David Magney Environmental Consulting

WETLAND RESTORATION PLAN AND MONITORING PROGRAM FOR THE REINKE PROPERTY, ROLLING OAKS DRIVE, THOUSAND OAKS, CALIFORNIA

Prepared for:

UNITED STATES ARMY CORPS OF ENGINEERS
AND
CALIFORNIA DEPARTMENT OF FISH AND GAME

On Behalf of:

RUDY REINKE

Mission Statement

To provide quality environmental consulting services with integrity that protect and enhance the human and natural environment

7 September 2000

DMEC

Wetland Restoration Plan and Monitoring Program for the Reinke Property, Rolling Oaks Drive, Thousand Oaks, California

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EXECUTIVE SUMMARY

Rudy Reinke has obtained approvals from the County of Ventura to build a single-family residence in Thousand Oaks, California (hereafter referred to as "the Reinke property" or "the property"). Ventura County is requiring Mr. Reinke to install a septic system leach field for sewage disposal. Mr. Reinke performed excavation activities in waters of the U.S. (including wetlands) and removed associated native riparian vegetation without the benefit of necessary permits from appropriate authorities (e.g. U.S. Army Corps of Engineers [Corps], California Department of Fish and Game [CDFG], Los Angeles Regional Water Quality Control Board [LARWQCB]).

Consequently, Mr. Reinke was in violation of the Federal Clean Water Act and the California Fish and Game Code, and was issued a notice of violation by the Corps. Currently, Mr. Reinke is applying, after-the-fact, for necessary Corps permits and CDFG authorization to complete his residence. Mr. Reinke shall mitigate for incurred project impacts as well as further impacts related to the project. Restoration specifications are presented for Mr. Reinke to implement in order to satisfy expected requirements for a Corps permit, and a CDFG Streambed Alteration Agreement.

A delineation of jurisdictional waters of the U.S. (including wetlands), expected to be directly or indirectly affected by the project, was conducted by David Magney Environmental Consulting (DMEC) to determine the presence and extent of waters of the U.S., including wetlands, existing in the vicinity of the proposed development (DMEC 2000a). The total area of jurisdictional waters of the U.S., including wetlands, within the project site and adjacent upstream areas, is approximately 1.29 acres. The initial activities have resulted unavoidable impacts to 0.96 acres of waters of the United States, including wetlands, most of which was comprised of Mulefat Scrub, and proposed construction activities will further result in unavoidable impacts to approximately 0.23 acre of waters/wetlands. The Corps verified the wetland delineation performed by DMEC.

The approach presented herein involves the restoration of physical, chemical, and biological attributes and processes to the impacted waters of the U.S., including wetlands, on the Reinke property. The overall mitigation objective is to have no net loss of wetland extent or function resulting from project implementation. This project will restore natural channel morphology and native plant communities and, therefore, will restore the entire suite of riparian ecosystem functions to the Reinke property.

SECTION I. INTRODUCTION

BACKGROUND

Rudy Reinke has obtained approvals from the County of Ventura to build a single-family residence at the corner of Rimrock Road and Rolling Oaks Drive, near Thousand Oaks. As part of the development, the Mr. Reinke must install a septic system leach field, which Ventura County requires to be protected from floods. To accommodate this requirement, Mr. Reinke excavated a channel to direct surface flows to the western edge of the property, excavated sediment to allow water to pass freely through two culverts under an old road bed, and removed native riparian vegetation from the low-laying areas of the property.

These excavation and vegetation removal actions were performed without the benefit of necessary permits from the Corps, LARWQCB, or CDFG. As a result, Mr. Reinke was found to be in violation of Section 404 of the Federal Clean Water Act and Section 1603 of the California Fish and Game Code, and thus, was issued a notice of violation by the Corps on 2 August 2000. Currently, Mr. Reinke is applying, after-the-fact, for the necessary Corps and CDFG permits to perform excavation, vegetation removal, and the consequent mitigation activities on the property. Additionally, Mr. Reinke is applying for Corps and CDFG authorization to complete his single-family residence since the complete project, as planned, will result in some additional unavoidable impacts to waters of the U.S., including wetlands.

PROJECT PURPOSE AND SCOPE

The purpose of this report is to detail measures that Mr. Reinke will take to mitigate for impacts to ecosystem function that have resulted and will result from his development activities. The proposed approach to mitigation is restoration, and this report provides a specific approach and specifications that Mr. Reinke will implement to satisfy expected requirements for a permit from the Corps pursuant to Section 404 of the Clean Water Act, and a Streambed Alteration Agreement from the CDFG pursuant to Section 1603 of the California Fish and Game Code.

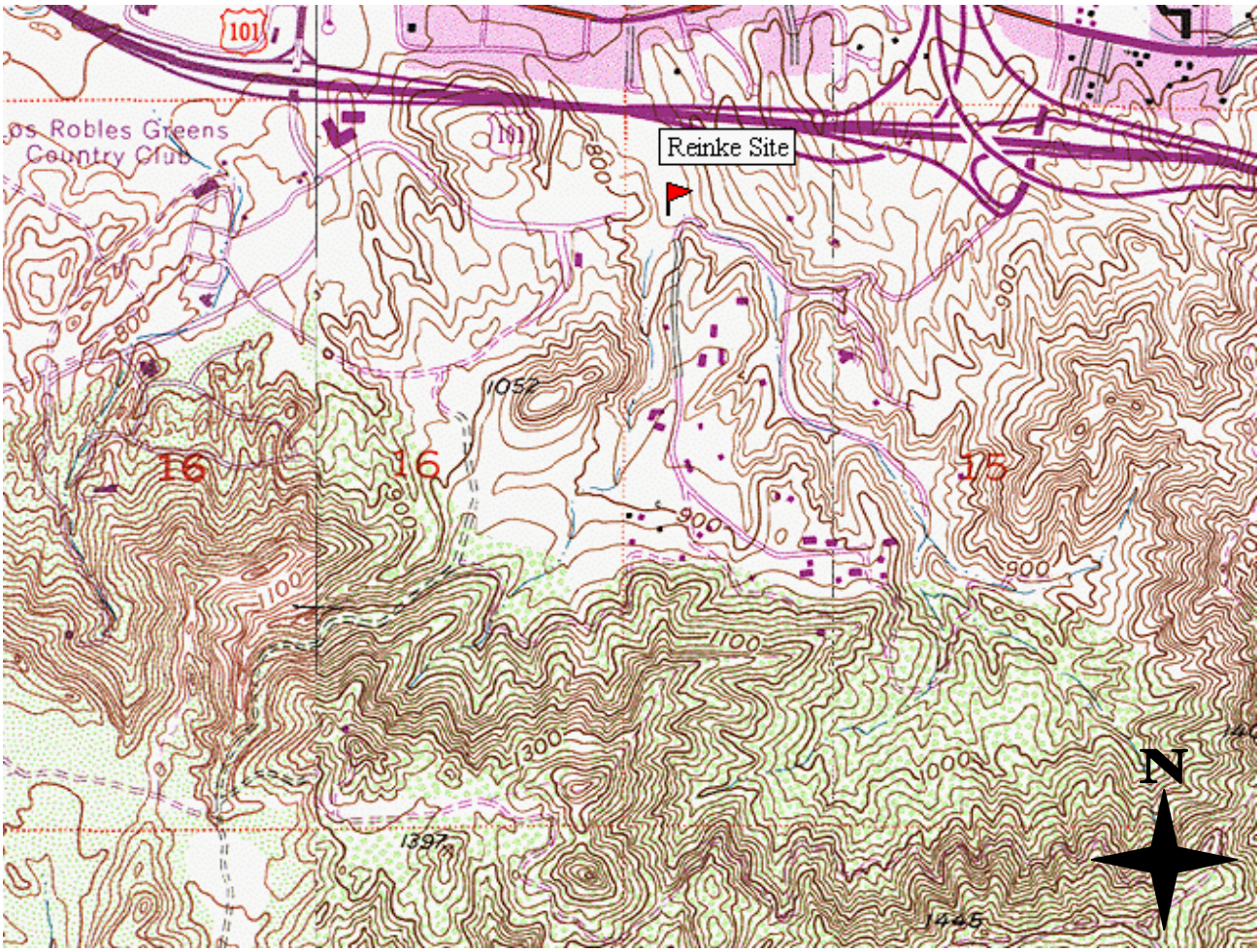
The restoration plan will incorporate the property's ability to naturally revegetate, with revegetation efforts focused primarily on areas where natural recolonization will take longer. Restoration of the project site will consist of strategies that include three basic components:

- Recontouring selected portions of the property;
- Planting selected portions with suitable native plant species to provide erosion control and to reestablish wildlife habitat; and
- Facilitating natural regeneration of the impact sites with native wetland/riparian plantings.

PROJECT LOCATION

The Reinke property is located in the Conejo Valley, at the southern edge of the City of Thousand Oaks in Ventura County, at the northeast corner of Rimrock Road and Rolling Oaks Drive, just south of U.S. 101, and west of Rancho Road (Figure 1, General Location Map). As shown in Figure 1, an unnamed tributary to Arroyo Conejo drains the property area to be developed. The stream flows directly north of the property's south edge, with two branches converging at the southwest corner of the property (Figure 2, Aerial Photograph of the Project Site). The property is approximately 3 acres in size.

Figure 1. General Location Map



Scale 1:15,840 USGS 7½-minute Thousand Oaks, California Quadrangle

Figure 2. Aerial Photograph of the Project Site

SECTION II. EXISTING CONDITIONS

HYDROLOGY AND GEOMORPHOLOGY

WATERSHED CHARACTERISTICS

The Calleguas Creek Watershed can be grouped into four primary subwatersheds that vary in physiography, land use, and discharge characteristics (Table 1, Primary Subwatersheds in the Calleguas Creek Watershed). The Reinke property is located in the upper Arroyo Conejo Subwatershed. Therefore, the project stream is tributary to Arroyo Conejo, which, in turn, is tributary to Calleguas Creek which discharges to Mugu Lagoon and the Pacific Ocean.

Table 1. Primary Subwatersheds in the Calleguas Creek Watershed

Subwatershed	Area (sq mi)	Primary Drainages
Calleguas Creek	218.0	Arroyo Simi, Arroyo Las Posas, Arroyo Santa Rosa, Conejo Creek, Calleguas Creek
Arroyo Conejo	45.7	Arroyo Conejo
Revolon Slough	59.4	Beardsley Wash, Revolon Slough
SW Oxnard Plain	20.6	Surface and shallow subsurface drainage to Mugu Lagoon and the Pacific Ocean

The Calleguas Creek Subwatershed is approximately 218 square miles, draining the Simi Valley, Moorpark, Somis, eastern Camarillo, and eastern Oxnard Plain areas. The Arroyo Conejo Subwatershed is substantially smaller, comprising approximately 45.7 square miles and draining the Thousand Oaks area. However, gage records indicate that most of the Calleguas Creek flood flows, as measured at Lewis Road, come from the Arroyo Conejo Subwatershed. The gage on Calleguas Creek at CSU Channel Islands measures discharge for a watershed area of 248 square miles and includes the 64.2 square miles measured by the gage on Conejo Creek above U.S. 101. Note that much of the discharge, measured by the gage on Calleguas Creek at CSU Channel Islands, can be accounted for by discharge measured by the gage on Conejo Creek above U.S. 101 (Figure 3, Flood Frequency from the Annual Maximum Series at Four Locations in the Calleguas Creek Watershed and Figure 4, Flow Duration Curve from Average Daily Discharge at Calleguas Creek at CSU Channel Islands [1969-1982] and Conejo Creek above U.S. 101 [1973-1983]). The Calleguas Creek Subwatershed has large areas of undeveloped upper watershed and large groundwater recharge zones in broad, alluvial valleys (Izbicki and Martin 1997). The Arroyo Conejo Subwatershed is largely developed and lacks the broad alluvial valleys that provide floodplain storage and groundwater recharge. These characteristics may contribute to the observed discharge patterns.

Figure 3. Flood Frequency from the Annual Maximum Series at Four Locations in the Calleguas Creek Watershed

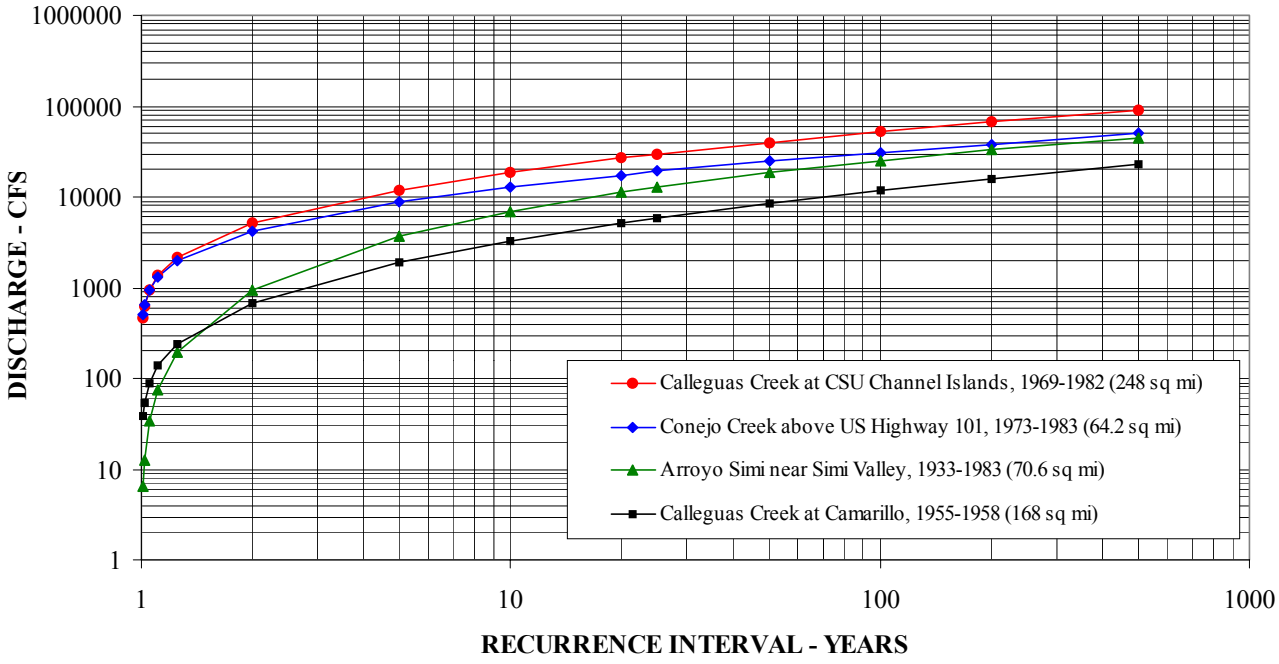
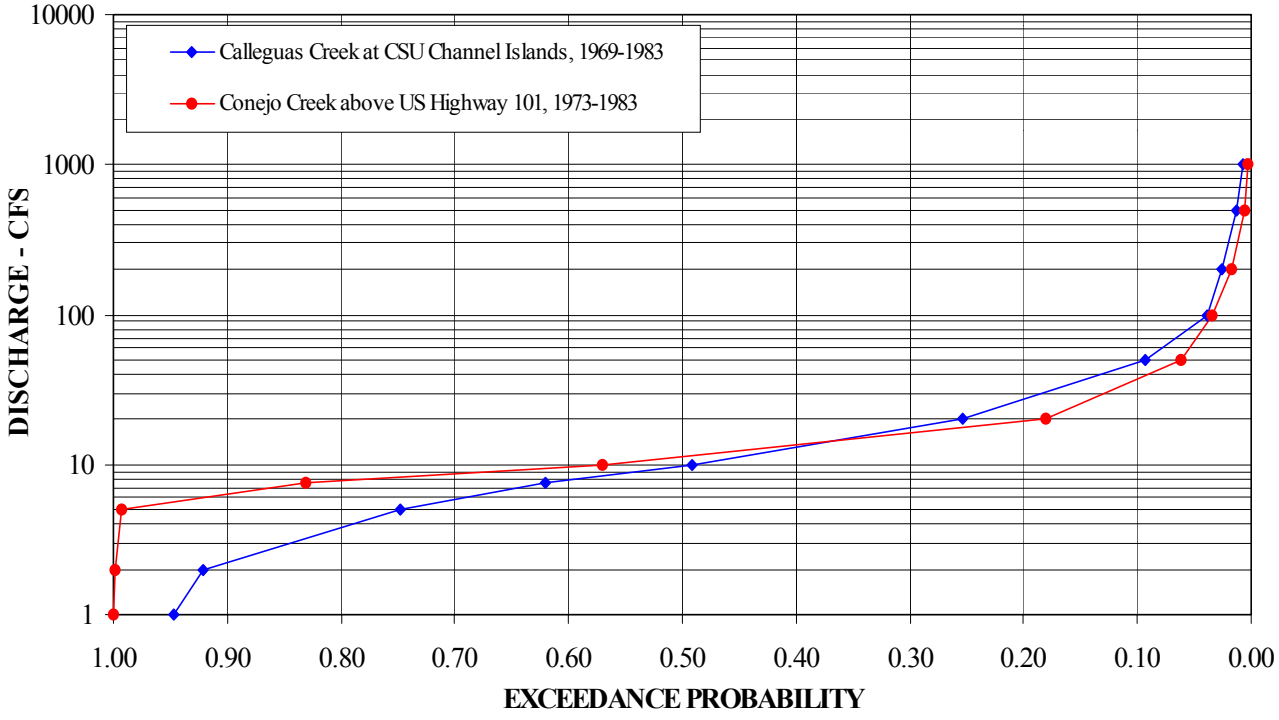


Figure 4. Flow Duration Curve from Average Daily Discharge at Calleguas Creek at CSU Channel Islands (1969-1982) and Conejo Creek above U.S. 101 (1973-1983)



The predominant land uses, up gradient of and adjacent to this stream type in the Calleguas Creek Watershed, include: open space, citrus or avocado orchards, and low-density residential and commercial development. However, intensified low to high-density residential/commercial development of these areas is an important recent trend (DMEC 2000b). This general statement fairly characterizes the Reinke property, too. In 1990, land use in the area contributing to the property was predominantly open space. By 2010, however, projections indicate that the area contributing to the property will be under urban land uses. Nevertheless, the watershed is not considered to be a priority subwatershed for sediment control treatment at this time (USDA-NRCS 1995).

SITE CHARACTERISTICS

The Reinke property includes the confluence of the two main streams that drain a 0.54 square mile subwatershed. The two streams flow along the south property boundary, one entering from the south and the other entering from the east. Under the current, post-graded conditions, the two streams meet just north of the south property boundary and flow north by northwest near the west property boundary. Just north of the north property boundary, the stream flows under an earthen roadbed through three 24-inch corrugated metal pipes (see Figure 2).

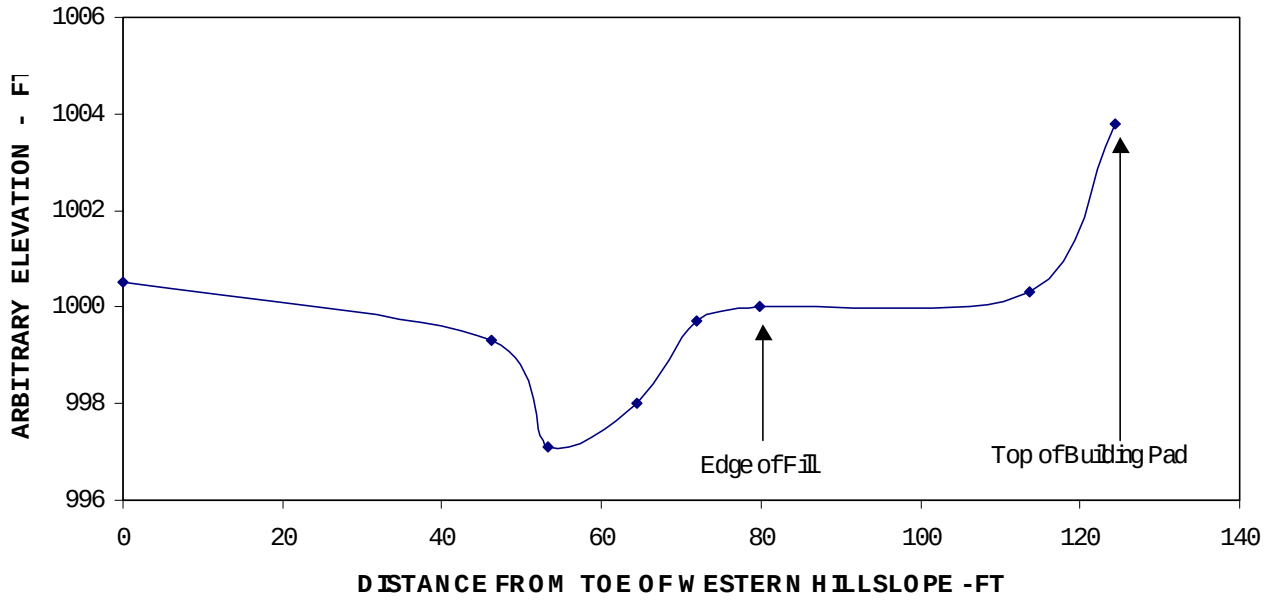
The Reinke property stream is typical of streams on alluvial fans in the Calleguas Creek Watershed. Streams on alluvial fans in the Calleguas Creek Watershed typically are Strahler Stream Order 2-4 (1:24,000) with watershed areas that range from less than 1 to 50 square miles (DMEC 2000b). Comparatively, the Reinke property stream is Strahler Stream Order 2 (1:24,000) with a watershed area of 0.54 square miles. Thus, the Reinke property stream is a small example of this stream type.

The Reinke property stream is relatively unconfined by local relief, even though the property is inset in a dissected alluvial fan. Under the current graded condition, the Reinke property stream has a width of 25.7 feet, a mean depth of 1.22 feet, and a slope of 0.012 (i.e. 1.2 percent) (Table 2, Existing Channel Morphology on 1 August 2000; Figure 5, Cross-Section of the Reinke Property Stream in the Existing, Post-Graded Condition on 1 August 2000).

Table 2. Existing Channel Morphology on 1 August 2000

Parameter	Measured Value
Width (ft)	25.7
Mean Depth (ft)	1.22
Cross-Sectional Area (sq ft)	31.35
Width:Graded Depth	21
Bank Height (ft)	1.7
Wetted Perimeter (ft)	26.1
Hydraulic Radius (ft)	1.2
Bed Slope	0.012
Valley Slope	0.012
Sinuosity (Channel Length/Valley Length)	1.0
Belt Width (ft)	124.4
Meander Width Ratio (Belt Width/Channel Width)	4.8

Figure 5. Cross-Section of the Reinke Property Stream in the Existing, Post-Graded Condition on 1 August 2000



The sinuosity – defined as the stream length divided by the valley length – is 1.0 throughout much of the site since the stream was straightened during grading activities (Figure 6, Plan View of the Reinke Property Stream in the Existing, Post-Graded Condition on 1 August 2000). Flows are ephemeral to seasonal. The specific stream power is low to moderate, although locally high specific stream powers occur during extremely high flows.

The channel substrate is typical of recently graded channels. The particle size distribution analyses show that there are abundant fines intermixed with coarse deposits. The D_{16}, D_{50}, and D_{84} are the particle sizes that are greater than or equal to 16, 50, and 84 percent of the particles, respectively. The D_{50} is the most commonly reported number. The D_{16} often is reported to gage the size of the fine particles that can clog interstitial spaces, while the D_{84} often is reported to gage the size of the largest particles that can have a substantial effect on flow resistance. The D_{16} and D_{50} on the Reinke property stream are 1 mm and 2 mm, respectively, while the D_{84} is 32 mm.

This distribution is caused by a strong bimodal distribution with one mode at less than 2 mm and another mode at greater than 23 mm to 32 mm (Figure 7, Cumulative Particle Size Distribution Function for the Reinke Property Stream in the Existing, Post-Graded Condition on 1 August 2000). This distribution results in an uncharacteristic "flat" cumulative particle size distribution function. Typical particle size distributions are not so strongly bimodal, resulting in the more typically observed "s-shaped" cumulative particle size distribution functions (Figure 8, Cumulative Particle Size Distribution Function for the Ventura River near Oak View under Undisturbed Conditions).

Surface water recharge to unconfined aquifers is a function of three parameters:

a) the amount of surface water that is not lost to evapotranspiration or runoff;

b) the vertical hydraulic conductivity of the recharge zone; and

c) the transmissivity and the potentiometric gradient of the unconfined aquifer which determines the rate at which the recharge zone is evacuated of recently recharged water. Surface water recharge to confined aquifers occurs as a function of these same three parameters in locations where confining layers are absent (e.g. at outcrops)(Fetter 1994).

The Reinke property is located on an alluvial fan at the edge of the Thousand Oaks Groundwater Basin, a small groundwater basin that, apparently, is poorly studied and relatively undeveloped (Bookman-Edmonston Engineering, Inc. 1998). Typically, alluvial fans are excellent recharge zones, since coarse-grained alluvial and colluvial deposits are abundant and may form upper outcrops of confined aquifers. Thus, the Reinke property could contribute to groundwater recharge in the Thousand Oaks Groundwater Basin. However, streams tend to be most closely linked to shallow semiperched and unconfined aquifers, particularly in near channel areas. These aquifers are recharged by precipitation, stream runoff, irrigation return flows, and urban water runoff so water quality is poor and there is little groundwater development.

Figure 6. Plan View of the Reinke Property Stream in the Existing, Post-Graded Condition on 1 August 2000

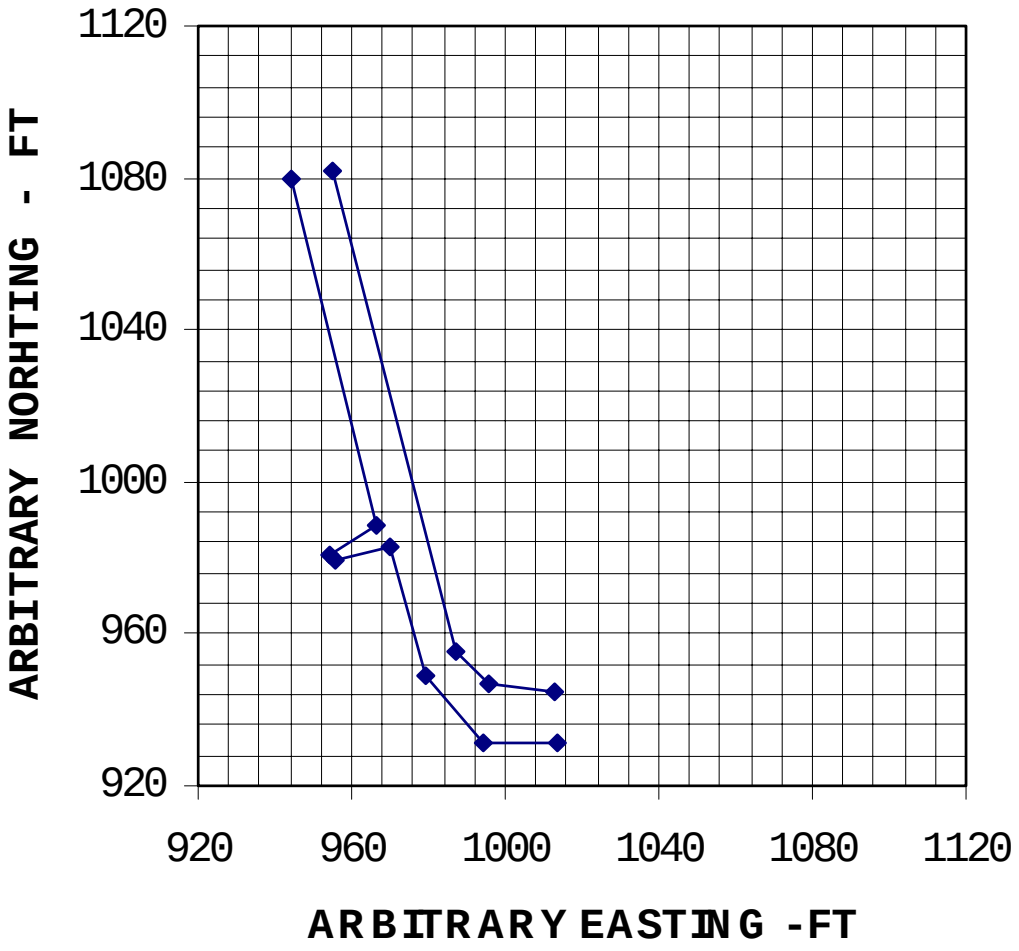


Figure 7. Cumulative Particle Size Distribution Function for the Reinke Property Stream in the Existing, Post-Graded Condition on 1 August 2000

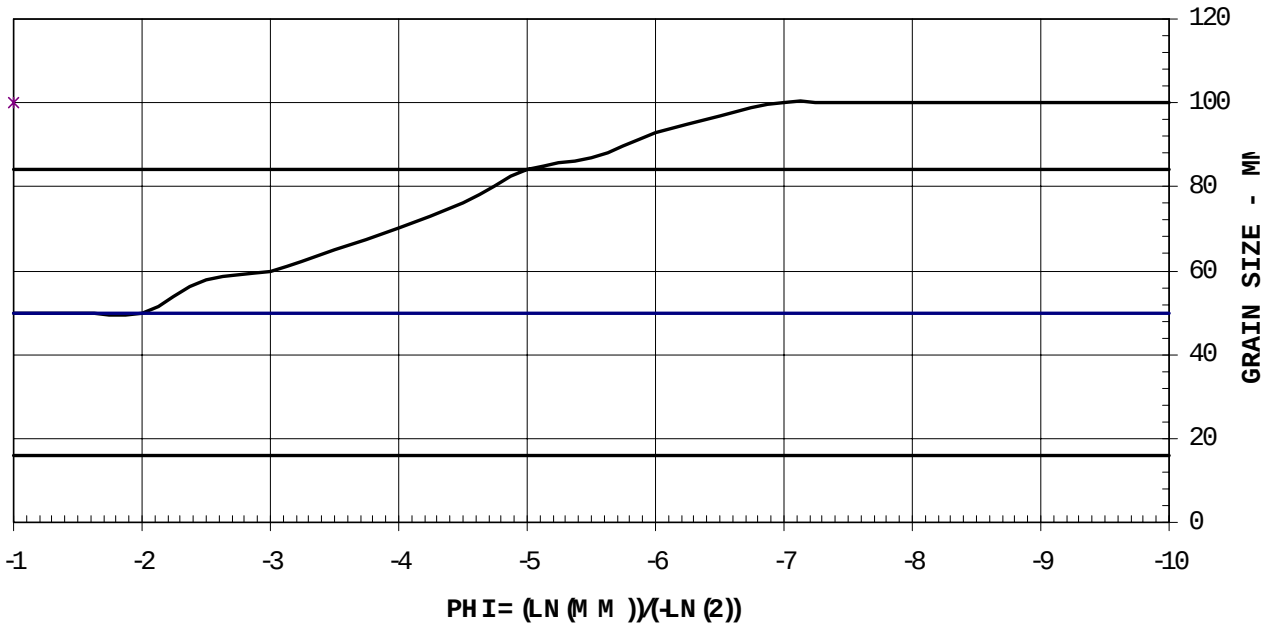
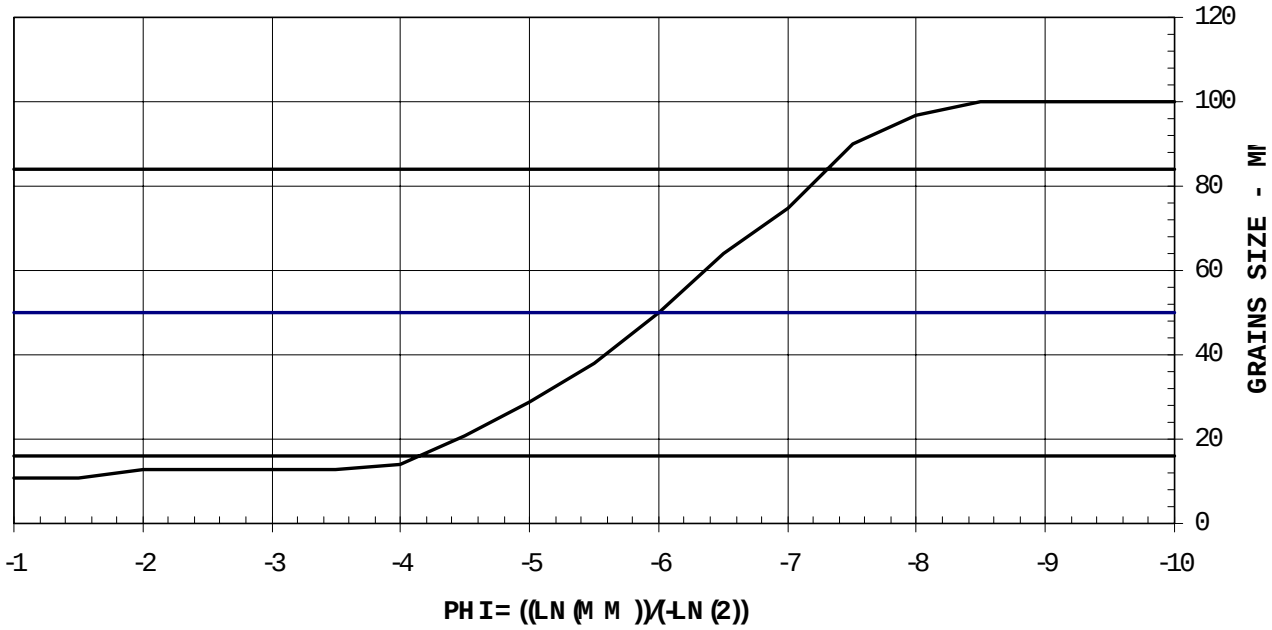


Figure 8. Cumulative Particle Size Distribution Function for the Ventura River near Oak View under Undisturbed Conditions



SOILS

The Soil Conservation Service (SCS, now the Natural Resource Conservation Service) Soil Survey for the Ventura Area (Edwards et al. 1970) mapped the property soils, including the unnamed tributary to Arroyo Conejo, as Cropley clay, 2-9 percent slopes, and Riverwash map units. The field investigations onsite confirmed both Cropley clay and Riverwash. These soils, and their inclusions, are described briefly below.

CROPLY SERIES

Cropley Series consists of well-drained clays that are very hard, firm, sticky, and plastic to 60 or more inches deep, overlaying sedimentary rocks. Cropley Series includes gently sloping to moderately sloping soils of alluvial fans and plains. For Cropley clay, 2-9 percent slopes, surface runoff is slow to medium and the erosion hazard is slight to moderate. The surface layer is very dark gray, neutral, and mildly alkaline by stratified, very dark grayish-brown, strongly calcareous clay, silty clay loam, and silt loam (Edwards et al. 1970). Field investigations revealed the presence of three inclusions: Rincon silty clay loam, Salinas clay loam, and Sorrento clay loam. All are recognized inclusions of Cropley clay.

Rincon Series consists of well-drained silty clay loams that are very hard, firm, sticky, and plastic. These soils have a sandy clay subsoil, which does not restrict root development, and inherent fertility is high. Rincon silty clay loam, 2 to 9 percent slopes, is a gently sloping to moderately sloping soil of the old alluvial fans and terraces, in material weathered from sedimentary rocks. Surface runoff is medium, permeability is slow, and the erosion hazard is slight to moderate. The surface layer is dark gray, slightly acid silty clay loam, about 16 inches thick. The subsoil is dark grayish-brown and brown, neutral to moderately alkaline sandy clay and sandy clay loam, about 24 inches thick (calcareous in the lower part). At 40 inches, this soil is stratified, yellowish-brown, calcareous sandy clay loam and sandy loam (Edwards et al. 1970).

Salinas Series consists of well-drained clay loams that are very hard, firm, sticky, and plastic to 60 or more inches deep. These soils formed on alluvial fans and plains, in alluvium derived from sedimentary rocks. Salinas clay loam, 0 to 2 percent slopes, is nearly level or level soil. Surface runoff is slow, permeability is moderately slow, and no erosion hazard exists. The surface layer is dark gray, neutral clay loam, about 26 inches thick. Below this stratum is dark gray through yellowish-brown and light yellowish-brown, calcareous clay loam and silt loam, which extends to a depth of more than 60 inches (Edwards et at.1970).

Sorrento Series, Heavy Variant, is a well-drained clay loam up to 60 inches deep. These soils formed on alluvial fans and plains, in alluvium derived predominantly from sedimentary rocks. Sorrento clay loam, heavy variant, 2 to 9 percent slopes, is a gently sloping to moderately sloping soil. Surface runoff is medium, permeability is slow, and erosion hazard is slight. The surface layer is dark grayish-brown, slightly acid clay loam about 14 inches thick. The next layer is dark grayish-brown, neutral heavy clay loam about 16 inches thick. Below this stratum at about 30 inches deep is brown, moderately alkaline heavy clay loam, which extends to a depth of more than 60 inches (Edwards et al. 1970).

RIVERWASH

Riverwash typically consists of highly stratified, water-deposited layers of stony and gravely sand that contains relatively small amounts of silt and clay. Riverwash is frequently inundated during and immediately following storms and is subject to scouring and deposition, and essentially unvegetated (Edwards et al. 1970).

VEGETATION AND HABITAT

This section presents the property area flora, determined by the floristic surveys, and describes the primary wildlife habitats classified from the data collected during site observation.

The various combinations, of certain flora species of an area, form the unique plant associations and wildlife habitats contributing to the landscape of an area. The Reinke property contains a relatively diverse flora consisting of at least 103 vascular plants, 56 (54%) of which are native species. Twenty-one (21) species have a wetland indicator status of FAC, seven (7) species are listed as FACW, and four (4) species are listed as OBL (Reed 1988) (see footnote 2 for wetland indicator status definitions). All vascular plant species, identified and recorded during the wetland delineation (DMEC 2000a) and subsequent field surveys, are listed in Table 3, Vascular Plant Species Observed at the Reinke Property. Table 3, which is alphabetized by scientific (botanical) name (according to Hickman 1993), provides a common name, growth habit, wetland indicator status according to Reed (1988), and botanical family name for each vascular plant species.

Table 3. Vascular Plant Species Observed at the Reinke Property

Scientific Name[1]	Common Name	Habit	Wetland Indicator Status[2]	Family
Achyracheana mollis	Blow Wives	AH	FAC*	Asteraceae
*Amaranthus albus**	White Amaranth	AH	FACU	Amaranthaceae
Ambrosia psilostachya	Western Ragweed	PH	FAC	Asteraceae
Amsinckia menziesii var. intermedia	Ranchers Fire	AH	.	Boraginaceae
*Anagallis arvensis**	Scarlet Pimpernel	AH	FAC	Primulaceae
Antirrhinum kelloggii	Kellogg Snapdragon	AV	.	Scrophulariaceae
*Aptenia cordifolia**	Apple Red Iceplant	S	(FACW)	Aizoaceae

[1] * = introduced/nonnative plant species.

[2] Wetland Indicator Status code definitions according to Reed (1988):
OBL = obligate wetland species, occurs almost always in wetlands (>99% probability).
FACW = facultative wetland species, usually found in wetlands (67-99% probability).
FAC = facultative species, equally likely to occur in wetlands or nonwetlands (34-66% probability).
FACU = facultative upland species, usually found in nonwetlands (67-99% probability).
+ or - symbols are modifiers that indicate greater or lesser affinity for wetland habitats.
NI = no indicator has been assigned due to a lack of information to determine indicator status.
* = a tentative assignment to that indicator status by Reed (1988).
Parentheses around a status indicates a wetland status as suggested by David L. Magney based on extensive field observations.

Scientific Name[1]	Common Name	Habit	Wetland Indicator Status[2]	Family
Artemisia californica	California Sagebrush	S	.	Asteraceae
Artemisia douglasiana	Mugwort	PH	FACW	Asteraceae
Asclepias fascicularis	Narrowleaf Milkweed	PH	FAC	Asclepiadaceae
*Avena barbata**	Slender Wild Oat	AG	.	Poaceae
Baccharis pilularis	Coyote Brush	S	.	Asteraceae
Baccharis salicifolia	Mulefat	S	FACW	Asteraceae
Bloomeria crocea	Golden Stars	PH	.	Alliaceae
*Brassica nigra**	Black Mustard	AH	.	Brassicaceae
Brassica rapa ssp. *sylvestris**	Field Mustard	AH	.	Brassicaceae
Brickellia californica	California Brickellbush	S	FACU	Asteraceae
*Bromus diandrus**	Ripgut Brome	AG	(FACU)	Poaceae
*Bromus hordeaceus**	Soft Chess	AG	FACU-	Poaceae
Bromus madritensis var. *madritensis**	Mediterranean Brome	AG	.	Poaceae
Bromus madritensis var. *rubens**	Red Brome	AG	NI	Poaceae
Calandrinia ciliata	Redmaids	AH	FACU*	Portulacaceae
Calochortus catalinae	Catalina Mariposa Lily	PH	.	Liliaceae
Camissonia bistorta	California Sun-cup	AH	.	Onagraceae
*Carduus pycnocephalus**	Italian Thistle	AH	.	Asteraceae
Castilleja exserta ssp. *exserta*	Purple Owl's-clover	AH	.	Scrophulariaceae
*Centaurea melitensis**	Tocalote	AH	.	Asteraceae
*Chamaesyce prostrata**	Prostrate Spurge	AH	.	Euphorbiaceae
*Chenopodium ambrosioides**	Mexican Tea	PH	FAC	Chenopodiaceae
Chenopodium berlandieri	Goosefoot	AH	.	Chenopodiaceae
Chlorogalum pomeridianum	Soap Plant	PH	.	Liliaceae
Clarkia purpurea ssp. *quadrivulnera*	Purple Farewell-to-Spring	AH	.	Onagraceae
Claytonia perfoliata	Miners Lettuce	AH	FAC	Portulacaceae
*Convolvulus arvensis**	Bindweed	PV	.	Convolvulaceae
Conyza canadensis	Common Horseweed	AH	FAC	Asteraceae

Scientific Name[1]	Common Name	Habit	Wetland Indicator Status[2]	Family
Eucrypta chrysanthemifolia	Common Eucrypta	AH	.	Hydrophyllaceae
*Foeniculum vulgare**	Sweet Fennel	PH	FACU	Apiaceae
Galium angustifolium ssp. *angustifolium*	Bedstraw	S	.	Rubiaceae
Galium aparine	Goose Grass	AH	FACU	Rubiaceae
Gnaphalium californicum	California Everlasting	AH	.	Asteraceae
Gnaphalium leucophyllum	White Everlasting	AH	(FAC)	Asteraceae
Hemizonia fasciculata	Fascicled Tarplant	AH	.	Asteraceae
Heterotheca grandiflora	Telegraph Weed	BH	.	Asteraceae
Hordeum murinum ssp. *leporinum**	Hair Barley	AG	NI	Poaceae
*Lactuca serriola**	Prickly Wild Lettuce	AH	FAC	Asteraceae
*Lamium amplexicaule**	Henbit	AH	.	Lamiaceae
Lessingia filaginifolia	Cudweed-aster	PH	.	Asteraceae
*Lolium multiflorum**	Italian Ryegrass	PG	FAC	Poaceae
*Lolium perenne**	Perennial Ryegrass	PG	FAC*	Poaceae
Lotus scoparius	Deerweed	S	.	Fabaceae
*Malva parviflora**	Cheeseweed	AH	.	Malvaceae
*Marrubium vulgare**	White Horehound	PH	FAC	Lamiaceae
*Medicago polymorpha**	Bur-clover	AH	(FACU-)	Fabaceae
*Melilotus indica**	Sourclover	AH	FAC	Fabaceae
Mimulus guttatus	Streamside Monkeyflower	AH	OBL	Scrophulariaceae
Mirabilis californica	California Wishbone Bush	S	.	Nyctaginaceae
Nassella pulchra	Purple Needlegrass	PG	.	Poaceae
*Nicotiana glauca**	Tree Tobacco	S	FAC	Solanaceae
*Olea europea**	European Olive	T	.	Oleaceae
Opuntia littoralis	Coastal Prickly Pear	S	.	Cactaceae
Opuntia prolifera	Coastal Cholla	S	.	Cactaceae
Phacelia cicutaria var. hispida	Hispid Caterpillar Phacelia	AH	.	Hydrophyllaceae
*Phalaris canariensis**	Canary Grass	AG	FACU	Poaceae
Pholistoma menziesii	Fiesta Flower	AH	.	Hydrophyllaceae
*Picris echioides**	Bristly Ox-tongue	AH	FAC*	Asteraceae
*Piptatherum miliaceum**	Smilo Grass	PG	(FACU)	Poaceae
*Plantago major**	Broadleaf Plantain	PH	FACW-	Plantaginaceae
Polycarpon tetraphyllum	Four-leaved Allseed	AH	.	Caryophyllaceae
*Polygonum arenastrum**	Doorweed	AH	FAC	Polygonaceae
*Portulaca oleraceus**	Common Purslane	AH	FAC	Portulacaceae
Psilocarphus brevissimus var. *brevissimus*	Woolly Marbles	AH	OBL	Asteraceae

Scientific Name[1]	Common Name	Habit	Wetland Indicator Status[2]	Family
Quercus agrifolia	Coast Live Oak	T	(FACU)	Fagaceae
Quercus lobata	Valley Oak	T	FAC	Fagaceae
*Raphanus sativus**	Wild Radish	AH	.	Brassicaceae
Rhamnus ilicifolia	Hollyleaf Redberry	S	.	Rhamnaceae
*Ricinus communis**	Castor Bean	S	FACU	Euphorbiaceae
*Rumex crispus**	Curly Dock	PH	FACW-	Polygonaceae
Rumex salicifolius	Willow Dock	PH	OBL	Polygonaceae
*Schinus molle**	Peruvian Pepper Tree	S	.	Anacardiaceae
*Senecio vulgaris**	Common Groundsel	AH	NI*	Asteraceae
*Silene gallica**	Windmill Pink	AH	.	Caryophyllaceae
*Silybum marianum**	Milk Thistle	AH	.	Asteraceae
*Sisymbrium irio**	London Rocket	AH	.	Brassicaceae
Solanum xantii	Chaparral Nightshade	S	.	Solanaceae
*Sonchus asper**	Prickly Sow-thistle	AH	FAC	Asteraceae
*Sonchus oleraceus**	Common Sow-thistle	AH	NI*	Asteraceae
Stellaria nitens	Shining Chickweed	AH	.	Primulaceae
Toxicodendron diversilobum	Poison Oak	S/V	.	Anacardiaceae
*Tribulus terrestris**	Puncture Vine	AH	.	Zygophyllaceae
*Urtica urens**	Dwarf Nettle	AH	(FACU)	Urticaceae
Verbena lasiostachys	Western Verbena	PH	FAC-	Verbenaceae
Veronica americana	American Brooklime	AH	OBL	Scrophulariaceae
*Vulpia bromoides**	Slender Fescue	AG	FACW	Poaceae
*Vulpia myuros**	Rattail Fescue	AG	FACU*	Poaceae
Xanthium strumarium	Cocklebur	AH	FAC	Asteraceae

Three upland plant communities and one wetland plant community currently exist - or existed prior to the recent disturbance - in the immediate vicinity of the proposed development site:

- California Annual Grassland-Scrub;
- Purple Needlegrass Grassland;
- Coastal Sage Scrub (Coast Prickly-pear Scrub, California Sagebrush Scrub, and Rock Outcrop); and
- Mulefat Scrub (wetland habitat).

Prior to disturbance, the Mulefat Scrub plant community predominated in a wetland that is jurisdictional pursuant to U.S. Federal and State of California rules and regulations. The Mulefat Scrub plant community was once well-established; however, the recent grading activities have converted the Mulefat Scrub to successional California Annual Grassland, which has a significant ground cover with several successional hydrophytic herbs and scattered successional shrubs.

UPLAND VEGETATION TYPES

The upland vegetation occurring immediately adjacent to the drainages in the vicinity of the development area consist of California Annual Grassland, Purple Needlegrass Grassland, and Coastal Sage Scrub. These plant communities are described below, and each description includes dominant and associate species found onsite, habitat/species ecological requirements, and/or environmental adaptations.

California Annual Grassland

California Annual Grassland occupies a substantial portion of the property. California Annual Grassland can occur on all aspects on most geomorphic features where soils are deep, particularly where slopes are gradual, at elevations between sea level and 1,200 meters (Sawyer and Keeler-Wolf 1995). California Annual Grassland is dominated by naturalized annual grasses (primarily of Mediterranean origin).

The predominant annual grass species found onsite include: *Avena barbata* (Slender Wild Oat), *Bromus* spp. (Ripgut Grass, Soft Chess, Mediterranean Brome, and Red Brome), *Hordeum murinum* ssp. *leporinum* (Hair Barley), and *Vulpia* spp. (Slender Fescue and Rattail Fescue). The perennial grasses found contributing to California Annual Grassland onsite include: *Lolium multiflorum* (Italian Ryegrass), *Nassella pulchra* (Purple Needlegrass), *Phalaris canariensis* (Canary Grass), and *Piptatherum miliaceum* (Smilo Grass).

Several native annual herbs and scattered conspicuous wildflowers were observed contributing to the California Annual Grassland onsite, including: *Amsinckia menziesii* var. *intermedia* (Ranchers Fire), *Calandrinia ciliata* (Redmaids), *Camissonia bistorta* (California Sun-cup), *Castilleja exserta* ssp. *exserta* (Purple Owls Clover), *Clarkia purpurea* ssp. *quadrivulnera* (Purple Farewell-to-Spring), *Conyza canadensis* (Common Horseweed), *Eremocarpus setigerus* (Dove Weed), *Eschscholzia californica* (California Poppy), *Eucrypta chrysanthemifolia* (Eucrypta), *Gnaphalium* spp. (Green Everlasting, White Everlasting), *Hemizonia fasciculata* (Fascicled Tarplant), *Heterotheca grandiflora* (Telegraph Weed), *Phacelia cicutaria* (Caterpillar Phacelia), and *Pholistoma menziesii* (Fiesta Flower).

The common native perennial herbs scattered within this grassland type include: *Ambrosia psilostachya* var. *californica* (Western Ragweed), *Asclepias fascicularis* (Narrowleaf Milkweed), *Bloomeria crocea* (Goldenstars), *Calochortus catalinae* (Catalina Mariposa Lily [a rare species]), *Chlorogalum pomeridianum* (Soap Plant), *Dichelostemma capitatum* (Blue Dicks), *Lessingia filaginifolia* (Cudweed-aster), and *Verbena lasiostachys* (Western Verbena).

The nonnative and often invasive or ruderal inhabitants scattered throughout the annual grassland onsite includes: *Anagallis arvensis* (Scarlet Pimpernel), *Brassica* spp. (mustards), *Carduus pycnocephalus* (Italian Thistle), *Centaurea melitensis* (Tocalote), *Convolvulus arvensis* (Bindweed), *Erodium cicutarium* (Redstem Filaree), *Foeniculum vulgare* (Sweet Fennel), *Lactuca serriola* (Prickly Wild Lettuce), *Malva parviflora* (Cheeseweed), *Marrubium vulgare* (White Horehound), *Medicago polymorpha* (Bur-clover), *Melilotus indica* (Sourclover), *Picris echioides* (Prickly Ox-

tongue), *Raphanus sativus* (Wild Radish), *Silybum marianum* (Milk Thistle), *Sonchus* spp. (sow-thistles), and *Tribulus terrestris* (Puncture Vine).

Grassland species composition may vary from stand to stand. This variation is demonstrated on the property, as the annual grassland establishing after the grading activities and within the moister areas of the property has a high percentage of herbaceous hydrophytes compared to annual grasses. This annual grassland stand is in succession towards the original wetland habitat. Conversely, portions of the more upland areas of the property, such as the northern and northeastern portion, include scattered *Quercus agrifolia* (Coast Live Oak) and *Quercus lobata* (Valley Oak). This stand consists of a higher content of typical California Annual Grassland species and includes patches of Wildflower Field (Holland 1996).

Wildflower Field is characterized by an amorphous grab bag of herb-dominated types noted for conspicuous annual wildflower displays, but dominance varies form site to site and from year to year at each particular site. Wildflower Field consists of an array of spring-flowering, native and non-native, herbs and forbs (wildflowers). Wildflower Field generally grows on fairly poor (soil) sites that are droughty and low in nutrients. It is typically associated with other grassland communities and grows as a ground layer below woodlands. Wildflower Field occurs in valleys and on foothills of the California Floristic Province, except the north coast and desert regions, up to 1,500 meters in elevation (Holland 1986).

Purple Needlegrass Grassland

Purple Needlegrass Grassland (Southern Coastal Needlegrass Grassland [Magney 1992]) is dominated by the tussock-forming, native perennial grass, *Nassella pulchra*. This grassland type grows on all topographic locations in deep, fine-textured soils that are moist during winter and very dry during summer at elevations between sea level and 1,300 meters (Sawyer and Keeler-Wolf 1995). Purple Needlegrass Series typically occurs on coastal terraces and foothills, in valleys of the Santa Ana Mountains, and in the Transverse Ranges.

Purple Needlegrass Grassland is found as small open pockets within Coastal Sage Scrub communities, such as Coast Prickly-pear Scrub, or intergrading with woodland as a ground layer. Stands of this once extensive and pristine grassland now typically include annual, introduced grass and forb species growing within the open gaps of the Purple Needlegrass ground layer. Perennial Grassland is similar to annual grassland, since annual grassland is the plant community that is largely replacing perennial grassland throughout California.

Purple Needlegrass Grassland exists on the northwestern side of the Reinke property intermixed and between the stands of Coastal Sage Scrub. The annual grass and native herb associates contributing to the Perennial Grassland ground layer are those typical of the California Annual Grassland onsite (described above).

Coastal Sage Scrub

Coastal Sage Scrub is a type of shrubland that is dominated by drought-tolerant, deciduous, low-growing shrubs and subshrubs. Coastal Sage Scrub forms various stands dominated by several

different soft-leaved and grayish-green shrub species, and forms stands with specific characteristics and site requirements; therefore, Coastal Sage Scrub is often considered as a collection of species-specific plant series.

The two Coastal Sage Scrub stands observed onsite are Coast Prickly-pear Scrub and California Sagebrush Scrub, including Rock Outcrop. These scrub types are considered sensitive, as rare plant and animal species (such as the federally threatened California Gnatcatcher [*Polioptila californica*]) typically occupy stands dominated by Coast Prickly-pear and California Sagebrush. The California Gnatcatcher is vulnerable to continual and severe habitat clearing and depletion due to spreading urbanization (Zedler et al. 1997).

Coast Prickly-pear Scrub

Coast Prickly-pear Scrub (Maritime Succulent Scrub [Holland 1986]; Southern Cactus Scrub [Magney 1992]) occurs on steep upland slopes with shallow soils, often with exposed parent material, at elevations between sea level and 1,300 meters (Sawyer and Keeler-Wolf 1995).

Coast Prickly-pear Scrub is a sensitive plant community consisting of predominantly succulent, malacophyllous (fleshy leaved or stemmed plants), and drought-tolerant, deciduous shrubs of less than 2 meters tall, and growth of these shrub types is concentrated in the spring. This scrub plant community forms an intermittent shrub canopy over a variable to sparse groundlayer of grasses or succulent herbs. Coast Prickly-pear Scrub is dominated by *Opuntia littoralis* (Coast Prickly-pear) and *Opuntia prolifera* (Coastal Cholla). Coast Prickly-pear has flat elliptic stem segments with straight long yellowish spines, while Coastal Cholla has tree-like stems of cylindrical segments with reddish- or yellowish-brown spines.

Coast Prickly-pear Scrub exists on the southeastern side of the Reinke property site, immediately up slope and north-northeast of the post-grading Mulefat Scrub habitat. The important native shrub associates contributing to this scrub community include: *Artemisia californica* (California Sagebrush), *Brickellia californica* (California Brickellbush), *Epilobium canum* (California Fuchsia), *Eriogonum fasciculatum* var. *polifolium* (California Buckwheat), *Lotus scoparius* (Deerweed), *Mirabilis californica* (California Wishbone Bush), *Nassella pulchra* (Purple Needlegrass [native perennial bunchgrass]), *Rhamnus ilicifolia* (Hollyleaf Redberry), *Solanum xantii* (Chaparral Nightshade), and *Toxicodendron diversilobum* (Poison Oak).

California Sagebrush Scrub

California Sagebrush Scrub occurs in shallow alluvial- or colluvial-derived soils, on steep south-facing slopes of infrequently flooded, low-gradient, alluvial floodplain deposits, at elevations between sea level and 1,200 meters (Sawyer and Keeler-Wolf 1995). It is dominated by *Artemisia californica*, which is a native, aromatic, slender-stemmed shrub with thread-like, soft, greenish-gray leaves, and is a typical shrub of Coastal Sage Scrub of xeric (dry) foothills, especially coastal.

California Sagebrush Scrub forms a continuous to intermittent canopy, consisting of several other characteristic Coastal Sage Scrub species as local shrub associates, growing over a variable ground

layer. Nonnative annual grasses, an occasional bunch of native perennial grass (*Nassella pulchra*), and native or introduced herbs are common in the sagebrush canopy gaps.

California Sagebrush Scrub occupies most of the western side of the Reinke property, immediately up slope and west-northwest of the post-grading Mulefat Scrub. It also occupies a northern portion of the property as small, scattered stands beneath the emergent oak trees. The scrub species observed occupying the California Sagebrush stands onsite are similar to those species listed above in the Coast Prickly-pear Scrub subsection.

Rock Outcrop

Rock outcrop is described as exposed parent material with little or no plant species present. Rock outcrop consists of large boulders and exposed bedrock, and they generally lack soil. These hard surfaces provide substrate to nonvascular plants, such as lichens and bryophytes (mosses, liverworts). Rock outcrop may consist of large and small sandstone or granite boulders, and some exposed bedrock, that is covered or partially covered with crustose (crust-like) and foliose (leaf-like) lichens. Rock Outcrop, at the Reinke property, occurs scattered throughout the dryer, south-facing, scrubby slopes.

PALUSTRINE WETLAND VEGETATION

The riparian habitat, located within the bed and banks of the Reinke property stream, had positive indicators of wetland hydrology, (standing or flowing water was present for much of the length of the creek), hydric soils (soils were saturated to the surface), and dominance by hydrophytes. A Palustrine System includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived slats is below 0.5‰ (Cowardin et al. 1979). The major habitat observed within the Palustrine System, as defined by Cowardin et al. (1979), Holland (1986), and Sawyer and Keeler-Wolf (1995), throughout the study area is Mulefat Scrub. A description of this habitat type observed within the Palustrine System is presented below.

Mulefat Scrub

Mulefat Scrub is a scrub community dominated by *Baccharis salicifolia*, which is classified as Palustrine, intermittently to infrequently flooded, broad-leaved evergreen scrub-shrub wetland (Cowardin et al. 1979). Mulefat is a native shrub or small tree that is found at elevations below 1,250 m (Hickman 1993). The National Inventory of Wetland Plants (Reed 1988) lists Mulefat with a wetland indicator status of FACW (i.e. facultative wetland species), which means that 67 to 99 percent of the observed occurrences are in jurisdictional waters of the U.S., including wetlands.

Mulefat Scrub forms a continuous scrub canopy of less than 4 m tall growing over a sparse ground layer. This habitat type requires seasonally flooded or saturated, freshwater, wetland habitats, such as canyon bottoms, irrigation ditches, and moist streamsides or channels. Mulefat often occurs in

pure stands or may mix, at a fine scale, with other wetland series. Mulefat often forms ecotonal transitions between riparian and upland scrub communities.

Prior to grading activities, the Mulefat Scrub habitat of the site occurred along the northeastern tributary to Arroyo Conejo and throughout the southern portion and low-laying areas of the property. Mulefat Scrub is (was) evident at all data points established onsite except for Data Point C1 (see DMEC 2000a Appendix), which is dominated by upland Coastal Sage Scrub. Mulefat Scrub occupies (occupied) approximately 0.96 acre within and adjacent to the drainage to the southern property line, then southward and southeast within the two tributary drainages.

The native and introduced associate species (many of them hydrophytes) observed growing within the areas once dominated by Mulefat include: annual grasses (*Avena barbata, Bromus diandrus, B. madritensis* ssp. *rubens*), Ranchers Fire (*Amsinckia menziesii* var. *intermedia*), Mugwort (*Artemisia douglasiana*), mustards (*Brassica nigra, Hirschfeldia incana*), Mexican Tea (*Chenopodium ambrosioides*), Pitseed Goosefoot (*Chenopodium berlandieri*), White Horehound (*Marrubium vulgare*), sweet-clovers (*Melilotus alba, M. indica*), Streamside Monkeyflower, (*Mimulus guttatus*), Bristly Ox-tongue (*Picris echioides*), Knotweed (*Polygonum arenastrum*), Common Purslane (*Portulaca oleraceus*), Castor Bean (*Ricinus communis*), Curly Dock (*Rumex crispus*), Common Speedwell (*Veronica anagallis-aquatica*), and Cocklebur (*Xanthium strumarium*).

SPECIAL-STATUS SPECIES

DEFINITIONS

Special-status species are plants and animals that are at least one of the following:

- *Listed as endangered* or *threatened* under the Federal or California Endangered Species Acts;
- *Listed as rare* under the California Native Plant Protection Act; or
- *Considered to be rare* (but not formally listed) by resource agencies, professional organizations (such as Audubon Society, CNPS, The Wildlife Society), and the scientific community.

Special-status species are further defined below in Table 4, Definitions of Special-status Species.

Table 4. Definitions of Special-status Species

- Plants and animals legally protected under the California and Federal Endangered Species Acts or under other regulations.
- Plants and animals considered sufficiently rare by the scientific community to qualify for such listing; or
- Plants and animals considered to be sensitive because they are unique, declining regionally or locally, or are at the extent of their natural range.

Special-status Plant Species	Special-status Animal Species
• Plants listed or proposed for listing as threatened or endangered under the Federal Endangered Species Act (50 CFR 17.12 for listed plants and various notices in Federal Register for proposed species). • Plants that are Category 1 or 2 candidates (C1 or C2) for possible future listing as threatened or endangered, or that are Federal Sensitive Species (FSS) with the potential to become threatened or endangered, under the Federal Endangered Species Act (55 CFR 6184, February 21, 1990). • Plants that meet the definitions of rare or endangered species under the CEQA (State CEQA Guidelines, Section 15380). • Plants considered by CNPS to be "rare, threatened, or endangered" in CA (Lists 1B and 2 in Skinner & Pavlik [1994]). • Plants listed by CNPS as plants needing more information, plants of limited distribution (Lists 3 & 4 in Skinner and Pavlik [1994]). • Plants listed or proposed for listing by the State of California as threatened or endangered under the California Endangered Species Act (14 CCR 670.5). • Plants listed under the California Native Plant Protection Act (California Fish and Game Code 1900 et seq.). • Plants considered sensitive by other federal agencies (i.e., U.S. Forest Service, Bureau of Land Management) or state and local agencies or jurisdictions. • Plants considered sensitive or unique by the scientific community; occurs at natural range limits (State CEQA Guidelines, Appendix G).	• Animals listed/proposed for listing as threatened/endangered under the Federal Endangered Species Act (50 CFR 17.11 for listed animals and various notices in Federal Register for proposed species). • Animals that are Category 1 or 2 candidates (C1 or C2) for possible future listing as threatened or endangered, or that are Federal Sensitive Species (FSS) with the potential to become threatened or endangered, under Federal Endangered Species Act (54 CFR 554). • Animals that meet the definitions of rare or endangered species under the CEQA (State CEQA Guidelines, Section 15380). • Animals listed or proposed for listing by the State of California as threatened and endangered under the CA Endangered Species Act (14 CCR 670.5). • Animal species of special concern to the CDFG (Remsen [1978] for birds; Williams [1986] for mammals). • Animal species fully protected in California (CA Fish & Game Code, Section 3511 [birds], 4700 [mammals], 5050 [reptiles, amphibians]).

To determine which special-status species are likely to occur at any of the riparian impact sites, a literature survey (including Skinner and Pavlik [1994]), and a search of the CDFG's Natural Diversity Database (NDDB 1999) Element Ranking system, was conducted for known occurrences in the vicinity of Carlisle Canyon.

The following subsection, Special-status Plants, provides the status, habitat requirements, distribution patterns, and survey results for the special-status species observed in the vicinity of the Reinke property. The information provided for the identified special-status species and habitat includes: scientific and common (vernacular) names; species status, including federal and state, CDFG's NDDB Element (Global and State) Ranking, and CNPS List and Rarity-Endangerment-Distribution (R-E-D) Code; physical descriptions; habitat requirements; species distribution; and survey results.

Listed species are those taxa that are formally listed as endangered or threatened by the federal government (e.g. U.S. Fish and Wildlife Service [USFWS]), pursuant to the Federal Endangered Species Act or as endangered, threatened, or rare (for plants only) by the State of California (i.e. California Fish and Game Commission), pursuant to the California Endangered Species Act or the California Native Plant Protection Act.

The CNPS's *Inventory of Rare and Endangered Vascular Plants of California* (Skinner and Pavlik 1994) categorizes rare California plants into one of five lists (1A, 1B, 2, 3, and 4) representing the five levels of status. One status code is assigned to a sensitive species to indicate its status of rarity or endangerment and distribution. A CNPS List is a more general designation than the three separate sets of information provided in a CNPS R-E-D Code (defined in Table 6). However, the CNPS List is a significant designation in terms of a species' overall status throughout all of California, and it works well in conjunction with R-E-D Code specifications. Table 5, California Native Plant Society List (CNPS List), provides a definition for each List code number.

Table 5. California Native Plant Society List (CNPS List)

CNPS List	Definition
1A	Presumed Extinct in California
1B	Rare or Endangered in California and elsewhere
2	Rare and Endangered in California, more common elsewhere
3	Need more information
4	Plants of Limited Distribution

The CNPS R-E-D Code is a three-numbered numeric ranking, which is assigned to a special-status species, consisting of one number (1, 2, or 3) for each of the three categories (Rarity-Endangerment-Distribution). Each number accurately describes the species' population levels and distribution patterns within each category. The three number-codes are described for each category in Table 6, California Native Plant Society R-E-D Code, and are specific for each category.

Table 6. California Native Plant Society R-E-D Code

Rarity (R)	
1	Rare, but found in sufficient numbers and distributed widely enough that the potential for extinction is low at this time
2	Distributed in a limited number of occurrences, occasionally more if each occurrence is small
3	Distributed in one to several highly restricted occurrences, or present in such small numbers that it is seldom reported
Endangerment (E)	
1	Not endangered
2	Endangered in a portion of its range
3	Endangered throughout its range
Distribution (D)	
1	More or less widespread outside California
2	Rare outside California
3	Endemic to California

Skinner and Pavlik 1994.

Several plant species are also considered rare or uncommon (Species of Special Concern [SSC], Forest Sensitive [FS], and Species of Local Concern [SLC]) by resource agencies and professional organizations (Audubon Society, CNPS, and The Wildlife Society). The CNPS *Inventory of Rare and Endangered Vascular Plants of California* (Skinner and Pavlik 1994) lists all rare and endangered California vascular plants, while Magney (2000) recently compiled a preliminary list of Ventura County vascular plants of local concern (Species of Local Concern) on behalf of CNPS.

The NDDB Element Ranking system provides a numeric global and state-ranking system for all special-status species tracked by the NDDB. The global rank (G-rank) is a reflection of the overall condition of an element (species or natural community) throughout its global range. The state ranking (S-rank) is assigned much the same way as the global rank, except state ranks in California often also contain a threat designation attached to the S-rank. This Element Ranking system is defined below in Table 7, Natural Diversity Data Base Element Ranking System.

As described for the NDDB ranking, not all special-status species considered in this report are tracked by CNPS, nor are R-E-D codes given to them; therefore, DMEC has applied the rules described above to "rank" those special-status species lacking such rankings or codes. This applies to rare lichen taxa that may occur onsite, for which CNPS has not yet developed or incorporated into its *Inventory of Rare and Endangered Vascular Plants of California* or developed and established by the California Lichen Society. Rarity G- and S-ranks devised for taxa of this report are followed by a "?", denoting tentative assignment.

SPECIAL-STATUS PLANTS

The literature review and database searches identified 13 special-status species of vascular plants that have the potential to occur in the vicinity of the Reinke property (NDDB 1999). Only one special-status plant species was observed onsite is *Calochortus catalinae*.

Table 8, Likelihood of Occurrence of Special-status Vascular Plants and Habitats at the Reinke Property, summarizes the literature and field survey results for special-status vascular plant species. It includes scientific names, common names, species status, habitat requirements, whether or not they were observed, and the likelihood of occurrence within the property boundaries if not directly observed.

Observed Special-status Vascular Plant Species

Calochortus catalinae (Catalina Mariposa Lily) is the only special-status plant species observed on the Reinke property prior to excavation activities.

Calochortus catalinae is a bulbiferous perennial herb with 20 to 60 cm stems (bulblet-bearing) and withering basal leaves from 10 to 30 cm. The inflorescence consists of 1 to 4 erect, bowl-shaped flowers with purple-spotted (near base) sepals (20 to 30 mm) and white, tinged lilac, purple-spotted, nearly glabrous flowers. The flowers include oblong, densely branched-hairy nectaries (not depressed) and erect, non-angled fruit (2 to 5 cm). *C. catalinae* blooms between February and May (Skinner and Pavlik 1994) and is part of the lily family (Liliaceae).

Table 7. Natural Diversity Data Base Element Ranking System

Global Ranking (G)	
G1	<6 viable elements occurrences (populations for species), OR < 1,000 individuals, OR < 809.4 hectares (ha) (2,000 acres [ac]).
G2	6 to 20 element occurrences OR 809.4 to 4,047 ha (2,000 to 10,000 ac).
G3	21 to 100 element occurrences OR 3,000 to 10,000 individuals OR 4,047 to 20,235 ha (10,000 to 50,000 ac).
G4	Apparently secure; this rank is clearly lower than G3, but factors exist to cause some concern (i.e. there is some threat, or somewhat narrow habitat).
G5	Population, or stand, demonstrably secure to ineradicable due to being commonly found in the world.
GH	All sites are **historic**; the element has not been seen for at least 20 years, but suitable habitat still exists.
GX	All sites are **extirpated;** this element is extinct in the wild.
GXC	Extinct in the wild; exists in cultivation.
G1Q	The element is very rare, but there is a taxonomic question associated with it.
Subspecies Level: Subspecies receive a **T-rank** attached to the G-rank. With the subspecies, the G-rank reflects the condition of the entire species, whereas the T-rank reflects the global situation of just the subspecies or variety. * For example: *Chorizanthe robusta* var. *hartwegii* is ranked G2T1. The G-rank refers to the whole species range (*Chorizanthe robusta*), whereas the T-rank refers only to the global condition of the variety (var. *hartwegii*).	
State Ranking (S)	
S1	Less than 6 element occurrences OR less than 1,000 individuals OR less than 809.4 ha (2,000 ac). S1.1 = very threatened S1.2 = threatened S1.3 = no current threats known
S2	6 to 20 element occurrences OR 3,000 individuals OR 809.4 to 4,047 ha (2,000 to 10,000 ac). S2.1 = very threatened S2.2 = threatened S2.3 = no current threats known.
S3	21 to 100 element occurrences OR 3,000 to 10,000 individuals OR 4,047 to 20,235 ha (10,000 to 50,000 ac). S3.1 = very threatened S3.2 = threatened S3.3 = no current threats known
S4	Apparently secure within California; this rank is clearly lower than S3 but factors exist to cause some concern (i.e., there is some threat, or somewhat narrow habitat). NO THREAT RANK.
S5	Demonstrably secure to ineradicable in California. NO THREAT RANK.
SH	All California sites are **historic**; the element has not been seen for at least 20 years, but suitable habitat still exists.
SX	All California sites are **extirpated;** this element is extinct in the wild.
Notes	
1. Other considerations used when ranking a species or natural community include the pattern of distribution of the element on the landscape, fragmentation of the population/stands, and historical extent as compared to its modern range. It is important to take an aerial view when ranking sensitive elements rather than simply counting element occurrences.	
2. Uncertainty about the rank of an element is expressed in two major ways: by expressing the rank as a range of values (e.g. S2S3 means the rank is somewhere between S2 and S3), and by adding a ? to the rank (e.g. S2?). This represents more certainty than S2S3, but less than S2. (Natural Diversity Data Base 1997.)	

Table 8. Likelihood of Occurrence of Special-status Vascular Plants at the Reinke Property

Scientific Name	Common Name	Status: Fed./State/NDDB/CNPS[1]	Preferred Habitat[2]	Likelihood of Occurrence[3]
Astragalus brauntonii	Braunton Milkvetch	E/-/G2, S2.2/1B, 3-2-3	Chap., CSS, Grassland	Possible
Calochortus catalinae	**Catalina Mariposa Lily**	-/-/-/4, 1-2-3	Chap., Cismont. Wld., CSS, Grassland	**Observed**
Calochortus plummerae	Plummer Mariposa Lily	C2/-/G3, S3.2/1B, 2-2-3	CSS, Chap., Gr., Wld.	Possible
Dudleya ambramsii ssp. *parva*	Conejo Dudleya	T/-/G3T2, S2.1/1B, 3-2-3	CSS, Grassland	Unlikely
Dudleya blochmaniae ssp. *blochmaniae*	Blochman Dudleya	C2/-/G2T2, S2.1/1B, 2-2-2	Coastal Sage Scrub, CBS, Grassland	Possible
Dudleya cymosa ssp. *ovatifolia*	Santa Monica Mtns. Dudleya	T/-/G5T2Q, S2.2/1B, 2-2-3	Chaparral, CSS	Possible
Dudleya verityi	Verity Dudleya	T/-/G1, S1.1/1B, 3-2-3	Chaparral, CSS, Wld.	Possible
Eriogonum crocatum	Conejo Buckwheat	C2/R/G2, S2.2/1B, 2-2-3	Chap., CSS, Grassland	Possible
Hemizonia minthornii	Santa Susana Tarplant	C2/R/G2, S2.2/1B, 2-2-3	Chaparral, CSS	Possible
Hemizonia parryi ssp. *australis*	Southern Tarplant	C2/-/G5T2, S2.1/1B, 3-3-2	Marsh, Grassland, Vernal Pool	Low
Juglans californica var. *californica*	Southern California Black Walnut	-/-/-/4, 1-2-3	Riparian Forest, Coast Live Oak Woodland	Likely
Pentachaeta lyonii	Lyon Pentachaeta	E/E/G1, S1.1/1B, 3-3-3	Chaparral, Grassland	Possible
Senecio aphanactis	Rayless Ragwort	-/-/G3?, S1.2/2, 3-2-1	Cismont. Wld., CSS	Unlikely

Catalina Mariposa Lily is an uncommon herb of heavy soil in open grassland, coastal scrub, and chaparral habitats and is known below 700 m (2,297 ft.) in elevation. It occurs primarily in the southern portion of the Central Coast and the western South Coast, and is known in Santa Cruz, San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, and San Diego Counties (including Santa Catalina Island and Santa Rosa Island). This species of the Lily family is not a federally-listed or state-listed species; however, it has a CNPS List 4 and an R-E-D Code of 1-2-3, it is a Species of Local Concern (Magney 2000), and it is threatened by development. (Skinner and Pavlik 1994.)

No specimens of this bulbiferous perennial herb remain onsite due to the construction of the building pad located in the immediate vicinity of where this species was growing (on the east/southeastern portion of the property). *C. catalinae* may reestablish itself if the underground bulbs were not disturbed during construction; however, this will be undetectable until the next few blooming seasons.

[1] See Tables 4 through 7 for definitions and explanations of rarity and legal status codes;
R=listed Rare; E=listed Endangered; T=listed Threatened; C2=Species of Special Concern; P=Proposed.
[2] Definitions of abbreviations:
Chap.=chaparral; CSS=coastal sage scrub; CBS=coastal bluff scrub; Gr.=grassland; Wld.=woodland; Cismont.=cismontane.
[3] Likelihood of occurrence is based on NDDB search, regional occurrences not tracked by the NDDB, & best professional judgment.

SPECIAL-STATUS LICHENS

Little is known about special-status lichen species, largely because much is still unknown about the distribution of California lichens. Riefner et al. (1995) and Hale and Cole (1988) identified a number of lichen taxa that they consider endangered to uncommon, and those species are used here as special-status lichens. In addition, Magney (1999) has prepared a list of rare California lichens, on behalf of the California Lichen Society, which is used to identify potential special-status lichen species of California.

Specific surveys for special-status lichen species were not conducted for this project; however, no federally or state listed lichens occur in California. Furthermore, the lichen flora throughout the Reinke property is of low species richness. Regardless, six (6) special-status species of lichen are known to occur in the region of the Reinke property (excluding tree lichens), and are summarized in Table 9, Likelihood of Occurrence of Special-status Lichens at the Reinke Property. (Note: common names are devised here, as most lichens have not been assigned vernacular names.)

Table 9. Likelihood of Occurrence of Special-status Lichens at the Reinke Property

Scientific Name	Common Name	Status: Fed/State/NDDB/CNPS[1]	Preferred Habitat	Likelihood of Occurrence
Caloplaca subpyracella	South Coast Jewel Lichen	-/-/G3, S3.3/4, 2-2-3	Rock Outcrops	Low
Gyalecta herrei	Herre Gyalecta Lichen	-/-/G3, S3.2/4, 2-2-3	Tree Bark	Low
Phaeophyscia kairomoi	Kairomo Brown Rock Lichen	-/-/G2, S2.3/4, 1-1-2	Rock Outcrops	Low
Teloschistes californica	California Shore Lichen	-/-/G2, S2.2/1B, 2-2-2	Shrubs, Trees	Very Low
Teloschistes flavicans	Yellow Shore Lichen	-/-/G3, S3.3/4, 1-2-1	Shrubs, Trees	Very Low
Xanthoparmelia californica	California Shield Lichen	-/-/G2, S2.2/1B, 2-2-2	Rock Outcrops	Low

SPECIAL-STATUS HABITATS

Special-status habitat types include plant communities that are threatened by urbanization and are continually influenced by human activities. Table 10, Likelihood of Occurrence of Sensitive Habitats at the Reinke Property, summarizes the database search (NDDB 199) and field surveys, resulting in seven sensitive and rare habitat types expected to occur in the vicinity of the Reinke property. Four of the seven potential sensitive habitat types are present onsite. Table 10 includes the NDDB global- and state-ranks and the likelihood of occurrence within the property boundaries if not directly observed. Each of these sensitive habitats is described in detail above in the Vegetation and Habitat subsection.

[1] Magney 1999; see Tables 4 through 7 for definitions of special-status species.

Table 10. Likelihood of Occurrence of Sensitive Habitats at the Reinke Property

Special-Status Habitat Types	NDDB Status	Likelihood of Occurrence
Coastal Sage Scrub	Habitat of Local Concern	**Observed**
Southern Cactus Scrub	Habitat of Local Concern	**Observed**
Southern Coast Live Oak Riparian Forest	G4, S4	Unlikely
Southern Riparian Scrub	G4, S4	**Observed**
Southern Sycamore Alder Riparian Woodland	G4, S4	Low
Valley Needlegrass Grassland	G1, S3.1	**Observed**
Valley Oak Woodland	G3, S2.1	Unlikely

SPECIAL-STATUS WILDLIFE

Database searches revealed a total of 10 special-status wildlife species with the potential to inhabit or frequent the Reinke property and surrounding areas (NDDB 1999). Several of the special-status wildlife species, known to occur in the vicinity of the property, require habitat consistent with the habitat types present onsite. For example, most outer boundaries of the property are occupied by Coastal Sage Scrub, Southern Cactus Scrub, Rock Outcrop, and Needlegrass Grassland.

No special-status, federally or state listed wildlife species were observed during the Reinke property survey; however, several special-status animals have the potential to occur in the vicinity of the property. Specific surveys, for special-status and listed wildlife species, were not conducted for this biological field survey, since emphasis was placed upon impacts to the vegetation and habitat types, which ultimately affect the wildlife of the area. Table 11, Likelihood of Occurrence of Special-status Wildlife at the Reinke Property, lists the scientific and common names of the wildlife species known to occur within the vicinity of the property, gives species status and habitat requirements, and gives the likeliness of each species that might inhabit the property.

Table 11. Likelihood of Occurrence of Special-status Wildlife at the Reinke Property

Scientific Name	Common Name	Status: Fed./State/NDDB[1]	Preferred Habitat	Likelihood of Occurrence
Aimophila ruficeps caescens	Southern California Rufous-crowned Sparrow	C2/-/G4T2T3, S2S3	Coastal Sage Scrub, sparse Chaparral	Possible
Campylorhynchus brunneicapillus	Coastal Cactus Wren	-/-/G5T2?, S2	CSS, *Opuntia* cacti	Possible
Cnemodophorus tigris multiscutatus	Coastal Western Whiptail	C2/-/G5T3?, S2S3	Woodland openings, riparian corridors	Possible
Danaus plexippus	Monarch Butterfly	-/-/G5, S3	Coastal Winter Roosts	Likely
Neotoma lepida	San Diego Desert Woodrat	-/-/G5T3T4, S3S4	Rock Outcrops, CSS	Likely
Phryrosoma coronatum blainvillei	San Diego Horned Lizard	C2/-/G4T3T4, S2S3	Coastal Sage Scrub, Chap.	Likely
Phryrosoma coronatum frontale	California Horned Lizard	C2/-/G4T3T4, S3S4	Lowland sandy washes with scattered shrubs	Possible
Polioptila californica californica	Coastal California Gnatcatcher	T/-/G2T2, S2	Coastal Sage Scrub, Southern Cactus	Possible
Riparia riparia (nesting)	Bank Swallow	-/T/G5, S2S3	Riparian/lowland habitats	Possible
Thamnophis hammondii	Two-striped Garter Snake	C2/-/G3?, S2	Along rocky, rip. streams	Unlikely

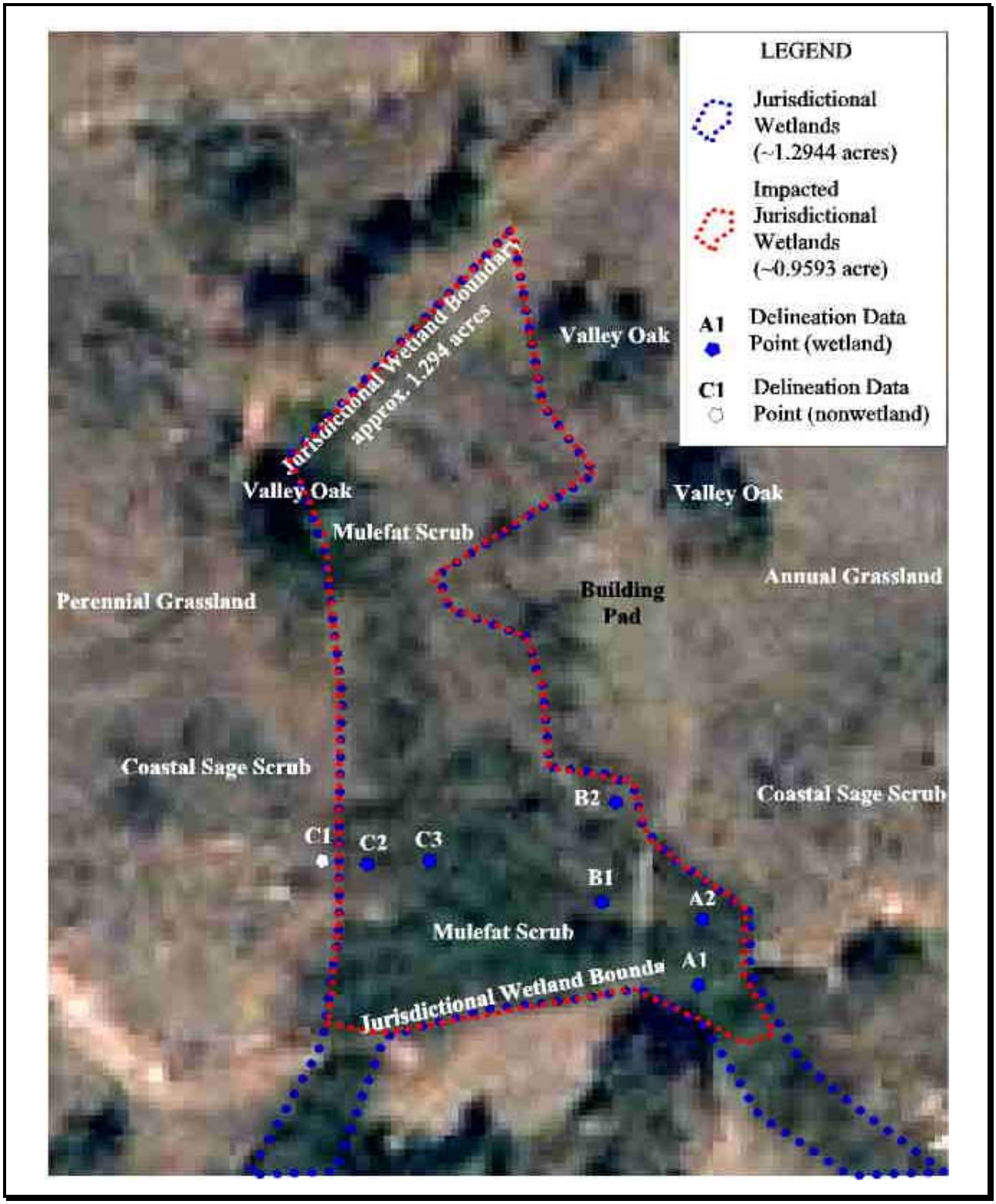
JURISDICTIONAL AREA

On 4 May 2000, David Magney and Cher Wellonen conducted a delineation of jurisdictional waters of the U.S., including wetlands, which were expected to be directly or indirectly affected by the project. The purpose of the wetland delineation study was to determine the presence and extent of jurisdictional waters of the U.S., including wetlands, existing on the Reinke property in the vicinity of the proposed development (DMEC 2000a).

For the purposes of this project, areas of waters of the U.S., including wetlands, and wetlands of the state under Corps and CDFG jurisdiction, respectively, include the bed and banks of the unnamed tributaries of Arroyo Conejo and the associated riparian wetland (Figure 9, Delineation of and Impacts to Jurisdictional Waters of the U.S., Including Wetlands, and Wetlands of the State on the Reinke Property). The total area of jurisdictional waters of the U.S., including wetlands, within the project site and adjacent upstream areas, is approximately 1.29 acres. Of this amount, approximately 0.96 acres are located on the Reinke property. In this instance, the jurisdictional wetlands for both the Corps and CDFG are basically the same and are not delineated separately. The results of the delineation were verified by the Corps (Spencer MacNeal, pers. comm.).

[1] See Tables 4 and 7 for definitions of legal status and rarity rankings:
E=listed Endangered; T=listed Threatened; C2=Species of Special Concern.

Figure 9. Delineation of and Impacts to Jurisdictional Waters of the U.S., Including Wetlands, and Wetlands of the State on the Reinke Property



SECTION III. IMPACT ASSESSMENT

Mr. Reinke excavated a channel to direct surface flows to the western edge of the property, excavated sediment to allow water to pass freely through two culverts under an old road bed, removed native riparian vegetation from the low-laying areas of the property, and extended his building pad onto the floodplain fringe water/wetland. All of these activities were completed without the benefit of a permit during the winter of 2000. These initial activities resulted in direct impacts to 0.96 acres of waters of the United States, including wetlands. Most of the impacted area was classified as Mulefat Scrub (Palustrine Evergreen Scrub-Shrub Wetland) (see Figure 9).

The onsite Mulefat Scrub riparian vegetation provided habitat for a number of plant and wildlife species. Mulefat Scrub is used as nesting and foraging habitat for several species of birds, and cover and foraging habitat for small and large mammals, some of which may have used the site as a movement corridor where the site vegetation provided cover from predators.

The functionality of the Mulefat Scrub habitat was increased by the presence of natural upland vegetation and habitats with high species richness, including Southern Cactus Scrub, Purple Needlegrass Grassland, and Oak Savannah.

To complete the single-family residence, Mr. Reinke also is proposing to bridge the east tributary to provide access to his property, to extend his building pad slightly to the west, and to maintain a septic leach field on a portion of the floodplain fringe water/wetland. These activities will result in unavoidable impacts to approximately 0.23 acre of waters of the U.S., including wetlands.

Riverine wetlands in the Calleguas Creek Watershed can be characterized as performing various hydrology/geomorphology, biogeochemistry, plant habitat, and wildlife habitat functions (Table 12, Ecosystem Functions of Riverine Wetlands in the Calleguas Creek Watershed) (DMEC 2000b). The performance of these functions is largely dependent upon the maintenance of natural channel morphology and native plant communities, both of which have been and will be altered by the proposed project. Thus, the completion of the proposed project will have negative effects on the overall ecosystem function of the Reinke property stream and the associated riparian wetlands.

Table 12. Ecosystem Functions of Riverine Wetlands in the Calleguas Creek Watershed

Function	Definition
Hydrology/Geomorphology	
Maintain Alluvial Corridor Integrity	Maintenance of physical attributes and processes that result in characteristic channel width, depth, slope, and roughness.
Maintain Surface Water Hydrology	Maintenance of a characteristic hydrograph, including the amount and time of water delivery to the channel network.
Maintain Subsurface Water Hydrology	Maintenance surface and ground water interactions between the channel and the local and regional aquifers.
Sediment Mobilization, Transport, and Storage	Maintenance of a characteristic sediment regime through the maintenance of a hydrograph and sediment delivery to the stream network.
Biogeochemistry	
Element and Compound Cycling	Abiotic and biotic processes that convert elements and compounds from one form to another.
Organic Carbon Export	Export of dissolved and particulate carbon, primarily through leaching and flushing.
Plant Habitat	
Maintain Native Plant Association	Maintenance of characteristic plant associations in terms of species composition of trees, saplings, seedlings, shrubs, and herbs.
Maintain Spatial Structure of Plant Association	Maintenance of the structural characteristics required for supporting native plant habitat and their animal associates.
Maintain Characteristic Detrital Biomass	The production, accumulation, and dispersal of dead plant biomass of all sizes. The sources may be up slope, up gradient, or on site.
Maintain Interspersion and Connectivity for Plant Populations	Maintenance of characteristic spatial relationships between plant habitats such that native plant species are capable of completing their life cycles.
Wildlife Habitat	
Maintain Native Vertebrate Associations	Maintenance of the diversity, density, and spatial distribution of aquatic and terrestrial vertebrates.
Maintain Native Invertebrate Associations	Maintenance of the diversity, density, and spatial distribution of aquatic and terrestrial invertebrates.
Maintain Interspersion and Connectivity for Animal Populations	Maintenance of characteristic spatial relationships between animal habitats such that native animal species are capable of completing their life cycles.

SECTION IV. RESTORATION PLAN

REGULATORY CONTEXT

This plan is prepared to meet regulatory requirements, issued by the Corps and the CDFG, to mitigate for unavoidable impacts to waters of the U.S., including wetlands, incurred during the development of a single-family residence of the Reinke property.

Historically, the effectiveness of restoration of waters/wetlands has been measured using an area metric alone. However, the Clinton Administration Wetlands Policy (1993) mandates that:

- "...all wetlands are not the same...";
- a fair, flexible approach should be encouraged that allows restoration of waters/wetland functions; and
- a hydrogeomorphic approach to restoring waters/wetlands functions should be used.

The restoration of functions is a preferable alternative to habitat enhancement and/or creation (Kusler and Kentula 1989). This is reflected in the Memorandum of Agreement (MOA) on Mitigation of 6 February 1990 that guides policy nationally for the U.S. Environmental Protection Agency (EPA), the Corps, and the U.S. Fish and Wildlife Service (USFWS). The MOA sets forth specific guidelines to

> "...restore and maintain the chemical, physical, and biological integrity of the Nation's waters, including wetlands".

Consistent with these directives, the approach presented herein involves the restoration of physical, chemical, and biological attributes and processes to the impacted waters of the U.S., including wetlands, on the Reinke property. Although the overall area of waters/wetlands is reduced by approximately 0.23 acre, overall ecosystem function will be restored by restoring natural stream morphology and revegetating with a more compositionally and structurally diverse assemblage of plant communities.

OBJECTIVES

Riparian ecosystems that were, or will be, disturbed or eliminated as a result of installation, repair, regrading, or restoration activities will be restored onsite and in-kind. The overall mitigation objective is to have no net loss of wetland extent or function resulting from project implementation.

This project targets the restoration of ecosystem functions through the restoration of geomorphic and biological attributes and processes on the Reinke property. Specifically, this project will restore natural channel morphology and native plant communities and, therefore, will restore the entire suite of riparian ecosystem functions to the Reinke property (Table 12) (DMEC 2000b).

APPROACH

The general technical approach to the restoration by DMEC is to focus on the physical and biological processes related to stream flow and sediment mobilization, transport, and deposition. Trying to enforce constraints on a river, even in a restoration context, often results in the failure of the effort (Gilvear and Bradley 1997). Thus, DMEC works with the natural physical and biological processes rather than fighting against them.

Some rivers are resilient to perturbation and can restore to pre-perturbed conditions in relatively short periods of time (Hecht 1984, Gilvear and Bradley 1997). However, removing the perturbation and not assisting in the restoration often results in incomplete restoration of the physical and biological attributes and processes of the ecosystem (Kondolf 1993). Therefore, the general approach to this restoration is to work with the physical attributes and processes to guide the restoration, but to rely upon the natural physical and biological processes of the river system to complete the project.

Each impact site will be planted at varying densities, with suitable indigenous riparian trees and shrubs, and affected sites will also receive selective erosion-control treatment, using bioengineering techniques and materials. These treatments will provide greater erosion protection than planting alone, which is only intended to provide limited protection of proposed nearby residences.

Specifically, the approach for the restoration at the Reinke property sites includes, but is not necessarily limited to:

- Recontouring portions of the restoration area to mimic natural conditions;
- Installing sediment retaining devices made of natural materials (e.g. coir rolls and blankets), if necessary;
- Removing existing nonnative, exotic plants from the restoration area;
- Collecting cuttings and seeds, if necessary, and propagating wetland/riparian plants;
- Installing temporary irrigation systems, where appropriate;
- Planting with native plant material (pole cuttings and seeds) and nursery-grown plants;
- Monitoring the work of the grading and planting contractors; and
- Monitoring the mitigation plantings for a 5-year period.

CONSTRAINTS

The episodic nature of weather and, therefore, stream discharge and sediment supply bears discussion. Flood events are episodic on the South Coast of California. For example, over a 29-year period (water years 1960-1988), annual peak flows in the Ventura River near Meiners Oaks varied from 38 cfs to 28,000 cfs (USGS Gage #11116550). Daily variations in flows also can be highly variable. During the 12 February 1992 flood, discharge in the Ventura River near Ventura increased from 100 cfs to 46,700 cfs in a period of three hours (Keller and Capelli 1992).

High sediment flux events also are episodic and often are related to wildfires coupled with high flows. Sediment rating curves may shift upwards 10 to 20 percent following significant wildfires, resuming their pre-fire relationships after two to five years (Wells and Brown 1982, Taylor 1983, Hecht 1984). A specific example is the Sisquoc River near Santa Maria, California where more than half of the bed load transported during a 60-year period was probably associated with the 1966 fire that burned approximately 35 percent of the watershed and the January to February 1969 high flows (Hecht 1993).

Fluvial geomorphologists have long recognized the unique geomorphic responses to episodic flood/high sediment flux events. Short-term variations in flow can result in a channel morphology that is adjusted to high flows but is not in equilibrium with subsequent low flows (Schumm and Lichty 1963). For example, the channel morphology created during high flows on alluvial fans may be completely reconfigured during low-flow events. The result is that subsequent high flows may not follow the previous paths and kinetic energy may be dissipated in previously unaffected areas (Dawdy 1979).

The episodic nature of flows and sediment fluxes cannot be controlled in stream restoration efforts. Thus, restoration in episodic stream systems must account for this inherent uncertainty. The episodic paradigm is based on episodic cycles of perturbation and recovery, not on the development of equilibrium landforms and mature habitats. Concepts and tools that are useful in other systems, such as channel-forming discharge dimensions, are less useful and must assume less significant roles. Similarly, design specifications and success criteria must be flexible to allow the natural physical processes to operate on the landscape.

RESTORATION DESIGN SPECIFICATIONS

PHYSICAL DESIGN SPECIFICATIONS

Hydraulic Geometry and Complimentary Analyses

The design channel morphology proposed herein is based upon hydraulic geometry and complimentary analyses coupled with flow frequency analyses. Width, depth, and velocity vary with discharge as simple power functions (Leopold and Maddock 1953, Eschner 1983, Leopold et al. 1964). At-a-station hydraulic geometry is the practice of exploring these relationships. At-a-station hydraulic geometry shows that natural channels conform to consistent geometric patterns and that deviations from these geometric patterns will result in erosion and deposition as channels trend toward the quasi-equilibrium form (Dunne and Leopold 1978). Thus, at-a-station hydraulic geometry equations are commonly used to generally predict the width, mean depth, and velocity at a range of discharges. Specifically, a design discharge is selected and used to develop design channel widths and depths through the application of the hydraulic geometry equations.

River response to changing discharge depends upon a variety of factors including, but not limited to, climate, geology, and land use. Thus, at-a-station hydraulic geometry relationships are

regionally specific and should be performed with data from within the same hydrophysiographic region. For this project, the at-a-station hydraulic geometry analysis was performed using data from Arroyo Simi at Madera Road Bridge (Water Year 1983). Width, mean depth, and velocity increase with discharge in log-linear fashion. The relationships can be modeled as simple power functions.

$$w = 4.21\ Q^{0.46}$$
$$H = 0.27\ Q^{0.27}$$
$$u = 0.86\ Q^{0.28}$$

where

w = width (ft)
H = mean depth (ft)
u = mean velocity (fs)
Q = discharge (cfs)

It must be emphasized that this approach has two limitations specific to this application. First, hydraulic geometry relationships are simple power functions based upon field observations made during the stated water years. The monitored channel was measured during the 1983 water year when channel modifications likely included, but were not necessarily limited to, sediment delivery above natural background rates, vegetation removal, and channel training. The natural channel response to varying discharge in the absence of channel modification cannot be ascertained from these data via this method. Second, hydraulic geometry relationships are not well defined at the extremes. In the Reinke property case, both the bankfull discharge and the channel dimensions are extremely low.

Nevertheless, hydraulic geometry relationships provide useful design specifications for projects of this scale. The Reinke property stream is small, so the design channel morphology will be very close to the natural stream morphology, i.e. deviations from the natural channel morphology will be negligible or small. Furthermore, rivers are conduits for energy, sediment, and biological materials, so rivers are capable of self-correction when deviations from the natural channel morphology are small and where impact pressures are removed. Thus, hydraulic geometry relationships are used herein to provide design channel morphology specifications, which in turn, will provide a template on which the natural river processes can operate.

In their undisturbed states, these types of streams have sinuosities that range from greater than 1 to 1.5 (DMEC 2000b). High sinuosity is related to high meander wavelength and/or amplitude.

Mender wavelength is the down-valley distance between successive analogous points on a channel, e.g. from the apex of one right bend to the apex of the next right bend. Meander wavelength in natural channels varies from approximately 7 to 10 bankfull widths (see summary in Leopold et al. 1964). The most commonly cited model, and the model used herein, is from Leopold and Wolman (1960):

$$\lambda = 10.9 w^{1.01}$$

where

λ = meander wavelength (ft)
w = width (ft)

Meander amplitude is the cross-valley distance between the centerlines at the apex of successive meander bends. Meander amplitude is less predictable (see summary in Leopold et al. 1964). Meander amplitude is determined by the balance between flow strength, bank resistance, and sediment supply (Knighton and Nanson 1993, van den Berg 1995), all of which are spatially variable across the landscape. Thus, moderate amplitude will be constructed and will form the template on which the river processes can operate.

Design Discharge

The most commonly used design discharge is the bankfull discharge. Bankfull discharge is the discharge that results in the maintenance of natural channel morphology (Wolman and Leopold 1957). The bankfull discharge typically is considered to be the discharge that, on the average and over many years, performs the most work on the river system. The primary geomorphic response to that work is sediment transport, and therefore, channel morphology maintenance. Small discharges occur frequently but move small amounts of sediment; large discharges move large amounts of sediment but occur infrequently. The moderate discharges occur moderately frequently and move moderate amounts of sediment, and it is these discharges that typically dominate sediment transport and channel morphology maintenance over long periods of time (Wolman and Miller 1960).

There are many methods by which bankfull discharge can be estimated (Williams 1978). In many circumstances, however, numerous methods return the same range of values (Larsen et al. unpublished data). For the purposes of this effort, bankfull discharge was assumed to have a 1.5-year recurrence interval based upon an annual flood series. The true bankfull discharge may occur more or less frequently than this, but a 1.5-year recurrence interval based upon the annual flood series is quite typical (Wolman and Leopold 1957, Williams 1978) and will suffice for this effort.

The 1.5-year return interval discharge can be estimated from an analysis of the most relevant regional stream gage. Arroyo Simi near Simi Valley (U.S. Geologic Survey Gage #11105850) is the most relevant gage and has a long record of measurement. The flood frequency from the annual maximum series indicates that the 1.5-year return interval discharge for this gage is approximately 500 cfs, and almost certainly is within the range of 300 to 700 cfs (Figure 10, Flood Frequency from the Annual Maximum Series at Arroyo Simi near Simi Valley [1933-1983]).

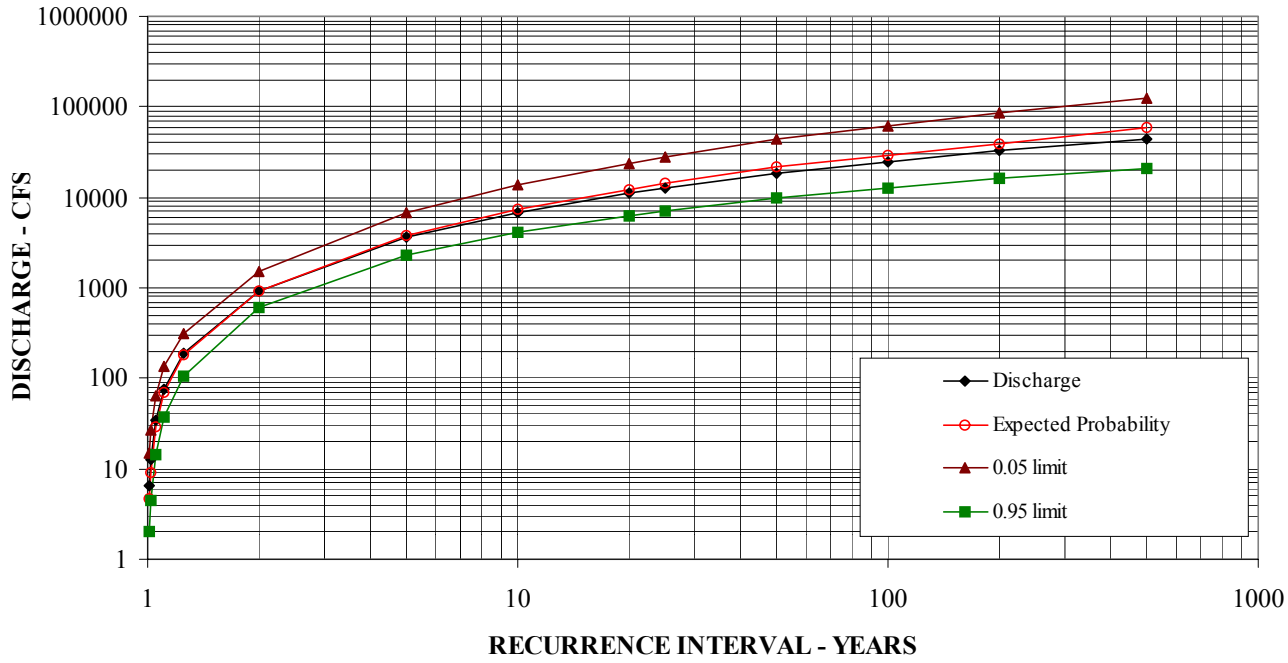
Assuming that discharge is linearly correlated with drainage area, then the Reinke property 1.5-year return interval discharge can be calculated by correcting for drainage area differences. Specifically,

$$Q_{Rbf} = Q_{ASbf} * (A_R / A_{AS})$$

where

Q_{Rbf} = bankfull discharge at the Reinke property (cfs)
Q_{Asbf} = bankfull discharge at the Arroyo Simi gage (cfs)
A_R = drainage area at the Reinke property (sq. mi)
A_{AS} = drainage area at the Arroyo Simi gage (sq mi)

Figure 10. Flood Frequency from the Annual Maximum Series at Arroyo Simi near Simi Valley (1933-1983)



The Reinke property stream has a drainage area of 0.54 square miles, and the gage on Arroyo Simi near Simi Valley has a drainage area of 70.6 square miles. Therefore, the corrected 1.5-year return interval discharge for the Reinke property is likely 3.8 cfs, and quite likely is within the range of 2.3 and 5.4 cfs.

Design Channel Parameters

Design channel widths and mean depths, then, are determined by inserting the design discharges into the hydraulic geometry equations (Table 13, Design Channel Parameters Based Upon Minimum, Median, and Maximum Design Discharge; Figure 11, Conceptual Grading and Planting Plan). These design channel widths and mean depths will be used to guide the recontouring of the stream channel.

Table 13. Design Channel Parameters Based Upon Minimum, Median, and Maximum Design Discharge

Parameter	Minimum	Median	Maximum
Bankfull Discharge (cfs)	2.3	3.8	5.4
Bankfull Width (ft)	6.2	7.8	9.1
Bankfull Mean Depth (ft)	0.33	0.39	0.43
Bankfull Velocity (fs)	1.12	1.25	1.38
Bankfull Cross-Sectional Area (sq ft)	2.05	3.04	3.91

Parameter	Minimum	Median	Maximum
Bankfull Width : Bankfull Mean Depth	19	20	21
Bankfull Wetted Perimeter (ft)	6.9	8.6	10.0
Bankfull Hydraulic Radius (ft)	0.30	0.35	0.39
Bankfull Manning's n	0.059	0.059	0.057
Bed Slope	<0.01	<0.01	<0.01
Sinuosity	>1.0 - $^{<}/_{=}$1.5	>1.0 - $^{<}/_{=}$1.5	>1.0 - $^{<}/_{=}$1.5
Meander Wavelength (ft)	69	87	101
D_{16} (mm)	No Specification	No Specification	No Specification
D_{50} (mm)	No Specification	No Specification	No Specification
D_{84} (mm)	No Specification	No Specification	No Specification

Channel Design Confirmation

The channel design parameters can be confirmed by the application of the Manning's Equation analytical solution. Manning's Equation relates flow velocity at a cross-section to the hydraulic radius, the bed slope, and a roughness coefficient, Manning's n. Manning's Equation states that:

$$u = 1.486/n * R^{2/3} * S^{1/2}$$

where

u = flow velocity (fs)
n = Manning's n
R = hydraulic radius (ft)
S = bed slope

and

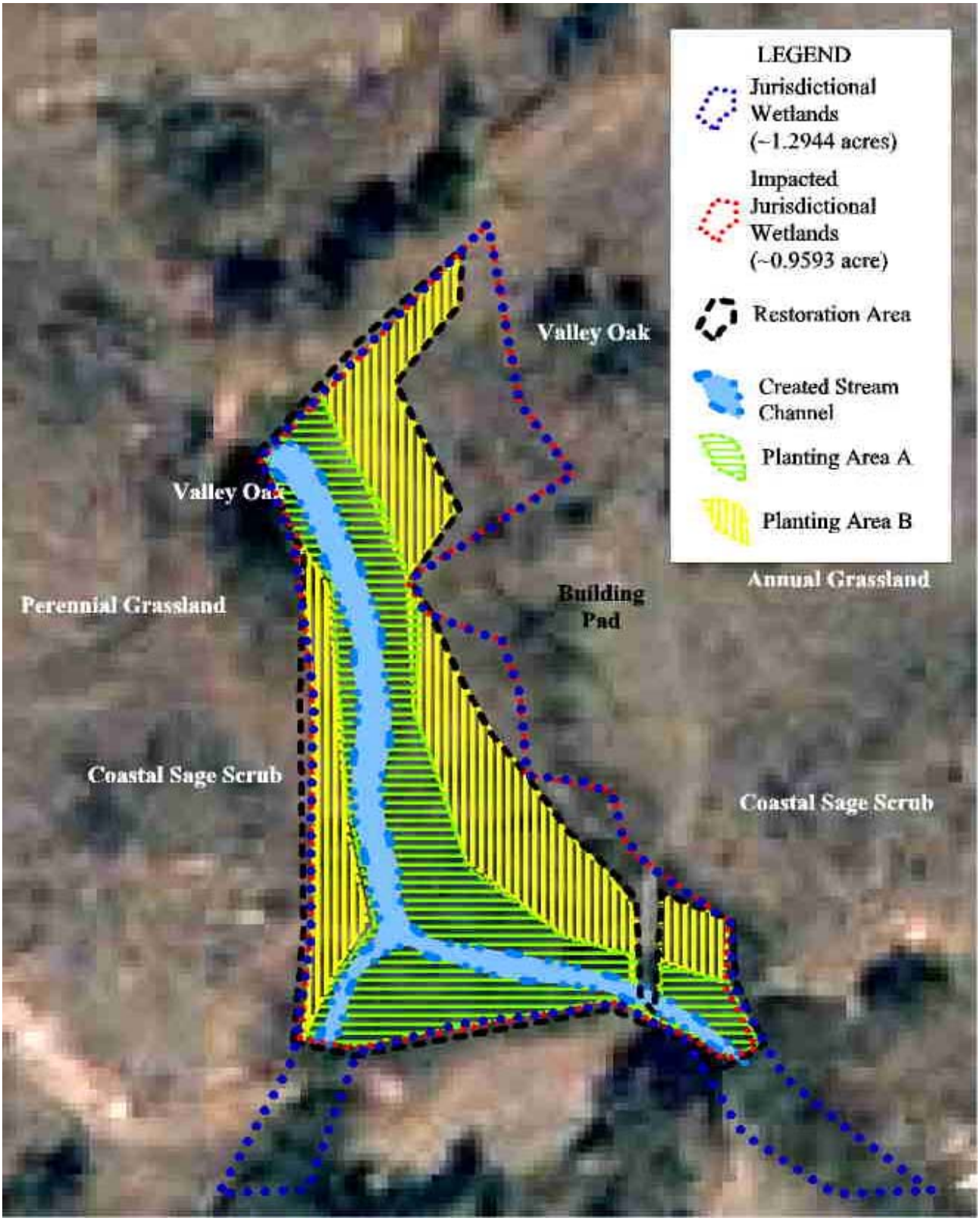
$$R = w * H/P$$

where

w = width (ft)
H = mean depth (ft)
P = wetted perimeter (ft)

Thus, Manning's Equation relates flow velocity to fundamental stream characteristics such as width, mean depth, cross-sectional area, hydraulic radius, wetted perimeter, and bed slope. Manning's n has been solved for empirically many times and tables of values are readily available (e.g. Dunne and Leopold 1978). Therefore, channel design parameters can be confirmed by inputting the design channel parameters into Manning's Equation and solving for Manning's n. If the channel design parameters are correct, then the resultant Manning's n value should fall within the range of previously measured values for natural streams.

Figure 11. Conceptual Grading and Planting Plan



This type of analysis was performed using the minimum, median, and maximum design channel parameters listed in Table 13. The resultant Manning's n values range from 0.057 to 0.059, which is within the expected range for rough, natural channels (Dunne and Leopold 1978). This generally confirms that the channel is sized correctly assuming that the design discharges are correct.

Grading

The material excavated from the channel was placed as fill on the floodplain and floodplain fringe areas. The fill extends from the building pad across the floodplain and floodplain fringe areas to very near the right bank of the channel (Figure 5). The already completed cut and fill activities have had two effects.

First, the channel is wider and, more importantly, deeper than was previously supported. Second, the surface elevation of the floodplain and floodplain fringe areas is higher. These activities likely will disconnect the floodplain from overbank flows. Furthermore, during the wet season, the deeper channel likely will cause local drawdowns in the shallow groundwater, similar to a "cone of depression" around a pumping well, along the fringe of the channel.

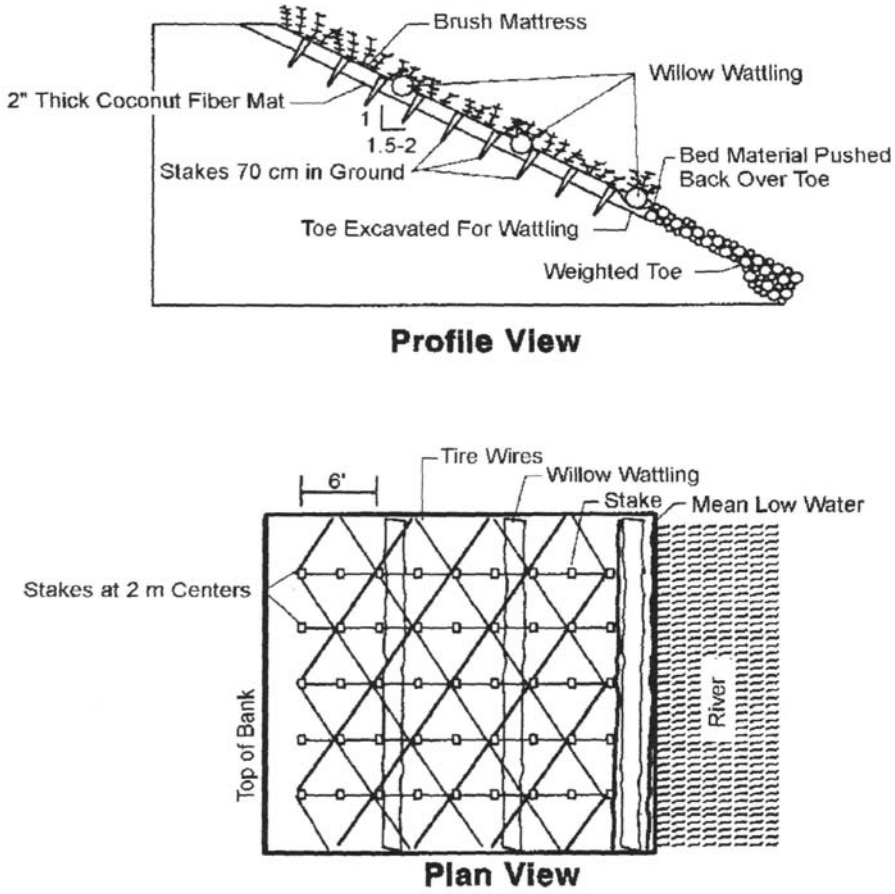
The fill on the floodplain and floodplain fringe areas, not including any fill critical to the support of the building pad or the septic leach field, will be removed and placed in the existing channel, and then the channel will be restored using the design parameters outlined herein. Every practicable effort will be taken to ensure that cut and fill are balanced so that no imported fill is required.

Bank Stabilization and Channel Migration

A great deal of effort will be employed in establishing vegetation on the stream banks to ensure long-term channel stability. Fine- and coarse-roots contribute to sediment cohesion by creating a composite material in which elastic fibers of relatively high tensile strength (i.e. roots) are embedded in a matrix of relatively plastic particle masses (i.e. sediments) (Gray and Leiser 1989). Therefore, fine- and coarse-roots reduce bed and bank erosion rates (Smith 1976). Furthermore, vegetation provides structural complexity that can reduce near-bank flow velocities (Steinman 1992, Prosser et al. 1995). Specific stream power, defined as the rate at which the potential energy of stream water is supplied to a unit area of the bed, decreases as velocity decreases. Thus, bed and bank vegetation can reduce specific stream power and, consequently, reduce bed and bank erosion rates. The geomorphic responses are that sediments are deposited and beds and banks are stabilized.

Some of the areas may be further stabilized using bioengineering techniques in combination with the plantings. Several treatments are available, of which two are recommended for use on the Reinke property, depending upon specific conditions and the general level of protection from flood scour desired. The recommended techniques include coir rolls and blankets (i.e. brush mattresses) (Figure 12, Coir Roll and Blanket Detail) and coir fabric soil wrap, consisting of soil-filled fabric "burrito-like" rolls with intervening wattling or pole plantings (Figure 13, Coir Soil Wrap Detail).

Figure 12. Coir Roll and Blanket Detail

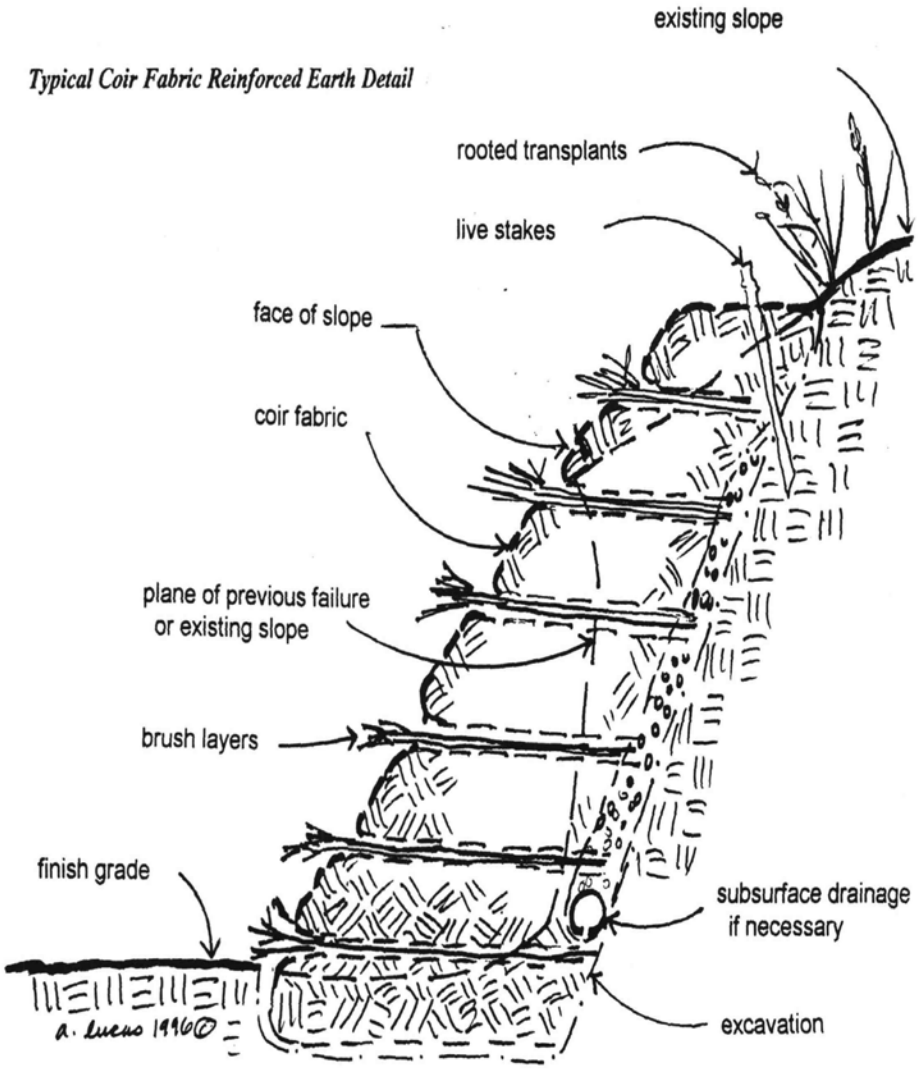


Nevertheless, the stream will continue to migrate across the low-laying portions of the property over time. It is extremely unlikely that the stream will migrate far enough to threaten either the building pad or the septic leach field since both are located on the colluvial toe slope of the eastern hill slope and not on the active floodplain. The vegetation, once established, will sustain itself during the slow channel migration process. This is the primary difference between hardscaped (e.g., rock riprap) and bioengineered solutions: hardscaped solutions seek to hold the channel in one specific location and fail if the channel migrates slightly, while bioengineered solutions can seek to guide the channel through a broad, general location (i.e., the low-laying portions of the property) and can continue to succeed during slow, natural channel migration.

BIOLOGICAL DESIGN SPECIFICATIONS

The general technical approach to riparian restoration by DMEC is to focus on the physical and biological processes related to stream flow, and possible sediment transportation or deposition. Trying to enforce constraints on a natural water system, even in a restoration context, often results in the failure of the effort (Gilvear and Bradley 1997). The general approach to this restoration plan is to work with, rather than fighting against, the natural, physical, and biological attributes and processes of the creek system to guide the restoration, and to rely on them for project completion.

Figure 13. Coil Soil Wrap Detail



Each impact site will be planted at varying densities, with suitable indigenous riparian trees and shrubs, and affected sites will also receive selective erosion-control treatment, using bioengineering techniques and materials. These treatments will provide greater erosion protection than planting alone, which is only intended to provide limited protection of proposed nearby residences.

The impact sites requiring plantings will be restored to a collective mosaic of riparian woodland growing over an understory of scrub and herbaceous emergent wetland species. The impact sites and their respective habitats to be restored are delineated above as Figure 11. The restoration areas will be planted with a combination of seed and vegetative material (cuttings) of plant species with local provenance so that the local genetic integrity of habitat is represented in the restored riparian ecosystem. Planting will occur in two zones, Zone A and Zone B, of the recontoured area (Figure 11). Recommended plants are listed in Table 14, Riparian Plant Palette.

The restoration area will be restored to a mosaic of Fremont Cottonwood (*Populus fremontii*)-California Sycamore (*Platanus racemosa*) Woodland and Mulefat (*Baccharis salicifolia*)-Arroyo Willow (*Salix lasiolepis*) Scrub in the active floodway and the adjacent low-laying areas. Mulefat Scrub was the predominant plant community prior to the recent grading activities, while Fremont Cottonwood, California Sycamore, and willows commonly intergrade with Mulefat Scrub at a fine scale (Sawyer and Keeler-Wolf 1995).

Since the moister portions of some impact/restoration sites already contain a wide variety of herbaceous wetland plants, "soil" from these areas will be salvaged and redeposited on top after fine grading is completed. Thus, the existing seed bank, and other existing propagules, will be salvaged and restored onsite without the delays inherent to planting collected seeds - which would need to be collected during subsequent seasons - or purchased seeds - which typically do not originate from the local area. The remainder of the plant material will be collected and propagated locally to ensure that all individuals are of local provenance.

The primary requirements for riparian tree and shrub establishment are bare surfaces that remain moist for at least a week, access to shallow groundwater in the first dry season, and the absence of high shear stress flows in the first wet season (McBride and Strahan 1984, Scott et al. 1996). The susceptibility to drought or high shear stress flows decreases markedly by the second year of growth due to the development of deep roots (McBride and Strahan 1984). Therefore, riparian vegetation will be planted primarily in the active floodway and the adjacent low-laying areas. However, it should be expected that some of the planted stock will not survive the first year season due to dry and wet season stresses that naturally occur on the margins of ephemeral and seasonal streams, i.e. drought in the dry season and high shear stress flows in the wet season.

Table 14. Riparian Plant Palette

Scientific Name	Common Name	Propagation Method
Zone A: Mulefat Scrub		
Baccharis salicifolia	Mulefat	Cuttings/Seeds
Cyperus eragrostis	Umbrella Sedge	Cuttings/Seed
Mimulus guttatus	Common Streamside Monkeyflower	Seed
Salix lasiolepis	Arroyo Willow	Cuttings
Zone B: Fremont Cottonwood Woodland		
Ambrosia psilostachya	Western Ragweed	Seed
Artemisia douglasiana	Mugwort	Cuttings/Seed
Juglans californica var. californica	Southern California Black Walnut	Cuttings/Seed
Platanus racemosa	Western Sycamore	Cuttings/Seed
Populus fremontii	Fremont Cottonwood	Cuttings
Quercus lobata	Valley Oak	Seeds (Acorns)
Rosa californica	California Wild Rose	Cuttings
Rubus ursinus	California Blackberry	Cuttings
Salix lasiolepis	Arroyo Willow	Cuttings
Sambucus mexicana	Blue Elderberry	Cuttings
Umbellularia californica	California Bay Laurel	Cuttings

In the initial years of habitat establishment, emphasis will be placed on control of invasive exotic plants in the restoration sites, and on the monitoring success of new plantings. Invasive exotic control is important to ensure decreased competition levels for the new plantings, and the control efforts will continue until the new vegetation is matured (for up to 5 years). Ultimately, this will reduce the risk of invasive exotics becoming dominant in restoration sites. Restored riparian communities will function as wildlife habitat and will provide forage for several animals.

Planting Area A

Planting Area A consists of the active floodway and some extremely low-laying portions of the adjacent floodplain (Figure 11). This area extends along most of the south and west property boundaries. Planting Area A will be planted with Mulefat Scrub, including Arroyo Willow (*Salix lasiolepis*) along portions of the stream bank (see Table 14). Planting Area A comprises approximately 0.40 acre.

Vegetation will not be planted on the channel bed; however, the channel banks will be planted extensively, particularly where high shear stress flows are expected to occur (e.g. on the outside of meander bends). Bioengineering treatments, as described above, also will be used where high shear stress flows are expected to occur. The bioengineering treatments will not completely prevent erosion during high shear stress flow events. However, the bioengineering treatments will provide substantial bank stabilization, especially during early site development. This will assist in the establishment of the bank revegetation since, as outlined above, high shear stress flows in the first wet season are an important cause of vegetation mortality. Once the bank vegetation is established, then it will impart strength to the banks.

Planting Area B

Planting Area B consists of the remaining low-laying portions of the adjacent floodplain (Figure 11). This area encompasses a large portion of the south property, and extends as strips along the upper edges of Planting Zone A, along most of the south and west property boundaries. Planting Area B will be planted with Fremont Cottonwood and California Sycamore (Table 14) as a dominant tree canopy. Planting Area B comprises approximately 0.33 acre.

In the initial years of habitat establishment, emphasis will be placed on control of invasive exotic plants in the restoration site, and on the monitoring success of new plantings. Invasive exotic control is important to ensure decreased competition levels for the new plantings, and the control efforts will continue until the new vegetation is matured (for up to 5 years). Ultimately, this will reduce the risk of invasive exotics becoming dominant in restoration sites.

DETAILS, SEQUENCE, AND SCHEDULE

FINAL DESIGN ACTIVITIES

Once this restoration and monitoring plan is approved, several tasks will need to be completed prior to implementation, including preparing a final grading plan and final planting specifications.

Final Grading Plan

A final grading plan will be developed and submitted to the Corps and the CDFG for approval. The final grading plan will be based on the information outlined herein, and will contain the details of the mass- and fine-grading efforts, including those typical of the restored surgical topography and the sediment and erosion control best management practices (BMPs). Fine grading is critical in wetland systems to obtain any level of successful wetland plant survival. Slight errors in site grading can adversely affect the success of planted hydrophytic species.

Final Planting Plan

A final planting plan will be developed and submitted to the Corps and the CDFG for approval. The final planting plan will be based upon the information outlined herein; but, it also will contain planting specification details, including species composition, abundance, and specific planting locations.

ADMINISTRATIVE ACTIVITIES

Mr. Reinke will secure all necessary permits, and solicit and select a qualified landscape contractor to implement this restoration plan. To complete site preparation and restoration planting by mid fall, Mr. Reinke should administer the permitting and contracting processes efficiently.

Permits and Approvals

The timing for the fine grading will depend upon obtaining the necessary permits and approvals from the federal (Corps), state (CDFG), and local agencies (Ventura County). However, site restoration, driveway regrading and bridge construction activities are proposed to be conducted during the fall months of 2000.

Contracting

Mr. Reinke will prepare a request for bids to qualified landscape contractors experienced with wetland restoration and that are approved by the Corps and the CDFG. To minimize delays in executing a contract, DMEC recommends that Mr. Reinke request all necessary contract information from each bidder as part of their bid submittal, rather than waiting until a contractor is selected.

ONSITE ACTIVITIES PRIOR TO IMPLEMENTATION

Sediment and Erosion Control

BMPs, with regard to sediment and erosion control, will be employed prior to restoration construction initiation. They will be inspected and maintained throughout the restoration effort.

Sediment and erosion control devices that can be installed, if surface or groundwater are present, include silt fencing and a desilting basin. Silt fencing will be installed (if necessary) along downstream edges of the grading areas to keep all sediments contained onsite. A temporary desilting basin will be constructed downstream of any work area that requires dewatering (if water is present at the time of restoration activities), or where surface or groundwater becomes turbid as a result of grading or restoration activities. No water originating from the restoration area will be discharged to the Reinke property stream that contains significant levels of turbidity, defined as increasing turbidity in the receiving water body by over 20 percent. Any discharged water (if present) will be monitored regularly to ensure compliance with this condition.

Heavy Equipment Staging and Servicing

An equipment staging and servicing area will be established to isolate potential fluid spills and will occur outside the Reinke property streambed and banks. The equipment area will be operated with BMPs intended to prevent the flow of equipment fluids to the surface or ground waters. The equipment staging and servicing area will be maintained throughout the restoration construction effort. All discharges of equipment fluids will be cleaned up and disposed of properly immediately upon their observation.

The grading contractor will obtain and keep oil absorbent pads onsite to clean up any accidental spills. No work within the Reinke property stream will be permitted unless suitable emergency supplies are available onsite.

No equipment will be fueled anywhere except at the staging and servicing area. Overflow catch pans will be placed under all equipment during refueling to prevent accidental discharge onto soil.

Plant Collection, Propagation, and Salvage Operations

Plants will be collected, stored, and grown at a qualified nursery facility experienced with growing California native plants (e.g. Matilija Nursery--805/523-8604, Ventura College Horticulture Department, Donald Rodrigues--805/654-6400 ex. 3207, Tree of Life Nursery--714/728-0685, and Mariposa Horticultural Enterprises--626/960-0196).

Plant material for the restoration will be derived from cuttings and/or seeds obtained from plants salvaged from disturbed areas and/or native plantings in the Arroyo Conejo Subwatershed. Pole cuttings will be made in the following manner:

- *Baccharis salicifolia* (Mulefat), *Salix lasiolepis* (Arroyo Willow), and *Populus fremontii* (Fremont Cottonwood) pole cuttings will be cut from mother plant stock with a diameter not less than ½" and a length of 36" to 60".

- Pole cuttings will be cut a second time with the cut tip under water.
- Pole cuttings will be stored with cut tips in water until planted or placed in adequate cold storage.
- Pole cuttings will be planted or placed in adequate cold storage within 48 hours of collection.

Any replacement tree/shrub stock that cannot be grown from cuttings or seeds will be obtained from an approved native plant nursery and will not be inoculated to prevent heart rot. The contractor will provide a list of all materials that must be obtained from sources other than the Arroyo Conejo Subwatershed prior to planting. Unacceptable plant material will be rejected, at the contractor's expense, by DMEC restoration specialists (or other qualified individuals contracted by Mr. Reinke).

Salvaged plants will be planted in appropriately sized containers and cared for until replanting in the mitigation areas occurs. Cuttings (for pole cuttings) can be stored without leaves, in cold storage until planted onsite, or in containers for later onsite planting, if cuttings are taken prior to planting time. All container plantings will be labeled with scientific name, date collected and transplanted, and location from which stock was obtained. No container plants will be accepted for restoration planting without proper labels.

ONSITE ACTIVITIES DURING IMPLEMENTATION

Delineate Work Area

All work areas will be demarcated with flags or stakes prior to construction activities. All contractors, subcontractors, and equipment operators will be instructed to remain within the flagged boundaries. Vegetation and soils will not be disturbed outside of the flagged boundaries. All debris, such as wood debris, nonnative gravel, cured or uncured concrete, nonnative rocks, rebar, flagging, trash, and excess fill will be removed from the mitigation sites prior to restoration activities described in this plan.

Mass and Fine Grading

All fine grading will be performed during a dry period to reduce the possibility of sediment and/or equipment fluid contamination of the surface and ground water. Temporary access to the project reach will be at the south entrance of the property. The restoration sites will be fine-graded using standard excavation equipment: one or more pickup trucks, a dump truck, and a rubber-tired, low ground-pressure backhoe.

All restoration activities, within the bed and banks of the Reinke property stream will be supervised by DMEC personnel or other qualified restoration ecologists approved by the Corps and CDFG.

Marking Planting Areas

Following the completion of fine grading, the revegetation planting polygons will be staked and flagged for the proposed restorative measures. Planting will not proceed until the restoration site fine grading and the staking and flagging of the planting areas are complete.

Invasive Exotic Plant Removal and Control

All invasive exotic plants will be removed by hand from the planting areas within 1 week of planting. Invasive exotic plant species targeted for regular removal include several shrub and herb species that grow on the Reinke property. A list of target invasive exotic plants to be eradicated and controlled is presented in Table 15, Target Invasive Exotic Plant Species for Removal.

All invasive exotic nonnative plants will be removed from the work areas and will be disposed of in a manner consistent with pertinent rules and regulations and that prevents their re-establishment. Removal will be conducted at least twice annually during spring and summer seasons, and as needed over the five-year monitoring period.

Table 15. Target Invasive Exotic Plant Species for Removal

Botanical Name	Common Name
Brassica nigra	Black Mustard
Carduus pycnocephalus	Italian Thistle
Centaurea melitensis	Tocalote
Foeniculum vulgare	Sweet Fennel
Lactuca serriola	Prickly Wild Lettuce
Malva parviflora	Cheeseweed
Medicago polymorpha	Burclover
Nicotiana glauca	Tree Tobacco
Picris echioides	Bristly Ox-tongue
Ricinus communis	Castor Bean
Silybum marianum	Milk Thistle
Tribulus terrestris	Puncture Vine

Invasive exotic plants will be removed by hand rather than by chemical means whenever possible. Where surface water is present, and control of invasive exotic plants is required within the streambed or bank with herbicides, the Contractor will hire a licensed pesticide applicator to apply only those herbicides that are approved for aquatic use, such as glyphosate (e.g. Rodeo). If surfactants are required, they will be restricted to non-ionic chemicals that are approved for aquatic use (e.g. Agri-Dex). (Note: The use of specific product names in this report should not be construed as advocacy on the part of DMEC; any specific product that meets the general specifications of this report will suffice.)

Mulch

Mulch on planting areas will be of sterile rice straw or chipped material (excluding material from invasive exotic plants). The salvaged "topsoil" replaced on planting areas will be amended with straw mulch, or composted or chipped material, at a 1:5 ratio (one part mulch to five parts topsoil). Straw mulch will be incorporated into the topsoil, or anchored with wood fiber and an organic binder if applied on top of soil. Additionally, mulch will be applied at a minimum of 3 inches deep and 2 feet in diameter at each container-planting site.

All mulch (chipped or rice straw bales) will be free of noxious weed seed, mold, and deleterious materials. Owner will furnish clearance evidence from the Ventura (or Los Angeles) County Agricultural Commissioner if straw sources originate from outside Ventura/Los Angeles Counties.

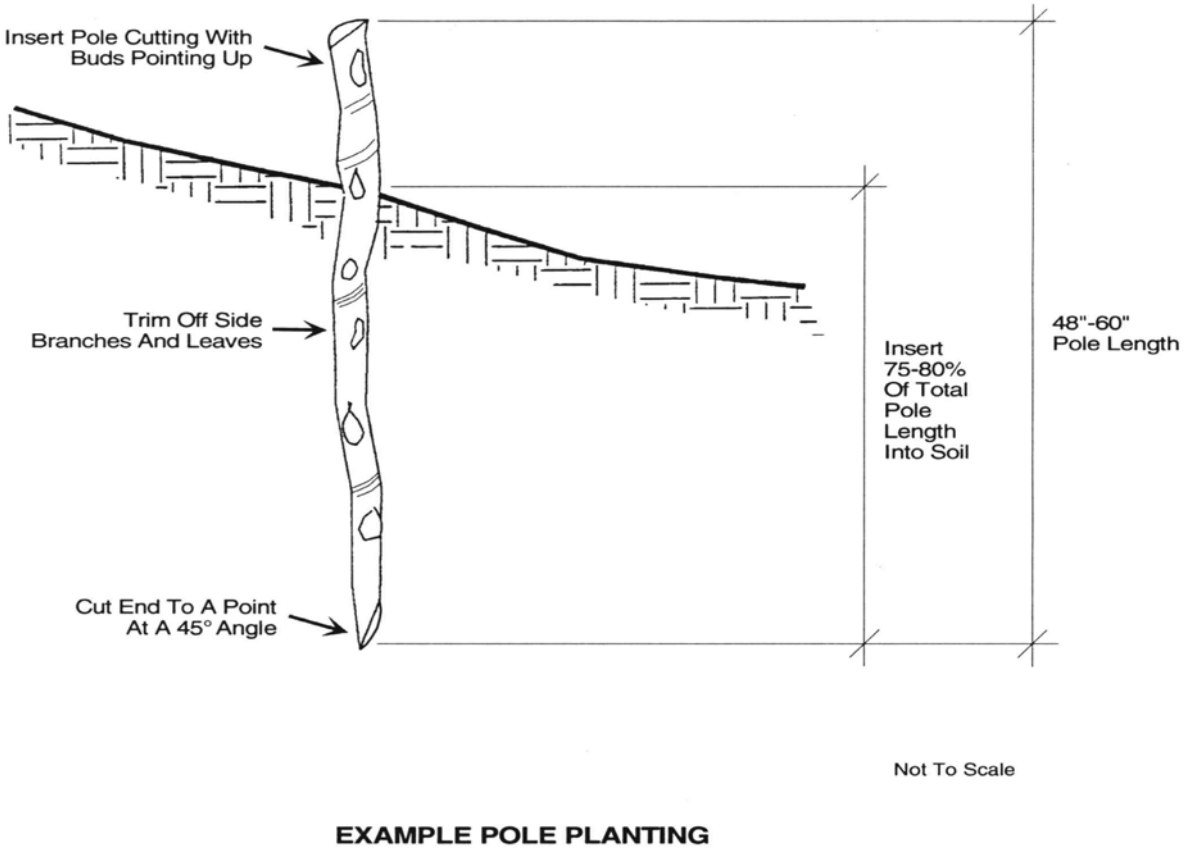
Planting

Planting activities will take place between the first wetting rains and before the last spring rains (generally between October and April). Within this window of opportunity, planting will begin as soon as possible following the completion of the fine grading and the staking and flagging of the planting zones. Each planting zone that will not have adequate access to shallow ground water, as determined by DMEC staff scientists, will be provided with supplemental irrigation. Supplemental planting will be conducted after the first year (Fall 2001) to fill in areas of the restoration site that have not adequately naturally revegetated. The floodplain cobble areas will only be sparsely planted.

Divisions will be planted within 2 hours of collection in moist soil, and the soil moisture will be maintained. Cuttings, 36- to 60-inches long, will be planted in vertical holes, immediately backfilled with native soil, and thoroughly irrigated, as illustrated in Figure 14, Example Pole Planting Detail. Container stock will be planted as follows:

1. Excavate a hole 2 times the diameter, and 1.5 times the height, of the container.
2. Remove roots and rocks from the hole.
3. Place slow-release fertilizer tablet in the hole.
4. Trim excess roots to obtain approximately equal root and shoot mass.
5. Clip root mass, if necessary, to relieve root binding.
6. Place root ball in hole and cover with native soil.
7. Place organic mulch 3 inches deep on top of soil around plant.
8. Install a root collar and basket of aluminum screen (as needed to prevent herbivory).
9. Irrigate immediately to saturate surrounding soil.

Figure 14. Example Pole Planting Detail



Root collars and screen baskets will be installed at least on those plants (including, but not necessarily restricted to, *Populus fremontii* and *Platanus racemosa*) expected to be browsed by deer, rabbits, or rodents (Figure 15, Example Container Plant Planting Detail). Additional irrigation may be necessary depending on soil moisture and timing of expected rainfall at the time of planting.

POST-IMPLEMENTATION ACTIVITIES

Mapping and Reporting the As-built Conditions

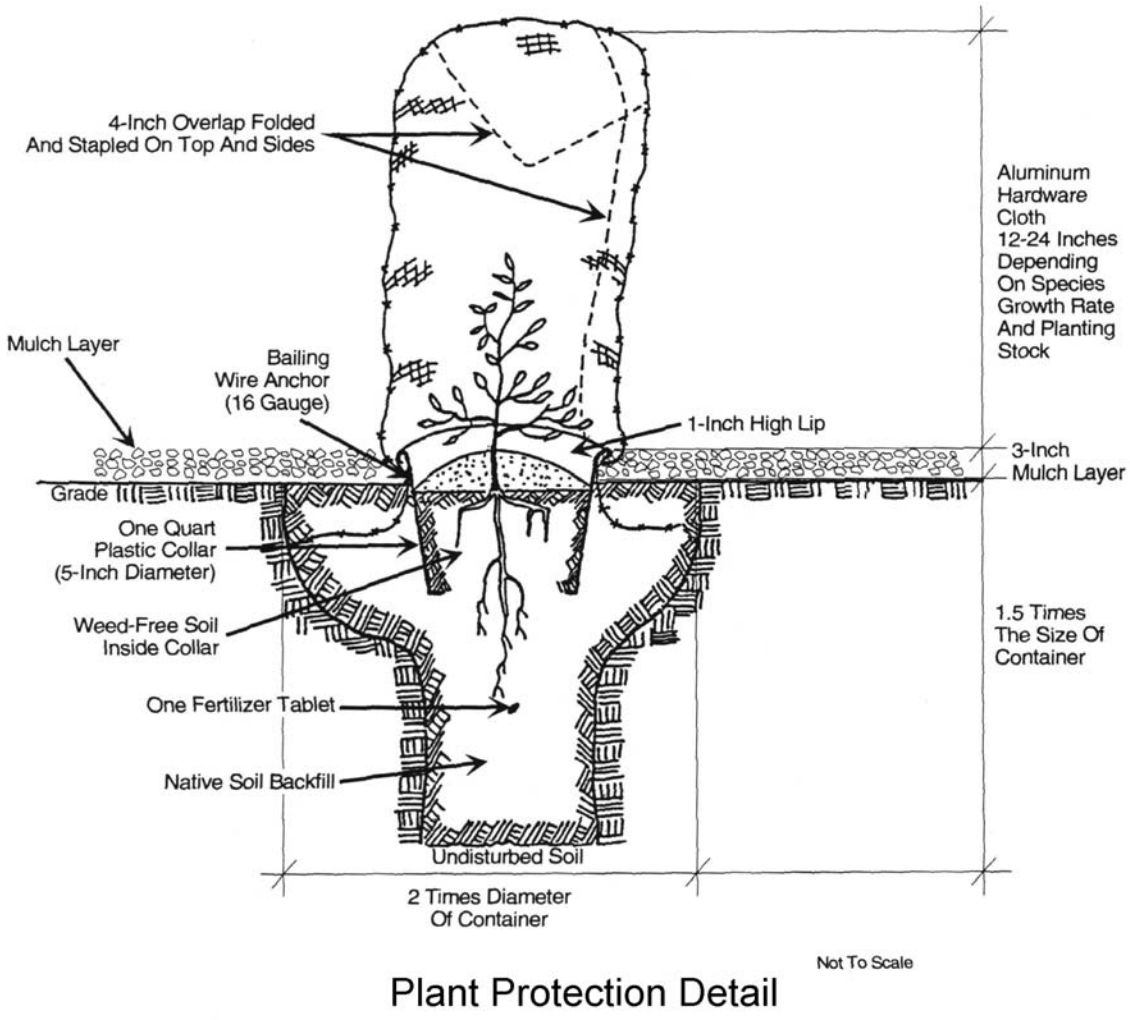
After restoration construction, including planting, is complete, as-built conditions will be mapped and baseline data will be collected. The as-built map will be used to report the as-built conditions to the Corps and the CDFG. The as-built map also will serve as the baseline from which to monitor the development of the restoration.

Irrigation

A temporary irrigation system will be installed only where necessary, for a period of 2 years or until plant establishment is achieved. Supplemental irrigation will not be necessary for willow saplings and other riparian tree species planted directly in the wet zone of the restored channels. Irrigation is

recommended for installation when natural moisture conditions are inadequate to ensure survival of plantings. Irrigation will be provided regularly (every other day, except when raining) to plantings during the first 3 months following planting.

Figure 15. Example Container Plant Planting Detail



Additional irrigation may be required during summer drought periods within the first 2 years. Irrigation will be phased out during the fall/winter of the second year unless unusually severe dry conditions threaten plant survival. All plantings must survive and grow for at least 3 years without supplemental water for compliance with recommended success criteria.

All temporary irrigation should be above ground. Water will be provided by Mr. Reinke, which will be stored in a temporary water storage tank(s) and/or supplied by a water truck. All piping is recommended to be white PVC, and all flex tubing black. The temporary irrigation system should be a combination of drip (to cuttings and/or container plantings) and low-precipitation overhead impact spray (for mulched and/or seeded areas), as appropriate.

At the onset of planting, watering will be performed three times per day, 3 to 4 times per week, for the first two weeks. Gradually, over a period of 6 months to one year, watering will be decreased, until heavy natural rainfall has occurred. At the end of the 24-month period, temporary irrigation will be discontinued.

Watering will not be necessary during the winter season if normal precipitation occurs regularly. However, if rainfall does not occur more frequently than at three-week intervals, during the first winter and spring, supplemental water will be applied in the planting areas.

Restoration Maintenance

Maintenance of the restoration areas is essential to achieve mitigation objectives and performance criteria. Many of the corrective actions triggered by non-attainment of the performance criteria involve maintenance, but routine maintenance will also be conducted even if not required to attain those criteria.

The restoration areas will be maintained in good ecological condition, and will be protected for the duration of the compliance/performance-monitoring period. Included maintenance measures are weed control, trash removal, replanting, and erosion control, as necessary. In addition, as part of maintenance activities, woody debris that is naturally deposited within the mitigation area should be retained onsite wherever possible to enhance habitat values for wildlife.

Maintenance visits, for the establishment of the vegetation, are critical for successful habitat establishment. Two visits per year, one in spring and one in fall, are considered sufficient; however, maintenance will be conducted more frequently during the first year, and is recommended to occur on a monthly basis for the first six months. The irrigation system should also be checked monthly, particularly during the dry season (June through October).

Protection measures are designed to safeguard the mitigation area so that site uses that are considered incompatible with long-term preservation of wetland/riparian species are prohibited.

These protection measures include:

- Meeting with Mr. Reinke staff and contract crews to discuss mitigation efforts and designate which areas to avoid;
- Providing physical protection of existing wetlands during construction;
- Fencing or marking the entire restoration area; and
- Posting educational signs describing the sensitive resources.

Restoration maintenance and protection measures will be accomplished by Mr. Reinke and a landscape contractor familiar with both native plant materials according to the techniques described in the following sections. Mr. Reinke's landscape contractor assigned to implement this plan must be approved as qualified and experienced with native wetland restoration and maintenance.

The plant installation contractor, or another approved landscape maintenance contractor, may conduct the remaining maintenance for the balance of the 5-year compliance period. The following maintenance measures will be conducted on a regular basis:

- **Irrigation.** Irrigation components will be monitored on a regular basis to verify that equipment is in working order. Replacement or repair of broken irrigation components will be completed as necessary. All site visits by contractors will be documented and submitted to the compliance monitor and Mr. Reinke.

- **Weeds**. Planted areas will be weeded to reduce plant competition. Weeding is necessary to encourage the success of planted native plant material and to discourage nonnative ruderal or weedy species from establishing populations at the restoration site. A minimum area of 1-square-meter around each new planting (excluding pole cuttings and wattles) will be kept weed-free. This process will be performed by hand wherever possible. Weeding will only be conducted by persons able to recognize native plant seedlings to avoid removal on natural colonization of the site by native plants.

- **Plant Protection Kits.** Plant protection kits will be inspected and repaired when necessary. Plant screens will be removed before the screens obstruct plant growth. The mulched area will be maintained weed-free.

- **Trash.** All trash will be removed in all mitigation areas on a regular basis, particularly following significant windstorm events.

Maintenance Schedule

Maintenance of all habitat restoration plantings, and control of invasive exotics, will be conducted according to the following schedule; however, the specific timing of maintenance activities may be dependent upon monitoring or other conditions that may require deviation from the schedule. Plantings will be maintained weekly for the first 3 months after planting, quarterly for the remainder of the first year, and semiannually thereafter. The installation contractor will guarantee the plantings for a period of 90 days from acceptance. The remaining maintenance will be performed quarterly for the first year and semiannually thereafter.

SCHEDULE

The restoration activities will be completed in as timely a fashion as is possible. The implementation schedule is included below (Table 16, Restoration Implementation Schedule). This schedule may be modified as necessary to properly implement all aspects of this riparian mitigation plan. This is particularly true with respect to planting, since planting should take place in the wet season.

Table 16. Suggested Restoration Implementation Schedule

Task/Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Prepare Detailed Grading Plan	■	■																	
Prepare Detailed Planting Plan			■	■															
Submit Bid Request(s)					■	■													
Select Contractor(s)							■												
Execute Contract(s)								■											
Conduct Start-up Meeting(s)									■										
Remove Invasive Plants									■					■					■
Grade Planting Site										■									
Install Erosion Control Devices									■	■									
Install Coir Blankets and Rolls											■								
Collect Cuttings and Seeds									■		■	■							
Plant Pole Cuttings											■	■							
Plant Seeds												■	■						
Plant Nursery-grown Plants												■	■						
Install Irrigation System										■	■								
Monitor Grading Contractor									■	■									
Monitor Planting Contractor									■	■	■	■	■						

SECTION V. MONITORING PLAN

GENERAL MONITORING APPROACH

The MOA on Mitigation of 6 February 1990 that guides policy for the U.S. Environmental Protection Agency (EPA), the Corps, and the U.S. Fish and Wildlife Service (USFWS) states:

> "Monitoring should be directed toward determining whether permit conditions are complied with and whether the purpose intended to be served by the condition is actually achieved."

In this regard, monitoring protocol need to be established that allow effective and efficient analyses of the project insofar as the project purposes are concerned. Thus, monitoring protocol include project standards (i.e., success criteria) that are triggers for more detailed analyses and/or the implementation of contingency measures.

Corps and CDFG compliance will be based on the Reinke property's restoration back to natural conditions, as measured against adjacent undisturbed habitats, up and down stream of the restoration site, after a period of five (5) years. Mr. Reinke, with the assistance of DMEC, will determine ecological conditions on similar adjacent habitats to be used as control sites for comparison with the restoration grading and plantings.

MONITORING PARAMETERS AND PROJECT STANDARDS

The focus of the monitoring portion of the overall project is on the restoration of riverine ecosystem function to the Reinke property. The monitoring protocol outlined below are focused on the physical and biological attributes and processes of the restored ecosystem. Below, monitoring parameters and project standards are described qualitatively and quantitatively; however, quantitative measurements will be used specifically to determine success.

At least two control sites will be established for each of the main Reinke property riparian habitat types that will be restored. The control sites will consist of sites that have not been disturbed significantly by human activities and are not likely to be disturbed in the foreseeable future.

The intent of this mitigation monitoring plan is to provide a reasonable and measurable mechanism to determine that the restoration objectives are met by the end of the 5-year monitoring period. Instead of using just plant growth and cover success thresholds, DMEC recommends direct measurement of the physical and biological attributes and processes that are key indicators of ecosystem function.

PHYSICAL PROJECT STANDARDS

The key physical attributes and processes to be monitored are bankfull width, mean bankfull depth, sinuosity, meander wavelength, the rate of bank erosion, and the in-channel sediment characteristics.

- **Bankfull Width and Mean Bankfull Depth**. A permanent cross-section will be established on the Reinke property stream. The cross-section will be measured annually following the cessation of annual high flows. Bankfull width and mean bankfull depth will be assessed to ensure that the stream morphology is not deviating from the stated objectives. Initial project standards are included below (Table 17, Physical Project Standards).
- **Sinuosity and Meander Wavelength**. A permanent longitudinal profile will be established on the Reinke property stream. The longitudinal profile will be measured annually following the cessation of high flows. Sinuosity and meander wavelength will be assessed to ensure that the stream morphology is not deviating from the stated objectives. Initial project standards are included below (Table 17).
- **Rate of Bank Erosion**. Bank pins will be placed at selected locations in the channel banks. Most bank pins will be constructed of brass welding rods that are 0.30 m long and 3.2 mm diameter. Sturdier bank pins will be used where banks are extremely resistant to penetration (e.g., bedrock banks). The sturdier bank pins will be metal spikes that are 0.18 m long and 6.4 mm diameter (see review in Lawler 1993). Bank erosion will be measured annually following the cessation of high flows. Bank erosion rates will be compared to published and unpublished bank erosion rates (Table 17).
- **In-Channel Sediment Characteristics**. Particle size distributions – the D_{16}, D_{50}, and D_{84} - of the channel bed will be performed annually following the cessation of high flows. Particle size distributions will be determined by a Wolman Pebble Count (Wolman 1954, Harrelson et al. 1994). There are no project standards for this metric at this time since the appropriate reference data do not exist. Rather, this metric will be compared to previous measurements to facilitate a simple trend analysis (Table 17).

Table 17. Physical Project Standards

Parameter	Project Standards	
	Minimum	Maximum
Bankfull Width (ft)	6.2	9.1
Bankfull Mean Depth (ft)	0.33	0.43
Bankfull Cross-Sectional Area (sq ft)	2.05	3.91
Bankfull Wetted Perimeter (ft)	6.9	10.0
Bankfull Hydraulic Radius (ft)	0.30	0.39
Bed Slope	<0.01	<0.01
Sinuosity	> 1.0	$^{<}/_{=}$ 1.5
Meander Wavelength (ft)	69	101
Rate of Bank Erosion (ft yr-)	Compare to Available Data	Compare to Available Data
D_{16} (mm)	No Standard at this Time	No Standard at this Time
D_{50} (mm)	No Standard at this Time	No Standard at this Time
D_{84} (mm)	No Standard at this Time	No Standard at this Time

BIOLOGICAL PROJECT STANDARDS

Habitat function comparisons with control sites would include:

- Comparing forage and cover for semi-aquatic species;
- Comparing forage and cover for terrestrial wildlife that frequent/inhabit property wetlands;
- Comparing suitable breeding and nesting habitats for birds currently inhabiting or frequenting riparian communities within the vicinity of the property, or for birds that are expected to breed in riparian habitats associated with perennial seeps and springs;
- Comparing suitable food sources, such as aquatic invertebrates, for native aquatic and terrestrial fauna associated with the existing two creeks; and
- Comparing species richness and diversity to determine that the restoration sites are self-sustaining wetland habitats, consisting of diverse native plant and wildlife assemblages.

Based on the species richness, diversity, composition, and percent cover or population size at each control site, mitigation restoration plantings will be required to meet minimum success thresholds, which are summarized in Table 18, Overall Success Criteria and Thresholds for Plantings. Milestones will be used that must be met for each year.

Table 18. Overall Success Criteria and Thresholds for Plantings

Year After Planting	Percent (Total) Cover Compared to Control Sites	Plant Species Richness & Diversity Compared to Control Sites[1]	Water Quality[2]	Wildlife Species Richness & Diversity Compared to Control Sites[3]	Percent of Plantings Surviving
1	25 percent	25 percent	40 percent	20 percent	95 percent
2	40 percent	40 percent	60 percent	30 percent	90 percent
3	60 percent	60 percent	75 percent	50 percent	80 percent
4	80 percent	80 percent	85 percent	65 percent	75 percent
5	90 percent	90 percent	95 percent	80 percent	70 percent

Ecological data will be sampled from two separate control sites (to be designated in the future) near the restoration site that are similar to the two habitat types intended to be created onsite. Indices for species richness, diversity, and total and relative percent cover will be established for the control sites for vascular plants during the spring and fall in order to establish comparison standards. Indices for species richness, diversity, and utilization will be established for mammals, birds, and macroinvertebrates at each of the control sites will also be established.

[1] Plant species richness and diversity thresholds will be established for vascular plants that are observed at the corresponding habitat type control sites.

[2] Water quality parameters measured will include clarity/turbidity, temperature, and percent cover of algae, as compared to the corresponding habitat type control sites. In the case for water quality, these sites will focus on habitats typically containing standing or flowing water.

The intent of the mitigation is to replace the habitat functions lost as a result of the repairs, installation, and regrading construction activities, to match real-time comparisons with similar habitats within the property. Survival and growth rates for specific plantings are less important than the overall restoration of habitat functions. The survival of plantings, and the planting growth rate, can be used as a guideline in this effort. Specific growth rates and survivability are not, in themselves, good measurements of habitat function. Regardless, survival and growth rates for specific species proposed for planting onsite are provided here as measurement tools, but are not intended to be used to determine mitigation success or failure.

Survival of 70 percent of each species, and at least 90 percent total canopy cover at the mitigation sites (compared to the control sites), will be considered successful after five (5) years. Thresholds of success, for each parameter itemized above in Table 18, must be met after five (5) years. Survival rates that are less than these thresholds will require remediation and additional monitoring until the mitigation sites are comparable in habitat function as the adjacent control sites.

General height and canopy cover guidelines for shrub (including some shrub-like herbaceous and vine species) and tree plantings are listed in Table 19, Minimum Height and Cover Criteria Guidelines for Shrub and Tree Plantings. These measurements are intended to be general guidelines for monitoring purposes.

Table 19. Minimum Height and Cover Criteria Guidelines for Shrub and Tree Plantings

Tree/Shrub/Herb Species Planted	Minimum Height/Canopy Cover (inches) for Each of the 5 Years After Planting				
	1	2	3	4	5
Ambrosia psilostachya	6/3	8/4	10/5	12/6	12/6
Artemisia douglasiana	6/4	12/6	24/10	30/15	36/18
Baccharis salicifolia	12/12	24/24	36/36	48/48	60/56
Cyperus eragrostis	6/3	8/4	10/5	12/6	12/6
Juglans californica ssp. *californica*	12/8	16/16	24/20	36/32	48/36
Mimulus guttatus	6/3	8/4	10/5	12/6	12/6
Platanus racemosa	12/12	36/36	60/40	48/44	108/54
Populus fremontii	12/12	40/32	50/40	80/60	96/72
Quercus lobata	6/4	18/8	36/12	3/24	72/36
Rosa californica	8/6	12/10	16/14	24/20	32/28
Rubus ursinus	8/8	12/16	16/24	20/32	28/60
Salix lasiolepis	48/48	68/60	120/72	140/96	180/120
Sambucus mexicana	12/12	18/18	24/24	36/36	48/48
Umbellularia californica	12/8	16/16	24/20	36/32	48/36

[3] Wildlife species richness and diversity thresholds will be established for macroinvertebrates (e.g. insects) and vertebrates (birds and mammals) that are observed at the corresponding habitat type control sites.

CONTINGENCY MEASURES

As reiterated throughout this document, DMEC fully anticipates the possibility that the site may not satisfy some or all of the stated project standards. If project standards are not satisfied at any time during the monitoring period, then immediate steps will be taken to develop and implement appropriate contingency measures.

Specific contingency measures are not outlined herein since approaches must be case specific. For example, excessive plant mortality could occur for a variety of reasons: inappropriate planting location, drought or flood damage, browsing damage, disease, or physical disturbance, to name a few. Clearly, merely replanting the same species in the same locations is not always the appropriate solution. Thus, contingency measures must be determined through detailed studies if and when the site fails to satisfy some or all of the project standards.

Finally, the general approach to this restoration is to work with the physical attributes and processes to guide the restoration and to rely upon the natural physical and biological processes of the river system to complete the project. Thus, it is possible that the initial appearance of deviation actually could be natural processes altering the trajectory to a state that is slightly different from, but equally functional as, the originally stated objectives. In this regard, this monitoring plan must remain flexible enough to allow the incorporation of the changing objectives (Weinstein et al. 1997).

SECTION VI. ACKNOWLEDGEMENTS

This restoration plan was written by Mark Rains, David Magney, and Cher Wellonen. Mr. Rains and Mr. Magney prepared graphics for this report, with assistance from Ms. Wellonen. Mr. Magney and Ms. Wellonen conducted the habitat assessment, mapped project site vegetation, and performed the delineation of jurisdictional wetlands. Mr. Rains and Ms. Wellonen conducted an additional site assessment to clarify the surficial geology, geomorphology, and hydrology of the restoration site.

Mr. Reinke reviewed a draft of this report and provided background and project development objectives.

SECTION VII. CITATIONS

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PERSONAL COMMUNICATIONS

MacNeal, Spencer, Regulatory Specialist, U.S. Army Corps of Engineers, Regulatory Branch, Los Angeles District, Ventura Field Office, 2 August 2000, letter verifying DMEC delineation of jurisdictional waters of the U.S. at the Reinke site.

APPENDIX. MITIGATION MONITORING FORMS

MITIGATION AREA FIELD MONITORING FORM

MITIGATION CONTROL SITE MONITORING FIELD DATA FORM

PHOTO DOCUMENTATION FORM

MITIGATION AREA FIELD MONITORING FORM

PROJECT NAME: Rudy Reinke Property, Rolling Oaks Drive, Thousand Oaks, California (Ventura County)
STREAMBED ALTERATION AGREEMENT NO.: _____
U.S. ARMY CORPS OF ENGINEERS PERMIT NO.: _____

Observation Date: _____ Monitor: _____

PURPOSE OF THIS MONITORING/OBSERVATION: Periodic report to assess plant growth, survival rates, condition of irrigation system (if applicable), and the progress of site mitigation plantings.

GENERAL PROGRESS OF THE MITIGATION PLANTINGS:

_____

_____

_____

_____

OVERALL OBSERVATIONS, CORRECTIVE MEASURES, AND RECOMMENDATIONS:
Plantings:

1. _____
2. _____
3. _____
4. _____

Use separate sheet for additional comments

Irrigation:

1. _____
2. _____
3. _____
4. _____

Use separate sheet for additional comments

IRRIGATION SITE CORRECTIONS AND SPRINKLER-HEAD LOCATION

_____

_____

_____

_____

DMEC

MITIGATION AREA FIELD MONITORING FORM (continued)

PROJECT NAME: Rudy Reinke Property, Rolling Oaks Drive, Thousand Oaks, California (Ventura County)

Observation Date: _____ Monitor(s): _____

Monitoring Site No.: _____ Monitoring Year: 1 2 3 4 5 (circle one)

PLANT COVER MEASUREMENTS: Species Count –

Planted Species	No. Planted	No. Surviving	Height	Canopy Cover	Success Criteria Met	Comments
Ambrosia psilostachya						
Artemisia douglasiana						
Baccharis salicifolia						
Cyperus eragrostis						
Juglans californica ssp. *c.*						
Mimulus guttatus						
Platanus racemosa						
Populus fremontii						
Quercus lobata						
Rosa californica						
Rubus ursinus						
Salix lasiolepis						
Sambucus mexicana						
Umbellularia californica						

Additional Comments:

DMEC

MITIGATION CONTROL SITE MONITORING FIELD DATA FORM

PROJECT NAME: Rudy Reinke Property, Rolling Oaks Drive, Thousand Oaks, California (Ventura County)

Observation Date: _____ Monitor: _____

Monitoring Year: 1 2 3 4 5 (circle one)

Control Site No.	Vegetation			Wildlife		Water Quality		
	Total % Cover (tree, shrub, & herbaceous layers)	Plant Species Richness (number of species)	Plant Species Diversity (no. of plant forms)	Macro-invertebrate Species Richness & Diversity	Wildlife Species Richness & Diversity	Temp.	Clarity/ Turbidity	Percent Cover Green Algae
1								
2								
3								
4								
5								
6								
7								
8								

Additional Comments/Observations:

DMEC

PHOTO DOCUMENTATION FORM

PROJECT NAME: Rudy Reinke Property, Rolling Oaks Drive, Thousand Oaks, California (Ventura County)

STREAMBED ALTERATION AGREEMENT NO.: _____

U.S. ARMY CORPS OF ENGINEERS PERMIT NO.: _____

Station Point No.: _____ **Mitigation/Control Area:** _____

Date Photo Taken: _____ **Monitor(s):** _____

Place first year 3 by 5-inch photograph so that bottom is approximately ½ inch above this sentence. Tape top edges. Write year and station point number on back of photograph. Overlay photographs from successive monitoring dates.