

## **Appendix G**

# **Geology and Soils Impacts Analysis**



# GEOLOGY AND SOILS IMPACTS ANALYSIS

Pixley Groundwater Banking Project  
Tulare County, California

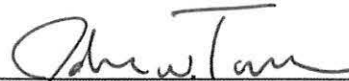
---

Soils and Geology

February 1, 2017  
Project FR1416066A

This report was prepared by the staff of Amec Foster Wheeler Environment & Infrastructure, Inc., under the supervision of the Hydrogeologist and Geologist whose seal and signatures appear hereon.

The findings, recommendations, specifications, or professional opinions presented in this report were prepared in accordance with generally accepted professional engineering and/or geologic practice and within the scope of the project. No other warranty, express or implied, is provided.



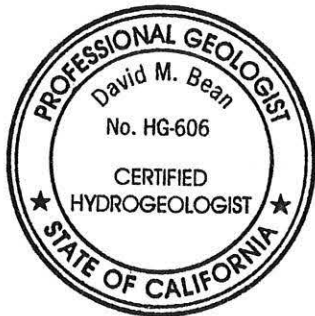
---

John W. Tanner  
Staff Geologist



---

David M. Bean, PG, CHG  
Principal Hydrogeologist



## TABLE OF CONTENTS

	<b>Page</b>
ABBREVIATIONS.....	1
1.0 INTRODUCTION AND OBJECTIVES .....	2
2.0 REGIONAL SETTING .....	3
3.0 LOCAL SETTING .....	3
4.0 EXISTING CONDITIONS .....	4
4.1 SEISMICITY .....	4
4.2 SOILS .....	5
5.0 PROPOSED PROJECT IMPACT ANALYSIS.....	7
I. RUPTURE OF A KNOWN EARTHQUAKE FAULT .....	7
II. STRONG SEISMIC GROUND SHAKING .....	7
III. SEISMIC-RELATED GROUND FAILURE .....	8
IV. LANDSLIDES.....	8
6.0 REFERENCES .....	10

### TABLES

Table 1 Proposed Project Area Soil Types

### FIGURES

Figure 1 Location Map  
Figure 2 Soils Map

**GEOLOGY AND SOILS IMPACTS ANALYSIS**  
Pixley Groundwater Banking Project  
Tulare County, California

**ABBREVIATIONS**

CEQA	California Environmental Quality Act
CISN	California Integrated Seismic Network
CVP	Central Valley Project
FKC	Friant-Kern Canal
Project	Pixley Groundwater Banking Project
SVWBA	South Valley Water Banking Authority
SWPPP	Stormwater Pollution Prevention Plan
um/s	Micro-meters per second

## 1.0 INTRODUCTION AND OBJECTIVES

Amec Foster Wheeler Environment & Infrastructure, Inc., has prepared this report on behalf of the project proponent South Valley Water Banking Authority (SVWBA), to assess the impacts to geology and soils, for the proposed Pixley Groundwater Banking Project (Project) in southern Tulare County, California (Figure 1).

The SVWBA, as the lead agency at the local level, is preparing a document pursuant to California Environmental Quality Act (CEQA) to examine the environmental impacts of the construction and operation/maintenance of the Project, which would include the following primary structures/features:

1. A Recharge Basins facility of 500 to 800 acres;
2. A wellfield of 16 recovery wells within the Recharge Basins facility's boundary;
3. A new 48-inch turnout from the west bank of the Friant-Kern Canal (FKC);
4. A 4.5-mile long, 48-inch diameter, bi-directional concrete pipeline from the new turnout to the in-lieu service area;
5. An approximately 2-acre pumping plant and regulating basin;
- 6) Approximately 14 acres of grower turnouts, related control facilities, connecting pipelines, and use of up to five recovery wells within an approximate 3,500-acre in-lieu service area;
6. A new 48-inch turnout to be built as an extension of the existing Deer Creek turnout structure;
7. Implementation of a groundwater monitoring program; and
8. The creation of a Technical Committee charged with monitoring of Project recharge and recovery operations to the SVWBA for the purposes of assessing performance and reporting results to identified stakeholders.

This environmental compliance document will also examine the environmental effects of approval of a program of groundwater banking and recovery, including necessary contracts and supporting actions to provide the ability to place into groundwater storage up to 30,000 acre-feet of water per year. Ten percent of the water placed into storage would not be returnable and left to improve groundwater conditions in the area. Up to 90,000 acre-feet of water could be stored at any one time. Up to 30,000 acre-feet of water could be returned to banking partners in any one year.

Potential banking partners include Friant Division Central Valley Project (CVP) contractors, Reclamation, CVP contractors within the Cross Valley, Delta-Mendota, San Luis Unit and Exchange Contractor service areas, the Kern County Water Agency and/or its member units, the Dudley Ridge Water District, the Tulare Lake Basin Water Storage District, and other water agencies, entities, or individuals within the Friant Division of the CVP.

Pixley Irrigation District also intends to use the proposed facilities to deliver irrigation water from the FKC or from Deer Creek to the new service area (the in-lieu service area) and to direct recharge via the Recharge Basins facility at times when the proposed facilities are not obligated for use by banking partners.

## **2.0 REGIONAL SETTING**

Generally, the proposed Project area is located on the North American Plate 15 miles west of the Sierra Nevada foothills and 70 miles east of the San Andreas transform fault system along the Coast Ranges. Along the western margin of the Sierra Nevada foothills are a series of accreted arc terranes that were subsequently intruded by plutons of the Sierra Nevada batholith. Contact between the two terranes is deep beneath the Great Valley. Farther west, the coastal range is characterized by marine greywackes and mélanges overlain by the coast range thrust; the upper plate consists of ophiolite overlain by the Great Valley Mesozoic turbidite sequence (Dickinson et al., 1996). The proposed Project area is located within the Great Valley geomorphic province, which is a large, elongate, northwest-trending trough extending more than 430 miles. Sedimentation within the valley consists of several thousand feet of marine and non-marine sedimentary rock derived from Mesozoic through recent age erosion of the Coast Ranges and the Sierra Nevada Mountains (Tulare County, 2012). The proposed Project area is underlain by part of the Great Valley Sequence, primarily younger unconsolidated Quaternary age alluvial fan deposits derived from the Sierra Nevada foothills.

## **3.0 LOCAL SETTING**

Land use within the Central Valley is dominated by agricultural use. The proposed Project is located in a low-density, scattered, rural residential development area, where vineyards, pistachios, almonds, alfalfa, and cotton are grown (P&P, 2008). The alluvial fan deposits that comprise the soils of the proposed Project area create a relatively flat (about 0.3 percent slope) surface (Figure 1). This nearly flat surface extends throughout the floor of the Central Valley. The soil types within the proposed Project area share moderate to well-drained characteristics, with the exception of the Centerville Clay, which is approximately 3.8 percent of the proposed Project area (Figure 2).

## **4.0 EXISTING CONDITIONS**

### **4.1 SEISMICITY**

There are no known earthquake faults within the proposed project area. The nearest active fault identified by the Alquist-Priolo Earthquake Fault Zone map is the Pond-Poso Creek fault located 15 miles southwest of the proposed Project area.

The Pond-Poso Creek fault consists of a 2/3 mile-wide zone of northwesterly trending normal faults, downthrown to the southwest and dipping approximately 50 to 70 degrees. Visible fault scarps suggest that a 2-mile segment of the fault is active. Subsurface data indicate that repeated movement has occurred along this fault since the Eocene and possibly the Paleocene. An upper limit to historic offset (as of 1974) was established with a fault trench. At a depth of approximately 10 feet from ground surface, 9 inches of vertical offset was observed (LADWP, 1974). From borehole data, approximately 50 feet of vertical offset is interpreted at a depth of 875 feet (Holzer, 1980). The Los Angeles Department of Water and Power identified several small epicenters, none greater than 4.0 magnitude, near the Pond-Poso Creek fault. Groundwater withdrawal and subsequent ground subsidence have been proposed as the cause of historical offset (Holzer, 1980).

The Alquist-Priolo Earthquake Fault Zone map identifies three other faults, the Kern Front, New Hope, and Premier faults, within 30 miles of the proposed Project area. The Kern Front, New Hope, and Premier faults have been identified as active, northwest striking, westerly dipping, normal faults that cut Quaternary deposits. They are located between 24 and 30 miles southeast of the proposed Project area along the western flank of the Sierra Nevada foothills. None of these faults are considered major faults, and none show evidence of pre-historic Holocene displacement (Smith, 1983). It has been determined that the reactivation of these faults are a result of fluid withdrawal from the Kern Front oil field (Smith, 1983).

Additionally, the San Andreas (56 miles west from proposed Project area), Owens Valley (70 miles east from proposed Project area), White Mountains fault zone (80 miles east from proposed Project area), Ortigalita, Nunez (110 miles northeast from proposed Project area), and White Wolf (75 miles south from proposed Project area) faults are considered active. The portion of the San Andreas Fault closest to the proposed Project area was last active in 1966 and has produced magnitude earthquakes varying from 6.0 to 7.9. In 1872, the Owens Valley fault ruptured the ground surface for about 60 miles producing a magnitude 7.4 earthquake. The White Mountains fault zone was last active in 1986 and produced a magnitude 6.4 earthquake. The Nunez fault was last active in 1983 and produced a magnitude 6.4 earthquake event. The White Wolf fault produced a magnitude 7.3 earthquake



in 1952 (Jennings and Saucedo, 1999). The Ortigalita fault historically ruptures by fault creep, meaning that it migrates continually at a slower rate (USGS, 2007). There is no known damage in the Project area from these earthquakes.

Ground shaking is the primary seismic hazard in the valley portion of Tulare County, including the proposed Project area. Earthquake damage caused by ground shaking is determined by the magnitude of an earthquake, the depth of focus, the distance from the fault, the intensity and duration of shaking, the local groundwater and soil conditions, topography, and the design and quality of materials and workmanship in construction.

The California Integrated Seismic Network (CISN) is a partnership among federal, state, and university agencies involved in California earthquake monitoring. CISN publishes maps and data that track the frequency and magnitude of ground shaking events throughout California. The peak ground acceleration, which is the measure of how hard the earth shakes in a given geographic area, has been identified by the California Geological Survey for the proposed Project area to have a 10 to 20 percent probability of exceeding 6 percent of the acceleration of gravity in 50 years (USGS, 2008). Tulare County is characterized as Severity Zone “Nil” and “Low” for ground shaking events (Tulare County, 2012).

## **4.2 SOILS**

Permeable soils are essential in recharge basins to allow percolation from surface water into groundwater. Locations with a high capacity for recharge, based on the saturated hydraulic conductivity of the soils, provide suitable conditions for significant recharge. The Akers-Akers saline Sodic complex soil that comprises 65.9 percent of the proposed recharge basins possess moderately slow to rapid saturated hydraulic conductivity, while the Hanford sandy loam that is found in 31.5 percent of the proposed recharge basins possesses moderately rapid to very rapid saturated hydraulic conductivity. The soils of the in-lieu area possess saturated hydraulic conductivity values that range from very slow to very rapid, with the majority of the area (69 percent) being characterized by moderately slow to very rapid hydraulic conductivity. Saturated hydraulic conductivity values for all soils found within the proposed Project area are summarized in Table 1, and a distribution of the soil types is shown on Figure 2.

Expansive soils are characterized by the ability to significantly swell or shrink as a result of variation in soil moisture content. Soil moisture content can vary due to circumstance, including, perched water, agricultural irrigation, and rainfall. Hazards to the proposed Project associated with expansive soils include the potential for damage to levees, wells, and pipeline connections constructed on soils that can significantly expand or contract with changes in soil water content. The proposed Project area contains three soil types that are considered to have

low shrink-swell potential, five soil types considered to have moderate shrink-swell potential, one soil type considered to have high shrink-swell potential, and one soil type that is too variable to categorize. The majority of the soil types in the proposed Project area (95 percent) are considered to have moderate to low shrink-swell potential. The majority (97 percent) of recharge basins have soils types that are considered to have low shrink-swell potential. Soils and their shrink-swell potential is summarized in Table 1.

The Centerville clay, located in the northeastern portion of the in-lieu area, and on an approximate 1,750 foot section of Avenue 80 where the proposed main trunk pipeline is proposed to be constructed, is considered to have high shrink-swell potential (Figure 2). Expansion and contraction of soils with high shrink-swell characteristics, including the Centerville clay, could damage buildings, foundations, and infrastructure including pipelines due to settlement and uplift.

**Table 1: Proposed Project Area Soil Types**

**Entire Proposed Project Area**

<b>Soil Type</b>	<b>Shrink Swell Potential</b>	<b>Acres in Proposed Project Area</b>	<b>Percent of Project Area</b>	<b>Saturated Hydraulic Conductivity um/s</b>
Colpien loam	Moderate	1534.1	37.1%	1.41 – 42.34
Flamen loam	Moderate	495.1	12.0%	0.42 – 14.11
Hanford sandy loam	Low	484.6	11.7%	14.11 – 141.14
Akers-Akers, saline-Sodic complex	Low	437.6	10.6%	1.41 – 42.43
Biggriz-Biggriz, saline-Sodic complex	Moderate	387.5	9.4%	1.41 – 14.11
Crosscreek-Kai association	Moderate	369.2	8.9%	0.07 – 42.34
Centerville clay high	High	159.6	3.9%	0.42 – 4.23
Exeter loam	Moderate	106.3	2.6%	0.07 – 141.14
Calgro-Calgro, saline-Sodic complex	Low	96.8	2.3%	0.07 – 141.14
Riverwash	Variable	61.1	1.5%	
<b>Total</b>		<b>4132</b>	<b>100.0%</b>	

## **Recharge Basins**

<b>Soil Type</b>	<b>Shrink Swell Potential</b>	<b>Acres in Proposed Project Area</b>	<b>Percent of Project Area</b>	
Hanford sandy loam	Low	181.2	31.5%	14.11 – 141.14
Akers-Akers, saline-Sodic, complex	Low	379.5	65.9%	1.41 – 42.34
Riverwash	Variable	15.3	2.7%	
<b>Total</b>		<b>576.0</b>	<b>100.0%</b>	

## **5.0 PROPOSED PROJECT IMPACT ANALYSIS**

### ***a. Would the proposed project expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:***

#### **i. RUPTURE OF A KNOWN EARTHQUAKE FAULT**

Seismically induced ground failures occur when ground movements are substantial enough to result in severe distress or infrastructure failure. Ground failure includes surface rupture of faults, sediment-stability failure due to soil liquefaction, lateral spreading, seismically induced landslides, and differential settlement.

Fault rupture occurs when fault displacement extends upward to the ground surface creating a visible offset. Ruptures may occur suddenly with earthquake events, or slowly over time due to fault creep. Fault ruptures have potential to damage structures, both above and below ground surface, and pose a threat of injury that could result in the loss of life. Fault ruptures are likely to occur along known faults. Surface fault rupture within the proposed Project area is highly unlikely, as no faults have been identified (see Section 4.1). The Project would not substantially increase human or environmental exposure to risk of loss, injury, or death as a result of fault ruptures, therefore, the impact of fault ruptures is considered less than significant.

#### **ii. STRONG SEISMIC GROUND SHAKING**

The proposed Project is expected to experience minimal effects from earthquake ground shaking due to the Project's distance of greater than 50 miles from any major fault, and the lack of any known faulting in the Project area (see Section 4.1). The Project would not substantially increase human or environmental exposure to risk of loss, injury, or death as a result of ground shaking, therefore, the impact of ground shaking is considered less than significant.

### **iii. SEISMIC-RELATED GROUND FAILURE**

Liquefaction is a process by which water-saturated sediments briefly lose strength and behave as a viscous fluid rather than a solid. Soils with poor drainage characteristics and soils where groundwater levels are at or near (30 feet) ground surface are at the greatest risk of liquefaction.

Liquefaction-induced lateral spreading is a lateral movement of gradually sloping ground as a result of liquefaction in near-surface soils during an earthquake.

The application of surface water during recharge conditions will raise groundwater elevations and increase soil saturation at or near ground surface. However, as described above in Section 3.0, soils within the Project area are moderately well, to well-drained, and groundwater levels average approximately 300 feet below ground surface. The ground surface at the proposed project area is relatively flat exhibiting average slopes of less than 1 percent (see Section 3.0).

Settlement can occur in loose unsaturated sandy soils during periods of strong seismic ground shaking. Settlement of sufficient magnitude to cause significant structural damage is normally associated with rapidly deposited alluvial soils or improperly founded or poorly compacted fill. These areas are known to undergo extensive settling with the addition of irrigation water. The soils of the proposed Project area are alluvial fan deposits that have been slowly deposited over the last several 100,000 years (see Section 2.0). Therefore, the proposed Project would not expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death as a result of ground failure or liquefaction. The impact of seismic related ground failure including liquefaction at the proposed Project area is considered less than significant.

### **iv. LANDSLIDES**

Seismically induced landslides can occur in hillside areas and along creeks. The likelihood of seismically induced landslides in the proposed Project area is highly unlikely due to the relatively low chance of significant ground shaking and nearly flat ground surface. The Project would not expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death as a result of landslides, therefore, the impact of landslides is considered less than significant (see Sections 3.0 and 4.1).

**Mitigation Measure:** No Mitigation is required.

***b. Would the proposed project result in soil erosion or the loss of topsoil?***

Erosion occurs as bare soils are worn away and transported to another area when exposed to water or wind. Construction of the recharge basins would require minor grading and compaction of soils on the relatively flat ground surface. Surface erosion and loss of topsoil can follow disturbances caused by grading, which could loosen soil and activate or hasten the loss of soils. Erosion and sediment control measures, if properly prescribed, implemented, and maintained, including a Stormwater Pollution Prevention Plan (SWPPP) in accordance with the Clean Water Act are expected to reduce erosion rates during and after construction. By implementing the requirements of a SWPPP, substantial soil erosion or the loss of topsoil is considered less than significant.

**Mitigation Measure:** No Mitigation is required.

***c. Would the proposed project be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the Project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?***

Ground failures including landslide, lateral spreading, subsidence, and liquefaction occur in geologic units where strong ground shaking may occur. The relatively seismically stable setting of the proposed Project area, the depth to groundwater of approximately 300 feet, the relatively flat ground surface, and the moderately well to well-drained characteristics of the soil create an environment where ground failure is unlikely to occur (see Section 4.1). The proposed Project will not be located on a geologic unit or soil that is unstable or that would become unstable as a result of the Project and potentially result in on- or off-site landslide, lateral spreading, liquefaction, or collapse (Figure 2). Therefore, the impact is considered less than significant.

Over pumping of groundwater and chronic water level declines in the Tule Basin and in other parts of the San Joaquin Valley have induced land subsidence due to deep compaction of fine-grained lithologies. Areas most vulnerable to subsidence are where pumping occurs beneath the Corcoran Clay west of the Project area. Land subsidence beneath portions of the Tule Basin of 12 to 16 feet from 1926 to 1970 has been reported (USGS, 1984). More recently between 2007 and 2011, an additional 0.5 to 1 foot of subsidence occurred in the Project area due to regional pumping (LSCE, 2014). Because the proposed project is located outside of the Corcoran Clay area, it is unlikely that it will significantly increase the rate of subsidence. Therefore, the impact is considered less than significant.

**Mitigation Measure:** No Mitigation is required.

***d. Would the proposed project be located on expansive soil defined in Table 18-1-B of the Uniform Building Code, creating substantial risks to life or property?***

The Centerville clay, a soil type with high shrink-swell potential, is present in a small portion (3.8 percent of the proposed Project area) of the in-lieu service area (Figure 2). Special engineering considerations should be taken in the construction of any structure or pipeline in the northeastern portion of the proposed in-lieu area as shown in Figure 2. A small portion of the in-lieu service area will be located on an expansive soil. However, because expansive soils at the proposed Project would not create a substantial risk to humans and the use of proper construction and engineering techniques will eliminate the possibility of damage to structures, the impact of expansive soils is considered less than significant.

**MITIGATION MEASURE:** No Mitigation is required.

***e. Would the proposed project leave soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems in areas where sewers are not available for the disposal of waste water?***

The construction and operation of the 576-acres of recharge basins would leave that area incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems. High permeability soils, located a distance of 50 feet or greater from the recharge basins, would not be adversely affected and would remain capable of adequately supporting the use of septic tanks or alternative waste water disposal systems.

**MITIGATION MEASURE:** No Mitigation is required

## **6.0 REFERENCES**

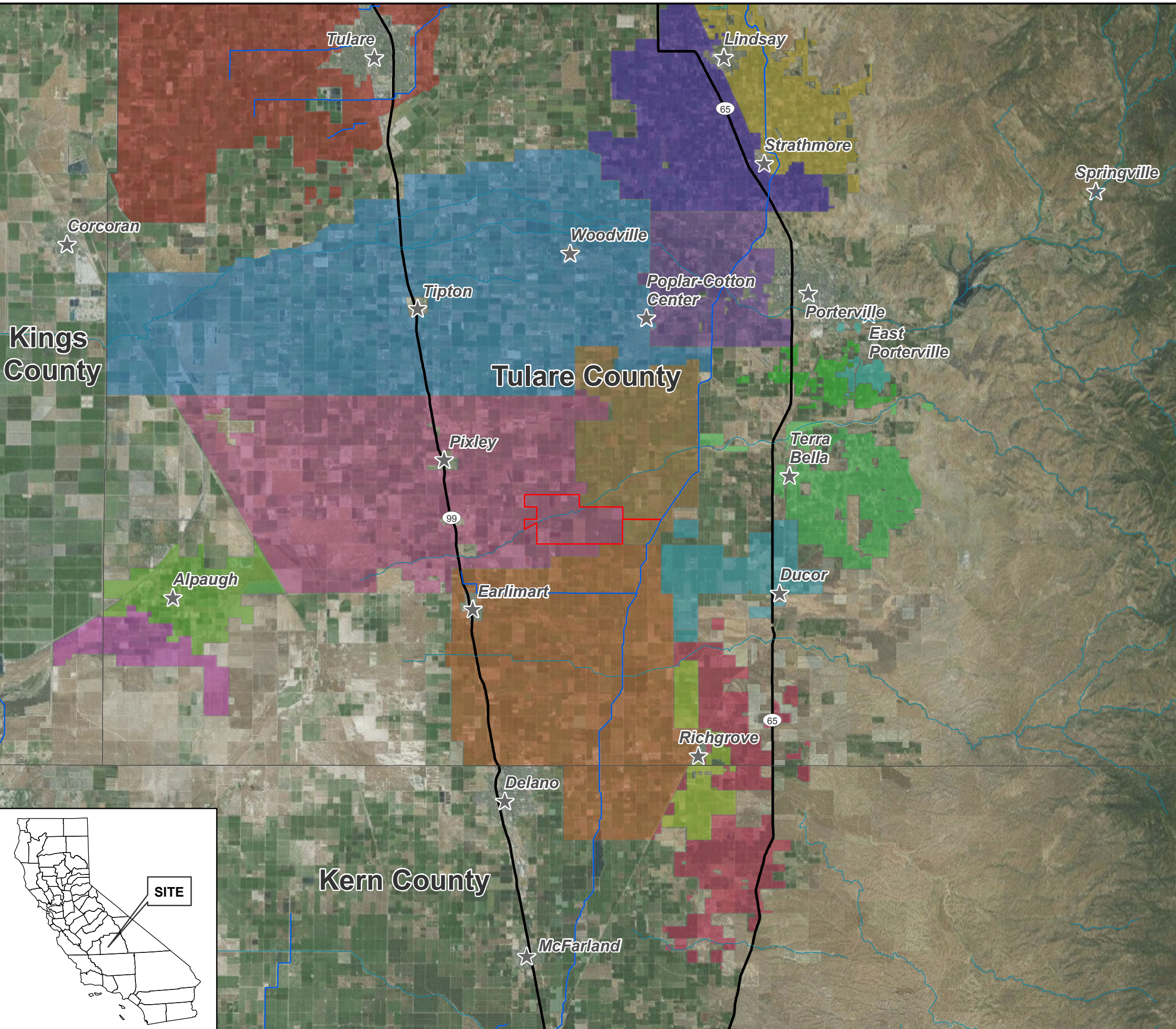
- Dickinson, W.R., Hopson, C.A. and Saleeby, J.B., 1996, Alternate Origins of the Coast Range Ophiolite (California): Introduction and Implications, GSA Today, Vol. 6, No. 2, February (Dickinson et al., 1996).
- Smith, Theodore, 1983, California Division of Mines and Geology, Fault Evaluation Report FER-143, Kern Front, New Hope, and Premier Faults, Kern County, December (Smith, 1983)
- Holzer, Thomas, 1980, Faulting Cause by Groundwater Level Declines, San Joaquin Valley, California, Water Resources Research, Volume 16, Issue 6, pages 1065-1070, December (Holzer, 1980)
- Los Angeles Department of Water and Power, 1974, San Joaquin Nuclear Project, Early Site Review Report, Vol. 1, (LADWP, 1974)

- Jennings, C.W. and Saucedo, G.J., 1999, Simplified Fault Activity Map of California, Revised 2002, Tousson Topozado and David Branum, (Jennings and Saucedo, 1999).
- Provost & Pritchard Engineering Group, Inc. 2008, Pixley I.D. and Delano-Earlimart I.D. Reconnaissance Study on a Joint Groundwater Bank within Pixley I.D., March (P&P, 2008).
- Williamson, A.K., Prudic, D.E., and Swain, L.A., 1989, Ground-water Flow in the Central Valley, California: United States Geological Survey, Professional Paper 1401–D, Page 127 (Williamson et al., 1989).
- Tulare County, 2012, Revised Draft General Plan 2030 Update, Tulare County, Resource Management Agency, <http://generalplan.co.tulare.ca.us/> (Tulare County, 2012).
- United States Geological Survey, 1984, Ireland R.L., Poland, J.F., and Riley, F.S., 1984, Land subsidence in the San Joaquin Valley, California, as of 1980: U.S. Geological Survey Professional Paper 437-I, 93 p., accessed August 18, 2008, at <http://pubs.er.usgs.gov/usgspubs/pp/pp437/> (USGS, 1984).
- United States Geological Survey, 2007, Assessment and Documentation of Transpressional Structures, Northeastern Diablo Range, for the Quaternary Fault Map Database: Collaborative Research with William Lettis & Associates, Inc., and the U.S. Geological Survey, (USGS, 2007)
- United States Geological Survey, 2008, Seismic Hazard Maps and Site-Specific Data. <https://earthquake.usgs.gov/hazards/hazmaps/> (USGS, 2008).
- United States Geological Survey, 2014, Seismic Hazard Maps and Site-Specific Data. <https://earthquake.usgs.gov/hazards/hazmaps/> (USGS, 2014).





Path: I:\FR14s\FR1416066A\SVWB\AIDraft\2015\_Impact\Revised\_Figure\_9-29-15\01\_FIG\_LOC\_MAP.mxd



**Explanation**

- Proposed ground water banking project
  - County boundary
  - Canal
  - Rivers and streams
  - Major roads
- Water Districts
- Alpaugh I.D.
  - Alta I.D.
  - Atwell Island W.D.
  - Delano-Earlimart I.D.
  - Ducor I.D.
  - Exeter I.D.
  - Ivanhoe I.D.
  - Kern-Tulare W.D.
  - Lewis Creek W.D.
  - Lindmore I.D.
  - Lindsay-Strathmore I.D.
  - Lower Tule River I.D.
  - Pixley I.D.
  - Porterville I.D.
  - Rag Gulch W.D.
  - Saucelito I.D.
  - St. Johns W.D.
  - Tea Pot Dome W.D.
  - Terra Bella I.D.
  - Tulare I.D.
  - Vandalia I.D.



Basemap modified from ESRI online shared content, aerial imagery web mapping services.

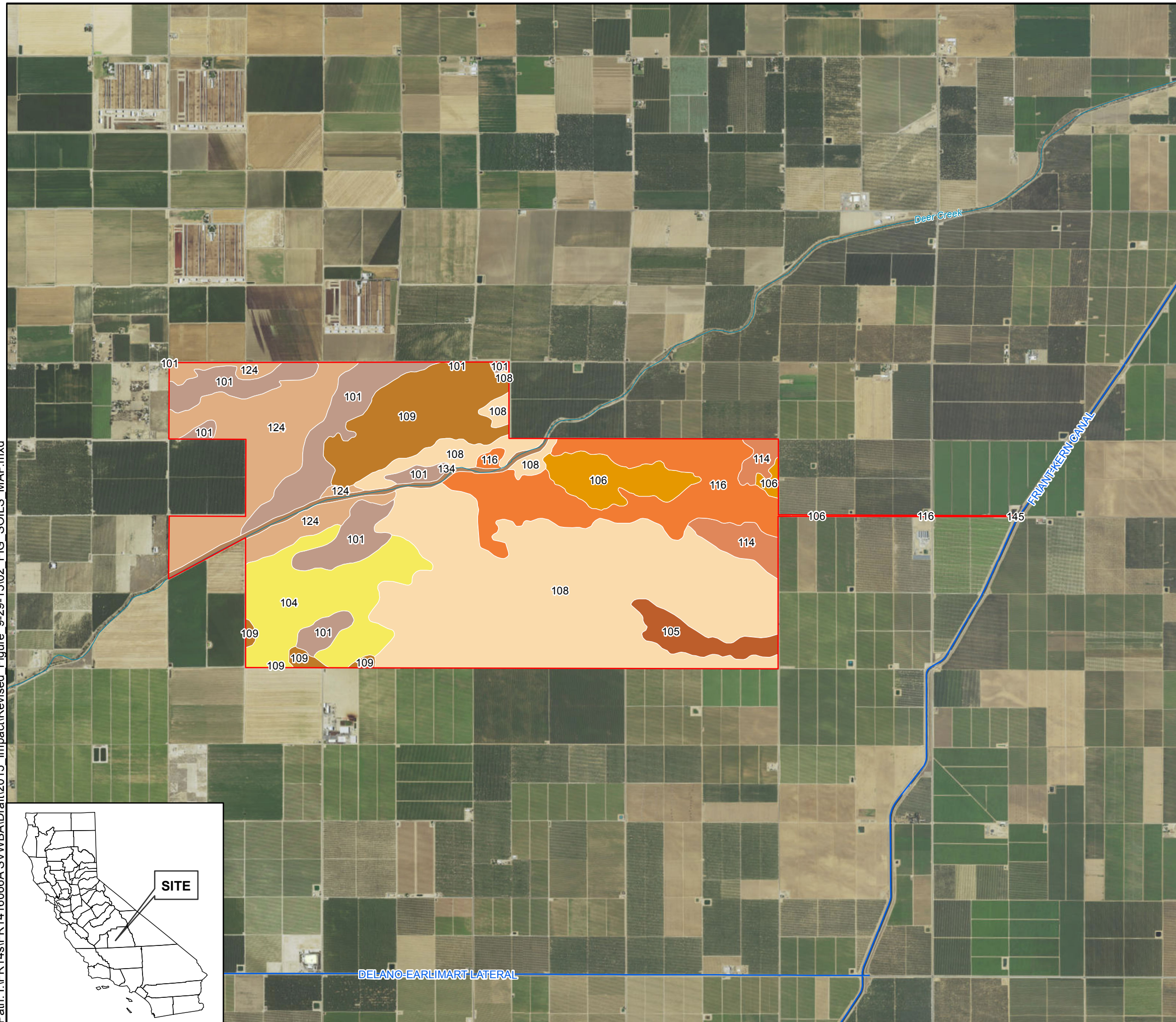
**LOCATION MAP**  
**PIXLEY GROUNDWATER BANKING**  
**PROJECT**  
 Geologic and Hydrologic Impacts Analysis  
 Tulare County, California






Date: 12/17/2015	Project No. FR141606A	Figure <b>1</b>
Submitted By: DMB	Drawn By: JWT	














Path: I:\FR14s\FR141606A\SVWBA\Draft\2015\_Impact\Revised\_Figure\_9-29-15\02\_FIG\_SOILS\_MAP.mxd



**Explanation**

-  Proposed ground water banking project
-  Canal
-  Rivers and streams

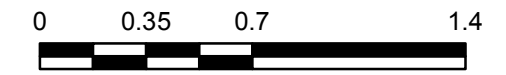
**Soil Type**

-  101 - Akers-Akers, saline-Sodic, complex
-  104 - Biggriz-Biggriz, saline-Sodic, complex
-  105 - Calgro-Calgro, saline-Sodic, complex
-  106 - Centerville clay
-  108 - Colpien loam
-  109 - Crosscreek-Kai association
-  114 - Exeter loam
-  116 - Flamen loam
-  124 - Hanford sandy loam
-  134 - Riverwash
-  145 - Water-perennial

N



Miles



Basemap modified from ESRI online shared content, aerial imagery web mapping services.



**SOIL MAP**  
**PIXLEY GROUNDWATER BANKING PROJECT**  
 Geologic and Hydrologic Impacts Analysis  
 Tulare County, California



Date: 12/16/2015	Project No. FR141606A
Submitted By: DMB	Drawn By: JWT

Figure  
**2**