

APPENDIX J-2 HABITAT RESTORATION PLAN

CHAPTER 1.0 INTRODUCTION

The Habitat Restoration Plan is a key component of the Adaptive Management Program for the proposed Rancho Mission Viejo (RMV) Open Space. It describes the spectrum of possible upland and wetland/riparian restoration activities within the proposed RMV Open Space and in areas subject to the aquatic resource management plan. The term “restoration” is used very broadly in this plan and covers a range of activities from enhancement of existing degraded habitats to creation of new habitats. The conceptual restoration activities described in this plan would be undertaken in accordance with certified/approved restoration plans for sites within RMV.

The remainder of Chapter 1 provides background information for the Habitat Restoration Plan as it relates to the proposed RMV Open Space. Chapter 2 describes the upland component of the Habitat Restoration Plan and Chapter 3 describes the wetland/riparian component.

1.1 Background

1.1.1 Relationship to the Southern Subregion NCCP/HCP

As noted above, the Habitat Restoration Plan is a key component of the Adaptive Management Program for the RMV Open Space, and is intended to be complementary to any NCCP/HCP Program completed in the future for the Southern Subregion. Implementation of an Adaptive Management Program is one of the three fundamental conservation planning principles set forth under the NCCP Conservation Guidelines (*Appendix F*). As stated in the NCCP Conservation Guidelines “...a status quo strategy of ‘benign neglect’ management likely will result in substantial further loss of CSS biodiversity...” The Guidelines concluded that habitat reserves...should be managed in ways responsive to new information as it accrues.” Although the Conservation Guidelines were directed toward coastal sage scrub (CSS) in a habitat reserve context, the same adaptive management principles apply to the diversity of vegetation communities and habitat types in protected open space such as the RMV Open Space.

a. NCCP/HCP Planning Guidelines Restoration Recommendations

The “Draft Southern NCCP/HCP Planning Guidelines” set forth in *Section 6* a set of restoration recommendations for upland and wetland/riparian habitats in the various sub-basins within the San Juan Creek and San Mateo Creek watersheds.

The upland restoration addressed in *Section 6* of the Draft Southern NCCP/HCP Planning Guidelines includes CSS and valley needlegrass grassland (VGL). Several restoration areas were selected within the RMV boundary on the basis of their important location and function in the Open Space area. Restoration in these areas would contribute to the Open Space function and would help maintain *net habitat value* on a *long-term basis* for sensitive species. The selected CSS and VGL restoration areas consist of the following:

- CSS restoration in Sulphur Canyon and elsewhere along Chiquadora Ridge in the Gobernadora sub-basin;
- CSS and VGL restoration along Chiquita Ridge in the Chiquita sub-basin;
- VGL restoration in the upper Cristianitos sub-basin and portions of Blind Canyon Mesa in the Gabino and Blind Canyons sub-basin; and
- CSS/VGL restoration in upper Gabino Canyon sub-basin; and
- CSS/VGL restoration in the Chiquita Canyon sub-basin.

The Draft Southern NCCP/HCP Planning Guidelines recommendations for wetland/riparian restoration include both abiotic (geomorphology and hydrology) and biotic (vegetation communities and habitats) components. Abiotic and biotic components must be addressed together because their functions are closely linked (e.g., excessive fine sediment generation adversely affects downstream habitat of the arroyo toad). Several areas within proposed RMV Open Space have been identified for restoration based on their impacts on habitat quality and long-term function. It should be noted that some of the wetland/riparian areas targeted for restoration may not be in designated Open Space *per se*, but may have a downstream habitat impacts that affect the function of the Open Space area. Areas identified for wetland/riparian restoration consist of the following:

- Gobernadora Creek to address historic meander condition and excessive sediment resulting from upstream land uses;
- Creation of breeding habitats in Gobernadora Creek for tricolored blackbird, least Bell's vireo, southwestern willow flycatcher and other riparian species;
- Upper Gabino Creek to address erosion and excessive sediment generation (this restoration program would occur in combination with upland CSS/VGL restoration);
- Chiquita Creek and upper Cristianitos to address locally-induced headcuts; and
- San Juan Creek to address invasive plants and animal species.

Although not part of the wetland/riparian restoration plan discussed here, additional wetland/riparian areas have been identified for enhancement through control of invasive species such as giant reed (*Arundo donax*), tamarisk (*Tamarix* spp.), pampas grass (*Cortaderia selloana*), castor bean (*Ricinus communis*), and tree tobacco (*Nicotiana glauca*). Major targeted areas include San Juan Creek, and lower Cristianitos Creek. Details of this program are provided in the Invasive Species Control Plan.

1.1.2 Relationship to the San Juan Creek Watershed and Western San Mateo Creek Watershed SAMP/MSAA

The Adaptive Management Program and this Habitat Restoration Plan are intended to be complementary to any SAMP/MSAA program that is completed in the future, and as such, have been structured to comply with the goals, objectives, and Tenets and Principles of the SAMP/MSAA. The U.S. Army Corps of Engineers (USACE) has stated the Purpose of the SAMP as follows:

The purpose of the effort is to develop and implement a watershed-wide aquatic resource management plan and implementation program (SAMP), which will include preservation, enhancement, and restoration and development within the study area. (underline added for emphasis)

One of the Objectives of the SAMP pertaining specifically to enhancement and restoration is as follows:

Preserve and enhance existing aquatic resources and establish a regional restoration management plan for aquatic resources in the study area, including development of a comprehensive aquatic resource reserve program. The aquatic resource reserve system would accommodate mitigation requirements for contemplated development within the watershed, and other conservation efforts. To the extent feasible, the ultimate goal is to provide for a comprehensive reserve and adaptive management program for both aquatic and upland natural resources. (underline added for emphasis)

This overall goal and restoration objective are reflected in several of the SAMP Tenets developed by the USACE:

- i. No net loss of acreage and functions of waters of the U.S./State
- ii. Maintain/restore riparian ecosystem integrity
- iv. Maintain/protect/restore riparian corridors
- v. Maintain and /or restore floodplain connection
- vi. Maintain and/or restore sediment sources and transport equilibrium

For example, restoring historic meander conditions and controlling excessive sediment being generated by upstream development in Gobernadora Creek, in conjunction with restoring riparian habitats in association with the Gobernadora Ecological Restoration Area (GERA), addresses all five of the Tenets expressed above.

The Watershed and Sub-basin Planning Principles (Watershed Planning Principles) provide a link between the goals and objectives of the SAMP/MSAA and the Tenets and Principles. The Watershed Planning Principles provide Planning Recommendations for relevant sub-basins that, in turn, have been translated into the specific restoration actions (including wetland/riparian and upland restoration) described in this plan. The Watershed Planning Principles Recommendations and associated restoration actions are as follows:

- Within the Chiquita sub-basin, address existing areas of channel incision that result from primarily localized processes/land uses, as contrasted with terrace-forming valley-deepening areas that are primarily a result of long-term geologic conditions. Site by site geomorphic analysis would be undertaken to define these areas.
 - This recommendation would be addressed through implementing creek stabilizations at locally-induced headcuts in Chiquita Creek that have been caused by road crossings and other anthropogenic causes.
- Within the Gobernadora sub-basin, protect the valley floor above the knickpoint to provide for creek meandering (as occurred historically) and for restoration of riparian processes and habitat. Floodplain restoration should account for both the existing and potential future sediment regimes and potentially excessive surface and groundwater. The existing channel that has isolated the creek from the floodplain in some areas also should be addressed as part of the restoration effort.
 - These recommendations would be addressed by implementing wetland/riparian restoration in the portion of the Gobernadora Creek below the Ranch boundary with Coto de Caza. Riparian restoration would provide a northward extension of riparian habitats suitable for the least Bell's vireo, southwestern willow flycatcher and other riparian species. Restoration may include construction of a detention/water quality basin below Coto de Caza and also may include creation of breeding habitat for the tricolored blackbird.
- Within the Cristianitos sub-basin, where feasible, protected headwater areas should be targeted for restoration of native vegetation to reduce the generation of fine sediments from the clayey terrains and to promote infiltration, and to enhance the value of upland habitats adjacent to streams. In addition, stream stabilization opportunities should be examined in Cristianitos Creek (above the confluence with Gabino Creek) in the context of longer-term geological processes.
 - These recommendations would be addressed both by VGL restoration in uplands in upper Cristianitos adjacent to the creek to reduce erosion-generated fine

sediments and by stabilizing locally-induced headcuts to the extent feasible (the origin of the headcuts as anthropogenic and/or geologic needs further investigation).

- Within the upper Gabino sub-basin, protect headwaters through restoration of existing gullies, using a combination of slope stabilization, grazing management, and native grasslands and/or scrub restoration. To the extent feasible, restore native grasses to reduce sediment generation and promote infiltration of stormwater.
 - These recommendations would be addressed by a three-pronged approach: (1) restoration of eroded gullies; (2) upland CSS/VGL restoration to reduce erosion-generated fine sediments; and (3) wetland/riparian restoration. Grazing in upper Gabino is addressed in the Grazing Management Plan.

1.2 Purpose of the Habitat Restoration Plan

The Habitat Restoration Plan is a key component of the Adaptive Management Program which is designed to fulfill the following purposes of the proposed RMV Conservation Plan:

1. The Adaptive Management Program is one of the four programmatic elements of the Conservation Strategy to carry out the Scientific Review Panel (SRP) and NCCP Science Advisors conservation planning principles and tenets of reserve design.
2. The Adaptive Management Program, and the Habitat Restoration Plan component, contribute to recovery of listed species in the Southern Subregion.
3. The Adaptive Management Program, and the Habitat Restoration Plan component, would be complementary with any future NCCP/HCP and SAMP/MSAA Programs.

CHAPTER 2.0 UPLAND HABITAT RESTORATION PLAN

This chapter describes the conceptual approach for the restoration of coastal sage scrub (CSS), valley needlegrass grassland (VGL), and mixed CSS/VGL vegetation communities in the RMV Open Space. The term “restoration” is used very broadly in this conceptual plan. It is intended to cover the spectrum of possible restoration activities within the Open Space areas, from creation of new habitats to enhancement of existing degraded habitats through timed grazing, prescribed burning, and other more direct, intensive measures. As an RMV-wide comprehensive program, this section summarizes restoration recommendations for several sub-basins and explains how these recommendations could contribute to a more effective Open Space and Adaptive Management Program. In addition, this section provides a conceptual approach to site preparation, general plant palettes for revegetation, timed grazing and prescribed burning, short-term, long-term monitoring and maintenance, and reporting of the restoration program. This conceptual upland habitat restoration plan is considered preliminary and will be subject to refinement and modification during environmental documentation processes. This section includes the following components of the upland portion of the Habitat Restoration Plan:

- Definition of Terms
- Habitat Restoration Goals
- Success Criteria
- Preliminary Designation of CSS Restoration Areas
- Preliminary Designation of VGL Restoration Areas
- Preliminary Designation of CSS/VGL Restoration Areas
- Implementation Plan
- Maintenance Plan
- Monitoring Program

2.1 Definition of Terms

As indicated above, the term “restoration” is used in the broad sense to refer to the spectrum of restoration activities to be conducted in the RMV Open Space. Where appropriate, several other terms will be used throughout this document to refer to specific kinds of restoration activities. These other terms are defined here.

Passive Restoration: Passive restoration generally refers to removing or controlling disturbance events such as discing that perpetuate non-native or disturbed habitats. Passive restoration may involve some site preparation and maintenance such as weed control, and trash and debris removal, but generally the site would be allowed to revegetate naturally without extensive intervention. Some initial seeding may be used if the natural seed bank onsite is inadequate.

Passive restoration sites would be monitored, and if habitat quality on the site does not appear to be improving by a designated period, active restoration may be applied.

Active Restoration: Active restoration broadly refers to the specific application of restoration techniques. On a large scale (e.g., 10s to 100s of acres), active restoration techniques may include timed-grazing or prescribed burning. On a smaller scale (e.g., a few acres or less), active restoration may include site-intensive techniques such as soil preparation, planting and/or seeding, irrigation, weed control, erosion control, etc. Active restoration implies a higher level of effort than passive restoration and typically is used on sites that would not regenerate naturally, or would only regenerate over an unacceptably long period of time without direct intervention. For example, a mitigation requirement that a site meet certain performance standards such as percent native plant cover or species occupation within five years probably would require active restoration to ensure that the performance standards were met.

Revegetation: Revegetation involves active restoration of a site whereby container plants and/or seeds are used to create or restore habitat. Typically the target native vegetation community is absent from the site; e.g., a site supporting non-native annual grasslands revegetated with VGL. Site preparation and maintenance may include annual grass and weed control, and trash and debris removal. Depending on site conditions, soil remediation and/or irrigation may be necessary to support a viable revegetation site. Generally, revegetation sites would have higher performance standards than passively restored sites and the monitoring and maintenance program is more specific as far as the responsibilities of the Restoration Ecologist and the Installation/Maintenance Contactor.

Enhancement: Enhancement generally refers to restoration of sites that support degraded forms of the target native vegetation community. The level of effort needed to enhance a site typically is less than revegetating a site because the target native community is already present. A primary enhancement approach in the Open Space where low quality native habitat is already present would include timed grazing and prescribed burning to control non-native invasive grasses and weeds. Seeding may be used to supplement the existing native vegetation, but planting of container plants and irrigation generally are not used on enhancement sites. Enhancement tends to be more passive, letting nature take its course.

In practice, there often is not a clear distinction between active and passive restoration, revegetation and enhancement because each site has its own distinct requirements for successful restoration. The Restoration Ecologist and RMV would have the flexibility to implement the appropriate restoration techniques in an adaptive fashion to produce the desired results in the most efficient manner. However, specific performance standards would be set for each restoration site so that success can be objectively measured.

2.2 Habitat Restoration Goals

The goal of this conceptual restoration plan is to provide a framework that would guide the restoration of CSS and VGL vegetation communities that would maintain or enhance biological values (e.g., ecosystem and species) in the Open Space. The restored vegetation communities should provide habitat values and functions that are equal to, or greater than, that of the vegetation communities prior to development.

The CSS restoration component of this plan primarily is intended to provide habitat within the Open Space that would be suitable for forage, cover, nesting and dispersal by the California gnatcatcher. The VGL revegetation component of this plan is intended to provide suitable habitat within the Open Space for VGL plant and animal species, such as the grasshopper sparrow.

Careful site selection is extremely important for the long-term success of a restoration program. Sites that are selected for restoration of CSS and VGL must contribute to the long-term net habitat value of the Open Space. The preliminary designation of restoration areas, as described below, considered both onsite and adjacent habitat conditions in order to provide the best opportunity for a successful restoration program that contributes to the long-term habitat values and functions of the Open Space. For example, the proposed CSS restoration areas are sited in locations along Chiquita and Chiquadora ridges that would augment existing high quality CSS that supports a *major population* of the California gnatcatcher. Successful restoration of CSS in these areas would increase the carrying capacity of these areas for the gnatcatcher. Similarly, the proposed VGL restoration areas are sited in locations that currently support low quality VGL or annual grasslands considered restorable to VGL because they are situated on clay soils and adjacent to existing VGL. Areas proposed for CSS/VGL restoration are sited in locations that appear to naturally support a mosaic of CSS and VGL, based on recent observations that grasslands in nearby areas appear to be gradually type-converting to a CSS/VGL mix. Furthermore, mature CSS vegetation is better able to withstand significant pressure from non-native plant species invasion than more uniform grasslands and therefore could provide a natural barrier that would protect VGL habitat, which typically suffers from invasive species dominance. The CSS/VGL matrix increases habitat diversity and value and likely reestablishes the historical condition of these areas. The co-occurrence of CSS and VGL habitats in this manner would increase the likelihood of the persistence of high quality native habitat in the long-term.

2.1.1 Time Lapse

With active restoration, CSS that is suitable cover, foraging, nesting and dispersal habitat for the California gnatcatcher may be achievable in three to five years from the initial installation of seed and container plants if environmental conditions are consistent with those that are optimal

for the vegetation. It is estimated that it would take three to four years for VGL habitat to develop enough structure to provide the functions and values needed for occupation by wildlife species. As CSS or VGL habitat matures, it would become increasingly suitable for a greater variety and higher number of plant and wildlife species.

For both CSS and VGL, the length of time to develop high quality habitat is largely dependent on a variety of factors, including weather, pest herbivory (e.g., pocket gophers, ground squirrels, rabbits), and weed competition. A longer time period may be required when any of the above factors is unusual (e.g., weather) or exceeds what normally occurs (e.g., abnormally high pest levels). As a hedge against drought conditions, the addition of temporary irrigation systems may be needed in some areas to ensure timely seed germination and seedling survival until seedlings have become established and are capable of surviving without supplemental water. The anticipated increase in the survival rate would help the vegetation develop more quickly than would be expected from a non-irrigated revegetation effort.

2.3 Success Criteria

The goal of the CSS restoration program is the establishment of self-sustaining habitat that would provide foraging, cover, nesting and dispersal habitat for the California gnatcatcher, as well as other resident sage scrub species. Similarly, the goal of VGL habitat revegetation and enhancement is to provide suitable habitat for various grassland plants, including native needlegrass and annual herbs and wildlife species such as the grasshopper sparrow. Performance criteria have been established to define when the restoration effort is successful and are outlined in *Section 2.3.3*.

2.3.1 Rationale for Expecting Success

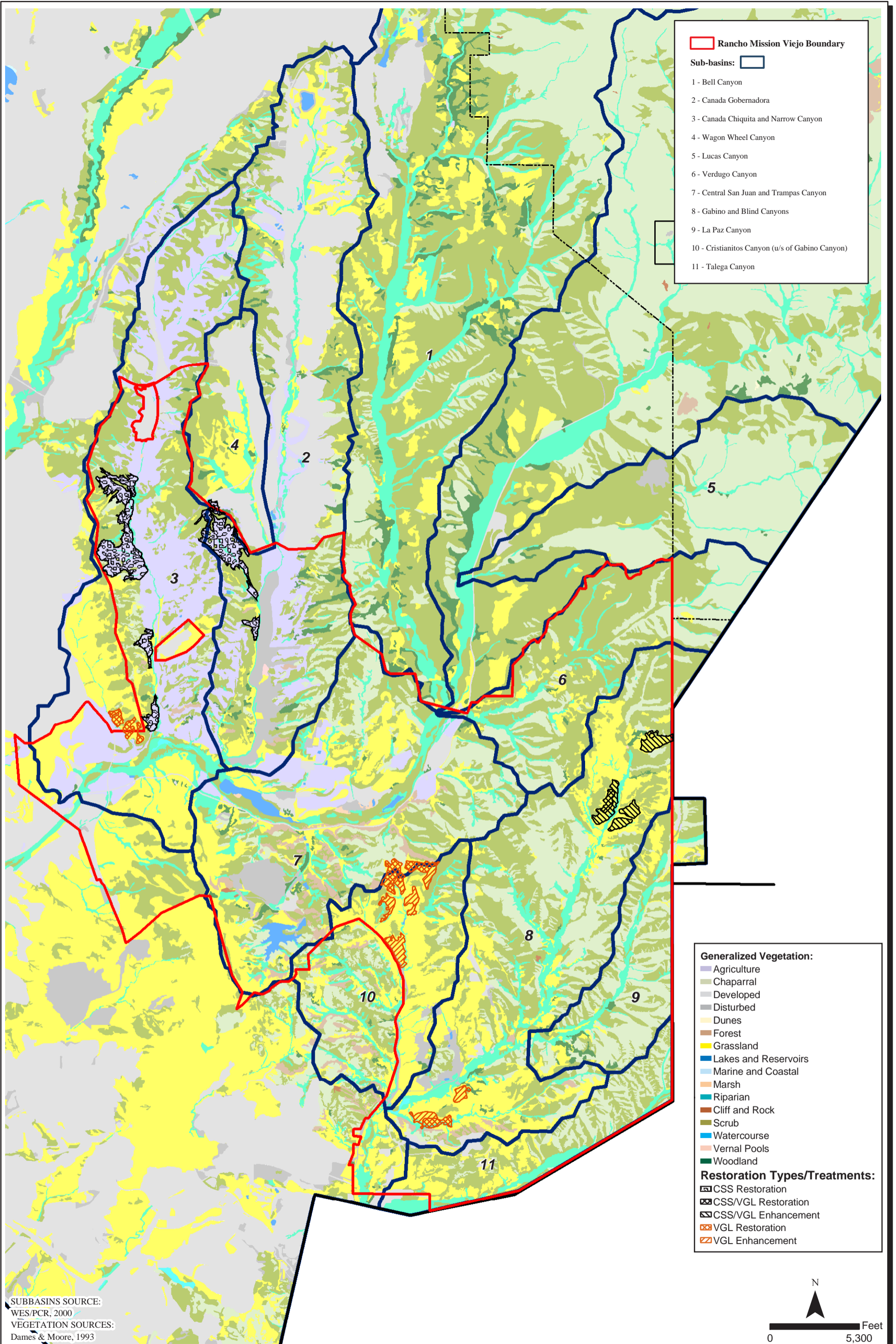
Based on current understanding of the preliminary restoration sites (including enhancement and revegetation sites), existing soils within the restoration sites would remain essentially undisturbed from the current condition. Soil texture, slope, and solar aspect are similar to other native vegetation areas in the vicinity. The target vegetation types are modeled after the existing native vegetation types adjacent to each area, i.e., CSS restoration areas are contiguous with existing CSS, etc. Planted species would be located according to the micro-climate and topography in which the species commonly occurs. The presence of adjacent existing native vegetation would accelerate the time required for animals to utilize these new biological resources as these sites establish and the vegetation matures.

2.3.2 Target Functions

The primary target function of the restored CSS is habitat that provides cover, foraging, nesting and dispersal habitat for the California gnatcatcher. To achieve the target functions and values of the proposed restoration, the plan would create a diversity of CSS subassociations that are most often used by the California gnatcatcher.

The primary target function of the restored VGL is habitat that includes a diversity of grassland plant species and an environment suitable for colonization by additional native grassland plant (including perennial bunch grasses and annual forbs) and wildlife species. A primary target animal species for restored VGL is the grasshopper sparrow, which prefers grasslands that contain vertical (e.g., perch sites) and horizontal (e.g., openings) structural diversity. Also, the restored VGL would provide foraging habitat for several raptors. Finally, certain areas of VGL would exhibit soil characteristics that are suitable for the introduction of special status plant species such as thread-leaved brodiaea, many-stemmed dudleya and intermediate mariposa lily.

The areas proposed for CSS/VGL restoration are located in upper Gabino Canyon and lower Chiquita Canyon (see description below). Target wildlife species have not been designated for upper Gabino Canyon because neither the California gnatcatcher or grasshopper sparrow is known to occur in this area nor have these areas been determined to be important for these species. However, it is expected that restoration of CSS/VGL in this area would attract a variety of native wildlife species, and it would not be surprising if the grasshopper sparrow used restored habitat in the future. CSS/VGL restoration in lower Chiquita Canyon would be consistent with the proposed CSS restoration in this area; some areas preliminarily designated as CSS restoration in *Figure 1* may be more suitable for CSS/VGL restoration over the long-term considering that small patches of VGL often occur in small openings in CSS. In any case, both the gnatcatcher and grasshopper sparrow would be target species for CSS/VGL restoration in Chiquita Canyon. It is expected that a variety of raptors would forage in CSS/VGL restoration areas in both upper Gabino and lower Chiquita canyons.



**RMV Habitat Restoration Plan
Preliminary Restoration Areas**

**FIGURE
1**

2.3.3 Performance Standards

A key component for evaluating the success of a restoration plan is setting appropriate performance standards. For example, survival of all container plants typically is required at the end of an initial four-month maintenance period. With such a performance standard, if it was determined that plant mortality, erosion problems, or seed germination progress was unacceptable, a replanting program would be initiated within the restoration area at the end of the first summer.

Specific performance standards must be attained within both passive and active restoration areas at the end of each year of the five years following initiation of the restoration effort. For passive restoration of CSS and VGL, the primary focus of the restoration effort is to control the cover of non-native grasses and weeds in the restoration area while native species are naturally reestablishing. Table 1 shows proposed performance standards for the allowable percent of non-native cover for CSS and VGL. For example, for VGL in year 3 the allowable non-native cover would be up to 60 percent. The proposed CSS performance standards are based on observed performance of other CSS restoration areas in coastal southern California such as the Palos Verdes Peninsula (Dudek, pers. obs.) and Turtle Rock (O'Connell and Erickson 1998). The proposed VGL performance standards are based on observed cover of VGL on portions of RMV in 1989 by St. John and 2001 by Dudek. St. John mapped some areas in the range of 80-100 percent needlegrass while Dudek mapped areas in the 50 percent range in a drought year.

Within CSS/VGL restoration areas, the non-native cover performance standard would be weighted by the acreage ratio of CSS/VGL. For example, for a 10-acre site with 8 acres of CSS and 2 acres of VGL the Year 1 calculation of percent non-native cover would be as follows:

$$\% \text{ non-native cover} = (((8 \text{ ac CSS} \times 0.1) + (2 \text{ ac VGL} \times 0.7)) / 10 \text{ ac}) \times 100 = 22\%$$

Because, by definition, passive restoration allows for the natural regeneration of the native vegetation community, quantitative yearly performance standards for native species cannot be prescribed *a priori* because each likely would regenerate at a different rate.

In contrast to passive restoration, specific performance standards for revegetation of native species can be set for active restoration sites. The long-term performance standards shown in Table 1 for native vegetation cover, species diversity, the overall survival rate of container plantings, and non-native cover are established to measure the success of the restoration program. For example, the criterion for CSS native vegetation cover in year 4 is 70 percent. Should it be determined that any part of the plantings have failed to meet yearly performance standards, corrective measures would be taken. The corrective measures would be implemented to bring the restoration effort into compliance with the required performance standards as

quickly as possible. These corrective measures may include replanting failed areas with container plantings of appropriate species, re-seeding, or adjustments to irrigation and maintenance practices.

For the CSS restoration areas, habitat occupation or utilization by gnatcatchers would likely offset apparent vegetation deficiencies such as cover and diversity in the first three years of monitoring. Multiple years of foraging and nesting by gnatcatchers within restoration areas would satisfy the overall success requirement of the CSS restoration, together with sufficient conformance to the performance criteria. Likewise, for VGL and CSS/VGL restoration areas, occupation by the grasshopper sparrow would likely satisfy the overall success requirement.

**TABLE 1
RECOMMENDED CSS AND VGL HABITAT PERFORMANCE
STANDARDS FOR ACTIVE REVEGETATION AREAS**

YEAR	% COVER ¹		% DIVERSITY ²		% SURVIVAL ³		% NON-NATIVE COVER ⁴	
	CSS	VGL	CSS	VGL	CSS	VGL	CSS	VGL
Year 1	20%	5%	70%	40%	70%	60%	10%	70%
Year 2	30%	15%	70%	40%	80%	80%	10%	70%
Year 3	50%	30%	70%	50%	80%	90%	10%	60%
Year 4	70%	50%	70%	50%	80%	90%	10%	50%
Year 5	80%	80%	70%	60%	80%	90%	10%	50%

- ¹ % Cover = Percent cover of native species (aggregate of all layers) within the designated area.
- ² % Diversity = Percent of species diversity originally installed that shall be represented. Replacement plantings shall be required if the total number of species lost exceed this percentage.
- ³ % Survival = Survival of all container stock and shrub transplants originally planted. This measure may include survival of individual volunteers. Any quantity of dead plants exceeding this percentage shall require replacement plantings, unless the project meets or exceeds the total native cover performance standard.
- ⁴ Non-native Cover = Maximum % cover of non-native species present during any given year.

2.4 Preliminary Designation of CSS Restoration Areas

The main goal of the CSS restoration program is to establish CSS in areas that would: (1) contribute to the Open Space by increasing the carrying capacity for the California gnatcatcher and other sage scrub species; and /or (2) would contribute to connectivity in certain important locations. With these goals in mind, the following areas have been tentatively identified for CSS restoration. As portrayed in *Figure 1*, these restoration areas total approximately 375 acres. Final selection of these areas for restoration/enhancement would require additional field study to determine the likelihood of a successful restoration program, including factors such as soil conditions and presence of exotic species both within the restoration area and surrounding habitat.

- Sulphur Canyon in the Gobernadora sub-basin was identified for restoration to provide additional habitat and enhance connectivity between Chiquita Canyon and Wagon Wheel Canyon to the west and Gobernadora and Bell canyons to the east. Sulphur Canyon is currently characterized by CSS on the slopes of the canyon and grazed annual grasses on the valley floor. The Sulphur Canyon restoration area totals approximately 131 acres. An additional 13-acre restoration area lies south of Sulphur Canyon on Chiquadora Ridge. Restoration in this area would help create a continuous band of CSS along the ridgeline.
- Several side canyons between Chiquita Ridge and Chiquita Creek were identified for restoration. Restoration of the two large canyons, totaling about 190 acres, located just northwest and southwest of the “Narrows” would greatly improve the habitat integrity of Chiquita Ridge, which narrows to less than 2,000 feet in width at the top of these side canyons. This restoration area would provide substantial “live-in” habitat for California gnatcatchers and other species, and improve the integrity of the Open Space along Chiquita Ridge. Two areas totaling about 21 acres each are located along lower Chiquita Ridge. Restoration of these two areas would extend native vegetation to the western edge of Chiquita Creek and provide additional habitat for the gnatcatcher and other resident CSS species.

2.5 Preliminary Designation of VGL Restoration Areas

The main goal of the VGL restoration program is to restore native grassland and enhance the quality of existing degraded native grassland in the Open Space such that net habitat value of the existing grassland system is maintained. Restoration of native grassland also would help stabilize areas that currently suffer from erosion such as upper Cristianitos and upper Gabino canyons. Areas identified for VGL restoration includes areas that: (1) currently support annual grasses, but have suitable clay soils and are adjacent to existing VGL; (2) currently support low

quality VGL (i.e., areas with less than 10 percent cover of native grasses); and (3) would contribute to an overall native grasslands ecosystem (i.e., small, isolated patches of native grasslands would not be considered valuable to the Open Space). Because establishing a functioning native grassland system is a goal of the restoration program, impacts to native grasslands in a particular sub-basin may be mitigated in another sub-basin to achieve greater value for the overall Open Space areas. Upper Cristianitos, portions of Blind Canyon mesa, and lower Chiquita Ridge totaling approximately 200 acres are recommended for VGL restoration.

- Upper Cristianitos is recommended for VGL revegetation and enhancement because of adjacent existing VGL and to reduce the generation of fine sediments from clayey terrains, promote stormwater infiltration and to enhance the value of upland habitats adjacent to Cristianitos Creek. This area includes patches of annual grassland underlain by clay soils suitable for revegetation and low quality VGL suitable for enhancement. These recommended revegetation and enhancement areas also are contiguous with existing medium quality grassland, suggesting a high likelihood of successful restoration. The revegetation and enhancement areas in upper Cristianitos total approximately 127 acres.
- Portions of Blind Canyon mesa totaling approximately 45 acres are recommended for grassland revegetation and enhancement. This area has at least one patch of annual grassland suitable for revegetation and possibly two patches of low quality VGL suitable for enhancement. These areas are adjacent to existing medium quality VGL, suggesting a high likelihood of successful restoration. Additional fieldwork in the area may reveal additional restoration opportunities.
- Three relatively small patches of potential VGL revegetation totaling approximately 28 acres were identified in the southern portion of Chiquita Ridge. These areas currently support annual grassland but are located in an area supporting a mosaic of medium quality VGL and CSS, indicating a high likelihood of successful revegetation.

2.6 Preliminary Designation of CSS/VGL Restoration Areas

Areas proposed for CSS/VGL restoration are sited in locations adjacent to areas that may naturally support a mosaic of CSS and VGL. A comparison of recent aerial photos (Year 2000) with the NCCP vegetation map and site-specific native grassland mapping by Dudek in 2001 indicates that some areas of upper Gabino Canyon mapped in the early 1990's as grassland appear to be type-converting to a CSS/VGL mix. This type conversion may be a result of the natural drought-wet cycle and the current mosaic of CSS and VGL in this area may reflect natural successional processes. CSS/VGL mosaics provide important biological and structural diversity and valuable habitat for a variety of plant and wildlife species.

The following areas are recommended for CSS/VGL restoration: upper Gabino Canyon; and in the Chiquita sub-basin in the area east of the Santa Margarita Water District wastewater treatment plant, the citrus groves west of Chiquita Creek and the disced areas west of the creek to the Chiquita ridgeline.

- Upper Gabino Canyon suffers from moderate to severe erosion and currently generates fine sediment due to extensive gully formation in the headwaters area. A combination of slope stabilization, grazing management and CSS/VGL restoration would reduce sediment generation and promote infiltration of stormwater which would reduce downstream impacts. This area has been identified for CSS/VGL restoration because some areas mapped as grassland in 1990 have since naturally revegetated with sparse CSS. Allowing a mixed community to regenerate may thus represent a more natural climax situation. This area has at least one area of annual grassland adjacent to the creek suitable for revegetation and several patches of low quality VGL suitable for enhancement. The revegetation area totals about 13 acres and the enhancement areas total about 87 acres.
- As discussed above for CSS, restoration of disturbed areas of Chiquita Canyon west of Chiquita Creek would provide additional habitat for upland species occupying Chiquita Ridge, and particularly the gnatcatcher. Restoration of areas previously used for agricultural purposes, including grazing and citrus, would also benefit riparian species by removing uses that may contribute to downstream impacts. Additional field work, including an analysis of soils, would be needed to identify the areas best revegetated with CSS alone or CSS/VGL.

2.7 Implementation Plan

Implementation of the upland component of the Habitat Restoration Plan would be comprised of several steps, including:

1. Assessment of the sites to determine the most effective restoration approach; i.e., passive restoration or active restoration, revegetation, or enhancement.
2. Determination of the appropriate restoration treatment.
3. Appropriate planting techniques.
4. Weed control.
5. Erosion control.

2.7.1 Site Assessment

A Restoration Ecologist would inspect each of the designated restoration sites and prepare a detailed restoration plan for each of the sites. A key initial determination would be whether the site can be passively restored or whether it would require active restoration (i.e., timed grazing, prescribed burning, planting, irrigation, etc.).

a. Passive Restoration

Passive restoration would receive first priority and primarily would involve removal or control of disturbance factors that perpetuate the non-native characteristics of the site (e.g., discing, over-grazing, non-native grasses and weeds). Depending on existing site conditions, passive restoration may involve active site preparation and treatment such as weed control (as described below). The key concept of passive restoration is that the native habitat would naturally reestablish if disturbance factors are kept in check. For passive restoration to be effective, the site likely would need to be relatively small and mostly bounded by native vegetation (to facilitate colonization by native species) and/or have an adequate seed bank to support the growth of native species.

b. Active Restoration

Active restoration would be implemented if passive restoration is considered to be inappropriate for the site; i.e., the native vegetation community is unlikely to naturally reestablish itself because of its large size, lack of immediately adjacent native habitat, and/or lack of a native seed bank. The key difference between passive and active restoration is that focused restoration activities would be implemented. Active restoration can take the form of enhancement or revegetation, as defined in *Section 2.1*. The two primary approaches to enhancement of large areas (i.e., 10s to 100s of acres) would be timed grazing and prescribed burning. For smaller areas, or where timed grazing or prescribed burning is not practical, enhancement actions may include mowing, selective use of herbicides, and pulling of weeds. On active revegetation sites native species would be planted through container stock and/or by seeding and closely monitored and maintained until success criteria are achieved.

2.7.2 Restoration Treatments

a. Site Preparation

Whether the restoration effort is passive or active, proper site preparation is critical to successful habitat restoration. Site preparation would include the removal of weeds and debris such as

scattered rocks and concrete that may interfere with restoration efforts. Initial weed eradication would be concentrated on removing standing biomass from the sites.

For both passive and active restoration sites, initial weed control efforts may involve a variety of treatments, including timed grazing, prescribed burning and chemical and mechanical (e.g., mowing, weed whacking, hand-pulling) treatments of non-native grasses and other exotic invasive species such as artichoke thistle (*Cynara cardunculus*), sweet fennel (*Foeniculum vulgare*) and mustard (*Brassica* spp.). Depending on the site, one or a combination of these treatments would be used. For example, chemical treatment of artichoke thistle on the Ranch has proven to be effective for this species, which is highly resistant to other forms of control such as grazing. Repetitive treatments are desirable over a prolonged period to effectively reduce the weed seed bank that is present in the soil. This process is anticipated to require one year to reduce the seed bank to the greatest extent possible within that time period. A “grow and kill” procedure involving site irrigation to promote weed seed germination followed by herbicide treatment to kill weed seedlings would be conducted where appropriate. Additional cycles of irrigation and herbicide treatment may be required in these areas.

b. Timed Grazing

For large areas of VGL restoration, and where appropriate, timed grazing (including cattle and goats) would be the primary enhancement technique. The use of cattle grazing to enhance and manage native grasslands is well established in the literature and meshes well with the existing and future cattle operations on the Ranch. Appropriately timed grazing can have several beneficial effects on the vigor of native grasslands:

- Removal of litter and thatch
- Recycling of nutrients
- Stimulation of tillering (sprouting of new stalks)
- Removal and control of alien species
- Reduced transpiration (loss of water) by alien species making more water available for native grasses.

Goats could be used on an “as-needed” basis in the spring to control weeds in native grasslands. As browsers, goats forage on leaves, flower buds and fibrous materials of noxious weeds that cattle may ignore. Removal of the leaves inhibits critical functions such as photosynthesis, transpiration and respiration. Goats tend to leave plant stems (as opposed to mowing and herbicides) and thus the plant is inhibited from sending out more roots and shoots. Removal of flower buds inhibits reproduction. Thus goats provide a biological control alternative to herbicides and more labor-intensive hand-pulling.

The use of timed cattle grazing to enhance and maintain CSS has not been well established in the literature and uncontrolled grazing generally is considered to be detrimental. Removal of intense grazing from grasslands may encourage establishment of CSS (Vogl 1976; Burcham 1957; Hobbs 1983; Kirkpatrick and Hutchinson 1980). The Southern Orange County NCCP Science Advisors hypothesized that grazing in post-fire and mid-successional CSS would result in decreased species diversity overtime. On the other hand, the relatively low intensity cattle grazing on RMV has not appeared to seriously affect of the quality of CSS in the subregion for the California gnatcatcher. The highest densities of the gnatcatcher occur in Chiquita Canyon in areas that have not burned since the 1950's, but have been consistently grazed. A management issue is whether some level of grazing is consistent with, or even beneficial to, managing CSS. A management hypothesis is that timed grazing benefits CSS by controlling the proliferation of annual grasses and maintaining a habitat structure suitable for the California gnatcatcher. This issue can be addressed by establishing grazing exclosures in Chiquita Canyon and monitoring the response of the CSS to the absence of cattle. Understanding the relationship between cattle grazing and CSS quality would be important for the long-term management of the Open Space because prescribed burning, for example, may not be practical in Chiquita Canyon, and because of the Ranch's desire to continue a viable ranching operation.

Timed grazing is anticipated to be used in the near-term for enhancement in the following areas:

- Upper Gabino Canyon CSS/VGL enhancement areas
- Upper Cristianitos VGL enhancement areas
- Blind Canyon enhancement areas

Timed-grazing may be used in the future on Chiquita Ridge and Chiquadora Ridge in the CSS and VGL restoration areas, as well a management tool for existing high quality VGL and CSS if management experiments demonstrate its efficacy for the latter habitat.

The Grazing Management Plan provides more detail on the use of timed grazing for the enhancement and management of VGL and potentially CSS.

c. Prescribed Burning

Prescribed burning, in conjunction with timed grazing, would be used to enhance both CSS and VGL where appropriate. It is envisioned that prescribed burning primarily would be used in the San Mateo Watershed portion of the Open Space where there are fewer constraints on its use (e.g., risks to property, public opposition, etc.).

It is generally believed that CSS is adapted to a fire regime, although the nature of this adaptation is not completely understood. High fire frequencies may be detrimental to the floristic

composition and structure of CSS (Malanson and O'Leary 1982). Alternatively, too long of fire intervals may result in senescence and reduced productivity. However, the CSS in lower and middle Chiquita Canyon south of Oso Parkway has not burned since the 1950's and this area supports the highest densities of California gnatcatchers in the subregion. A potential confounding factor is that this area has been consistently grazed, which suggests that in the absence of fire grazing may be a positive contributing factor to the productivity of the area for the gnatcatcher by helping to maintain the appropriate habitat structure and control the proliferation of invasive species. As noted above in the discussion of grazing, the use of grazing as an enhancement/management tool in the Open Space needs to be tested.

Prescribed burning is anticipated to be used in the San Mateo Watershed in conjunction with timed grazing in the following areas:

- Upper Gabino Canyon CSS/VGL enhancement areas
- Upper Cristianitos VGL enhancement areas
- Blind Canyon enhancement areas

Following Menke's (1996) recommendation, prescribed burning would be used a secondary component of enhancement, with grazing as the primary component. While fire has a beneficial effect in reducing litter, thatch and alien species, frequent burning can damage native grasses. Menke recommends burning only every third or fourth year.

The Fire Management Plan provides more detail on the use of prescribed burning for the enhancement and management of VGL and CSS.

d. Revegetation

In smaller areas that require intensive revegetation of CSS, VGL and CSS/VGL, restoration would be achieved through a process involving site preparation, installation of temporary irrigation (where necessary), selective container plant installation, and seed installation throughout all active restoration areas. Container plants would be installed in all CSS and VGL revegetation areas. Native grass container plants would be salvaged from development sites or from nursery grown stock.

Habitat enhancement for VGL and CSS/VGL would primarily involve long term control of annual grasses and exotic species that now coexist with native grassland species. Selected enhancement areas have been identified in previously mapped VGL habitat where non-native species are dominant. These areas would receive native grass plants that are salvaged from development areas, where possible and practical, and the grassland seed mix.

The following sections describe the revegetation treatments that would be used for each habitat type. Long-term maintenance is described in *Section 2.8* and would begin after the mitigation installation work receives final approval and acceptance.

1. CSS Habitat Revegetation

The revegetation treatment for CSS would rely upon the use of container plants and a native seed mix to reintroduce CSS species to the revegetation sites. Container plant installation would be an important component of the revegetation treatment at these sites to facilitate more rapid plant establishment and area coverage, particularly on the steeper slopes. Species with seed that is not readily available or that do not readily germinate would be introduced using nursery-grown container plants. Container plants would be inoculated with appropriate mycorrhizae by the nursery staff to promote more healthy, vigorous growth. Most native CSS species that are installed from nursery containers are capable of seed production within the first year after installation. This on-site seed production is an important part of the revegetation process.

Native seed would originate from local sources in Southern California to the greatest extent feasible. The seed mix would contain appropriate mycorrhizae to help promote healthy, vigorous plant growth. Common CSS species such as California sagebrush (*Artemisia californica*), California bush sunflower (*Encelia californica*), orange bush monkey-flower (*Mimulus aurantiacus*), coastal goldenbush (*Isocoma menziesii*), white sage (*Salvia apiana*), California buckwheat (*Eriogonum fasciculatum*), and native bunchgrass (*Nassella* spp.) would be included in the seed mix.

Revegetation would consist of a native seed mix and container plants of coastal sage scrub species. The seed mix also would contain nurse crop species that would provide initial soil surface stabilization. Although each site would need to be evaluated for the most appropriate species, a sample plant palette for the revegetation areas based on typical CSS stands in the Southern NCCP/HCP planning area is provided in *Tables 2 and 3*.

TABLE 2
CONCEPTUAL CSS RESTORATION CONTAINER PLANT PALETTE¹

Botanical Name	Common Name	Size	Typical Spacing (in feet)
<i>Artemisia californica</i>	California sagebrush	1 gal.	4
<i>Baccharis pilularis</i>	Coyote bush	1 gal.	6
<i>Bothriochloa barbinodis</i>	Beard-grass	1 gal	20
<i>Encelia californica</i>	California bush sunflower	1 gal.	4
<i>Eriogonum fasciculatum</i>	California buckwheat	1 gal.	5
<i>Galium angustifolium</i>	Narrow-leaved bedstraw	1 gal.	20
<i>Heteromeles arbutifolia</i>	Toyon	1 gal.	12
<i>Isocoma menziesii</i>	Coastal goldenbush	1 gal.	4
<i>Isomeris arborea</i>	Bladderpod	1 gal.	6
<i>Keckiella cordifolia</i>	Heart-leaved penstemon	1 gal.	12
<i>Leymus condensatus</i>	Giant wild rye	1 gal.	5
<i>Malosma laurina</i>	Laurel sumac	1 gal.	12
<i>Marah macrocarpus</i>	Manroot	1 gal.	6
<i>Melica imperfecta</i>	Coast range melic	1 gal.	?
<i>Mimulus aurantiacus</i>	Orange bush monkey-flower	1 gal.	6
<i>Mirabilis californica</i>	Coastal wishbone plant	1 gal.	6
<i>Nassella lepida</i>	Foothill needlegrass	1 gal.	?
<i>Opuntia littoralis</i>	Coastal prickly pear	1 gal.	6
<i>Opuntia prolifera</i>	Coast cholla	1 gal.	6
<i>Rhus integrifolia</i>	Lemonadeberry	1 gal.	12
<i>Salvia apiana</i>	White sage	1 gal.	4
<i>Sambucus mexicana</i>	Mexican elderberry	1 gal.	12

- 1 The plant palette for any given revegetation site would be site-specific to reflect the species composition of the native vegetation in the vicinity and other site conditions such as slope, aspect and soil conditions.

**TABLE 3
CONCEPTUAL CSS REVEGETATION SEED MIX**

Botanical Name	Common Name	%P/%G¹	Lbs/Ac
<i>Ambrosia psilostachya</i>	Western ragweed	20/30	1.0
<i>Artemisia californica</i>	California sagebrush	15/50	6.0
<i>Deinandra fasciculata</i>	Fascicled tarweed	10/25	1.0
<i>Dichelostemma capitatum</i>	Blue dicks	95/50	0.5
<i>Encelia californica</i>	California bush sunflower	40/60	6.0
<i>Eriogonum fasciculatum</i>	California buckwheat	10/65	20
<i>Galium angustifolium</i>	Narrow-leaved bedstraw	80/30	1.0
<i>Gnaphalium californicum</i>	California everlasting	10/25	0.5
<i>Gnaphalium canescens</i>	Felty everlasting	10/25	0.5
<i>Isocoma menziesii</i>	Coastal goldenbush	30/30	6.0
<i>Lotus scoparius</i>	Deerweed	90/60	1.0
<i>Lupinus bicolor</i>	Miniature lupine	98/80	2.0
<i>Lupinus succulentus</i>	Arroyo lupine	95/85	6.0
<i>Melica imperfecta</i>	Coast range melic	90/60	1.0
<i>Mimulus aurantiacus</i>	Orange bush monkey-flower	2/60	1.0
<i>Nassella lepida</i>	Foothill needlegrass	60/60	1.5
<i>Nassella pulchra</i>	Purple needlegrass	70/60	3.0
<i>Salvia apiana</i>	White sage	70/30	8.0

¹ %P = seed purity or the amount of seed vs. other non-seed material such as stems, leaves, chaff, anthers, etc. %G = percent viable seed. These two measures are used as minimum standards for seed. Together they define the amount of Pure Live Seed (%PLS) in each pound of seed. Seed is tested for these standards because it can have a significant effect on the vegetation coverage that would result from putting down a pound of seed with a high PLS vs. a low PLS.

2. VGL Habitat Revegetation and Enhancement

Revegetation and enhancement of VGL would require a variety of treatments that would vary depending on the site location and feasibility. Where timed grazing and prescribed burning are not appropriate, treatments would consist of container plant installations, native bunchgrass salvaged plant transplantations (where practical), and seeding. In areas where a CSS/VGL plant species matrix is appropriate, the CSS plant palette would supplement the VGL plant palette. A list of proposed VGL plant and seed species is provided in *Tables 4 and 5*.

**TABLE 4
CONCEPTUAL VGL REVEGETATION AND
ENHANCEMENT CONTAINER PLANT PALETTE**

Botanical Name	Common Name	Size	Typical Spacing (in feet)
<i>Artemisia californica</i>	California sagebrush	1 gal.	4
<i>Ericameria palmeri</i> var. <i>pachylepsis</i>	grassland goldenbush	1 gal.	20
<i>Eriogonum fasciculatum</i>	California buckwheat	1 gal.	20
<i>Isocoma menziesii</i>	coast goldenbush	1 gal.	20
<i>Leymus condensatus</i>	giant wild rye	1 gal.	5
<i>Nassella lepida</i>	foothill stipa	1 gal. ¹	3
<i>Nassella pulchra</i>	Purple needlegrass	1 gal. ¹	3

¹ Use 1-gallon containers for salvaged plants and C-10 leach tube (1 5/8"x8 1/4") for nursery grown plants. Nursery plants would be used only to supplement quantities of salvage plants to achieve the total quantity.

**TABLE 5
CONCEPTUAL VGL REVEGETATION AND ENHANCEMENT SEED MIX**

Botanical Name	Common Name	%P/%G ¹	Lbs/Ac
<i>Agrostis diegoensis</i> (?)	Leafy bentgrass	90/80	1.0
<i>Aristida ternipes</i> var. <i>hamulosa</i>	Hook three-awn grass	?90/70	1.0
<i>Bloomeria crocea</i> var. <i>crocea</i>	Common golden star	90/60	3.0
<i>Calochortus splendens</i>	lilac mariposa	90/80	2.0
<i>Castilleja exserta</i>	Common owl's-clover	50/50	2.0
<i>Dichelostemma capitatum</i>	blue dicks	90/80	1.0

TABLE 5
CONCEPTUAL VGL REVEGETATION AND ENHANCEMENT SEED MIX

Botanical Name	Common Name	%P/%G¹	Lbs/Ac
<i>Eschscholzia californica</i>	California poppy	90/80	2.0
<i>Deinandra fasciculata</i>	Fascicled tarweed	20/80	0.5
<i>Deinandra paniculata</i>	paniculate tarweed	20/80	0.5
<i>Lasthenia californica</i>	coast goldfields	50/60	1.0
<i>Lupinus bicolor</i>	Lindley's annual lupine	98/85	4.0
<i>Melica imperfecta</i>	California melic	80/60	2.0
<i>Nassella lepida</i>	foothill stipa	90/60	6.0
<i>Nassella pulchra</i>	purple needlegrass	90/80	6.0
<i>Osmadenia tenella</i>	rosin-weed	unknown	0.5
<i>Plantago erecta</i>	California plantain	90/80	3.0
<i>Sisyrinchium bellum</i>	blue-eyed grass	95/75	1.0

¹ %P = seed purity or the amount of seed vs. other non-seed material such as stems, leaves, chaff, anthers, etc. %G = percent viable seed. These two measures are used as minimum standards for seed. Together they define the amount of Pure Live Seed (%PLS) in each pound of seed. Seed is tested for these standards because it can have a significant effect on the vegetation coverage that would result from putting down a pound of seed with a high PLS vs. a low PLS.

Treatments for the enhancement areas would rely heavily on weed removal and replacement by salvaged plants from within developed areas. Native bunchgrass plants within the limits of grading would be salvaged prior to grading and relocated in the VGL enhancement areas to the extent feasible. If feasible, depending on the progress of site preparation activities, plants shall be removed and immediately relocated to a receptor hole in the enhancement area. Otherwise, salvaged plants would be potted and stored until the following fall when the receiving site is ready. A receptor hole shall be dug in the enhancement areas to the same depth and twice the width of the salvaged bunchgrass. The salvaged bunchgrass shall then be planted according to the techniques described in *Section 2.7.3*. If it is determined that a plant salvage is not feasible, container plants would be substituted.

2.7.3 Planting Techniques

All container plants and salvaged plants shall be installed using industry standard techniques. A hole twice the diameter of the rootball would be excavated to the depth of the rootball. Each hole would be filled with water and allowed to drain prior to plant installation. Each container

plant rootball shall be scarified prior to installation if dead roots occur on the surface of the rootball. Salvaged plant rootballs do not need scarification. Planting backfill shall be native soil.

CSS species would receive a 2-inch thick layer of bark mulch 18 inches out from the base of each plant to reduce weed growth and water evaporation. After installation, each plant shall be irrigated to the depth of the rootball.

2.7.4 Seed Application

A two-step hydroseed technique would be used to install all seed mixes. This technique involves an initial application of a hydroseed slurry composed of water, seed, fertilizer (if any), and a low volume of fiber mulch. The second hydroseed slurry application contains water and a heavier volume of fiber mulch. The purpose of the two-step process is to achieve the greatest seed-soil contact. In any cases where seed applications are within small in-fill enhancement areas, installation would be performed using hand broadcast methods.

2.7.5 Irrigation System & Schedule

Where needed, temporary on-grade irrigation systems would be installed to enhance germination and establishment of native seedlings. The systems would be controlled automatically by irrigation clocks, and may be designed to shut off during rains events. Areas of similar topography may be controlled by a single remote control valve. The precipitation rate of the system would be approximately 0.2 inch per hour for any given area of the system.

The frequency and duration of irrigation are critical to seed germination and establishment. The application of water shall be keyed to existing conditions and water requirements of each stage of seed germination and seedling establishment. Irrigation shall be used to maximize container plant survival and deep root growth while minimizing non-native species growth and seed production. During September and October of each year, the plants should show signs of water stress and dormancy; a condition that is typical for CSS and VGL species during the fall season.

The sites shall be reviewed by onsite personnel regularly for appropriate soil moisture. Visibly moist, but not saturated, soil in the top 3-4 inches is the desired condition during seed germination and seedling establishment. As the winter season progresses, soil moisture would naturally penetrate to deeper soil horizons. As seedlings reach 3-4 inches in height, irrigation frequency should be reduced to weekly, biweekly, and monthly intervals.

During each inspection, holes shall be dug with a hand shovel or using a soil probe to determine the depth and amount of soil moisture. Enough holes shall be dug to establish a representative sample of the site, i.e., until soil conditions are the same in more than three holes dug across the

site. The irrigation schedule shall be modified as necessary based on this inspection. Irrigation heads shall be adjusted or capped where wet areas occur next to dry areas to facilitate additional irrigation of the drier areas.

Irrigation system operation shall be suspended in anticipation of rain events. The system shall be shut-off at a master control valve three to five days prior to a predicted rain storm or series of storms. System operation shall be resumed immediately if a predicted storm does not materialize and if the site requires supplemental irrigation to maintain soil moisture conditions that are sufficient for seed germination and seedling establishment. System operation shall be resumed after a rain event upon a site inspection to determine soil moisture levels.

2.7.6 Weed Control

In restoration areas where a considerable weed seed bank has built up in the soil, weed control activities would be performed for the first year prior to container plant and seed installation. Weed abatement is most effective when time is given to repeated treatment of resprouting weeds. This is especially true for persistent weeds such as artichoke thistle, black mustard, sweet fennel (*Foeniculum vulgare*), smooth cat's-ear (*Hypochoeris glabra*), tocalote (*Centaurea melitensis*), wild radish (*Raphanus sativus*), Crete hedychnois (*Hedypnois cretica*), Italian thistle (*Carduus pycnocephalus*), bull-thistle (*Cirsium vulgare*), milk-thistle (*Silybum marianum*), and annual grasses. Early treatment and regular follow-up treatment of these species would reduce the weed density in the restoration areas over the long-term. Herbicide treatment of non-native grasses and follow-up treatment to reduce seed production would be essential for establishing native vegetation cover.

2.7.7 Erosion Control

Where needed, rice straw wattles would be installed on the slopes and a silt fence at the bottom of the slopes as erosion control devices. The location of these applications would be determined by the Restoration Ecologist. Soil stability would be inspected by the Restoration Ecologist during the rainy season to establish any further erosion control applications that might be necessary.

2.8 Maintenance and Monitoring Plan

Maintenance and monitoring activities that are necessary to ensure successful habitat revegetation and enhancement would be conducted according to this plan. The Maintenance and Monitoring Plan provides direction to the Restoration Ecologist, RMV, and the Installation/Maintenance Contractor for routine maintenance of the restoration projects to be conducted throughout the initial plant establishment period and five-year monitoring period. This section is intended to provide a brief description of those activities.

2.8.1 Maintenance Activities

Maintenance activities shall apply to all areas of revegetation and enhancement. Immediately following implementation of the restoration program, a maintenance program would be initiated to ensure successful germination and growth of the installed native species.

Because mature CSS effectively controls non-native species, restored CSS and CSS/VGL areas likely would become self-sustaining over time, needing very little or no maintenance once established. Maintenance activities for CSS and CSS/VGL would thus focus on ensuring the establishment of self-sustaining habitat during the five-year maintenance period. Maintenance activities shall include weed control, supplemental irrigation (as appropriate), pest control (as appropriate), and site access restrictions.

Restored VGL likely would require additional maintenance to reduce the buildup of non-native biomass. Native perennial grasses benefit from biomass reduction because it removes thatching that begins to crowd out new growth. Historically grasslands were grazed to prevent this and consequently, grasses have adapted to this condition. Depending on the restoration site, the grass thatch that is built up should be removed periodically. In the first few years of revegetation sites, mowing and/or with hand tools such as rakes and weed whip machines should be used. Once native grasses are well established timed grazing and prescribed burning can be used for long-term management. Biomass reduction for VGL restoration areas should begin in the summer or fall after two years of active growth, and continue annually. A determination of which method would be most effective and feasible would be made by the Restoration Ecologist and RMV.

2.8.2 Four-Month Maintenance and Monitoring Period

During the four-month period following completion of restoration activities, weed control measures, irrigation schedules, and special management needs would be determined. A replanting program would be initiated at the completion of the four-month maintenance period if 100 percent container plant survival is not attained. The plant establishment period shall be included in the installation contract to be performed by the Installation/Maintenance Contractor.

Successful completion of the contract shall include 100 percent survival of all container plants at the end of the plant establishment period. New replacement plants shall be provided and installed for the Installation/Maintenance Contractor to obtain final contract sign-off and payment.

2.8.3 Five-Year Maintenance and Monitoring Program

Following the four-month maintenance period, a long-term five-year maintenance program would be initiated. Long-term maintenance would be initiated following the end of the plant establishment period. Maintenance shall occur on an as-needed basis throughout the five-year maintenance period. Maintenance personnel are expected to conduct maintenance activities on a timely basis by conducting work at a frequency and intensity that would result in the greatest potential for native vegetation to establish and become the dominant vegetation type within the restoration area. If necessary, corrective measures (such as re-seeding or container planting) would be promptly implemented to bring the restoration effort into compliance with the performance standards shown in Table 1.

Supplemental irrigation of restoration sites would be conducted only when determined to be necessary by the Restoration Ecologist. Irrigation schedules would provide adequate water to maximize the survival of installed container plants and seedling establishment without creating conditions that promote non-native species that are dependent upon constant moist soil conditions.

Irrigation of the restoration sites would be closely monitored, and if necessary, the irrigation schedule and rates for each area would be modified to provide moisture and ensure successful germination and growth. The Restoration Ecologist would determine the need for changes in irrigation schedules in consultation with the Installation/Maintenance Contractor. An accurate record of these activities would be maintained by the Installation/Maintenance Contractor.

2.8.4 Weed Control

It shall be the Installation/Maintenance Contractor's responsibility to control weeds within the restoration areas. Before initiating any weed control measures, the Installation/Maintenance Contractor would meet onsite with the Restoration Ecologist and RMV to determine the extent and methods of weed control. The Installation/Maintenance Contractor would notify RMV at least three days prior to implementing approved weed control measures. Weed control would be conducted in all active restoration areas for the duration of the five-year maintenance period. As outlined in *Section 2.3.3* and Table 1 no more than 10 percent non-native cover in any given year during the five-year maintenance period would be tolerated within CSS restoration areas. In VGL restoration areas the percent of non-native cover ranges from 70 percent in Year 1 to 50

percent in Year 5. In CSS/VGL restoration areas the allowable percent non-native cover is a function of the ratio of CSS to VGL in the restoration area, as described in *Section 2.3.3*.

During the five-year maintenance program, non-native grasses shall be removed with hand tools, by hand, or treated with a monocot-specific herbicide. Hand tools such as “weed whips” shall be used only where solid patches of non-native grasses are present and in the absence of native seedlings. Hand removal shall be used where native shrub seedlings are present. Chemical treatment shall be limited to large areas of non-native grass with no native species present. Target non-native grass species include Italian ryegrass (*Lolium multiflorum*), wild oat (*Avena* spp.), Bermuda grass (*Cynodon dactylon*), brome grasses (*Bromus* spp.), and any future investigations of veldt grass (*Ehrharta calycina*), which is expanding into Orange County. After the five-year maintenance program, or sooner if deemed appropriate by the Restoration Ecologist, timed grazing or prescribed burning may be used for long-term weed control, as described in the Grazing and Fire Management plans.

Herbicide treatments would be used on non-native weedy forbs such as smooth cat’s-ear, tocalote, Crete hedypnois, Italian thistle, bull-thistle, milk-thistle, Carolina geranium (*Geranium carolinianum*), scarlet pimpernel (*Anagallis arvensis*), red-stemmed filaree (*Erodium cicutarium*), white-stemmed filaree (*E. moschatum*), and broad-lobed filaree (*E. botrys*).

Species such as black mustard (*Brassica nigra*), wild radish (*Raphanus sativus*), etc. that can be successfully removed by hand shall be hand-pulled once individuals reach approximately 12 inches of height. Artichoke thistle, sweet fennel and other weeds that cannot be successfully removed by hand, shall be spot-sprayed with a broadleaf herbicide. Weeding should focus on the elimination of weed seed production and weed plant removal. All weeds shall be disposed of off-site at an approved disposal location.

The prime period for weed removal is in the spring during the months of March and April. Weed eradication at this time is ideal because soils are typically still moist enough for hand-pulling and therefore can be removed before their detrimental effects of robbing native plants of sunlight, moisture, and nutrients occur. Additionally, it is imperative that weeds are removed before they can successfully produce seeds and contribute to the weed seed bank. If weeds are not controlled during this period of time, successful establishment of CSS species or VGL species would be prolonged or reduced.

This ideal weeding period happens to coincide with the California gnatcatcher breeding season (February 15 - July 30). Therefore, in the event that a gnatcatcher or multiple gnatcatchers inhabit a restoration site, special arrangements for weed removal would be made. Those arrangements would include: **(1)** The presence of a wildlife biologist during the weed removal event and the establishment of flagging to determine the allowable proximity of weeding

activities to the gnatcatchers, and especially nest sites; **(2)** Hand weeding only would be allowed within the area designated by the wildlife biologist; and **(3)** Restrict weeding to no more than four hours between 11:00 am and 5:00 pm to allow for sufficient foraging time. Weed removal activities would be discontinued if the wildlife biologist notes any obvious gnatcatcher distress.

Although the welfare of the gnatcatchers is paramount, it is critical that successful weed eradication take place during the spring to ensure establishment of quality CSS habitat. Mature CSS habitat has the capacity to withstand invasive weed species. Therefore, careful attention to the exclusion of weedy invasive species during the maturation of CSS species is key to the long-term success of the restoration program.

2.8.5 Clearing and Trash Removal

Pruning or clearing of native revegetation plantings would be prohibited. The revegetation areas would be allowed to develop naturally. Plant debris of native shrubs would not be removed from the restoration sites. Native plant debris provides valuable micro-habitats for invertebrates, reptiles, small mammals, and birds; all necessary elements of normally functioning CSS and VGL communities. The decomposition of the plant debris also is essential for the replenishment of the soil's nutrients and minerals.

Trash shall be regularly removed from restoration areas by hand and appropriately disposed of offsite. Such trash shall be removed as needed, but at no less than at 1-month intervals for the first year, and quarterly thereafter.

2.8.6 Pest Control

Pests, including insects, mites, snails, rabbits, and rodents, are expected to occur within the restoration areas. In accordance with an Integrated Pest Management Program, active control of pests with the use of chemical pesticides would be avoided in favor of allowing natural environmental controls to take effect or the use of directed controls (e.g., trapping). If destruction of the habitat plantings by pests becomes a problem, the Installation/Maintenance Contractor would consult with RMV and the Restoration Ecologist to determine remedial measures to be taken.

2.9 Monitoring Program

Monitoring of the restoration areas shall be accomplished by the Restoration Ecologist, under direction of RMV. Restoration efforts would be considered successful when the performance standards stated in *Section 2.3.3* and Table 2 for the specific vegetation type have been met. At

that point, the restoration project would be considered to be established. Vegetation monitoring would continue to the end of the full five-year monitoring period. Vegetation monitoring would consist of qualitative and quantitative data collection and analysis. The results of these surveys would be recorded and included in annual reports submitted to RMV for incorporation into the overall Open Space report.

2.9.1 Monitoring Period for Project Success

Qualitative surveys consisting of a site walkover and characterization of the restoration sites would be conducted. For active restoration sites, the Installation/Maintenance Contractor shall be present during qualitative surveys to review maintenance activities and requirements.

Quantitative surveys would involve the collection and analysis of transect data to describe the vegetation structure, identify trends in habitat development, and identify existing and potential problems that could negatively affect project success.

2.9.2 Qualitative Data Collection

After the initial planting effort has been completed in a revegetation or enhancement area, the area would be monitored every two weeks for the initial four-month period, quarterly through the end of year 2, and semi-annually for years 3-5. For passive restoration sites, the areas would be monitored quarterly through the end of year 2, and semi-annually for years 3-5. Qualitative surveys would be conducted by the Restoration Ecologist and consist of a general site walkover and a characterization of the revegetation planting on active restoration sites. General observations, such as health of planted species, signs of over watering, and drought stress would be noted. Revegetation plantings would be examined to visually estimate percentage of cover, species mortality, species composition, seedling recruitment, and soil, weed, and pest problems. Maintenance needs would be recorded and submitted by the Restoration Ecologist to RMV and Installation/Maintenance Contractor for appropriate action subsequent to each survey.

The irrigation system would be tested regularly by the Installation/Maintenance Contractor during the irrigation season to ensure that it is functioning properly. Maintenance needs would be recorded and submitted to the Restoration Ecologist and RMV for appropriate action.

2.9.3 Quantitative Data Collection Methods

To augment qualitative survey data, more precise data would be collected and analyzed by the Restoration Ecologist to document and evaluate the progress of the restoration program toward meeting habitat goals. Immediately following project initiation (i.e., site preparation for passive and active restoration sites and installation on active sites), permanent sampling locations would

be established within the restoration areas, marked and recorded on maps. These sampling stations would be surveyed two times per year to determine germination and transplant success, species mortality, pest problems, percentage of relative cover, and species composition. The frequency of data collection may be reduced to one time per year at the discretion of the Restoration Ecologist and RMV. Consistent sampling techniques would be used throughout the monitoring process to ensure accuracy in comparative analysis.

Quantitative plant distribution data would be collected from sampling locations (transect lines for CSS and CSS/VGL and quadrats for VGL) to compare the restored vegetation with the habitat characteristics of comparable existing CSS and VGL vegetation in the general project area. All transects would be 25 meters long and would be established randomly within the revegetation areas. The number and locations of transect lines and quadrats within a restoration area would be determined at the time of project installation, but would be adequate to provide a representative sampling of the restoration area.

CSS and CSS/VGL transect data would be collected by recording each species that intersects an imaginary vertical plane located at each half-meter mark along the transect. All species present within a 5-meter wide band centered on the transect line would be recorded. Relative species cover and species diversity would be derived from these data.

One-meter quadrat samples within the VGL enhancement areas would be taken randomly each year. The sampling methodology would consist of randomly tossing a 1-meter quadrant frame in front or to the side of the field monitor. Native and non-native vegetation cover would be estimated within the quadrat. A count of individual species would be made for each quarter quadrat in a clockwise pattern beginning in the lower left quarter. Individuals would be categorized by size class within one of the quadrat quarters, alternating in a clockwise pattern for each successive quadrat sample.

A reference transect of existing established CSS and VGL habitat occupying similar topography and subject to similar environmental conditions would be established as a control. Each transect sampling area would be photographed to document the progress of revegetation over the five-year monitoring period. Photo-documentation would be included in all status reports.

Transect data collection shall be achieved by recording each plant species that intersects an imaginary vertical plain at each half-meter along the transect line. Data would be converted to relative cover.

2.9.4 Record Keeping

Following each monitoring visit, the Restoration Ecologist would recommend actions, as needed, to RMV that would promote survival and coverage criteria as described in the performance standards. The Restoration Ecologist, RMV, and Installation/Maintenance Contractor would work together to monitor, maintain, and replant restoration areas, if necessary.

Over the five-year period following restoration implementation, an annual report prepared by the Restoration Ecologist that discusses the results of the restoration monitoring and maintenance efforts for that year would be submitted to RMV for incorporation into the overall report for the Open Space. Vegetation cover by species, compliance with required performance standards, species heights, seedling recruitment, pest problems, weed control problems, pest control measures implemented, additional required maintenance procedures, and the general health of the revegetation plantings would be summarized in these reports. Photo-documentation of the sites would be included in the reports to provide a visual record of the restoration progress.

2.10 Completion of Restoration

2.10.1 Notification of Completion

Upon completion of Year 5 of the monitoring period or when the restoration area(s) have achieved the Year 5 performance criteria, the Restoration Ecologist shall prepare a final report for RMV that describes the relative success of each restoration area.

2.10.2 Contingency Measures

Contingency measures would be implemented if restoration efforts fail to meet performance criteria at the end of the five-year monitoring period. Such measures shall include additional container plant and/or seed installation, additional weed control efforts, an evaluation and appropriate modification of the irrigation system, and the extension of the maintenance and monitoring period until such time that the performance criteria are achieved.

2.10.3 Long-Term Management

Long-term management beyond the five-year monitoring program would be in accordance with the Adaptive Management Program for the proposed RMV Open Space. RMV would determine whether a restoration site would be subject to long-term monitoring and management.

CHAPTER 3.0 AQUATIC RESOURCES HABITAT RESTORATION PLAN

This chapter describes the conceptual approach for the creation, restoration and/or enhancement of wetlands and non-wetland riparian habitats in the proposed RMV Open Space. This section includes a summary of the invasive exotic control program for San Juan Creek as set forth in greater detail in the Invasive Species Control Plan (*Appendix I*). As with the upland habitats, the term “restoration” is inclusive in this conceptual plan for aquatic resources as it addresses the spectrum of possible restoration activities within the Open Space, ranging from creation of new habitats that in some instances may require substantial grading to enhancement of existing degraded habitats that could include limited grading or may require far less intensive measures such as minor recontouring, removal of invasive species and/or some replanting.

As an RMV-wide comprehensive program, this section summarizes restoration recommendations for several sub-basins and explains how these actions, as part of the Adaptive Management Program, could contribute to a more effective Open Space. The restoration recommendations have been developed to ensure no-net-loss of either acreage or function associated with waters of the United States subject to the jurisdiction of the U.S. Army USACE of Engineers (USACE) pursuant to Section 404 of the Clean Water Act and waters of the State subject to the jurisdiction of the California Department of Fish and Game (CDFG) pursuant to Section 1600 of the Fish and Game Code. The approach taken in this program is consistent with recent Regulatory Guidance Letter No. 02-2, dated December 24, 2002, issued by the USACE regarding mitigation, which emphasized watershed-wide and function-based programs where feasible.

Although a watershed and function-based approach, this section also describes site preparation, plant palettes, short-term and long-term monitoring and maintenance, and reporting of the restoration program to provide a framework and guidance for the restoration plan. This Conceptual Aquatic Resources Habitat Restoration Plan (ARHRP) is a working draft and would be subject to refinement and modification during environmental documentation and approval processes; however, it is important to note that substantial data have been collected on the aquatic ecosystems on the RMV. These data, along with data collected during monitoring of approximately 120 acres of created and restored wetland and riparian areas on RMV, provide a robust data set that can be used to inform and guide future restoration projects.

Finally, this plan provides for low intensity monitoring and maintenance (as necessary) for approximately 18 acres of existing created alkali marsh, alkali meadow, and southern riparian scrub in the Gobernadora Ecological Restoration Area (GERA). These 18 acres of existing wetland habitat were created in 1998 and 1999 as part of the Ladera Ranch wetland restoration program that, according to conditions in the Section 404 and 1603 Authorizations from the USACE and CDFG, included a sliding scale whereby excess creation areas (i.e., not specifically

needed to offset impacts associated with Ladera Ranch) could be utilized for future projects within RMV. The 18 acres have achieved the five-year performance standards and would be subject to ongoing monitoring until such time as they are used to offset future impacts association with RMV development authorizations.

This section includes the following components of the aquatic resources portion of the ARHRP:

- Regulatory Considerations
- Definition of Terms
- Habitat Restoration Goals
- Success Criteria
- Preliminary Designation of Streams to be Restored
- Preliminary Designation of Wetland Restoration/Enhancement Areas
- Preliminary Designation of Non-Wetland Riparian Restoration/Enhancement Areas
- Implementation Plan
- Maintenance Plan
- Monitoring Program

3.1 Regulatory Considerations

The USACE and U.S. Environmental Protection Agency (EPA) regulations at 33 CFR 320-330 and 40 CFR 230 authorize the USACE to require compensatory mitigation for unavoidable impacts to waters of the U.S., including wetlands. CDFG similarly requires mitigation to compensate for impacts to streambeds and lakes and associated aquatic-dependent resources pursuant to Section 1600 of the Fish and Game Code. Both the USACE and CDFG recognize the value of providing mitigation that maximizes the functions of the compensatory mitigation and, in particular the USACE has been moving away from evaluation of compensatory mitigation on a purely acre-for-acre basis to a function-based evaluation. This approach is set forth in a Regulatory Guidance Letter (RGL) published by the USACE on December 24, 2002¹ and in a Special Public Notice published by the Los Angeles District on January 27, 2003.² In both documents the USACE encouraged utilization of functional assessments for evaluating impacts to aquatic resources and determining appropriate mitigation ratios. On page 2 of the December 24, 2002 RGL, the USACE notes:

¹ U.S. Army Corps of Engineers. 2002. *Regulatory Guidance Letter No. 02-2: Guidance on Compensatory Mitigation Projects for Aquatic Resource Impacts Under the Corps Regulatory Program Pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899*. December 24, 2002, 16pp.

² U.S. Army Corps of Engineers, Los Angeles District. 2003. *Special Public Notice: Mitigation and Monitoring Requirements*. January 27, 2003, 41pp.

The USACE has traditionally used acres as a standard measure for determining impacts and required mitigation for wetlands and other aquatic resources, primarily because useful functional assessment methods were not available. However, Districts are encouraged to increase their reliance on functional assessment methods.

3.2 Definition of Terms

As indicated above, the term “restoration” is used in the broad sense to refer to the spectrum of restoration and enhancement activities to be conducted in the Open Space. Where appropriate, several other terms would be used throughout this section to refer to specific kinds of restoration activities. Most of these terms were generally defined in the previous section for upland habitats, but are presented here again because they are tailored for aquatic resources. These other terms are defined here.

Wetland Functional Assessment: A methodology whereby various hydrologic, biogeochemical and habitat functions typically associated with wetlands or other components of the aquatic ecosystem are qualitatively or quantitatively scored or rated. The USACE has developed one approach, the Hydrogeomorphic (HGM) Approach, which utilizes “variables” to define or describe each function associated with a particular wetland type. The HGM approach has been designed for evaluating functional losses associated with specific projects and can be used for very small projects with minor impacts (e.g., impacts to fractions of an acre) or for projects that cover thousands of acres on the landscape that affect multiple areas of the aquatic ecosystem. The USACE has also developed a functional assessment tool for evaluating large areas at a coarser scale that is often utilized for evaluating large watershed areas.³ In addition to using the functional assessment to evaluate impacts, the approach can be used to design wetland restoration sites to ensure that the target functions are achieved.⁴

Passive Restoration: Passive restoration generally refers to removing or controlling disturbance events such as intrusion by cattle that degrade wetland or riparian areas resulting in conversion from native to non-native or disturbed habitats. Passive restoration may involve some site preparation and maintenance such as weed control, and trash and debris removal, but generally the site would be allowed to revegetate naturally without extensive intervention. Where non-native cover is particularly high, weed removal may be more intensive. Some initial seeding or planting of cuttings or container stock may be used if the natural seed bank onsite is inadequate, particularly in areas where removal of substantial weed cover has left areas somewhat

³ Smith, RD. 2000. *Assessment of Riparian Ecosystem Integrity In the San Juan and San Mateo Creek Watersheds, Orange County, California*. U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, MS, USA.

⁴ RMV has created and performed associated monitoring of approximately 125 acres of wetland and/or riparian habitat between 1989 and 1993. Of the 125 acres, approximately 45 acres were designed, implemented and monitoring for a variety of variables/functions using the HGM approach. Performance standards have been achieved for all 125 acres.

unvegetated. Passive restoration sites would be monitored, and if the site is not meeting performance standards by a designated period, more intensive restoration approaches may be implemented.

Active Restoration: Active restoration broadly refers to the specific application of restoration techniques. On any scale (e.g., from less than 1 acre to 100 acres such the GERA), active restoration may include site-intensive techniques such as grading, soil preparation, planting and/or seeding, irrigation, weed control, erosion control, etc. Active restoration implies a higher level of effort than passive restoration and typically is used on sites that would not regenerate naturally, or would only regenerate over an unacceptably long period of time without direct intervention. For example, a mitigation requirement that a site meet certain performance standards such as percent native plant cover or species occupation within five years probably would require active restoration to ensure that the performance standards were achieved. Two types of active restoration are “Enhancement” and “Revegetation.”

A. Enhancement: Enhancement generally refers to restoration of sites that support degraded forms of the target native vegetation community. The level of effort needed to enhance a site typically is less than revegetating a site because the target native community is already present. For aquatic ecosystems, primary enhancement measures may include timed grazing, complete elimination of grazing by fencing aquatic resources, and removal of invasive plant species. Seeding may be used to supplement the existing native vegetation, but planting of container plants and irrigation generally are not used on enhancement sites. Enhancement tends to be more passive, letting nature take its course; as contrasted with other types of active wetland/riparian restoration.

In practice, there often is not a clear distinction between active and passive restoration, revegetation and enhancement because each site has its own distinct requirements for successful restoration. The Restoration Ecologist and RMV would have the flexibility to implement the appropriate restoration techniques in an adaptive fashion to produce the desired results in the most efficient manner. However, specific performance standards would be set for each restoration site relative to hydrologic, biogeochemical and habitat functions so that success can be objectively measured.

B. Revegetation: Revegetation involves active restoration of a site whereby container plants and/or seeds are used to create or restore habitat. Typically the target native vegetation community is absent from the site; e.g., a site supporting ruderal vegetation revegetated with wet meadow vegetation or mulefat scrub. Depending on site conditions, some grading may be required to restore or enhance site hydrology. Irrigation, though not necessary, may be desirable to hasten establishment of the target species, which in turn reduces the amount of non-native species able to colonize the site. Generally,

revegetation sites would have higher performance standards than passively restored sites and the monitoring and maintenance program is more specific as far as the responsibilities of the Restoration Ecologist and the Installation/Maintenance Contactor.

3.3 Habitat Restoration Goals

The goal of this conceptual restoration plan, as a component of the Adaptive Management Program, is to provide a framework to guide restoration of the aquatic ecosystem in a manner that would maintain or enhance hydrologic, biogeochemical and habitat functions that would be impacted by development. The restored aquatic ecosystem should exhibit hydrologic, biogeochemical and habitat functions that are equal to, or greater than, those exhibited by the aquatic ecosystem(s) prior to development.

Like the CSS and VGL restoration program described in Chapter 2.0, the aquatic habitat restoration program is intended to provide replacement aquatic habitat and/or enhanced aquatic functions within the Open Space that would compensate for loss of hydrologic, biogeochemical functions and habitat functions and also ensuring no-net-loss in the amount of the aquatic ecosystem.

The primary focus of the restoration program would be on the hydrogeomorphic processes, which are key in achieving other goals such as establishment of target vegetation communities and associated faunal components. Failure to restore degraded or lost hydrogeomorphic processes would generally result in ultimate failure in achieving the goals of establishing target biotic communities.

Site selection is extremely important for the long-term success of a restoration program. Sites that are selected for restoration of aquatic habitat areas, including wetlands and/or riparian areas must contribute to the long-term net aquatic resource values and fully mitigate the loss of aquatic resources and associated hydrologic, biogeochemical and habitat functions. The preliminary designation of restoration areas, as described below, is based upon detailed investigations of the aquatic resources within the RMV study area and provides the best opportunity for a successful restoration program that contributes to the long-term aquatic functions of the Open Space.

As noted above, significant restoration efforts within portions of the Open Space have already been successfully implemented within the GERA, Cañada Chiquita, and Narrow Canyon (approximately 120 acres combined among the sites, of which approximately 18 acres in GERA have been “banked” for future projects).⁵ Besides creating habitat currently occupied by a

⁵ Department of the Army Permit 97-00342-ES and Streambed Alteration Agreement 5-081-98.

number of listed or other special-status species such as least Bell's vireo, southwestern willow flycatcher, yellow-breasted chat, yellow warbler, southwestern pond turtle, southern tarplant, and Coulter's saltbush, these efforts have demonstrated that where suitable conditions exist, habitat creation or restoration can be very successful.

Finally, invasive exotic control has also been implemented in Cristianitos Creek by Northrop Grumman (formerly TRW), and this program would continue until the lease with RMV expires.

3.3.1 Relationship of Restoration Timing to Project Phasing

Timeframes for the establishment of wetland and/or riparian habitats vary significantly according to the type of habitat subject to restoration/creation. For example, creation of emergent marsh habitats requires little time, and it is possible to establish functioning marsh habitat in as little as 1.5 to 2 years when sufficient hydrology is present. Similarly, creation of alkali or wet meadow habitat can be achieved in approximately 2 to 3 years with irrigation to hasten establishment and early growth. Habitats with woody vegetation such as mulefat scrub, southern willow scrub, or willow forest require more time, with substantial function achieved at between four and seven years. Southern coast live oak or coast live oak-sycamore riparian forest requires substantially longer time to reach maturity and exhibit a full suite of habitat functions.

Phasing of development associated with the proposed development alternatives is expected to extend over a 15- to 25-year time period. Development of the first planning area is expected to begin in 2005. Development of other planning areas would follow in 2007. Project phasing would provide opportunities to implement and, in many instances, finalize compensatory mitigation in advance of impacts. The existing 18 acres of created habitat in GERA, that includes alkali marsh, alkali meadow, southern riparian scrub, and southern willow scrub, would be used to compensate for impacts associated with the initial phases of development.

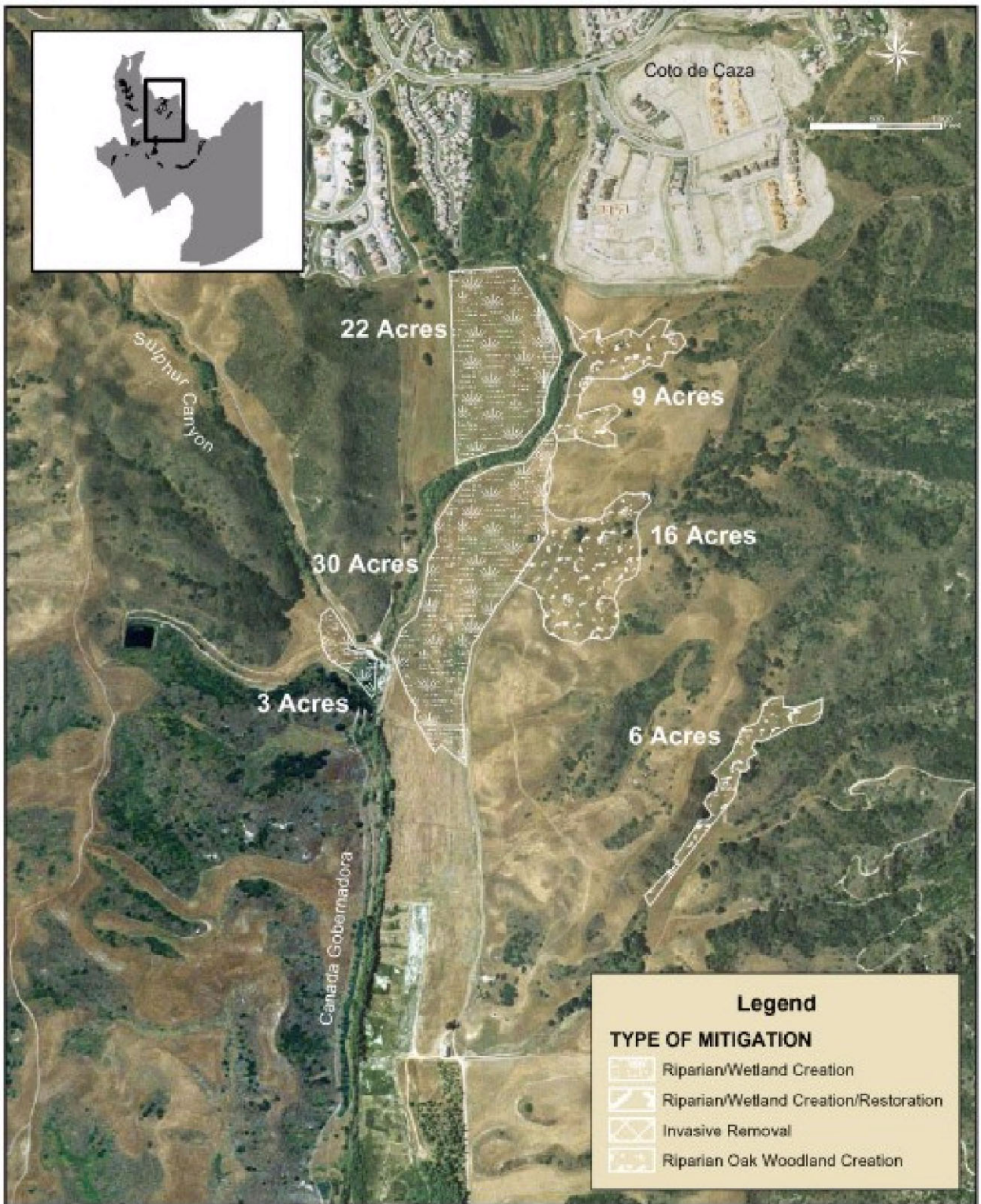
Use of a function-based evaluation of affected resources in conjunction with the use of a function-based (e.g., HGM or similar methodology) mitigation design would ensure full replacement of aquatic functions in advance of essentially all project impacts. This function-based approach, coupled with the opportunity to implement, monitor, and complete the aquatic resource creation, restoration, and/or enhancement in advance of impacts would provide high levels of certainty that all impacted functions are replaced.

3.4 Preliminary Designation of Wetland and/or Riparian Restoration Areas

The main goal of the ARHRP is to describe the methodologies for: (1) enhancement or restoration of wetland and/or riparian habitats that have been substantially degraded such that measurable losses of hydrologic, biogeochemical or habitat functions have occurred, and whereby the lost function(s) can be restored or reintroduced; (2) creation of wetland and/or riparian habitats to replace wetland or riparian areas lost to development, ensuring a no-net-loss of wetland/riparian acreage; and (3) enhancement, restoration, or creation wetland and/or riparian habitats that would replace hydrologic, biogeochemical and habitat functions such that there is no-net-loss of wetland functions. As noted above, a substantial portion of the compensatory mitigation can be implemented in advance of impacts, providing a high level of certainty that no-net-loss of function or acreage occurs. Areas evaluated and identified as potential restoration sites are set forth below. Based on the detailed evaluations performed all of these sites represent excellent candidate sites; however, it may not be necessary or desirable to use each site, or only portions of these sites may ultimately be utilized. The final selection of restoration sites will be determined in conjunction with USACE and CDFG as part of the permitting of project impacts.

3.4.1 Potential Habitat Creation/Restoration Areas

- **GERA** currently includes approximately 18 acres of alkali marsh, alkali meadow and southern riparian scrub habitat created for the Ladera Ranch Project that was not needed to compensate for project impacts and, as established in the Ladera Ranch 404 and 1603 Authorizations, is available to use as compensation for impacts associated with future RMV projects. This existing creation area would be subject to ongoing monitoring and maintenance until it is “utilized” to offset impacts associated with the early phases of the development program.
- **Gobernadora Canyon** immediately downstream of Coto de Caza, extending to below the confluence with Sulphur Canyon (*Figure 2*). This includes the proposed location of a multi-purpose basin and wetland complex that would cover an estimated 40 acres and would serve a number of functions including detention and harvesting of storm waters by the Santa Margarita Water District (SMWD) and creation of riparian habitat along with re-establishment of a meander of the channel through the upper reaches of Gobernadora Creek. The 40-acre extends to where Gobernadora Creek crosses from the east to the west side of the valley bottom. Approximately 22 acres have been identified that would be available for creation of riparian habitat that would not be subject to manipulation by SMWD.

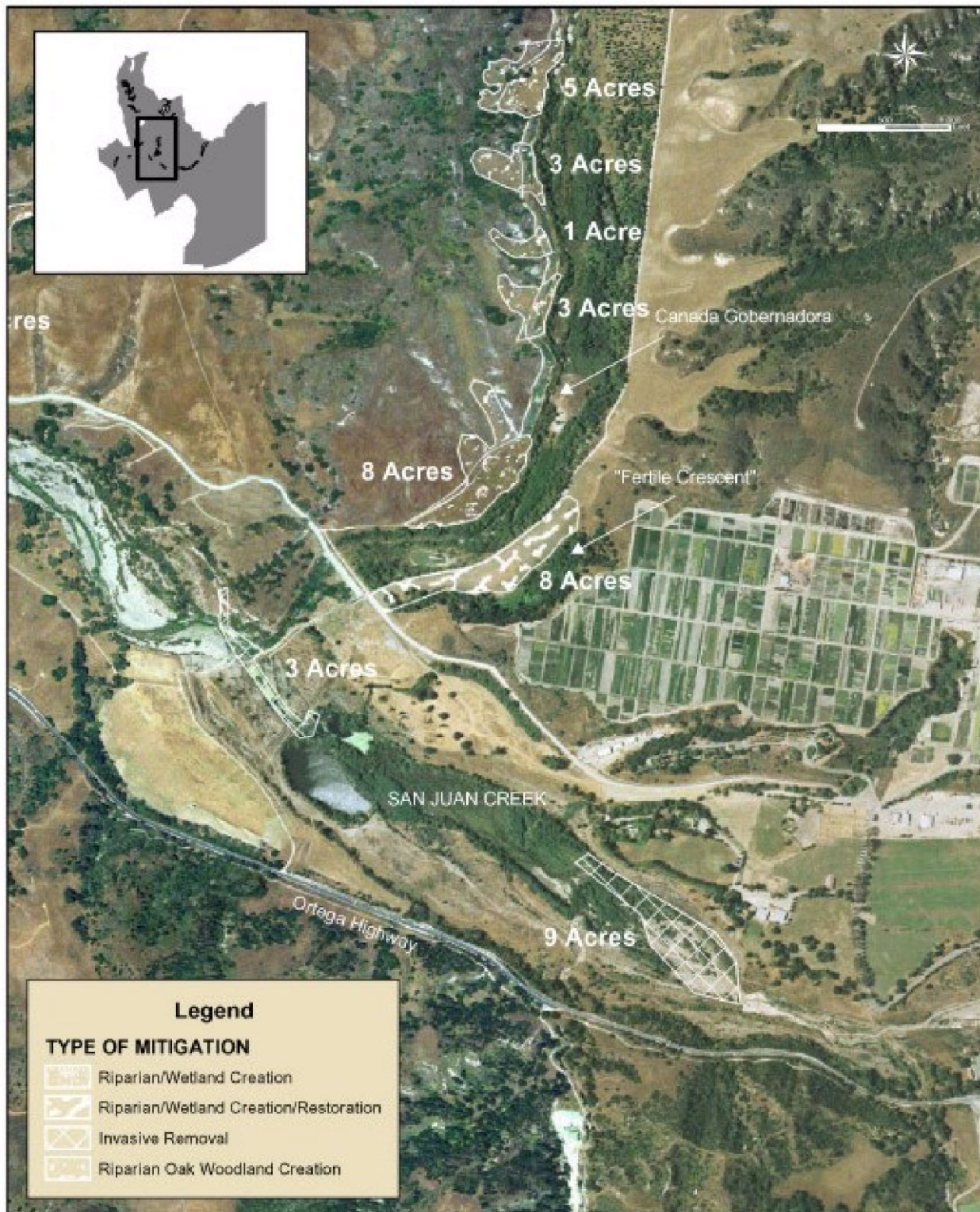


SOURCE: Glen Lukos Associates

RMV Habitat Restoration Plan
Canada Gobernadora Proposed Mitigation Areas

Below the area where the creek crosses the valley bottom, an additional 30 acres have been identified as candidate areas for creation of alkali marsh, alkali meadow, southern willow riparian habitat and mulefat scrub. In addition to the marsh, meadow, willow and mulefat creation areas, an additional 51 acres have been identified as potential southern coast live oak riparian habitat creation areas.

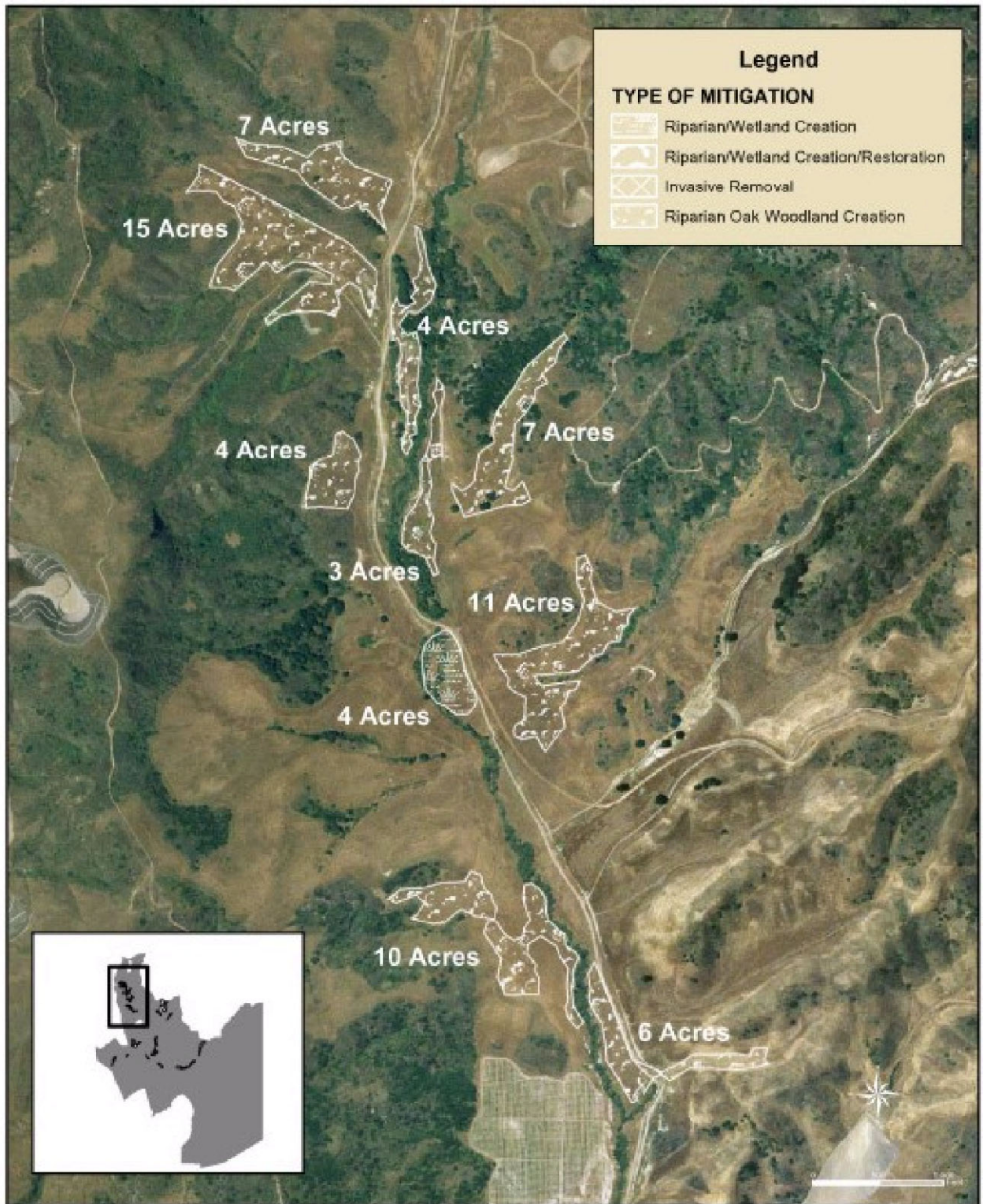
- **Gobernadora Canyon/Fertile Crescent** at the “mouth of Cañada Gobernadora (*Figure 3*). This area exhibits appropriate hydrology for restoration due to the presence of high groundwater and sheet flow from Gobernadora Creek. This area has been degraded by grazing and past agricultural practices. Some site grading and site preparation would be necessary to restore hydrology to a larger area and to provide for a mosaic of aquatic habitat types. Habitat creation/restoration in this area would, among other things, be targeted at the southwestern pond turtle which has recently colonized a pond created nearby in GERA in 1999/2000. Approximately 8 acres have been identified as available for habitat restoration or creation.
- **Sulphur Canyon** at the confluence with Gobernadora Creek (*Figure 2*). This area exhibits appropriate hydrology for restoration due to the presence of high groundwater and sheet flow from Sulphur Canyon Creek. This area has been degraded by grazing and past agricultural practices. Some site grading and site preparation would be necessary to restore hydrology to a larger area and to provide for a mosaic of aquatic habitat types. Approximately 3 acres have been identified as available for habitat restoration or creation.
- **Chiquita Creek between the “Narrows” and the SMWD Treatment Facility.** Approximately four acres have been identified in this area for creation of mulefat scrub immediately adjacent to Chiquita Creek (*Figure 4*). An additional 64 acres have been identified as candidate areas for southern coast live oak riparian habitat.
- **Chiquita Creek between SMWD Treatment Facility and New Ortega Highway (*Figure 5*).** Detailed investigations of the slope wetlands on both sides of lower Chiquita Canyon indicate subsurface flows to the creek along with typically perennial flows (but intermittent flows during dry climatic cycles) would allow for expansion of the wetlands in this area with only minimal grading. Approximately 11 acres have been identified as available for alkali marsh, alkali meadow, or willow riparian habitat creation.



SOURCE: Glen Lukos Associates

RMV Habitat Restoration Plan
San Juan Creek and Canada Gobernadora Proposed Mitigation Areas

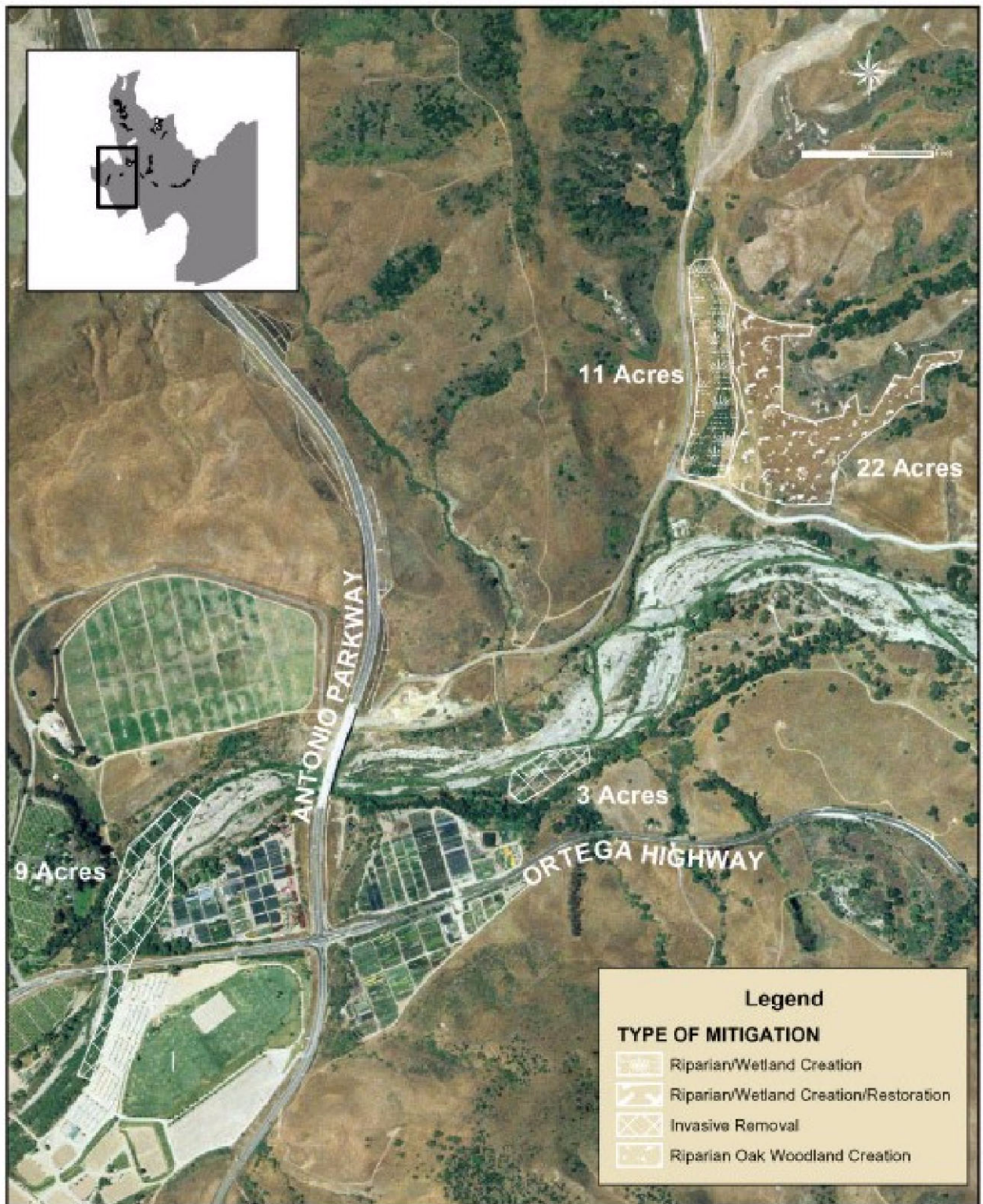
FIGURE 3



SOURCE: Glen Lukos Associates

**RMV Habitat Restoration Plan
Canada Chiquita North of SMWD Treatment Facility
Proposed Mitigation Areas**

**FIGURE
4**



SOURCE: Glen Lukos Associates

San Juan Creek and Canada Chiquita Proposed Mitigation Areas

RMV Habitat Restoration Plan

FIGURE
5

In addition to candidate sites for alkali marsh, alkali meadow, or willow riparian habitat creation, an additional 22 acres in proposed lower Chiquita Canyon in Open Space, have been identified as potential southern coast live oak riparian habitat creation.

3.4.2 Stream Restoration

- **Gobernadora Creek at the knickpoint** located adjacent to GERA. Detailed investigations by Balance Hydrologics indicate that the knickpoint is a key area in preventing continuing headcutting and incision in the middle reach of Gobernadora Creek. Restoration of this area would ensure long-term functioning of the upper one-half of GERA which supports approximately 40 acres of wetland habitats, including southern willow riparian forest, alkali marsh and alkali meadow, and mulefat scrub. This 40-acre portion of GERA supports least Bell's vireo, southwestern willow flycatcher, yellow-breasted chat, as well as southern tarplant.
- **Chiquita Creek between the "Narrows" and the SMWD Treatment Facility.** Studies indicate areas of significant entrenchment of the channel at various points along Chiquita Creek, which supports a mosaic of southern arroyo willow riparian forest, alkali meadow, alkali marsh and freshwater marsh. Reversal of the entrenchment would ensure long-term functioning of substantial portions of Chiquita Creek. Reversal of the entrenchment would also provide for passive- or active-expansion of the wetland and riparian vegetation adjacent to the creek.
- **Restoration of Upper Reaches of Gabino Creek,** which exhibits areas of headcutting, entrenchment, and channel degradation. This restoration effort would be conducted in conjunction with restoration of adjacent uplands with CSS/VGL that would serve to enhance runoff and fine sediment regimes that have contributed to the loss of aquatic function.

3.4.3 Invasive Exotic Control

- **Removal of Giant Reed from San Juan Creek** has been identified as a "high priority" component of the Invasive Species Control Plan (*Figures 3, 5 and 6*). San Juan Creek supports populations of the arroyo toad and least Bell's vireo, along with other special-status species such as the yellow-breasted chat, yellow warbler, southwestern pond turtle, and two-striped garter snake. As set forth in the Invasive Species Control Plan, giant reed can have a number of adverse impacts on native riparian ecosystems including alteration of hydrologic regimes, alteration of fire regimes, elimination of native riparian habitat (i.e., willow scrub and forest) by direct competition. Elimination of giant reed would

substantially enhance the ability of the reach of San Juan Creek associated with the RMV portion of the Open Space to support the arroyo toad and least Bell's vireo, contributing significantly to recovery of these species within the subregion.

3.5 Success Criteria

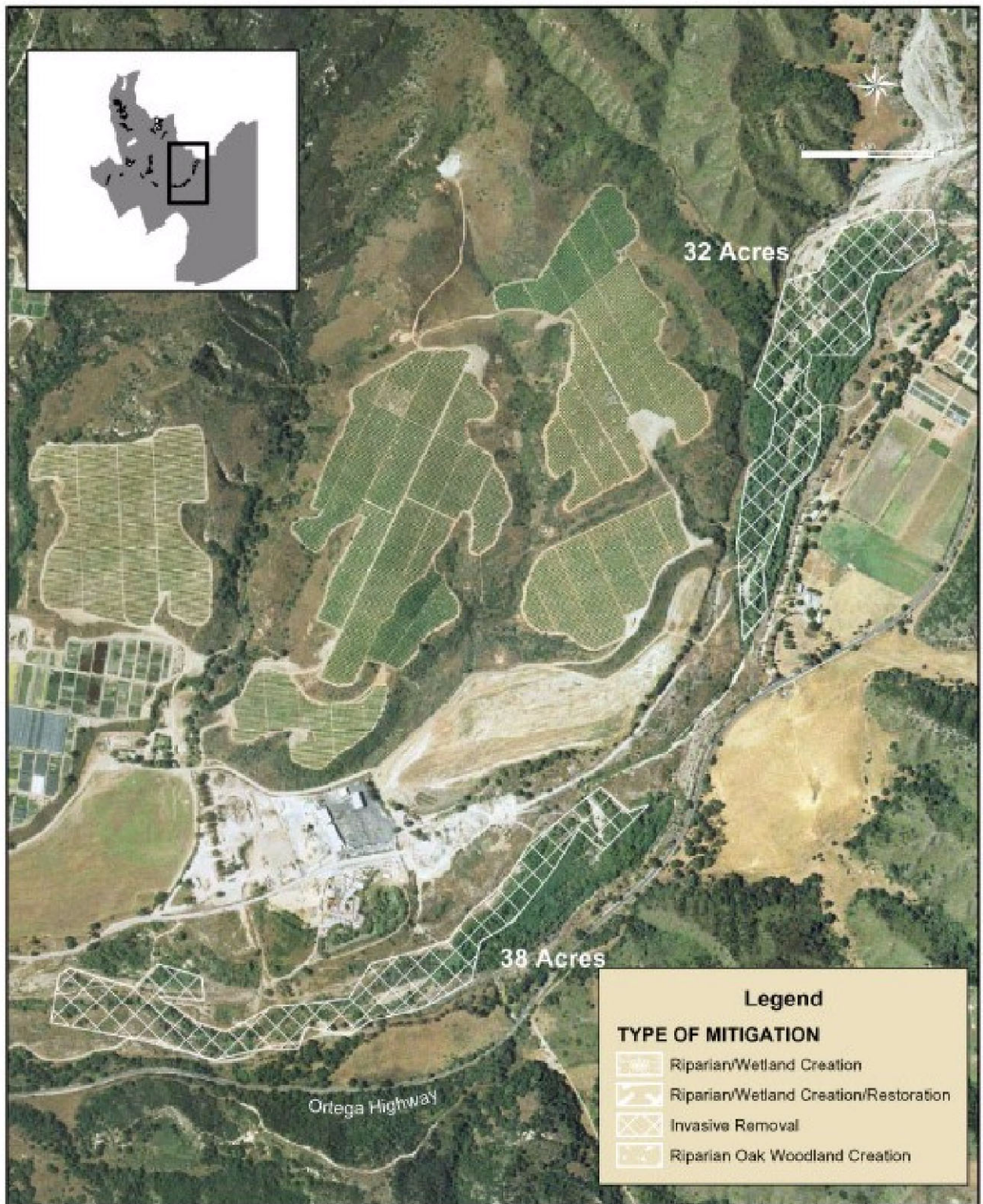
The goal of the wetland/riparian restoration program is the establishment of self-sustaining habitats that provide hydrologic, biogeochemical and habitat functions typical of the target geomorphic settings and associated wetland and/or riparian habitat types.

3.5.1 Rationale for Expecting Success

There are a number of reasons why wetland and/or riparian enhancement, restoration, or creation would be successful within the RMV Open Space.

A variety of investigations have been completed that address the aquatic resources within the RMV study area. These investigations include the following:

- PCR Services Corporation, PWA Ltd., and Balance Hydrologics, Inc. 2002. *Baseline Geomorphic and Hydrologic Conditions, Rancho Mission Viejo: Portions of the San Juan and Western San Mateo Watersheds.*
- PCR Services, Dudek & Associates. 2002. *Geomorphic and Hydrologic Needs of Aquatic and Riparian Endangered Species.*
- PCR Services. 2003. *Functional Evaluation of Slope Wetlands, Rancho Mission Viejo.*
- PCR Services. 2003. *Functional Evaluation of Vernal Pools, Rancho Mission Viejo.*



SOURCE: Glen Lukos Associates

RMV Habitat Restoration Plan
San Juan Creek Invasives Eradication

FIGURE
6

- Balance Hydrologics. 2002. *Preliminary Technical Memo: Geologic and Hydrogeologic Framework for Restoration Design of Lower Gobernadora Canyon*
- NCCP/SAMP Working Group. 2002. *Watershed and Sub-Basin Planning Principles*.
- Glenn Lukos Associates. 2002. *Ladera Ranch Wetland Mitigation Monitoring: Fourth Annual Report*. October 2002.

These studies provide sufficient data relative to surface water and groundwater conditions to provide detailed planning, including site design, for aquatic habitat restoration at the candidate locations. All of the candidate restoration sites have been subject to detailed investigations and sufficient hydrology data have been collected for each of the sites, to ensure successful implementation.

In addition to these detailed studies, RMV has established a successful aquatic habitat track record by creating approximately 120 acres of wetland and or riparian habitat within the GERA and Chiquita Canyon. Habitat created in GERA within the last 13-14 years, has variously supported least Bell's vireo, southwestern willow flycatcher, southwestern pond turtle, yellow-breasted chat, and yellow warbler. In addition, both the GERA and Chiquita sites support over 10,000 individuals of southern tarplant, a CNPS List 1B taxon and an identified species that were targets of the restoration efforts.

3.5.2 Target Functions

Target functions to be enhanced, restored or created, vary from site to site based on site-specific conditions and associated site-specific goals. For example, there are two primary goals associated with restoration efforts in Upper Gobernadora: **(1)** reestablishment of sinuosity/meander to the creek; and **(2)** creation of a large block of wetland/riparian habitat that would serve as replacement habitat to compensate for losses of wetland/riparian habitats in other portions of RMV. Reestablishment of sinuosity/meander to the creek would in turn result in restoration of a variety of hydrologic, biogeochemical and habitat functions that can be directly measured. Similarly, creation of a large block of wetland and riparian habitat would result in establishment of a variety of hydrologic, biogeochemical and habitat functions that can be directly measured. Specific target functions would be determined upon selection of the candidate sites. Selection of candidate sites would be determined by **(1)** mitigation needs for planned activities and **(2)** contribution of the candidate site to the overall function of the Open Space.

In a similar manner, removal of giant reed from San Juan Creek would result in enhanced hydrology because water usage by this species is approximately twice that of native riparian habitats (i.e., southern willow riparian forest, mulefat scrub, etc.). Giant reed removal would also provide for restoration of sediment regimes and would allow for expansion of native riparian vegetation into the areas that are currently infested. These changes are expected provide a measurable benefit to two listed species, the arroyo toad and least Bell's vireo, both of which occur in San Juan Creek.

3.5.3 Performance Standards

Performance standards for each of these restoration program components would be markedly different because they would be developed to address the desired function. For example, as noted above, the primary purpose for removal of giant reed from San Juan Creek is to enhance/increase usable or potential habitat for the arroyo toad and least Bell's vireo. As such, performance standards would be developed that (1) measure use by these species or (2) measure habitat functions typical of areas occupied by these species.

As discussed above in *Section 3.1* (and summarized below), a representative number of wetland functions, as described in *A Guidebook for Application of Hydrogeomorphic Assessments to Riverine Wetlands*, would be evaluated as part of the overall quantitative monitoring program to ensure no-net-loss of wetland function through successful implementation of the mitigation program components. Because of the varying nature of the mitigation program components, they have been separated into three categories for purposes of establishing performance standards. The categories to be addressed below are:

- Emergent Marsh, Wet Meadow, and/or Riparian Scrub/Forest Creation
- Southern Coast Live Oak Riparian Forest
- Invasive Exotic Removal from San Juan and/or Trabuco Creeks

Habitat Creation or Restoration: Emergent Marsh, Wet Meadow, and/or Riparian Scrub/Forest

The HGM variables to be evaluated for performance were determined based upon their use in mitigation programs that have already been completed in GERA, Chiquita Canyon, and the Arroyo Trabuco. Variables to be monitored include: Plant Roughness, Coarse Woody Debris (for woody riparian areas only), Aerial Net Primary Productivity, Surfaces Suitable for Microbial Activity, Percent Cover of Vegetation (in each strata), and Species Composition. The quantitative vegetation sampling would provide sufficient data to determine performance for the following variables: Plant Roughness, Aerial Net Primary Productivity, Surfaces Suitable for Microbial Activity, Percent Cover of Vegetation (in each strata), Species Composition, Recruitment of Natives, and Habitat Heterogeneity. Coarse Woody Debris would be evaluated using direct visual estimates.

In addition to the identified wetland functions that would be evaluated by measuring specific variables, a variety of hydrological indicators would be evaluated because the presence of such indicators provide valuable information regarding wetland functioning. Hydrological indicators that would be monitored include the presence of debris rack, sediment deposits, drainage patterns, water marks, ponding duration, ponding depth, and extent of ponding.

Standard Vegetation Monitoring procedures would be as follows:

- **First-Year Monitoring.** During the first year, monitoring would occur every month. One quantitative survey would be performed to determine planted species' growth performance. The following performance standards would be achieved at the end of the first year:
 - 30 percent coverage of native species relative to reference standard (5 percent deviation allowed);
 - percent cover of non-native species not exceeding 10 percent (includes tree and shrub layers only and does not include herb layer);
 - recruitment of native hydrophytes ratio of seedlings to saplings would be at least 50 percent of that of reference site;
 - habitat heterogeneity would be 50 percent (or greater) of the reference site.

Replanting would be performed, as necessary, during the appropriate planting period, with the appropriate-sized stock or by seeding to ensure that these performance standards are achieved. If substantial non-compliance with the performance standards occurs, RMV would consult with the USACE and CDFG to determine whether corrective measures and an extension of the five-year monitoring period would be necessary. At the end of the first year, a report summarizing the performance of the emergent marsh, and riparian habitats would be submitted to the USACE and CDFG.

- **Second-Year Monitoring.** During the second year, monitoring would occur on a quarterly basis. One quantitative survey would be performed to determine planted species' growth performance. The following performance standards would be achieved at the end of the second year:
 - at least 45 percent coverage of native species relative to reference standard (<5 percent deviation allowed);

- percent cover of non-native species not exceeding 10 percent (includes tree and shrub layers only and does not include herb layer);
- recruitment of native hydrophytes ratio of seedlings to saplings would be at least 75 percent of that of reference site;.
- habitat heterogeneity would be 75 percent (or greater) of the reference site.

Replanting would be performed, as necessary, during the appropriate planting period, with the appropriate-sized stock to ensure that these performance standards are met. If substantial non-compliance with the performance standards listed above occurs, RMV would consult with the USACE and CDFG to determine whether corrective measures and an extension of the five-year monitoring period would be necessary. At the end of the second year, a report summarizing the revegetation site performance would be submitted to the USACE and CDFG.

- **Third-Year Monitoring.** During the third year, monitoring would occur quarterly. One quantitative survey would be performed to determine planted species growth performance. The following performance standards would be achieved at the end of the year:

- at least 65 percent coverage of native species relative to reference standard (<5 percent deviation allowed);
- percent cover of non-native species not exceeding 10 percent (includes tree and shrub layers only and does not include herb layer);
- recruitment of native hydrophytes ratio of seedlings to saplings would be at least 75 percent of that of reference site;.
- habitat heterogeneity would be 75 percent (or greater) of the reference site.

Replanting would be performed, as necessary with the appropriate-sized stock to ensure that these performance standards are achieved. If substantial non-compliance with the performance standards listed above occurs, RMV would consult with the USACE and CDFG to determine whether corrective measures and an extension of the five-year monitoring period would be necessary. At the end of the third year, a report summarizing the revegetation site performance would be submitted to the USACE and CDFG.

- **Fourth-Year Monitoring.** During the fourth year, monitoring would occur quarterly. One quantitative survey would be performed to determine planted species' growth performance. The following performance standards would be achieved at the end of the year:

- at least 75 percent coverage of native species relative to reference standard (<5 percent deviation allowed);
- percent cover of non-native species not exceeding the reference site by more than 10 percent (includes tree and shrub layers only and does not include herb layer);
- recruitment of native hydrophytes ratio of seedlings to saplings would be at least 75 percent of that of reference site,;
- habitat heterogeneity would be 75 percent (or greater) of the reference site.

Replanting would be performed as necessary, during the appropriate planting period, with the appropriate-sized stock to ensure that these performance standards are achieved. If substantial non-compliance with the performance standards listed above occurs, RMV would consult with the USACE and CDFG to determine whether corrective measures and an extension of the five-year monitoring period would be necessary. At the end of the fourth year, a report summarizing the revegetation site performance would be submitted to the USACE and CDFG.

- **Fifth Year Monitoring.** During the fifth year, monitoring would occur quarterly. One quantitative survey would be performed to determine planted species' growth performance. The following performance standards would be achieved at the end of the year:

- at least 85 percent coverage of native species relative to reference standard (<5 percent deviation allowed);
- percent cover of non-native species not exceeding 10 percent (includes tree and shrub layers only and does not include herb layer);
- recruitment of native hydrophytes ratio of seedlings to saplings would be at least 75 percent of that of reference site,;
- habitat heterogeneity would be 75 percent (or greater) of the reference site;

Replanting would be performed, as necessary, during the appropriate planting period, with the appropriate-sized stock to ensure that these performance standards

are achieved. If substantial non-compliance with the performance standards listed above occurs, RMV would consult with the USACE and CDFG to determine whether corrective measures and an extension of the five-year monitoring period would be necessary. At the end of the fifth year, a report summarizing the revegetation site performance would be submitted to the applicant for distribution to the USACE and CDFG.

Hydrological Indicators

- **First-Year Monitoring.** One quantitative survey would be performed, at the end of the first year to determine compliance with the following performance standards:⁶
 - The presence of Debris Rack, Sediment Deposits, Water Marks and/or Drainage Patterns individually or in combination, within the created wetland would achieve between 25 percent and 75 percent of the reference standard based upon visual estimates.
 - If the collective measure of hydrologic indicators does not achieve the performance standard, additional grading, planting, or configuration of the wetland would be performed to ensure hydrological functioning within the created wetlands.
- **Second-Year Monitoring.** One quantitative survey would be performed, at the end of the second year to determine compliance of the referenced variables with the following performance standards:
 - The presence of Debris Rack, Sediment Deposits, Water Marks and/or Drainage Patterns individually or in combination, within the created wetland would achieve between 25 percent and 75 percent of the reference standard based upon visual estimates.
 - If the collective measure of hydrologic indicators does not achieve the performance standard, additional grading, planting, or configuration of the wetland would be performed to ensure hydrological functioning within the created wetlands.
- **Third-Year Monitoring.** One quantitative survey would be performed, at the end of the third year to determine compliance of the referenced variables with the following performance standards:

⁶ The performance standards are adapted from the USACE HGM Riverine Guidebook .

- The presence of Debris Rack, Sediment Deposits, Water Marks and/or Drainage Patterns individually or in combination, within the created wetland would achieve between 75 percent and 125 percent of the reference standard based upon visual estimates.
- If the collective measure of hydrologic indicators does not achieve the performance standard, additional grading, planting, or configuration of the wetland would be performed to ensure hydrological functioning within the created wetlands.
- **Fourth-Year Monitoring.** One quantitative survey would be performed, at the end of the fourth year to determine compliance of the referenced variables with the following performance standards:
 - The presence of Debris Rack, Sediment Deposits, Water Marks and/or Drainage Patterns individually or in combination, within the created wetland would achieve between 75 percent and 125 percent of the reference standard based upon visual estimates.
 - If the collective measure of hydrologic indicators does not achieve the performance standard, additional grading, planting, or configuration of the wetland would be performed to ensure hydrological functioning within the created wetlands.
- **Fifth-Year Monitoring.** One quantitative survey would be performed, at the end of the fifth year to determine compliance of the referenced variables with the following performance standards:
 - The presence of Debris Rack, Sediment Deposits, Water Marks and/or Drainage Patterns individually or in combination, within the created wetland would achieve between 75 percent and 125 percent of the reference standard based upon visual estimates.
 - If the collective measure of hydrologic indicators does not achieve the performance standard, additional grading, planting, or configuration of the wetland would be performed to ensure hydrological functioning within the created wetlands.

Coarse Woody Debris (For Woody Riparian Sites Only)

- **First-Year Monitoring.** One quantitative survey would be performed, at the end of the first year to determine compliance with the following performance standard:

- The amount of coarse woody debris within the created wetland would achieve between 25 percent and 75 percent of the reference standard based upon visual estimates.
- If the measure of coarse woody debris in the created wetland does not achieve the performance standard, additional coarse woody debris would be added in the form of willow, sycamore, and/or oak snags.
- **Second-Year Monitoring.** One quantitative survey would be performed, at the end of the second year to determine compliance of the referenced variables with the following performance standard:
 - The amount of coarse woody debris within the created wetland would achieve between 25 percent and 75 percent of the reference standard based upon visual estimates.
 - If the measure of coarse woody debris in the created wetland does not achieve the performance standard, additional coarse woody debris would be added in the form of willow, sycamore, and/or oak snags.
- **Third-Year Monitoring.** One quantitative survey would be performed, at the end of the third year to determine compliance of the referenced variables with the following performance standard:
 - The amount of coarse woody debris within the created wetland would achieve between 75 percent and 125 percent of the reference standard based upon visual estimates.
 - If the measure of coarse woody debris in the created wetland does not achieve the performance standard, additional coarse woody debris would be added in the form of willow, sycamore, and/or oak snags.
- **Fourth-Year Monitoring.** One quantitative survey would be performed, at the end of the fourth year to determine compliance of the referenced variables with the following performance standard:
 - The amount of coarse woody debris within the created wetland would achieve between 75 percent and 125 percent of the reference standard based upon visual estimates.

- If the measure of coarse woody debris in the created wetland does not achieve the performance standard, additional coarse woody debris would be added in the form of willow, sycamore, and/or oak snags.
- **Fifth-Year Monitoring.** One quantitative survey would be performed, at the end of the fifth year to determine compliance of the referenced variables with the following performance standard:
 - The amount of coarse woody debris within the created wetland would achieve between 75 percent and 125 percent of the reference standard based upon visual estimates.
 - If the measure of coarse woody debris in the created wetland does not achieve the performance standard, additional coarse woody debris would be added in the form of willow, sycamore, and/or oak snags.

Microtopographic Complexity

- **First-Year Monitoring.** One quantitative survey would be performed, at the end of the first year to determine compliance with the following performance standard:
 - The number of depressions and/or hummocks per unit area (e.g., 10 x 10 m) within the created wetland would achieve between 25 percent and 75 percent of the reference standard based upon visual estimates.
 - If the measure of microtopographic complexity does not achieve the performance standard, additional grading would be performed to increase the number of depressions and hummocks in the created wetlands.
- **Second-Year Monitoring.** One quantitative survey would be performed, at the end of the second year to determine compliance of the referenced variables with the following performance standard:
 - The number of depressions and/or hummocks per unit area (e.g., 10 x 10 m) within the created wetland would achieve between 25 percent and 75 percent of the reference standard based upon visual estimates.
 - If the measure of microtopographic complexity does not achieve the performance standard, additional grading would be performed to increase the number of depressions and hummocks in the created wetlands.

- **Third-Year Monitoring.** One quantitative survey would be performed, at the end of the third year to determine compliance of the referenced variables with the following performance standard:
 - The number of depressions and/or hummocks per unit area (e.g., 10 x 10 m) within the created wetland would achieve between 75 percent and 125 percent of the reference standard based upon visual estimates.
 - If the measure of microtopographic complexity does not achieve the performance standard, additional grading would be performed to increase the number of depressions and hummocks in the created wetlands.

- **Fourth-Year Monitoring.** One quantitative survey would be performed, at the end of the fourth year to determine compliance of the referenced variables with the following performance standard:
 - The number of depressions and/or hummocks per unit area (e.g., 10 x 10 m) within the created wetland would achieve between 75 percent and 125 percent of the reference standard based upon visual estimates.
 - If the measure of microtopographic complexity does not achieve the performance standard, additional grading would be performed to increase the number of depressions and hummocks in the created wetlands.

- **Fifth-Year Monitoring.** One quantitative survey would be performed, at the end of the fifth year to determine compliance of the referenced variables with the following performance standard:
 - The number of depressions and/or hummocks per unit area (e.g., 10 by 10m) within the created wetland would achieve between 75 percent and 125 percent of the reference standard based upon visual estimates.
 - If the measure of microtopographic complexity does not achieve the performance standard, additional grading would be performed to increase the number of depressions and hummocks in the created wetlands

Habitat Creation or Restoration: Southern Coast Live Oak Riparian Forest

The HGM variables to be evaluated for performance are generally related to habitat structure composition, and diversity. Variables to be monitored include: Aerial Net Primary Productivity, Percent Cover of Vegetation (in each strata), and Species Composition. The quantitative vegetation sampling would provide sufficient data to determine performance for the following variables: Aerial Net Primary Productivity, Percent Cover of Vegetation (in each strata), Species Composition, Recruitment of Natives, and Habitat Heterogeneity.

Standard Vegetation Monitoring procedures would be as follows:

- **First-Year Monitoring.** During the first year, monitoring would occur every month. One quantitative survey would be performed to determine planted species' growth performance. The following performance standards would be achieved at the end of the first year:
 - 20 percent coverage of native species relative to reference standard (5 percent deviation allowed);
 - percent cover of non-native species not exceeding 10 percent (includes tree and shrub layers only and does not include herb layer);
 - recruitment of native canopy or woody understory ratio of seedlings to saplings would be at least 50 percent of that of reference site;
 - habitat heterogeneity would be 50 percent (or greater) of the reference site.

Replanting would be performed, as necessary, during the appropriate planting period, with the appropriate-sized stock or by seeding to ensure that these performance standards are achieved. If substantial non-compliance with the performance standards occurs, RMV would consult with the USACE and CDFG to determine whether corrective measures and an extension of the five-year monitoring period would be necessary. At the end of the first year, a report summarizing the performance of the emergent marsh, and riparian habitats would be submitted to the USACE and CDFG.

- **Second-Year Monitoring.** During the second year, monitoring would occur on a quarterly basis. One quantitative survey would be performed to determine planted species' growth performance. The following performance standards would be achieved at the end of the second year:

- at least 35 percent coverage of native species relative to reference standard (<5 percent deviation allowed);
- percent cover of non-native species not exceeding 10 percent (includes tree and shrub layers only and does not include herb layer);
- recruitment of native canopy or woody understory ratio of seedlings to saplings would be at least 50 percent of that of reference site;.
- habitat heterogeneity would be 75 percent (or greater) of the reference site.

Replanting would be performed, as necessary, during the appropriate planting period, with the appropriate-sized stock to ensure that these performance standards are met. If substantial non-compliance with the performance standards listed above occurs, RMV would consult with the USACE and CDFG to determine whether corrective measures and an extension of the five-year monitoring period would be necessary. At the end of the second year, a report summarizing the revegetation site performance would be submitted to the USACE and CDFG.

- **Third-Year Monitoring.** During the third year, monitoring would occur quarterly. One quantitative survey would be performed to determine planted species growth performance. The following performance standards would be achieved at the end of the year:

- at least 45 percent coverage of native species relative to reference standard (<5 percent deviation allowed);
- percent cover of non-native species not exceeding 10 percent (includes tree and shrub layers only and does not include herb layer);
- recruitment of native canopy or woody understory ratio of seedlings to saplings would be at least 75 percent of that of reference site;.
- habitat heterogeneity would be 75 percent (or greater) of the reference site.

Replanting would be performed, as necessary with the appropriate-sized stock to ensure that these performance standards are achieved. If substantial non-compliance with the performance standards listed above occurs, RMV would consult with the USACE and CDFG to determine whether corrective measures and an extension of the five-year monitoring period would be necessary. At the end of the third year, a

report summarizing the revegetation site performance would be submitted to the USACE and CDFG.

- **Fourth-Year Monitoring.** During the fourth year, monitoring would occur quarterly. One quantitative survey would be performed to determine planted species' growth performance. The following performance standards would be achieved at the end of the year:

- at least 60 percent coverage of native species relative to reference standard (<5 percent deviation allowed);
- percent cover of non-native species not exceeding the reference site by more than 10 percent (includes tree and shrub layers only and does not include herb layer);
- recruitment of native canopy or woody understory ratio of seedlings to saplings would be at least 75 percent of that of reference site;.
- habitat heterogeneity would be 75 percent (or greater) of the reference site.

Replanting would be performed as necessary, during the appropriate planting period, with the appropriate-sized stock to ensure that these performance standards are achieved. If substantial non-compliance with the performance standards listed above occurs, RMV would consult with the USACE and CDFG to determine whether corrective measures and an extension of the five-year monitoring period would be necessary. At the end of the fourth year, a report summarizing the revegetation site performance would be submitted to the USACE and CDFG.

- **Fifth Year Monitoring.** During the fifth year, monitoring would occur quarterly. One quantitative survey would be performed to determine planted species' growth performance. The following performance standards would be achieved at the end of the year:

- at least 75 percent coverage of native species relative to reference standard (<5 percent deviation allowed);
- percent cover of non-native species not exceeding 10 percent (includes tree and shrub layers only and does not include herb layer);
- recruitment of native canopy or woody understory ratio of seedlings to saplings would be at least 75 percent of that of reference site;.
- habitat heterogeneity would be 75 percent (or greater) of the reference site;

Replanting would be performed, as necessary, during the appropriate planting period, with the appropriate-sized stock to ensure that these performance standards are achieved. If substantial non-compliance with the performance standards listed above occurs, RMV would consult with the USACE and CDFG to determine whether corrective measures and an extension of the five-year monitoring period would be necessary. At the end of the fifth year, a report summarizing the revegetation site performance would be submitted to the applicant for distribution to the USACE and CDFG.

3.6 Implementation Plan

Implementation of the ARHRP would be comprised of several steps, including:

1. Assessment of site hydrology, including preparation of water budgets where appropriate (preparation of water budgets would typically be needed for wetland creation projects to ensure that sufficient hydrology is present to support the target community; but would not be required for activities such as giant reed or pampas grass removal);
2. Assessment of the sites to determine the most effective restoration approach; i.e., passive restoration or active restoration, amount of grading where necessary, revegetation, or enhancement;
3. Appropriate planting techniques; and
4. Assessment of site-appropriate methods for invasives control (see Invasive Species Control Plan, *Appendix I*).

3.6.1 Assessment of Site Hydrology

As noted above, detailed investigations regarding site hydrology have already been conducted for Gobernadora Creek and Canyon, Chiquita Creek and Canyon, and portions of San Juan Creek. Prior to implementation of site-specific restoration at any of the sites addressed in this program, a site-specific implementation plan would be developed that includes an appropriate level of hydrological analysis, including, as appropriate, a detailed water budget, grading plans (where necessary) that address proposed hydrological modifications and/or enhancements, and performance standards relative to site hydrology.

3.6.2 Assessment of Restoration Approach

Upon completion of the hydrological assessment and (as necessary) preparation of water budgets, the restoration approach would be determined. Where grading is determined to be a necessary component of the program, grading plans would be developed that provide the restoration personnel with sufficient detail to properly implement the program. It is important to note that “in-the-field” adjustments are often necessary during final grading to ensure the highest level of function. Where substantial grading is required, it is expected that the majority of the non-native seed banks would have been removed and that grow-and-kill programs or other intensive site preparation would not be necessary.

For projects where significant grading is not required it may be necessary to conduct grow-and-kill programs or other types of weed/invasives removal. A variety of approaches, including hand removal, mechanical removal, or herbicide use may be appropriate depending on site-specific conditions. It is also likely that some sites may receive a variety of treatments, including heavy grading in some areas, light grading in other areas, and no grading with only weed control in other areas.

For many restoration sites, it is often necessary to evaluate soil conditions and, as appropriate, augment or rehabilitate poor or damaged soils. Soils on the RMV are, however, generally well understood and past restoration projects have been conducted without the need for soil augmentation.

a. Passive Restoration

Unlike the CSS and VGL restoration programs, where passive restoration would receive first priority, for the ARHRP passive restoration would typically follow invasive exotic species control. For example, as giant reed is removed from portions of San Juan Creek, it is expected that native riparian habitats such as southern arroyo willow or mulefat scrub would reestablish. The key concept of passive restoration, in the context of the aquatic ecosystem, is that the native habitat would naturally reestablish if the removal sites are kept free of the target invasives. For passive restoration to be effective, however, the site likely would need to be bounded by native vegetation (to facilitate colonization by native species) and/or have an adequate seed bank to support the growth of native species.

b. Active Restoration

Active restoration would be implemented if passive restoration is considered to be inappropriate for the site; i.e., the native vegetation community is unlikely to naturally reestablish itself

because of its large size, lack of immediately adjacent native habitat, and/or lack of a native seed bank. Furthermore, if passive restoration is determined not to work, active restoration would be implemented. The key difference between passive and active restoration is that focused restoration activities would be implemented.

3.6.3 Revegetation Efforts

The revegetation treatment for Alkali or Freshwater Marsh, Wet Meadow, Southern Willow Riparian Forest and Southern Coast Live Oak Riparian Forest would rely upon the use of container plants and a native seed mix to reintroduce the appropriate wetland/riparian species to revegetation sites. *Tables 6 through 9* provide conceptual plant palettes for each of these vegetation communities.

Container plant installation would be an important component of the revegetation treatment at these sites to facilitate more rapid plant establishment and area coverage. Species with seed that is not readily available or that do not readily germinate would be introduced using nursery-grown container plants. Both container stock and seed would originate from the San Juan and San Mateo Creek watersheds. All of the target species are available within the GERA and/or Chiquita Canyon restoration areas, having been documented during extensive monitoring programs.

TABLE 6
CONCEPTUAL ALKALI OR FRESH WATER MARSH
RESTORATION CONTAINER PLANT PALETTE

Botanical Name	Common Name	Size	Typical Spacing (in feet)
<i>Scirpus americanus</i>	Olive's bulrush	liners	4
<i>Scirpus californicus</i>	California bulrush	1 gal.	4
<i>Scirpus acutus</i>	Hardstem bulrush	1 gal	4
<i>Juncus xiphioides</i>	Iris-leaved rush	liners	4
<i>Scirpus pungens</i>	Three-square	liners	4
<i>Eleocharis macrostachya</i>	Creeping spikerush	liners	3
<i>Typha dominicensis</i>	Southern cattail	1 gal	5
<i>Scirpus maritimus</i>	Alkali bulrush	1 liners	4
<i>Paspalum distichum</i>	Knot grass	Liners	4
<i>Berula erecta</i>	Water parsnip	Liners	10
<i>Polvaonum lapathifolium</i>	Willow smartweed	seed	scattered
<i>Baccharis douglasii</i>	Douglas baccharis	1 gal.	6
<i>Cyperus erarostis</i>	Tall nutsedge	seed	scattered
<i>Epilobium ciliatum</i>	Willow herb	seed	scattered
<i>Bidens laevis</i>	Burr marigold	seed	scattered
<i>Pluchea odorata</i>	Marsh fleabane	seed	scattered
<i>Anemopsis californica</i>	Yerba mansa	liners	6

**TABLE 7
CONCEPTUAL ALKALI MEADOW CONTAINER PLANT PALETTE**

Botanical Name	Common Name	Size	Typical Spacing (in feet)
<i>Distichlis spicata</i>	Saltgrass	liners	4
<i>Juncus Mexicanus</i>	Mexican rush	liners	4
<i>Juncus rugulosus</i>	Wrinkled rush	liners	4
<i>Muhlenbergia rigens</i>	Deer grass	liners	4
<i>Leymus triticoides</i>	Alkali ryegrass	liners	5
<i>Carex preagracilis</i>	Clustered field sedge	liners	5
<i>Centromadia parryi australis</i>	Southern tarplant	seed	random
<i>Anemopsis californica</i>	Yerba mansa	liners	5
<i>Eleocharis macrostachya</i>	Creeping spikerush	liners	3
<i>Juncus bufonius</i>	Toad rush	seed	scattered
<i>Spergularia marina</i>	Marsh sand-spurry	seed	scattered
<i>Atriplex coulteri</i>	Coulter's saltbush	seed	site-specific

**TABLE 8
CONCEPTUAL SOUTHERN WILLOW RIPARIAN FOREST**

Botanical Name	Common Name	Size	Spacing
<i>Salix lasiolepis</i>	Arroyo willow	liners or gallon	10 to 20 ft
<i>Salix laevigeta</i>	Red willow	liners or gallon	10 to 20 ft
<i>Salix gooddingii</i>	Black willow	liners or gallon	10 to 20 ft
<i>Salix exigua</i>	Narrow-leaf willow	liners or gallon	10 to 20 ft
<i>Populus trichocarpa balsamifera</i>	Black cottonwood	liners or gallon	10 to 20 ft
<i>Baccharis salicifolia</i>	Mulefat	liners or gallon	10 to 20 ft
<i>Baccharis emoryi</i>	Emoryi baccharis	liners or gallon	10 to 20 ft
<i>Baccharis douglasiana</i>	Douglas baccharis	liners or gallon	10 to 20 ft
<i>Eleocharis montevidensis</i>	Slender creeping spikerush	liners	4 ft
<i>Juncus mexicanus</i>	Mexican rush	liners	4 ft

Botanical Name	Common Name	Size	Spacing
<i>Juncus rugulosus</i>	Wrinkled rush	liners	4 ft
<i>Juncus macrophyllous</i>	Large-leaved rush	liners	4 ft
<i>Artemisia douglasiana</i>	Mugwort	liners	6.0
<i>Cyperus eragrostis</i>	Tall nudsetide	liners	4 ft
<i>Leymus triticoides</i>	Alkali ryegrass	liners	4 ft

TABLE 9
CONCEPTUAL SOUTHERN COAST LIVE OAK RIPARIAN FOREST
RESTORATION CONTAINER PLANT PALETTE

Botanical Name	Common Name	Size	Typical Spacing (in feet)
<i>Quercus agrifolia</i>	Coast live oak	1 gal	20
<i>Platanus racemosa</i>	Western sycamore	1 gal.	30
<i>Sambucus mexicanus</i>	Mexican elderberry	1 gal	20
<i>Heteromoles arbutifolia</i>	Tovon	1 gal	20
<i>Rhamnus ilicifolia</i>	Redberry	1 gal	16
<i>Rhamnus californica</i>	Coffee berry	1 gal.	16
<i>Ribes speciosum</i>	Fuschia flowered gooseberry	1 gal.	16
<i>Leymus triticoides</i>	Alkali ryegrass	1 gal.	8
<i>Leymus condensatus</i>	Giant ryegrass	liners	8
<i>Muhlenbergia rigens</i>	Deergrass	1 gal	8
<i>Baccharis salicifolia</i>	Mulefat	1 gal	8
<i>Baccharis douglasii</i>	Douglas baccharis	1 gal.	8
<i>Artemisia douglasiana</i>	Mugwort	liners	8
<i>Pholistima auitum</i>	Fiesta flower	seed	scattered
<i>Anemopsis californica</i>	Yerba mansa	liners	6

3.6.4 Planting Techniques

All container plants and salvaged plants would be installed using industry standard techniques. A hole twice the diameter of the rootball would be excavated to the depth of the rootball. Each hole would be filled with water and allowed to drain prior to plant installation. Each container plant rootball would be scarified prior to installation if dead roots occur on the surface of the rootball. Salvaged plant rootballs do not need scarification. Planting backfill would be native soil.

Oak woodland species would receive a 2-inch thick layer of bark mulch 18 inches out from the base of each plant to reduce weed growth and water evaporation. After installation, each plant would be irrigated to the depth of the rootball.

3.6.5 Seed Application

A two-step hydroseed technique would be used to install all seed mixes. This technique involves an initial application of a hydroseed slurry composed of water, seed, fertilizer (if any), and a low volume of fiber mulch. The second hydroseed slurry application contains water and a heavier volume of fiber mulch. The purpose of the two-step process is to achieve the greatest seed-soil contact. In any cases where seed applications are within small in-fill enhancement areas, installation would be performed using hand broadcast methods.

3.6.6 Irrigation System and Schedule

Where needed, temporary on-grade irrigation systems would be installed to enhance germination and establishment of native plantings. The systems would be controlled automatically by irrigation clocks, and may be designed to shut off during rains events. Areas of similar topography may be controlled by a single remote control valve. The precipitation rate of the system would be approximately 0.2 inch per hour for any given area of the system.

The frequency and duration of irrigation are critical to seed germination and container plant establishment. The application of water would be keyed to existing conditions and water requirements of each stage of seed germination and seedling establishment. Irrigation would be used to maximize container plant survival and deep root growth while minimizing non-native species growth and seed production.

During each inspection, holes would be dug with a hand shovel or using a soil probe to determine the depth and amount of soil moisture. Enough holes would be dug to establish a representative sample of the site, i.e., until soil conditions are the same in more than three holes dug across the site. The irrigation schedule would be modified as necessary based on this

inspection. Irrigation heads would be adjusted or capped where wet areas occur next to dry areas to facilitate additional irrigation of the drier areas.

Irrigation system operation would be suspended in anticipation of rain events. The system would be shut-off at a master control valve three to five days prior to a predicted rain-storm or series of storms. System operation would be resumed immediately if a predicted storm does not materialize and if the site requires supplemental irrigation to maintain soil moisture conditions that are sufficient for seed germination and seedling establishment. System operation would be resumed after a rain event upon a site inspection to determine soil moisture levels.

3.6.7 Weed Control

In wetland and riparian restoration areas, weed seed bank build up can occur quickly if weeds are not controlled. The suite of weeds that colonize wetland and riparian sites on RMV and south Orange County vary with annual rainfall patterns, hydrologic characteristics of specific wetland sites, seasonality and types of disturbance that site receive (e.g., regular flood scour, sediment deposition, etc.). Weed abatement is most effective when time is given to repeated treatment of resprouting weeds. The following species are those most likely to require some level of control during the establishment phase of restoration projects: bristly ox-tongue (*Picris echioides*), Spanish sunflower (*Pulicaria paludosa*), yellow sweet-clover (*Melilotus indica*), white sweet clover (*Melilotus albus*), burr clover (*Medicago polymorpha*), English plantain (*Plantago major*), prickly lettuce (*Lactuca serriola*), Bermuda grass (*Cynodon dactylon*), Italian ryegrass (*Lolium multiflorum*), bull-thistle (*Cirsium vulgare*), sugar beets (*Beta vulgaris*), and poison hemlock (*Conium maculatum*). Where they become established, other invasives such as giant reed, tamarisk, and African umbrella sedge (*Cyperus involucratus*), should also be removed immediately. Early treatment and regular follow-up treatment of these species would reduce the weed density in the restoration areas over the long-term. Herbicide treatment of non-native grasses and follow-up treatment to reduce seed production would be essential for establishing native vegetation cover.

3.7 Maintenance and Monitoring Plan

Maintenance and monitoring activities that are necessary to ensure successful habitat revegetation and enhancement would be conducted in accordance with this plan. The Maintenance and Monitoring Plan provides direction to the Restoration Ecologist, RMV, and the Installation/Maintenance Contractor for routine maintenance of the restoration projects to be conducted throughout the initial plant establishment period and five-year monitoring period. This section is intended to provide a brief description of those activities.

3.7.1 Maintenance Activities

Maintenance activities would apply to all revegetation and enhancement areas. Immediately following implementation of the restoration program, a maintenance program would be initiated to ensure successful germination and growth of the installed native species.

Because mature habitats effectively control non-native species, restored wetland and riparian areas likely would become self-sustaining over time, needing very little or no maintenance once established. Maintenance activities for wetland and restoration areas would thus focus on ensuring the establishment of self-sustaining habitat during the five-year maintenance period. Maintenance activities would include weed control, supplemental irrigation (as appropriate), pest control (as appropriate), and site access restrictions.

3.7.2 Four-Month Maintenance and Monitoring Period

During the four-month period following completion of restoration activities, weed control measures, irrigation schedules, and special management needs would be determined. A replanting program would be initiated at the completion of the four-month maintenance period if 100 percent container plant survival is not attained (woody species only).⁷ The plant establishment period would be included in the installation contract to be performed by the Installation/Maintenance Contractor. Successful completion of the contract would include 100 percent survival of all container plants at the end of the plant establishment period (woody species only). New replacement plants would be provided and installed for the Installation/Maintenance Contractor to obtain final contract sign-off and payment.

3.7.3 Five-Year Maintenance and Monitoring Program

Following the four-month maintenance period, a long-term five-year maintenance program would be initiated. Long-term maintenance would be initiated following the end of the plant establishment period. Maintenance would occur on an as-needed basis throughout the five-year maintenance period. Maintenance personnel are expected to conduct maintenance activities on a timely basis by conducting work at a frequency and intensity that would result in the greatest potential for native vegetation to establish and become the dominant vegetation type within the restoration area. If necessary, corrective measures (such as re-seeding or container planting) would be promptly implemented to bring the restoration effort into compliance with the performance standards noted above in *Section 3.5.3*.

⁷ Up to ten percent loss of herbaceous container stock (e.g., *Scirpus* spp. *Juncus* spp. or *Carex* spp. is acceptable as these species reproduce vegetatively, often making it difficult to determine which individual represents the original planting. Where die-off greater than ten percent is evident in the first four months, other problems such as insufficient hydrology or soil chemistry may need to be evaluated to determine reasons for high mortality.

Supplemental irrigation of restoration sites would be conducted as necessary as determined by the Restoration Ecologist. Irrigation schedules would provide adequate water to maximize the survival of installed container plants and seedling establishment. Irrigation of the restoration sites would be closely monitored, and if necessary, the irrigation schedule and rates for each area would be modified to provide moisture and ensure successful germination and growth. The Restoration Ecologist would determine the need for changes in irrigation schedules in consultation with the Installation/Maintenance Contractor. An accurate record of these activities would be maintained by the Installation/Maintenance Contractor.

3.7.4 Weed Control

It would be the Installation/Maintenance Contractor's responsibility to control weeds within the restoration areas. Before initiating any weed control measures, the Installation/Maintenance Contractor would meet onsite with the Restoration Ecologist and RMV to determine the extent and methods of weed control. The Installation/Maintenance Contractor would notify RMV at least three days prior to implementing approved weed control measures. Weed control would be conducted in all active restoration areas for the duration of the five-year maintenance period. No more than 10 percent non-native cover in any given year during the five-year maintenance period would be accepted within wetland or riparian restoration areas.

During the five-year maintenance program, the non-native species noted above in Implementation Section, would be removed with hand tools, by hand, or treated with appropriate herbicides. Hand tools such as "weed whips" would be used only where solid patches of non-native grasses are present and in the absence of native seedlings. Hand removal would be used where native herb, shrub or tree seedlings are present. Chemical treatment would be limited to large areas of non-native grass with no native species present.

The prime period for weed removal is in the spring during the months of March and April. Weed eradication at this time is ideal because soils are typically still moist enough for hand-pulling and therefore can be removed before their detrimental effects of robbing native plants of sunlight, moisture, and nutrients occur. Additionally, it is imperative that weeds are removed before they can successfully produce seeds and contribute to the weed seed bank. If weeds are not controlled during this period of time, successful establishment of target wetland habitats would be extended in duration and potentially reduced in extent.

3.7.5 Clearing and Trash Removal

Pruning or clearing of native revegetation plantings would be prohibited. The revegetation areas would be allowed to develop naturally. Plant debris of native shrubs would not be removed from

the restoration sites. Native plant debris provides valuable micro-habitats for invertebrates, reptiles, small mammals, and birds; all necessary elements of normally functioning wetland and/or riparian communities. The decomposition of the plant debris also is essential for the replenishment of the soil's nutrients and minerals.

Trash would be regularly removed from restoration areas by hand and appropriately disposed of offsite. Such trash would be removed as needed, but at no less than at 1-month intervals for the first year, and quarterly thereafter.

3.7.6 Pest Control

Pests, including insects, mites, snails, rabbits, and rodents, are expected to occur within the restoration areas, especially in southern coast live oak riparian forest. In accordance with an Integrated Pest Management Program, active control of pests with the use of chemical pesticides would be avoided in favor of allowing natural environmental controls to take effect or the use of directed controls (e.g., trapping). If destruction of the habitat plantings by pests becomes a problem, the Installation/Maintenance Contractor would consult with RMV and the Restoration Ecologist to determine remedial measures to be taken.

3.8 Monitoring Program

As noted above under the Performance Standards in *Section 3.5.3*, each of the three specific components of the Restoration Program (i.e., habitat creation, stream restoration/rehabilitation, invasive exotic removal) each has its own set of performance standards and as such, each has a separate monitoring program relative to the methods used. The monitoring program set forth below is separated accordingly.

3.8.1 Habitat Creation or Restoration: Emergent Marsh, Wet Meadow, Riparian Scrub/Oak Forest

Monitoring would be performed by an agency-approved biologist (or Restoration Ecologist) with appropriate credentials and experience in native habitat restoration, restoration monitoring, wetland delineation, and the USACE's HGM approach. The performance of the mitigation would be evaluated by evaluating the target function variables described above in *Section 3.5.2*. Due to overlap among the variables, field data collected for Percent Vegetative Cover, Coarse Woody Debris (based upon direct visual estimates), Microtopographic Complexity, Species Composition, Seedling Recruitment, and Habitat Heterogeneity would provide the information necessary to determine performance compliance for all variables. RMV or a designated Restoration Ecologist would be responsible for development of data sheets to be used in collection of the information

associated with each variable (it should be noted that Appendix 3 of the Guidebook provides examples of data sheets that can be used or modified for use in the field during monitoring of the variables). The target function variables are described below.

Percent Vegetative Cover

The Percent Vegetative Cover would be determined using standard quantitative vegetation sampling methodologies which utilize transects or quadrats that characterize each vegetation strata (canopy, shrub, and herbaceous) in terms of total cover. Included in this variable would be percent cover by non-native invasive species. Data regarding non-native invasive species would be used in determining the types of remedial measures needed to ensure that the mitigation area remains healthy.

Species Composition

Data regarding Species Composition would be collected during the quantitative vegetation sampling discussed above.

Recruitment of Native Hydrophytes

Beginning with year three of the five-year monitoring program, recruitment of native hydrophytes would be evaluated by comparison with the reference site. The measurement of recruitment of native hydrophytes would be conducted during performance of quantitative vegetation surveys (by transect or quadrat sampling method) and would be conducted for appropriate vegetation strata.⁸ Comparison of the mitigation site with the reference site could be accomplished by measuring the ratio of seedlings/saplings/or clonal shoots to established shrub/trees or by absolute numbers as determined appropriate by the Restoration Ecologist.

Habitat Heterogeneity (Vegetation Patchiness)

Beginning with year three of the five-year monitoring program, vegetation patchiness would be evaluated by comparison with the reference site. Characterization of habitat heterogeneity or patchiness greatly depends upon scale and would be based upon direct visual observations made during performance of quantitative sampling.

⁸ For example, areas of willow riparian forest would include three strata - canopy, shrub, and herbaceous layers whereas, mulefat scrub would include only the shrub and herb layers.

Coarse Woody Debris (Riparian Habitats Only)

Coarse Woody Debris would be evaluated by direct visual observation, comparing the reference site with the GERA mitigation areas. For purposes of this mitigation program, Coarse Woody Debris is defined as woody vegetation deriving from trees and/or shrubs greater than 2.5 inches in diameter.

Microtopographic Complexity (Oak restoration areas not included)

Microtopographic Complexity would be evaluated by direct observation, comparing the restoration sites with reference sites. Microtopographic complexity would be measured during performance of vegetation transects, recording number of hummocks/mounds and depressions along with the change in topographic relief by class.⁹

Specific Conductance (Oak habitats not included)

Specific conductance would be measured using appropriate devices. Measurements obtained during monitoring of mitigation areas in Chiquita and GERA used and Oakton hand-held conductivity meter. Any similar device is appropriate/acceptable.

Hydrological Indicators (Oak habitats not included)

In addition to the variables referenced above, observations regarding field indicators for hydrology would be recorded during quantitative sampling for comparison with the reference site(s). Hydrological indicators to be recorded (as appropriate for each site), by direct observation, include Debris Rack, Sediment Deposits, Ponding Duration, Ponding Depth, Ponding Extent, Water Marks, and Drainage Patterns in the Wetland.

Wetland Delineation (Oak habitats not included)

Determination that the mitigation wetlands, expected to meet Section 404 wetland criteria, exhibit wetland hydrology, soils, and vegetation would be made using the 1987 Corps Manual.

Selection of Reference Site(s)

A reference site (or sites) would be identified in Chiquita Canyon, Canada Gobernadora, or other appropriate canyons in the Open Space as determined appropriate by the Restoration Ecologist in coordination with the USACE and CDFG. The reference sites would be located in areas that would be preserved in perpetuity and would correspond to wetlands to be impacted relative to the

⁹ The HGM Guidebook for Riverine Wetlands suggests microdepression size classes of 0.5, 1.0, and 1.5 meters with depths of 5, 10, and 15 centimeters.

functions, and related variables, discussed throughout this mitigation program. The reference site(s) would be approved by the USACE and CDFG prior to implementation of the mitigation program.

3.8.2 Record Keeping

Following each monitoring visit, the Restoration Ecologist would recommend actions, as needed, to RMV that would promote survival and coverage criteria as described in the performance standards. The Restoration Ecologist, RMV, and Installation/Maintenance Contractor would work together to monitor, maintain, and replant restoration areas, if necessary.

Over the five-year period following restoration implementation, an annual report prepared by the Restoration Ecologist that discusses the results of the restoration monitoring and maintenance efforts for that year would be submitted to RMV for incorporation into the overall report for the Open Space. Vegetation cover by species, compliance with required performance standards, species heights, seedling recruitment, pest problems, weed control problems, pest control measures implemented, additional required maintenance procedures, and the general health of the revegetation plantings would be summarized in these reports. Photo-documentation of the sites would be included in the reports to provide a visual record of the restoration progress.

3.9 Completion of Restoration

3.9.1 Notification of Completion

Upon completion of Year 5 of the monitoring period or when the restoration area(s) have achieved the Year 5 performance criteria, the Restoration Ecologist would prepare a final report for RMV that describes the relative success of each restoration area.

3.9.2 Contingency Measures

Contingency measures would be implemented if restoration efforts fail to meet performance criteria at the end of the five-year monitoring period. Such measures would include additional container plant and/or seed installation, additional weed control efforts, an evaluation and appropriate modification of the irrigation system, and the extension of the maintenance and monitoring period until such time that the performance criteria are achieved.

3.9.3 Long-Term Management

Long-term management beyond the five-year monitoring program would be in accordance with the overall Adaptive Management Program for the RMV Open Space. RMV would determine whether a restoration site would be subject to long-term monitoring and management.