APPENDIX G

TECHNICAL REPORT FOR THE REPORT OF WASTE DISCHARGE AT THE PISTACHIO PROCESSING FACILITY

This page intentionally left blank

Technical Report for the Report of Waste Discharge

Pistachio Processing Facility

S. Stamoules, Inc.
Mendota, CA
June 2022

Valley Science and Engineering
2902 W Main St
Visalia, CA 93291
Ph. (559) 732-3665
valleyirrigation.com/se

Technical Report for the Report of Waste Discharge
Pistachio Processing Facility
S. Stamoules, Inc. – Mendota, CA

Prepared For:	Ron Ollivier South Valley Engineering, Inc. 19325 Flight Path Way Bakersfield, CA 93308
Prepared By:	Valley Science and Engineering 2902 W Main St Visalia, CA 93291 (559) 732-3665
Author(s):	Michael S. Sowers, CPSS, CCA-WR Managing Soil Scientist
Reviewed By:	Steven L. Venner, CCA-NW Managing Soil Scientist Daniel J Bruner, PG, CHG, Managing Geologist
Report Date:	June xx, 2022
Project Number:	2020210059

Technical Report for the Report of Waste Discharge
Pistachio Processing Facility
S. Stamoules, Inc. – Mendota, CA

This report, sealed by a Certified Hydrogeologist registered in the State of California and a certified Professional Soil Scientist, contains information and data developed by a team of professionals including soil scientists, geologists, engineers, testing laboratories, and other professionals. This report does not contain design plans and specifications.

Submitted By:

Michael S. Sowers, CPSS, CCA-WR,
Managing Soil Scientist

Daniel J. Bruner, PG, CHG #991
Managing Geologist

CONTENTS

TABLES

FIGURES

APPENDICES

EXECUTIVE SUMMARY

S. Stamoules, Inc. is submitting this Report of Waste Discharge, which consists of State Form 200 and a Technical Report. The Technical Report thoroughly characterizes process wastewater discharge to obtain a discharge permit to land for treatment from the California Regional Water Quality Control Board – Central Valley Region (Regional Board).

S. Stamoules is proposing to build a pistachio processing facility located approximately 9 miles southwest of Mendota, California. The proposed facility will consist of an office building, water storage tank, huller building(s), and silos. Process wastewater produced from facility operations will be screened then conveyed to a series of 2 lined settling ponds before discharge to a 3,700-acre land application area for final treatment.

The proposed facility will utilize an existing on-site water well as the source water for pistachio hulling and facility operations. The proposed facility will be constructed in stages with the estimated final build-out occurring in 2029. Annual process wastewater discharge at final build-out is estimated at 311.36 million gallons with 311.10 million gallons of discharge occurring during September and October (processing season). The 3,700-acre land application area consists of existing pistachio orchards that are irrigated by double-row drip irrigation, which effectively wet approximately 40% (1,480 acres) of the land application area. The land application area has the capacity to receive and effectively treat the estimated maximum annual flow of 311.36 million gallons.

The anticipated maximum biochemical oxygen demand loading rate is estimated to be 65.2 pounds per acre per day at the estimated maximum flow utilizing 1,480 acres during the processing season. Total gross nitrogen load to the land application area is estimated to be 162 pounds per acre (lb/ac) at the maximum annual flow. Crop nitrogen uptake for pistachio coupled with denitrification through gaseous loss results in a negative nitrogen balance of -77 lb/ac. The annual fixed dissolved solids load is estimated at 988 lb/ac.

Deep percolation is associated with high precipitation months and is similar to the rainfall amount or is controlled through supplemental fresh water irrigation management. Supplemental irrigation will be required during each month of the growing season, which includes the processing season. The land application area, with the proposed flows, is well-suited to provide sufficient acreage to control deep percolation and leaching losses to control the potential for negative impacts to groundwater quality. Monitoring and reporting has been proposed to document the quality and quantity of the process wastewater applied to the land application area and to manage nutrient and hydraulic loading rates within crop uptake and land application area treatment capacity.

1.0 PROJECT DESCRIPTION

1.1 Introduction

S. Stamoules, Inc. (Stamoules) is submitting this Technical Report of Waste Discharge that thoroughly characterizes the projected process wastewater discharge from their proposed pistachio processing facility to obtain Waste Discharge Requirements (Permit) for discharge to land for treatment. The Permit will be issued and administered by the California Regional Water Quality Control Board – Central Valley Region (Regional Board).

1.2 Facility Location

Stamoules is proposing to build a pistachio processing facility (proposed facility) located on S. Newcomb Avenue between North Avenue and Annedale Avenue, approximately 9 miles southwest of Mendota, California in Section 26, Township 14 south, and Range 13 east of the Mt. Diablo Meridian. Land surrounding the proposed facility consists predominantly of agricultural land uses, with the unincorporated community of Pilibos Ranch located approximately 0.25 miles to the southeast (Figure 1).

1.3 Facility Description

The proposed facility will process field-harvested pistachios by first pre-cleaning the pistachios to remove leaves and stems before being sent to the huller building(s). In the huller building, mechanical peelers that use a combination of water and abrasion, will be used to remove the hulls from the pistachios. After hulling, the pistachios will be conveyed to compressed gas fired dryers that heat the product and ready it for bulk storage in on-site silos. The silos will store the product for approximately 2 to 8 months, depending on market demand. A site plan for the proposed facility, prepared by Engle & Company Engineers, is provided in Appendix A.

Two-lined reservoirs will serve as a buffer for short-term process wastewater retention and provide settling capacity for flow between the proposed facility and the land application area (LAA). The proposed LAA is existing pistachio orchards, owned and operated by Stamoules, located to the northeast of the proposed facility. Existing subsurface piping will be utilized to transport the process wastewater to the orchards where it will be irrigated via drip irrigation.

Construction of the proposed facility is expected to commence in 2022 and phased over approximately 7 years, with final build-out occurring in 2029. All calculations associated with water use and process wastewater discharge are based on final build-out projections.

1.4 Processing Schedule

The proposed facility will operate year-round, however, processing of pistachios occurs in conjunction with harvest, which typically begins in September and continues through October (peak season). During the peak season, the proposed facility will operate approximately 17 hours per day, 6 to 7 days per week. The rest of the year, the proposed facility will operate 5 days a week, 9 hours per day.

1.5 Facility Water Source

The fresh water supply (source water) for the proposed facility and processing pistachios will be sourced from an existing groundwater supply well (26-2 SW), located near the north property boundary, that is owned and operated by Stamoules (Appendix A). Source water volumes required at final build-out will necessitate the use of additional existing wells and/or the installation of new wells.

1.6 Water Flow Through the Facility

Source water exiting existing groundwater supply well(s) will be pumped to sand media filters to remove suspended materials. After filtration and before being stored in a 250,000-gallon storage tank, the source water will be disinfected with an injection of sodium hypochlorite. The source water used for domestic and drinking purposes will be pumped to a potable water treatment system for additional treatment. The source water used for the proposed facility process operations will be pumped to the hulling building and used in the hull removal process. After hull removal, the process wastewater will be conveyed to the huller pit via a concrete flume. From the huller pit, the process wastewater will be pumped through screens to remove larger sized debris. After screening, the process wastewater will discharged into the settling ponds for fine solids removal. The process wastewater will be pumped from the settling ponds to the LAA, via an existing subsurface water delivery system, for final treatment and reuse. A water flow diagram, prepared by South Valley Engineering is provided in Appendix B.

1.7 Stormwater Disposal

The proposed facility will be designed to capture and direct all stormwater to proposed retention and infiltration basins. All stormwater runoff will be segregated from the process wastewater and there will be no potential stormwater discharge off-site or to surface water.

1.8 Sanitary Wastewater

Domestic sanitary wastewater generated at the proposed facility will be managed within a separate system. The sanitary wastewater will not be comingled with the process wastewater. The domestic sanitary wastewater disposal system will be permitted though the Fresno County Department of Health. Therefore, no additional consideration will be given to the domestic wastewater in the remainder of this Technical Report.

2.0 SOURCE AND PROCESS WASTEWATER CHARACTERISTICS

The following narrative describes the quality and quantity of the source water and process wastewater. The source water quality affects the quality of the process wastewater. The projected quality of the process wastewater has been evaluated to determine appropriate operations management to minimize the potential impacts to groundwater quality.

2.1 Source Water Quality

Source water quality was determined by laboratory analysis of water samples collected from the source water supply on October 27, 2020. The source water was tested for the following parameters, the results of which are presented in Table 1:

- total dissolved solids (TDS),
- electrical conductivity (EC),
- nitrate-nitrogen,
- pH, and
- general minerals (total hardness, total alkalinity, carbonate, bicarbonate, calcium, magnesium, sodium, potassium, chloride, sulfate, iron, manganese, fluoride, zinc, and copper).

Key results of the source water quality include the following:

- TDS = 1,100 milligram per liter (mg/L),
- EC = 1,540 micromhos per centimeter (µmhos/cm),
- nitrate-nitrogen = less than (<) 0.2 mg/L,
- pH = 8.2 standard units (s.u.)

2.2 Projected Wastewater Quality

The proposed facility will strictly process pistachios. Since there is no process wastewater quality data for the proposed facility, the projected process wastewater quality was estimated by utilizing published data from a similar pistachio huller facility. Specifically, wastewater quality data from The Wonderful Company, LLC Firebaugh Pistachio Processing Plant (Firebaugh Plant) 2021 Annual Monitoring Report (The Wonderful Company, LLC, 2020) was used for projection purposes (Table 1).

Methods

This section describes the method used to determine the projected process wastewater quality expected from the proposed facility. During pistachio processing, the actual process wastewater quality will be the result of comingling the source water constituents and the constituents added to the source water as it is used throughout facility for processing the pistachios. The constituents that would be added to any given source water during pistachio processing (process addition constituents), was estimated by subtracting the source water constituent concentrations from the process wastewater constituent concentrations at the Firebaugh Plant. The process addition constituents at the Firebaugh Plant are presented in Table 1.

The projected process wastewater quality for the proposed facility was then estimated by summing the proposed facility source water constituent concentrations described above (Section 2.1) and the Firebaugh Plant process addition constituent concentrations (Table 1).

Projected Process Wastewater Quality

Table 1 shows the projected process wastewater quality for the proposed facility. Below is a summary of the key parameters for consideration of land application as irrigation water:

- pH = 5.0 s.u.
- EC = 4,343 µmhos/cm
- Total nitrogen = 130 mg/L
- TDS = 3,980 mg/L
- Chloride = 115 mg/L
- Potassium = 713 mg/L
- Biochemical Oxygen Demand (BOD) = 3,773 mg/L

The estimated pH of the process wastewater is lower than the typically acceptable range of 6.0 to 9.0 s.u. Potassium, EC, TDS, and BOD concentrations are within the range of concentrations common to other processing facilities permitted by the Regional Board. Regardless, when it is blended with fresh water, the combined fresh water and process wastewater quality should be acceptable quality for irrigation (Table 1). The projected blended irrigation water quality was calculated utilizing flow-weighted constituent concentrations for the month of October. October is the month that is projected to have the highest constituent load. Process wastewater discharge volumes and water balances are discussed in subsequent sections of this Technical Report.

When managed correctly and applied at agronomic rates, the process wastewater would be a valuable irrigation and nutrient source.

2.3 Projected Process Wastewater Quantity

Projected monthly flow rates were calculated utilizing projected pumping rates, hours of operation, and operational days (Table 2). Peak season pumping rate, at final build-out, is projected at 5,000 gallons per minute (gpm). Utilizing a 17-hour workday, daily flow during the peak season is projected to be 5.1 million gallons per day (MGD). Monthly flow during the peak season is projected to range between 153.0 and 158.1 million gallons (MG). During the off-season (November through August), the projected pumping rate is projected at 2.0 gpm. Utilizing a 9-hour workday, daily flow during the off-season is estimated to range between 1,095 and 1,100 gallons per day. Monthly flow during the off-season is projected to range between 0.022 and 0.045 MG. Flow rates, on any given day, may vary based on production levels and the day of the week. Total annual flow, at final build-out, is calculated to be 311.36 MG.

2.4 Chemical Usage

A list of projected chemicals that may be in the processing operation are summarized in Table 3. Wastewater generated from sanitation is expected to be a minor component of the waste stream. Actual chemicals used in the operation will be dependent upon suppliers and product availability.

2.5 Solids Management

Solids produced by the proposed facility will consist of stems and leaves, which are removed during the pre-cleaning process, residual solids generated from screening and settlement of the process wastewater, and blank and/or broken shells.

Stems and leaves generated from pre-cleaning will be combined with other green waste from the farming operation for composting. Solids removed from screens and settling ponds will be pressed to reduce water content, then temporarily stored on a concrete pad(s) for drying. After drying, residual solids will be shipped off site for use as cattle feed and/or sent to a composting facility. Blank and/or broken shells will be segregated and shipped separately to be composted. Future use of blank or broken shells may include their use as road base material and/or feedstock for a gasifier system.

3.0 LAND APPLICATION AREA SITE CHARACTERISTICS

The process wastewater will be discharged to a 3,700-acre LAA located approximately 2.5 miles northeast of the proposed facility between Belmont and W. California Avenues (Figure 1). The LAA is surrounded by agricultural fields with multiple agricultural production structures and an airstrip located within. Several residential dwellings are located within and directly adjacent to the LAA.

3.1 Climate

The LAA is located in Fresno County, California with a surface elevation ranging from approximately 180 to 250 feet above mean sea level, based on the U.S. Geologic Survey topographical map (Figure 2). Climate at the site is described as semi-arid with cool, somewhat moist winters and hot, dry summers. The average maximum air temperatures in July and August are 96.7 and 95.0 °F respectively, cooling to an average maximum of 57.0 °F in December (Table 4).

Soil temperatures affect plant growth, nutrient uptake, and microbiological activity, which are important for reusing nutrients supplied by the land application of process wastewater. Average daily soil temperatures, measured at four inch depth, ranged from a high of 81.0 °F in July to a low of 49.2 °F in January (California Department of Water Resources, n.d.). These soil temperatures are high enough to support plant growth and subsequent process wastewater nutrient uptake throughout the year.

The approximate 100-year annual precipitation occurred in 1983 and totaled 21.6 inches of precipitation (National Oceanic and Atmospheric Administration, n.d.). The 30-year average annual precipitation occurring between 1991 and 2020 is 6.7 inches (California Department of Water Resources, n.d.).

3.2 Topography and Physiography

Surface topography within the LAA consists of basin and stream flood plains formed in mixed alluvium with slopes of 0 to 2%. The LAA topography is flat with a general slope of less than 1% at elevations above mean sea level ranging from 250 feet (ft) in the west to 180 ft in the east.

Regionally the topography slopes generally to west, away from Highway 5 towards the San Joaquin River.

The proposed facility will be located in the Westside Subbasin 5-22.09 of the San Joaquin Groundwater Basin (California Department of Water Resources, 2003). The basin has a surface area of 972 square miles and consists mainly of the lands in the Westlands Water District. It is located between the Coast Range foothills on the west and the San Joaquin River Drainage and Fresno Slough on the east. The subbasin is bordered on the southwest by the Pleasant Valley Groundwater Subbasin and on the west by Tertiary marine sediments of the Coast Ranges, on the Coast Ranges, on the north and northeast by the Delta-Mendota Groundwater Subbasins.

3.3 Hydrogeology

The aquifer system comprising the Westside Subbasin consists of unconsolidated continental deposits of Tertiary and Quaternary age. These deposits form an unconfined to semi-confined upper aquifer and a confined lower aquifer. These aquifers are separated by an aquitard named the Corcoran Clay (E-Clay) member of the Tulare Formation.

The unconfined to semi-confined aquifer (upper zone) above the Corcoran Clay includes younger alluvium, older alluvium, and part of the Tulare Formation. These deposits consist of highly lenticular, poorly sorted clay, silt, and sand intercalated with occasional beds of well-sorted fine to medium- grained sand.

The Corcoran Clay is a lacustrine diatomaceous clay unit that underlies much of the subbasin. The Corcoran Clay in the LAA is 50 to 75 ft thick and 400 and 600 ft deep (Westlands Water District GSA & County of Fresno GSA-Westside & Luhdorff & Scalmanini Consuting Engineers, 2020), Figures 2-30 and 2-31) (California Department of Water Resources, 2018). Prior to groundwater development, the Corcoran Clay effectively separated the upper and lower zones. Numerous wells penetrate the clay have allowed partial interaction between the zones.

Primary recharge to the aquifer system is from the seepage of Coast Range streams along the west side of the subbasin and the deep percolation of surface irrigation. Secondary recharge to the upper and lower aquifers occurs from areas to the east and northeast as subsurface flows.

Groundwater levels were generally at their lowest levels in the late 1960s, prior to importation of surface water. The Central Valley Project began delivering surface water to the San Luis Unit in 1967-68. Water levels gradually increased to a maximum in about 1987-88, with fluctuations since then.

Based on static water level measurements in the upper zone of the Westlands Water District as of April 2016, groundwater occurs approximately 5 to 10 ft below the LAA (Westlands Water District, 2016). Groundwater in the upper zone flows northeast with a gradient under LAA of approximately 17 ft per mile (0.0032 ft per foot).

The aquifer transmissivity (T) is its ability to transmit groundwater flow through a vertical strip that is one-foot wide through the entire saturated thickness under a unit hydraulic gradient. Pumping tests were performed on wells completed in the upper zone of the Firebaugh Canal Water District

(FCWD), which provides irrigation water to 22,000 acres of farmland near Mendota and Firebaugh (Kenneth D. Schmidt and Associates, 2007). The Corcoran Clay is approximately 350 ft deep and 60 to 100 ft thick in the FCWD. Values of T calculated from 6 well pumping tests ranged from 78,000 to 446,000 gallons per day per foot (gpd/ft). The T selected for this antidegradation analysis was derived from a 14-day test conducted at 2,210 gallons per minute on a well designated FCWD11. This well is perforated from 112 to 247 ft deep and located on the south end of the FCWD, approximately 2.5 miles northeast of the Site in Section 24 of Township 13 South Range 14 East of the Mt. Diablo Meridian. The test indicated a T of 200,000 gpd/ft.

The groundwater flow rate beneath the LAA was calculated by multiplying the transmissivity by the width of the site perpendicular to the northeast regional gradient and the regional gradient, as follows:

- Minimum flow rate = 200,000 gpd/ft × 1 MG/1,000,000 gallons × 20,200 ft wide × 17 ft per mile (0.0032) = 12.9 MGD

The most recent, representative groundwater quality found was obtained from the California Groundwater Ambient Monitoring and Assessment (GAMA) program (United States Geological Survey Department of the Interior, 2013). The closest groundwater samples to the LAA collected during the GAMA study were from 3 nested monitoring wells located in Mendota with screen depths of 58 to 78 ft for well DM-U-11, 330 to 350 ft for well DM-U-12, and 530 to 550 ft for well DM-U-10. Wells DM-U-11 and DM-U-12 were installed in the upper zone and well DM-U-10 was installed in the lower zone. Laboratory and field specific conductance values in groundwater samples from these wells were 948/961 µmhos/cm for well DM-U-11, 1360/1380 µmhos/cm for well DM-U-12, and 2570/2610 µmhos/cm for well DM-U-10.

3.4 Soil Characterization

The purpose of this section is to summarize relevant soil characteristics within the 3,700-acre LAA for beneficial reuse of the process wastewater via drip irrigation on pistachio. This section will briefly describe the soils mapped at the site and identify the properties important to management of the wash water. The information presented is based upon a review of data published in the Web Soil Survey for Fresno County, California, Western Part (Appendix C).

Soil Classification

The Natural Resources Conservation Service has mapped the soils at the LAA as predominately a Calflax, clay loam in the middle, Tranquility (complex), clay towards the north, Excelsior sandy loam on the southwest end, and Ciervo, clay on the western boarders. The Calflax series consists of very deep, moderately well drained soils on fan skirts formed in alluvium derived from calcareous sedimentary rock. The Tranquility soil complex consists of very deep, somewhat poorly and poorly drained soil formed the same parent material. Excelsior soil consists of very deep, well-drained soils on alluvial fans, bars, and channels on flood plains. These soils are formed from mixed alluvium dominantly from igneous and calcareous sedimentary rock. The Ciervo series consists of very deep, moderately well drained soils on fan skirts. These soils formed in alluvial material derived dominantly from sedimentary rock. The official soil description (OSD) for each the soil series is contained in Appendix D. All soils mapped at the LAA are suited for process wastewater land treatment with proper agronomic management of the crops and irrigation (Table 5).

Soil Properties

Soil hydraulic properties affect atmospheric oxygen diffusion and infiltration, storage, and movement of water into the soil profile. Knowledge of soil hydraulic properties is critical in establishing irrigation schedules and minimizing percolate losses of water, nutrients, and salts from the root zone. Because of its capacity to hold water and adsorb/filter nutrients, the soil acts as a "surge tank" to buffer between process wastewater-irrigated land and groundwater, thereby allowing both storage and treatment to occur.

Table 5 provides physical soil properties for the Calflax, Tranquility, Excelsior, and Ciervo, soil types based on the Fresno County Soil Survey Northwestern Part (Soil Survey). The available water holding capacity (AWHC) for these soil series are as follows:

- Calflax – 0.08 to 0.19 inches of water per inch of soil (in/in), and for a soil depth of five ft (60 inches), is 8.9 inches
- Tranquility – 0.08 to 0.16 in/in, and for a soil depth of 60 inches, ranges from 6.5 to 8.1 inches
- Excelsior – 0.05 to 0.21 in/in, and for a soil depth of 60 inches, ranges from 6.4 to 8.0 inches
- Ciervo – 0.13 to 0.18 in/in, and for a soil depth of 60 inches, is 10.3 inches

Saturated hydraulic conductivity (Ksat) is a measurement of the rate of water movement through the soil. The hydraulic conductivity of the soils within the LAA varies drastically, especially between the Tranquility and Excelsior (sandy substratum) series where Ksat ranges from 0.003 to 20.0 inches per hour, which is considered very slow to rapid. These Kast values have the potential for ponding or rapid water movement in the soil. The Tranquility soil complex and Excelsior (sandy substratum) soil series only account for approximately 15% of the soils mapped in the LAA. This Ksat range can be suitable for process wastewater land treatment with proper irrigation management. The vast majority (85%) of the soils mapped in the LAA have Ksat that range from 0.1 to 6.0 inches per hour, which is considered slow to moderately rapid. This Ksat range is generally suitable for process wastewater land treatment because it will allow sufficient infiltration rates while providing the water retention time necessary for treatment and utilization.

Cation exchange capacity (CEC) is the total amount of extractible cations that can be held by the soil. Soils with higher clay and/or organic matter content have higher CEC values than soils with higher sand and/or low organic matter content. Soils with high CEC values have an increased ability to retain cations, thus reducing the potential for groundwater impact from nutrient applications. The CEC of the soils within the LAA, based on the Soil Survey, are as follows:

- Calflax – 22.6 milliequivalents per 100 grams (meq/100g)
- Tranquility – 35.0 to 37.1 meq/100g
- Excelsior – 9.0 to 9.4 meq/100g
- Ciervo – 30.4 meq/100g

The CEC of the soils within the LAA varies between the Excelsior (sandy substratum) and Tranquility series where CEC ranges from 9.0 to 37.1 meq/100g, respectively. The Excelsior soil, which only accounts for approximately 11% of the soils mapped in the LAA, exhibits the lowest

CEC due to its sandy texture. The vast majority (89%) of the soils mapped in the LAA have CEC values ranging from 22.6 to 37.1 meq/100g, which is considered moderate to high. The vast majority of the soils mapped within the LAA have an increased ability to retain cations contained in the process wastewater such as potassium, calcium, sodium, and magnesium.

4.0 WASTE MANAGEMENT PLAN

This section describes and demonstrates the management of the LAA to reuse the process wastewater from the proposed facility. It includes a description of the projected amount of process wastewater that will be discharged to the LAA to maintain crop viability, control soil salinity, and meet crop hydraulic and nutrient requirements.

4.1 Process Wastewater Discharge and Application

The LAA consists of 26 existing pistachio orchards/fields totaling 3,700 acres (Figure 3, Table 6). Process wastewater will be pumped from the proposed facility to a series of 2 lined settling ponds prior to discharge to the LAA (Appendix A and Table 7). The east and west lined settling pond have capacities of approximately 2.7 and 10.0 MG, respectively.

The frequency and rate of water application will be managed to meet evapotranspiration demands. Approximately 99% of the process wastewater discharged from the proposed facility will occur in September and October, in conjunction with the pistachio processing season. Supplemental irrigation will be required during and outside of the processing season to meet crop demand.

4.2 Water Balance Considerations

Design parameters, including crop evapotranspiration rate, precipitation rate, water availability, and soil water holding capacity were used to calculate the water balance. Precipitation, evapotranspiration, and evaporation values utilized in the water balance calculations are summarized in Table 4. Water balances have been prepared to identify the acreage needed for the discharge at final build-out and incorporates the 100-year return precipitation design and 30-year average precipitation (Table 8 and Appendix E). The following sections discuss the water balances using each of these parameters.

Precipitation

Precipitation influences percolate losses by adding to the quantity of water already in the soil. For calculation purposes and perspective, the following precipitation scenarios were evaluated for the proposed cropping system, and both were normalized to the average monthly distribution (Table 4):

- 100-year return high annual precipitation
- 30-year annual average precipitation

Using the 100-year return high annual precipitation provides a margin of safety for designing water management to achieve reliable groundwater quality protection goals. Historical precipitation data for the 100-year high return precipitation was obtained from the National Weather Service for Fresno, California (National Oceanic and Atmospheric Administration, n.d.) and the 30-year annual average precipitation was obtained from the following California Irrigation Management Information Systems (CIMIS) weather stations (California Department of Water Resources, n.d.)

- Firebaugh/Telles station #7: January 1991 through March 1992.
- Westland station #105: April 1992 through December 2020.

The annual precipitation with a 100-year return frequency is the 21.6 inches of rainfall measured in 1983 in Fresno. The 30-year average at the Firebauh/Telles and Westlands CIMIS stations is 6.70 inches. To account for the actual effective rainfall that might infiltrate the soil and become available for crop use, an efficiency factor of 85% was applied to the monthly precipitation amounts and were based upon the same assumptions used for monthly irrigation efficiency.

Evapotranspiration

Monthly evapotranspiration data were obtained from actual monthly values derived from the Firebauh/Telles and Westlands CIMIS stations described above. Reference evapotranspiration (ETo) averages 62.6 inches per year. After multiplying the appropriate crop coefficients (Table 9) by ETo, the estimated evapotranspiration rate (ETc) for pistachio is 54.2 inches (Table 4). For months when pistachio is dormant (January through March, November, and December), a "fallow" crop coefficient was utilized to determine ETc. Settling pond evaporation rates were not considered in any of the water balance calculations, so actual process wastewater irrigation volumes are expected be less than depicted in the water balances.

Land Application Site Water Balances

The LAA water balances are based on irrigation to control percolate losses of water below the root zone while maintaining the potential for an excellent crop and efficient nutrient removal from the soil profile. For the proposed flow at the 100-year return design precipitation and 30-year average precipitation, the percolate losses can be agronomical managed within the leaching requirements. A water balance was also calculated utilizing only freshwater and the 100-year return design precipitation for comparison. The water balances for the proposed flow and both precipitation scenarios and only freshwater irrigation are summarized in Table 8 with detailed monthly calculations in Appendices E1, E2, and E3. The leaching requirement at the 100-year return design precipitation was calculated to maintain soil EC near a target level of 2.0 millimhos per centimeter, thus providing a leaching requirement of 13.7%. Utilizing the 30-year average precipitation, the leaching requirement is 18.0%. Utilizing the 100-year return design precipitation and freshwater only, the leaching requirement is 12.1%.

Proposed Discharge

Using the proposed annual discharge of 311.36 MG, with 311.10 MG occurring in September and October, and the 100-year return design precipitation (highest projected total hydraulic load), the proposed 3,700-acres of pistachio has sufficient capacity to receive the process wastewater hydraulic load. Supplemental irrigation will be required to meet crop demand, even during September and October. Annual supplemental irrigation is projected to be 4,601.6 MG (Appendix E1). Under the 30-year average precipitation, the annual supplemental irrigation needed to meet crop demand is 6,952.6 MG (Appendix E2). Utilizing only freshwater irrigation, coupled with the 100-year return precipitation, 4,844.7 MG of water is needed to meet crop demand (Appendix E3).

Supplemental irrigation demand is met by an interconnected, closed-loop, irrigation system consisting of 17 irrigation wells, which includes the proposed source well (26-2 SW, Figure 3).

4.3 Process Wastewater Constituent Loading and Balances

This section will describe the capabilities of the LAA to accept the process wastewater discharge from the proposed facility. The calculations for the average process wastewater quality concentrations (Table 1) and the proposed discharge of 311.36 MG per year were used to estimate the mass loading of constituents on the LAA (Table 10).

Nitrogen Load

Total gross nitrogen (total Kjeldahl nitrogen + nitrate-nitrogen) mass loading is estimated at 338,093 pounds (lb) at the proposed flow. Across the 3,700-acre LAA, the total gross nitrogen load is estimated at 91 pounds per acre (lb/ac).

Gross nitrogen loading, adjusted to account for gaseous nitrogen losses including volatilization of ammonia and denitrification of 20%, produces an adjusted net nitrogen load of 73 lb/ac.

Nitrogen Balance

A nitrogen balance provides an example of how the process wastewater nitrogen load will be managed. Nitrogen can be removed from a land application site through crop removal, and to a lesser extent, by gaseous losses where volatilization and denitrification of nitrogen constituents are lost to the atmosphere. Gaseous losses of nitrogen can be regulated by many factors, but primarily by environmental conditions such as temperature, available carbon, and soil moisture.

Crop selection and management primarily regulate the removal of nitrogen by a crop. Stamoules plans to irrigate the existing pistachio on the LAA to consume the water and applied nutrients. The nitrogen load from process wastewater is within the capacity of the land treatment system, which allows for irrigation without over loading the soil with nutrients.

The nitrogen balance calculated for the LAA has been evaluated using the following criteria:

- Proposed process wastewater flow,
- Acreage of the land application area,
- Nitrogen concentration of the process wastewater,
- Estimated gaseous losses of nitrogen constituents, and
- Estimated nitrogen uptake for pistachio.

Pistachio nitrogen uptake was estimated at 150 lb/ac. This uptake includes nitrogen retained tree biomass (roots, trunks, branches, leaves, etc.) and nitrogen removed from harvested fruit (California Department of Food and Agriculture, n.d.).

Based on the estimated net nitrogen load of 73 lb/ac compared to the 150 lb/ac nitrogen uptake, the net nitrogen balance for the LAA would be a negative 77 pounds per acre per year (lb/ac/yr, Table 11). Based on the calculated nitrogen balance, the application of commercial nitrogen fertilizers may be required to maintain the pistachio productivity. Additionally, the application of fertilizers to supplement other macro and micronutrients will be based on soil and/or tissue sample data if a deficiency of a nutrient is apparent and affecting tree growth and health, which in turn affects water and nutrient consumption.

Potassium Load

Total potassium mass loading is estimated at 1,852,097 lb at the proposed flow (Table 10). Across the 3,700-acre LAA, the total potassium load is estimated at 501 lb/ac.

Potassium Balance

Pistachio potassium uptake was estimated at 113 lb/ac utilizing a 3,000 lb/ac marketable yield. This uptake includes potassium retained tree biomass (roots, trunks, branches, leaves, etc.) and potassium removed from harvested fruit (California Department of Food and Agriculture, n.d.). The potassium load is estimated at 501 lb/ac, which equates to a positive annual balance of 388 lb/ac (Table 12). Potassium is generally immobile in the soil so an accumulation has a low potential to impact groundwater, especially in soils with higher amounts of clay, where higher CEC increase the soils capability of retaining potassium and other cations (Section 3.4). Additionally, soil potassium is maintained on site due to the relatively flat field conditions and under the management practices planned to control potential runoff.

Biochemical Oxygen Demand Load

The projected process wastewater BOD concentration is 3,773 mg/L (Table 1). Using the BOD concentration and the annual projected flow of 311.36 MG, the annual BOD load to the LAA would be 9,796,706 lb (Table 10). As mentioned previously, the pistachio crop is irrigated utilizing drip irrigation, which effectively wets approximately 40% of the available 3,700 acres of the LAA, resulting in wetted area of 1,480 acres. The wetted area must be considered in regards to the BOD loading, on a per acre bases, for proper BOD treatment. The BOD application rate was calculated utilizing the effectively wetted acreage of 1,480 acres. Based on this information the estimated annual BOD load is 6,619 lb/ac. The calculated daily average BOD load is 18 lb/ac and a daily maximum BOD load is 108 lb/ac (Table 13). The projected BOD loading rate, in addition to the dose and rest application with drip irrigation, coupled with the 2-month processing season, presents a low potential risk associated with organic loading.

5.0 PROCESS WASTEWATER IRRIGATION MANAGEMENT

The purpose of this section is to provide the basis under which the LAA will be managed to recycle the process wastewater and nutrients in a manner protective of groundwater. Based on the acreage of the LAA, the capacity for water and nutrients does not limit process wastewater application.

5.1 Farming Objectives

The proposed facility will manage irrigation to distribute process wastewater as a water and nutrient resource within agronomic needs to enhance the LAA operation. Irrigation systems, irrigation rates, hydraulic loadings, nutrient loadings, and salts management will be based on known agricultural best management practices. The available acreage is sufficient to plan hydraulic loading and nutrient loading goals based on crop requirements. The objective of the operations will be to efficiently and beneficially use the nutrients and water that is available from the process wastewater.

5.2 Monitoring

Monitoring and reporting is essential to good management and compliance. The proposed monitoring program was assembled to provide the data necessary to assess the performance of the land treatment system and its associated infrastructure.

Source Water Quality

The source water will be monitored on an annual basis for general minerals (alkalinity, bicarbonate, boron, calcium, carbonate, chloride, conductivity, copper, hardness, hydroxide, iron, magnesium, manganese, nitrate, pH, potassium, sodium, sulfate, TDS, and zinc accompanied with an anion-cation balance), EC, total Kjeldahl nitrogen, and ammonia-nitrogen.

Process Wastewater Quality and Quantity

The proposed facility will monitor process wastewater quality on a weekly, monthly, and annual basis by the collection and analysis of representative samples of the water distributed to the LAA from the final (west) lined settling pond. (Appendix A).

Process wastewater quality samples will be collected from the west lined settling pond, prior to discharge to the LAA, and will be analyzed for the following parameters on a weekly basis during the processing season: pH, BOD, EC, fixed dissolved solids, potassium, and total Kjeldahl nitrogen. On a twice per season basis, the process wastewater samples will be analyzed for nitrate as nitrogen (N), nitrite as N, total N, total suspended solids, TDS, and general minerals. Flow (discharge) from the west lined setting pond will be measured on a continuous basis either by meter or pump runtime estimates.

The east and west lined setting ponds will be measured weekly for dissolve oxygen (DO), pH, and freeboard, when water is present. Annually, the condition of ponds' liner will be inspected and solids depth will be measured.

Based on the monitored constituents present in the process wastewater and the volume of water applied, monthly loading rates will be calculated to monitor nutrient and hydraulic loading to the land application fields. Average daily loading rates on a monthly basis will be calculated for BOD in pounds per acre per day. Monthly average hydraulic loading will be reported in inches applied. During the processing season, supplemental irrigation hydraulic loading will be measured daily. In the off-season, supplemental irrigation volumes will be measured monthly.

Groundwater Monitoring

Groundwater sampling will not be conducted at the LAA. As proposed, the LAA poses a minimal threat to groundwater and does not warrant the necessity for groundwater monitoring.

5.3 Reporting

An annual report will be prepared to document the quality and quantity of the process wastewater and supplemental irrigation water applied to the LAA. Nutrient and hydraulic loading rates will also be prepared to document that loading rates are agronomic and within the LAA treatment capacity.

5.4 Antidegradation Analysis

An antidegradation analysis was prepared to conform to the directives of the California State Water Resources Control Board Resolution No. 68-16 (California Environmental Protection Agency - State Water Resources Control Board, 1968), which prohibits degradation of groundwater quality unless it is shown that:

a) The degradation does not result in water quality less than that prescribed in state and regional policies, including violation of one or more water quality objectives;

b) The discharger employs best practicable treatment or control (BPTC) to minimize degradation;

c) The degradation will not unreasonably affect present and anticipated future beneficial uses; and

d) The degradation is consistent with the maximum benefit of the people of the State.

The constituent of concern for the antidegradation analysis is salinity, measured as EC or TDS. The future steady-state EC concentration of groundwater under the LAA can be estimated with a simple algebraic equation:

$$Cmix = [(Cp \times Qp) + (Cgw \times Qgw)] / (Qp + Qgw),$$

Where:

Cmix = concentration of EC in mixture (future groundwater)

Cp = concentration of EC in percolate; 3,254 µmhos/cm (Table 1)

Qp = flow rate of percolate; 0.001091 OR 5.1 MGD (Table 2)

Cgw = concentration of EC in ambient groundwater; 948 µmhos/cm (Section 3.3)

Qgw = flow rate of groundwater; 12.9 MGD (section 3.3)

Solving for Cmix indicates that the EC concentration of groundwater beneath the LAA could potentially increase from 948 mg/L to 2,292 µmhos/cm (100-year precipitation and Qgw=12.9 MGD). Using only supplemental irrigation, the EC concentration of groundwater beneath the LAA could potentially increase from 948 mg/L to 2,163 µmhos/cm. The mixing analysis results are shown in Table 14. A majority of the potential increase in groundwater salinity, when comparing process wastewater irrigation to only fresh water irrigation, is due to a significant increase in potassium concentrations in the process wastewater (Table 1). There are no maximum contaminate level (MCL) or other numeric limit established for potassium except for the overall limits for EC and TDS, to which potassium would contribute. Potassium is an important nutrient for crops and, if readily available, plants will take up potassium in excess of their needs. Therefore, the application of process wastewater high in potassium to crops would be beneficial.

Further, the positively charged ion in potassium binds readily to soils allowing for greater retention time in the root zone for crop uptake, especially in soils with high CEC (Section 3.4).

Antidegradation Analysis Conclusions

Based upon the foregoing information, the project complies with these criteria as follows:

1. Salinity contributions from the proposed facility's pistachio processing operation are minimized by BPTC, as potassium, the leading contributor to the salts load, is an important element for crop grown and is a positively charged ion that bonds to soil reducing the potential for groundwater degradation.
2. By complying with the Basin Plan water quality objectives, degradation of groundwater quality with salinity should not unreasonably affect present or anticipated future beneficial uses of groundwater.
3. By complying with water quality objectives of the San Joaquin Groundwater Basin Plan and providing economic benefits to the community and the State, degradation of groundwater with salinity contributions caused by discharge of process wastewater to the LAA during operation of the proposed facility is consistent with the maximum benefit of the people of the State.

5.5 Economics and Practicality

The proposed facility will be constructed on property currently owned by Stamoules and will provide full-time employment for approximately 14 employees. The location of the proposed facility will reduce transportation impacts by reducing transportation distance for freshly harvested fruit and for finished nuts. The surrounding area is existing agricultural land with associated farming structures and equipment staging/storage. The reuse of the process wastewater as a supplement to the current fresh water irrigation, not only reduces fresh irrigation water usage, it reduces the amount of supplemental fertilizers needed at the LAA. Additionally, the proposed facility would be a benefit to the community and protective of the environment, by reducing trucking and economically, by providing additional tax revenue.

6.0 SUMMARY

Stamoules' proposed facility will process, dry, and store field-harvested pistachios. The proposed facility will consist of an office building, huller building(s), and silos. Process wastewater produced from facility operations will be screened then conveyed to a series of 2 lined settling ponds before discharge to a 3,700-acre LAA for final treatment.

The estimated maximum process wastewater flow at final build-out is 311.36 MG per year with 311.10 MG of discharge occurring during the processing season. The 3,700-acre LAA provides capability to support future growth of the processing operations. The soil physical and chemical characteristics present limited inhibitions for the treatment of applied process wastewater.

Based on the projected process wastewater quality and quantity, the 3,700-acre LAA provides sufficient acreage to maintain agronomic nitrogen loads and an acceptable maximum BOD load of 108 lb/ac/day. The hydraulic balance demonstrates the ability to limit percolation to the salts leaching requirement and leaching losses only during high rainfall periods when the process wastewater is not being applied to the LAA. Supplemental freshwater irrigation will be required to meet crop hydraulic demand during the processing season.

Daily, weekly, monthly, quarterly, and annual monitoring of the process wastewater quality and quantity applied to the LAA and crop sampling will be conducted to document the performance of the land application operations. Regular monitoring will provide feedback on system performance to correct short-term problems before they can become a threat to groundwater quality. Therefore, the discharge of process wastewater to the 3,700-acre LAA has a low probability of degrading groundwater at the site and groundwater monitoring should not be necessary.

REFERENCES

California Department of Food and Agriculture. (n.d.). *Pistachio nitrogen uptake and partitioning*. Department of the Interior, United States Geological Survey. Retrieved February 18, 2022, from https://www.cdfa.ca.gov/is/ffldrs/frep/FertilizationGuidelines/N_Pistachio.html

California Department of Water Resources. (2003). Basin Report 5-22.09: San Joaquin Valley groundwater basin westside subbasin. In *California's groundwater (Bulletin 118 - Update 2003).* Washington, DC: Author. Retrieved February 2022, from https://data.cnra.ca.gov/dataset/bulletin-118-update-2003-basin-reports/resource/e5529385-f67a-4006-8f66-d1daa9e6753e

California Department of Water Resources. (2018, November 18). [Data file]. Retrieved from Groundwater Information Center Interactive Map Application: https://sgma.water.ca.gov

California Department of Water Resources. (n.d.). *Monthly report - Firebaugh/Telles - station 7; Westland - station 105*, [Data file]. Retrieved March 11, 2021, from California Irrigation Management Information System: http://cimis.water.ca.gov

California Department of Water Resources. (n.d.). *Office of Water Use Efficiency, Sacramento, California*, [Data file]. Retrieved March 11, 2021, from California Irrigation Management Information System: http://wwwcimis.water.ca.gov/cimis/welcome.jsp

California Environmental Protection Agency - State Water Resources Control Board. (1968). Statement of a policy with respect to maintaining high quality of waters in California. Sacramento, CA: Author.

Kenneth D. Schmidt and Associates. (2007). *Groundwater conditions in the Firebaugh Canal Water District and CCID Camp 13 Drainage District*. Fresno, CA: Author.

National Oceanic and Atmospheric Administration. (n.d.). *National weather service Fresno climate*. Retrieved November 17, 2021, from https://www.weather.gov/hnx/fatmain

Snyder, R. L., Orang, M., Matyac, S., & Eching, S. (2007). *Crop coefficients*. Davis, CA: University of California. Retrieved from http://biomet.ucdavis.edu/Evapotranspiration/CropCoef/Kc.pdf

Soil Survey Staff, Natural Resources Conservation Service. (n.d.). *Web soil survey custom soil resource report - Fresno County, California*. U.S. Department of Agriculture. Retrieved August 25, 2021, from Web Soil Survey.

The Wonderful Company, LLC. (2020). Firebaugh Plant waste discharge requirements order R5-2020-0034. Fresno, CA: Author.

U.S. Environmental Protection Agency - Environmental Research Information Center. (1977). *Pollution abatement in the fruit and vegetable industry. 3. waste treatment*, (EPA/625/3-77/007C). Cincinnati, OH: U.S. Environmental Protection Agency.

United States Geological Survey Department of the Interior. (2013). *Groundwater-quality data in the western San Joaquin Valley study unit, 2010: results from the California GAMA Program*, Data Series 706. Author.

University of California - Davis. (2021). *California fertilization guidelines: pistachio*. Retrieved January 6, 2021, from University of California - Davis fertilizer research and education program: http://geisseler.ucdavis.edu/Guidelines/Pistachio.html

University of California & Merced County Cooperative Extension & Doll, D. (2017). *Advances in pistachio production short course - pistachio irrigation: determining water needs and managing drought*. Retrieved January 6, 2021, from https://ucanr.edu: https://ucanr.edu/sites/PistachioShortCourse/2017_Short_Course_22/Agenda_and_Presentations/

University of California Cooperative Extension - Division of Agriculture and Natural Resources. (1994). *Using reference evapotranspiration and crop coefficients to estimate crop evapotranspiration for agronomic crops, grasses, and vegetable crops.* Davis, CA: Author.

Westlands Water District. (2016). *Deep groundwater conditions report - December 2015*. Author.

Westlands Water District GSA & County of Fresno GSA-Westside & Luhdorff & Scalmanini Consuting Engineers. (2020). *Westside subbasin groundwater sustainability plan*. Fresno, CA: Author.

TABLES

Table 1. Source Water and Projected Process Wastewater Quality

Constituent	Units	S. Stamoules Source Water [1]	The Wonderful Company, LCC, Firebaugh Plant			Projected Process Wastewater Quality [5]	Projected Blended Process Wastewater Quality [6]
			Process Wastewater Quality [2]	Source Water Quality [3]	Process Addition [4]		
		10/27/2020	2021 Average	10/18/2021			
Biochemical Oxygen Demand	mg/L	--	3,773	--	3,773	**3,773**	**2,346**
Total Suspended Solids	mg/L	--	415	--	415	**415**	**293**
pH	s.u.	8.22	5.2	8.4	-3.2	**5.0**	**6.2**
Electrical Conductivity	µmhos/cm	1,540	3,463	660	2,803	**4,343**	**3,254**
Total Kjeldahl Nitrogen	mg/L	--	164.4	--	164.4	**164.4**	**139.5**
Ammonia-Nitrogen	mg/L	--	--	--	--	**--**	**--**
Nitrate-Nitrogen	mg/L	<0.2	0.57	0.18	0.39	**0.59**	**0.44**
Total Nitrogen	mg/L	<0.2	130	<1.0	130	**130**	**80**
Total Dissolved Solids	mg/L	1,100	3,200	320	2,880	**3,980**	**2,861**
Fixed Dissolved Solids	mg/L	--	1,408	--	1,408	**1,408**	**900**
Total Hardness	mg/L $CaCO_3$	110	--	13	--	**110**	**110**
Calcium	mg/L	31	68	20	48	**79**	**60**
Magnesium	mg/L	7	21.5	15	7	**14**	**11**
Sodium	mg/L	310	205	87	118	**428**	**382**
Potassium	mg/L	2	715	3.5	711	**713**	**437**
Chloride	mg/L	80	165.0	130.0	35.0	**115**	**101**
Sulfate	mg/L	480	58	34	24	**504**	**494**
Bicarbonate	mg/L $CaCO_3$	210	895	94	801	**210**	**210**
Carbonate	mg/L $CaCO_3$	<5.0	--	<4.1	<4.1	**<9.1**	**<7.5**
Total Alkalinity	mg/L $CaCO_3$	170	895	94	801	**971**	**660**
Iron	mg/L	<0.05	1.49	0.15	1.34	**1.39**	**0.87**
Manganese	mg/L	0.14	0.89	0.02	0.87	**1.01**	**0.67**
Fluoride	mg/L	0.39	--	--	--	**0.39**	**0.39**
Zinc	mg/L	<0.05	--	--	--	**<0.05**	**<0.05**
Boron	mg/L	--	1.17	0.18	0.99	**0.99**	**0.60**
Copper	mg/L	0.02	--	--	--	**--**	**--**

NOTES:

Abbreviations: -- = not tested, $CaCO_3$ = calcium carbonate, mg/L = milligrams per liter, s.u. = standard units, µmhos/cm = micromhos per centimeter, < = less than method detection limit.

1 Water samples were collected from the proposed source water supply by South Valley Pump, Inc. personnel on October 27, 2020. The water samples were analyzed by BC Laboratory, Inc. in Bakersfield California.

2 Process wastewater quality represents the actual analytical test results from The Wonderful Company, LLC, Firebaugh Plant 2021 Annual Monitoring Report.

3 Source water quality obtained from The Wonderful Company, LLC, Firebaugh Plant 2021 Annual Monitoring Report.

4 Process addition represents an example of the constituents added to the process wastewater stream during pistachio processing at The Wonderful Company, LLC Firebaugh Plant. Process addition = process wastewater quality - source water quality.

5 Projected process wastewater quality was calculated by adding the S. Stamoules source water quality to the process addition values.

6 Projected water quality after blending with fresh irrigation water. Blending ratio calculated from design water balance calculations for the month of October (Appendix E-1).

Table 2. Projected Process Wastewater Flow

Month	Calendar Days	Operational Days [1]	Flow Rate	Monthly Flow Estimate		
			gpm	gallons per day	gallons	million gallons
January	31	21	2	1,095	23,000	0.023
February	28	20	2	1,100	22,000	0.022
March	31	22	2	1,091	24,000	0.024
April	30	22	2	1,091	24,000	0.024
May	31	21	2	1,095	23,000	0.023
June	30	22	2	1,091	24,000	0.024
July	31	22	2	1,091	24,000	0.024
August	31	22	2	2,045	45,000	0.045
September	30	30	5,000	5,100,000	153,000,000	153.000
October	31	31	5,000	5,100,000	158,100,000	158.100
November	30	22	2	1,091	24,000	0.024
December	31	22	2	1,091	24,000	0.024
Processing Season Total	**61**	**277**	**--**	**--**	**311,100,000**	**311.10**
Annual Total	**365**	**20**	**--**	**--**	**311,357,000**	**311.36**

NOTES:

Abbreviations: -- = not applicable, gpm = gallons per minute.

1 Estimated days of the calendar month that facility will be operational.

Table 3. Proposed Chemical Usage

Product Name [1]	Comment (uses / liquid, dry powder / active ingredient)
Aqua-Chlor 12.5	Disinfectant /sanitizer
Sani-T-10®	Disinfectant /sanitizer
Sodium Hypochlorite	Disinfectant /sanitizer for source water
Chlorinated degreasers	Sanitizer
Chlorine dioxide	Sanitizer

NOTE:

1 Proposed list of chemicals derived from preliminary process wastewater flow diagrams. Actual chemicals used in the operation will be dependent upon suppliers and product availability.

Table 4. Precipitation, Evapotranspiration, and Temperatures

Month	Precipitation [1]					Evapotranspiration [5]				Temperatures [6]			
	100-Year Return [2]	10-Year Return Design [3]	30-Year Average [4]	10-Year Average [4]	30-Year Average Monthly Distribution	Reference ETo	Pond Evaporation	Pistachio ETc	Fallow ETc	Air Average Maximum	Air Average Minimum	Air Daily Average	Soil Average 4-inch Depth
	1983	2011-2020	1991-2020	2011-2020									
	inches				%	inches				degrees Fahrenheit			
Jan	5.1	1.7	1.4	0.9	20.5%	1.3	1.4	1.1	1.1	57.1	37.0	47.0	49.2
Feb	3.7	1.5	1.2	0.6	17.5%	2.2	2.4	1.7	1.7	63.3	39.0	51.1	52.2
Mar	4.5	1.4	1.1	1.2	16.2%	4.0	4.4	1.8	1.8	69.5	42.4	55.9	57.4
Apr	2.8	0.6	0.5	0.4	7.1%	6.0	6.6	1.5	2.4	76.0	45.9	60.9	63.2
May	0.0	0.7	0.5	0.4	7.9%	8.2	9.0	5.8	2.0	84.5	52.2	68.4	71.1
Jun	0.0	0.1	0.0	0.1	0.7%	9.1	10.0	10.3	1.5	92.0	58.2	75.1	77.0
Jul	0.0	0.0	0.0	0.0	0.1%	9.3	10.2	11.1	1.5	96.7	62.7	79.7	81.0
Aug	0.1	0.0	0.0	0.0	0.0%	8.3	9.1	9.5	1.4	95.0	61.2	78.1	79.2
Sep	1.0	0.0	0.0	0.0	0.2%	6.4	7.0	6.1	1.3	90.6	57.0	73.8	74.4
Oct	0.1	0.5	0.4	0.3	5.9%	4.4	4.9	2.6	2.1	80.3	48.4	64.3	66.5
Nov	2.5	0.8	0.6	0.7	9.4%	2.2	2.5	1.4	1.4	66.8	39.9	53.4	57.4
Dec	1.8	1.2	1.0	0.9	14.2%	1.3	1.4	1.3	1.3	57.0	35.1	46.0	50.0
Annual	**21.6**	**8.5**	**6.7**	**5.5**	**100%**	**62.6**	**68.9**	**54.2**	**19.4**				

NOTES:

Abbreviations: ETo = evapotranspiration, ETc = crop evapotranspiration (ETo x crop coefficient (Kc)).

1 Precipitation data based on data obtained from the California Irrigation Management Information Systems (CIMIS).

2 1983 was the greatest precipitation year since 1887 based on historic rainfall data from the National Weather Service for Fresno, California. CIMIS data for the past 100 years was not accurate for nearby stations (National Oceanic and Atmospheric Administration, n.d.).

3 The 10-year return design precipitation is the greatest annual precipitation in the past 10 years (2011-2020) distributed monthly in accordance with historical (long-term average) rainfall patterns (California Department of Water Resources, n.d.).

4 Average precipitation data was calculated based on data from CIMIS for January 1991 to March 1992 from the Firebaugh/Telles station (#7) and April 1992 to December 2020 from the Westlands station (#105) (California Department of Water Resources, n.d.).

5 Evapotranspiration (ETo) provided by CIMIS for January 1991 to March 1992 from the Firebaugh/Telles station (#7) and April 1992 to December 2020 from the Westlands station (#105). Crop evapotranspiration (ETc) was derived by multiplying CIMIS ETo data by the appropriate crop coefficient (Kc). For months when pistachio crop is dormant, fallow ETc was utilized (California Department of Water Resources, n.d.).

6 Temperature data collected from CIMIS for January 1991 to March 1992 from the Firebaugh/Telles station (#7) and April 1992 to December 2020 from the Westlands station (#105) (California Department of Water Resources, n.d.).

Table 5. Soil Physical Characteristics

Series [1]	Slope	Acres Mapped [2]	Map Unit [3]	Depth [4]	Soil Horizon Designations [5]	USDA Texture [6]	Soil Structure	Sand [7]	Silt [7]	Clay [7]	Organic Matter	Moist Bulk Density	Ksat [8]	AWHC [9]		CEC [10]
				inches				%				g/cm^3	in/hr	in/in	in/60 inches	meq/100g
Tranquillity clay, saline-sodic	0 to 2%	521.7	285	0 - 22	Ap	clay	Subangular Blocky	6	39	55	1.0 - 1.3	1.25 - 1.3	0.06 - 0.2	0.13 - 0.16	8.1	37.1
				22 - 53	Bkss	clay	Subangular Blocky	12	37	51	0.5 - 0.7	1.20 - 1.3	0.06 - 0.2	0.11 - 0.15		
				53 - 71	Bk	clay	Subangular Blocky	14	38	48	0.1 - 0.2	1.20 - 1.25	0.06 - 0.2	0.11 - 0.14		
Tranquillity clay, saline-sodic, wet	0 to 2%	521.7	285	0 - 6	Ap1	clay	Subangular Blocky	20	30	50	1.0 - 1.3	1.25 - 1.26	0.06 - 0.2	0.11 - 0.15	6.5	35.0
				6 - 16	Ap2	clay	Subangular Blocky	17	32	51	0.5 - 0.9	1.25 - 1.34	0.06 - 0.2	0.08 - 0.14		
				16 - 31	Bknssyz1	clay	Subangular Blocky	12	35	53	0.4 - 0.6	1.20 - 1.25	0.003 - 0.06	0.08 - 0.13		
				31 - 48	Bknssyz2	clay	Massive	15	34	51	0.4 - 0.5	1.20 - 1.26	0.003 - 0.06	0.08 - 0.13		
				48 - 65	Bknyz	silty clay	Massive	11	41	48	0.4 - 0.5	1.20 - 1.26	0.003 - 0.06	0.08 - 0.13		
Excelsior sandy loam	0 to 2%	330.6	445	0 - 7	Ap	sandy loam	Massive	60	28	12	0.5 - 1.0	1.40 - 1.60	2.0 - 6.0	0.09 - 0.13	8.0	9.0
				7 - 23	C1	sandy loam	Massive	60	28	12	0.3 - 0.8	1.40 - 1.60	2.0 - 6.0	0.06 - 0.15		
				23 - 72	C2	sandy loam	Massive	55	35	10	0.1 - 0.4	1.45 - 1.60	0.6 - 6.0	0.09 - 0.21		
Excelsior sandy loam, sandy substratum	0 to 2%	80	447	0 - 7	Ap	sandy loam	Massive	60	28	12	0.5 - 1.0	1.40 - 1.60	2.0 - 6.0	0.09 - 0.13	6.4	9.4
				7 - 23	C1	sandy loam	Massive	60	28	12	0.3 - 0.8	1.40 - 1.60	2.0 - 6.0	0.09 - 0.13		
				23 - 53	C2	sandy loam	Massive	55	35	10	0.1 - 0.7	1.30 - 1.60	0.6 - 2.0	0.08 - 0.15		
				53 - 72	C3	loamy sand	Massive	80	15	5	0.1 - 0.2	1.45 - 1.65	6.0 - 20.0	0.05 - 0.08		
Ciervo clay, saline-sodic [11]	0 to 2%	274.3	459/462	0 - 17	Ap	clay	Subangular Blocky	32	28	40	0.5 - 1.0	1.25 - 1.50	0.2 - 0.6	0.13 - 0.18	10.3	30.4
				17 - 27	Bw	clay	Subangular Blocky	17	36	47	0.4 - 0.8	1.15 - 1.35	0.1 - 0.2	0.13 - 0.18		
				27 - 41	Bknyz	silty clay	Platy	11	42	47	0.3 - 0.7	1.15 - 1.35	0.1 - 0.2	0.13 - 0.18		
				41 - 60	Bknz	clay loam	Massive	35	31	34	0.3 - 0.6	1.15 - 1.30	0.1 - 0.2	0.13 - 0.18		

Table 5. Soil Physical Characteristics

Series [1]	Slope	Acres Mapped [2]	Map Unit [3]	Depth [4]	Soil Horizon Designations [5]	USDA Texture [6]	Soil Structure	Sand [7]	Silt [7]	Clay [7]	Organic Matter	Moist Bulk Density	Ksat [8]	AWHC [9]		CEC [10]
				inches				%				g/cm^3	in/hr	in/in	in/60 inches	meq/100g
Calflax clay loam	0 to 2%	2701.4	482	0 - 8	Ap	clay loam	Subangular Blocky	28	40	32	0.5 - 2.0	1.30 - 1.45	0.2 - 0.6	0.14 - 0.19	8.9	22.6
				8 - 26	Bw	clay loam	Subangular Blocky	27	35	38	0.3 - 1.0	1.30 - 1.45	0.2 - 0.6	0.14 - 0.19		
				26 - 33	Bny	loam	Subangular Blocky	34	40	26	0.1 - 0.4	1.35 - 1.50	0.2 - 0.6	0.14 - 0.19		
				33 - 47	Bnyz1	silt loam	Subangular Blocky	23	52	25	0.1 - 0.4	1.30 - 1.50	0.2 - 0.6	0.08 - 0.18		
				47 - 65	Bnyz2	loam	Massive	33	45	22	0.1 - 0.3	1.30 - 1.50	0.2 - 0.6	0.08 - 0.18		
Acre-weighted Site Average															**8.6**	**23.5**

NOTES:

Based on information from a Custom Soil Survey Resource Report for Fresno County, California Western Part (Soil Survey Staff, Natural Resources Conservation Service, n.d.).

Abbreviations: AWHC = available water holding capacity, CEC = cation exchange capacity, g/cm^3 = grams per cubic centimeter, in = inches, in/hour = inches per hour, in/in = inches per inch, in/60 inches = inches per 60 inches, Ksat = saturated hydraulic conductivity, meg/100g = milliequivalents per 100 grams.

1 Soil series are differentiated by variability in physical and chemical properties. All soils within a series have similar horizonation (layers).

2 Mapped acres do not represent actual farmed acres.

3 Map unit numbers correspond to the descriptions and map symbols contained in the Fresno County Soil Survey.

4 Typical depth below ground surface of each horizon (distinct layer of soil) in each soil series.

5 Soil horizon designations represent layers of pedogenically derived or modified soil. Ap = tillage or other disturbance layer; Bw = layer of weak structural development; Bny = layer of accumulated clay with secondary carbonate accumulation (k), sodium accumulation (n), gypsum accumulation (y), slickensides (ss), and accumulation of soluble salts (z). The numbers 1 and 2 represent a series of similar but distinguishable layers.

6 Texture based on USDA NRCS Soil Survey Engineering Properties table.

7 Sand, silt, and clay given as a percentage of the soil mineral constituents.

8 Ksat is the abbreviation for saturated hydraulic conductivity. Ksat provides measurement of the ease of vertical water movement in soil. Permeability classes are as follows: Rapid: 6.0 to 20 in/hr; Moderately Rapid: 2.0 to 6.0 in/hr; Moderate: 0.6 to 2.0 in/hr; Mod. slow: 0.2 to 0.6 in/hr; Slow: 0.06 to 0.2 in/hr. Very Slow: less than 0.06

9 Available water holding capacity is the amount of water available for use by plants in inches of water per inch of soil (field capacity minus permanent wilting point). The AWHC for a soil depth of 60 inches uses the average of the range of AWHC of each horizon as an estimate for the water balance calculations. The assumed root zone for the crops that will likely be grown at the land application area is approximately 60 inches for pistachios.

10 CEC provides measurement of the extractible cations held in the soil.

11 Ciervo clay, Ciervo clay saline-sodic, and Ciervo clay saline-sodic wet (Map units 459 and 462) have been combined since the soil physical characteristics for each mapping unit is similar.

Table 6. Land Application Area Fields

Section-Field	Total Acres	Wetted Area Acres [1]
2-1	160	64
2-2	160	64
2-3	160	64
2-4	160	64
3-1	145	58
3-2	160	64
3-3	150	60
3-4	160	64
5-1	160	64
5-2-1	55	22
5-2-2	90	36
5-3	160	64
5-4	150	60
7-1	160	64
7-2	160	64
7-3	160	64
7-4	160	64
8-1	105	42
8-2 W	75	30
8-2 E	60	24
8-3	160	64
8-4	150	60
33-1	160	64
33-2	160	64
33-3	160	64
33-4	160	64
Total	**3,700**	**1,480**

NOTES:

Pistachio trees are irrigated utilizing surface drip irrigation. Tree rows contain two drip lines, one on each side of a tree.

Section and Field numbers obtained from Stamoules Produce, Inc.

1 Wetted acreage assumes 40% of the field is effectively wetted.

Table 7. Lined Settling Pond Capacity

Pond	Pond Area				Acres	Depth	Cubic Feet	Gallons	Million Gallons	Acre-feet
	Top	Bottom	Mid	Average						
	square feet					feet				
East Lined Settling Pond	52,470	16,555	34,038	34,354	0.79	10.5	360,721	2,698,189	2.7	8.28
West Lined Settling Pond	113,096	68,268	85,782	89,049	2.04	15	1,335,728	9,991,242	10.0	30.67
Total	**165,566**	**84,823**	**119,820**	**123,403**	**2.83**	**--**	**1,696,448**	**12,689,431**	**12.7**	**38.96**

NOTE:
Dimensions of ponds dervied from plans provided by South Valley Engineering, Inc.

Table 8. Summary of Water Balance Results for the Proposed Cropping System

Crop [1]	Annual Process Wastewater Flow	Leaching Requirement	Leaching Fraction	
	MG	%	%	inches
100-Year Return Precipitation				
Pistachio	311.36	13.7%	13.7%	9.7
30-Year Average Precipitation				
Pistachio	311.36	18.0%	18.0%	14.2
100-Year Return Precipitation (No Flow)				
Pistachio	0.00	12.1%	12.1%	8.4

NOTES:

Abbreviation: MG = million gallons.

1 Proposed cropping system is 3,700 acres of pistachio.

Table 9. Crop Coefficients

Month	Grass [1]	Pistachio [2]	Fallow	Open Water Surfaces [1]
Jan	0.70		0.85	1.10
Feb	0.70		0.77	1.10
Mar	0.70		0.45	1.10
Apr	0.70	0.25	0.40	1.10
May	0.70	0.71	0.25	1.10
Jun	0.70	1.13	0.16	1.10
Jul	0.70	1.19	0.16	1.10
Aug	0.70	1.15	0.17	1.10
Sep	0.70	0.95	0.20	1.10
Oct	0.70	0.60	0.48	1.10
Nov	0.70		0.61	1.10
Dec	0.70		1.05	1.10

NOTES:

Crop and bare soil (fallow) coefficients (Kc) unless otherwise noted, are derived from "Crop Coefficients" by R.L. Snyder et.al. Crop coefficients are used to derive irrigation needs by multiplying the reference evapotranspiration by the coefficient. Blank cells indicate that a particular crop is not growing during those months. Use Bare soil (fallow) crop coefficient for those months (Snyder, R. L., Orang, M., Matyac, S., & Eching, S., 2007).

1 From University of California Cooperative Extension Division of Agriculture and Natural Resources. 1994. *Using Reference Evapotranspiration (ETo) and Crop Coefficients to Estimate Crop Evapotranspiration for Agronomic Crops,* Grasses, and Vegetable Crops (University of California Cooperative Extension - Division of Agriculture and Natural Resources, 1994).

2 From "*Pistachio Irrigation: Determining Water Needs and Managing Drought*" (University of California & Merced County Cooperative Extension & Doll, D., 2017).

Table 10. Process Wastewater Constituent Mass Loads

Flow	Total N	Net Total N [1]	BOD	TDS	FDS	Na	K	Ca	Mg	Cl	SO_4
MG/year	pounds per year										
311.36	338,093	270,474	9,796,706	10,334,935	3,656,650	1,111,395	1,852,097	205,141	35,575	298,622	1,307,447
	pounds per acre per year [2]										
311.36	91	73	6,619	2,793	988	300	501	55	10	81	353

NOTES:

Constituent mass loads calculated from average process wastewater constituent concentrations and projected total annual flow.

Pounds per year = parts per million (milligrams per liter) × million gallons per year × 8.34 million pounds per million gallons.

Abbreviations: BOD = biochemical oxygen demand, Ca = calcium, Cl = chloride, FDS = fixed dissolved solids, K = potassium, Mg = magnesium, MG/year = million gallons per year, N = nitrogen, Na = sodium, NO_3-N = nitrate-nitrogen, SO_4 = sulfate, TDS = total dissolved solids, TKN = total Kjeldahl nitrogen, Total N = TKN + NO_3-N,

1 Net total N assumes a 20% loss of the gross total N to account for volatilization and denitrification in the soil/plant system. Net total N represents the amount of nitrogen available for crop uptake.

2 Calculation based on a 3,700-acre land application area except for BOD where a wetted acerage of 1,480 (40%) was used.

Table 11. Agronomic Nitrogen Balance

Crops [1]	Gross Nitrogen Additions [2]		Nitrogen Losses			Agronomic Nitrogen Balance [6]
	Process Wastewater Total N	Commercial Fertilizer [3]	Pistachio Uptake [4]	Gaseous Losses [5]	Total Removal and Loss	
	pounds of nitrogen per acre					
Pistachio	91	0	150	18	168	**-77**

NOTES:

Abbreviations: Total N = total Kjeldahl nitrogen + nitrate-nitrogen.

1 Proposed cropping system is 3,700 acres of pistachio.

2 Nitrogen addition calculated from projected process wastewater quality and annual flow.

3 Example nitrogen balance assumes no commercial nitrogen added. Soil testing and crop observation will determine need for fertilization.

4 Pistachio uptake of nitrogen estimated at 150 pounds per acre per year. This uptake includes nitrogen retained in tree biomass (roots, trunks, branches, leaves, etc.) and nitrogen removed from harvested fruit (California Department of Food and Agriculture, n.d.).

5 Assumes gaseous loss of 20% of applied nitrogen through micropore denitrification and ammonia volatilization.

6 Total gross nitrogen additions minus total nitrogen removal and losses. Positive values indicate additional nitrogen available. Negative values indicate nitrogen demand in excess of application rates.

Table 12. Potassium Balance

Crops [1]	Potassium Additions [2]		Potassium Losses	Potassium Balance [5]
	Process Wastewater	Commercial Fertilizer [3]	Pistachio Uptake [4]	
	pounds of potassium per acre			
Pistachio	501	0	113	**388**

NOTES:

1 Proposed cropping system is 3,700 acres of pistachio.

2 Potassium addition calculated from projected process wastewater quality and annual flow.

3 Example potassium balance assumes no commercial nitrogen added. Soil testing and crop observation will determine need for fertilization.

4 Pistachio uptake of potassium estimated at 113 pounds per acre per year. This uptake includes potassium retained in tree biomass (roots, trunks, branches, leaves, etc.) and potassium removed from harvested fruit (California Department of Food and Agriculture, n.d.).

5 Potassium additions minus potassium removal. Positive values indicate additional potassium available. Negative values indicate potassium demand in excess of application rates.

Table 13. Biochemical Oxygen Demand Loading

Cropping [1]	Annual BOD Load [2]		Daily Average BOD Load [3]	Daily Maximum BOD Load [3, 4]
	pounds	pounds per acre		
Pistachio	9,796,706	6,619	18	108

NOTES:

Abbreviation: BOD = biochemical oxygen demand.

1 Proposed cropping is 3,700 acres of pistachio and assumes 40.0 % of the land area is effectively wetted.

2 BOD addition calculated from projected process wastewater quality and annual flow.

3 A typically accepted design treatment capacity for chemical oxygen demand is 100 pounds per acre per day annual average (EPA, 1977. Pollution abatement in the fruit and vegetable industry).

4 Daily maximum BOD load was estimated utilizing the projected BOD load during the processing season (September and October).

Table 14. Projected Groundwater (Cmix) Electrical Conductivity, 100-year Precipitation

Annual Percolate Volume	Qp	Cp		Qgw	Cgw	Cmix
MG	MGD	µmhos/cm	mg/L	MGD	µmhos/cm	
Proposed Flow of 311.36 MG						
973.32	2.7	8,793	5,628	12.9	948	2,292
Supplemental Irrigation Only						
846.85	2.3	8,921	5,710	12.9	948	2,163

NOTES:

Abbreviations: MG = million gallons per year, MGD = million gallons per day, mg/L = milligrams per liter, µmhos/cm = micromhos per centimeter.

Calculated future groundwater concentrations using the Cmix method that computes the results of mixing of percolate with groundwater. Cmix = [(Cp × Qp) + (Cgw × Qgw)] / (Qp + Qgw),

Where:

Cmix = calculated concentration in groundwater following mixing of percolate

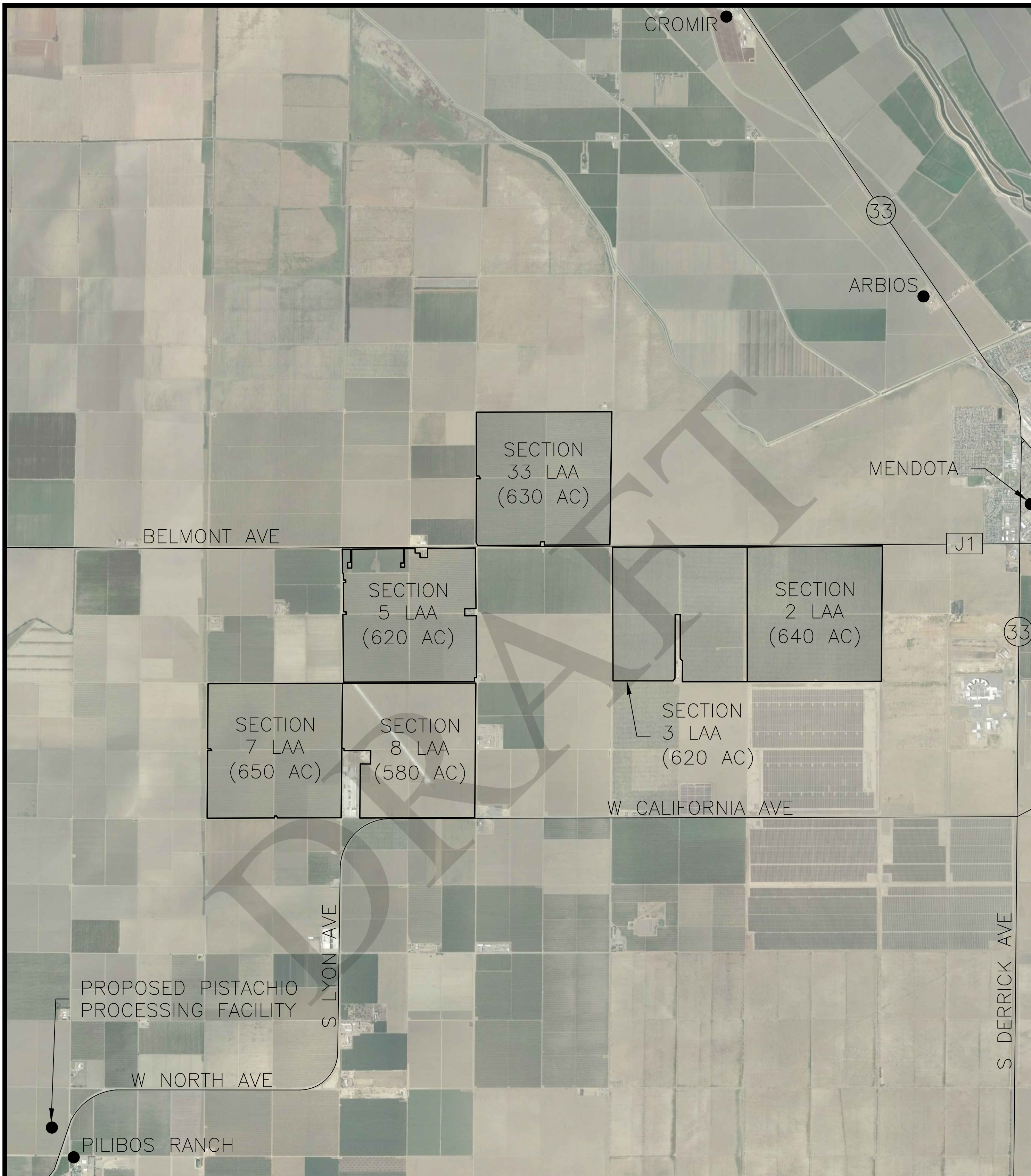
Qp = flow rate of soil water percolate (see Appendix E1)

Cp = average concentration in annual soil water percolate from water balance (see Appendix E1).

Qgw = flow rate of groundwater (see Section 3.3)

Cgw = concentrations in groundwater sample (see Section 3.3)

FIGURES



EXPLANATION:

LAA – LAND APPLICATION AREA
AC – ACRES

0 1 mi
1"=1 mi
(SCALE AND LOCATIONS APPROXIMATE)
(SOURCE: Google Earth Pro Image April 2021, ©2021 Google™)

N

Figure 1. Site Location Map

PROJECT NUMBER: 2021210059	S. Stamoules Pistachio Processing Facility Report of Waste Discharge
DATE: 2/2/2022	
DWG NO: 2021210059 F1-3.DWG	South Valley Engineers S. Newcomb Ave. Mendota, California 93640
DWG BY: 6NSG / PROJECT MANAGER: 10MSS	
REVISED:	VALLEY SCIENCE AND ENGINEERING

S:\[Working Drafting]\2021210059 South Valley Engineering\DWG\2021210059 F1-3.dwg February 2, 2022 NG711452

EXPLANATION:

LAA – LAND APPLICATION AREA
AC – ACRES

0 4000'
1"=4000'
(SCALE AND LOCATIONS APPROXIMATE)

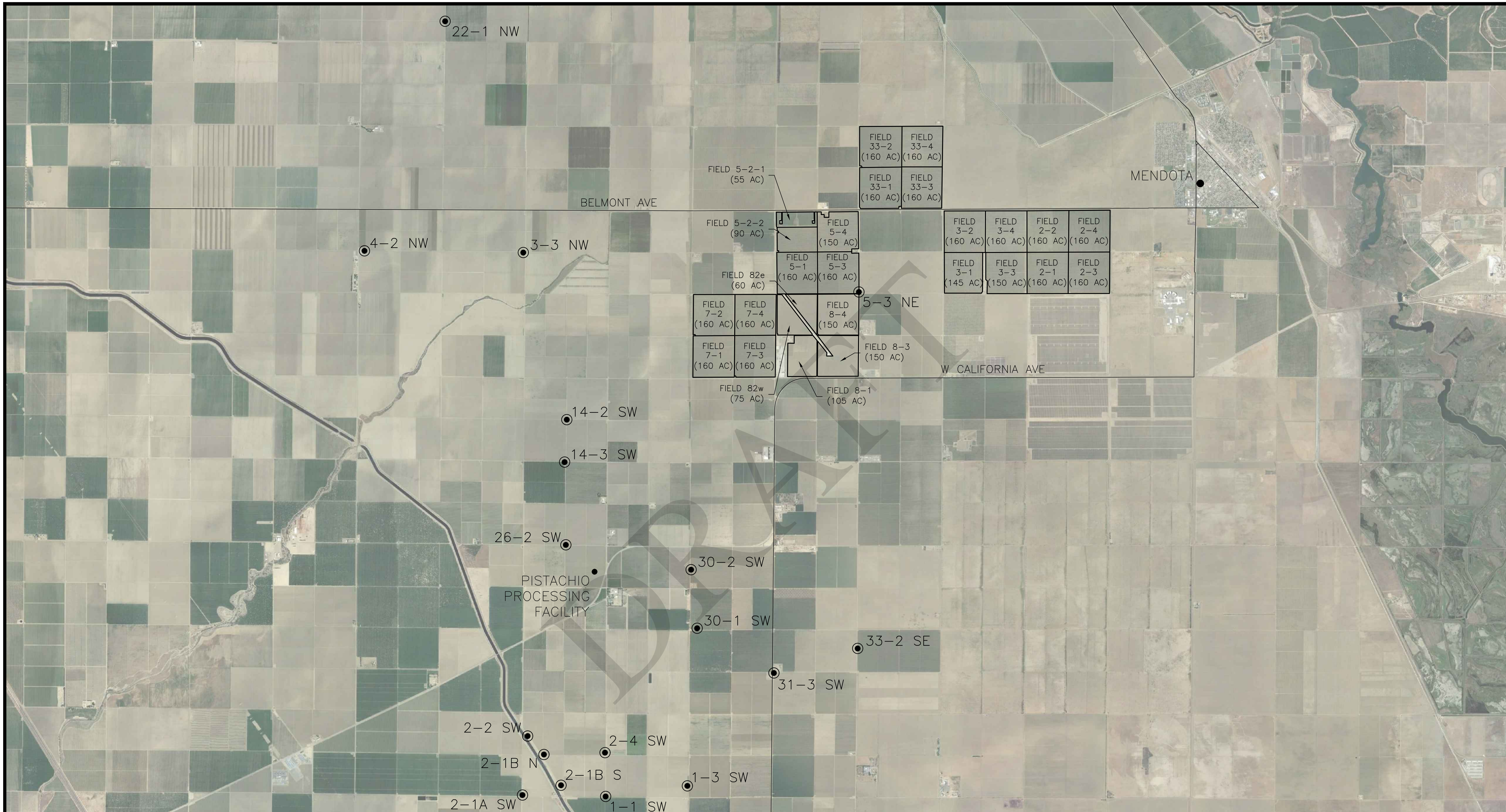
(SOURCE: ©2013 National Geographic Society, i-cubed)

N

Figure 2. Regional Topographic Map

PROJECT NUMBER: 2021210059	S. Stamoules Pistachio Processing Facility Report of Waste Discharge
DATE: 2/2/2022	
DWG NO: 2021210059 F1-3.DWG	South Valley Engineers S. Newcomb Ave. Mendota, California 93640
DWG BY: 6NSG / PROJECT MANAGER: 10MSS	
REVISED:	VALLEY SCIENCE AND ENGINEERING

S:\[Working Drafting]\2021210059 South Valley Engineering\DWG\2021210059 F1-3.dwg February 2, 2022 NG711452



LEGEND:

3-3 NW SOURCE WATER WELLS

EXPLANATION:

AC – ACRES

0 6000'

1"=6000'

(SCALE AND LOCATIONS APPROXIMATE)

N

Figure 3. Land Application Area Field Map

PROJECT NUMBER: 2021210059	S. Stamoules Pistachio Processing Facility Report of Waste Discharge
DATE: 4/22/2022	
DWG NO: 2021210059 F1-3.DWG	South Valley Engineers S. Newcomb Ave. Mendota, California 93640
DWG BY: 6NSG · PROJECT MANAGER: 10MSS	
REVISED:	VALLEY SCIENCE AND ENGINEERING

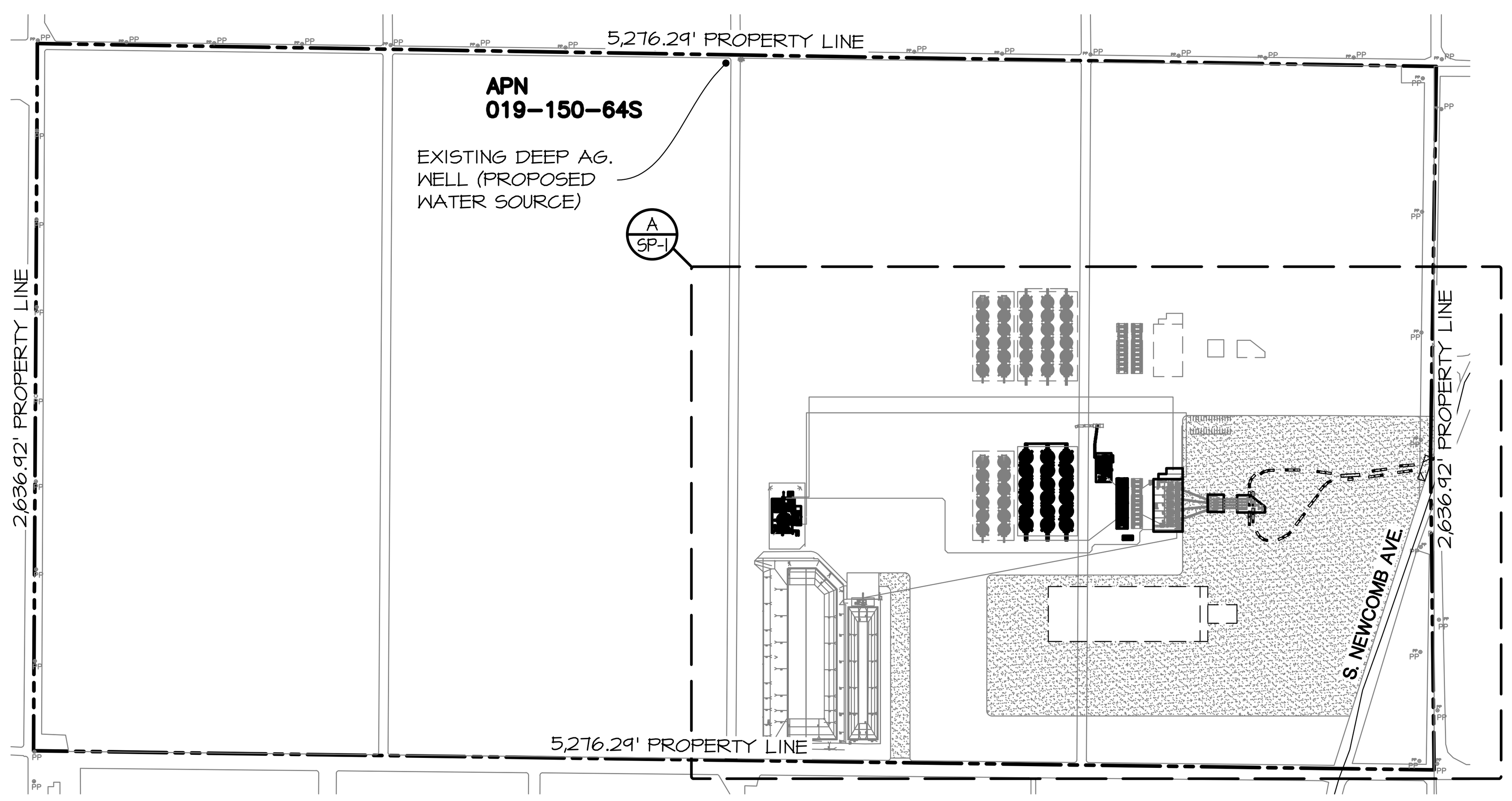
(SOURCE: Google Earth Pro Image April 2021, ©2021 Google™)

C:\Users\NG711452\Desktop\Working Drafting Gulati\2021210059 South Valley Engineering\DWG\2021210059 F1-3.dwg April 22, 2022 NG711452

APPENDICES

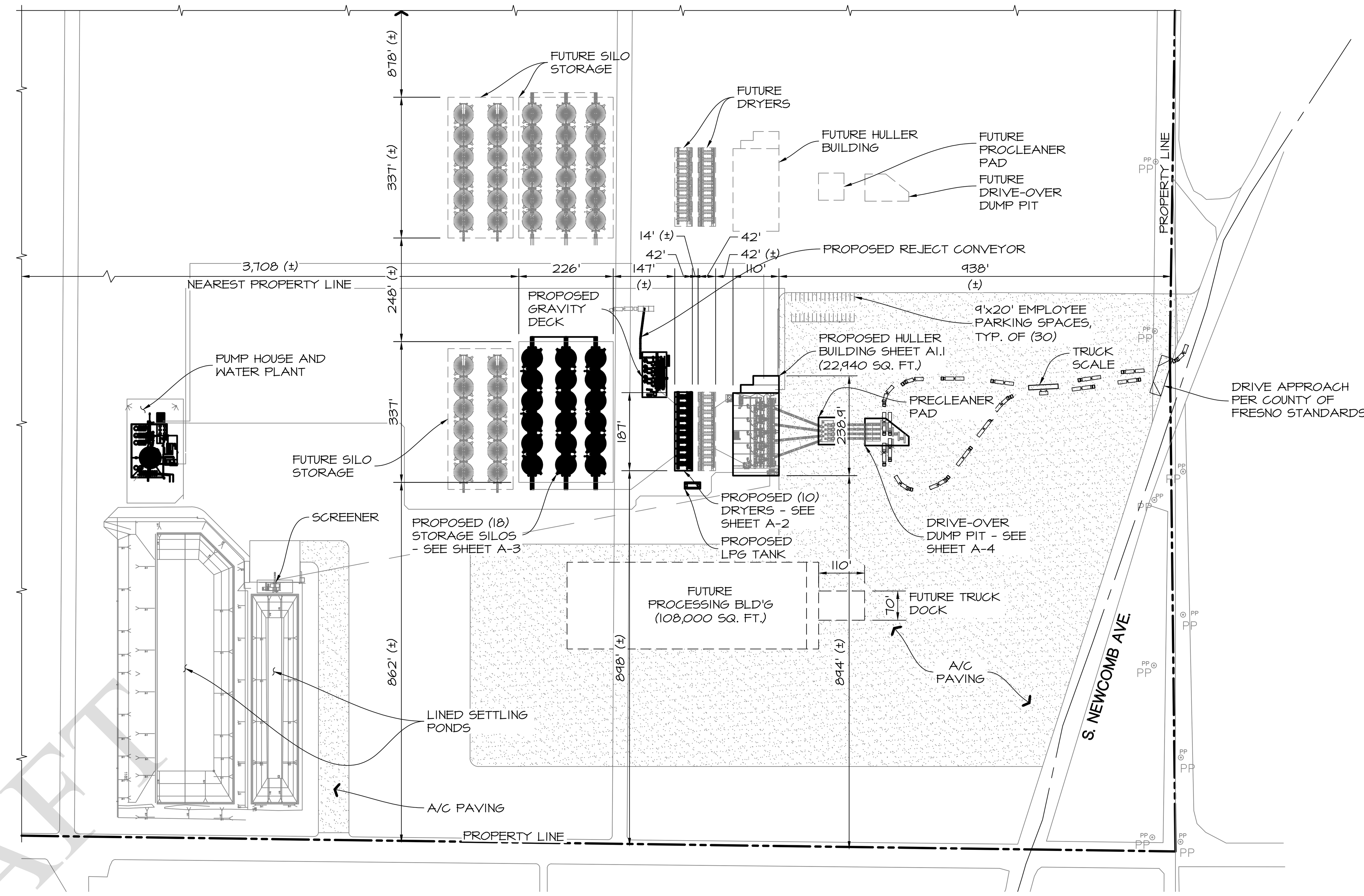
Appendix A.

Site Plan



OVERALL SITE PLAN

1" = 500'



(A) PARTIAL SITE PLAN

1" = 200'

VICINITY MAP

N.T.S.

DATE	ISSUED FOR
9/4/20	SITE PLAN REVIEW

ENGEL & COMPANY
Engineers
4009 UNION AVENUE
BAKERSFIELD, CA 93305
www.engelengineers.com (661) 327-7025

DRAWN: AJK
DATE: 09/04/2020
CHECKED: PJA
APPROVED:

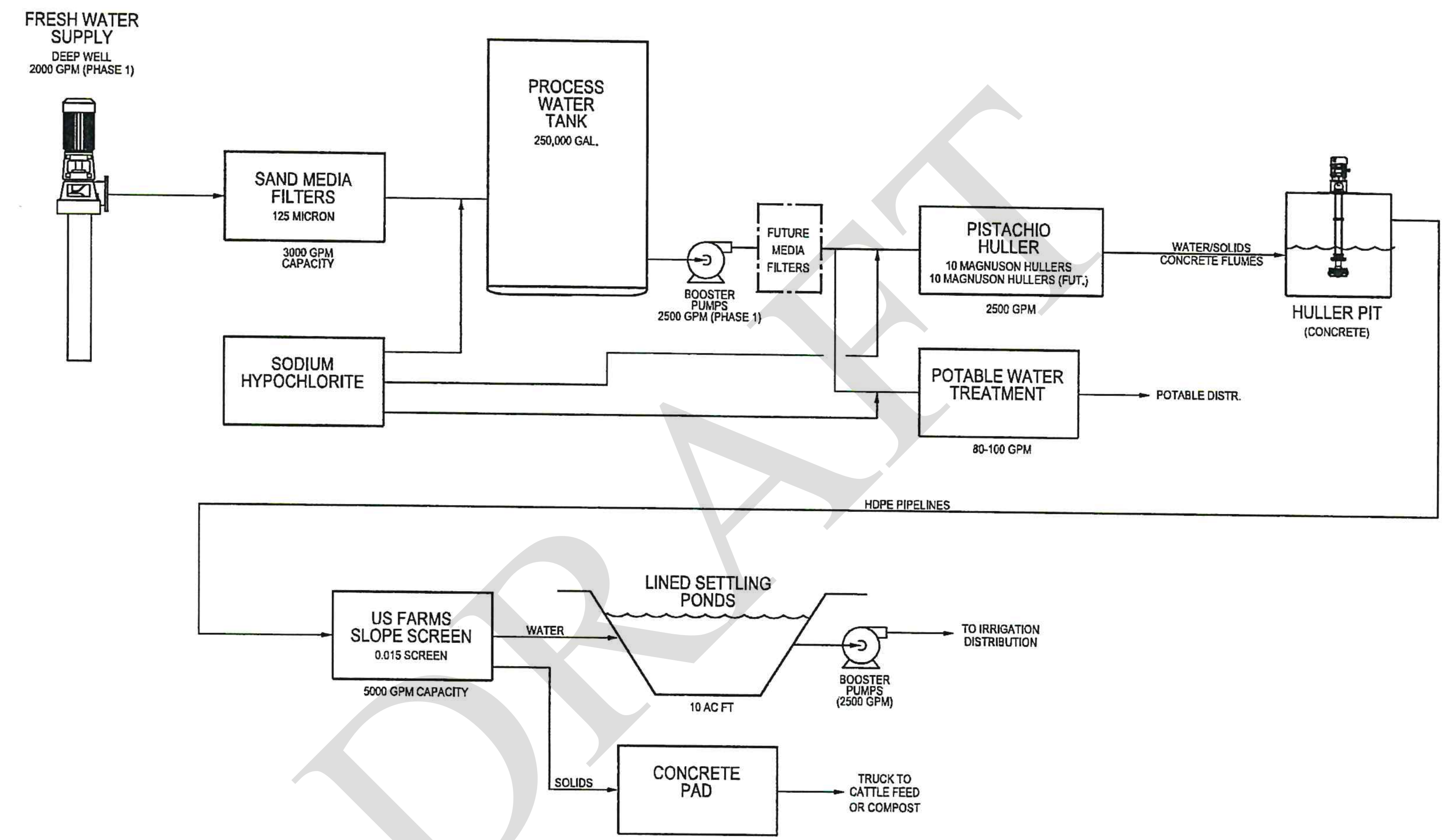
Site Plan
Conditional Use Permit
Opa Pistachios ™
W. Panoche Rd
Mendota, California 93640

SHEET NO. **SP-1**
OF
23133

Appendix B.

Wastewater Process Flow

REF. 1



REV	DESCRIPTION	BY	DATE

South Valley COMPANIES, INC
Water Systems & Pumps
Electrical • Service • Installation
19325 Flightpath Way
Bakersfield, CA 93308
(661) 831-5703
Lic. #410385

ENGR: RLO
DRFT: RLO
DATE: 12/17/20
SCALE: NTS
PROJ #:
B OPA WW PFD

OPA PISTACHIO
2021 HULLER FACILITY
WASTE WATER PROCESS FLOW
MENDOTA, CA

REV: 1.0

P-1

SHEET 1 OF 1

Appendix C.

Soil Report for Fresno County, California, Western Part

USDA United States Department of Agriculture

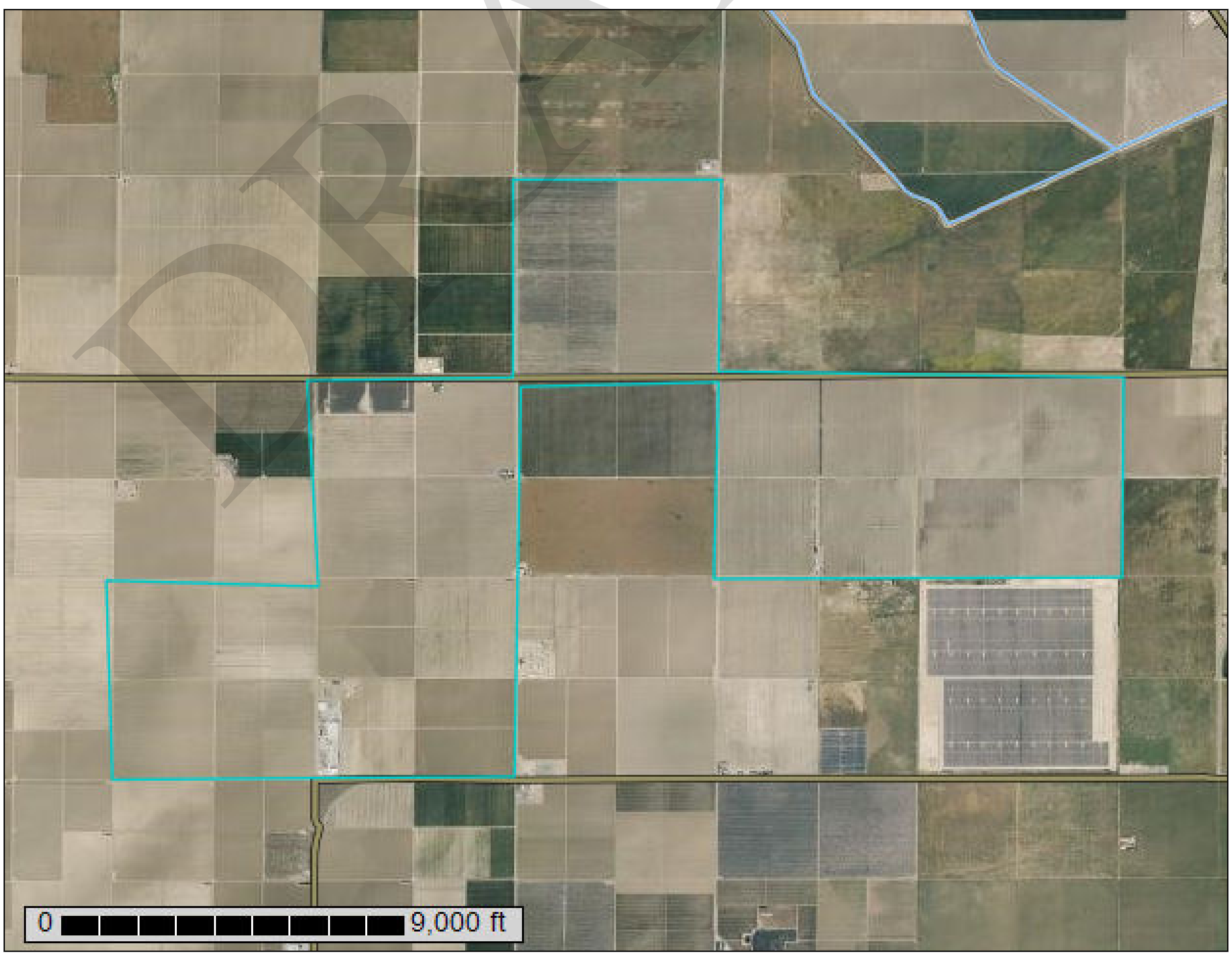
NRCS Natural Resources Conservation Service

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

Fresno County, California, Western Part

S. Stamoules Inc



August 25, 2021

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://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

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 Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

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.

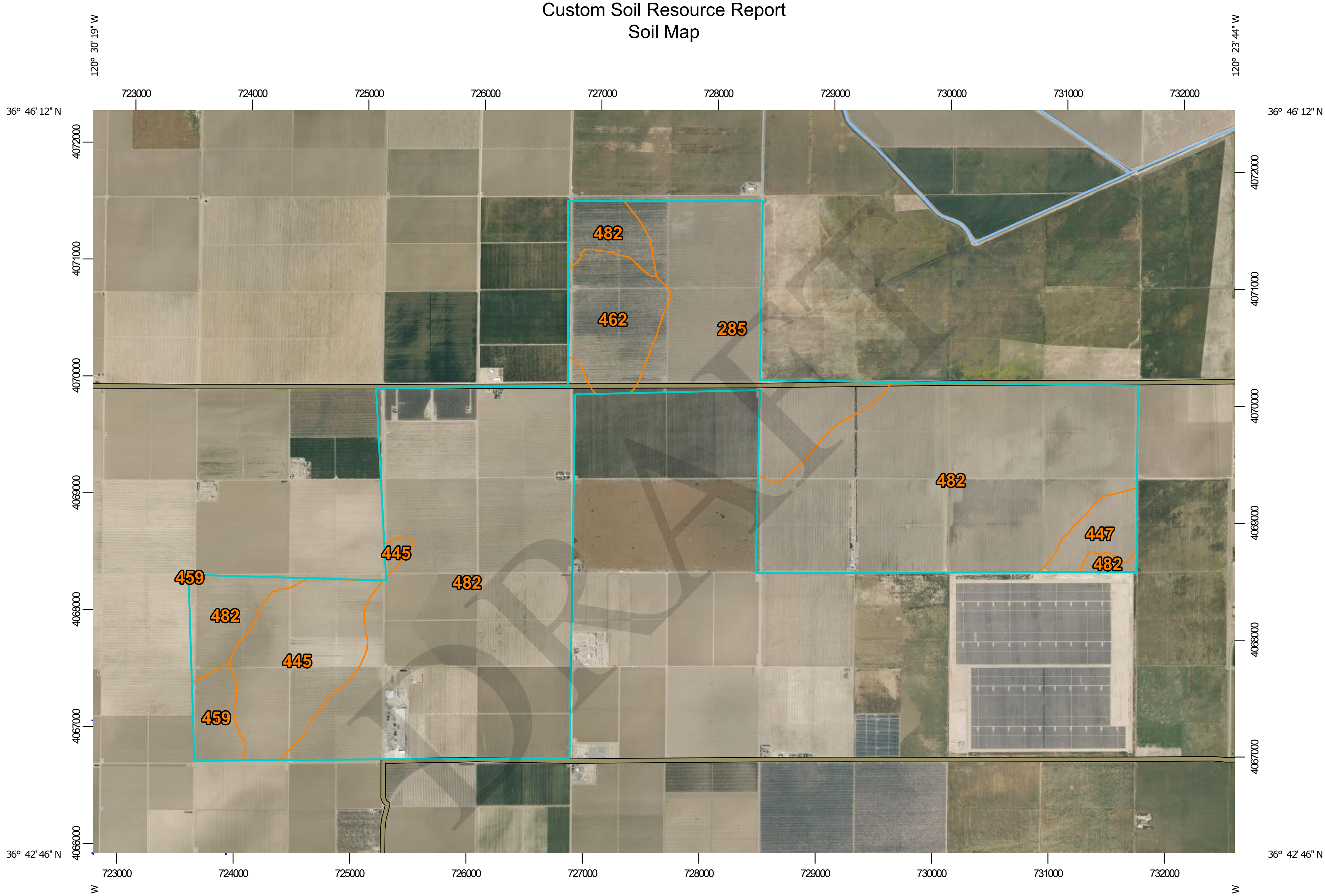
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree 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: 1:44,800 if printed on A landscape (11" x 8.5") sheet.

Meters: 0 500 1000 2000 3000

Feet: 0 2000 4000 8000 12000

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

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

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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

Soil Survey Area: Fresno County, California, Western Part
Survey Area Data: Version 15, May 29, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 18, 2019—Apr 12, 2019

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

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
285	Tranquillity-Tranquillity, wet, complex, saline-sodic, 0 to 1 percent slopes	521.7	13.3%
445	Excelsior sandy loam, 0 to 2 percent slopes, MLRA 17	330.6	8.5%
447	Excelsior sandy loam, sandy substratum, 0 to 2 percent slopes	80.0	2.0%
459	Ciervo clay, 0 to 2 percent slopes	72.9	1.9%
462	Ciervo, wet-Ciervo complex, saline-sodic, 0 to 1 percent slopes	201.4	5.2%
482	Calflax clay loam, saline-sodic, wet, 0 to 1 percent slopes, MLRA 17	2,701.4	69.1%
Totals for Area of Interest		**3,908.0**	**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.

Fresno County, California, Western Part

285—Tranquillity-Tranquillity, wet, complex, saline-sodic, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: hnz4
Elevation: 130 to 360 feet
Mean annual precipitation: 7 to 8 inches
Mean annual air temperature: 62 to 64 degrees F
Frost-free period: 220 to 250 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Tranquillity, clay, saline-sodic, and similar soils: 60 percent
Tranquillity, clay, saline-sodic, wet, and similar soils: 25 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tranquillity, Clay, Saline-sodic

Setting

Landform: Fan skirts
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from calcareous sedimentary rock

Typical profile

Ap - 0 to 22 inches: clay
Bkss - 22 to 53 inches: clay
Bk - 53 to 71 inches: clay

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: High
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: Very rareNone
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Gypsum, maximum content: 3 percent
Maximum salinity: Slightly saline to moderately saline (4.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 20.0
Available water supply, 0 to 60 inches: Moderate (about 7.9 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Tranquillity, Clay, Saline-sodic, Wet

Setting

Landform: Fan skirts
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from calcareous sedimentary rock

Typical profile

Ap1 - 0 to 6 inches: clay
Ap2 - 6 to 16 inches: clay
Bknssyz1 - 16 to 31 inches: clay
Bknssyz2 - 31 to 48 inches: clay
Bknyz - 48 to 65 inches: silty clay

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 48 to 60 inches
Frequency of flooding: Very rareNone
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Gypsum, maximum content: 8 percent
Maximum salinity: Moderately saline (8.0 to 15.0 mmhos/cm)
Sodium adsorption ratio, maximum: 50.0
Available water supply, 0 to 60 inches: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Ciervo, clay, saline-sodic, wet

Percent of map unit: 5 percent
Landform: Fan skirts
Hydric soil rating: No

Armona, loam, partially drained

Percent of map unit: 4 percent
Landform: Flood plains on basin floors
Hydric soil rating: Yes

Calflax, clay loam, saline-sodic, wet

Percent of map unit: 2 percent
Landform: Fan skirts
Hydric soil rating: No

Deldota, clay, partially drained

Percent of map unit: 2 percent
Landform: Fan skirts
Hydric soil rating: No

Tachi, clay

Percent of map unit: 2 percent
Landform: Flood plains on basin floors
Hydric soil rating: Yes

445—Excelsior sandy loam, 0 to 2 percent slopes, MLRA 17

Map Unit Setting

National map unit symbol: 2ss8v
Elevation: 200 to 1,000 feet
Mean annual precipitation: 5 to 8 inches
Mean annual air temperature: 62 to 65 degrees F
Frost-free period: 240 to 300 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Excelsior and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Excelsior

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous coarse-loamy alluvium derived from sedimentary rock

Typical profile

Ap - 0 to 7 inches: sandy loam
A - 7 to 23 inches: sandy loam
C - 23 to 72 inches: sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Very rareNone

Frequency of ponding: None
Calcium carbonate, maximum content: 3 percent
Gypsum, maximum content: 1 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 10.0
Available water supply, 0 to 60 inches: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 7c
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Cerini

Percent of map unit: 6 percent
Landform: Alluvial fans
Hydric soil rating: No

Excelsior

Percent of map unit: 4 percent
Landform: Alluvial fans
Hydric soil rating: No

Kimberlina

Percent of map unit: 3 percent
Landform: Alluvial fans
Hydric soil rating: No

Westhaven

Percent of map unit: 1 percent
Landform: Alluvial fans
Hydric soil rating: No

Bakersfield

Percent of map unit: 1 percent
Hydric soil rating: Yes

447—Excelsior sandy loam, sandy substratum, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: hnzw
Elevation: 180 to 900 feet
Mean annual precipitation: 6 to 8 inches
Mean annual air temperature: 62 to 64 degrees F
Frost-free period: 240 to 280 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Excelsior, sandy loam, sandy substratum, and similar soils: 85 percent
Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Excelsior, Sandy Loam, Sandy Substratum

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from calcareous sedimentary rock

Typical profile

Ap - 0 to 7 inches: sandy loam
A - 7 to 23 inches: sandy loam
C1 - 23 to 53 inches: stratified loamy sand to silt loam
C2 - 53 to 72 inches: loamy sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Negligible
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: RareNone
Frequency of ponding: None
Calcium carbonate, maximum content: 3 percent
Gypsum, maximum content: 1 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 10.0
Available water supply, 0 to 60 inches: Moderate (about 6.8 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Excelsior, sandy loam

Percent of map unit: 4 percent
Landform: Alluvial fans
Hydric soil rating: No

Kimberlina, sandy loam

Percent of map unit: 4 percent
Landform: Alluvial fans
Hydric soil rating: No

Excelsior, sandy loam, saline-sodic

Percent of map unit: 2 percent
Landform: Alluvial fans
Hydric soil rating: No

Wasco, sandy loam

Percent of map unit: 2 percent
Landform: Alluvial fans
Hydric soil rating: No

Polvadero, sandy loam

Percent of map unit: 2 percent
Landform: Fan remnants
Hydric soil rating: No

Westhaven, loam

Percent of map unit: 1 percent
Landform: Alluvial fans
Hydric soil rating: No

459—Ciervo clay, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: hp02
Elevation: 210 to 730 feet
Mean annual precipitation: 6 to 8 inches
Mean annual air temperature: 62 to 64 degrees F
Frost-free period: 240 to 280 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Ciervo, clay, and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ciervo, Clay

Setting

Landform: Fan skirts
Landform position (two-dimensional): Footslope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from calcareous sedimentary rock

Typical profile

Ap - 0 to 17 inches: clay
Bw - 17 to 27 inches: clay
Bknyz - 27 to 41 inches: silty clay
Bknz - 41 to 60 inches: clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Medium

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: Very rareNone
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Gypsum, maximum content: 5 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 12.0
Available water supply, 0 to 60 inches: High (about 9.8 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Ciervo, clay loam

Percent of map unit: 5 percent
Landform: Fan skirts
Hydric soil rating: No

Ciervo, clay, saline-sodic, wet

Percent of map unit: 4 percent
Landform: Fan skirts
Hydric soil rating: No

Ciervo, clay, saline-sodic

Percent of map unit: 4 percent
Landform: Fan skirts
Hydric soil rating: No

Tranquillity, clay, saline-sodic

Percent of map unit: 3 percent
Landform: Fan skirts
Hydric soil rating: No

Cerini, clay loam

Percent of map unit: 2 percent
Landform: Alluvial fans
Hydric soil rating: No

Westhaven, loam

Percent of map unit: 1 percent
Landform: Alluvial fans
Hydric soil rating: No

Panoche, clay loam

Percent of map unit: 1 percent
Landform: Alluvial fans
Hydric soil rating: No

462—Ciervo, wet-Ciervo complex, saline-sodic, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: hp04
Elevation: 170 to 580 feet
Mean annual precipitation: 6 to 8 inches
Mean annual air temperature: 62 to 64 degrees F
Frost-free period: 240 to 270 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Ciervo, clay, saline-sodic, wet, and similar soils: 50 percent
Ciervo, clay, saline-sodic, and similar soils: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ciervo, Clay, Saline-sodic, Wet

Setting

Landform: Fan skirts
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from calcareous sedimentary rock

Typical profile

Ap - 0 to 17 inches: clay
Bw - 17 to 27 inches: clay
Bknyz - 27 to 41 inches: silty clay
Bknz - 41 to 60 inches: clay loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 48 to 60 inches
Frequency of flooding: Very rareNone
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Gypsum, maximum content: 5 percent
Maximum salinity: Moderately saline to strongly saline (8.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum: 50.0
Available water supply, 0 to 60 inches: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): 3s

Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Ciervo, Clay, Saline-sodic

Setting

Landform: Fan skirts
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from calcareous sedimentary rock

Typical profile

Ap - 0 to 17 inches: clay
Bw - 17 to 27 inches: clay
Bknyz - 27 to 41 inches: silty clay
Bknz - 41 to 60 inches: clay loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Very rareNone
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Gypsum, maximum content: 5 percent
Maximum salinity: Slightly saline to strongly saline (4.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum: 40.0
Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Ciervo, clay loam, saline-sodic, wet

Percent of map unit: 5 percent
Landform: Fan skirts
Hydric soil rating: No

Calflax, clay loam, saline-sodic, wet

Percent of map unit: 3 percent
Landform: Fan skirts
Hydric soil rating: No

Panoche, clay loam

Percent of map unit: 3 percent
Landform: Alluvial fans
Hydric soil rating: No

Tranquillity, clay, saline-sodic

Percent of map unit: 3 percent
Landform: Fan skirts
Hydric soil rating: No

Cerini, clay loam

Percent of map unit: 3 percent
Landform: Fan skirts
Hydric soil rating: No

Ciervo, clay

Percent of map unit: 3 percent
Landform: Fan skirts
Hydric soil rating: No

482—Calflax clay loam, saline-sodic, wet, 0 to 1 percent slopes, MLRA 17

Map Unit Setting

National map unit symbol: 2vncl
Elevation: 160 to 340 feet
Mean annual precipitation: 7 to 9 inches
Mean annual air temperature: 62 to 64 degrees F
Frost-free period: 230 to 250 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Calflax, clay loam, saline-sodic, wet, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Calflax, Clay Loam, Saline-sodic, Wet

Setting

Landform: Fan skirts
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from calcareous sedimentary rock

Typical profile

Ap - 0 to 8 inches: clay loam
Bw - 8 to 26 inches: clay loam
Bny - 26 to 33 inches: loam
Bnyz1 - 33 to 47 inches: silt loam
Bnyz2 - 47 to 65 inches: loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 48 to 60 inches
Frequency of flooding: RareNone
Frequency of ponding: None
Calcium carbonate, maximum content: 3 percent
Gypsum, maximum content: 5 percent
Maximum salinity: Slightly saline to strongly saline (4.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum: 40.0
Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Ciervo, clay, saline-sodic, wet

Percent of map unit: 6 percent
Landform: Fan skirts
Hydric soil rating: No

Cerini, clay loam

Percent of map unit: 2 percent
Landform: Alluvial fans
Hydric soil rating: No

Lethent, clay loam

Percent of map unit: 2 percent
Landform: Fan remnants
Hydric soil rating: No

Posochanet, clay loam, saline-sodic, wet

Percent of map unit: 2 percent
Landform: Fan skirts
Hydric soil rating: No

Kimberlina, fine sandy loam

Percent of map unit: 1 percent
Hydric soil rating: No

Twisselman, clay, saline-sodic

Percent of map unit: 1 percent
Hydric soil rating: No

Garces, silt loam

Percent of map unit: 1 percent
Hydric soil rating: No

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Appendix D.

Official Soil Series Descriptions

Established Series
BRY/KDA/CAF/KDA
10/2002

CALFLAX SERIES

The Calflax series consists of very deep, moderately well drained soils on fan skirts These soils formed in alluvium derived from calcareous sedimentary rock. Slope is 0 to 2 percent. The mean annual precipitation is about 7 inches and the mean annual temperature is about 63 degrees F.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, thermic Sodic Haplocambids

TYPICAL PEDON: Calflax clay loam, saline-sodic - on a slope of less than 1 percent in a fallow field. The elevation is 168 feet. (Colors are for dry soil unless otherwise stated. When described on January 14, 1982, the soil was slightly moist below 8 inches).

Ap--0 to 8 inches; light yellowish brown (2.5Y 6/4) clay loam, dark grayish brown (2.5Y 4/2) moist; strong coarse subangular blocky structure parting to strong medium subangular blocky; hard, very friable, moderately sticky and moderately plastic; few fine and common medium and fine roots; many very fine tubular and interstitial pores; slightly effervescent, carbonates disseminated; electrical conductivity is 3.6 decisiemens per meter; sodium adsorption ratio is 4; slightly alkaline (pH 7.4); abrupt smooth boundary. (6 to 10 inches thick)

Bw--8 to 26 inches; light olive brown (2.5Y 5/4) clay loam, olive brown (2.5Y 4/4) moist; moderate coarse prismatic and moderate medium subangular blocky structure; hard, friable, moderately sticky and moderately plastic; common very fine roots; many very fine tubular and interstitial pores; slightly effervescent, carbonates disseminated; electrical conductivity is 2.8 decisiemens per meter; sodium adsorption ratio is 5; slightly alkaline (pH 7.4); clear smooth boundary. (16 to 20 inches thick)

Bny--26 to 33 inches; light yellowish brown (2.5Y 6/4) loam, olive brown (2.5Y 4/4) moist; moderate coarse subangular blocky structure; slightly hard, very friable, slightly sticky and moderately plastic; common very fine and few fine roots; many very fine tubular and interstitial pores; slightly effervescent, carbonates disseminated; common fine irregularly shaped soft masses of calcium sulfate (gypsum); electrical conductivity is 3.4 decisiemens per meter; sodium adsorption ratio is 14; slightly alkaline (pH 7.4); abrupt smooth boundary. (5 to 9 inches thick)

Bnyz1--33 to 47 inches; pale yellow (2.5Y 7/4) silt loam, light olive brown (2.5Y 5/4) and dark grayish brown (2.5Y 4/2) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky and moderately plastic; few very fine and fine roots; common very fine tubular and interstitial pores; strongly effervescent, carbonates disseminated; many fine irregularly shaped soft masses of calcium sulfate (gypsum); electrical conductivity is 7.0 decisiemens per meter; sodium adsorption ratio is 14; few fine prominent strong brown (7.5YR 5/6) masses of iron/magnesium redox concentrations; slightly alkaline (pH 7.5); abrupt smooth boundary. (12 to 16 inches thick)

Bnyz2--47 to 65 inches; pale yellow (2.5Y 7/4) loam, light yellowish brown (2.5Y 6/4) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; few fine tubular and many very fine interstitial pores; very slightly effervescent, carbonates disseminated; few fine irregularly shaped soft masses of calcium sulfate (gypsum); electrical conductivity is 7.1 decisiemens per meter; sodium adsorption ratio is 16; slightly alkaline (pH 7.6).

TYPE LOCATION: Fresno County, California; approximately 7 miles southeast of the community of Mendota; approximately 0.2 mile south of the middle of section 4 then about 132 feet west of the road; approximately 1,900 feet north and 2,500 feet east of the southwest corner of section 4, T. 15 S., R. 15 E., MDB&M; Latitude 36 degrees, 39 minutes, 08 seconds north and Longitude 120 degrees, 20 minutes, 33 seconds west; USGS Tranquillity Topographic Quadrangle, NAD 27.

RANGE IN CHARACTERISTICS: Unless irrigated, the soil between depths of 4 and 12 inches is usually not moist in some or all parts for as long as 70 to 90 consecutive days. It is usually dry from March or April to December or January. The mean annual soil temperature is 62 to 66 degrees F. and the temperature is always above 47 degrees F. The particle size control section averages 18 to 35 percent clay. Organic matter content is less than 1 percent below the A horizon and decreases irregularly with increasing depth. It is saline-sodic in a horizon at least 10 inches thick, within 40 inches of the soil surface, for a period of at least one month. Irrigation, drainage, and reclamation practices have an effect on the salinity, sodicity and gypsum content of this soil.

The A horizon has color of 2.5Y 6/2, 6/3 or 6/4. Moist color is 2.5Y 4/2, 4/3 or 4/4. Organic matter content is 0.5 to 2 percent. Clay content is 27 to 40 percent. Calcium carbonate equivalent is 1 to 2 percent. Gypsum content is 0 to 3 percent. Electrical conductivity is 2 to 8 decisiemens per meter. Sodium adsorption ratio is 2 to 12. Reaction is slightly alkaline or moderately alkaline.

The Bw horizon has color of 2.5Y 6/4 or 5/4. Moist color is 2.5Y 4/3, 4/4 or 5/4. Organic matter content is 0.3 to 1 percent. Clay content is 27 to 40 percent. Calcium carbonate equivalent is 1 to 3 percent. Gypsum content is 0 to 3 percent. Electrical conductivity is 2 to 8 decisiemens per meter. Sodium adsorption ratio is 2 to 20. Reaction is slightly alkaline or moderately alkaline.

The Bny and Bnyz horizons have color of 2.5Y 5/4, 6/4 or 7/4. Moist color is 2.5Y 4/4, 5/4 or 6/4. Organic matter is 0.1 to 0.4 percent. Texture is loam, silt loam or clay loam. Clay content is 18 to 35 percent. Calcium carbonate equivalent is 1 to 3 percent. Gypsum content is 2 to 5 percent. Most of the gypsum in this soil has been applied during saline-sodic reclamation practices. Gypsum has been translocated in the profile by pedogenic and anthropogenic processes. In some pedons, the "y" subscript is absent because little gypsum has been applied. Electrical conductivity is 2 to 16 decisiemens per meter. Sodium adsorption ratio is 13 to 40. Redoximorphic concentrations, when present, have moist color of 7.5YR 5/6, 5/8 or 6/6. Reaction is slightly alkaline to strongly alkaline.

COMPETING SERIES: There are no competing series at this time.

GEOGRAPHIC SETTING: Calflax soils are on fan skirts. The soils formed in alluvium derived from calcareous sedimentary rock. Slope is 0 to 2 percent. Elevation is 154 to 705 feet. The climate is arid with hot, dry summers and cool, moist winters. Mean annual precipitation is 6 to 8 inches. Mean January temperature is about 45 degrees F.; mean July temperature is about 83 degrees F.; mean annual temperature is 62 to 64 degrees F. The frost-free season is 230 to 270 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Ciervo, Cerini, Panoche, Lethent, Tranquillity and Posochanet series. Ciervo and Tranquillity soils, on fan skirts, have a fine particle-size control section. Cerini soils, on alluvial fans, are highly stratified and are not saline-sodic. Panoche soils, on alluvial fans, have an organic matter content that decreases regularly with increasing depth. Lethent soils, on fan remnants, have a natric horizon and a fine particle-size control section. Posochanet soils, on fan skirts, have a fine-silty particle size control section.

DRAINAGE AND PERMEABILITY: Moderately well drained; low runoff; moderately slow permeability. Many pedons have a transient perched water table at a depth of 4 to 6 feet that is influenced by irrigation. The high water table has a direct impact on the salinity and sodicity of the soil. Drainage and reclamation practices have an effect on the depth to the water table and salinity. This soil is subject to changes in depth to the water table and salinity of the soil.

USE AND VEGETATION: Most areas of these soils are cultivated and irrigated. They are principally used for crops such as cotton, seed alfalfa, sugar beets, wheat and safflower. Some areas are used for home site development. Native vegetation is annual grasses, forbs, and saltbrush (Atriplex spp.).

DISTRIBUTION AND EXTENT: Southern part of San Joaquin Valley, California. The series is moderately extensive. MLRA 17.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Davis, California

SERIES ESTABLISHED: Fresno County, California, 2002. The name Calflax comes from the name of a ranch and from the USGS Calflax 7.5 minute Topographic Quadrangle.

REMARKS: Previously mapped as Panoche series in the Soil Survey of the Mendota Area, California, Series 1940, No. 18. When described in 1982, the typical pedon did not have a high water table within 6 feet of the soil surface. Subsequently this area developed a water table as high as 4 feet that necessitated a change in the mapping. The typical pedon is now mapped as Calflax clay loam, saline-sodic, wet. The typical pedon description is typical of these soils before they develop a high water table.

ADDITIONAL DATA: Characterization samples for other pedons S87CA-019-002 (4105-4110) and S94CA-019-002 (taxadjunct, 2029-2038) from the Fresno County, California, Western Part Soil Survey were analyzed by the NSSl, Lincoln, NE.

National Cooperative Soil Survey
U.S.A.

Established Series
Rev. SDF/KDA/MAV
05/2003

CIERVO SERIES

The Ciervo series consists of very deep, moderately well drained soils on fan skirts. These soils formed in alluvium derived dominantly from sedimentary rock. Slope is 0 to 2 percent. The mean annual precipitation is about 7 inches and the mean annual temperature is about 63 degrees F.

TAXONOMIC CLASS: Fine, smectitic, thermic Vertic Haplocambids

TYPICAL PEDON: Ciervo clay, saline-sodic - on a slope of less than 1 percent in a cultivated unplanted field at an elevation of 247 feet. (Colors are for dry soil unless otherwise stated. When described on September 18, 1985, the soil was dry from 0 to 17 inches and moist below.)

Ap1--0 to 7 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium and coarse subangular blocky structure; hard, firm, very sticky, and very plastic; few very fine, fine and medium roots; common very fine tubular pores; strongly effervescent, carbonates disseminated, calcium carbonate equivalent is 3 percent; electrical conductivity is 1.2 decisiemens per meter; sodium adsorption ratio is 3; moderately alkaline (pH 8.1); abrupt smooth boundary. (3 to 10 inches thick)

Ap2--7 to 17 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate coarse subangular blocky structure; very hard, firm, moderately sticky, and moderately plastic; few very fine and fine roots; common very fine tubular pores; strongly effervescent, carbonates disseminated, calcium carbonate equivalent is 3 percent; electrical conductivity is 1.2 decisiemens per meter; sodium adsorption ratio is 6; moderately alkaline (pH 8.3); abrupt smooth boundary. (5 to 15 inches thick)

Bw--17 to 27 inches; light gray (2.5Y 7/2) clay, light olive brown (2.5Y 5/4) moist; weak medium subangular blocky structure; extremely hard, firm, moderately sticky, and moderately plastic; few very fine and fine roots; common very fine tubular pores; strongly effervescent, carbonates disseminated and segregated as few fine irregularly shaped threads, calcium carbonate equivalent is 4 percent; electrical conductivity is 1.5 decisiemens per meter; sodium adsorption ratio is 12; strongly alkaline (pH 8.6); abrupt smooth boundary. (6 to 15 inches thick)

Bknyz--27 to 41 inches; light gray (2.5Y 7/2) silty clay, light olive brown (2.5Y 5/4) and dark grayish brown (2.5Y 4/2) moist; weak medium platy structure; hard, very friable, moderately sticky, and moderately plastic; few very fine and fine roots; many very fine tubular pores; strongly effervescent, carbonates disseminated and segregated as few fine irregularly shaped threads, calcium carbonate equivalent is 3 percent; common fine irregularly shaped soft masses of gypsum crystals, calcium sulfate content is 5 percent; electrical conductivity is 9.5 decisiemens per meter; sodium adsorption ratio is 21; moderately alkaline (pH 8.0); abrupt smooth boundary. (10 to 22 inches thick)

Bknz--41 to 60 inches; light gray (2.5Y 7/2) clay loam, light olive brown (2.5Y 5/4) moist; massive; hard, very friable, slightly sticky, and moderately plastic; few very fine roots; common very fine tubular pores; strongly effervescent, carbonates disseminated and segregated as few fine irregularly shaped threads, calcium carbonate equivalent is 3 percent; electrical conductivity is 12.4 decisiemens per meter; sodium adsorption ratio is 29; moderately alkaline (pH 8.2).

TYPE LOCATION: Fresno County, California; approximately 3.1 miles east of the California Aqueduct, and 8 miles southwest of the community of Mendota; about 1,300 feet north and 2,400 feet east of the southwest corner of section 9, T.15S., R.14E., MDBM; Latitude 36 degrees, 38 minutes, 12 seconds north and Longitude 120 degrees, 27 minutes, 04 seconds west; USGS Tranquillity Topographic Quadrangle, NAD 27.

RANGE IN CHARACTERISTICS: Unless irrigated, the soil between the depths of 4 and 12 inches is dry in all parts from April 1 to December 1 and is moist in some or all parts for only 70 to 90 consecutive days from December through March. The soil temperature is always above 47 degrees F. The mean annual soil temperature is 63 to 65 degrees F. Organic matter content is less than 1 percent and decreases regularly with depth. Clay content is 20 to 55 percent but the 10 to 40 inch control section averages 35 to 50 percent clay. Clay content usually decreases with depth. Carbonates are commonly disseminated in the A horizon and segregated below as soft masses or threads. Calcium carbonate equivalent is 1 to 5 percent. Gypsum content is 0 to 5 percent. Gypsum content is variable due to additions of gypsum as a soil amendment. Gypsum crystals are present in some part of most pedons. Salinity is 0 to 16 decisiemens per meter. Sodium adsorption ratio is 1 to 50. Some areas are nonsaline-nonsodic. Reaction is moderately alkaline or strongly alkaline. Nonsaline-nonsodic phases are moderately alkaline.

The A horizon has color of 2.5Y 5/2, 6/2, 6/4 or 7/2. Moist color is 2.5Y 4/2, 4/3, 4/4 or 5/4. Texture is clay loam or clay. Linear extensibility percent is 6 to 9.

The Bw horizon has color of 2.5Y 5/2, 5/4, 6/2, 6/4, 7/2 or 7/4. Moist color is 2.5Y 4/2, 4/4, 5/2 or 5/4. Texture is clay loam, clay or silty clay. Linear extensibility percent is 6 to 9.

The Bknyz and Bknz horizons have color of 2.5Y 5/2, 5/4, 6/2, 6/4, 7/2 or 7/4. Moist color is 2.5Y 4/2, 4/4, 5/2, or 5/4. Texture is loam, clay loam, or silty clay loam. Some pedons do not have a Bknyz horizon. Linear extensibility percent is 6 to 9 in the Bknyz horizon and 3 to 6 in the Bknz horizon.

COMPETING SERIES: This is the Caticon series. Caticon soils (MLRA 42) are well drained soils that have 7.5YR hues, on lake plains on basin floors. Most precipitation falls during the months of July through September.

GEOGRAPHIC SETTING: Ciervo soils are on fan skirts. Slope is 0 to 2 percent. The soils formed in alluvium derived dominantly from sedimentary rock. Elevation is 170 to 735 feet. The climate is arid with hot, dry summers and cool, moist winters. Many days in winter have ground fog. Mean annual precipitation is 6 to 8 inches. Mean January temperature is about 45 degrees F; mean July temperature is about 82 degrees F; mean annual temperature is about 62 to 64 degrees F. Frost-free season is 240 to 280 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Tranquillity, Posochanet, Calflax and Panoche soils. Tranquillity soils have intersecting slickensides. Posochanet soils have a fine-silty particle-size control section. Calflax and Panoche soils have a fine-loamy particle-size control section. Tranquillity, Posochanet and Calflax soils are on fan skirts. Panoche soils are on alluvial fans.

DRAINAGE AND PERMEABILITY: Moderately well drained; medium or high runoff; very slow permeability. Nonsaline-nonsodic phases have slow permeability.

USE AND VEGETATION: Used mainly for irrigated cropland to produce crops such as cotton, alfalfa, sugar beets, wheat, onions and tomatoes. Native vegetation is annual grasses, forbs and saltbush (Atriplex spp.).

DISTRIBUTION AND EXTENT: Southern part of the San Joaquin Valley in California. The soils are of large extent. MLRA 17.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Davis, California

SERIES ESTABLISHED: Fresno County, California, l985. Ciervo soils are named after a mountain peak in the area.

REMARKS: Previously mapped as Oxalis and Panoche series in the Soil Survey of the Mendota Area, California, Series 1940, No. 18 and in the Soil Survey of the Coalinga Area, California, Series 1944, No 1. Clay texture is the dominant surface texture of this soil and texture which was determined in the field, therefore clay texture was described in the Ap1 horizon. The laboratory data showed 39.3 percent clay. This soil occurs in an area which is subject to dramatic changes in soil salinity and sodicity due to position on the landscape (fan skirts) and the prevalence of perched water tables near the surface.

Major Diagnostic Horizons:
The Ciervo series was initially classified as Vertic Torriorthents. This was changed to Vertic Haplocambids when a cambic horizon was described in the Ciervo profiles. The presence of a cambic horizon is based on the following characteristics:
1. Soil structure in the cambic horizon (unless moist from irrigation or rainfall or drastically modified by deep ripping).
2. Removal of carbonates or gypsum from the cambic horizon.
3. Accumulation of carbonates or gypsum below the cambic horizon which supports loss of carbonate or gypsum from overlying horizons.
4. Higher chroma in the cambic horizon in some pedons.
5. Most areas of Ciervo soil are irrigated with 2 to 3 feet of water per year applied for crop production. Previous to irrigation, only about 7 inches of precipitation, coupled with flood water, was available for soil development. Movement of carbonates, gypsum, fertilizers, and salt through the soil profile has created more pronounced cambic horizons because of application of irrigation water.
1. Ochric Epipedon--0 to 17 inches (Ap1, Ap2).
1.1 Cambic Horizon -- 17 to 27 inches (Bw).
1.2 Removal of carbonates or gypsum from the cambic horizon. Pedons which have a horizon with 5 percent gypsum qualify for a gypsic horizon. They are not classified as gypsic horizons however, because 5 percent gypsum is the minimum requirement for a gypsic horizon and 5 percent gypsum is the maximum gypsum found in the Ciervo series. In all instances where gypsum content is as high as 5 percent, there have been significant amounts of gypsum that have been added as a soil amendment.
1.3 Zone of redistribution -- 27 to 60 inches (Bknyz, Bknz).
Other Diagnostic Features and Characteristics:
1. Fine Family
1.1 NSSL results show 34 to 47 percent clay in the typical pedon. There is an average 45 percent clay from 10 to 40 inches.
2. Smectitic Mineralogy
2.1 X-ray diffraction studies show smectite is the dominant clay mineral in this soil.
3. Thermic Temperature Regime
3.1 Soil temperature regime is assumed to be thermic based upon data from Mendota Dam and Panoche Junction. MAAT is 62 to 64 degrees F.
4. Vertic Subgroup
4.1 Linear extensibility percent is 8for the typical pedon to a depth of 104 cm.
4.2 Since this soil is cultivated and irrigated, cracks are difficult to observe. If unirrigated, cracks are assumed to be at least 5 mm wide at a depth of 50 cm, at least 30 cm long in some part, and extend upward to the soil surface or the base of an Ap horizon.
5. Torric Moisture Regime
5.1 Unless irrigated, the 4 to 12 inch SMCS is assumed to be dry in all parts from April 1 to December 1 and is moist in some or all parts for only 70 to 90 consecutive days. Based upon data from Mendota Dam (MAP 7.7 inches) and Panoche Junction (MAP 6.0 inches) climate stations.
5.2 The soil temperature exceeds 47 degrees F. from January to December (365 days).

ADDITIONAL DATA: NSSL characterization data pedon sample number S85CA019-005 (5375-5379) for the typical pedon. Other pedons with NSSL data are S85CA019-004 (5369-5374) and S86CA019-012 (3158-3162).

Established Series
Rev. KKC/ARW/JJJ
12/2002

EXCELSIOR SERIES

The Excelsior series consists of very deep, well drained soils on alluvial fans and bars and channels on flood plains. These soils formed in mixed alluvium dominantly from igneous and calcareous sedimentary rocks. Slope is 0 to 2 percent. The mean annual temperature is about 63 degrees F. and the mean annual precipitation is about 7 inches.

TAXONOMIC CLASS: Coarse-loamy, mixed, superactive, calcareous, thermic Typic Torrifluvents

TYPICAL PEDON: Excelsior sandy loam, on a slope of less than 1 percent under cotton at 235 feet elevation. (Colors are for dry soil unless otherwise stated. When described on 3/24/76 the soil was slightly moist below 2 inches.)

Ap--0 to 8 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial pores; moderately alkaline (pH 8.1); abrupt smooth boundary. (6 to 10 inches thick)

C1--8 to 20 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; many very fine interstitial pores; slightly effervescent, carbonates disseminated; strongly alkaline (pH 8.8); abrupt smooth boundary. (8 to 22 inches thick)

C2--20 to 26 inches; pale brown (10YR 6/3) loamy sand, brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; strongly effervescent, carbonates disseminated; strongly alkaline (pH 9.0); clear smooth boundary. (4 to 10 inches thick)

C3--26 to 60 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; moderate coarse subangular blocky structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common very fine and few fine roots; common very fine and fine tubular pores; strongly effervescent, carbonates disseminated; very strongly alkaline (pH 9.5).

TYPE LOCATION: Kings County, California; approximately 1,500 feet west of Highway 43 and 250 feet south of Iona Avenue; 1500 feet west and 250 feet south of the northeast corner of section 17, T. 19 S., R. 22 E., MDB&M; Latitude 36 degrees, 17 minutes, 00 seconds north and Longitude 119 degrees, 36 minutes, 17 seconds west; USGS Remnoy Topographic Quadrangle, NAD 27.

RANGE IN CHARACTERISTICS: The soil moisture control section of 8 to 20 inches is dry in all parts from April 1 through December and is not continuously moist for 90 consecutive days. The organic matter is less than 1 percent at the surface and decreases irregularly with increasing depth. The mean annual soil temperature ranges from 61 degrees to 65 degrees F.

The A horizon has color of 10YR 5/2, 5/3, 6/2, 6/3, 7/2; 2.5Y 6/2 or 7/2. Moist color is 10YR 4/2, 5/2; 2.5Y 4/2 or 5/2. Texture is loamy sand, sandy loam, fine sandy loam or loam. Calcium carbonate equivalent is 0 to 3 percent. It is noneffervescent to strongly effervescent with disseminated carbonates. Electrical conductivity is 0 to 8 decisiemens per meter. Sodium adsorption ratio is 0 to 13. Electrical conductivity and sodium adsorption ratio are affected by agricultural practices. Reaction is slightly alkaline to strongly alkaline. Eroded phases are present in some areas.

The C horizon has color of 10YR 6/2, 6/3, 7/2, 7/3,; 2.5Y 6/2, 6/4, 7/2 or 7/4. Moist color is 10YR 4/2, 4/3, 5/2; 2.5Y 4/2, 5/2 or 5/4. Texture is stratified loamy sand, sandy loam, fine sandy loam, loam and silt loam. Few fine distinct relict redoximorphic masses of iron accumulation occur in the lower C horizon in some pedons. Calcium carbonate equivalent is 1 to 5 percent. It is very slightly effervescent to violently effervescent and has disseminated and/or segregated carbonates. Electrical conductivity is 0 to 16 decisiemens per meter. Sodium adsorption ratio is 0 to 80. Electrical conductivity and sodium adsorption ratio are affected by agricultural practices. Reaction is moderately alkaline or very strongly alkaline.

COMPETING SERIES: These are the Anthony, Gila, Rucker, and Tobler series. Anthony soils (MLRA 40, 41, 42), Gila soils (MLRA 40, 41, 42), Rucker soils (MLRA 41) and Tobler soils (MLRA 30, 42, 70) are all on alluvial fans and flood plains. They are all intermittently moist in some part of soil moisture control section as a result of precipitation in the late summer months. Rucker soils have mean annual precipitation of 10 to 12 inches. Tobler soils have color hues of 2.5YR and 5YR.

GEOGRAPHIC SETTING: Excelsior soils are on alluvial fans and bars and channels on flood plains. Slope is 0 to 2 percent. These soils formed in mixed alluvium dominantly from igneous and calcareous sedimentary rocks. Elevation is 180 to 1,000 feet. The climate is arid with hot dry summers and cool moist winters. The mean annual precipitation is 5 to 8 inches. Mean January temperature is 45 degrees F.; mean July temperature is 80 degrees F.; mean annual temperature is 62 to 65 degrees F. Frost-free season is 240 to 300 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Grangeville, Nord, Panoche and Wasco soils. Grangeville and Nord soils, on alluvial fans and flood plains, have a mollic epipedon. Panoche soils, on alluvial fans, have a fine-loamy particle-size control section. Wasco soils, on alluvial fans, have a regular decrease in organic-carbon with increasing depth and are not calcareous in all parts between the depths of 10 and 20 inches.

DRAINAGE AND PERMEABILITY: Well drained; negligible to medium runoff; moderate to slow permeability, with slow permeability in saline-sodic horizons.

USE AND VEGETATION: This soil is used for irrigated cropland growing alfalfa, barley, cotton and grapes. It is also used for dairy and cattle production and building site development.

DISTRIBUTION AND EXTENT: San Joaquin Valley. The series is of moderate extent. MLRA 17.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Davis, California

SERIES ESTABLISHED: Kings County, California, 1980.

National Cooperative Soil Survey
U.S.A.

Established Series
Rev. BRY/KDA/JJJ/MAV
01/2003

TRANQUILLITY SERIES

The Tranquillity series consists of very deep, somewhat poorly drained soils on fan skirts. These soils formed in alluvium derived dominantly from calcareous sedimentary rock. Slope is 0 to 1 percent. The mean annual precipitation is about 8 inches and the mean annual air temperature is 63 degrees F.

TAXONOMIC CLASS: Fine, smectitic, thermic Sodic Haploxererts

TYPICAL PEDON: Tranquillity clay, saline-sodic, wet - on a nearly level slope of less than 1 percent in a cultivated fallow field at 172 feet elevation. (Colors are for air dry soil unless otherwise stated). When described April 22, 1986, the soil was dry from 0 to 6 inches and moist below.)

Ap1--0 to 6 inches; grayish brown (2.5Y 5/2) clay; dark grayish brown (2.5Y 4/2) moist; strong coarse subangular blocky structure, extremely hard, very firm, very sticky and very plastic; common very fine roots; few very fine tubular pores; violently effervescent, carbonates disseminated; calcium carbonate equivalent is 3 percent; electrical conductivity is 2.6 decisiemens per meter; sodium adsorption ratio is 14; moderately alkaline (pH 8.2); abrupt smooth boundary. (2 to 8 inches thick)

Ap2--6 to 16 inches; grayish brown (2.5Y 5/2) clay; dark grayish brown (2.5Y 4/2) moist; moderate medium subangular blocky structure, very hard, very firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; violently effervescent, carbonates disseminated and segregated as few fine irregularly shaped concentrations; calcium carbonate equivalent is 4 percent; common fine irregularly shaped gypsum crystals; gypsum content is less than 1 percent; electrical conductivity is 8.7 decisiemens per meter; sodium adsorption ratio is 24; moderately alkaline (pH 8.3); abrupt smooth boundary. (8 to 18 inches thick)

Bknssyz1--16 to 31 inches; grayish brown (2.5Y 5/2) clay; dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure, very hard, very firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; common intersecting slickensides; strongly effervescent, carbonates disseminated and segregated as common fine threads; calcium carbonate equivalent is 4 percent; common fine irregularly shaped gypsum crystals; gypsum content is 1 percent; electrical conductivity is 10.7 decisiemens per meter; sodium adsorption ratio is 28; moderately alkaline (pH 8.2); abrupt smooth boundary. (14 to 16 inches thick)

Bknssyz2--31 to 48 inches; light yellowish brown (2.5Y 6/4) clay; olive brown (2.5Y 4/4) moist; massive, hard, very firm, very sticky and very plastic; few very fine tubular pores; common intersecting slickensides; strongly effervescent, carbonates disseminated and segregated as common fine threads; calcium carbonate equivalent is 4 percent; common fine irregularly shaped gypsum crystals; gypsum content is 2 percent; electrical conductivity is 10.9 decisiemens per meter; sodium adsorption ratio is 29; few fine prominent, recent brown (7.5YR 4/4) moist, irregularly shaped masses of iron accumulation; moderately alkaline (pH 8.2); abrupt smooth boundary. (15 to 19 inches thick)

Bknyz--48 to 65 inches; light yellowish brown (2.5Y 6/4) silty clay; olive brown (2.5Y 4/4) moist; massive, hard, firm, sticky and very plastic; few very fine tubular pores; strongly effervescent, carbonates disseminated and segregated as common fine threads; calcium carbonate equivalent is 4 percent; common fine irregularly shaped gypsum crystals; gypsum content is 6 percent; electrical conductivity is 12.6 decisiemens per meter; sodium adsorption ratio is 33; moderately alkaline (pH 8.2); abrupt smooth boundary

TYPE LOCATION: Fresno County, California; approximately 3 miles south of the community of Mendota and 142 feet south of Jensen Avenue; approximately 142 feet south and 1,550 feet west of the northeast corner of section 19, T. 14 S., R. 15 E., MDB&M; Latitude 36 degrees 42 minutes 16 seconds north and Longitude 120 degrees 22 minutes 26 seconds west; USGS Tranquillity Topographic Quadrangle, NAD 27.

RANGE IN CHARACTERISTICS: Unless irrigated, vertical cracks, when dry, extend from the surface and range from 0.5 to 2 inches wide at a depth of 20 inches. The cracks usually close from December thru April for 100 to 151 consecutive days. Intersecting slickensides occur in some horizon or horizons below a depth of 16 inches, just below the modified Ap horizons. The mean annual soil temperature is 63 to 66 degrees F.

The Ap horizon has color of 5Y 4/1, 5/1, 5/2; 2.5Y 5/2, 5/3, 5/4, 6/2, 6/3 or 6/4. Moist color is 5Y 4/1, 4/2, 4/3, 4/4; 2.5Y 4/2, 4/3 or 4/4. Organic matter is 0.5 to 2 percent. Texture is clay or silty clay. Linear extensibility percent is 9 to 15. Calcium carbonate equivalent is 1 to 4 percent. Gypsum content is 0 to 3 percent. Electrical conductivity is 0 to 15 decisiemens per meter. Sodium adsorption ratio is 4 to 25.

The B horizon has color of 5Y 5/2, 6/1, 6/2; 2.5Y 5/2, 6/2, 6/3 or 6/4. Moist color is 5Y 5/1; 2.5Y 4/2, 4/3, 4/4, 5/2 or 5/3. Organic matter content is 0.1 to 1 percent. Texture is clay or silty clay. Linear extensibility percent is 6 to 15 to a depth of at least 50 inches and is 3 to 14 below 50 inches. Calcium carbonate equivalent is 2 to 5 percent. Gypsum content is 0 to 8 percent. Electrical conductivity is 2 to 15 decisiemens per meter. Sodium adsorption ratio is 8 to 50. Most horizons above 40 inches have a sodium adsorption ratio greater than 13 for 6 or more months in most years. Electrical conductivity, sodium adsorption ratio and gypsum content are affected by agricultural practices and the depth to a high water table.

COMPETING SERIES: These are the Alcapay and Chinapoint (T) series. Alcapay soils (MLRA 17), in nearly level basins, have mean annual precipitation of 14 to 16 inches and have 10YR color hues. Chinapoint (T) soils (MLRA 19), on hills and terraces near the coast of California, have a paralithic contact at a depth of 20 to 40 inches and have 10YR color hues.

GEOGRAPHIC SETTING: Tranquillity soils are on fan skirts. Slope is 0 to 1 percent. Elevation is 135 to 360 feet. These soils formed in alluvium derived dominantly from calcareous sedimentary rock. The climate is arid with hot dry summers and cool, somewhat moist winters. Fog is common in the winter. The mean annual precipitation is 7 to 8 inches. Mean January temperature is about 44 degrees F; mean July temperature is about 81 degrees F; mean annual temperature is 62 to 64 degrees F. The frost-free season is 220 to 250 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Calflax, Ciervo, Lillis and Tachi series. Calflax soils, on fan skirts, have a fine-loamy particle-size control section. Ciervo soils, on fan skirts, do not have intersecting slickensides. Lillis soils, on fan skirts, have a very fine particle-size control section and B horizons that have electrical conductivity of 8 to 50 decisiemens per meter. Tachi soils, on flood plains on basin floors, have a very fine particle-size control section.

DRAINAGE AND PERMEABILITY: Somewhat poorly drained; runoff is high; very slow permeability. A high water table is at a depth of 4 to 6 feet or greater.

USE AND VEGETATION: These soils are used for irrigated crops such as cotton and wheat. They are also used for wildlife habitat and recreation on the west edge of the Mendota Wildlife Management Area. Vegetation on wildlife management areas consists primarily of timothy, watergrass and saltbush (Atriplex spp.).

DISTRIBUTION AND EXTENT: San Joaquin Valley, California. The series is of large extent. MLRA 17.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Davis, California

SERIES ESTABLISHED: Fresno County, California, 2002. Tranquillity soils are named after the Tranquillity USGS Topographic Quadrangle and the community of Tranquillity.

REMARKS: Previously mapped as Oxalis series in the Soil Survey of the Mendota Area, California, Series 1940, No. 18.

ADDITIONAL DATA: Characterization data sample numbers S86CA019-001 (3123-3127) for this official series typical pedon. Another characterization data sample number is S87CA019-013 (1470-1477) for a taxonomic unit. Other NSSL data sample numbers include S85CA019-002 (5357-5362). Reference sample numbers S81CA019-006 (827434-827436), S82CA019-003 (837804-837805) and S82CA019-005 (837806-837808) are not available online from the NSSC laboratory.

National Cooperative Soil Survey
U.S.A.

Appendix E.

Design Water Balance Calculations

Appendix E1. Design Water Balance 100-Year Return - Proposed Flow

Estimated Pond Area: 3 Acres **Acres** 3,700

Field: Land Application Area **Total Pond Capacity:** 12.7 MG **AWHC (inches):** 8.6

Crop: Pistachio **Initial Pond Volume:** 0.0 MG **Minimum Soil Depth (inches):** 60 **Initial Available Water (inches):** 8.6

Month	ppt [1]	Process Wastewater	Settling Ponds		Gross Water Applied [2]						Net Water Applied [3]			ET [4]		Available Water [5]	Surplus [6]
			Input	Volume	Process Wastewater		Settling Ponds		Supplemental		Process Wastewater	Supplemental	Total	Potential	Estimate		
	inches	MG				in/ac	MG	in/ac		MG	in/ac						
Jan	5.1	0.02	0.0	0.0	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	1.1	1.1	8.6	3.3
Feb	3.7	0.02	0.0	0.0	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	1.7	1.7	8.6	1.5
Mar	4.5	0.02	0.0	0.0	0.02	0.0	0.0	0.0	0.7	70.3	0.0	0.6	4.4	1.8	1.8	8.6	2.6
Apr	2.8	0.02	0.0	0.0	0.02	0.0	0.0	0.0	1.7	170.8	0.0	1.4	3.8	1.5	1.5	8.6	2.3
May	0.0	0.02	0.0	0.0	0.02	0.0	0.0	0.0	5.1	512.4	0.0	4.3	4.3	5.8	5.8	7.2	0.0
Jun	0.0	0.02	0.0	0.0	0.02	0.0	0.0	0.0	11.2	1,125.3	0.0	9.5	9.5	10.3	9.4	7.3	0.0
Jul	0.0	0.02	0.0	0.0	0.02	0.0	0.0	0.0	11.9	1,195.6	0.0	10.1	10.1	11.1	10.2	7.2	0.0
Aug	0.1	0.05	0.0	0.0	0.05	0.0	0.0	0.0	10.1	1,014.8	0.0	8.6	8.7	9.5	8.7	7.2	0.0
Sep	1.0	153.0	0.0	0.0	153.0	1.5	0.0	0.0	4.1	411.9	1.3	3.5	5.7	6.1	5.5	7.3	0.0
Oct	0.1	158.1	0.0	0.0	158.1	1.6	0.0	0.0	1.0	100.5	1.3	0.9	2.3	2.6	2.4	7.1	0.0
Nov	2.5	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	1.4	1.2	8.0	0.0
Dec	1.8	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	1.3	1.3	8.2	0.0
Total	**21.6**	**311.4**	**0.0**	**0.0**	**311.4**	**3.1**	**0.0**	**0.0**	**45.8**	**4,601.6**	**2.6**	**38.9**	**59.9**	**54.2**	**50.7**		**9.7**

Leaching Fraction [7]	13.7%
Leaching Requirement [8]	13.7%

NOTES:

Abbreviations: AWHC = available soil water holding capacity, EC = electrical conductivity, ET = evapotranspiration, in/ac = inches per acre, MG = million gallons, ppt = precipitation, µmhos/cm = micromhos per centimeter.

1 1983 was the greatest precipitation year since 1887 based on historic rainfall data from the National Weather Service for Fresno, California. CIMIS data for the past 100 years was not accurate for nearby stations. (National Oceanic and Atmospheric Administration, n.d.).

2 Gross water applied is the total volume of process wastewater and fresh water discharge to the land application site from the facility, settling ponds (if any) or from the source water well.

3 Net water applied is based on an assumed irrigation efficiency of 85% for drip irrigation and effective precipitation assumed at 85%.

4 The potential evapotranspiration (ET) for pistachio is from data collected for January 1991 through March 1992 from the Firebaugh/Telles station (#7) and April 1992 through December 2020 from the Westlands station (#105). The Potential ET for November through March uses the ET rate for bare soil since pistachio is dormant during those months (California Department of Water Resources, n.d.).

5 Plant available water in soil profile at month end. Initial available water assumed at field capacity. The AWHC was calculated from physical soil characteristics from the Soil Survey of Fresno County, Western Part. (Soil Survey Staff, Natural Resources Conservation Service, n.d.).

6 Estimated soil water balance. Surplus is water in excess of soil water holding capacity.

7 Leaching fraction = % of gross water input estimated to percolate beyond root zone = surplus / (precipitation + gross irrigation).

8 Leaching requirement = quantity of surplus required to drain through the soil to leach sufficient soluble salts to maintain soil salinity (EC) at a level of 2.0 mmhos/cm.

Appendix E2. Design Water Balance 30-Year Average - Proposed Flow

Estimated Pond Area: 3 Acres **Acres** 3,700

Field: Land Application Area **Total Pond Capacity:** 12.7 MG **AWHC (inches):** 8.6

Crop: Pistachio **Initial Pond Volume:** 0.0 MG **Minimum Soil Depth (inches):** 60 **Initial Available Water (inches):** 8.6

Month	ppt [1]	Process Wastewater	Settling Ponds		Gross Water Applied [2]						Net Water Applied [3]			ET [4]		Available Water [5]	Surplus [6]
			Input	Volume	Process Wastewater		Settling Ponds		Supplemental		Process Wastewater	Supplemental	Total	Potential	Estimate		
	inches	MG	MG	MG	MG	in/ac	MG	in/ac	in/ac	MG	in/ac	in/ac	in/ac	in/ac	in/ac	in/ac	in/ac
Jan	1.4	0.02	0.0	0.0	0.02	0.0	0.0	0.0	2.2	221.0	0.0	1.9	3.0	1.1	1.1	8.6	1.9
Feb	1.2	0.02	0.0	0.0	0.02	0.0	0.0	0.0	2.5	251.2	0.0	2.1	3.1	1.7	1.7	8.6	1.5
Mar	1.1	0.02	0.0	0.0	0.02	0.0	0.0	0.0	4.0	401.9	0.0	3.4	4.3	1.8	1.8	8.6	2.5
Apr	0.5	0.02	0.0	0.0	0.02	0.0	0.0	0.0	3.0	301.4	0.0	2.6	3.0	1.5	1.5	8.6	1.5
May	0.5	0.02	0.0	0.0	0.02	0.0	0.0	0.0	8.5	854.0	0.0	7.2	7.7	5.8	5.8	8.6	1.9
Jun	0.0	0.02	0.0	0.0	0.02	0.0	0.0	0.0	12.6	1,265.9	0.0	10.7	10.7	10.3	10.3	8.6	0.4
Jul	0.0	0.02	0.0	0.0	0.02	0.0	0.0	0.0	11.9	1,195.6	0.0	10.1	10.1	11.1	11.1	7.7	0.0
Aug	0.0	0.05	0.0	0.0	0.05	0.0	0.0	0.0	10.1	1,014.8	0.0	8.6	8.6	9.5	9.0	7.3	0.0
Sep	0.0	153.0	0.0	0.0	153.0	1.5	0.0	0.0	4.8	482.3	1.3	4.1	5.4	6.1	5.6	7.1	0.0
Oct	0.4	158.1	0.0	0.0	158.1	1.6	0.0	0.0	2.9	291.4	1.3	2.5	4.1	2.6	2.4	8.6	0.2
Nov	0.6	0.02	0.0	0.0	0.02	0.0	0.0	0.0	3.3	331.6	0.0	2.8	3.3	1.4	1.4	8.6	2.0
Dec	1.0	0.02	0.0	0.0	0.02	0.0	0.0	0.0	3.4	341.6	0.0	2.9	3.7	1.3	1.3	8.6	2.4
Total	**6.7**	**311.4**	**0.0**	**0.0**	**311.4**	**3.1**	**0.0**	**0.0**	**69.2**	**6,952.6**	**2.6**	**58.8**	**67.1**	**54.2**	**52.9**		**14.2**

Leaching Fraction [7]	18.0%
Leaching Requirement [8]	18.0%

NOTES:

Abbreviations: AWHC = available soil water holding capacity, EC = electrical conductivity, ET = evapotranspiration, in/ac = inches per acre, MG = million gallons, ppt = precipitation, µmhos/cm = micromhos per centimeter.

1 Average precipitation data was calculated based on data from CIMIS for January 1991 to March 1992 from the Firebaugh/Telles station (#7) and April 1992 to December 2020 from the Westlands station (#105). (California Department of Water Resources, n.d.).

2 Gross water applied is the total volume of process wastewater and fresh water discharge to the land application site from the facility, settling ponds (if any) or from the source water well.

3 Net water applied is based on an assumed irrigation efficiency of 85% for drip irrigation and effective precipitation assumed at 85%.

4 The potential evapotranspiration (ET) for pistachio is from data collected for January 1991 through March 1992 from the Firebaugh/Telles station (#7) and April 1992 through December 2020 from the Westlands station (#105). The potential ET for November through March uses the ET rate for bare soil since pistachio is dormant during those months (California Department of Water Resources, n.d.).

5 Plant available water in soil profile at month end. Initial available water assumed at field capacity. The AWHC was calculated from physical soil characteristics from the Soil Survey of Fresno County, Western Part. (Soil Survey Staff, Natural Resources Conservation Service, n.d.).

6 Estimated soil water balance. Surplus is water in excess of soil water holding capacity.

7 Leaching fraction = % of gross water input estimated to percolate beyond root zone = surplus / (precipitation + gross irrigation).

8 Leaching requirement = quantity of surplus required to drain through the soil to leach sufficient soluble salts to maintain soil salinity (EC) at a level of 2.0 mmhos/cm.

Appendix E3. Design Water Balance 100-Year Return - Supplemental Irrigation

Estimated Pond Area: 3 Acres **Acres** 3,700

Field: Land Application Area **Total Pond Capacity:** 12.7 MG **AWHC (inches):** 8.6

Crop: Pistachio **Initial Pond Volume:** 0.0 MG **Minimum Soil Depth (inches):** 60 **Initial Available Water (inches):** 8.6

Month	ppt [1]	Process Wastewater	Settling Ponds		Gross Water Applied [2]						Net Water Applied [3]			ET [4]		Available Water [5]	Surplus [6]
			Input	Volume	Process Wastewater		Settling Ponds		Supplemental		Process Wastewater	Supplemental	Total	Potential	Estimate		
	inches	MG				in/ac	MG	in/ac		MG	in/ac						
Jan	5.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	1.1	1.1	8.6	3.3
Feb	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	1.7	1.7	8.6	1.5
Mar	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	1.8	1.8	8.6	2.0
Apr	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	92.4	0.0	0.8	3.1	1.5	1.5	8.6	1.6
May	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	512.4	0.0	4.3	4.3	5.8	5.8	7.2	0.0
Jun	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.2	1,125.3	0.0	9.5	9.5	10.3	9.4	7.3	0.0
Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.9	1,195.6	0.0	10.1	10.1	11.1	10.2	7.2	0.0
Aug	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.1	1,014.8	0.0	8.6	8.7	9.5	8.7	7.2	0.0
Sep	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	703.3	0.0	6.0	6.8	6.1	5.5	8.4	0.0
Oct	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	200.9	0.0	1.7	1.8	2.6	2.6	7.6	0.0
Nov	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	1.4	1.3	8.5	0.0
Dec	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	1.3	1.3	8.6	0.0
Total	**21.6**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**48.2**	**4,844.7**	**0.0**	**41.0**	**59.4**	**54.2**	**50.9**		**8.4**

Leaching Fraction [7]	12.1%
Leaching Requirement [8]	12.1%

NOTES:

Abbreviations: AWHC = available soil water holding capacity, EC = electrical conductivity, ET = evapotranspiration, in/ac = inches per acre, MG = million gallons, ppt = precipitation, µmhos/cm = micromhos per centimeter.

1 1983 was the greatest precipitation year since 1887 based on historic rainfall data from the National Weather Service for Fresno, California. CIMIS data for the past 100 years was not accurate for nearby stations. (National Oceanic and Atmospheric Administration, n.d.).

2 Gross water applied is the total volume of fresh water applied.

3 Net water applied is based on an assumed irrigation efficiency of 85% for drip irrigation and effective precipitation assumed at 85%.

4 The potential evapotranspiration (ET) for pistachio is from data collected for January 1991 through March 1992 from the Firebaugh/Telles station (#7) and April 1992 through December 2020 from the Westlands station (#105). The potential ET for November through March uses the ET rate for bare soil since pistachio is dormant during those months (California Department of Water Resources, n.d.).

5 Plant available water in soil profile at month end. Initial available water assumed at field capacity. The AWHC was calculated from physical soil characteristics from the Soil Survey of Fresno County, Western Part. (Soil Survey Staff, Natural Resources Conservation Service, n.d.).

6 Estimated soil water balance. Surplus is water in excess of soil water holding capacity.

7 Leaching fraction = % of gross water input estimated to percolate beyond root zone = surplus / (precipitation + gross irrigation).

8 Leaching requirement = quantity of surplus required to drain through the soil to leach sufficient soluble salts to maintain soil salinity (EC) at a level of 2.0 mmhos/cm.