# *APPENDIX C*

## *WATER SUPPLY AND WASTEWATER TREATMENT ANALYSIS*

# WATER AND WASTEWATER FEASIBILITY STUDY

**For**

# YOCHA DEHE WINTUN NATION

# "FEE TO TRUST" CONVERSION

**Assessor's Parcel Numbers:**

**047-020-01, 048-230-01, 060-020-19, 060-020-20, 060-030-16 & 060-030-17**

**JOB No. 2303-15-H-2**

**FEBRUARY 2011**

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# 1.0 Introduction

Laugenour and Meikle has been retained to prepare this Water and Wastewater Feasibility Study for the "Fee-To-Trust" Conversion by the Yocha Dehe Wintun Nation. This Study will be used to support the Environmental Assessment (EA) being prepared by Analytic Environmental Services (AES) for the project. The scope of this Study includes site background and field investigations, an evaluation of facility requirements, and a preliminary assessment of onsite water and wastewater infrastructure facility requirements.

## 1.1 Background

The project is located at County Road 75A and State Highway 16, approximately 1.2 miles north of Brooks, a small, unincorporated community in western Yolo County and 2 miles north of the existing Cache Creek Casino Resort. The project boundary will be contiguous with the existing Community Trust Property at County Road 75A. A Vicinity Map is shown in Figure 1-1.

## 1.2 Project Description

Two alternative designs, along with a no-action alternative, are being considered for this project: Alternative "A" – 853± acre trust acquisition and development of 25 residences for Tribal members, plus three (3) cultural/educational facilities, Tribal school, domestic water storage tank, and a wastewater treatment plant and supporting uses; Alternative "B" – 751± acre trust acquisition and would be the same development as Alternative A; and Alternative "C" – No Federal action as described in the EA.

The EA parcels included in the proposed Fee-to-Trust conversion with corresponding Assessor's Parcel Numbers (APN) and acreage for each parcel are shown in Table 1-1. Each parcels existing and proposed land use is shown in Figure 1-2, Location & Use Map. The projected development of the parcels is shown in Figure 1-3, Projected Use Map.

**Table 1-1 EA Parcels**

| EA Parcel | APN | Area (Acres) | EA Parcel | APN | Area (Acres) | EA Parcel | APN | Area (Acres) |
|---|---|---|---|---|---|---|---|---|
| 1 | 060-030-16 | 55.92 | 6 | 060-020-18 | 17.82 | 11 | 060-010-01 | 4.49 |
| 2 | 060-030-17 | 92.14 | 7 | 060-020-19 | 19.76 | 12 | 060-013-01 | 2.30 |
| 3 | 060-030-01 | 17.69 | 8 | 060-020-20 | 153.70 | 13 | 060-014-01 | 1.55 |
| 4 | 060-030-08 | 26.32 | 9 | 048-230-01 | 316.41 | 14 | 060-020-11 | 10.41 |
| 5 | 060-030-09 | 16.02 | 10 | 047-020-01 | 113.09 | 15 | 060-020-14 | 5.28 |

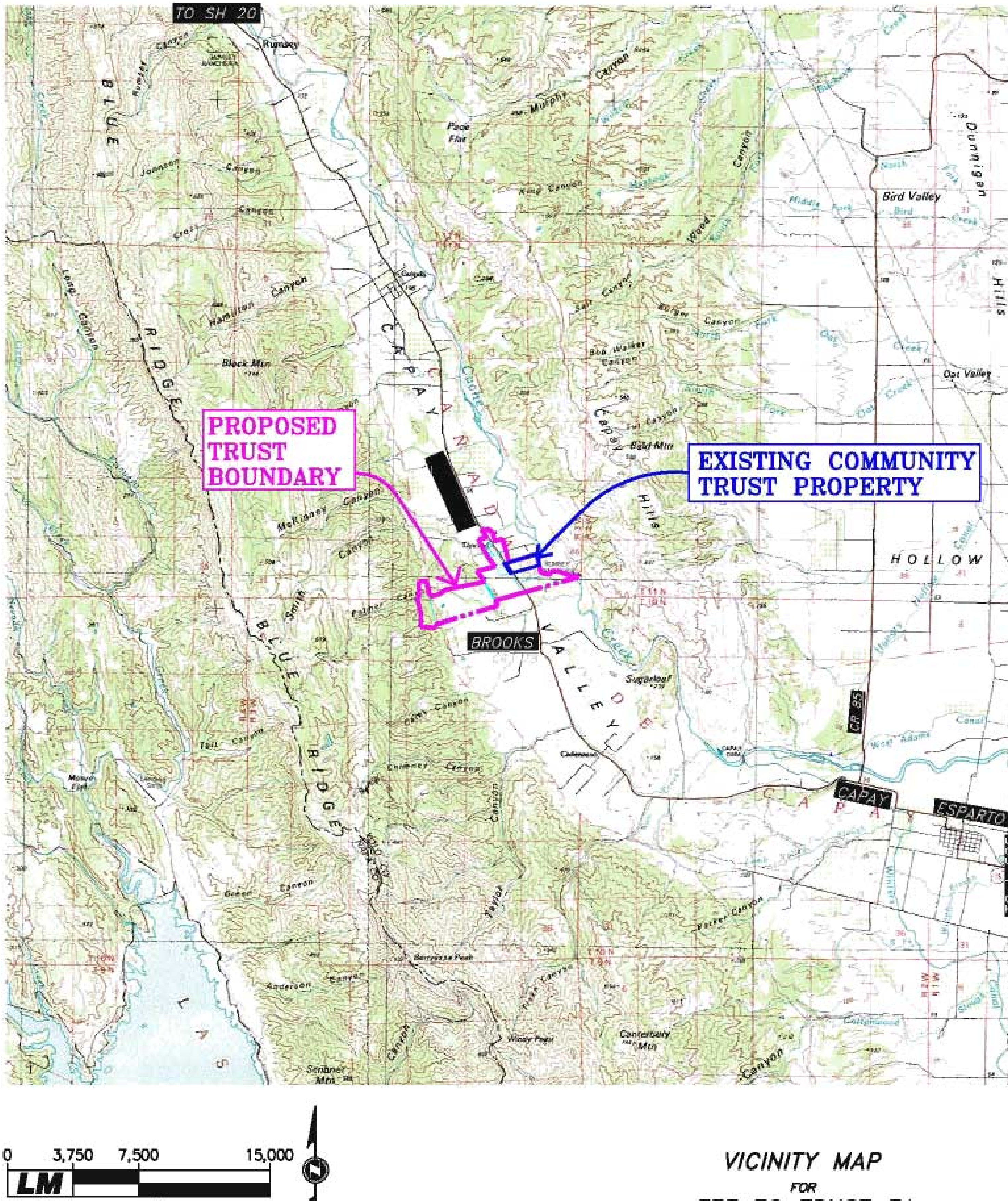
Although all of the parcels listed above are included in the proposed Fee-to-Trust conversion, this study only evaluates Parcels 1, 2, 7, 8, 9, and 10 since they are the only parcels currently identified as sites for potential water and wastewater infrastructure improvements. In Parcel 8, improvements to existing County Road 76 and wastewater treatment facilities are proposed. The remaining EA parcels (Parcels 3-6 and 11-15) will continue to be used as agricultural land with no new improvements currently under consideration.

## 1.3 Objectives

The goal of this Study is to identify and evaluate the water supply and wastewater infrastructure service requirements for the identified parcels on a preliminary design level. Specific objectives of this Study are to:

- Estimate water and wastewater flows for the project; and
- Evaluate facility requirements for acquiring water and wastewater service.

The proposed improvements and their impacts will be the same regardless of which project alternative is selected. Therefore, the findings of this Report are appropriate for Alternative "A" and Alternative "B".




VICINITY MAP
FOR
FEE TO TRUST EA
YOCHA DEHE WINTUN NATION

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FIGURE 1-1

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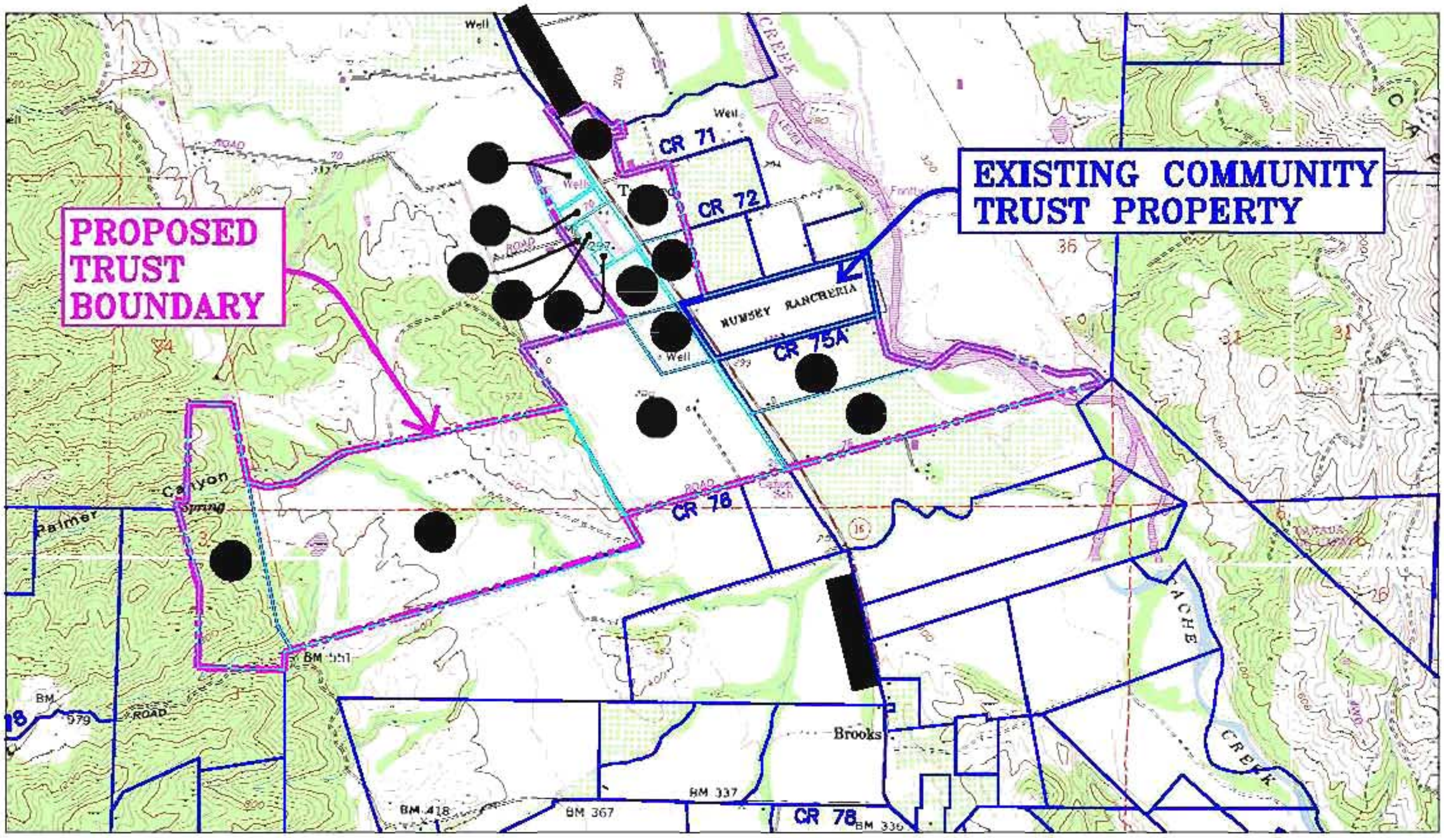
X:\Land Projects\2303-15-H-2\dwg\2303-15-H-2_Fig_1-1_G&W_Vicinity Map




| EIS PARCEL IDENTIFICATION | ASSESSOR PARCEL NUMBER | ACREAGE | EXISTING USE | PROPOSED USE |
|---|---|---|---|---|
| 1 | 060-030-016 | 55.92 | CULTURAL EDUCATION FACILITIES & AGRICULTURE | 84,600 SF OF SUPPORT FACILITIES AND AGRICULTURE |
| 2 | 060-030-017 | 92.14 | AGRICULTURE | CULTURAL RESOURCE CENTER AND AGRICULTURE |
| 3 | 060-030-001 | 17.69 | AGRICULTURE | AGRICULTURE |
| 4 | 060-030-008 | 26.32 | AGRICULTURE | AGRICULTURE |
| 5 | 060-030-009 | 16.02 | AGRICULTURE | AGRICULTURE |
| 6 | 060-020-018 | 17.82 | AGRICULTURE | AGRICULTURE |
| 7 | 060-020-019 | 19.76 | AGRICULTURE | AGRICULTURE |
| 8 | 060-020-020 | 153.70 | AGRICULTURE | AGRICULTURE WITH RANCH HOUSE |
| 9 | 048-230-001 | 316.41 | AGRICULTURE | 23 HOMES, SUPPORT INFRASTRUCTURE & AGRICULTURE |
| 10 | 047-020-001 | 113.09 | NONE | 2 HOMES, SUPPORT INFRASTRUCTURE |
| 11 | 060-010-001 | 4.49 | AGRICULTURE | AGRICULTURE |
| 12 | 060-013-001 | 2.30 | AGRICULTURE | AGRICULTURE |
| 13 | 060-014-001 | 1.55 | AGRICULTURE | AGRICULTURE |
| 14 | 060-020-011 | 10.41 | AGRICULTURE | AGRICULTURE |
| 15 | 060-020-014 | 5.28 | AGRICULTURE | AGRICULTURE |

0 1500 3000 6000

SCALE: 1"=3000'

*LEGEND*

● *EA PARCEL (TYP.)*

## *LOCATION & USE MAP*
*FOR*
## *FEE TO TRUST EA*
## *YOCHA DEHE WINTUN NATION*

**FIGURE 1–2**

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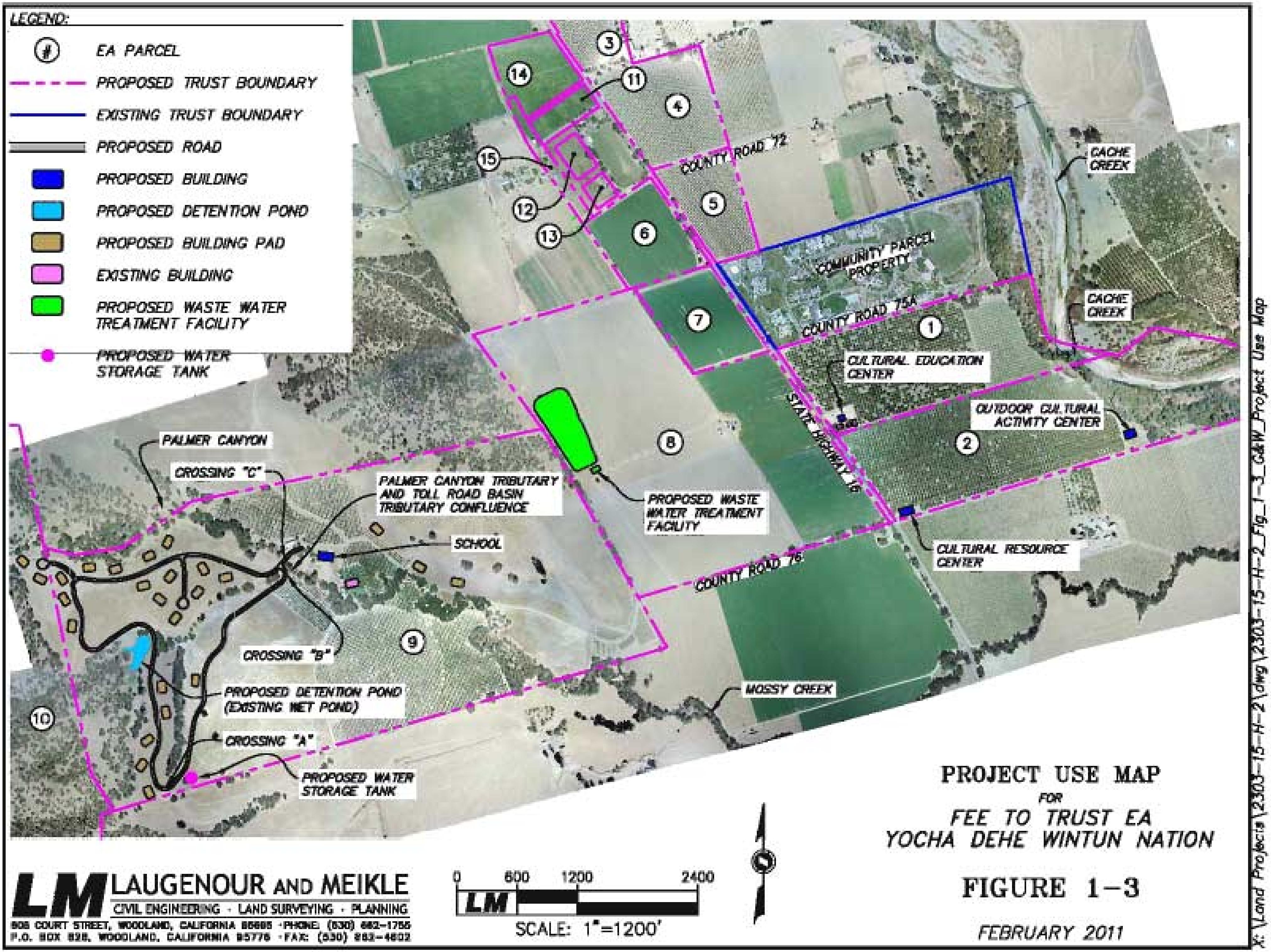
X:\Land Projects\2303-15-H-2\dwg\2303-15-H-2_Fig_1-2_G&W_Location Map



LEGEND:
EA PARCEL
PROPOSED TRUST BOUNDARY
EXISTING TRUST BOUNDARY
PROPOSED ROAD
PROPOSED BUILDING
PROPOSED DETENTION POND
PROPOSED BUILDING PAD
EXISTING BUILDING
PROPOSED WASTE WATER TREATMENT FACILITY
PROPOSED WATER STORAGE TANK
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
COUNTY ROAD 72
COUNTY ROAD 75A
COUNTY ROAD 75
STATE HIGHWAY 16
COMMUNITY PARCEL PROPERTY
CACHE CREEK
CACHE CREEK
CULTURAL EDUCATION CENTER
OUTDOOR CULTURAL ACTIVITY CENTER
CULTURAL RESOURCE CENTER
PROPOSED WASTE WATER TREATMENT FACILITY
PALMER CANYON
CROSSING "C"
PALMER CANYON TRIBUTARY AND TOLL ROAD BASIN TRIBUTARY CONFLUENCE
SCHOOL
CROSSING "B"
PROPOSED DETENTION POND (EXISTING WET POND)
CROSSING "A"
PROPOSED WATER STORAGE TANK
MOSSY CREEK
PROJECT USE MAP
FOR
FEE TO TRUST EA
YOCHA DEHE WINTUN NATION
FIGURE 1-3
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0 600 1200 2400
SCALE: 1"=1200'
X:\Land Projects\2303-15-H-2\dwg\2303-15-H-2_Fig_1-3_G&W_Project Use Map

# 2.0 Projected Flows

## 2.1 Introduction

This section outlines the design criteria and general assumptions for estimating the water demands and wastewater production anticipated for the Project. The analysis begins with estimates on water usage which are based on actual meter readings that are available from the existing Community Trust Property. Separate domestic and irrigation metered systems are setup on the property. The meter readings were recorded and the data was used to back-calculate the corresponding wastewater flows.

## 2.2 Water Demands

### 2.2.1 Methodology:

The proposed water uses parallel current water uses experienced at the Community Trust Property (Rancheria). The water supplied will be used for drinking, cooking, cleaning, dishwashing, bathing, restrooms, laundry, pools, water features, fire protection, and landscaping. Domestic and irrigation meter readings were recorded for the existing Community facilities during portions of 2008 and 2009. A "Summary of Existing Water Usage" is included in Appendix A.

The existing Community Trust Property consists of 28 homes, an office/community center, and other facility buildings. Approximately half of the homes on the existing Community Trust Property have full-time residents. Each home resides approximately three (3) persons. The existing office and community center employs approximately 28 people during normal business hours. Therefore, on weekdays, the estimated number of people being served is approximately (28 employees) + (3 residents x 14 homes) = 70± persons per day. On weekends, (3 residents x 14 homes) + (1 resident x 8 homes) = 50± persons per day.

In reference to the "Summary of Existing Water Usage" Table in Appendix A, the domestic water usage on an average business day in 2008 was 11,000± gallons per day. Therefore, the average water demand for domestic water use is approximately 11,000 gpd/70 persons = 160± gpd per person.

### 2.2.2 Proposed Potable Water Demands:

For the proposed domestic use, it is assumed an average of three (3) residents occupy each proposed home on Parcels 9 and 10. The Tribe is anticipating 20 new employees for business operations in the proposed and existing Community and Governmental facility buildings. It is estimated that no more than five (5) employees would occupy one parcel on Parcels 1 and 2. An estimated 15 new employees would occupy the existing Community Trust Parcel and the Tribal School on Parcel 9, but due to uncertainties of actual employment and employee locations, contingencies have been included in projected water demands. Based on these occupancies and the calculated demand of 160 gpd per person (see Section 2.2.1), the projected domestic water demands on Parcels 1, 2, 9, and 10 are tabulated in Table 2-1.

### 2.2.3 Irrigation Demands:

The existing water usage for developed landscape irrigation on an average day in 2009 was 275,000± gpd. The existing developed landscaped area is approximately 40 acres on the existing Rancheria community. Therefore, average water demand for developed site landscaping is approximately 275,000 gpd/40 acres= 7,000± gpd per acre. Agricultural irrigation demand varies greatly depending on soils and crop types. The existing crop selection and/or rotation include: alfalfa, walnuts, almonds, olives and grapes. Among the crop selection, alfalfa crops demand the highest annual average of 51.4 inches of water (Appendix C, Agricultural Use Demand). This depth is equivalent to 3,800 gpd/acre of agricultural land. This average demand would be considered as the design agricultural water demand in this Study.

For the proposed agriculture use, the acreage of land to be irrigated is approximated on Table 2-1. The projected agricultural water demands for each parcel are tabulated in Table 2-1, Average Day Water Demands.

## Table 2-1 Average Day Water Demands

| EA PARCEL | GROSS ACREAGE | PROPOSED HOME UNITS | PROPOSED BUILDING (SF) | OCCUPANTS | AVERAGE DAY DEMAND, GPD | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | POTABLE | LANDSCAPE | | AG IRRIGATION | | |
| | | | | | ALT. A & B (GPD) | DEVELOPED LANDSCAPE AREAS (ACREAGE) | DEVELOPED LANDSCAPE (GPD) | APPROXIMATE AGRICULTURAL ACREAGE | ALT. A (GPD) | ALT. B (GPD) |
| 1 | 55.92 | | 3,800 | 5 | 100[1] | 0.3 | 2,100[4] | 27 | 102,600[5] | 102,600 |
| 2 | 92.14 | | 19,000 | 5 | 100 | 0.16 | 1,120 | 52 | 197,600 | 197,600 |
| 3 | 17.69 | | | | | | | 13 | 49,400 | |
| 4 | 26.32 | | | | | | | 21 | 79,800 | |
| 5 | 16.02 | | | | | | | 14 | 53,200 | |
| 6 | 17.82 | | | | | | | 15 | 57,000 | |
| 7 | 19.76 | | | | | | | 15 | 57,000 | 57,000 |
| 8 | 153.70 | | | | | | | 136 | 516,800 | 516,800 |
| 9 | 316.41 | 23 | 20,000 (EST.) | 125[2] | 20,000[3] | 4 | 28,000 | 112 | 425,600 | 425,600 |
| 10 | 113.09 | 2 | | | | | | 0 | 0 | 0 |
| 11 | 4.49 | | | | | | | 4 | 15,200 | |
| 12 | 2.30 | | | | | | | 2 | 7,600 | |
| 13 | 1.55 | | | | | | | 1 | 3,800 | |
| 14 | 10.41 | | | | | | | 10 | 38,000 | |
| 15 | 5.28 | | | | | | | 3 | 11,400 | |
| **TOTALS** | **852.90** | **25** | **42,800** | **135** | **20,200** | **4.46** | **31,220** | **425** | **1,615,000** | **1,299,600** |

1 5 OCCUPANTS X 20 GPD PER PERSON (CPC).

2 RESIDENT (25 HOMES X 3 PERSONS PER HOME = 75) + SCHOOL (EMPLOYEES, STUDENTS, AND CONTINGENCIES = 50 PERSONS).

2 125 PERSONS X 160 GPD/PERSON.

3 4 ACRES x 7,000 GPD PER ACRE = DEVELOPED LANDSCAPE (GPD).

4 3,800 GPD PER ACRE ASSUMING ALFALFA AS THE HIGHEST DEMAND CROP USING 51.44 ANNUAL INCHES OF WATER NEEDED PER "TYPICAL YEAR SURFACE IRRIGATION" FOUND IN APPENDIX C.

Design potable water demands for EA Parcels 1 and 2 and EA Parcels 9 and 10 are shown in Table 2-2.

**Table 2-2 Design Potable Water Demands for Parcels 1, 2, 9, and 10**

| EA PARCEL | AVERAGE DAY POTABLE WATER DEMAND[1] | | RECOMMENDED DAILY POTABLE SUPPLY[3] | | MAXIMUM DAY DEMAND[4] | | PEAK HOUR DEMAND[5] | |
|---|---|---|---|---|---|---|---|---|
| | gpd | gpm | gpd | gpm | gpd | gpm | gpd | gpm |
| 1 | 100 | 1[2] | 150 | 2 | 200 | 2 | 340 | 4 |
| 2 | 100 | 1 | 150 | 2 | 200 | 2 | 340 | 4 |
| 9 & 10 | 20,000 | 14 | 30,000 | 21 | 40,000 | 28 | 68,000 | 48 |
| **TOTALS** | **20,200** | **16** | **30,300** | **25** | **40,400** | **32** | **68,680** | **56** |

1. PER TABLE 2-1.
2. USE MINIMUM AVERAGE DAY OF 1 GPM.
3. 1.5 TIMES THE AVERAGE DAY DEMAND TO ALLOW FOR LOSSES, PUMPS TO REST, AND WELLS TO RECHARGE.
4. MAXIMUM DAY DEMAND PEAKING FACTOR OF 2.0 APPLIED.
5. PEAK HOUR PEAKING FACTOR OF 3.4 APPLIED.

Design water demands for Alternatives "A" and "B" are shown in Table 2-3. Table 2-3 is a summary of the "Totals" presented in Table 2-2 with the addition of irrigation demands for Alternative A and Alternative B.

**Table 2-3 Design Water Demands for Alternatives "A" and "B"**

| ALT. | AVERAGE DAY DEMAND[1] | | MAXIMUM DAY DEMAND | | PEAK HOUR DEMAND | | DEVELOPED[1] LANDSCAPE | | AGRICULTURAL[1] IRRIGATION | |
|---|---|---|---|---|---|---|---|---|---|---|
| | gpd | gpm | gpd | gpm | gpd | gpm | gpd | gpm | gpd | gpm |
| A | 20,200 | 16 | 40,400 | 32 | 68,680 | 56 | 31,220 | 22 | 1,615,000 | 1,122 |
| B | 20,200 | 16 | 40,400 | 32 | 68,680 | 56 | 31,220 | 22 | 1,299,600 | 903 |

1 PER TABLE 2-1.

# 2.3 Wastewater Flows

## 2.3.1 Methodology:

The wastewater flows are estimated to be 95% of the domestic water demands in Section 2.1. This assumes 5% of the water is lost in the system due to consumption, evaporation, and leakage which is typical for most municipal wastewater systems.

From Section 2.1, the average water demand for domestic water use is about 160 gpd per person. Assuming 5% loss, the average wastewater demand is about 160 gpd x 95% = 152 gpd per person. Using the Yolo County Improvement Standards dated August 5, 2008, the average daily wastewater flows can be determined using the following formula:

$$Q_d = (Q_a \times PF) + I$$

where:
$Q_d$ = Design Flow
$Q_a$ = Minimum Average Daily Flow
PF = Peaking Factor
I = Infiltration / Inflow Allowance

Using this formula, the average daily wastewater flows for Parcels 1, 9, and the Community Trust Parcel are calculated in Table 2-4:

### Table 2-4 Design Wastewater Flows

| EA PARCEL | GROSS ACREAGE | PROPOSED HOME UNITS | PROPOSED NON-RESIDENTIAL BUILDINGS (SF) | AVERAGE OCCUPANCY | AVERAGE DAILY FLOW (GPD)[1] | PEAKING FACTOR | AVERAGE DAILY DRY WEATHER WASTEWATER PEAK FLOW (GPD) | AVERAGE DAILY WET WEATHER WASTEWATER PEAK FLOW (GPD)[2] |
|---|---|---|---|---|---|---|---|---|
| 1 | 55.92 | -- | 3,800 | 5 | 760[1] | 3 | 2,280 | 12,000 |
| 2 | 92.14 | -- | 19,000 | 5 | 760 | 3 | 2,280 | |
| 9 &10 | 429.50 | 25 | 20,000 | 125 | 19,000 | 3 | 57,000 | 68,400 |
| Existing Community Parcel Property | 64.3 | ----3 | | 84 | 10,080 | 3 | 30,240 | 12,000 |
| | | | ----4 | 28 | 3,360 | 4 | 13,440 | |

1 AVERAGE DAILY FLOW = 5 OCCUPANTS X 152 GPD PER PERSON.

2 4,000 GALLONS PER INCH DIAMETER MILE PER DAY (6” PIPES, PRELIMINARY ESTIMATE).

3 28 EXISTING HOMES (3 RESIDENTS PER HOME).

4 28 EMPLOYEES ON EXISTING COMMUNITY PARCEL.

## 2.3.2 Existing Community Parcel Property Wastewater Flows:

Although septic systems exist for the Community Parcel Property wastewater flows generated from the existing Community Parcel Property will be considered in the design capacity of the proposed wastewater treatment plant. Assuming full-use of the existing Community Parcel Property, per Section 2.1 “Water Demands”, there will be 112 occupants on a normal business day (28 homes x 3 residents/house + 28 employees).

### 2.3.3 Infiltration/Inflow Considerations:

Infiltration/inflow (I/I) was considered in the design peak flows for the sewer system. Per the Yolo County Improvement Standards, I/I allowance shall be 600 gallons per gross acre per day. This standard appears inappropriate for the nature of this development due to the steep gradients of the area and the use of lift stations for the parcels. An I/I approach based on pipe size has been selected to quantify I/I. An I/I rate of 4,000 gallons per inch diameter per mile of pipe length per day was established from the City of West Sacramento Standard Specifications 2002. Preliminary pipe lengths of 2.85 miles of 6-inch sewer piping from Parcel 9 to the WWTP, and 0.5 miles of 6-inch sewer piping from Parcel 1 to the WWTP and the existing Community Parcel Property to the WWTP have been determined to estimate I/I. These will be refined during the design phase of the project.

## 2.4 Recycled Water

A recycled water system will be implemented to supplement the supply of irrigation water to all of Alternative "A", all of Alternative "B", Parcel 1 and Parcel 2 only, or Parcel 9 and Parcel 10 only. Referring to Table 2-4, the average daily dry weather wastewater flow from Parcel 1, Parcel 2, Parcel 9, Parcel 10, and the existing Community Parcel is 105,240 gpd (2,280 + 2,280 + 57,000 + 30,240 + 13,440). Considering the average day irrigation water demands calculated in Table 2-1, the approximate potential for use of irrigation water provided by recycled water is tabulated in Table 2-5. A monthly hydrological balance will be presented in Section 4.3. The hydrologic balance will present supplemental irrigation demand by recycled water.

**Table 2-5 Recycled Water Potential**

| | AVERAGE DAILY DRY WEATHER WASTEWATER FLOW (gpd) | DEVELOPED LANDSCAPE IRRIGATION[1] (gpd) | AGRICULTURAL IRRIGATION[1] (gpd) | RECYCLED WATER POTENTIAL FROM WW |
|---|---|---|---|---|
| ALTERNATIVE "A" | 105,240 | 31,220 | 1,615,000 | 6.4% |
| ALTERNATIVE "B" | 105,240 | 31,220 | 1,299,600 | 7.9% |
| PARCEL 1 & 2 | 105,240 | 140,000 | 3,220 | 73.5% |
| PARCEL 9 & 10 | 105,240 | 28,000 | 28,000 | 100% |

[1] PER TABLE 2-1.

Recycled water system requirements are discussed in Section 3.3.3.

# 3.0 Water Supply

## 3.1 Introduction

This section describes components necessary to provide water supply services for the two project alternatives.

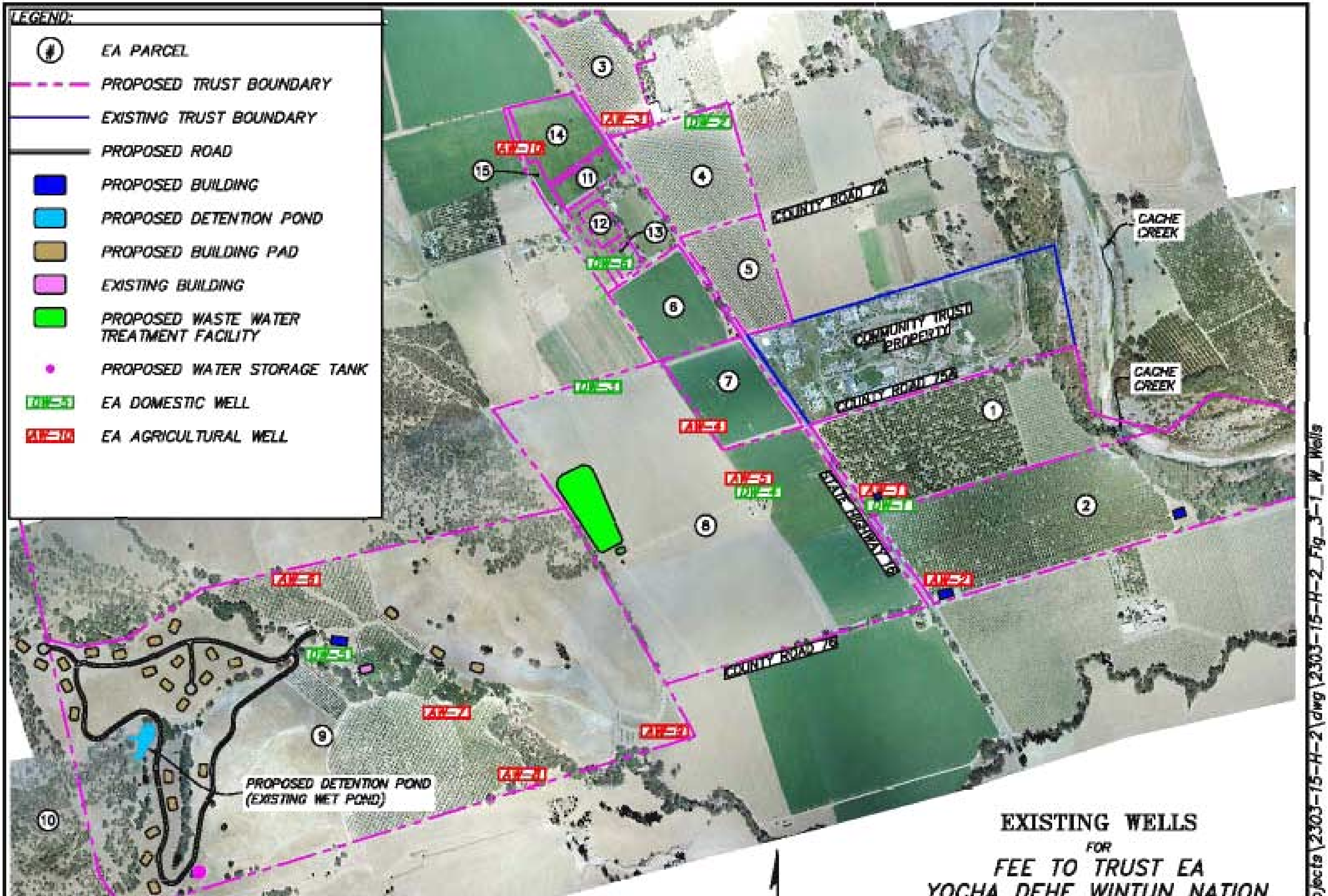
## 3.2 Existing Sources and Facilities

The Fee-to-Trust parcels have domestic wells that serve the existing ranches and facilities, along with irrigation wells that service the existing agricultural needs of the parcels as shown on Figure 3-1. In general, the aquifers are more plentiful closer to Cache Creek to the east. Therefore, the existing groundwater supply in Parcel 9 and Parcel 10 is more problematic than for the parcels to the east.

Table 3-1 identifies which parcels possess existing domestic wells. These facilities are not metered, so the actual yields of the domestic wells are unknown. Typical domestic wells range from 5 gpm to 15 gpm and is assumed that the existing wells fall into this range. Supply capacities of existing wells should be evaluated prior to suggesting its use in the proposed developments. It is assumed that the existing domestic wells are only adequate for their current uses.

**Table 3-1 Existing Domestic Wells**

| EA PARCEL | PATWINNAME | FORMER PROPERTY NAME | DOMESTIC WELL NO. | EXISTING FACILITY |
|---|---|---|---|---|
| 1 | CHALOM | DAVIS | DW-1 | CULTURAL EDUCATION CENTER |
| 2 | CHALOM | DAVIS | - | - |
| 3 | SEKARROBEH LEYO | YATES | - | - |
| 4 | SEKARROBEH LEYO | YATES | DW-2 | RANCH |
| 5 | SEKARROBEH LEYO | YATES | - | - |
| 6 | KISI | YATES | - | - |
| 7 | KISI | YATES | - | - |
| 8 | KISI | FARNHAM | DW-3 | RANCH |
| 9 | KISI | BURNETT | DW-4 | RANCH |
| 10 | KISI | BURNETT | - | - |
| 11 | KISI | VIEU | - | - |
| 12 | KISI | VIEU | - | - |
| 13 | KISI | VIEU | DW-5 | RANCH |
| 14 | KISI | VIEU | - | - |
| 15 | KISI | VIEU | - | - |

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EXISTING WELLS
FOR
FEE TO TRUST EA
YOCHA DEHE WINTUN NATION

FIGURE 3-1

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### 3.2.1 Existing Groundwater Quality:

The Maintenance and Operations Department of the existing community has confirmed that the water supply from these existing domestic wells are only softened by water softening units at the buildings. Water treatment systems (filtration, chlorination, activated carbon, etc.) are recommended for the proposed buildings.

Table 3-2 identifies the existing agricultural wells on the Fee-to-Trust properties. The pumps in Parcels 7 and 8 are interconnected with pipes so that water can be diverted to either property as needed. In Parcel 9, although four wells exist on the property, none of them are used since the yield is not considered dependable for agricultural usage. Instead, water is pumped from the wells in Parcels 7 and 8.

**Table 3-2 Existing Agricultural Wells**

| EA PARCEL | PATWINNAME | FORMER PROPERTY NAME | PARCEL ACREAGE | APPROX. AGRICULTURAL IRRIGATION ACREAGE | AG WELL NO. | WELL CAPACITY (gpm) | WELL USE (gpm) | APPROX. DEMAND (gpm) |
|---|---|---|---|---|---|---|---|---|
| 1 | CHALOM | DAVIS | 56.49 | 27 | AW-1 | 450 | 450 | |
| | | **TOTAL:** | **56.49** | **27** | | | **450** | **71**[1] |
| 2 | CHALOM | DAVIS | 100.89 | 52 | AW-2 | 500 | 500 | |
| | | **TOTAL:** | **100.89** | **52** | | | **500** | **138** |
| 3 | SEKARROBEH LEYO | YATES | 17.04 | 13 | AW-3 | 300 | 250 | |
| 4 | | YATES | 23.61 | 21 | - | - | - | |
| 5 | | YATES | 14.34 | 14 | - | - | - | |
| | | **TOTAL:** | **54.99** | **48** | | | **250** | **127** |
| 6 | KISI | YATES | 17.97 | 15 | - | - | - | |
| 7 | | YATES | 18.95 | 15 | AW-4 | 750 | 750 | |
| 8 | | FARNHAM | 150.12 | 136 | AW-5 | 750 | 350 | |
| 9 | | BURNETT | 328.03 | 112 | AW-6 | 40 | 0 | |
| | | | | | AW-7 | 100 | 0 | |
| | | | | | AW-8 | 80 | 0 | |
| | | | | | AW-9 | Unknown | 5 | |
| 10 | | BURNETT | 114.37 | 0 | - | - | - | |
| | | **TOTAL:** | **629.44** | **278** | | | **1,105** | **734** |
| 11 | KISI | VIEU | 4.81 | 4 | - | - | - | |
| 12 | | VIEU | 2.3 | 2 | - | - | - | |
| 13 | | VIEU | 1.55 | 1 | - | - | - | |
| 14 | | VIEU | 9.95 | 10 | - | - | - | |
| 15 | | VIEU | 4.72 | 3 | AW-10 | 400 | 400 | |
| | | **TOTAL:** | **23.33** | **20** | | | **400** | **53** |

1. SAMPLE IRRIGATION WATER DEMAND CALCULATION USING AN AVERAGE WATER DEMAND OF 3,800 GPD PER ACRE:
27 ACRES x 3,800 gpd/1,440 min./day = 71 GPM

Using an average water demand for agriculture of 3,800 gpd per acre, Table 3-2 indicates that the irrigation systems for Parcels 1, 2 (Chalom), Parcels 3-5 (Sekarrobeh Leyo), and 11-15 (Kisi) are more than adequate to meet demand. However, the system for Parcels 6-10 (Kisi) may be near or at capacity. The Maintenance and Operations Department of the existing trust lands has confirmed that groundwater used for irrigation is not treated. Likewise, no treatment of groundwater for future irrigation use is proposed.

# 3.3 Proposed Sources and Facilities

## 3.3.1 Groundwater Quality Requirements:

Groundwater is anticipated to be the primary source of potable water for the project. Potable water requires compliance with federal EPA water requirements. These requirements are more stringent when compared to irrigation water requirements. Water treatment will be required to meet the EPA water requirements. A combination of the continued use of groundwater along with the addition of treated recycled water is anticipated to be the source of irrigation water for the project.

## 3.3.2 Preliminary Groundwater Well Design Flows:

The groundwater pump draw rate would normally range between 5 gpm to 15 gpm supply. As discussed in the footer of Table 2-2, the recommended potable water supply accounts for water supply losses from treatment for Total Dissolved Solids (TDS), water softening process, continual water supply to protect excessive pump wear and tear, and well recharge. A 1.5 factor is therefore applied to account for these losses and the recommended average potable water flow requirement is 12 gpm for Parcels 1 and 2 and 72 gpm for Parcels 9 and 10.

In Parcel 1, the capacity of the existing domestic well that serves the existing Cultural Education Center is not known, and is assumed to only have adequate capacity for its current use. Therefore, a new domestic well or connection to the existing water facilities in the Community Trust Property will likely be required to serve the developments in Parcel 1 and Parcel 2.

In Parcel 9, the capacity of the existing domestic well that serves the existing Ranch house is also not known, and is assumed to only have adequate capacity for its current use. Therefore, a new domestic well will likely be required to serve the proposed homes and the Tribal School in Parcel 9 and Parcel 10.

There appears to be ample capacity to provide domestic landscape irrigation for the proposed development in Parcel 1 and Parcel 2. In Parcel 9, since individual single-family homes are proposed, and providing recycled water to this remote location may be cost prohibitive, it is likely that irrigation will come from the proposed domestic water supply.

## 3.3.3 Recycled Water:

A recycled water system can be implemented to supplement the supply of irrigation water for landscaping and/or agricultural use. Recycled water refers to wastewater that has been treated sufficiently to meet the California Department of Health Services' (DHS) comprehensive recycled water regulations that define treatment processes, water quality criteria, and treatment reliability requirements for public use of recycled water. These regulations are contained in Title 22, Division 4, Chapter 3, of the California Administrative

Code, more commonly referred to as Title 22. Approved by the State in December 2000, Title 22 prescribes recycled water criteria and divides them into several categories based upon the extent of public access or risk of exposure. In general, Title 22 regulations are more stringent for uses with high potential for public contact and less stringent for uses with low potential for public contact.

For this project, an opportunity to implement a recycled water system will be as part of a regional wastewater treatment plant (WWTP) on Parcel 8. The WWTP is discussed in Section 4.3. Such a system will require recycled water to be pumped from the WWTP to a reservoir. The reservoir will be piped to the adjacent parcel(s) where it will interface with their irrigation system. The cost-versus-benefit associated with implementing and maintaining a recycled water system would be evaluated during design development.

### 3.3.4 Surface Water:

The proximity of the project to Cache Creek may provide opportunities to tap in to the available creek water supply to supplement the supply of irrigation water. The Tribe has existing water service agreements with the Yolo County Flood Control and Water Conservation District in the vicinity of Cache Creek Casino that allows surface flows to be diverted from Cache Creek for agricultural and non-agricultural (i.e. irrigation of golf course) uses. This water use is metered by the District, and a fee is subsequently paid by the Tribe. These agreements can be amended to allow additional diversion adjacent to the Fee-to-Trust properties subject to approval by the District.

The waters of Cache Creek are naturally high in Boron which can be toxic to sensitive crops. Also, Cache Creek is impaired by Mercury that originates largely from abandoned mines in the upper watershed. If this water diversion option is pursued, the existing water quality should be evaluated during design development to determine if additional treatment is required.

Surface water can be diverted from Cache Creek, filtered and pumped to storage tanks, holding ponds, or be used directly to supplement the irrigation water supply. Such a system will alleviate the demands on the groundwater aquifer, and will serve the purpose of recharging the groundwater supply by reducing the irrigation pumping. The feasibility and costs associated with water rights and a diversion system should be evaluated during design development.

### 3.3.5 Water Treatment:

Use of groundwater for potable water supply will require a chlorination system at a minimum, but will also likely require additional treatment including filtration. Additional water quality sampling is required to determine exact groundwater treatment requirements and compliance with drinking water regulations. Filtration is a process that will produce a waste stream which must be handled and discharged into the wastewater treatment system.

To address issues with total dissolved solids (TDS) and water hardness, an electrodialysis reversal (EDR) treatment system is recommended. EDR is a membrane process that is capable of filtering out TDS and hardness from water using electrical currents without the addition of sodium chloride or increasing salinity. This process operates at a low pressure, and is more efficient than reverse osmosis (RO) systems for removing moderate levels of hardness and TDS. Use of the EDR system would reduce the salt issue related to wastewater treatment and help in the reclaimed water used for irrigation water.

Since existing irrigation water is not treated, no treatment is recommended for any proposed irrigation.

### 3.3.6 Water Storage Tank and Pump Station:

Water storage tanks are required to provide reserve water supply for domestic use, fire suppression, and emergency needs. Domestic storage relates to the amount of water necessary to meet peak demands and is intended to make up the difference (if any) between the peak demands and the available supply. Fire storage is the amount of stored water required to provide a specified fire flow rate for a specified duration. Emergency storage is the volume of water needed to meet demand during emergency situations and is typically based on an assessment of risk and the degree of system dependability.

The amount of storage required for Parcels 1, 2, 9, and 10 is based on: (1) fire flow reserve; (2) average daily demand; and (3) daily peak hour demand. Referring to the California Fire Code, the fire flow requirements for 2-hour duration are as follows:

Cultural/Educational Facilities (Type IIIA Construction: 0 SF - 17,000 SF) = 1,750 gpm = 210,000 gal.

One- and Two- family Dwellings (3,600 SF – 5,200 SF) = 1,500 gpm = 180,000 gal.

Tribal School (Type IV Construction: 17,401 SF-21,300 SF) = 2,500 gpm = 300,000 gal.

There are reductions allowed for in the Fire Code if sprinkler systems are used in buildings. Those reductions are not considered here, therefore, the recommended water storage requirements are as follows:

**Table 3-3 Potable Water Storage Requirements for Parcels 1, 2, 9, and 10**

| PARCEL | FIRE STORAGE (gal) | AVERAGE DAILY DEMAND (gal) | DAILY PEAK DEMAND (gal) | MINIMUM STORAGE REQUIRED (gal) |
|---|---|---|---|---|
| 1 & 2 | 210,000 | 200 | 680 | 210,880 |
| 9 & 10 | 300,000 | 20,000 | 68,000 | 388,000 |

For both Alternatives "A" and "B", the recommended storage sizes for newly constructed water tanks are 211,000 gallons for Parcels 1 and 2; and 388,000 gallons for Parcels 9 and 10. Preliminary locations of the tanks for Parcel 9 and 10 are shown on Figure 1-3.

It will be expensive and problematic to provide a new water tank to service the remotely located Cultural Education Center, Cultural Resource Center, and Outdoor Cultural Activity Center. From the description of the Outdoor Cultural Activity Center, it does not appear that those uses will warrant the need for fire protection. The conversion of existing residence and associated outbuildings for the Cultural Education Center, may also not warrant fire protection depending on final size and classification. The building types and sizes for the Cultural Resource Center are not yet defined as this is noted for a future phase. It is recommended that each of these facilities be reviewed for domestic and fire flow requirements as they develop.

Domestic water demands for Parcels 1 and 2 would be no more than a standard domestic use could be supplied by standard wells. If it is determined by the Fire Marshal that the new structures in Parcels 1 and 2 require formal fire protection, then, as an alternative to constructing a new water storage tank, an option would be to tie into the existing water storage tank currently serving the existing Community Trust Property to the north to provide fire flow. This existing tank has a capacity of 300,000 gallons and was sized as follows:

| | |
|---|---|
| Fire Storage: | 270,000 gallons |
| Domestic: | 5,400 gallons |
| Emergency: | 27,000 gallons |
| **TOTAL:** | **302,400 gallons** |

It is recommended that, during design development, the water demands of the existing Community Trust Property are re-evaluated to determine if adequate capacity exists in the existing storage tank to serve both the existing and proposed developments, if required. If a new tank is required for Parcels 1 and 2, it will be developed similar to the existing well and tank system to handle both fire flow and domestic demands. The ultimate pumping capacity will be dependent on fire flow requirements and the selected project alternative. The two systems will be interconnected to provide for redundancy in design.

Proposed water storage tanks will be of welded steel construction meeting all American Water Works Association (AWWA) specifications for welded steel tanks. The tanks will be cylindrical with a height and diameter that can be screened with landscaping and natural features. The tank size will be of standard pre-engineered tank dimensions, which are typically in 8-foot increments. It is possible that the tank will be partially or completely buried, but for the purpose of this analysis, it is assumed that the tank will be located at grade. The tank will be located at the higher elevations of Parcel 1, and located above the base flood elevation.

In Parcel 9, the tank will likely be located on the higher elevations along the hillside to allow gravity water service. Tank water level controls would be designed to maintain 40 psi flowing pressure and a minimum of 20 psi pressure for the building’s fire sprinklered system. Due to topographic and economic feasibility for the tank on Parcel 9, its location may result in groups of homes unable to be serviced by gravity only. Booster pumps for the building’s domestic and fire sprinklered systems may be required for Lots 2 thru 4 to maintain a minimum of 20 psi flowing pressure during fire-suppression. If it is determined this method of operation is not acceptable for these three lots, then alternate sites may be required at lower elevations. Site development along the new road could easily allow an alternate layout to provide full gravity services.

# 4.0 Wastewater Facility

## 4.1 Introduction

This section describes the components necessary to provide wastewater collection, treatment, and disposal service for the project's two alternatives. It begins with a discussion of existing onsite facilities and then details collection, treatment, and disposal requirements. The final discussion is a preliminary level evaluation of the onsite wastewater system requirements for each alternative.

## 4.2 Existing Treatment Facilities and Methods

The proposed site is rural with no existing wastewater facilities available. The nearest wastewater treatment facility is located at the Cache Creek Casino approximately 1.5 miles to the south along Highway 16. The existing Rumsey Indian Rancheria community is serviced by septic systems and leach fields. The homes have individual septic tank and leach bed systems for wastewater treatment and disposal. The soil conditions are favorable for septic and leach systems. The school, community center, etc., also utilize septic tanks and leach beds. Leach beds were used instead of leach fields to reduce disposal system footprints.

## 4.3 Proposed Wastewater Treatment Plant

### 4.3.1 Introduction:

A WWTP on Parcel 8 could treat effluent wastewater generated from proposed Parcels 1, 2, 9, 10, and the existing Community Parcel. This section will discuss: the means of conveying wastewater, the quantities of wastewater, wastewater treatment methods, recycled water storage, and recycled water requirements when in use for irrigation.

The wastewater treatment facility proposed for Parcels 1, 2, 9 and 10 for Alternative "A" would also be appropriate for Alternative "B".

### 4.3.2 Wastewater Conveyance:

Wastewater will be conveyed away from proposed homes and buildings by gravity pipe systems to a wastewater lift station and pumped towards the WWTP on Parcel 8. Gravity pipe conveyance would be the primary means until pipe depth and/or slopes become the limiting factor. Sewer lift stations will then be required to capture and pump wastewater towards the WWTP.

Typical sewer lift stations are equipped with two submerged parallel sump pumps. The two pumps cycle on one after another at specified water elevations determined during design development. During peak flows, both of the pumps are programmed to cycle on to prevent overflowing of the sewer lift station. The proposed lift stations will be designed similar to the described function. Preliminary layout of the sewer lift stations for Parcels 9 and 10 is shown on Figure 4-1, Proposed Sewer Lift Stations.

### 4.3.3 Wastewater Quantity

The WWTP would have the capacity to treat 200,000 gallons per day of wastewater generated from Parcels 1, 2, 9, 10, the existing Community Parcel, and I/I of pipes and manholes (Table 2-4).

### 4.3.4 Wastewater Treatment Methods

The WWTP will treat wastewater according to the California Title 22 recycled water quality standards. All influent wastewater will be treated and provide water suitable for all recycled water uses identified for the project.

One method considered for wastewater treatment is using a membrane bioreactor (MBR) system at the tertiary treatment stage. The MBR system is a process that uses membranes comparable to that used for production of potable water. The biosolids produced by the WWTP will be dewatered and trucked off-site to be disposed at a licensed landfill. The recycled water tank, reservoir, and the WWTP will be detailed in the design phase of the project.

### 4.3.5 Recycled Water Storage and Hydrologic Balance Methodology

A hydrologic balance (Table 4.1) has been performed with this EA to determine a preliminary size for the recycled water reservoir. The reservoir will be sized to retain a 100-year storm event, 24-hour duration and the peak wastewater flows generated from Parcels 1, 2, 9, 10, and the existing Community Parcel.

This section discusses the parameters and assumptions on Table 4.1.

The hydrologic balance analyzes monthly percentages of the 25 inches mean-annual precipitation averaged from 20-years of Capay Station rainfall data presented by the California Department of Water Resources (DWR), California Data Exchange Center.

Monthly evaporation rates were determined from pond evaporation rates methods discussed in the "Evaporation from Water Surfaces in California", DWR Bulletin 73-79, November 1979.

No percolation would occur since the recycled water pond would likely be lined with an impermeable plastic or fabric.

Net water gain is the precipitation amount generated by a 100-year storm event, 24-hour duration. The monthly volume of water gain is then determined by the preliminary size of the recycled water reservoir. The preliminary pond volume is approximately 6 acres footprint, with approximately 5 feet of water depth during peak conditions.

Irrigation demands were estimated and presented in Section 2.2.3 and Table 2.1. The water balance takes these demands and applies a monthly irrigation percentage to the irrigation demand. This method accounts for winter months when irrigation is minimal. The monthly irrigation percentage is the complement of the fraction of that month's rainfall to the maximum rainfall in a year (100% - month rainfall/maximum annual rainfall).

Per Table 4-1, the maximum storage volume required for the recycled water reservoir is approximately 30 acre-feet.

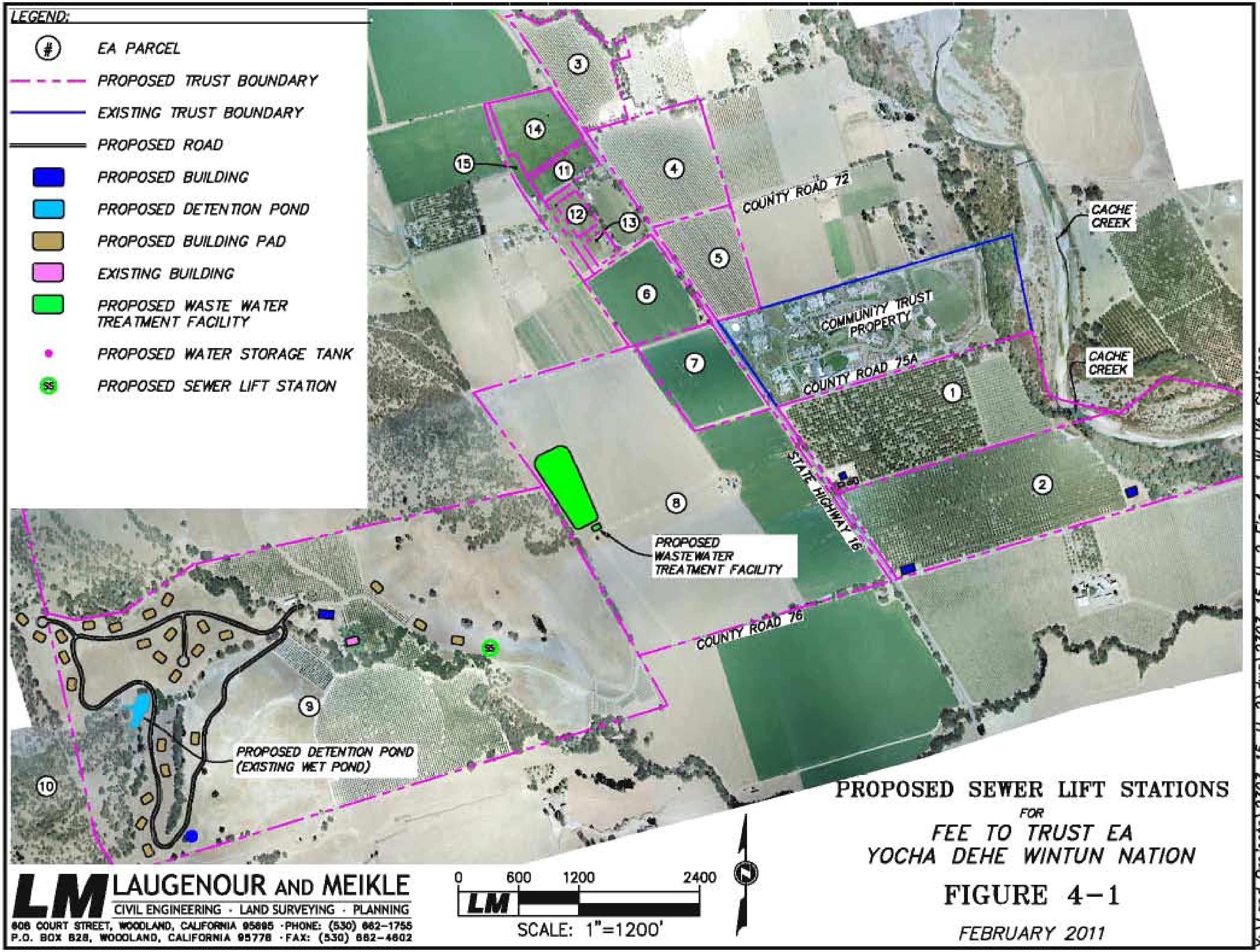
# TABLE 4-1 SEWER POND WATER BALANCE - YOCHA DE HE HOUSING PROJECT

Laugenour and Meikle    Mean Annual Precipitation:    28 inches
Job # 2303-15-H
11/12/2009

| MONTH | (days) | PRECIPI-TATION (see note) (INCHES) | EVAPOR-ATION (INCHES) | NET WATER GAIN (INCHES) | NATURAL WATER GAIN POND 1 (AC.-FT./MO.) | INFLOW[1] 0.745 AC.-FT/DAY 22.347 AC.-FT/MO. (per day) | (per mo.) | Irrigation Demand Alternate A (gpd) | Alternate B (gpd) | Irrigation Demand Alternate A (AC-FT/DAY) | Alternate B (AC-FT/DAY) | Alternate A (AC-FT/MO.) | Alternate B (AC-FT/MO.) | % of Irrigation | STORAGE CHANGE Alt A (AC.-FT./MO.) | STORAGE CHANGE Alt B (AC.-FT./MO.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| January | 31 | 6.21 | 0.53 | 5.68 | 1.893 | 0.745 | 23.092 | 1,783,000 | 1,467,600 | 5.47 | 4.50 | 169.64 | 139.63 | 22.5% | -13.20 | -6.446 |
| February | 28 | 8.01 | 0.76 | 7.25 | 2.417 | 0.745 | 20.857 | 1,783,000 | 1,467,600 | 5.47 | 4.50 | 153.22 | 126.12 | 0.0% | 23.27 | 23.274 |
| March | 31 | 3.75 | 1.76 | 1.99 | 0.664 | 0.745 | 23.092 | 1,783,000 | 1,467,600 | 5.47 | 4.50 | 169.64 | 139.63 | 53.2% | -66.43 | -50.476 |
| April | 30 | 1.23 | 2.97 | -1.74 | -0.578 | 0.745 | 22.347 | 1,783,000 | 1,467,600 | 5.47 | 4.50 | 164.17 | 135.13 | 84.6% | -117.09 | -92.529 |
| May | 31 | 0.50 | 4.88 | -4.38 | -1.460 | 0.745 | 23.092 | 1,783,000 | 1,467,600 | 5.47 | 4.50 | 169.64 | 139.63 | 93.7% | -137.39 | -109.262 |
| June | 30 | 0.16 | 5.15 | -4.99 | -1.664 | 0.745 | 22.347 | 1,783,000 | 1,467,600 | 5.47 | 4.50 | 164.17 | 135.13 | 98.0% | -140.27 | -111.799 |
| July | 31 | 0.00 | 7.51 | -7.51 | -2.503 | 0.745 | 23.092 | 1,783,000 | 1,467,600 | 5.47 | 4.50 | 169.64 | 139.63 | 100.0% | -149.05 | -119.042 |
| August | 31 | 0.06 | 7.60 | -7.54 | -2.513 | 0.745 | 23.092 | 1,783,000 | 1,467,600 | 5.47 | 4.50 | 169.64 | 139.63 | 99.2% | -147.75 | -117.977 |
| September | 30 | 0.29 | 5.60 | -5.31 | -1.769 | 0.745 | 22.347 | 1,783,000 | 1,467,600 | 5.47 | 4.50 | 164.17 | 135.13 | 96.3% | -137.56 | -109.589 |
| October | 31 | 1.09 | 2.37 | -1.28 | -0.427 | 0.745 | 23.092 | 1,783,000 | 1,467,600 | 5.47 | 4.50 | 169.64 | 139.63 | 86.4% | -123.91 | -97.980 |
| November | 30 | 1.57 | 0.91 | 0.66 | 0.221 | 0.745 | 22.347 | 1,783,000 | 1,467,600 | 5.47 | 4.50 | 164.17 | 135.13 | 80.4% | -109.35 | -86.014 |
| December | 31 | 5.12 | 0.48 | 4.64 | 1.546 | 0.745 | 23.092 | 1,783,000 | 1,467,600 | 5.47 | 4.50 | 169.64 | 139.63 | 36.1% | -36.61 | -25.777 |
| Annual Total | 365 | 28.00 | 40.5 | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| January | 31 | 6.21 | 0.53 | 5.68 | 1.893 | 0.745 | 23.092 | 1,783,000 | 1,467,600 | 5.47 | 4.50 | 169.64 | 139.63 | 22.5% | -13.20 | -6.446 |
| February | 28 | 8.01 | 0.76 | 7.25 | 2.417 | 0.745 | 20.857 | 1,783,000 | 1,467,600 | 5.47 | 4.50 | 153.22 | 126.12 | 0.0% | 23.27 | 23.274 |
| March | 31 | 3.75 | 1.76 | 1.99 | 0.664 | 0.745 | 23.092 | 1,783,000 | 1,467,600 | 5.47 | 4.50 | 169.64 | 139.63 | 53.2% | -66.43 | -50.476 |
| April | 30 | 1.23 | 2.97 | -1.74 | -0.578 | 0.745 | 22.347 | 1,783,000 | 1,467,600 | 5.47 | 4.50 | 164.17 | 135.13 | 84.6% | -117.09 | -92.529 |
| May | 31 | 0.50 | 4.88 | -4.38 | -1.460 | 0.745 | 23.092 | 1,783,000 | 1,467,600 | 5.47 | 4.50 | 169.64 | 139.63 | 93.7% | -137.39 | -109.262 |
| June | 30 | 0.16 | 5.15 | -4.99 | -1.664 | 0.745 | 22.347 | 1,783,000 | 1,467,600 | 5.47 | 4.50 | 164.17 | 135.13 | 98.0% | -140.27 | -111.799 |
| July | 31 | 0.00 | 7.51 | -7.51 | -2.503 | 0.745 | 23.092 | 1,783,000 | 1,467,600 | 5.47 | 4.50 | 169.64 | 139.63 | 100.0% | -149.05 | -119.042 |
| August | 31 | 0.06 | 7.60 | -7.54 | -2.513 | 0.745 | 23.092 | 1,783,000 | 1,467,600 | 5.47 | 4.50 | 169.64 | 139.63 | 99.2% | -147.75 | -117.977 |
| September | 30 | 0.29 | 5.60 | -5.31 | -1.769 | 0.745 | 22.347 | 1,783,000 | 1,467,600 | 5.47 | 4.50 | 164.17 | 135.13 | 96.3% | -137.56 | -109.589 |
| October | 31 | 1.09 | 2.37 | -1.28 | -0.427 | 0.745 | 23.092 | 1,783,000 | 1,467,600 | 5.47 | 4.50 | 169.64 | 139.63 | 86.4% | -123.91 | -97.980 |
| November | 30 | 1.57 | 0.91 | 0.66 | 0.221 | 0.745 | 22.347 | 1,783,000 | 1,467,600 | 5.47 | 4.50 | 164.17 | 135.13 | 80.4% | -109.35 | -86.014 |
| December | 31 | 5.12 | 0.48 | 4.64 | 1.546 | 0.745 | 23.092 | 1,783,000 | 1,467,600 | 5.47 | 4.50 | 169.64 | 139.63 | 36.1% | -36.61 | -25.777 |
| Annual Total | 365 | 28 | 40.5 | | | | | | | | | | | | | |

[1]Determined from Table 2-4
NOTE: Precipitation is based on two 100-yr event falling in two successive years.


LEGEND:
EA PARCEL
PROPOSED TRUST BOUNDARY
EXISTING TRUST BOUNDARY
PROPOSED ROAD
PROPOSED BUILDING
PROPOSED DETENTION POND
PROPOSED BUILDING PAD
EXISTING BUILDING
PROPOSED WASTE WATER TREATMENT FACILITY
PROPOSED WATER STORAGE TANK
PROPOSED SEWER LIFT STATION
COUNTY ROAD 72
CACHE CREEK
COMMUNITY TRUST PROPERTY
COUNTY ROAD 75A
CACHE CREEK
STATE HIGHWAY 16
PROPOSED WASTEWATER TREATMENT FACILITY
COUNTY ROAD 76
PROPOSED DETENTION POND (EXISTING WET POND)
1
2
3
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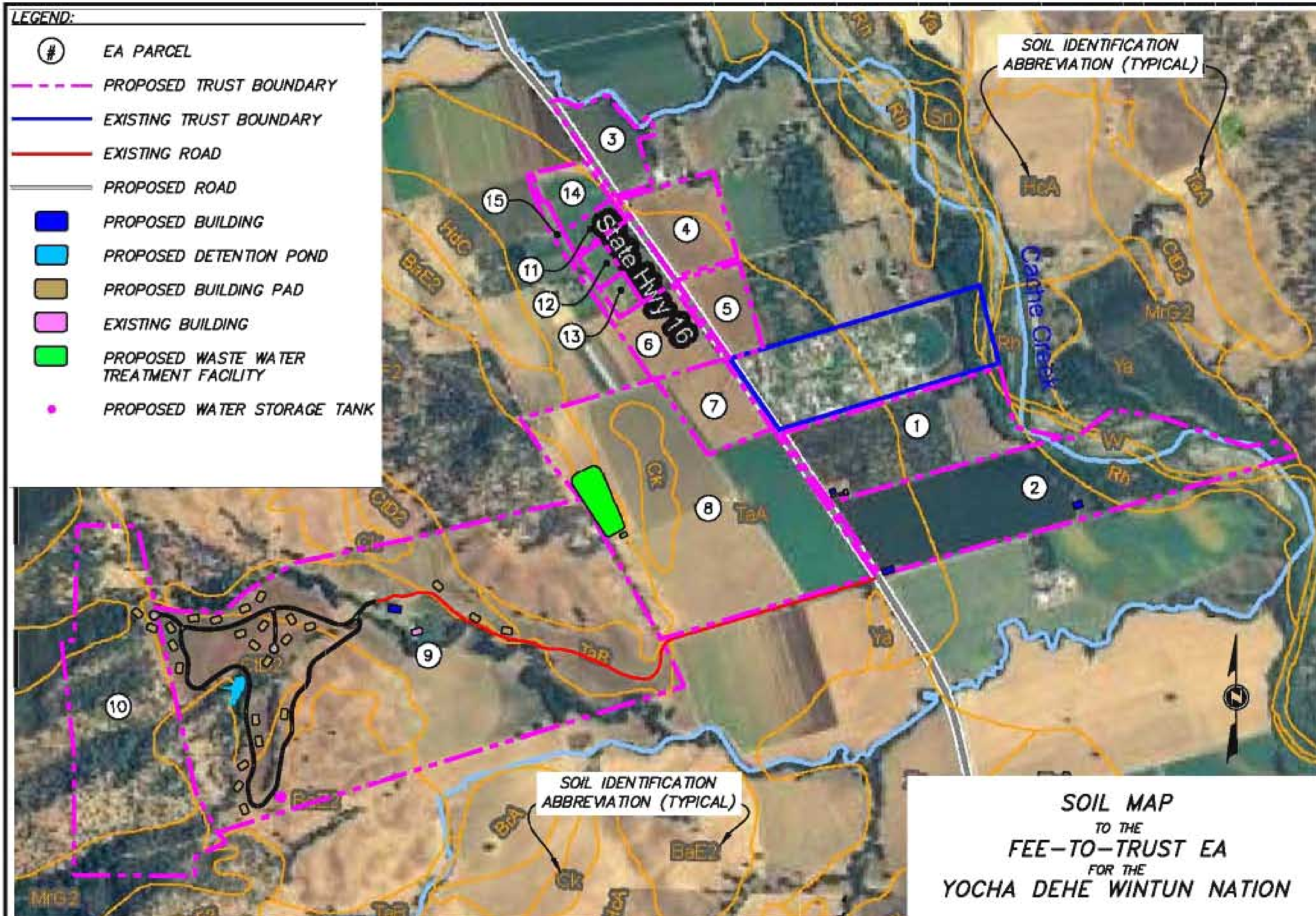
LM LAUGENOUR AND MEIKLE
CIVIL ENGINEERING · LAND SURVEYING · PLANNING
608 COURT STREET, WOODLAND, CALIFORNIA 95695 · PHONE: (530) 662-1755
P.O. BOX 828, WOODLAND, CALIFORNIA 95776 · FAX: (530) 662-4602
0 600 1200 2400
SCALE: 1"=1200'
PROPOSED SEWER LIFT STATIONS
FOR
FEE TO TRUST EA
YOCHA DEHE WINTUN NATION
FIGURE 4-1
FEBRUARY 2011
X:\Land Projects\2303-15-H-2\dwg\2303-15-H-2_Fig_4-1_W_Lift_Stations




SOIL MAP
TO THE
FEE-TO-TRUST EA
FOR THE
YOCHA DEHE WINTUN NATION

FIGURE 4-2

FEBRUARY 2011

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X:\Land Projects\2303-15-H-2\dwg\2303-15-H-2_Fig_1-4_G_Soil

# 4.4 Septic and Leach Field Systems

An alternative to the WWTP would be to provide septic systems and leach fields or communal septic systems and leach fields for the proposed developments, especially for EA Parcels 1, 2 9 and 10. This alternative's major advantage is its reduced construction and maintenance costs. The existing Community Trust Parcel is serviced entirely by septic and leach field systems and has not experienced any major issues related to wastewater processing. The hillside terrain associated with Parcels 9 and 10 may present challenges for this method of disposal. The Outdoor Cultural Activity Center on Parcel 2 is to close to Cache Creek for this method of disposal. Portable units may be the best solution for this interim use.

## 4.4.1 Septic Collection and Leach Field Treatment - Individual Systems:

Septic systems have two major components – the septic tank and leach field.

The septic tank component of a septic system is an underground, watertight containment that first receives sewage conveyed by a building's sewer line. The primary function of the septic tank is to separate all solid and semi-solid materials from the sewage flow before the clarified liquid passes on to the leach field.

The leach field follows the septic tank. This component can be described as gravel filled excavations with perforated pipes running the trench length, and backfilled with gravel. Depending upon the type of leach field required these trenches (or beds) vary in depth, width, length, and elevation below or above ground level. The function of the leach field is to biologically and physically treat the liquid sewage within the subsurface soil environment. This treated water then returns to the environment via percolation into the soil, evaporation, or transpiration.

### 4.4.1.1 <u>Standard Leach Lines:</u>

The vast majority of septic systems constructed in Yolo County utilize standard leach lines. Standard leach lines consist of 100-foot long, 2-foot wide by 2½-foot deep trenches that follow the contours of the land with 1½-inch graded, washed gravel placed into the trenches to a depth of 1-foot deep. Rigid perforated drainpipe is run the length of each trench and then covered with gravel. A permeable soil barrier, usually straw, is placed over the gravel, and soil is backfilled into the trenches up to ground level.

Standard leach lines are allowable where there is at least 5 feet of soil depth above high seasonal groundwater level or bedrock and percolation (perc) test rates are between 5 and 60 minutes per inch.

Standard leach lines may be installed on flat or convex contour topography. Standard leach lines may not be installed on slopes greater than 30%.

### 4.4.1.2 <u>Evapotranspiration – Absorption System (ETA)</u>:

The evapotranspiration – absorption system, or ETA, is comprised of a large excavated area. A typical excavation is 30-feet wide by 100-feet long and 2½-feet deep, and backfilled with 1½-feet of gravel. A series of rigid perforated pipes are run through the graveled area, covered with a soil barrier, and then backfilled with topsoil. The intended effect of this design is to allow maximum plant transpiration or evaporation across the surface of the leach field.

ETA fields are required in areas where perc rates are very slow (in excess of 60 minutes per inch) or where space may be very limited. Seasonal high groundwater or bedrock must not be present within 5-feet of the excavation bottom. ETA fields may be installed on flat land areas with less than 2% slope. During the design phase of the project, if test results reveal very slow percolation rates, an ETA system will be recommended as the feasible treatment method.

**4.4.1.3 Elevated Leach Field Systems:**

The elevated leach field is identical in design to the ETA system previously described. However, the leach field bottom can be at or above the undisturbed or natural surface of the soil. To accomplish this imported soil or topsoil the site is graded to form an elevated base. A gravel bed and perforated pipe system is constructed on top of this base and soil is mounded to provide sides and the final cover. Because of the elevated leach field height, most all installation requires a sewage lift station.

Elevated leach fields are required in areas where high seasonal groundwater or shallow bedrock conditions exist. A minimum 5-foot separation is required between the leach field bottom and seasonal high groundwater/bedrock. A minimum 5 feet of unsaturated soil is necessary for providing adequate sewage treatment before groundwater is encountered. The natural ground surface percolation rate should not exceed 120 minutes per inch. The percolation rate of the mound base fill material should be less than natural or undisturbed surface soil. The soil should have a slope of no more than 2% for an elevated leach field system.

Unless the site design restricts gravity sewer flows, elevated leach field systems will not be anticipated for this project.

### 4.4.2 Placement of Septic System and Leach Field:

Appropriate locations for septic tanks:

- Within 10 to 30-feet from the building.
- Within a short distance to driveway to allow year-round access by a septic pumper for cleaning or maintenance.
- Within an area which will allow easy future hook-up to a public sewer system, should it become available.

Appropriate areas for leach fields include:

- Well drained vegetative groundcover areas.
- Non-root crop vegetable gardens.
- Fallow areas.
- Areas down gradient of the structure to allow gravity flow.

Areas where septic systems are not allowed include:

- Areas within 10-feet of structures, i.e., pools, foundations, vertical supports.
- Areas that will be or are under pavement or structures.

- Areas not owned or controlled by the property owner or easement dedicated for surface or subsurface improvements.
- Slopes greater than 30%.

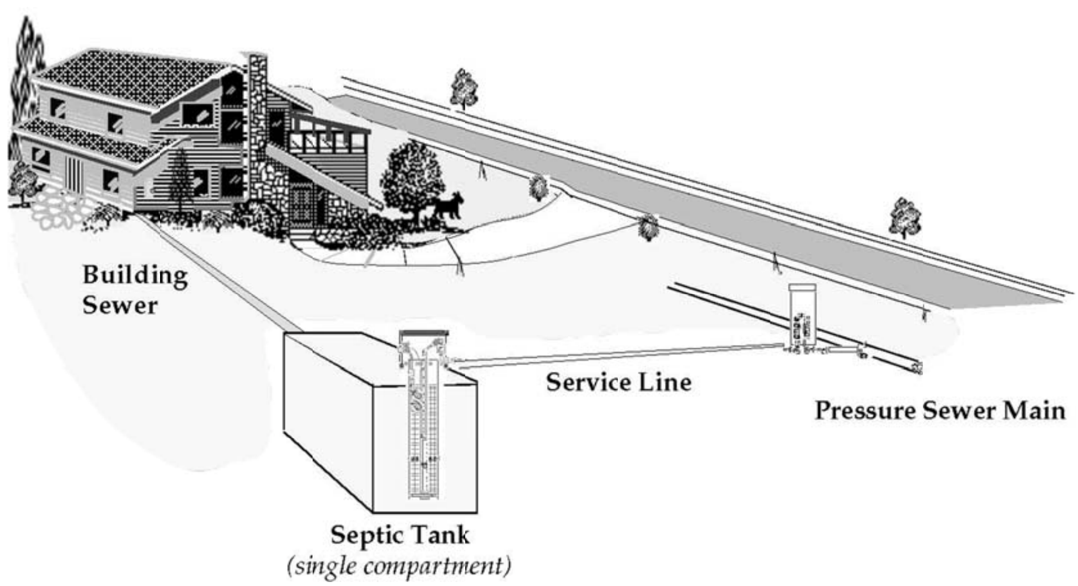
Areas not recommended for septic systems include:

- Areas up-gradient or up-hill from water wells.
- Areas subject to flooding including landscape irrigation, crop irrigation, and natural drainage.
- Heavily landscaped areas where excessive soil may be placed over the leach field.
- Near or under plants or trees having invasive roots.

For single family homes, the septic system capacity and leach field area can be determined by knowing the number of bedrooms, actual soil type, and leach field type. Unless conditions warrant, percolation tests for single-family homes are not required.

### 4.4.3 Septic Tank Effluent Pumping (STEP) Collection - Community System:

If the homes and/or buildings are to be placed on a communal wastewater treatment system, one option is to construct a STEP collection system together with a community treatment system. A STEP system is comprised of a pre-treatment tank and a small submersible pump with a control panel located on each house and building. Wastewater travels through a pipe into the STEP tank. The wastewater solids accumulate in the bottom of the tank and slowly degrade. When the liquid level in the tank reaches the proper height, the control system turns on the pump which then pumps a set volume of liquid out of the tank to the pressure main, and then to the community wastewater treatment facility. Similar to a septic tank, the solids will need to be pumped out every 3 to 10 years, depending on usage.



The advantages of the STEP system are as follows:

- Pumping eliminates the need for gravity fall, so wastewater can be transmitted on flat or uphill terrain. If the treatment facility is located on Parcel 8 which is across Highway 16, gravity flow will likely not be an option.
- STEP systems require small diameter PVC pipes, usually Class 200, that parallels the ground surface profile similar to a water line.
- Infiltration/inflow (I/I) is greatly reduced, thereby minimizing the hydraulic load on the treatment facility, and, more importantly, on the effluent disposal system under critical wet winter conditions; and
- Unlike gravity systems, there are no minimum velocities to design for.

# 5.0 Conclusions

Each of the two project alternatives were evaluated and found to be feasible in terms of water and wastewater. The potable water supply requirements can be satisfied through onsite wells and offsite wells. Wastewater service could be provided by a combination of a communal wastewater treatment facility and individual septic systems. Specific conclusions are summarized below.

## 5.1 Water Supply

Groundwater is anticipated to be the primary source of potable water and irrigation for the project, and will require treatment to meet regulations for potable water.

In Parcel 1, the capacity of the existing domestic well that serves the existing Cultural Education Center is not known, and is assumed to have adequate capacity for the residential use. The new use may actually reduce demand, therefore, a new domestic well would not be required to serve Parcel 1; however, a new well will be required to serve the development in Parcel 2.

In Parcel 9, the capacity of the existing domestic well that serves the existing Ranch house is also not known, and is assumed to only have adequate capacity for its current use. Therefore, a new domestic well will be required to serve homes in Parcel 9 and Parcel 10.

There is ample capacity to provide developed landscape irrigation for the proposed developments in Parcel 1 and 2. In Parcels 9 and 10, developed landscape irrigation would likely be supplied from the new domestic water well. All existing agricultural irrigation would still be supplied by the existing agricultural well system. Since existing irrigation water is not treated, no treatment is recommended for any proposed irrigation.

Use of groundwater for potable water supply will require a chlorination system at a minimum, but will most likely require additional treatment including filtration. Additional water quality sampling is required to determine exact groundwater treatment requirements and compliance with drinking water regulations.

Water storage tanks are required to provide reserve water supply for domestic use, fire suppression and emergency needs. For both Alternatives "A" and "B", the recommended storage size for the newly constructed water tank for Parcels 9 & 10 is 388,000 gallons.

It will be expensive and problematic to provide a new water tank for fire service to the remotely located Cultural Education Center, Cultural Resource Center, and Outdoor Cultural Activity Center on Parcels 1 and 2. From the description of the Outdoor Cultural Activity Center, it does not appear that this use will warrant fire protection. The conversion of the existing residence and associated outbuildings for the Cultural Education Center, also, may not warrant fire protection depending on final size and use classification. The building types and sizes for the Cultural Resource Center are not yet defined as this is noted for a future phase. It is recommended that each of these facilities be reviewed for domestic and fire flow requirements as they develop.

It is recommended that, during design development, the water demands of the existing Community Trust Property are re-evaluated to determine if adequate capacity exists in the existing storage tank to serve both the existing and proposed developments, if required.  If a new tank is required for Parcels 1 and 2, it will be developed similar to the existing well and tank system to handle both fire flow and domestic demands. The ultimate pumping capacity will be dependent on fire flow requirements and the selected project alternative. The two systems will be interconnected to provide for redundancy in design.

## 5.2 Wastewater Treatment Facilities

The WWTP will treat wastewater that meets the California Title 22 recycled water quality standards.  All influent wastewater will be treated to this level and provide treatment suitable for all recycled water uses identified for the project.

Wastewater will be treated using a membrane bioreactor (MBR) system at the tertiary treatment stage. The MBR system is a process that uses membranes comparable to that used for production of potable water.  The biosolids produced by the WWTP will be dewatered and trucked off-site to be disposed at a licensed landfill.  The recycled water tank, reservoir, and the WWTP will be detailed in the design phase of the project.

Septic and leach field treatment is a viable option for remotely located residence or facilities. This would apply to development within Parcel 1 and Parcel 2, the Cultural Education Center and Cultural Resource Center which are remote relative to Parcel 8 and the proposed WWTP location.

# Summary of Existing Water Usage
# Rumsey Rancheria Community
# 2008 Water Use Readings

| | | Domestic x100 | | Irrigation x1000 | |
|---|---|---|---|---|---|
| Day | Date | Reading | Delta | Reading | Delta |
| Mon | 8/25/2008 | 133518 | | 90821 | |
| Tue | 8/26/2008 | 133599 | 81 | 91096 | 275 |
| Wed | 8/27/2008 | 133828 | 229 | 91351 | 255 |
| Thu | 8/28/2008 | 134057 | 229 | 91585 | 234 |
| Fri | 8/29/2008 | 134126 | 69 | 91820 | 235 |
| Sat | 8/30/2008 | | 20 | | 244 |
| Sun | 8/31/2008 | | 20 | | 244 |
| Mon | 9/1/2008 | | 20 | | 244 |
| Tue | 9/2/2008 | 134204 | 20 | 92794 | 244 |
| Wed | 9/3/2008 | 134423 | 219 | 93104 | 310 |
| Thu | 9/4/2008 | 134494 | 71 | 93428 | 324 |
| Fri | 9/5/2008 | 134720 | 226 | 93643 | 215 |
| Sat | 9/6/2008 | | 23 | | 275 |
| Sun | 9/7/2008 | | 23 | | 275 |
| Mon | 9/8/2008 | 134789 | 23 | 94467 | 275 |
| Tue | 9/9/2008 | 135014 | 225 | | 224 |
| Wed | 9/10/2008 | | 74 | | 224 |
| Thu | 9/11/2008 | 135161 | 74 | | 224 |
| Fri | 9/12/2008 | 135233 | 72 | 95363 | 224 |
| Sat | 9/13/2008 | | 24 | | 260 |
| Sun | 9/14/2008 | | 24 | | 260 |
| Mon | 9/15/2008 | 135305 | 24 | 96143 | 260 |
| Tue | 9/16/2008 | 135558 | 253 | 96314 | 171 |
| Wed | 9/17/2008 | | 22 | | 188 |
| Thu | 9/18/2008 | 135601 | 22 | 96689 | 188 |
| Fri | 9/19/2008 | 135673 | 72 | 96850 | 161 |
| Sat | 9/20/2008 | | 24 | | 198 |
| Sun | 9/21/2008 | | 24 | | 198 |
| Mon | 9/22/2008 | 135744 | 24 | 97443 | 198 |
| Tue | 9/23/2008 | | 148 | | 190 |
| Wed | 9/24/2008 | 136040 | 148 | 97823 | 190 |
| Thu | 9/25/2008 | 136113 | 73 | 97840 | 155 |
| Fri | 9/26/2008 | | 56 | | 155 |
| Sat | 9/27/2008 | | 56 | | 155 |
| Sun | 9/28/2008 | | 56 | | 155 |

**Appendix A**

# Summary of Existing Water Usage
# Rumsey Rancheria Community
# 2008 Water Use Readings

| | | Domestic x100 | | Irrigation x1000 | |
|---|---|---|---|---|---|
| Mon | 9/29/2008 | 136336 | 56 | 98596 | 155 |
| Tue | 9/30/2008 | 136565 | 229 | 98763 | 167 |
| Wed | 10/1/2008 | 136566 | 1 | 98926 | 163 |
| Thu | 10/2/2008 | 136566 | 0 | 99115 | 189 |
| Fri | 10/3/2008 | 136637 | 71 | 99328 | 213 |
| Sat | 10/4/2008 | | 22 | | 187 |
| Sun | 10/5/2008 | | 22 | | 187 |
| Mon | 10/6/2008 | 136702 | 22 | 99889 | 187 |
| Tue | 10/7/2008 | 136918 | 216 | 100032 | 143 |
| Wed | 10/8/2008 | 137147 | 229 | 100235 | 203 |
| Thu | 10/9/2008 | 137147 | 0 | 100401 | 166 |
| Fri | 10/10/2008 | | 18 | | 191 |
| Sat | 10/11/2008 | | 18 | | 191 |
| Sun | 10/12/2008 | | 18 | | 191 |
| Mon | 10/13/2008 | 137219 | 18 | 101166 | 191 |
| Tue | 10/14/2008 | | 154 | | 227 |
| Wed | 10/15/2008 | 137526 | 154 | 101619 | 227 |
| Thu | 10/16/2008 | 137599 | 73 | 101789 | 170 |
| Fri | 10/17/2008 | 137814 | 215 | 102049 | 260 |
| Sat | 10/18/2008 | | 22 | | 278 |
| Sun | 10/19/2008 | | 22 | | 278 |
| Mon | 10/20/2008 | 137880 | 22 | 102883 | 278 |
| Tue | 10/21/2008 | 138105 | 225 | 103175 | 292 |
| Wed | 10/22/2008 | 138173 | 68 | 103386 | 211 |
| Thu | 10/23/2008 | 138241 | 68 | 103578 | 192 |
| Fri | 10/24/2008 | | 18 | | 163 |
| Sat | 10/25/2008 | | 18 | | 163 |
| Sun | 10/26/2008 | | 18 | | 163 |
| Mon | 10/27/2008 | 138312 | 18 | 104229 | 163 |
| Tue | 10/28/2008 | 138531 | 219 | 104397 | 168 |
| Wed | 10/29/2008 | 138585 | 54 | 104534 | 137 |
| Thu | 10/30/2008 | | 1 | | 134 |
| Fri | 10/31/2008 | 138586 | 1 | 104802 | 134 |

Average per day (Mon-Fri): 10,980 gpd

Average per day (Mon-Sun): 208,672 gpd

**Appendix A**

# Summary of Existing Water Usage
# Rumsey Rancheria Community
# 2009 Water Use Readings

| Day | Date | Domestic x100 Reading | Domestic x100 Delta | Irrigation x1000 Reading | Irrigation x1000 Delta |
|---|---|---|---|---|---|
| Mon | 8/3/2009 | | | | |
| Tue | 8/4/2009 | 162392 | | 138481 | |
| Wed | 8/5/2009 | 162542 | 150 | 138740 | 259 |
| Thu | 8/6/2009 | 162696 | 154 | 138995 | 255 |
| Fri | 8/7/2009 | 162698 | 2 | 139293 | 298 |
| Sat | 8/8/2009 | | 33 | | 305 |
| Sun | 8/9/2009 | | 33 | | 305 |
| Mon | 8/10/2009 | 162796 | 33 | 140209 | 305 |
| Tue | 8/11/2009 | 163000 | 76 | 140513 | 305 |
| Wed | 8/12/2009 | 163056 | 56 | 140775 | 262 |
| Thu | 8/13/2009 | 163056 | 0 | 141015 | 240 |
| Fri | 8/14/2009 | 163058 | 2 | 141307 | 292 |
| Sat | 8/15/2009 | | 103 | | 303 |
| Sun | 8/16/2009 | | 103 | | 303 |
| Mon | 8/17/2009 | 163366 | 103 | 142215 | 303 |
| Tue | 8/18/2009 | 163366 | 0 | 142558 | 343 |
| Wed | 8/19/2009 | 163369 | 3 | 142943 | 385 |
| Thu | 8/20/2009 | 163569 | 200 | 143095 | 152 |
| Fri | 8/21/2009 | 163767 | 198 | 143409 | 314 |
| Sat | 8/22/2009 | | 157 | | 326 |
| Sun | 8/23/2009 | | 157 | | 326 |
| Mon | 8/24/2009 | 164239 | 157 | 144388 | 326 |
| Tue | 8/25/2009 | | 8 | | 303 |
| Wed | 8/26/2009 | 164255 | 8 | 144993 | 303 |
| Thu | 8/27/2009 | | 198 | | 187 |
| Fri | 8/28/2009 | 164651 | 198 | 145367 | 187 |
| Sat | 8/29/2009 | | 49 | | 266 |
| Sun | 8/30/2009 | | 49 | | 266 |
| Mon | 8/31/2009 | 164799 | 49 | 146165 | 266 |
| Tue | 9/1/2009 | 164995 | 196 | 146421 | 256 |
| Wed | 9/2/2009 | 165192 | 197 | 146625 | 204 |
| Thu | 9/3/2009 | 165390 | 198 | 146799 | 174 |
| Fri | 9/4/2009 | 165454 | 64 | 146951 | 152 |

Average per day (Mon-Fri): 10,690 gpd

Average per day (Mon-Sun): 273,258 gpd

**Appendix A**

2009

# Rumsey Indian Rancherria

| | Date | Tank Leve | Tank | Pump House | Community Center | Irrigatio Meter | Domestic Meter | |
|---|---|---|---|---|---|---|---|---|
| | 8-4-09 | 8.6 | .74 | .58 | .95 | 138481 | 162392 | |
| | 8-5-09 | 8.9 | .65 | .60 | .95 | 138740 | 162542 | CG |
| | 8-6-09 | 9.0 | .88 | .85 | .94 | 138495 | 162696 | CG |
| | 8-7-09 | 8.9 | .45 | .60 | .29 | 139293 | 162698 | CG |
| | 8-10-09 | 8.6 | .99 | .69 | .13 | 140209 | 162796 | CG |
| 2:25 PM | 8-10-09 | 8.7 | 1.08 | .59 | | | | CG |
| | 8-11-09 | 8.9 | 1.1 | .67 | .25 | 140513 | 163000 | CG |
| 4:3 pm | 8-11-09 | 9.1 | 1.09 | .64 | .24 | | | |
| | 8-12-09 | 9.0 | .69 | .82 | .17 | 140775 | 163056 | CG |
| 4:20 PM | 8-12-09 | 8.9 | .54 | .58 | | | | CG |
| | 8-13-09 | 8.8 | .34 | .48 | .18 | 141015 | 163056 | CG |
| | 8-14-09 | 8.6 | 1.1 | .40 | .14 | 141307 | 163058 | CG |
| | 8-17-09 | 8.9 | .83 | .50 | .10 | 142915 | 163366 | CG |
| | 8-18-09 | 8.8 | .44 | .55 | .08 | 142558 | 163366 | CG |
| 2:3 PM | 8-18-09 | 8.6 | 1.88 | .53 | | | | CG |
| | 8-19-09 | 8.5 | 1.8 | .36 | .15 | 142942 | 163369 | CG |
| 4:3 pm | 8-19-09 | 8.5 | 1.3 | .54 | | | | CG |
| | 8-20-09 | 8.8 | 1.4 | .82 | .15 | 143095 | 163569 | CG |
| | 8-21-09 | 8.9 | 1.1 | .87 | .35 | 143409 | 163767 | CG |
| 2:3 pm | 8-21-09 | 8.9 | 1.2 | .71 | | | | CG |
| | 8-24-09 | 8.9 | .92 | .90 | .22 | 144380 | 164239 | CG |
| | 8-26-09 | 8.5 | .82 | .59 | .47 | 144993 | 164255 | CG |
| | 8-27-09 | 8.8 | 1.1 | .82 | .49 | 145208 | 164453 | CG |
| 4:10 pm | 8-27-09 | 8.9 | 1.0 | .75 | | | | |
| | 8-28-09 | 8.9 | 1.1 | .68 | .36 | 145367 | 164651 | CG |
| | 8-31-09 | 8.6 | .95 | .53 | .14 | 146165 | 164799 | CG |
| | 9-1-09 | 8.5 | .94 | .61 | .33 | 146421 | 164995 | CG |
| 3:57 PM | 9-1-09 | 8.5 | 1.0 | .64 | | | | |
| | 9-2-09 | 8.7 | 1.0 | .90 | .92 | 146695 | 165192 | CG |
| | 9-3-09 | 9.0 | .86 | .70 | .32 | 146797 | 165390 | CG |
| | 9-4-09 | 8.9 | .67 | .68 | .17 | 146951 | 165454 | CG |

**Appendix A**

# 2008 domestic meter Reading

Dom.
8-25 = 13351.8
8-26 = 13359.9

8-27 = 13382.8
8-28 = 13405.7

8-29 = 13412.6
9-2 = 13420.4

9-3 = 13442.3
9-4 = 13449.4

9-5 = 13472.0
9-8 = 13478.9

Dom.
9-9 = 13501.4 45.7
9-11 = 13546.1 shut off
9-12 = 13523.3 shut off
9-15 13530.5 7.2

9-16 = 13552.8
9-18 = 13560.1

9-19 = 13567.3
9-22 = 13574.4

9-24 = 13604.0
9-25 = 13611.3

9-29 = 13633.6
9-30 = 13656.5

Dom.
10-1 = 13656.6
10-2 = 13656.6
10-3 = 13663.7
10-6 = 13670.2
10-7 = 13691.8
10-8 = 13714.7
10-9 = 13714.7
10-13 = 13721.9
10-15 = 13752.6
10-16 = 13759.9
10-17 = 13781.4
10-20 = 13788.0
10-21 = 13810.5

Dom
10-22 = 13817.3
10-23 = 13824.1
10-27 = 13831.2
10-28 = 13853.1
10-29 = 13858.5
10-31 = 13858.6

**Appendix A**

2008 irrigation meter Readings.

IRRG,
9-9 = 94747
9-10 = 95189

9-12 95363
9-15 96143

9-16 96314
9-18 96689

9-19 96850
9-22 97443

9-24 97823
9-25 97840

IGGAN.
8-25 = 90821
8-26 = 91096
275

8-27 = 91351
8-28 = 91585
234

8-29 = 91820
9-2 = 92794
974

9-3 = 93104
9-4 = 93428
324

9-5 = 93643
9-8 = 94467

9-12 = 95363

IRRG
9-29 = 98596
9-30 = 98763
10-1 = 98926
10-2 = 99115
10-3 = 99328
10-6 = 99889
10-7 = 100032
10-8 = 100235
10-9 = 100401
10-13 = 101166
10-15 = 101619
10-16 = 101789
10-17 = 102049
10-20 = 102883
10-21 = 103175

IRRG
10-22 = 103386
10-23 = 103578
10-27 = 104229
10-28 = 104397
10-29 = 104534
10-31 = 104802

**Appendix A**

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

# Custom Soil Resource Report for

# Yolo County, California

## ~ Yocha-De-He Wintun Nation ~ Fee-to-Trust EIS


Appendix B

September 18, 2009

# Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://soils.usda.gov/sqi/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://soils.usda.gov/contact/state_offices/).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

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# Contents

# How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

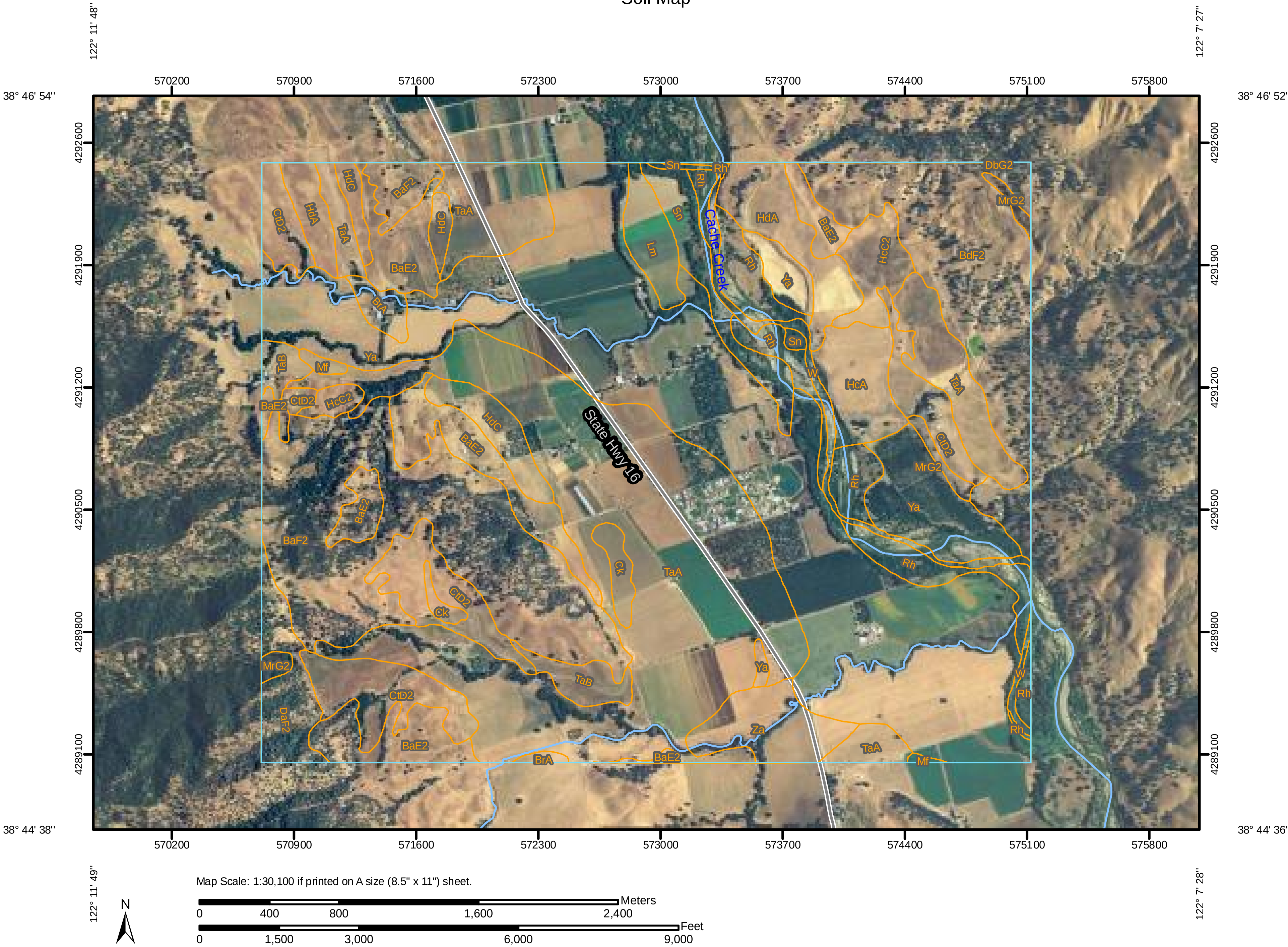
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

# Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

# Soil Map




Map Scale: 1:30,100 if printed on A size (8.5" x 11") sheet.

Meters: 0, 400, 800, 1,600, 2,400

Feet: 0, 1,500, 3,000, 6,000, 9,000

Appendix B

## MAP LEGEND

**Area of Interest (AOI)**
- Area of Interest (AOI)

**Soils**
- Soil Map Units

**Special Point Features**
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

**Special Line Features**
- Gully
- Short Steep Slope
- Other

**Political Features**
- Cities

**Water Features**
- Oceans
- Streams and Canals

**Transportation**
- Rails
- Interstate Highways
- US Routes
- Major Roads

## MAP INFORMATION

Map Scale: 1:30,100 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 10N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Yolo County, California
Survey Area Data: Version 7, Dec 12, 2007

Date(s) aerial images were photographed: 6/30/2005

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

# Map Unit Legend

| Yolo County, California (CA113) | | | |
|---|---|---|---|
| **Map Unit Symbol** | **Map Unit Name** | **Acres in AOI** | **Percent of AOI** |
| BaE2 | Balcom silty clay loam, 15 to 30 percent slopes, eroded | 222.4 | 5.9% |
| BaF2 | Balcom silty clay loam, 30 to 50 percent slopes, eroded | 413.1 | 11.0% |
| BdF2 | Balcom-Dibble complex, 30 to 50 percent slopes, eroded | 268.0 | 7.2% |
| BrA | Brentwood silty clay loam, 0 to 2 percent slopes | 22.2 | 0.6% |
| Ck | Clear Lake clay | 24.7 | 0.7% |
| CtD2 | Corning gravelly loam, 2 to 15 percent slopes, eroded | 207.0 | 5.5% |
| DaF2 | Dibble clay loam, 30 to 50 percent slopes, eroded | 59.7 | 1.6% |
| DbG2 | Dibble-Millsholm complex, 50 to 75 percent slopes, eroded | 0.1 | 0.0% |
| HcA | Hillgate loam, 0 to 2 percent slopes | 64.6 | 1.7% |
| HcC2 | Hillgate loam, 2 to 9 percent slopes, eroded | 55.3 | 1.5% |
| HdA | Hillgate loam, moderately deep, 0 to 2 percent slopes | 99.1 | 2.6% |
| HdC | Hillgate loam, moderately deep, 2 to 9 percent slopes | 63.6 | 1.7% |
| Lm | Loamy alluvial land | 39.1 | 1.0% |
| Mf | Marvin silty clay loam | 7.3 | 0.2% |
| MrG2 | Millsholm rocky loam, 15 to 75 percent slopes, eroded | 20.2 | 0.5% |
| Rh | Riverwash | 138.6 | 3.7% |
| Sn | Soboba gravelly sandy loam | 60.7 | 1.6% |
| TaA | Tehama loam, 0 to 2 percent slopes | 860.8 | 23.0% |
| TaB | Tehama loam, 2 to 5 percent slopes | 42.1 | 1.1% |
| W | Water | 40.6 | 1.1% |
| Ya | Yolo silt loam | 969.5 | 25.9% |
| Za | Zamora loam | 68.4 | 1.8% |
| **Totals for Area of Interest** | | **3,747.2** | **100.0%** |

# Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

# Yolo County, California

## BaE2—Balcom silty clay loam, 15 to 30 percent slopes, eroded

### Map Unit Setting

*Elevation:* 300 to feet
*Mean annual precipitation:* 17 to 20 inches
*Mean annual air temperature:* 61 to 63 degrees F
*Frost-free period:* 250 days

### Map Unit Composition

*Balcom and similar soils:* 85 percent
*Minor components:* 15 percent

### Description of Balcom

#### Setting

*Landform:* Hills
*Landform position (two-dimensional):* Backslope
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Concave
*Across-slope shape:* Convex
*Parent material:* Residuum weathered from calcareous sandstone

#### Properties and qualities

*Slope:* 15 to 30 percent
*Depth to restrictive feature:* 37 inches to paralithic bedrock
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high (0.20 to 0.57 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Calcium carbonate, maximum content:* 10 percent
*Maximum salinity:* Nonsaline (0.0 to 2.0 mmhos/cm)
*Available water capacity:* Moderate (about 6.8 inches)

#### Interpretive groups

*Land capability (nonirrigated):* 6e
*Ecological site:* Fine Loamy 9-13" p.z. (R015XE020CA)

#### Typical profile

*0 to 24 inches:* Silty clay loam
*24 to 37 inches:* Silty clay loam
*37 to 41 inches:* Weathered bedrock

### Minor Components

#### Dibble

*Percent of map unit:* 5 percent

#### Sehorn

*Percent of map unit:* 5 percent

#### Corning

*Percent of map unit:* 3 percent



Appendix B

**Positas**

*Percent of map unit:* 2 percent

## BaF2—Balcom silty clay loam, 30 to 50 percent slopes, eroded

**Map Unit Setting**

*Elevation:* 300 to 1,000 feet
*Mean annual precipitation:* 17 to 20 inches
*Mean annual air temperature:* 61 to 63 degrees F
*Frost-free period:* 250 days

**Map Unit Composition**

*Balcom and similar soils:* 85 percent
*Minor components:* 15 percent

**Description of Balcom**

**Setting**

*Landform:* Hills
*Landform position (two-dimensional):* Backslope
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Concave
*Across-slope shape:* Concave
*Parent material:* Residuum weathered from calcareous sandstone

**Properties and qualities**

*Slope:* 30 to 50 percent
*Depth to restrictive feature:* 37 inches to paralithic bedrock
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high (0.20 to 0.57 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Calcium carbonate, maximum content:* 10 percent
*Maximum salinity:* Nonsaline (0.0 to 2.0 mmhos/cm)
*Available water capacity:* Moderate (about 6.8 inches)

**Interpretive groups**

*Land capability (nonirrigated):* 7e
*Ecological site:* Fine Loamy 9-13" p.z. (R015XE020CA)

**Typical profile**

*0 to 24 inches:* Silty clay loam
*24 to 37 inches:* Silty clay loam
*37 to 41 inches:* Weathered bedrock

**Minor Components**

**Dibble**

*Percent of map unit:* 5 percent

**Positas**

*Percent of map unit:* 5 percent

**Sehorn**

*Percent of map unit:* 5 percent

## BdF2—Balcom-Dibble complex, 30 to 50 percent slopes, eroded

### Map Unit Setting

*Elevation:* 300 to 1,000 feet
*Mean annual precipitation:* 12 to 40 inches
*Mean annual air temperature:* 61 to 64 degrees F
*Frost-free period:* 150 to 250 days

### Map Unit Composition

*Balcom and similar soils:* 45 percent
*Dibble and similar soils:* 40 percent
*Minor components:* 14 percent

### Description of Balcom

**Setting**

*Landform:* Hills
*Landform position (two-dimensional):* Backslope
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Concave
*Across-slope shape:* Concave
*Parent material:* Residuum weathered from calcareous sandstone

**Properties and qualities**

*Slope:* 30 to 50 percent
*Depth to restrictive feature:* 20 to 40 inches to paralithic bedrock
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high (0.20 to 0.57 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Calcium carbonate, maximum content:* 10 percent
*Maximum salinity:* Nonsaline (0.0 to 2.0 mmhos/cm)
*Available water capacity:* Low (about 5.5 inches)

**Interpretive groups**

*Land capability (nonirrigated):* 7e
*Ecological site:* Fine Loamy 9-13" p.z. (R015XE020CA)

**Typical profile**

*0 to 20 inches:* Silty clay loam
*20 to 30 inches:* Silty clay loam
*30 to 34 inches:* Weathered bedrock

**Description of Dibble**

**Setting**

*Landform:* Hills
*Landform position (two-dimensional):* Backslope
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Concave
*Across-slope shape:* Convex
*Parent material:* Residuum weathered from siltstone

**Properties and qualities**

*Slope:* 30 to 50 percent
*Depth to restrictive feature:* 20 to 40 inches to paralithic bedrock
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately high (0.00 to 0.20 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water capacity:* Low (about 4.9 inches)

**Interpretive groups**

*Land capability (nonirrigated):* 7e
*Ecological site:* Fine Loamy 9-13" p.z. (R015XE020CA)

**Typical profile**

*0 to 4 inches:* Clay loam
*4 to 30 inches:* Silty clay
*30 to 34 inches:* Weathered bedrock

**Minor Components**

**Unnamed**

*Percent of map unit:* 14 percent

## BrA—Brentwood silty clay loam, 0 to 2 percent slopes

**Map Unit Setting**

*Elevation:* 50 to 400 feet
*Mean annual precipitation:* 12 to 20 inches
*Mean annual air temperature:* 61 to 63 degrees F
*Frost-free period:* 280 days

**Map Unit Composition**

*Brentwood and similar soils:* 85 percent
*Minor components:* 15 percent

**Description of Brentwood**

**Setting**

*Landform:* Alluvial fans
*Landform position (two-dimensional):* Toeslope
*Landform position (three-dimensional):* Base slope
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Alluvium derived from sedimentary rock

**Properties and qualities**

*Slope:* 0 to 2 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high (0.20 to 0.57 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline (0.0 to 2.0 mmhos/cm)
*Available water capacity:* High (about 10.8 inches)

**Interpretive groups**

*Land capability classification (irrigated):* 1
*Land capability (nonirrigated):* 4c

**Typical profile**

*0 to 10 inches:* Silty clay loam
*10 to 35 inches:* Silty clay loam
*35 to 60 inches:* Silty clay loam

**Minor Components**

**Yolo**

*Percent of map unit:* 5 percent

**Zamora**

*Percent of map unit:* 5 percent

**Rincon**

*Percent of map unit:* 3 percent

**Myers**

*Percent of map unit:* 2 percent

## Ck—Clear Lake clay

**Map Unit Setting**

*Elevation:* 10 to 400 feet
*Mean annual precipitation:* 10 to 35 inches
*Mean annual air temperature:* 57 to 63 degrees F
*Frost-free period:* 200 to 360 days

**Map Unit Composition**

*Clear lake and similar soils:* 85 percent
*Minor components:* 15 percent

**Description of Clear Lake**

**Setting**

*Landform:* Basin floors
*Landform position (two-dimensional):* Toeslope
*Landform position (three-dimensional):* Talf
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Alluvium derived from sedimentary rock

**Properties and qualities**

*Slope:* 0 to 2 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Poorly drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* Rare
*Frequency of ponding:* None
*Calcium carbonate, maximum content:* 5 percent
*Maximum salinity:* Nonsaline to slightly saline (0.0 to 8.0 mmhos/cm)
*Sodium adsorption ratio, maximum:* 5.0
*Available water capacity:* High (about 10.0 inches)

**Interpretive groups**

*Land capability classification (irrigated):* 2w
*Land capability (nonirrigated):* 4w

**Typical profile**

*0 to 25 inches:* Clay
*25 to 60 inches:* Clay

**Minor Components**

**Capay**

*Percent of map unit:* 3 percent
*Landform:* Basin floors

**Riz**

*Percent of map unit:* 3 percent
*Landform:* Terraces

**Sacramento**

*Percent of map unit:* 3 percent
*Landform:* Basin floors

**Willows**

*Percent of map unit:* 3 percent
*Landform:* Basin floors

**Willows variant**

*Percent of map unit:* 3 percent

## CtD2—Corning gravelly loam, 2 to 15 percent slopes, eroded

**Map Unit Setting**

*Elevation:* 120 to 600 feet
*Mean annual precipitation:* 16 to 30 inches
*Mean annual air temperature:* 61 to 63 degrees F
*Frost-free period:* 250 to 280 days

**Map Unit Composition**

*Corning and similar soils:* 85 percent
*Minor components:* 15 percent

**Description of Corning**

**Setting**

*Landform:* Terraces
*Landform position (two-dimensional):* Footslope
*Landform position (three-dimensional):* Tread
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Mixed gravelly alluvium derived from sedimentary rock

**Properties and qualities**

*Slope:* 2 to 15 percent
*Depth to restrictive feature:* 14 inches to abrupt textural change
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.06 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water capacity:* Very low (about 1.7 inches)

**Interpretive groups**

*Land capability (nonirrigated):* 4e
*Ecological site:* CLAYPAN (R015XE087CA)

**Typical profile**

*0 to 14 inches:* Gravelly loam
*14 to 27 inches:* Clay
*27 to 60 inches:* Very gravelly clay

**Minor Components**

**Hillgate**

*Percent of map unit:* 5 percent

**Positas**

*Percent of map unit:* 5 percent

**Balcom**

*Percent of map unit:* 3 percent

**Sehorn**

*Percent of map unit:* 2 percent

## DaF2—Dibble clay loam, 30 to 50 percent slopes, eroded

### Map Unit Setting

*Elevation:* 500 to 2,000 feet
*Mean annual precipitation:* 12 to 40 inches
*Mean annual air temperature:* 61 to 64 degrees F
*Frost-free period:* 150 to 250 days

### Map Unit Composition

*Dibble and similar soils:* 85 percent
*Minor components:* 15 percent

### Description of Dibble

**Setting**

*Landform:* Hills
*Landform position (two-dimensional):* Backslope
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Convex
*Across-slope shape:* Convex
*Parent material:* Residuum weathered from siltstone

**Properties and qualities**

*Slope:* 30 to 50 percent
*Depth to restrictive feature:* 20 to 40 inches to paralithic bedrock
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately high (0.00 to 0.20 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water capacity:* Low (about 4.9 inches)

**Interpretive groups**

*Land capability (nonirrigated):* 6e
*Ecological site:* Fine Loamy 9-13" p.z. (R015XE020CA)

**Typical profile**

*0 to 4 inches:* Clay loam
*4 to 30 inches:* Silty clay
*30 to 34 inches:* Weathered bedrock

**Minor Components**

**Balcom**

*Percent of map unit:* 5 percent

**Millsholm**

*Percent of map unit:* 5 percent

**Sehorn**

*Percent of map unit:* 3 percent

**Positas**

*Percent of map unit:* 2 percent

## DbG2—Dibble-Millsholm complex, 50 to 75 percent slopes, eroded

**Map Unit Setting**

*Elevation:* 500 to 2,000 feet
*Mean annual precipitation:* 12 to 50 inches
*Mean annual air temperature:* 57 to 64 degrees F
*Frost-free period:* 130 to 330 days

**Map Unit Composition**

*Dibble and similar soils:* 60 percent
*Millsholm and similar soils:* 30 percent
*Minor components:* 10 percent

**Description of Dibble**

**Setting**

*Landform:* Hills
*Landform position (two-dimensional):* Backslope
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Concave
*Across-slope shape:* Concave
*Parent material:* Residuum weathered from siltstone

**Properties and qualities**

*Slope:* 50 to 75 percent
*Depth to restrictive feature:* 30 inches to paralithic bedrock
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately high (0.00 to 0.20 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water capacity:* Low (about 4.9 inches)

**Interpretive groups**

*Land capability (nonirrigated):* 7e
*Ecological site:* Shallow Loamy Hills 13-18" P.Z. (R015XE083CA)

**Typical profile**

*0 to 4 inches:* Clay loam
*4 to 30 inches:* Silty clay
*30 to 39 inches:* Weathered bedrock

### Description of Millsholm

**Setting**

*Landform:* Hills
*Landform position (two-dimensional):* Backslope
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Concave
*Across-slope shape:* Convex
*Parent material:* Residuum weathered from sedimentary rock

**Properties and qualities**

*Slope:* 50 to 75 percent
*Depth to restrictive feature:* 19 inches to lithic bedrock
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.20 to 1.98 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water capacity:* Very low (about 2.7 inches)

**Interpretive groups**

*Land capability (nonirrigated):* 7e
*Ecological site:* Shallow Loamy Hills 13-18" P.Z. (R015XE083CA)

**Typical profile**

*0 to 4 inches:* Loam
*4 to 19 inches:* Stony loam
*19 to 23 inches:* Unweathered bedrock

### Minor Components

**Rock land**

*Percent of map unit:* 10 percent

## HcA—Hillgate loam, 0 to 2 percent slopes

### Map Unit Setting

*Elevation:* 10 to 350 feet
*Mean annual precipitation:* 22 inches
*Mean annual air temperature:* 64 degrees F
*Frost-free period:* 280 days

### Map Unit Composition

*Hillgate and similar soils:* 85 percent

*Minor components:* 15 percent

**Description of Hillgate**

**Setting**

*Landform:* Terraces
*Landform position (two-dimensional):* Footslope
*Landform position (three-dimensional):* Tread
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Mixed alluvium

**Properties and qualities**

*Slope:* 0 to 2 percent
*Depth to restrictive feature:* 15 inches to abrupt textural change
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.06 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water capacity:* Very low (about 2.2 inches)

**Interpretive groups**

*Land capability classification (irrigated):* 3s
*Land capability (nonirrigated):* 4s

**Typical profile**

*0 to 15 inches:* Loam
*15 to 39 inches:* Clay
*39 to 70 inches:* Clay loam

**Minor Components**

**Tehama**

*Percent of map unit:* 7 percent

**Corning**

*Percent of map unit:* 5 percent

**San ysidro**

*Percent of map unit:* 3 percent

## HcC2—Hillgate loam, 2 to 9 percent slopes, eroded

**Map Unit Setting**

*Elevation:* 10 to 350 feet
*Mean annual precipitation:* 22 inches
*Mean annual air temperature:* 64 degrees F
*Frost-free period:* 280 days

**Map Unit Composition**

*Hillgate and similar soils:* 85 percent
*Minor components:* 15 percent

**Description of Hillgate**

**Setting**

*Landform:* Terraces
*Landform position (two-dimensional):* Footslope
*Landform position (three-dimensional):* Tread
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Mixed alluvium

**Properties and qualities**

*Slope:* 2 to 9 percent
*Depth to restrictive feature:* 11 inches to abrupt textural change
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.06 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water capacity:* Very low (about 1.7 inches)

**Interpretive groups**

*Land capability classification (irrigated):* 3e
*Land capability (nonirrigated):* 4e

**Typical profile**

*0 to 11 inches:* Loam
*11 to 30 inches:* Clay
*30 to 70 inches:* Clay loam

**Minor Components**

**Tehama**

*Percent of map unit:* 7 percent

**Corning**

*Percent of map unit:* 5 percent

**San ysidro**

*Percent of map unit:* 3 percent

## HdA—Hillgate loam, moderately deep, 0 to 2 percent slopes

**Map Unit Setting**

*Elevation:* 10 to 350 feet
*Mean annual precipitation:* 22 inches
*Mean annual air temperature:* 64 degrees F

*Frost-free period:* 280 days

**Map Unit Composition**

*Hillgate and similar soils:* 85 percent
*Minor components:* 15 percent

**Description of Hillgate**

**Setting**

*Landform:* Terraces
*Landform position (two-dimensional):* Footslope
*Landform position (three-dimensional):* Tread
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Mixed alluvium

**Properties and qualities**

*Slope:* 0 to 2 percent
*Depth to restrictive feature:* 25 inches to abrupt textural change
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.06 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water capacity:* Low (about 3.8 inches)

**Interpretive groups**

*Land capability classification (irrigated):* 3s
*Land capability (nonirrigated):* 4s

**Typical profile**

*0 to 25 inches:* Loam
*25 to 39 inches:* Clay
*39 to 70 inches:* Clay loam

**Minor Components**

**Tehama**

*Percent of map unit:* 10 percent

**San ysidro**

*Percent of map unit:* 5 percent

## HdC—Hillgate loam, moderately deep, 2 to 9 percent slopes

**Map Unit Setting**

*Elevation:* 10 to 350 feet
*Mean annual precipitation:* 22 inches
*Mean annual air temperature:* 64 degrees F
*Frost-free period:* 280 days

**Map Unit Composition**

*Hillgate and similar soils:* 85 percent
*Minor components:* 15 percent

**Description of Hillgate**

**Setting**

*Landform:* Terraces
*Landform position (two-dimensional):* Footslope
*Landform position (three-dimensional):* Tread
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Mixed alluvium

**Properties and qualities**

*Slope:* 2 to 9 percent
*Depth to restrictive feature:* 25 inches to abrupt textural change
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.06 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water capacity:* Low (about 3.8 inches)

**Interpretive groups**

*Land capability classification (irrigated):* 3e
*Land capability (nonirrigated):* 4e

**Typical profile**

*0 to 25 inches:* Loam
*25 to 39 inches:* Clay
*39 to 70 inches:* Clay loam

**Minor Components**

**Corning**

*Percent of map unit:* 5 percent

**Tehama**

*Percent of map unit:* 5 percent

**San ysidro**

*Percent of map unit:* 3 percent

**Sehorn**

*Percent of map unit:* 2 percent

## Lm—Loamy alluvial land

**Map Unit Setting**

*Elevation:* 30 to 400 feet

*Mean annual precipitation:* 14 inches
*Mean annual air temperature:* 61 degrees F
*Frost-free period:* 270 days

**Map Unit Composition**

*Loamy alluvial land:* 85 percent
*Minor components:* 15 percent

**Description of Loamy Alluvial Land**

**Setting**

*Landform:* Flood plains
*Landform position (two-dimensional):* Toeslope
*Landform position (three-dimensional):* Talf
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Mixed alluvium

**Properties and qualities**

*Slope:* 0 to 2 percent
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* High (1.98 to 5.95 in/hr)
*Depth to water table:* About 36 to 72 inches
*Frequency of flooding:* Rare
*Maximum salinity:* Nonsaline (0.0 to 2.0 mmhos/cm)
*Available water capacity:* Moderate (about 6.7 inches)

**Interpretive groups**

*Land capability classification (irrigated):* 4s
*Land capability (nonirrigated):* 4s

**Typical profile**

*0 to 10 inches:* Gravelly sandy loam
*10 to 30 inches:* Stratified sand to gravelly loam
*30 to 60 inches:* Stratified gravelly sand to gravelly loam

**Minor Components**

**Unnamed**

*Percent of map unit:* 4 percent
*Landform:* Alluvial fans

**Rieff**

*Percent of map unit:* 4 percent

**Soboba**

*Percent of map unit:* 4 percent

**Yolo**

*Percent of map unit:* 3 percent

## Mf—Marvin silty clay loam

**Map Unit Setting**

*Elevation:* 20 to 100 feet
*Mean annual precipitation:* 20 inches
*Mean annual air temperature:* 63 degrees F
*Frost-free period:* 280 days

**Map Unit Composition**

*Marvin and similar soils:* 85 percent
*Minor components:* 15 percent

**Description of Marvin**

**Setting**

*Landform:* Rims on basin floors
*Landform position (two-dimensional):* Toeslope
*Landform position (three-dimensional):* Rise, talf
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Mixed silty and clayey alluvium

**Properties and qualities**

*Slope:* 0 to 1 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Somewhat poorly drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* Rare
*Frequency of ponding:* None
*Calcium carbonate, maximum content:* 5 percent
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
*Available water capacity:* High (about 10.5 inches)

**Interpretive groups**

*Land capability classification (irrigated):* 2s
*Land capability (nonirrigated):* 4s

**Typical profile**

*0 to 12 inches:* Silty clay loam
*12 to 41 inches:* Silty clay
*41 to 60 inches:* Silty clay loam

**Minor Components**

**Capay**

*Percent of map unit:* 5 percent
*Landform:* Rims

**Rincon**

*Percent of map unit:* 5 percent

**Pescadero**

*Percent of map unit:* 3 percent

**Unnamed**

*Percent of map unit:* 2 percent

## MrG2—Millsholm rocky loam, 15 to 75 percent slopes, eroded

**Map Unit Setting**

*Elevation:* 500 to 2,500 feet
*Mean annual precipitation:* 12 to 50 inches
*Mean annual air temperature:* 57 to 63 degrees F
*Frost-free period:* 130 to 330 days

**Map Unit Composition**

*Millsholm and similar soils:* 75 percent
*Minor components:* 25 percent

**Description of Millsholm**

**Setting**

*Landform:* Hills
*Landform position (two-dimensional):* Backslope
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Concave
*Across-slope shape:* Concave
*Parent material:* Residuum weathered from sedimentary rock

**Properties and qualities**

*Slope:* 15 to 75 percent
*Depth to restrictive feature:* 19 inches to lithic bedrock
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.20 to 1.98 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water capacity:* Very low (about 2.7 inches)

**Interpretive groups**

*Land capability (nonirrigated):* 7e
*Ecological site:* Shallow Loamy Hills 13-18" P.Z. (R015XE083CA)

**Typical profile**

*0 to 4 inches:* Loam
*4 to 19 inches:* Stony loam
*19 to 23 inches:* Unweathered bedrock

**Minor Components**

**Rock outcrop**

*Percent of map unit:* 10 percent

**Balcom**

*Percent of map unit:* 5 percent

**Dibble**

*Percent of map unit:* 3 percent

**Rock land**

*Percent of map unit:* 3 percent

**Corning**

*Percent of map unit:* 2 percent

**Positas**

*Percent of map unit:* 2 percent

## Rh—Riverwash

**Map Unit Setting**

*Elevation:* 0 to 500 feet
*Mean annual precipitation:* 17 to 20 inches
*Frost-free period:* 230 to 280 days

**Map Unit Composition**

*Riverwash:* 85 percent
*Minor components:* 15 percent

**Description of Riverwash**

**Setting**

*Landform:* Channels on streams
*Landform position (two-dimensional):* Toeslope
*Landform position (three-dimensional):* Talf
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Mixed sandy and gravelly alluvium

**Properties and qualities**

*Slope:* 0 to 2 percent
*Drainage class:* Excessively drained
*Capacity of the most limiting layer to transmit water (Ksat):* High to very high (5.95 to 19.98 in/hr)
*Frequency of flooding:* Frequent
*Available water capacity:* Very low (about 2.9 inches)

**Interpretive groups**

*Land capability (nonirrigated):* 8

**Typical profile**
*0 to 6 inches:* Gravelly sand
*6 to 60 inches:* Stratified gravelly coarse sand to sandy loam

**Minor Components**

**Loamy alluvial land**
*Percent of map unit:* 10 percent

**Soboba**
*Percent of map unit:* 5 percent

## Sn—Soboba gravelly sandy loam

**Map Unit Setting**
*Elevation:* 30 to 400 feet
*Mean annual precipitation:* 10 to 20 inches
*Mean annual air temperature:* 61 to 63 degrees F
*Frost-free period:* 175 to 250 days

**Map Unit Composition**
*Soboba and similar soils:* 85 percent
*Minor components:* 15 percent

**Description of Soboba**

**Setting**
*Landform:* Alluvial fans
*Landform position (two-dimensional):* Toeslope
*Landform position (three-dimensional):* Base slope
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Recent sandy and gravelly alluvium derived from igneous rock

**Properties and qualities**
*Slope:* 0 to 1 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Excessively drained
*Capacity of the most limiting layer to transmit water (Ksat):* High to very high (5.95 to 19.98 in/hr)
*Depth to water table:* About 36 to 60 inches
*Frequency of flooding:* Rare
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline (0.0 to 2.0 mmhos/cm)
*Available water capacity:* Very low (about 2.0 inches)

**Interpretive groups**
*Land capability classification (irrigated):* 4s
*Land capability (nonirrigated):* 4s

**Typical profile**

*0 to 4 inches:* Gravelly sandy loam
*4 to 60 inches:* Stratified very cobbly sand to very gravelly loamy sand

**Minor Components**

**Loamy alluvial land**

*Percent of map unit:* 3 percent

**Arbuckle**

*Percent of map unit:* 3 percent

**Reiff, sandy loam**

*Percent of map unit:* 3 percent

**Riverwash**

*Percent of map unit:* 3 percent
*Landform:* Channels

**Reiff, gravelly loam**

*Percent of map unit:* 3 percent

## TaA—Tehama loam, 0 to 2 percent slopes

**Map Unit Setting**

*Elevation:* 50 to 500 feet
*Mean annual precipitation:* 15 to 35 inches
*Mean annual air temperature:* 63 degrees F
*Frost-free period:* 265 days

**Map Unit Composition**

*Tehama and similar soils:* 85 percent
*Minor components:* 15 percent

**Description of Tehama**

**Setting**

*Landform:* Alluvial fans
*Landform position (two-dimensional):* Toeslope
*Landform position (three-dimensional):* Base slope
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Mixed alluvium

**Properties and qualities**

*Slope:* 0 to 2 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None

*Frequency of ponding:* None
*Maximum salinity:* Nonsaline (0.0 to 2.0 mmhos/cm)
*Available water capacity:* High (about 10.3 inches)

**Interpretive groups**
*Land capability classification (irrigated):* 2s
*Land capability (nonirrigated):* 4s

**Typical profile**
*0 to 10 inches:* Loam
*10 to 40 inches:* Clay loam
*40 to 63 inches:* Gravelly loam

### Minor Components

**Zamora**
*Percent of map unit:* 4 percent

**Yolo**
*Percent of map unit:* 4 percent

**Brentwood**
*Percent of map unit:* 4 percent

**Rincon**
*Percent of map unit:* 3 percent

## TaB—Tehama loam, 2 to 5 percent slopes

### Map Unit Setting
*Elevation:* 50 to 500 feet
*Mean annual precipitation:* 15 to 35 inches
*Mean annual air temperature:* 63 degrees F
*Frost-free period:* 265 days

### Map Unit Composition
*Tehama and similar soils:* 85 percent
*Minor components:* 15 percent

### Description of Tehama

**Setting**
*Landform:* Alluvial fans
*Landform position (two-dimensional):* Toeslope
*Landform position (three-dimensional):* Base slope
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Mixed alluvium

**Properties and qualities**
*Slope:* 2 to 5 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Well drained

*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline (0.0 to 2.0 mmhos/cm)
*Available water capacity:* Moderate (about 7.3 inches)

**Interpretive groups**

*Land capability classification (irrigated):* 2e
*Land capability (nonirrigated):* 4e

**Typical profile**

*0 to 10 inches:* Loam
*10 to 40 inches:* Clay loam

**Minor Components**

**Rincon**

*Percent of map unit:* 10 percent

**Unnmamed**

*Percent of map unit:* 5 percent

## W—Water

**Map Unit Composition**

*Water:* 100 percent

## Ya—Yolo silt loam

**Map Unit Setting**

*Elevation:* 30 to 400 feet
*Mean annual precipitation:* 16 to 22 inches
*Mean annual air temperature:* 61 degrees F
*Frost-free period:* 270 days

**Map Unit Composition**

*Yolo and similar soils:* 85 percent
*Minor components:* 14 percent

**Description of Yolo**

**Setting**

*Landform:* Alluvial fans
*Landform position (two-dimensional):* Toeslope
*Landform position (three-dimensional):* Base slope
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Fine-loamy alluvium derived from sedimentary rock

**Properties and qualities**

*Slope:* 0 to 1 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.57 to 1.98 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline (0.0 to 2.0 mmhos/cm)
*Available water capacity:* High (about 11.0 inches)

**Interpretive groups**

*Land capability classification (irrigated):* 1
*Land capability (nonirrigated):* 4c

**Typical profile**

*0 to 26 inches:* Silt loam
*26 to 65 inches:* Silt loam

**Minor Components**

**Sycamore**

*Percent of map unit:* 2 percent
*Landform:* Alluvial fans

**Zamora**

*Percent of map unit:* 2 percent

**Soboba**

*Percent of map unit:* 2 percent

**Reiff**

*Percent of map unit:* 2 percent

**Loamy alluvial land**

*Percent of map unit:* 2 percent

**Brentwood**

*Percent of map unit:* 2 percent

**Arbuckle**

*Percent of map unit:* 2 percent

## Za—Zamora loam

**Map Unit Setting**

*Elevation:* 30 to 400 feet
*Mean annual precipitation:* 22 inches
*Mean annual air temperature:* 61 degrees F
*Frost-free period:* 250 to 330 days

**Map Unit Composition**

*Zamora and similar soils:* 85 percent
*Minor components:* 15 percent

**Description of Zamora**

**Setting**

*Landform:* Alluvial fans
*Landform position (two-dimensional):* Toeslope
*Landform position (three-dimensional):* Base slope
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Mixed alluvium derived from sedimentary rock

**Properties and qualities**

*Slope:* 0 to 1 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high (0.20 to 0.57 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline (0.0 to 2.0 mmhos/cm)
*Available water capacity:* High (about 10.2 inches)

**Interpretive groups**

*Land capability classification (irrigated):* 1
*Land capability (nonirrigated):* 4c

**Typical profile**

*0 to 10 inches:* Loam
*10 to 40 inches:* Clay loam
*40 to 51 inches:* Loam
*51 to 60 inches:* Gravelly loam

**Minor Components**

**Rincon**

*Percent of map unit:* 4 percent

**Tehama**

*Percent of map unit:* 4 percent

**Brentwood**

*Percent of map unit:* 4 percent

**Yolo**

*Percent of map unit:* 3 percent

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SURFACE IRRIGATION
IRRIGATION TRAINING AND RESEARCH CENTER
CALIFORNIA POLYTECHNIC STATE UNIVERSITY, SAN LUIS OBISPO

| 1997 (Typical Year) | January | February | March | April | May | June | July | August | September | October | November | December | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | inches | inches | inches | inches | inches | inches | inches | inches | inches | inches | inches | inches | inches |
| Precipitation | 8.22 | 0.28 | 0.81 | 0.3 | 0.44 | 0.35 | 0.09 | 0.31 | 0.31 | 0.82 | 4.92 | 2.74 | 19.59 |
| Grass Reference ETo | 0.73 | 2.36 | 4.13 | 5.82 | 7.62 | 8 | 8.36 | 7.11 | 5.82 | 3.86 | 1.25 | 1.14 | 56.22 |
| | | | | | | | | | | | | | |
| Apple, Pear, Cherry, Plum and Prune | 0.86 | 0.92 | 1.22 | 2.58 | 6.85 | 7.83 | 8.18 | 6.94 | 5.45 | 2.96 | 0.6 | 1.06 | 45.45 |
| Apples, Plums, Cherries etc w/covercrop | 0.88 | 2.56 | 3.87 | 4.91 | 8.21 | 9.5 | 9.78 | 8.29 | 6.66 | 4.1 | 1.09 | 1.42 | 61.27 |
| Peach, Nectarine and Apricots | 0.86 | 0.92 | 1.24 | 2.37 | 6.68 | 7.93 | 7.99 | 7 | 5.47 | 2.74 | 0.61 | 1.06 | 44.86 |
| Immature Peaches, Nectarines, etc | 0.86 | 0.93 | 1 | 1.34 | 4.24 | 5.04 | 5.11 | 4.55 | 3.41 | 1.88 | 0.61 | 1.06 | 30.03 |
| Almonds | 0.86 | 0.92 | 1.45 | 3.16 | 7.03 | 7.72 | 7.72 | 6.63 | 5.21 | 2.85 | 0.6 | 1.06 | 45.19 |
| Almonds w/covercrop | 0.88 | 2.26 | 3.31 | 4.84 | 8.06 | 8.9 | 9.03 | 7.75 | 5.96 | 3.53 | 1.01 | 1.37 | 56.91 |
| Immature Almonds | 0.86 | 0.93 | 1.2 | 2.29 | 5.23 | 5.7 | 5.82 | 5.09 | 3.79 | 2.06 | 0.61 | 1.06 | 34.62 |
| Walnuts | 0.86 | 0.92 | 1.38 | 1.94 | 6.3 | 9.13 | 9.35 | 8.05 | 5.98 | 3.22 | 0.71 | 1.06 | 48.91 |
| Pistachio | 0.86 | 0.92 | 0.76 | 1.27 | 2.97 | 6.53 | 8.93 | 7.49 | 5.89 | 3.2 | 0.66 | 1.06 | 40.52 |
| Pistachio w/ covercrop | 0.88 | 2.26 | 3.13 | 3.99 | 5.9 | 8.22 | 9.65 | 8.28 | 6.76 | 4.14 | 1.15 | 1.37 | 55.75 |
| Immature Pistachio | 0.86 | 0.93 | 0.76 | 0.79 | 1.87 | 4.43 | 6.19 | 5.31 | 4.22 | 2.43 | 0.66 | 1.06 | 29.49 |
| Misc. Deciduous | 0.86 | 0.92 | 1.22 | 2.49 | 6.54 | 7.49 | 7.77 | 6.76 | 5.34 | 2.66 | 0.6 | 1.06 | 43.71 |
| Grain and Grain Hay | 0.88 | 2.52 | 4.55 | 6.43 | 4.14 | 0.38 | 0.1 | 0.33 | 0.31 | 0.81 | 0.64 | 1.15 | 22.24 |
| Rice | 0.86 | 0.92 | 0.76 | 0.89 | 7.49 | 9.76 | 10.35 | 8.76 | 3.23 | 0.81 | 0.64 | 1.06 | 45.52 |
| Cotton | 0.86 | 0.92 | 0.76 | 1.09 | 1.98 | 5.19 | 8.91 | 7.77 | 5.95 | 2.26 | 0.64 | 1.05 | 37.38 |
| Safflower and Sunflower | 0.88 | 1.22 | 2.17 | 5.52 | 8.8 | 8.21 | 1.28 | 0.33 | 0.31 | 0.81 | 0.64 | 1.06 | 31.21 |
| Corn and Grain Sorghum | 0.86 | 0.92 | 1.75 | 1.6 | 2.84 | 7.55 | 8.66 | 6.18 | 0.83 | 0.81 | 0.64 | 1.05 | 33.7 |
| Misc. field crops | 0.86 | 0.92 | 1.75 | 1.6 | 2.87 | 7.63 | 8.26 | 3 | 0.31 | 0.81 | 0.64 | 1.05 | 29.71 |
| Alfalfa Hay and Clover | 0.88 | 2.5 | 4.29 | 5.23 | 6.99 | 7.52 | 7.51 | 6.29 | 5.37 | 2.44 | 1.07 | 1.35 | 51.44 |
| Pasture and Misc. Grasses | 0.86 | 1.54 | 2.69 | 4.89 | 7.59 | 8.09 | 8.36 | 7.25 | 5.75 | 3.28 | 0.92 | 1.06 | 52.27 |
| Small Vegetables | 0.88 | 1.65 | 4.09 | 6.28 | 2.29 | 0.36 | 0.1 | 1.45 | 1.91 | 1.75 | 1 | 1.33 | 23.07 |
| Tomatoes and Peppers | 0.86 | 0.92 | 1.5 | 1.11 | 4.05 | 8.73 | 7.24 | 0.8 | 0.31 | 0.81 | 0.64 | 1.05 | 28.03 |
| Potatoes, Sugar beets, Turnip etc.. | 0.86 | 1.27 | 2.69 | 6.19 | 8.55 | 8.89 | 7.75 | 0.4 | 0.31 | 0.81 | 0.64 | 1.05 | 39.41 |
| Melons, Squash, and Cucumbers | 0.86 | 0.92 | 0.76 | 0.31 | 1.23 | 1.66 | 5.33 | 5.98 | 1.92 | 0.81 | 0.64 | 1.05 | 21.47 |
| Onions and Garlic | 0.88 | 2.3 | 3.78 | 5.33 | 5.29 | 1 | 0.11 | 0.33 | 0.31 | 0.81 | 1.25 | 1.15 | 22.52 |
| Strawberries | 0.86 | 0.92 | 1.75 | 1.6 | 2.87 | 7.63 | 8.26 | 3 | 0.31 | 0.81 | 0.64 | 1.05 | 29.71 |
| Flowers, Nursery and Christmas Tree | 0.86 | 0.92 | 1.22 | 2.49 | 6.54 | 7.49 | 7.77 | 6.76 | 5.34 | 2.66 | 0.6 | 1.06 | 43.71 |
| Citrus (no ground cover) | 0.88 | 2.36 | 3.56 | 4.55 | 5.81 | 6.09 | 6.08 | 5.33 | 4.33 | 3.46 | 1.12 | 1.4 | 44.98 |
| Immature Citrus | 0.88 | 1.6 | 2.23 | 2.83 | 3.61 | 3.9 | 3.73 | 3.51 | 2.78 | 2.54 | 0.88 | 1.24 | 29.73 |
| Avocado | 0.86 | 0.92 | 1.22 | 2.49 | 6.54 | 7.49 | 7.77 | 6.76 | 5.34 | 2.66 | 0.6 | 1.06 | 43.71 |
| Misc Subtropical | 0.86 | 0.92 | 1.22 | 2.49 | 6.54 | 7.49 | 7.77 | 6.76 | 5.34 | 2.66 | 0.6 | 1.06 | 43.71 |
| Grape Vines with 80% canopy | 0.86 | 0.93 | 0.94 | 1.28 | 3.83 | 6.58 | 6.78 | 5.38 | 3.27 | 0.83 | 0.61 | 1.06 | 32.34 |
| Grape Vines with cover crop (80% canopy) | 0.88 | 2.04 | 2.92 | 3.2 | 5.89 | 7.49 | 7.53 | 6.28 | 4.06 | 2.41 | 0.8 | 1.33 | 44.82 |
| Immature Grapes Vines with 50% canopy | 0.86 | 0.93 | 0.88 | 0.94 | 2.89 | 4.9 | 4.74 | 4.13 | 2.25 | 0.83 | 0.61 | 1.05 | 25.01 |
| Idle | 0.86 | 0.92 | 0.76 | 0.31 | 0.44 | 0.36 | 0.1 | 0.33 | 0.31 | 0.81 | 0.65 | 1.05 | 6.9 |

SPRINKLER IRRIGATION
IRRIGATION TRAINING AND RESEARCH CENTER
CALIFORNIA POLYTECHNIC STATE UNIVERSITY, SAN LUIS OBISPO

| 1997 (Typical Year) | January | February | March | April | May | June | July | August | September | October | November | December | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | inches | inches | inches | inches | inches | inches | inches | inches | inches | inches | inches | inches | inches |
| Precipitation | 8.22 | 0.28 | 0.81 | 0.3 | 0.44 | 0.35 | 0.09 | 0.31 | 0.31 | 0.82 | 4.92 | 2.74 | 19.59 |
| Grass Reference ETo | 0.73 | 2.36 | 4.13 | 5.82 | 7.62 | 8 | 8.36 | 7.11 | 5.82 | 3.86 | 1.25 | 1.14 | 56.22 |
| | | | | | | | | | | | | | |
| Apple, Pear, Cherry, Plum and Prune | 0.86 | 0.92 | 1.45 | 3.23 | 6.92 | 7.33 | 7.86 | 6.65 | 5.17 | 2.62 | 0.6 | 1.06 | 44.67 |
| Apples, Plums, Cherries etc w/covercrop | 0.88 | 2.56 | 3.81 | 4.82 | 7.96 | 9.17 | 9.46 | 7.96 | 6.54 | 3.75 | 1.05 | 1.42 | 59.37 |
| Peach, Nectarine and Apricots | 0.86 | 0.92 | 1.24 | 2.37 | 6.26 | 7.6 | 7.8 | 6.77 | 5.37 | 2.7 | 0.61 | 1.06 | 43.56 |
| Immature Peaches, Nectarines, etc | 0.86 | 0.93 | 1 | 1.34 | 4.4 | 5.39 | 5.37 | 4.72 | 3.71 | 2.04 | 0.61 | 1.06 | 31.42 |
| Almonds | 0.86 | 0.92 | 1.45 | 3.12 | 5.78 | 7.03 | 7.02 | 5.74 | 4.84 | 2.41 | 0.61 | 1.06 | 40.83 |
| Almonds w/covercrop | 0.88 | 2.26 | 3.17 | 4.15 | 7.79 | 7.9 | 7.81 | 6.76 | 5.34 | 3.57 | 0.98 | 1.37 | 51.98 |
| Immature Almonds | 0.86 | 0.93 | 1.2 | 2.37 | 5.57 | 5.87 | 5.94 | 5.22 | 3.96 | 2.28 | 0.61 | 1.06 | 35.88 |
| Walnuts | 0.86 | 0.92 | 1.58 | 2.44 | 7 | 9.13 | 9.43 | 8 | 5.96 | 3.12 | 0.65 | 1.06 | 50.15 |
| Pistachio | 0.86 | 0.92 | 0.76 | 1.27 | 3.01 | 6.55 | 8.91 | 7.49 | 5.9 | 3.25 | 0.66 | 1.06 | 40.65 |
| Pistachio w/ covercrop | 0.88 | 2.26 | 3.13 | 4.14 | 6.17 | 8.39 | 9.61 | 8.25 | 6.73 | 4.32 | 1.14 | 1.37 | 56.41 |
| Immature Pistachio | 0.86 | 0.93 | 0.76 | 0.79 | 1.9 | 4.76 | 6.4 | 5.6 | 4.39 | 2.23 | 0.63 | 1.06 | 30.32 |
| Misc. Deciduous | 0.86 | 0.92 | 1.45 | 3.12 | 6.54 | 7.07 | 7.54 | 6.47 | 4.92 | 2.7 | 0.6 | 1.06 | 43.26 |
| Grain and Grain Hay | 0.88 | 2.52 | 4.55 | 6.43 | 4.14 | 0.38 | 0.1 | 0.33 | 0.31 | 0.81 | 0.64 | 1.15 | 22.24 |
| Cotton | 0.86 | 0.92 | 0.76 | 0.98 | 1.56 | 5.25 | 8.88 | 7.78 | 5.93 | 2.21 | 0.64 | 1.06 | 36.83 |
| Safflower and Sunflower | 0.88 | 1.22 | 2.17 | 5.52 | 8.8 | 8.21 | 1.28 | 0.33 | 0.31 | 0.81 | 0.64 | 1.06 | 31.21 |
| Corn and Grain Sorghum | 0.86 | 0.92 | 1.75 | 1.32 | 2.93 | 7.52 | 8.65 | 5.67 | 0.65 | 0.81 | 0.64 | 1.06 | 32.78 |
| Misc. field crops | 0.86 | 0.92 | 1.75 | 1.32 | 2.83 | 7.63 | 8.23 | 2.69 | 0.31 | 0.81 | 0.64 | 1.06 | 29.06 |
| Alfalfa Hay and Clover | 0.88 | 2.5 | 4.29 | 5.23 | 6.99 | 7.52 | 7.51 | 6.29 | 5.37 | 2.44 | 1.07 | 1.35 | 51.44 |
| Pasture and Misc. Grasses | 0.86 | 1.54 | 2.69 | 4.89 | 7.59 | 8.09 | 8.36 | 7.25 | 5.75 | 3.28 | 0.92 | 1.06 | 52.27 |
| Small Vegetables | 0.88 | 1.67 | 4.17 | 10.31 | 2.98 | 0.37 | 0.1 | 1.45 | 2.15 | 2.73 | 1.37 | 1.33 | 29.5 |
| Tomatoes and Peppers | 0.86 | 0.92 | 1.41 | 0.87 | 4.11 | 8.63 | 7.71 | 1.01 | 0.31 | 0.81 | 0.64 | 1.06 | 28.35 |
| Potatoes, Sugar beets, Turnip etc.. | 0.86 | 1.27 | 2.7 | 6.19 | 8.55 | 8.89 | 7.75 | 0.4 | 0.31 | 0.81 | 0.64 | 1.06 | 39.42 |
| Melons, Squash, and Cucumbers | 0.86 | 0.92 | 0.76 | 0.31 | 1.12 | 1.83 | 5.74 | 5.9 | 2.05 | 0.81 | 0.64 | 1.06 | 22 |
| Onions and Garlic | 0.88 | 2.3 | 3.78 | 5.33 | 5.29 | 1 | 0.1 | 0.33 | 0.31 | 0.81 | 1.25 | 1.15 | 22.51 |
| Strawberries | 0.86 | 0.92 | 1.75 | 1.32 | 2.83 | 7.63 | 8.23 | 2.69 | 0.31 | 0.81 | 0.64 | 1.06 | 29.06 |
| Flowers, Nursery and Christmas Tree | 0.86 | 0.92 | 1.45 | 3.12 | 6.54 | 7.07 | 7.54 | 6.47 | 4.92 | 2.7 | 0.6 | 1.06 | 43.26 |
| Citrus (no ground cover) | 0.88 | 2.36 | 3.6 | 4.79 | 6.07 | 6.47 | 6.2 | 5.7 | 4.67 | 3.76 | 1.14 | 1.4 | 47.05 |
| Immature Citrus | 0.88 | 1.6 | 2.29 | 3.09 | 3.99 | 4.36 | 4.24 | 3.83 | 3.29 | 2.59 | 1.04 | 1.24 | 32.44 |
| Avocado | 0.86 | 0.92 | 1.45 | 3.12 | 6.54 | 7.07 | 7.54 | 6.47 | 4.92 | 2.7 | 0.6 | 1.06 | 43.26 |
| Misc Subtropical | 0.86 | 0.92 | 1.45 | 3.12 | 6.54 | 7.07 | 7.54 | 6.47 | 4.92 | 2.7 | 0.6 | 1.06 | 43.26 |
| Grape Vines with 80% canopy | 0.86 | 0.93 | 1.05 | 1.38 | 4.1 | 6.11 | 6.44 | 5.13 | 3.03 | 0.82 | 0.61 | 1.06 | 31.51 |
| Grape Vines with cover crop (80% canopy) | 0.88 | 2.04 | 2.78 | 3.04 | 6.04 | 7.15 | 7.25 | 5.81 | 4.29 | 2.5 | 0.87 | 1.33 | 43.98 |
| Immature Grapes Vines with 50% canopy | 0.86 | 0.93 | 0.95 | 1 | 3.11 | 4.83 | 4.9 | 4.06 | 2.4 | 0.83 | 0.62 | 1.06 | 25.54 |

DRIP IRRIGATION
IRRIGATION TRAINING AND RESEARCH CENTER
CALIFORNIA POLYTECHNIC STATE UNIVERSITY, SAN LUIS OBISPO

| 1997 (Typical Year) | January | February | March | April | May | June | July | August | September | October | November | December | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | inches | inches | inches | inches | inches | inches | inches | inches | inches | inches | inches | inches | inches |
| Precipitation | 8.22 | 0.28 | 0.81 | 0.3 | 0.44 | 0.35 | 0.09 | 0.31 | 0.31 | 0.82 | 4.92 | 2.74 | 19.59 |
| Grass Reference ETo | 0.73 | 2.36 | 4.13 | 5.82 | 7.62 | 8 | 8.36 | 7.11 | 5.82 | 3.86 | 1.25 | 1.14 | 56.22 |
| | | | | | | | | | | | | | |
| Apple, Pear, Cherry, Plum and Prune | 0.86 | 0.93 | 1.23 | 2.59 | 7.07 | 7.99 | 8.22 | 7.09 | 5.52 | 2.79 | 0.6 | 1.07 | 45.96 |
| Apples, Plums, Cherries etc w/covercrop | 0.88 | 2.56 | 3.85 | 5.08 | 8.38 | 9.88 | 10.17 | 8.72 | 6.75 | 4.15 | 1.12 | 1.42 | 62.96 |
| Peach, Nectarine and Apricots | 0.86 | 0.93 | 1.25 | 2.39 | 6.52 | 7.66 | 7.74 | 6.73 | 5.3 | 2.65 | 0.6 | 1.07 | 43.7 |
| Immature Peaches, Nectarines, etc | 0.86 | 0.93 | 1.01 | 1.36 | 3.98 | 4.64 | 4.53 | 4.06 | 3.16 | 1.76 | 0.6 | 1.06 | 27.97 |
| Almonds | 0.86 | 0.93 | 1.46 | 3.19 | 7.06 | 7.69 | 7.75 | 6.74 | 5.17 | 2.67 | 0.6 | 1.07 | 45.19 |
| Almonds w/covercrop | 0.88 | 2.27 | 3.31 | 5.07 | 8.21 | 8.9 | 8.94 | 7.72 | 6.05 | 3.48 | 0.99 | 1.38 | 57.21 |
| Immature Almonds | 0.86 | 0.93 | 1.21 | 2.12 | 4.42 | 4.76 | 4.77 | 4.21 | 3.29 | 1.76 | 0.6 | 1.06 | 30 |
| Walnuts | 0.86 | 0.93 | 1.39 | 1.94 | 6.28 | 9.1 | 9.28 | 8.02 | 5.88 | 3.09 | 0.65 | 1.07 | 48.49 |
| Pistachio | 0.86 | 0.93 | 0.76 | 1.27 | 3.01 | 6.6 | 9.13 | 7.91 | 6.08 | 3.12 | 0.65 | 1.07 | 41.4 |
| Pistachio w/ covercrop | 0.88 | 2.27 | 3 | 3.84 | 5.69 | 7.96 | 9.64 | 8.27 | 6.64 | 4.04 | 1.09 | 1.38 | 54.7 |
| Immature Pistachio | 0.86 | 0.93 | 0.77 | 0.79 | 1.83 | 4.14 | 5.48 | 4.87 | 3.73 | 2.21 | 0.63 | 1.06 | 27.32 |
| Misc. Deciduous | 0.86 | 0.93 | 1.23 | 2.51 | 6.74 | 7.63 | 7.78 | 6.71 | 5.36 | 2.66 | 0.6 | 1.07 | 44.07 |
| Cotton | 0.87 | 0.93 | 0.77 | 1.09 | 2.08 | 5.12 | 8.91 | 7.8 | 5.04 | 1.32 | 0.63 | 1.06 | 35.62 |
| Misc. field crops | 0.87 | 0.93 | 1.77 | 1.49 | 2.9 | 7.69 | 8.14 | 2.89 | 0.31 | 0.81 | 0.63 | 1.06 | 29.5 |
| Small Vegetables | 0.88 | 1.63 | 3.77 | 5.83 | 1.48 | 0.36 | 0.09 | 1.45 | 1.67 | 1.54 | 0.97 | 1.33 | 21 |
| Tomatoes and Peppers | 0.87 | 0.93 | 1.51 | 0.88 | 4.03 | 8.57 | 7.48 | 1.01 | 0.31 | 0.81 | 0.63 | 1.06 | 28.1 |
| Potatoes, Sugar beets, Turnip etc.. | 0.87 | 1.25 | 2.5 | 5.83 | 8.22 | 8.63 | 7.39 | 0.4 | 0.31 | 0.81 | 0.63 | 1.06 | 37.9 |
| Melons, Squash, and Cucumbers | 0.87 | 0.93 | 0.77 | 0.31 | 1.23 | 1.21 | 4.28 | 5.2 | 1.86 | 0.81 | 0.63 | 1.06 | 19.16 |
| Onions and Garlic | 0.88 | 2.27 | 3.7 | 5.09 | 5.06 | 1.2 | 0.09 | 0.32 | 0.31 | 0.81 | 1.25 | 1.15 | 22.15 |
| Strawberries | 0.87 | 0.93 | 1.77 | 1.49 | 2.9 | 7.69 | 8.14 | 2.89 | 0.31 | 0.81 | 0.63 | 1.06 | 29.5 |
| Flowers, Nursery and Christmas Tree | 0.86 | 0.93 | 1.23 | 2.51 | 6.74 | 7.63 | 7.78 | 6.71 | 5.36 | 2.66 | 0.6 | 1.07 | 44.07 |
| Citrus (no ground cover) | 0.88 | 2.35 | 3.37 | 4.13 | 5.45 | 5.64 | 5.61 | 4.99 | 4.09 | 3.38 | 1.09 | 1.41 | 42.39 |
| Immature Citrus | 0.88 | 1.64 | 2.28 | 2.52 | 3.4 | 3.62 | 3.47 | 3.22 | 2.65 | 2.24 | 0.98 | 1.24 | 28.14 |
| Avocado | 0.86 | 0.93 | 1.23 | 2.51 | 6.74 | 7.63 | 7.78 | 6.71 | 5.36 | 2.66 | 0.6 | 1.07 | 44.07 |
| Misc Subtropical | 0.86 | 0.93 | 1.23 | 2.51 | 6.74 | 7.63 | 7.78 | 6.71 | 5.36 | 2.66 | 0.6 | 1.07 | 44.07 |
| Grape Vines with 80% canopy | 0.86 | 0.93 | 0.95 | 1.27 | 3.86 | 6.65 | 6.91 | 5.41 | 3.26 | 0.85 | 0.6 | 1.06 | 32.62 |
| Grape Vines with cover crop (80% canopy) | 0.88 | 2.05 | 2.88 | 3.26 | 5.63 | 7.58 | 7.65 | 6.22 | 4.06 | 2.35 | 0.81 | 1.34 | 44.72 |
| Immature Grapes Vines with 50% canopy | 0.86 | 0.94 | 0.89 | 0.93 | 2.67 | 4.22 | 4.29 | 3.41 | 2.02 | 0.82 | 0.61 | 1.06 | 22.73 |