unaltered conditions*." For this project, the Corps recommended against using the traditional HGM model because the project area is not within the established reference domain of an existing HGM handbook..

TABLE 3-1
HARC METRICS

Attributes[1]	Metric	Function Group[2]	Source Method[3]	Example Functions per Attribute Group[4]
Buffer	~~Percent of area with buffer*~~	~~Geo~~	~~CRAM~~	• Moderation of groundwater flow
~~4 (20%)~~	Average buffer width	Geo	CRAM	• Nutrient cycling
3 (20 %)	Buffer condition	Geo	CRAM	• Maintenance of plant and animal communities
	Land use land cover	Geo	LLFA	
Hydrology	Source	Hydro, Geo	CRAM	• Moderation of groundwater flow
~~6 (30%)~~	Hydroperiod	Hydro, Geo	CRAM	• Surface/Subsurface water storage
5 (33 %)	Floodplain connection	Hydro, Geo	CRAM	
	~~Altered hydraulic conveyance~~	~~Hydro, Geo~~	~~LLFA~~	• Nutrient cycling
	Surface water persistence	Hydro, Geo	SMR HGM	• Removal of elements and compounds
	Flood prone area	Hydro, Geo	SMR HGM	• Retention of particulates
				• Export of organic carbon
				• Maintenance of plant and animal communities
Structure – Abiotic	~~Sediment Regime~~	~~Geo~~	~~LLFA~~	• Surface/Subsurface water storage
~~3 (15%)~~	Topographic complexity	Geo, Hab	CRAM	• Dissipation of energy; flood control
2 (13 %)	Substrate condition	Geo, Hab	CRAM	
				• Maintenance of plant and animal communities
Structure – Biotic	Vertical biotic structure	Hab	CRAM	• Dissipation of energy; flood control
~~8 (40%)~~	Interspersion and zonation	Hab	CRAM	
5 (33 %)	Nativeness	Hab	SMR HGM	• Nutrient cycling
	~~Canopy~~	~~Hab~~	~~SMR HGM~~	• Removal of elements and compounds
	~~Age distribution~~	~~Hab~~	~~SMR HGM~~	
	Riparian vegetation condition	Hab	LLFA	• Retention of particulates
	Riparian corridor continuity	Hab	LLFA	• Export of organic carbon
	~~Invasive, exotic plants~~	~~Hab~~	~~LLFA~~	• Maintenance of plant and animal communities

Strikethrough metrics represent the metrics that were excluded from the final analysis.

[1] Overall, the HARC is based on CRAM, which measures attributes including buffer, hydrology, abiotic, and biotic structure.

[2] Attributes are grouped into Hydrology ('Hydro'), Biogeochemical ('Geo'), and Habitat ('Hab').

[3] Source methods used to develop the HARC methods.

Table format based on Smith et al. (1995), Hauer and Smith (1998).

As no usable reference domain exists, the HGM model cannot be used in this region because the metrics have not been scaled in reference to a disturbance gradient. Therefore, the HARC uses another approach to scaling the metrics, which does not require a reference domain.

"Universal" wetland metrics reflect the "common, visible characteristics of all wetlands in all regions of California," independent of any reference domain (Collins et al. 2004, 2006; Sutula et al. 2006). The HARC used metrics based on the universal aspects of wetlands, and followed the approach of Smith (2003). In that study, Smith (2003) stated that culturally unaltered reference conditions are "*conditions that existed prior to grazing, agriculture, fire suppression, water resource management, transportation corridors, urbanization, and other cultural alterations….*" The advantages of this approach to defining reference conditions are as follows: 1) It is an absolute (and objective) standard from which to compare stream reaches within a given project site; and 2) does not require extensive reconnaissance in the watershed prior to site assessment. The method provided here is based on the culturally unaltered approach. In other words, the HARC was composed of metrics that are known to respond to anthropogenic disturbance (i.e., stress) on wetlands. The culturally unaltered approach is a more conservative method of defining reference conditions than the reference domain method used in traditional HGM. While the reference domain method selects actual reference sites within the target watershed, the culturally unaltered approach evaluates assessment reaches relative to theoretical, pristine reference sites. Thus, in a heavily impacted watershed, HGM's reference domain would likely show some signs of impairment, leading all assessment reaches to be evaluated against a lower standard. The culturally unaltered approach circumvents this problem by using theoretical reference sites.

3.2 OVERALL HARC SCORE

Riparian and wetland habitats perform many functions. In this HARC, three distinct attributes are evaluated, and relevant metric scores are combined together to calculate the HARC Score for each. For example, metrics associated with hydrology are combined mathematically, and the resulting HARC Score is an indication of the hydrologic quality of the assessment reach. Some metrics are associated with more than one function, and therefore influence the HARC scores for all relevant functions. For example, hydroperiod is a phenomenon affecting both the hydrological and biogeochemical properties of a reach, and the Hydroperiod metric would therefore be included in the calculation of HARC scores for both the Hydrology and Biogeochemical functions.

In order to summarize results, an overall HARC AW-Total Score was also calculated by computing the arithmetic mean of all metric scores for each reach to get an average score. This approach was chosen for the following reasons: As the HARC method is not HGM, and the metrics assessed are not as detailed as those in a formal HGM, it was reasonable to incorporate all fifteen metrics to give an overall quality score for each particular reach. This HARC AW-Total Score is *not equivalent* to HGM's functional capacity index. The HARC

AW-Total Score was utilized to understand the overall distribution of scores throughout the project site (i.e., whether or not the method adequately captured the range of disturbances present on the project site). It was also used to evaluate the condition of reaches without the need for weighting of scores or use of complicated equations. The use of HARC Total Scores may allow the grouping of reaches into general condition groups such as high, medium, and low scoring reaches. This grouping may be useful in explaining trends in wetland and riparian quality across such a large project area.

3.3 HARC ATTRIBUTE CATEGORIES – WETLAND AND RIPARIAN HABITATS

In addition to evaluating reaches based on the HARC AW-Total Scores as described above, the HARC method also combines selected metrics into three discreet attribute categories. Table 3-1 shows the range of metrics assessed in the field and which metrics would be included in each of three overall attributes based on HGM: hydrology, physical processes (e.g., biogeochemical), and habitat. There are a total of five hydrological, ten biogeochemical, and eight habitat metrics, although some metrics are used in more than one of these categories. There are a total of 15 distinct metrics (Table 3-1), and the HARC AW-Total Score is the average of the scores obtained from these 15 metrics (see Appendix A for detailed scoring explanations). All metrics were assessed at all sites, but only a relevant subset of the metrics was used for the evaluation of each particular function. For example, only metrics related to the hydrologic condition of the reach were included in the hydrology condition score. Ephemeral drainages perform biogeochemical functions (Jones and Smock 1991; Dieterich and Anderson 1998), whereas other resource classes (e.g., riparian willow forests) also provide various habitat-related functions. Some metrics were relevant to the calculation of more than one attribute. For example, because the source of water entering an aquatic system can affect both flow dynamics and water chemistry, the source metric was used in the calculation of the hydrology and biogeochemical attributes.

The following subsections summarize the attributes (hydrology, biogeochemical, habitat) and metrics discussed in this report (see also Table 3-1 and Appendix A).

3.3.1 Hydrology

The Hydrology attribute is by far the most important attribute for wetland and riparian habitats, as the other functions depend on, and form in response to, the flow of water and what nutrients and pollutants occur in the water. The hydrological metrics describe the source of water, the duration and magnitude of flows (hydroperiod), whether or not flows reach the floodplain, the presence of flow restrictions, the duration of water flows or ponding within the creek or on the floodplain, and the width of the floodplain. High quality streams and wetlands have "natural flow regimes" (Poff et al. 1997), with an undisturbed source of water such as precipitation, groundwater, or snowmelt, a seasonal fluctuation in water levels as a result of winter and spring flood events, and have well-developed floodplains that have the ability to retain moisture and allow for groundwater recharge. The Hydrology attribute is composed of six metrics that relate directly to water source, hydroperiod, and floodplain availability and condition (see below and Table 3-1 The HARC scores for the Hydrology attribute were calculated by taking the arithmetic mean of these six metric scores. The metrics included in the Hydrology attribute (five total) are as follows:

- **Source.** Source of water describes the primary origin of water input to the stream or wetland, and the degree to which water input has been affected or is controlled by anthropogenic activities or land use changes. Presence of septic tanks, culverts, riprap, etc., would cause a reach to score lower than a similar reach in an undisturbed area.
- **Hydroperiod.** Hydroperiod is the seasonal, and in some wetlands, daily pattern of water level fluctuation. Hydroperiod defines regular changes in the duration, frequency, timing, and extent or depth of inundation or saturation in a wetland. A reach subject to a natural flow regime would score higher than one in which flow is artificially augmented or diverted.
- **Floodplain Connection.** Floodplain connection describes relationship between riverine wetlands and the adjacent floodplain that influences the ability of water to flow into or out of the wetland or to inundate adjacent uplands during high water periods. Presence of bank stabilization and channel incision inhibit Floodplain Connection. The emphasis of this metric is evidence of flow (e.g., wrack deposits), and this metric is more qualitative than the flood prone area metric.
- **Surface Water Persistence.** Surface Water Persistence refers to the duration of flow/ponding or surface saturation in a stream or wetland, and affects groundwater recharge. Perennial streams and wetlands that store ponded water for more than one day would score higher than ephemeral/intermittent streams and wetlands with no features allowing ponding/storage to occur.
- **Flood Prone Area.** This metric assesses the extent to which flood flows are impeded. Presence of bank stabilization, channel incision, or other obstacles constraining flood flows would cause a reach to score lower than a similar reach with an unrestricted floodplain. The emphasis of this metric is size, width, and geomorphology (i.e., cross-section, shape) of the drainage, and this metric is more quantitative than the floodplain connection metric. A reach may score high for the floodplain connection metric (e.g., evidence of wrack deposits), but score lower for this metric because of geomorphology.

3.3.2 Biogeochemical

This attribute describes the relative ability of wetland and riparian habitats to perform specific functions such as maintenance of water quality, cycling of nutrients, retention of particulates, and export of organic carbon. High quality streams and wetlands have intact, vegetated buffers, which attenuate effects of pollutants entering into these habitats, and allow for a balanced process of nutrient cycling. Properly functioning reaches also have a normal flooding regime that allows for the transportation of water to all active parts of the bankfull channel, floodplain, and terrace. Substrate type is an important feature, as soils that are compacted or do not have any organic material may not allow Biogeochemical functions to occur effectively. Thus, high quality buffers, an active floodplain, and permeable, organic-rich substrates allow streams and wetlands to properly perform this function. The Biogeochemical attribute is composed of ten metrics incorporating hydrology (five), buffer (three), and substrate (two) (see below and Table 3-1), described below. The HARC score for the Biogeochemical function was calculated by taking the arithmetic mean of these ten metric scores.

Hydrology metrics included in the biogeochemical attribute (five total):

- **Source.** See description above
- **Hydroperiod.** See description above
- **Floodplain Connection.** See description above
- **Surface Water Persistence.** See description above
- **Flood Prone Area.** See description above

Buffer metrics included in the biogeochemical attribute (three total):

- **Average Buffer Width.** Average Buffer Width refers to the width, perpendicular to the channel to which the buffer extends. A value approaching 100m is considered optimal; scores decrease as buffer width is reduced below 100m.
- **Buffer Condition.** Buffer condition is assessed based on vegetative cover, substrate condition, and indicators of disturbance, and is assessed only for the portion of the wetland border that has already been identified or defined as buffer. Stressors such as invasive plant species, presence of trash, and disturbed, compacted soils decrease buffer condition.
- **Land Use/Land Cover (LULC).** This metric assesses the percent of the drainage basin of a reach containing LULC types with the potential to increase the nutrient, pesticide, hydrocarbon, or sediment loading in downstream surface waters. Minimal presence of these LULC types within a drainage basin would result in a high score for this metric.

Abiotic Structure Metrics included in the biogeochemical attribute (two total):

- **Topographic Complexity.** Topographic Complexity refers to the presence of a variety of elevation or depth zones within a stream or wetland. These zones provide niches for fauna, surfaces for growth of a variety of plant species, areas that modify flow/hydrology, and zones that promote biogeochemical processes. Highly complex reaches containing diverse physical features would score higher than uniform, homogeneous reaches.

- **Substrate Condition.** Substrate Condition describes the extent to which soil is intact (unaltered), is subject to regular saturation or inundation, and exhibits an accumulation of organic matter or coarse litter. Coarse litter consists of the fallen stems, leaves, and other small parts of plants that accumulate on the wetland surface. These features increase habitat complexity, and indicate optimal substrate condition.

3.3.3 Habitat

Numerous plant and animal species depend on the unique ecosystems developed within wetland and riparian habitats, either for foraging, breeding, or dispersal. High quality streams and wetlands usually contain high species diversity, a dominance of native plant species, complex biological structure, and evidence of vegetation recruitment (i.e., the presence of seedlings and/or saplings). The habitat attribute is composed of eight metrics incorporating the biological structure and condition of wetland and riparian habitat, including abiotic (two) and biotic (six) structure metrics. The HARC score for the Habitat function was calculated by taking the arithmetic mean of these eight metric scores.

Abiotic Structure Metrics included in the habitat attribute (two total):

- **Topographic Complexity.** See above.
- **Substrate Condition.** See above.

Biotic Structure Metrics included in the habitat attribute (six total):

- **Vertical Biotic Structure.** The vertical component of biotic structure consists of the distribution of vegetation among categories of height above the wetland substrate or with depth below the water surface. Presence of well-developed herb, shrub, and tree layers across an entire reach would represent an optimal condition.
- **Interspersion and Zonation.** Horizontal biotic structure is commonly recognized as plant zonation and its interspersion. Interspersion measures the complexity of the edges between zones; the more curves and meanders in the zone boundary, the greater the interspersion. Reaches having at least two distinct plant zones and fairly high degrees of interspersion received optimal scores for this metric.
- **Nativeness.** This metric assesses the extent to which native species dominate the plant community within a reach. The reference condition was defined as containing at least 75 percent native plant species, and no stratum (herb, shrub, or tree) dominated by an exotic species.

- **Riparian Vegetation Condition.** The Riparian Vegetation Condition metric evaluates whether the riparian area adjacent to a reach is in a natural state free from chronic disturbance and anthropogenic modifications, or whether impairments to the riparian corridor exist. Degradations of the riparian vegetation caused by natural forces such as fires or flooding, did not result in lower scores for affected reaches because of the temporary nature of these disturbances.
- **Riparian Corridor Continuity.** This indicator was measured at the riparian reach scale as the percent of flood-prone area along the main stem channel of the riparian reach occupied by native and non-native vegetation communities with adequate height and structure to allow faunal movement. For example, annual grassland with no shrub or tree component was considered to represent a corridor gap. The reference condition was defined as having <5 percent of the riparian area adjacent to the reach unsuitable for faunal movement.

3.4 METRICS EXCLUDED FROM ANALYSIS

In addition to the 15 distinct metrics used in the HARC, six other metrics were initially included but were later removed from the analysis. The decision to eliminate these six metrics from consideration was made based on the results of a Principal Components Analysis which evaluated variances and correlations among metric scores. Details of this analysis are included in Appendix B. Metrics excluded from consideration included:

- **Altered Hydraulic Conveyance.** This metric assesses the extent (percentage) of linear modification of the channel. Stressors may include road crossings, riprap, or other modifications that would alter the flow regime within a reach. This metric was highly correlated with the Topographic Complexity metric.
- **Percent of Area with Buffer.** The buffer is the upland area extending at least 10m horizontally from the immediate edge of the stream or wetland that is in a natural or semi-natural state and currently not dedicated to anthropogenic uses. The buffer can include adjacent wetlands of the same or different class, stream channels, open water, or other aquatic habitats. Intensive land uses such as plowed, agricultural cropland, paved areas, some dirt roads, unfenced pastures, landscaped parks, etc. do not constitute buffers. Mowed areas are considered buffers, but deep-ripped agricultural fields are not. An intact buffer around a high percentage of the reach would result in a high score for this metric. This metric was highly correlated with both the Buffer Width and Buffer Condition metrics.
- **Sediment Regime.** Sediment Regime is assessed based on the extent to which a reach allows natural depositional and scouring processes to occur. An optimal reach would exhibit a sediment regime in equilibrium with respect to supply, erosion, and deposition processes, and not affected by cultural alteration. Presence of culverts, down cutting, and

areas functioning as sediment traps can degrade the sediment regime. This metric was highly correlated with the Flood Prone Area metric.

- **Canopy.** This metric is a calculation of the amount of cover provided to a reach by the surrounding tree and shrub layers. More than 50 percent tree cover was defined as optimal; lesser amounts of tree cover and cover by shrubs alone resulted in reduced scores. This metric was highly correlated with the Vertical Biotic Structure metric.
- **Age Distribution.** This metric assesses the extent of recruitment by wetland indicator species (e.g., *Salix* sp., *Baccharis* sp., *Populus* sp., *Platanus* sp., etc). Reaches containing mature trees, saplings, and seedlings were considered optimal; sites without all three age classes were evaluated relative to this ideal. This metric was highly correlated with the Vertical Biotic Structure, Percent of Area with Buffer and Buffer Condition metrics.
- **Invasive, Exotic Plants.** This metric assesses the dominance of non-native plants known to be invasive into native habitats. The reference condition was defined as containing very few exotic species, composing ≤5 percent of the total riparian vegetation. This metric was highly correlated with both the Nativeness and Riparian Vegetation Condition metrics.

3.5 HARC FIELD METHODS

The study area was divided into 57 reaches based on criteria described in MacNeil (2001), shown in Table 3-2. Not all criteria were used at all locations. Some commonly used criteria were substrate type (e.g., sand vs. silt), water regime (e.g., ephemeral vs. perennial stream segments), and adjacent land use (open space, paved road, agricultural field, etc.).

At each reach, a jurisdictional determination and delineation of waters of the U.S. were completed and widths of both the Corps and CDFG jurisdictions were recorded. Delineations followed protocols developed and/or used by the Corps (Environmental Laboratory 1987; Reed et al. 1988, 1986; Corps 2001a, 2001b; Tiner 1999; Rosgen 1984; USDA 2002). The extent of CDFG jurisdictional streambeds were evaluated according to Section 1600 et seq. of the California Fish and Game Code, guidance from ESD-CDFG (1994), and Cowardin et al. (1979). The Corps and CDFG jurisdictions are summarized as follows:

- **US Army Corps of Engineers Jurisdiction.** The Corps has jurisdiction over all Waters of the United States under section 404 of the Clean Water Act, including rivers, lakes, perennial, intermittent, and ephemeral streams, and wetlands. Wetlands must have indicators of hydrology, hydric soils, and hydrophytic vegetation, unless the area being delineated is a recognized problem area (e.g., inherent characteristic, such as soil color, can lead to spurious or unreliable results) or an atypical situation exists (e.g., vegetation has been removed from a site). Corps jurisdiction over non-wetland Waters of the U.S. extends outward to the ordinary high water mark (OHWM).

TABLE 3-2
FUNCTION-MODIFYING FACTORS USED TO ESTABLISH STREAM REACH BOUNDARIES

Function Modifier Group	Specific Function Modifier	Indicator or Reference
Hydrology	Strahler Stream Order (1957)	USGS Topographic Map (Lower [1,2] or Higher [3-5] Order Stream)
	Degradation/Aggradation Trend	Clear Channel Scour/Accretion
	Flood Prone Area (FPA)	Degree of Channel Confinement (0,1,2 sides); Degree of Floodplain Displacement Versus Channel Bottom (0,1,2 steep banks)
	Channel Type	Channel Number, Channel Configuration/Pattern Relative to FPA
Geomorphology	Substrate Type	Sand, Silt, Clay, Cobbles (large, small, mixed), Porosity, Organic Content
	Channel Slope	Low (<2%) or High (>2%)
	Channel/Floodplain Topography	Pits, Hummocks, Tenajas, Step-Pool Complexes, Secondary Channels inside/outside FPA
Habitat	Vegetation Association	Tree, Sapling, Shrub Types, Age Stand Distribution, Prevalence and Types of Exotic Species
	Vegetation Density	Percent Canopy Cover, Density, Basal Area
	Vegetation Location	Within Channel, On Adjacent Floodplain
	Vegetation Connectivity	Visual Assessment of Connectivity to Upstream, Downstream, Sides
	Wildlife Use	Invertebrate/Vertebrate Presence and Usage Indicators
Level of Disturbance	Adjacent Land Condition/Use	Native, Non-native, or Degraded Native, Land Use Category (Residential, Commercial, Industrial, Agriculture, Open Space)
	Channel Modifications	Unmodified, Modified
	Sediment and Debris	Proximity of Sources, Degree of Impact to Channel Dynamics
	Floodplain Habitat Condition	Intact, Natural Degradation, Anthropogenic Degradation

Source: MacNeil (2001).

- **California Department of Fish and Game Jurisdiction.** Under CDFG Code Section 1600 et seq., CDFG has the authority to regulate any activity which would "substantially divert or obstruct the natural flow of, or substantially change… the bed, channel, or bank of, any river, stream, or lake." A streambed includes the bed and banks of the stream, and CDFG jurisdiction includes areas laterally extending to the upland edge of riparian vegetation. Riparian habitat may extend beyond those areas delineated by an OHWM or as wetlands. As such, CDFG jurisdiction may be wider than that of the Corps (Larsen 2007).

At each reach, 10m x 50m plots were defined and outlined with pin flags. Some metrics, as discussed in other sections of this document, are based on data collected in plots. In reaches where plots were not completed, the data used to evaluate these metrics was estimated from similar reaches within the project area and through analysis of vegetation and topographic maps and aerial photographs. The plots were located in representative portions of the reach, and were located in the appropriate cross-sectional zone(s) of the riparian area: bankfull, floodplain, and terrace zones (up to three plots per reach). Tributary reaches were assessed with one plot (located in bankfull or floodplain area) and SCR reaches were assessed with up to three plots. The locations of the plots were generally based on methods utilized by Lee et. al. (1997, 2001), whose HGM studies conducted sampling within the bankfull and floodplain areas. In this study, the terrace areas were also incorporated into the data because much of the project site (i.e., the Santa Clara River) has extensive terraces. For some data collected, especially data for the habitat metrics, the plot data were averaged across two or three plots sampled within a reach. The intent was to capture the variability within a reach due to geomorphic position (i.e., bankful, floodplain, terrace).

Within these plots, biological (e.g., vegetation type and percent cover) and physical data (e.g., soil characteristics) were collected, and the HARC metrics were assessed. The reach and plot locations were documented with digital photography and a sub-meter Trimble GPS unit. Selected site photographs have been included in Appendix D. This analysis used a GIS layer (URS 2003) of Corps and CDFG jurisdiction as the assessment area within each reach.

Certain reaches within the project area were not surveyed during on-the-ground field studies due to poor accessibility or insufficient time and resources. These reaches were instead evaluated using 6-foot resolution color aerial photographs taken in 2003, combined with 2-foot contour topographic maps and vegetation/habitat maps. Metric scores obtained through aerial photograph interpretation were compared with ground survey results from similar areas to verify accuracy. Use of this method is not anticipated to affect the results of the assessment because the reaches assessed by aerial photograph interpretation are generally small, ephemeral drainages, and are mostly located outside of the impact area. Use of remote methods for delineation and functional assessment have been used for other large-scale, watershed (or sub-watershed)-level analysis (e.g., Lichvar et al. 2003, Smith 2003).

An evaluation of potential changes in baseline condition will be completed during the Fall of 2007. The purpose of the fieldwork is to evaluate the change in wetland and riparian condition, if any, between the original field work time period (2003-2004) and the present (2007); especially in light of the 2005 flooding events of the Santa Clara River.

3.6 VALIDITY OF ASSESSMENT PROCESS AND METRICS

3.6.1 Combining Metrics from Different Methods

There are no strict rules for developing and using wetland/riparian assessment methods, and the methods themselves vary from quantitative methods based on reference site data (e.g., HGM, IBI approaches; e.g., Chipps et al. 2006) to rapid assessment methods (Fennessy et al. 2004, 2007) to very qualitative methods (e.g., Stein and Ambrose 1998). If a formal HMG method were to be utilized, then it would be important to be situated in the applicable region for the method, and follow strict rules regarding data collection and use of equations. However, the foundation for the HARC method is largely CRAM, which is a more qualitative method than HGM, with metrics from HGM (more quantitative) and LFFA added as appropriate to better evaluate conditions within the project area. An important point to consider is that the HARC was applied equally to all sites across the project area; thus, each site can be ranked against the other regardless of the applicability of the method to established HGM methods.

The LLFA metrics, developed for use in two different Counties in California (Orange, Riverside) were general enough to apply to all riparian corridors in Southern California. Landscape-based metrics are commonly used for assessment, and often correlate very well with more site-based assessment methods (e.g., Chung 2006; Weller et al. 2007; Hychka et al. 2007).

As stated in Sutula et al. (2006), there is "*no comprehensive guide to RAM* [rapid assessment method] *development that defines the steps, identifies the important issues and considerations in each step, and discusses the tradeoffs of various options or approaches*" (p. 158). Assembling a RAM involves choosing attributes and developing metrics, as well as organizing these components into a "single assessment framework" (Sutula et al. 2006). The attributes reflect common, visible characteristics of all wetlands in California, and these characteristics in turn influence key wetland/riparian functions. The HARC utilizes universal metrics applicable to all wetland/riparian areas of Southern California.

3.6.2 Temporal Variability and Succession

The issues of temporal variability and habitat succession, especially in riverine systems, are shortcomings of traditional HGM (e.g., Kusler 2004b). The key issue is that HGM functional assessments conducted at the same exact location over several years (or even months) may result in different scores due to successional change. The HARC minimizes the effects of temporal change due to the following:

- Data collection was performed during one specific time period, within which little variability or succession was documented during fieldwork (late 2003 to early 2004).

Thus, the HARC baseline fieldwork was a “snap shot” of the condition during one time period.

- The HARC metrics are universal metrics applicable to all wetlands/riparian habitat in California, and reflect the characteristics of a RAM. The metrics, unlike HGM variables, are not developed through intense data collection that is specific to a localized reference domain. The HARC metrics, ranging from semi-quantitative to qualitative, were not considered significantly sensitive to temporal variability and successional issues.

3.6.3 Main Channel and Tributaries

The HGM methods, in particular, make provisions for stream size, position in the watershed, and gradient (e.g., Lee et al. 1997, 2001; MacNeil 2001). An example would be the development of two sets of metric rating scales- one for large streams of high order (such as the Santa Clara River reaches), and one set for low order, headwater drainages (such as the tributaries). This same approach was utilized in the HARC, albeit to a lesser degree than HGM methods. The HARC includes some categorical scoring provisions for Santa Clara River vs. tributaries, as well as riverine vs. seep/slope wetlands. The following metrics include some modification: Land Use Land Cover, Hydroperiod, Floodplain Connection, Flood Prone Area, Topographic Complexity, Substrate Condition, Vertical Biotic Structure, Canopy Cover, and Age Distribution (the latter two metrics were eventually excluded from the final HARC calculations). Other metrics are sufficiently general that no direct provision for Santa Clara River vs. tributary scoring was necessary. In these cases, the evaluator considered the same metrics, but evaluated the metrics using a larger scale. For example, assessing a Santa Clara River reach would entail evaluating a larger area of stream channel than a tributary, but a general evaluation of quality would still be possible in both cases. Also, because the plot-based approach is common to all reaches irrespective of Santa Clara River vs. tributary, comparison between sites is reasonable. Yet, at the same time, it should be recognized that a 0.5 score for a given metric, such as Flood Prone Area, would mean something different for a Santa Clara River reach than a 0.5 score for a small tributary. For each location (Santa Clara River, tributary), the rating score suggests low quality in both cases. This does not mean, though, that the widths are similar- the metric is scaled for the site context. In the case of Flood Prone Area, the bankful channel would be different between the Santa Clara River and tributary; thus, stating that the Flood Prone Area is twice the bankful channel may mean a width of one meter for the tributary, and 100 meters for the Santa Clara River.

3.6.4 Current Condition

With any assessment method conducted during one field season, questions arise about whether or not the baseline conditions have changed since the time of the assessment. The water year 2005 included an approximately 50-year flood event; such an event would undoubtedly serve to change the geomorphology and vegetation structure along the Santa Clara River.

3.6.5 The HGM Approaches

Two HGM approaches, the Draft Santa Margarita River (SMR HGM) and Draft Santa Barbara coastal streams hydrogeomorphic (SB HGM) models, were considered for use with this project. Another method, the “Central Coast HGM,” was not considered because it was the least applicable of the three HGM approaches (Lee et al. 1996). Although both are theoretically usable in the Santa Clara River watershed, either model would have to be adapted or modified to this system. The methods have not been tested; therefore there would be little validity to using the SMR or SB model in the Santa Clara River system. Modifying HGM approaches is a common practice, though, as few HGM models are available across the U.S., especially in California. For example, DMEC (2000) used a “truncated version” of the SMR HGM for work in the Calleguas Creek Watershed and other nearby watersheds. In this case, the method was modified to be more qualitative rather than quantitative.

3.6.6 Sensitivity Analysis Procedure

Another procedure to be conducted includes an assessment of the validity of the method referred to as a “sensitivity analysis,” which will be modified from standard HGM procedures (see Software Tools for HGM Guidebook Developers; http://el.erdc.usace.army.mil/wetlands/datanal.html). This procedure is expected to show that the HARC is not overly sensitive to one metric over the other, mainly due to the fact that the attributes (hydrologic, biogeochemical, habitat) are simple additive equations (as opposed to complex equations with HGM). Thus, each metric (used within an attribute score or total score) should have an equivalent effect.

3.6.7 CRAM – Past and Present

The CRAM has continued to be developed and tested since the time of the field evaluation (2003 – 2004; Collins et al. 2007; http://www.cramwetlands.org). The following list demonstrates the CRAM version history since version 2.0:

- Version 5.0 9/18/2007
- Version 4.6 9/10/2007
- Version 4.2.3 11/1/2006
- Version 4.1 7/11/2006
- Version 4.0 5/25/2006
- Version 3.0 9/30/2004

- Version 2.0 1/27/2004

Because the HARC had to be conducted at a specific time period before the finalization of the Draft EIS/EIR and Section 404(b)(1) alternatives analysis, an older version of CRAM was utilized (version 2.0; Collins et al. 2004). Many of the metrics used in the HARC did not substantially change over the three-year time period. The most recent version of CRAM (version 5.0) was compared to the HARC (see Table 3-3). Results demonstrated that the LLFA and HGM components of HARC were similar to some metrics of the subsequent version 5.0 of CRAM (bold items in Table 3-3).

3.6.8 Review Process for CRAM and HARC Method Development

The CRAM has been developed and validated by a core team of wetland scientists from various Federal and State agencies, namely the Corps, San Francisco Estuary Project, and the Southern California Coastal Water Research Project (SCCWRP). In addition, numerous individuals from agencies, the private sector (i.e., wetland consultants), and non-profit groups sit on regional teams that serve as technical advisors. The CDFG has representatives on the Southern California, San Francisco Bay, and Central Coast Regional Teams. One core team member and two regional team members of CRAM were also involved in technical oversight of the HARC: Aaron Allen, PhD (Core Team; Corps); Spencer MacNeil, D.Env. (Southern California Regional Team; Corps) and Erik Larsen, D.Env. (Southern California Regional Team; URS). Thus, many of the same individuals who helped with the development of CRAM have also been involved in the development and review of HARC.

3.7 APPLICATION OF THE HARC TO THE NEWHALL RANCH RMDP

The proposed RMDP includes the issuance of a long-term, Section 404 Standard Individual Permit (SIP) by the Corps and a Master Lake or Streambed Alteration Agreement (Master LSAA) by CDFG for construction and maintenance of bank stabilization, grade control structures, utility crossings, storm drains, bridges, roads, building pads, nature trails, and a water reclamation plant outfall within jurisdictional areas on Newhall Ranch. These facilities would supply a portion of the infrastructure required to build out the residential, commercial, industrial, and mixed uses, and public facilities outlined in the Newhall Ranch Specific Plan over the next 15 to 20 years. The components of the proposed project would be constructed by the Newhall Land and Farming Company or other private or public agencies. The

TABLE 3-3
RELATIONSHIP BETWEEN HARC AND CRAM VERSION 5.0

Attributes	HARC Metrics	Source Method	CRAM version 5.0 Metrics
Buffer	Average Buffer Width	CRAM	No Change
	Buffer Condition	CRAM	No Change
	Land Use Land Cover	LLFA	Buffer and Landscape Context: Landscape Connectivity; % of Wetland with Buffer
Hydrology	Source	CRAM	Water Source
	Hydroperiod	CRAM	Hydroperiod or Channel Stability
	Floodplain Connection	CRAM	Hydrologic Connectivity
	Surface Water Persistence	SMR HGM	No Direct Match; Similar to the following metrics: Hydrologic Connectivity; Hydroperiod or Channel Stability; Topographic Complexity
	Flood Prone Area	SMR HGM	Hydrology: Hydrologic Connectivity
Structure – Abiotic	Topographic Complexity	CRAM	No Change
	Substrate Condition	CRAM	Minor Change- Structural Patch Richness
Structure – Biotic	Vertical Biotic Structure	CRAM	No Change
	Interspersion and Zonation	CRAM	Horizontal Interspersion and Zonation
	Nativeness	SMR HGM	Biotic Structure: Plant Community (No. Plant Layers; No. co-dominant spp.; % Invasion)
	Riparian Vegetation Condition	LLFA	Biotic Structure: Plant Community (No. Plant Layers; No. co-dominant spp.; % Invasion)
	Riparian Corridor Continuity	LLFA	Buffer and Landscape Context: Landscape Connectivity; % of Wetland with Buffer

proposed Section 404 Permit and LSAA would include construction of the above-mentioned facilities, as well as routine maintenance activities conducted by the Los Angeles County Department of Public Works (LACDPW). By seeking a long-term, comprehensive SIP and Master LSAA, Newhall Land can facilitate a streamlined permit evaluation and decision process by the Corps and CDFG, and can provide an opportunity to design a long-term, regionally-based planning and mitigation program for impacts to the affected wetland and riparian habitats.

The HARC impact analysis for the RMDP analyzed proposed permanent and temporary impacts to wetland and riparian habitats within the project area. Impacts were determined based on direct modifications to habitat within a given reach, as well as indirect impacts resulting from modifications to upstream reaches or surrounding upland areas (e.g., changes in land use/land cover). Post-project HARC AW-Total Scores for existing reaches were determined using the same scoring criteria as were used to evaluate the existing conditions (see Appendix A). However, some assumptions were necessary in order to consistently evaluate reaches across the site that sustained similar levels of project-related impact or enhancement. Post-project scoring assumptions included:

- **Buffer Condition.** All buffer areas within proposed detention basins were scored as having a Buffer Condition value of 0.5. A score of 0.5 was applied in situations where the tributary watershed is to become substantially urbanized. This score takes into account the presence of detention basins and landscaped areas.
- **Source.** For assessment reaches along the Santa Clara River mainstem, the effects of urbanization in tributary watersheds were assessed to have an adverse effect of 0.1 on this metric. The primary water source for the riverine reaches is discharge from POTW upstream of the project area, and urbanization within the project site would therefore have only a limited effect on this metric. For tributary reaches, which mostly lack perennial flows, a score of 0.5 was applied in situations where the tributary watershed was to become substantially urbanized. This score takes into account the presence of detention basins, which would prevent dry-weather nuisance flows from entering tributary drainages, and would help to attenuate storm flows.
- **Hydroperiod.** In Santa Clara River reaches, project features would not affect this metric. Hydroperiod in these reaches is determined by upstream processes, and the vast majority of these occur outside of the project area. In tributary drainages, hydroperiod was affected by project features, and was scored according to the guidelines in Appendix A. Ephemeral drainages with completely urbanized watersheds scored 0.5 for this metric.
- **Nativeness.** In areas where no project-related impacts would occur, but the RMDP proposes restoration or exotic species removal, the Nativeness metric was scored as 0.9. These areas scored higher than sites proposed for restoration following temporary impacts, because the earth disturbance associated with construction would not affect these areas. Native plants within these reaches would remain in place, and only exotic species would be removed.
- **Riparian Corridor Continuity.** Each reach was scored based on the percentage of reach uninterrupted by project-related facilities, as explained in Appendix A. However, an additional 0.1 was subtracted from the final score for this metric for each proposed bridge crossing within the assessment reach, due to the fact that bridges, and their associated roads, represent more substantial breaks in the riparian corridor than do instream features, such as grade control structures.

  In some cases, the proposed RMDP and alternatives call for the relocation of existing assessment reaches into areas that are currently not jurisdictional. For many metrics, (Floodplain Connection, Flood-prone Area, Substrate Condition, Vertical Biotic Structure, Interspersion/Zonation, Nativeness, Riparian Vegetation Condition) this resulted in a disassociation of the post-project scores from the existing conditions; post-project quality of these reaches would be determined by the standards and specifications used in construction of the realigned channels. The metric scores assigned to realigned channels were derived from a combination of the scoring guides for the HARC metrics (Appendix A) and the specifications and enhancement measures proposed in the RMDP.

This approach led to the formation of the following assumptions for scoring reaches with no existing jurisdictional status:

- **Floodplain Connection.** If the newly constructed channel was equally wide or wider than the flood-prone area of the existing reach, a score of 0.75 was assigned. Such a conveyance would be wide enough to contain terraces and benches in addition to the active stream channel, and these areas would be inundated during high flows. However, even the highest flows would not overtop the buried bank stabilization, and a score greater than 0.75 would therefore not be appropriate.
- **Flood-Prone Area.** If the newly constructed channel was equally wide or wider than the flood-prone area of the existing reach, a score of 0.75 was assigned. This indicates that the constructed channel would contain some space for floodplain habitat adjacent to the active channel of the stream, but would not represent a truly unrestricted system.
- **Substrate Condition.** Newly created channels excavated in uplands, as well as those where temporary impact zones completely cover the reach, received scores of 0.65 for Substrate Condition. The effects of urbanization were assessed to have an adverse effect of 0.1 on this metric. An urbanized situation was given the 0.75 Score, from which 0.1 was subtracted. This results in the 0.65 post-project score.
- **Vertical Biotic Structure.** Generally, post-project scores were derived assuming a 5-year mitigation commitment following construction. Therefore, the post-project scores represent an estimate of what the functions would be five years following project construction within the reach and watershed. Reaches proposed for restoration following construction disturbance received a score of 0.75 for Vertical Biotic Structure.
- **Interspersion and Zonation.** Because reaches would be revegetated to simulate natural conditions, with riparian species, transitional species, and upland species planted within the channel, banks, and upland buffer areas, respectively, reaches proposed for restoration following construction disturbance received a score of 0.75 for Interspersion and Zonation.
- **Nativeness.** Following construction, temporary impact zones would be revegetated with native species as specified in the RMDP. However, although no exotic species would be planted, it is unrealistic to believe that the impacted reaches would contain only natives after five years of mitigation monitoring. Because 75 percent native species is a more

realistic expectation for a mitigation site after five years, these reaches were assigned a score of 0.75 for this metric, in accordance with the guidelines in Appendix A.

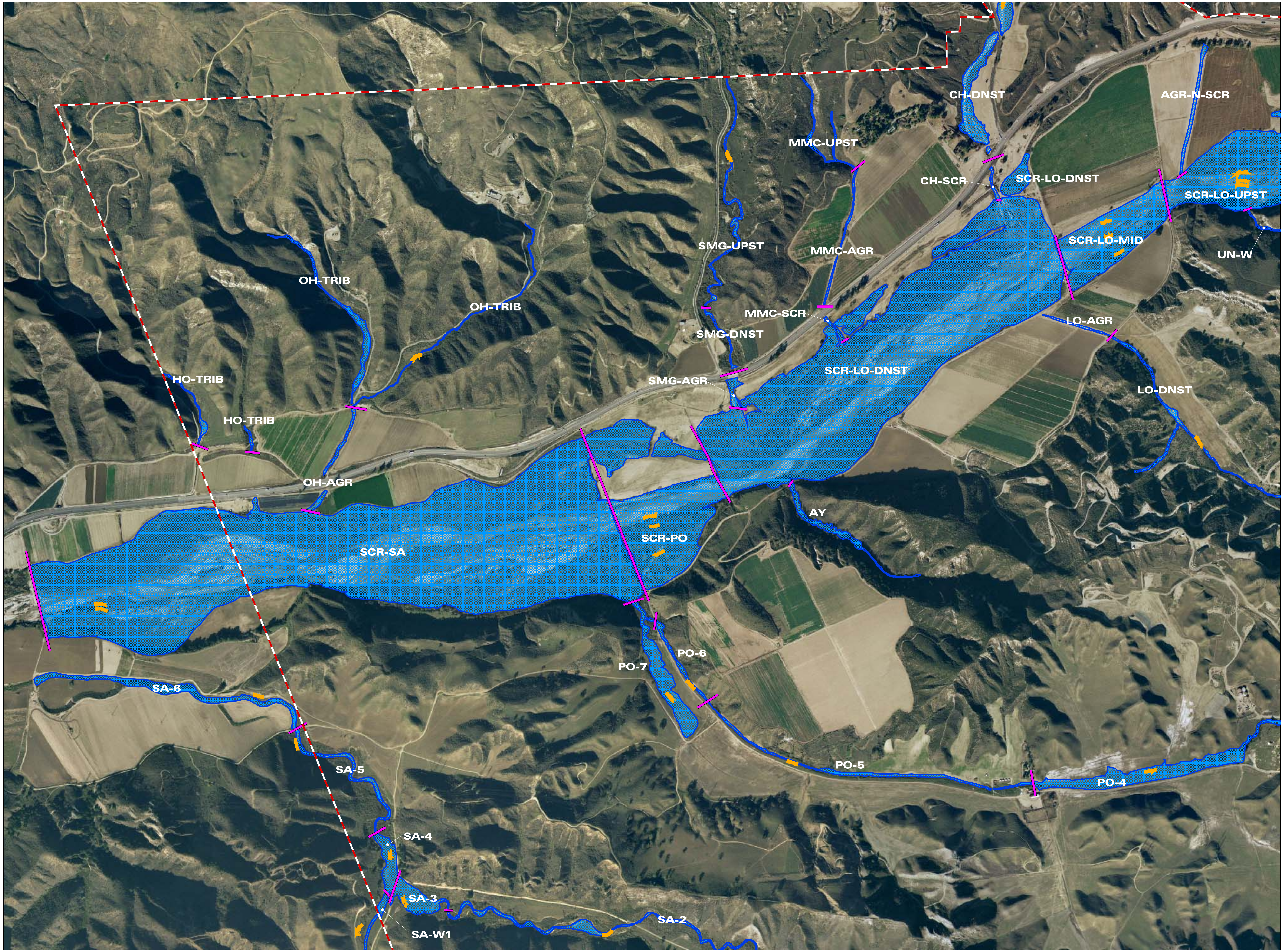
- **Riparian Vegetation Condition.** After five years, mitigation plantings in temporary impact zones would have sufficient time to become established and for shrub and herb species to become mature. However, the lack of mature trees at this point could increase the susceptibility of the plantings to erosion, as has been evidenced in locations where the buried bank stabilization approach has been used. Therefore, constructed channels received a score of 0.75 for the Riparian Vegetation Condition metric.

4.1 CLASSIFICATION OF WETLAND AND RIPARIAN HABITATS

The project area was divided into a total of 57 reaches: seven along the Santa Clara River, 15 within the tributaries on the north side of the river, and 35 within the southern tributaries. Figure 4-1 shows the distribution of reaches across the project site. A few of the minor reaches were not accessible in the field (e.g., Ayers Canyon); these ephemeral stream reaches were delineated and assessed by analyzing aerial photographs of the project area and available data (URS 2003).

Each reach was classified according to wetland and riparian habitat categories developed for this HARC. Classification is based on Brinson (1993), Ferren et al. (1996), URS (2003), and Corps (2004b). Five wetland/riparian habitat types were observed within the project site, and each type was further described with a series of vegetation codes (vegcodes) corresponding to the dominant vegetation community present within the reach. The vegcodes relate to the vegetation communities discussed in URS (2003). Table 4-1 summarizes all reach classifications for the project area. The five wetland/riparian habitat types observed within Newhall Ranch were:

- **Perennial River.** This class included the seven reaches of the Santa Clara River.
- **Perennial/Intermittent/Ephemeral Tributary.** These classes included the tributaries to the Santa Clara River. Although most of these tributaries were intermittent or ephemeral, some tributaries contained perennial reaches (e.g., Potrero Canyon). The wetter reaches often contained willow scrub and freshwater marsh vegetation.
- **Riverine Persistent Emergent Alkali Marsh.** This wetland classification included marshes in a riverine context, and was characterized by mesic meadow (URS 2003) and willow scrub habitats. These wetlands were located in reaches with perennial groundwater inputs to the creek beds, and were found within four reaches of Salt Creek, Potrero Canyon, and Middle Canyons: SA-3 [9 n (native plant species)/1 nn (non-native plant species)], SA-4 [11 n/1 nn], PO-4 [6 n/0 nn], and MI-5 [17 n/7 nn].
- **Seep Palustrine Alkali Marsh.** This wetland classification included only one site within the project area; reach PO-7 within the lower Potrero Canyon sub-watershed. This non-riverine wetland was classified as a seep because groundwater inputs keep the soils saturated but little or no evidence of surface flows is present (Ferren et al. 1996; Corps 2004b). Historically this wetland was probably part of a larger complex of wetlands within Potrero Canyon. Vegetation consisted of mesic meadow habitat, dominated by herbaceous wetland plant species [8 n/5 nn].
- **Slope Palustrine Alkali Marsh.** This wetland classification included only one site within the project area, reach MI-6 within the lower Middle Canyon sub-watershed. This wetland was classified as a slope because groundwater inputs were observed to flow on



Newhall Ranch

Hybrid Functional Assessment of Wetland and Riparian Habitats for the Newhall Ranch Habitat Management Plan

Legend

- Project Area Boundary
- Sampling Location
- Reach Break
- CDFG Functional Assessment

N W E S

1:15600

650 0 650 1300 Feet

1 inch is equivalent to 1300 feet

URS

Index Grid

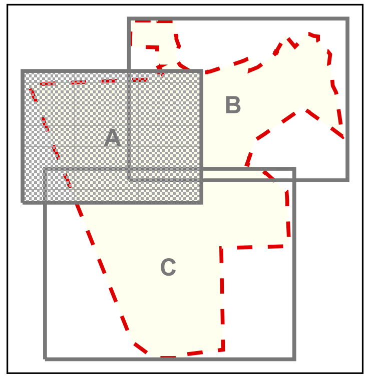
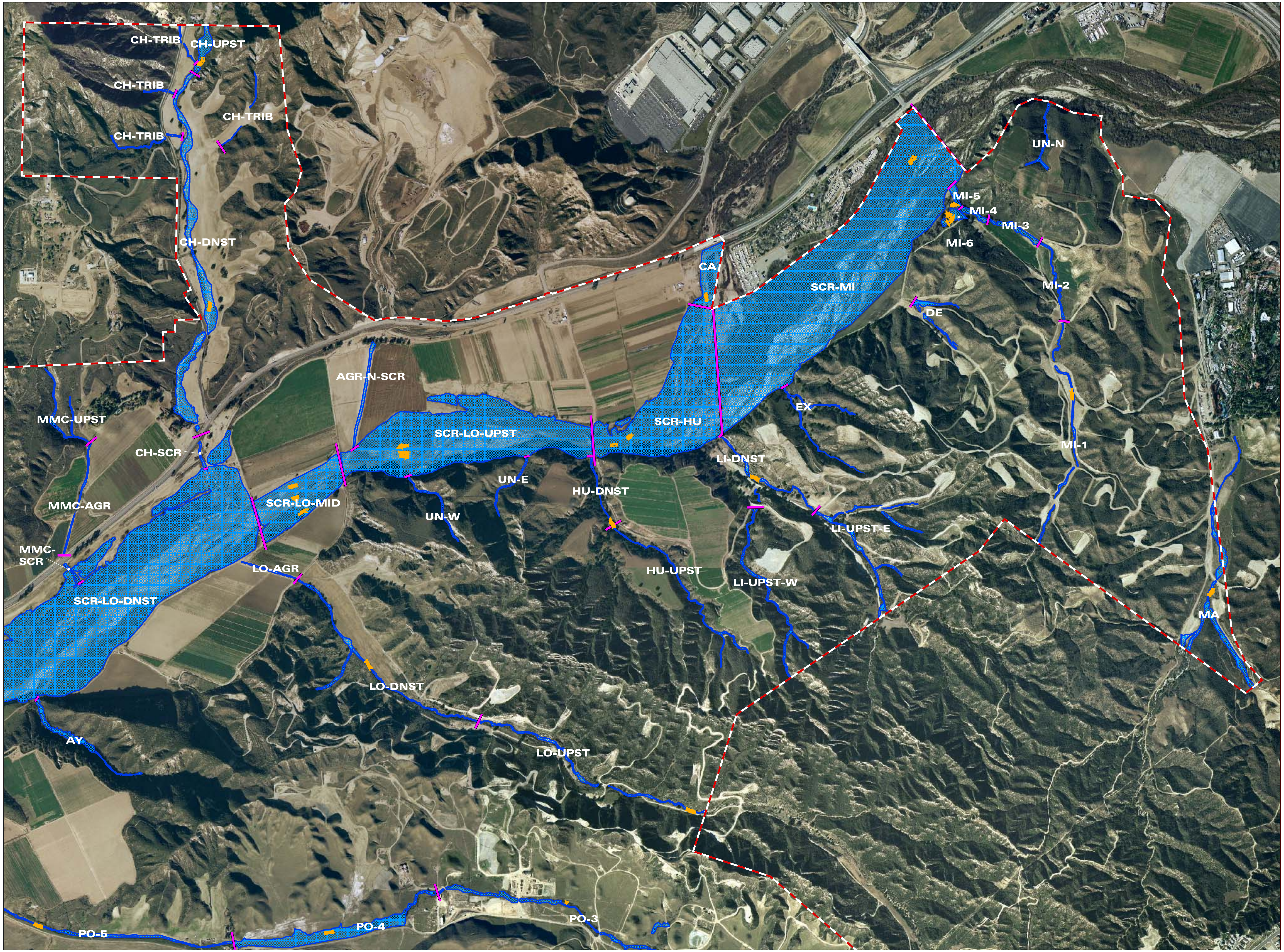


Figure 4-1a

Site Map with Reach Designations and Plot Locations



Newhall Ranch

Hybrid Functional Assessment of Wetland and Riparian Habitats for the Newhall Ranch Habitat Management Plan

Legend
- Project Area Boundary
- Sampling Location
- Reach Break
- CDFG Functional Assessment

Figure 4-1b

Site Map with Reach Designations and Plot Locations

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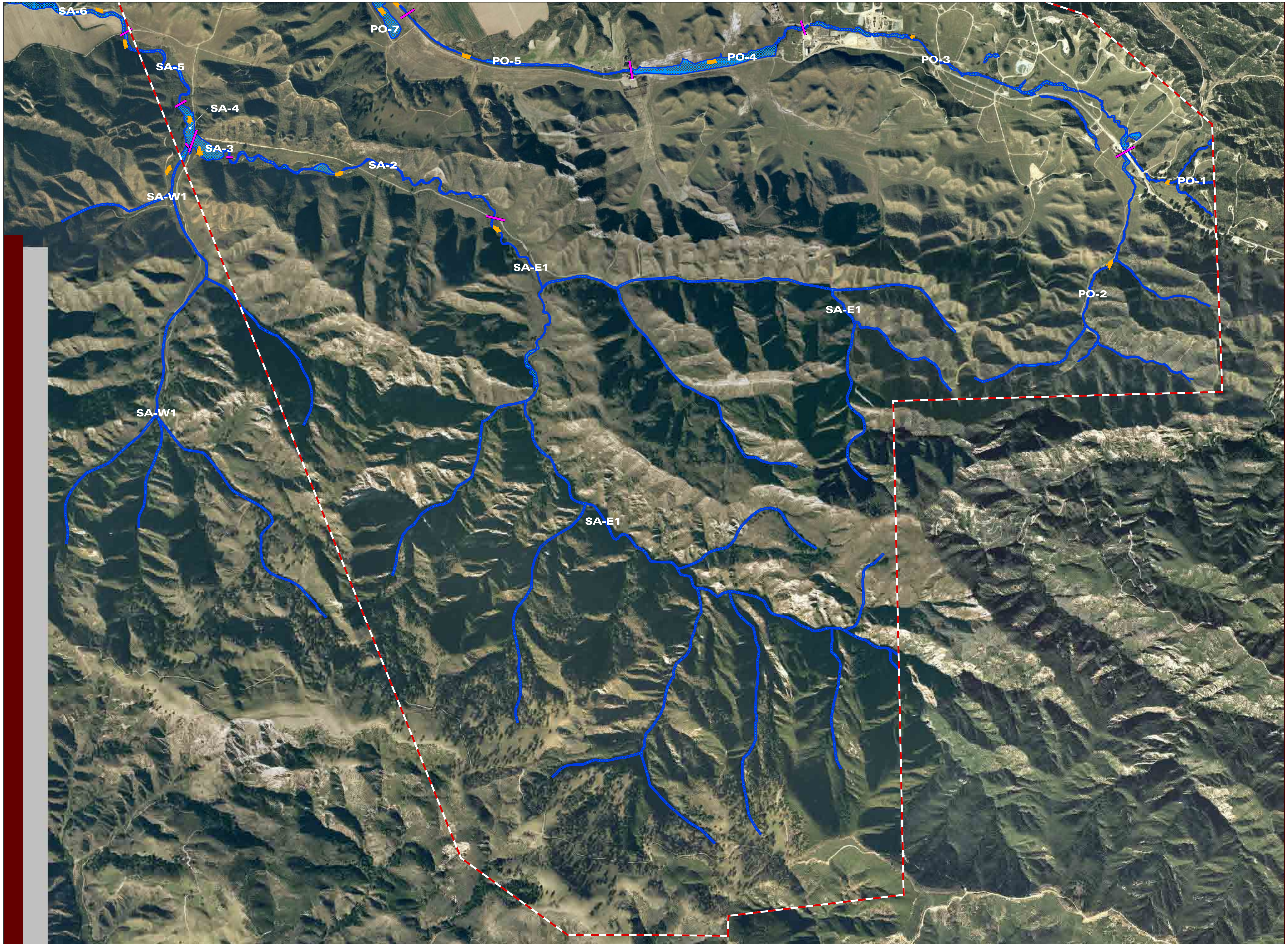

Newhall Ranch

Hybrid Functional Assessment of Wetland and Riparian Habitats for the Newhall Ranch Habitat Management Plan

Legend

- Project Area Boundary
- Sampling Location
- Reach Break
- CDFG Functional Assessment

N
W E
S

1:22800

950 0 950 1900 Feet

1 inch is equivalent to 1900 feet

URS

Index Grid

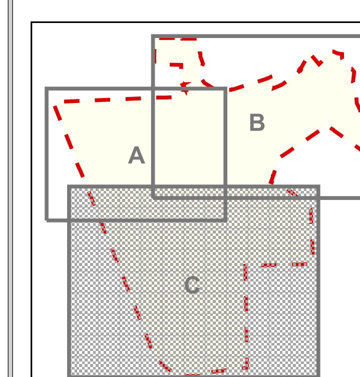

Figure 4-1c

Site Map with Reach Designations and Plot Locations

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TABLE 4-1
RIPARIAN AND WETLAND HABITAT CLASSIFICATION FOR NEWHALL RANCH

Drainage	Reach ID	Plot Position(s)[1]	Jurisdictional Status[2]	Stream/Wetland Classification[3]
Santa Clara River Mainstem (7 reaches)				
SCR Mainstem	SCR-SA	FP T	ACOE Wetland WoUS CDFG Riparian	Perennial River – MFS Perennial River – CWRF/Arundo
SCR Mainstem	SCR-PO	FP T1 T2	ACOE Wetland WoUS ACOE Wetland WoUS CDFG Riparian	Perennial River – MFS Perennial River – CWRF Perennial River – AWS
SCR Mainstem	SCR-LO-DNST	---	ACOE Wetland WoUS CDFG Riparian	Perennial River – MFS
SCR Mainstem	SCR-LO-MID	BF/FP1 FP2 T	ACOE Wetland WoUS CDFG Riparian CDFG Riparian	Perennial River – FWM Perennial River – MFS/Tamarix Perennial River – CWRF
SCR Mainstem	SCR-LO-UPST	FP1 FP2 T	ACOE Wetland WoUS CDFG Riparian CDFG Riparian	Perennial River – FWM Perennial River – MFS Perennial River – CWRF
SCR Mainstem	SCR-HU	FP T	ACOE Non-wetland WoUS CDFG Riparian	Perennial River – CWRF Perennial River – CWRF
SCR Mainstem	SCR-MI	BF/FP T	ACOE Wetland WoUS CDFG Riparian	Perennial River – FWM Perennial River – CWRF/Arundo
Northern Drainages (15 reaches)				
Homestead	HO-TRIB	---	ACOE Non-wetland WoUS[4]	Ephemeral Tributary – GBS
Off-Haul	OH-TRIB	BF	ACOE Non-wetland WoUS[4]	Ephemeral Tributary – GBS
Off-Haul	OH-AGR	---	ACOE Non-wetland WoUS[4]	Ephemeral Tributary – GBS
San Martinez Grande	SMG-UPST	BF/FP	ACOE Non-wetland WoUS	Intermittent Tributary – MFS/MM/Tamarix
San Martinez Grande	SMG-DNST	---	ACOE Non-wetland WoUS	Ephemeral Tributary – MFS
San Martinez Grande	SMG-AGR	---	ACOE Non-wetland WoUS	Ephemeral Tributary – MFS/AWS
Mid-Martinez Canyon	MMC-UPST	---	ACOE Non-wetland WoUS	Ephemeral Tributary – MFS
Mid-Martinez Canyon	MMC-SCR	---	ACOE Non-wetland WoUS	Ephemeral Tributary – Disturbed
Mid-Martinez Canyon	MMC-AGR	---	ACOE Non-wetland WoUS	Ephemeral Tributary – Disturbed
Chiquito	CH-UPST	BF/FP	ACOE Non-wetland WoUS	Ephemeral/Intermittent Tributary – SWS

TABLE 4-1 (CONTINUED)
RIPARIAN AND WETLAND HABITAT CLASSIFICATION
FOR NEWHALL RANCH

Drainage	Reach ID	Plot Position(s)[1]	Jurisdictional Status[2]	Stream/Wetland Classification[3]
Chiquito	CH-TRIB	---	ACOE Non-wetland WoUS	Ephemeral Tributary – Disturbed
Chiquito	CH-DNST	BF/FP	ACOE Non-wetland WoUS	Ephemeral Tributary – AS
Chiquito	CH-SCR	---	ACOE Non-wetland WoUS	Ephemeral Tributary – MFS
Ag Drainage	SCR-AGR-N	---	ACOE Non-wetland WoUS	Ephemeral Tributary – Disturbed
Castaic	CA	BF/FP	ACOE Non-wetland WoUS	Intermittent Tributary – MFS/Tamarix
Southern Drainages (35 reaches)				
Salt	SA-E1	BF/FP	ACOE Non-wetland WoUS[4]	Ephemeral Tributary – MFS
Salt	SA-2	BF/FP	ACOE Non-wetland WoUS[4]	Ephemeral Tributary – MFS
Salt	SA-W1	BF/FP	ACOE Non-wetland WoUS[4]	Ephemeral/Intermittent Tributary – MFS/SWS
Salt	SA-3 (Riv-PerAM)	BF/FP	ACOE Wetland WoUS	Riverine Persistent Emergent Alkali Marsh – MM/SWS
Salt	SA-4 (Riv-PerAM)	BF/FP	ACOE Wetland WoUS	Riverine Persistent Emergent Alkali Marsh – MM/SWS
Salt	SA-5	BF/FP	ACOE Non-wetland WoUS	Ephemeral Tributary – MFS/Tamarix
Salt	SA-6	BF	ACOE Wetland WoUS[5]	Perennial Tributary – SWS
Potrero	PO-1	BF/FP	ACOE Non-wetland WoUS	Ephemeral Tributary – CLOW
Potrero	PO-2	BF	ACOE Non-wetland WoUS	Ephemeral Tributary – CLOW
Potrero	PO-3	BF/FP	ACOE Non-wetland WoUS	Ephemeral Tributary – CWRF
Potrero	PO-4 (Riv-PerAM)	BF	ACOE Wetland WoUS	Riverine Persistent Emergent Alkali Marsh – MM
Potrero	PO-5	BF/FP	ACOE Wetland WoUS	Perennial Tributary – SWS
Potrero	PO-6	BF	ACOE Wetland WoUS[5]	Perennial Tributary – SWS/Tamarix
Potrero	PO-7 (Seep-PalAM)	BF/FP	ACOE Wetland WoUS	Seep Palustrine Alkali Marsh – MM
Ayres	AY	---	ACOE Non-wetland WoUS	Ephemeral Tributary – CLOW
Long	LO-UPST	BF/FP	ACOE Non-wetland WoUS	Ephemeral Tributary – AS
Long	LO-DNST	BF/FP	ACOE Non-wetland WoUS	Ephemeral Tributary – AS
Long	LO-AGR	---	ACOE Non-wetland WoUS	Ephemeral Tributary – Disturbed
Unnamed	UN-E	---	ACOE Non-wetland WoUS	Ephemeral Tributary – GBS

TABLE 4-1 (CONTINUED)
RIPARIAN AND WETLAND HABITAT CLASSIFICATION
FOR NEWHALL RANCH

Drainage	Reach ID	Plot Position(s)[1]	Jurisdictional Status[2]	Stream/Wetland Classification[3]
Unnamed	UN-W	---	ACOE Non-wetland WoUS	Ephemeral Tributary – GBS
Humble	HU-UPST	---	ACOE Non-wetland WoUS	Ephemeral Tributary – CLOW
Humble	HU-DNST	BF/FP	ACOE Non-wetland WoUS[5]	Intermittent Tributary – SW
Lion	LI-UPST-E	---	ACOE Non-wetland WoUS	Ephemeral Tributary – AS
Lion	LI-UPST-W	---	ACOE Non-wetland WoUS	Ephemeral Tributary – AS
Lion	LI-DNST	BF/FP	ACOE Non-wetland WoUS	Ephemeral Tributary – AS
Exxon	EX	---	ACOE Non-wetland WoUS	Ephemeral Tributary – CLOW
Dead End	DE	---	ACOE Non-wetland WoUS	Ephemeral Tributary – GBS
Middle	MI-1	BF	ACOE Non-wetland WoUS	Ephemeral Tributary – Disturbed
Middle	MI-2	---	ACOE Non-wetland WoUS	Ephemeral Tributary – Disturbed
Middle	MI-3	---	ACOE Non-Wetland WoUS	Ephemeral Tributary – CWRF
Middle	MI-4	---	ACOE Non-Wetland WoUS	Ephemeral Tributary – CWRF
Middle	MI-5	BF/FP	ACOE Wetland WoUS	Riverine Persistent Emergent Alkali Marsh – CLOW/CWRF
Middle	MI-6 (Slope-PalAM)	BF/FP	ACOE Wetland WoUS	Slope Palustrine Alkali Marsh – MM
Magic Mountain	MA	BF	ACOE Non-wetland WoUS	Ephemeral Tributary – GBS
Unnamed	UN-N	---	ACOE Non-wetland WoUS	Ephemeral Tributary – GBS

1 BF – Bankfull Channel; FP – Floodplain; T – Terrace.

2 ACOE (or Corps) jurisdictional infers CDFG and Corps jurisdiction; CDFG Riparian infers jurisdictional to CDFG only.

3 Classification generally based on Brinson (1993) and Ferren et al. (1996).

4 Atypical Situation – Fire (“natural events”).

5 Atypical Situation – Irrigation (“man-induced wetlands”).

? Requires confirmation from ACOE (Corps); may not be jurisdictional.

Key to Vegcodes:

AS-Alluvial Scrub; AWS-Arrow Weed Scrub; CLOW-Coast Live Oak Woodland; CWRF-Cottonwood Willow Riparian Forest; Disturbed-Non-native herbs and shrubs, scattered elements of MFS or GBS may be present; GBS-Great Basin Scrub; MFS-Mulefat Scrub; MM-Mesic Meadow; SW-Sycamore Woodland; SWS-Southern Willow Scrub (Codes based on URS Delineation Report dated September 2003).

the surface and down the slope (Ferren et al. 1996, Corps 2004b). Vegetation included wetland species in the tree, shrub, and herb layers [15 n/0 nn].

Table 4-1 lists the jurisdictional status and wetland classification of each reach within the project area.

4.2 ASSESSMENT OF WETLAND AND RIPARIAN HABITATS

Data for the HARC were collected during October through December 2003. During this time, a wildfire burned portions of the project area, including some tributary drainages assessed in this document (see CDF 2003). Reaches that were burned in the fire were treated as "atypical situations" due to a natural disturbance (per Environmental Laboratory 1987). The most extensive burn areas were within the Salt Creek sub-watershed and some of the ephemeral northern tributaries.

Each riparian reach or wetland was assessed according to the HARC methods developed for this assessment. Each reach was assigned Hydrology, Biogeochemical, and Habitat attribute scores, as well as an HARC Total Score incorporating all metrics used in the assessment. Reach HARC Total Scores are shown geographically in Figure 4-2, and all attribute scores are summarized in the succeeding figures. Additional results are located in Appendix C.

4.2.1 HARC Total Score (Figures 4-3 through 4-4)

For discussion purposes, the HARC AW-Total Score data were divided into high, medium, and low quality groups according to the 0.8 and 0.4 percent scores used in two other CRAM studies (Ambrose et al. 2006; Wijte et al. 2006). Figure 4-3 shows HARC Total Scores; 26 reaches scored between 0.8 and 1.0, 27 reaches scored between 0.4 and 0.8, and four reaches scored between below 0.4. The high, medium, and low groupings approximately represent natural breaks in the data when the scores are arranged from the highest to the lowest HARC Total Score. The small number of low-scoring reaches was expected, because most sites are free from the severe impacts and chronic disturbances that result in such scores. The shape of this score distribution along with the presence of very high (0.98) and low (0.10) scores suggests that the HARC did in fact capture the disturbance gradient present in the project area, and was sensitive enough to detect variability (in condition) among reaches.

Figure 4-4 shows HARC Total Scores for the Santa Clara River reaches. The highest quality mainstem reaches were SCR-SA, SCR-PO, SCR-HU, and SCR-MI, and the lower quality reaches were those in the vicinity of Long Canyon (SCR-LO-DNST, SCR-LO-MID, and SCR-LO-UPST). The main factors controlling differences between these sites were grazing impacts to vegetation and substrate, adjacent land uses (agriculture), geomorphology (e.g., channel incision), and presence of invasive species (especially *Tamarix* sp.).

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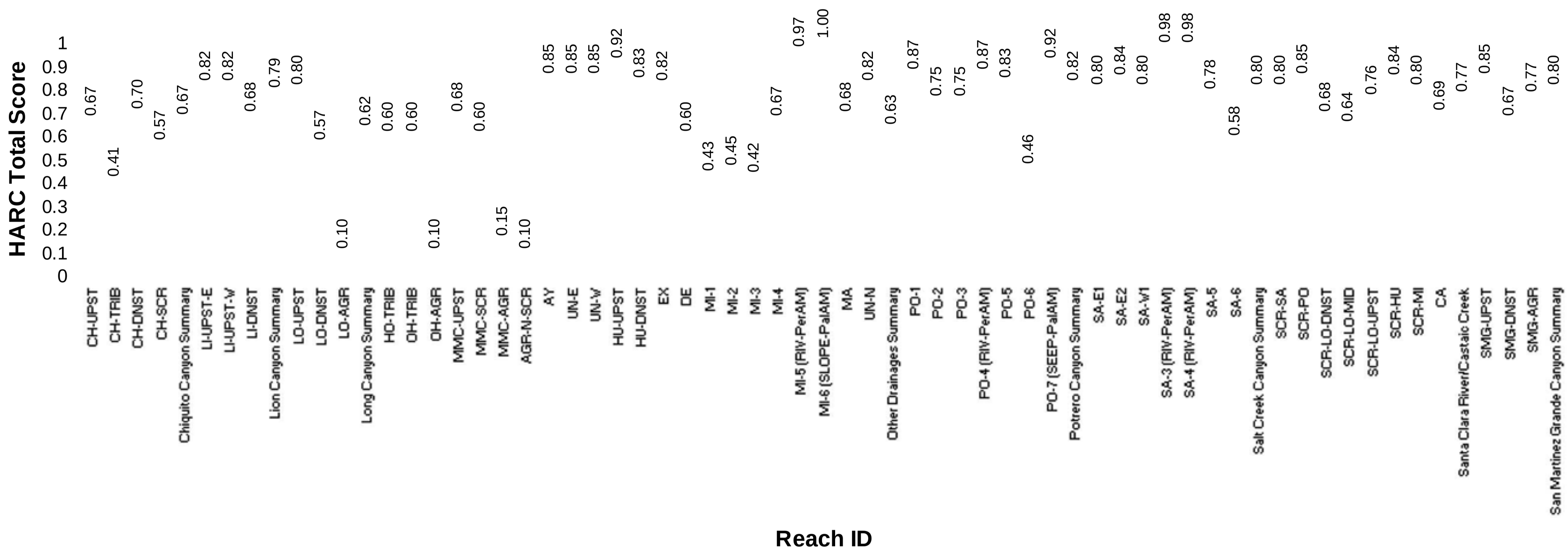
Figure 4.5-1. **Existing Functional Assessment Reaches and Scores**

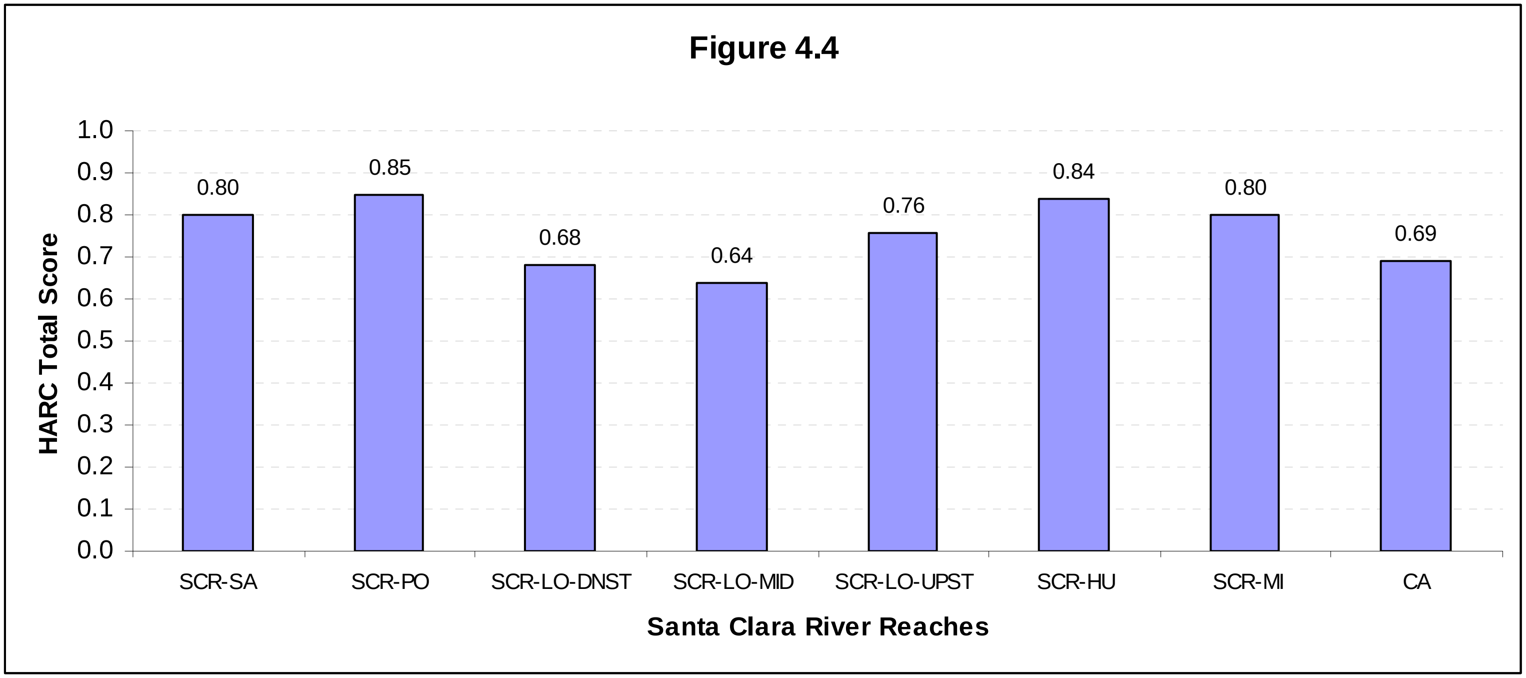
October 2006

FIGURE 4-3
HARC TOTAL SCORE DISTRIBUTION BY REACH



HARC Total Score = sum of all 15 attribute scores/15. For drainage summary scores, values are area-weighted.

FIGURE 4-4
HARC TOTAL SCORES FOR SANTA CLARA RIVER REACHES



HARC Total Score = (Sum of all 15 attribute scores)/15

4.2.2 Average HARC Scores Per Tributary System (Figures 4-5a, 4-5b)

Figure 4-5a shows average HARC scores for the major tributaries. These scores were based on the HARC Total Scores for all reaches in each tributary system, and were weighted to account for differing reach areas. In general, Humble, Salt, Potrero, and Lion were higher scoring tributary systems than San Martinez Grande, Middle, Chiquito, and Long. Figure 4-5b shows the number of HARC AW-Score Units present in each tributary, calculated by multiplying reach area by HARC Total Score for each reach present and adding the products.

The number of AW-Score Units present may be influenced more by size than by quality. As Salt and Potrero are two of the largest tributary systems, the number of HARC AW-Score Units present is high.

4.2.3 Function Scores (Figures 4-6 through 4-8)

For the Hydrology, Biogeochemical, and Habitat functions (see figures 4-6, 4-7, and 4-8, respectively, the southern tributaries generally outscored the northern drainages. In general, the scores for these three functions showed similar geographic trends, and high quality sites were rated as such within each attribute category. Table 4-2 shows correlations of the five functions based on reach scores. All functions were well correlated with the HARC Total Score ($r^2 > 0.9$), which suggested each function was robust enough to capture the disturbance gradient across the project site.

TABLE 4-2
CORRELATIONS FROM ATTRIBUTE DATA

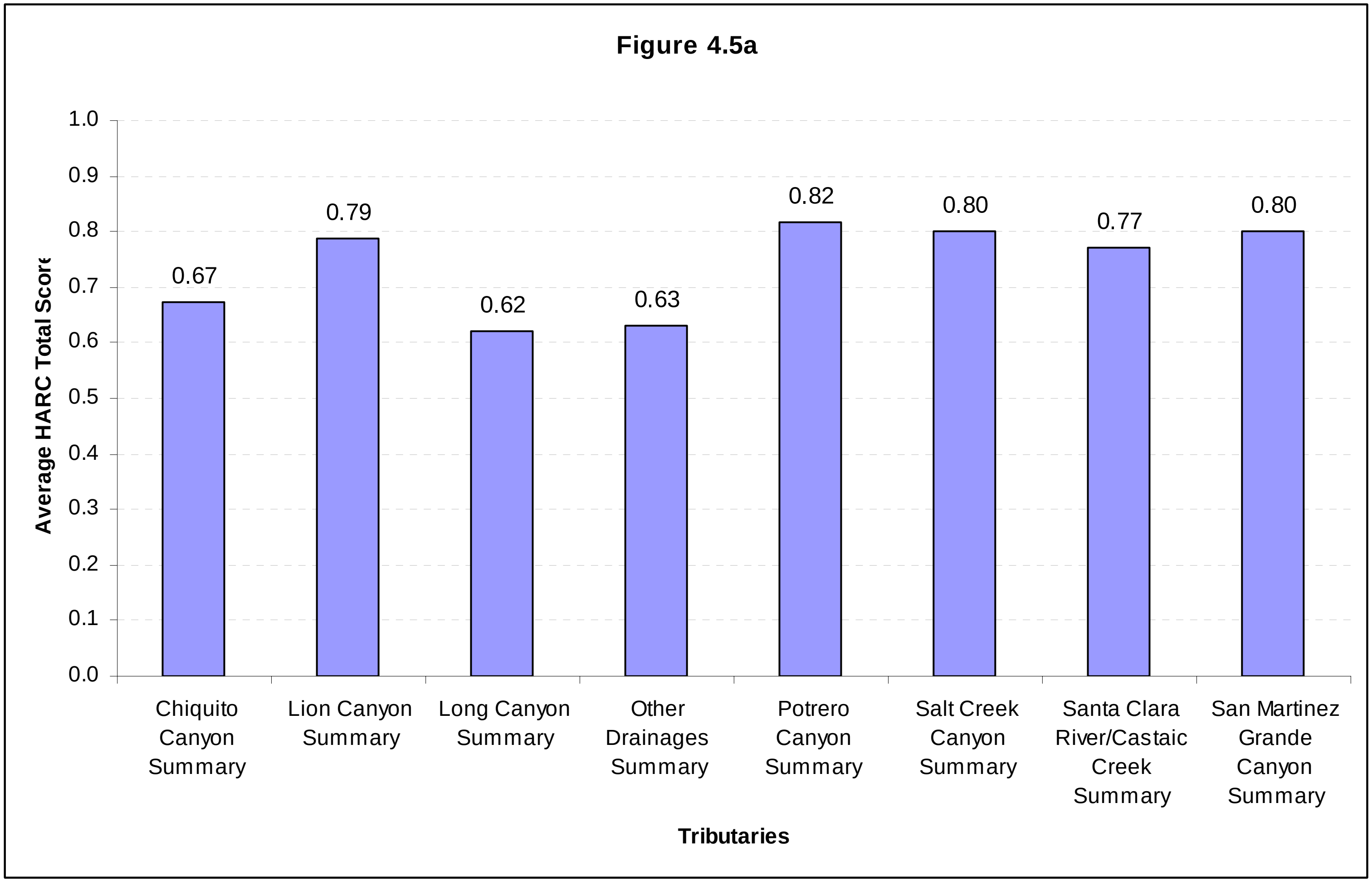
	Hydrology	Biogeochemical	Habitat	HARC Total Score
Hydrology	1.00			
Biogeochemical	0.94	1.00		
Habitat	0.79	0.86	1.00	
HARC Total Score	0.91	0.98	0.95	1.00

4.2.4 Metric Scores (Figures 4-9, 4-10a, 4-10b, and 4-11)

Average scores for each metric, as well as detailed figures showing the score distributions for the Source, Floodplain Connection, and Substrate Condition metrics are discussed below.

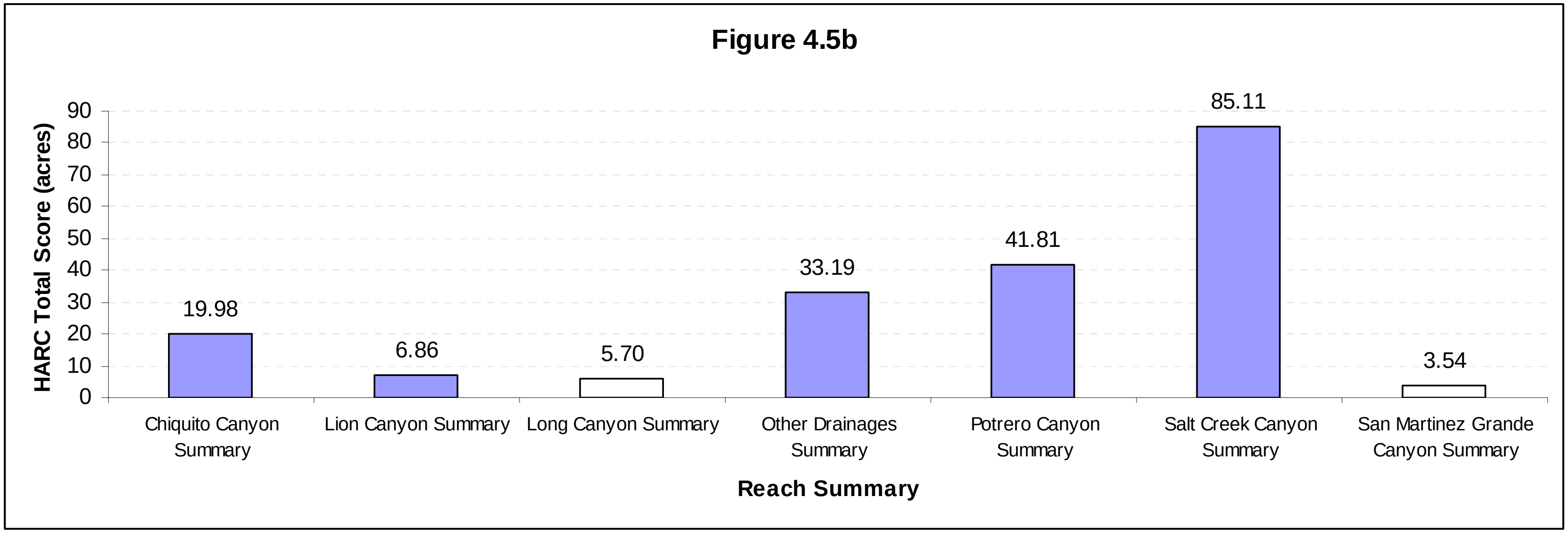
Figure 4-9 shows the score distribution of all 15 metrics used in the HARC. All metrics received a high score of 1.0 for one or more reaches, and most metrics had a low score of zero. The low scores for eight metrics never reached zero; low scores were either 0.1 or 0.25. A high average score suggested several reaches had high scores, whereas a low mean

FIGURE 4-5a
AVERAGE HARC TOTAL SCORES FOR SELECTED TRIBUTARIES



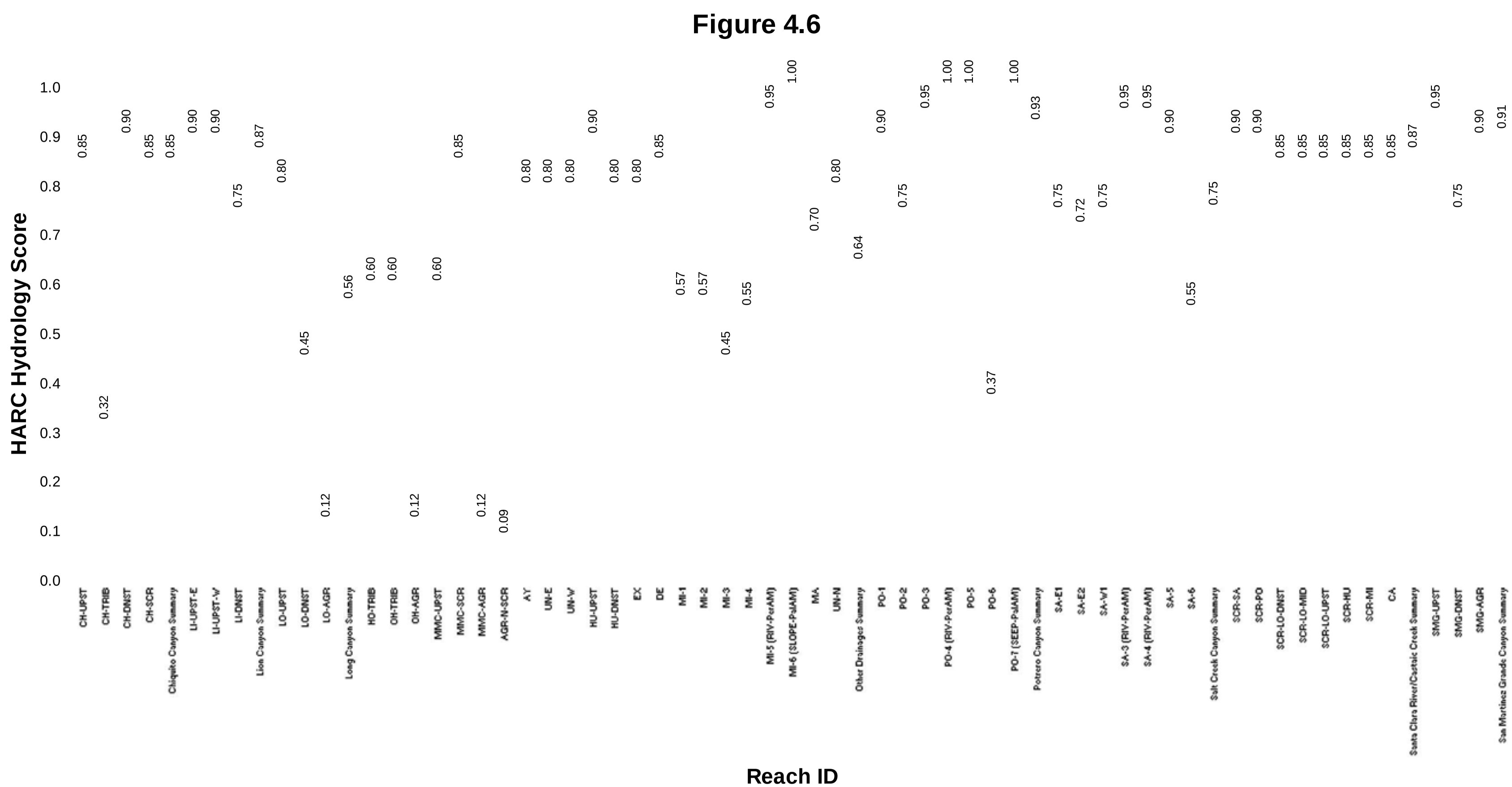
Average HARC Total Score = sum of (HARC Total Score for reach x assessment area of reach) for all reaches in tributary/sum of assessment areas for all reaches in tributary.

FIGURE 4-5b
HARC AREA-WEIGHTED SCORES PRESENT IN SELECTED TRIBUTARIES



Number of AW-Score Units present = sum of (HARC Total Score for reach) x (assessment area of reach in acres) for all reaches within a tributary.

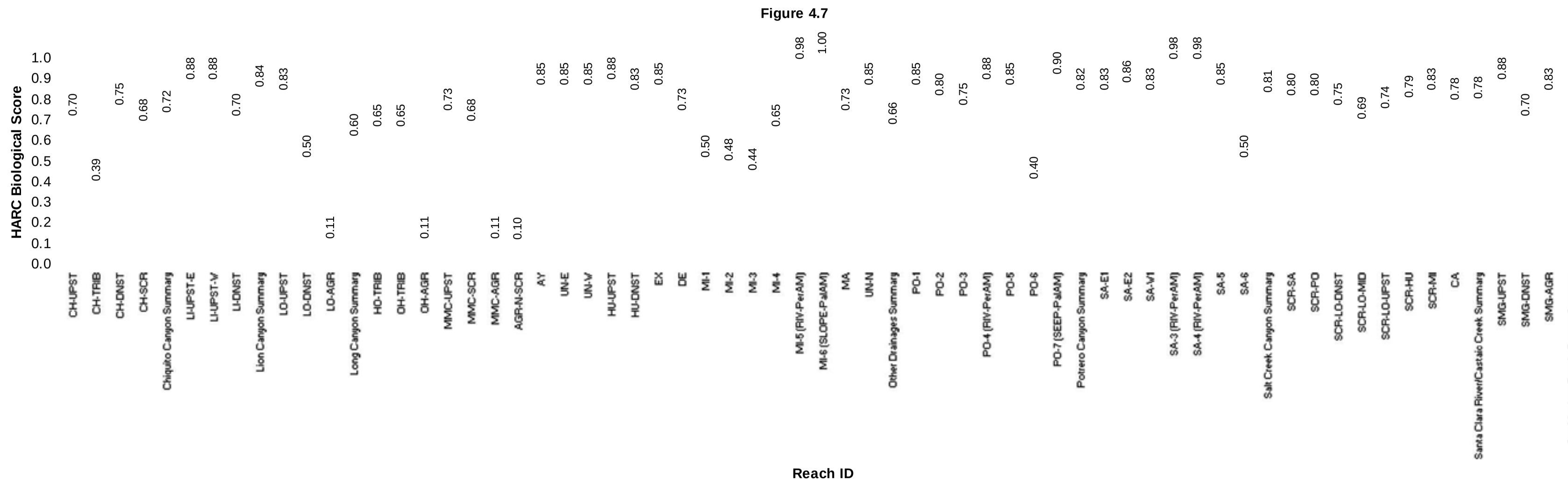
FIGURE 4-6
HARC SCORES FOR HYDROLOGY ATTRIBUTE CATEGORY



HARC Hydrology Score = (sum of all five metrics included in Hydrology function)/5

Average HARC Hydrology Score (river/tributary) = sum of (HARC Hydrology Score for reach x assessment area of reach) for all reaches in tributary/sum of assessment areas for all reaches in tributary

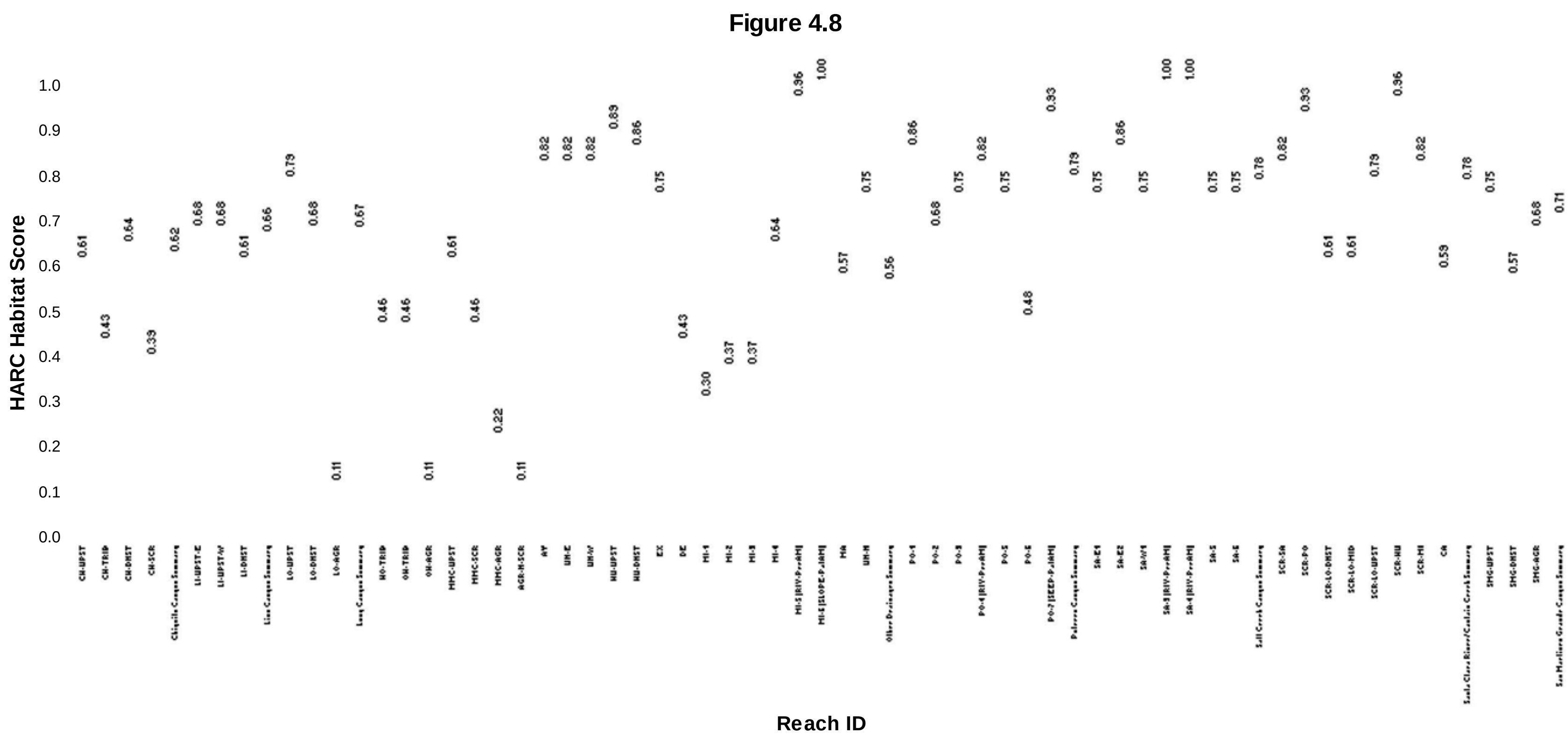
FIGURE 4-7
HARC SCORES FOR BIOGEOCHEMICAL ATTRIBUTE CATEGORY



HARC Biogeochemical Score = (sum of all ten metrics included in Biogeochemical function)/10

Average HARC Biogeochemical Score (river/tributary) = sum of (HARC Biogeochemical Score for reach x assessment area of reach) for all reaches in tributary/sum of assessment areas for all reaches in tributary

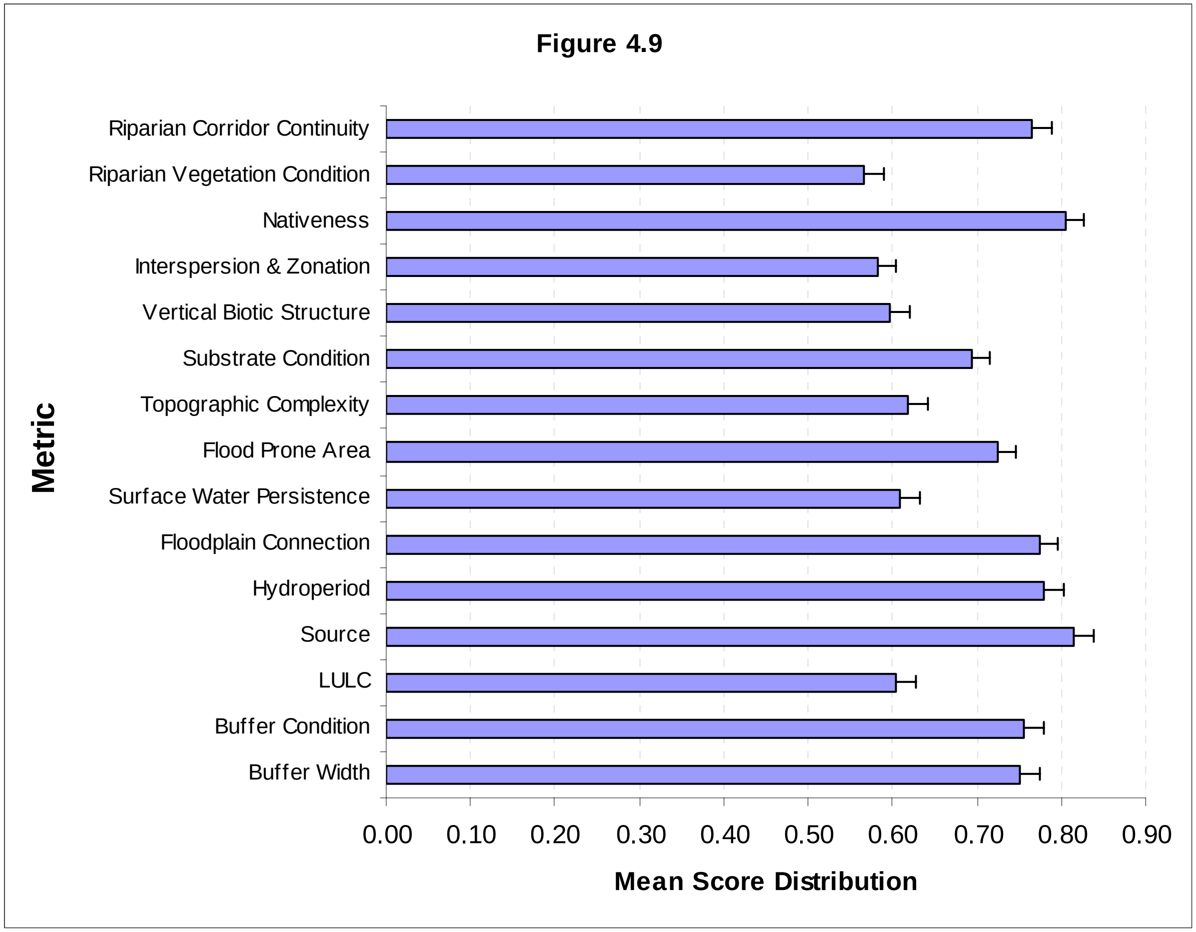
FIGURE 4-8
HARC SCORES FOR HABITAT ATTRIBUTE CATEGORY



HARC Habitat Score = (sum of all eight metrics included in Habitat function)/8

Average HARC Habitat Score (river/tributary) = sum of (HARC Habitat Score for reach x assessment area of reach) for all reaches in tributary/sum of assessment areas for all reaches in tributary

FIGURE 4-9
SCORE DISTRIBUTION FOR THE 15 DISTINCT METRICS



Error bars represent the positive standard error of each mean score.

suggested that some reaches scored very low. The Source (Hydrology attribute) metric had the highest average score. This result can be attributed to the fact that many reaches were headwaters without extensive modifications upstream. The Riparian Vegetation Condition (Habitat) metric, had the lowest average score. However, a few high scoring reaches displayed good distribution with respect to seedlings, saplings, and mature trees.

The Source metric (Hydrology) shown on Figure 4-10a shows that approximately half of the reaches are part of tributaries having intact, undeveloped headwaters, and received 1.0 scores. The Santa Clara River, on the other hand, is affected by publicly owned treatment works upstream of the project site and thus scored lower than 1.0 for this metric.

The Floodplain Connection metric (Hydrology) shown on Figure 4-10b shows that 30 sites had 1.0 scores. The HARC method was able to capture such disturbances as channel incision and other channel modifications.

The Substrate Condition metric (Biogeochemical) shown on Figure 4-11 shows 14 sites scoring 1.0. For the SCR sites, some reaches scored poorly (0.5) due to excessive cattle grazing resulting in soil compaction. Other sites scored lower due to channel modifications which caused fine sediments to accumulate in some reaches.

The Nativeness metric (Habitat) shows seven reaches scoring at the 0.5 level. For the SCR reaches, tamarisk (*Tamarix* sp.) (SCR-SA, SCR-PO) and *Arundo donax* (SCR-MI) were the primary invasive species of concern, while tamarisk, tree tobacco (*Nicotiana glauca*) and non-native grasses were present in the tributaries. Within the Salt Creek reaches, SA 5 – 6, the HARC captured the presence of *Tamarix* sp. seedlings in the relatively undisturbed Salt Creek sub-watershed with a slight reduction in Nativeness scores. In general, this metric showed that most of the project area has been degraded by the presence of exotic plants.

FIGURE 4-10a
SOURCE METRIC

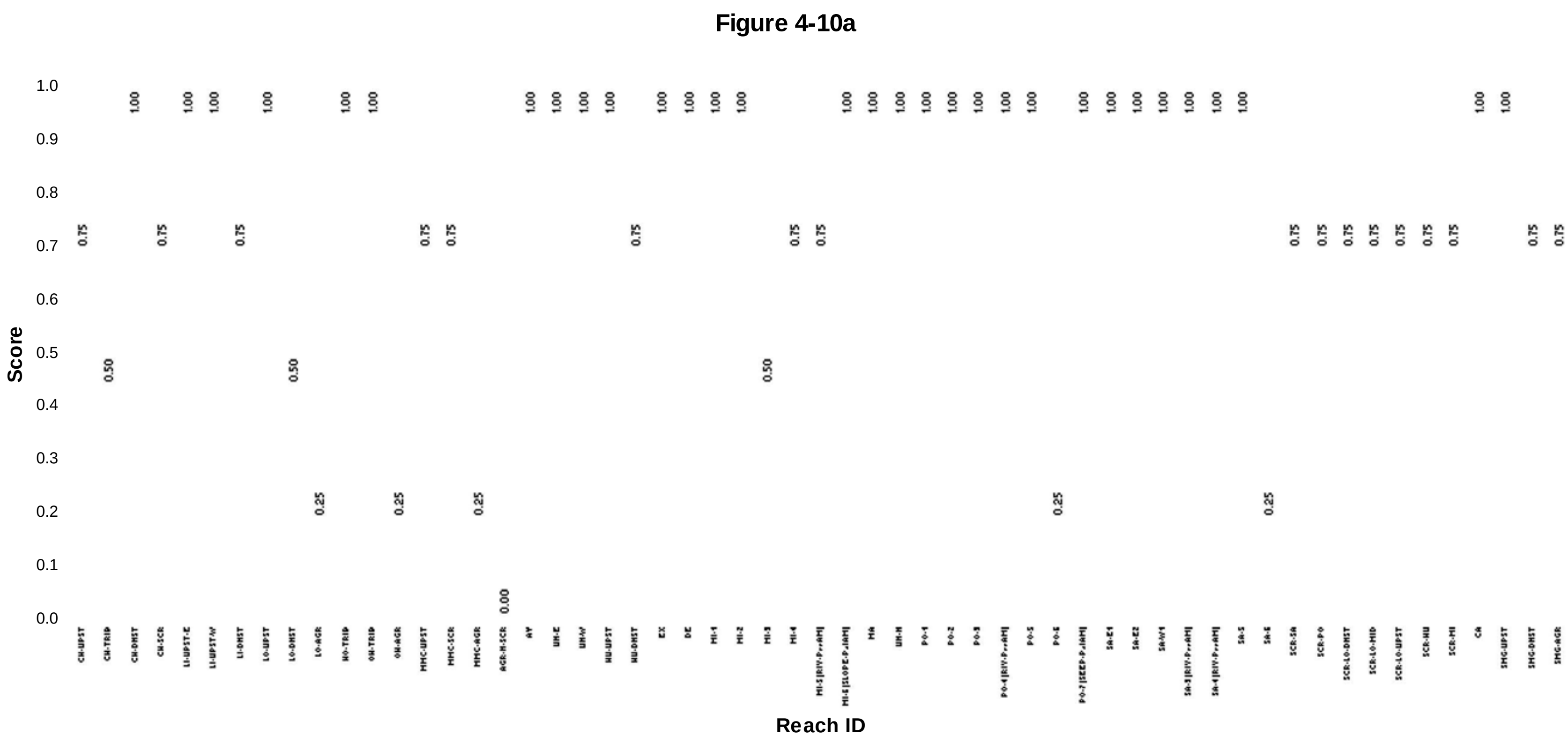


FIGURE 4-10b
FLOODPLAIN CONNECTION METRIC

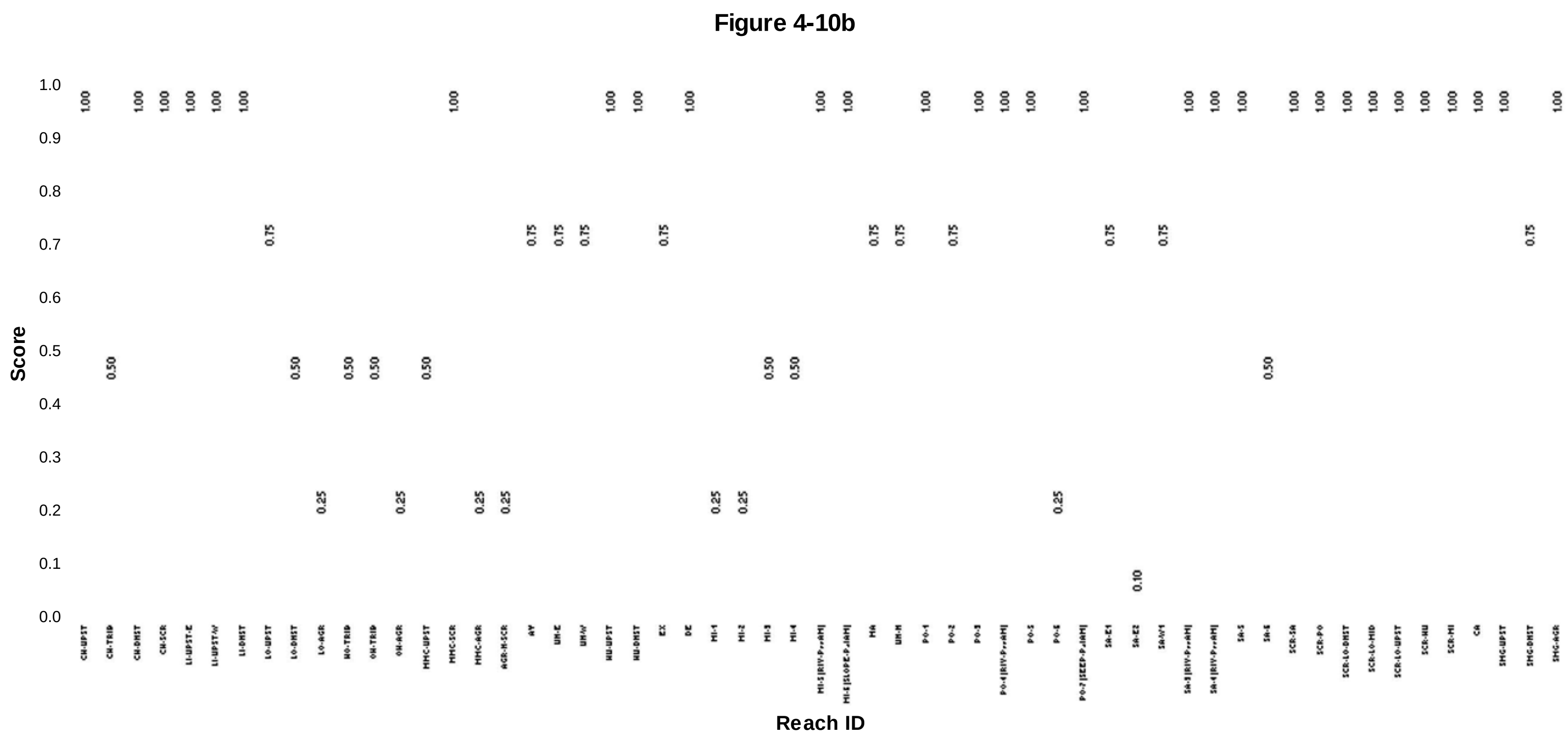
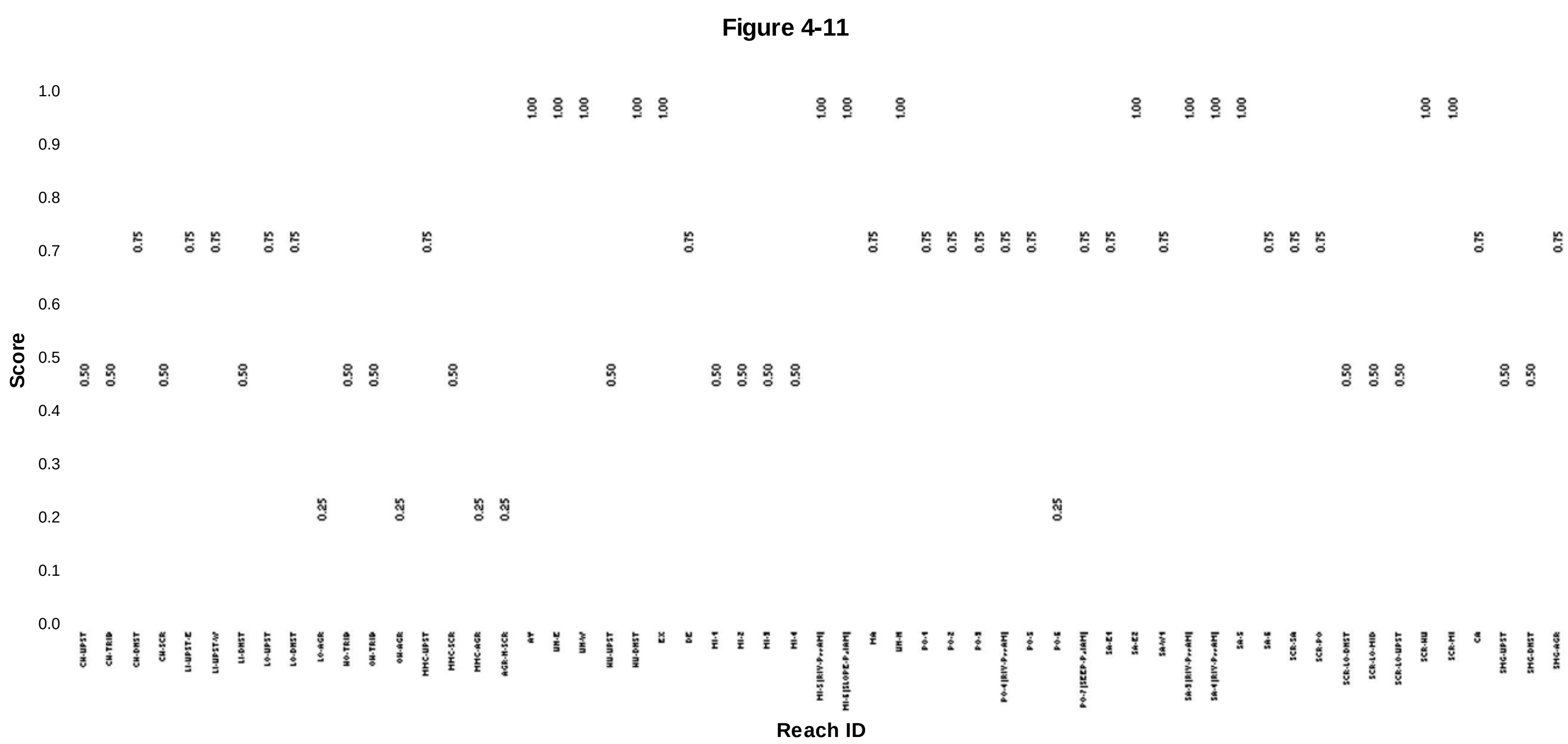


FIGURE 4-11
SUBSTRATE CONDITION METRIC



4.3 ASSESSMENT OF PROPOSED RMDP AND ALTERNATIVES

4.3.1 Alternative 1: No Project/No Action Alternative

Under this alternative, the proposed RMDP would not be approved, and none of the proposed project facilities would be constructed. Therefore, this alternative would not result in any changes from the existing conditions within the project site. The existing agricultural, and oil/gas land uses onsite would continue, and the site would remain under private ownership. This alternative would not involve the elimination or creation of any jurisdictional areas, and no changes to existing metric scores would occur. Implementation of Alternative 1 would not induce any change in the number of HARC AW-Score Units present onsite. However, it is possible that the existing land uses onsite could result in some level of degradation over time as existing non-native species become more established and there are further geomorphic effects from continued grazing.

4.3.2 Alternative 2: Proposed RMDP

Under this alternative, buried bank stabilization, bridges, grade control structures, debris and detention basins, trail crossings, building pads, temporary haul routes, and a water reclamation plant outfall would be constructed within jurisdictional areas onsite. In addition, certain assessment reaches would be realigned into areas that are currently non-jurisdictional, and new jurisdictional areas would be created adjacent to the existing river corridor. The facilities proposed are depicted graphically in Figure 4-12. In areas where buried bank stabilization is proposed, existing banks would be recontoured to allow greater habitat potential, and would be revegetated with appropriate native riparian and upland plants.

4.3.2.1 Santa Clara River Mainstem

Along the river mainstem, several segments of buried bank stabilization are proposed, and these would affect all seven assessment reaches within the river corridor. However, bank stabilization in each of these reaches would only affect one side of the drainage. Bridges across the river are proposed at Potrero Canyon (Reach SCR-PO), and Long Canyon (Reach SCR-LO-MID). In addition, the previously permitted bridge at Commerce Center Drive would cross the river at the upstream edge of the project area, in reach SCR-MI. Overall, implementation of the proposed project would increase the average HARC Total Scores within Santa Clara River reaches by an average of 0.02 HARC Total Score Units, from 0.76 to 0.78 (area weighted average, average change in Total Score for SCR reaches = [(sum of proposed AW-Total Score for all SCR reaches)/(Sum of proposed Assessment Area for all SCR reaches)] - [(sum of existing AW-Total Score for all SCR reaches)/(Sum of existing Assessment Area for all SCR reaches)].

The proposed project would increase the jurisdictional width of the river corridor in some reaches, as existing agricultural areas within the floodplain and adjacent to existing jurisdictional areas would be excavated to channel grade and thereby reconnected hydrologically to the river. These increases would occur primarily in reaches SCR-HU, SCR-LO-UPST, SCR-LO-MID, and SCR-PO. Overall, implementation of the proposed project

FIGURE 4-12
PROPOSED FACILITIES AND LAND USES – ALTERNATIVE 2

IN PREP

Similar to EIS/EIR Figure 2.0-38

would increase the assessment area within the river mainstem by 39.94 acres. Exact acreages for each reach are presented in tabular format in Appendix C. Due to the changes in HARC Score and acreage of assessment reaches discussed above, the proposed project would result in a net gain of 42.85 HARC Total Score AW-Score Units, a net loss of 2.70 HARC Hydrology AW-Score Units, a net gain of 9.75 HARC Biogeochemical AW-Score Units, and a net increase of 98.39 HARC Habitat AW-Score Units within the river mainstem and Castaic Creek.

4.3.2.2 Potrero Canyon

Within the Potrero Canyon tributary, the proposed project would convert the upstream portion (Reaches PO-1, PO-2, and the upstream portion of PO-3) to an underground storm drain system, and the existing jurisdictional drainage would be eliminated in those reaches. Downstream of these reaches, the drainage would be placed into a soft-bottom channel with buried bank stabilization on both sides. This channel would be generally co-located with the existing drainage, although some minor realignment would occur. Within the lined, soft-bottom channel, grade control structures and bridge crossings would be installed at frequent intervals. The wetland at the downstream end of Potrero Canyon (Reach PO-7) would become hydrologically isolated from the active stream channel under this alternative, and would likely not persist due to this hydrologic interruption. Implementation of the proposed project would also indirectly facilitate substantial urbanization of the Potrero Canyon sub-watershed. Overall, implementation of the proposed project would decrease the HARC Total Scores within Potrero Canyon by an area-weighted average of 0.14 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of the proposed project would change the assessment area of several reaches within the Potrero Canyon drainage, as some reaches would be completely eliminated, and others would be routed into fixed-width channels lined with buried bank stabilization. Overall, implementation of the proposed project would decrease the assessment area within Potrero Canyon by 14.75 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. Combined with the changes in HARC Total Scores discussed above, the proposed project would result in a net decrease of 15.86 HARC AW-Total Score Units, loss of 19.31 HARC Hydrology AW-Score Units, loss of 15.86 HARC Biogeochemical AW-Score Units, and loss of 14.79 HARC Habitat AW-Score Units within the Potrero Canyon tributary.

4.3.2.3 Chiquito Canyon

Under the proposed project, the entire mainstem of this intermittent tributary (reaches CH-UPST and CH-DNST) would be realigned into a soft-bottom channel that would be constructed parallel to the existing Chiquito Canyon Road right-of-way. Although portions of this channel would overlap with existing jurisdictional areas, a substantial amount of realignment and straightening of the drainage would occur. Several grade control structures and bridge crossings are proposed within the lined channel throughout both of these reaches. The majority of the Chiquito Canyon watershed would be urbanized under the proposed project, and some of the ephemeral, first-order tributaries to this drainage (combined into reach CH-TRIB) would be eliminated and converted to buried storm drains to accommodate this development. The existing confluence where Chiquito Canyon enters the Santa Clara River (reach CH-SCR) would be angled slightly to the west of its current trajectory through the installation of buried bank stabilization along the River. Overall, implementation of the proposed project would decrease the HARC Total Scores within Chiquito Canyon by an area-weighted average of 0.09 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of the proposed project would change the assessment area of several reaches within the Chiquito Canyon drainage, as the CH-TRIB reach would be completely eliminated, and others would be routed into fixed-width channels lined with buried bank stabilization. Overall, implementation of the proposed project would decrease the assessment area within Chiquito Canyon by 2.08 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. Combined with the changes in HARC Total Scores discussed above, the proposed project would result in a net loss of 2.97 HARC Total Score AW-Score Units, loss of 6.92 HARC Hydrology AW-Score Units, loss of 4.80 HARC Biogeochemical AW-Score Units, and a loss of 0.05 HARC Habitat AW-Score Units within Chiquito Canyon.

4.3.2.4 San Martinez Grande Canyon

Under the proposed project, this intermittent tributary (reaches SMG-UPST and SMG-DNST) would be realigned into a soft-bottom channel that would be constructed parallel to the existing San Martinez Grande Canyon Road right-of-way. Although portions of this channel would overlap with existing jurisdictional areas, a substantial amount of realignment and straightening of the drainage would occur. Several grade control structures are proposed within the lined channel throughout both of these reaches, and one new bridge crossing would be installed within each reach. The majority of the San Martinez Grande Canyon watershed within the project area would be urbanized under the proposed project, although a substantial portion would also fall within the proposed San Martinez Grande spineflower preserve. Overall, implementation of the proposed project would decrease the HARC Total Scores within San Martinez Grande Canyon by an area-weighted average of 0.14 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of the proposed project would change the assessment area of several reaches within the San Martinez Grande Canyon drainage, as the drainage would be routed into a fixed-width channel lined with buried bank stabilization. Overall, implementation of the proposed project would increase the assessment area within San Martinez Grande Canyon by 3.16 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. Combined with the changes in HARC Total Scores discussed above, the proposed project would result in a net increase of 1.60 HARC Total Score AW-Score Units, 1.43 HARC Hydrology AW-Score Units, 1.36 HARC Biogeochemical AW-Score Units, and 2.10 HARC Habitat AW-Score Units within the San Martinez Grande Canyon tributary.

4.3.2.5 Long Canyon

Under the proposed project, the Long Canyon drainage would be a soft-bottom channel lined on both sides with buried bank stabilization. The lined channel within the upstream reach (LO-UPST) would be co-located with the existing stream, but the lower portion of the downstream reach (LO-DNST) would be realigned to the east. The existing agricultural drainage which conveys flows from the Long Canyon drainage to the River (LO-AGR) would be relocated to the east, into a soft-bottom channel in what is currently an upland area. The proposed Long Canyon channel would feature grade control structures installed at approximately equal intervals between the upstream project boundary and the Santa Clara River, and three new roadway bridges would be constructed across the lined channel. Overall, implementation of the proposed project would increase the HARC Total Scores within Long Canyon by an area-weighted average of 0.04 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of the proposed project would change the assessment area of several reaches within the Long Canyon drainage, as the drainage would be routed into a fixed-width channel lined with buried bank stabilization. Overall, implementation of the proposed project would increase the assessment area within Long Canyon by 4.97 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. When this change in acreage is combined with the changes in HARC Total Scores discussed above, the proposed project would result in a net gain of 3.48 HARC Total Score AW-Score Units, 3.33 HARC Hydrology AW-Score Units, 3.13 HARC Biogeochemical AW-Score Units, and 4.01 HARC Habitat AW-Score Units within Long Canyon.

4.3.2.6 Lion Canyon

The western branch of this drainage (reach LI-UPST-W) would not require any bank protection, because the reach falls largely into land designated as open space. However, the lower portion of this reach is in an area proposed for development. This portion of the reach would be graded, and streamflows would pass underneath the proposed development via an underground storm drain system. The eastern branch of the drainage (LI-UPST-E) also falls largely within a proposed open space area, and would also not require any bank protection.

The only project feature proposed within this reach would be an arch culvert and wildlife under crossing, at the proposed intersection of this drainage with Magic Mountain Parkway. Downstream of the confluence of the eastern and western branches of this drainage (reach LI-DNST), the proposed project would install eight grade control structures. One road crossing is also proposed within this reach. Overall, implementation of the proposed project would decrease the HARC Total Scores within Lion Canyon by an area-weighted average of 0.13 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of the proposed project would change the assessment area of several reaches within the Lion Canyon drainage, as the drainage would be routed into a fixed-width channel lined with buried bank stabilization. Overall, implementation of the proposed project would decrease the assessment area within Lion Canyon by 3.14 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. When this change in acreage is combined with the changes in HARC Total Scores discussed above, the proposed project would result in a net loss of 2.96 HARC Total Score AW-Score Units, 3.33 HARC Hydrology AW-Score Units, 3.31 HARC Biogeochemical AW-Score Units, and 2.22 HARC Habitat AW-Score Units in Lion Canyon.

4.3.2.7 Other Drainages Onsite

In addition to the Santa Clara River and the five tributary drainages discussed above, the RMDP site also contains a large number of ephemeral, first- and second-order streams. These small drainages pervade the site due to the varied onsite topography, and the majority of them occur in areas proposed for urban development. Because of the small size and low flow rates exhibited by these streams, no bank stabilization or grade control structures are proposed within these drainages. In areas proposed for development, these minor jurisdictional drainages would be eliminated, and flows would instead be conveyed by underground storm drain systems (Reaches OH-TRIB, OH-AGR, MMC-UPST, MMC-AGR, AGR-N-SCR, MA, MI-1, MI-2, MI-3, and DE). In some cases, headwaters of such streams would be eliminated, but downstream areas would remain intact (Reaches EX, UN-E, UN-W, and UN-N). Chronic impacts from onsite land uses, such as those from agriculture, grazing, and oil and gas operations, would be eliminated from the site under this alternative. Overall, implementation of the proposed project would increase the HARC Total Scores within minor ephemeral and intermittent drainages onsite by an area-weighted average of 0.11 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of the proposed project would change the assessment area of several minor drainages within the RMDP site, as portions of many of these drainages would be eliminated as described above. Overall, implementation of the proposed project would decrease the assessment area within the minor intermittent and ephemeral drainages onsite by 25.68 acres.

Exact changes in acreage for each reach are presented in tabular format in Appendix C. When this change in acreage is combined with the changes in HARC Total Scores discussed above, the proposed project would result in a net loss of 15.66 HARC Total Score AW-Score Units, 16.4 HARC Hydrology AW-Score Units, 16.72 HARC Biogeochemical AW-Score Units, and 13.08 HARC Habitat AW-Score Units.

4.3.2.8 <u>Alternative 2 Summary</u>

On a project-wide scale, the proposed RMDP would result in a net gain of 25.51 acres of HARC assessment area onsite (coterminous with CDFG jurisdictional area), and would increase the overall riparian condition of the onsite aquatic resources by 35.39 HARC Total Score AW-Score Units and 101.53 HARC Habitat AW-Score Units. However, the proposed project would also result in a project-wide decrease of 20.87 HARC Hydrology AW-Score Units, and 2.45 HARC Biogeochemical AW-Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C. Changes in AW-Total Score Units for the river and major onsite drainages are presented in Table 4-3.

4.3.3 Alternative 3

Under this alternative, buried bank stabilization, bridges, grade control structures, debris and detention basins, trail crossings, building pads, temporary haul routes, and a water reclamation plant outfall would be constructed within jurisdictional areas onsite. In addition, certain assessment reaches would be realigned into areas that are currently non-jurisdictional, and new jurisdictional areas would be created adjacent to the existing river corridor. The facilities proposed are depicted graphically in Figure 4-13.

4.3.3.1 <u>Santa Clara River Mainstem</u>

Along the river mainstem, several segments of buried bank stabilization are proposed, and these would affect all seven assessment reaches within the river corridor. However, bank stabilization in each of these reaches would only affect one side of the drainage. One bridge across the river is proposed at Long Canyon (Reach SCR-LO-MID). In addition, the previously permitted bridge at Commerce Center Drive would cross the river at the upstream edge of the project area, in reach SCR-MI. Overall, implementation of Alternative 3 would increase the HARC Total Scores within Santa Clara River by an area-weighted average of 0.01 HARC Total Score Units.

Implementation of Alternative 3 would increase the jurisdictional width of the river corridor in some reaches, as existing agricultural areas within the floodplain and adjacent to existing jurisdictional areas would be excavated to channel grade and thereby reconnected hydrologically to the river. These increases would occur primarily in reaches SCR-HU, SCR-LO-UPST, SCR-LO-MID, and SCR-PO. Overall, implementation of Alternative 3 would increase the assessment area within the river mainstem by 68.46 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. Combined with the changes in HARC Score discussed above, Alternative 3 would result in a net gain of 58.05 HARC Total Score AW-Score Units, loss of 5.67 HARC Hydrology

TABLE 4-3
IMPACTS TO RIPARIAN CONDITION RESULTING FROM IMPLEMENTATION OF ALTERNATIVE 2 (PROPOSED RMDP) (HARC AW-TOTAL SCORE UNITS)

	Santa Clara River	Chiquito	San Martinez Grande	Lion	Long	Potrero	Salt	Other Drainages	Totals
Existing Condition	579.52	12.59	2.84	5.41	3.55	34.5	71.85	21.27	731.52
Proposed Project	622.37	9.62	4.44	2.45	7.03	18.64	97.05	5.61	767.20
Change	+42.85	-2.97	+1.60	-2.96	+3.48	-15.86	+25.20	-15.66	+35.68
Percentage of Change	+7.4%	-23.6%	+56.3%	-54.7%	+98.0%	-46.0%	+35.1%	-73.6%	+4.9%

FIGURE 4-13
PROPOSED FACILITIES AND LAND USES – ALTERNATIVE 3

Similar to EIS/EIR Figure 3.0-5

AW-Score Units, gain of 18.19 HARC Biogeochemical AW-Score Units, and an increase of 126.53 HARC Habitat AW-Score Units within the river mainstem.

4.3.3.2 Potrero Canyon

Within the Potrero Canyon tributary, Alternative 3 would convert the upstream portion (Reaches PO-1, PO-2, and the upstream portion of PO-3) to an underground storm drain system, and the existing jurisdictional drainage would be eliminated in those reaches. Downstream of these reaches, the drainage would be placed into a soft-bottom channel with buried bank stabilization on both sides. This channel would be generally co-located with the existing drainage, although some minor realignment would occur. Within the lined, soft-bottom channel, grade control structures and bridge crossings would be installed at frequent intervals. In reach PO-4, which contains a relatively high quality saltgrass-dominated palustrine fringe wetland, bank stabilization would be located beyond the lateral limits of the assessment reach. Also, bank stabilization would be discontinued immediately upstream of the wetland at the downstream end of Potrero Canyon (Reach PO-7), and no project facilities would be constructed within that reach. Implementation of Alternative 3 would also indirectly facilitate substantial urbanization of the Potrero Canyon sub-watershed. Overall, implementation of Alternative 3 would decrease the HARC Total Scores within Potrero Canyon by an area-weighted average of 0.24 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of Alternative 3 would change the assessment area of several reaches within the Potrero Canyon drainage, as some reaches would be completely eliminated, and others would be routed into fixed-width channels lined with buried bank stabilization. Overall, implementation of this alternative would increase the assessment area within Potrero Canyon by 38.19 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. Combined with the changes in HARC Total Scores discussed above, Alternative 3 would result in a net gain of 12.26 HARC Total Score AW-Score Units, 12.87 HARC Hydrology AW-Score Units, 12.12 HARC Biogeochemical AW-Score Units, and 12.25 HARC Habitat AW-Score Units within the Potrero Canyon tributary.

4.3.3.3 Chiquito Canyon

Under Alternative 3, the entire mainstem of this intermittent tributary (reaches CH-UPST and CH-DNST) would be realigned into a soft-bottom channel that would be constructed parallel to the existing Chiquito Canyon Road right-of-way. This is similar to the actions proposed within this drainage under the proposed project, except that the channel proposed under Alternative 3 in the upstream portion of the drainage (Reach CH-UPST) would be more nearly co-located with the existing jurisdictional drainage. Although portions of this channel would overlap with existing jurisdictional areas, a substantial amount of realignment and straightening of the drainage would occur. Several grade control structures and bridge crossings are proposed within the lined channel throughout both of these reaches. The majority of the Chiquito Canyon watershed would be urbanized under this alternative, and some of the ephemeral, first-order tributaries to this drainage (combined into reach CH-TRIB) would be eliminated and converted to buried storm drains to accommodate this development. The existing confluence where Chiquito Canyon enters the Santa Clara River (reach CH-SCR) would be angled slightly to the west of its current trajectory through the installation of buried bank stabilization along the River. Overall, implementation of Alternative 3 would decrease the HARC Total Scores within Chiquito Canyon by an area-weighted average of 0.03 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of the proposed project would change the assessment area of several reaches within the Chiquito Canyon drainage, as the CH-TRIB reach would be completely eliminated, and others would be routed into fixed-width channels lined with buried bank stabilization. Overall, implementation of Alternative 3 would decrease the assessment area within Chiquito Canyon by 4.73 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. Combined with the changes in HARC Total Scores discussed above, Alternative 3 would result in a net increase of 2.40 HARC Total Score AW-Score Units, 0.86 HARC Biogeochemical AW-Score Units, and 4.8 HARC Habitat AW-Score Units within Chiquito Canyon. However, Alternative 3 would also result in the loss of 0.3 HARC Hydrology AW-Score Units within this drainage.

4.3.3.4 San Martinez Grande Canyon

Under Alternative 3, this intermittent tributary (reaches SMG-UPST and SMG-DNST) would be realigned into a soft-bottom channel that would be constructed parallel to the existing San Martinez Grande Canyon Road right-of-way. However, this channel would be wider than that proposed under the proposed project, and would be more nearly co-located with the existing jurisdictional drainage. Nonetheless, although portions of this channel would overlap with existing jurisdictional areas, a substantial amount of realignment and straightening of the drainage would occur. Several grade control structures are proposed within the lined channel throughout both of these reaches, and one new bridge crossing would be installed within each reach. The majority of the San Martinez Grande Canyon watershed within the project area would be urbanized under this alternative, although a substantial portion would also fall within the proposed San Martinez Grande spineflower preserve. Overall, implementation of Alternative 3 would decrease the HARC Total Scores within San Martinez Grande Canyon by an area-weighted average of 0.12 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of this alternative would change the assessment area of several reaches within the San Martinez Grande Canyon drainage, as the drainage would be routed into a fixed-width channel lined with buried bank stabilization. Overall, implementation of

Alternative 3 would increase the assessment area within San Martinez Grande Canyon by 11.61 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. Combined with the changes in HARC Total Scores discussed above, Alternative 3 would result in a net gain of 7.48 HARC Total Score AW-Score Units, 7.05 HARC Hydrology AW-Score Units, 6.68 HARC Biogeochemical AW-Score Units, and 8.87 HARC Habitat AW-Score Units within the San Martinez Grande Canyon tributary.

4.3.3.5 Long Canyon

Under Alternative 3, the facilities proposed in the Long Canyon drainage would be the same as those proposed under the proposed project, discussed above. Overall, implementation of Alternative 3 would increase the HARC Total Scores within Long Canyon by an area-weighted average of 0.04 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of Alternative 3 would change the assessment area of several reaches within the Long Canyon drainage, as the drainage would be routed into a fixed-width channel lined with buried bank stabilization. Overall, implementation of this alternative would increase the assessment area within Long Canyon by 5.05 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. When this change in acreage is combined with the changes in HARC Total Scores discussed above, Alternative 3 would result in a net increase of 3.51 HARC Total Score AW-Score Units, 3.37 HARC Hydrology AW-Score Units, 3.15 HARC Biogeochemical AW-Score Units, and 4.05 HARC Habitat AW-Score Units within Long Canyon.

4.3.3.6 Lion Canyon

The western branch of this drainage (reach LI-UPST-W) would not require any bank protection, because the reach falls largely into land designated as open space. However, the lower portion of this reach is in an area proposed for development. This portion of the reach would be graded, and streamflows would pass underneath the proposed development via an underground storm drain system. The eastern branch of the drainage (LI-UPST-E) also falls largely within a proposed open space area, and would also not require any bank protection. The only project feature proposed within this reach would be an arch culvert and wildlife under crossing, at the proposed intersection of this drainage with Magic Mountain Parkway. Downstream of the confluence of the eastern and western branches of this drainage (reach LI-DNST), the proposed project would install eight grade control structures. One road crossing is also proposed within this reach. Overall, implementation of the proposed project would decrease the HARC Total Scores within Lion Canyon by an area-weighted average of 0.13 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of the proposed project would change the assessment area of several reaches within the Lion Canyon drainage, as the drainage would be routed into a fixed-width channel lined with buried bank stabilization. Overall, implementation of the proposed project would decrease the assessment area within Lion Canyon by 3.15 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. When this change in acreage is combined with the changes in HARC Total Scores discussed above, the proposed project would result in a net loss of 2.97 HARC Total Score AW-Score Units, 3.33 HARC Hydrology AW-Score Units, 3.31 HARC Biogeochemical AW-Score Units, and 2.23 HARC Habitat AW-Score Units in Lion Canyon.

4.3.3.7 Other Drainages Onsite

In addition to the Santa Clara River and the five tributary drainages discussed above, the RMDP site also contains a large number of ephemeral, first- and second- order streams. These small drainages pervade the site due to the varied onsite topography, and the majority of them occur in areas proposed for urban development. Because of the small size and low flow rates exhibited by these streams, no bank stabilization or grade control structures are proposed within these drainages. In areas proposed for development, these minor jurisdictional drainages would be eliminated, and flows would instead be conveyed by underground storm drain systems (Reaches OH-TRIB, OH-AGR, MMC-UPST, MMC-AGR, AGR-N-SCR, MA, MI-1, MI-2, MI-3, and DE). In some cases, headwaters of such streams would be eliminated, but downstream areas would remain intact (Reaches EX, UN-E, UN-W, and UN-N). Overall, implementation of Alternative 3 would increase the HARC Total Scores within minor ephemeral and intermittent drainages onsite by an area-weighted average of 0.16 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of Alternative 3 would change the assessment area of several minor drainages within the RMDP site, as portions of many of these drainages would be eliminated as described above. Overall, implementation of Alternative 3 would decrease the assessment area within the minor intermittent and ephemeral drainages onsite by 23.30 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. When this change in acreage is combined with the changes in HARC Total Scores discussed above, the proposed project would result in a net loss of 13.36 HARC Total Score AW-Score Units, 14.21 HARC Hydrology AW-Score Units, 14.34 HARC Biogeochemical AW-Score Units, and 10.97 HARC Habitat AW-Score Units.

4.3.3.8 Alternative 3 Summary

On a project-wide scale, Alternative 3 would result in a net gain of 124.65 acres of HARC assessment area onsite (coterminous with CDFG jurisdictional area), and would increase the overall functional capacity of the onsite aquatic resources by 98.26 HARC Total Score AW-

Score Units, 22.81 HARC Hydrology AW-Score Units, 47.34 HARC Biogeochemical AW-Score Units, and 170.36 HARC Habitat AW-Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C. Changes in AW-Total Score Units for the river and major onsite drainages are presented in Table 4-4.

4.3.4 Alternative 4

Under this alternative, buried bank stabilization, bridges, grade control structures, debris and detention basins, trail crossings, building pads, temporary haul routes, and a water reclamation plant outfall would be constructed within jurisdictional areas onsite. In addition, certain assessment reaches would be realigned into areas that are currently non-jurisdictional, and new jurisdictional areas would be created adjacent to the existing river corridor. The facilities proposed are depicted graphically in Figure 4-14.

4.3.4.1 Santa Clara River Mainstem

Along the river mainstem, several segments of buried bank stabilization are proposed, and these would affect all seven assessment reaches within the river corridor. However, bank stabilization in each of these reaches would only affect one side of the drainage. One bridge across the river is proposed at Long Canyon (Reach SCR-LO-MID). In addition, the previously permitted bridge at Commerce Center Drive would cross the river at the upstream edge of the project area, in reach SCR-MI. Overall, implementation of the proposed project increase HARC Total Scores within Santa Clara River reaches by an area-weighted average of 0.02 HARC Total Score Units.

Implementation of Alternative 4 would increase the jurisdictional width of the river corridor in some reaches, as existing agricultural areas within the floodplain and adjacent to existing jurisdictional areas would be excavated to channel grade and thereby reconnected hydrologically to the river. These increases would occur primarily in reaches SCR-HU, SCR-LO-UPST, SCR-LO-MID, and SCR-PO. Overall, implementation of Alternative 4 would increase the assessment area within the river mainstem by 68.48 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. Combined with the changes in HARC Score discussed above, Alternative 4 would result in a net gain of 66.43 HARC Total Score AW-Score Units, 22.88 HARC Hydrology AW-Score Units, 32.48 HARC Biogeochemical AW-Score Units, and 124.11 HARC Habitat AW-Score Units within the river mainstem.

4.3.4.2 Potrero Canyon

Within the Potrero Canyon tributary, Alternative 4 would convert the upstream portion (Reaches PO-1, PO-2, and the upstream portion of PO-3) to an underground storm drain system, and the existing jurisdictional drainage would be eliminated in those reaches. Downstream of these reaches, the drainage would be placed into a soft-bottom channel with

TABLE 4-4
RIPARIAN CONDITION RESULTING FROM IMPLEMENTATION OF ALTERNATIVE 3 COMPARED TO EXISTING CONDITION AND ALTERNATIVE 2 (HARC AW-SCORE UNITS)

	Santa Clara River	Chiquito	San Martinez Grande	Lion	Long	Potrero	Salt	Other Drainages	Totals
Existing Condition	579.52	12.59	2.84	5.41	3.55	34.5	71.85	21.27	731.52
Alternative 3	637.56	14.99	10.32	2.44	7.06	46.77	97.05	7.91	824.08
Change	+58.04	+2.4	+7.48	-2.97	+3.51	+12.27	+25.19	-13.36	+92.56
Percentage Change	+10.0%	+19.1%	+236.4%	-54.9%	+98.9%	+35.6%	+35.1%	-62.8%	+12.7%
Alternative 2	622.37	9.62	4.44	2.45	7.03	18.64	97.05	5.61	767.20
Change Relative to Alternative 2	+15.19	+5.37	+5.88	-0.01	+0.03	+28.13	No Change	+2.30	+56.88

FIGURE 4-14
PROPOSED FACILITIES AND LAND USES – ALTERNATIVE 4

IN PREP

Similar to EIS/EIR Figure 3.0-6

buried bank stabilization on both sides. This channel would be generally co-located with the existing drainage, although some minor realignment would occur. Within the lined, soft-bottom channel, grade control structures and bridge crossings would be installed at frequent intervals. In areas where the existing jurisdictional drainage is relatively wide, such as the palustrine fringe wetland in reach PO-4, Alternative 4 would result in narrowing of the stream channel to fit the proposed lined channel. The proposed lined channel would be discontinued immediately upstream of the wetland at the downstream end of Potrero Canyon (Reach PO-7), and no project facilities would be constructed within that reach. Implementation of Alternative 4 would also indirectly facilitate substantial urbanization of the Potrero Canyon sub-watershed. Overall, implementation of Alternative 4 would decrease the HARC Total Scores within Potrero Canyon by an area-weighted average of 0.18 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of Alternative 4 would change the assessment area of several reaches within the Potrero Canyon drainage, as some reaches would be completely eliminated, and others would be routed into fixed-width channels lined with buried bank stabilization. Overall, implementation of this alternative would increase the assessment area within Potrero Canyon by 21.25 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. Combined with the changes in HARC Total Scores discussed above, Alternative 4 would result in a net increase of 6.19 HARC Total Score AW-Score Units, 4.02 HARC Hydrology AW-Score Units, 4.18 HARC Biogeochemical AW-Score Units, and 8.17 HARC Habitat AW-Score Units within the Potrero Canyon tributary.

4.3.4.3 Chiquito Canyon

Under Alternative 4, the entire mainstem of this intermittent tributary (reaches CH-UPST and CH-DNST) would be realigned into a soft-bottom channel that would be constructed parallel to the existing Chiquito Canyon Road right-of-way. This is similar to the actions proposed within this drainage under the proposed project. Although portions of this channel would overlap with existing jurisdictional areas, a substantial amount of realignment and straightening of the drainage would occur. Several grade control structures and bridge crossings are proposed within the lined channel throughout both of these reaches. The majority of the Chiquito Canyon watershed would be urbanized under this alternative, and the three ephemeral, first-order tributaries to this drainage (combined into reach CH-TRIB) would be eliminated and converted to buried storm drains to accommodate this development. The existing confluence where Chiquito Canyon enters the Santa Clara River (reach CH-SCR) would be angled slightly to the west of its current trajectory through the installation of buried bank stabilization along the River. Overall, implementation of Alternative 4 would decrease HARC Total Scores within Chiquito Canyon by an area-weighted average of 0.02 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of the proposed project would change the assessment area of several reaches within the Chiquito Canyon drainage, as the CH-TRIB reach would be completely eliminated, and others would be routed into fixed-width channels lined with buried bank stabilization. Overall, implementation of Alternative 4 would decrease the assessment area within Chiquito Canyon by 2.07 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. Combined with the changes in HARC Total Scores discussed above, Alternative 4 would result in a net loss of 1.71 HARC Total Score AW-Score Units, 4.79 HARC Hydrology AW-Score Units, 2.89 HARC Biogeochemical AW-Score Units, and 0.08 HARC Habitat AW-Score Units within Chiquito Canyon.

4.3.4.4 San Martinez Grande Canyon

Under Alternative 4, this intermittent tributary (reaches SMG-UPST and SMG-DNST) would be realigned into a soft-bottom channel that would be constructed parallel to the existing San Martinez Grande Canyon Road right-of-way. This channel would be identical to that proposed under the proposed project. Although portions of this channel would overlap with existing jurisdictional areas, a substantial amount of realignment and straightening of the drainage would occur. Several grade control structures are proposed within the lined channel throughout both of these reaches, and three new bridge crossings would be installed, one within the reach SMG-UPST and two within SMG-DNST. The majority of the San Martinez Grande Canyon watershed within the project area would be urbanized under this alternative, although a substantial portion would also fall within the proposed San Martinez Grande spineflower preserve. The boundaries of the preserve under this alternative would be the same as those proposed under the proposed project. Overall, implementation of Alternative 4 would decrease the HARC Total Scores within San Martinez Grande Canyon by an area-weighted average of 0.12 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of this alternative would change the assessment area of several reaches within the San Martinez Grande Canyon drainage, as the drainage would be routed into a fixed-width channel lined with buried bank stabilization. Overall, implementation of Alternative 4 would increase the assessment area within San Martinez Grande Canyon by 3.26 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. Combined with the changes in HARC Total Scores discussed above, Alternative 4 would result in a net increase of 1.82 HARC Total Score AW-Score Units, 0.25 HARC Hydrology AW-Score Units, 1.45 HARC Biogeochemical AW-Score Units, and 2.55 HARC Habitat AW-Score Units within the San Martinez Grande Canyon tributary.

4.3.4.5 Long Canyon

Under Alternative 4, the Long Canyon drainage would be placed in a soft-bottom channel lined on both sides by buried soil cement bank stabilization. This channel would feature grade control structures to prevent excessive scour, but the number of structures proposed would be reduced compared to the proposed project, especially in the downstream reaches. As under the proposed project, the downstream-most of reach in Long Canyon (reach LO-AGR) would be completely graded to allow for urban development, and the drainage would be relocated into the proposed soft-bottom channel. Overall, implementation of Alternative 4 would increase the HARC Total Scores within Long Canyon by an area-weighted average of 0.03 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of Alternative 4 would change the assessment area of several reaches within the Long Canyon drainage, as the drainage would be routed into a fixed-width channel lined with buried bank stabilization. Overall, implementation of this alternative would increase the assessment area within Long Canyon by 4.24 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. When this change in acreage is combined with the changes in HARC Total Scores discussed above, Alternative 4 would result in a net gain of 2.99 HARC Total Score AW-Score Units, 3.13 HARC Hydrology AW-Score Units, 2.75 HARC Biogeochemical AW-Score Units, and 3.34 HARC Habitat AW-Score Units within Long Canyon.

4.3.4.6 Lion Canyon

The western branch of this drainage (reach LI-UPST-W) would not require any bank protection, because the reach falls largely into land designated as open space. However, the lower portion of this reach is in an area proposed for development. This portion of the reach would be graded, and streamflows would pass underneath the proposed development via an underground storm drain system. The eastern branch of the drainage (LI-UPST-E) also falls largely within a proposed open space area, and would also not require any bank protection. The only project feature proposed within this reach would be an arch culvert and wildlife under crossing, at the proposed intersection of this drainage with Magic Mountain Parkway. Downstream of the confluence of the eastern and western branches of this drainage (reach LI-DNST), the proposed project would install eight grade control structures. One road crossing is also proposed within this reach. The treatment of Lion Canyon under Alternative 4 would be substantially similar to that envisioned under the proposed project. Overall, implementation of the proposed project would decrease the HARC Total Scores within Lion Canyon by an area-weighted average of 0.13 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of the proposed project would change the assessment area of several reaches within the Lion Canyon drainage, as the drainage would be routed into a fixed-width channel lined with buried bank stabilization. Overall, implementation of the proposed project would decrease the assessment area within Lion Canyon by 3.15 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. When this change in acreage is combined with the changes in HARC Total Scores discussed above, the proposed project would result in a net loss of 2.97 HARC Total Score AW-Score Units, 3.33 HARC Hydrology AW-Score Units, 3.31 HARC Biogeochemical AW-Score Units, and 2.23 HARC Habitat AW-Score Units in Lion Canyon.

4.3.4.7 Other Drainages Onsite

In areas proposed for development, some minor jurisdictional drainages would be eliminated, and flows would instead be conveyed by underground storm drain systems. Reaches OH-TRIB, OH-AGR, MMC-UPST, MMC-AGR, AGR-N-SCR, MA, MI-1, MI-2, MI-3, and DE would be converted to underground storm drains under this alternative. In some cases, headwaters of such streams would be eliminated, but downstream areas would remain intact (Reaches EX, UN-E, UN-W, and UN-N). Overall, implementation of Alternative 4 would increase the HARC Total Scores within minor ephemeral and intermittent drainages onsite by an area-weighted average of 0.17 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of Alternative 4 would change the assessment area of several minor drainages within the RMDP site, as portions of many of these drainages would be eliminated as described above. Overall, implementation of Alternative 4 would decrease the assessment area within the minor intermittent and ephemeral drainages onsite by 24.25 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. When this change in acreage is combined with the changes in HARC Total Scores discussed above, Alternative 4 would result in a net loss of 13.98 HARC Total Score AW-Score Units, 14.84 HARC Hydrology AW-Score Units, 15.02 HARC Biogeochemical AW-Score Units, and 11.5 HARC Habitat AW-Score Units within the minor drainages onsite.

4.3.4.8 Alternative 4 Summary

On a project-wide scale, Alternative 4 would result in a net gain of 89.92 acres of HARC assessment area onsite (coterminous with CDFG jurisdictional area), and would increase the overall functional capacity of the onsite aquatic resources by 82.86 HARC Total Score AW-Score Units, 30.69 HARC Hydrology AW-Score Units, 42.81 HARC Biogeochemical AW-Score Units, and 150.61 HARC Habitat AW-Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C. Changes in AW-Total Score Units for the river and major onsite drainages are presented in Table 4-5.

TABLE 4-5
RIPARIAN CONDITION RESULTING FROM IMPLEMENTATION OF ALTERNATIVE 4 COMPARED TO EXISTING CONDITION AND ALTERNATIVE 2 (HARC AW-SCORE UNITS)

	Santa Clara River	Chiquito	San Martinez Grande	Lion	Long	Potrero	Salt	Other Drainages	Totals
Existing Condition	579.52	12.59	2.84	5.41	3.55	34.5	71.85	21.27	731.52
Alternative 4	645.95	10.88	4.65	2.44	6.53	40.70	96.23	7.29	814.67
Change	+66.43	-1.71	+1.81	-2.97	+2.98	+6.20	+24.38	-13.98	+83.15
Percentage of Change	+11.5%	-13.6%	+63.7%	-54.9%	+83.9%	+18.0%	+33.9%	-65.7%	+11.4%
Alternative 2	622.37	9.62	4.44	2.45	7.03	18.64	97.05	5.61	767.20
Change Relative to Alternative 2	+23.58	-1.26	+0.21	-0.01	-0.50	+22.06	-0.82	+1.68	+47.47

4.3.5 Alternative 5

Under this alternative, buried bank stabilization, bridges, grade control structures, debris and detention basins, trail crossings, building pads, temporary haul routes, and a water reclamation plant outfall would be constructed within jurisdictional areas onsite. In addition, certain assessment reaches would be realigned into areas that are currently non-jurisdictional, and new jurisdictional areas would be created adjacent to the existing river corridor. The facilities proposed are depicted graphically in Figure 4-15.

4.3.5.1 Santa Clara River Mainstem

Along the river mainstem, several segments of buried bank stabilization are proposed, and these would affect all seven assessment reaches within the river corridor. However, bank stabilization in each of these reaches would only affect one side of the drainage, and in most areas the bank stabilization would be constructed outside of the jurisdictional river corridor. Two bridges are proposed across the river, one at Long Canyon (Reach SCR-LO-MID) and one at Potrero Canyon (Reach SCR-PO). In addition, the previously permitted bridge at Commerce Center Drive would cross the river at the upstream edge of the project area, in reach SCR-MI. Overall, implementation of the proposed project would increase the HARC Total Scores within Santa Clara River by an area-weighted average of 0.01 HARC Total Score Units.

Implementation of Alternative 5 would increase the jurisdictional width of the river corridor in some reaches, as existing agricultural areas within the floodplain and adjacent to existing jurisdictional areas would be excavated to channel grade and thereby reconnected hydrologically to the river. These increases would occur primarily in reaches SCR-HU, SCR-LO-UPST, SCR-LO-MID, and SCR-PO. Overall, implementation of Alternative 5 would increase the assessment area within the river mainstem by 53.87 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. Combined with the changes in HARC Score discussed above, Alternative 5 would result in a net gain of 52.75 HARC Total Score AW-Score Units, 10.74 HARC Hydrology AW-Score Units, 18.43 HARC Biogeochemical AW-Score Units, and 106.8 HARC Habitat AW-Score Units within the river mainstem.

4.3.5.2 Potrero Canyon

Within the Potrero Canyon tributary, Alternative 5 would convert the upstream portion (Reaches PO-1, PO-2, and the upstream portion of PO-3) to an underground storm drain system, and the existing jurisdictional drainage would be eliminated in those reaches. Downstream of these reaches, buried bank stabilization would be constructed on either side of the existing drainage, creating a lined channel. The activities proposed in Potrero Canyon under Alternative 5 would differ from the proposed project in that the bank stabilization would be constructed beyond the lateral jurisdictional limits of the drainage, and no

FIGURE 4-15
PROPOSED FACILITIES AND LAND USES – ALTERNATIVE 5

IN PREP

Similar to EIS/EIR Figure 3.0-7

permanent or temporary loss of jurisdictional areas would result from the construction of bank stabilization. Within the lined, soft-bottom channel, grade control structures and bridge crossings would be installed at intervals, but would be reduced in number compared to the proposed project. The proposed lined channel would be discontinued immediately upstream of the wetland at the downstream end of Potrero Canyon (Reach PO-7), and no project facilities would be constructed within that reach. Implementation of Alternative 5 would also indirectly facilitate substantial urbanization of the Potrero Canyon sub-watershed. Overall, implementation of Alternative 5 would decrease the HARC Total Scores within Potrero Canyon by an area-weighted average of 0.12 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of Alternative 5 would change the assessment area of several reaches within the Potrero Canyon drainage, as some reaches would be completely eliminated, and others would be lined with buried bank stabilization. Overall, implementation of this alternative would increase the assessment area within Potrero Canyon by 65.19 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. Combined with the changes in HARC Total Scores discussed above, Alternative 5 would result in a net gain of 40.52 HARC Total Score AW-Score Units, 39.26 HARC Hydrology AW-Score Units, 37.27 HARC Biogeochemical AW-Score Units, and 43.84 HARC Habitat AW-Score Units within the Potrero Canyon tributary.

4.3.5.3 Chiquito Canyon

Under Alternative 5, the entire mainstem of this intermittent tributary (reaches CH-UPST and CH-DNST) would be realigned into a soft-bottom channel that would be constructed parallel to the existing Chiquito Canyon Road right-of-way. Although this is similar to the actions proposed within this drainage under the proposed project, the channel proposed under Alternative 5 would be substantially wider. The majority of this new channel would overlap with existing jurisdictional areas, but some realignment and straightening of the drainage would still be required, especially in the lower portion of reach CH-DNST. Several grade control structures and bridge crossings are proposed within the lined channel throughout both of these reaches. The majority of the Chiquito Canyon watershed would be urbanized under this alternative, and the three ephemeral, first-order tributaries to this drainage (combined into reach CH-TRIB) would be eliminated and converted to buried storm drains to accommodate this development. The existing confluence where Chiquito Canyon enters the Santa Clara River (reach CH-SCR) would be angled slightly to the west of its current trajectory through the installation of buried bank stabilization along the River. Overall, implementation of Alternative 5 would increase the HARC Total Scores within Chiquito Canyon by an area-weighted average of 0.01 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of the proposed project would change the assessment area of several reaches within the Chiquito Canyon drainage, as the CH-TRIB reach would be completely eliminated, and others would be routed into fixed-width channels lined with buried bank stabilization. Overall, implementation of Alternative 5 would increase the assessment area within Chiquito Canyon by 12.62 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. Combined with the changes in HARC Total Scores discussed above, Alternative 5 would result in a net gain of 8.74 HARC Total Score AW-Score Units, 6.35 HARC Hydrology AW-Score Units, 7.18 HARC Biogeochemical AW-Score Units, and 10.89 HARC Habitat AW-Score Units within Chiquito Canyon.

4.3.5.4 San Martinez Grande Canyon

Under Alternative 5, this intermittent tributary (reaches SMG-UPST and SMG-DNST) would be lined with buried bank stabilization and straightened somewhat. Although the majority of this bank stabilization would line the existing jurisdictional areas, some realignment and straightening of the drainage would occur in the downstream end. Several grade control structures are proposed within the lined channel throughout both of these reaches, and three new bridge crossings would be installed, one within the reach SMG-UPST and two within SMG-DNST. The majority of the San Martinez Grande Canyon watershed within the project area would be urbanized under this alternative, although a substantial portion would also fall within the proposed San Martinez Grande spineflower preserve, which would be larger under Alternative 5 than under the proposed project. Overall, implementation of Alternative 5 would decrease the HARC Total Scores within San Martinez Grande Canyon by an area-weighted average of 0.1 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of this alternative would change the assessment area of several reaches within the San Martinez Grande Canyon drainage, as portions of the drainage would be routed into a fixed-width channel lined with buried bank stabilization. Overall, implementation of Alternative 5 would increase the assessment area within San Martinez Grande Canyon by 16.64 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. Combined with the changes in HARC Total Scores discussed above, Alternative 5 would result in a net gain of 11.39 HARC Total Score AW-Score Units, 10.61 HARC Hydrology AW-Score Units, 10.35 HARC Biogeochemical AW-Score Units, and 12.66 HARC Habitat AW-Score Units within the San Martinez Grande Canyon tributary.

4.3.5.5 Long Canyon

Under Alternative 5, the treatment of the Long Canyon drainage would be substantially the same as that proposed under Alternative 4, described above. Overall, implementation of Alternative 5 would increase the HARC Total Scores within Long Canyon by an area-weighted average of 0.04 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of Alternative 5 would change the assessment area of several reaches within the Long Canyon drainage, as the drainage would be routed into a fixed-width channel lined with buried bank stabilization. Overall, implementation of this alternative would increase the assessment area within Long Canyon by 4.24 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. When this change in acreage is combined with the changes in HARC Total Scores discussed above, Alternative 5 would result in a net increase of 3.05 HARC Total Score AW-Score Units, 3.39 HARC Hydrology AW-Score Units, 2.84 HARC Biogeochemical AW-Score Units, and 3.34 HARC Habitat AW-Score Units within Long Canyon.

4.3.5.6 Lion Canyon

The western branch of this drainage (reach LI-UPST-W) would not require any bank protection, because the reach falls largely into land designated as open space. However, the lower portion of this reach is in an area proposed for development. This portion of the reach would be graded, and streamflows would pass underneath the proposed development via an underground storm drain system. The eastern branch of the drainage (LI-UPST-E) also falls largely within a proposed open space area, and would also not require any bank protection. The only project feature proposed within this reach would be an arch culvert and wildlife under crossing, at the proposed intersection of this drainage with Magic Mountain Parkway. Downstream of the confluence of the eastern and western branches of this drainage (reach LI-DNST), the proposed project would install eight grade control structures. One bridge is also proposed within this reach. Overall, implementation of the proposed project would decrease the HARC Total Scores within Lion Canyon by an area-weighted average of 0.13 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of the proposed project would change the assessment area of several reaches within the Lion Canyon drainage, as the drainage would be routed into a fixed-width channel lined with buried bank stabilization. Overall, implementation of the proposed project would decrease the assessment area within Lion Canyon by 3.15 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. When this change in acreage is combined with the changes in HARC Total Scores discussed above, the proposed project would result in a net loss of 2.97 HARC Total Score AW-Score Units, 3.33 HARC Hydrology AW-Score Units, 3.31 HARC Biogeochemical AW-Score Units, and 2.23 HARC Habitat AW-Score Units in Lion Canyon.

4.3.5.7 Other Drainages Onsite

In areas proposed for development, some minor jurisdictional drainages would be eliminated, and flows would instead be conveyed by underground storm drain systems. Reaches OH-TRIB, OH-AGR, MMC-UPST, MMC-AGR, AGR-N-SCR, MA, MI-1, MI-2, MI-3, and DE would be converted to underground storm drains under this alternative. In some cases, headwaters of such streams would be eliminated, but downstream areas would remain intact (Reaches EX, UN-E, UN-W, and UN-N). Overall, implementation of Alternative 5 would increase the HARC Total Scores within minor ephemeral and intermittent drainages onsite by an area-weighted average of 0.16 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of Alternative 5 would change the assessment area of several minor drainages within the RMDP site, as portions of many of these drainages would be eliminated as described above. Overall, implementation of Alternative 5 would decrease the assessment area within the minor intermittent and ephemeral drainages onsite by 24.26 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. When this change in acreage is combined with the changes in HARC Total Scores discussed above, the proposed project would result in a net loss of 14.14 HARC Total Score AW-Score Units, 14.85 HARC Hydrology AW-Score Units, 15.11 HARC Biogeochemical AW-Score Units, and 11.78 HARC Habitat AW-Score Units.

4.3.5.8 Alternative 5 Summary

On a project-wide scale, Alternative 5 would result in a net gain of 146.83 acres of HARC assessment area onsite (coterminous with CDFG jurisdictional area), and would increase the overall functional capacity of the onsite aquatic resources by 123.01 HARC Total Score AW-Score Units, 73.89 HARC Hydrology AW-Score Units, 80.36 HARC Biogeochemical AW-Score Units, and 189.40 HARC Habitat AW-Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C. Changes in AW-Total Score Units for the river and major onsite drainages are presented in Table 4-6.

4.3.6 Alternative 6

Under this alternative, buried bank stabilization, bridges, grade control structures, debris and detention basins, trail crossings, building pads, temporary haul routes, and a water reclamation plant outfall would be constructed within jurisdictional areas onsite. In addition, certain assessment reaches would be realigned into areas that are currently non-jurisdictional, and new jurisdictional areas would be created adjacent to the existing river corridor. The facilities proposed are depicted graphically in Figure 4-16.

TABLE 4-6
RIPARIAN CONDITION RESULTING FROM IMPLEMENTATION OF ALTERNATIVE 5 COMPARED TO EXISTING CONDITION AND ALTERNATIVE 2 (HARC AW-SCORE UNITS)

	Santa Clara River	Chiquito	San Martinez Grande	Lion	Long	Potrero	Salt	Other Drainages	Totals
Existing Condition	579.52	12.59	2.84	5.41	3.55	34.5	71.85	21.27	731.5
Alternative 5	632.26	21.33	14.23	2.44	6.60	75.02	95.82	7.12	854.8
Change	+52.74	+8.74	+11.99	-2.97	+3.05	+40.52	+23.97	+14.15	+123.3
Percent of Change	+9.1%	+69.4%	+422.2%	-54.9%	+85.9%	+117.4%	+33.4%	+66.5%	+16.9%
Alternative 2	622.37	9.62	4.44	2.45	7.03	18.64	97.05	5.61	767.20
Change Relative to Alternative 2	+9.89	+11.71	+9.79	-0.01	-0.43	+56.38	-1.23	+1.51	+87.62

FIGURE 4-16
PROPOSED FACILITIES AND LAND USES – ALTERNATIVE 6

IN PREP

Similar to EIS/EIR Figure 3.0-8

4.3.6.1 Santa Clara River Mainstem

Along the river mainstem, several segments of buried bank stabilization are proposed, and these would affect all seven assessment reaches within the river corridor. However, bank stabilization in each of these reaches would only affect one side of the drainage, and in most areas the bank stabilization would be constructed outside of the jurisdictional river corridor. Two bridges are proposed across the river, one at Long Canyon (Reach SCR-LO-MID) and one at Potrero Canyon (Reach SCR-PO). The bridge at Commerce Center Drive, previously permitted to cross the river at the upstream edge of the project area, in reach SCR-MI, would not be constructed under this alternative. Overall, implementation of the proposed project would increase the HARC Total Scores within Santa Clara River reaches by an area-weighted average of 0.06 HARC Total Score Units.

Implementation of Alternative 6 would increase the jurisdictional width of the river corridor in some reaches, as existing agricultural areas within the floodplain and adjacent to existing jurisdictional areas would be excavated to channel grade and thereby reconnected hydrologically to the river. These increases would occur primarily in reaches SCR-HU, SCR-LO-UPST, SCR-LO-MID, and SCR-PO. Overall, implementation of Alternative 6 would increase the assessment area within the river mainstem by 66.51 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. Combined with the changes in HARC Score discussed above, Alternative 6 would result in a net gain of 104.08 HARC Total Score AW-Score Units, 40.76 HARC Biogeochemical AW-Score Units, and 125.69 HARC Habitat AW-Score Units within the river mainstem. However, this alternative would also result in a net loss of 5.22 HARC Hydrology AW-Score Units within the river mainstem.

4.3.6.2 Potrero Canyon

Within the Potrero Canyon tributary, Alternative 6 would involve the construction of buried bank stabilization beyond the lateral jurisdictional limits of the drainage, along the entire length of the tributary. No permanent or temporary loss of jurisdictional areas would result from the construction of bank stabilization, and grade control structures would not be constructed within Potrero Canyon under this alternative. Implementation of Alternative 6 would indirectly facilitate substantial urbanization of the Potrero Canyon sub-watershed, although the extent of this urbanization would be less than would occur under the proposed project because the Potrero spineflower preserve would be larger under Alternative 6. Overall, implementation of Alternative 6 would decrease the HARC Total Scores within Potrero Canyon by an area-weighted average of 0.1 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of Alternative 6 would increase the assessment area of several reaches within the Potrero Canyon drainage, as the existing channel would be widened and additional floodplain/terrace areas would be created. Overall, implementation of this alternative would increase the assessment area within Potrero Canyon by 127.57 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. Combined with the changes in HARC Total Scores discussed above, Alternative 6 would result in a net gain of 86.89 HARC Total Score AW-Score Units, 80.34 HARC Hydrology AW-Score Units, 79.55 HARC Biogeochemical AW-Score Units, and 90.33 HARC Habitat AW-Score Units within the Potrero Canyon tributary.

4.3.6.3 Chiquito Canyon

Under Alternative 6, the entire mainstem of this intermittent tributary (reaches CH-UPST and CH-DNST) would be realigned into a soft-bottom channel that would be constructed parallel to the existing Chiquito Canyon Road right-of-way. The treatment of this drainage under Alternative 6 would be substantially similar to the actions proposed under Alternative 3. Although portions of this channel would overlap with existing jurisdictional areas, a substantial amount of realignment and straightening of the drainage would occur. Several grade control structures and bridge crossings are proposed within the lined channel throughout both of these reaches. The majority of the Chiquito Canyon watershed would be urbanized under this alternative, and some of the ephemeral, first-order tributaries to this drainage (combined into reach CH-TRIB) would be eliminated and converted to buried storm drains to accommodate this development. The existing confluence where Chiquito Canyon enters the Santa Clara River (reach CH-SCR) would be angled slightly to the west of its current trajectory through the installation of buried bank stabilization along the River. Overall, implementation of Alternative 6 would increase the HARC Total Scores within Chiquito Canyon by an area-weighted average of 0.01 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of the proposed project would change the assessment area of several reaches within the Chiquito Canyon drainage, as the CH-TRIB reach would be completely eliminated, and others would be routed into fixed-width channels lined with buried bank stabilization. Overall, implementation of Alternative 6 would increase the assessment area within Chiquito Canyon by 4.52 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. Combined with the changes in HARC Total Scores discussed above, Alternative 6 would result in a net increase of 3.33 HARC Total Score AW-Score Units, 1.26 HARC Biogeochemical AW-Score Units, and 5.01 HARC Habitat AW-Score Units within Chiquito Canyon. However, Alternative 6 would also result in a loss of 0.55 HARC Hydrology AW-Score Units in this drainage.

4.3.6.4 San Martinez Grande Canyon

Under Alternative 6, this intermittent tributary (reaches SMG-UPST and SMG-DNST) would be lined with buried bank stabilization along one side, and bank stabilization would be constructed beyond the lateral limits of the existing jurisdictional drainage. One grade control structure is proposed within the lined channel, in reach SMG-AGR downstream of SR-126. Two new bridge crossings would be installed, one within the reach SMG-UPST and one within SMG-DNST. The majority of the San Martinez Grande Canyon watershed within the project area would be urbanized under this alternative, although a substantial portion would also fall within the proposed San Martinez Grande spineflower preserve. The boundaries of this preserve would be the same under this alternative as under the proposed project. Overall, implementation of Alternative 6 would decrease the HARC Total Scores within San Martinez Grande Canyon by an area-weighted average of 0.07 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of this alternative would change the assessment area of several reaches within the San Martinez Grande Canyon drainage, as new jurisdictional areas would be created between the existing stream channel and proposed bank stabilization. Overall, implementation of Alternative 6 would increase the assessment area within San Martinez Grande Canyon by 20.04 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. Combined with the changes in HARC Total Scores discussed above, Alternative 6 would result in a net gain of 14.35 HARC Total Score AW-Score Units, 13.32 HARC Hydrology AW-Score Units, 12.91 HARC Biogeochemical AW-Score Units, and 14.99 HARC Habitat AW-Score Units within the San Martinez Grande Canyon tributary.

4.3.6.5 Long Canyon

Under Alternative 6, the downstream portion of the Long Canyon drainage (reach LO-DNST) would be routed into a soft-bottom channel lined with buried bank stabilization. Although a portion of this channel would overlap with the existing jurisdictional area, a substantial portion of the drainage would be realigned and the new channel would flow through what is currently an upland area. Grade control structures would be installed at intervals within the lined channel. In the upstream reach, the drainage would be left in its natural state with the exception of an arch culvert and wildlife under crossing that would be constructed where the proposed Magic Mountain Parkway alignment intersects the stream. Overall, implementation of Alternative 6 would decrease the HARC Total Scores within Long Canyon by an area-weighted average of 0.01 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of Alternative 6 would change the assessment area of several reaches within the Long Canyon drainage, as the drainage would be routed into a fixed-width channel lined with buried bank stabilization. Overall, implementation of this alternative would increase the assessment area within Long Canyon by 2.18 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. When this change in acreage is combined with the changes in HARC Total Scores discussed above, Alternative 6 would result in a net increase of 1.28 HARC Total Score AW-Score Units, 2.03 HARC Hydrology AW-Score Units, 1.43 HARC Biogeochemical AW-Score Units, and 2.19 HARC Habitat AW-Score Units within Long Canyon.

4.3.6.6 Lion Canyon

The western branch of this drainage (reach LI-UPST-W) would not require any bank protection, because the reach falls largely into land designated as open space. However, the lower portion of this reach is in an area proposed for development. This portion of the reach would be graded, and streamflows would pass underneath the proposed development via an underground storm drain system. The eastern branch of the drainage (LI-UPST-E) also falls largely within a proposed open space area, and would also not require any bank protection. The only project feature proposed within this reach would be an arch culvert and wildlife under crossing, at the proposed intersection of this drainage with Magic Mountain Parkway. Downstream of the confluence of the eastern and western branches of this drainage (reach LI-DNST), eight grade control structures would be installed. One bridge is also proposed within this reach. Overall, implementation of the proposed project would decrease the HARC Total Scores within Lion Canyon by an area-weighted average of 0.08 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of the proposed project would change the assessment area of several reaches within the Lion Canyon drainage, as the drainage would be routed into a fixed-width channel lined with buried bank stabilization. Overall, implementation of the proposed project would decrease the assessment area within Lion Canyon by 3.15 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. When this change in acreage is combined with the changes in HARC Total Scores discussed above, the proposed project would result in a net loss of 2.78 HARC Total Score AW-Score Units, 3.52 HARC Hydrology AW-Score Units, 3.31 HARC Biogeochemical AW-Score Units, and 2.23 HARC Habitat AW-Score Units in Lion Canyon.

4.3.6.7 Other Drainages Onsite

In areas proposed for development, some minor jurisdictional drainages would be eliminated, and flows would instead be conveyed by underground storm drain systems. Reaches OH-TRIB, OH-AGR, MMC-UPST, MMC-AGR, AGR-N-SCR, MA, and MI-1 would be converted to underground storm drains under this alternative. In some cases, headwaters of such streams would be eliminated, but downstream areas would remain intact (Reaches EX, DE, UN-E, and UN-W). Overall, implementation of Alternative 6 would increase the HARC Total Scores within minor ephemeral and intermittent drainages onsite by an area-weighted average of 0.15 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of Alternative 6 would change the assessment area of several minor drainages within the RMDP site, as portions of many of these drainages would be eliminated as described above. Overall, implementation of Alternative 6 would decrease the assessment area within the minor intermittent and ephemeral drainages onsite by 19.06 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. When this change in acreage is combined with the changes in HARC Total Scores discussed above, the proposed project would result in a net loss of 10.1 HARC Total Score AW-Score Units, 10.46 HARC Hydrology AW-Score Units, 10.83 HARC Biogeochemical AW-Score Units, and 8.08 HARC Habitat AW-Score Units within minor drainages onsite.

4.3.6.8 <u>Alternative 6 Summary</u>

On a project-wide scale, Alternative 6 would result in a gain of 221.68 acres of HARC assessment area onsite (coterminous with CDFG jurisdictional area), and would increase the overall functional capacity of the onsite aquatic resources by 216.65 HARC Total Score AW-Score Units, a gain of 104.27 HARC Hydrology AW-Score Units, gain of 145.77 HARC Biogeochemical AW-Score Units, and an increase of 254.96 HARC Habitat AW-Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C. Changes in AW-Total Score Units for the river and major onsite drainages are presented in Table 4-7.

4.3.3 Alternative 7

Under this alternative, buried bank stabilization, bridges, grade control structures, debris and detention basins, trail crossings, building pads, temporary haul routes, and a water reclamation plant outfall would be constructed within jurisdictional areas onsite. In addition, certain assessment reaches would be realigned into areas that are currently non-jurisdictional, and new jurisdictional areas would be created adjacent to the existing river corridor. The facilities proposed are depicted graphically in Figure 4-17.

4.3.7.1 <u>Santa Clara River Mainstem</u>

Along the river mainstem, several segments of buried bank stabilization are proposed, and these would affect all seven assessment reaches within the river corridor. However, bank stabilization would be constructed outside of the jurisdictional river corridor, and would be located far enough set back from the stream to pass the FEMA 100-Year flood. One bridge is proposed across the river, at Long Canyon (Reach SCR-LO-MID). The bridge at Commerce Center Drive, previously permitted to cross the river at the upstream edge of the project area, in reach SCR-MI, would not be constructed under this alternative. Overall, implementation of the proposed project would increase the HARC Total Scores within Santa Clara River by an area-weighted average of 0.04 HARC Total Score Units.

TABLE 4-7
RIPARIAN CONDITION RESULTING FROM IMPLEMENTATION OF ALTERNATIVE 6 COMPARED TO EXISTING CONDITION AND ALTERNATIVE 2 (HARC AW-SCORE UNITS)

	Santa Clara River	Chiquito	San Martinez Grande	Lion	Long	Potrero	Salt	Other Drainages	Totals
Existing Condition	579.52	12.59	2.84	5.41	3.55	34.5	71.85	21.27	731.52
Alternative 6	683.60	15.92	17.19	2.63	4.83	121.39	91.75	11.16	948.46
Change	+104.08	+3.33	+14.35	-2.78	+1.28	+86.89	+19.9	-10.11	+216.94
% of Change	+18.0%	+26.4%	+505.3%	-51.4%	+36.1%	+251.9%	+27.7%	-47.5%	+29.7%
Alternative 2	622.37	9.62	4.44	2.45	7.03	18.64	97.05	5.61	767.20
Change Relative to Alternative 2	+61.23	+6.30	+12.75	+0.18	-2.20	+102.75	-5.05	+5.55	+181.26

FIGURE 4-17
PROPOSED FACILITIES AND LAND USES – ALTERNATIVE 7

IN PREP

Similar to EIS/EIR Figure 3.0-9

Implementation of Alternative 7 would increase the jurisdictional width of the river corridor in some reaches, as existing agricultural areas within the floodplain and adjacent to existing jurisdictional areas would be excavated to channel grade and thereby reconnected hydrologically to the river. These increases would occur primarily in reaches SCR-HU, SCR-LO-UPST, SCR-LO-MID, and SCR-PO. Overall, implementation of Alternative 7 would increase the assessment area within the river mainstem by 279.24 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. Combined with the changes in HARC Score discussed above, Alternative 7 would result in a net gain of 254.08 HARC Total Score AW-Score Units, 212.01 HARC Hydrology AW-Score Units, 224.88 HARC Biogeochemical AW-Score Units, and 301.25 HARC Habitat AW-Score Units within the river mainstem.

4.3.7.2 Potrero Canyon

Within the Potrero Canyon tributary, Alternative 7 would involve the construction of buried bank stabilization beyond the lateral jurisdictional limits of the drainage, along the entire length of the tributary. No permanent or temporary loss of jurisdictional areas would result from the construction of bank stabilization, and grade control structures would not be constructed within Potrero Canyon under this alternative. Implementation of Alternative 7 would indirectly facilitate substantial urbanization of the Potrero Canyon sub-watershed. Overall, implementation of Alternative 7 would decrease the HARC Total Scores within Potrero Canyon by an area-weighted average of 0.11 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of Alternative 7 would increase the assessment area of several reaches within the Potrero Canyon drainage, as the existing channel would be widened and additional floodplain/terrace areas would be created. Overall, implementation of this alternative would increase the assessment area within Potrero Canyon by 147.30 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. Combined with the changes in HARC Total Scores discussed above, Alternative 7 would result in a net gain of 98.73 HARC Total Score AW-Score Units, 97.87 HARC Hydrology AW-Score Units, 93.47 HARC Biogeochemical AW-Score Units, and 104.12 HARC Habitat AW-Score Units within the Potrero Canyon tributary.

4.3.7.3 Chiquito Canyon

Under Alternative 7, buried bank stabilization would be constructed along the east bank of the Chiquito Canyon drainage, but would be placed beyond the lateral limits of the jurisdictional stream. No grade control structures are proposed in Chiquito Canyon under this alternative. Three bridges are proposed to cross the stream within reach CH-DNST. The majority of the Chiquito Canyon watershed would be urbanized under this alternative.

Overall, implementation of Alternative 7 would increase the HARC Total Scores within Chiquito Canyon by an area-weighted average of 0.01 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of the proposed project would change the assessment area of several reaches within the Chiquito Canyon drainage, as new jurisdictional areas would be created between the existing stream channel and the proposed stabilization on the east bank. Overall, implementation of Alternative 7 would increase the assessment area within Chiquito Canyon by 38.09 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. Combined with the changes in HARC Total Scores discussed above, Alternative 7 would result in a net gain of 26.23 HARC Total Score AW-Score Units, 26.03 HARC Hydrology AW-Score Units, 26.91 HARC Biogeochemical AW-Score Units, and 21.06 HARC Habitat AW-Score Units within Chiquito Canyon.

4.3.7.4 San Martinez Grande Canyon

Under Alternative 7, this intermittent tributary (reaches SMG-UPST and SMG-DNST) would be lined with buried bank stabilization along one side, and bank stabilization would be constructed beyond the lateral limits of the existing jurisdictional drainage. One grade control structure is proposed within the lined channel, in reach SMG-AGR downstream of SR-126. Two new bridge crossings would be installed, one within the reach SMG-UPST and one within SMG-DNST. The majority of the San Martinez Grande Canyon watershed within the project area would be urbanized under this alternative, although a substantial portion would also fall within the proposed San Martinez Grande spineflower preserve, which would be larger than under the proposed project. Overall, implementation of Alternative 7 would decrease the HARC Total Scores within San Martinez Grande Canyon by an area-weighted average of 0.08 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of this alternative would change the assessment area of several reaches within the San Martinez Grande Canyon drainage, as new jurisdictional areas would be created between the existing stream channel and proposed bank stabilization. Overall, implementation of Alternative 7 would increase the assessment area within San Martinez Grande Canyon by 21.05 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. Combined with the changes in HARC Total Scores discussed above, Alternative 7 would result in a net gain of 14.91 HARC Total Score AW-Score Units, 14.87 HARC Hydrology AW-Score Units, 14.13 HARC Biogeochemical AW-Score Units, and 16.04 HARC Habitat AW-Score Units within the San Martinez Grande Canyon tributary.

4.3.7.5 Long Canyon

Under Alternative 7, buried bank stabilization would be constructed along the entire length of the Long Canyon drainage, but would be constructed beyond the lateral limits of the jurisdictional stream. No grade control structures would be constructed in Long Canyon. Two bridges are proposed, one at the proposed Magic Mountain Parkway crossing, and another in the downstream portion of the drainage. Overall, implementation of Alternative 7 would increase the HARC Total Scores within Long Canyon by an area-weighted average of 0.06 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of Alternative 7 would change the assessment area of several reaches within the Long Canyon drainage, as the drainage would be routed into a fixed-width channel lined with buried bank stabilization. Overall, implementation of this alternative would increase the assessment area within Long Canyon by 37.87 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. When this change in acreage is combined with the changes in HARC Total Scores discussed above, Alternative 7 would result in a net gain of 25.99 HARC Total Score AW-Score Units, 25.10 HARC Hydrology AW-Score Units, 24.34 HARC Biogeochemical AW-Score Units, and 28.52 HARC Habitat AW-Score Units within Long Canyon.

4.3.7.6 Lion Canyon

No bank protection or grade control structures would be installed within Lion Canyon under this alternative. Three road crossings are proposed, two of which would be arch culverts with wildlife under crossings. Overall, implementation of the proposed project would decrease the HARC Total Scores within Lion Canyon by an area-weighted average of 0.08 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of the proposed project would change the assessment area of several reaches within the Lion Canyon drainage due to the construction of project features. Overall, implementation of the proposed project would increase the assessment area within Lion Canyon by 7.83 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. When this change in acreage is combined with the changes in HARC Total Scores discussed above, the proposed project would result in a net increase of 5.02 HARC Total Score AW-Score Units, 4.78 HARC Hydrology AW-Score Units, 4.55 HARC Biogeochemical AW-Score Units, and 5.66 HARC Habitat AW-Score Units in Lion Canyon.

4.3.7.7 Other Drainages Onsite

In areas proposed for development, some minor jurisdictional drainages would be eliminated, and flows would instead be conveyed by underground storm drain systems. Reaches OH-

AGR, MMC-UPST, MMC-AGR, AGR-N-SCR would be converted to underground storm drains under this alternative. In some cases, headwaters of such streams would be eliminated, but downstream areas would remain intact (Reaches EX and DE). Overall, implementation of Alternative 7 would increase the HARC Total Scores within minor ephemeral and intermittent drainages onsite by an area-weighted average of 0.10 HARC Total Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C.

Implementation of Alternative 7 would change the assessment area of several minor drainages within the RMDP site, as portions of many of these drainages would be eliminated as described above. Overall, implementation of Alternative 7 would decrease the assessment area within the minor intermittent and ephemeral drainages onsite by 14.33 acres. Exact changes in acreage for each reach are presented in tabular format in Appendix C. When this change in acreage is combined with the changes in HARC Total Scores discussed above, the proposed project would result in a net loss of 7.29 HARC Total Score AW-Score Units, 8.11 HARC Hydrology AW-Score Units, 8.63 HARC Biogeochemical AW-Score Units, and 4.60 HARC Habitat AW-Score Units.

4.3.7.8 Alternative 7 Summary

On a project-wide scale, Alternative 7 would result in a net gain of 540.12 acres of HARC assessment area onsite (coterminous with CDFG jurisdictional area), and would increase the overall functional capacity of the onsite aquatic resources by 442.57 HARC Total Score AW-Score Units, gain of 396.37 HARC Hydrology AW-Score Units, gain of 403.64 HARC Biogeochemical AW-Score Units, and an increase of 504.09 HARC Habitat AW-Score Units. Exact changes in HARC Scores for all metrics and all reaches are presented in tabular format in Appendix C. Changes in AW-Total Score Units for the river and major onsite drainages are presented in Table 4-8.

Table 4-9 provides a comparative summary of the impacts all seven alternatives considered in this analysis, based on the number HARC AW-Total Score Units that would be present under each alternative.

The HARC revealed patterns in the relative quality of wetland and riparian habitats within Newhall Ranch. Reaches with low functional scores represent locations where future restoration opportunities may be appropriate. Restoration may consist of direct activities such as invasive plant removal and channel reconfiguration, or more indirect methods, such as removing an artificial source of hydrology (e.g., direct runoff from an adjacent agricultural field) and removing cattle from an area. Reaches with high scores represent locations where avoidance and minimization may be warranted. Reaches with low scores may be suitable locations for development, especially if restoration is not practicable.

TABLE 4-8
RIPARIAN CONDITION RESULTING FROM IMPLEMENTATION OF ALTERNATIVE 7 COMPARED TO EXISTING CONDITION AND ALTERNATIVE 2 (HARC AW-SCORE UNITS)

	Santa Clara River	Chiquito	San Martinez Grande	Lion	Long	Potrero	Salt	Other Drainages	Totals
Existing Condition	579.52	12.59	2.84	5.41	3.55	34.5	71.85	21.27	731.52
Alternative 7	833.60	38.81	17.75	10.43	29.54	133.23	97.04	13.97	1,174.38
Change	+254.08	+26.22	+14.91	+5.02	+25.99	+98.73	+25.19	-7.30	442.86
Percentage Change	+43.8%	+208.3%	+525.0%	+92.8%	+732.1%	+286.2%	+35.1%	-34.3%	+60.5%
Alternative 2	622.37	9.62	4.44	2.45	7.03	18.64	97.05	5.61	767.20
Change Relative to Alternative 2	+211.23	+29.19	+13.31	+7.98	+22.51	+114.59	-0.01	+8.36	+407.18

TABLE 4-9
SUMMARY OF IMPACTS TO RIPARIAN CONDITION – ALL ALTERNATIVES

Reach Score	Santa Clara River	Chiquito	San Martinez Grande	Lion	Long	Potrero	Salt	Other Drainages	Totals
Existing Condition	579.5	12.6	2.8	5.4	3.6	34.5	71.9	21.3	731.5
Alternative 2	622.4	9.6	4.4	2.5	7.0	18.6	97.1	5.6	767.2
Change	42.9	-3.0	1.6	-3.0	3.5	-15.9	25.2	-15.7	35.7
Percentage of Change	7%	-24%	56%	-55%	98%	-46%	35%	-75%	5%
Alternative 3	637.6	15.0	10.3	2.4	7.1	46.8	97.1	7.9	824.1
Change	58.0	2.4	7.5	-3.0	3.5	12.3	25.2	-13.4	92.6
Percentage of Change	10%	19%	263%	-55%	99%	36%	35%	-63%	13%
Change (Alt 3 v. 2)	15.2	5.4	5.9	0.0	0.0	28.1	0.0	2.3	56.9
Alternative 4	646.0	10.9	4.7	2.4	6.5	40.7	96.2	7.3	814.7
Change	66.4	-1.7	1.8	-3.0	3.0	6.2	24.4	-14.0	83.2
Percentage of Change	11%	-14%	64%	-55%	84%	18%	34%	-66%	11%
Change (Alt 4 v. 2)	23.6	1.3	0.2	0.0	-0.5	22.1	-0.8	1.7	47.5
Alternative 5	632.3	21.3	14.2	2.4	6.6	75.0	95.8	7.1	854.8
Change	52.7	8.7	11.4	-3.0	3.1	40.5	24.0	-14.2	123.3
Percentage of Change	9%	69%	401%	-55%	86%	117%	33%	-67%	17%
Change (Alt 5 v. 2)	9.9	11.7	9.8	0.0	-0.4	56.4	-1.2	1.5	87.6
Alternative 6	683.6	15.9	17.2	2.6	4.8	121.4	91.8	11.2	948.5
Change	104.1	3.3	14.4	-2.8	1.3	86.9	19.9	-10.1	216.9
Percentage of Change	18%	26%	505%	-51%	36%	252%	28%	-48%	30%
Change (Alt 6 v. 2)	61.2	6.3	12.8	0.2	-2.2	102.8	-5.3	5.6	181.3
Alternative 7	833.6	38.8	17.8	10.4	29.5	133.2	97.0	14.0	1,174.4
Change	254.1	26.2	14.9	5.0	26.0	98.7	25.2	-7.3	442.8

TABLE 4-9 (CONTINUED)
SUMMARY OF IMPACTS TO RIPARIAN CONDITION – ALL ALTERNATIVES

Reach Score	Santa Clara River	Chiquito	San Martinez Grande	Lion	Long	Potrero	Salt	Other Drainages	Totals
Percentage of Change	44%	208%	525%	93%	732%	286%	35%	-34%	61%
Change (Alt 7 v. 2)	211.2	29.2	13.3	8.0	22.5	114.6	0.0	8.4	407.2

5.1 RELATIONSHIP TO ALTERNATIVES ANALYSIS

This HARC provides data on the condition of wetland/riparian habitats found on Newhall Ranch. The numbers of AW-Score Units present pre- and post-project are anticipated to be a major factor in the evaluation of alternatives to the proposed project, as well as in the determination of the Least Environmentally Damaging Practicable Alternative (LEDPA) for the project.

5.2 PROTECTION OF UNIQUE HABITATS

As stated in Section 4, the assessment identified three unique wetland types within the project area: riverine alkali, seep, and slope wetlands. These wetland types are regionally rare, and are supported by groundwater discharge (Corps 2003). This hydrological situation results in the formation of hydric soils supporting wetland plant communities adapted to alkaline conditions, which often display a high proportion of native plant species. These wetland communities would be difficult to re-create or mitigate elsewhere if impacted by development activities. The six reaches within which these wetlands occur were among the highest scoring reaches across the project area, and included SA-3/4, PO-4/7, and MI-5/6. It is recommended that these reaches be candidates for protection, avoidance and/or minimization measures. These wetlands are also sensitive to indirect impacts, such as changes in upstream hydrology that may cause a “type change” of vegetation (e.g., a *Typha* sp. invasion into an alkali marsh after freshwater flow augmentation).

5.3 RESTORATION OF DEGRADED REACHES

The results of the HARC may provide guidance to future restoration work, with the goal of improving wetland function by increasing the scores for applicable metrics. For example, repairing the cause (change in hydroperiod) and symptoms (isolation of floodplain) of channel incision would elevate the Floodplain Connection metric (increase Hydrology function), as well as provide additional wetland/riparian habitat. Or, in some locations, diverting an artificial source of hydrology (e.g., agricultural runoff) would improve hydrologic function of the reach. Removing cattle grazing from various reaches would reduce soil compaction (increase of Biogeochemical attribute) and allow the herbaceous plant layer to recover (increase of Habitat attribute). Removing invasive plant species and providing buffers would maintain and/or increase Habitat function scores.

5.4 SALT CREEK CONSERVATION AREA

As identified in the Newhall Ranch Specific Plan, the entire Salt Creek sub-watershed (High Country SMA and Salt Creek dedication area) has been identified for preservation. This preserve area contains two reaches, SA-3 and SA-4, which contain high quality riverine alkali wetlands. Aside from the presence of a few invasive but not dominant plant species, these are high-quality wetlands and preserving these resources will serve to conserve wetland type diversity in the landscape, as well as unique plant communities, thereby enhancing biodiversity. Monitoring and invasive species removal activities will be necessary to improve and maintain the quality of these wetlands. The presence of *Tamarix* sp., an invasive species tolerant of alkaline conditions, is an immediate threat to these wetlands.

Ambrose, R.F., Callaway, J.C., and S.F. Lee. 2006. An evaluation of compensatory mitigation projects permitted under Clean Water Act Section 401 by the California State Water Resources Control Board, 1992-2002. Final report (review copy) prepared for the State of California, California Environmental Protection Agency, and California State Water Resources Control Board. August. 153p. <URL: www.swrcb.ca.gov/>.

Brinson, M.M. 1993. A Hydrogeomorphic Classification of Wetlands. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

California Department of Forestry and Fire Protection (CDF). 2003. Simi-Verdale Final Report: Emergency Watershed Protection Assessment, Simi and Verdale Incidents, November 10, 2003. <URL: http://frap.cdf.ca.gov/socal03/reports/>.

Cal-IPC. 2006. California Invasive Plant Inventory. Cal-IPC Publication 2006-02. California Invasive Plant Council, Berkeley, CA. 39p. <URL: http://www.cal-ipc.org>.

Center for Watershed Protection (CWP). 2007. Glossary. <URL: http://www.cwp.org/ wetlands/articles/glossary.pdf> Accessed: March 2, 2007.

Chipps, S.R., D.E. Hubbard, K.B. Werlin, Neil J. Haugerud, K.A. Powell, J. Thompson, and T. Johnson. 2006. Association between wetland disturbance and biological attributes in floodplain wetlands. Wetlands 26(2): 497-508.

Chung, Y.C. 2006. Cumulative impacts to riparian wetlands in the Aliso Creek and San Juan Creek Watersheds. Doctoral Dissertation, Environmental Science and Engineering Program, School of Public Health, UCLA. 279p.

Collins, J.N., E.D. Stein, M. Sutula, R. Clark, A.E. Fetscher, L. Grenier, C. Grosso, and A. Wiskind. 2007. California Rapid Assessment Method (CRAM) for Wetlands and Riparian Areas. Version 5.0. 151p. <URL: http://www.cramwetlands.org>.

Collins, J.N., Stein, E.S., and M. Sutula (authors in alphabetical order). 2004. DRAFT California Rapid Assessment Method (CRAM) for Wetlands – User's Manual and Scoring Forms. Version 2.0. January 27. http://www.wrmp.org/cram.html.

Collins, J.N., E.D. Stein, M. Sutula, R. Clark, A.E. Fetscher, L. Grenier, C. Grosso, and A. Wiskind. 2006. California Rapid Assessment Method (CRAM) for Wetlands and Riparian Areas. Version 4.2.3. 136 p. <URL: http://www.cramwetlands.org>.

Cowardin, L.M., V. Carter, F.C.Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the U.S. U.S. Fish and Wildlife Service, Washington, D.C.

David Magney Environmental Consulting (DMEC). 2000. Calleguas Creek Watershed Wetland Restoration Plan. October. <URL: http://www.magney.org/files/reports.htm>.

Dieterich, M., and N.H. Anderson. 1998. Dynamics of abiotic parameters, solute removal and sediment retention in summer-dry headwater streams of western Oregon. Hydrobiologia 379:1-15.

Environmental Laboratory. 1987. Corps of Engineers Wetland Delineation Manual. Technical Report Y-87-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Environmental Services Division, CDFG (ESD-CDFG). 1994. A Field Guide to Lake and Streambed Alteration Agreements Sections 1600-1607, California Fish and Game Code. Sacramento, California. January.

Fennessy, M.S., A.D. Jacobs, and M.E. Kentula. 2007. An evaluation of rapid methods for assessing the ecological condition of wetlands. Wetlands 27(3): 453-560.

2004. Review of Rapid Methods for Assessing Wetland Condition. EPA/620/R-04/009. U.S. Environmental Protection Agency, Washington, D.C. 75p. <URL: http://www. wrmp.org/docs/cram/EPA_Rapid_Method_Review.pdf>.

Ferren, W.R., P.L. Fiedler, and R.A. Leidy. 1996. Wetlands of the Central and Southern California Coast and Coastal Watersheds. Final Report Prepared for the USEPA, Region IX. San Francisco, CA. February. http://ucjeps. berkeley. edu/ wetlands/titlepag.html.

Hauer, F.R., and R.D. Smith. 1998. The hydrogeomorphic approach to Functional Assessment of riparian wetlands: evaluating impacts and mitigation on river floodplains in the U.S.A. Freshwater Biology 40: 517-530.

Houlahan, J.E., P.A. Keddy, K. Makkay, and C.S. Findlay. 2006. The effects of adjacent land use on wetland species richness and community composition. Wetlands 26(1): 79-96.

Hychka, K.C., D. H. Wardrop, and R.P. Brooks. 2007. Enhancing a landscape assessment with intensive data: a case study in the Upper Juniata watershed. Wetlands 27(3): 446-461.

Jones, J.B., and L.A. Smock. 1991. Transport and retention of particulate organic matter in two low-gradient headwater streams. Journal of the North American Benthological Society 10(2):115-126.

Kusler, J. 2006. Recommendations for Reconciling Wetland Assessment Techniques. Institute for Wetland Science and Public Policy, The Association of State Wetland Managers, Inc. 120p. <URL: http://www.aswm.org>.

2004a. Wetland Assessment in the Courts. Final Report 2: Wetland Assessment for Regulatory Purposes. Institute for Wetland Science and Public Policy, The Association of State Wetland Managers, Inc. 64p. <URL: http://www.aswm.org>.

2004b. Assessing Functions and Values. Final Report 1: Wetland Assessment for Regulatory Purposes. Institute for Wetland Science and Public Policy, The Association of State Wetland Managers, Inc. 120p. <URL: http://www.aswm.org>.

2004c. Integrating Wetland Assessment into Regulatory Permitting: Recommendations and a Proposed Assessment Process. Final Report 3: Wetland Assessment for Regulatory Purposes. Institute for Wetland Science and Public Policy, The Association of State Wetland Managers, Inc. 133p. <URL: http://www.aswm.org>.

Larsen, E.S. 2007. Regulation, Characterization, and Assessment of Riparian Habitat in Federal and State Jurisdiction, Orange County, CA. Doctoral Dissertation, Environmental Science and Engineering Program, School of Public Health, UCLA. 537p.

Lee et al. (“et al” is not sufficient – need proper reference for this one) 1996. Draft HGM Guidebook for the Northern Portions of the California Central Coast between Pacifica and Santa Cruz.

Lee, L.C., Rains, M.C., Mason, J.A., and W.J. Kleindl. 1997. Peer Review Draft Guidebook to Hydrogeomorphic Functional Assessment of Riverine Waters/Wetlands in the Santa Margarita Watershed. The National Wetland Science Training Cooperative, Seattle, WA.

Lee, L.C., Fieldler, P.L., Stewart, S.R., Curry, R.R., Partridge, D.J., Mason, J.A., Inlander, E.M., Almy, R.B., Aston, D.L., and M.E. Spencer. 2001. Draft Guidebook for Reference Based Assessment of the Functions of Riverine Waters/Wetlands Ecosystems in the South Coast Region of Santa Barbara County, California. Santa Barbara County Water Agency, Santa Barbara, CA.

Lichvar, R., Gustina, G., and M. Ericsson. 2003. Planning Level Delineation and Geospatial Characterization of Aquatic Resources for San Jacinto and Portions of Santa Margarita Watersheds, Riverside County, California. ERDC/CRREL TR-03-4. March.

MacNeil, S.D. 2001. Hydrogeomorphic Assessment of Aliso Creek Watershed Streams: Developing a Foundation for Holistic Permitting and Management. Dissertation, UC Los Angeles.

McCune, B., Grace, J.B. 2002. Analysis of Ecological Communities. MjM Software Design, Gleneden Beach, OR. 300p.

McCune, B., Mefford, M.J. 1999. PC-ORD. Multivariate analysis of ecological data, Version 4. Mjm Software Design, Gleneden Beach, Oregon, USA. <URL: http://www.ptinet.net/~mjm >.

Minitab Inc. 2005. Minitab Statistical Software, Release 14.20 for Windows. State College, PA, USA. <URL: http://www.minitab.com >.

PCR Services Corporation. 2000a. Functional Assessment: Characterization and Functional Assessment of Aquatic Resources in Segunda Deshecha on the Talega Project Site for Talega Associates, Orange County, California. (revised July 2000).

2000b. Biological Resource Assessment of the Proposed Santa Clara River Significant Ecological Area. Santa Clara River (Including existing SEA Nos. 19, 23, and 61). Final Report.

Poff, N.L., Allan, J.D., Bain, M.B., Karr, J.R., Prestegaard, K.L., Richter, B.D., Sparks, R.E., and J.C. Stromberg. 1997. The Natural Flow Regime: A Paradigm for River Conservation and Restoration. BioScience 47(11):769-784.

Reed, P.B. 1988. National List of Plant Species that Occur in Wetlands: California (Region 0). US Fish and Wildlife Service Biology Report 88(26.10). 135p. [*see also* Reed, P.B. 1996. Draft National List of Plant Species that Occur in Wetlands: California (Region 0). US Fish and Wildlife Service. <URL: http://enterprise.nwi.fws.gov/list96.htm >.

Rheinhardt, R.D., Brinson, M.M., and P.M. Farley. 1997. Applying wetland reference data to functional assessment, mitigation, and restoration. Wetlands 17(2): 195-215.

Rosgen, D.L. 1984. A classification of natural rivers. Catena 22: 169-199.

Smith, R.D. 2003. Assessment of Riparian Ecosystem Integrity: San Jacinto and Upper Santa Margarita River Watersheds, Riverside County, California. U.S. Army Engineer Research and Development Center, Waterways Experiment Station, Vicksburg, MS. Final Report to the U.S. Army Corps of Engineers, Los Angeles District.

Smith, R.D., Ammann, A., Bartoldus, C., and M.M. Brinson. 1995. An Approach for Assessing Wetland Functions Using Hydrogeomorphic Classification, Reference Wetlands, and Functional Indices. Technical Report WRP-DE-9. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS.

Stein, E.D. and R.F. Ambrose. 1998. A rapid impact assessment method for use in a regulatory context. Wetlands 18: 379-392.

Sutula, M.A., Stein, E.D., Collins, J.N., Fetscher, A.E., and R. Clark. 2006. A practical guide for the development of a wetland assessment method: the California experience. Journal of the American Water Resources Association. Paper No. 04215. February. Pages 157-175.

Tiner, R.W. 1999. Wetland indicators: a guide to wetland identification, delineation, classification, and mapping. Lewis Publishers/CRC Press, Boca Raton, FL, USA. 392p.

URS Corporation (URS). 2003. Jurisdictional Delineation, Newhall Ranch Project, for a Portion of the Santa Clara River and its Tributaries, Los Angeles County, California. Draft Report.

U.S. Army Corps of Engineers (Corps). 2004a. Application for permit, Notice of Intent to Prepare a Draft EIS/EIR and Notice of a Public Scoping Meeting. Public Notice and document dated January 20, 2004. <URL: http://www.spl.usace.army.mil/regulatory/pn/pubnot.html >.

2004b. Appendix A: Wetlands and other waters of the U.S. Within the Los Angeles District. In: Mitigation and Monitoring Guidelines. Public Notice and document dated January 27. <URL: http://www.spl.usace.army.mil/regulatory/mmg.pdf >.

2004c. Intent to Prepare a Draft Environmental Impact Statement/Environmental Impact Report (DEIS/DEIR) for Proposed Future Permit Actions Under Section 404 of the Clean Water Act for the Newhall Ranch Specific Plan and Associated Facilities Along Portions of the Santa Clara River and its Side Drainages, in Los Angeles County, CA. Department of the Army; Corps of Engineers. Federal Register Vol. 69, No. 19.

2001a. Final Summary Report: Guidelines for Jurisdictional Determinations for Waters of the United States in the Arid Southwest. South Pacific Division. <URL: http://spl.usace.army.mil/ regulatory.html >.

2001b. Minimum Standards for Acceptance of Preliminary Wetlands Delineations. Sacramento District, Regulatory Branch. November 30. <URL: http://spk.usace.army.mil/cpk-co/regulatory.html >.

1997. National Action Plan to Implement the Hydrogeomorphic Approach to Assessing Wetland Functions. Federal Register Vol. 62, No. 119, Pages 33607-33620.

U.S. Department of Agriculture (USDA). 2002. Field Indicators of Hydric Soils in the United States: Guide for Identifying and Delineating Hydric Soils, Version 5.0. Natural Resources Conservation Service, Wetland Science Institute, Soil Survey Division. 34p.

U.S. Fish and Wildlife Service (USFWS). 1995. Endangered and Threatened Wildlife and Plants; Final Rule Determining Endangered Status for the Southwestern Willow Flycatcher. Department of the Interior; Fish and Wildlife Service. Federal Register Vol. 60, Pages 10694-10715.

1994. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for the Arroyo Southwestern Toad. Department of the Interior; Fish and Wildlife Service. Federal Register Vol. 59, No. 241, Pages 64859-64866.

1986. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for the Least Bell's Vireo. Final Rule. Department of the Interior; Fish and Wildlife Service. Federal Register Vol. 51, Pages 16474-16482.

1980a. Endangered and Threatened Wildlife and Plants; Proposed Designation of Critical Habitat for the Endangered Unarmored Threespine Stickleback. Department of the Interior; Fish and Wildlife Service. Federal Register Vol. 45, No. 223, Pages 76012-76015.

1980b. Habitat Evaluation Procedure (HEP) Manual (102 ESM). Division of Ecological Services, Washington, D.C.

Weller, D.E., M.N. Snyder, D.F. Whigham, A.D. Jacobs, and T.E. Jordan. 2007. Landscape indicators of wetland condition I the Nanticoke River watershed, Maryland and Delaware, USA. Wetlands 27(3): 498-514.

Wijte, A., Wechsler, S.P., Adelson, M.G., and T.I. Sweaney. 2006. Final Report: Assessment of status of riverine wetlands in the Santa Ana and San Jacinto River Watersheds. Prepared for the Santa Ana Regional Water Quality Control Board. Submitted for review November 30. 97p. < URL: http://www.swrcb.ca.gov/>.

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A.1 INTRODUCTION

The purpose of this assessment is to characterize and evaluate the condition of wetland and riparian habitats within the Newhall Ranch project area. A Hybrid Assessment of Riparian Condition (HARC) method was developed by combining components of three established functional assessment methods adapted for use at the project site.

A.1.1 Metrics and Attributes

The HARC metrics are indicators of wetland condition (or quality), and were evaluated quantitatively (and semi-quantitatively) in this assessment. Every metric was scaled to have a value, or metric score, between 0 (degraded condition) and 1.0 (optimal condition). These metric scores were the basic components used to calculate the HARC scores. A total of 21 different metrics were initially measured; 15 metrics were included in the final method (see Table A-1). Individual metrics were modified for use in particular wetland functional types (e.g., riverine vs. slope wetlands), allowing for equal comparison among all reaches, and thus all wetland functional types, after completion of the assessment. The metrics are organized into two main parts- those used in the final method (Part I; M-1 through M-15) and those that were excluded (Part II; EM-1 through EM-6). Within each part, the metrics are divided up in to the following attribute categories: buffer, hydrology, abiotic (or physical) structure, and biotic (or biological) structure. The range of metrics used to assess the condition of hydrology, biogeochemical, and habitat attributes of wetland and riparian areas on Newhall Ranch are described below. These metrics were adapted from assessment methods as described in the HARC document text.

A.1.2 Main Channel and Tributaries

The HGM methods, in particular, make provisions for stream size, position in the watershed, and gradient (e.g., Lee et al. 1997, 2001; MacNeil 2001). An example would be the development of two sets of metric rating scales- one for large streams of high order (such as the Santa Clara River), and one set for low order, headwater drainages (such as the tributaries). This same approach was utilized in the HARC, albeit to a lesser degree than HGM methods. The HARC includes some provisions for Santa Clara River vs. tributaries, as well as riverine vs. seep/slope wetlands. The following metrics include some modification: Land Use Land Cover, Hydroperiod, Floodplain Connection, Flood Prone Area, Topographic Complexity, Substrate Condition, Vertical Biotic Structure, Canopy Cover, and Age Distribution (the latter two were eventually excluded from the final HARC calculations). Other metrics are sufficiently general that no direct provision for Santa Clara River vs. tributary is necessary. In these cases, the evaluator considers the same metrics, but evaluates the metrics using a larger scale. For example, a Santa Clara River reach would entail evaluating a larger area of stream channel than a tributary, but a general evaluation of quality is still possible in both cases. Also, because the plot-based approach is common to all reaches

TABLE A-1
HARC METRICS (BASED ON TABLE 3-1 FROM THE HARC TEXT)

Attributes[1]	Metric	Function Group[2]	Source Method[3]	Example Functions per Attribute Group[4]
Buffer (three metrics, 20 percent of total metrics)	~~Percent of area with buffer*~~	~~Geo~~	~~CRAM~~	• Moderation of groundwater flow • Nutrient cycling • Maintenance of plant and animal communities
	Average buffer width	Geo	CRAM	
	Buffer condition	Geo	CRAM	
	Land use land cover	Geo	LLFA	
Hydrology (five metrics, 33 percent of total metrics)	Source	Hydro, Geo	CRAM	• Moderation of groundwater flow • Surface/Subsurface water storage • Nutrient cycling • Removal of elements and compounds • Retention of particulates • Export of organic carbon • Maintenance of plant and animal communities
	Hydroperiod	Hydro, Geo	CRAM	
	Floodplain connection	Hydro, Geo	CRAM	
	~~Altered hydraulic conveyance~~	~~Hydro, Geo~~	~~LLFA~~	
	Surface water persistence	Hydro, Geo	SMR HGM	
	Flood prone area	Hydro, Geo	SMR HGM	
Abiotic Structure (two metrics, 13 percent of total metrics)	~~Sediment Regime~~	~~Geo~~	~~LLFA~~	• Surface/Subsurface water storage • Dissipation of energy; flood control • Maintenance of plant and animal communities
	Topographic complexity	Geo, Hab	CRAM	
	Substrate condition	Geo, Hab	CRAM	
Biotic Structure (five metrics, 33 percent of total metrics)	Vertical biotic structure	Hab	CRAM	• Dissipation of energy; flood control • Nutrient cycling • Removal of elements and compounds • Retention of particulates • Export of organic carbon • Maintenance of plant and animal communities
	Interspersion and zonation	Hab	CRAM	
	Nativeness	Hab	SMR HGM	
	~~Canopy~~	~~Hab~~	~~SMR HGM~~	
	~~Age distribution~~	~~Hab~~	~~SMR HGM~~	
	Riparian vegetation condition	Hab	LLFA	
	Riparian corridor continuity	Hab	LLFA	
	~~Invasive, exotic plants~~	~~Hab~~	~~LLFA~~	

Strikethrough text represents the metrics that were excluded from the final analysis; these metrics are discussed in Part II of Appendix A.

1 Overall, the HARC is based on CRAM, which measures attributes including buffer, hydrology, abiotic, and biotic structure.

2 Attributes are grouped into Hydrology (‘Hydro’), Biogeochemical (‘Geo’), and Habitat (‘Hab’).

3 Source methods used to develop the HARC methods; table format based on Smith et al. (1995), Hauer and Smith (1998).

irrespective of Santa Clara River vs. tributary, comparison between sites is reasonable. Yet, at the same time, it should be recognized that a 0.5 score for a given metric, such as Flood Prone Area, would mean something different for a Santa Clara River reach than a 0.5 score for a small tributary. For each location (Santa Clara River, tributary), the rating score suggests low quality in both cases. This does not mean, though, that the widths are similar the metric is scaled for the site context. In the case of Flood Prone Area, the bankful channel would be different between the Santa Clara River and tributary; thus, stating that the Flood Prone Area is twice the bankful channel may mean a width of one meter for a small tributary, and 100 meters for a major river.

A.1.3 Reaches, Assessment Areas, and Plots

The basic unit of the HARC analysis is the reach, a homogeneous unit of a drainage separated by other reaches by various indicators of functional change (see Table 3-2 of HARC document). The assessment area (AA) for the HARC may be thought of as equivalent to a reach, although often the more important term is the assessment width. The width would be 50 meter perpendicular section through the reach, inclusive of both Corps and CDFG jurisdictional areas. Some metrics rely on the assessment width for determining a score. For some data collected, especially data for the habitat metrics, the plot data was averaged across two or three plots sampled within the bank full, floodplain and terrace geomorphic units of a reach. The intent was to capture the variability within a reach due to geomorphic position (i.e., bank full, floodplain, terrace).

Note**:** For most metrics, modification was necessary from the original text. Acronyms in [ ] refer to the source methodology from which the metric is based.

A.2 METRICS USED IN THE PRESENT VERSION OF THE HARC

A.2.1 Metrics Related to Buffer

A.2.1.1 M-1 (Metric-1): Average Width of Buffer [CRAM Version 2.0; also Referred to as "Average Buffer Width"]

A.2.1.1.1 Definition. Buffer width was measured in meters along lines-of-sight perpendicular to the wetland boundary.

Step 1: The perimeter of the Assessment Area was divided into four sections.

Step 2: Width of the buffer in each of the four sections was estimated, up to a maximum value of 100 meters per side.

Step 3: The arithmetic mean of the four estimated widths was calculated to derive an average width of buffer for the reach.

The assessment method for this attribute was the same across all wetland classes. Assessment was initiated by GIS analysis in the office and verified through field measurements. Scores were assigned following the guidelines in Table A-2.

TABLE A-2
SCORING GUIDELINES: AVERAGE BUFFER WIDTH

Metric	Score
> 100 m	1.0
60 – 100 m	0.75
30 – 60 m	0.50
< 30 m	0.10
None	0.0

A.2.1.2 M-2: Buffer Condition [CRAM version 2.0]/Adjacent Area to Corps/CDFG Jurisdiction

A.2.1.2.1 Definition. Buffer condition was assessed according to its vegetative cover, substrate condition, and indicators of disturbance. These conditions were assessed only for the portion of the reach border already identified or defined as buffer. In instances where two sides featured significantly different buffers, each side was evaluated and the mean score was assumed to be representative of buffer condition in the reach. Scores were assigned following the guidelines in Table A-3.

TABLE A-3
SCORING GUIDELINES: BUFFER CONDITION

Metric	Score
Area is characterized by natural, undisturbed upland with native vegetation and lack of invasive plants, lack of substrate disturbance, and lack of trash.	1.0
Buffer appears to have been moderately disturbed and may be characterized by presence of invasive plants, etc., (minor to moderate amounts of trash or debris visible); abandoned field; shrubland or Buffer recently burned, but recoverable; dirt road crossing; or mowed, non-native ruderal.	0.75
Disced ruderal; dry-land farming; active agriculture.	0.50
Dirt road, not recoverable; residential; pastureland; landscaped park.	0.25
Buffer is highly disturbed, barren ground visible with highly compacted soils, moderate to high amounts of trash and other large debris; urban or industrial.	0.10
No buffer present.	0.0

A.2.1.3 M-3: Land Use/Land Cover (LULC) [LLFA]

Four sub-indicators were used to evaluate the LULC metric. Sub-indicators were calculated based on the percentage of the drainage basin with LULC types having the potential to increase the nutrient, pesticide, hydrocarbon, or sediment loading in downstream surface waters. The reference standard condition was defined as <5 percent of the watershed and surrounding landscape area containing these LULC types. This metric was assessed at the tributary scale (e.g., Potrero Canyon sub-watershed), and reflects upland areas adjacent to and upstream from a particular reach. For tributaries, all LULC within the sub-basin that drains into a particular reach was considered. For the Santa Clara River (SCR) reaches, all LULC within 300 meters was considered.

Example stressors include active oil production platforms, septic tanks, unpaved roads, etc. Indicator scores were assigned based on the range of indicator values in Table A-4.

TABLE A-4
SCORING GUIDELINES: LAND USE/LAND COVER

Metric	Score
<5 percent of watershed/landscape with LULC types that increase N/P/H/S.	1.0
>5 and <15 percent of watershed/landscape with LULC types that increase N/P/H/S; or recently burned open space.	0.75
>15 and <30 percent of watershed/landscape with LULC types that increase N/P/H/S.	0.50
>30 and <50 percent of watershed/landscape with LULC types that N/P/H/S.	0.25
>50 percent of watershed/landscape with LULC types that increase N/P/H/S.	0.10

A.2.2 Metrics Related to Hydrology

A.2.2.1 M-4: Water Source [CRAM Version 2.0; also Referred to as "Source"]

A.2.2.1.1 Definition. Source of water describes the primary origin of water input to the assessment reach and the degree to which water input has been affected or is controlled by anthropogenic activities or land use changes. This metric was assessed at the reach scale, and scores were influenced by upstream activities. Example stressors included septic tanks, outfalls, urban and agricultural runoff, etc. Scores were assigned following the guidelines in Table A-5.

A.2.2.2 M-5: Hydroperiod [CRAM Version 2.0]

A.2.2.2.1 Definition. Hydroperiod is the seasonal and (in some wetlands) daily pattern of water level fluctuation. Hydroperiod defines regular changes in the duration, frequency, timing, and extent or depth of inundation or saturation in a wetland.

TABLE A-5
SCORING GUIDELINES: SOURCE

Metric	Score
Water source derived from precipitation, groundwater and/or natural overland or tributary flow from catchment. No indications of artificial water sources.	1.0
Source of water is primarily natural; however, may receive occasional or small amounts of inflow from anthropogenic sources, such as urban runoff, seepage, agriculture or POTW discharge. Natural flow regime.	0.75
Source of water is primarily anthropogenic, and receives inflow from anthropogenic sources, such as urban runoff, seepage, agriculture or POTW discharge. Non-natural flow regime.	0.50
Primarily supported by direct irrigation, pumped water, artificially impounded water, or other artificial hydrology; may be perennialized flow; channel incision present.	0.25
No natural or non-natural flows occur at the present time.	0.0

A.2.2.2.2 Indicators. This metric evaluates changes in the hydroperiod of a wetland and the degree to which these changes affect the structure and composition of the wetland plant community. Field indicators included focus on changes to the plant community and evaluation of the physical properties such as slope, flow augmentation or diversion, upstream impoundments, etc.

A.2.2.2.3 Riverine Reaches. It is assumed that changes in either peak flow or base flow can affect riverine form and function. However, changes in peak flow will have a more profound effect because of changes to channel slope, hydraulic radius, and width to depth ratio. Decreases in base flow, especially during the dry season, can influence the availability of water for fish and wildlife.

This metric was assessed initially using site imaging, and scores were confirmed or adjusted based on field indicators. Site imaging analysis involved reviewing maps and aerial photos of the surrounding watershed for evidence of diversions, flow augmentations, or upstream constrictions. Dams and other upstream impoundments were considered to impact Hydroperiod if they controlled more than 25 percent drainage area upstream of the assessment area or if they were close enough to the assessment area to substantially affect the magnitude or timing of inflows. Diversions were considered to affect Hydroperiod if they routinely reduced either base flow or storm flow to the assessment reach by more than 15 percent. Constrictions of the active channel within 1 km (upstream) of the assessment area were also considered as hydrologic alterations. In riverine reaches, the Hydroperiod metric was scored following the guidelines presented in Table A-6a.

A.2.2.2.4 Depressional, Lacustrine, Slope and Seep Wetlands. Hydroperiod for depressional and lacustrine wetlands was evaluated based on a review of surrounding land uses and evidence of any diversions or augmentations of flow to the wetland.

TABLE A-6a
RIVERINE SCORING GUIDELINES: HYDROPERIOD

Metric	Score
Subject to natural peak flows and base flow.	1.0
Peak flow relatively natural, but base flows altered either by augmentation or reduction; or Reach has recently burned, but is recoverable; temporary peak flows are anticipated.	0.75
Peak flows altered by upstream activities (augmentation or reduction), but base flows are relatively natural.	0.50
Assessment area is subject to alteration of both peak flow and base flow. Recoverable.	0.25
Assessment area is subject to alteration of both peak flow and base flow. Not recoverable.	0.10

Field indicators for altered hydroperiod in slope or seep wetlands included evidence of diverting, ditching or draining in or around the wetland. Additional field indicators may include encroachment of terrestrial vegetation or desiccation during periods of the year when comparable wetlands are typically inundated or saturated. In agricultural or range settings, spring boxes upstream of the wetland may suggest a diversion. In depressional, lacustrine, slope and seep wetlands, the Hydroperiod metric was scored according to the guidelines in Table A-6b.

TABLE A-6b
SLOPE/SEEP SCORING GUIDELINES: HYDROPERIOD

Metric	Score
Subject to natural hydroperiod; the “natural flow regime.”	1.0
Hydroperiod minimally altered; however alteration has little to no effect on plant community as evidenced by a lack of indicators.	0.75
Hydroperiod moderately altered such that it moderately affects the plant community.	0.50
Hydroperiod severely altered such that plant community is substantially degraded or reduced in extent as evidenced by a prevalence of indicators. Variable is recoverable.	0.25
Hydroperiod severely altered such that plant community is substantially degraded or reduced in extent as evidenced by a prevalence of indicators. Variable is not recoverable.	0.10

A.2.2.3 M-6: Floodplain Connection [CRAM Version 2.0]

A.2.2.3.1 Definition. Floodplain connection describes the relationship between riverine wetlands and the adjacent floodplain that influences the ability of water to flow into or out of the wetland or to inundate adjacent uplands during high water periods.

A.2.2.3.2 Field Indicators. Scoring of this metric was based solely on field indicators, including channel incision and evidence of occasional inundation of banks or terraces.

A.2.2.3.3 Riverine Reaches. Indicators for floodplain connection in riverine, estuarine, and lagoon wetlands were based on evidence of overbank flow, such as wrack, debris, fine sediment deposits, and evidence of ponding on benches adjacent to the stream or tidal channel. The extent and vigor of adjacent riparian or hydric vegetation can also provide an indicator for this attribute. Finally, structural conditions, such as depth, presence of levees, and condition of the bank were used to score this attribute. In riverine reaches, the Floodplain Connection metric was scored according to the guidelines presented in Table A-7.

TABLE A-7
SCORING GUIDELINES: FLOODPLAIN CONNECTION

Metric	Score
Adjacent to an unrestricted floodplain that is comprised of natural or open space lands or agricultural lands.	1.0
In most years, storm flows or storm surges can escape the active channel and access adjacent benches, riparian areas, or the marsh plain. However, unnatural levees, berms or adjacent land uses restricts the extent of overbank inundation; or naturally confined channel.	0.75
Moderate channel constriction, incision, bank armoring agricultural constraint, or adjacent road precludes water from accessing adjacent benches, riparian areas or the marsh plain, except in very high flows; however, access is still possible.	0.50
All overbank flow beyond the bankfull channel is contained within a defined conveyance or channel and cannot access adjacent riparian areas, benches or marsh plain.	0.25
Channel is channelized and contains concrete or rip-rap slopes/bottom.	0.0

A.2.2.4 M-7: Surface Water Persistence/Recharge [SMR HGM]

Surface Water Persistence refers to the duration of flow/ponding or surface saturation in a stream or wetland, and affects groundwater recharge. Perennial streams and wetlands that store ponded water for more than one day would score higher than ephemeral/intermittent streams and wetlands with no features allowing ponding/storage to occur. Metric scores were assigned based on the range of indicator values in Table A-8.

A.2.2.5 M-8: Flood Prone Area [SMR HGM]

This metric assesses the extent to which flood flows are impeded. Slope (non-riverine) wetlands would not be subject to the width requirements. Scores were assigned following the guidelines in Table A-9.

A.2.3 Structure – Abiotic [also Referred to as “Physical Structure”]

A.2.3.1 M-9: Topographic Complexity [CRAM Version 2.0]

A.2.3.1.1 Definition. Topographic complexity is the presence or absence of a variety of elevation or depth zones within a wetland that provide niches for fauna, surfaces for growth

TABLE A-8
SCORING GUIDELINES: SURFACE WATER PERSISTANCE

Measurement	Score
Evidence of surface water ponding/storage on floodplain for greater than one day (intermittent). Substrate porosity is such that runoff persists; floodplain has complex microtopographic relief; or perennially flowing/saturated; or adjacent wetlands.	1.0
Evidence of surface water ponding/storage on floodplain for greater than one day (intermittent). Floodplain has simple microtopographic relief. (Non-wetland floodplain).	0.75
Evidence of surface water ponding/storage for less than one day (ephemeral).	0.50
Assessment area provides no features for ponding/storing water. Variable is recoverable and sustainable through natural processes.	0.25
Assessment area provides no features for ponding/storing water. Variable is not recoverable and sustainable through natural processes under current conditions.	0.0

TABLE A-9
SCORING GUIDELINES: FLOODPRONE AREA

Measurement	Score
Floodprone area not modified by cultural processes. FPA > 2.0x bankfull width.	1.0
Floodprone area confined by artificial structure(s) or culturally accelerated channel incision is minimal; FPA > 2.0x bankfull width; disturbance affects one side of drainage; or naturally v-shaped channels for small drainages.	0.75
Floodprone area is artificially confined or culturally accelerated channel incision is present; FPA > 1.5x bankfull width; disturbance affects one side of drainage.	0.50
Floodprone area is artificially confined or culturally accelerated channel incision is present; FPA < 1.5x bankfull width; disturbance affects both sides of drainage; variable is recoverable through natural processes under current conditions.	0.25
Floodprone area is artificially confined or culturally accelerated channel incision is present; FPA < 1.5x bankfull width; disturbance affects both sides of drainage Variable is not recoverable through natural processes under current conditions.	0.10
Floodprone area is completely modified by concrete and/or rip-rap; disturbance affects both sides of drainage; variable is not recoverable through natural processes under current conditions.	0.0

of a variety of plant species, areas that modify flow/hydrology, and zones that promote biogeochemical processes. This metric is different than abiotic patch richness in that it evaluates the relative abundance or distribution of physical zones within the assessment area, whereas abiotic patch richness addresses solely the number of different habitat types.

A.2.3.1.2 <u>Field Indicators</u>. The typical indicators are usually habitat elements or habit features within a wetland class. Care must be taken to distinguish indicators of topographic complexity or habitat features within a wetland from different kinds of wetlands.

A.2.3.1.3 Riverine Reaches. Topographic complexity in riverine reaches was evaluated by counting the number of features that affected elevation or influenced the path of water flow along a transect across the assessment area. Trampling, filling, burying or other alterations of topographic features indicated a degraded condition. Lower order riverine wetlands have inherently less topographic complexity (hence fewer categories) and have more subtle indicators of topographic complexity, such as large rocks, middens, or accumulations of woody debris. In riverine reaches, the Topographic Complexity metric was scored as shown in Table A-10a.

TABLE A-10a
RIVERINE SCORING GUIDELINES: TOPOGRAPHIC COMPLEXITY

Metric	Score
Assessment area is dominated by a complex arrangement of micro and macro topographic features, such as meanders, bars, benches, secondary channels, backwaters, roots, pits, and ponds. Higher gradient systems may contain plunge-pool sequences.	1.0
Some macrotopographic features present, such as secondary channels; however, the complexity and interspersion of such features has been reduced by substrate alteration, flooding, grazing, trampling, or placement of fill material; or naturally v-shaped channel is a small drainage.	0.75
Assessment area consists of a single channel without macrotopographic features such as benches or secondary channels; however, the channel has microtopographic features such as bars, braiding, and presence of woody debris.	0.50
Assessment area consists of a single channel without macrotopographic features such as benches or secondary channels; however, the channel has microtopographic features such as bars, braiding, and presence of woody debris. Features may be the result of anthropogenic disturbance.	0.25
Assessment area consists of a uniform, straight channel with no substantive topographic features.	0.10

A.2.3.1.4 Seeps and Springs. Topographic complexity in slope or seep wetlands is indicated by changes in slope, ponded areas, or mounds. These areas typically support plant communities with different tolerances to inundation/saturation, or salinity. In slope and seep wetlands, the Topographic Complexity metric was evaluated as shown in Table A-10b.

A.2.3.2 M-10: Substrate Condition [CRAM version 2.0]

A.2.3.2.1 Definition. Substrate Condition describes the presence of intact (unaltered) soil that is subject to regular saturation or inundation and exhibits an accumulation of organic matter or coarse litter. Coarse litter consists of the fallen stems, leaves, and other small parts of plants that accumulate on the wetland surface and that can be morphologically identified.

A.2.3.2.2 Field Indicators. Field indicators of substrate condition include presence/absence of organic materials and the degree to which soils have been compacted.

TABLE A-10b
SLOPE/SEEP SCORING GUIDELINES: TOPOGRAPHIC COMPLEXITY

Metric	Score
Assessment area has a variety of slopes that support different moisture and/or alkalinity gradients. Each sub-slope contains features such as mounds and pits. Assessment area is characterized by a variety of elevations or zones that provide a diversity of moisture regimes. These elevation zones may or may not be indicated by different plant communities or evidence or visible topographic features (e.g., islands, bars).	1.0
Assessment area has a variety of slopes that support different moisture and/or alkalinity gradients; however, each sub-slope lacks topographic features, such as mounds and pits. Assessment area has some degree of elevation complexity; reduced or moderate number or width of zones.	0.75
Assessment area has a single, uniform slope. However, that slope has topographic features such as mounds and pits. Assessment area has some degree of elevation complexity; reduced or moderate number or width of zones.	0.50
Assessment area has a single, uniform slope with little to no topographic features. Assessment area is homogeneous with little to no variety of elevations, moisture regimes, or plant communities.	0.25

A.2.3.2.3 Riverine Reaches. Substrate condition in riverine wetlands was evaluated by observing evidence of redoximorphic features, ponding, or organic matter accumulation on the surface or within the top 30 cm of substrate. Special attention was given to pits, ponds, and backwaters as well as the portion of the floodplain that was within the assessment area. Indicators of good Substrate Condition may include leaf litter accumulation, coarse woody debris, dried algal mats, algal coating on sand grains in the channel bed, or organic streaking in the soil horizon. Excessive sediment deposition, filling, down cutting, trampling, or compaction may reduce Substrate Condition. In riverine reaches, the Substrate Condition metric was scored as shown in Table A-11a.

A.2.3.2.4 Depressional Wetlands, Springs, and Seeps. Substrate condition in depressional, lacustrine, slope and seep wetlands was evaluated by observing evidence of redoximorphic features, ponding, or organic matter accumulation on the surface or within the top 30 cm of substrate. Indicators of good Substrate Condition may include leaf litter accumulation, coarse woody debris, dried algal mats, algal coating on sand grains in the channel bed, or organic streaking in the soil horizon. Excessive sediment deposition, filling, down cutting, trampling, or compaction may reduce Substrate Condition. In depressional, lacustrine, slope, and seep wetlands, the Substrate Condition metric was scored as shown in Table A-11b.

TABLE A-11a
RIVERINE SCORING GUIDELINES: SUBSTRATE CONDITION

Metric	Score
Soils in the assessment area or adjacent to the active channel are relatively intact, show evidence of surficial organic matter accumulation, fallen trees, branches, and twigs or other course woody debris, decayed leaf litter, and fine detrital organic matter. Redoximorphic features may be visible within 30 cm of the surface; organic or clay layers may be present within the soil column (top 30cm).	1.0
Channel and adjacent benches are dominated by unconsolidated sand or other poorly formed native soils and/or bedrock outcrops. Substrate may exhibit moderate embeddedness or compaction; lack of organic layers in column; cattle may have had minor to moderate effects on sandy substrates.	0.75
Soils may exhibit some evidence of sparse organic litter or coarse woody debris. However, the assessment areas is mainly characterized by disturbed conditions, such as substantial filling, compaction, tilling, grazing, or similar activity, but appear recoverable with minimal intervention.	0.50
Soils are extremely compacted, dominated by imported fill or other predominantly upland (non-native) soils or have been deeply ripped, disced, or drained.	0.25
Channel is lined with concrete or rip-rap.	0.0

TABLE A-11b
SLOPE/SEEP SCORING GUIDELINES: SUBSTRATE CONDITION

Metric	Score
Soils in the assessment area are relatively intact, show evidence of surficial organic matter accumulation, branches, and twigs or other course woody debris, decayed leaf litter, and/or fine detrital organic matter. Redoximorphic features may be visible within 30 cm of the surface.	1.0
Soils lack significant organic matter accumulation, but there is soil cracking, evidence of organic matter accumulation, layering or initial formation of soil horizons.	0.75
Soils may exhibit some evidence of sparse organic litter or coarse woody debris. However, the assessment area is mainly characterized by disturbed conditions, such as substantial filling, compaction, tilling, grazing, or similar activity, but appear recoverable with minimal intervention.	0.50
Soils are extremely compacted, dominated by imported fill or other predominantly upland (non-native) soils or have been deeply ripped, disked, or drained.	0.25

A.2.4 Structure – Biotic [also Referred to as "Biological Structure"]

A.2.4.1 M-11: Vertical Biotic Structure [CRAM version 2.0]

A.2.4.1.1 Definition. The vertical component of biotic structure consists of the distribution of vegetation among categories of height above the wetland substrate or with depth below the water surface.

A.2.4.1.2 Field Indicators. Vertical Biotic Structure must be assessed in the field. The vertical component of biotic structure is commonly recognized as the overall number and spatial extent of the expected number of typical plant height classes. For some wetlands (e.g., forested riverine and lacustrine wetlands), the height classes are often arranged as overlapping layers or plant strata. In other wetlands, the plant height classes are represented by dispersed and non-overlapping plant patches.

Standing live and dead vegetation were considered in the assessment. The length of prostrate stems or shoots, and the horizontal extent of canopies were not considered, as only the vertical aspect of structure was included in this metric. The rules given in Tables A-12a and A-12b below were used to incorporate the number of height classes in the assessment area, and the percentage of the assessment area that has these height classes, to obtain scores for the Vertical Biotic Structure metric.

TABLE A-12a
RULES FOR DETERMINING VEGETATION HEIGHT CLASSES FOR EACH WETLAND SYSTEM

Wetland System	Height Class		
	Tall	Medium	Short
Riverine/Alluvial Scrub	> 3 m	1-3 m	< 1
Depressional, Slope and Seep	>1 (e.g., saplings)	0.3 – 1 m (e.g., *Scirpus*)	< 0.3 m (e.g., *Distichlis*)

TABLE A-12b
SCORING GUIDELINES: VERTICAL BIOTIC STRUCTURE

Metric	Score
Most of the Assessment Area supports 3 height classes of vegetation; T/S/H; may also include vine layer.	1.0
About half of the Assessment Area supports 3 vegetative strata and/or most is covered by at least 2 height classes.	0.75
Between one quarter and half of the assessment areas supports 3 vegetative height classes and/or at least half of the site support 2 height classes.	0.50
Less than one quarter of the Assessment Area supports 3 height classes OR less than one-half supports 2 or more height classes OR only one height class is present.	0.25

A.2.4.2 M-12: Interspersion and Zonation [CRAM Version 2.0]

A.2.4.2.1 Definition. Horizontal biotic structure is commonly recognized as plant zonation and its interspersion. Interspersion is essentially a measure of the amount of edge between plant zones.

A.2.4.2.2 Field Indicators. The distribution and abundance of horizontal plant zones plus their interspersion were combined to derive scores for this metric. The zones are usually apparent as different plant patches that signify different elevations or distances away from the usual high water contour of a wetland, such as the shoreline of a lake, bank of a channel, or the transition from the wetland to the adjacent upland. For large wetlands, the prominent zonation is evident in aerial photographs of scale 1:24,000 or smaller. For vernal pools and other depressional wetlands that might be more or less round in plan form, the plant zones might be more or less concentric. For small wetlands, the zonation is only apparent in the field. The zones may be discontinuous and they can vary in number within a wetland. Plant zones often consist of more than one plant species, but some zones may be mono-specific. In most cases, one plant species dominates each zone. The number of zones present, as well as the degree of interspersion among these zones, was used to evaluate the Interspersion and Zonation metric as shown in Table A-13.

TABLE A-13
SCORING GUIDELINES: INTERSPERSION AND ZONATION

Metric	Score
2 or more plant zones exist along most of the active channel or shoreline, plus various tributary channels, meander scars, paleo-channels, or other features, producing a complex mosaic of vegetation in overhead view (zones can include submerged or emergent vegetation).	1.0
2 or more plant zones exist along about half of the main active channel or shoreline, and along a few of the tributary channels and other topographic features.	0.75
2 or more plant zones are apparent along about one quarter to half of the main active channel or shoreline.	0.50
2 or more plant zones are apparent along less than one quarter of the active channel; OR sparse shrubs occur in confined/ incised channel.	0.25
Unvegetated channel.	0.10

A.2.4.3 M-13: Ratio of Native to Non-native Plants [SMR HGM; also Referred to as "Nativeness"]

This metric was scored based on data collected in 10 m X 50 m plots assessed within reaches. The 50/20 Rule (Environmental Laboratory 1987) was utilized to determine dominant vegetation. Scores were determined using the criteria shown in Table A-14.

A.2.4.4 M-14: Riparian Vegetation Condition [LLFA]

Under culturally unaltered conditions, a complex interaction of many factors such as the size of the watershed, discharge, channel geometry, substrate type, and slope determine the size of the area that typically supports riparian vegetation. In general, as stream order increases, the width of the bankfull channel and the size of the area supporting riparian vegetation also increase. Floodprone area represents a scaled metric that can be applied consistently in different stream orders throughout a watershed. Floodprone area was determined in the field by projecting the elevation corresponding to two times the maximum depth of the bankfull

TABLE A-14
SCORING GUIDELINES: NATIVENESS

Measurement	Score
75 – 100 percent of the plant species are native and no stratum is dominated by non-native species.	1.0
50 - < 75 percent of species are native and/or up to 25 percent of the strata present are dominated by non-native species.	0.75
25 - < 50 percent of species are native and/or up to 25 percent of the strata present are dominated by non-native species.	0.50
10 – < 25 percent of species are native and/or up to 50 percent of the strata present are dominated by non-native species.	0.25
0 - < 10 percent of species are native and/or up to 100 percent of the strata present are dominated by non-native species.	0.10
No vegetation present. Variable is not recoverable and sustainable through natural processes under current conditions.	0.0

channel until it intersected the surface of the adjacent floodplain/terrace on both sides of the main stem channel.

This indicator was assigned a score by observing the condition of vegetation along the riparian reach and matching these field observations to the descriptions in Table A-15. In inaccessible reaches, field observations were supplemented with aerial photography and riparian vegetation community maps developed by URS (2003b). The reference standard condition was defined as vegetation with either no chronic disturbance or recovered from historical disturbance. Scores were assigned following the guidelines in Table A-15.

TABLE A-15
SCORING GUIDELINES: RIPARIAN VEGETATION CONDITION

Description of Conditions	Score
Vegetation represents reference condition with no chronic disturbance or recovered from historical disturbance. Presence of areas disturbed through natural processes (i.e., fire and flood) do not detract from score.	1.0
Native vegetation recovering with minor chronic disturbance (i.e., grazing). Presence of areas disturbed through natural processes (i.e., fire and flood) do not detract from score. Invasive, exotic species may be present.	0.75
Native vegetation common and widespread with moderate grazing pressure. Presence of areas disturbed through natural processes (i.e., fire and flood) do not detract from score. Invasive, exotic species may be present.	0.50
Native vegetation localized with heavy grazing pressure. Presence of areas disturbed through natural processes (i.e., fire and flood) do not detract from score.	0.25
Native vegetation absent, area hardened (i.e., paved, urban, etc.) or graded. Restoration impractical and unlikely for economic or political reasons.	0.0

A.2.4.5 M-15: Riparian Corridor Continuity [LLFA]

This indicator was measured at the riparian reach scale as the percent of flood prone area along the main stem channel of the riparian reach occupied by native and non-native vegetation communities with adequate height and structure to allow faunal movement. For example, annual grassland with no shrub or tree component was considered to represent a corridor gap. The difference between this indicator and Area of Native Riparian Vegetation was that for the Riparian Corridor Continuity indicator, the vegetation corridor could be composed of native or non-native riparian species, whereas for the Native Riparian Vegetation indicator, only native riparian vegetation communities were considered. The reference condition was defined as >95 percent of the floodplain of the main stem channel of the riparian reach occupied with riparian vegetation communities. Indicator scores were assigned based on the range of indicator values in Table A-16.

TABLE A-16
SCORING GUIDELINES: RIPARIAN CORRIDOR CONTINUITY

Indicator Value Range	Score
<5 percent of riparian reach with gaps/breaks due to cultural alteration	1.0
>5 and <15 percent of riparian reach with gaps/breaks due to cultural alteration	0.75
>15 and <30 percent of riparian reach with gaps/breaks due to cultural alteration	0.50
>30 and <50 percent of riparian reach with gaps/breaks due to cultural alteration	0.25
>50 percent of riparian reach with gaps/breaks due to cultural alteration	0.10

A.3 METRICS EXCLUDED FROM THE FINAL HARC

A.3.1 Metrics Related to Buffer

A.3.1.1 EM-1 (Excluded Metric-1): Percentage of Assessment Area with Buffer [CRAM Version 2.0; Excluded from Final Metrics]

A.3.1.1.1 Definition. The buffer is the upland area extending at least 10 meters (m) horizontally from the immediate edge of the Assessment Area that is in a natural or semi-natural state and currently not dedicated to anthropogenic uses. The buffer can include adjacent wetlands of the same or different class, stream channels, open water, or other aquatic habitats. For the riverine wetland class, the upstream and downstream reaches should be scored as part of the buffer. The height to which the buffer extends above or below the wetland is not considered as part of a horizontal buffer.

Intensive land uses are not buffers (e.g., plowed, agricultural cropland; paved areas; some dirt roads; housing developments, unfenced pastures; landscaped parks; etc.). Mowed areas are considered buffers, but deep-ripped agricultural fields are not considered buffers.

The assessment of this attribute was the same across all wetland classes. Assessments were conducted first in the office with aerial photographs, and then verified in the field. Scores were assigned following the guidelines in Table A-17.

TABLE A-17
SCORING GUIDELINES: PERCENT WITH BUFFER

Metric	Score
< 75 - 100 percent	1.0
50 - 75 percent	0.75
25 - 50 percent	0.50
< 25 percent	0.10
None	0.0

A.3.2 Metrics Related to Hydrology

A.3.2.1 EM-2: Altered Hydraulic Conveyance [LLFA; Excluded from Final Metrics]

This indicator was measured as the percent of the main stem channel through the riparian reach with altered hydraulic conveyance. At the riparian reach and riparian reach tributary scale, aerial photography and field observations were used to estimate the value of the metric. This metric was assessed within a particular reach, and assesses the extent of linear modification of the channel. Stressors within a reach may include road crossings, rip-rap, etc.

The reference condition was defined as <5 percent of the main stem channel in the riparian reach, or major tributaries to the riparian reach, with altered hydraulic conveyance. Indicator scores were assigned based on the range of indicator values in Table A-18.

TABLE A-18
SCORING GUIDELINES: ALTERED HYDRAULIC CONVEYANCE

Metric	Score
<5 percent of riparian reach main stem with AHC	1.0
>5 and <15 percent of riparian reach main stem with AHC	0.75
>15 and <30 percent of riparian reach main stem with AHC	0.50
>30 and <50 percent of riparian reach main stem with AHC	0.25
>50 percent of riparian reach main stem with AHC	0.1

A.3.3 Metrics Related to Abiotic (or Physical) Structure

A.3.3.1 EM-3: Sediment Regime – [LLFA; Excluded from Final Metrics]

This indicator was assigned a score by matching field observations to the descriptions in Table A-19. The reference condition was defined as exhibiting a sediment regime in equilibrium with respect to supply, erosional and depositional processes, and not affected by cultural alteration.

A.3.4 Metrics Related to Biotic (or Biological) Structure

A.3.4.1 EM-4: Canopy [SMR HGM; Excluded from Final Metrics]

Canopy cover was evaluated using the criteria listed in Table A-20 below. For reaches where more than one plot was studied, percent cover was averaged among the total number of plots.

A.3.4.2 EM-5: Age Distribution [SMR HGM; Excluded from Final Metrics]

This metric assesses the extent of plant recruitment at a site. The presence of seedlings, saplings, and adult trees at a site indicates that recruitment is occurring. This metric was applied to wetland indicator species only (e.g., *Salix* sp., *Baccharis* sp., *Populus* sp., *Platanus* sp., etc.). In some cases, oak trees (*Quercus* sp.) were also included if in multiple layers. In slope (non-riverine) wetlands, absence of mature trees was not considered to be an indication that recruitment was not occurring, and thus the presence of saplings and seedlings was sufficient to achieve a high score. Scores were assigned following the guidelines in Table A-21.

A.3.4.3 EM-6: Invasive, Exotic Plant Species [LLFA; Excluded from Final Metrics]

This metric evaluates the extent to which invasive, exotic species have invaded an assessment reach. Invasive species were defined as those on the Cal-IPC list of invasive species (Cal-IPC 2006; High, Medium, Low). Percent cover measurements for exotics were based on plot data within a given reach. Average cover for each included species was determined for tree, shrub, and herb layers, and then summed to give the total cover per given plot. This indicator was scored by matching field observations to the description of condition in Table A-22. The reference standard condition was defined as exotic plant species absent or rare, composing ≤5 percent total vegetation.

TABLE A-19
SCORING GUIDELINES: SEDIMENT REGIME

Metric: Description of Conditions	Score
Movement of sediment in the channel is in equilibrium in terms of supply, erosion, and deposition processes that reflect culturally unaltered conditions. On higher-order streams there are alternating point bars; bank erosion occurs, but is stabilized and moderated by vegetation; and channel width, form, and floodplain area is consistent through the reach. In low-order streams with bedrock control, some of these indicators may not be apparent, but overall bank and hill slope erosion is moderated by vegetation, and there are no apparent culturally induced catastrophic failures.	1.0
Movement of sediment in the channel is in equilibrium with the current hydrologic regime, as opposed to a culturally unaltered condition, and exhibits an overall balance in terms of erosion and deposition processes. On higher-order streams there are alternating point bars; bank erosion occurs, but is stabilized and moderated by vegetation; and channel width, form, and floodplain area are consistent through the reach. In low-order streams with bedrock control, some of these indicators may not be apparent, but overall bank and hill slope erosion is moderated by vegetation, and no culturally induced catastrophic failures are apparent; or recent fires have temporarily altered (or are expected to alter) sediment regime.	0.75
Sediment disequilibrium is minor and localized within the reach. This includes small, localized areas of bank protection, slumping, or encroachment on the floodplain and channel. This condition class also includes previously disrupted reaches on a recovery trajectory, such as deeply entrenched streams where down cutting has been arrested by structural grade control, and there is sufficient room for lateral channel migration and establishment of a functional floodplain within the incised channel.	0.50
Sediment erosion and deposition out of equilibrium. Water inflow is sediment rich or poor, or accelerated bank erosion exists. Channel not actively incising, but extensive disequilibrium is evident. Typical indicators include extensive bank slumping (erosion events that exceed any moderating influence of native vegetation), active gullies feeding into the reach from adjacent hill slopes, shoaling of sediments rather than deposition in sorted lateral and mid-channel bars. Apparently stable channels should be placed in this category if there is evidence of regular mechanical disruption, such as bulldozing of the channel bottom and clearing of riparian vegetation to improve flood conveyance.	0.25
Sediment dynamics within most of the reach are seriously disrupted. This includes reaches where no significant storage or recruitment of sediment occurs (i.e., reaches in underground tunnels/culverts, and reaches hardened with rock or concrete). It also includes reaches that are either actively incising or functioning as sediment traps (e.g., sediment basins). This also includes reaches that have been subject to recent changes likely to induce severe disequilibrium, such as extensive floodplain filling, change in slope, channel straightening, or other changes that are likely to cause channel down cutting during future high-flow events.	0.10

TABLE A-20
SCORING GUIDELINES: CANOPY

Measurement	Score
Percent cover of tree layer is > or = 50 percent.	1.0
Percent cover of tree layer is 25 percent - <50 percent.	0.75
Percent cover of tree layer is < 25 percent; OR Seep/Slope H layer 100 percent.	0.50
If no trees, percent cover of shrub layer is >50 percent.	0.25
If no trees, percent cover of shrub layer is <25 percent.	0.10
No vegetation present. Variable is not recoverable and sustainable through natural processes under current conditions.	0.0

TABLE A-21
SCORING GUIDELINES: AGE DISTRIBUTION

Measurement	Score
Assessment area supports trees, saplings, and seedlings.	1.0
Assessment area supports trees, saplings or seedlings.	0.75
Assessment area has no trees but does support saplings and/or seedlings; OR Shrub/Herb present for same indicator species.	0.50
Assessment area supports trees/shrubs but no saplings or seedlings are present; Seep/Slope wetlands with herbaceous layer 100 percent but no saplings or seedlings.	0.25
Assessment area does not support trees/shrubs, saplings, or seedlings. Variable is recoverable and sustainable through natural processes under current conditions.	0.10
Assessment area does not support trees/shrubs, saplings, or seedlings. Variable is not recoverable and sustainable through natural processes under current conditions.	0.0

TABLE A-22
SCORING GUIDELINES: INVASIVE, EXOTIC PLANT SPECIES

Description of Condition	Index
Invasive plant species absent or rare composing ≤5 percent total vegetation.	1.0
Invasive plant species present but localized and composing >5 and ≤20 percent of vegetation.	0.75
Invasive plant species common and composing >20 and ≤50 percent of vegetation.	0.50
Invasive plant species widespread and composing >50 and ≤75 percent of vegetation.	0.25
Invasive plant species dominant and composing >75 percent of vegetation; recoverable.	0.10
Invasive plant species dominant and composing >75 percent of vegetation; not recoverable.	0.0

Note: If invasive plant species are dominant outside of plots but within reach, score may be reduced by one level.

APPENDIX B DESCRIPTION OF METRIC REDUCTION PROCESS

B.1 HFA METHODS SECTION SUPPLEMENTAL TEXT

B.1.1 Minitab

Correlations were performed on the raw metric data, and some metrics were found to have significant correlation with all other metrics. This finding suggested that some metrics were indeed redundant.

B.1.2 PC-ord

The 21 metrics were evaluated for redundancy, and indicated significant correlations with one another. A multivariate method, Principal Components Analysis, was utilized to for data reduction purposes. This multivariate technique results in the identification of “gradients” within the data, along three different “Axes” (representation of the gradients). The PCA assigned scores to each metric based on their relation to each other and the gradients. These PCA scores were then used to obtain correlations between the metrics and the “main matrix,” or the Axes.

B.1.3 Excel

The correlation scores for the first two axes were evaluated. Metrics with correlations below 0.50 were considered for exclusion from the method. The metrics were then compared to the three main functions and the other metrics. The metrics chosen for exclusion from further iterations of the method were: BPER, AHC, SR, CAN, AGE, INV. Each of these six metrics were significantly correlated with all other metrics (with a few exceptions). Function scores were then recalculated using 15 metrics, and these final scores were compared to the original scores using 21 metrics.

B.1.4 Minitab

Basic statistical tests were performed on the old and new approaches (i.e., final scores for all metrics combined).

a. F-test (equality of variances); Test statistic = 1.10; p-value = 0.73

   - Variances equal

b. Paired t-test; assume difference = 0.00; t-value = 6.03; p-value < 0.0001

   - There is a difference between old and new final scores

c. Paired t-test; assume difference = 0.02; t-value = -0.23; p-value = 0.82

- No difference is found if the null hypothesis is the difference is 0.02 (or 2 percent). The 2 percent value, incidentally, is the average percent difference between old and new final scores, for each metric. This suggests that the two approaches have similar results (+/- 2 percent). In addition, the difference seemed to make reaches score higher, suggesting a more conservative approach. See Tables B-1 and B-2 and Figure B-1 below.

TABLE B-1
THE 15 NEW METRICS AND SIX EXCLUDED METRICS.
PEARSON 'r' CORRELATION REFLECTS THE STRENGTH OF RELATIONSHIP BETWEEN TWO METRICS

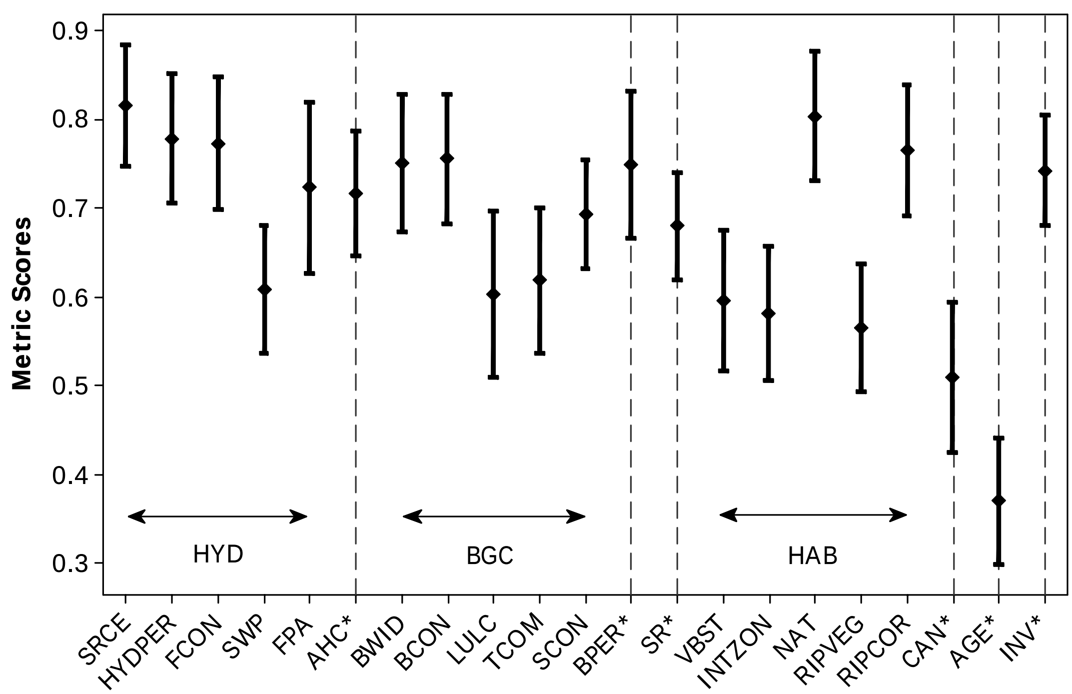
H Metrics	PCA Axis	Correlation with PCA Axis	Correlation with all Other Metrics	Correlation with HYD	
FPA	1.00	0.85	0.76	0.87	
SWP	1.00	0.77	0.68	0.69	
FCON	1.00	0.76	0.69	0.84	
SRCE	2.00	0.77	0.74	0.79	
HYDPER	2.00	0.69	0.69	0.79	
BGC Metrics				Correlation with BGC	
TCOM	1.00	0.86	0.75	0.70	
SCON	1.00	0.76	0.80	0.78	
BCON	1.00	0.73	0.84	0.88	
BWID	2.00	0.89	0.78	0.80	
LULC	2.00	0.89	0.64	0.68	
H Metrics				Correlation with HAB	
INTZON	1.00	0.84	0.75	0.85	
RIPVEG	1.00	0.83	0.85	0.88	
RIPCOR	1.00	0.77	0.81	0.77	
VBST	1.00	0.73	0.67	0.79	
NAT	2.00	0.72	0.79	0.73	
Excluded				Correlation with Other Metrics	Pearson Correlation (r)
SR	1.00	0.86	0.88	FPA	0.79
CAN	1.00	0.76	0.70	VBST	0.83
BPER	2.00	0.90	0.79	BWID/BCON	0.91/0.87
AHC	2.00	0.70	0.68	TCOM	0.65
INV	2.00	0.68	0.53	NAT/RIPVEG	0.58/0.56
AGE	N/A	0.63 (1)/-0.04 (2)	0.51	BPER/BWID	0.68/0.66

TABLE B-2
EXAMPLE NEW AND OLD FINAL SCORES, SHOWING DIFFERENCES AND AVERAGE OF 2 PERCENT

Reach	New Total	New Rank	Difference	Old Rank	Reach	Old Total
MI-6 (SLOPE-PalAM)	1.00	1.00	+0.02	1.00	SA-3 (RIV-PerAM)	0.98
SA-3 (RIV-PerAM)	0.98	2.00	+0.00	2.00	SA-4 (RIV-PerAM)	0.96
SA-4 (RIV-PerAM)	0.98	3.00	+0.02	2.00	MI-5 (RIV-PerAM)	0.96
MI-5 (RIV-PerAM)	0.97	4.00	+0.02	3.00	MI-6 (SLOPE-PalAM)	0.95
PO-7 (SEEP-PalAM)	0.92	5.00	+0.04	5.00	PO-7 (SEEP-PalAM)	0.88
PO-4 (RIV-PerAM)	0.87	6.00	+0.06	7.00	PO-4 (RIV-PerAM)	0.81

Average for these six example sites = 0.03.
New Total > Old Total in every case; thus, difference conservative, ranking sites higher than old method.
Overall average for all sites = 0.02.

FIGURE B-1
INTERVAL PLOT (MEAN, +/- 95 PERCENT CONFIDENCE INTERVALS) OF METRICS



* Vertical, dashed lines indicate metrics chosen for exclusion from the method. Arrow indicates the composition of the new functions. 'CAN' (canopy) and 'AGE' (age distribution) were outliers (i.e., do not follow trends for other metrics and did not vary between sites). The other metrics chosen for exclusion were similar to other metrics within a particular function group (HYD = hydrology; BGC = biogeochemical; HAB = habitat).

B.2 LITERATURE CITED

McCune, B., Grace, J.B. 2002. Analysis of Ecological Communities. MjM Software Design, Gleneden Beach, OR. 300p.

McCune, B., Mefford, M.J. 1999. PC-ORD. Multivariate analysis of ecological data, Version 4. Mjm Software Design, Gleneden Beach, Oregon, USA. http://www.ptinet.net/~mjm.

Minitab Inc. 2005. Minitab Statistical Software, Release 14.20 for Windows. State College, PA, USA. http://www.minitab.com.

Reach ID	Plot Position(s)	Buffer Width	Buffer Condition	LULC	Source	Hydroperiod	Floodplain Connection	Surface Water Persistence	Flood Prone Area	Topographic Complexity	Substrate Condition	Vertical Biotic Structure	Interspersion & Zonation	Nativeness	Riparian Vegetation Condition	Riparian Corridor Continuity	Total Points	% Score	Assessment Area (Acres)	HARC Total Score	HARC Hydrology Score	HARC Biogeochemical Score	HACR Habitat Score	HARC AW-Total Score	HARC AW-Hydrology	HARC AW-Biogeochemical	HARC AW-Habitat
		CRAM	CRAM	LLFA	CRAM	CRAM	CRAM	SMR HGM	SMR HGM	CRAM	CRAM	CRAM	CRAM	SMR HGM	LLFA	LLFA											
		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	15.00	100%									
CH-UPST	BF / FP	0.50	0.75	0.25	0.75	0.75	1.00	0.75	1.00	0.75	0.50	0.50	0.50	0.75	0.50	0.75	10.00	66.67%	1.06	0.67	0.85	0.70	0.61	0.71	0.90	0.74	0.65
CH-TRIB	---	0.50	0.75	0.25	0.50	0.50	0.50	0.00	0.10	0.25	0.50	0.25	0.25	0.75	0.25	0.75	6.10	40.67%	1.32	0.41	0.32	0.39	0.43	0.54	0.42	0.51	0.57
CH-DNST	BF / FP	0.50	0.75	0.25	1.00	1.00	1.00	0.50	1.00	0.75	0.75	0.25	0.50	0.75	0.75	0.75	10.50	70.00%	15.92	0.70	0.90	0.75	0.64	11.15	14.33	11.94	10.24
CH-SCR	---	0.50	0.75	0.25	0.75	1.00	1.00	0.50	1.00	0.50	0.50	0.25	0.25	0.50	0.25	0.50	8.50	56.67%	0.34	0.57	0.85	0.68	0.39	0.19	0.29	0.23	0.13
Chiquito Canyon Summary																			18.65	0.67	0.86	0.72	0.62	12.59	15.95	13.43	11.58
LI-UPST-E	---	1.00	1.00	1.00	1.00	1.00	1.00	0.50	1.00	0.50	0.75	0.50	0.50	1.00	0.75	0.75	12.25	81.67%	3.06	0.82	0.90	0.88	0.68	2.50	2.76	2.68	2.08
LI-UPST-W	---	1.00	1.00	1.00	1.00	1.00	1.00	0.50	1.00	0.50	0.75	0.50	0.50	1.00	0.75	0.75	12.25	81.67%	2.38	0.82	0.90	0.88	0.68	1.94	2.14	2.08	1.61
LI-DNST	BF / FP	0.75	0.75	0.75	0.75	0.50	1.00	0.50	1.00	0.50	0.50	0.25	0.50	1.00	0.75	0.75	10.25	68.33%	1.42	0.68	0.75	0.70	0.61	0.97	1.06	0.99	0.86
Lion Canyon Summary																			6.86	0.79	0.87	0.84	0.66	5.41	5.96	5.75	4.55
LO-UPST	BF / FP	0.75	0.75	1.00	1.00	1.00	0.75	0.50	0.75	1.00	0.75	0.50	0.75	1.00	1.00	0.50	12.00	80.00%	2.32	0.80	0.80	0.83	0.79	1.85	1.85	1.91	1.82
LO-DNST	BF / FP	0.75	0.50	0.25	0.50	0.50	0.50	0.50	0.25	0.50	0.75	0.50	0.75	1.00	0.75	0.50	8.50	56.67%	2.91	0.57	0.45	0.50	0.68	1.65	1.31	1.45	1.97
LO-AGR	---	0.00	0.00	0.10	0.25	0.10	0.25	0.00	0.00	0.10	0.25	0.25	0.10	0.00	0.00	0.10	1.50	10.00%	0.48	0.10	0.12	0.11	0.11	0.05	0.06	0.05	0.05
Long Canyon Summary																			5.70	0.62	0.56	0.60	0.67	3.55	3.22	3.41	3.85
HO-TRIB	---	1.00	1.00	0.75	1.00	0.75	0.50	0.50	0.25	0.25	0.50	0.25	0.25	1.00	0.25	0.75	9.00	60.00%	1.01	0.60	0.60	0.65	0.46	0.60	0.60	0.65	0.47
OH-TRIB	BF	1.00	1.00	0.75	1.00	0.75	0.50	0.50	0.25	0.25	0.50	0.25	0.25	1.00	0.25	0.75	9.00	60.00%	4.29	0.60	0.60	0.65	0.46	2.57	2.57	2.79	1.99
OH-AGR	---	0.00	0.00	0.10	0.25	0.10	0.25	0.00	0.00	0.10	0.25	0.25	0.10	0.00	0.00	0.10	1.50	10.00%	1.32	0.10	0.12	0.11	0.11	0.13	0.16	0.14	0.15
MMC-UPST	---	1.00	1.00	1.00	0.75	1.00	0.50	0.50	0.25	0.50	0.75	0.25	0.25	1.00	0.50	1.00	10.25	68.33%	1.19	0.68	0.60	0.73	0.61	0.82	0.72	0.87	0.72
MMC-SCR	---	0.50	0.75	0.25	0.75	1.00	1.00	0.50	1.00	0.50	0.50	0.25	0.25	0.50	0.50	0.75	9.00	60.00%	0.43	0.60	0.85	0.68	0.46	0.26	0.36	0.29	0.20
MMC-AGR	---	0.00	0.00	0.10	0.25	0.10	0.25	0.00	0.00	0.10	0.25	0.25	0.10	0.50	0.25	0.10	2.25	15.00%	0.77	0.15	0.12	0.11	0.22	0.12	0.09	0.08	0.17
AGR-N-SCR	---	0.00	0.10	0.10	0.00	0.10	0.25	0.00	0.10	0.10	0.25	0.25	0.10	0.00	0.00	0.10	1.45	9.67%	1.32	0.10	0.09	0.10	0.11	0.13	0.12	0.13	0.15
AY	---	1.00	1.00	1.00	1.00	1.00	0.75	0.50	0.75	0.50	1.00	1.00	0.50	1.00	0.75	1.00	12.75	85.00%	2.57	0.85	0.80	0.85	0.82	2.19	2.06	2.19	2.11
UN-E	---	1.00	1.00	1.00	1.00	1.00	0.75	0.50	0.75	0.50	1.00	1.00	0.50	1.00	0.75	1.00	12.75	85.00%	0.67	0.85	0.80	0.85	0.82	0.57	0.54	0.57	0.55
UN-W	---	1.00	1.00	1.00	1.00	1.00	0.75	0.50	0.75	0.50	1.00	1.00	0.50	1.00	0.75	1.00	12.75	85.00%	0.72	0.85	0.80	0.85	0.82	0.61	0.58	0.61	0.59
HU-UPST	---	1.00	1.00	1.00	1.00	1.00	1.00	0.50	1.00	0.75	0.50	1.00	1.00	1.00	1.00	1.00	13.75	91.67%	1.48	0.92	0.90	0.88	0.89	1.36	1.33	1.30	1.32
HU-DNST	BF / FP	1.00	1.00	0.50	0.75	0.50	1.00	0.75	1.00	0.75	1.00	1.00	1.00	0.75	0.75	0.75	12.50	83.33%	0.43	0.83	0.80	0.83	0.86	0.36	0.34	0.35	0.37
EX	---	1.00	1.00	1.00	1.00	1.00	0.75	0.50	0.75	0.50	1.00	0.50	0.50	1.00	0.75	1.00	12.25	81.67%	1.21	0.82	0.80	0.85	0.75	0.99	0.97	1.03	0.91
DE	---	0.75	0.50	0.50	1.00	1.00	1.00	0.50	0.75	0.50	0.75	0.25	0.25	0.75	0.25	0.25	9.00	60.00%	1.30	0.60	0.85	0.73	0.43	0.78	1.11	0.95	0.56
MI-1	BF	0.75	0.50	0.25	1.00	1.00	0.25	0.50	0.10	0.10	0.50	0.25	0.25	0.50	0.25	0.25	6.45	43.00%	1.77	0.43	0.57	0.50	0.30	0.76	1.01	0.88	0.53
MI-2	---	0.75	0.50	0.10	1.00	1.00	0.25	0.50	0.10	0.10	0.50	0.25	0.25	0.50	0.25	0.75	6.80	45.33%	0.78	0.45	0.57	0.48	0.37	0.35	0.45	0.37	0.29
MI-3	---	0.75	0.50	0.25	0.50	0.50	0.50	0.50	0.25	0.10	0.50	0.25	0.25	0.50	0.25	0.75	6.35	42.33%	1.27	0.42	0.45	0.44	0.37	0.54	0.57	0.55	0.47
MI-4	---	1.00	1.00	0.75	0.75	0.75	0.50	0.50	0.25	0.50	0.50	1.00	0.75	0.50	0.50	0.75	10.00	66.67%	0.87	0.67	0.55	0.65	0.64	0.58	0.48	0.56	0.56
MI-5 (RIV-PerAM)	BF / FP	1.00	1.00	1.00	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.75	1.00	14.50	96.67%	0.28	0.97	0.95	0.98	0.96	0.27	0.27	0.27	0.27
MI-6 (SLOPE-PalAM)	BF / FP	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	15.00	100.00%	2.12	1.00	1.00	1.00	1.00	2.12	2.12	2.12	2.12
MA	BF	1.00	0.75	1.00	1.00	1.00	0.75	0.50	0.25	0.25	0.75	0.50	0.50	1.00	0.50	0.50	10.25	68.33%	6.56	0.68	0.70	0.73	0.57	4.48	4.59	4.76	3.75
UN-N	---	1.00	1.00	1.00	1.00	1.00	0.75	0.50	0.75	0.50	1.00	0.50	0.50	1.00	0.75	1.00	12.25	81.67%	0.83	0.82	0.80	0.85	0.75	0.68	0.67	0.71	0.63
Other Drainages Summary																			33.20	0.64	0.65	0.67	0.57	21.27	21.70	22.17	18.88
PO-1	BF / FP	1.00	0.75	0.75	1.00	1.00	1.00	0.50	1.00	0.75	0.75	1.00	0.75	1.00	0.75	1.00	13.00	86.67%	2.37	0.87	0.90	0.85	0.86	2.06	2.13	2.02	2.03
PO-2	BF	1.00	1.00	0.75	1.00	0.75	0.75	0.50	0.75	0.75	0.75	0.50	0.25	1.00	0.50	1.00	11.25	75.00%	6.90	0.75	0.75	0.80	0.68	5.17	5.17	5.52	4.68
PO-3	BF / FP	0.50	0.50	0.25	1.00	1.00	1.00	0.75	1.00	0.75	0.75	1.00	0.75	1.00	0.75	0.25	11.25	75.00%	9.40	0.75	0.95	0.75	0.75	7.05	8.93	7.05	7.05
PO-4 (RIV-PerAM)	BF	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00	0.75	0.75	0.75	1.00	1.00	0.75	0.75	13.00	86.67%	11.93	0.87	1.00	0.88	0.82	10.34	11.93	10.44	9.80
PO-5	BF / FP	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00	0.50	0.75	0.75	0.75	1.00	0.50	1.00	12.50	83.33%	3.06	0.83	1.00	0.85	0.75	2.55	3.06	2.60	2.29
PO-6	BF	0.75	0.25	0.75	0.25	0.25	0.25	1.00	0.10	0.10	0.25	0.75	0.50	0.75	0.25	0.75	6.95	46.33%	1.06	0.46	0.37	0.40	0.48	0.49	0.39	0.42	0.51
PO-7 (SEEP-PalAM)	BF / FP	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00	1.00	0.75	1.00	1.00	1.00	0.75	1.00	13.75	91.67%	7.47	0.92	1.00	0.90	0.93	6.85	7.47	6.72	6.94
Potrero Canyon Summary																			42.18	0.82	0.93	0.82	0.79	34.50	39.08	34.76	33.30
SA-E1	BF / FP	1.00	1.00	1.00	1.00	0.75	0.75	0.50	0.75	0.75	0.75	0.50	0.75	0.75	0.75	1.00	12.00	80.00%	47.02	0.80	0.75	0.83	0.75	37.62	35.27	38.79	35.27
SA-2	BF / FP	1.00	1.00	1.00	1.00	0.75	1.00	0.75	1.00	1.00	1.00	0.50	0.75	1.00	0.75	1.00	13.50	90.00%	4.95	0.90	0.90	0.95	0.86	4.46	4.46	4.70	4.24
SA-W1	BF / FP	1.00	1.00	1.00	1.00	0.75	0.75	0.50	0.75	0.75	0.75	0.50	0.50	1.00	0.75	1.00	12.00	80.00%	16.28	0.80	0.75	0.83	0.75	13.03	12.21	13.43	12.21
SA-3 (RIV-PerAM)	BF / FP	1.00	1.00	1.00	1.00	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	14.75	98.33%	4.14	0.98	0.95	0.98	1.00	4.07	3.94	4.04	4.14
SA-4 (RIV-PerAM)	BF / FP	1.00	1.00	1.00	1.00	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	14.75	98.33%	3.82	0.98	0.95	0.98	1.00	3.75	3.63	3.72	3.82
SA-5	BF / FP	0.50	0.75	0.75	1.00	0.75	1.00	0.75	1.00	1.00	1.00	0.50	0.50	0.75	0.50	1.00	11.75	78.33%	3.07	0.78	0.90	0.85	0.75	2.41	2.76	2.61	2.30
SA-6	BF	0.10	0.50	0.10	0.25	0.25	0.50	1.00	0.75	0.75	0.75	1.00	0.75	0.75	0.50	0.75	8.70	58.00%	11.75	0.58	0.55	0.50	0.75	6.81	6.46	5.82	8.81
Salt Creek Canyon Summary																			91.04	0.79	0.75	0.80	0.78	72.15	68.72	73.12	70.80
SCR-SA	FP / T	0.75	0.75	0.25	0.75	0.75	1.00	1.00	1.00	1.00	0.75	1.00	0.75	0.75	0.50	1.00	12.00	80.00%	182.78	0.80	0.90	0.80	0.82	146.22	164.50	146.22	150.14
SCR-PO	FP / T1 / T2	0.75	0.75	0.25	0.75	0.75	1.00	1.00	1.00	1.00	0.75	1.00	1.00	1.00	0.75	1.00	12.75	85.00%	45.72	0.85	0.90	0.80	0.93	38.87	41.15	36.58	42.46
SCR-LO-DNST	---	0.75	0.75	0.25	0.75	0.75	1.00	0.75	1.00	1.00	0.50	0.50	0.50	0.75	0.25	0.75	10.25	68.33%	182.14	0.68	0.85	0.75	0.61	124.46	154.82	136.61	110.59
SCR-LO-MID	BF-FP1 / FP2 / T	0.50	0.50	0.10	0.75	0.75	1.00	0.75	1.00	1.00	0.50	0.50	0.50	0.75	0.25	0.75	9.60	64.00%	22.67	0.64	0.85	0.69	0.61	14.51	19.27	15.53	13.76
SCR-LO-UPST	FP1 / FP2 / T	0.75	0.75	0.10	0.75	0.75	1.00	0.75	1.00	1.00	0.50	0.50	1.00	1.00	0.50	1.00	11.35	75.67%	79.59	0.76	0.85	0.74	0.79	60.23	67.66	58.50	62.54
SCR-HU	FP / T	0.75	0.75	0.10	0.75	0.75	1.00	0.75	1.00	1.00	1.00	1.00	1.00	0.75	1.00	1.00	12.60	84.00%	38.44	0.84	0.85	0.79	0.96	32.29	32.68	30.18	37.07
SCR-MI	BF-FP / T	0.75	1.00	0.25	0.75	0.75	1.00	0.75	1.00	1.00	1.00	0.50	0.75	0.75	0.75	1.00	12.00	80.00%	170.76	0.80	0.85	0.83	0.82	136.61	145.15	140.88	140.27
CA	BF / FP	0.50	0.75	0.75	1.00	0.50	1.00	0.75	1.00	0.75	0.75	0.50	0.75	0.10	0.50	0.75	10.35	69.00%	38.16	0.69	0.85	0.78	0.59	26.33	32.44	29.57	22.35
Santa Clara River/Castaic Creek Summary																			760.27	0.76	0.87	0.78	0.76	579.52	657.65	594.07	579.17
SMG-UPST	BF / FP	1.00	1.00	0.75	1.00	1.00	1.00	0.75	1.00	0.75	0.50	0.75	0.75	1.00	0.50	1.00	12.75	85.00%	2.06	0.85	0.95	0.88	0.75	1.75	1.96	1.80	1.55
SMG-DNST	---	0.75	0.75	0.75	0.75	1.00	0.75	0.50	0.75	0.50	0.50	0.50	0.75	0.75	0.50	0.50	10.00	66.67%	0.49	0.67	0.75	0.70	0.57	0.33	0.37	0.34	0.28
SMG-AGR	---	0.75	0.75	0.75	0.75	1.00	1.00	0.75	1.00	0.75	0.75	0.50	0.50	1.00	0.50	0.75	11.50	76.67%	0.99	0.77	0.90	0.83	0.68	0.76	0.89	0.82	0.67
San Martinez Grande Canyon Summary																			3.54	0.80	0.91	0.84	0.71	2.84	3.22	2.96	2.50
Mean or total		0.75	0.76	0.60	0.82	0.78	0.79	0.61	0.72	0.62	0.69	0.60	0.58	0.80	0.57	0.77	11.42	76.12%	961.43	0.76	0.85	0.78	0.75	731.81	815.50	749.67	724.63

Santa Clara River

SCR-SA_BF/FP.

Upstream view.

Reach is relatively complex and intact, but riparian vegetation is somewhat degraded and surrounding land uses may contribute pollutants.

Total HFA Score = .800

Santa Clara River

SCR-SA_FP.

Downstream view of a backwater, floodplain wetland.

Total HFA Score = .800

Santa Clara River

SCR-PO-FP.

Upstream view of floodplain wetland. *Populus* sp. seedlings and *Baccharis/Salix* sp. saplings are evident in the wetland area.

Total HFA Score = .850

Santa Clara River

SCR-PO-T1.

Wetland area on lower terrace. *Salix* spp. and *Juncus acutus* are present.

Total HFA Score = .850

Santa Clara River

SCR-PO-T2.

Non-wetland riparian habitat on upper terrace. Site is dominated by *Populus fremontii* and *Pluchia sericea*.

Total HFA Score = .850

Santa Clara River

SCR-PO_BF/FP/T.

Downstream view.

Total HFA Score = .850

Santa Clara River

SCR-PO_BF/FP/T.

Upstream view over the reach. Note the expansive terrace area dominated by *Populus fremontii*.

Total HFA Score = .850

Santa Clara River

SCR-LO-DNST_FP/T.

Upstream view of interface of terrace (left) and floodplain (right), including a floodplain wetland (center). This reach is surrounded by agricultural land uses, and cattle have affected the vegetation and substrate.

Total HFA Score = .683

Santa Clara River

SCR-LO-MID_BF/T.

Northerly view of an existing road crossing. Note the agricultural/disturbed nature of the terrace, including the non-native, invasive plant *Arundo donax* (around base of poles).

Total HFA Score = .640

Santa Clara River

SCR-LO-MID_BF/FP.

Upstream view of bankfull channel, floodplain wetland, and dry, sandy floodplain area. This reach is bordered by agriculture, and cattle have degraded the riparian vegetation.

Total HFA Score = .640

Santa Clara River

SCR-LO-UPST_BF/FP.

Upstream view of floodplain wetland. Site is dominated by various wetland herb species, including numerous seedlings and saplings.

Total HFA Score = .757

Santa Clara River

SCR-LO-UPST_FP.

Downstream view of heavily grazed floodplain. Note the lack of an herb layer, with scattered shrubs. A stem of *Arundo donax* is visible in the foreground.

Total HFA Score = .757

Santa Clara River

SCR-HU_BF/FP.

Upstream view. This reach supports a well-developed, continuous riparian corridor with multiple vegetation strata present in a complex mosaic.

Total HFA Score = .840

Santa Clara River

SCR-MI_BF/FP.

Downstream view. Despite some adjacent agriculture, this reach supports well-developed, relatively complex native riparian vegetation.

Total HFA Score = .800

Northern Tributaries:
Off-Haul Canyon

OH-TRIB-WEST_BF.

Upstream view of ephemeral tributary after wildfire. This reach was scored as an atypical situation due to burning.

Total HFA Score = .600

Northern Tributaries:
Off-Haul Canyon

OH-TRIB-EAST_BF.

Upstream view of ephemeral tributary after wildfire.

Total HFA Score = .600

Northern Tributaries:
San Martinez Grande Canyon

SMG-UPST_BF/FP.

This channel is entrenched, but appears to be at a new equilibrium state. Site had alkaline soils and salt crusts, and was dominated by alkaline-tolerant species such as *Tamarix* sp., *Scirpus* spp., and *Distichlis spicata.*

Total HFA Score = .850

Northern Tributaries:
Mid-Martinez Canyon

MMC-UPST_BF.

Upstream view. This ephemeral drainage does not support a riparian vegetation community.

Total HFA Score = .683

Northern Tributaries:
Mid-Martinez Canyon

MMC-AGR_BF.

Downstream view. This drainage is typical of many low quality, agricultural drainages evaluated during the functional assessment, and shows signs of chronic disturbance.

Total HFA Score = .150

Northern Tributaries:
Chiquito Canyon

CH-UPST_BF/FP.

Upstream view of drainage. Site was dominated by *Lepidospartum squamatum* and was characterized by sandy, well-drained soils.

Total HFA Score = .667

Northern Tributaries:
Castaic Creek

CA_BF/FP.

Upstream view. Site was dominated by *Salix* spp., *Baccharis salicifolia* and non-native *Tamarix* sp.

Total HFA Score = .690

Southern Tributaries:
Salt Creek

SA-E1_BF/FP.

Downstream view. This intermittent stream reach supports moderately developed riparian habitat and intact hydrology.

Total HFA Score = .800

Southern Tributaries:
Salt Creek

SA-2_BF/FP.

Upstream view. This intermittent stream reach supports moderately developed riparian habitat, and includes distinct channel and terrace areas.

Total HFA Score = .900

Southern Tributaries:
Salt Creek

SA-W1_BF/FP.

Upstream view. Site was recently burned by wildfire. Dominant shrubs are native *Baccharis salicifolia* and *Salix* spp.

Total HFA Score = .800

Southern Tributaries:
Salt Creek

SA-3_BF/FP.

Riverine seep wetland dominated by *Scripus* spp. and *Salix* spp. This reach was one of the highest scoring reaches in the functional assessment.

Total HFA Score = .983

Southern Tributaries:
Salt Creek
SA-3_FP.

Downstream view of floodplain of riverine seep wetland with numerous seedlings and saplings of native *Populus*, *Salix*, and *Baccharis*. Dominant herb is *Distichlis spicata*.

Total HFA Score = .983

Southern Tributaries:
Salt Creek

SA-4_BF/FP.

Downstream view of riverine seep wetland, showing distinct wrack-line from a recent high-flow event. The reach supports complex, native vegetation.

Total HFA Score = .983

Southern Tributaries:
Salt Creek

SA-4_FP.

Downstream view of *Salix* spp.-dominated, riverine seep wetland. Mature native vegetation in all strata is present.

Total HFA Score = .983

Southern Tributaries:
Salt Creek

SA-5_BF/FP.

Upstream view. The site has suffered minor disturbances from cattle, and agricultural uses occur in the vicinity.

Total HFA Score = .783

Southern Tributaries:
Salt Creek

SA-6_BF/FP.

Upstream view. Drainage was entrenched well below adjacent agricultural field.

Total HFA Score = .580

**Southern Tributaries:
Potrero Canyon**

PO-1_BF/FP.

Upstream view. Intermittent drainage with mix of native riparian, transitional, and upland vegetation.

Total HFA Score = .893

**Southern Tributaries:
Potrero Canyon**

PO-2_BF.

Downstream view. Site was recently burned by wildfire.

Total HFA Score = .867

**Southern Tributaries:
Potrero Canyon**

PO-3_BF/FP.

Upstream view of shallow bankfull channel and wide floodplain dominated by *Populus fremontii*.

Total HFA Score = .750

Southern Tributaries:
Potrero Canyon

PO-4_BF/FP.

Upstream view of riverine seep wetland dominated by *Distichlis spicata* and *Anemopsis californica*. Grazing influence was observed.

Total HFA Score = .867

Souhern Tributaries:
Potrero Canyon

PO-5_BF/FP.

Downstream view. Channel is deeply incised, but supports a mix of native and exotic riparian vegetation.

Total HFA Score = .833

Southern Tributaries:
Potrero Canyon

PO-6_BF.

Upstream view of incised channel, with isolated floodplain. The floodplain is regularly disced.

Total HFA Score = .463

Southern Tributaries:
Potrero Canyon

PO-7_BF/FP.

Downstream view of seep wetland. Water flowing within this wetland eventually combines with PO-6 before entering the Santa Clara River.

Total HFA Score = .917

Southern Tributaries:
Long Canyon

LO-UPST_BF/FP.

Upstream view of ephemeral drainage. Banks are incised, and vegetation consists of mainly native upland species.

Total HFA Score = .800

Southern Tributaries:
Long Canyon

LO-DNST_BF/FP.

Downstream view. Drainage was incised at least 1 meter below adjacent agricultural lands.

Total HFA Score = .567

**Southern Tributaries:
Humble Canyon**

HU-DNST_BF/FP.

Downstream view. Source of hydrology was from upstream agricultural activities. This site was the only site within the Newhall Ranch area dominated by sycamores (*Platanus racemosa*).

Total HFA Score = .833

**Southern Tributaries:
Lion Canyon**

LI-UPST_BF/FP.

Downstream view of ephemeral drainage. Vegetation consists of mainly native upland species, including oak trees.

Total HFA Score = .817

**Southern Tributaries:
Lion Canyon**

LI-DNST_BF/FP.

Upstream view of ephemeral drainage. Vegetation consists of mainly native upland species. Channel incision is evident.

Total HFA Score = .683

Southern Tributaries:
Exxon Canyon

EX_BF.

Downstream view of ephemeral drainage, including connection to the Santa Clara River (background).

Total HFA Score = .817

Southern Tributaries:
Dead End Canyon

DE_BF.

Upstream view of this ephemeral drainage dominated by upland plant species.

Total HFA Score = .600

Southern Tributaries:
Middle Canyon

MI-1_BF.

Upstream view of this ephemeral drainage dominated by weedy herbs and shrubs (especially *Salsola* sp.).

Total HFA Score = .430

Southern Tributaries: Middle Canyon

MI-4_BF.

Lateral view of incised, ephemeral section with *Populus fremontii* dominating the abandoned floodplain area.

Total HFA Score = .667

Southern Tributaries: Middle Canyon

MI-5_BF/FP.

Upstream view of riverine seep wetland. A perennial source of groundwater entered the wetland in this location, resulting in well-developed hydric soils.

Total HFA Score = .967

Southern Tributaries: Middle Canyon

MI-6_BF/FP.

Lateral view across the slope wetland. Dominant vegetation in this view are *Salix* spp., *Scirpus americanus*, and *Mimulus guttatus*.

Total HFA Score = 1.00

Southern Tributaries:
Middle Canyon

MI-6_BF/FP.

Up-slope view of slope wetland. Dominant vegetation is this view are *Eleocharis* sp. and *Scirpus americanus.*

Total HFA Score = 1.00

Southern Tributaries:
Middle Canyon

MI-6_BF/FP.

View of saturated soils of the slope wetlands. Sub-surface / Surface flow was from left to right.

Total HFA Score = 1.00

Southern Tributaries:
Magic Mountain Canyon

MA_BF.

Incised, ephemeral tributary, dominated by upland plant species.

Total HFA Score = .683