APPENDIX A

Soil and Water Analysis Report

Prepared by

Provost & Pritchard

December 2018

SOIL & WATER ANALYSIS REPORT

for

AQUAMARINE SOLAR PROJECT

Site Location

Northwest Corner of Laurel and 25th Avenue
Lemoore, California

County of Kings

Prepared for
Bert Verrips, AICP, Environmental Consulting Services
11942 Red Hill Avenue
Santa Ana, CA 92705

Phone (714) 838-0192

December 10, 2018

Donald Ikemiya, PE
RCE 56630, Expires 6/30/19
Provost & Pritchard Consulting Group
130 N. Garden Street
Visalia, California 93291
(559) 636-1166
FAX (559) 636-1177
dikemiya@ppeng.com
www.ppeng.com

D. Ryan Dodd
CPSS, CCA 342713
Provost & Pritchard Consulting Group
130 N. Garden Street
Visalia, California 93291
(559) 636-1166
FAX (559) 636-1177
rdodd@ppeng.com
www.ppeng.com

CPSS
Certified Professional Soil Scientist
D. RYAN DODD
342713

CERTIFIED CROP ADVISER
D. RYAN DODD
342713

AQUAMARINE SOLAR PROJECT
SOIL & WATER ANALYSIS REPORT

Table of Contents

List of Tables

List of Exhibits

A. PROJECT SUMMARY

1. The proposed Aquamarine Solar Project (**AQSP**) is a solar energy generation facility to be located in Kings County, California. The AQSP site consists of 871 acres subject to a Farmland Security Zone (**FSZ**) contract. AQSP is located west of 25th Avenue, south of the Avenal Cutoff Road, and north of Laurel Avenue, as depicted in **Exhibit 1 – Vicinity Map**.

2. During soil testing for this report, the site consisted of three fallow fields (Fields 1, 2, and 3) and two recently harvested cotton fields (Fields 4 and 5). **Exhibit 2 – Parcel Map** depicts the Kings County parcels drawn over an aerial photo.

3. This report provides an analysis of soil conditions at the proposed AQSP site. A review of publicly available information and field samples collected from the AQSP site was performed to determine the historical, existing, and reasonably foreseeable quality of the site for sustaining agricultural production. Factors considered include surface water quality and availability, groundwater quality and availability, and soil conditions.

B. REPORT SUMMARY

1. On November 26, 2013, the Kings County Board of Supervisors adopted Resolution No. 13-058, recognizing that:

   - Due to reduced surface water deliveries, poor groundwater quality and severe groundwater overdrafts, impaired soil conditions, and regulatory burdens, circumstances exist on agricultural preserves located within a portion of Kings County south of State Route 198 and west of State Route 41 that limit the use of much of the land within that territory for most agricultural activities.
   - It is reasonably foreseeable that certain parcels located there that currently are used for more intensive agricultural activities will be used in the near future eventually be used for less intensive uses, including dry farm seasonal grazing.

2. Kings County can determine that solar energy generation facilities located within this region that maintain a reasonably foreseeable agricultural use on the site in addition to the commercial solar generation facility may be compatible with a Farmland Security Zone Contract pursuant to Government Code 51238.1(a) if a finding can be made, based upon substantial evidence, and taking into account surface water availability, ground water quality and availability, and soil

conditions, that the proposed agricultural operation is a reasonably foreseeable use of the land.

3. Provost and Pritchard Consulting Group evaluated the existing, historic, and reasonably foreseeable soil, water quality, and water availability conditions of the AQSP site and determined that adverse soil conditions and water quality and availability conditions make dry farm seasonal sheep grazing a reasonably foreseeable agricultural activity to occur on the AQSP site.

C. METHODOLOGY

1. The following methodology and information was used to evaluate the agricultural resources for the facility:

   - Soil information was derived from the USDA Natural Resources Conservation Service (**NRCS**).
   - Soil samples were collected from multiple locations at the AQSP site and analyzed for agricultural suitability.
   - Water supply and quality data available from surface water sources serving the site.
   - Water quality data available from groundwater sources near the site.

2. Site specific information was analyzed and interpreted to determine conclusions.

D. NRCS SOIL INFORMATION

1. According to the NRCS (Soil Survey Area: Kings County, California, Survey Area Data: Version 8, Aug 27, 2009) soils at the site consist almost entirely of Lethent clay loam. A small strip of Panoche clay loam, saline-alkali is located on the western side of the site and is depicted in **Exhibit 3 – NRCS Soil Survey Map**. These soils are typically neutral to alkaline.

2. As mapped by the NRCS, the property is subject to saline-sodic conditions (8.0 to 16.00 mmhos/cm) and has drainage limitations. The capacity of the most limiting layer to transmit water (saturated hydraulic conductivity; Ksat) is low (0.00 to 0.06 in/hr).

3. The Lethent Clay Loam soil is relatively level and generally used for agriculture. The Land Capability Class designation is 7s (non-irrigated) and 3s (irrigated). Class 7 soils have very severe limitations that make them unsuitable for

cultivation and that restrict their use mainly to pasture, grazing, forestland, or wildlife habitat. Class 3 soils have severe limitations that restrict the choice of plants or that require special conservation practices, or both. The letter "s" indicates that the soil is limited mainly because it is shallow, droughty, or stony.

4. Saline conditions are native in the Lethent clay loam and have been exacerbated by poor natural drainage and the application of insufficient water to leach salt from the root zone. Long term soil salinity conditions are expected to increase, due to the lack of a subsurface drainage system and a sustainable leachate disposal outlet.

E. SOIL SAMPLING RESULTS

On October 15th, 2018, 18 composite soil samples were collected from 44 boring locations. Two depths (0-1 feet and 1-2 feet) were collected per boring location and five boring locations were used per composite sample (except for Field 1, which used four). Approximate sampling locations are depicted on Exhibit 4 – Soil Borings Location Map. Detailed laboratory results are included in Exhibit 5 – Soil Sample Results.

Soil data from a previous project site overlapping with the AQSP boundary was also used. Three boring locations (Sites 7-9) were analyzed at 0-1 feet and 1-2 feet as individual samples and are shown in Exhibit 4.

1. The following soil interpretations are defined:

   - **Electrical Conductivity** - Soils are considered saline when the electrical conductivity of saturation extracts (**EC**) are above 4 decisiemens per meter (**dS/m**). High soil salinity reduces the amount of water available to plants because as salinity increases above a threshold amount, plants must expend more energy to extract water from soil and thus plant growth slows. At sufficiently high salinity levels, plants can no longer extract water and permanently wilt.
   - **Sodium** - Sodium (**Na**) levels above 10 milliequivalents per liter (**meq/l**) are considered high. Excess sodium disperses clay particles by destroying soil structure which severely limits infiltration and movement of soil water Soil salinity offsets sodicity so permeability is maintained until salinity drops to about 4 dS/m. At that point gypsum or another source of soluble calcium must be added to displace the sodium on soil particles and maintain permeability. The resulting sodium ions must then be leached from the root zone for the soil to sustain acceptable crop yields.
   - **Exchangeable Sodium Percentage** - Soils are considered sodic when the exchangeable sodium percentage (**ESP**) is above 15%. Sodic soils tend to

develop poor drainage over time because sodium ions on clay particles cause the soil particles to disperse. Sodic soils are hard and cloddy when dry and tend to crust. Infiltration rates are usually low, especially soils high in silt and clay. Poor plant growth and germination are also common. Soil pH is usually alkaline, and plant nutritional imbalances may occur.

- **Boron** - Boron (**B**) levels above 2.0 mg/L are considered high. Boron toxicity often starts with a browning, yellowing and drying of leaf tips. These symptoms may progress to the entire leaf. Overall growth is often stunted, and crop yields are reduced.

2. **Table 1 – Soil Sampling Results Summary** and **Exhibit 5 – Soil Sample Results** provide the results from soil analysis. Of the 9 soil sampling locations, all locations showed significant limitations related to salinity. Soil salinity is the limiting factor and it is related to poor drainage conditions.

Table 1
Soil Sampling Results Summary

Sample Description	Sample Depth	pH	EC dS/m >4	Na meq/L >10	ESP % >15	B mg/L >2	Interpretation
Field – 1	0-1'	7.9	**8.67**	**41.2**	10.9	**6.9**	Saline with excessive sodium & boron
Field – 1	1-2'	7.9	**11.20**	**63.9**	**16.5**	**13.8**	Saline-sodic with excessive sodium & boron
Field – 2W	0-1'	7.7	**11.00**	**61.2**	**16.1**	**5.3**	Saline-sodic with excessive sodium & boron
Field – 2W	1-2'	8.0	**25.60**	**201**	**35.0**	**15.5**	Saline-sodic with excessive sodium & boron
Field – 2E	0-1'	7.8	**11.80**	**70.1**	**16.9**	**5.3**	Saline-sodic with excessive sodium & boron
Field – 2E	1-2'	7.8	**12.70**	**76.5**	**18.8**	**6.8**	Saline-sodic with excessive sodium & boron
Field – 3W	0-1'	8.0	**5.47**	**27.6**	9.8	**2.7**	Saline with excessive boron
Field – 3W	1-2'	8.0	**10.20**	**61.4**	**16.9**	**7.9**	Saline-sodic with excessive sodium & boron
Field – 3E	0-1'	8.0	**5.61**	**26.3**	8.9	**2.8**	Saline with excessive boron
Field – 3E	1-2'	7.8	**9.81**	**59.8**	**16.7**	**6.6**	Saline-sodic with excessive sodium & boron
Field – 4W	0-1'	7.9	**8.68**	**46.3**	13.0	**3.4**	Saline with excessive boron
Field – 4W	1-2'	7.9	**8.64**	**48.2**	13.6	**6.7**	Saline with excessive boron
Field – 4E	0-1'	7.8	**9.44**	**51.8**	13.9	**5.3**	Saline with excessive boron
Field – 4E	1-2'	8.0	**10.60**	**64.5**	**17.0**	**8.0**	Saline-sodic with excessive sodium & boron
Field – 5W	0-1'	7.8	**9.90**	**55.5**	14.3	**5.5**	Saline with excessive sodium
Field – 5W	1-2'	7.9	**10.80**	**66.8**	**16.8**	**9.0**	Saline-sodic with excessive sodium & boron
Field – 5E	0-1'	7.8	**10.60**	**58.3**	**15.2**	**6.8**	Saline-sodic with excessive sodium & boron
Field – 5E	1-2'	7.9	**12.10**	**78.3**	**19.2**	**11.0**	Saline-sodic with excessive sodium & boron

Bold *= Greater than generally acceptable agricultural limitations*

3. **Table 2 – Previous Soil Sampling Results Summary** provide the results from the 2014 soil analysis. Of the three soil sampling locations, all locations showed significant limitations related to salinity. Soil salinity is the limiting factor and it is related to poor drainage conditions.

Table 2
Previous Soil Sampling Results Summary

Sample Description	Sample Depth	EC dS/m >4	Na meq/l >10	ESP % >15	B mg/l >2	Interpretation
Site 7	0-1'	**7.12**	**34.1**	8.6	**4.9**	Saline with excessive sodium & boron
Site 7	1-2'	**8.89**	**48.3**	12.8	**8.9**	Saline with excessive sodium & boron
Site 8	0-1'	**4.30**	**15.8**	4.1	1.3	Saline with excessive sodium
Site 8	1-2'	**6.10**	**23.7**	5.8	**3.0**	Saline with excessive sodium & boron
Site 9	0-1'	**5.17**	**18.5**	4.7	**2.6**	Saline with excessive sodium & boron
Site 9	1-2'	**7.90**	**40.5**	11.1	**8.4**	Saline with excessive sodium & boron

Bold *= Above acceptable agricultural limitations*

4. Saline-sodic conditions at the AQSP site are naturally occurring and have been exacerbated by poor natural drainage and limited water supply availability. Under these conditions, insufficient applications of water cause insufficient salt leaching from the root zone. The lack of subsurface drainage systems and a sustainable disposal outlet are expected to increase soil salinity conditions.

F. SITE WELL INFORMATION

1. Water quality data from an operating irrigation well less than 1 mile north of the AQSP are summarized in **Table 3**.

Table 3

Site Groundwater Characteristics
North Tip Well

Constituent	Result	Units	Acceptable Range	Result
EC	1450	µS/cm	750 – 3,000, high	OK
Sodium (Na)	11	mg/L	Greater than 70, high	OK
Chloride (Cl)	3.9	mg/L	140 - 350, plant injury can occur	OK
Boron (B)	**1.28**	mg/L	Greater than 1.0, high	**High**
pH	8.2	pH units	Between 6.5 - 8.4, normal	OK
Adj. SAR	**16.4**	Ratio	Between 0.1 – 4.0, normal	**High**
TDS (calc'd from EC)	**971**	mg/L	Greater than 500, high	**High**

2. Groundwater in the surrounding area is typically high in salinity, sodium, chloride, carbonates and bicarbonates, and boron. These groundwater conditions are typically above the maximums recommended for tolerant crops. Growing crops utilizing solely groundwater is not feasible. **Table 4** describes the results from a monitoring well adjacent to the AQSP site, derived from the Geotracker GAMA groundwater information system.

Table 4

Site Groundwater Characteristics
USGS Monitoring Well 361145119541601

Constituent	Result	Units	Acceptable Range	Result
EC	**3600**	µS/cm	750 – 3,000, high	**High**
Sodium (Na)	**360**	mg/L	Greater than 70, high	**High**
Chloride (Cl)	68	mg/L	140 - 350, plant injury can occur	OK
Boron (B)	**5.9**	mg/L	Greater than 1.0, high	**High**
pH	7.9	pH units	Between 6.5 - 8.4, normal	OK
SAR	**4.3**	Ratio	Between 0.1 – 4.0, normal	**High**
TDS	**3270**	mg/L	Greater than 500, high	**High**

G. SURFACE WATER QUALITY AND AVAILABILITY

1. The AQSP site is located within Westlands Water District (**WWD**). WWD irrigation supply water quality information is from the California Department of Water Resources (**DWR**) Water Quality Selected Grab Sample at Check 21 taken during July 2018 and is provided in **Table 5**.

Table 5

Westlands Water District Irrigation Supply Water Characteristics
DWR California Aqueduct Check 21

Constituent	Check 21 Result	Units	Acceptable Range	Result
EC	437	µS/cm	750 – 3,000, high	OK
Sodium (Na)	51	mg/L	Greater than 70, high	OK
Chloride (Cl)	69	mg/L	140 - 350, plant injury can occur	OK
Boron (B)	0.1	mg/L	Greater than 1.0, high	OK
pH	8.3	pH units	Between 6.5 - 8.4, normal	OK
TDS	246	mg/L	Greater than 500, high	OK

2. Surface water quality from WWD is appropriate for growing crops. Water quality of available surface water is not a concern with regard to cultivated agricultural operations in the region.

3. The most limiting factor in the region for long term sustainability of irrigated agriculture is availability of surface water to the AQSP site. Average annual rainfall is about 5 to 8 inches and, in most years, available surface water must be supplemented with groundwater to irrigate planned crops. Additional pressure for releases of water to meet environmental requirements and other uses means that future water allocations are not expected to increase.

4. Central Valley Project (**CVP**) WWD allocations are unreliable and water deliveries to the AQSP site have averaged 37% for the past seven years. Even in wet years like 2011, the WWD allocation was only 80%. The 2018 allocation is 50%. Erratic allocations indicate that surface water supplies are highly variable which makes farming sustainability in these soil conditions tenuous.

5. A summary of the water allocations for Westlands Water District is provided in **Table 6**.

Table 6
Westlands Water District Water Allocation

Water Year	Allocation
2018	50%
2017	100%
2016	5%
2015	0%
2014	0%
2013	20%
2012	40%
2011	80%

6. As noted above, without sufficient allocations of surface water supplies, available groundwater would likely not be capable of sustaining economically viable crops on the site. Crops in the region typically require approximately three to four acre-feet of water per acre and historic, current, and projected water allocations do not provide sufficient water to support this.

7. Even in years of full entitlement (100% allocation), the AQSP site would only receive a maximum water allocation from WWD of 2.6 acre-feet per acre and would not be enough to irrigate all the available cropland.

H. CONCLUSIONS

1. The AQSP site is not suitable for sustaining profitable long-term agricultural crop production. Saline-sodic soils found at the AQSP site are not appropriate for most agricultural crops and will cause damage to many of the crops typically grown in the region. Reclamation of these soils is not feasible due to a lack of a subsurface drainage system on the site and the lack of an ultimate drainage water disposal solution, if a system were installed.

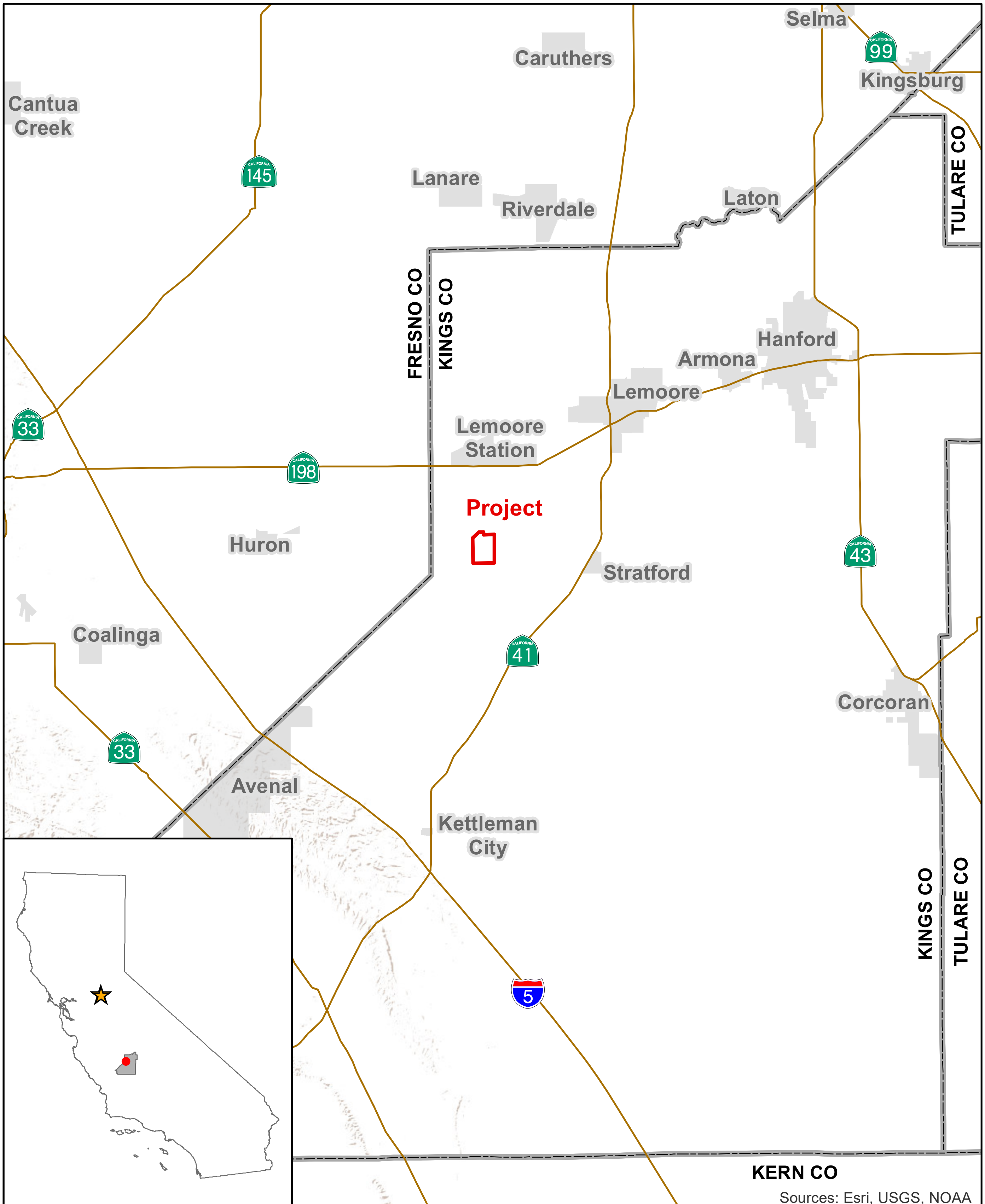
2. Groundwater in the area is typically poor quality. Local groundwater conditions indicate high levels of salinity, boron, chloride, sodium, carbonates and bicarbonates are commonly found in concentrations that are not recommended for most crops. Long-term usage of such groundwater is not sustainable since leaching excess salts through the soil is difficult due to a lack of a drainage system and outlet. Additionally, dilution of groundwater with surface water is not always feasible due to water allocation curtailments.

3. **Water availability is the limiting factor** for the AQSP site and broader area. Conversion of these parcels from irrigated agriculture would free up the water supply for use on other parcels in the area.

4. The severe limitation of reliable water availability and related soil salinity issues constitute specific circumstances under which Kings County can make the finding that a reasonably foreseeable agricultural use of the site would be dry land farming with seasonal grazing. Since the proposed project is compatible for use with dry-farm seasonal grazing or a similar agricultural activity, the AQSP is a compatible use with a Farmland Security Zone contract pursuant to Government Code Section 51238.1(a) and the County of Kings Implementation Procedures for the California Land Conservation "Williamson" Act of 1965.

Exhibit 1

Vicinity Map



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PROVOST&
PRITCHARD
CONSULTING GROUP
An Employee Owned Company

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Miles

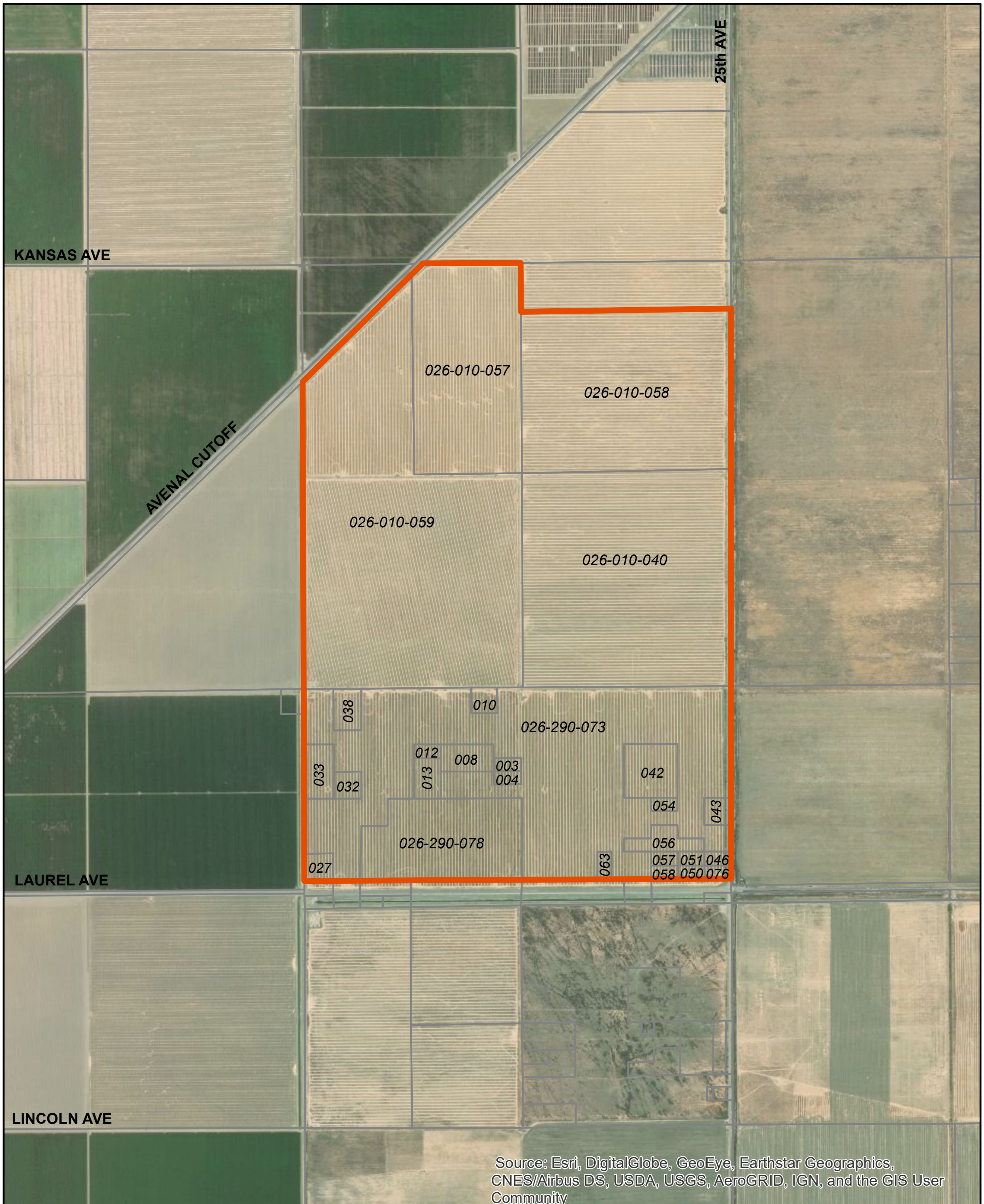
Aquamarine Site

Aquamarine Solar Project

Vicinity Map

Exhibit 2

Parcel Map



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PROVOST& PRITCHARD
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Feet

Parcel
Aquamarine Site

Aquamarine Solar Project

Parcel Map

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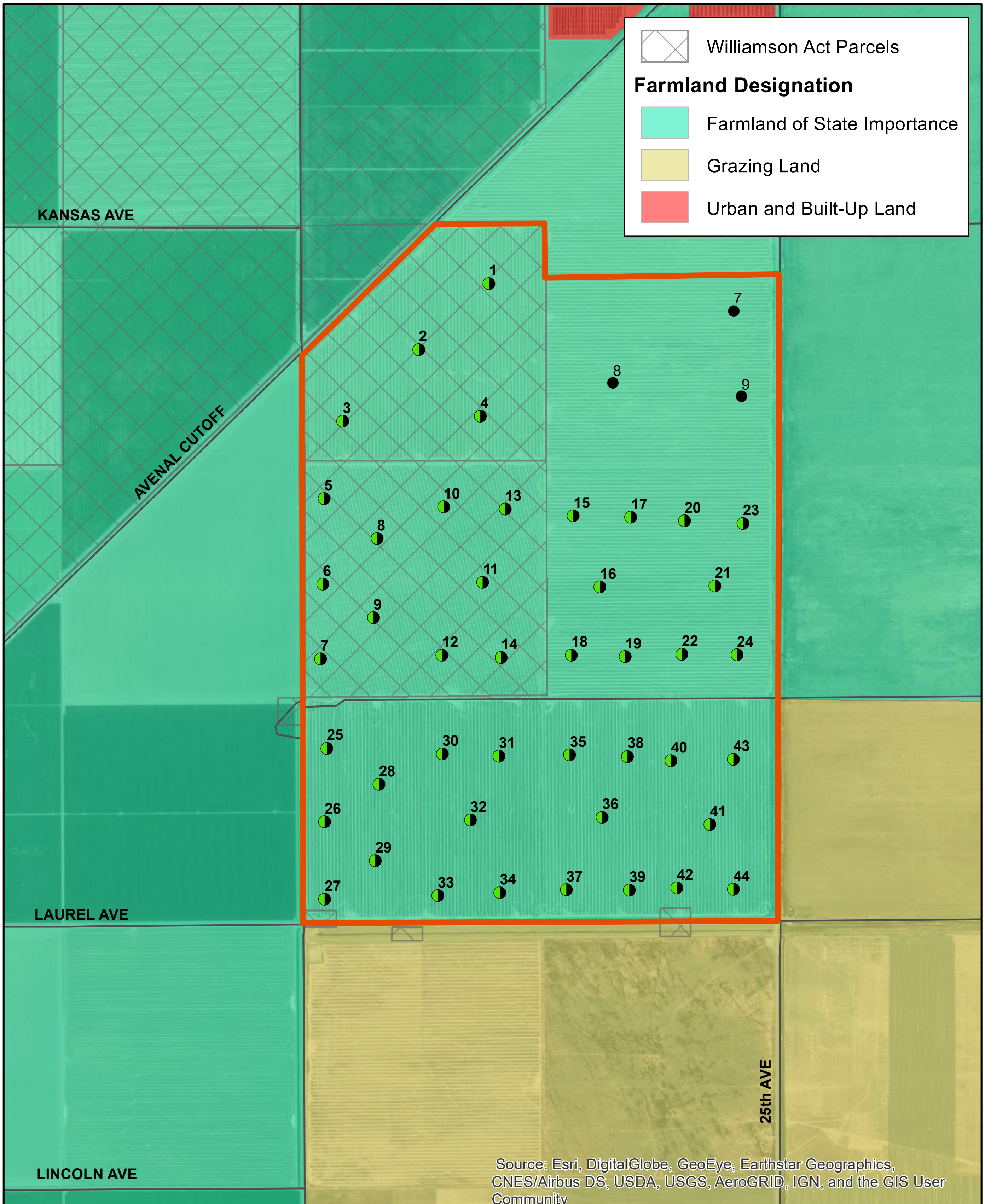
Exhibit 3

Agricultural Preserves Map



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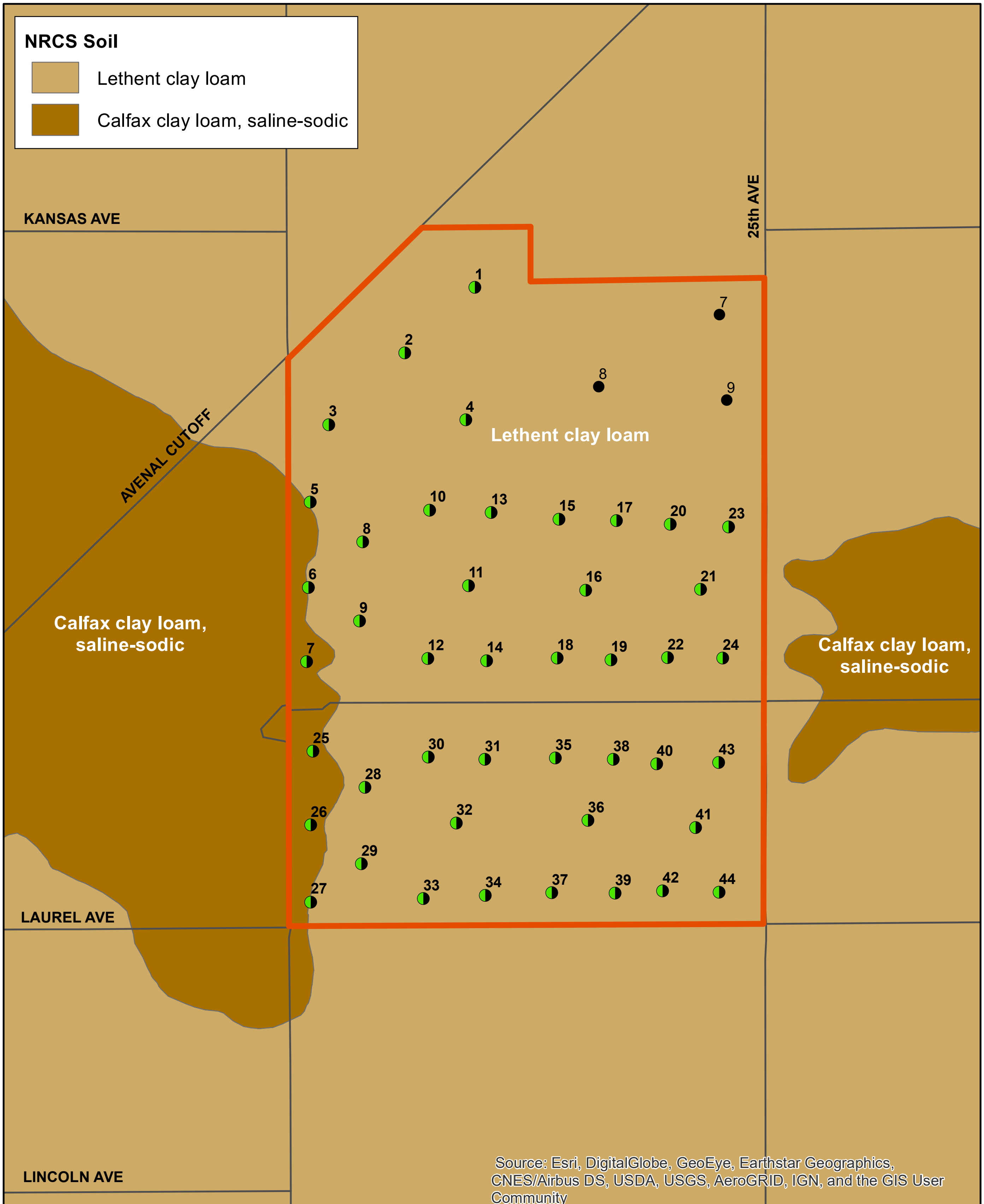
Soil Boring Location
Previous Soil Boring Location
Aquamarine Site

Aquamarine Solar Project

Farmland Designation

Exhibit 4

NRCS Soil Survey Map



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Soil Boring Location

Previous Soil Boring Location

Aquamarine Site

Aquamarine Solar Project

Soil Map

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Exhibit 5

Soil Boring Locations

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Aquamarine Solar Project

Soil Boring Locations

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Exhibit 6

Soil Sample Results

DELLAVALLE Laboratory, Inc.
Chemists and Consultants

Report of Soil Analysis

1910 W. McKinley, Suite 110, Fresno, CA 93728
FAX (559) 268-8174 - (800) 228-9896 - (559) 233-6129

Lab No. 285908
Sampled Date 10/15/2018
Submitted Date 10/16/2018
Submitted by Donald Ikemiya
Reported Date 10/25/2018
Location/Project Aquamarine Solar Project
Copy To rdodd/jmuell@ppeng.com
Fax (559) 636-1177
E-mail

Provost & Pritchard - Visalia
130 N Garden St
Visalia CA 93291
14015
08

ID: Open (Int Solar)

No.	Description	% SP	units pH	dS/m EC	meq/l Ca	meq/l Mg	meq/l Na	meq/l Cl	% ESP	T/ac-6" GR	+\- Lime	lbs/ac-6" Lime	mg/l B	mg/kg NO_3-N	mg/kg PO_4-P	mg/kg K	mg/kg Acid K	mg/kg Zn
	RL--->	0.50	1.0	0.01	0.1	0.1	0.1	0.1	0.1	0.1		500	0.1	1.0	2.0	2.0	40.0	0.1
	NAPT Methods--->	S1.00	S1.10	S1.20	S1.60	S1.60	S1.60	S1.40	Calc.			S2.50	S1.50	S3.10	S4.10	S5.10		S6.10
	Handbook 60--->									Hndbk 60-22d	Hndbk 60-23a						SSSA,p5 61 mod	
1	Field - 1 (0-1')	42	7.9	8.67	27.2	13.3	41.2		10.9	<0.1	-		6.9	32	20	403		0.9
2	Field - 1 (1-2')	51	7.9	11.20	25.2	15.2	63.9		16.5	0.9	-		13.8	34	13	272		0.3
3	Field - 2W (0-1')	52	7.7	11.00	24.1	14.8	61.2		16.1	1.9	-		5.3	34	13	324		1.1
4	Field - 2W (1-2')	51	8.0	25.60	25.2	34.2	204		35.0	2.4	-		15.5	32	11	266		0.4
5	Field - 2E (0-1')	58	7.8	11.80	30.8	15.0	70.1		16.9	2.8	-		5.3	38	12	379		1.0
6	Field - 2E (1-2'	54	7.8	12.70	27.9	14.6	76.5		18.8	3.1	-		6.8	33	12	364		0.9
7	Field - 3W (0-1')	46	8.0	5.47	15.8	6.7	27.6		9.8		-		2.7	12	9	444		0.7
8	Field - 3W (1-2')	58	8.0	10.20	24.3	10.9	61.4		16.9	3.1	-		7.9	10	11	358		0.6
9	Field - 3E (0-1')	51	8.0	5.61	18.0	6.9	26.3		8.9		-		2.8	8	8	481		0.7
10	Field - 3E (1-2'	58	7.8	9.81	23.9	10.1	59.8		16.7	2.9	-		6.6	11	10	382		0.6
11	Field - 4W (0-1')	56	7.9	8.68	24.1	11.2	46.3		13.0	2.0	-		3.4	3	9	386		0.9
12	Field - 4W (1-2')	57	7.9	8.64	23.9	11.2	48.2		13.6	0.6	-		6.7	2	12	331		0.4
13	Field - 4E (0-1')	58	7.8	9.44	25.2	13.3	51.8		13.9	0.9	-		5.3	5	10	438		0.8
14	Field - 4E (1-2')	56	8.0	10.60	24.2	14.0	64.5		17.0	0.8	-		8.0	4	10	364		0.6
15	Field - 5W (0-1')	58	7.8	9.90	26.8	14.6	55.5		14.3	0.8	-		5.5	35	19	476		0.9
16	Field - 5W (1-2')	55	7.9	10.80	27.2	14.8	66.8		16.8	0.8	-		9.0	18	13	362		0.8
17	Field - 5E (0-1')	60	7.8	10.60	27.0	13.4	58.3		15.2	<0.1	-		6.8	50	19	467		1.0
18	Field - 5E (1-2')	55	7.9	12.10	27.2	15.6	78.3		19.2	0.7	-		11.0	21	13	378		0.8

Report of Soil Analysis

DELLAVALLE Laboratory, Inc.
Chemists and Consultants

1910 W. McKinley, Suite 110, Fresno, CA 93728
FAX (559) 268-8174 - (800) 228-9896 - (559) 233-6129

Provost & Pritchard Eng - Visalia
130 N Garden St
Visalia CA 93291
14015
01

ID: Open

Lab No. 208245
Sampled Date 7/21/2014
Submitted Date 7/22/2014
Submitted by
Reported Date 7/30/2014
Location/Project [redacted]
Copy To
Fax (559) 636-1177
E-mail [redacted]

No.	Description		SP	pH	EC	Ca	Mg	Na	Cl	ESP	GR	Lime	Lime	B	NO_3-N	PO_4-P	K	Acid K	Zn
			%	units	dS/m	meq/l	meq/l	meq/l	meq/l	%	T/ac-6"	+\-	lbs/ac-6"	mg/l	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
	RL--->		0.50	1.0	0.01	0.1	0.1	0.1	0.1	0.1	0.1		500	0.1	1.0	2.0	2.0	40.0	0.1
	NAPT Methods--->		S1.00	S1.10	S1.20	S1.60	S1.60	S1.60	S1.40	Calc.			S2.50	S1.50	S3.10	S4.10	S5.10		S6.10
	Handbook 60--->										Hndbk 60-22d	Hndbk 60-23a						SSSA,p5 61 mod	
[redacted]																			
13	Site 7	0-1'	48	7.9	7.12	29.7	14.1	34.1		8.6		+		4.9	63	17	526		0.6
14	Site 7	1-2'	50	8.0	8.89	25.9	14.1	48.3		12.8	5.7	+		8.9	47	14	422		0.4
15	Site 8	0-1'	52	7.9	4.30	24.8	11.3	15.8		4.1		+		1.3	53	11	442		0.4
16	Site 8	1-2'	50	7.9	6.10	31.4	13.2	23.7		5.8		+		3.0	33	10	345		0.3
17	Site 9	0-1'	53	8.0	5.17	26.7	11.4	18.5		4.7		+		2.6	35	9	508		0.9
18	Site 9	1-2'	51	8.0	7.90	25.9	11.9	40.5		11.1	7.1	+		8.4	32	11	414		0.3

Exhibit 7

Soil Resource Report

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

Kings County, California

Aquamarine Solar Project Site

November 9, 2018

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.

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Contents

How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

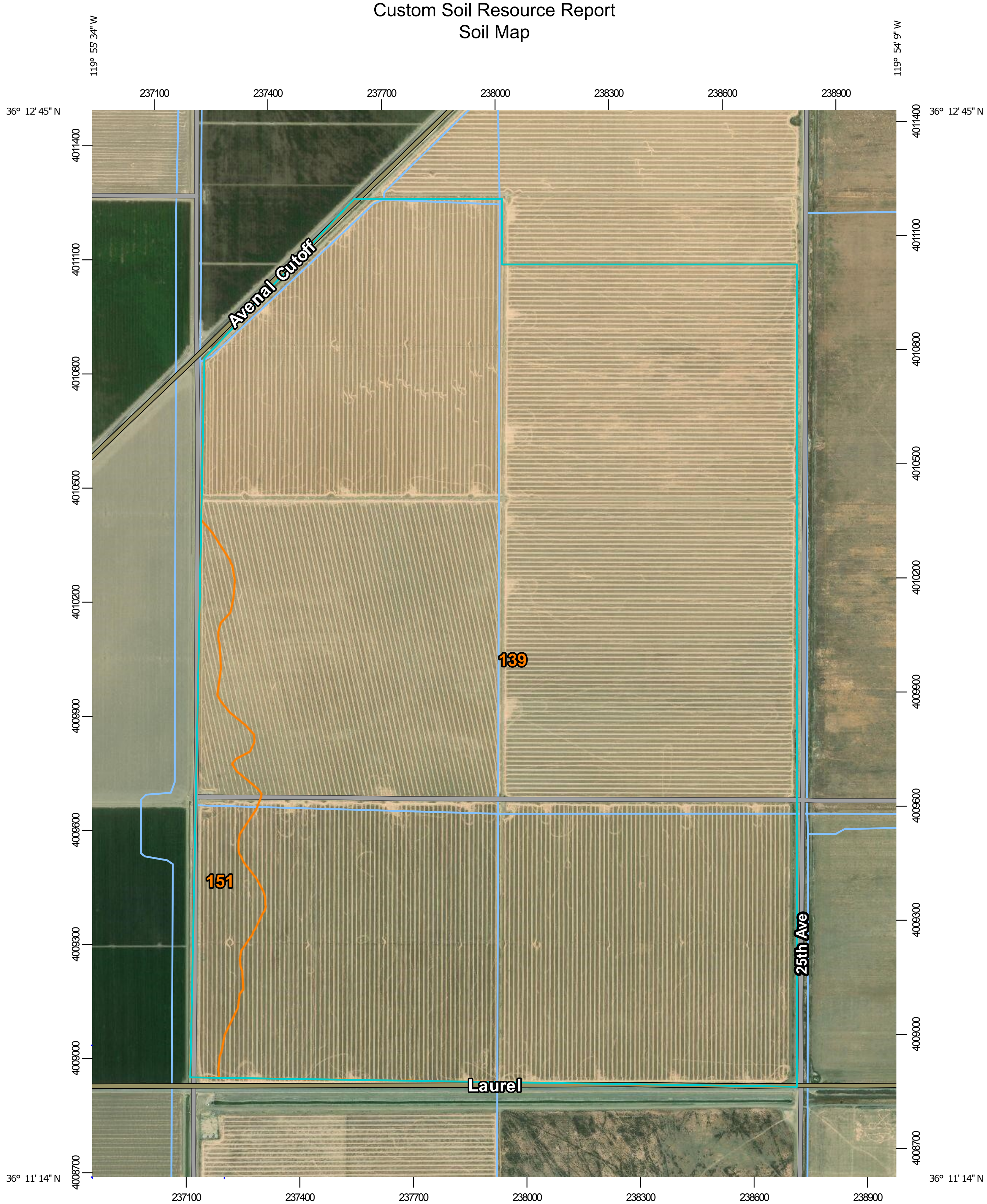
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree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

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

Soil Map

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

Soil Map



Map Scale: 1:13,700 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0, 200, 400, 800, 1200

Feet: 0, 500, 1000, 2000, 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N 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: Kings County, California
Survey Area Data: Version 14, Sep 12, 2018

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

Date(s) aerial images were photographed: Jul 24, 2016—Oct 23, 2017

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
139	Lethent clay loam	816.7	95.4%
151	Calflax clay loam, saline-sodic, 0 to 2 percent slopes, MLRA 17	39.3	4.6%
Totals for Area of Interest		**855.9**	**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.

Kings County, California

139—Lethent clay loam

Map Unit Setting

National map unit symbol: hhjs
Elevation: 190 to 500 feet
Mean annual precipitation: 5 to 8 inches
Mean annual air temperature: 63 to 66 degrees F
Frost-free period: 250 to 300 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Lethent and similar soils: 85 percent
Minor components: 12 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lethent

Setting

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

Typical profile

Ap - 0 to 6 inches: clay loam
Btk - 6 to 24 inches: clay loam
Bt - 24 to 31 inches: clay loam
C - 31 to 60 inches: sandy loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: 4 to 8 inches to natric
Natural drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Gypsum, maximum in profile: 3 percent
Salinity, maximum in profile: Moderately saline to strongly saline (8.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 70.0
Available water storage in profile: Very low (about 0.8 inches)

Interpretive groups

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

Minor Components

Garces

Percent of map unit: 3 percent
Hydric soil rating: No

Gepford

Percent of map unit: 2 percent
Hydric soil rating: No

Houser

Percent of map unit: 2 percent
Hydric soil rating: No

Panoche

Percent of map unit: 2 percent
Hydric soil rating: No

Unnamed, rare flooding

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

Twisselman

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

Unnamed, rare flooding

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

151—Calflax clay loam, saline-sodic, 0 to 2 percent slopes, MLRA 17

Map Unit Setting

National map unit symbol: 2vncm
Elevation: 160 to 730 feet
Mean annual precipitation: 6 to 11 inches
Mean annual air temperature: 61 to 66 degrees F
Frost-free period: 230 to 250 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Calflax, clay loam, saline-sodic, 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

Setting

Landform: Fan skirts
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 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 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: 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: More than 80 inches
Frequency of flooding: Very rare
Frequency of ponding: None
Calcium carbonate, maximum in profile: 3 percent
Gypsum, maximum in profile: 5 percent
Salinity, maximum in profile: Very slightly saline to strongly saline (2.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 30.0
Available water storage in profile: Moderate (about 7.8 inches)

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

Minor Components

Calflax, clay loam, saline-sodic, wet
Percent of map unit: 3 percent
Landform: Fan skirts
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Posochanet, clay, saline-sodic
Percent of map unit: 2 percent
Landform: Fan skirts
Hydric soil rating: No

Ciervo, clay, saline-sodic
Percent of map unit: 1 percent
Landform: Fan skirts
Hydric soil rating: No

Cerini, clay loam
Percent of map unit: 1 percent
Landform: Alluvial fans

Hydric soil rating: No

Panoche

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

Westhaven

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

Garces, silt loam

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

Twisselman, clay, saline-alkali

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

Kimberlina, sandy loam

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

Unnamed hydric

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

Lethent

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

Avenal

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

Soil Information for All Uses

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

AOI Inventory

This folder contains a collection of tabular reports that present a variety of soil information. Included are various map unit description reports, special soil interpretation reports, and data summary reports.

Map Unit Description (Brief, Generated)

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 in this report, along with the maps, provide information on the composition of map units and properties of their components.

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.

The Map Unit Description (Brief, Generated) report displays a generated description of the major soils that occur in a map unit. Descriptions of non-soil (miscellaneous areas) and minor map unit components are not included. This description is generated from the underlying soil attribute data.

Additional information about the map units described in this report is available in other Soil Data Mart reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the Soil Data Mart reports define some of the properties included in the map unit descriptions.

Report—Map Unit Description (Brief, Generated)

Kings County, California

Map Unit: 139—Lethent clay loam

Component: Lethent (85%)

The Lethent component makes up 85 percent of the map unit. Slopes are 0 to 1 percent. This component is on valleys, rims on basin floors. The parent material consists of alluvium derived from sedimentary rock. Depth to a root restrictive layer, natric, is 4 to 8 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7s. Irrigated land capability classification is 3s. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 3 percent. The soil has a moderately saline horizon within 30 inches of the soil surface. The soil has a maximum sodium adsorption ratio of 43 within 30 inches of the soil surface.

Component: Garces (3%)

Generated brief soil descriptions are created for major soil components. The Garces soil is a minor component.

Component: Houser (2%)

Generated brief soil descriptions are created for major soil components. The Houser soil is a minor component.

Component: Panoche (2%)

Generated brief soil descriptions are created for major soil components. The Panoche soil is a minor component.

Component: Gepford (2%)

Generated brief soil descriptions are created for major soil components. The Gepford soil is a minor component.

Component: Unnamed, rare flooding (1%)

Generated brief soil descriptions are created for major soil components. The Unnamed soil is a minor component.

Component: Twisselman (1%)

Generated brief soil descriptions are created for major soil components. The Twisselman soil is a minor component.

Component: Unnamed, rare flooding (1%)

Generated brief soil descriptions are created for major soil components. The Unnamed soil is a minor component.

Map Unit: 151—Calflax clay loam, saline-sodic, 0 to 2 percent slopes, MLRA 17

Component: Calflax, clay loam, saline-sodic (85%)

The Calflax, clay loam, saline-sodic component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. This component is on fan skirts, valleys. The parent material consists of alluvium derived from calcareous sedimentary rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is very rarely flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7s. Irrigated land capability classification is 2s. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 2 percent. The soil has a very slightly saline horizon within 30 inches of the soil surface. The soil has a maximum sodium adsorption ratio of 14 within 30 inches of the soil surface.

Component: Calflax, clay loam, saline-sodic, wet (3%)

Generated brief soil descriptions are created for major soil components. The Calflax soil is a minor component.

Component: Posochanet, clay, saline-sodic (2%)

Generated brief soil descriptions are created for major soil components. The Posochanet soil is a minor component.

Component: Twisselman, clay, saline-alkali (1%)

Generated brief soil descriptions are created for major soil components. The Twisselman soil is a minor component.

Component: unnamed hydric (1%)

Generated brief soil descriptions are created for major soil components. The unnamed hydric soil is a minor component.

Component: Avenal (1%)

Generated brief soil descriptions are created for major soil components. The Avenal soil is a minor component.

Component: Cerini, clay loam (1%)

Generated brief soil descriptions are created for major soil components. The Cerini soil is a minor component.

Component: Panoche (1%)

Generated brief soil descriptions are created for major soil components. The Panoche soil is a minor component.

Component: Westhaven (1%)

Generated brief soil descriptions are created for major soil components. The Westhaven soil is a minor component.

Component: Garces, silt loam (1%)

Generated brief soil descriptions are created for major soil components. The Garces soil is a minor component.

Component: Ciervo, clay, saline-sodic (1%)

Generated brief soil descriptions are created for major soil components. The Ciervo soil is a minor component.

Component: Kimberlina, sandy loam (1%)

Generated brief soil descriptions are created for major soil components. The Kimberlina soil is a minor component.

Component: Lethent (1%)

Generated brief soil descriptions are created for major soil components. The Lethent soil is a minor component.

Land Classifications

This folder contains a collection of tabular reports that present a variety of soil groupings. The reports (tables) include all selected map units and components for each map unit. Land classifications are specified land use and management groupings that are assigned to soil areas because combinations of soil have similar behavior for specified practices. Most are based on soil properties and other factors that directly influence the specific use of the soil. Example classifications include ecological site classification, farmland classification, irrigated and nonirrigated land capability classification, and hydric rating.

Land Capability Classification

The land capability classification of map units in the survey area is shown in this table. This classification shows, in a general way, the suitability of soils for most kinds of field crops (United States Department of Agriculture, Soil Conservation Service, 1961). Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forestland, or for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit.

Capability classes, the broadest groups, are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

- Class 1 soils have slight limitations that restrict their use.
- Class 2 soils have moderate limitations that restrict the choice of plants or that require moderate conservation practices.
- Class 3 soils have severe limitations that restrict the choice of plants or that require special conservation practices, or both.
- Class 4 soils have very severe limitations that restrict the choice of plants or that require very careful management, or both.
- Class 5 soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.
- Class 6 soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.
- Class 7 soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat.
- Class 8 soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, 2e. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage);

s shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class 1 there are no subclasses because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class 5 are subject to little or no erosion.

Report—Land Capability Classification

Land Capability Classification–Kings County, California				
Map unit symbol and name	Pct. of map unit	Component name	Land Capability Subclass	
			Nonirrigated	Irrigated
139—Lethent clay loam				
	85	Lethent	7s	3s
151—Calflax clay loam, saline-sodic, 0 to 2 percent slopes, MLRA 17				
	85	Calflax, clay loam, saline-sodic	7s	2s

Prime and other Important Farmlands

This table lists the map units in the survey area that are considered important farmlands. Important farmlands consist of prime farmland, unique farmland, and farmland of statewide or local importance. This list does not constitute a recommendation for a particular land use.

In an effort to identify the extent and location of important farmlands, the Natural Resources Conservation Service, in cooperation with other interested Federal, State, and local government organizations, has inventoried land that can be used for the production of the Nation's food supply.

Prime farmland is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forestland, or other land, but it is not urban or built-up land or water areas. The soil quality, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management, including water management, and acceptable farming methods are applied. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. The water supply is dependable and of adequate quality. Prime farmland is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not frequently flooded during the growing season or is protected from flooding. Slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

For some of the soils identified in the table as prime farmland, measures that overcome a hazard or limitation, such as flooding, wetness, and droughtiness, are needed. Onsite evaluation is needed to determine whether or not the hazard or limitation has been overcome by corrective measures.

A recent trend in land use in some areas has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

Unique farmland is land other than prime farmland that is used for the production of specific high-value food and fiber crops, such as citrus, tree nuts, olives, cranberries, and other fruits and vegetables. It has the special combination of soil quality, growing season, moisture supply, temperature, humidity, air drainage, elevation, and aspect needed for the soil to economically produce sustainable high yields of these crops when properly managed. The water supply is dependable and of adequate quality. Nearness to markets is an additional consideration. Unique farmland is not based on national criteria. It commonly is in areas where there is a special microclimate, such as the wine country in California.

In some areas, land that does not meet the criteria for prime or unique farmland is considered to be *farmland of statewide importance* for the production of food, feed, fiber, forage, and oilseed crops. The criteria for defining and delineating farmland of statewide importance are determined by the appropriate State agencies. Generally, this land includes areas of soils that nearly meet the requirements for prime farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods. Some areas may produce as high a yield as prime farmland if conditions are favorable. Farmland of statewide importance may include tracts of land that have been designated for agriculture by State law.

In some areas that are not identified as having national or statewide importance, land is considered to be *farmland of local importance* for the production of food, feed, fiber, forage, and oilseed crops. This farmland is identified by the appropriate local agencies. Farmland of local importance may include tracts of land that have been designated for agriculture by local ordinance.

Report—Prime and other Important Farmlands

Prime and other Important Farmlands–Kings County, California		
Map Symbol	**Map Unit Name**	**Farmland Classification**
139	Lethent clay loam	Farmland of statewide importance
151	Calflax clay loam, saline-sodic, 0 to 2 percent slopes, MLRA 17	Farmland of statewide importance

Taxonomic Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (Soil Survey Staff, 1999 and 2003). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. This table shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Twelve soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol.* An example is Alfisols.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalfs (*Ud*, meaning humid, plus *alfs*, from Alfisols).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; type of saturation; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalfs*, the suborder of the Alfisols that has a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineralogy class, cation-exchange activity class, soil temperature regime, soil depth, and reaction class. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, active, mesic Typic Hapludalfs.

SERIES. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile.

References:

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.

Soil Survey Staff. 2006. Keys to soil taxonomy. 10th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. (The soils in a given survey area may have been classified according to earlier editions of this publication.)

Report—Taxonomic Classification of the Soils

[An asterisk by the soil name indicates a taxadjunct to the series]

Taxonomic Classification of the Soils–Kings County, California	
Soil name	**Family or higher taxonomic classification**
Calflax	Fine-loamy, mixed, superactive, thermic Sodic Haplocambids
Lethent	Fine, montmorillonitic, thermic Typic Natrargids

Soil Chemical Properties

This folder contains a collection of tabular reports that present soil chemical properties. The reports (tables) include all selected map units and components for each map unit. Soil chemical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil chemical properties include pH, cation exchange capacity, calcium carbonate, gypsum, and electrical conductivity.

Chemical Soil Properties

This table shows estimates of some chemical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Cation-exchange capacity is the total amount of extractable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. The ability to retain cations reduces the hazard of ground-water pollution.

Effective cation-exchange capacity refers to the sum of extractable cations plus aluminum expressed in terms of milliequivalents per 100 grams of soil. It is determined for soils that have pH of less than 5.5.

Soil reaction is a measure of acidity or alkalinity. It is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Calcium carbonate equivalent is the percent of carbonates, by weight, in the fraction of the soil less than 2 millimeters in size. The availability of plant nutrients is influenced by the amount of carbonates in the soil.

Gypsum is expressed as a percent, by weight, of hydrated calcium sulfates in the fraction of the soil less than 20 millimeters in size. Gypsum is partially soluble in water. Soils that have a high content of gypsum may collapse if the gypsum is removed by percolating water.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Sodium adsorption ratio (SAR) is a measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration. Soils that have SAR values of 13 or more may be characterized by an increased dispersion of organic matter and clay particles, reduced saturated hydraulic conductivity and aeration, and a general degradation of soil structure.

Chemical Soil Properties–Kings County, California								
Map symbol and soil name	**Depth**	**Cation-exchange capacity**	**Effective cation-exchange capacity**	**Soil reaction**	**Calcium carbonate**	**Gypsum**	**Salinity**	**Sodium adsorption ratio**
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
139—Lethent clay loam								
Lethent	0-6	20-30	—	7.8-9.6	1-3	0	4.0-8.0	0
	6-24	25-40	—	7.9-9.0	1-5	1-3	4.0-16.0	15-70
	24-31	20-30	—	7.9-9.0	0-3	1-3	8.0-16.0	15-70
	31-60	10-20	—	7.9-9.0	0-3	0-3	8.0-16.0	5-13
151—Calflax clay loam, saline-sodic, 0 to 2 percent slopes, MLRA 17								
Calflax, clay loam, saline-sodic	0-8	21-32	—	7.4-8.4	1-2	0-3	2.0-8.0	2-12
	8-26	21-31	—	7.4-8.4	1-3	0-3	2.0-8.0	2-20
	26-33	14-27	—	7.4-8.4	1-3	2-5	2.0-8.0	3-20
	33-47	14-27	—	7.4-9.0	1-3	2-5	2.0-16.0	13-30
	47-65	14-26	—	7.4-9.0	1-3	2-5	2.0-16.0	13-30

Soil Physical Properties

This folder contains a collection of tabular reports that present soil physical properties. The reports (tables) include all selected map units and components for each map unit. Soil physical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Engineering Properties

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Hydrologic soil group is a group of soils having similar runoff potential under similar storm and cover conditions. The criteria for determining Hydrologic soil group is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Listing HSGs by soil map unit component and not by soil series is a new concept for the engineers. Past engineering references contained lists of HSGs by soil series. Soil series are continually being defined and redefined, and the list of soil series names changes so frequently as to make the task of maintaining a single national list virtually impossible. Therefore, the criteria is now used to calculate the HSG using the component soil properties and no such national series lists will be maintained. All such references are obsolete and their use should be discontinued. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups, A, B, C, and D, and three dual groups, A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.

The four hydrologic soil groups are described in the following paragraphs:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Percentage of rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

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.

Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Engineering Properties–Kings County, California

Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
139—Lethent clay loam														
Lethent	85	D	0-6	Clay loam	CL	A-6, A-7	0- 0- 0	0- 0- 0	100-100-100	100-100-100	90-95-100	70-78-85	30-38-45	10-15-20
			6-24	Clay loam, clay, silty clay	CH, CL	A-7	0- 0- 0	0- 0- 0	100-100-100	100-100-100	90-95-100	70-83-95	40-50-60	15-23-30
			24-31	Clay loam	CL	A-6, A-7	0- 0- 0	0- 0- 0	100-100-100	100-100-100	90-95-100	70-75-80	30-38-45	10-15-20
			31-60	Sandy loam, loam, clay loam	CL, CL-ML, SC, SC-SM	A-4, A-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	60-78-95	35-55-75	25-33-40	5-10-15
151—Calflax clay loam, saline-sodic, 0 to 2 percent slopes, MLRA 17														
Calflax, clay loam, saline-sodic	85	C	0-8	Clay loam	CL	A-7-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	94-99-100	76-81-89	38-43-54	19-23-29
			8-26	Clay loam	CL	A-7-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	88-99-100	70-81-83	37-49-52	19-27-29
			26-33	Clay loam, loam	CL	A-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	91-99-100	67-75-84	28-36-45	12-18-25
			33-47	Clay loam, loam, silt loam	CL	A-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	93-100-100	80-87-97	28-36-45	12-17-25
			47-65	Clay loam, loam	CL	A-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	95-99-100	72-76-89	28-32-45	12-15-25

Physical Soil Properties

This table shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In this table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In this table, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (Ksat), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3- or 1/10-bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute linear extensibility, shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates in the table are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity (Ksat) is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at 1/3- or 1/10-bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. The amount and type of clay minerals in the soil influence volume change.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In this table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The content of organic matter in a soil can be maintained by returning crop residue to the soil.

Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion factors are shown in the table as the K factor (Kw and Kf) and the T factor. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and Ksat. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor Kw indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind and/or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are described in the "National Soil Survey Handbook."

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Reference:
United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. (http://soils.usda.gov)

Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Physical Soil Properties–Kings County, California														
Map symbol and soil name	**Depth**	**Sand**	**Silt**	**Clay**	**Moist bulk density**	**Saturated hydraulic conductivity**	**Available water capacity**	**Linear extensibility**	**Organic matter**	**Erosion factors**			**Wind erodibility group**	**Wind erodibility index**
										Kw	**Kf**	**T**		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
139—Lethent clay loam														
Lethent	0-6	-35-	-34-	27-31- 35	1.40-1.45-1.50	0.42-0.91-1.40	0.13-0.14-0.15	3.0- 4.5- 5.9	0.5- 0.8-1.0	.37	.37	2	6	48
	6-24	-26-	-29-	35-45- 55	1.35-1.43-1.50	0.01-0.22-0.42	0.06-0.08-0.10	6.0- 7.5- 8.9	0.5- 0.8-1.0	.28	.28			
	24-31	-33-	-32-	30-35- 40	1.40-1.45-1.50	0.01-0.22-0.42	0.06-0.09-0.12	3.0- 4.5- 5.9	0.5- 0.5-0.5	.32	.32			
	31-60	-65-	-15-	10-20- 30	1.40-1.50-1.60	0.42-0.91-1.40	0.02-0.06-0.10	0.0- 1.5- 2.9	0.5- 0.5-0.5	.24	.24			
151—Calflax clay loam, saline-sodic, 0 to 2 percent slopes, MLRA 17														
Calflax, clay loam, saline-sodic	0-8	20-28- 40	20-40- 52	27-32- 40	1.30-1.35-1.45	1.40-3.00-4.00	0.14-0.16-0.19	3.6- 4.6- 6.4	0.5- 0.8-2.0	.37	.37	5	6	48
	8-26	20-27- 40	20-35- 52	27-38- 40	1.30-1.40-1.45	1.40-3.00-4.00	0.14-0.16-0.19	3.5- 5.7- 6.3	0.3- 0.5-1.0	.32	.32			
	26-33	20-34- 40	25-40- 50	18-26- 35	1.35-1.45-1.50	1.40-2.00-4.00	0.11-0.14-0.19	1.8- 3.3- 5.1	0.1- 0.3-0.4	.43	.43			
	33-47	20-23- 40	25-52- 60	18-25- 35	1.30-1.45-1.50	1.40-2.00-4.00	0.08-0.10-0.18	1.8- 3.2- 5.1	0.1- 0.3-0.4	.49	.49			
	47-65	20-33- 40	25-45- 50	18-22- 35	1.30-1.40-1.50	1.40-2.00-4.00	0.08-0.10-0.18	1.8- 2.6- 5.0	0.1- 0.2-0.3	.49	.49			

Water Features

This folder contains tabular reports that present soil hydrology information. The reports (tables) include all selected map units and components for each map unit. Water Features include ponding frequency, flooding frequency, and depth to water table.

Hydrologic Soil Group and Surface Runoff

This table gives estimates of various soil water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas.

Surface runoff refers to the loss of water from an area by flow over the land surface. Surface runoff classes are based on slope, climate, and vegetative cover. The concept indicates relative runoff for very specific conditions. It is assumed that the surface of the soil is bare and that the retention of surface water resulting from irregularities in the ground surface is minimal. The classes are negligible, very low, low, medium, high, and very high.

Report—Hydrologic Soil Group and Surface Runoff

Absence of an entry indicates that the data were not estimated. The dash indicates no documented presence.

Hydrologic Soil Group and Surface Runoff–Kings County, California			
Map symbol and soil name	**Pct. of map unit**	**Surface Runoff**	**Hydrologic Soil Group**
139—Lethent clay loam			
Lethent	85	Very high	D
151—Calflax clay loam, saline-sodic, 0 to 2 percent slopes, MLRA 17			
Calflax, clay loam, saline-sodic	85	Low	C

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