The coastal sage scrub is in different phases of succession from burns. Therefore, the coastal sage scrub plant community in the Chiquita Canyon Conservation Area is a mosaic of at least four age stands, including mature unburned and three in successional phases of fire recovery.

1.2.3 Oak Woodland

Oak woodlands at Chiquita Canyon Conservation Area are the only community dominated by arboreal species. They are dominated by coast live oaks (*Quercus agrifolia*). This type of community is recognized as Coast Live Oak Woodland (Holland 1986) or as Coast Live Oak Series (Sawyer et al 1995). Some locations of oaks could be classified as oak savannah, because the tree canopies are distinct and do not form a contiguous overhead canopy. In other areas, the oaks form the contiguous canopy of oak woodlands. In areas where the oak woodlands are adjacent to coastal sage scrub, a shrub layer is present as an understory. The shrub layer shares many of the same species as coastal sage scrub, including California sagebrush, deerweed (*Lotus scoparius*), monkeyflower, laurel sumac and California buckwheat. Additionally, Mexican elderberry (*Sambucus mexicana*) is also often present amongst the oaks. Herbaceous species are also present and often include exotic brome grasses, miner's lettuce (*Claytonia perfoliata*) and chickweed (*Stellaria media*). Where oak woodlands are adjacent to annual grasslands, the shrub layer is depauperate, and the understory is primarily herbaceous, and often dominated by annual grasses.

The oak woodland areas are patchily distributed throughout the Chiquita Canyon Conservation Area at eighteen distinct sites, covering a total of 14.7 acres. These sites are located on the slopes of hills adjacent to coastal scrub, annual grasslands or ecotones, primarily on north-facing slopes and narrow canyons (Figure 2).

Burned Oak Woodland

The August 1996 burn came up to, but did not substantially impact any oak woodlands. On May 29, 1997, 0.6 acre of oak woodlands burned in Chiquita Canyon Conservation area. The May 13, 2002 burn affected 8.2 acres of oak woodlands and an estimated 297 mature and sapling trees were burned to varying degrees. Fire effects on oaks were assessed in June-July 2002. At that time, 75 mature and sapling trees exhibited resprouting (Harmsworth 2002). Seedling oaks were not censused, because moderate to intense fire is known to severely effect oaks less than 3 inches in diameter DBH. Additionally, no assessment of the oak woodland understory species was made. The fire likely reduced shrub species and the herbaceous cover (see coastal sage scrub). The post-fire succession in the understory of the oak woodland is likely to reflect the post-fire succession in the coastal sage scrub and annual grassland, based on the pre-fire understory.

1.2.4 Perennial Grasslands

Two types of perennial native grasslands are located in Chiquita Canyon Conservation Area and both are considered rare by the State of California (CDFG 2003). Holland (1986) combines these grassland types into a single plant community, Valley needlegrass grassland, that includes many types of needlegrass grasslands.

The perennial native grassland at the northeastern part of the site may be categorized as Coyote Brush/Purple Needlegrass series (Wolf et al 2001). This grassland is dominated by Purple needlegrass (*Nassella pulchra*) with coyote brush (*Baccharis pilularis*) also present, along with non-native grasses. This grassland series covers 3.1 acres.

Two other grasslands areas also occur in the Chiquita Canyon Conservation Area. They both share similar species, and are therefore categorized as the same series - Purple Needlegrass Grassland Series. Italian ryegrass (Lolium multiflorum) is also a common species in this series. These grasslands do not conform to the soils description for the Italian ryegrass/purple needlegrass association described in Sawyer et al. 1995, as they occur on heavy clay not serpentine soils. The Purple Needlegrass Grassland Series contains a number of forb species including Pacific sanicle (*Sanicula crassicaulis*), blue dicks (*Dichelostemma pulchellum*) and golden stars (*Bloomeria crocea*) as well as other annual exotic grasses including bromes. These two grasslands cover a total of 1.3 acres. The southern Purple Needlegrass grassland is larger, covering 1.1 acres, while the smaller Purple Needlegrass grassland is quite small, covering 0.2 acres. Figure 2 shows the locations all of these grassland areas.

Burned Perennial Grasslands

The August 1996 fire did not impact any of the perennial grasslands. The May 29, 1997, 1.1 acres of perennial grasslands burned in Chiquita Canyon Conservation area, including the Coyote Brush/Purple Needlegrass series and the small Purple Needlegrass grassland series. The May 13, 2002 burn affected 0.2 acre of perennial grassland. Both of these grasslands recovered from these spring burns within the next growing season.

1.2.5 Ecotone

Within the Chiquita Canyon Conservation Area are areas where shrubs are establishing on the edges of the annual grasslands. These areas have been identified as ecotones and occur in the upper elevations of annual grass-dominated valleys along the eastern ridges as well as in narrow bands along the coastal sage scrub edge in many areas. Some of these ecotone areas have been the focus of vegetation manipulation. The ecotone areas cover 9.3 acres of the Chiquita Canyon Conservation Area.

Burned Ecotones

Neither the August 1996 nor the May 29, 1997 fires occurred in areas where ecotones are present. The May 13, 2002 burn affected 9.1 acres of ecotones. Post-fire succession will reflect similar trends occurring in the adjacent coastal sage scrub and annual grasslands.

1.2.6 Non Wetland Drainages

The conservation Easement is the upper watershed of Chiquita Canyon. Small drainages start in the steeper coastal sage scrub which merge into larger drainages in the broad valleys. Drainage patterns range from incised channels with depths of approximately 20 feet to flat impoundment areas. The annual runoff in these drainages are highly ephemeral and do not support any native obligate wetland vegetation. The soils are not classified as wetland soils. Therefore, these drainages are classified as non-wetland watercourses. These drainages vary in the density of native species with sparse mulefat (*Baccharis salicifolia*), as well as elderberry (*Sambucus mexicana*), toyon (*Heteromeles arbutifolia*) and coast live oak (*Quercus agrifolia*) interspersed with coastal sage scrub species and areas of dense annual grasses. Appendix II contains a map of all drainages and evaluations for functional features, including native and exotic cover.

1.2.7 Sensitive Plant Species

While no federally or state-listed threatened or endangered plant species occur in the Conservation Area, six sensitive plant species have been located on the site (Harmsworth 2004). These species and an overview of their status and occurrence in the Conservation Area are included in Table 1.

Table 1. Sensitive Plant Species Within the Conservation Area

Common Name (*Scientific Name*)	Status: Fed/State/ CNPS/Other*	Location within the Conservation Area	Number of individuals / Locations
California Copperleaf *(Acalypha californica)*	--/--/--/LR	Occurs within coastal sage scrub. Plants were located on the west side of the project site on a southeast-facing slope.	60 / 1
Catalina mariopsa lily *(Calochortus catalinae)*	--/--/List 4/--	Occurs in coastal sage scrub, native and annual grassland. Generally found throughout the study area but more prevalent in recently burned areas, especially on the center ridgeline.	6638 / 25
Intermediate Mariposa Lily *(Calochortus weedii* var. *intermedius)*	FSC/--/List 1B/--	Occurs in openings of coastal sage scrub and native grasslands, often on a sandy rocky substrate. Generally most abundant in recently burned coastal sage scrub area on the eastern ridgeline.	590 / 23
Western Dichondra *(Dichondra occidentalis)*	--/--/List 4/--	Occurs in openings of coastal sage scrub. Recorded in recently burned area of coastal sage scrub habitat in rocky sandy soil.	845 / 2

Common Name (*Scientific Name*)	Status: Fed/State/ CNPS/Other*	Location within the Conservation Area	Number of individuals / Locations
California chocolate lily *(Fritillaria biflora)*	--/--/--/LR	Occurs within coastal sage scrub/ native perennial in clay soils. Recorded on the north ridge.	25 / 1
Coulter's matilija poppy *(Romneya coulteri)*	--/--/List 4/--	Occurs in coastal sage scrub. Recorded from one area in the northern portion of the center ridge.	500 / 1

* Rare Plant Status Categories:

Federal:

FSC = Federal Special Concern Species

California Native Plant Society (CNPS)

- List 1B = PLANTS RARE, THREATENED, OR ENDANGERED IN CALIFORNIA AND ELSEWHERE. Plants meet definitions of Sec. 1901, Chapter 10 (Native Plant Protection Act) or Secs. 2062 and 2067 (California Endangered Species Act) and are eligible for state listing. CEQA consideration is mandatory.
- 4 = PLANTS OF LIMITED DISTRIBUTION; A WATCH LIST. CEQA consideration is being recommended by CNPS.

LR -Locally rare, Rare in Orange County (Dames & Moore and Bramlet 1994)

SECTION 2 – SOIL TAXONOMY AND ANALYSIS

The Conservation Area contains several soil types that support different vegetation communities. To provide a better understanding of the potential restoration areas, the soils within the Conservation Area were analyzed to determine the correlation between soil type and plant communities. This analysis is necessary to determine appropriate restoration in the areas that had been historically disturbed by dry-land farming and cattle gazing. Restoration and future management will be based on the soil analysis information. Soil/plant community relations will provide managers with the necessary insight on the proper habitat restoration of the disturbed land.

Analysis of the soils occurring in the Conservation Area began with a review of the Natural Resources Conservation Soil Taxonomy of 1999 and Soil Survey of 1978. See Figure 3 for the map of the Soil Survey. The Soil Survey was verified in the field first through a walkover and examination of surface soil characteristics. Based on the review of the Soil Survey, detailed soil characterization was undertaken in each of the different soil types. Seventeen soil pits were examined within Conservation Area. Figure 4 shows the location of the soil pits. Determination of soil pit locations was based on soil type, existing vegetation, and landscape position. Several pits were dug in each soil series to determine the soil plant community relationships. The soil pits were located in valleys, on alluvial fans, and slopes. The soil pits were dug by backhoe to a depth of 3 to 5.5 feet depending on the depth to the parent material. Detailed field notes of the soil profile were documented with key features being the soil horizon depth, color, texture, moisture, presence of roots, pores, and other noteworthy observations. The detailed data sheets are presented in Appendix III. The following sections summarize the taxonomy and soil analysis in relation to existing vegetation and appropriate habitat restoration.

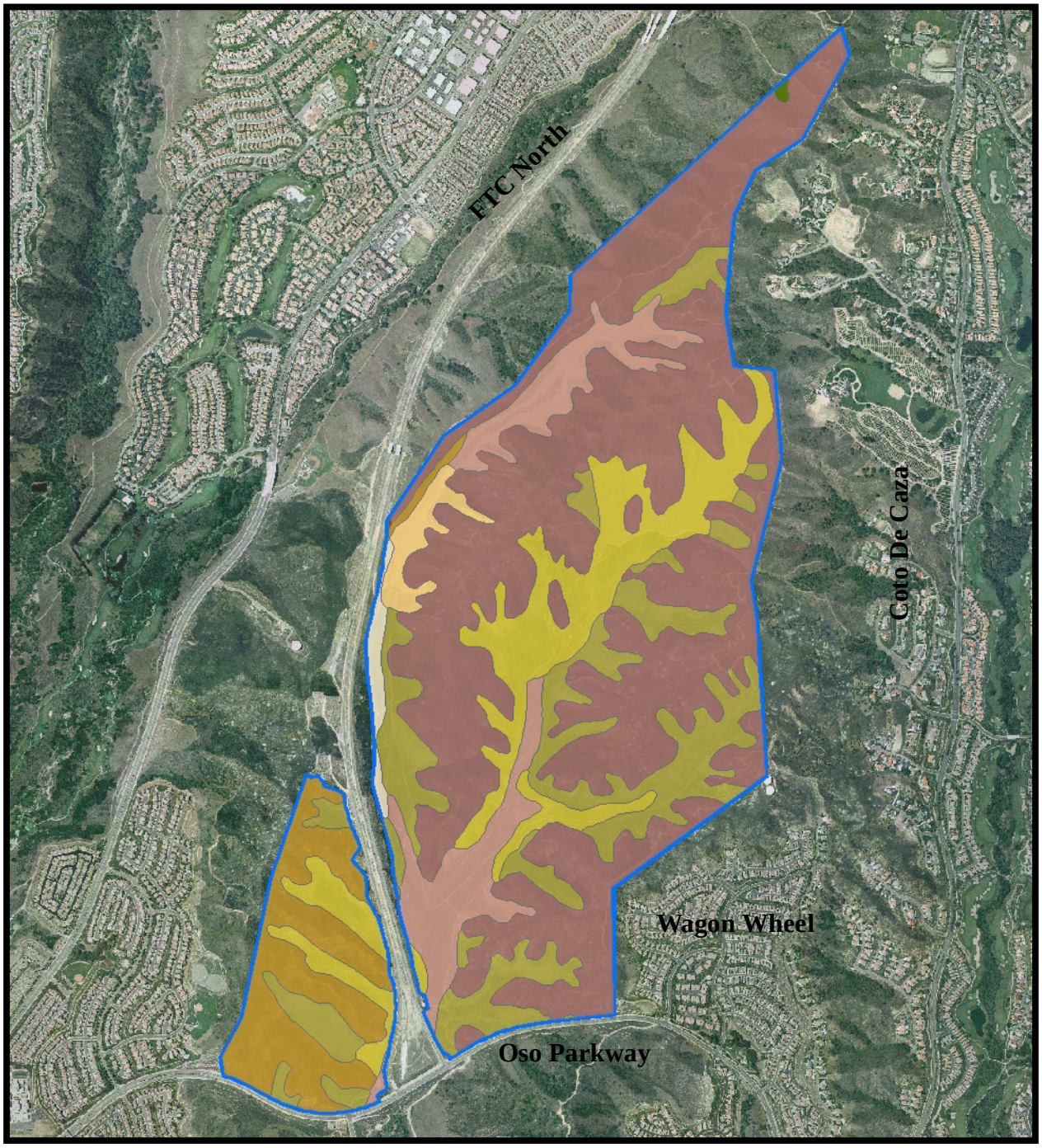
2.1 SOIL ORDERS

Two soil orders occur in Conservation Area, Mollisols and Entisols. See Figure 5 for locations of the soil Orders within Conservation Area. Mollisols typically support perennial grassland vegetation and the Entisols typically support trees and shrubs. Diagnostic characteristics of Mollisols are, they are mineral soils with a mollic epipedon. A mollic epipedon is dark in color, relatively thick and contains at least 5.8 g kg^{-1} of organic carbon. Entisols are characterized by the lack of discernable diagnostic horizons. Since Entisols form on recent erosional surfaces, they are not in place long enough for pedegonic processes to form distinct horizons (NRCS, 1999).

2.1.1 Mollisols

Suborder

Xerolls is the one suborder of Mollisols occurring in Conservation Area. Xerolls occur in xeric moisture regimes of a Mediterranean climate characterized by moist cool winters and warm dry summers. Diagnostic characteristics of Xerolls are soils with a relatively thick mollic epipedon, a cambic or argillic horizon, and an accumulation of carbonates in the lower part of the B-horizon. The epipedon is dark in color and contains a high



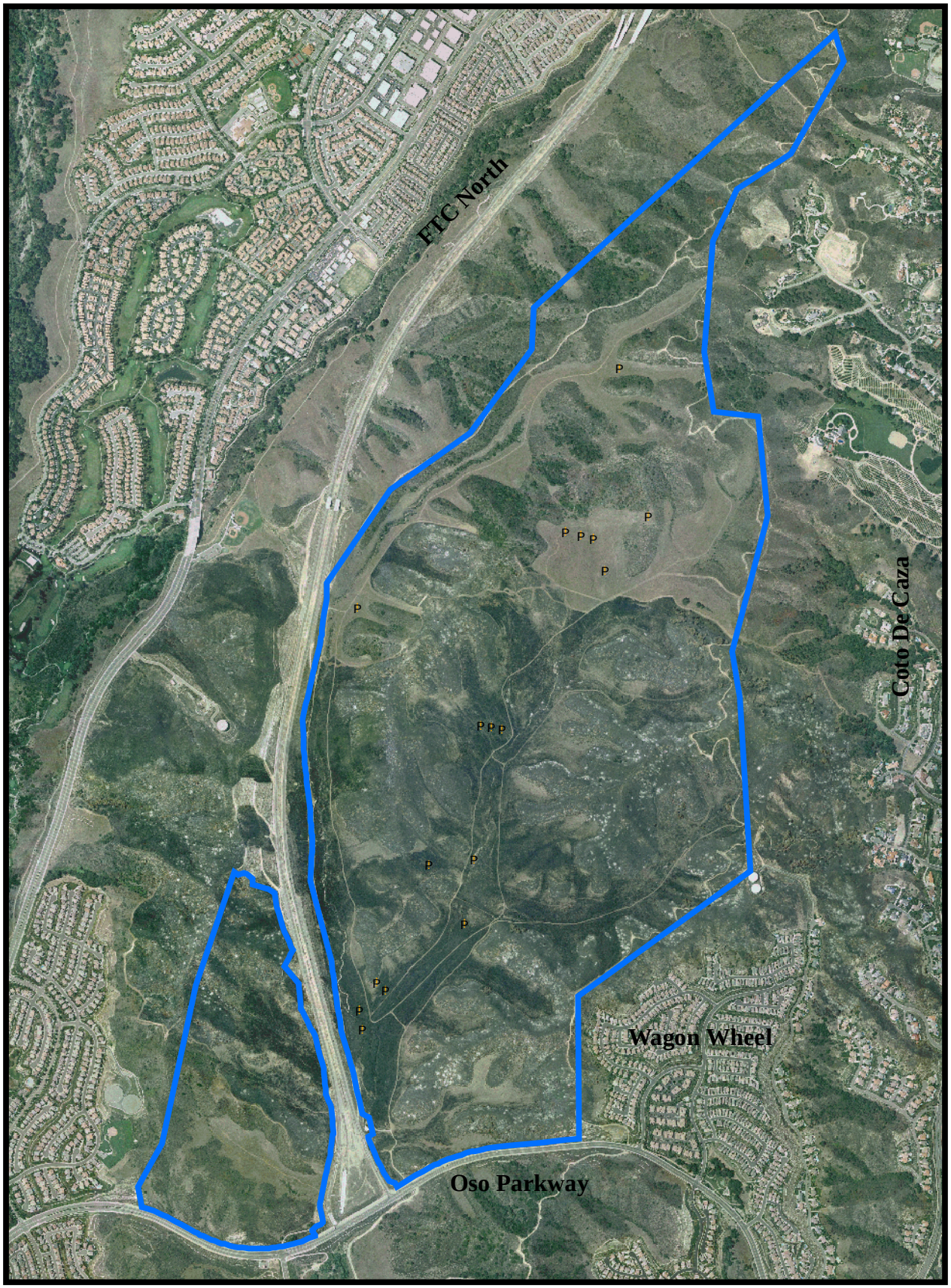
Chiquita Canyon Conservation Area
Soil Phases
Figure 3

Soil Phase

- Bosanko-Balcom Complex, 15 to 30% slopes
- Botella Clay Loam, 2 to 9% slopes
- Botella Clay Loam, 9 to 15% slopes
- Botella Loam, 2 to 9% slopes
- Calleguas Clay Loam, 50 to 75% slopes
- Capistrano Sandy Loam, 2 to 9% slopes
- Capistrano Sandy Loam, 9 to 15% slopes
- Cieneba Sandy Loam, 30 to 75% slopes
- Myford Sandy Loam, 15 to 30% slopes

Conservation Boundary

0 1,000 2,000 4,000
Feet



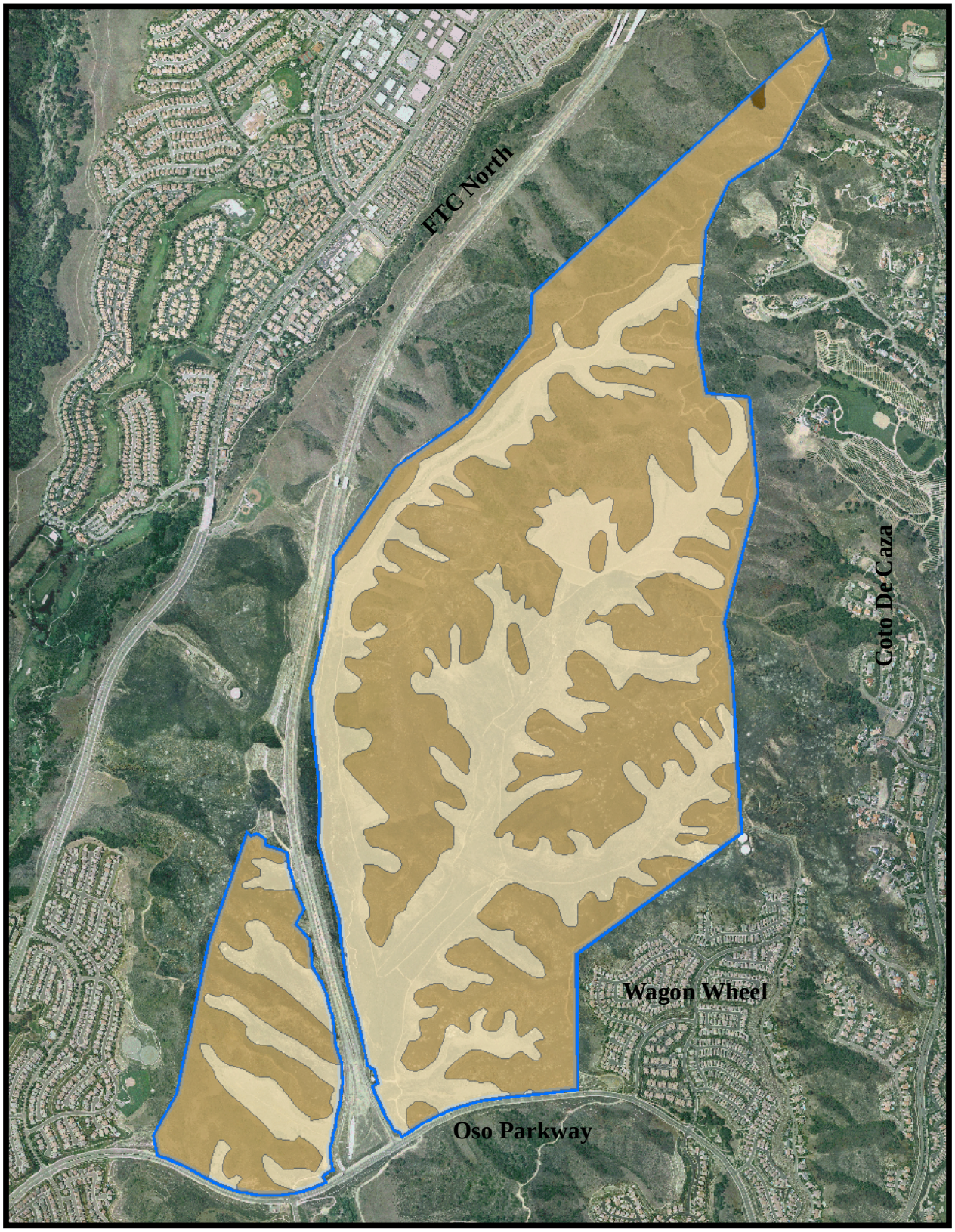
Chiquita Canyon Conservation Area
Soil Pit Locations

Figure 4

Conservation Boundary

0 1,000 2,000 4,000 Feet

P Soil Pits



Soil Orders

- Alfisols
- Entisols
- Mollisols

Conservation Boundary

0 1,000 2,000 4,000 Feet

Chiquita Canyon Conservation Area
Soil Orders
Figure 5

amount of carbon. The dominant vegetation supported by Xerolls generally is bunchgrass (NRCS, 1999).

Great Groups

Two great groups of Xerolls occur in the Conservation Area. The first great group of Xerolls is Argixerolls. The subgroup is Pachic Argixerolls that are characterized by having an argillic horizon and no natric horizon (NRCS, 1999). The soil does contain clay in the upper layers and the clay rapidly decreases, by more than 20%, with increasing depth within a depth of less than 150 cm from the surface of the soil (NRCS, 1999). Argixerolls of the Conservation Area are found on the valley floors in the larger valleys. Habitat conversion to exotic species has occurred on the Argixerolls of the Conservation Area.

The second great group is Haploxeroll. The subgroup is Entic Haploxerolls that are typically recently formed soils, have little development in the subsoil and some have unaltered recent parent materials below the mollic epipedon (NRCS, 1999). Haploxerolls commonly have a cambic horizon below the mollic epipedon and do not have an argillic or natric horizon (NRCS, 1999). The Haploxerolls of the Conservation Area occur in valleys and on alluvial fans. Within the Conservation Easement, native habitats supported by Haploxerolls have been converted to exotic plant communities from land uses including dryland farming and cattle grazing. Dominant exotic species are non-native grasses, mustards, wild radish, storksbill, and tocalote.

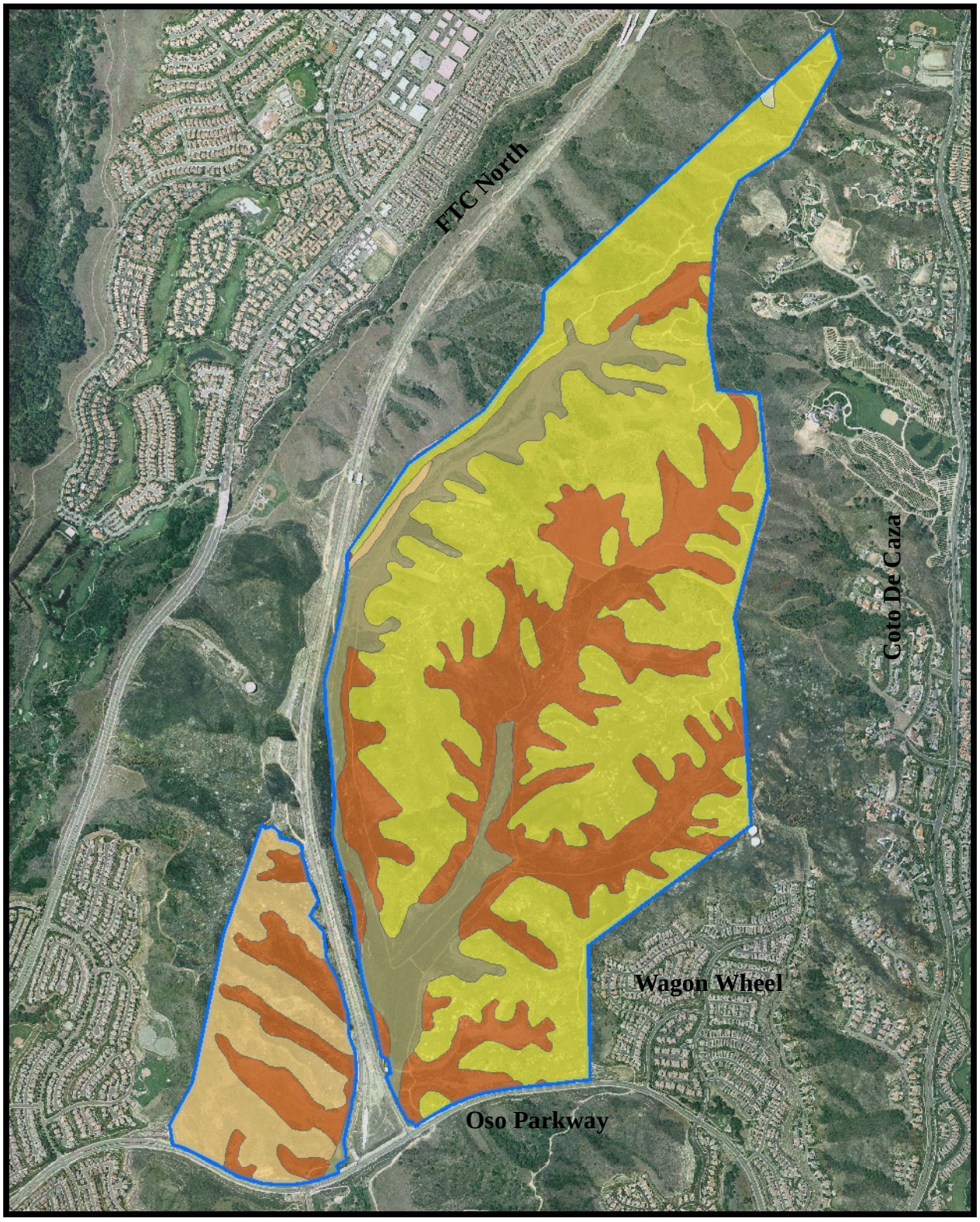
Soil Series and Analysis

Of the four dominant Soil Series that occur in the Conservation Area, the Botella Series and Capistrano Series are classified in the Xerolls and Haploxeroll great groups, respectively. The Botella Series and Capistrano Series occur in the valleys and on alluvial fans. Figure 6 shows the locations of the soil series within Conservation Area.

<u>Botella Series</u>

The Botella series are Mollisols of the Pachic Argixerolls subgroup. Soils of the Botella series typically form in sedimentary alluvium and occur on alluvial fans. Soils are well drained and are moderately slowly permeable. They occur on slopes ranging from 2 to 15 percent and elevations ranging from 25 to 1500 feet. The available water holding capacity of the Botella soils ranges from 9.5 to 11.5 inches with an effective rooting depth of 60 inches or greater. Typical vegetation of Botella soils are annual grasses, forbs, and some oaks and brush (NRCS, 1978).

A typical soil profile for the Botella series is described by the NRCS (1978) as follows. The A horizon is 5 to 18 inches with a texture of very fine sandy loam, loam, sandy clay loam, or clay loam. Moist soil color of the horizon is in the 10YR hue and ranges from gray to dark gray. Soil structure can vary between granular to subangular blocky. The B-horizon is 11 to 30 inches with a texture of sandy clay loam, clay loam, or silty clay loam. Moist soil color of the horizon is in the 10YR hue and ranges from grayish brown to dark grayish brown. Soil structure for the horizon is prismatic or subangular blocky. The C-horizon has a texture of sandy loam, fine sandy loam, sandy clay loam, or clay loam.



Chiquita Canyon Conservation Area
Soil Series
Figure 6

Soil Series

- Bosanko Series
- Botella Series
- Calleguas Series
- Capistrano Series
- Cieneba Series
- Myford Series

Conservation Boundary

0 1,000 2,000 4,000 Feet

Botella soils occur in the valleys and lowest points of Conservation Area. Dominant vegetation at present time supported by the Botella soils are the exotic species wild radish, mustard, non-native grasses, and erodium and the native species ragweed, doveweed, tarweed, and telegraph weed.

Over the Conservation Area, six soil profiles were described from soil pits in the Botella Series, five in the Botella Loam 2 to 9 percent slopes and one in the Botella Clay Loam 2 to 9 percent slopes. One soil profile was described from a soil pit at the interface between Botella Loam and the Capistrano Sandy Loam. See Appendix II for Field Sheets and for soil pit photos.

The average depth of the soil profiles in the Botella Series was 50 to 60 inches. Soil color was typically dark throughout the profiles, particularly in the lower horizons. On average, a 15 to 20 inch horizon of clay accumulation was present with clay to sandy clay texture. In addition, clay was present in all horizons with a predominance of soil textures being a loam or clay texture. Few to common fine roots and pores were found to depth in all of the profiles.

The proposed habitat restoration in the Botella soils is native perennial grassland. This conclusion is based on the high clay content, dark color, deep soil profile, and high nutrient content of the soils. The high clay content indicates a higher available water capacity. The thickness and dark color of the profiles indicates a high nutrient content. Grassland species thrive on soils that are deep with a higher nutrient load and higher moisture content. Shrub communities, particularly coastal sage scrub, thrive on low nutrient, shallow soils. Coastal sage scrub species are also drought tolerant and tend to grow on drier soils than would support grassland species. In addition, the low landscape position of the Botella series is indicative of grassland habitat. Grasslands tend to occur in valleys, flat plains, or gentle rolling hills.

Capistrano Series

The Capistrano Series soils are Mollisols within the Entic Haploxerolls subgroup. Soils of the Capistrano Series, occurring on alluvial fans and plains in small valleys, formed in granitic alluvium. Slopes where the soil occurs range from 2 to 15 percent at elevations ranging from 25 to 2500 feet. Typical vegetation supported by Capistrano soils is mostly grasses and a few oaks in some places. Capistrano soils are well drained and moderately rapidly permeable. Available water holding capacity is 5.5 to 7.5 inches and effective rooting depth of 60 inches or more. Throughout, the soil is medium acid (NRCS, 1978).

The NRCS (1978) describes the typical soil profile of the Capistrano series as consisting of an A and C horizon only. The A horizon ranges in thickness from 20 to 40 inches. Granular, subangular blocky, or massive is the soil structure. Texture of the A horizon is fine sandy loam, sandy loam, or coarse sandy loam and gravels may be present. In the 10YR hue, moist color of the horizon ranges from brown to dark grayish brown. The C-horizon has a texture of sandy loam, coarse sandy loam, or fine sandy loam and may be gravelly. In the 10YR hue, the color ranges from brown and light yellowish brown to brownish yellow or grayish brown. Places of the horizon may be mottled.

Capistrano sandy loam, 2 to 9 percent soil occurs in the valleys and on alluvial fans in Conservation Area. Exotic species are dominant. Dominant exotics are non-native

grasses, wild radish, mustard, erodium, and tocalote. The native species that persists in these soils are doveweed, vinegar weed, lupinus bicolor, and grassland golden bush.

The Capistrano sandy loam, 9 to 15 percent slopes soils occur mostly on alluvial fans of the narrower valleys on the east side of Conservation Area. Dominant vegetation on this soil series is mostly exotic species such as non-native grasses, erodium, mustard, tocalote, and wild radish. The dominant native species that persist are stephanomeria, tarweed, and telegraph weed.

Six soil profiles were described from soil pits in the Capistrano Series. Five soil pits were analyzed In the Capistrano Sandy Loam 2 to 9 percent slopes, and one soil pit was described in the Capistrano Sandy Loam 9 to 15 percent. See Appendix III for Field Sheets and soil pit photos.

The average depth of the soil profiles in the Capistrano Series was 50 to 65 inches. Soil color was typically dark in the upper 40 to 50 inches with the lower horizons being slightly lighter in color relative to the Botellas Series. On average, a 35-inch clay accumulation layer having a sandy clay or loamy clay texture was present. Clay was present in all horizons of the profiles with a predominance of soil textures being sandy clay and sandy clay loam. Few to common fine roots, especially along ped faces, and a few fine to coarse pores were found to depth in all profiles. Small Gravels were common to occasional throughout most profiles and cobbles were present in half of the profiles, typically below 35 inches.

Native perennial grassland is proposed to be restored on the Capistrano Sandy Loam 2 to 9 percent slopes is native perennial grassland. The conclusion is based on the high clay content, dark color, deeper soil profile, and higher nutrient content of the soils. Grassland species tend to thrive on more moist, higher nutrient holding soils. Characteristics of the profile suggesting the Capistrano series would support grasslands are the high clay content that indicates a higher available water capacity and the thick dark color of the profiles that indicates a high nutrient content. In addition, the low, relatively flat landscape position of the Capistrano series is indicative of grassland habitat rather than shrub land.

The proposed habitat type of the Capistrano Sandy Loams 9 to 15 percent is perennial grassland/shrub land ecotone and shrub land. Native habitat appropriate for this soil is primarily indicated by its landscape position on alluvial fans. The soil profile incorporates characteristics of both typical grassland and shrub land soils of Chiquita. Grassland soil characteristics of the profile are the presence of clay in all of the layers and the thickness of the profile. Shrub land soil characteristics of the profile are the presence of gravels in all of the layers and the light color of the lower horizons indicating a loss of organic matter. Species of both habitat types are currently supported by the soils. Exotic species at present time dominate these soils but a few native shrubs, such as deerweed and California sagebrush, are found on these alluvial fans.

2.1.2 ORDER ENTISOLS

Suborder

Within the Conservation Area, the suborder Orthents is classified under Entisols. Orthents are Entisols that developed recently and developed on erosional surfaces. Orthents generally occur on slopes twenty-five percent or more (NRCS, 1999).

Great Group

Orthents within the Conservation Easement are classified in Xerorthents Great Group. Xerorthents occur in Mediterranean climates and have a xeric moisture regime. Vegetation supported by Xerorthents is typically shrubs and trees. The subgroup is Typic Xerorthents. Diagnostic characteristics of the soils generally tend to be moderately deep to deep and typically do not have ground water within the upper 150 centimeters. The epipedon is thin and ochric due to the young age of the soil (NRCS, 1999).

Soil Series and Analysis

Two of the dominant Soil Series within the Conservation Area are Xerorthents. These Xerorthents are the Calleguas Series on the slopes of the smaller western ridges of the Conservation area, and the Cieneba Series in the larger central and eastern ridges of the Conservation Area. See Figure 6 for Soil Series locations within Conservation Area.

Calleguas Series

Soils of the Calleguas series typically formed from weathered lime coated shale or lime coated sandstone material or a both. The soil occurs in the uplands on very steep, generally south facing, slopes ranging from 50 to 75 percent and elevation ranging from 200 to 2,500 feet. Calleguas soil is well drained and moderately permeable. The available water capacity is 1.5 to 3.5 inches and effective rooting depth in the soil ranges from 10 to 19 inches. Typical vegetation supported by Calleguas soil is mustard and brush (NRCS, 1978).

The NRCS (1978) describes the typical soil profile for the Calleguas series consisting of an A and a C-horizon. The A horizon ranges in thickness from 10 to 19 inches with 5 to 35 percent of the volume consisting of small rock fragments. Soil structure for the layer is granular or massive. Moist soil color is grayish brown in either the 10YR or the 2.5YR hue. Clay loam or loam is the texture of the horizon. Ranging from highly weathered to hard rock, the C-horizon is comprised of lime coated sandstone or calcareous shale or both (NRCS, 1978).

Calleguas soils occur on slopes of the west canyon of Conservation Area. No soil profiles were taken in this soil type. The vegetation supported by the soils is mostly high quality coastal sage scrub. Dominant native species are California sagebrush, white and black sage, monkey bush, and prickly pear cactus. Some areas of the Calleguas soils on the less steep slopes are impacted by exotic species due to historic dry-land farming and cattle grazing within the Conservation Area. Dominant exotic species that have invaded the area are non-native grasses and mustard. Restoration of these soil areas will be as coastal sage scrub.

Cieneba Series

The Cieneba Series occurs on slopes ranging from 9 to 75 percent at elevations of 200 to 4000 feet. Formation of the soil is from weathering of granitic rocks of the Santa Ana Mountains. The soils are somewhat excessively drained and are moderately rapidly permeable. Vegetation supported by the soil is mostly shrub species. Available water holding capacity of the soils ranges from 0.75 to 2.5 inches with an effective rooting depth of 5 to 15 inches (NRCS, 1978).

The NRCS (1978) describes the typical Cieneba soil profile consisting of an A and C-horizon. Depth of the A horizon is 5 to 19 inches. Soil texture is fine gravelly sandy loam, coarse sandy loam, or sandy loam with a structure of generally granular or massive. Moist color is in the 10YR hue and ranges from pale brown to yellowish brown. The C-horizon is comprised of weathered granodiorite.

The Cieneba soils in the Conservation Area occur on the slopes of the main canyon and support primarily coastal sage scrub. Generally, these slope areas were not tilled for dry-land farming. Dominant species are California sagebrush, black and white sage, buckwheat, monkey bush, and on some slopes toyon. Few areas are impacted by exotic species such as non-native grasses, mustard and artichoke thistle. Cieneba soils that were near the slope break at the interface with the valley appear to have been dry-farmed. It is these area that are dominated by exotic species.

Three soil profiles were described from soil pits in the Cieneba Series. One soil pit location was chosen to define the soil in the coastal sage scrub habitat type currently found most often in this soil series. The objective was to compare this profile with the other two profiles within this series where dry-land farming had occurred. An additional soil profile was described at the interface of the Cieneba and Botella Series. See Appendix III for Field Sheets and soil pit photos.

The average depth of the soil profiles in the Cieneba Series was 36 inches. Soil color of the upper horizons, approximately 7-10 inches, was comparable to the Botella and Capistrano Series, with the Cieneba soils being slightly lighter. The soils became significantly lighter with increasing depth. No layer of clay accumulation is evident in the profiles. Soil texture was predominantly sandy loam or loamy sand. Few fine roots were found to depth along ped faces and in fracture zones. Pores were found in the upper layers and not to depth. Gravels and cobbles were present in the profiles throughout the horizons.

Proposed habitat restoration for the Cieneba series soils is coastal sage scrub. The soils are indicative of supporting shrub species due to their shallow nature, lack of thick dark upper horizons, sandy texture, and presence of cobbles and gravels. The light colors of the horizons indicate a low nutrient content of the soil. Typically, coastal sage scrub species are supported by low nutrient soils. Coastal sage scrub species are also drought tolerant and tend to grow on drier soils than would support grassland species. The steep sloping landscape position points to the series supporting shrubs as well.

A few clay inclusions occur in the Cieneba series that suggest grassland/forbland habitats rather than shrub land. Soil Pit 5 is located in one such clay inclusion (see Figure 4). The clay inclusion has a clay texture and dark color throughout the profile. In addition, the profile is deep. All of the indications point to grassland as opposed to shrub land habitat. Presently, Italian rye grass dominates this clay inclusion and other similar areas within slopes. A remnant grassland/forbland area exists within the Cieneba series

on a similar clay inclusion. Dominant species of this native remnant patch are bunchgrass, blue-eyed grass, blue dicks, and golden stars. In areas of clay inclusions on slopes, perennial grasslands will be restored.

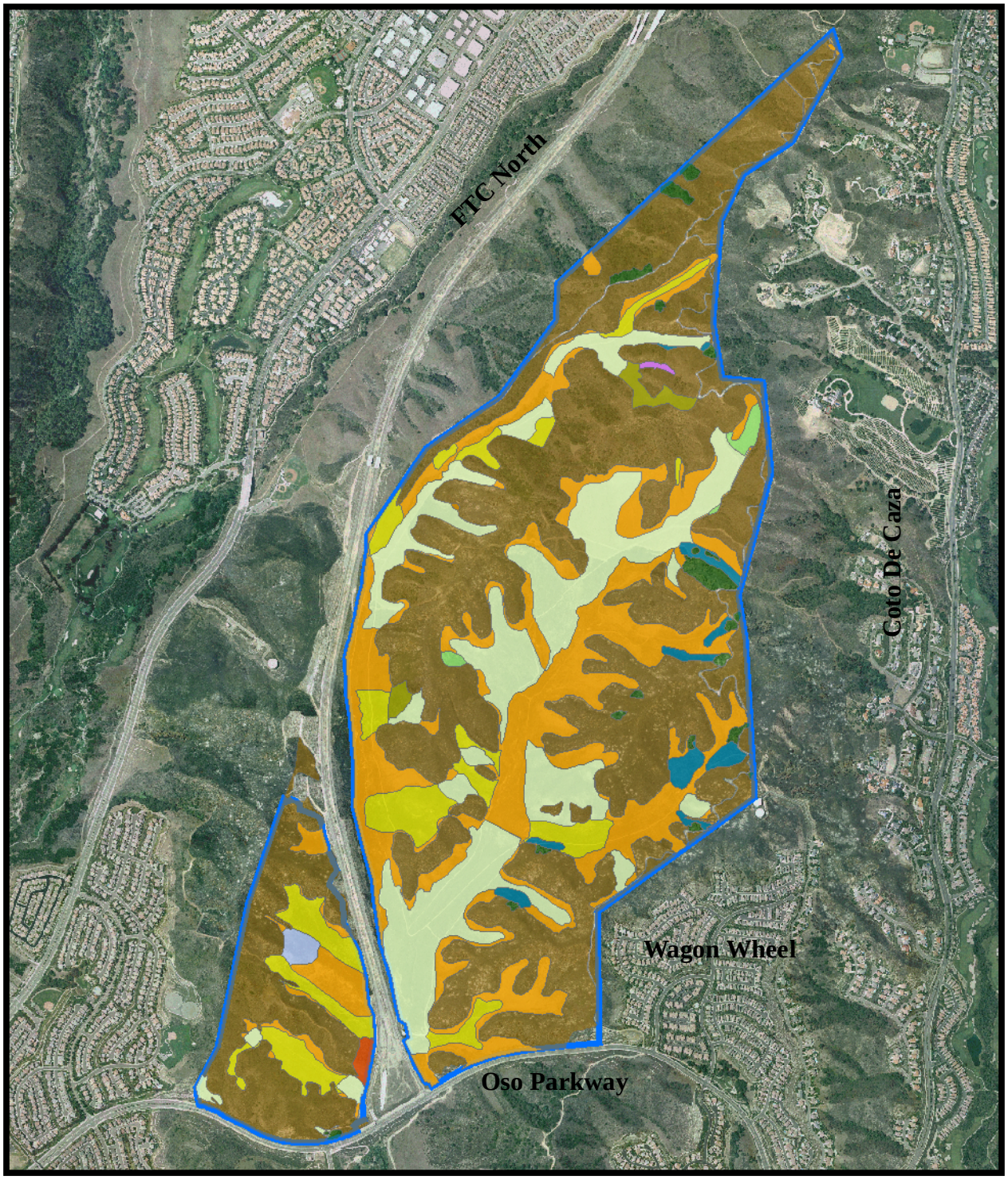
2.2 Summary of Restoration Areas

Restoration of each habitat will depend on the soils and existing vegetation as described in the preceding sections. Table 2 presents the estimated acreage of each restored habitat. Figure 7 shows the proposed habitat restoration areas based on soils, slope, and existing vegetation. The acreage for restoration of non-wetland water courses is based on the areas of each drainage dominated by exotic species as Described in Appendix II.

Opportunities for salvage and relocation of rare plant species have also been identified based on the preceding soil analysis. Specific salvage and relocation for thread-leaved brodiaea (*Brodiaea filifolia*) is presented in Appendix IV.

Table 2. Acreage of Proposed Habitat Restoration in the Conservation Area

Habitat Type	Acres
Coastal Sage Scrub	241
Coastal Sage Scrub/Perennial Grassland Ecotone	92
Perennial Grassland	182
Oak Woodland/Oak Savannah	31
Native Forb /Native Forb/Perennial Grassland	6
Non-Wetland Water Courses	13



Chiquita Canyon Conservation Area
Proposed Habitat Restoration Areas
Figure 7

Existing Habitats

- Oak Woodland Enhancement
- Existing Perennial Grassland
- Existing Coastal Sage Scrub
- Conservation Boundary

0 1,000 2,000 4,000 Feet

Habitat Restoration Areas

- Coastal Sage Scrub
- Ecotone
- Ecotone/Grassland
- Forbland
- Grassland
- Grassland/Forbland
- Oak Woodland
- Oak Woodland/Grassland

SECTION 3 – RESTORATION SPECIFICATIONS

The restoration within the Conservation Area is designated mainly within areas that have been historically disturbed by dry land farming. As discussed in the previous section, specific habitats will be restored on particular soil series. Restoration generally will proceed under the following specifications which will be adaptively managed for specific habitats and areas based on several factors, including the level of historic disturbance, density and type of exotic species, soil series, and distance from existing native habitats. Therefore, methods outlined in the following section will be used, or adapted, as necessary and in various combinations based on specific existing field conditions, including prevailing weather conditions each year.

Restoration will be phased so that there will be minimum impact to the overall ecology of the Conservation Area. Restoration generally can be divided into four phases: 1) site preparation, 2) seeding/planting, 3) establishment maintenance, and 4) post-establishment, long-term management. Under this restoration model, there will be approximately two years when each restoration area is under very active restoration, followed by approximately three years of establishment activities such as weeding. It is envisioned that restoration would begin with approximately 75 -100 acres in the first year, and would proceed in subsequent years until all the specified areas are restored. Therefore, in any one year there will be from between 75 - 200 acres in active restoration activities of site preparation and seeding/planting. Restoration will begin with coastal sage scrub areas as these are adjacent to existing habitat and will require the use of all the existing roads. Native grassland restoration will proceed from the north end of the site to take advantage of the prevailing winds out of the northwest. Oak woodlands and non-wetland drainages will be restored as adjacent coastal sage scrub and native grassland areas are scheduled for restoration.

3.1 SITE PREPARATION

Restoration of each specified habitat shall require site preparation that will vary in time, intensity and method. This preparation will consist of weed control and removal as well as soil nutrient and microbial evaluations for potential amendments. Site preparation will require 1 – 2 years depending on particular areas, the type and density of exotic species, and the specific habitat to be restored. Additionally, some areas may need particular soil amendments such as native mulches, mycorrhizal fungi, and algae.

As the phased restoration proceeds, initial site preparation and weed removal of will begin outside of the breeding season of grassland birds to avoid disrupting nesting. Weed control would continue so that no suitable nesting habitat is available prior to seeding/planting.

3.1.1 Weed Removal

All areas to be restored are presently dominated by exotic species. Weed control will be required to thin or remove mainly the annual grasses, exotic mustards, wild radish, filaree, and sow thistle (*Sonchus oleraceus*). During site preparation, weeds shall be removed before seed production to limit additional weed seed on the site. Weed removal

may employ mechanical methods, such as mowing and weed whipping. Native grass straw mulch may be applied to areas after mowing to shade out weed seedlings. In combination with particular seeding methods, such as imprinting which requires ripping the soil, weed seed may be brought to the surface and controlled with a series of "grow and kill' treatments. Areas dominated mainly by annual grasses may be treated with an herbicide specific to control grasses such as flurazifop-p (Fusillade). Selected broadleaf species such as artichoke thistle, mustards and wild radish may require spot application with a glyphosate herbicide. Only herbicides registered for use in wildlands would be used judiciously in the Conservation Area.

The amount of site preparation weeding that is required for each area will vary depending on the soil and soil seed bank as well as the weeds present. The method of seeding for each area will also influence the timing of site preparation. Areas will be evaluated after each weeding event to assess the progress of site preparation and to plan the next step. Areas will be released for seeding/planting depending on seeding method and whether enough progress has been made in management of the weed species.

In summary, the following methods will be employed over the Conservation Area in various combinations based on adaptive management of the specific areas for seeding/planting.

- Mowing
- Specific hand weeding of target weeds
- Mulching with native grass straw
- Specific herbicide application for target weeds
- Ripping and tilling in combination with "grow and kill" herbicide application

3.1.2 Soil Amendments

Several soil amendments have been shown to be important tools in native habitat restoration while other amendments are still experimental. Most of these amendments are living components of the soil ecosystem. The following sections outline the potential use of soil amendments for restoration within the Conservation Area.

Arbuscular Mycorrhizal (AM) Fungi

Studies are currently underway in 2003/2004 to determine whether native AM fungi inoculum or commercial AM fungi inoculum has a positive effect on the establishment of native grasslands compared to plots with no inoculum. Earlier studies within the Conservation Easement from 1999 - 2004 on establishment of coastal sage scrub showed no significant difference in establishment of native species between plots treated with and without commercial AM fungi (EARTHWORKS, unpublished data). However, plots treated with AM fungi seemed to have less mustard and wild radish. It is generally known that the Brassicaceae (Mustard) family is not mycorrhizal, and it is believed that AM fungi may have a detrimental effect on members of the family. Baseline tests of AM infectivity for the current 2003/2004 study indicate the soil in the restoration area has more AM potential than in the 1999 study baseline soil tests although data is not directly comparable because methods of infectivity differed. It is possible that when discing in the annual grassland areas was discontinued in 1999, AM fungi have

increased because most annual grass species are mycorrhizal., and once the soil disturbance was stopped some species of AM fungi would have increased over the site.

Depending on the results of current studies, soil evaluations, site preparation and seeding method, soils will be amended with AM fungi through incorporation in the seed mix applied for each habitat. If native AM inoculum is used, the inoculum will be developed from sources within the Conservation Area or close to the Conservation Area, such as Bell Canyon. Native inoculum will be most likely used in restoration of the native grassland areas since there are few, if any, native grasses presently in the soil in these areas, and therefore, we expect few species of mycorrhizae associated with native grasses to be present. Coastal sage scrub restoration areas are immeditaely down slope of existing scrub, and AM fungi native to this habitat likely will move into the restoration areas. If commercial AM is applied to coastal sage scrub, *Glomus intraradices* will be used. This species is native in most areas of the Western region and has been used on successful scrub restoration sites without inhibiting subsequent colonization by other native mycorrhizae (EARTHWORKS, unpublished data).

The AM fungi used for the project will be provided by a person or company with experience in AM fungi development. The AM fungi supplied for the project will be applied at the rate of 3,600,000 live propagules per acre, based on the guarantee of the supplier. The AM fungi will be applied with the seed in any seed method that is specified for particular areas, including imprinting, range drill seeding, and hydroseeding.

Algae

Native algae may be applied to the sites to speed the development of soil crusts and diminish the opportunity for weed seed germination. This amendment is still experimental, but it is a potential tool to be used in combination with other microbial amendments and restoration activities.

Fertilizer

Fertilizer most likely will not be necessary since the generally luxuriant growth of the existing exotic species indicates sufficient nutrients for habitat restoration. Soil nutrient tests will include standard agricultural suitability as well as total organic content and organic nitrogen. The long-term success of the restoration will depend on adequate amounts of organic material in the soils (Claussen, 2000). If fertilization should be required, then a slow release, low phosphorous complete fertilizer coated with polyurethane will be used. If soil tests show an over abundance of available nitrogen in the soil, then additional mulch may be applied to the specific sites.

3.2 Plant Sources and Species

To the extent possible, all plant material for the restoration shall be obtained from native plant communities growing within the western edge of the Santa Ana Mountains to the coastal hills. For those species that function as erosion control (small fescue and wooly plantain) or do not exist in large enough quantities within the specified area, it will be necessary to either use seed that is commercially grown or extend the collection area on a species by species basis. TCA will contract with a seed collection contractor specializing in native seed to ensure that seed material will be collected from the

Conservation Area and other sites as close as possible to the Conservation Area. The following sections list the species to be used in each specific habitat.

3.2.1 Coastal Sage

The coastal sage scrub seed mixes are designed to model species occurring on the corresponding aspects in the mature coastal sage scrub in the Conservation Area. The species selected for the restoration represent the more common and abundant species observed in the existing habitat as well as species that are early colonizers in scrub habitats after disturbance such as fires. Some less common species also have been included. Plant species shown in Tables 1 and 2 were determined from direct observation at the Conservation Area from 2002 – 2004. Additionally, line-intercept transect data in mature coastal sage scrub recorded in 1998 and 2002 were analyzed to determine approximate cover targets for species in the restoration areas. Appendix II shows the percent cover of all species recorded in coastal sage scrub transects in 1998, a relatively wet year, and from 2002, a historic dry year. Slopes with northerly and easterly aspects will be seeded with the species listed in Table 3. Slopes with southerly and westerly aspects will be seeded with the species listed in Table 4. Additional species have been included in the seed mix as a nurse crop and for erosion control until the coastal sage scrub species establish on the slopes.

As the coastal sage scrub restoration establishes, it will be possible to add less common species to these restoration areas by hand seeding in selected microhabitats. This hand seeding will reduce wasting seed of these less common species and will increase the likelihood that these species will be planted in the proper microhabitats.

3.2.2 Perennial Grassland

The species selected for the native grassland restoration are based on species noted in perennial grasslands within the region as well as the three small remnant native grasslands within the Conservation Easement. As previously discussed, native grasslands differ in species composition based on the amount of clay in the soil and the slope of the site. Table 5 lists the species to be used on slope sites with clay soils. Table 6 lists the species to be used in the lower valleys with sandy clay loam to clay loam soils.

3.2.3 Coastal Sage Scrub/Perennial Grassland Ecotone

The species selected for the ecotone area between coastal sage scrub and native grassland areas are based on species noted in such areas within the region as well as the ecotone area adjacent to the remnant native grasslands within the Conservation Easement. Table 7 lists the species to be seeded in the ecotone areas. This lists contains species that are found on the previous coastal sage scrub and native grassland species lists. Ultimately, the ecotone area will likely contain other species from both habitats.

3.2.4 Oak Woodland/Oak Savannah

The species selected for the oak woodland and oak savannah area are presented Tables 8 and 9. These same species will be used to restore the extent of existing oak woodlands and to enhance the understory area of the existing woodlands.

3.2.5 Non-Wetland Drainages

The species selected for the non-wetland drainages mirror drainages with intact vegetation. The drainage swales will be seeded with a grassland mix. The banks will be planted with larger shrub species from containers with smaller shrubs and bunch grasses seeded between the container. Tables 10, 11, and 12 present the species to be used to restore the drainages.

Table 3. Coastal Sage Scrub Seed Mix Northerly- and Easterly-Facing Slopes

Scientific Name	Common Name	Minimum Purity/Germination[1]	Pounds of seed per acre[2]
Artemisia californica	California sagebrush	15/50	2.0
Brickellia californica	California brickellbush	TBD	0.25
Encelia californica	California encelia	40/60	1.0
Eriogonum fasciculatum	California buckwheat	10/65	3.0
Eriophyllum confertiflorum	golden yarrow	30/60	2.5
Gnaphalium californicum	California everlasting	TBD	0.5
Hazardia squarrosa	saw-toothed goldenbush	TBD	0.5
Hemizonia fasciculata	fascicled tarweed	10/25	0.5
Heteromeles arbutifolia	toyon	TBD	0.1
Leymus condensatus	giant wild rye	70/80	0.4
Lotus scoparius	deerweed	90/60	3.0
Lupinus bicolor	miniature lupine	98/80	3.0
Lupinus truncatus	collar lupine	80/80	1.5
Malosma laurina	laurel sumac	TBD	0.1
Melica imperfecta	melic grass	90/60	2.0
Mimulus aurantiacus	sticky monkey flower	TBD	1.5
Mimulus brevipes	slope semaphore	TBD	0.2
Mirabilis californica	California wishbone	TBD	0.5
Nassella lepida[3]	foothill needlegrass	70/60	1.5
Nassella pulchra[3]	purple needlegrass	70/60	1.5
Phacelia distans	common phacelia	98/75	0.4
Plantago insularis[4]	wooly plantain	98/75	20.0
Rhus integrifolia	lemonadeberry	TBD	0.1
Salvia apiana	white sage	70/50	1.5
Sanicle arguta	sharped-tooth sanicle	TBD	0.2
Sisyrinchium bellum	blue-eyed grass	90/70	0.5
Vulpia microstachys[4]	Small fescue	90/80	6.0

[1] Minimum germination may be adjusted after germination tests on special local collection.
[2] Bulk seed rate may be adjusted depending on results of tests for germination.
[3] Seed of *Nassella* spp. shall be de-awned.
[4] Erosion control and nurse crop species.

Table 4. Coastal Sage Scrub Seed Mix Southerly- and Westerly-Facing Slopes

Scientific Name	Common Name	Minimum Purity/Germination[1]	Pounds of seed per acre[2]
Artemisia californica	California sagebrush	15/50	1.5
Brickellia californica	California brickellbush	TBD	0.5
Castilleja exserta	purple owl's clover	50/60	0.2
Encelia californica	California encelia	40/60	1.5
Eriogonum fasciculatum	California buckwheat	10/65	5.0
Gnaphalium californicum	California everlasting	TBD	0.5
Hazardia squarrosa	saw-toothed goldenbush	TBD	0.5
Hemizonia fasciculata	fascicled tarweed	10/25	2.0
Lotus scoparius	deerweed	90/60	6.0
Lupinus bicolor	miniature lupine	98/80	4.0
Lupinus truncatus	collar lupine	80/80	1.5
Malosma laurina	laurel sumac	TBD	0.1
Melica imperfecta	melic grass	90/60	2.5
Mimulus aurantiacus	sticky monkey flower	5/70	0.5
Mimulus brevipes	slope semaphore	TBD	0.2
Mirabilis californica	California wishbone	TBD	0.5
Nassella lepida[3]	foothill needlegrass	70/60	2.5
Opuntia littoralis [4]	coast prickly pear	pads	30-60 pads
Phacelia distans	common phacelia	98/75	0.2
Phacelia ramosissima	branching phacelia	80/70	0.2
Plantago insularis [5]	wooly plantain	98/75	20.0
Rhus integrifolia	lemonadeberry	TBD	0.2
Salvia mellifera	black sage	70/50	1.0
Sisyrinchium bellum	blue-eyed grass	90/70	0.5
Solanum douglasii	Douglas' nightshade	TBD	0.1
Vulpia microstachys [5]	Small fescue	90/80	6.0

[1] Minimum germination may be adjusted after germination tests on special local collection.
[2] Bulk seed rate may be adjusted depending on results of tests for germination.
[3] Seed of *Nassella* spp. shall be de-awned.
[4] Planted as pads in groups of 30 for total of 90 pads/acre.
[5] Erosion control and nurse crop species.

Table 5. Native Perennial Grassland Seed Mix For Slopes with Clay Soils

Scientific Name	Common Name	Minimum Purity/Germination [1]	Pounds of Seed Per Acre [2]
Bloomeria crocea	golden stars	TBD	0.2
Dichelostemma capitatum	blue dicks	95/50	1.0
Filago californica	California filago	TBD	0.5
Gnaphalium palustre	lowland everlasting	10/25	0.5
Hemizonia fasiculata	tarweed	20/70	2.0
Nassella pulchra [3]	purple needlegrass	60/60	10.0
Nemophila menziesii	baby blue eyes	98/85	0.5
Plantago ovata [4]	wooly plantain	98/75	20.0
Poa secunda	bluegrass	60/60	1.5
Orthocarpus purpurascens	owl's clover	50/50	0.5
Sanicle crassicaulis	Pacific sanicle	TBD	0.5
Sisyrinchium bellum	blue-eyed grass	95/75	1.5
Vulpia microstachys [4]	small fescue	70/70	6.0

[1] Minimum germination may be adjusted after germination tests on special local collection.
[2] Bulk seed rate may be adjusted depending on results of tests for germination.
[3] Seed of *Nassella* spp. shall be de-awned.
[4] Erosion control and nurse crop species.

Table 6. Native Perennial Grassland Seed Mix for Valleys and Slopes with Sandy Clay Loam to Clay Loam Soils

Scientific Name	Common Name	Minimum Purity/Germination[1]	Pounds of Seed Per Acre [2]
Asclepias fascicularis	narrow-leaf milkweed	TBD	0.25
Ambrosia psilostachys	western ragweed	20/70	0.25
Amsinckia menziesii var. *intermedia*	common fiddleneck	30/70	1.0
Bromus carinatus	California brome	95/80	2.0
Castilleja exserta	purple owl's clover	50/60	0.5
Dichelostemma capitatum	blue dicks	95/50	1.0
Ericameria palmeri	grassland goldenbush	TBD	0.25
Filago californica	California filago	TBD	0.5
Gnaphalium palustre	lowland everlasting	10/25	0.5
Hemizonia fasiculata	tarweed	20/70	2.0
Lasthenia californica	goldfields	50/60	0.5
Layia platyglossa	tidy tips	80/75	0.5
Lotus purshianus	Spanish clover	98/70	1.5
Lotus strigosus	strigose lotus	98/70	1.5
Lupinus bicolor	miniature lupine	98/85	3.0
Lupinus succulentus	arroyo lupine	98/85	1.5
Lupinus truncatus	collar lupine	98/70	1.5
Melica imperfecta	melic grass	90/60	1.5
Nassella lepida [3]	foothill needlegrass	60/60	2.0
Nassella pulchra [3]	purple needlegrass	60/60	10.0
Nemophila menziesii	baby blue eyes	98/85	0.5
Plantago ovata [4]	wooly plantain	98/75	20.0
Poa secunda	bluegrass	60/60	1.5
Sisyrinchium bellum	blue-eyed grass	95/75	1.5
Vulpia microstachys [4]	small fescue	70/70	4.0

[1] Minimum germination may be adjusted after germination tests on special local collection.
[2] Bulk seed rate may be adjusted depending on results of tests for germination.
[3] Seed of *Nassella* spp. shall be de-awned.
[4] Erosion control and nurse crop species.

Table 7. Ecotone Seed Mix

Scientific Name	Common Name	Minimum Purity/Germination[1]	Pounds of Seed Per Acre [2]
Artemisia californica	California sagebrush	15/50	0.2
Asclepias fascicularis	narrow-leaf milkweed	TBD	0.2
Amsinckia menziesii var. *intermedia*	common fiddleneck	30/70	0.5
Baccharis pilularis	coyote bush	15/60	0.1
Bromus carinatus	California brome	95/80	2.0
Cryptantha intermedia	popcorn flower	TBD	0.5
Datura wrightii	tolugacha	TBD	0.2
Dichelostemma capitatum	blue dicks	95/50	1.0
Hazardia squarosa	goldenbush	TBD	0.5
Hemizonia fasiculata	tarweed	20/70	2.0
Isocoma menzesii	coast goldenbush	TBD	0.5
Lasthenia californica	goldfields	50/60	1.5
Lessingia filaginifolia	California aster	TBD	0.5
Lotus scoparius	deerweed	90/60	1.0
Lotus strigosus	strigose lotus	98/70	1.5
Lupinus bicolor	miniature lupine	98/85	3.0
Lupinus truncatus	collar lupine	98/70	1.5
Melica imperfecta	melic grass	90/60	1.5
Nassella lepida [3]	foothill needlegrass	60/60	3.0
Nassella pulchra [3]	purple needlegrass	60/60	8.0
Plantago ovata [4]	wooly plantain	98/75	20.0
Sisyrinchium bellum	blue-eyed grass	95/75	1.5
Vulpia microstachys [4]	small fescue	70/70	4.0

[1] Minimum germination may be adjusted after germination tests on special local collection.
[2] Bulk seed rate may be adjusted depending on results of tests for germination.
[3] Seed of *Nassella* spp. shall be de-awned.
[4] Erosion control and nurse crop species.

Table 8. Oak Woodland Seed Mix

Scientific Name	Common Name	Minimum Purity/Germination[1]	Pounds of seed per acre[2]
Bromus carinatus	California brome	95/80	3.0
Galium aparine	goose grass	10/25	1.0
Nassella lepida	foothill needlegrass	60/60	2.0
Nassella pulchra	purple needlegrass	60/60	5.0
Plantago ovata	wooly plantain	98/75	20
Sisyrinchium bellum	blue-eyed grass	95/75	0.5
Vulpia microstachys	fescue	70/70	6.0

[1] Minimum germination may be adjusted after germination tests on special local collection.
[2] Bulk seed rate may be adjusted depending on results of tests for germination.

Table 9. Oak Woodland Container Plant Species

Scientific Name	Common Name	Spacing [1]	Plants per Acre
Heteromeles arbutifolia	toyon	20’	10
Quercus agrifolia	coast live oak (acorns)	5’	100
Quercus agrifolia	coast live oak	25’	190
Rhamnus californica	coffeeberry	20’	25
Rhus integrifolia	lemonadeberry	15’	10
Sambucus mexicana	Mexican elderberry	15’	25

[1] Spacing = on-center distance from other container planted shrub/tree species.

Table 10. Non-Wetland Drainage Swale Seed Mix

Scientific Name	Common Name	Minimum Purity/Germination[1]	Pounds of seed per acre[2]
Amsinckia menziesii	common fiddleneck		1.0
Bromus carinatus	California brome		3.0
Gnaphalium palustre	lowland everlasting	10/25	1.0
Nassella lepida	foothill needlegrass		1.0
Nassella pulchra	purple needlegrass		3.0
Vulpia microstachys	fescue		6.0

[1] Minimum germination may be adjusted after germination tests on special local collection.
[2] Bulk seed rate may be adjusted depending on results of tests for germination.

Table 11. Non-Wetland Drainage Banks Seed Mix

Scientific Name	Common Name	Minimum Purity/Germination[1]	Pounds of seed per acre[2]
Artemisia californica	California sagebrush	15/50	2.0
Calystegia macrostegia	morning glory	TBD	0.5
Erigonium fasciculatum	California buckwheat	10/65	3.0
Gnaphalium californicum	California everlasting	TBD	1.0
Isocoma menziesii	goldenbush	TBD	0.5
Lotus scoparius	deerweed	90/60	4.0
Mimulus aurantiacus	monkeybush	5/70	2.5
Nassella lepida[3]	foothill needlegrass	60/60	2.0
Nassella pulchra	purple needlegrass	60/60	2.0
Salvia apiana	white sage	70/50	2.0
Salivia mellifera	black sage	70/50	2.0
Verbena lasiostachys	common verbena		1.0

[1] Minimum germination may be adjusted after germination tests on special local collection.
[2] Bulk seed rate may be adjusted depending on results of tests for germination.
[3] Seed of *Nassella* spp. shall be de-awned.

Table 12. Non-Wetland Drainage Banks Container Plant Species

Scientific Name	Common Name	Spacing [1]	Plants per Acre
Baccharis salicifolia	mulefat	5’	25
Heteromeles arbutifolia	toyon	20’	5
Malosma laurina	laurel sumac	20’	5
Platanus racemosa	sycamore	40’	2
Quercus agrifolia	coast live oak	25’	5
Rhamnus californica	coffeeberry	20’	10
Rhus integrifolia	lemonadeberry	15’	10
Sambucus mexicana	Mexican elderberry	15’	15

[1] Spacing = on-center distance from other container planted tree/shrub species.

3.3 SEEDING AND PLANTING SPECIFICATIONS

The following methods will be used to seed and plant during the restoration of varios habitats within the Conservation Area. As site preparation of each area proceeds, the specific methods that best suit an area based on the density and type of weeds will be determined and implemented. Thus, the methods presented here will be used to adapt to site conditions and weather patterns and predictions for each year.

3.3.1 Seeding

Tests are currently underway to determine the optimum seeding method to use in various areas of the site based on weed densities; however, several physical factors will also determine what method of seeding is used. The following sections define several methods of seeding that will be used over the Conservation Area under particular circumstances. As-built plans will be prepared for each area to document the methods used.

Imprint Seeding

Most areas that have very dense weed species and few native species will be seeded by imprinting the seeds. Areas of shallow soil and the presence of rocks will limit the use of imprinting. Prior to imprinting an area, and as part of site preparation, soil will be ripped or tilled to prepare the seed bed.

Imprinting will apply the specific seed mix and specified AM fungi amendments at the same time through separate gandy boxes:

- 60 liters L/ac of AM fungi,
- specified seed mix for each area.

Range Drill Seeding

Range drill seeding will be implemented where the occurrence of native species is somewhat high, making ripping and tilling undesirable methods for site preparation. Range drill seeding can be accomplished over mowed stubble if the thatch is not too thick. In some case the thatch may be broken down by with a light disc prior to drill seeding. Drill seeding will be accomplished by dividing the seed mix in tow equal parts and applying each half of the seed mix in perpendicular passes with the range drill seeder.

Drill seeding will apply the specific seed mix and specified AM fungi amendments at the same time through separate gandy boxes, and with light seeds and heavy seeds separated into separate gandy boxes:

- 60 liters L/ac of AM fungi,
- specified seed mix for each area.

Hydroseeding

In areas that are not accessible by imprinter or drill seeder, a two-step hydroseeding technique shall be used to the apply seed. In the first step, a hydraulic application of a slurry mixture containing water, cellulose wood fiber, seed, and AM fungi will proceed as follows:

- 500 pounds lbs/ac of virgin cellulose wood fiber,
- 60 liters L/ac of AM fungi,
- specified seed mix for each area.

The second step will consist of the following slurry mixture:

- 1500 pounds/acre of virgin cellulose wood fiber, and
- 160 pounds lbs/ac M-binder.

3.3.2 Planting Technique

Container plants consist of either dominant tree species or large shrubs that are difficult to establish from seed, and they will be used in oak woodland areas and non-wetland drainage areas only. The layout for container plants will be determined for each area based on micro topographic features. Spacing of plants within the groups will follow the specifications presented in the tables for container plant palettes. Planting sites will be marked on the site using different colored pin flags under the supervision of the

restoration specialist. Groups of container plants will be spaced in a natural looking mosaic in each area. As-built drawings of oak woodland and non-wetland drainage container planting will be prepared.

All container plants are to be planted to the following specifications:

- Planting holes shall be made with the minimum disturbance to accommodate the containers.
- Prior to planting, the planting hole shall be filled with water, and allowed to drain.
- Plants shall be set in the planting hole so that the crown of the root ball is approximately 0.5 inch above finish grade. Under no circumstance should the plant crown be buried.
- A watering basin shall be provided around each plant from 18 – 24 inches in diameter.
- Watering basins shall be filled with water after planting.
- Plant basins shall be mulched with approximately 4 – 6 inches of approved wood mulch after planting.

3.4 SITE MAINTENANCE

One of the goals for the restoration is to provide self-sustaining habitats. However, initially, maintenance of the restoration area will be necessary to establish the new seeding/planting. Maintenance will include any activities required to meet the performance standards set forth in this plan, in the estimation of the restoration specialist. These include, but are not limited to, the following:

- Weed control,
- Site irrigation,
- Erosion control repair,
- Pest and disease control,
- Replacement planting/seeding.

The establishment maintenance period is generally three to five years duration with the most intense maintenance in the first and second years, and only seasonal weeding activities in the third through fifth years. The amount of maintenance each year will depend on weather conditions and how well the site develops. The following specifications for maintenance may require adjustments as determined by the restoration specialist over the five-year maintenance period.

3.4.1 Weed Control

During the active maintenance period, the target cover from exotic weed species will be five percent or less. Weeds will be removed on a regular basis, as necessary, before they set seed and/or before they reach approximately 12 inches in height. Weeds will be removed from the site if seeds have set prior to removal. Otherwise, weeded material may be left on site to provide organic material for soil development.

Weed control will mainly employ hand and mechanical methods. Spot spraying of herbicides will be used for certain species such as artichoke thistle.

3.4.2 Irrigation of Container Plants

Temporary irrigation will only be used in the oak woodland and non-wetland drainage areas where container planting will be used. Irrigation will occur be used in the first several years of planting to extend the rainy season and establish the trees and shrubs, as necessary. The timing of irrigation events will depend on evapotranspiration between irrigation events and soil moisture. The following management scheme is anticipated as a guideline for water management of native trees and shrubs:

- Irrigate soil to full field capacity to the desired depth (approximately 18 inches after planting; and 18–24 inches during plant establishment).
- Allow soil to dry down to approximately 50-60 percent of field capacity in the top 6-12 inches before the next irrigation cycle. Depth of soil dry down between irrigation events will depend on development of container plants.

Wetting of the full root zone and drying of the soil between irrigation events is essential to the maintenance of the plants and the promotion of a deep root zone that will support the vegetation in the years after establishment. A soil probe or shovel shall be used to examine soil moisture and rooting depth directly.

3.4.3 Seeding and Plant Replacement

Target values for relative cover of the native vegetation, including nurse and erosion control species, will be as follows with at least 30 percent in Year 1, 50 percent in Year 2, and 70 percent in Years 3, 4, and 5. Actual cover values will depend mainly on weather conditions (seasonal rainfall and temperature) during the establishment period.

Areas of significant erosion shall be repaired and re-seeded in the first fall season after damage. Re-seeding will occur in areas if coverage is less than 20 percent in any area of 25 square feet.

Survival of container plants will only be an issue in the oak woodland and non-wetland drainages. Survival of plants within the first growing season should be 80 percent. Plants shall be replaced if survivorship falls below 80 percent in the first and second season. Replacements will be planted as previously specified and maintained for one growing season with hand-irrigation, as necessary. As sites develop, it is impractical to implement direct counts of all the container plants. Replacement planting after the second season shall only be specified if the visual estimate indicates substantial mortality and the function of these species has not been replaced by natural recruitment.

3.4.4 Pest Management

Local wildlife such as rabbits, pocket gophers and ground squirrels may be expected to browse on the plantings. If the restoration specialist determines that the plantings are being jeopardized by wildlife, corrective measures such as organic, nontoxic deterrents and fencing/plant cages maybe used. Invertebrate pests are rarely a serious problem in coastal sage scrub restoration.

3.5 SUMMARY OF IMPLEMENTATION, MAINTENANCE, AND MONITORING

The Table 13 summarizes the timing and activities for the implementation, maintenance, and monitoring of the habitat restoration. The timing is described in general terms by season. Exact dates for each phase of implementation and maintenance will depend on the onset and duration of seasonal rainfall as well as other factors such as the temperatures prior to, during and following rain events. Rainfall and temperature will define the type and the density of weed species as well as native species that will germinate in any given year and season.

Horticultural monitoring will take place daily during seeding and planting, bimonthly in the first six months after implementation, monthly during year two, and quarterly after that for the through the fifth year. Horticultural monitoring will guide weeding and irrigation schedules for the project.

Table 13
Summary of Restoration Time Table

Restoration Tasks	Year 1 Year 2				Year 3 Year4				Year 4 Year 5				Year 6 Year 7				Year 8 Year9				Year 10 Year 11				Year 12 Year 13			
	F	W	S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W	S	S
Seed Collection	X X	X X	X X	X X	X X	X X	X X	X X	*	*	*	*																
Site Preparation Weeding	X X	X X	X X	X X	X X	X X	X X	X X	*	*	*	*																
Plant Container Plants	X				X																							
Container Plant Irrigation	X	X	X	X	X X	X X	X X	X X	X X	X X	X X	X X	*	*	*	*												
Seed	X	X			X X	X X			X	X																		
Maintenance Weeding	X	X	X	X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X *	X *	X *	X *	*	*	*	*				
Remedial Planting/Seeding					* *				* *				* *				*											
Horticultural Monitoring	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X				
Performance Monitoring				X			X X				X X				X X				X X				X X				X X	

SECTION 4 - PERFORMANCE MONITORING

In order to assure that the revegetation performance standards are met, the revegetation shall be qualitatively monitored annually after installation for four years. Photo-documentation at permanent points will be conducted for inclusion in the annual performance monitoring report. In the fifth year, the site shall be monitored quantitatively to determine if each restoration area achieves the performance standards. Monitoring will consist of random transects over each restoration area. The number of samples necessary will be evaluated to ensure statistical confidence based on variation over the site.

Annual performance monitoring will take place each year in mid-spring or as close to mid-spring as each year's rainy season permits. Results from the annual performance monitoring will be used to evaluate the progress of the mitigation habitat toward the ultimate standards of the project. Performance monitoring shall be conducted by qualified plant ecologists. The annual monitoring report will be submitted to the TCA. It is the responsibility of TCA to submit the annual report to USFWS by November 30 of each year.

4.1 PERFORMANCE STANDARDS

Performance standards have been developed to assess an increase in functions and values of each habitat. Performance will be assessed as the restoration areas develop trends in cover, species diversity, as well as soil development so that the habitat quality of the site is restored. Specifically, the restoration will be considered successful when the following criteria are met for each habitat type:

Coastal Sage Scrub

- The site does not require significant maintenance measures during the last two years of the establishment period as documented by the restoration specialist's annual monitoring report.
- The majority of plant species set seed, and seedlings of at least five coastal sage scrub species demonstrate recruitment in the site in the fifth year of monitoring based on information from quantitative monitoring.
- AM fungi establishment on the site is demonstrated by root colonization of 90 percent of seedlings randomly sampled over the site.
- The habitat resists invasion by exotic plant species as demonstrated by less than 25 percent cover of annual grass species and less aggressive exotic forbs. (Note: The 25 percent cover standard for these species is based on the percent exotic species in the adjacent reference sites within the Conservation Area [see Appendix I]). There shall be no aggressive, invasive exotic species, such as *Cynara cardunculus* and *Nicotiana glauca*.
- The relative cover of native plant species is at least 80 percent.
- The site demonstrates 80 percent of the native species richness found in the reference habitat in the Conservation Area.

Perennial Grasslands and Grassland/Forbs

- The site does not require significant maintenance measures during the last two years of the establishment period as documented by the restoration specialist's annual monitoring report.
- The native grasses set seed.
- AM fungi establishment on the site is demonstrated by root colonization of 90 percent of seedlings randomly sampled over the site.
- The habitat resists invasion by exotic plant species as demonstrated by less than 25 percent cover of annual grass species and less aggressive exotic forbs. There shall be no aggressive, invasive exotic species, such as *Cynara cardunculus*. The relative cover of native plant species is at least 60 percent.
- The site demonstrates 80 percent of the native species richness found in the reference habitat in the Conservation Area.

Grassland.Scrub Ecotone

- The site does not require significant maintenance measures during the last two years of the establishment period as documented by the restoration specialist's annual monitoring report.
- The majority of plant species set seed, and seedlings of at least three coastal sage scrub species demonstrate recruitment in the site in the fifth year of monitoring based on information from quantitative monitoring.
- AM fungi establishment on the site is demonstrated by root colonization of 90 percent of seedlings randomly sampled over the site.
- The habitat resists invasion by exotic plant species as demonstrated by less than 25 percent cover of annual grass species and less aggressive exotic forbs. There shall be no aggressive, invasive exotic species, such as *Cynara cardunculus* and *Nicotiana glauca*.
- The relative cover of native plant species is at least 70 percent with approximately 10 – 30 percent cover from shrub species.

Oak Woodland

- The site does not require significant maintenance measures during the last two years of the establishment period as documented by the restoration specialist's annual monitoring report.
- At least 60 percent of container plants have survived in the site in the fifth year of monitoring based on information from quantitative monitoring.
- AM fungi establishment on the site is demonstrated by root colonization of 90 percent of understory seedlings randomly sampled over the site.
- The habitat resists invasion by exotic plant species as demonstrated by less than 25 percent cover of annual grass species and less aggressive exotic forbs. There shall be no aggressive, invasive exotic species, such as *Cynara cardunculus* and *Nicotiana glauca*.
- The relative cover of native plant species is at least 75 percent with at least 5 percent cover from oak saplings and elderberry shrubs.

Non-Wetland Drainages

- The site does not require significant maintenance measures during the last two years of the establishment period as documented by the restoration specialist's annual monitoring report.
- The habitat resists invasion by exotic plant species as demonstrated by less than 25 percent cover of annual grass species and less aggressive exotic forbs. There shall be no aggressive, invasive exotic species, such as *Cynara cardunculus* and *Nicotiana glauca*.
- The relative cover of native plant species is at least 80 percent.
- The site demonstrates 80 percent of the native species richness found in the reference habitat in the Conservation Area.

4.2 MONITORING METHODOLOGY

The selection of variables measured for the performance monitoring will be based on the goals of the restoration program, development characteristics of each plant community, and the performance standards outlined above. Variables will include native species cover, exotic species cover, percent bare ground and litter, as well as species frequency and seedling frequency in monitoring transects and quadrats. Where applicable, shrub height will also be measured to provide an additional parameter to assess habitat suitability. The number of sampling units in each habitat will be determined by areas to ensure statistical confidence based on the variation over the site.

4.2.1 Coastal Sage Scrub and Ecotone Vegetation Sampling

Vegetation sampling in coastal sage scrub will utilize the line-intercept method to measure vegetation cover. This method is best suited to measure scrub vegetation and will provide the most efficient and reliable method for estimating cover and species composition over the mitigation site.

Locations of the transects will be randomly selected within each restoration area. At each randomly selected site, a 25-meter line intercept transect will be performed in shrub and ecotone communities. A 25-meter tape will be stretched taut, perpendicular to the main line at the randomly selected locations. Length of vegetative cover for each plant that comes into contact with the transect tape and vertical plane under the tape will be measured and entered into a hand-held computer. Data to be recorded will include the species, length of vegetative cover in meters, plant number (if a continuous segment of tape consisted of more than one of the same species), and the developmental stage of the plant (seedling, juvenile, or adult). Annual grasses will be grouped together in one measurement and species of annual grasses will be noted.

Seedlings will be identified for shrubs and sub-shrubs and will be determined by being small in size, having a non-woody base, and usually the result of germination during the same year as the transect reading. Juveniles and adults will be identified as definitely woody at the base of the stem. Bare ground will be recorded as areas with no vegetative cover and litter will be recorded in areas of no vegetative cover but with dead vegetative matter covering the ground. Data on the height of the shrubs will also be recorded for all woody shrubs along the transect.

Cover data will be reported as actual linear measurements and absolute percent cover as well as relative cover. Frequency data will be reported as the percent of transects a species is reported to occur in. Height data will be reported as the average height of the shrub species.

Additionally, the restoration area will be walked and a list prepared of all species observed. This species list will be reported in the annual report in addition to the transect data.

4.2.2 Perennial Grassland Vegetation Sampling

Vegetation sampling in perennial grassland habitats will utilize the point-intercept method to estimate vegetation cover and species diversity. This method is best suited to measure grassland habitats, and it will provide the most efficient and reliable method for estimating cover and species composition over the mitigation site.

Locations of the transects will be randomly selected within each restoration area. At each randomly selected site, a 25-meter point intercept transect will be performed with points at every 5 meters. A 25-meter tape will be stretched taut, perpendicular to the main line at the randomly selected locations. At each 5 meter mark, a 1/2 meter quadrat will be placed. Native and non native plant cover will be estimated and entered into a hand-held computer. Data to be recorded will include the species present with quadrats, and native and non native vegetative cover in relative percent.

Additionally, the restoration area will be walked and a list prepared of all species observed. This species list will be reported in the annual report in addition to the transect data.

4.2.3 Oak Woodland Vegetation Sampling

Vegetation sampling in oak woodlands will utilize belt transects to measure vegetation cover. This method is best suited to measure woodland vegetation, and it will provide the most efficient and reliable method for estimating cover and species composition over the sites.

Locations of the belt transects will be randomly selected within each restoration area. At each randomly selected site, a 25-meter x 2 meter belt transect will be performed. A 25-meter tape will be stretched taut, perpendicular to the main line at the randomly selected locations. Data to be recorded will include the species within the belt transect, and estimate of understory cover, and the height and cover of tree species will be recorded. Annual grasses will be grouped together in one measurement and species of annual grasses will be noted.

Cover data will be reported for understory species as an estimate of relative cover. Cover for tree species will be reported as absolute cover based on the volume of sampled trees. Each tree canopy within the belt will be measured from two perpendicular diameter measurements. Frequency data will be reported as the percent of transects a species is reported to occur in. Height data will be reported as the average height of the tree species.

Additionally, the restoration area will be walked and a list prepared of all species observed. This species list will be reported in the annual report in addition to the transect data. The percent survivorship of tree species will be determined from direct counts over the site.

4.2.4 Non-Wetland Drainages

Vegetation sampling for non-wetland drainages will utilize belt transects across the drainage to estimate vegetation cover. This method is best suited to measure the swale and bank vegetation, and it will provide the most efficient and reliable method for estimating cover and species composition over the drainages.

Locations of the belt transects will be randomly selected within each restored drainage. At each randomly selected site, a 2 meter belt transect will be performed. A meter tape will be stretched across drainages as a cross section. Data to be recorded will include the species within the belt transect, and estimate of understory cover, and the height and cover of tree species will be recorded. Annual grasses will be grouped together in one measurement and species of annual grasses will be noted.

Cover data will be reported for understory species as an estimate of relative cover. Cover for tree species will be reported as absolute cover based on the volume of sampled trees. Each tree canopy within the belt will be measured from two perpendicular diameter measurements. Frequency data will be reported as the percent of transects a species is reported to occur in. Height data will be reported as the average height of the tree species.

Additionally, the restoration area will be walked and a list prepared of all species observed. This species list will be reported in the annual report in addition to the transect data.

4.3 ARBUSCULAR MYCORRHIZAL FUNGI SAMPLING

To determine if AM is persistent throughout restoration site, roots of seedling species known to have a symbiotic relationship with AM will be sampled and analyzed for AM fungi. Locations for root samples will be randomly selected on each discrete slope. Soil will be collected at each random site in three locations in close proximity to plant species known to be mycorrhizal symbionts. Samples will be collected at a depth of approximately 2-3 inches.

Roots will be washed and stained with 0.05 percent of Trypan Blue Stain. Roots will then be mounted on slides and analyzed using a compound microscope. Data will be recorded on the presence or absence of AM fungi in the roots.

Alternatively, soil from each site may be collected and used to determine an mycorrhizal infectivity index, or MIP, of the soil. In this case, soil would be used from the site to grow test plants. These test plants would then be harvested and root infectivity would be determined as above. Baseline data is presently under investigation and would be used to measure the success of the restoration sites.

4.4 WILDLIFE SAMPLING

Wildlife sampling within the restored areas would be incorporated in the annual Management Plan Report for the Conservation Area. Under this existing report, particular avian surveys are performed every two years, mainly for the California gnatcatcher and the Coastal cactus wren. General wildlife observations are also included for the Conservation Area.

SECTION – 5 REFERENCES

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APPENDIX I

Vegetation Transect Data

The following vegetation data was collected in the Conservation Easement Area in 1998 and 2002 by Harmsworth Associates. The data was collected in coastal sage scrub. These data are used for this restoration plan to identify target dominant species and rarer species, and to set relevant performance standards for native plants and exotic species.

Coastal Sage Scrub Transect Data (Harmsworth 1999)

species	css1	css2	css3	css4	css5	css6	css7	css8	css9	c
agrpal Tota	0	0	0	0	0	0	0	0	0.0344	
amamen Tc	0	0	0	0	0	0	0	0	0	
anearv Tot	0.0196	0	0	0	0.0624	0	0	0.01	0.0288	
artcal Total	0.3352	0.1288	0.3952	0.2004	0.5592	0.478	0.1776	0.1324	0.2744	
avebar Tot	0	0	0	0	0	0	0	0.0152	0	
avefat Tota	0	0	0	0	0	0 0016	0.0004	0	0	
bacpil Total	0	0	0	0	0	0	0	0	0	
bg Total	0	0.0644	0.0652	0.0116	0.072	0.042	0.0112	0.0032	0	
blocro Tota	0	0	0	0	0	0	0	0	0.0216	
branig Tota	0	0	0	0.2372	0	0	0	0.0048	0.0096	
brodia Tota	0	0	0	0.0032	0	0.0056	0	0.0464	0.0696	
brohor Tota	0	0	0	0	0	0	0	0	0.1304	
bromad Tot	0.0372	0.0052	0.002	0.486	0.0172	0	0.0572	0.2664	0.0012	
calmac Tot	0	0	0	0	0	0	0	0	0	
calspi Total	0	0	0	0	0	0	0	0	0.0004	
cenmel Tot	0	0.064	0	0.516	0.002	0.0248	0	0.1968	0.02	
cirocc Total	0	0	0	0	0	0	0	0	0	
cirvul Total	0.0052	0	0	0.0964	0	0	0	0	0	
conarv Tota	0	0	0	0	0	0	0	0	0.0024	
crymen Tot	0	0	0.0476	0	0 2808	0.0216	0.044	0	0	
crymic Tota	0	0	0	0	0	0.002	0	0	0	
cuscal Tota	0.214	0.1168	0.032	0	0	0	0.0128	0	0	
daupus Tot	0	0	0	0	0	0	0.0024	0	0.01	
dicsap Tota	0	0	0	0	0	0	0	0	0	
dudlan Tota	0	0	0	0.002	0	0	0	0	0	
enccal Tota	0	0	0.0216	0	0	0	0	0	0	
epican Tota	0	0	0	0	0	0	0	0	0.02	
erifas Total	0.6812	0.3236	0.3356	0.072	0.1644	0.4248	0.612	0.104	0.1412	
erifol Total	0	0	0	0	0	0	0	0	0.0248	
fesaru Tota	0	0	0	0	0	0	0	0	0	
filgal Total	0	0	0	0	0	0	0	0	0	
galarg Tota	0	0	0	0	0	0.0064	0.06	0.036	0.1472	
galapa Tota	0	0	0	0	0	0	0	0	0.0104	
gasven Tot	0	0	0	0	0	0	0	0	0.0008	
gnacal Tota	0	0	0	0	0	0	0	0	0.0008	
gnapal Tota	0	0	0	0	0	0	0	0	0.0012	
gnasp Tota	0.0024	0.0044	0.0072	0.0036	0.0028	0.0808	0	0	0	
hazaqu Tot	0	0	0	0.0028	0.0008	0.022	0	0	0	
hirinc Total	0.1592	0.1424	0	0.0196	0	0	0	0.0692	0.0308	
hypgla Tota	0	0	0	0	0.0044	0	0	0.0028	0.0272	
juniruf Tota	0	0	0	0	0	0	0	0	0.0148	
lesfil Total	0	0	0	0	0.002	0	0	0	0.0016	
litter Total	0	0.1576	0.0364	0.0172	0.0716	0.0472	0.0192	0	0.0156	
lolmul Total	0	0	0	0	0	0	0	0	0	
lotsco Total	0.062	0.0032	0.0332	0	0.0784	0.0028	0.0488	0.0712	0	
mailau Tota	0	0	0	0	0	0	0	0	0	
malsax Tot	0	0	0	0	0	0	0	0	0	
marmac To	0	0	0	0	0	0	0	0	0	
marvul Tota	0	0.0492	0	0	0	0	0	0	0	
mellmp Tot	0.2496	0	0.0024	0.0224	0.014	0.0004	0.0116	0.0168	0.078	

ss10	css11	css12	css13	css14	css15	css16	css17	css18	css19	css20
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0.0044	0	0	0	0	0
0	0	0	0.1028	0.0004	0.016	0	0	0	0	0
0.31	0.3596	0	0.4604	0.5712	0.4396	0.3604	0.5096	0.2676	0.342	0.2964
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0.1296	0	0.0324	0	0	0	0	0
0	0.0468	0	0	0.1008	0	0.084	0	0.0316	0.0468	0
0	0	0	0.0456	0	0	0	0	0	0	0.026
0	0	0	0.0004	0	0.01	0	0	0	0	0
0.006	0.0156	0	0.056	0.0008	0.0016	0	0	0	0.002	0.0068
0	0	0	0.2	0	0	0	0	0	0	0.1008
0.0284	0.0184	0.0268	0	0.0304	0.1052	0	0.0024	0.0008	0.0724	0.332
0	0	0	0	0	0	0.0024	0	0	0	0.0008
0	0	0	0	0	0	0	0	0	0	0
0	0.0044	0.0096	0.4136	0.0136	0.0228	0	0	0	0	0
0	0.004	0	0	0	0	0.0084	0	0	0.0006	0
0	0	0	0.0172	0	0	0	0.1432	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0.0432	0	0	0.0004	0.0468	0.0144	0.0036	0.0004	0.0304	0.0128
0	0	0	0	0.0068	0	0	0	0	0	0
0	0.0248	0	0	0.0008	0	0.0504	0	0.0792	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0.0004
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0.428	0	0.0292	0.1068	0	0.4228	0.4164	0.2372	0.0468	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0.048	0
0	0.0012	0	0	0	0	0	0	0	0	0.0012
0	0.0052	0	0	0	0	0	0	0	0	0.054
0	0	0	0	0	0.1176	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0.0068	0.002	0.0348	0.012	0.0072	0.0056	0	0	0.0204	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0.002	0.0904	0.0112	0.036	0	0.3528	0	0.0076	0.0308	0.2596	0.214
0	0.002	0	0.0008	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0.132	0	0	0	0	0	0	0.05
0.022	0.0588	0.0984	0.0736	0.1788	0.016	0.1004	0	0.0856	0.3196	0.0588
0	0	0	0.0004	0	0	0	0	0.0016	0	0
0	0.0528	0	0	0	0	0.0312	0	0.0012	0.0048	0
0	0	0	0	0	0	0	0	0.3836	0	0
0	0.0048	0	0	0	0	0	0	0	0	0
0	0	0.0944	0	0	0	0	0	0	0.0492	0
0	0	0.1512	0	0	0	0	0	0	0	0
0.008	0.2644	0	0.0632	0	0.0364	0	0	0	0	0.346

mimaur Tot	0.0736	0.014	0.0744	0	0	0	0	0	0.2032
mircal Total	0	0	0	0.0404	0	0.0072	0	0.032	0
naalep Tote	0.4192	0.0096	0.1136	0.2232	0.0068	0.068	0.6016	0.582	0.0924
naapul Tota	0	0	0	0	0.02	0	0	0	0.1024
nicgla Total	0	0.002	0	0	0	0	0	0	0
opurit Total	0.0224	0.234	0.2572	0	0.0624	0.1012	0.1652	0.1676	0.028
oxacor Tote	0	0	0	0	0	0	0	0	0.0012
paecal Tote	0	0	0	0	0	0	0	0	0
paland Tote	0	0	0	0	0	0	0	0	0.002
picech Tota	0	0	0	0	0	0	0	0	0
pentri Total	0	0	0	0	0	0	0	0	0.0096
quearg Tote	0	0	0	0	0	0	0	0	0
ralcal Total	0	0	0	0	0	0	0	0	0.0008
rhuint Total	0	0	0	0.0776	0	0	0	0	0
rock Total	0	0	0	0	0.0036	0	0	0	0
salapi Total	0	0	0	0.2544	0	0	0	0.052	0.1388
salmel Tota	0	0	0	0	0	0	0	0	0
sammex Tc	0.002	0	0	0	0	0	0	0	0
sancra Tote	0	0	0	0	0	0	0	0	0.0036
siebel Total	0	0	0	0	0	0	0	0	0.002
solidou Tote	0	0	0	0.0028	0	0	0	0	0
sonasp Tot	0.0024	0	0	0	0	0	0	0	0.0096
toxdiv Total	0	0	0	0	0	0	0	0	0
verlas Total	0	0	0	0	0	0	0	0	0.01
vulmyu Tote	0	0	0	0	0.0008	0	0	0	0.182
water Total	0	0	0	0	0	0	0	0	0.0152
grand total	2.2852	1.3192	1.4236	2.2688	1.4456	1.3264	1.854	1.8588	1.9152

CSS

Plot #s	Grid Numbe	Compass E	Location	Comments
1	66	106		
2	144	172		
3	148	20	ne of lotus swath	
4	276	250	bottom at rhus	
5	338	100	1st finger n of dike	
6	375	164		
7	379	150	nw of fire/fire deer road	
8	387	128	nw burn ridge	
9	394	56	sw of platanus	
10	406	288	se of dike	
11	448	268	s of dendritic drainage	
12	502	128	cnr of finger and 3 intersection	
13	607	290	n edge of baccharis dom slope	
14	654	338	tween rhus	
15	679	82	in salvia dom	
16	690	232	w of oaks	
17	707	190	se of other transect	
18	707	132		
19	757	196	from rocky gulterrezia	
20	782	270	5m off road near oaks	

0.6736	0	0.2624	0.114	0.004	0.004	0.0132	0	0.026	0	0
0	0.0064	0	0	0	0	0	0	0.036	0	0
0.122	0.0768	0	0.1748	0	0.6204	0.0668	0.65	0.2408	0	0.1444
0	0	0	0.0264	0.2156	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0.0404	0	0	0	0.0628	0.1392	0.0052	0.2484	0	0
0	0	0	0	0	0	0	0	0	0	0
0.0328	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0.0016	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0.0036	0	0	0	0
0	0	0	0.0032	0.006	0.01	0.0008	0.0016	0	0	0.006
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.0036	0	0	0	0	0	0
0.1964	0.044	0.0012	0	0.0972	0.078	0	0	0	0.0164	0.052
0	0	0.5728	0	0	0	0	0	0	0	0
0	0	0.2172	0	0	0	0	0	0	0	0
0.0168	0	0	0	0.0028	0.0036	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0.004	0	0	0.0028	0.0488	0	0	0	0.006	0.0056
0	0	0	0	0	0	0	0.0232	0	0	0
0	0	0	0.0568	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0.0092	0	0.1372	0	0.0112	0	0	0	0	0.0376
0	0	0	0	0	0	0	0	0	0	0
1.416	1.814	1.4472	2.312	1.3568	2.0776	1.3036	1.9644	1.6708	1.2652	1.8376

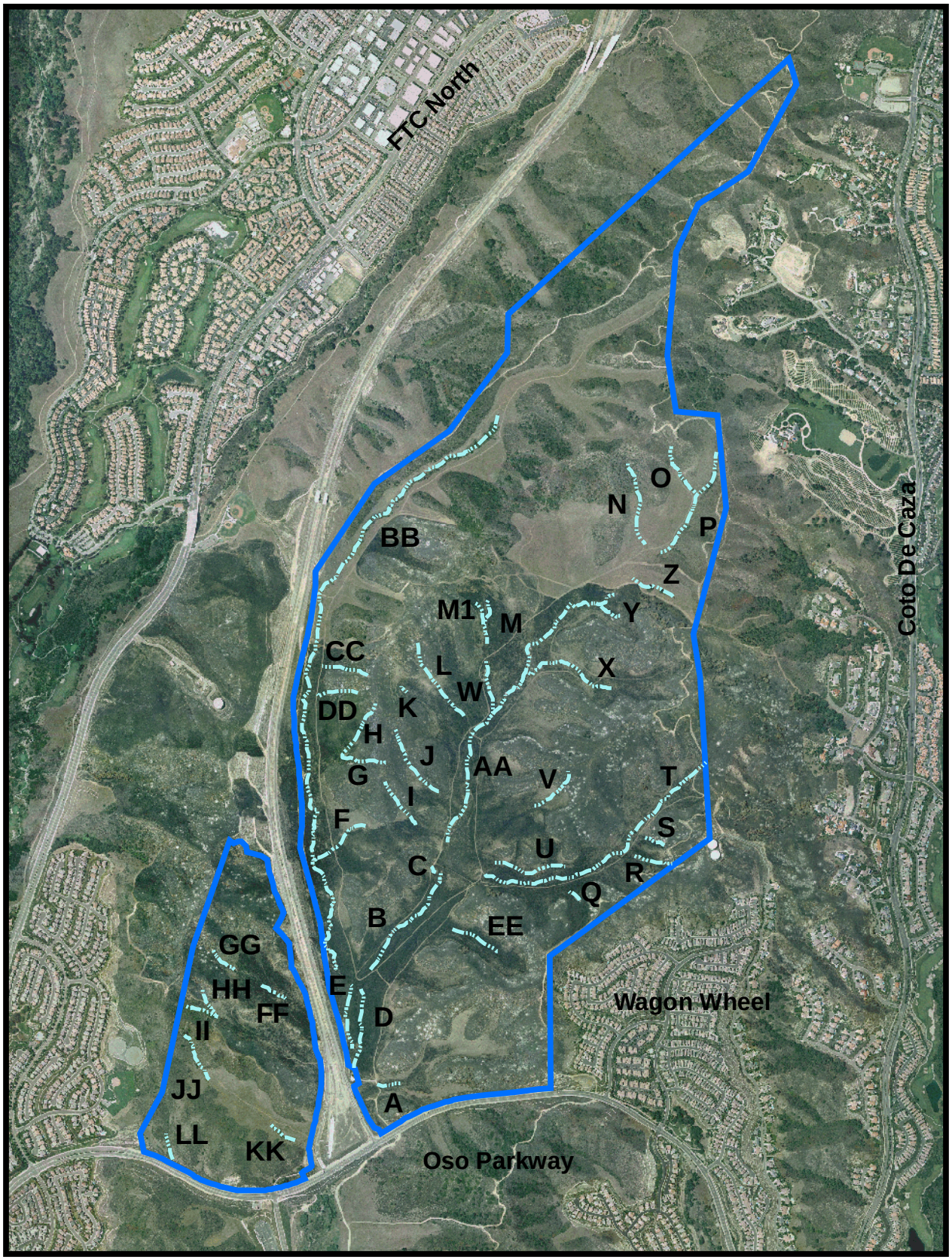
Appendix II

Description of Non-Wetland Drainages

Chiquita Canyon Conservation Area contains 38 incised channels. Thirty-one incised channels occur in the Main Canyon and the remaining seven occur in the West Canyon. Total length of all channels is approximately 11,827 meters. Average channel length is 311 meters with the longest channel being 2,371 meters and the shortest 30 meters. Average channel width is 400 cm and average channel depth is 130 cm. Channel vegetation ranges from native tree/shrub overstory, native shrub understory to segments of nonnative grasses and herbaceous species. Native overstory trees and shrubs are *Sambucus mexicana, Rhus integrifolia, Quercus agrifolia* and a few individuals of *Rhamnus californica*. Dominant native coastal sage scrub species occupying the channels understory are *Artemisia californica, Eriogonum fasciculatum, Salvia apiana, Mimulus aurantiacus,* and *Opuntia littoralis*. The nonnative grasses *Bromus diandrus, Hordeum leporinum, Lolium multiflorum, Avena* sp., and *Bromus hordeaceus* and the nonnative herbaceous species *Raphanus sativus*, *Brassica nigra,* and *Marrubium vulgare* are invasive species dominating segments of a majority of the channels. Total linear coverage by nonnative vegetation on both sides of all channels is 10,395 meters.

Landscape location, vegetative cover and morphology of the 38 incised channels varies. Three channels occurring on slopes dominated by native coastal sage scrub species are stable with no evidence of erosion, bank slumping, or sediment filling. Vegetative cover for eight of the channels occurring in valleys is entirely nonnative annual grasses and herbaceous species. The eight incised channels are beginning to fill in with sediment and some of the channels are subject to erosion and bank sloughing. Fifteen channels occurring on slopes are dominated by native coastal sage scrub species for at least half of the reach and by nonnative species as the channels enter the valley. The channels are stable for the section of the reach dominated by native species but are beginning to fill in with sediment and in some channels erosion is occurring in segments of the reach. Twelve channels, eight of which occur in valleys and four on slopes, are surrounded by nonnative grassland but do still have remnant coastal sage scrub species in parts of the reach. The channels occurring in the valleys appear to be subject to more bank cutting, erosion deep incision and head cutting. Bank slumping is also occurring in some of the larger channels.

Four incised channels seem to be negatively effected by a berm located at the Southern end of the Main Canyon. Three of the four channels are occupied solely by nonnative grasses and herbaceous species and the fourth channel has only 50 feet of the 1,450 foot reach covered by native vegetation while the remainder is covered by nonnative grasses and herbaceous species. Upstream the channels are subject to erosion, slumping and head cutting and downstream the channels are filling in with sediment.

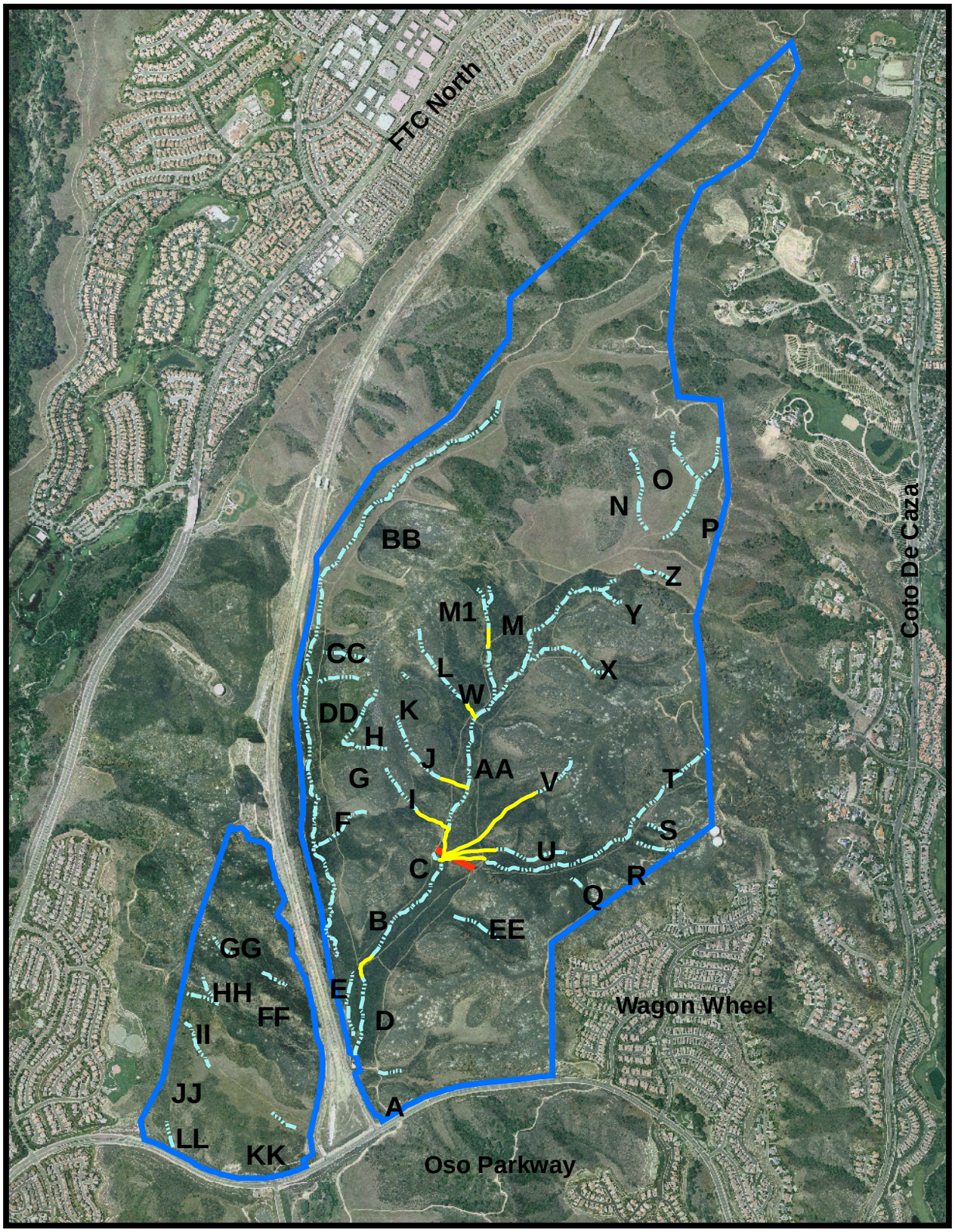


Chiquita Canyon Conservation Area
Drainages

Conservation Boundary

0 1,000 2,000 4,000 Feet

Drainages



Chiquita Canyon Conservation Area
Berm Removal

Conservation Boundary

Drainages

Berm Removal

Re-established Drainage Connections

0 1,000 2,000 4,000 Feet

Based on the analysis of existing conditions, it is possible to restore the vegetation of the non-wetland drainages in conjunction with the restoration of the surrounding annual grasslands to perennial grasslands as described in Section 3 of the comprehensive habitat restoration plan. Based on Smith and Klimas (2004), the general design criteria for riparian ecosystem restoration for the non-wetland drainages within the Upper Chiquita Canyon Conservation Area, restoration of the drainages and surrounding annual grassland areas would follow the "Natural Template" restoration model. This restoration model would result in an increase in habitat integrity indices for the Upper Chiquita Canyon local drainage area.

The following table documents the specific areas of restoration potential within the drainages. See Section 3 of the plan for specifications for planting and seeding within the non-wetland drainages and for seeding for restoration of the surrounding annual grasslands.

UPPER CHIQUITA CONSERVATION AREA NON-WETLAND DRAINAGE RESTORATION POTENTIAL

MAIN CANYON DRAINAGES

DRAINAGE	LINEAR METERS	LINEAR M EXOTICS *	LINEAR M CSS *	LINEAR M RIPARIAN *
A	215	430	0	0
B	440	850	0	30
C	30	60	0	0
D	320	640	0	0
E	195	390	0	0
F	351	504	30	168
G	87	0	60	114
H	180	16	172	172
I	170	162	130	48
J	415	170	460	200
K	82	74	50	40
L	390	400	300	80
M	200	400	0	0
N	380	90	440	230
O	182	0	214	150
P	613	371	680	175
Q	116	74	108	50
R	150	120	60	120
S	67	24	30	80
T	959	1,176	442	300
U	272	242	302	0
V	246	184	308	0
W	205	230	120	60
X	321	112	450	80
Y	74	108	40	0
Z	115	110	80	40
AA	1,283	818	1,460	288

BB	2,371	2,258	2,100	384
CC	147	102	152	40
DD	119	58	100	80
EE	120	240	0	0
TOTAL M	10,815	10,413	8,288	2,929
* Includes both sides of drainage				

WEST CANYON DRAINAGES

DRAINAGE	LINEAR METERS	LINEAR M EXOTICS *	LINEAR M CSS *	LINEAR M RIPARIAN *
FF	155	310	0	0
GG	170	50	210	80
HH	70	0	140	0
II	124	28	160	60
JJ	250	250	180	70
KK	153	146	160	0
LL	90	0	140	40
TOTAL M	1,012	784	990	250
* Includes both sides of drainage				

TOTALS FOR MAIN AND WEST CANYON

CANYON	LINEAR METERS	LINEAR M EXOTICS	LINEAR M CSS	LINEAR M RIPARIAN
MAIN CYN	10,815	10,413	8,288	2,929
WEST CYN	1,012	784	990	250
TOTAL M	11,827	11,197	9,278	3,179

TOTAL RESTORATION POTENTIAL

	LINEAR M EXOTICS	LINEAR M CSS	TOTAL M
MAIN CYN	10,413	8,288	18,701
WEST CYN	784	990	1,774
		GRAND TOTAL	**20,475**

Functions and Values Analysis

Hydrogeomorphic Method (HGM) was utilized at Upper Chiquita Canyon Conservation Area to assess riparian functions of the non-wetland drainages. The HGM is a scientific method based rapid assessment tool for evaluating water/wetland functions (Lee *et al* 1997). Emphasis is placed on the hydrologic and geomorphic functions prevalent to the water/wetland being assessed (Lee *et al* 1997).

The major components of the HGM consist of classification of the water/wetland and its comparison to a reference site (Lee *et al* 1997). Classification and the use of a reference site is necessary because not all water/wetlands are the same and certain functions may not be present in all types of fully functioning water/wetlands. Scoring of the HGM variables for the water/wetland is accomplished by comparing the water/wetland to an intensively studied reference site that is in the same subclass and in the same geographic region (Lee *et al* 1997). Reference sites define the relevant functions for the class and the range of functioning for each function in the water/wetland class (Lee *et al* 1997). Upper Chiquita Canyon drainages are in the riparian class and the 1st and 2nd stream order subclass. The reference site is the Santa Margarita Watershed.

The assessment of the 38 channels within the Upper Chiquita Canyon Conservation Easement began with determing the floodprone area which would constitute the assessment area. Since the channels are intermittent and no clear bankfull characteristics were present in the channels, such as shelving, soil characteristic changes or destruction of terrestrial vegetation, the assessor used their best professional judgment to determine the floodprone and subsequently the assessment area. Several HGM defined variables of the channel were then observed and scored according to data interpreted from the reference site. Scores for all variables are 0.0, 0.1, 0.25, 0.5, 0.75, or 1.0 with 0.0 being function non-existent and not recoverable under current conditions and 1.0 being function fully functioning under current conditions. A summary of variables is provided below.

Alterations of Hydroregime

Alterations of the hydroregime affecting the assessment area are observed. Alterations can occur through cultural processes such as damming or diverting water flow for water harvesting or for farming purposes etc. The alteration of the hyrdroregime can cause changes to the channel in the discharge, bedload, morphology of the channel etc.

Floodprone Area

The floodprone area is defined as a horizontal plane projected at a level that is twice the bankfull thalweg depth of the stream. The variable scores the extent of the area that has been modified by cultural processes such as concrete bottom, culvert, entrenchment etc.

Sediment Delivery to Water/Wetland

Sediment delivery to the water/wetland is observed to see if it is increased due to culturally accelerated processes such as citrus orchards, grazing, road crossings etc. An increase in sediment delivery can result in aggradation of the channel and floodprone area.

Trees

Trees are defined as having a dbh $\geq$ 5" and $\geq$ 20' in height. Trees, when located in the bankfull channel, can provide bank stabilization, are a source of woody debris for the channel, and can reduce the hydrologic energy of the stream during high flows.

Saplings

Saplings are defined as single stem woody species < 5" dbh and ≥ 3' in height. Saplings located in the bankfull channel can provide bank stabilization, are a source of woody debris for the channel, and can reduce the hydrologic energy of the stream during high flows.

Shrubs

Shrubs are defined as multiple stem woody species. Shrubs can dissipate hydrologic energy by providing surface roughness in the stream and provide storage for surface water.

Macro/Micro Topographic Complexity

Topographic complexity is defined as the micro and macrotopographic relief of the assessment area. Macrotopographic relief is generally large-scale features that include secondary channels, in channel ponds etc. Microtopographic relief is generally small-scale features that include such features as pit and mound and hummock and hollow patterns. Topographic relief features dissipate hydrologic energy by providing surface roughness in the stream and provide storage for surface water.

Soil Pore Space

Soil pore space is defined as the space between the soil particles and is the space in soil that is available for subsurface water storage. Ability of the soil to hold subsurface water is related to the texture of the soil and permeability. The variable considers the ease at which subsurface water can access the subsurface storage space.

Subsurface flow into the Water/Wetland

Subsurface flow into the water/wetland is defined as flow into the water/wetland by means of interflow and return flow. The variable considers flow into the water/wetland that can be stored in the system.

Litter

Litter is defined as leaf litter and other detrital matter in the assessment area. Litter and detrital layers provide short-term sources of nutrients and organic carbon. Annual grasses are considered as litter since they will provide organic carbon and nutrients at some point in the year.

Soil Organic Matter

Soil organic matter is observed in the A horizon layer in the assessment area of the channel. Organic matter provides the channel with a source of nutrients and organic carbon for a short term.

Fine Woody Debris

Fine woody debris is defined as woody material that is dead and down in the assessment area. An accumulation of fine woody debris in the channel provides storage for surface water and can also dissipate hydrologic energy.

Ratio of Native to Non-Native Vegetation

The ratio of native to non-native vegetation for each stratum is observed within the stream channel. A healthy plant community will have a high percentage of natives over non-natives while a system that has been disturbed will have a higher percentage of non-native invasive plants.

Contiguous Vegetation Cover

The vegetation extending from upstream and downstream in the channel to the uplands is observed and scored. A contiguous cover of native vegetation will provide connectivity throughout the riverine system both horizontally and vertically.

APPENDIX III

SOIL PROFILES

The following descriptions summarize the information from soil pits within each of the major soil types in the Upper Chiquita Conservation Area. Field sheets and photographs of the soil pits follow the summary of specific soil types.

Kelley/
Riedelbauch
12/2/03

FIELD SHEET FOR RECORDING SOIL CHARACTERISTICS

No. Pit 1

Soil Series Bakelia [illegible] Phase

Location [illegible] Chambers Co.

Geographical Landscape Valley floor [illegible]

Elevation Slope 2% Aspect [illegible] Erosion

Groundwater Drainage [illegible] Saline/Sodic Class

Parent Rock/Material [illegible]

Climate: [illegible] MAP MAT MAST MSST MWST

Natural Cover [illegible] Soil Region Profile Group

Higher Categories

Competing Soil Series

Associated Soil Series

PROFILE SKETCH	BDY	COLOR	TEXTURE	STRUCTURE	CONSISTENCE Dry	CONSISTENCE Moist	CONSISTENCE Wet	REACTION	MISC: Roots, Pores, Clay films, Etc.
	1-0		duff, ashes, leaves, seeds		X				burned area
	0-3"	10YR 4/2 Dry; 10YR 3/2 moist	Sandy loam	Platy (compacted)					common fine to coarse roots; common fine pores; [illegible]
	wavy 3-11"	10YR 5/2-D; 10YR 4/2 M	Sandy loam	platy, subang.					common fine to coarse roots; common fine to coarse pores; roots along ped faces; [illegible]
	abrupt 11-25 smooth	10YR 4/2 D; 10YR 4/1 M	loamy sand	Slightly platy (to massive)					bottom of plow pan; com fine roots; com fine gravel
	25-37 gradual	10YR 4/3 D; 10YR 4/2 M	loamy coarse sand with thin silt lenses	massive					[illegible] charcoal flecks; com fine roots; [illegible]
	37-39 clear	10YR 4/2-D; 10YR 4/2-M	Clayey coarse sand	granular		X			[illegible] fine gravel; com fine roots
	39-40 [illegible]	10YR 4/3-M	Sand	granular		X			few fine roots

Natural Land Division

Soil Rating (Storie Index) Soil Grade

Land Use Capability Unit

Present Use fallow / [illegible]

Suitability: Irrigated Crops Range

Nonirrigated Crops Timber

Soil Management

Remarks [illegible] disturbed / [illegible] plow pan / [illegible]

Kelley
Riddell-Wine
12/12/03

2

FIELD SHEET FOR RECORDING SOIL CHARACTERISTICS

No. B+2

Soil Series (3) Batelle loam 2-9% slopes ______ Phase ______

Location 1120443353 3773592 Ch... ... Soil ... Near Pit 2 ... Toll Road 241

Geographical Landscape Valley floor / stream terrace (distal edge of fan)

Elevation ______ Slope 4-5% ______ Aspect SW ______ Erosion ______

Groundwater ______ Drainage ... drainage Saline/Sodic Class ______

Parent Rock/Material Dep. sands / silts few gravels

Climate: Med. ______ MAP ______ MAT ______ MAST ______ MSST ______ MWST ______

Natural Cover ... / ... grasses / ... (... Ave?) Soil Region ______ Profile Group ______

Higher Categories ______

Competing Soil Series ______

Associated Soil Series ______

PROFILE SKETCH	BDY	COLOR	TEXTURE	STRUCTURE	CONSISTENCE Dry	CONSISTENCE Moist	CONSISTENCE Wet	REACTION	MISC: Roots, Pores, Clay films, Etc.
	2-0		duff - leaves, Stems, seeds		X				...
	0-8" abrupt	10YR 4/... - D 10YR 3/1 - W	Sandy loam (slightly ... / ...)	platy	X				Com. fine to coarse roots Com. fine to coarse pores
	8-22 gradual	10YR 4/2 - D 10YR 3/2 - W	Sandy clay loam (loamy sand)	blocky, subangular		Slightly ...			Com. fine roots Com. fine pores ... gravel
	22-36" wavy	10YR 4/2 - D 10YR 4/2 - W	Silty sand (S. ...)	Massive		X			Stone ... Com. fine roots
	36-45" gradual	10YR 3/1 - W	Sandy clay	Massive		X			Com. sm. gravels Few fine roots
	45-60"	10YR 1/2 - W	Sandy clay	Massive		X			... fine roots ... gravels

Natural Land Division ______

Soil Rating (Storie index) ______ Soil Grade ______

Land Use Capability Unit ______

Present Use Fallow

Suitability: Irrigated Crops ______ Range ______

Non-irrigated Crops ______ Timber ______

Soil Management ______

Remarks Grazed or past / cultivated

Soil Pit 1 Botella Loam, 2 to 9% Slopes

Soil Pit 2 Botella Loam, 2 to 9% Slopes

Kinney
Riedelbehr[illegible]
12/2/03

FIELD SHEET FOR RECORDING SOIL CHARACTERISTICS

No. R13

Soil Series [illegible] loam / [illegible] 30-45% slopes Phase

Location [illegible] [illegible] Rd

Geographical Landscape Hillslope [illegible]

Elevation ______ Slope 20-25% Aspect SE Erosion ______

Groundwater ______ Drainage [illegible] Saline/Sodic Class ______

Parent Rock/Material Sandstone

Climate: [illegible] MAP ______ MAT ______ MAST ______ MSST ______ MWST ______

Natural Cover [illegible] Soil Region ______ Profile Group ______

Higher Categories [illegible]

Competing Soil Series ______

Associated Soil Series ______

PROFILE SKETCH	BDY	COLOR	TEXTURE	STRUCTURE	CONSISTENCE Dry	CONSISTENCE Moist	CONSISTENCE Wet	REACTION	MISC: Roots, Pores, Clay films, Etc.
	0-6 abrupt	10YR 4/3-D 10YR [illegible]-W	fine sandy loam	[illegible]	x				[illegible]
	6-12 abrupt wavy	10YR [illegible]-D 10YR 3/3-W	Sandy loam	blocky [illegible]	X				[illegible]
[illegible]	12-17 [illegible]	10YR [illegible]-D 10YR 4/4 W	[illegible]	[illegible]	X				[illegible] roots [illegible]
	17-22 abrupt	White [illegible]	Coarse		X				[illegible]
	22 to depth		Coarse		X				Sandstone [illegible] layers [illegible]

Natural Land Division ______

Soil Rating (Storie index) ______ Soil Grade ______

Land Use Capability Unit ______

Present Use fallow

Suitability: Irrigated Crops ______ Range ______

Nonirrigated Crops ______ Timber ______

Soil Management ______

Remarks [illegible] Burned

Valley
Riverside Co MS
12/2/03

3

FIELD SHEET FOR RECORDING SOIL CHARACTERISTICS

No. P-1 Y

Soil Series 131 Botella loam 2-9% Slopes Phase

Location 11S4W3457 Chiquita Cyn. San Diego Cyn. Dr. 241 toll road

Geographical Landscape Valley floor or low terrace

Elevation Slope 2% Aspect SSW Erosion

Groundwater Drainage Well drained Dunnage Saline/Sodic Class

Parent Rock/Material Dep. sands/silts

Climate: Arid MAP MAT MAST MSST MWST

Natural Cover Lepidospartal / Atriplex / grass Soil Region Profile Group

Higher Categories

Competing Soil Series

Associated Soil Series

PROFILE SKETCH	BDY	COLOR	TEXTURE	STRUCTURE	CONSISTENCE Dry	CONSISTENCE Moist	CONSISTENCE Wet	REACTION	MISC. Roots, Pores, Clay films, Etc.
	1-0		duff-leaves, stems, seeds						Burned forest
	0-6 abrupt wavy	10YR 4/2-D 10YR 3/2-M	Sandy loam	platy (compacted)	X				Com fine to very fine roots; Com cobbles (to 4"); Com fine pores; Occ charcoal fgmts
	6-14 abrupt wavy	10YR 4/2-D 10YR 3/2-M	loamy sand	Slightly blky (subang)	X				Com. gravels & cobbles; Com fine to coarse roots; Frequent krotovinas
	14-20 abrupt smooth	10YR 4/2-D 10YR 4/2-M	Sandy (Strat. silts)	agency (Stratified)		slightly			Strat silts & Sands; Com. gravels; occ cobbles & boulders; Com fine roots
	20-38 gradual	10YR 3/2-M	Clay	massive		X			Com fine roots
	38-51+	10YR 3/2-M	loamy Sand	grainy		X			Com fine roots

Natural Land Division

Soil Rating (Storie Index) Soil Grade

Land Use Capability Unit

Present Use fallow / plowed in past

Suitability: Irrigated Crops Range

Nonirrigated Crops Timber

Soil Management

Remarks loss dirt / plow pan / hard pan

Kelly
[illegible]
12/2/07

FIELD SHEET FOR RECORDING SOIL CHARACTERISTICS

No. Pit 5

Soil Series 142 Cieneba Sandy Loam 30-75% Phase

Location [illegible] [illegible]

Geographical Landscape [illegible] slope 40' South of small drainage pass slip

Elevation ______ Slope 30-35% Aspect NE Erosion ______

Groundwater ______ Drainage 40' South of small drainage Saline/Sodic Class ______

Parent Rock/Material poss Clay body formed from [illegible] Mat. [illegible]

Climate: [illegible] MAP ______ MAT ______ MAST ______ MSST ______ MWST ______

Natural Cover [illegible] Soil Region ______ Profile Group ______

Higher Categories ______

Competing Soil Series ______

Associated Soil Series ______

PROFILE SKETCH	BDY	COLOR	TEXTURE	STRUCTURE	CONSISTENCE Dry	CONSISTENCE Moist	CONSISTENCE Wet	REACTION	MISC: Roots, Pores, Clay films, Etc.
	1-0		[illegible]						Burned [illegible]
	0-15 abrupt smooth	10YR 3/1 wet	Clay or Clay loam	platy	Dry	moist			[illegible] gravels 6" com [illegible] esp on ped [illegible] com charcoal(s) com [illegible]
	15-45 gradual	10YR 3/1 wet	clay	blky angular		slight			[illegible] charcoal(s) [illegible] cracks [illegible] N2t com fine to coarse roots disseminated carbonate
	45-60	10YR 3/2 wet	clay	blky angular	X				occ. cobbles (to 6") occ cobbles (to 6") com. fine [illegible] ped faces com fine to [illegible] in peds Stringers of carbonate throughout

Natural Land Division ______

Soil Rating (Stone index) ______ Soil Grade ______

Land Use Capability Unit ______

Present Use Fallow [illegible]

Suitability: Irrigated Crops ______ Range ______

Nonirrigated Crops ______ Timber ______

Soil Management ______

Remarks Poss [illegible] / dry [illegible] / [illegible] / poss. vertisol w/ deep [illegible]

Soil Pit 3 Interface Between Cieneba Sandy Loam 30 to 75% Slopes and Botella Loam 2 to 9% Slopes

Soil Pit 5 Cieneba Sandy Loam 30 to 75% Slopes

[illegible]

FIELD SHEET FOR RECORDING SOIL CHARACTERISTICS

No. [illegible]

Soil Series 131 [illegible] loam 2 to 5% slopes Phase

Location [illegible] [illegible]

Geographical Landscape Valley [illegible] (?) [illegible]

Elevation Slope 2% Aspect [illegible] Erosion

Groundwater Drainage [illegible] Saline/Sodic Class

Parent Rock/Material [illegible]

Climate: [illegible] MAP MAT MAST MSST MWST

Natural Cover [illegible] Soil Region Profile Group

Higher Categories

Competing Soil Series

Associated Soil Series

PROFILE SKETCH	BDY	COLOR	TEXTURE	STRUCTURE	CONSISTENCE Dry	CONSISTENCE Moist	CONSISTENCE Wet	REACTION	MISC: Roots, Pores, Clay films, Etc.
	1-0		[illegible] sands [illegible]						[illegible]
	0-3 gradual	10YR 4/2 D 10YR 3/2 W	sand	granular (crust compacted)	X				com. fine [illegible] [illegible] acc. sm. gravel
	3-12 gradual	10YR 4/2 D 10YR 3/2 W	Sand	granular (slightly [illegible])	X				com. [illegible] roots; com. sm. gravels ([illegible]); com. [illegible]
	12-30 abrupt	10YR 4/2 D 10YR 3/2 W	[illegible] sands (some very coarse sands)	granular	X				com. sm. gravels [illegible] (to 2") com. [illegible] com. [illegible] roots
	30-41 gradual	OM 10YR 2/1 W clay 10YR 2/2 W	Clay [illegible] [illegible] OM	[illegible]		X			com. fine [illegible] roots [illegible] com. fine pores
	41-60	10YR 3/2 W	fine to coarse sands (stratified) [illegible] clay/sand	granular		X			acc. fine [illegible] roots; few [illegible]; few sm. gravels

Natural Land Division

Soil Rating (Storie index) Soil Grade

Land Use Capability Unit

Present Use fallow / [illegible]

Suitability: Irrigated Crops Range

Nonirrigated Crops Timber

Soil Management

Remarks [illegible] / [illegible] / [illegible] sands deposited on dark [illegible] [illegible] high om [illegible]

Soil Pit 4 Botella Loam 2 to 9% Slopes

Soil Pit 6 Botella Loam 2 to 9% Slopes

Kelley / Riedel-Lewis
12/12/03

FIELD SHEET FOR RECORDING SOIL CHARACTERISTICS

No. P17

Soil Series: 135 Capistrano Sandy loam 2 to 9% slopes Phase ____

Location: 1150443334 / 3718359 Chiquita Cyn Mid-canyon old test plots

Geographical Landscape: gentle slope alluvial fan

Elevation ____ Slope 3-5% Aspect S Erosion ____

Groundwater ____ Drainage [illegible] Saline/Sodic Class ____

Parent Rock/Material: hillslope colluvium

Climate: Med. t ____ MAP ____ MAT ____ MAST ____ MSST ____ MWST ____

Natural Cover: Annual / Art[illegible] / [illegible] Soil Region ____ Profile Group ____

Higher Categories ____

Competing Soil Series ____

Associated Soil Series ____

PROFILE SKETCH	BDY	COLOR	TEXTURE	STRUCTURE	CONSISTENCE Dry	CONSISTENCE Moist	CONSISTENCE Wet	REACTION	MISC: Roots, Pores, Clay films, Etc.
	4-0		duff leaves stems		X				Burned
	0-3	10YR 4/2-D 10YR 3/1-W	Sandy loam (compacted)	platy (compacted)	X				com fine [illegible] roots
	3-9	10YR 4/2-D 10YR 3/1-W	Sandy ~~loam~~	sub angular blocky		slight			com fine roots
	9-50	10YR 3/2 D 10YR 2/2-W	Sandy clay	ang blocky		slight			com fine roots [illegible]

Natural Land Division ____

Soil Rating (Storie Index) ____ Soil Grade ____

Land Use Capability Unit ____

Present Use: fallow / previously farmed

Suitability: Irrigated Crops ____ Range ____

Nonirrigated Crops ____ Timber ____

Soil Management ____

Remarks: [illegible] cobbles throughout [illegible] / [illegible] hard pan disseminated calcium carbonate [illegible] throughout ([illegible] of carbonate)

D. Kelly
M. Riedel-Lehrke
12/3/03

pics 17-19
75? pics

FIELD SHEET FOR RECORDING SOIL CHARACTERISTICS

No. 1218

Soil Series Edge of 131 / 135 Capistrano Sandy loam 2 to 9% / Botella loam 2/9% Phase

Location [illegible] Sycamore Cyn Main Ave south of [illegible]

Geographical Landscape Valley floor Stream terrace (high?)

Elevation ______ Slope 2% Aspect W Erosion ______

Groundwater ______ Drainage [illegible] Saline/Sodic Class ______

Parent Rock/Material Mixed fine to coarse sediments few gravels

Climate: [illegible] MAP ______ MAT ______ MAST ______ MSST ______ MWST ______

Natural Cover [illegible] Soil Region ______ Profile Group ______

Higher Categories ______

Competing Soil Series ______

Associated Soil Series ______

PROFILE SKETCH	BDY	COLOR	TEXTURE	STRUCTURE	CONSISTENCE Dry	CONSISTENCE Moist	CONSISTENCE Wet	REACTION	MISC: Roots, Pores, Clay films, Etc.
	1-0		[illegible]		X				
	0-5 wavy abrupt	10YR 4/? D 10YR 4/2 W	Silty clay loam	Platy compacted	X				Buried A [illegible]
	5-12 gradual	10YR 5/? D 10YR 3/? W	Sandy fine loam	weak platy weak [illegible]		X			com fine to coarse [illegible] [illegible] com fine to [illegible] pores
	12-25 gradual	10YR 4/2 W	Sandy clay loam	weak [illegible]		X			[illegible] com fine to [illegible] pores [illegible] gravels
	25-46 gradual	10YR 4/2 W	Sandy clay loam	Massive		X			[illegible] com fine roots
	46-62	10YR 4/2 W	loamy clay	Massive		X		- -	[illegible] few fine [illegible] pores few fine roots [illegible] few fine pores

Natural Land Division ______

Soil Rating (Storie index) ______ Soil Grade ______

Land Use Capability Unit ______

Present Use [illegible]

Suitability: Irrigated Crops ______ Range ______

Nonirrigated Crops ______ Timber ______

Soil Management ______

Remarks [illegible] increasing clay [illegible] w/ depth from 2nd horizon

O. Kelly
K. Riedel-Lehrke
12/3/03

p20 p21
2 labels
p[illegible]

FIELD SHEET FOR RECORDING SOIL CHARACTERISTICS

No. Pit 9

Soil Series 135 Capistrano Sandy loam 2 to 9% Phase

Location 11S 0493784 / 3[illegible] Chiquita Cyn. [illegible] old [illegible] plots most Northern

Geographical Landscape hillslope alluvial fan

Elevation ______ Slope 5-10% Aspect SE Erosion ______

Groundwater ______ Drainage well drained Saline/Sodic Class ______

Parent Rock/Material hillslope colluvium

Climate: ______ MAP ______ MAT ______ MAST ______ MSST ______ MWST ______

Natural Cover [illegible] / Mustard / [illegible] Soil Region ______ Profile Group ______

Higher Categories ______

Competing Soil Series ______

Associated Soil Series ______

PROFILE SKETCH	BDY	COLOR	TEXTURE	STRUCTURE	CONSISTENCE Dry	CONSISTENCE Moist	CONSISTENCE Wet	REACTION	MISC: Roots, Pores, Clay films, Etc.
	½-0		duff [illegible]		X				Duff cover
	0-7 abrupt wavy	10YR 3/2-D 10YR 2/1-W	Clay loam	platy (compacted)	X				com. fine to coarse roots; com. mycorrhizal hyphae; com. fine to coarse pores
	7-30 gradual	10YR 3/2-D 10YR 2/2-W	loamy clay	Strong blocky subang.	X				deep cracks to 45"; com. fine roots exped faces; few dis. carbonate flecks; com. coarse roots; com. fine to coarse pores
	30-50 gradual	10YR [illegible]-D 10YR 3/2-W	loamy clay	weak blocky subang.	X				com. fine to coarse roots exp ped faces
	50-60	10YR 5/3-D 10YR 4/3-W	clayey coarse sand	massive	X				fine dis. carbonate flecks throughout; com. fine to coarse pores; few roots; few pores; com. cobbles (1 to 4")

Natural Land Division ______

Soil Rating (Stone index) ______ Soil Grade ______

Land Use Capability Unit ______

Present Use fallowed previous dryland farm

Suitability: Irrigated Crops ______ Range ______

Nonirrigated Crops ______ Timber ______

Soil Management ______

Remarks dist. claypan / hardpan. Sm stones + gravel throughout [illegible] (to 2") possible vertisol

Soil Pit 7 Capistrano Sandy Loam 2 to 9% Slopes

Soil Pit 9 Capistrano Sandy Loam 2 to 9% Slopes

Kelly
Rindofinardo
12/3/03

10

22-23
2 pics
2P - Seedlings
24/25

FIELD SHEET FOR RECORDING SOIL CHARACTERISTICS

No. * P.l 10

Soil Series 125 Capistrano Sandy loam 2-9% Phase

Location US 0444 3624 / 37 8391 Chiquita Cyn Marcys old test plots middle one

Geographical Landscape Gentle hillslope alluvial fan

Elevation ______ Slope 5-10% Aspect SE Erosion ______

Groundwater ______ Drainage 125' Esofgrange Saline/Sodic Class ______

Parent Rock/Material hillslope colluvium

Climate: Medit MAP ____ MAT ____ MAST ____ MSST ____ MWST ____

Natural Cover mustard/Annual forest/Sage Soil Region ______ Profile Group ______

Higher Categories ______

Competing Soil Series ______

Associated Soil Series ______

PROFILE SKETCH	BDY	COLOR	TEXTURE	STRUCTURE	CONSISTENCE Dry	CONSISTENCE Moist	CONSISTENCE Wet	REACTION	MISC: Roots, Pores, Clay films, Etc.
	½ 0		duff bare stems		X				burned area
	0-4 clear wavy	10YR 3/2-D 10YR 2/2-W	Sandy clay loam	platy compacted	X				Myc ? many fine to coarse roots com fine gravel (to 1") com fine to coarse pores
	4-16 gradual	10YR 3/2-D 10YR 2/2-W	Sandy clay loam	blocky subang.		v. f. / 2 sandy			com gravels (to 2") com fine to coarse roots com large cracks com fine pores
	16-38 grad.	10YR 4/2-D 10YR 3/2-W	Sandy clay loam	blky weak subang		X			com gravels (to 2") com fine to coarse roots esp on ped faces com fine pores com diss. carbonate flecks
	38-54 grad	10YR 5/3-D 10YR 3/3-W	coarse sandy clay	Massive		X			com gravels occ cobbles (to 2") few fine to coarse roots few fine to coarse pores few finely diss carbonate flecks
	54-64	10YR 5/4-D 10YR 4/4-W	Clayey sand	grainy	X				few roots com large cobbles (to 6") com gravels few pores

Natural Land Division ______

Soil Rating (Stone index) ______ Soil Grade ______

Land Use Capability Unit ______

Present Use fallow/dryland farm in past

Suitability: Irrigated Crops ______ Range ______

Nonirrigated Crops ______ Timber ______

Soil Management ______

Remarks dist plowpan/hardpan. Clay content increases w/ depth from 1st horizon

D. Kelley
M. Riedeldehrke
12/3/03

6 25-29
4 pics

FIELD SHEET FOR RECORDING SOIL CHARACTERISTICS

No. P+11

Soil Series: 131 Botella loam 2 to 9% Phase:

Location: 11S 0440324 / 3919065 Chiquita Cyn main cyn 2nd to last valley in north-east end

Geographical Landscape: Narrow valley floor

Elevation: Slope: 4% Aspect: SW Erosion:

Groundwater: Drainage: Saline/Sodic Class:

Parent Rock/Material: alluvial fill / alluvial fan materials

Climate: Medit. MAP: MAT: MAST: MSST: MWST:

Natural Cover: Annual forest / Annual / Forest Soil Region: Profile Group:

Higher Categories:

Competing Soil Series:

Associated Soil Series:

PROFILE SKETCH	BDY	COLOR	TEXTURE	STRUC-TURE	CONSISTENCE Dry	Moist	Wet	REAC-TION	MISC: Roots, Pores, Clay films, Etc.
	1-0		duff - leaves stems seeds						
	0-10 abrupt wavy	10YR 4/2-D 10YR 3/2-W	Sandy clay loam	weak platy weakly compacted	X				Com fine to coarse roots Com fine to coarse pores
	10-48 clear wavy	10YR 3/2-D 10YR 2/2-W	sandy clay loam	weak subang blocky structure		Slightly			Com fine to coarse roots/pores Com coarse gravels scatt. throughout roots on ped faces + in peds
	48-60	10YR 4/3-D 10YR 3/2-W	loamy sand	granular		Slightly			Com fine yellow carbonate stringers Com fine to coarse roots/pores

Natural Land Division

Soil Rating (Stone index) Soil Grade

Land Use Capability Unit

Present Use: fallow / past dryland farming

Suitability: Irrigated Crops Range

Nonirrigated Crops Timber

Soil Management

Remarks: dist. plowpan / hardpan Small rounded gravels throughout
Valley in-fill [illegible]

Soil Pit 11 Botella Loam 2 to 9%

Soil Pit 8 Interface Between Botella Loam 2 to 9% Slopes and Capistrano Sandy Loam 2 to 9%

Valley
Riedel-Uhrle

30-32
3pi:5

FIELD SHEET FOR RECORDING SOIL CHARACTERISTICS

No. 9112

Soil Series 132 Bottle Clay loam 2 to 9% Phase

12/1/03 Location 1150445336 4918362 Chig Cyn Main Cyn West Valley Across from drive crossing

Geographical Landscape alluvial fan

Elevation ______ Slope 5% Aspect W Erosion ______

Groundwater ______ Drainage 150' fallow ag Saline/Sodic Class ______

Parent Rock/Material hillslope colluvium / alluvial fan gravels materials

Climate: ______ MAP ______ MAT ______ MAST ______ MSST ______ MWST ______

Natural Cover Range / oaks / Sagebrush / previously dry farmed grazing Soil Region ______ Profile Group ______

Higher Categories ______

Competing Soil Series ______

Associated Soil Series ______

PROFILE SKETCH	BDY	COLOR	TEXTURE	STRUCTURE	CONSISTENCE Dry	CONSISTENCE Moist	CONSISTENCE Wet	REACTION	MISC: Roots, Pores, Clay films, Etc.
	1-0	— — —	dry leaves stems seeds		X				
	0-7 abrupt wavy	10YR 7/2-D 10YR 2/2-W	Clay loam	platy (compacted)	X				com fine to coarse roots/pores com gravels (to 2") many roots on ped faces fungal hyphae?
	7-17 clear	10YR 6/1-D 10YR 2/1-W	Sandy clay	blky ang		X			com fine to coarse roots/pores to (1½") many roots on ped faces coarse roots along ped faces com sm gravels
	17-33 grad	10YR 3/2-W	Sandy clay	weak blky subang		X			com sm carbonate flecks
	33-63	10YR 3/2-W	coarse Sandy clay	massive		X			com fine to coarse roots/pores com sm gravels few C/M roots com sm gravels com fine pores

Natural Land Division ______

Soil Rating (Storie index) ______ Soil Grade ______

Land Use Capability Unit ______

Present Use fallow / prev dry farm ag

Suitability Irrigated Crops ______ Range ______

Nonirrigated Crops ______ Timber ______

Soil Management ______

Remarks diff plow pan / hoof pan Carbonate flecks fairly diss throughout except for 0-7"

Soil Pit 12 Botella Clay Loam 2 to 9%

D. Kelley / M. Kiddl / Lehrke 12/3/03

33 + 34
2 pits

FIELD SHEET FOR RECORDING SOIL CHARACTERISTICS

No. Pit 13

Soil Series 142 Geneva Sandy loam 30-75% Phase

Location 115 0444209 3719923 Chiquito Cyn. Maya Cyn. bump by Ashbar + plantings

Geographical Landscape top of small hill (knoll)

Elevation Slope 0-2% Aspect SE Erosion

Groundwater Drainage Saline/Sodic Class

Parent Rock/Material Sandstone weathered rock regolith

Climate: Medit MAP MAT MAST MSST MWST

Natural Cover Annual grass / Skeg / Amphipsi / Erset Soil Region Profile Group

Higher Categories

Competing Soil Series

Associated Soil Series

PROFILE SKETCH	BDY	COLOR	TEXTURE	STRUCTURE	CONSISTENCE Dry	CONSISTENCE Moist	CONSISTENCE Wet	REACTION	MISC: Roots, Pores, Clay films, Etc.
	½-0		duff, leaves, seeds, stems		X				
	0-2 abrupt wavy	10YR4/2-D 10YR3/2-W	loamy sand	platy compacted	X				com fine to coarse roots; com gravels to cobbles; com fine to coarse pores
	2-7 abrupt	10YR3/2-D 10YR3/1-W	loamy sand	blky angular		slight			com fine roots on ped faces; com gravels + cobbles; com fine to coarse pores
	7-15 grad	10YR4/4-W	clayey sand	vertical fracture zones		slight			highly weathered regolith (C horizon); clay incr. w/ depth of soil profile; vertical fracture zone w/ organic infill; roots along ped faces; com gravels + cobbles
	15-30 grad	10YR4/4-W	coarse sandstone	some vertical fracture zones		slight			partially weath. sandstone; cracks fractured (vertical); + com gravels + cobbles

Natural Land Division

Soil Rating (Storie index) Soil Grade

Land Use Capability Unit

Present Use fallow area, dryland ag

Suitability: Irrigated Crops Range

Nonirrigated Crops Timber

Soil Management

Remarks residual soil app. large surface of large cobbles (to 12-14") stable position 5-8" to regolith (sandstone) can see rock features visible in regolith (strat. veins) dist plowpan / hardpan