Appendix A.
Vascular Plants of Newark Specific Plan Areas 3 and 4

Appendix A. Vascular Plant Species Observed at Newark Specific Plan Areas 3 and 4.		
FAMILY NAME	**SCIENTIFIC NAME**	**COMMON NAME**
Aizoaceae	*Mesembryanthemum nodiflorum*	slenderleaf iceplant
Apiaceae	*Conium maculatum*	poison hemlock
	Foeniculum vulgare	fennel
Arecaceae	*Phoenix canariensis*	Canary Island date palm
	Washingtonia robusta	Washington fan palm
Asteraceae	*Baccharis pilularis*	coyote brush
	Carduus pycnocephalus	Italian thistle
	Chamomilla suaveolens	pineapple weed
	Cotula coronopifolia	common brassbuttons
	Dittrichia graveolens	stinkwort
	Grindelia stricta	coast gumweed
	Hemizonia pungens	tarweed
	Picris echioides	prickly ox-tongue
	Xanthium strumarium	rough cockle-bur
Boraginaceae	*Amsinckia* sp.	fiddleneck
Brassicaceae	*Brassica nigra*	black mustard
	Brassica rapa	field mustard
	Capsella bursa-pastoris	shepherd's purse
	Cardaria draba	hoary cress
	Hirschfeldia incana	mustard
	Lepidium latifolium	perennial pepperweed
	Raphanus sativus	wild radish
Caryophyllaceae	*Spergularia macrotheca*	sticky sandspurry
Chenopodiaceae	*Atriplex rosea*	tumbling oracle
	Atriplex triangularis	spearscale
	Beta vulgaris	common beet
	Chenopodium album	white goosefoot
	Salicornia virginica	pickleweed
	Salsola tragus	Russian thistle
Cyperaceae	*Scirpus robustus*	alkali bulrush
Fabaceae	*Lathyrus* sp.	sweet pea
	Lotus corniculatus	bird’s-foot trefoil
	Medicago polymorpha	bur clover
	Melilotus indicus	sweetclover
	Vicia sativa	common vetch
Frankeniaceae	*Frankenia salina*	alkali heath
Geraniaceae	*Erodium cicutarium*	red-stemmed filaree
	Geranium dissectum	cutleaf geranium
Juncaceae	*Juncus bufonius*	toad rush
	Juncus effusus	bog rush

Appendix A. Vascular Plant Species Observed at Newark Specific Plan Areas 3 and 4.		
FAMILY NAME	**SCIENTIFIC NAME**	**COMMON NAME**
Lythraceae	*Lythrum hyssopifolium*	hyssop loosestrife
Malvaceae	*Lavatera cretica*	Cornish mallow
	Malva neglecta	common mallow
	Malva parviflora	cheeseweed
	Malvella leprosa	alkali mallow
Myoporaceae	*Myoporum laetum*	lollypop tree
Oxidalidaceae	*Oxalis corniculata*	yellow sorrel
Papaveraceae	*Eschscholzia californica*	California poppy
Plantaginaceae	*Plantago coronopus*	plantain
Poaceae	*Avena fatua*	wild oats
	Avena sativa	hay oats
	Bromus diandrus	ripgut brome
	Bromus hordeaceous	soft chess
	Cortaderia selloana	pampas grass
	Crypsis schoenioides	Prickle grass
	Cynodon dactylon	Bermuda grass
	Distichlis spicata	saltgrass
	Elytrygia elongata	tall wheatgrass
	Glyceria sp.	Manna grass
	Monerma cylindrica	thintail
	Hordeum marinum	Mediterranean barley
	Hordeum murinum	foxtail
	Hordeum vulgare	common barley
	Lolium multiflorum	Italian ryegrass
	Parapholis incurva	Sickle grass
	Phalaris minor	Mediterranean canarygrass
	Phalaris paradoxa	hood canarygrass
	Phragmites australis	common reed
	Poa annua	annual bluegrass
	Triticum aestivum	wheat
Polygonaceae	*Polygonum arenastrum*	common knotweed
	Rumex crispus	curly dock
	Rumex salicifolius	willow-leaved dock
Primulaceae	*Anagallis arvensis*	scarlet pimpernel
Salicaceae	*Salix laevigata*	red willow
	Salix lasiolepis	arroyo willow
Tamaricaceae	*Tamarix parviflora*	smallflower tamarisk
Typhaceae	*Typha latifolia*	broad-leaf cattail
Ulmaceae	*Ulmus pumila*	Chinese elm
Urticaceae	*Urtica dioca*	stinging nettle

Appendix B.
Special-Status Plant Species
Considered but Rejected for Occurrence at the Project Site

Scientific Name	Common Name	Lack of Serpentine Soils	Lack of Alkaline Soils	Lack of other Edaphic Features	Lack of Vernal Pool Habitat	Believed to Be Extirpated from Santa Clara County	Lack of Associated Species	Highly Degraded Site Conditions
Amsinckia lunaris	bent-flowered fiddleneck						X	X
Erodium macrophyllum	round-leaved filaree							X
Castilleja affinis ssp. *neglecta*	Tiburon Indian paintbrush	X						
Castilleja rubicundula ssp. *rubicundula*	pink creamsacs	X						
Ceanothus ferrisae	coyote ceanothus	X		X				
Cirsium fontinale var. *campylon*	Mt. Hamilton thistle	X		X				X
Dudleya setchellii	Santa Clara Valley dudleya	X						
Eriogonum luteolum var. *caninum*	Tiburon buckwheat	X						
Erysimum franciscanum	San Francisco wallflower	X					X	X
Fritillaria agrestis	stinkbells	X						X
Fritillaria liliacea	fragrant fritillary	X						X
Hoita strobilina	Loma Prieta hoita	X		X				X
Leptosiphon acicularis	bristly leptosiphon							X
Leptosiphon grandiflorus	large-flowered leptosiphon			X			X	X
Lessingia hololeuca	woolly-headed lessingia	X						
Lessingia micradenia var. *glabrata*	smooth lessingia	X						
Malacothamnus arcuatus	arcuate bush mallow			X				X
Malacothamnus hallii	Hall’s bush mallow			X				X
Micropus amphibolus	Mt. Diablo cottonweed			X				
Microseris sylvatica	sylvan microseris	X				X		
Navarretia cotulifolia	cotula navarretia			X				
Perideridia gairdneri ssp. *gairdneri*	Gairdner's yampah				X			
Ranunculus lobbii	Lobb's aquatic buttercup				X			
Streptanthus albidus ssp. *albidus*	Metcalf Canyon jewel-flower	X						
Streptanthus albidus ssp. *peramoenus*	most beautiful jewel-flower	X						X
Trifolium amoenum	showy Indian clover	X				X	X	X
Trifolium depauperatum var. *hydrophilum*	saline clover				X			
Tropidocarpum capparideum	caper-fruited tropidocarpum		X			X		

Appendix C.
Waters of the U.S. Jurisdictional Determination

H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

NEWARK AREAS 3 AND 4
NEWARK, ALAMEDA COUNTY, CALIFORNIA
PRELIMINARY DELINEATION OF WETLANDS AND OTHER WATERS

Prepared by

H. T. HARVEY & ASSOCIATES

Prepared for

SOBRATO DEVELOPMENT COMPANIES

20 June 2007

Project Number 2596-03

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FIGURES:

TABLES:

List of Preparers:

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Kelly Hardwicke, Ph.D., Plant Ecologist
Ed Kentner, Ph.D., Plant Ecologist
Brian Cleary, M.S., Plant Ecologist

EXECUTIVE SUMMARY

H. T. Harvey & Associates' biologists surveyed the Newark Areas 3 & 4 project site, located in the northwestern portion of Alameda County, California for areas potentially meeting the physical criteria of Waters of the U.S. The approximately 640-acre project site is located in the City of Newark.

Summary of Jurisdictional Waters

Potential Jurisdictional Waters	Acres
Wetlands	242.89
Other Waters	34.21
Jurisdictional Areas Total	**277.10**
Areas with Wetland Characteristics Determined to be Non-Jurisdictional	0.82
Upland	361.70
Total Area of Study Site	**639.62**

INTRODUCTION

PROJECT AREA DESCRIPTION

The current project site encompasses two planning areas (identified as "Newark Areas 3 and 4") located within the city limits of the City of Newark ("City"), Alameda County, California (Figure 1). To guide future development, the City initiated a comprehensive revision to its General Plan in the mid-1980s. After a long planning process the City Council adopted the General Plan Update (GPU) in 1992 designating these planning sites as Areas 3 and 4. Area 3 is bounded by Cherry Street, Stevenson Boulevard, the Union Pacific railroad tracks and Mowry Avenue. It includes existing facilities such as the Silliman Recreation Complex and Ohlone College, and a large portion that is currently undeveloped. Portions of Area 3 have previously been studied as part of the environmental approval process and have received permits from the U.S. Army Corps of Engineers (USACE) for those projects (Corps File No. 27848S and 24851S). Thus, the only portion of Area 3 included in the current analysis is a 77 ac parcel located at the corner of Cherry Street and Stevenson Boulevard. Area 4 (approximately 563 ac) comprises a largely undeveloped area within the City located between Mowry Avenue and Stevenson Boulevard, west of the Union Pacific railroad tracks.

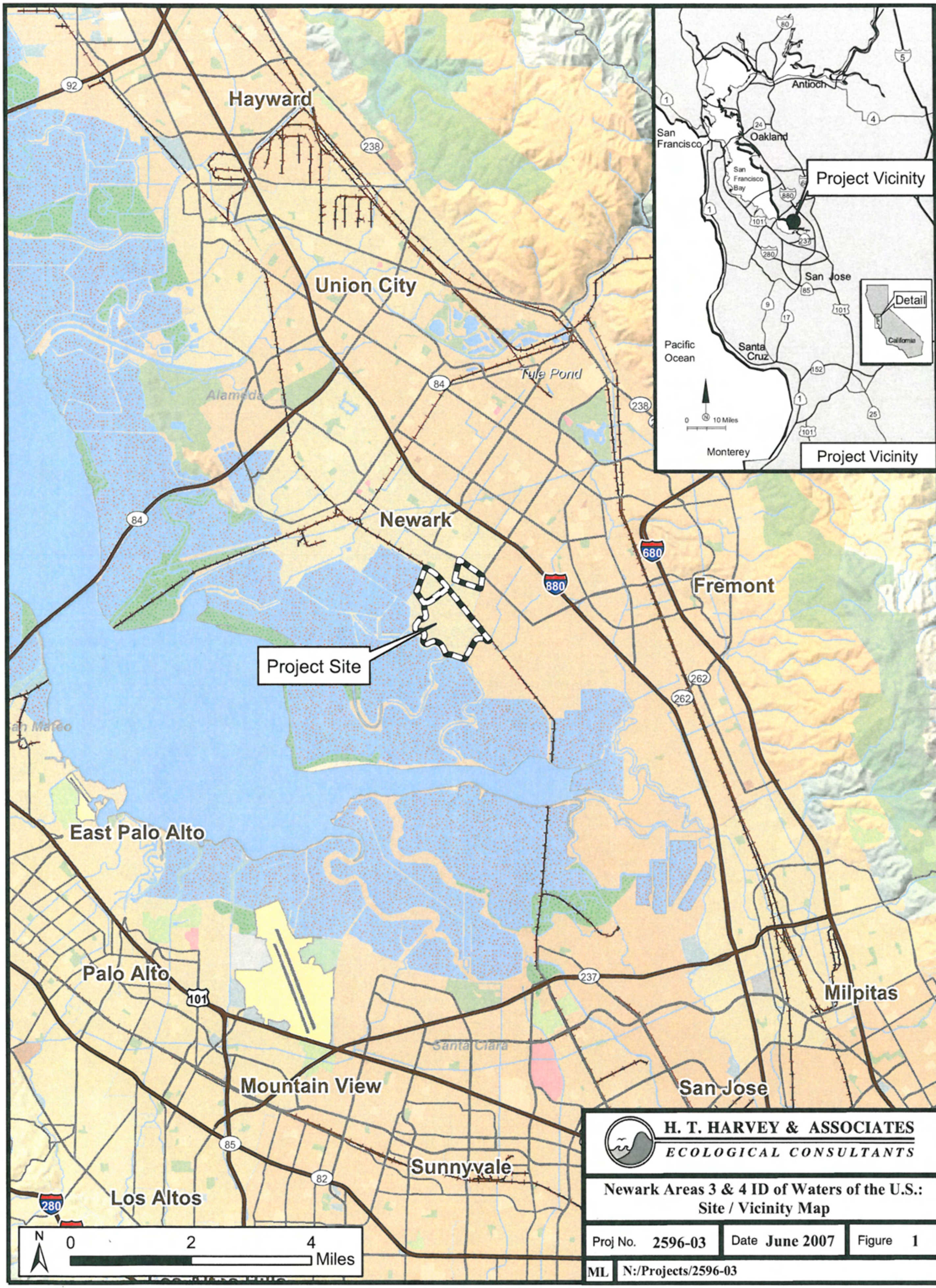
The study area occurs on several U.S. Geological Survey Quadrangle maps including Newark, Niles, Mountain View, and Milpitas (Figure 2). In general the project site slopes from east to west and spans an elevation range of approximately 20 ft. The highest elevation is 19.2 ft (National Geodetic Vertical Datum, NGVD) located along the eastern boundary of the parcel adjacent to Cherry Street. The lowest elevation occurs along the extreme southwestern part of the property and is at –1.8 feet NGVD. The average annual precipitation of the site is 16 in, and the average annual temperature is 57° Fahrenheit.

The National Wetland Inventory (NWI) depicts nine wetland types on the project site: 1-4), palustrine emergent diked impounded temporary, seasonal, semi-permanent, and permanent; 5-6), palustrine unconsolidated bottom diked/impounded semi-permanent and permanent; 7), estuarine subtidal unconsolidated bottom subtidal; and 8), estuarine intertidal streambed regularly flooded; and 9), palustrine farmed (NWI 1985). There is also one relatively recently constructed, mitigation wetland that is not shown on the NWI map, but is clearly visible on the aerial within Area 3 north and adjacent to the Union Pacific Railroad tracks on the eastern boundary of the project site (Figure 3).

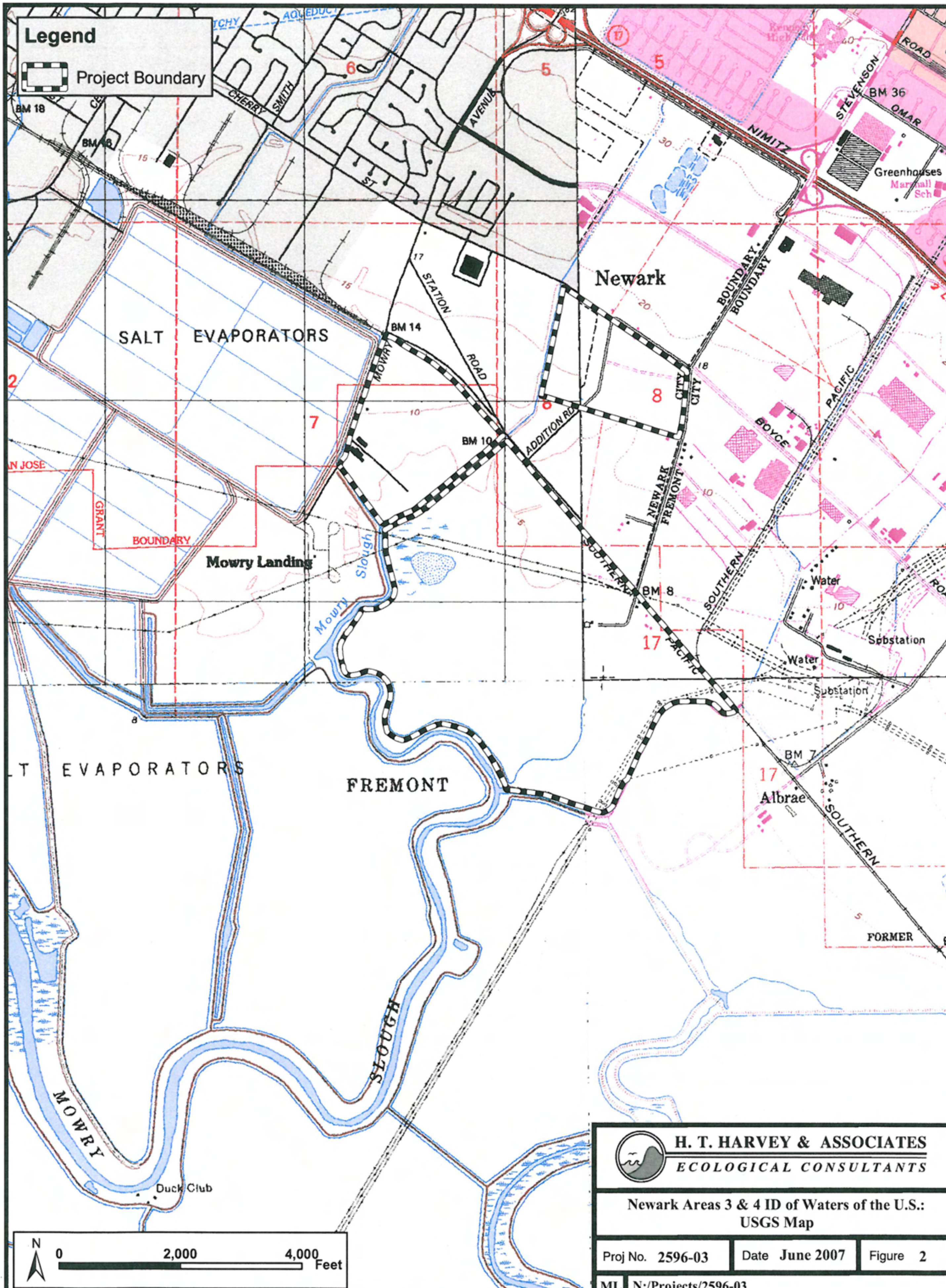
The majority of the project site is in active agricultural use, including production of forage hay, and has been continually farmed for over 100 years. Two small parcels are currently used as auto wrecking facilities. Soils from ten different soil series underlay the project site. However, the hydrologic conditions that contributed to the formation of the soils have been significantly altered by the construction of the salt pond levees in the early part of the 1900s and construction of numerous drainage channels as part of agricultural production. Much of the land closest to Mowry Slough was leveled and recontoured to create duck ponds several decades ago. Evidence of these duck ponds (winter ponding and surface salt accumulation) is clearly visible on aerial photographs of the study area. Soil series present on-site include: Clear Lake clay drained (0 to 2% slopes, 1% of the project site), Marvin silt loam saline-alkali (0.6% of the project area), Omni silty clay loam drained (6.6% of the project site), Omni silty clay loam strongly saline (61.9% of the project site), Pescadero clay ponded (0.1% of the project site), Reyes clay (1.1% of the project site), Reyes clay ponded (less than 1% of the project site), Reyes clay drained (17.8% of the project site), Willows clay drained (1.6% of the project site), and Xerothents clayey (7.3% of the project site). These soils are poorly drained and formed in alluvium, with the exception of the Xerothents which consist of materials used for fill for building sites; additionally, most of these soils are saline and/or alkaline, with shallow water tables (SCS 1975, Figure 4).

SURVEY PURPOSE

H. T. Harvey & Associates plant ecologists Amanda Breen, Ph.D., Kelly Hardwicke, Ph.D., Ed Kentner, Ph. D., Brian Cleary, M.S. and Patrick Boursier, Ph.D. surveyed the project area for areas that may meet the physical criteria of "Waters of the United States" (jurisdictional waters) during the 2005-2006 and 2006-2007 winter/spring seasons when precipitation falls in California. Surveys were conducted within the entire project area. The purpose of this work was to identify the extent and distribution of potential jurisdictional waters such as wetlands and other waters occurring within the project boundaries under conditions existing at the time of the survey.



Hayward
Union City
Newark
Fremont
Project Site
Tule Pond
Alameda
East Palo Alto
Palo Alto
Mountain View
Sunnyvale
Los Altos
Milpitas
San Jose
Santa Clara
San Mateo
Project Vicinity
San Francisco
Oakland
Antioch
San Francisco Bay
Pacific Ocean
Santa Cruz
Monterey
Detail
California
0 10 Miles
0 2 4 Miles
H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS
Newark Areas 3 & 4 ID of Waters of the U.S.: Site / Vicinity Map
Proj No. 2596-03
Date June 2007
Figure 1
ML N:/Projects/2596-03



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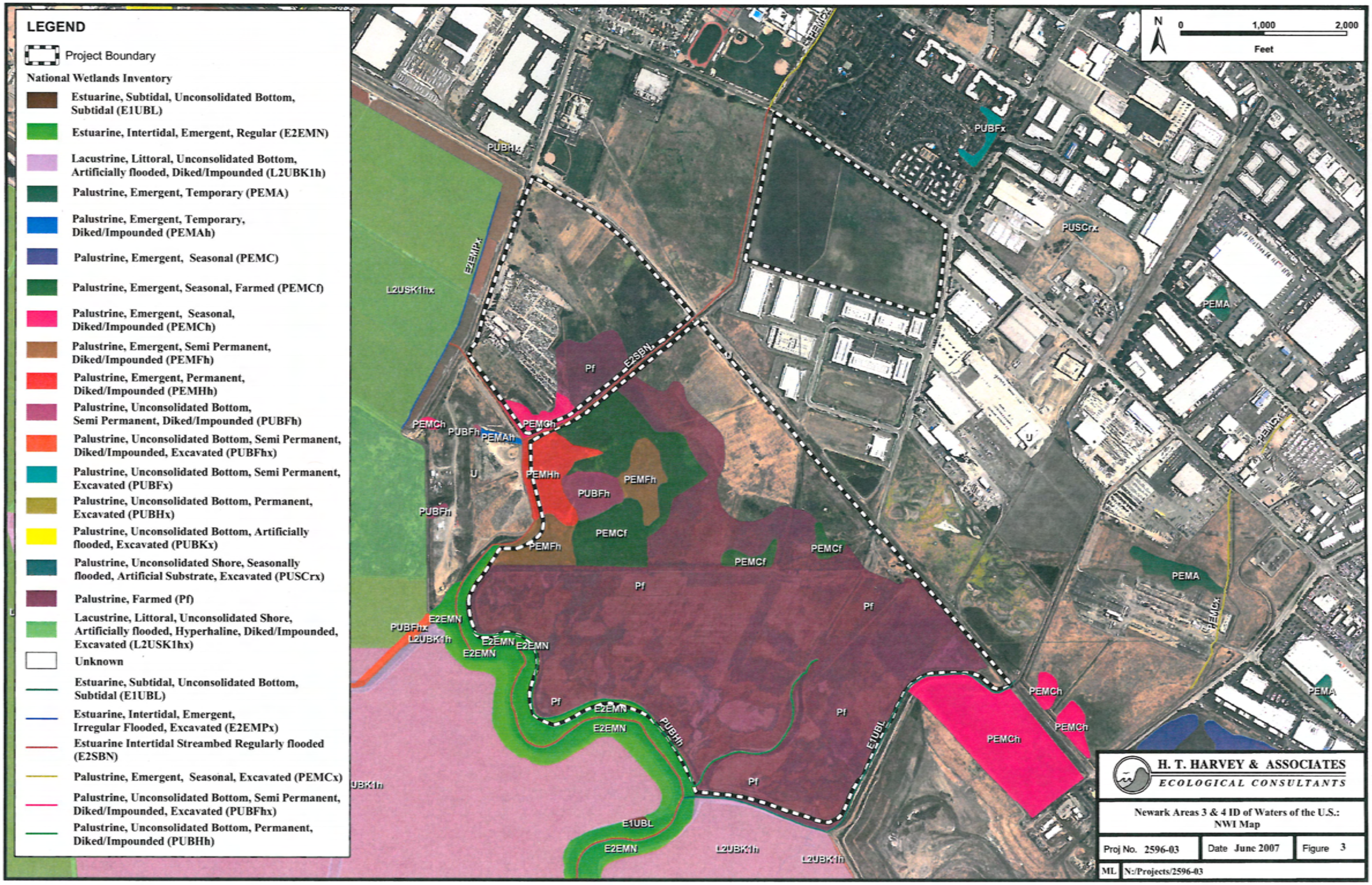
ECOLOGICAL CONSULTANTS

Newark Areas 3 & 4 ID of Waters of the U.S.: USGS Map

Proj No. 2596-03	Date June 2007	Figure 2

ML N:/Projects/2596-03


LEGEND
Project Boundary
National Wetlands Inventory
Estuarine, Subtidal, Unconsolidated Bottom, Subtidal (E1UBL)
Estuarine, Intertidal, Emergent, Regular (E2EMN)
Lacustrine, Littoral, Unconsolidated Bottom, Artificially flooded, Diked/Impounded (L2UBK1h)
Palustrine, Emergent, Temporary (PEMA)
Palustrine, Emergent, Temporary, Diked/Impounded (PEMAh)
Palustrine, Emergent, Seasonal (PEMC)
Palustrine, Emergent, Seasonal, Farmed (PEMCf)
Palustrine, Emergent, Seasonal, Diked/Impounded (PEMCh)
Palustrine, Emergent, Semi Permanent, Diked/Impounded (PEMFh)
Palustrine, Emergent, Permanent, Diked/Impounded (PEMHh)
Palustrine, Unconsolidated Bottom, Semi Permanent, Diked/Impounded (PUBFh)
Palustrine, Unconsolidated Bottom, Semi Permanent, Diked/Impounded, Excavated (PUBFhx)
Palustrine, Unconsolidated Bottom, Semi Permanent, Excavated (PUBFx)
Palustrine, Unconsolidated Bottom, Permanent, Excavated (PUBHx)
Palustrine, Unconsolidated Bottom, Artificially flooded, Excavated (PUBKx)
Palustrine, Unconsolidated Shore, Seasonally flooded, Artificial Substrate, Excavated (PUSCrx)
Palustrine, Farmed (Pf)
Lacustrine, Littoral, Unconsolidated Shore, Artificially flooded, Hyperhaline, Diked/Impounded, Excavated (L2USK1hx)
Unknown
Estuarine, Subtidal, Unconsolidated Bottom, Subtidal (E1UBL)
Estuarine, Intertidal, Emergent, Irregular Flooded, Excavated (E2EMPx)
Estuarine Intertidal Streambed Regularly flooded (E2SBN)
Palustrine, Emergent, Seasonal, Excavated (PEMCx)
Palustrine, Unconsolidated Bottom, Semi Permanent, Diked/Impounded, Excavated (PUBFhx)
Palustrine, Unconsolidated Bottom, Permanent, Diked/Impounded (PUBHh)
N
0
1,000
2,000
Feet
PUBHx
E2EMPx
L2USK1hx
PUBFx
PUSCrx
PEMA
E2SBN
Pf
PEMCh
PUBFh
PEMAh
PEMHh
PUBFh
PEMFh
PEMCf
PEMFh
U
PEMCf
PEMCx
PEMA
E2EMN
PUBFhx
L2UBK1h
E2EMN
PUBHh
E1UBL
PEMCh
L2UBK1h
H. T. HARVEY & ASSOCIATES
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Newark Areas 3 & 4 ID of Waters of the U.S.: NWI Map
Proj No. 2596-03
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Figure 3
ML
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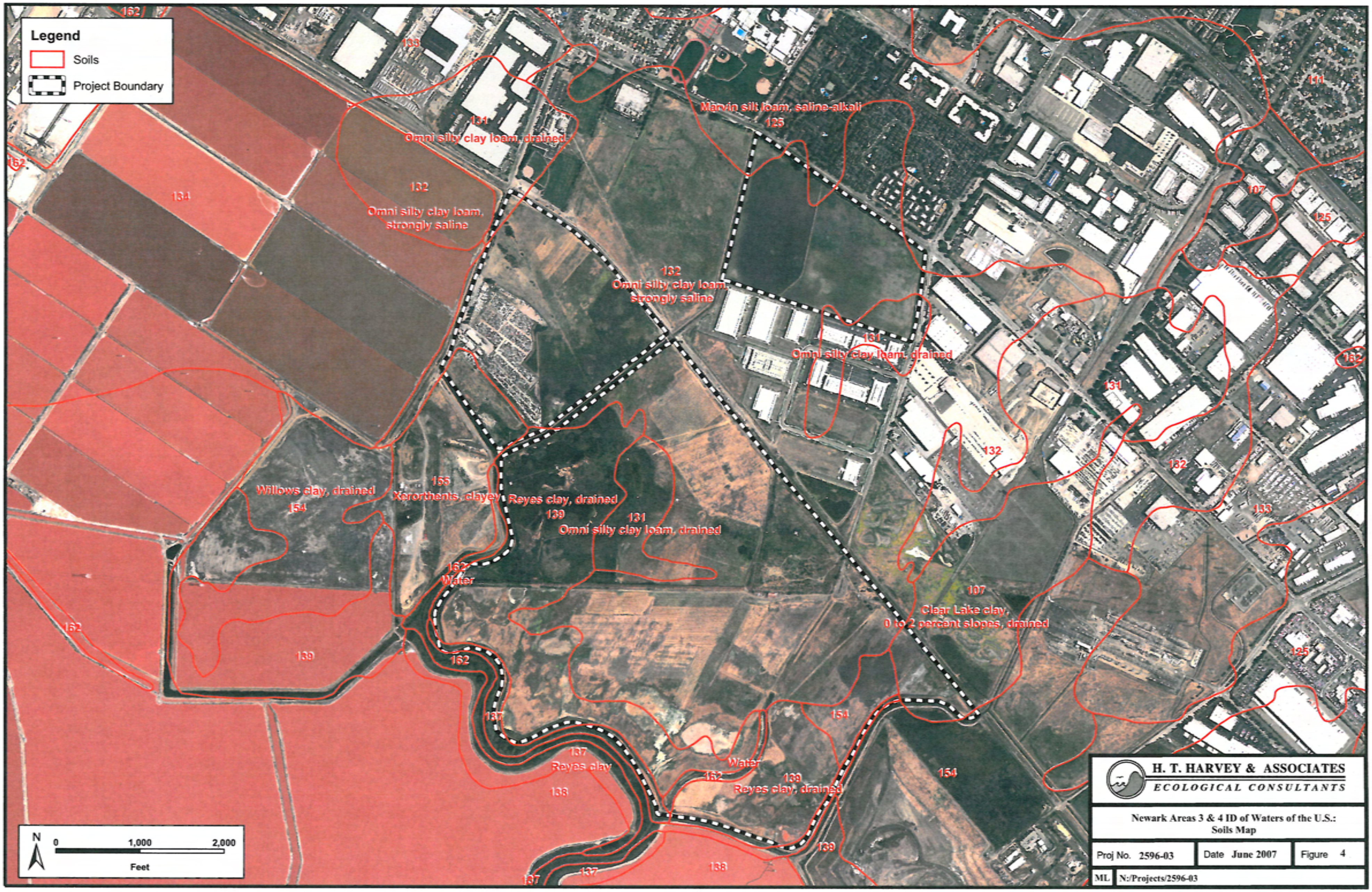


Legend
Soils
Project Boundary
Marvin silt loam, saline-alkali
125
131
Omni silty clay loam, drained
132
Omni silty clay loam, strongly saline
134
133
111
107
125
132
Omni silty clay loam, strongly saline
131
Omni silty clay loam, drained
131
132
132
133
155
Xerorthents, clayey
Willows clay, drained
154
Reyes clay, drained
139
131
Omni silty clay loam, drained
162
Water
107
Clear Lake clay, 0 to 2 percent slopes, drained
152
139
162
137
137
Reyes clay
138
Water
162
139
Reyes clay, drained
154
154
125
139
137
137
138
N
0
1,000
2,000
Feet
H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS
Newark Areas 3 & 4 ID of Waters of the U.S.:
Soils Map
Proj No. 2596-03
Date June 2007
Figure 4
ML
N:/Projects/2596-03

SURVEY METHODS

Surveys were conducted within the project boundaries for areas that meet the physical criteria of waters of the U.S. Surveys for jurisdictional waters were conducted throughout the winter and spring of 2005-06 and 2006-07. This encompassed a year of above average rainfall in the winter and spring (2005 to 2006) and a year of average rainfall (2006-2007). The site was visited no fewer than 50 separate times commencing in November of 2005 and continuing into June of 2007. The purpose of many of these visits was to hike the property to determine the state of soil saturation during the rainfall season before and after the soil profile had become charged with soil moisture.

Please note: This report does not evaluate whether any areas meeting the physical criteria for waters of the U.S. are nevertheless not subject to USACE jurisdiction as a result of either prior determinations of prior converted cropland status or USACE guidance issued in response to the U.S. Supreme Court decisions on SWANCC (2003) or Rapanos (2007).

The vegetation, soils, and hydrology of the site were examined following the guidelines outlined in the *Routine Determination Method* in the Corps of Engineers 1987 Wetlands Delineation Manual (Environmental Laboratory 1987). In addition, the *Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region* (*Regional Supplement* USACE 2006) was followed to document site conditions relative to hydrophytic vegetation, hydric soils and wetland hydrology. As noted in the latter report, the *Regional Supplement* is designed to be used with the current version of the *Corps 1987 Manual*; where differences in the two documents occur, the *Regional Supplement* takes precedence over the *Corps 1987 Manual*. This report was also compiled in accordance with guidance provided in *Information Needed for Verification of Corps Jurisdiction* (USACE San Francisco District 2000).

The project site was examined for topographic features, drainages, alterations to site hydrology and areas of significant recent disturbance. A determination was then made as to whether normal environmental conditions were present at the time of the field surveys. Data were used to document which portions of the site were wetlands. Generally, surveys conducted examined the vegetation, soils, and hydrology using the "Routine Determination Method, On-Site Inspection Necessary (Section D)" outlined in the Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987), despite on-going farm practices. This three-parameter approach to identifying wetlands is based upon the presence of hydrophytic vegetation, hydric soils, and wetland hydrology. However, due to the altered site conditions, we utilized methods described in the Regional Supplement for *Difficult Wetland Situations in the Arid West: Managed Plant Communities* and *Corps 1987 Manual* for Atypical Situations, including using the two-parameter wetland delineation approach in addition to the three-parameter approach. In these cases, vegetation was observed and recorded, but not used in the final determination on the data form. Thus, the hydrophytic vegetation determination included an analysis of the condition that might exist on site in the unmanaged condition by observing portions of the study area with similar soils and hydrological characteristics that are in a relatively undisturbed state.

Overall, the approach used to identify wetlands included digging soil pits to sample soil from various depths, observing vegetation growing in proximity to the soil sample area, and determining current hydrologic features (surface and subsurface) present near the sample area. Sample locations that exhibited only two of the wetland parameters (hydrology and soils) were analyzed on a case-by-case basis. In addition, surface ponding was monitored on the site and documented.

Prior to site surveys, topographic maps and aerial photographs of the study area were obtained from several sources and reviewed. These sources included the U.S. Geological Survey Maps and National Wetlands Inventory Maps for the Newark, Niles, Mountain View, and Milpitas quadrangles and historic aerial photography. A topographic map was produced specifically for this project by Kier & Wright Engineers. The map resolution was at a 0.1-ft contour interval.

A brief overview of the USACE methodology specifically applicable to the identification of jurisdictional waters on the project site is summarized below.

IDENTIFICATION OF SECTION 404 WETLANDS AND OTHER WATERS

Vegetation. Plants observed at each of the sample sites were identified to species using *The Jepson Manual* (Hickman 1993). Additional references included *A Flora of the Marshes of California* (Mason 1969), *Manual of the Grasses of the United States* (Hitchcock 1971), and *Weeds of California* (Robbins et al. 1970). The wetland indicator status of each species was obtained from the 1988 Wetland Plant List, California (Reed 1988). The names of plants were generally not taken from *The Jepson Manual* (Hickman 1993) as these names are not totally consistent with scientific names used in the 1988 Wetland Plant List, California (Reed 1988) and the National List of Scientific Plant Names (Smithsonian Institution 1982).

A list of species for each observation area was then compiled and a visual estimate of the percent cover of plant species was made following guidance provided in the *Regional Supplement*. It was then determined which of the observation areas supported wetland vegetation using the applicable Indicator (*i.e.*, 1-Dominance Test; 2-Prevalence Test; or, 3-Morphological Adaptations) as described in the *Regional Supplement*.

Wetland indicator species are designated according to their frequency of occurrence in wetlands. For instance, a species with a presumed frequency of occurrence of 67 to 99 percent in wetlands is designated a facultative wetland indicator species. The five basic levels of wetland indicator status described in the *Regional Supplement* do not include plus (+) or minus (-) indicators. The wetland indicator groups, indicator symbol and the frequency of occurrence of species within them in wetlands are as follows:

***Table 1. Wetland Indicator Status Categories for Vascular Plants.**

INDICATOR CATEGORY	SYMBOL	FREQUENCY OF OCCURRENCE
OBLIGATE	OBL	greater than 99%
FACULTATIVE WETLAND	FACW	67 - 99%
FACULTATIVE	FAC	34 - 66%
FACULTATIVE UPLAND	FACU	1 - 33%
UPLAND	UPL	less than 1%

*Based upon information contained in *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987). "NOL" = not on the list; "NI" = not an indicator.

Obligate and facultative wetland indicator species are hydrophytes that occur "in areas where the frequency and duration of inundation or soil saturation produce permanently or periodically saturated soils of sufficient duration to exert a controlling influence on the plant species present" (Environmental Laboratory 1987). Facultative indicator species may be considered wetland indicator species when found growing in hydric soils that experience periodic saturation. A complete list of the vascular plants observed on the project site, and their current indicator status has been provided in Appendix A. Plants species that are not on the regional list of wetland indicator species are upland species.

Soils. Where possible, the top 22 in of the soil profile was examined for hydric soil indicators. Diagnostic features include numerous indicators defined and described by the National Technical Committee for Hydric Soils (NTCHS). These indicators include the presence of organic soils (Histosols, A1), histic epipedons (A2), depleted matrix (F3), redox depressions (F8), redox dark surface (F6), and mottling indicated by the presence of gleyed or bright spots of colors (in the former case, blue grays; in the latter case, orange red, or red brown) within the soil horizons observed, among other features. Mottling of soils usually indicates poor aeration and lack of good drainage. Munsell Soil Notations (Kollmorgen Instruments Corp. 1990) were recorded for the soil matrix for each soil sample. The last digit of the Munsell Soil Notation refers to the chroma of the sample. This notation consists of numbers beginning with 0 for neutral grays and increasing at equal intervals to a maximum of about 20. Chroma values of the soil matrix that are one (1) or less, or two (2) or less when mottling is present, are typical of soils which have developed under anaerobic conditions. In addition, several hydric soil features listed as field characteristics in the Corps 1987 Manual, including aquic or peraquic moisture regime, were described and utilized, where applicable, in making the determination relative to hydric soil conditions.

In sandy soils, such as alluvial deposits in the bottom of drainage channels, hydric soil indicators include high organic matter content in the surface horizon (Sandy Mucky Mineral, S1) and streaking of subsurface horizons by organic matter (A5). All soil colors indicated in this report were taken under clear, sunny skies using moistened soil samples.

The Soil Survey of Alameda County, California, Western Part, (SCS 1981) was consulted to determine which soil types have been mapped on the project site. Descriptions of soil mapping units and the list of hydric soils in Alameda County, Western Part are included in Appendix B.

SURVEY RESULTS

We identified approximately 242.89 ac of potential jurisdictional wetlands and approximately 34.21 ac of potential jurisdictional "other waters" within the Newark Areas 3 & 4 project area. A total of 85 sample points were taken throughout the project site (Appendix C).

Table 2. Summary of Jurisdictional Waters

Potential Jurisdictional Waters	Acres
Wetlands	242.89
Other Waters	34.21
Jurisdictional Areas Total	**277.10**
Areas with Wetland Characteristics Determined to be Non-Jurisdictional	0.82
Upland	361.70
Total Area of Study Site	**639.62**

Information pertinent to the identification of jurisdictional waters assembled during the investigations is presented in four appendices attached to this report.

- Appendix A — Plant List
- Appendix B — Soil Descriptions
- Appendix C — USACE Data Forms
- Appendix D — Photo Monitoring Summary

OBSERVATIONS / RATIONALE / ASSUMPTIONS

- The on-site determination assumed normal circumstances, and results are based upon existing conditions present at the time of the surveys. Average rainfall from 2002-2006 period was measured at Union City, California to be 18.8 in (+/- 4.7 in). However, rainfall during this period was 76% of the average annual total precipitation (CIMIS 2007). Wetland parameters were also observed throughout the project site in the 2005-2006 rainfall period, in which the project area received 91% of the average annual total precipitation.

- Soils on-site are dark and of low chroma, most likely due to the accumulation of organic matter and presence of small soil particle size that developed during historic inundation (Photograph 1). All soils are listed on the Alameda County hydric soil list and all of these soils were historically hydric in nature. Often, beneath the disked Ap (plow) layer, historic mottling was observed along with an obvious redox depletion zone of high value/low chroma.

Photograph 1. Low chroma soils

- This wetland delineation represents the second year of effort on this site, as it was also monitored during the 2005-2006 wet season. The total rainfall was similar between the two monitoring seasons, and the areas ultimately determined to be potential jurisdictional wetlands were very similar for the two survey efforts, although some differences were apparent. To a certain degree the observed difference in the extent of seasonal wetlands on site may be partly attributed to maintenance of drainage ditches, and replacement of collapsed/blocked culverts on-site that were enacted in the summer of 2006. Undoubtedly, the pattern of rainfall differed between the two years, influencing the amount and duration of water retention in depressions. In 2005-2006, most of the rainfall occurred during the cool winter and early spring, reducing evaporation of incident rainfall, as opposed to 2006-2007 when much of the rainfall occurred during warmer mid- and late-spring. Secondly, rainfall patterns tended to have several consecutive days of heavy rain in 2005-2006 fully filling up depressions, while large rainfall events in 2006-2007 tended to be separated by weeks at a time and there were many small rainfall events.

- The majority of the project area is annually disked and planted. Thus, the interface between the disked (Ap horizon) and non-disked sub-soil horizons has developed into a "plow pan."

- If present, soil moisture occurred within 8-10 in of the soil surface above the plow pan. Beneath the plow pan, moisture seeped from between soil peds, but was not considered to be true saturation.

- Wetland hydrology on site can be split into three different sources including localized ground water, surface precipitation and seeps. Each of these types of hydrology and the zone of their influence within the study area is shown on Figure 6 (oversize). Ground water does not appear to influence all areas of the project site. Rather, the localized groundwater occurring within several perennial ponds allows water in the top several inches of the soil to move laterally away from the ponds into the adjacent agricultural fields. Such areas affected by localized groundwater were labeled as Number 1 (Ground Water) on Figure 6. Areas of the project site mainly influenced by surface precipitation flowing to slight depressions are labeled as #2 (Surface Precipitation). Lastly, the presence of surface and subsurface water deriving from underground seeps appears to influence areas labeled as #3 (Seep) within the project area (Photograph 2). The remaining areas on site are influenced by a combination of these hydrologic features.

Photograph 2. Ground water-influenced wetland

Photograph 3. Topography of site showing slight topographic depressions within the otherwise flat agricultural fields.

- The project area is relatively flat, with little elevation change across large portions of the property (Photograph 3). Point elevation was used to quantify these subtle gradients which establish the contributing watershed for each wetland area. Small gradients in elevation (less than 1 ft difference between upland areas and potential wetland areas) at this project site result in subtle depressions. The landscape surrounding these slight depressions then becomes the contributing watershed to these potential wetlands.

- Earthern roads and levees may support facultative hydrophytes (annual bluegrass, *Poa annua*, FACW). However, this is because these areas are extremely compacted. Since they have no supporting wetland hydrology, do not show evidence of hydric soils, and do not meet the minimum of 5% vegetation cover to be considered wetlands, roads and levees were not delineated as wetlands.

- Factors that strongly determined plant distribution on site included not only the degree and duration of soil reducing conditions, but also soil chemistry. In some locations, sparse stands of salt-tolerant hydrophytes were observed in areas totally devoid of wetland hydrology. The inherent high salinity of many of the soils on site precluded the growth and development of the standard suite of invasive, upland grasses and forbs and selected for those species able to tolerate saline conditions. Many of these same plants, like Meditteranean barley or even saltgrass are able to invade these locations with marginal hydrology due to their ability to tolerate salt and from the absence of any competitors.

- Mapping was based on direct observation of wetland hydrology over a 2 yr monitoring period (*i.e.*, 2005-06, and 2006-07).

Photograph 4. Soil scald from efflorescent salts.

- In addition, we observed that some areas of the project site appear to be "scalded" or, in extreme cases, showed evidence of a flocculated, efflorescent salt crust (Photograph 4), which occurs on clay soils with high salinity as a result of wicking and evaporation from moisture held below the A horizon. This is not the typical salt crust resulting from evaporated inundation, which serves as a primary indicator of hydrology. Plant growth in these areas was stunted, with black mustard, Italian ryegrass (*Lolium multiflorum*), planted oats (*Avena fatua*) and wheat (*Triticum aestivum*) all reaching maturity (flowering) at extremely reduced heights (2-5 in). These areas did not show any corroborating signs of saturation during the growing season from photo monitoring or soil data pits, as the soil was consistently found to be dry and powdery, and point-topographical elevations as well as ground surveys indicated a mildly convex landform in these areas that did not support depressional ponding. These areas were not found to meet wetland parameters for hydrology or vegetation.

- In addition, wetland areas appearing on several historic photographs contained "volunteer" hydrophytes, and showed evidence of heavy clay clods created while disking soil within potential wetlands. Upland areas of the project site did not contain these clods.

- Even though rainfall was slightly less than average for the 2006-07 monitoring season, the relatively low position of the property on the landscape, together with the presence of seeps and subsurface groundwater meant that the site wetted up quickly and behaved normally from a hydrologic perspective.

- Because the majority of the project site is actively farmed (*i.e.*, disked, planted with cultivated oats and wheat), a three-parameter approach for wetland delineation could not be used on the entire site. However, we documented the occurrence of upland species and wetland species in these areas for ancillary use to demonstrate, through the germination and growth of volunteer (*i.e.*, not planted) species, the observed difference between upland and potential wetland areas.

- Further, because of the level of disturbance to vegetation and topography on-site, historic depressional edges and wetland boundaries within these planted fields have been blurred and do not resemble natural wetland-upland interfaces. Transitional areas exist between clear wetlands and uplands that may be between 20-100 ft wide, and conflicting indicators exist within these areas for both hydrology and vegetation. In these cases, we attempted to find the approximate centerline of the transitional areas and demarcated boundaries based on this, but concede that the boundary in these areas could be moved to either include more wetlands or more uplands and still fall within this transitional layer.

- One portion of the project area within Area 3 (Figure 6, oversized) known as the "Ohlone college property" has already received a USACE Jurisdictional Determination (Bob Smith, renewed by Mark D'Avignon). This property is bounded by Mowry Avenue to the northwest, Cherry Avenue to the northeast, Alameda County Flood Control District channel on the southeast, and the Union Pacific Railroad tracks to the southwest (approximately 81 ac). This JD (USACE File # 27848S) verified approximately 70,150 ft^2 (1.61 ac) of jurisdictional features within this area identified as "other waters."

1) Italian ryegrass (*Lolium multiflorum*, FAC) was encountered throughout most of the study area. Habitats where it was found included seasonal wetlands, uplands dominated with ripgut brome (*Bromus diandrus*, UPL) and black mustard (*Brassica nigra*, UPL), levee slopes, levee tops, side slopes of dirt fill piles and on compacted dirt roads. However, in very wet portions of the project site, its growth is severely stunted (2 in) versus its growth in upland areas (16 in). We believe, for these reasons, that Italian ryegrass is not indicative of wetlands at this project site. Because of this, and our observations of this species elsewhere in California and around San Francisco Bay, its presence was noted but it was treated as an

unreliable indicator species. As noted, the sample point data forms included with this delineation document our finding that Italian ryegrass can occur in areas exhibiting both clear wetland characteristics (although growth and subsequent flowering are severely stunted, and morphological indicators of stress such as chlorosis and necrosis are typically present) and clear upland characteristics. In fact, growth may be greatest, with tallest bolting height and highest percent cover, in transition areas that are neither very dry nor very wet, or in areas that exhibit saline scalding.

In general, it is our experience deriving from field investigations and our professional opinion that use of the facultative indicator status (FAC*) for perennial ryegrass when used to define the extent and distribution of wetland habitats in California may be a valid status in some environmental settings but on average this status is incorrect as broadly applied to all biotic habitats. Insofar as this "tentative" indicator status was formally assigned to this species in 1988, and was based on "limited information," certainly sufficient additional field evidence regarding the preferred distribution of this species has been compiled over the last 19 years to warrant a review of the information and reanalysis of its indicator status. Below are two examples demonstrating the different settings this plant is observed within.

1. San Francisco Bay/Coastal Regions. In geographic areas of relatively high rainfall, extensive fog cover and/or low evaporation potential (*e.g.*, Santa Rosa average annual rainfall 35.60 in, total annual evaporation potential rate 35.60 in), such as along the coast and around San Francisco Bay, it has been our observation that perennial ryegrass is able to germinate and grow in settings that are clearly devoid of wetland hydrology and hydric soil features. It has also been our observation that this species occurs in many areas around the Bay ostensibly because of its relative salt tolerance and much less because of its tolerance to reducing soil conditions. Thus, this species can and does occur on broad, relatively flat agricultural fields that were once part of a widespread natural wetland complex many years ago that have since been diked and drained. Such areas are underlain by relatively dense clays that are commonly moderately saline, owing to a historical hydrologic condition that has long since been permanently modified with the construction of dikes and draining of the perimeter of the bay in the early 1900s. Typical associate species in these settings include many upland plants such as ripgut brome and black mustard. Invariably, when "more reliable" wetland indicators plants occur within such landscapes, they do so within topographic depressions or within ponded/saturated soil situations that completely exclude perennial ryegrass. In such environmental settings, we consider a facultative wetland indicator status for perennial ryegrass to be very unreliable.

2. Central Valley Region. Somewhat in contrast to our observations regarding the distribution of perennial ryegrass around San Francisco Bay, in the Central Valley region of California (*e.g.*, Five Points average annual rainfall 11.41 in, total annual evaporation potential rate 60.52 in), a region characterized by lower average annual rainfall amounts, and very high evaporation potential, we believe that the wetland indicator status of facultative is more accurately applied. Perennial ryegrass is commonly observed in these regions as occurring along a relatively narrow band restricted to the upper perimeter of seasonal depressions, such as vernal pools, and along the banks of seasonal channels. Immediately behind this band of perennial ryegrass, going away from the pool, the dominant plants are

routinely soft chess or wild oats, both considered UPL in character; while wetland species with indicator status' of FACW or OBL occur closer to ponded water and/or saturated soil conditions just beyond the perennial ryegrass band. Thus, in the Central Valley of California, perennial ryegrass is not observed to co-occur with upland (UPL) species and it does not exist in conditions where "true" hydrophytes (*i.e.*, FACW and OBL) are seen growing. Thus, this species germinates and grows within a very narrow topographic/hydrologic setting, being excluded under environmental conditions that are a little drier or a little wetter.

Photograph 5. Italian ryegrass on site.

In terms of taxonomic treatment, it is common practice for Italian ryegrass (a.k.a. annual ryegrass, Photograph 5) (*Lolium multiflorum*) and perennial ryegrass (*Lolium perenne*) to be treated as the same plant with an indicator status of FAC*, in Region 0 (California). The assumption that Italian ryegrass and perennial ryegrass are equivalent in terms of wetland indicator status is not valid, particularly, as our sample points demonstrate, at the Newark Areas 3 & 4 project site. In fact, the issue of the taxonomic treatment of these taxa (either as two species or only as separate subspecies (*Lolium perenne* ssp. *perenne* and *Lolium perenne* ssp. *multiflorum*) is on-going. In California, the editors of the Jepson Manual (Hickman 1996), recognized as the authoritative treatise of vascular plants throughout the state, rejects this treatment and maintains species status for both of the plants.

Regardless of taxonomic treatment, there is clear and ample evidence in the scientific literature to suggest that these two plants differ greatly in genetic, anatomical, and physiological features, as well as in ecological function. Italian ryegrass (annual ryegrass) is less tolerant of soil salinity and is commonly used to control soil erosion in brush lands and rangelands after fires and it is also used in seed mixtures along road cuts; neither of these relatively xeric environmental settings can be considered wetlands by any means. To confuse matters more in the field, annual ryegrass and perennial ryegrass commonly co-occur and are interfertile and intergrade, producing hybrids.

Jepson (1996) separates the two species by the presence (*L. multiflorum*) or absence (*L. perenne*) of awns on the lemmas, and with the presence (*L. perenne*) or absence (*L. multiflorum*) of sterile shoots at the base of the plant. The annual growth habit of annual ryegrass allows it to readily invade areas with marginal or variable wetland ecology such as in agricultural fields during years of above average rainfall.

- The site was visited no fewer than 50 separate times commencing in November of 2005 and continuing into June of 2007. The purpose of many of these visits was to hike the property to photo-document site conditions but also to determine the state of soil saturation during the rainfall season before and after the soil profile had become fully charged with soil moisture.

Appendix D shows photographic monitoring of three representative wetlands at five different monitoring dates during the rainfall season of 2006-07.

- In order to determine the lateral extent of soil saturation, at various locations (shown on Figure 6) a series of soil saturation soil test pits were excavated along a transect to a depth of approximately 24 in that ran along a topographic and/or hydrologic gradient. Numerous soil test pit transects were conducted across the site at various times during the rainfall season which allowed relatively fast and reliable determination of the state of saturation and duration of such events. These pits were left open for the duration of the monitoring work.

- As described above, the hydrophytic vegetation determination included an analysis of the condition that might exist on site in the unmanaged state by observing portions of the study area with similar soils and hydrological characteristics that are in a relatively undisturbed state (per guidance provided in the Regional Supplement). This obvious step was taken as several factors influenced the vegetation community on site including: (1) on-going farming practices; (2) modification in the site hydrology over the last century associated with salt production on adjacent lands, and agricultural activities on site; and (3) the strongly saline soil conditions.

- Despite all of the man-induced modifications to the site over the years, we observed that it was not uncommon for a mixture of native and non-native hydrophytes to colonize fields that were disked and planted to cereal grain crops just a few months earlier. Thus, our general approach was to use two or three parameters, where applicable, and as noted on each individual field data form. Areas supporting a predominance of hydrophytes amongst stunted, chlorotic barley or oats were mapped as wetlands, as well as, areas barren of vegetation due to prolonged seasonal inundation and/or highly saline soil conditions.

- One of the study sites located adjacent to, and south of, the Union Pacific railroad tracks, west of Stevenson Boulevard, is entirely underlain with imported fill dirt.

- The location of historic slough channels, as mapped by the U.S. Geodetic Survey in 1857) are shown in Figure 5.

AREAS MEETING THE REGULATORY DEFINITION OF SECTION 404 WATERS

Identification of Section 404 Potential Jurisdictional Wetlands (Special Aquatic Sites)

In general, areas that were considered wetlands included some or all of the following physical characteristics:

- solid stands of hydrophytes, generally of normal stature, occurring as a monoculture or in combination with other annual or perennial hydrophytes;

- areas observed to be ponded and/or saturated for long duration

- fields with very low occurrence of planted barley and oats; these species were generally very sparse, only a few inches high, and exhibited clear indicators of chlorosis and necrosis, a direct result of water logging stress;

- areas where the structure of the surface soils were much more clod-like in nature, as opposed to crumbly, resulting from disking operations.

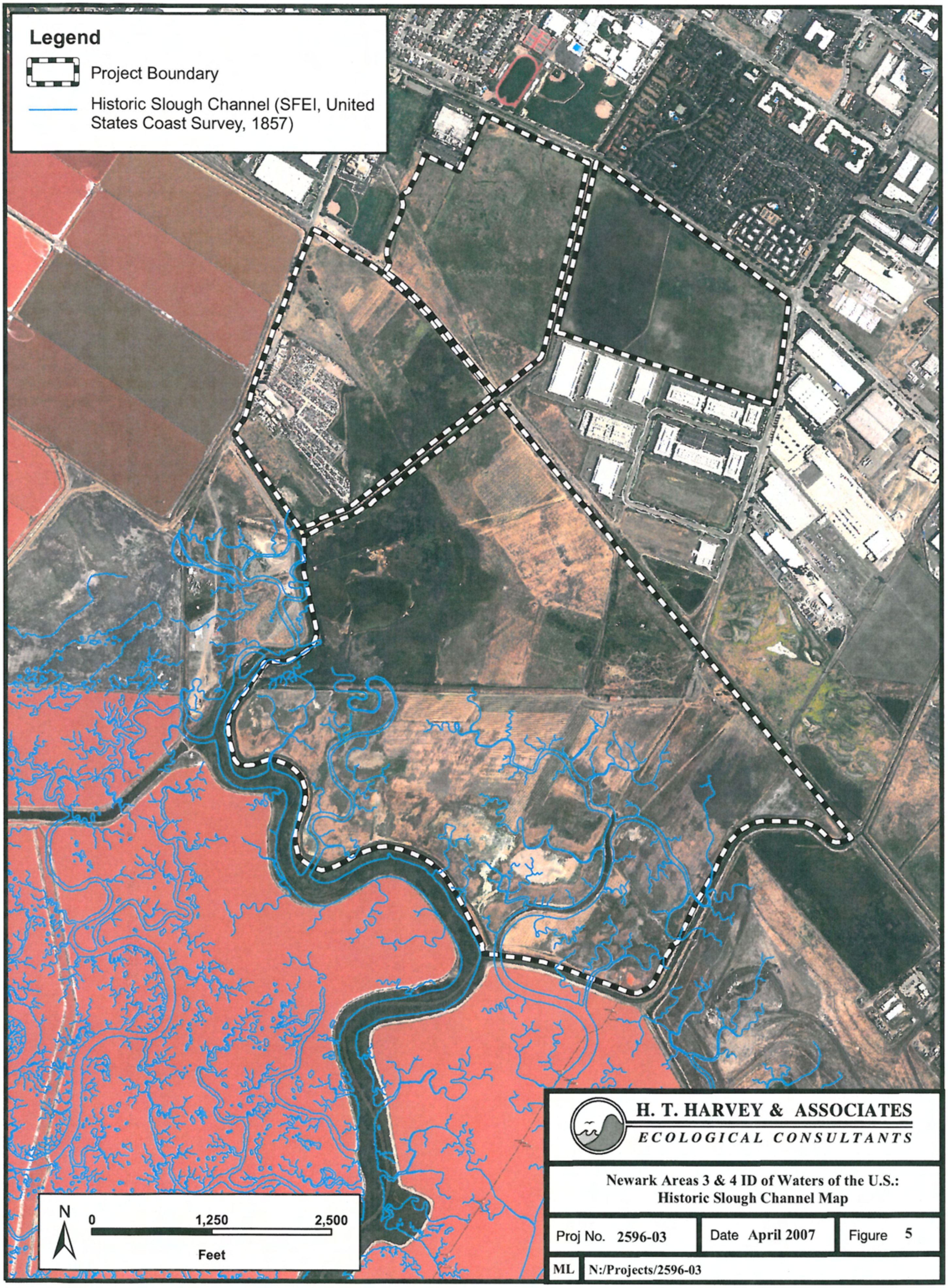
Approximately 242.89 ac of potential wetlands were identified on the project site (Figure 6). Three parameters identifying Section 404 wetlands were observed at 29 sample points: 3, 5, 6, 7, 9, 12, 15, 18, 20, 21, 22, 24, 25, 30, 32, 35, 36, 37, 38, 39, 46, 50, 53, 54, 58, 60, 61, 63, 65, 67, and 70 (Figure 5; Appendix C).

Vegetation. With few exceptions the type, extent and vigor of vegetation that occurs on site has been affected by on-going farming practices. Because of this, it was determined that the majority of the site meets the definition of a *Problematic Hydrophytic Vegetation* situation as defined in the Arid West Regional Supplement. In particular, the Supplement describes and defines two situations that directly apply to this site, including: *Managed Plant Communities* and *Vigor and Stress Responses to Wetland Conditions*.

Hydrophytic vegetation occurs sporadically within plowed and disked fields, intermixed with planted upland species such as oats (*Avena fatua*, NOL) and wheat (*Triticum aestivum*, NOL), both upland species. Several other species of non-planted or previously-planted upland annuals such as Italian ryegrass, Mediterranean barley (*Hordeum hystrix*, FAC), and common beet (*Beta vulgaris*; FACU), were also occasionally mixed with hydrophytic vegetation in wetland or transitional areas. Italian ryegrass grew equally well in wetland sites and upland sites, as did the planted, horticultural species, while common knotweed (*Polygonum arenastrum*, FAC), sweet clover (*Melilotus indicus*, FAC), white goosefoot (*Chenopodium album*, FAC), common brass-buttons (*Cotula coronopifolia*, FACW), annual pickleweed (*Salicornia europea*, OBL), annual bluegrass (*Poa annua*, FACW) and bristly ox-tongue (*Picris echioides*, FAC*) typically occurred in field areas with sufficient hydrology to support wetland conditions.

Hydrophytes such as pickleweed (*Salicornia virginica*, OBL), Mediterranean beard grass (*Polypogon maritimus*, OBL), alkali heath (*Frankenia salina*, FACW), and broad-leaved peppergrass (*Lepidium latifolium*, FACW) dominate areas near aquatic habitat, and extend into upland habitat 6 ft or more. Areas under the influence of highly saline soils, such as those mapped in Omni silty clay loam, strongly saline (Appendix B), particularly in the southern portion of Area 4, often support hydrophytic and halophytic vegetation, such as sticky sand spurrey (*Spergularia macrotheca*, FAC) and slenderleaf iceplant (*Mesembryanthemum nodiflorum*, NOL), especially where sufficient wetland hydrology is present. Within less disturbed wetlands, such as those occurring around perennially flooded, unvegetated flats, or perennially saturated areas supporting pickleweed, stands of alkali bulrush (*Scirpus robustus*, OBL) and broad-leaved cattail (*Typha latifolia*, OBL) occur, often surrounded by stands of saltgrass (*Distichlis spicata*, FACW).

Hydrology. Saturated or inundated soil (A3 and A1, respectively), non-riverine sediment deposits (B2), non-efflorescent salt crusts resulting from evaporation following inundation


Legend
Project Boundary
Historic Slough Channel (SFEI, United States Coast Survey, 1857)
N
0
1,250
2,500
Feet
H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS
Newark Areas 3 & 4 ID of Waters of the U.S.:
Historic Slough Channel Map
Proj No. 2596-03
Date April 2007
Figure 5
ML
N:/Projects/2596-03


Legend
Project Boundary
Aquatic (29.5 ac)
Wetland (247.2 ac)
Upland (285.3 ac)
USACE Sample Points
Trend Points
USACE File #'s:
27848S
24851S
1.61 acres - Waters of the U.S.
Hydrology most influenced by:
1 Ground Water
2 Surface Precipitation
3 Seep
0
650
1,300
Feet
H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS
Newark Areas 3 & 4 ID of Waters of the U.S.
Proj No. 2596-03
Date April 2007
Figure 5

(B11), and/or surface soil cracks (B6) were found within sample points located within wetlands on-site as listed above (Appendix C). Essentially, topographic relief within agricultural areas was extremely subtle, but in many places, even subtle relief appeared to drive wetland formation in areas supported by incident precipitation (Appendix D, Figure 6). A point-elevation topographic map for the site was used to confirm field observations of slightly convex areas that contributed runoff to nearby, gently concave depressional areas. These gentle depressions that collected incident precipitation, even when no longer saturated during soil pit data collection in mid-March through April of 2007, were distinctly wetter within the Ap (plow) layer than observed in surrounding upland areas. However, due to the comprehensive full-year monitoring protocols used for this delineation, we had records of soil saturation from earlier in the growing season to inform our hydrological observations when making determinations regarding presence or absence of wetland hydrology within specific areas. Other wetlands on-site, such as those driven by hydrology from ground water and tidal sources or even by seeps (Appendix D, Figure 6), exhibited less ephemeral hydrology and tended to be saturated or inundated for longer duration into the spring growing season, and were thus less problematic.

Soils. Low chroma, low value soil colors (*e.g.*, 10YR 3/1), and in some cases, gleyed soils (F2) occurred at the wetland sample points listed above (Appendix C). All soils within the project area are on the Alameda County hydric soils list (Appendix C), and soils across the site are historically hydric, as these areas were typically tidal flats or seasonally inundated before anthropogenic activities and flood control structures erected as much as 80 years ago actively drained areas to be used in agricultural production. In some wetlands on-site, soils were clearly hydric, with reducing conditions indicated by strong hydrogen sulfide odors (A4), redox dark surface (F6), and perennial saturation. These indicators occurred in areas that remain saturated for all or most of the year, within less disturbed wetlands still supporting native hydrophytic vegetation.

The Omni soil phases all exhibited a dark surface (value of 2 or less and chroma of 2 or less) within the Ap horizon; this layer was immediately underlain within 12 in of the soil surface with a depleted matrix (low chroma and high value). These characteristics are described by the Soil Conservation Service in the Soil Survey Manual for the County. Thus, it was determined that the Omni soils met the field characteristics of Indicator A11: Depleted below Dark Surface. It is important to note, however, that in most locations on site, these soils exhibit redoximorphic features and hydric soil indicators that formed in the distant past when conditions may have been wetter than they are today. As directed by the *Regional Supplement*, when clear evidence of hydrophytic vegetation and wetland hydrology was present the hydric soil indicators described above were assumed to be contemporary.

Portions of the property, nearest Mowry Slough and the Cargill salt ponds along the western boundary of the study area, and areas currently permanently inundated, are described as being underlain by Reyes clay, drained. While this soil is present beneath the perennial ponds noted above, areas that have been farmed for long duration no longer exhibit the typical gleyed soils typical of this soil phase. This condition may have resulted from diking and draining that took place in the last century and/or due to land-planing and disking operations activities associated with farming practices that have move top soil from the adjacent Omni series into these once low-lying areas.

Wetland areas within agricultural fields tended to have a much shorter duration of saturation within the top 12 in of the soil profile, which in these areas was a fluffed, well-mixed Ap (plow) layer. Soil profiles in these wet agricultural areas sometimes showed historic redox features in the form of Fe^{2+} concentrations along pore linings in peds occurring below the Ap, or high value redox depletions within the matrices of lower layers, but were often too well mixed within the rooting layer (Ap) to display clear mottling patterns there, even when the wetland in question demonstrated clear wetland hydrology and ponding or saturation during two weeks or more of the growing season (Appendix D). Due to the intensive field monitoring conducted, we were able to track saturation levels during the growing season in areas with historical soil indicators, and elsewhere across the site (Appendix D). All areas where soils were demonstrably saturated within the upper 12 in during at least two weeks (often much longer duration) of the growing season, which previously corresponded to the *Corps 1987 Manual* indicator "Aquic Moisture Regime" were treated as hydric for purposes of this delineation whether redox features were present in the upper 12 in or not.

B) Identification of Other Waters

Approximately 34.21 ac of "other waters" were identified on the project site (Figure 6, Sample Point 74). "Other waters" were identified in an area that once supported duck ponds in the western central portion of the project site and in man-made ditches located throughout the project site. "Other waters" extend to the OHW mark on opposing channel banks and were indicated by physical characteristics such as a clear, natural line impressed on the bank, the presence of standing water, or the presence of mudflats with no emergent wetland vegetation. These areas within the project boundaries possess positive field indicators such as hydrophytic vegetation, wetland hydrology, and hydric soils that are used to identify "other waters." In addition the ponds and ditches contain water and an ordinary high water line.

AREAS MEETING THE REGULATORY DEFINITION OF HISTORIC OR CURRENT SECTION 10 WATERS

The location of historic slough channels are shown in Figure 5. This information was taken from a scan of mapping that was done by the U.S. Coast Survey in 1857. Such tidal channels and marshes were primarily concentrated throughout the southwestern portion of the project site. Levee construction in the last century drained these areas, that undoubtedly subsequently subsided. During the many decades of farming activities the fields have been disked, shallow ripped and land planed to increase agricultural production; thus, very few of these historical features can be seen today. No current Section 10 waters exist on-site as the entire study area has been diked and drained, and tidal waters within Mowry Slough are prevented from entering any of the lands by using water control structures such as flap gates or bladder culverts.

AREAS NOT MEETING THE REGULATORY DEFINITION OF JURISDICTIONAL WATERS

In general, areas that were not considered wetlands included some or all of the following physical characteristics:

- relatively tall stands of planted oats or barley, occurring as monocultures or in combination with some ryegrass;

- areas where ponding and/or saturation were never observed;

- stormwater retention basins constructed within uplands on the auto dismantler properties (totaling approximately 0.82 ac), and;

- portions of some fields that were underlain with saline-sodic soils of very high sodium concentration and low pH; these areas never exhibited hydric soil conditions, rather, plant germination and growth and plant selection was driven more by soil chemistry and structure (*i.e.*, flocculation) than by hydric soil conditions. Such sites appear as white scalds on the landscape that undoubtedly developed these extreme conditions over many decades of seasonal inundation prior to the last century. Under the recent and on-going farming activities, these once-topographic depressions are now generally flat with little ability to collect and pond surface incident rainfall.

The remainder of the project site (approximately 361.70 ac) met none of the regulatory definitions of jurisdictional waters. Information relative to plants, soils and hydrology are summarized in data forms (see Appendix C) for Sample Points 1, 2, 8, 10, 11, 13, 14, 16, 19, 23, 26, 27, 28, 29, 31, 33, 34, 40, 41, 42, 43, 44, 45, 47, 48, 49, 51, 52, 55, 56, 57, 59, 62, 64, 66, 68, 69, 71, 73, and 75 (Figure 5). Positive indicators included low chroma soils (10YR 3/1) throughout the project site and the presence of opportunistic facultative hydrophytes such as Italian ryegrass and Mediterranean barley. In general, planted wheat and oats were not stunted in growth, had good percent cover, and were not chlorotic in these areas. In addition, upland species such as black mustard, ripgut brome, bur clover (*Medicago polymorpha*, UPL), and common beet dominated these areas. Upland areas did not show any signs of active hydrology and were elevated topographically, even if only by slight convex relief, from clearly moist areas. Upland, elevated areas on-site also included saline scald areas with stunted vegetative growth. These areas were not considered potential jurisdictional wetlands due to the lack of wetland vegetation or presence of clear wetland hydrology.

Soils were observed to be clay loams, typically with matrix colors of 10YR 4/2 to 10 YR 3/1 with no mottles and no other indicators of regular inundation (*i.e.*, organic buildup, streaking, or depletions); further, these areas were not observed to be saturated for significant periods (less than 2 weeks) during the growing season. No evidence of wetland hydrology, such as inundation, saturation, sediment deposits, cracking of the soil surface, hardened (non-efflorescent) salt crust, biotic crusts, or drainage patterns in wetlands was observed in any of these locations.

DISCUSSION

As described above, areas meeting the physical criteria of jurisdictional wetlands were observed within several areas totaling 242.89 ac of the approximately 640-ac study area. The wetlands on-site have three primary sources of hydrology, including incidental rainfall, groundwater table fed by springs, and lateral seeps. Depressional wetlands without access to high ground water tables or lateral seeps were mainly fed by ponding of incidental rainfall, low areas with high groundwater tables tended to produce perennial brackish wetlands and other waters, and lateral seeps fed and enhanced hydrology in other depressional or low areas. In addition, areas totaling 34.21 ac met the technical criteria of jurisdictional "other waters". Based upon an extensive review of point topographic maps, historic and current aerial photographs, and information contained in the county soil survey, levees and re-routing channels appear to have been constructed in and surrounding the historic tidal flat wetlands on-site to meet agricultural and recreational needs. These channels connect to Mowry Slough via a pump and eventually drain to the San Francisco Bay.

The process of delineating the wetlands within this site required a fully comprehensive delineation approach, complete with extensive wet-season site and photographic monitoring, and the establishment of multiple trend data transects. The vast majority of the soils on-site, whether currently functioning as a wetland or not, are historically hydric and are on the Alameda County hydric soils list (Appendix B). As discussed further below, even currently wet areas did not always show current redoximorphic features due to widespread low value, low chroma soil colors and soil ped-turbation from disking. The determination of hydric soils in these areas had to be based upon the criteria used by the NRCS to inform the 1995 definition of hydric soils used to create the current National hydric soils list. Any soils observed to be ponded or saturated to the surface for long (7-30 days) or very long (> 30 days) duration during the growing season were thus treated as hydric even in the absence of redoximorphic features. Sources of hydrology were complex and varied, and topographic relief, although a large factor in hydrology of the site, was very low and sometimes difficult to gauge on the ground without the help of point topographic maps. Finally, vegetation was severely and significantly disturbed on this site from continuing agricultural activities, leading to the use of a two parameter approach in most areas. However, morphological indicators of plant stress, community composition, and vegetation structure were noted by delineators when deliberating the exact placements of wetland-upland boundaries. Boundaries in this highly altered system are very broad compared to natural wetland-upland interfaces, and transitional areas with characteristics of both wetlands and uplands exist that are generally between 30-100-ft wide in some areas. We attempted to find the approximate centerlines of these transitional areas when making boundary placement decisions on-site.

Uplands outside of active agricultural areas include levees, berms, and other miscellaneous convex relief forms that are most likely composed of fill material removed from nearby channels during construction and/or fill material brought from other locations. Within the fields themselves, repeated landplaning and disking have muted what few contours existed within the historic tidal flats that formed tidal channels and depressional wetlands, decreasing the acreage of areas saturated or inundated during the growing season. Thus, wet areas within the agricultural fields are the disturbed remnants of historically more pronounced natural channels and depressions. Also, disking has expanded the Ap (plow) layer, allowing for more rapid evaporation of soil moisture from within this top layer in any slightly convex areas within the fields. Ditching and the construction of culverts have drained other sources of historic wetland hydrology on-site, or removed barriers to free drainage that once existed.

Some slightly convex areas, specifically in the south-central and southwestern portions of the project site, no longer have active wetland hydrology, but support facultative wetland plants. Upland plants in these areas also tend to show some of the same morphological features (chlorosis, necrosis, stunted growth, flowering at low canopy height, low percent ground cover) observed in true wetland agricultural areas. However, at no time during extensive, long term monitoring over the 2006-2007 winter-spring wet season was there evidence that these areas ever collected runoff precipitation, or even remained saturated in the upper layers of soil for any significant, consecutive periods following rain events. Furthermore, investigative, trend soil pits and sample point soil pits (primarily corresponding to sample data points 10, 11, 13, 14, 40-45, and 47-49) in these areas had drier soil than surrounding depressional areas, and in some cases were extremely dry and powdery, more so than any other pits on-site. These problematic areas are underlain with Omni silty clay loam, strongly saline, which is also mapped as underlying much of the remainder of project site. However, the problematic areas under discussion appeared to represent inclusions of very strongly saline soils. These areas showed visible saline scalding (Photograph 4) and had flocculated, efflorescent salt crusts in the areas of highest salinity. We therefore determined the hydrophytic character of the vegetation in these areas to be a consequence of the extreme salinity of the soils instead of reflecting true anaerobic, hydric conditions; as hydrophytes are often also halophytes, strong salinity reduces the ability of plants to utilize any available water in the soil due to changes in osmotic potential, and salt toxicity produces many of the same morphological alterations in plants seen from anoxic root conditions.

In conclusion, jurisdictional wetlands across the site are complex, highly disturbed and affected by agricultural and other anthropogenic activities, and extensive due to the abundance of wetland hydrology drivers found at this site. This methodology used in preparing this report represents our best efforts to characterize a variety of agricultural field conditions exhibiting a range of conflicting indicators, including broad transitional areas, as either upland or wetland. The overall approach was to focus field efforts on documenting the extent and distribution of hydric soil and wetland hydrologic field characteristics during the rainfall period. Notes were also maintained as to the type and location of hydrophytic vegetation during this period. Once rainfall had tapered off in the late spring, the focus shifted to tracking the distribution of upland and wetland vegetation throughout the study area. This work continued into the early summer. At the end of the multi-month field survey effort, we found a very high correspondence between those areas we determined to meet the hydric soil/wetland hydrology parameters in the winter and spring and where we eventually documented hydrophytic vegetation (as shown in Photographs 6 and 7).

Photograph 6. Showing demarcation of wetlands (left side of pink survey flags) from uplands (right side of flags).

Those areas on site that showed consistent ponding/saturation during the rainfall months of November through March (*e.g.*, see Appendix D) eventually supported hydrophytic vegetation in those same locations almost without exception.

Photograph 7. Looking across typical agricultural field showing green hydrophytic vegetation restricted to topographic depressions surrounded by upland grasses.

As part of this submittal we are requesting that the USACE review the information contained in this report and consider several of the wetlands and other water for disclaimer based upon the Supreme Court's decision in Solid Waste Agency of Northern Cook County v. United States Army Corps of Engineers, 531 U.S. 159 (2001) regarding isolated waters, upon the guidance provided in *Interim Guidance concerning waters of the U.S. in light of SWANCC (App. A of Advance Notice of Proposed Rulemaking on CWA definition of waters of the U.S., published in 68 Fed. Reg. 1995)* and upon guidance recently put forth by the Corps and Environmental Protection Agency in *Clean Water Act Jurisdiction, Following the U.S. Supreme Court's Decision in Rapanos v. United States & Carabell v. United States* (2007).

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APPENDIX A.

PLANTS OBSERVED

Appendix A. Plants Observed within the Newark Areas 3 & 4 Project Site.

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	INDICATOR STATUS
Papaveraceae	*Eschscholzia californica*	California poppy	UPL/NOL
Plantaginaceae	*Plantago coronopus*	plantain	FAC
Poaceae	*Avena fatua*	wild oats	UPL/NOL
	Avena sativa	hay oats	UPL/NOL
	Bromus diandrus	ripgut brome	UPL/NOL
	Bromus hordeaceous	soft chess	FACU
	Cortaderia selloana	pampas grass	UPL/NOL
	Crypsis schoenioides	Prickle grass	OBL
	Cynodon dactylon	Bermuda grass	FAC
	Distichlis spicata	saltgrass	FACW
	Elytrygia elongata	tall wheatgrass	UPL/NOL
	Glyceria sp.	Manna grass	---
	Hainardia cylindrica (=*Monerma cylindrica*)	thintail	FACW
	Hordeum hystrix (=*Hordeum murinum* ssp. *gussoneanum*)	Mediterranean barley	FAC
	Hordeum murinum	foxtail	UPL/NOL
	Hordeum vulgare	common barley	UPL/NOL
	Lolium multiflorum	Italian ryegrass	FAC (ind. for *L. perenne*)
	Parapholis incurva	Sickle grass	OBL
	Phalaris minor	Mediterranean canarygrass	UPL/NOL
	Phalaris paradoxa	hood canarygrass	UPL/NOL
	Phragmites australis	common reed	FACW
	Poa annua	annual bluegrass	FACW
	Triticum aestivum	wheat	UPL/NOL
Polygonaceae	*Polygonum arenastrum*	common knotweed	FAC
	Rumex crispus	curly dock	FACW
	Rumex salicifolius	willow-leaved dock	OBL
Primulaceae	*Anagallis arvensis*	scarlet pimpernel	FAC
Salicaceae	*Salix laevigata*	red willow	FACW†
	Salix lasiolepis	arroyo willow	FACW
Tamaricaceae	*Tamarix parviflora*	smallflower tamarisk	FAC
Typhaceae	*Typha latifolia*	broad-leaf cattail	OBL
Ulmaceae	*Ulmus pumila*	Chinese elm	UPL/NOL
Urticaceae	*Urtica dioca*	stinging nettle	FACW

The species are arranged alphabetically by family name for all vascular plants encountered during the plant survey. Plants are also listed alphabetically within each family. Species nomenclature is from Hickman (1993) except where different nomenclature has been adopted by Reed (1988).
NOL = Not on List, † = Indicator status not available from 1988 list, but taken from 1996 list

Appendix A. Plants Observed within the Newark Areas 3 & 4 Project Site.			
FAMILY NAME	**SCIENTIFIC NAME**	**COMMON NAME**	**INDICATOR STATUS**
Aizoaceae	*Mesembryanthemum nodiflorum*	slenderleaf iceplant	UPL/NOL
Apiaceae	*Conium maculatum*	poison hemlock	FACW
	Foeniculum vulgare	fennel	FACU
Arecaceae	*Phoenix canariensis*	Canary Island date palm	UPL/NOL
	Washingtonia robusta	Washington fan palm	UPL/NOL
Asteraceae	*Baccharis pilularis*	coyote brush	UPL/NOL
	Carduus pycnocephalus	Italian thistle	UPL
	Chamomilla suaveolens	pineapple weed	UPL
	Cotula coronopifolia	common brassbuttons	FACW
	Dittrichia graveolens	dittrichia	UPL/NOL
	Grindelia stricta	coast gumweed	FACW
	Hemizonia pungens	tarweed	FAC
	Picris echioides	prickly ox-tongue	FAC
	Xanthium strumarium	rough cockle-bur	FAC
Boraginaceae	*Amsinckia* sp.	fiddleneck	---
Brassicaceae	*Brassica nigra*	black mustard	UPL/NOL
	Brassica rapa	field mustard	UPL/NOL
	Capsella bursa-pastoris	shepherd's purse	FACW
	Cardaria draba	hoary cress	UPL/NOL
	Hirschfeldia incana	mustard	UPL/NOL
	Lepidium latifolium	broad-leaved pepper-grass	FACW
	Raphanus sativus	wild radish	UPL/NOL
Caryophyllaceae	*Spergularia macrotheca*	sticky sandspurry	FAC
Chenopodiaceae	*Beta vulgaris*	common beet	FACU
	Chenopodium album	white goosefoot	FAC
	Salicornia virginica	pickleweed	OBL
	Salsola kali	Russian thistle	FACU
Cyperaceae	*Scirpus robustus*	alkali bulrush	OBL
Fabaceae	*Lathyrus* sp.	sweet pea	---
	Lotus corniculatus	bird's-foot trefoil	FAC
	Medicago polymorpha	bur clover	UPL/NOL
	Melilotus indicus	sweetclover	FAC
	Vicia sativa	common vetch	FACU
Frankeniaceae	*Frankenia salina*	alkali heath	FACW
Geraniaceae	*Erodium cicutarium*	red-stemmed filaree	UPL/NOL
	Geranium dissectum	cutleaf geranium	UPL/NOL
Juncaceae	*Juncus bufonius*	toad rush	FACW
	Juncus effusus	bog rush	OBL
Malvaceae	*Lavatera cretica*	Cornish mallow	UPL/NOL
	Malva neglecta	common mallow	UPL
	Malva parviflora	cheeseweed	UPL/NOL
	Malvella leprosa	alkali mallow	FAC
Myoporaceae	*Myoporum laetum*	lollypop tree	UPL/NOL
Oxidalidaceae	*Oxalis corniculata*	yellow sorrel	FACU

APPENDIX B.

SOILS

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in 1975. Soil names and descriptions were approved in April 1975. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1975. This survey was made cooperatively by the Soil Conservation Service and the University of California Agricultural Experiment Station. It is part of the technical assistance furnished to the Alameda County Resource Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

TABLE 12.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Altamont	Fine, montmorillonitic, thermic Typic Chromoxererts
Azule	Fine, montmorillonitic, thermic Mollic Haploxeralfs
Baywood	Sandy, mixed, thermic Entic Haploxerolls
Baywood Variant	Sandy, mixed, thermic Aquic Haploxerolls
Botella*	Fine-loamy, mixed, thermic Pachic Argixerolls
Clear Lake	Fine, montmorillonitic, thermic Typic Pelloxererts
Climara	Fine, montmorillonitic, thermic Chromic Pelloxererts
Contra Costa	Fine, mixed, thermic Mollic Haploxeralfs
Danville	Fine, montmorillonitic, thermic Pachic Argixerolls
Diablo	Fine, montmorillonitic, thermic Chromic Pelloxererts
Gaviota	Loamy, mixed, nonacid, thermic Lithic Xerorthents
Laugenour	Coarse-loamy, mixed (calcareous), thermic Aeric Fluvaquents
Los Gatos	Fine-loamy, mixed, mesic Typic Argixerolls
Los Osos	Fine, montmorillonitic, thermic Typic Argixerolls
Marvin	Fine, montmorillonitic, thermic Aquic Haploxeralfs
Maymen	Loamy, mixed, mesic Dystric Lithic Xerochrepts
Millsholm	Loamy, mixed, thermic Lithic Xerochrepts
Montara	Loamy, serpentinitic, thermic Lithic Haploxerolls
Omni	Fine, montmorillonitic (calcareous), thermic Fluvaquentic Haplaquolls
Pescadero	Fine, montmorillonitic, thermic Aquic Natrixeralfs
Pleasanton	Fine-loamy, mixed, thermic Mollic Haploxeralfs
Reyes	Fine, mixed, acid, thermic Sulfic Haplaquepts
Rincon	Fine, montmorillonitic, thermic Mollic Haploxeralfs
Sycamore	Fine-silty, mixed, nonacid, thermic Aeric Haplaquepts
Tierra	Fine, montmorillonitic, thermic Mollic Palexeralfs
Vallecitos	Clayey, montmorillonitic, thermic Lithic Ruptic-Xerochreptic Haploxeralfs
Willows	Fine, montmorillonitic, thermic Typic Pelloxererts
Xeropsamments	Xeropsaments
Xerorthents	Xerorthents
Yolo	Fine-silty, mixed, nonacid, thermic Typic Xerorthents

*This soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series.

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In most areas this soil is used for urban development. In some areas it is used for vegetable crops.

This soil has some limitations for urban development. Because of low strength and the moderate shrink-swell potential, foundations for houses and roads need to be specially designed. Building pads should be shaped to provide drainage away from the building site, thus keeping the soil beneath the building dry and reducing the hazard of differential settlement.

Most plants used for landscaping do well on this soil and will respond to nitrogen and phosphate fertilizer. For maximum growth, lawns need 1 pound of elemental nitrogen per 1,000 square feet every 8 weeks, from April through October. Irrigation water should be applied at a slow rate to encourage deep rooting. Shrubs and trees should be drip irrigated to encourage deep rooting.

Head lettuce and cauliflower are the major crops. They are double cropped using head lettuce in summer and cauliflower in winter. In a few areas, tomatoes are grown instead of head lettuce. Returning crop residue to the soil helps to maintain tilth and improve the rate of water intake. Minimum tillage reduces soil compaction. Water should be applied only in the amount that meets the needs of the crop; over-irrigation wastes water and leaches nutrients from the soil. Nitrogen is needed for good crop growth. The average yield per acre of head lettuce is 550 cartons; cauliflower, 460 cartons; and tomatoes, 25 tons.

Capability unit IIIc-1(14), nonirrigated; capability class I(14), irrigated.

107—Clear Lake clay, 0 to 2 percent slopes, drained. This is a very deep, poorly drained soil that formed in alluvium in basins. Elevation ranges from 10 to 200 feet. The average annual precipitation is 17 inches, and the mean annual temperature is 57 degrees F. The average frost-free season ranges from 300 to 330 days.

Typically, the surface layer is very dark gray, neutral and moderately alkaline clay about 37 inches thick. The underlying material is calcareous, dark gray and grayish brown clay and silty clay to a depth of 60 inches or more.

Included in mapping are small areas of Omni silty clay loam, drained; Willows clay, drained; and Pescadero clay, drained.

Permeability is slow. The available water capacity is 7.0 to 9.5 inches. The root zone for water-tolerant plants is 60 or more inches deep, but it is restricted to a depth of 48 to 60 inches for water-sensitive plants. Drainage has been improved by reclamation and flood control structures, and the water table is now at a depth of 48 to 60 inches. Runoff is slow, and there is no hazard of erosion.

This soil is used for urban development. A few areas are used as dryland pasture and for volunteer hay.

This soil has limitations that must be overcome before construction is feasible. The shrink-swell potential is high; as a result, foundations can shift and crack. Building pads should be shaped to provide drainage away from the building site, thus keeping the soil beneath the foundation dry and reducing the hazards of differential settlement and shrink-swell. The high shrink-swell potential and low strength affect the construction of roads and streets. Suitable base material is needed. The slow permeability and the high water table are limitations for septic tank absorption fields and can contribute to failure of septic systems.

Since the water intake rate and permeability are slow, lawns should be watered slowly to reduce runoff. Lawn grasses grow best if 1 pound of elemental nitrogen per 1,000 square feet is applied every 8 weeks, from April through October. Shrubs and trees can be drip irrigated to encourage deep rooting. Plants that require good drainage and aeration should not be planted. Some ornamental plants respond to sulfur and to iron and aluminum chelates. Adding organic matter to the soil improves the rate of water intake, aeration, and soil tilth.

If areas of this soil are used as pasture, grazing should be delayed until the grasses are 4 to 6 inches high and until the soil is dry. If this soil is grazed when wet, it is subject to churning and puddling. Enough residue should be left on the surface after the grazing season to prevent deterioration of the soil and to prevent the infestation of weeds.

Capability unit IIIs-5(14), nonirrigated; IIs-5(14), irrigated.

108—Clear Lake clay, 2 to 9 percent slopes, drained. This is a very deep, poorly drained soil that formed in alluvium. Elevation ranges from 10 to 200 feet. The average annual precipitation is 17 inches, and the mean annual temperature is 57 degrees F. The average frost-free season ranges from 300 to 320 days.

Typically, the surface layer is very dark gray, neutral to moderately alkaline clay about 37 inches thick. The underlying material is dark gray and grayish brown, calcareous clay and silty clay to a depth of 60 inches or more.

Included in mapping are small areas of Danville silty clay loam, Omni silty clay loam, drained, and Rincon clay loam.

Permeability is slow. The available water capacity is 7.0 to 9.5 inches. Drainage has been improved by flood control structures and natural stream cutting. The root zone is more than 60 inches deep. The water table is below a depth of 60 inches. Runoff is medium, and the hazard of erosion is slight to moderate.

This soil is used primarily for urban development. A few areas are used as dryland pasture and for volunteer hay.

This soil has many limitations for use as building sites. The shrink-swell potential is high; as a result, foundations can shift and crack. Building pads should be shaped so that water is drained away from the building site, thus keeping the soil beneath the foundation dry

These soils have many limitations for use as building sites. The Los Osos soil is subject to slippage if it is wet, especially if slopes have been altered and the natural grade has been increased. The shrink-swell potential is high; as a result, foundations can shift and crack. Building pads should be shaped so that water is drained away from the building site, thus keeping the soil beneath the foundation dry and reducing the hazards of differential settlement and shrink-swell. The high shrink-swell potential and low strength affect the construction of roads and streets. Suitable base material is needed. In sloping areas, interceptor drains should be provided to keep moisture from beneath the roads. Because the Millsholm soil is shallow to bedrock, installing buried utility lines is difficult.

The steep banks that result from shaping these soils for use as building sites are highly erodible. They should be seeded to a fast-growing cover as soon as possible to reduce the hazard of erosion. Using straw mulch or jute netting helps to reduce the hazard of erosion during establishment of the grass cover. If runoff from higher areas is a problem, diversions may be needed at the head of these slopes.

Because the available water capacity is low, lawns should be watered frequently and lightly to reduce runoff. Shrubs and trees can be drip irrigated to encourage deeper rooting. Lawn grasses grow best if 1 pound of elemental nitrogen per 1,000 square feet is applied every 8 weeks, from April through October. Adding organic matter to the soil can improve the rate of water intake, aeration, and soil tilth.

If used for recreation, the soils in this complex are best suited as sites for paths and trails that are established across the slope to reduce the hazard of erosion. Natural vegetation should be protected from fire and excessive foot traffic to control erosion and to maintain its esthetic value.

Capability subclass VIe(15), nonirrigated.

124—Los Osos-Millsholm complex, 50 to 75 percent slopes. This complex consists of very steep soils on uplands at an elevation between 300 and 1,500 feet. The average annual precipitation is 20 inches, and the mean annual temperature is 57 degrees F. The average frost-free season ranges from 300 to 320 days. This complex is about 50 percent Los Osos silty clay loam and 30 percent Millsholm silt loam. The components of this map unit are so intricately intermingled that it was not practical to map them separately at the scale used. Included in mapping, and making up about 20 percent of this map unit, are Los Gatos loam and Rock outcrop.

The Los Osos soil is moderately deep and well drained. It formed in material that weathered from sedimentary rock. This soil is on side slopes. Typically, the surface layer is grayish brown, medium acid silty clay loam about 8 inches thick. The subsoil is dark grayish brown, slightly acid silty clay loam and heavy silty clay loam and extends to a depth of 30 inches. It is underlain by weathered shale.

Permeability of the Los Osos soil is slow. The available water capacity is 3.5 to 6.5 inches. The root zone is 24 to 40 inches deep. Runoff is very rapid, and the hazard of erosion is very high.

The Millsholm soil is shallow and well drained. It formed in material that weathered from sedimentary rock. This soil is on ridges. Typically, the surface layer is grayish brown, medium acid silt loam about 7 inches thick. The subsoil is light olive brown, medium acid silt loam and extends to a depth of 20 inches. It is underlain by shale bedrock.

Permeability of the Millsholm soil is moderate. The available water capacity is 1.5 to 3.5 inches. The root zone is 10 to 20 inches deep. Runoff is very rapid, and the hazard of erosion is very high.

These soils are used mainly for recreation. The steep slopes limit the potential for recreation uses to a few paths and trails. To reduce the hazard of erosion, natural vegetation should be protected from fire, and paths and trails should be established across the slope.

Capability subclass VIIe(15), nonirrigated.

125—Marvin silt loam, saline-alkali. This is a very deep, somewhat poorly drained soil on low alluvial terraces. This soil is slightly affected by alkali. It formed in alluvium that derived mainly from sedimentary rock. Elevation ranges from 10 to 40 feet. Slopes are 0 to 2 percent. The average annual precipitation ranges from 16 to 18 inches, and the mean annual temperature is 57 degrees F. The average frost-free season is 300 to 320 days.

Typically, the surface layer is grayish brown, neutral silt loam about 4 inches thick. The subsoil extends to a depth of 36 inches. It is grayish brown, moderately alkaline heavy silty clay loam and clay. The substratum is mottled, light brownish gray and light yellowish brown heavy clay loam extending to a depth of 60 inches or more.

Included in mapping are small areas of Pescadero clay and Willows clay.

Permeability is slow. The available water capacity is 8.0 to 9.0 inches. The root zone for water-loving plants is 60 inches deep; for most of the commonly grown cultivated crops, the water table restricts the root zone to a depth of about 50 inches. Drainage has been improved by flood control structures. The water table is below a depth of 50 inches. Five percent of this map unit is not suited to most crops because of excess alkali.

This soil is used for urban development. A few small areas are used for vegetable crops.

Urban structures require special design because of the low strength and the high shrink-swell potential. Most of the plants used in landscaping should be tolerant of saline-alkali salts. Irrigation water should be applied slowly. Lawns respond to 1 pound of elemental nitrogen per 1,000 square feet every 6 to 8 weeks, from April through October. Adding organic matter to the soil can improve the rate of water intake, aeration, and soil tilth.

Salt accumulation is a hazard on this slowly permeable soil if it is used for irrigated crops. Water should be applied slowly, and drainage is needed to remove excess surface and subsurface water and to maintain the water table below a depth of 50 inches. All crops respond to nitrogen and phosphate fertilizer.

Capability unit IVs-6(14), nonirrigated; IIIw-6(14), irrigated.

126—Maymen loam, 30 to 75 percent slopes. This is a shallow, somewhat excessively drained soil on uplands. It formed in material that weathered from sedimentary rock. Elevation ranges from 100 to 2,000 feet. The average annual precipitation is 22 inches, and the mean annual temperature is 56 degrees F. The average frost-free season ranges from 300 to 320 days.

Typically, the surface layer and subsoil are light brownish gray, strongly acid loam underlain by shale bedrock at a depth of 19 inches.

Included in mapping are small areas of Millsholm silt loam, Los Gatos loam, and a few areas of a very strongly acid, moderately deep, loamy soil.

Permeability is moderate. The available water capacity is 1 to 3 inches. The root zone is 10 to 20 inches deep. Runoff is rapid to very rapid, and the hazard of erosion is high to very high.

This soil is used for urban development, recreation, and watershed. If it is used for urban development, steep slopes and shallowness to bedrock are the main limitations. The steep banks that result from shaping this soil for use as building sites are highly erodible. They should be seeded to a fast-growing cover as soon as possible to reduce the hazard of erosion. Using straw mulch or jute netting helps to reduce the hazard of erosion during establishment of the grass cover. If runoff from higher areas is a problem, diversions may be needed at the head of these slopes. Tall trees used in landscaping are susceptible to windthrow because the soil is shallow. This soil is best suited to short trees. Lawn grasses grow best if about 1 pound of elemental nitrogen per 1,000 square feet is applied every 8 weeks, from April through October. Some ornamental plants respond to sulfur and to iron and aluminum chelates. Adding organic matter to the soil can improve the rate of water intake, aeration, and soil tilth.

The natural vegetation in recreation areas needs to be protected from fire and other destructive forces. To reduce the hazards of erosion and sedimentation, thick stands of eucalyptus trees should be thinned and regrowth controlled to reduce the fire hazard. The natural vegetation provides cover and food for deer, bush rabbits, quail, and songbirds.

Capability class VIIe(15), nonirrigated.

127—Maymen-Los Gatos complex, 30 to 75 p cent slopes. This complex consists of steep and v steep soils on uplands at an elevation of 400 to 1, feet. Slopes range from 30 to 75 percent but are ma 50 to 75 percent. The average annual precipitation is inches, and the mean annual temperature is 56 degr F. The average frost-free season ranges from 300 to days.

This complex is about 50 percent Maymen soils 35 percent Los Gatos soils. The components of this are so intricately intermingled that it was not practica map them separately at the scale used. Included in m ping, and making up 15 percent of this complex, small areas of Millsholm silt loam and some Rock crop.

The Maymen soil is shallow and somewhat excess ly drained. This soil is on the upper part of slopes and ridges. It formed in material that weathered from s mentary rock. Typically, the surface layer and subsoil light brownish gray, strongly acid loam. They are unc lain by shale at a depth of 19 inches.

Permeability of the Maymen soil is moderate. available water capacity is 1 to 3 inches. The root z is 10 to 20 inches deep. Runoff is rapid to very ra and the hazard of erosion is high to very high.

The Los Gatos soil is moderately deep and v drained. It is on lower slopes and north-facing slop Typically, the surface layer is brown, neutral loam ab 11 inches thick. The subsoil extends to a depth of inches. It is brown and reddish brown, neutral and slig ly acid loam and heavy loam and is underlain by sa stone.

Permeability of the Los Gatos soil is moderately sl The available water capacity is 3.5 to 8.0 inches. T root zone is 24 to 40 inches deep. Runoff is rapid to v rapid, and the hazard of erosion is high to very hi

These soils are used for low density urban devel ment, recreation, and watershed.

Urban development is limited by steep slopes a shallowness or moderate depth to bedrock. The ste banks that result from shaping these soils for use building sites are highly erodible. They should be seec to a fast-growing cover as soon as possible to redu the hazard of erosion. Using straw mulch or jute nett helps to reduce the hazard of erosion during establi ment of the grass cover. If runoff from higher areas is problem, diversions may be needed at the head of the slopes.

The Maymen soil is best suited to short trees. T trees are susceptible to windthrow. Shrubs and trees c be drip irrigated to encourage deeper rooting. La grasses grow best if about 1 pound of elemental nit gen per 1,000 square feet is applied every 8 weeks, fr April through October. Some ornamental plants respo to sulfur and to iron and aluminum chelates. Add organic matter to the soil can improve the rate of wa intake, aeration, and soil tilth.

The natural vegetation has esthetic value and supplies food and shelter for deer, rabbits, quail, and songbirds. It should be protected from fire. Thick stands of eucalyptus trees should be thinned to reduce the hazard of fire. Protecting the vegetation reduces the hazards of erosion and sedimentation.

Capability subclass VIIe(15), nonirrigated.

128—Millsholm silt loam, 30 to 50 percent slopes. This is a shallow, well drained soil on uplands. This soil formed in material that weathered from sedimentary rock. The elevation ranges from 300 to 1,500 feet. The average annual precipitation is 20 inches, the mean annual temperature is 57 degrees F, and the average frost-free season ranges from 300 to 320 days.

Typically, the surface layer is grayish brown, medium acid silt loam about 6 inches thick. The subsoil extends to a depth of 20 inches. It is a light olive brown, medium acid silt loam and it is underlain by shale bedrock.

Included in mapping are small areas of Maymen loam and Los Gatos loam and a shallow, brown silt loam soil that is underlain by soft bedrock.

Permeability is moderate. The available water capacity is 1.5 to 3.5 inches. The root zone is 10 to 20 inches deep. Runoff is rapid, and the hazard of erosion is high.

This soil is used as rangeland and watershed and for recreation and low density urban uses. Because this soil is shallow and steep, it is poorly suited to intensive urban development. Cuts should be protected from erosion by structural measures, mulching, and seeding with a fast-growing cover. Most of the plants that are used for landscaping respond to nitrogen fertilizer. Water should be applied frequently and slowly to reduce runoff. Natural vegetation should be protected from fire and other destructive forces to reduce soil loss and sedimentation.

Capability subclass VIIe(15), nonirrigated.

129—Millsholm silt loam, 50 to 75 percent slopes. This is a shallow, well drained soil that formed in material that weathered from sedimentary rock. This soil is on uplands at an elevation of 300 to 1,500 feet. The average annual precipitation is 20 inches, and the mean annual temperature is 57 degrees F. The average frost-free season is 300 to 320 days.

Typically, the surface layer is grayish brown, medium acid silt loam about 6 inches thick. The subsoil extends to a depth of 20 inches. It is light olive brown, medium acid silt loam and is underlain by shale bedrock.

Included in mapping are small areas of Maymen loam, Los Gatos loam, and Rock outcrop.

Permeability is moderate. The available water capacity is 1.5 to 3.5 inches. The root zone is 10 to 20 inches deep. Runoff is very rapid, and the hazard of erosion is very high.

This soil is used for recreation, watershed, and homesites. In most areas this soil is in natural vegetation that has a high esthetic value. The natural vegetation provides food and cover for deer, rabbits, quail, and songbirds. It should be protected from fire and other destructive forces to reduce the hazards of erosion and sedimentation.

Capability subclass VIIe(15), nonirrigated.

130—Montara-Rock outcrop complex, 30 to 75 percent slopes. This complex consists of steep and very steep soils on uplands at an elevation of about 200 to 1,500 feet. The average annual precipitation is 19 inches, and the mean annual temperature is 57 degrees F. The average frost-free season ranges from 300 to 320 days. Montara soils make up about 65 percent of the complex and Rock outcrop, 20 percent. Included in mapping, and making up about 15 percent of this complex are small areas of Millsholm silt loam and Los Gatos loam.

Montara soils are shallow and somewhat excessively drained. Typically, the surface layer is very dark grayish brown, mildly alkaline and moderately alkaline clay loam about 14 inches thick. It is underlain by ultrabasic rock.

Permeability is moderately slow. The available water capacity is 1.5 to 3.5 inches. The root zone is 10 to 20 inches deep. Runoff is rapid to very rapid, and the hazard of erosion is high to very high.

Rock outcrop consists of large areas of exposed ultrabasic rock. Runoff is very rapid, but the hazard of erosion is slight.

Most areas of Montara soils are used as parks; some areas are used as homesites. The natural vegetation needs to be protected from fire and other destructive forces to reduce the hazard of erosion.

Capability subclass VIIs(15), nonirrigated.

131—Omni silty clay loam, drained. This is a very deep, poorly drained soil on flood plains. It formed in alluvium that derived from mixed rock sources. Elevation ranges from 5 to 30 feet. The slopes are 0 to 2 percent. The average annual precipitation is 15 inches, and the mean annual air temperature is 57 degrees F. The average frost-free season ranges from 300 to 320 days.

Typically, the surface layer is grayish brown, moderately alkaline silty clay loam and silty clay about 15 inches thick. The subsoil extends to a depth of 52 inches. It is mottled, dark gray, mildly alkaline clay in the upper part and mottled light olive brown, moderately alkaline clay in the lower part. The substratum is mottled, light olive brown, moderately alkaline silty clay loam to a depth of 60 inches or more.

Included in mapping are small areas of Botella loam; Danville silty clay loam; and Clear Lake clay, drained.

Permeability is slow. The available water capacity is 7.5 to 10 inches. The root zone is 60 inches deep. Runoff is slow, and the hazard of erosion is slight. Drainage has been improved by flood control structures. The water table is below a depth of 5 feet.

This soil is used for urban development and for vegetable crops. The potential of this soil for urban use is limited by low strength and by the high shrink-swell potential.

The major crops are head lettuce and tomatoes, which are double-cropped with cauliflower. Head lettuce or tomatoes are grown and harvested in summer, and cauliflower is grown in winter. The yield of head lettuce is 550 crates; tomatoes, 25 tons; cauliflower, 460 crates. Crop residue should be returned to the soil to help maintain soil tilth and improve the water intake rate. Proper tillage practices minimize soil compaction. Water should be applied slowly and only in the amount needed for crop growth. Over-irrigation wastes water, leaches nutrients, and increases the risk of salt accumulation at the lower end of the run. Nitrogen fertilizer is needed for good crop growth.

Capability unit IIIs-3(14), nonirrigated; IIs-3(14), irrigated.

132—Omni silty clay loam, strongly saline. This is a very deep, poorly drained soil on flood plains. This soil formed in alluvium that derived from mixed rock sources. The slopes are less than 2 percent. Elevation ranges from 5 to 15 feet. The average annual precipitation is 16 inches, and the mean annual temperature is 57 degrees F. The average frost-free season ranges from 300 to 320 days.

Typically, the surface layer is grayish brown, moderately alkaline silty clay loam and silty clay about 15 inches thick. The subsoil extends to a depth of 52 inches. It is mottled, dark gray, mildly alkaline clay in the upper part and mottled, light olive brown, moderately alkaline clay in the lower part. The substratum is mottled, light olive brown silty clay loam to a depth of 60 inches or more.

Included in mapping are small areas of Willows clay, drained.

Permeability is slow. The available water capacity is 1.5 to 4.0 inches. The root zone for water-tolerant plants is 60 inches deep; but it is restricted to a depth of 48 inches for water-sensitive plants. Runoff is slow, and there is no hazard of erosion. The surface layer has excess saline salts.

Areas of this Omni soil were shaped for use as commercial salt ponds. Low levees were built around these areas. Most of these ponds have been abandoned and are now idle or are used as a source of sanitary landfill, though the high water table presents some problems for this use. Although the surface layer does have varying amounts of saline salts, this soil has fair potential for the development of habitat for wetland wildlife. Pickleweed, cordgrass, and saltgrass provide food and cover for wildlife.

Capability subclass VIw(14), nonirrigated.

133—Pescadero clay, drained. This is a very deep, poorly drained soil that formed on basin rims in alluvium that derived from sedimentary rock. Elevation ranges from 5 to 50 feet. The slopes are 0 to 2 percent. The average annual precipitation is 16 inches, and the mean annual temperature is 57 degrees F. The average frost-free season is 300 to 320 days.

Typically, the surface layer is a gray, slightly acid clay loam about 2 inches thick. The subsoil extends to a depth of 30 inches. It is mottled, dark gray and light gray, moderately alkaline clay. The substratum is gray, light olive gray, and light gray calcareous clay loam and extends to a depth of more than 60 inches.

Included in mapping are small areas of Willows clay, drained, and Omni silty clay loam, drained.

Permeability is very slow. The available water capacity is 3 to 7 inches. The water table has been lowered to a depth of 60 inches in most areas by flood control structures and natural stream cutting. The root zone for salt-tolerant plants is 60 inches deep. About 10 to 20 percent of this map unit is not suited to most vegetation. Runoff is very slow and some areas are ponded. Erosion is not a hazard.

This Pescadero soil is used mainly as dryland pasture and for open-type sanitary landfill. The main limitations to these uses are the clayey texture, excess salts, and ponding of water in winter. The clayey texture makes the soil material poorly suited to use as landfill cover material. This soil is difficult to work when wet or dry. Excess saline and alkali salts make revegetation difficult.

If used as dryland pasture, this soil should not be grazed when wet. Natural vegetation should be protected from over-grazing to help reduce invasion of undesirable weeds. Surface drainage is needed to reduce ponding in rainy periods.

Capability subclass VIs(14), nonirrigated.

134—Pescadero clay, ponded. This is a very deep, poorly drained soil that formed on basin rims in alluvium that derived from sedimentary rock. The slope is less than 2 percent. Elevation ranges from 5 to 15 feet. The average annual precipitation is 16 inches, and the mean annual temperature is 57 degrees F. The average frost-free season is 300 to 320 days.

Typically, the surface layer is gray, strongly alkaline clay loam about 2 inches thick. The subsoil extends to a depth of 30 inches. It is mottled, dark gray and light gray, strongly alkaline clay. The substratum is gray, light olive gray, and light gray, calcareous clay loam and extends to a depth of more than 60 inches.

Included in mapping are areas of Omni silty clay loam, strongly saline, and Reyes clay, ponded.

Permeability is very slow. The available water capacity is 2 to 6 inches. All rainfall is ponded unless levees or outlets are open. Most areas have no vegetation. The water table is usually at a depth of about 4 feet, but in winter it can rise up to 1 1/2 feet from the surface. Runoff is very slow, and erosion is not a hazard.

In most areas this soil has been shaped and ponded for use as commercial salt ponds. Areas that have been used as salt ponds have a high concentration of salt in the upper 30 inches of the soil material and are covered by water up to 3 feet deep.

If this soil is drained and if the excess salts are flushed out of the surface layer, salt-tolerant plants can provide some food and cover for wetland wildlife.

Capability subclass VIIIw(14), nonirrigated.

135—Pits, gravel. This miscellaneous area consists of large excavations that are the result of commercial sand and gravel extraction operations. Many of these gravel pits are now used to recharge the water table reservoir with imported water to prevent salt water intrusion of wells.

Capability classification not assigned.

136—Pleasanton gravelly loam, 0 to 5 percent slopes. This is a very deep, well drained soil on low terraces. This soil formed in alluvium that derived from sedimentary rock. Elevation ranges from 100 to 300 feet. The average annual precipitation is 16 inches, and the mean annual temperature is 57 degrees F. The average frost-free season ranges from 300 to 310 days.

Typically, the surface layer is grayish brown, slightly acid and neutral gravelly loam about 21 inches thick. The subsoil extends to a depth of 64 inches. It is brown, neutral gravelly sandy clay loam and gravelly loam about 43 inches thick. The substratum is yellowish brown, mildly alkaline gravelly fine sandy loam and extends to a depth of more than 60 inches.

Included in mapping are areas of Botella loam, Danville silty clay loam, and Rincon clay loam.

Permeability is moderately slow. The available water capacity is 5.5 to 8.0 inches. The root zone is more than 60 inches deep. Runoff is slow, and the hazard of erosion is slight.

This soil is used as dryland pasture and for low-density urban development. The natural vegetation should be protected from over-grazing to prevent infestation by weeds that are poisonous to livestock. There are few limitations for low-density urban uses. Septic tank filter fields should be enlarged or installed below a depth of about 5 feet because of the moderately slow permeabilty of the subsoil. Most of the plants used in landscaping respond to nitrogen and phosphate fertilizer. Lawn grasses grow best if 1 pound of elemental nitrogen per 1,000 square feet is applied every 8 weeks, from March to November.

Capability unit IIIe-3(14), nonirrigated; IIe-3(14), irrigated.

137—Reyes clay. This is a very deep, very poorly drained soil that formed in alluvium that derived from mixed sources. This soil is on tidal flats. The slope is less than 2 percent. The elevation ranges from sea level to 5 feet. The average annual rainfall is 15 inches, and the mean annual temperature is 57 degrees F. The average frost-free season ranges from 300 to 320 days.

Typically, the surface layer is olive gray, strongly alkaline clay about 6 inches thick. The underlying material, to a depth of 42 inches, is mottled dark greenish gray and black, strongly alkaline clay. Below that, to a depth of 72 inches, it is dark greenish gray, strongly alkaline silty clay. The underlying material contains polysulfides.

Included in mapping are small areas of a very poorly drained, strongly saline clay that does not contain polysulfides. Also included are small areas of Pescadero clay, drained.

Permeability is very slow. The available water capacity is 0.5 inch to 3.0 inches. The water table is between depths of 8 and 24 inches. Runoff is very slow, and most areas are subject to tidal inundation. There is no hazard of erosion. This soil is extremely acid when drained.

This soil is used for wildlife habitat. The natural vegetation is pickleweed, cordgrass, saltgrass, and other salt-tolerant plants that provide cover and food for waterfowl and other birds.

Capability subclass VIIIw(14), nonirrigated.

138—Reyes clay, ponded. This is a very deep, very poorly drained soil that formed in alluvium that derived from mixed sources. This soil is on tidal flats. The slope is less than 2 percent. The elevation ranges from sea level to 5 feet. The average annual precipitation is 15 inches, and the mean annual temperature is 57 degrees F. The average frost-free season ranges from 300 to 320 days.

Typically, the surface layer is olive gray, strongly alkaline clay about 6 inches thick. The underlying material, to a depth of 42 inches, is mottled dark greenish gray and black, strongly alkaline clay. Below that, to a depth of 72 inches, it is dark greenish gray, strongly alkaline silty clay. The underlying material contains polysulfides.

Included in mapping are small areas of a very poorly drained, strongly saline clay that does not contain polysulfides. Also included are small areas of Pescadero clay, ponded.

Permeability is very slow. This soil is ponded and is protected from tidal inundation by levees. Erosion is not a hazard. The areas are devoid of vegetation. This soil becomes extremely acid when drained.

This soil is used for commercial salt ponds and wildlife habitat.

Capability subclass VIIIw(14), nonirrigated.

139—Reyes clay, drained. This is a very deep, very poorly drained soil that formed in alluvium that derived from mixed sources. This soil is on tidal flats. The slope is less than 2 percent. This soil is at sea level and ranges to an elevation of 5 feet. The average annual precipitation is 16 inches, and the mean annual temperature is 57 degrees F. The average frost-free season ranges from 300 to 320 days.

Typically, the surface layer is olive gray, strongly acid clay about 6 inches thick. The underlying material to a depth of 42 inches is mottled dark greenish gray and black, extremely acid clay. Below that, to a depth of 72 inches, it is dark greenish gray, extremely acid silty clay. The underlying material contains polysulfides.

Included in mapping are small areas of a very poorly drained, strongly saline clay soil that does not contain polysulfides. Also included are small areas of Pescadero clay, drained.

Permeability is very slow. The available water capacity is 2.0 to 3.5 inches. The root zone for salt- and water-tolerant plants is 60 inches deep, and it is 2 to 4 feet deep for water-sensitive plants. The water table has been lowered to a depth of about 4 feet. Runoff is very slow, and there is no hazard of erosion.

This soil is used as dryland pasture and for barley. The natural vegetation is mainly mouse barley, saltgrass, pickleweed, and saltbush. The grazing capacity is about 1.5 AUM per acre. Pasture grasses should not be grazed when this soil is wet.

Capability unit IVw-9(14), nonirrigated.

140—Rincon clay loam, 0 to 2 percent slopes. This is a very deep, well drained soil that formed in alluvium that derived from sedimentary rock. It is on low terraces. Elevation ranges from 20 to 200 feet. The average annual precipitation is 16 inches, and the mean annual temperature is 57 degrees F. The average frost-free season ranges from 300 to 320 days.

Typically, the surface layer is grayish brown and dark grayish brown neutral clay loam about 16 inches thick. The subsoil extends to a depth of 52 inches. It is dark grayish brown, neutral heavy clay loam in the upper part, and brown, neutral and mildly alkaline clay in the lower part. The substratum is yellowish brown, calcareous clay loam and extends to a depth of 60 inches or more.

Included in mapping are small areas of Danville silty clay loam; Clear Lake clay, drained; and Yolo silt loam.

Permeability is slow. The available water capacity is 8 to 10 inches. The root zone is more than 60 inches deep. Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for urban development. In a few small areas it is used for row crops.

This soil has limitations for use as building sites. The shrink-swell potential is high; as a result, foundations can shift and crack. Building pads should be shaped so that water is drained away from the building site, thus keeping the soil beneath the foundation dry and reducing the hazards of differential settlement and shrink-swell. The high shrink-swell potential and low strength affect the construction of roads and streets. Suitable base material is needed. In sloping areas, intercepting drains should be provided to keep moisture from beneath the roads.

The water intake rate and permeability are slow; therefore, lawns should be watered slowly to reduce runoff. Shrubs and trees can be drip irrigated to encourage deep rooting. Lawn grasses grow best if 1 pound of elemental nitrogen per 1,000 square feet is applied every 8 weeks, from April through October. Some ornamental plants respond to sulfur and to iron and aluminum chelates. Adding organic matter to the soil can improve the rate of water intake, aeration, and soil tilth.

Capability unit IIIs-3(14), nonirrigated; IIs-3(14), irrigated.

141—Riverwash. This miscellaneous area consists of very gravelly, cobbly, or stony sediment on creek bottoms. Most areas are in the vicinity of the city of Niles. In some areas, Riverwash has been used as a source of construction material and fill.

Capability subclass VIIIw(14), nonirrigated.

142—Quarry. This miscellaneous area consists of large excavations, on uplands, from which rock is extracted for use as landfill.

Capability classification not assigned.

143—Sycamore silt loam, drained. This is a very deep, poorly drained soil that formed in alluvium that derived from sedimentary rock. It is on flood plains and has slopes of 0 to 2 percent. Elevation ranges from 10 to 50 feet. The average annual precipitation is 16 inches, and the mean annual temperature is 57 degrees F. The average frost-free season ranges from 300 to 320 days.

Typically, the surface layer is light brownish gray, moderately alkaline silt loam about 18 inches thick. The subsoil extends to a depth of 44 inches. It is mottled, grayish brown and light olive gray, moderately alkaline silt loam. The substratum is mottled, light olive gray, moderately alkaline heavy silt loam and extends to a depth of 60 inches or more.

Included in mapping are small areas of Laugenour loam, drained, and Omni silty clay loam, drained.

Permeability is moderate. The available water capacity is 8.0 to 10.5 inches. The root zone is more than 60 inches deep. In most places, natural stream cutting and flood control structures have lowered the water table to a depth of 72 inches. Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for row crops. Head lettuce, cauliflower, and tomatoes are the major crops. Head lettuce or tomatoes are grown and harvested in summer, cauliflower in winter. Returning crop residue to the soil helps to maintain tilth and improve the rate of water intake. Minimum tillage reduces soil compaction. Water should be applied only in the amount necessary for crop growth. Overirrigation wastes water and leaches nutrients. Nitrogen is needed for good crop growth. In a few areas this soil is used for urban development.

Permeability is slow. The available water capacity is 3 to 6 inches. The root zone is 24 to 40 inches deep. Runoff is rapid, and the hazard of erosion is moderate to high.

In landscaping, the soils in this complex are best suited to shallow-rooted plants. Irrigation water should be applied slowly to reduce the loss of water and the hazard of erosion. Most plants respond to nitrogen and phosphate fertilizer. One pound of elemental nitrogen per 1,000 square feet should be applied to lawn grasses every 8 weeks, from April to November. If the subsoil is exposed, adding organic matter to the soil improves tilth and increases the rate of water intake and aeration.

Capability classification not assigned.

153—Vallecitos-Rock outcrop complex, 30 to 50 percent slopes. This complex of steep soils and Rock outcrop is in the Coyote Hills at an elevation of 5 to 290 feet. The average annual precipitation is 15 inches, and the mean annual temperature is 57 degrees F. The average frost-free season ranges from 300 to 320 days. This complex is about 65 percent Vallecitos gravelly loam and 20 percent Rock outcrop. Included in mapping and making up about 15 percent of the complex are small areas of Contra Costa clay loam.

The Vallecitos soil is shallow and well drained. It formed in residual material that weathered from metasedimentary rock. Typically, the surface layer is brown, neutral gravelly loam about 6 inches thick. The subsoil extends to a depth of 16 inches. It is reddish brown neutral heavy clay loam and brown, slightly acid heavy clay loam. It is underlain by sandstone bedrock.

Permeability is slow. The root zone is 10 to 20 inches deep. The available water capacity is 1 to 3 inches. Runoff is rapid, and the hazard of erosion is high.

Rock outcrop consists of exposed metamorphosed sandstone and large sandstone boulders.

Areas of this complex are used for recreation. The natural vegetation should be protected from fire and excessive foot traffic to maintain its esthetic value. If paths and trails are built, they should be established across the slope to reduce the hazard of erosion.

Capability subclass VIIe(15), nonirrigated.

154—Willows clay, drained. This is a very deep, poorly drained soil on basin rims. It formed in alluvium that derived mainly from sedimentary rock. The slope ranges between 0 and 2 percent. The elevation is 10 to 200 feet. The average annual precipitation is 16 inches, and the mean annual temperature is 57 degrees F. The average frost-free season ranges from 300 to 320 days.

Included in mapping are small areas of Clear Lake clay and Omni silty clay loam.

Typically, the surface layer is black, moderately alkaline clay about 19 inches thick. The next layer is mottled, dark gray, moderately alkaline clay about 10 inches thick. The underlying material consists of mottled, grayish brown, calcareous clay and extends to a depth c more than 60 inches.

Permeability is very slow. The available water capacit is 4.0 to 6.5 inches. The root zone is 60 inches deep The water table has been lowered to a depth of 5 to (feet by flood control structures and natural downcuttin of stream beds. Runoff is slow, and there is no hazard o erosion.

This soil is used mainly for industrial and commerica development. A few areas are used as dryland pasture

This soil has limitations for use as building sites. The shrink-swell potential is high; as a result, foundations can shift and crack. Building pads should be shaped so that water is drained away from the building site, thus keeping the soil beneath the foundation dry and reducing the hazards of differential settlement and shrink-swell. The high shrink-swell potential and low strength affect the construction of roads and streets. Suitable base material is needed.

The water intake rate and permeability are slow; therefore lawns should be watered slowly to reduce runoff. Shrubs can be drip irrigated to encourage deep rooting. Lawn grasses grow best if 1 pound of elemental nitrogen per 1,000 square feet is applied every 8 weeks, from April through October. Some ornamental plants respond to sulfur and to iron and aluminum chelates. Adding organic matter to the soil can improve the rate of water intake, aeration, and soil tilth.

Capability unit IIIs-5(14), nonirrigated, and IIs-5(14), irrigated.

155—Xerorthents, clayey. This map unit consists of clayey material that is used as fill for building sites. The slopes are less than 2 percent. Elevation ranges from near sea level to 50 feet. The average annual precipitation is 16 inches, and the mean annual temperature is 57 degrees F. The average frost-free season ranges from 300 to 320 days.

Typically, these soils are dark brown, dark grayish brown, grayish brown, or brown. The texture is mainly heavy clay loam, but the range includes silty clay and clay. Reaction is mildly acid to moderately alkaine except where these soils are limed. Large pieces of asphalt, concrete, and sandstone and fragments of glass and other debris make up as much as 15 percent, by volume, of the profile.

Permeability is slow to very slow. The available water capacity is 6 to 7 inches. The root zone is 60 inches deep. Runoff is slow, and erosion is not a hazard.

Areas of this map unit are used mainly as sites for industrial development; however, certain limitations should be overcome before construction is feasible. The shrink-swell potential is high; as a result, foundations can shift and crack. Building pads should be shaped so that water is drained away from the building site, thus keeping the soil beneath the foundation dry and reducing the hazards of differential settlement and shrink-swell. The high shrink-swell potential and low strength affect the construction of roads and streets. Suitable base material is needed.

The water intake rate and permeability are slow; therefore, lawns should be watered slowly to reduce runoff. Shrubs can be drip irrigated to encourage deep rooting. Lawn grasses grow best if 1 pound of elemental nitrogen per 1,000 square feet is applied every 8 weeks, from April through October. Some ornamental plants respond to sulfur and to iron and aluminum chelates. Adding organic matter to the soil can improve the rate of water intake, aeration, and tilth.

Capability classification not assigned.

156—Xeropsamments, fill. This unit consists of sandy material that was dredged from old beach areas. Slopes are less than 2 percent. Elevation ranges from near sea level to 10 feet. The average annual precipitation is 17 inches, and the mean annual temperature is 57 degrees F. The average frost-free season ranges from 300 to 320 days.

Included in mapping, and making up about 10 percent of the map unit, are a few areas that are underlain by strongly alkaline clay at a depth of 36 to 48 inches. Also included, and making up about 5 percent of the map unit, are concave areas that have a water table within a depth of 36 inches and can be ponded in winter.

Typically, Xeropsamments are moderately alkaline sands that extend to a depth of 60 inches. In a few areas they are as much as 5 percent, by volume, shells that are less than one inch in diameter.

These soils are rapidly permeable. The root zone for water-tolerant plants is 60 inches deep; the water table restricts the root zone for water-sensitive plants to a depth of 40 to 60 inches. The available water capacity is 3 to 4 inches. Runoff is slow, and the hazard of erosion is slight. Soil blowing is a serious hazard.

These soils are used mainly for urban and industrial development and as airfields. A few areas are used for small grain. Levees prevent erosion of this fill material.

Frequent and light applications of irrigation water and fertilizer are needed to establish a vegetative cover. Most plants respond to nitrogen and phosphate fertilizer. Iron and aluminum chelates are needed for some ornamental plants.

Capability classification not assigned.

157—Xerorthents-Altamont complex, 30 to 50 percent slopes. This complex consists of soils on foothills adjacent to the bay. The elevation ranges from 200 to 1,500 feet. The average annual precipitation is 16 inches, and the mean annual temperature is 57 degrees F. The average frost-free season ranges from 300 to 320 days. Xerorthents, clayey, make up about 75 percent of this complex; Altamont clay, 20 percent.

Xerorthents consist of soil material that resulted from cutting or filling for urban development; therefore, the soil characteristics are variable. Fill areas consist of heavy clay loam, silty clay, and clay and are as much as 20 percent angular fragments of shale and sandstone. Colors are variable. Reaction is mildly alkaline or moderately alkaline, and these soils are calcareous throughout the profile. Cut areas consist of interbedded shale and fine-grained sandstone. The bedrock dips between 50 and 80 degrees.

Permeability is slow or very slow, depending on the soil texture and on the amount of compaction that takes place during construction.

The Altamont soil is deep and well drained. It formed in the material that weathered from soft, interbedded sedimentary rock and makes up most of the undisturbed areas of this complex. Typically, the surface layer is dark brown, slightly acid to mildly alkaline clay about 28 inches thick. The next layer is finely mixed dark brown and dark yellowish brown, calcareous clay about 9 inches thick. The underlying material extends to a depth of 50 inches. It is yellowish brown, calcareous clay. Below that is highly fractured and weathered fine-grained sandstone and shale.

Permeability is slow. The available water capacity is 5.0 to 9.5 inches. The root zone is 40 to 60 inches deep. Runoff is rapid, and the hazard of erosion is high.

Areas of this complex are used mainly for residential developments that have a density of two to four single family dwellings per acre. Approximately 25 percent of the area is covered by buildings or other urban related structures.

Certain limitations should be overcome before construction is feasible. The shrink-swell potential is high; as a result, foundations can shift and crack. Building pads should be shaped so that water is drained away from the building site, thus keeping the soil beneath the foundation dry and reducing the hazards of differential settlement and shrink-swell. The high shrink-swell potential and low strength affect the construction of roads and streets. Suitable base material is needed. In sloping areas, intercepting drains should be provided to keep moisture from beneath the roads.

Steep banks that result from reshaping these soils for use as building sites are highly erodible. These soils should be seeded to a fast-growing cover as soon as possible to reduce the hazard of erosion. Using straw mulch or jute netting helps to reduce the hazard of erosion during establishment of the grass cover. If runoff from higher areas is a problem, diversions may be needed at the head of these slopes.

The water intake rate and permeability are slow; therefore, lawns should be watered slowly to reduce runoff. Shrubs and trees can be drip irrigated to encourage deep rooting. Lawn grasses grow best if 1 pound of nitrogen per 1,000 square feet is applied every 8 weeks, from April through October. Some ornamental plants respond to sulfur and to iron and aluminum chelates.

difference, however, does not significantly affect their use and management.

Clear Lake series

The Clear Lake series consists of very deep, poorly drained soils that formed in alluvium that derived mainly from sedimentary rock sources. These soils are in basins or in areas of the coastal valley. The slopes are concave and range from 0 to 9 percent. The average annual precipitation ranges from 14 to 20 inches. The mean annual temperature is 57 degrees F.

Clear Lake soils are similar to Altamont, Diablo, and Climara soils. They are associated with Omni and Pescadero soils. Altamont, Diablo, and Climara soils have a lithic or paralithic contact within a depth of 60 inches and in some horizons have moist chroma of 1.5 or more above a depth of 40 inches. Omni soils do not have intersecting slickensides, and the content of organic matter decreases irregularly with depth. The Pescadero soils have a natric horizon.

Typical pedon of Clear Lake clay, drained, near Russell City, 2,000 feet east and 1,650 feet north of the sewage disposal plant on Depot Road:

Ap—0 to 9 inches; very dark gray (N 3/0) clay, black (N 2/0) moist; strong coarse prismatic structure parting to coarse angular blocky; extremely hard, very firm, very sticky and very plastic; many fine tubular pores; neutral; gradual smooth boundary.

A12—9 to 26 inches; very dark gray (N 3/0) clay, black (N 2/0) moist; strong coarse prismatic structure parting to coarse angular blocky; extremely hard, very firm, very sticky and very plastic: many very fine roots; very few very fine tubular pores; many slickensides; moderately alkaline; gradual wavy boundary.

ACca—26 to 37 inches; very dark gray (N 3/0) clay, black (10YR 2/1) moist; strong coarse prismatic structure parting to coarse angular blocky; extremely hard, firm, very sticky and very plastic; common very fine roots; very few very fine tubular pores; many intersecting slickensides; lime occurring in seams; moderately alkaline; gradual smooth boundary.

C1ca—37 to 48 inches; dark gray (5Y 4/1) clay, very dark gray (5Y 3/1) moist; many fine distinct yellowish brown (10YR 5/4) mottles; weak fine angular blocky structure; slightly hard, friable, sticky and plastic; few very fine roots; few very fine pores; many intersecting slickensides; lime occurring as fine soft masses; moderately alkaline; gradual smooth boundary.

C2ca—48 to 60 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; many fine distinct yellowish brown (10YR 5/6) mottles; weak fine angular blocky structure; hard, friable, sticky and plastic; no roots; many very fine tubular pores; lime occurring throughout the soil matrix; moderately alkaline.

In summer, cracks that are 1/2 inch to 2 inches wide extend from the surface to the C horizon and form very coarse and coarse prismatic structure.

The A horizon is dark gray, very dark gray, or black (N 4/0, 3/0, 2/0). It is slightly acid to moderately alkaline. In some pedons, a few fine concretions of lime are in the Ap or A12 horizon. The C horizon is olive, light olive brown, grayish brown, dark gray, or dark grayish brown (5Y 5/3; 2.5Y 5/4, 5/2, 4/1, 4/2) clay loam, silty clay loam, silty clay, or clay.

Climara series

The Climara series consists of moderately deep, well drained soils that formed in residuum of ultrabasic rock. Climara soils are on uplands and have slopes ranging from 30 to 50 percent. The average annual precipitation ranges from 18 to 22 inches, and the mean annual temperature is 57 degrees F.

Climara soils are similar to Altamont, Diablo, and Clear Lake soils and are near Los Osos and Altamont soils. Altamont and Diablo soils have a paralithic contact at a depth greater than 40 inches. Clear Lake soils have chroma of less than 1.5 at a depth of 40 inches or more and do not have a paralithic or lithic contact. Los Osos soils have a mollic epipedon and an argillic horizon.

Typical pedon of Climara clay, on a moderately steep west-facing grassy slope, in the hills east of San Leandro, 400 feet north of the county dog pound, in the NW1/4SW1/4NW1/4 of sec. 32, T. 2 W., R. 2 S. (projected):

A11—0 to 9 inches; black (10YR 2/1) clay, dry and moist; strong coarse prismatic structure; very hard, firm, sticky and very plastic; common fine roots; common fine tubular pores; neutral; diffuse wavy boundary.

A12—9 to 22 inches; black (10YR 2/1) clay, dry and moist; strong coarse prismatic structure; very hard, firm, sticky and very plastic; common fine roots; common fine tubular pores; few intersecting slickensides; neutral; clear wavy boundary.

A13—22 to 27 inches; black (10YR 2/1) clay, dry and moist; some splotches of variegated very dark grayish brown (2.5Y 3/2) and olive (5Y 4/4, 5/6) moist; strong coarse prismatic structure; very hard, firm, sticky and very plastic; common fine roots; common fine tubular pores; numerous slickensides; mildly alkaline; clear wavy boundary.

C1ca—27 to 33 inches; variegated very dark brown (10YR 2/2), olive brown (2.5Y 4/4), and olive (2.5Y 4/4) clay, dry and moist; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; common fine tubular pores;

B1—11 to 19 inches; brown (10YR 4/3) loam, dark brown (7.5YR 3/2) moist; massive; hard, friable, slightly sticky and slightly plastic; many very fine and few fine and medium roots; few medium and fine tubular pores, many very fine tubular pores, and many very fine interstitial pores; many discontinuous clay films in pores; neutral; gradual smooth boundary.

B2t—19 to 32 inches; reddish brown (5YR 5/4) heavy loam, dark reddish brown (5YR 3/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many very fine and few fine and medium roots; few medium and fine and many very fine tubular pores and many very fine interstitial pores; continuous clay films in pores; neutral; gradual smooth boundary.

B3t—32 to 40 inches; brown (7.5YR 5/4) loam, dark brown (7.5YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; many very fine tubular and interstitial pores; slightly acid; gradual irregular boundary.

R—40 inches; very pale brown (10YR 7/4) shattered sandstone.

The A11 horizon is loam or silt loam. It is brown or dark brown (10YR 4/3, 3/3). Structure is moderate fine or moderate medium granular or subangular blocky. Reaction ranges from medium acid to neutral. The B2t horizon is heavy loam or clay loam that is as much as 15 percent pebbles. It is brown or reddish brown (7.5YR 5/4, 5YR 4/4). Depth to bedrock is 24 to 40 inches.

Los Osos series

The Los Osos series consists of moderately deep, well drained soils that formed in residuum of interbedded sedimentary rock. The slopes range from 9 to 75 percent. The average annual precipitation ranges from 15 to 25 inches, and the mean annual temperature is 57 degrees F.

Los Osos soils are similar to Los Gatos soils and are associated with Los Gatos, Maymen, and Millsholm soils. Los Gatos soils have a fine-loamy control section. Maymen and Millsholm soils have a lithic contact within a depth of 20 inches.

Typical pedon of Los Osos silty clay loam, 40 feet east and 120 feet south of the northwest corner of sec. 19, T. 2 S., R. 1 W. (projected). This site is outside the survey area:

A1—0 to 8 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate medium granular structure; hard, friable, sticky and plastic; few medium and many fine and very fine roots; few medium and common very fine pores; few worm casts; medium acid; gradual wavy boundary.

B21t—8 to 24 inches; dark grayish brown (10YR 4/2) heavy silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, friable, sticky and plastic; few fine and many very fine roots; few medium and common very fine pores; many moderately thick clay films on faces of peds; slightly acid; gradual wavy boundary.

B22t—24 to 30 inches; dark grayish brown (10YR 4/2) silty clay loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; hard, friable, sticky and plastic; few fine and many very fine roots; few medium and fine and common very fine pores; common thin clay films in pores and on faces of peds; slightly acid; clear irregular boundary.

Cr—30 inches; pale olive (5Y 6/3) weathered shale.

The A1 horizon is grayish brown or dark grayish brown (10YR 5/2, 4/2). It is medium acid or slightly acid. Structure is weak to moderate medium granular or fine subangular blocky. The B2t horizon is dark grayish brown or grayish brown (10YR 4/2, 5/2). Interbedded sedimentary rock is at a depth of 24 to 40 inches.

Marvin series

The Marvin series consists of very deep, somewhat poorly drained soils on low alluvial terraces. These soils formed in mixed alluvium that derived mainly from sedimentary rock sources. The slopes range from 0 to 2 percent. The average annual precipitation ranges from 15 to 18 inches. The mean annual temperature is 57 degrees F.

Marvin soils are similar to Rincon soils and are associated with Danville and Pescadero soils. Rincon soils are well drained. Danville soils have a mollic epipedon. Pescadero soils have a natric horizon.

Typical pedon of Marvin silt loam, saline-alkali, in the city of Newark, about 1,200 feet northwest of the intersection of Central and Filbert Streets, 1,300 feet southwest of Filbert Street, SE1/4SW1/4SW1/4 of sec. 1, T. 5 S., R. 2 W.

Ap—0 to 4 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and few fine tubular pores; neutral; clear smooth boundary.

B1t—4 to 11 inches; grayish brown (10YR 5/2) heavy silty clay loam, very dark gray (10YR 3/1) moist; dark grayish brown (2.5Y 4/2) stains, very dark grayish brown (2.5Y 3/2) moist; moderate coarse angular blocky structure; very hard, firm, sticky and plastic; many very fine roots; many very fine tubular pores; moderately alkaline; gradual smooth boundary.

B21t—11 to 23 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; few fine distinct light yellowish brown (2.5Y 6/4) mottles, olive brown (2.5Y 4/4) moist; moderate coarse angular blocky structure; hard, firm, sticky and plastic; common very fine roots; common very fine tubular pores; continuous moderately thick clay films on faces of peds; very slightly effervescent; moderately alkaline; diffuse smooth boundary.

B22t—23 to 36 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; common medium and coarse distinct gray (10YR 5/1) mottles, very dark gray (10YR 3/1) moist; moderate coarse angular blocky structure; hard, firm, sticky and plastic; few very fine roots; common very fine tubular pores; common moderately thick clay films on faces of peds; strongly effervescent, soft masses of lime; moderately alkaline; clear smooth boundary.

C—36 to 60 inches; light brownish gray (2.5Y 6/2) and light yellowish brown (2.5Y 6/3) heavy clay loam, dark grayish brown (2.5Y 4/2) and olive brown (2.5Y 4/4) moist; few fine and medium distinct olive gray (5Y 5/2) mottles, dry and moist; weak coarse angular blocky structure; hard, friable, sticky and slightly plastic; many very fine tubular pores; few thin clay films on faces of peds and lining pores; violently effervescent, soft masses of lime; moderately alkaline.

The A horizon is 3 to 12 inches thick. It ranges from grayish brown to dark grayish brown (10YR 5/2, 4/2). The A horizon is neutral to mildly alkaline. The B2t horizon is 20 to 25 inches thick. It is grayish brown or dark grayish brown (2.5Y 5/2, 4/2) heavy clay loam, heavy silty clay loam, silty clay, or clay. The C horizon is dark grayish brown, light brownish gray, or light olive brown (2.5Y 4/2, 6/2, 5/6). It ranges from loam to heavy clay loam. In places, small concretions and soft masses of lime are in the upper part of the C horizon.

Maymen series

The Maymen series consists of shallow, somewhat excessively drained soils that formed in residuum of sedimentary rock. The slopes range from 30 to 75 percent. The average annual precipitation ranges from 18 to 26 inches. The mean annual temperature is 56 degrees F.

Maymen soils are similar to and are associated with Gaviota and Millsholm soils. Gaviota and Millsholm soils have a base saturation of more than 60 percent.

Typical pedon of Maymen loam, in the city of Oakland, on a southwest-facing slope at the intersection of Skyline Boulevard and Manzanita Drive, opposite Snake Road:

A1—0 to 9 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, friable, sticky and slightly plastic; many fine, medium, and coarse roots; many fine interstitial and tubular pores; strongly acid; diffuse wavy boundary.

B2—9 to 19 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak medium and fine subangular blocky structure; slightly hard, friable, sticky and slightly plastic; many fine, medium, and coarse roots; many fine interstitial and tubular pores; strongly acid; clear wavy boundary.

R—19 inches; light yellowish brown (10YR 6/4) shale that has dark yellowish brown (10YR 4/4) coatings.

The A horizon is light brownish gray or pale brown (10YR 6/2, 6/3). The B2 horizon is loam, silt loam, and light clay loam. Depth to bedrock ranges from 10 to 20 inches.

Millsholm series

The Millsholm series consists of shallow, well drained soils that formed in residuum of shale and fine grained sandstone. The slopes range from 9 to 75 percent. The average annual precipitation ranges from 15 to 25 inches. The mean annual temperature is 57 degrees F.

Millsholm soils are similar to Gaviota and Maymen soils. Gaviota soils are less than 18 percent clay and do not have a cambic horizon. Maymen soils have a base saturation of less than 60 percent.

Typical pedon of Millsholm silt loam, near the junction of Palomares and Stonybrook Roads, in the SE1/4SE1/4NE1/4 sec. 28, T. 3 S., R. 1 W.

A1—0 to 7 inches; grayish brown (2.5Y 5/2) silt loam, olive brown (2.5Y 4/3) moist; massive; hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine pores; few worm casts; medium acid; clear smooth boundary.

B21—7 to 14 inches; light olive brown (2.5Y 5/3) silt loam, olive brown (2.5Y 3/3) moist; massive; hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine pores; few thin discontinuous clay films in pores; medium acid; clear smooth boundary.

B22—14 to 20 inches; light olive brown (2.5Y 5/4) silt loam, olive brown (2.5Y 4/4) moist; massive; very hard, firm, sticky and plastic; many fine roots; many very fine pores; few thin continuous clay films in pores; medium acid; clear irregular boundary.

R—20 inches; grayish brown (2.5Y 5/2) shale, dark grayish brown (2.5Y 4/2) moist.

The A1 horizon is light olive brown (2.5Y 5/4) or grayish brown (2.5Y 5/2) loam or silt loam. It is medium acid or slightly acid. The B2 horizon is massive or has weak fine to medium subangular blocky structure. The bedrock is at a depth of 10 to 20 inches.

Montara series

The Montara series consists of shallow, well drained soils that formed in residuum of ultrabasic rock. The slopes range from 30 to 75 percent. The average annual precipitation ranges from 18 to 20 inches. The mean annual temperature is 58 degrees F.

Montara soils are similar to Climara, Maymen, and Millsholm soils. Climara soils are fine textured and have slickensides. Millsholm and Maymen soils have an ochric epipedon.

Typical pedon of Montara clay loam, in the Oakland Hills, on an east-facing slope, in Joaquin Miller Park, in the SW1/4NW1/4, sec. 34, T. 1 S., R. 3 W. (projected):

A11—0 to 6 inches; very dark grayish brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, friable, sticky and plastic; many fine, medium, and coarse roots; many fine interstitial pores; mildly alkaline; diffuse smooth boundary.

A12—6 to 14 inches; very dark grayish brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) moist; moderate very fine granular structure; slightly hard, friable, sticky and plastic; many fine, medium, and coarse roots; many very fine interstitial pores; moderately alkaline; abrupt wavy boundary.

R—14 inches; ultrabasic rock.

The A1 horizon is very dark grayish brown, dark grayish brown, dark gray, or very dark gray (10YR 3/2, 4/2, 4/1, 3/1). In places, the lower part of the A12 horizon is calcareous. Depth to bedrock is 10 to 20 inches.

Omni series

The Omni series consists of very deep, poorly drained soils that formed in alluvium that derived from mixed rock sources. These soils are on the lower flood plains. The slopes are 0 to 2 percent. The average annual precipitation ranges from 15 to 18 inches. The mean annual temperature is 57 degrees F.

Omni soils are associated with Botella, Clear Lake, and Marvin soils. Botella soils are well drained and have a fine-loamy control section. Clear Lake soils have intersecting slickensides. Marvin soils are somewhat poorly drained and have a fine control section.

Typical pedon of Omni silty clay loam, drained, in the NW1/4NW1/4NE1/4 of sec. 27, T. 4 S., R. 2 W. (projected):

Ap—0 to 6 inches; grayish brown (10YR 5/2) silty clay loam, very dark brown (10YR 2/2) moist; weak fine granular structure; hard, friable, slightly sticky and plastic; many very fine and fine and few medium roots; many fine tubular and interstitial pores; moderately alkaline; clear wavy boundary.

A12—6 to 15 inches; grayish brown (10YR 5/2) silty clay that has common fine distinct mottles; very dark gray (5Y 3/1) moist; weak fine subangular blocky structure; hard, friable, sticky and plastic; common fine roots; many very fine tubular pores; slightly effervescent; moderately alkaline; diffuse wavy boundary.

B21g—15 to 25 inches; dark gray (5Y 4/1) clay with common medium prominent light yellowish brown (2.5Y 6/4) mottles, dark olive gray (5Y 3/2) moist; weak medium subangular blocky structure; hard, friable, sticky and plastic; common fine roots; many very fine tubular pores; slightly effervescent; mildly alkaline; clear smooth boundary.

B22cag—25 to 35 inches; light olive brown (2.5Y 5/4) clay that has common medium prominent gray (2.5Y 6/1) and yellowish brown (10YR 5/6) mottles, very dark gray (N 3/0) moist; weak medium subangular blocky structure; hard, friable, sticky and plastic; few fine roots; many very fine tubular pores; strongly effervescent, soft masses of lime; moderately alkaline; gradual wavy boundary.

B23cag—35 to 52 inches; light olive brown (2.5Y 5/4) clay that has many coarse distinct gray (2.5Y 6/1) and light yellowish brown (2.5Y 6/4) mottles, dark gray (N 4/0) moist; weak medium and fine subangular blocky structure; hard, friable, sticky and plastic; very few fine roots; many fine tubular pores; strongly effervescent, soft masses of lime; moderately alkaline; gradual smooth boundary.

Cca—52 to 60 inches; light olive brown (2.5Y 5/4) silty clay loam that has few fine faint light olive brown (2.5Y 5/6) mottles, olive brown (2.5Y 4/4) moist; weak fine subangular blocky structure; hard, friable, slightly sticky and plastic; no roots; few fine tubular pores; strongly effervescent; moderately alkaline.

The A horizon is grayish brown, dark grayish brown, very dark grayish brown, gray, or dark gray (10YR 5/2, 4/2, 3/2, 5/1, 4/1). The B2 horizon is dark gray, grayish brown, and light olive brown (10YR 4/1, 5/2; 2.5Y 5/4). It is heavy silty clay loam, silty clay, or clay. The C horizon is light olive brown, olive brown, or olive yellow (2.5Y 5/4, 4/4, 6/6). It is silty clay loam or clay loam. In places, this horizon has thin strata of very fine sand.

Pescadero series

The Pescadero series consists of very deep, poorly drained soils that formed in alluvium that derived from sedimentary rock sources. These soils are on the basin rims. They have slopes of less than 2 percent. The average annual precipitation ranges from 14 to 18 inches. The mean annual temperature is 57 degrees F.

Pescadero soils are similar to Clear Lake and Marvin soils, which do not have a natric horizon.

Typical pedon of Pescadero clay, drained, north of the city of Livermore, 150 feet south of Hartford Avenue and 0.7 mile east of the junction of North Livermore and Hartford Avenues (outside the survey area):

A2—0 to 2 inches; gray (10YR 5/1) clay loam, dark gray (10YR 4/1) moist; weak thin platy structure; hard, friable, sticky and plastic; common very fine roots; few fine tubular pores; slightly acid; clear wavy boundary.

B21t—2 to 12 inches; dark gray (N 4/0) clay, very dark gray (N 3/0) moist; few fine prominent olive (5Y 4/3) mottles; moderate medium prismatic structure; very hard, firm, slightly sticky and plastic; common very fine roots; many very fine tubular pores; few thin clay films on faces of peds; moderately alkaline; gradual wavy boundary.

B22t—12 to 20 inches; dark gray (10YR 4/1) clay, black (10YR 2/1) moist; common fine prominent very dark gray (5Y 3/1) mottles; moderate medium prismatic structure; very hard, firm, slightly sticky and plastic; few very fine roots; many very fine tubular pores; common moderately thick clay films on faces of peds; slightly effervescent; moderately alkaline; gradual wavy boundary.

B23tca—20 to 30 inches; light gray (5Y 7/1) clay, gray (5Y 5/1) moist; moderate medium prismatic structure; hard, firm, sticky and plastic; few very fine and fine roots; many very fine tubular pores; common moderately thick clay films on faces of peds; strongly effervescent; moderately alkaline; gradual wavy boundary.

C1ca—30 to 40 inches; gray (5Y 6/1) clay loam, gray (5Y 5/1) moist; massive; very hard, firm, slightly sticky and plastic; no roots; many very fine tubular pores; violently effervescent, soft masses of lime; moderately alkaline; gradual wavy boundary.

C2ca—40 to 58 inches; light olive gray (5Y 6/2) clay loam, olive gray (5Y 5/2) moist; massive; very hard, firm, slightly sticky and plastic; common very fine tubular pores; violently effervescent, soft masses of lime; moderately alkaline; gradual wavy boundary.

C3ca—58 to 72 inches; light gray (5Y 7/2) clay loam, olive gray (5Y 5/2) moist; massive; hard, firm, slightly sticky and plastic; few very fine tubular pores; violently effervescent, many soft masses of lime; moderately alkaline.

Drainage of the Pescadero soils has been improved by the use of deep drainage ditches and natural stream cutting. The water table is below a depth of 4 feet in most years. In winter, these soils are subject to ponding where surface drainage is not provided.

The A2 horizon is gray, light gray, or light brownish gray (10YR 5/1, 7/1, 6/2) loam or clay loam. It is dominantly slightly acid or moderately alkaline but is strongly alkaline in ponded areas. If present, the A1 horizon is dark gray or dark grayish brown (10YR 4/1, 4/2) clay loam or silty clay loam. The B2t horizon is moderately alkaline or strongly alkaline. Structure is columnar or prismatic. Content of saline and alkali salts increases with depth. In some pedons, gypsum is at a depth of 36 to 48 inches.

Pleasanton series

The Pleasanton series consists of very deep, well drained soils that formed on low terraces in alluvium that derived from sedimentary rock sources. The slopes range from 0 to 5 percent. The average annual precipitation is 16 inches. The mean annual temperature is 57 degrees F.

Pleasanton soils are similar to Rincon soils, which are more than 35 percent clay in the argillic horizon.

Typical pedon of Pleasanton gravelly loam, in the SE1/4NE1/4NE1/4 of sec. 24, T. 3 S., R. 2 E. (outside the survey area):

Ap—0 to 9 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, slightly sticky and slightly plastic; many very fine and common fine and medium roots; common very fine and fine interstitial pores; 20 percent gravel; slightly acid; abrupt smooth boundary.

A12—9 to 21 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, slightly sticky and slightly plastic; many very fine and common fine and medium roots; common very fine and fine interstitial pores; 20 percent gravel; neutral; clear smooth boundary.

B2t—21 to 48 inches; brown (10YR 4/3) gravelly sandy clay loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; very hard, friable, sticky and plastic; common very fine and fine roots; many very fine and fine and few medium tubular pores; common moderately thick clay films on faces of peds and lining pores; 20 percent gravel; neutral; gradual wavy boundary.

B3t—48 to 64 inches; brown (10YR 4/3) gravelly loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; very hard, friable, sticky and plastic; few very fine roots; many very fine and common fine pores; few thick and few thin clay films on faces of peds and lining pores; 20 percent gravel; neutral; gradual wavy boundary.

C—64 to 72 inches; yellowish brown (10YR 5/4) gravelly fine sandy loam, dark yellowish brown (10YR 4/4) moist; massive; hard, friable, sticky and slightly plastic; many very fine, common fine, and few medium pores; few thin clay films in pores; 25 percent gravel; mildly alkaline.

The A horizon is grayish brown, brown, or pale brown (10YR 5/2, 5/3, 6/3). The B2t horizon is dark brown or brown (10YR 4/3, 5/3). Reaction is neutral or mildly alkaline. The C horizon is gravelly silt loam, gravelly loam, or gravelly fine sandy loam. Gravel content ranges from 15 to 35 percent throughout. In some pedons, the C horizon is calcareous.

Reyes series

The Reyes series consists of very deep, very poorly drained soils on tidal flats. These soils formed in alluvium that derived from mixed sources. The average annual precipitation ranges from 14 to 18 inches. The mean annual temperature is 57 degrees F.

Reyes soils are near Laugenour, Pescadero, and Willows soils. Laugenour soils are stratified sandy loam, fine sandy loam, and loam. Pescadero soils have a natric horizon. Willows soils have intersecting slickensides.

Typical pedon of Reyes clay, in the city of Hayward, 500 feet northeast of the end of the flood control road adjacent to the flood control channel, T. 4 S., R. 3 W. (This pedon is covered by water at high tide.)

A1—0 to 6 inches; olive gray (5Y 4/2) clay, dark olive gray (5Y 3/2) moist; massive; hard, friable, sticky and plastic; many fine, medium, and coarse roots; estimated 5 percent fibers; strongly alkaline; clear smooth boundary.

C1—6 to 18 inches; mottled dark greenish gray (5GY 4/1) and black (N 2/0) clay; massive; hard, friable, sticky and plastic; many fine, medium, and coarse roots; strong odor of hydrogen sulfide when treated with hydrochloric acid; strongly alkaline; clear smooth boundary.

C2—18 to 23 inches; mottled dark greenish gray (5GY 4/1) and black (N 2/0, 10YR 2/1) clay; massive; hard, friable, sticky and plastic; many fine roots; strong odor of hydrogen sulfide when treated with hydrochloric acid; strongly alkaline; clear smooth boundary.

C3—23 to 42 inches; mottled dark greenish gray (5GY 4/1) and black (N 2/0) clay; massive; hard, friable, sticky and plastic; no roots; strong odor of hydrogen sulfide when treated with hydrochloric acid; strongly alkaline; gradual smooth boundary.

C4—42 to 72 inches; dark greenish gray (5GY 4/1) silty clay; massive; hard, friable, sticky and plastic; strong odor of hydrogen sulfide when treated with hydrochloric acid; strongly alkaline.

Reyes soils are very poorly drained unless the drainage has been altered. This soil is covered with water at high tides. The A1 horizon is olive gray, dark gray, or dark grayish brown (5Y 5/2, 4/1, 2.5Y 4/2). The upper part of the C horizon has black (N 2/0), reddish brown, and yellowish brown (5YR 5/4, 10YR 5/6) mottles. The C horizon is strongly alkaline except where the water table has been lowered. Some pedons have jarosite in the C horizon, but most sulfides occur as black (N 2/0) mottling that becomes dark gray when exposed to air or when treated with dilute hydrochloric acid.

Rincon series

The Rincon series consists of very deep, well drained soils that formed in alluvium that derived from sedimentary rock sources. These soils are on low terraces. The slopes range from 0 to 2 percent. The average annual precipitation ranges from 14 to 20 inches. The mean annual temperature is 57 degrees F.

Rincon soils are associated with and are similar to Danville, Marvin, and Pleasanton soils. Danville soils have a mollic epipedon. Marvin soils are somewhat poorly drained. Pleasanton soils are less than 35 percent clay in the argillic horizon.

Typical pedon of Rincon clay loam, 150 feet west of Mountain House Road, between Mountain House School and an east-west dirt road in the SE1/4SE1/4SE1/4NW1/4 of sec. 6, T. 2 S., R. 4 E. (outside the survey area):

Ap—0 to 8 inches; grayish brown (10YR 5/2) clay loam, dark brown (10YR 3/3) moist; massive; very hard, friable, sticky and plastic; many fine and few medium and very fine roots; common fine and few very fine and medium tubular pores; neutral; abrupt smooth boundary.

A12—8 to 16 inches; dark grayish brown (10YR 4/2) clay loam, dark brown (10YR 3/3) moist; massive; very hard, friable, sticky and plastic; many fine and very fine roots; common fine and very fine tubular pores; neutral; abrupt smooth boundary.

B21t—16 to 28 inches; dark grayish brown (10YR 4/2) heavy clay loam, dark brown (10YR 3/3) moist; weak coarse blocky structure; very hard, friable, sticky and plastic; many fine and very fine roots; many fine and very fine tubular pores; few thin clay films on faces of peds and lining pores; neutral; gradual wavy boundary.

B22t—28 to 38 inches; brown (10YR 5/3) and grayish brown (10YR 5/2) clay, dark brown (10YR 4/3) and dark grayish brown (10YR 4/2) moist; moderate coarse blocky structure; extremely hard, firm, sticky and very plastic; few fine and many very fine roots; common fine and very fine tubular pores; common thin clay films on faces of peds and lining pores; neutral; gradual wavy boundary.

B3t—38 to 52 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; moderate medium blocky structure; extremely hard, very firm, sticky and very plastic; few fine and very fine roots; common fine and very fine tubular pores; common thin and few moderately thick clay films on faces of peds and lining pores; mildly alkaline; gradual wavy boundary.

very fine and fine exped roots; common very fine and fine tubular pores; many thick clay films on faces of peds; neutral; clear wavy boundary.

B22t—17 to 24 inches; grayish brown (10YR 5/2) clay that has gray (10YR 5/1) stains on peds, dark grayish brown (10YR 4/2) moist; strong coarse prismatic structure; very hard, firm, sticky and very plastic; few very fine and fine exped roots; few very fine and fine tubular pores; many thick clay films on faces of peds; neutral; clear wavy boundary.

B3t—24 to 32 inches; brown (10YR 5/3) clay, dark brown (10YR 3/3) moist; moderate coarse angular blocky structure; very hard, firm, sticky and plastic; very few very fine interstitial and tubular pores; common thin clay films on faces of peds; neutral; clear wavy boundary.

C—32 to 60 inches; variegated yellowish brown (10YR 5/4) and brown (10YR 5/3) sandy clay loam, dark yellowish brown (10YR 4/4) moist; many medium distinct very pale brown (10YR 7/4) mottles; massive; very hard, firm, sticky and plastic; neutral.

The A1 horizon is dark grayish brown, grayish brown, or dark gray (10YR 4/2, 5/2, 4/1). Reaction is medium acid or slightly acid. The A2 horizon is also medium acid or slightly acid. It is sandy loam or loam. The B2t horizon is very dark brown, grayish brown, dark grayish brown, or very dark grayish brown (10YR 2/2, 4/2, 5/2, 3/2). The C horizon is sandy clay loam or clay loam.

Vallecitos series

The Vallecitos series consists of shallow, well drained soils that formed in residuum of metasedimentary rock. The slopes range from 30 to 50 percent. The average annual precipitation ranges from 14 to 18 inches. The mean annual temperature is 57 degrees F.

Vallecitos soils are similar to Contra Costa soils, which have a lithic contact between depths of 20 to 40 inches.

Typical pedon of Vallecitos gravelly loam, in the SW1/4SW1/4 of sec. 9, T. 5 S., R. 4 E. (outside the survey area):

A11—0 to 1 1/2 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; moderate medium granular structure; soft, friable, slightly sticky and plastic; many very fine roots; many very fine pores; 20 percent gravel; neutral; clear smooth boundary.

A12—1 1/2 to 6 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; massive; hard, friable, slightly sticky and plastic; many very fine roots; many very fine pores; 20 percent gravel; neutral; abrupt wavy boundary.

B21t—6 to 12 inches; reddish brown (5YR 4/3) heavy clay loam, dark reddish brown (5YR 3/3) moist; weak medium angular blocky structure; very hard, firm, slightly sticky and very plastic; many very fine roots; many very fine pores; thin continuous clay films lining pores and as bridges; 10 percent gravel; neutral; clear smooth boundary.

B22t—12 to 16 inches; brown (10YR 5/3) heavy clay loam, dark brown (10YR 4/3) moist; massive; very hard, firm, slightly sticky and very plastic; few very fine roots; common very fine pores; thin continuous clay films lining pores; slightly acid; abrupt irregular boundary.

R—16 inches; bluish gray (5B 5/1) fine-grained, metamorphosed sandstone that has calcite seams; clay films along cleavage planes.

The A1 horizon is brown or pale brown (10YR 5/3, 6/3). The B2t horizon is reddish brown or brown (5YR 4/3; 7.5YR 5/4; 10YR 5/3). Some pedons do not have a B2t horizon. Depth to bedrock ranges from 10 to 20 inches.

Willows series

The Willows series consists of very deep, poorly drained soils that formed in mixed alluvium that derived mainly from sedimentary rock sources. These soils are on the upper edge of the basin rim and have slopes ranging from 0 to 2 percent. The average annual precipitation ranges from 14 to 18 inches, and the mean annual temperature is 57 degrees F.

Willows soils are similar to Clear Lake soils and are near Danville and Omni soils. Clear Lake soils do not have excess salts. Danville and Omni soils have a mollic epipedon.

Typical pedon of Willows clay, in the city of Hayward, 200 feet southeast of Corporate Avenue, near the Eden Industrial Park, in the SE1/4SW1/4 of sec. 32, T. 3 S., R. 2 W. (projected):

A11—0 to 9 inches; black (N 2/0) clay, moist and dry; moderate very coarse prismatic structure; very hard, firm, sticky and very plastic; few medium and many very fine roots; common very fine tubular pores; moderately alkaline; clear smooth boundary.

A12—9 to 19 inches; black (5Y 2/1) clay, moist and dry; moderate very coarse prismatic structure that parts to moderate medium angular blocky; very hard, firm, sticky and very plastic; common very fine roots; many very fine tubular pores; many intersecting slickensides; moderately effervescent; moderately alkaline; gradual smooth boundary.

ACcs—19 to 29 inches; dark gray (5Y 4/1) clay, very dark gray (5Y 3/1) moist; many medium distinct dark grayish brown (10YR 4/2) mottles; many medium prominent yellowish brown (10YR 5/4) mottles; moderate very coarse prismatic structure that parts to moderate medium angular blocky; very hard, firm, sticky and plastic; few very fine roots; many very fine tubular pores; many large intersecting slickensides; many seams of gypsum; strongly effervescent; moderately alkaline; clear smooth boundary.

C1ca—29 to 48 inches; grayish brown (2.5Y 5/2) clay; dark grayish brown (2.5Y 4/2) moist; many medium faint grayish brown (10YR 5/2) and many medium prominent yellowish brown (10YR 5/4) mottles; weak coarse angular blocky structure; very hard, firm, sticky and plastic; few very fine roots; common very fine tubular pores; many slickensides; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C2ca—48 to 72 inches; grayish brown (2.5Y 5/2) clay; dark grayish brown (2.5Y 4/2) moist; many fine distinct dark greenish gray (5GY 4/1) mottles; massive; very hard, firm, sticky and plastic; few very fine roots; few very fine tubular pores; many irregularly shaped hard lime concretions about 1/8 to 1/4 inch in diameter; violently effervescent; moderately alkaline.

These soils have cracks that are 1 to 2 inches wide at the surface (unless plowed) and extend to a depth of 30 to 40 inches. The A1 horizon is black (N 2/0) or very dark gray (N 3/0; 5Y 3/1, 2/1). Moist value is 2 or 3. Structure is granular, angular blocky, or prismatic. Reaction ranges from mildly alkaline to strongly alkaline. Secondary calcium carbonate occurs in most places at a depth of 14 to 40 inches. Soft masses of secondary calcium carbonate are common in the lower part of the AC horizon and in the C horizon. The C horizon has mottled colors with a matrix of grayish brown, light olive brown, or yellowish brown (2.5Y 5/2, 5/4; 10YR 5/4).

Yolo series

The Yolo series consists of very deep, well drained soils that formed in alluvium that derived from sedimentary rock sources. These soils are on alluvial fans and flood plains of the larger streams. The slopes are less than 2 percent. The average annual precipitation ranges from 14 to 18 inches. The mean annual temperature is 57 degrees F.

Yolo soils are associated with Sycamore soils, which are poorly drained and have distinct mottling in the B2 horizon.

Typical pedon of Yolo silt loam, in the city of Fremont, 500 feet northwest of Mowry Avenue and 100 feet northeast of Parkside Drive, in the SE1/4NW1/4, sec. 28, T. 4 S., R. 1 W. (projected):

Ap—0 to 8 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, sticky and plastic; many medium, fine, and very fine roots; few very fine and fine tubular pores; neutral; clear smooth boundary.

C1—8 to 18 inches; brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; massive; hard, friable, sticky and plastic; common coarse, fine, and very fine roots; very few very fine and fine tubular pores; mildly alkaline; gradual smooth boundary.

C2—18 to 34 inches; brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; massive; hard, friable, sticky and plastic; common fine and very fine roots; very few tubular pores; moderately alkaline; diffuse smooth boundary.

C3—34 to 60 inches; brown (10YR 5/3) silt loam, dry and moist; massive; hard, friable, sticky and plastic; common fine and very fine roots; many very fine tubular pores; moderately alkaline.

The A horizon is grayish brown or brown (10YR 5/2, 5/3). The C horizon is silt loam or silty clay loam and has thin strata of very fine sandy loam. It is brown, grayish brown, or pale brown (10YR 5/3, 5/2, or 6/3).

Formation of the soils

In this section, the factors that affect the formation of soils in the survey area are discussed and important processes in morphology are described.

Soil is a natural formation on the surface of the earth in which plants grow. It is composed of mineral and organic material. Soils differ in their appearance, composition, productivity, and management requirements in different localities and even within short distances. Five soil-forming factors cause soils to differ. They are parent material, relief, climate, plants and animals, and time. The relative effect of each of these factors varies from one soil to another.

The process of soil formation is quite complex. The influence of each soil-forming factor and the relationships among these factors are more easily described by relating soils within areas of a similar landform or geomorphic unit. In the paragraphs that follow, the landscape and climate are discussed. Then the soil-forming factors are considered in relation to the soils in each geomorphic unit.

Landscape

The survey area is bordered on the west by San Francisco Bay and on the east by ridges of the Coast Range.

The upland area of the Coast Range is hilly to very steep. Folding and faulting have formed a topography made up of nearly parallel, northwest-trending ridges that consist mainly of steeply dipping sedimentary rock. These ridges are at an elevation of about 500 to 2,000 feet. A few major streams in the area dissect the hills at approximately right angles to the ridges. The drainage pattern of most of the smaller streams has been altered by horizontal fault displacement at the foot slopes.

Terraces border the foothills in the northern half of the survey area and extend almost to the tidal areas. The bay plain extends from the foothills or terraces to the tidal flats of the bay. A few small but prominent hills are adjacent to the tidal areas and consist primarily of steep-

FIELD OFFICE OFFICIAL LIST OF HYDRIC SOIL MAP UNITS
FOR
ALAMEDA COUNTY WESTERN PART, CALIFORNIA

Map Units are listed in alpha-numeric order by map unit symbol. The 'HYDRIC CRITERIA' column refers to criteria defined in 'Hydric Soils of the United States' (USDA Miscellaneous Publication No. 1491 June, 1991.) The 'FSA ITEMS' column contains information needed for Food Security Act determinations required by Section 512.11(h)(4) of the National Food Security Act Manual (August 1991).

March 17, 1992

Soil Survey Area No.: CA610
Soil Survey Name: ALAMEDA COUNTY WESTERN PART, CALIFORNIA

Map Symbol	Map Unit Name (C) Component (I) Inclusion	Hyd?	Hydric Criteria	Hydric Landforms	FSA Items	Footnotes
100	ALTAMONT CLAY, 5 TO 15 PERCENT SLOPES					
	(C) ALTAMONT	N				
101	ALTAMONT CLAY, 15 TO 30 PERCENT SLOPES					
	(C) ALTAMONT	N				
102	ALTAMONT CLAY, 30 TO 50 PERCENT SLOPES					
	(C) ALTAMONT	N				
103	AZULE CLAY LOAM, 9 TO 30 PERCENT SLOPES					
	(C) AZULE	N				
104	AZULE CLAY LOAM, 30 TO 50 SLOPES					
	(C) AZULE	N				
105	BAYWOOD VARIANT, SAND					
	(C) BAYWOOD VARIANT	N				
106	BOTELLA LOAM, 0 TO 2 PERCENT SLOPES					
	(C) BOTELLA	N				
	(I) OMNI	Y	2B3	Flood Plain	1,5	1
107	CLEAR LAKE CLAY, 0 TO 2 PERCENT SLOPES, DRAINED					
	(C) CLEAR LAKE	Y	2B3,4	Basin Floor	4,5	1
108	CLEAR LAKE CLAY, 2 TO 9 PERCENT SLOPES, DRAINED					
	(C) CLEAR LAKE	Y	2B3	Basin Rim	1,5	1

Soil Survey Area No.: CA610
Soil Survey Name: ALAMEDA COUNTY WESTERN PART, CALIFORNIA

Map Symbol	Map Unit Name (C) Component (I) Inclusion	Hyd?	Hydric Criteria	Hydric Landforms	FSA Items	Footnotes
125	MARVIN SILT LOAM, SALINE-ALKALI					
	(C) MARVIN	Y	2B3	Fluvial Terrace	1,5	1
126	MAYMEN LOAM, 30 TO 75 PERCENT SLOPES					
	(C) MAYMEN	N				
127	MAYMEN-LOS GATOS COMPLEX, 30 TO 75 PERCENT SLOPES					
	(C) LOS GATOS	N				
	(C) MAYMEN	N				
128	MILLSHOLM SILT LOAM, 30 TO 50 PERCENT SLOPES					
	(C) MILLSHOLM	N				
129	MILLSHOLM SILT LOAM, 50 TO 75 PERCENT SLOPES					
	(C) MILLSHOLM	N				
130	MONTARA-ROCK OUTCROP COMPLEX, 30 TO 75 PERCENT SLOPES					
	(C) MONTARA	N				
	(C) ROCK OUTCROP	N				
131	OMNI SILTY CLAY LOAM, DRAINED					
	(C) OMNI	Y	2B3	Flood Plain	1,5	1
132	OMNI SILTY CLAY LOAM, STRONGLY SALINE					
	(C) OMNI	Y	2B3,4	Flood Plain	4,5	1
133	PESCADERO CLAY, DRAINED					
	(C) PESCADERO	Y	2B3	Basin Rim	1,5	1

Soil Survey Area No.: CA610
Soil Survey Name: ALAMEDA COUNTY WESTERN PART, CALIFORNIA

Map Symbol	Map Unit Name (C) Component (I) Inclusion	Hyd?	Hydric Cri- teria	Hydric Landforms	FSA Items	Foot- notes
134	PESCADERO CLAY, PONDED					
	(C) PESCADERO	Y	2B3,3	Basin Rim	4,5	1
135	PITS, GRAVEL					
	(C) PITS	Y	3	Fluvial Terrace	4	
136	PLEASANTON GRAVELLY LOAM, 0 TO 5 PERCENT SLOPES					
	(C) PLEASANTON	N				
137	REYES CLAY					
	(C) REYES	Y	2B3,3,4	Tidal Flat	4	1
138	REYES CLAY, PONDED					
	(C) REYES	Y	2B3,3,4	Tidal Flat	4	
139	REYES CLAY, DRAINED					
	(C) REYES	Y	2B3,3,4	Tidal Flat	4	1
140	RINCON CLAY LOAM, 0 TO 2 PERCENT SLOPES					
	(C) RINCON	N				
	(I) CLEAR LAKE	Y	2B3	Fluvial Terrace	1,5	1
141	RIVERWASH					
	(C) RIVERWASH	Y	4	Low Floodplain	4	
142	QUARRY					
	(C) QUARRY	Y	3	Hillside	4	
143	SYCAMORE SILT LOAM, DRAINED					
	(C) SYCAMORE	N				
	(I) UNNAMED	Y	2B3	Flood Plain	1,5	
144	SYCAMORE SILT LOAM, CLAY SUBSTRATUM					
	(C) SYCAMORE	N				
	(I) UNNAMED	Y	2BE	Flood Plain	1,5	

Soil Survey Area No.: CA610
Soil Survey Name: ALAMEDA COUNTY WESTERN PART, CALIFORNIA

Map Symbol	Map Unit Name (C) Component (I) Inclusion	Hyd?	Hydric Cri-teria	Hydric Landforms	FSA Items	Foot-notes
153	VALLECITOS-ROCK OUTCROP COMPLEX, 30 TO 50 PERCENT SLOPES					
	(C) ROCK OUTCROP	N				
	(C) VALLECITOS	N				
154	WILLOWS CLAY, DRAINED					
	(C) WILLOWS	N				
	(I) UNNAMED	Y	2&3	Depression	1,5	
155	XERORTHENTS, CLAYEY					
	(C) XERORTHENTS	N				
156	XEROPSAMMENTS, FILL					
	(C) XEROPSAMMENTS	N				
	(I) UNNAMED	Y	3	Depression	4,5	
157	XERORTHENTS-ALTAMONT COMPLEX, 30 TO 50 PERCENT SLOPES					
	(C) ALTAMONT	N				
	(C) XERORTHENTS	N				
158	XERORTHENTS-LOS OSOS COMPLEX, 30 TO 50 PERCENT SLOPES					
	(C) LOS OSOS	N				
	(C) XERORTHENTS	N				
159	XERORTHENTS-MILLSHOL M COMPLEX, 30 TO 50 PERCENT SLOPES					
	(C) MILLSHOLM	N				
	(C) XERORTHENTS	N				
160	XERORTHENTS-MILLSHOL M COMPLEX, 50 TO 75 PERCENT SLOPES					
	(C) MILLSHOLM	N				
	(C) XERORTHENTS	N				