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May 3, 2022

Mr. Brent Grizzle
Materra Farming Company LLC
PO Box 9308
Bakersfield, CA 93389

Pavement Structural Section and Infrastructure Development
Tract 941 Unit 5 Gateway - Infrastructure Development
NEC Rood Road and Carr Road
Calexico (East), California
LCI Project No. LE22078

Dear Mr. Grizzle:

Landmark Consultants, Inc. is pleased to present this report of our geotechnical investigation for the proposed development of infrastructure within Tract 941-Unit 5 development located at Lots 27, 29, 30 and SE ¼ of the SW ¼ of Section 7 Tract 17S range 16E of the Gateway of the Americas CSA surrounding the Calexico East POE.

This report provides pavement structural sections, groundwater conditions and utility backfill requirements based on the existing site soil conditions. It is our understanding that Carr, Stergios, Zinetta and Maggio Roads will be extended eastward from Rood Road to Los Alamo Road and Los Alamo Road will be extended northward from Carr Road to approximately 185 feet north of Maggio Road. Sewer and storm drain pipeline depth is anticipated to be approximately 8 to 12 feet below ground surface.

Field Investigation

Subsurface exploration was performed on April 14, 2022 using CalPac Drilling of Yucaipa, California to advance six (6) borings to a depth of 21.5 feet below existing ground surface. The borings were advanced with a truck-mounted, CME 75 drill rig using 6-inch diameter, hollow-stem, continuous-flight augers. The approximate boring locations were established in the field and plotted on the site map by sighting to discernable site features. The boring locations are shown on the Site and Exploration Plan (Plate A-2).

A professional engineer observed the drilling operations and maintained a log of the soil encountered and sampling depths, visually classified the soil encountered during drilling in accordance with the Unified Soil Classification System, and obtained bulk samples of the subsurface materials at selected intervals. After logging and sampling the soil, the borings were backfilled with auger cuttings.

Laboratory Testing

Laboratory tests were conducted on selected bulk (auger cuttings) soil samples obtained from the soil borings to aid in classification and evaluation of selected engineering properties of the site soils. The tests were conducted in general conformance to the procedures of the ASTM and Caltrans Testing Manual (CAL) referenced below. The laboratory testing program consisted of the following tests:

- Plasticity Index (ASTM D4318)
- Particle Size Analyses (ASTM D422)
- Unit Dry Densities (ASTM D2937)
- Moisture Contents (ASTM D2216)
- Moisture-Density Relationship (ASTM D1557)
- R Value (CAL 301)
- Chemical Analysis (Caltrans Methods)

The laboratory test results are presented on the subsurface logs (Appendix B) and on Plates C-1 through C-7 in Appendix C

Site Conditions

The project site is located at the northeast corner of Rood Road and Carr Road at the Gateway of the Americas CSA east of Calexico, California. The site consists of fallow agricultural land with brush and weeds covering the site. Adjacent properties are flat-lying and are approximately at the same elevation with this site. The Gateway of the Americas Wastewater Treatment Plant is located at the east-south end of Zinetta Road. The Alamo River forms the eastern side of the site followed by active agricultural fields. Existing warehouse/office buildings are located to the west side of the project site across Rood Road.

Geologic Setting

The project site is located in the Salton Trough region of the Colorado Desert physiographic province of southeastern California. The Salton Trough is a topographic and geologic structural depression resulting extending from the San Gorgonio Pass to the Gulf of California (Norris & Webb, 1990). The Salton Trough is bounded on the northeast by the San Andreas fault and Chocolate Mountains and the southwest by the Peninsular Range and faults of the San Jacinto Fault Zone. The Salton Trough represents the northward extension of the Gulf of California, containing both marine and non-marine sediments deposited since the Miocene Epoch (Morton, 1977). Tectonic activity that formed the trough continues at a high rate as evidenced by deformed young sedimentary deposits and high levels of seismicity. Figure 1 shows the location of the site in relation to regional faults and physiographic features.

The Imperial Valley is directly underlain by lacustrine deposits, which consist of interbedded lenticular and tabular silt, sand, and clay. The Late Pleistocene to Holocene (present) lake deposits are probably less than 100 feet thick and derived from periodic flooding of the Colorado River which intermittently formed a fresh water lake (Lake Cahuilla). Older deposits consist of Miocene to Pleistocene non-marine and marine sediments deposited during intrusions of the Gulf of California. Basement rock consisting of Mesozoic granite and Paleozoic metamorphic rocks are estimated to exist at depths between 15,000 - 20,000 feet.

Subsurface Soil and Groundwater

The UC Davis California Soil Resource Lab “SoilWeb Earth” computer application (UC Davis, 2021) for Google Earth indicates that surficial deposits at the project site consist predominantly of silty clay loams overlying fine sands of the Vint-Indio and Meloland-Holtville soil groups (see Plate A-3). These loams are formed in sediment and alluvium of mixed origin (Colorado River overflows and fresh-water lake-bed sediments).

Subsurface soils encountered during the field exploration conducted on April 14, 2022 consist of stiff silty clays and clays with interbedded silty sands (SM) and clayey silt/sandy clayey silts (ML) to a depth of 21.5 feet, the maximum depth of exploration. The subsurface logs (Plates B-1 through B-6) depict the stratigraphic relationships of the various soil types.

Groundwater was encountered in the borings at a depth of 13 to 18.5 feet below ground surface at the time of drilling, but may rise with time to approximately 8 to 10 feet below ground surface at this site. There is uncertainty in the accuracy of short-term water level measurements, particularly in fine-grained soil. Groundwater levels may fluctuate with precipitation, irrigation of adjacent properties, site landscape watering, drainage, and site grading. The referenced groundwater level should not be interpreted to represent an accurate or permanent condition.

Excavations for Utilities

Shallow, temporary excavations, less than four feet deep, in native clayey soils should stand nearly vertical for short duration. All temporary excavations over four feet in depth will require shoring or slope inclinations in conformance to Cal OSHA standards for Type C soils. These temporary deep excavations will require slope inclinations no steeper than 1½(H):1(V) unless trench shoring is used.

An adequately designed, braced excavation such as sheetpile retention system may be used for temporary shoring of the sewerline excavation. The strut loads may be designed by apparent earth pressure. The apparent earth pressure may be taken as a trapezoidal distribution that is maximum from 0.2 to 0.8H and has the value of 35H psf where H is the height of the excavation in feet.

All discussions in this section regarding stable excavation slopes assumes minimal equipment vibration and adequate setback of excavated material and construction equipment from the top of the excavation. We recommended that the minimum setback distance be equal to the depth of excavation and at least 5 feet from the crown of the slope. If excavated materials are stockpiled adjacent to the excavation, the weight of the material should be considered as a surcharge load for slope stability.

The project specifications should clearly state that all excavations be constructed in conformance to the Cal OSHA requirements. The project documents should state that the contractor has sole responsibility for the safety of his personnel.

The excavations for the sewer pipeline deeper than 8 feet will probably encounter the groundwater table. Therefore, seepage and pumping subgrade conditions may be anticipated. An adequately designed dewatering system, such as well points or sumps, may be required to control groundwater seepage and prevent running groundwater conditions. The bottoms of manholes with bottom located below groundwater should be underlain by a minimum of 12 inches of 1-inch crushed rock (ASTM C33, size 57).

There are multiple approaches to dewatering the pipeline route. Dewatering and selection of an appropriate dewatering system is the Contractor's responsibility. Specifications can be written as a performance requirement with a specified drawdown. This report may be made available to the dewatering contractors for their initial assessment of the site conditions; however, it is the Contractor's responsibility to evaluate the soil and groundwater conditions to determine the appropriate dewatering methods.

Bedding and Backfill of Utilities

Prior to placement of utility bedding, the exposed subgrade at the bottom of trench excavations should be examined for soft, loose, or unstable soil. Loose materials at trench bottoms resulting from excavation disturbance should be removed to firm material. If extensive soft or unstable areas are encountered, these areas should be over-excavated to a depth of at least 2 feet or to a firm base and be replaced with additional bedding material.

Backfill Materials: Pipe zone backfill (i.e., material beneath and in the immediate vicinity of the pipe) should consist of a 4 to 8 inch bed of ⅜-inch crushed rock, sand/cement slurry (3 sack cement factor), and/or crusher fines (sand) extending to a minimum of 12 inches above the top of pipe. If crushed rock is used for pipe zone backfill for utilities, the crushed rock material should be completed surrounded by a non-woven filter fabric such as Mirafi 140N or equivalent. The filter fabric shall cover the trench bottom, sidewalls and over the top of the crushed rock. The filter fabric is recommended to inhibit the migration of fine material into void spaces in the crushed rock which may create the potential for sinkholes or depressions to develop at the ground surface.

Pipe bedding should be in accordance with pipe manufacturer's recommendations. Recommendations provided above for pipe zone backfill are minimum requirements only. More stringent material specifications may be required to fulfill local codes and/or bedding requirements for specific types of pipes. On-site soil free of debris, vegetation, and other deleterious matter may be suitable for use as utility trench backfill above pipezone, but may be difficult to uniformly maintain at specified moistures and compact to the specified densities. Native backfill should only be placed and compacted after encapsulating buried pipes with suitable bedding and pipe envelope material.

Compaction Criteria: Mechanical compaction is recommended; ponding or jetting should not be allowed, especially in areas supporting structural loads or beneath concrete slabs supported-on-grade, pavements, or other improvements. All trench backfill should be placed and compacted in accordance with recommendations provided above for engineered fill.

The pipe zone material (crusher fines, sand) shall be compacted to a minimum of 95% of ASTM D1557 maximum density. Pipe deflection should be checked to not exceed 2% of pipe diameter. Native sandy/clay/silt soils may be used to backfill the remainder of the trench. Soils used for trench backfill shall be placed in maximum 6 inch lifts (loose), compacted to a minimum of 90% of ASTM D1557 maximum density at a minimum of 2% above optimum (sandy silts) and 4% above optimum (clays) moisture. Imported granular material is acceptable for backfill of utility trenches.

Backfill soil of utility trenches within paved areas should be uniformly moisture conditioned to a minimum of 4% above optimum moisture, placed in layers not more than 6 inches in thickness and mechanically compacted to a minimum of 90% of the ASTM D1557 maximum dry density, except that the top 12 inches shall be compacted to 95% (if granular trench backfill).

Soil Parameters for Pipeline Design

Structural design of pipes requires proper evaluation of all possible loads acting on the pipeline, including dead and live or transient loads. The stresses induced in a buried pipe by the imposed load depend on the type of pipe (i.e., rigid or flexible). The maximum dead load imposed on the pipeline by the backfilled soil is a function of the depth and width of the trench, soil unit weight, angle of internal friction, coefficient of active earth pressure, and coefficient of friction at the interface between the backfill and native soils.

The values of the various soils parameters that the engineer may use for the design of the pipelines are as follows:

- **Soil bulk unit weight γ = 125 pcf**
- Angle of internal friction of soils φ = 25 degrees
- Soil Cohesion c = 200 psf
- Coefficient of friction between backfill and native soils f = 0.4
- Coefficient of active earth pressure = 0.4
- Coefficient of friction at cement-mortar coated steel pipe – soil interface and concrete pipe – soil interface= 0.35
- Coefficient of friction at tape-wrapped steel pipe – soil interface = 0.20 to 0.25

The modulus of soil reaction, E' for insitu soils at pipe invert may be assumed to be in the range of 200 ksf for initial flexible pipe deflection calculation.

Vertical Loads on Underground Pipelines

Vertical loads to the pipelines are dependent upon the geometry of the trench. In general, the narrower the trench is at the top of the conduit with respect to the diameter of the conduit, the less vertical load is applied to the conduit. As the trench backfill and bedding compress or consolidate over time in a narrow trench, the weight of the soil mass is partially offset by the frictional resistance along the trench sidewalls.

In addition, the type of bedding supporting the pipeline affects the bearing strength of the conduit. This is accounted by a load factor that is multiplied to the design strength of the conduit.

For rigid conduits, the design strength requirement is expressed as the three-edge bearing strength or $D_{0.01}$ load (load at which a 0.01 inch crack develops) and can be estimated by the following general equation:

$$P_{design} = D_{0.01} = \frac{Pdl + Pll}{Lf} N$$

where:

P_{design} = Design three edge load value ($D_{0.01}$)
P_{dl} = Load per unit length from soil overburden (W)
P_{ll} = Load per unit length from applied live loads at top of the trench
N = Safety factor, usually 1.25 to 1.50
L_f = Load factor depending on the class of bedding used

For vertical or near vertical trenches or under ditches that have a trench width, B, at the top of the conduit of less than 3 conduit diameters, the load from the soil overburden, P_{dl}, can be estimated from Marston's equation:

$$P_{dl} = W = C_w \gamma B^2$$

where:

C_w = Coefficient depending on friction angle of soil and height/width ratio, H/B
γ = Wet unit weight of backfill (approximately 125 pcf)
B = Width of trench at top of conduit

However, for sloped trenches or conduits under embankments, the soil load can be estimated as:

$$P_{dl} = C_p \gamma H B_c$$

where:
C_p = Pressure transfer coefficient that is dependent on the H/B_c ratio, and shear strength and relative compressibility of the soil with respect to the conduit.
H = Height of soil overburden above conduit
B_c = Outside diameter of the conduit
γ = Wet unit weight (approximately 125 pcf for native soils)

The load from applied live loads such as traffic or heavy construction equipment is usually estimated from elastic Boussineq’s stress distributions. Such distribution charts and equations are readily available in civil engineering references and are not included within this report.

In summary, the vertical load to the pipelines can be reduced by maintaining vertical or near vertical trench walls by means of shoring or trench boxes. Alternatively, a vertical underditch just large enough to accommodate the sewer pipe and bedding may be excavated to the middle of the sloped ditch. The effect is on the sewer is about the same as if the vertical trench was extended to the surface.

Dewatering

Based upon the groundwater measurements in the borings, dewatering may be required for deeper utility installation. A silty sand layer was encountered at depth of 2 to 18 feet below ground surface at the time of drilling. Groundwater may rise to 8 feet below ground surface when excavations are left open. If pipe subgrade extends into sandy silts or silty sands (or within 2 feet of groundwater), running groundwater is probable and is better controlled by well point dewatering systems to minimum 2 feet below pipe flowline.

The responsibility of dewatering and selection of an appropriate system should be the Contractor's responsibility. Specifications should be written as a performance requirement with a specified drawdown. Landmark Consultants was not contracted to specify dewatering systems or perform dewatering studies.

Concrete Mixes and Corrosivity

Selected chemical analyses for corrosivity were conducted on bulk samples of the near surface soil from the project site (Plate C-7). The native soils were found to have S0 to S1 (low to moderate) levels of sulfate ion concentration (504 to 1,116 ppm). Sulfate ions in high concentrations can attack the cementitious material in concrete, causing weakening of the cement matrix and eventual deterioration by raveling. The following table provides American Concrete Institute (ACI, 2019) recommended cement types, water-cement ratio and minimum compressive strengths for concrete in contact with soils:

Concrete Mix Design Criteria due to Soluble Sulfate Exposure

Sulfate Exposure Class	Water-soluble Sulfate (SO_4) in soil, ppm	Cement Type	Maximum Water-Cement Ratio by weight	Minimum Strength f'c (psi)
S0	0-1,000	–	–	–
S1	1,000-2,000	II	0.50	4,000
S2	2,000-20,000	V	0.45	4,500
S3 – Option 1	Over 20,000	V (plus Pozzolon)	0.45	4,500
S3 – Option 2	Over 20,000	V	0.40	5,000

Note: From ACI 318-19 Table 19.3.1.1 and Table 19.3.2.1

A minimum of 6.0 sacks per cubic yard of concrete (4,000 psi) of Type II or V Portland Cement with a maximum water/cement ratio of 0.50 (by weight) should be used for concrete placed in contact with native soil on this project (sitework including streets, sidewalks, driveways, curbs, thrust blocks, etc.). Admixtures may be required to allow placement of this low water/cement ratio concrete.

The native soil has moderate levels of chloride ion concentration (220 to 280 ppm). Chloride ions can cause corrosion of reinforcing steel, anchor bolts and other buried metallic conduits. Resistivity determinations on the soil indicate very severe potential for metal loss because of electrochemical corrosion processes. Mitigation of the corrosion of steel can be achieved by using steel pipes coated with epoxy corrosion inhibitors, asphaltic and epoxy coatings, cathodic protection or by encapsulating the portion of the pipe lying above groundwater with a minimum of 3 inches of densely consolidated concrete.

Traffic Loading and Pavement Structural Sections

Pavements should be designed according to the 2020 Caltrans Highway Design Manual or other acceptable methods. Traffic indices were not provided by the project engineer or owner; therefore, we have provided structural sections for several traffic indices for comparative evaluation. The public agency or design engineer should decide the appropriate traffic index for the site. Maintenance of proper drainage is necessary to prolong the service life of the pavements

The predominant native subgrade soils are sandy silts that yield an R-Value strength of 16 to 17 when tested in accordance with test method CAL 301. We are providing pavement structural sections determined by the Caltrans gravel equivalent method (2020), an R-value of 16 for the subgrade soil and various traffic indices. The following table provides our estimates for asphaltic concrete (AC) sections.

Pavement Structural Sections

R-Value of Subgrade Soil - 16 Design Method - Caltrans 2020

Traffic Index	Flexible Pavements		Rigid (PCC) Pavements	
	Asphaltic Concrete Thickness (in.)	Aggregate Base Thickness (in.)	Concrete Thickness (in.)	Aggregate Base Thickness (in.)
4.0	3.0	5.0	5.0	5.0
5.0	3.0	8.0	5.5	6.0
6.0	3.0	11.5	6.0	7.0
6.5	4.0	12.0	7.0	8.0
8.0	5.0	14.5	8.0	10.0
9.0	5.0	18.0	8.0	11.0
10.0	5.0	21.0	9.0	13.0

Notes:

1) Asphaltic concrete shall be Caltrans, Type A HMA (Hot Mix Asphalt), ¾ inch maximum (½ inch maximum for parking areas), with PG70-10 asphalt concrete, compacted to a minimum of 95% of the Hveem density (CAL 308) or a minimum of 92% of the Maximum Theoretical Density (ASTM D2041).
2) Aggregate base shall conform to Caltrans Class 2 (¾ in. maximum), compacted to a minimum of 95% of ASTM D1557 maximum dry density.
3) Place pavements on 12 inches of moisture conditioned (minimum 4% above optimum if clays) native clay soil compacted to a minimum of 90% (95% if sand subgrade) of the maximum dry density determined by ASTM D1557. Prewetting of subgrade soils (to 3.5 feet) may be required depending on moisture of subgrade at time of aggregate base placement.
4) Portland cement concrete for pavements should have Type II or V cement, a minimum compressive strength of 4,500 psi at 28 days, and a maximum water-cement ratio of 0.50.
5) Typical Street Classifications (Imperial County).

Parking Areas:	TI = 4.0
Cul-de-Sacs:	TI = 5.0
Local Streets:	TI = 6.0
Minor Collectors:	TI = 6.5 (trash truck areas)
Major Collectors:	TI = 8.0
Minor Arterial:	TI = 10.0
Primary Arterial:	TI = 11.0

The opportunity to provide professional services for project design is appreciated. Please contact our office with any questions or comments.

Respectfully Submitted,
Landmark Consultants, Inc.

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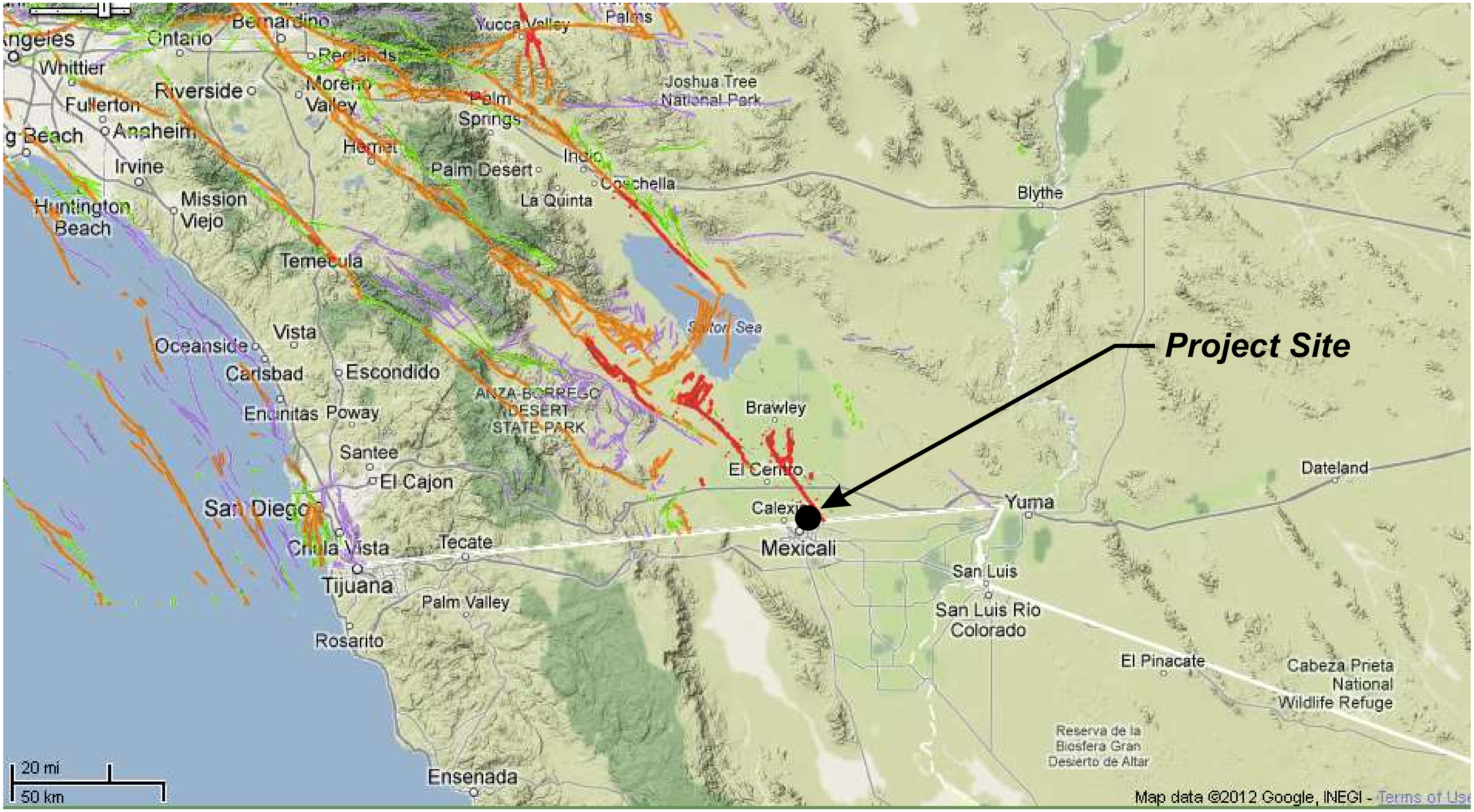
FIGURES



Source: California Geological Survey 2010 Fault Activity Map of California
http://www.quake.ca.gov/gmaps/FAM/faultactivitymap.html#

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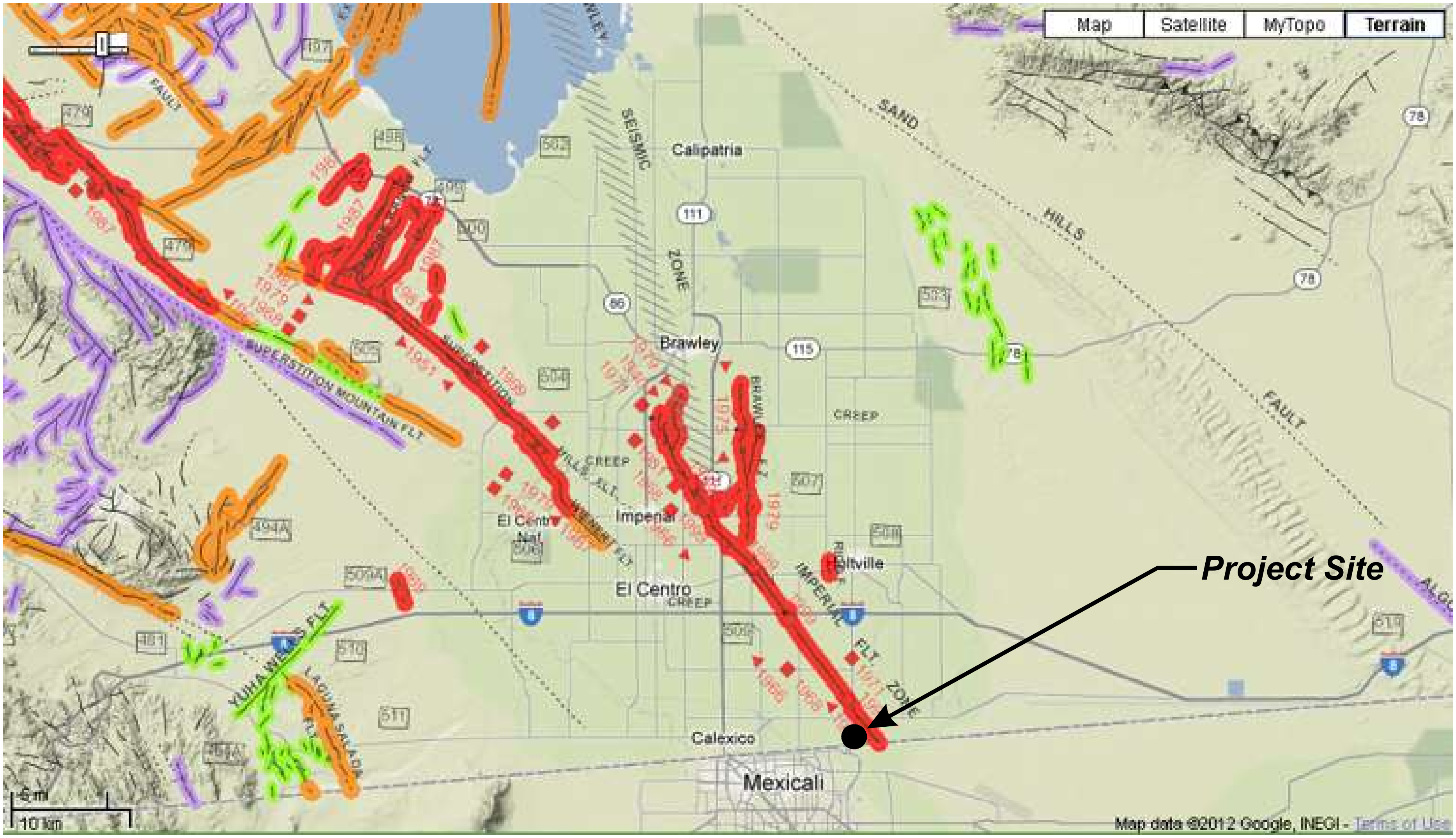
Regional Fault Map

Figure 1



Source: California Geological Survey 2010 Fault Activity Map of California
http://www.quake.ca.gov/gmaps/FAM/faultactivitymap.html#

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Map of Local Faults

Figure 2

EXPLANATION

Fault traces on land are indicated by solid lines where well located, by dashed lines where approximately located or inferred, and by dotted lines where concealed by younger rocks or by lakes or bays. Fault traces are queried where continuation or existence is uncertain. Concealed faults in the Great Valley are based on maps of selected subsurface horizons, so locations shown are approximate and may indicate structural trend only. All offshore faults based on seismic reflection profile records are shown as solid lines where well defined, dashed where inferred, queried where uncertain.

FAULT CLASSIFICATION COLOR CODE

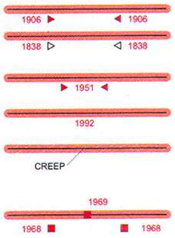
(Indicating Recency of Movement)

Fault along which historic (last 200 years) displacement has occurred and is associated with one or more of the following:

(a) a recorded earthquake with surface rupture. (Also included are some well-defined surface breaks caused by ground shaking during earthquakes, e.g. extensive ground breakage, not on the White Wolf fault, caused by the Arvin-Tehachapi earthquake of 1952). The date of the associated earthquake is indicated. Where repeated surface ruptures on the same fault have occurred, only the date of the latest movement may be indicated, especially if earlier reports are not well documented as to location of ground breaks.

(b) fault creep slippage - slow ground displacement usually without accompanying earthquakes.

(c) displaced survey lines.



A triangle to the right or left of the date indicates termination point of observed surface displacement. Solid red triangle indicates known location of rupture termination point. Open black triangle indicates uncertain or estimated location of rupture termination point.

Date bracketed by triangles indicates local fault break.

No triangle by date indicates an intermediate point along fault break.

Fault that exhibits fault creep slippage. Hachures indicate linear extent of fault creep. Annotation (creep with leader) indicates representative locations where fault creep has been observed and recorded.

Square on fault indicates where fault creep slippage has occured that has been triggered by an earthquake on some other fault. Date of causative earthquake indicated. Squares to right and left of date indicate terminal points between which triggered creep slippage has occurred (creep either continuous or intermittent between these end points).

Holocene fault displacement (during past 11,700 years) without historic record. Geomorphic evidence for Holocene faulting includes sag ponds, scarps showing little erosion, or the following features in Holocene age deposits: offset stream courses, linear scarps, shutter ridges, and triangular faceted spurs. Recency of faulting offshore is based on the interpreted age of the youngest strata displaced by faulting.

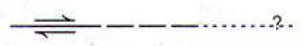
Late Quaternary fault displacement (during past 700,000 years). Geomorphic evidence similar to that described for Holocene faults except features are less distinct. Faulting may be younger, but lack of younger overlying deposits precludes more accurate age classification.

Quaternary fault (age undifferentiated). Most faults of this category show evidence of displacement sometime during the past 1.6 million years; possible exceptions are faults which displace rocks of undifferentiated Plio-Pleistocene age. Unnumbered Quaternary faults were based on Fault Map of California, 1975. See Bulletin 201, Appendix D for source data.

Pre-Quaternary fault (older that 1.6 million years) or fault without recognized Quaternary displacement. Some faults are shown in this category because the source of mapping used was of reconnaissnce nature, or was not done with the object of dating fault displacements. Faults in this category are not necessarily inactive.

ADDITIONAL FAULT SYMBOLS

Bar and ball on downthrown side (relative or apparent).

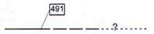


Arrows along fault indicate relative or apparent direction of lateral movement.

Arrow on fault indicates direction of dip.

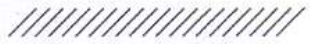
Low angle fault (barbs on upper plate). Fault surface generally dips less than 45° but locally may have been subsequently steepened. On offshore faults, barbs simply indicate a reverse fault regardless of steepness of dip.

OTHER SYMBOLS

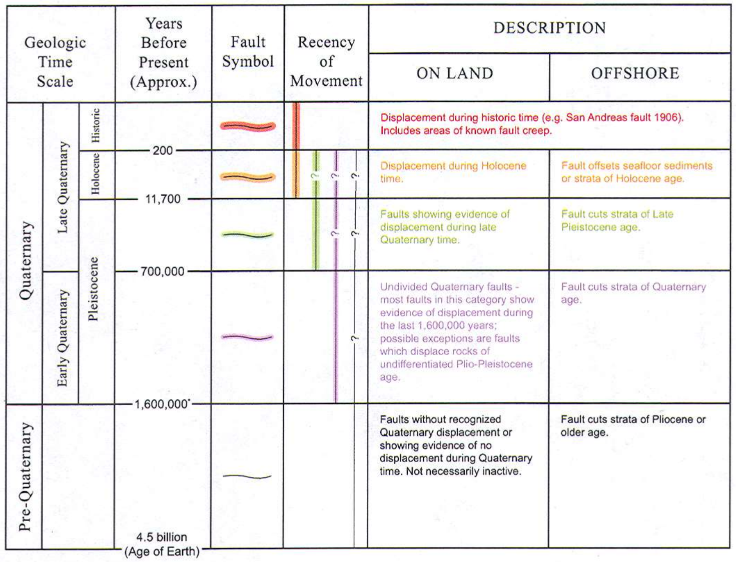


Numbers refer to annotations listed in the appendices of the accompanying report. Annotations include fault name, age of fault displacement, and pertinent references including Earthquake Fault Zone maps where a fault has been zoned by the Alquist-Priolo Earthquake Fault Zoning Act. This Act requires the State Geologist to delineate zones to encompass faults with Holocene displacement.

Structural discontinuity (offshore) separating differing Neogene structural domains. May indicate discontinuities between basement rocks.



Brawley Seismic Zone, a linear zone of seismicity locally up to 10 km wide associated with the releasing step between the Imperial and San Andreas faults.



Geologic Time Scale			Years Before Present (Approx.)	Fault Symbol	Recency of Movement	DESCRIPTION	
						ON LAND	OFFSHORE
Quaternary	Late Quaternary	Historic	200			Displacement during historic time (e.g. San Andreas fault 1906). Includes areas of known fault creep.	
		Holocene	11,700		? ? ?	Displacement during Holocene time.	Fault offsets seafloor sediments or strata of Holocene age.
		Pleistocene	700,000		? ?	Faults showing evidence of displacement during late Quaternary time.	Fault cuts strata of Late Pleistocene age.
	Early Quaternary		1,600,000*		?	Undivided Quaternary faults - most faults in this category show evidence of displacement during the last 1,600,000 years; possible exceptions are faults which displace rocks of undifferentiated Plio-Pleistocene age.	Fault cuts strata of Quaternary age.
Pre-Quaternary			4.5 billion (Age of Earth)			Faults without recognized Quaternary displacement or showing evidence of no displacement during Quaternary time. Not necessarily inactive.	Fault cuts strata of Pliocene or older age.

* Quaternary now recognized as extending to 2.6 Ma (Walker and Geissman, 2009). Quaternary faults in this map were established using the previous 1.6 Ma criterion.

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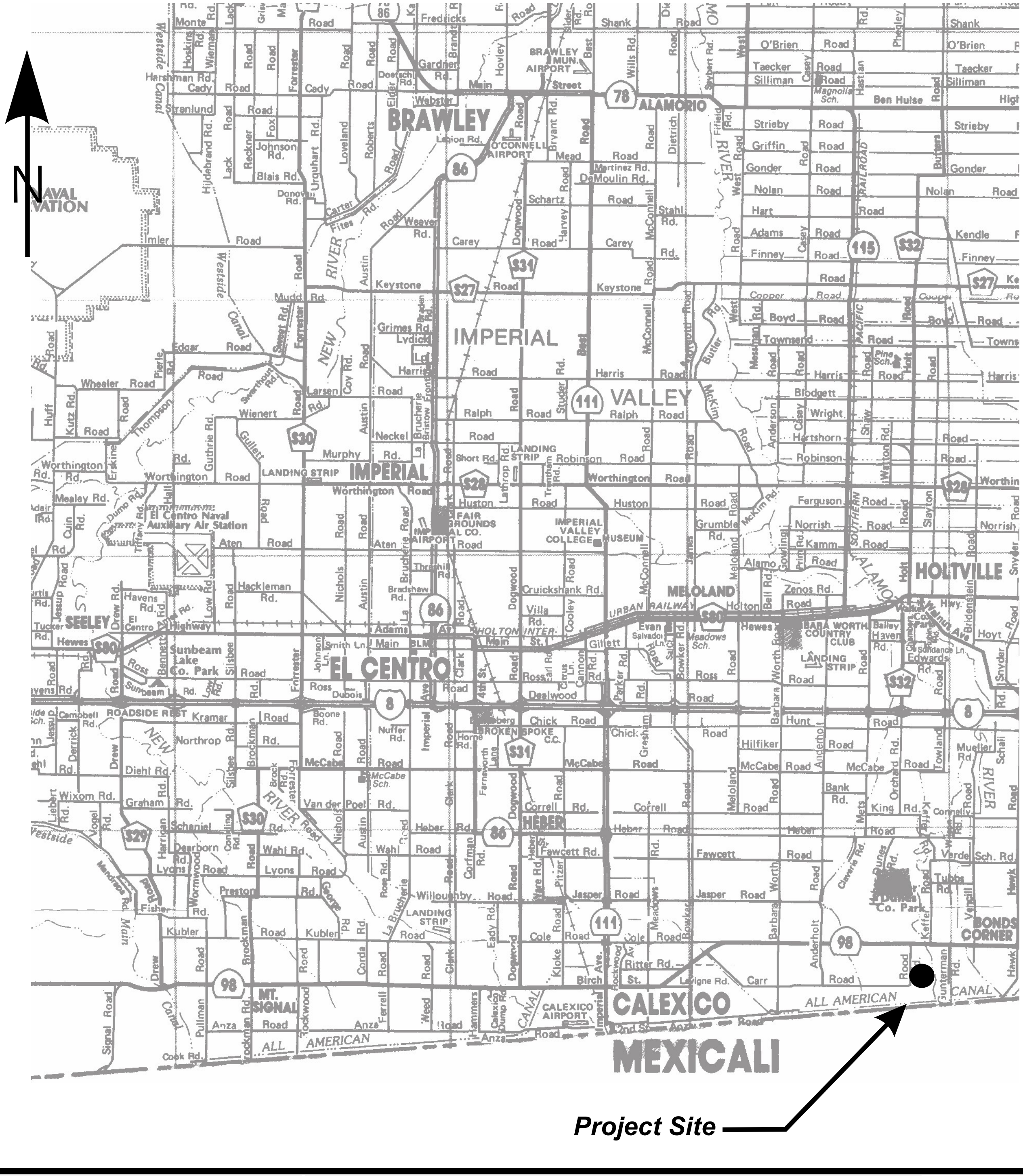
Fault Map Legend

Figure 3

APPENDIX A



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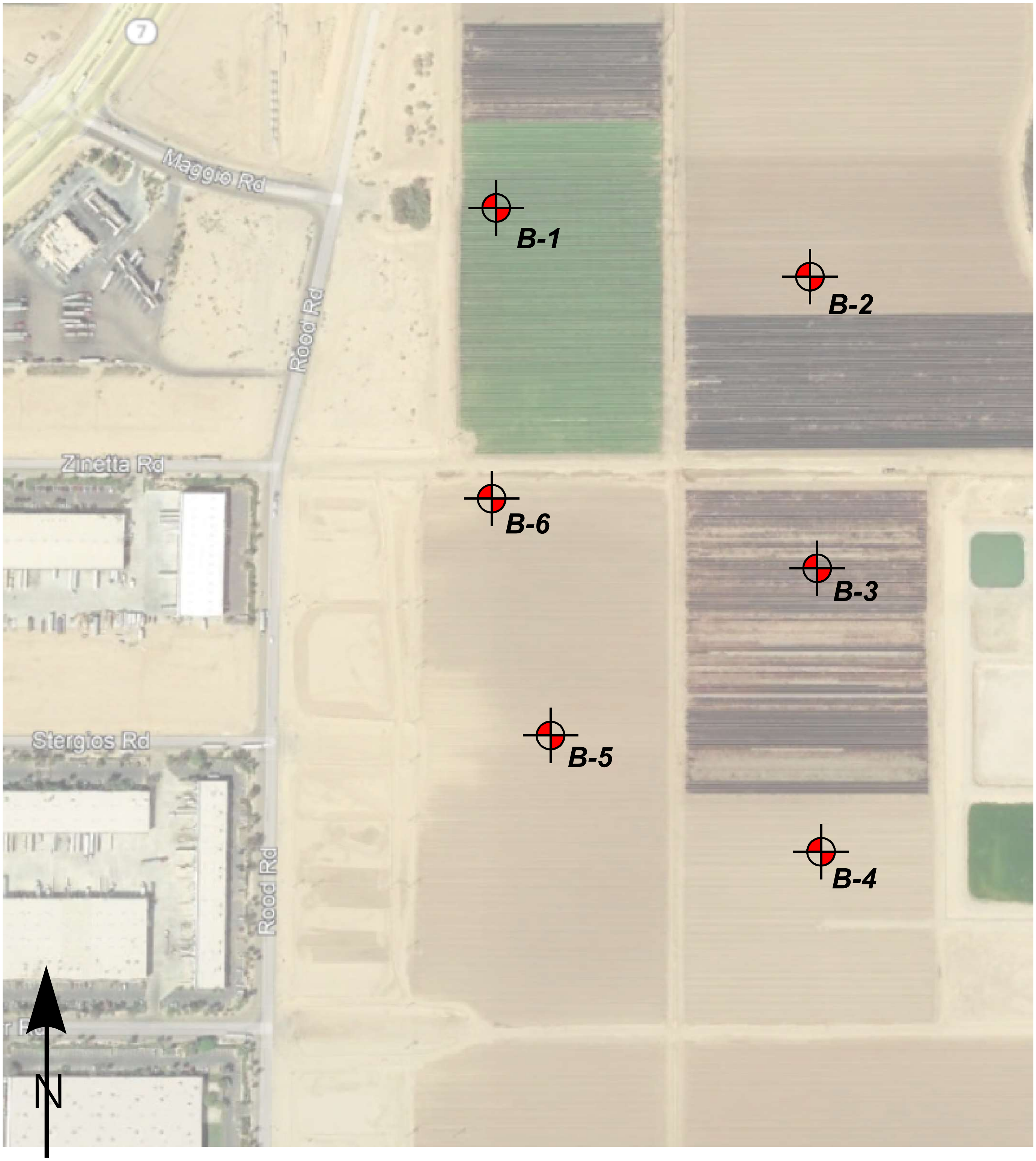
Vicinity Map

Plate A-1



Legend

⊕ *Approximate Boring Location*

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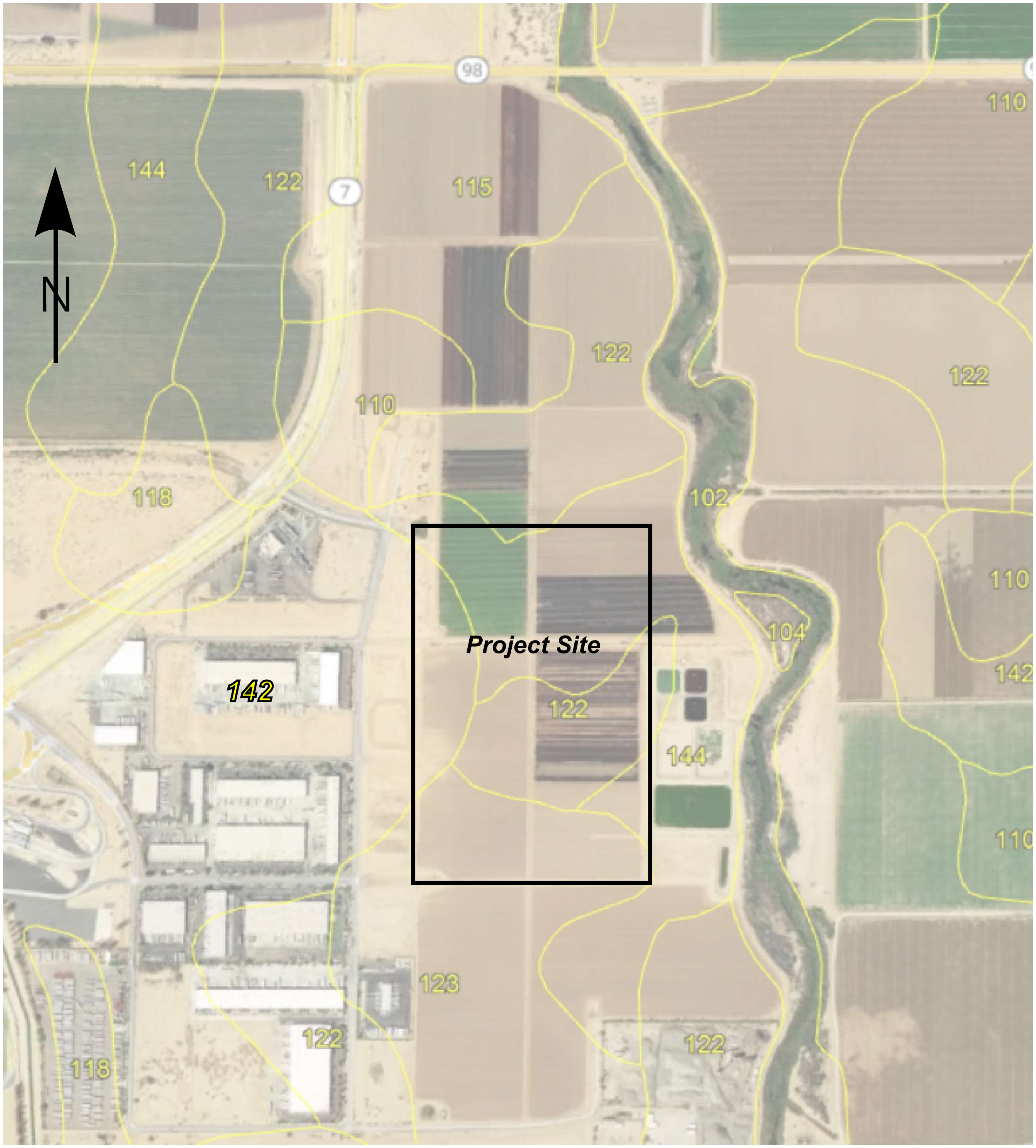
Site and Exploration Map

Plate A-2



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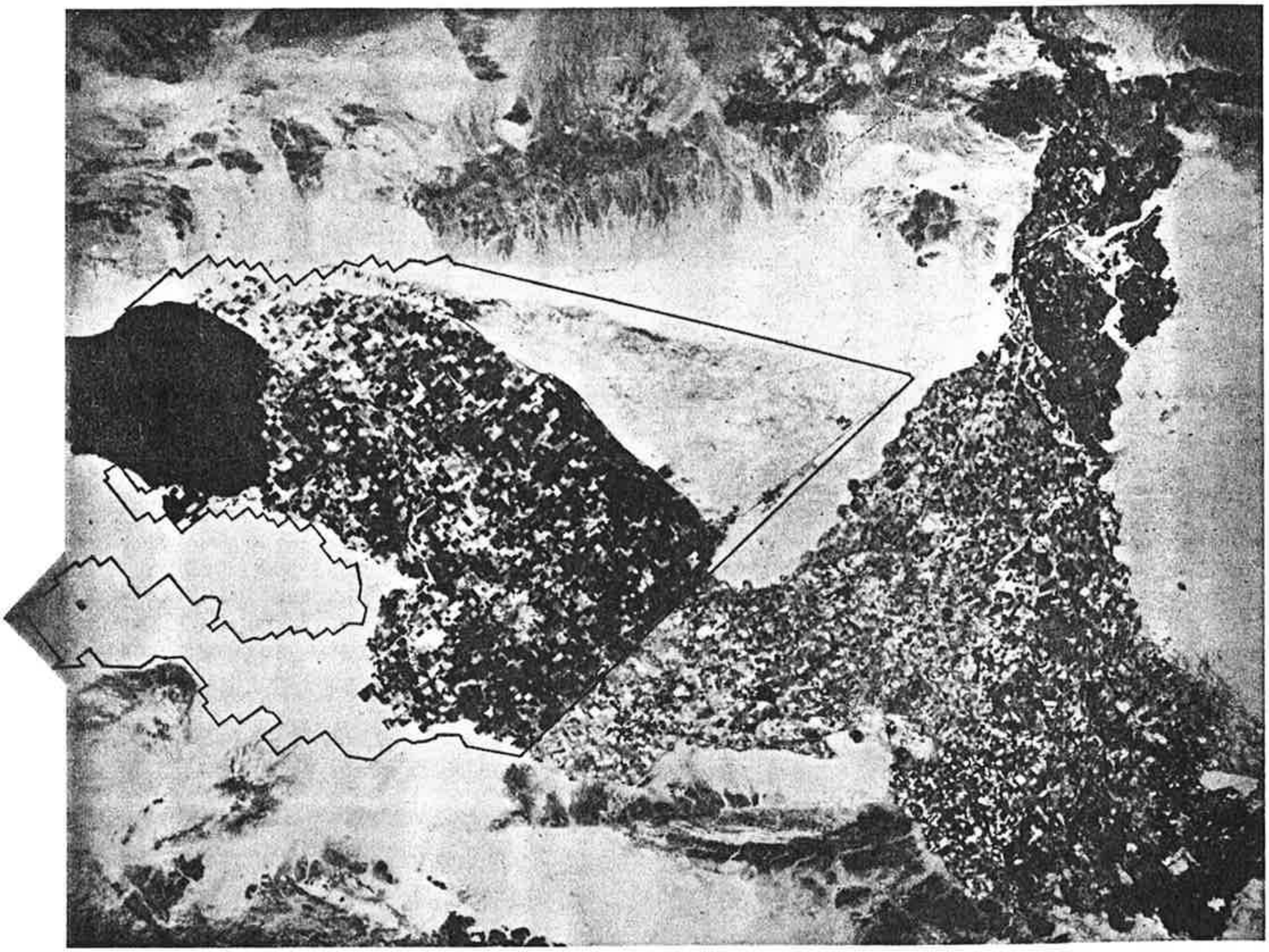
Soil Survey Map

Plate
A-3

Soil Survey of

IMPERIAL COUNTY CALIFORNIA IMPERIAL VALLEY AREA



United States Department of Agriculture Soil Conservation Service
in cooperation with
University of California Agricultural Experiment Station
and
Imperial Irrigation District

TABLE 11.--ENGINEERING INDEX PROPERTIES

[The symbol > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
100	0-13	Loamy fine sand	SM	A-2	0	100	100	75-85	10-30	---	NP
Antho	13-60	Sandy loam, fine sandy loam.	SM	A-2, A-4	0	90-100	75-95	50-60	15-40	---	NP
101*:											
Antho	0-8	Loamy fine sand	SM	A-2	0	100	100	75-85	10-30	---	NP
	8-60	Sandy loam, fine sandy loam.	SM	A-2, A-4	0	90-100	75-95	50-60	15-40	---	NP
Superstition	0-6	Fine sand	SM	A-2	0	100	95-100	70-85	15-25	---	NP
	6-60	Loamy fine sand, fine sand, sand.	SM	A-2	0	100	95-100	70-85	15-25	---	NP
102*.											
Badland											
103	0-10	Gravelly sand	SP, SP-SM	A-1, A-2	0-5	60-90	50-85	30-55	0-10	---	NP
Carsitas	10-60	Gravelly sand, gravelly coarse sand, sand.	SP, SP-SM	A-1	0-5	60-90	50-85	25-50	0-10	---	NP
104*											
Fluvaquents											
105	0-13	Clay loam	CL	A-6	0	100	100	90-100	70-95	35-45	15-30
Glenbar	13-60	Clay loam, silty clay loam.	CL	A-6	0	100	100	90-100	70-95	35-45	15-30
106	0-13	Clay loam	CL	A-6, A-7	0	100	100	90-100	70-95	35-45	15-25
Glenbar	13-60	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	35-45	15-25
107*	0-13	Loam	ML, CL-ML, CL	A-4	0	100	100	100	70-80	20-30	NP-10
Glenbar	13-60	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	95-100	75-95	35-45	15-30
108	0-14	Loam	ML	A-4	0	100	100	85-100	55-95	25-35	NP-10
Holtville	14-22	Clay, silty clay	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
	22-60	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	95-100	65-85	25-35	NP-10
109	0-17	Silty clay	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
Holtville	17-24	Clay, silty clay	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
	24-35	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	95-100	65-85	25-35	NP-10
	35-60	Loamy very fine sand, loamy fine sand.	SM, ML	A-2, A-4	0	100	100	75-100	20-55	---	NP
110	0-17	Silty clay	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-35
Holtville	17-24	Clay, silty clay	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-35
	24-35	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	95-100	55-85	25-35	NP-10
	35-60	Loamy very fine sand, loamy fine sand.	SM, ML	A-2, A-4	0	100	100	75-100	20-55	---	NP

See footnote at end of table.

TABLE 11.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
111*:											
Holtville	0-10	Silty clay loam	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
	10-22	Clay, silty clay	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
	22-60	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	95-100	65-85	25-35	NP-10
Imperial	0-12	Silty clay loam	CL	A-7	0	100	100	100	85-95	40-50	10-20
	12-60	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	100	85-95	50-70	25-45
112 Imperial	0-12	Silty clay	CH	A-7	0	100	100	100	85-95	50-70	25-45
	12-60	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	100	85-95	50-70	25-45
113 Imperial	0-12	Silty clay	CH	A-7	0	100	100	100	85-95	50-70	25-45
	12-60	Silty clay, clay, silty clay loam.	CH	A-7	0	100	100	100	85-95	50-70	25-45
114 Imperial	0-12	Silty clay	CH	A-7	0	100	100	100	85-95	50-70	25-45
	12-60	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	100	85-95	50-70	25-45
115*:											
Imperial	0-12	Silty clay loam	CL	A-7	0	100	100	100	85-95	40-50	10-20
	12-60	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	100	85-95	50-70	25-45
Glenbar	0-13	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	70-95	35-45	15-25
	13-60	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	35-45	15-25
116*:											
Imperial	0-13	Silty clay loam	CL	A-7	0	100	100	100	85-95	40-50	10-20
	13-60	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	100	85-95	50-70	25-45
Glenbar	0-13	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	70-95	35-45	15-25
	13-60	Clay loam, silty clay loam.	CL	A-6	0	100	100	90-100	70-95	35-45	15-30
117, 118 Indio	0-12	Loam	ML	A-4	0	95-100	95-100	85-100	75-90	20-30	NP-5
	12-72	Stratified loamy very fine sand to silt loam.	ML	A-4	0	95-100	95-100	85-100	75-90	20-30	NP-5
119*:											
Indio	0-12	Loam	ML	A-4	0	95-100	95-100	85-100	75-90	20-30	NP-5
	12-72	Stratified loamy very fine sand to silt loam.	ML	A-4	0	95-100	95-100	85-100	75-90	20-30	NP-5
Vint	0-10	Loamy fine sand	SM	A-2	0	95-100	95-100	70-80	25-35	---	NP
	10-60	Loamy sand, loamy fine sand.	SM	A-2	0	95-100	95-100	70-80	20-30	---	NP
120* Laveen	0-12	Loam	ML, CL-ML	A-4	0	100	95-100	75-85	55-65	20-30	NP-10
	12-60	Loam, very fine sandy loam.	ML, CL-ML	A-4	0	95-100	85-95	70-80	55-65	15-25	NP-10

See footnote at end of table.

TABLE 11.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
121----------------- Meloland	0-12	Fine sand-------	SM, SP-SM	A-2, A-3	0	95-100	90-100	75-100	5-30	---	NP
	12-26	Stratified loamy fine sand to silt loam.	ML	A-4	0	100	100	90-100	50-65	25-35	NP-10
	26-71	Clay, silty clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-40
122----------------- Meloland	0-12	Very fine sandy loam.	ML	A-4	0	95-100	95-100	95-100	55-85	25-35	NP-10
	12-26	Stratified loamy fine sand to silt loam.	ML	A-4	0	100	100	90-100	50-70	25-35	NP-10
	26-71	Clay, silty clay, silty clay loam.	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-40
123*: Meloland----------	0-12	Loam-------------	ML	A-4	0	95-100	95-100	95-100	55-85	25-35	NP-10
	12-26	Stratified loamy fine sand to silt loam.	ML	A-4	0	100	100	90-100	50-70	25-35	NP-10
	26-38	Clay, silty clay, silty clay loam.	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-40
	38-60	Stratified silt loam to loamy fine sand.	SM, ML	A-4	0	100	100	75-100	35-55	25-35	NP-10
Holtville---------	0-12	Loam-------------	ML	A-4	0	100	100	85-100	55-95	25-35	NP-10
	12-24	Clay, silty clay	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-35
	24-36	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	95-100	55-85	25-35	NP-10
	36-60	Loamy very fine sand, loamy fine sand.	SM, ML	A-2, A-4	0	100	100	75-100	20-55	---	NP
124, 125----------- Niland	0-23	Gravelly sand---	SM, SP-SM	A-2, A-3	0	90-100	70-95	50-65	5-25	---	NP
	23-60	Silty clay, clay, clay loam.	CL, CH	A-7	0	100	100	85-100	80-95	40-65	20-40
126----------------- Niland	0-23	Fine sand-------	SM, SP-SM	A-2, A-3	0	90-100	90-100	50-65	5-25	---	NP
	23-60	Silty clay------	CL, CH	A-7	0	100	100	85-100	80-95	40-65	20-40
127----------------- Niland	0-23	Loamy fine sand	SM	A-2	0	90-100	90-100	50-65	15-30	---	NP
	23-60	Silty clay------	CL, CH	A-7	0	100	100	85-100	80-95	40-65	20-40
128*: Niland------------	0-23	Gravelly sand---	SM, SP-SM	A-2, A-3	0	90-100	70-95	50-65	5-25	---	NP
	23-60	Silty clay, clay, clay loam.	CL, CH	A-7	0	100	100	85-100	80-100	40-65	20-40
Imperial----------	0-12	Silty clay------	CH	A-7	0	100	100	100	85-95	50-70	25-45
	12-60	Silty clay loam, silty clay.	CH	A-7	0	100	100	100	85-95	50-70	25-45
129*: Pits											
130, 131----------- Rositas	0-27	Sand-------------	SP-SM	A-3, A-1, A-2	0	100	80-100	40-70	5-15	---	NP
	27-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2, A-1	0	100	80-100	40-85	5-30	---	NP

See footnote at end of table.

TABLE 11.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
132, 133, 134, 135- Rositas	0-9	Fine sand-------	SM	A-3, A-2	0	100	80-100	50-80	10-25	---	NP
	9-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2, A-1	0	100	80-100	40-85	5-30	---	NP
136---------------- Rositas	0-4	Loamy fine sand	SM	A-1, A-2	0	100	80-100	40-85	10-35	---	NP
	4-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2, A-1	0	100	80-100	40-85	5-30	---	NP
137---------------- Rositas	0-12	Silt loam-------	ML	A-4	0	100	100	90-100	70-90	20-30	NP-5
	12-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2, A-1	0	100	80-100	40-85	5-30	---	NP
138*:											
Rositas-----------	0-4	Loamy fine sand	SM	A-1, A-2	0	100	80-100	40-85	10-35	---	NP
	4-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2, A-1	0	100	80-100	40-85	5-30	---	NP
Superstition------	0-6	Loamy fine sand	SM	A-2	0	100	95-100	70-85	15-25	---	NP
	6-60	Loamy fine sand, fine sand, sand.	SM	A-2	0	100	95-100	70-85	15-25	---	NP
139---------------- Superstition	0-6	Loamy fine sand	SM	A-2	0	100	95-100	70-85	15-25	---	NP
	6-60	Loamy fine sand, fine sand, sand.	SM	A-2	0	100	95-100	70-85	15-25	---	NP
140*: Torriorthents											
Rock outcrop											
141*: Torriorthents											
Orthids											
142---------------- Vint	0-10	Loamy very fine sand.	SM, ML	A-4	0	100	100	85-95	40-65	15-25	NP-5
	10-60	Loamy fine sand	SM	A-2	0	95-100	95-100	70-80	20-30	---	NP
143---------------- Vint	0-12	Fine sandy loam	ML, CL-ML, SM, SM-SC	A-4	0	100	100	75-85	45-55	15-25	NP-5
	12-60	Loamy sand, loamy fine sand.	SM	A-2	0	95-100	95-100	70-80	20-30	---	NP
144*:											
Vint--------------	0-10	Very fine sandy loam.	SM, ML	A-4	0	100	100	85-95	40-65	15-25	NP-5
	10-40	Loamy fine sand	SM	A-2	0	95-100	95-100	70-80	20-30	---	NP
	40-60	Silty clay------	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
Indio-------------	0-12	Very fine sandy loam.	ML	A-4	0	95-100	95-100	85-100	75-90	20-30	NP-5
	12-40	Stratified loamy very fine sand to silt loam.	ML	A-4	0	95-100	95-100	85-100	75-90	20-30	NP-5
	40-72	Silty clay------	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35

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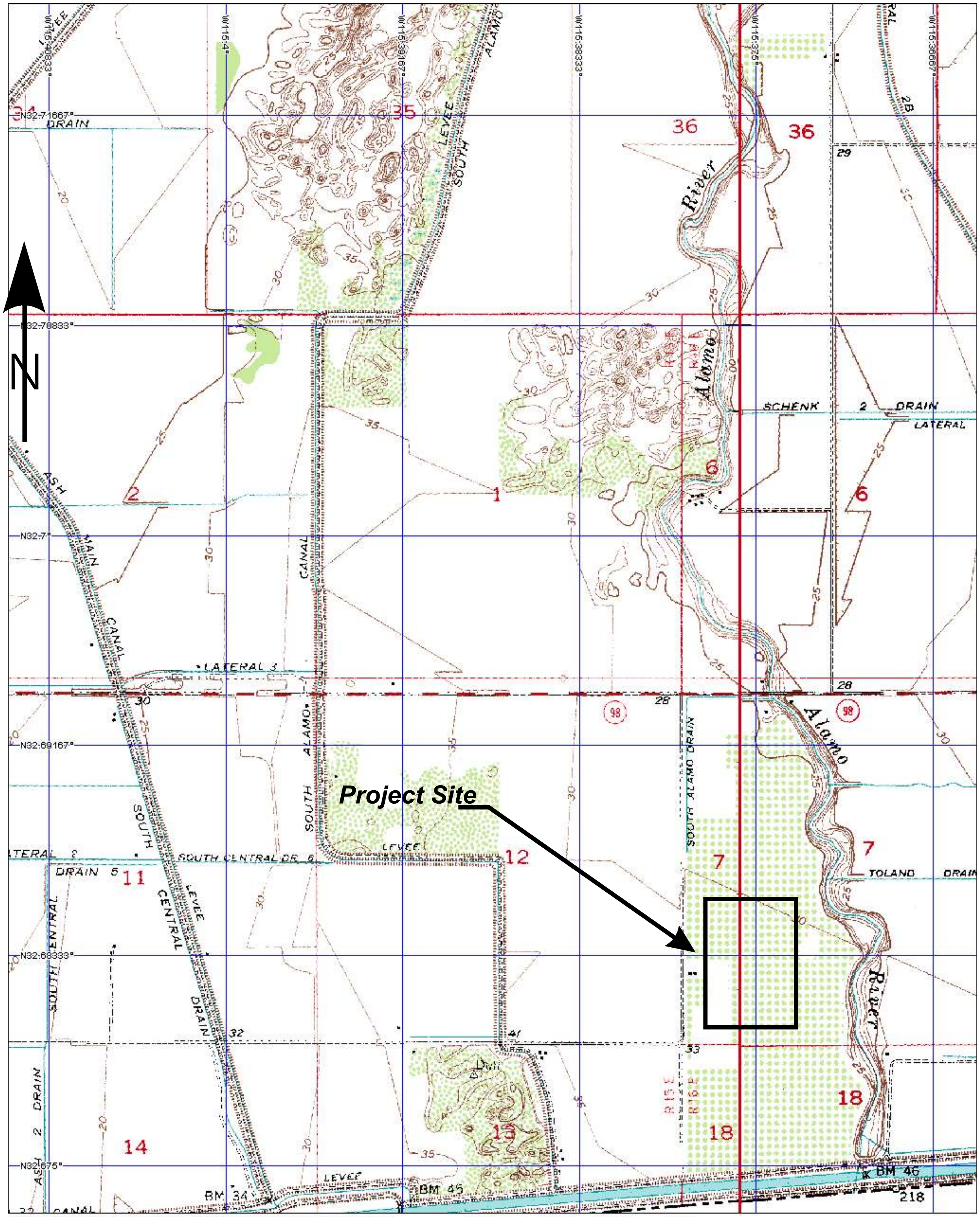
* See description of the map unit for composition and behavior characteristics of the map unit.



3-D TopoQuads Copyright © 1999 DeLorme Yarmouth, ME 04096 Source Data: USGS

650 ft Scale: 1 : 22,400 Detail: 13-2 Datum: WGS84

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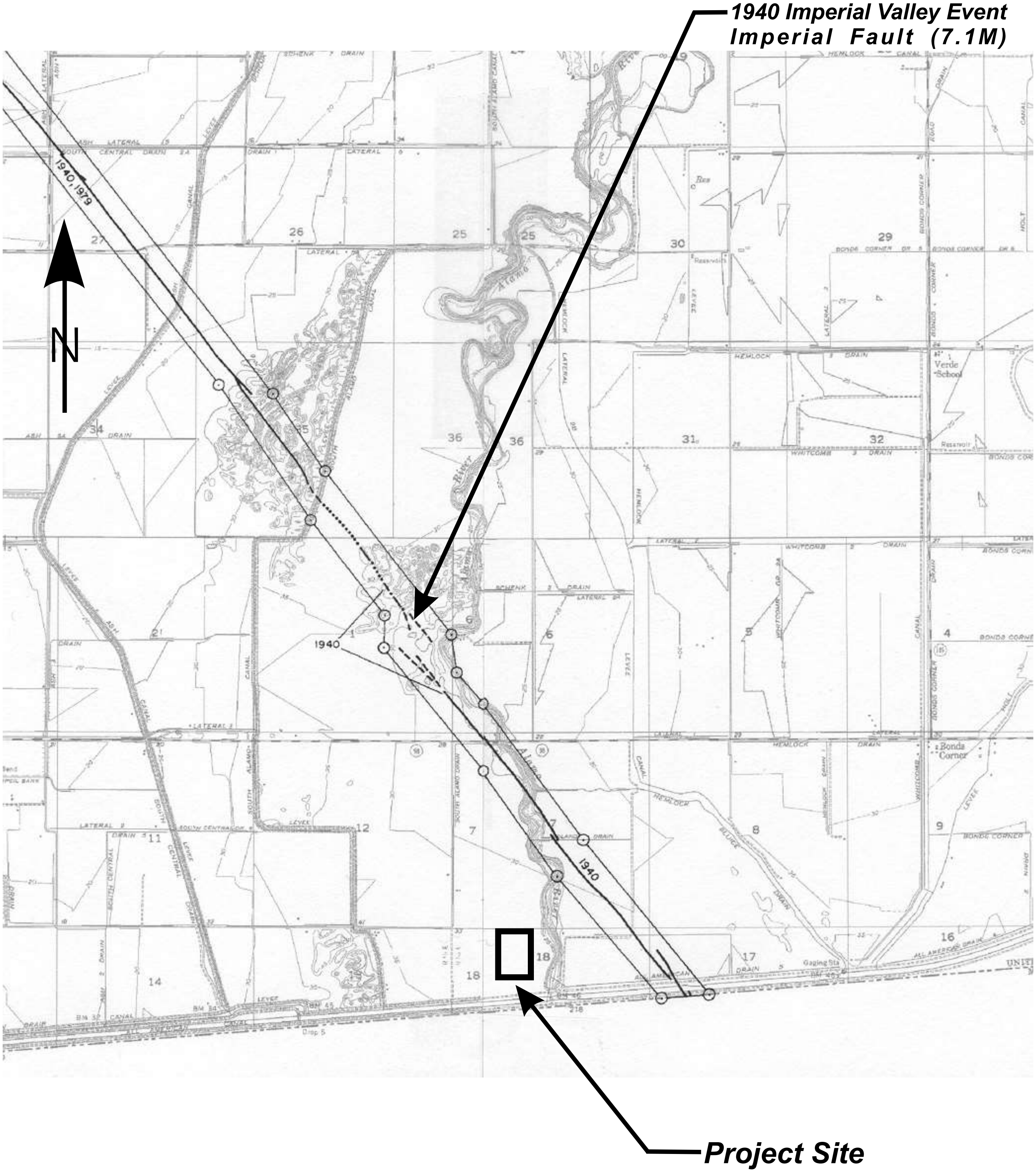
Topographic Map

Plate A-4



Mapped Fault Trace
1940 Imperial Valley Event
Imperial Fault (7.1M)

Project Site

LANDMARK
Geo-Engineers and Geologists

Project No.: LE22078

Alquist-Priolo Earthquake Fault Zone Map

Plate
A-5

APPENDIX B

LOG OF BORING No. B-1

SHEET 1 OF 1

	FIELD					LABORATORY		
DEPTH	SAMPLE	USCS CLASS.	BLOW COUNT	POCKET PEN. (tsf)	DESCRIPTION OF MATERIAL	DRY DENSITY (pcf)	MOISTURE CONTENT (% dry wt.)	OTHER TESTS
					SILTY CLAY (CL): Lt. brown, dry to moist with depth, medium plasticity			
5			10		SANDY SILT (ML): Lt. brown, moist, medium dense, with very fine grained sand			
				1.5	SILTY CLAY (CL): Brown, very moist, stiff to very stiff, medium plasticity			
10			12		SILTY SAND (SM): Lt. brown, wet to saturated, loose, fine to medium grained sand ▼	107.6	22.2	
15			3		CLAYEY SILT (ML): Brown, saturated, very soft, low plasticity, some very fine grained sand			
20			15	2.5	SILTY CLAY/CLAY (CL-CH): Dark brown, very moist, very stiff, medium to high plasticity	99.7	25.2	
25					Groundwater measured at 13 feet at time of drilling. This is not considered the stabilized groundwater depth as groundwater may rise to a level higher than that measured in borehole.			
30								
35								
40								
45								
50								
55								
60								

DATE DRILLED: 4/14/22

LOGGED BY: J. Avalos

SURFACE ELEVATION: Approximately 28'

TOTAL DEPTH: 21.5 feet

TYPE OF BIT: Hollow Stem Auger

HAMMER WT.: 140 lbs.

DEPTH TO WATER: ~13 ft.

DIAMETER: 8 in.

DROP: 30 in.

PROJECT No. LE22078

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PLATE B-1

LOG OF BORING No. B-2

SHEET 1 OF 1

DEPTH	FIELD				DESCRIPTION OF MATERIAL	LABORATORY		
	SAMPLE	USCS CLASS.	BLOW COUNT	POCKET PEN. (tsf)		DRY DENSITY (pcf)	MOISTURE CONTENT (% dry wt.)	OTHER TESTS
	☒	▨			SILTY CLAY (CL): Lt. brown, dry to moist with depth, medium plasticity			
5	◪	▨	14	3.5	Dark brown, very stiff	94.9	11.1	
10	⧄	░	7		SILTY SAND (SM): Lt. brown, very moist, loose, fine grained sand			
15	⧄	░	6		Saturated, w/thin interbedded silty clay layer ▼			
20	⧄	▨	9	3.0	SILTY CLAY/CLAY (CL-CH): Dark brown, very moist, very stiff, medium to high plasticity			
25					Groundwater measured at 16.7 feet at time of drilling. This is not considered the stabilized groundwater depth as groundwater may rise to a level higher than that measured in borehole.			
30								
35								
40								
45								
50								
55								
60								

DATE DRILLED: 4/14/22

LOGGED BY: J. Avalos

SURFACE ELEVATION: Approximately 30'

TOTAL DEPTH: 21.5 feet

TYPE OF BIT: Hollow Stem Auger

HAMMER WT.: 140 lbs.

DEPTH TO WATER: ~16.7 ft.

DIAMETER: 8 in.

DROP: 30 in.

PROJECT No. LE22078

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PLATE B-2

LOG OF BORING No. B-3

SHEET 1 OF 1

DEPTH	FIELD				DESCRIPTION OF MATERIAL	LABORATORY		
	SAMPLE	USCS CLASS.	BLOW COUNT	POCKET PEN. (tsf)		DRY DENSITY (pcf)	MOISTURE CONTENT (% dry wt.)	OTHER TESTS
					SILTY CLAY (CL): Lt. brown, dry to moist with depth, medium plasticity			LL=35% PI=24%
5			8		SILTY SAND/SANDY SILT (SM): Lt. brown, very moist, loose, with fine grained sand			
10			12	4.0	SILTY CLAY (CL): Dark brown, very moist, very stiff, medium plasticity			
					SILTY SAND (SM): Lt. brown, very moist, loose to medium dense, fine grained sand		22.7	LL=21% PI=4% % passing #200 = 52% <2μ = 21.7%
15			10		Saturated ▼	101.7	23.7	
20			4	4.0	SILTY CLAY/CLAY (CL-CH): Dark brown, very moist, very stiff, medium to high plasticity			
25					Groundwater measured at 16.0 feet at time of drilling. This is not considered the stabilized groundwater depth as groundwater may rise to a level higher than that measured in borehole.			
30								
35								
40								
45								
50								
55								
60								

DATE DRILLED: 4/14/22

LOGGED BY: J. Avalos

SURFACE ELEVATION: Approximately 30'

TOTAL DEPTH: 21.5 feet

TYPE OF BIT: Hollow Stem Auger

HAMMER WT.: 140 lbs.

DEPTH TO WATER: ~16.0 ft.

DIAMETER: 8 in.

DROP: 30 in.

PROJECT No. LE22078

LANDMARK
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PLATE B-3

LOG OF BORING No. B-4

SHEET 1 OF 1

DEPTH	FIELD: SAMPLE	FIELD: USCS CLASS.	FIELD: BLOW COUNT	FIELD: POCKET PEN. (tsf)	DESCRIPTION OF MATERIAL	LABORATORY: DRY DENSITY (pcf)	LABORATORY: MOISTURE CONTENT (% dry wt.)	LABORATORY: OTHER TESTS
	☒				SILTY CLAY (CL): Lt. brown, dry to moist with depth, medium plasticity			
					SILTY SAND (SM): Lt. brown, moist, loose, fine grained sand			
5	⧄		8					
10	⧄		13		Very moist, medium dense, w/thin interbedded clay layer			
15	⧄		6		CLAYEY SILT (ML): Brown, saturated, soft to firm, low plasticity, some fine grained sand ▼		23.8	LL=24% PI=9%
20	⧄		6	4.5	SILTY CLAY/CLAY (CL-CH): Dark brown, very moist, hard, medium to high plasticity			
25					Groundwater measured at 16.25 feet at time of drilling. This is not considered the stabilized groundwater depth as groundwater may rise to a level higher than that measured in borehole.			
30								
35								
40								
45								
50								
55								
60								

DATE DRILLED: 4/14/22

LOGGED BY: J. Avalos

SURFACE ELEVATION: Approximately 33'

TOTAL DEPTH: 21.5 feet

TYPE OF BIT: Hollow Stem Auger

HAMMER WT.: 140 lbs.

DEPTH TO WATER: ~16.25 ft

DIAMETER: 8 in.

DROP: 30 in.

PROJECT No. LE22078

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PLATE B-4

LOG OF BORING No. B-5

SHEET 1 OF 1

DEPTH	FIELD				DESCRIPTION OF MATERIAL	LABORATORY		
	SAMPLE	USCS CLASS.	BLOW COUNT	POCKET PEN. (tsf)		DRY DENSITY (pcf)	MOISTURE CONTENT (% dry wt.)	OTHER TESTS
	☒	▨			SILTY CLAY (CL): Lt. brown, dry to moist with depth, medium plasticity			
5	⧄	▥	12		SILTY SAND/SANDY SILT (SM): Lt. brown, moist, medium dense, fine grained sand		8.8	
10	⧄	▨	12	2.0	SILTY CLAY (CL): Brown, very moist, stiff, medium plasticity			
15	⧄	░	11		SILTY SAND (SM): Lt. brown, very moist, medium dense, fine grained sand ▼ Saturated			
20	⧄	▨	12		SANDY SILT (ML): Brown, saturated, medium dense, w/very fine grained sand			
25					Groundwater measured at 14.4 feet at time of drilling. This is not considered the stabilized groundwater depth as groundwater may rise to a level higher than that measured in borehole.			
30								
35								
40								
45								
50								
55								
60								

DATE DRILLED: 4/14/22

LOGGED BY: J. Avalos

SURFACE ELEVATION: Approximately 31'

TOTAL DEPTH: 21.5 feet

TYPE OF BIT: Hollow Stem Auger

HAMMER WT.: 140 lbs.

DEPTH TO WATER: ~14.4 ft.

DIAMETER: 8 in.

DROP: 30 in.

PROJECT No. LE22078

LANDMARK
Geo-Engineers and Geologists

PLATE B-5

LOG OF BORING No. B-6

SHEET 1 OF 1

FIELD							LABORATORY		
DEPTH	SAMPLE	USCS CLASS.	BLOW COUNT	POCKET PEN. (tsf)	DESCRIPTION OF MATERIAL	DRY DENSITY (pcf)	MOISTURE CONTENT (% dry wt.)	OTHER TESTS
0	☒	▨			SILTY CLAY (CL): Lt. brown, dry to moist with depth, medium plasticity			
5	⧄	░	27		SILTY SAND (SM): Lt. brown, moist, medium dense, fine grained sand			
10	⧄	▨	10	2.0	SILTY CLAY (CL): Brown, very moist, stiff, medium plasticity		24.7	LL=26% PI=16% % passing #200 = 76.6% <2μ = 32.3%
15	⧄	░	22		SILTY SAND (SM): Lt. brown, very moist, medium dense, fine grained sand Saturated			
20	⧄	▨	13	+4.5	▼ FAT CLAY (CH): Dark brown, very moist, hard, high plasticity			
25					Groundwater measured at 18.5 feet at time of drilling. This is not considered the stabilized groundwater depth as groundwater may rise to a level higher than that measured in borehole.			
30								
35								
40								
45								
50								
55								
60								

DATE DRILLED: 4/14/22

LOGGED BY: J. Avalos

SURFACE ELEVATION: Approximately 31'

TOTAL DEPTH: 21.5 feet

TYPE OF BIT: Hollow Stem Auger

HAMMER WT.: 140 lbs.

DEPTH TO WATER: ~18.5 ft.

DIAMETER: 8 in.

DROP: 30 in.

PROJECT No. LE22078

LANDMARK
Geo-Engineers and Geologists

PLATE B-6

DEFINITION OF TERMS

PRIMARY DIVISIONS			SYMBOLS		SECONDARY DIVISIONS
Coarse grained soils More than half of material is larger that No. 200 sieve	**Gravels**	Clean gravels (less than 5% fines)	▨	**GW**	Well graded gravels, gravel-sand mixtures, little or no fines
	More than half of coarse fraction is larger than No. 4 sieve		▨	**GP**	Poorly graded gravels, or gravel-sand mixtures, little or no fines
		Gravel with fines	▨	**GM**	Silty gravels, gravel-sand-silt mixtures, non-plastic fines
			▨	**GC**	Clayey gravels, gravel-sand-clay mixtures, plastic fines
	Sands	Clean sands (less than 5% fines)	▨	**SW**	Well graded sands, gravelly sands, little or no fines
	More than half of coarse fraction is smaller than No. 4 sieve		▨	**SP**	Poorly graded sands or gravelly sands, little or no fines
		Sands with fines	▨	**SM**	Silty sands, sand-silt mixtures, non-plastic fines
			▨	**SC**	Clayey sands, sand-clay mixtures, plastic fines
Fine grained soils More than half of material is smaller than No. 200 sieve	**Silts and clays**		▨	**ML**	Inorganic silts, clayey silts with slight plasticity
	Liquid limit is less than 50%		▨	**CL**	Inorganic clays of low to medium plasticity, gravely, sandy, or lean clays
			▨	**OL**	Organic silts and organic clays of low plasticity
	Silts and clays		▨	**MH**	Inorganic silts, micaceous or diatomaceous silty soils, elastic silts
	Liquid limit is more than 50%		▨	**CH**	Inorganic clays of high plasticity, fat clays
			▨	**OH**	Organic clays of medium to high plasticity, organic silts
Highly organic soils			▨	**PT**	Peat and other highly organic soils

GRAIN SIZES

Silts and Clays	Sand			Gravel		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

200 40 10 4 3/4" 3" 12"

US Standard Series Sieve Clear Square Openings

Sands, Gravels, etc.	Blows/ft. *
Very Loose	0-4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	Over 50

Clays & Plastic Silts	Strength **	Blows/ft. *
Very Soft	0-0.25	0-2
Soft	0.25-0.5	2-4
Firm	0.5-1.0	4-8
Stiff	1.0-2.0	8-16
Very Stiff	2.0-4.0	16-32
Hard	Over 4.0	Over 32

* Number of blows of 140 lb. hammer falling 30 inches to drive a 2 inch O.D. (1 3/8 in. I.D.) split spoon (ASTM D1586).

** Unconfined compressive strength in tons/s.f. as determined by laboratory testing or approximated by the Standard Penetration Test (ASTM D1586), Pocket Penetrometer, Torvane, or visual observation.

Type of Samples:

◩ Ring Sample ⧅ Standard Penetration Test ⌶ Shelby Tube ☒ Bulk (Bag) Sample

Drilling Notes:

1. Sampling and Blow Counts
   - Ring Sampler - Number of blows per foot of a 140 lb. hammer falling 30 inches.
   - Standard Penetration Test - Number of blows per foot.
   - Shelby Tube - Three (3) inch nominal diameter tube hydraulically pushed.
2. P. P. = Pocket Penetrometer (tons/s.f.).
3. NR = No recovery.
4. GWT ▽ = Ground Water Table observed @ specified time.

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Project No. LE22078

Key to Logs

Plate
B-7

APPENDIX C

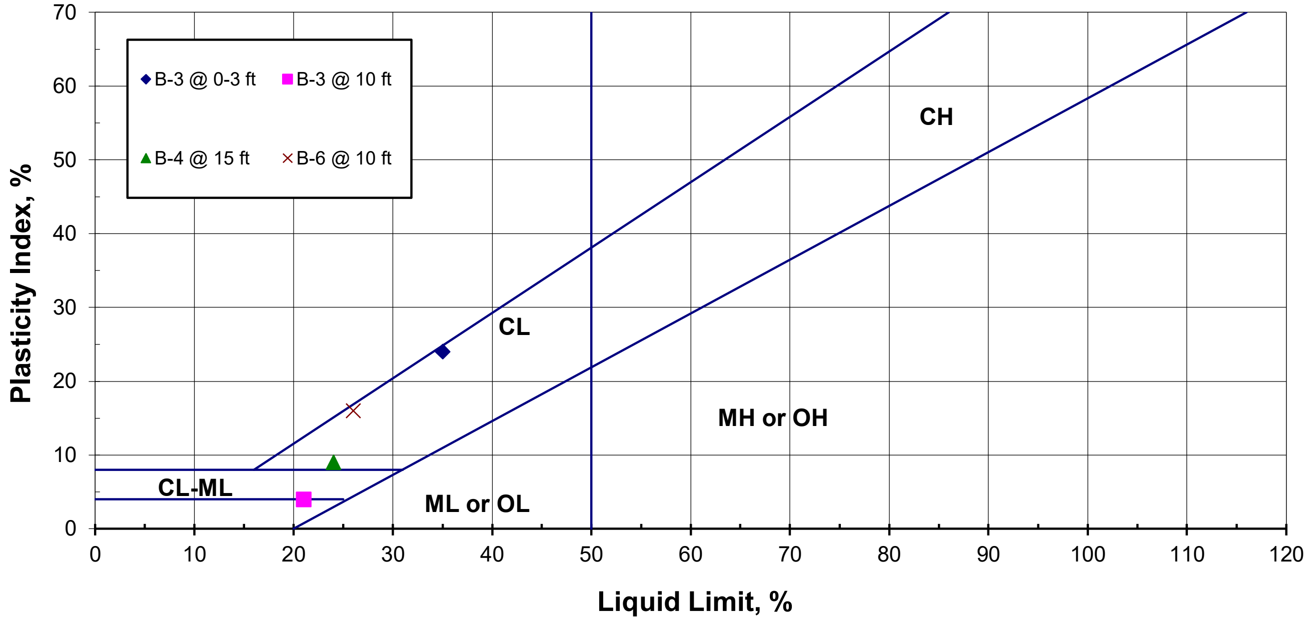
LANDMARK CONSULTANTS, INC.

CLIENT: Materra Farming Company LLC
PROJECT: Tract 941 Unit 5 Gateway - Infrastructure Development
JOB No.: LE22078
DATE: 04/27/22

ATTERBERG LIMITS (ASTM D4318)

Sample Location	Sample Depth (ft)	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	USCS Classification
B-3	0-3	35	11	24	CL
B-3	10	21	17	4	CL-ML
B-4	15	24	15	9	CL
B-6	10	26	10	16	CL

PLASTICITY CHART



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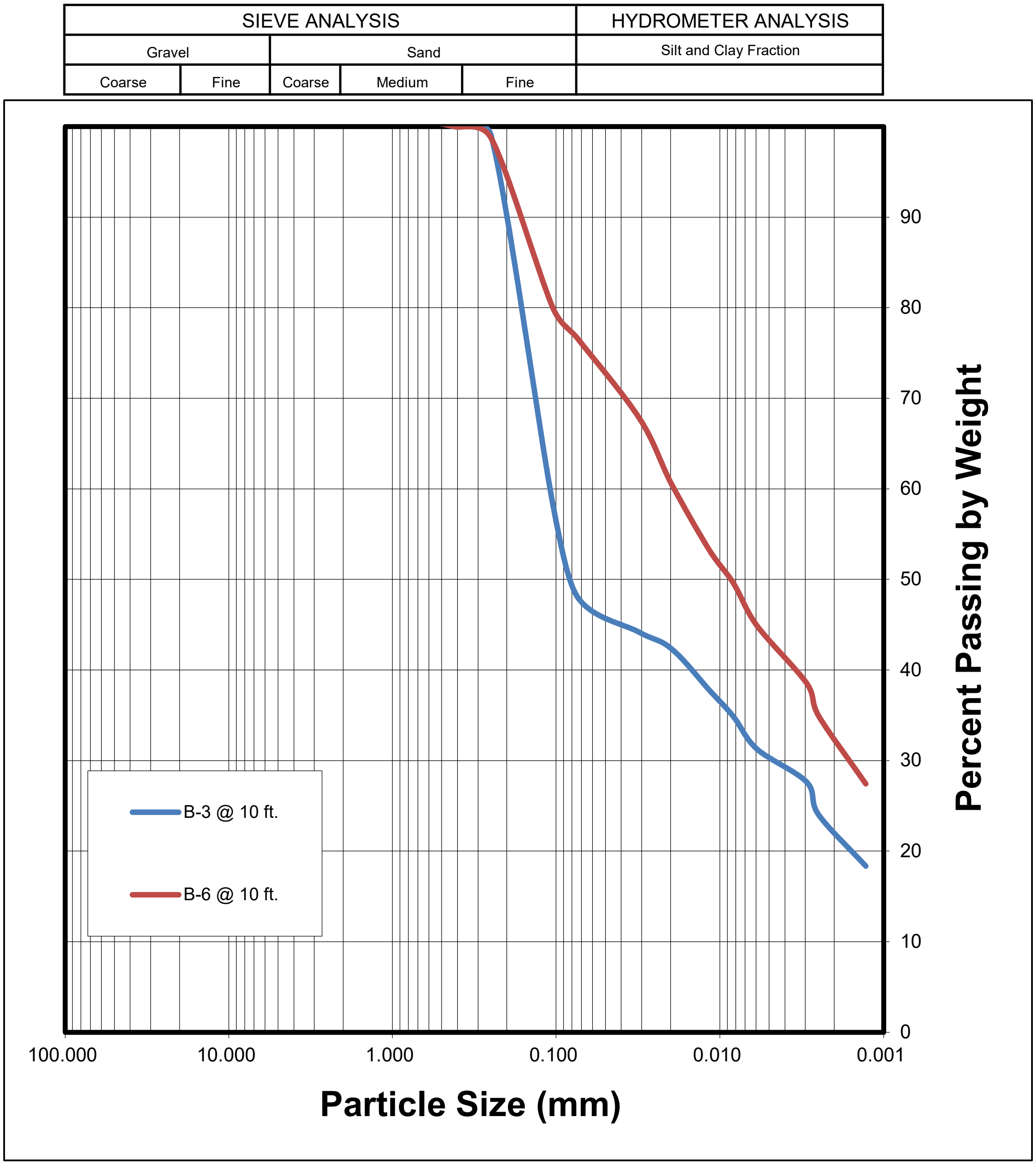
Project No.: LE22078

**Atterberg Limits
Test Results**

**Plate
C-1**



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Grain Size Analysis

Plate
C-2

Client: Manterra

Project: Tract 941 Units Gateways Infrastructure

Project No.: LE22078

Date: 4/21/2022

Lab. No.: EC22-251

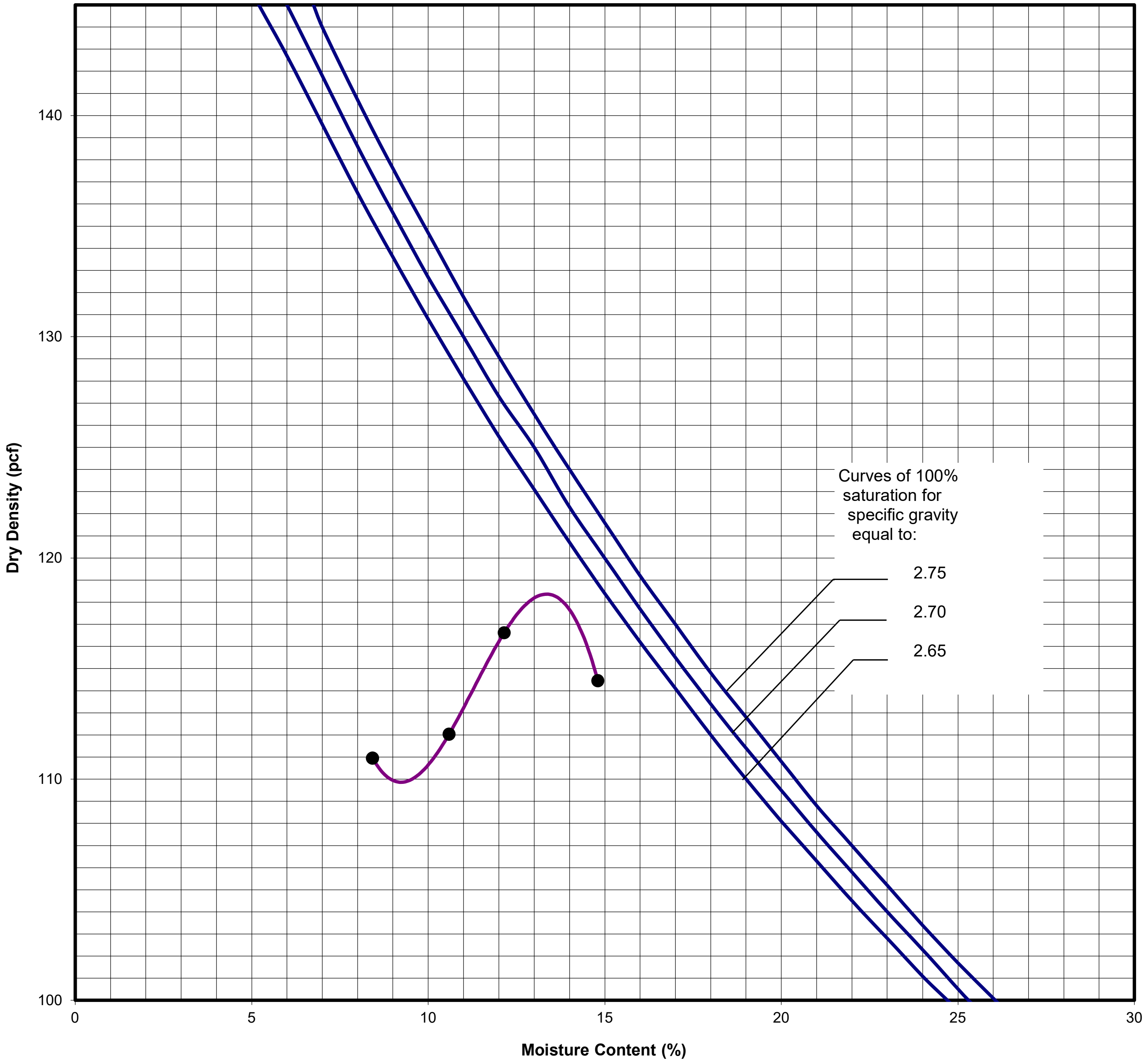
Soil Description: Silty Clay (CL)

Sample Location: B-1 @ 0'-3'

Test Method: D1557-A

Maximum Dry Density (pcf): **118.4**

Optimum Moisture Content (%): **13.4**



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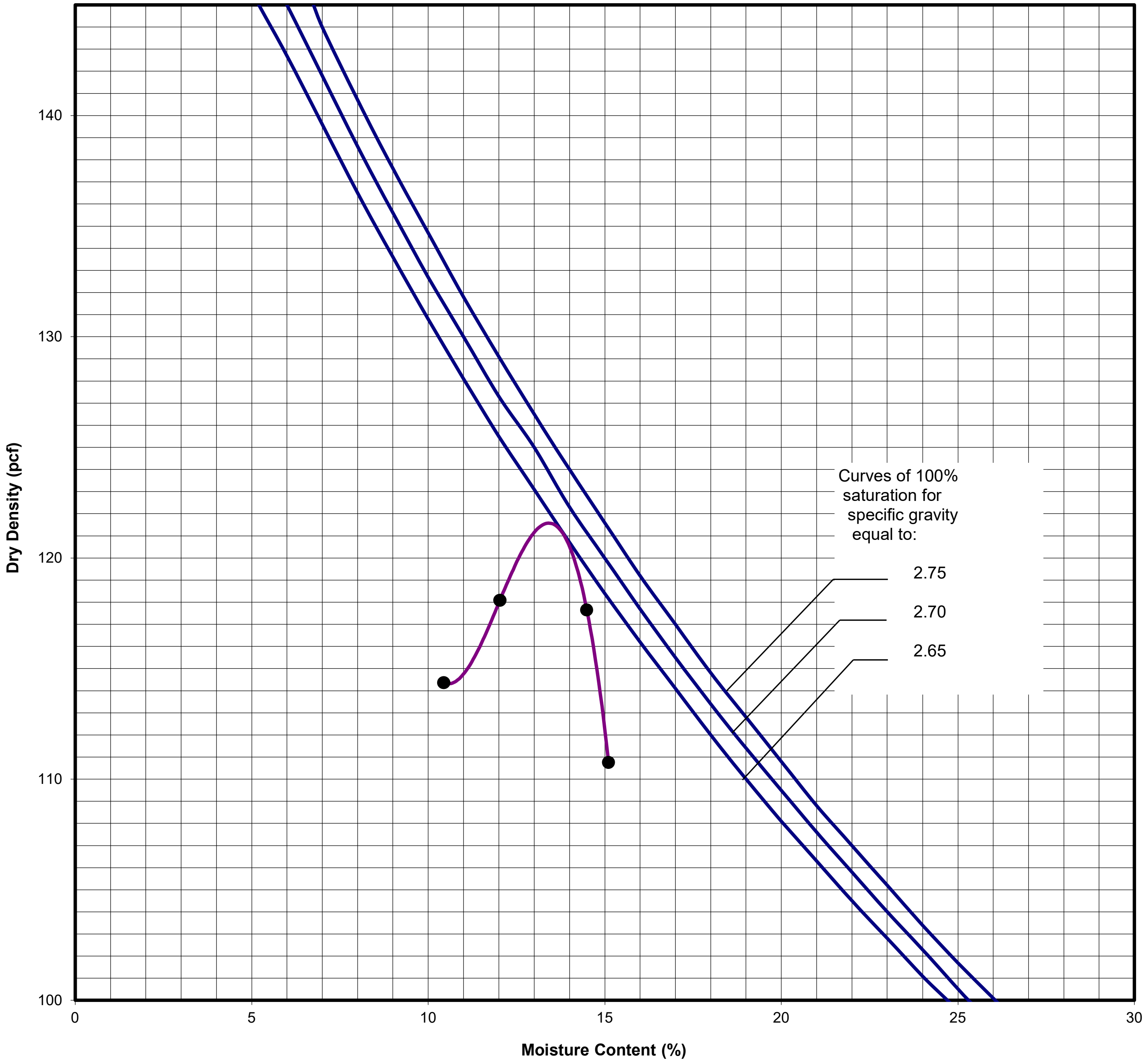
Moisture Density Relationship

Plate C-3

Client: Manterra
Project: Tract 941 Units Gateways Infrastructure
Project No.: LE22078
Date: 4/21/2022
Lab. No.: EC2-253

Soil Description: Silty Clay (CL)
Sample Location: B-3 @ 0'-3'
Test Method: D1557-A
Maximum Dry Density (pcf): **121.6**
Optimum Moisture Content (%): **13.4**



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Moisture Density Relationship

Plate C-4

LANDMARK CONSULTANTS, INC.

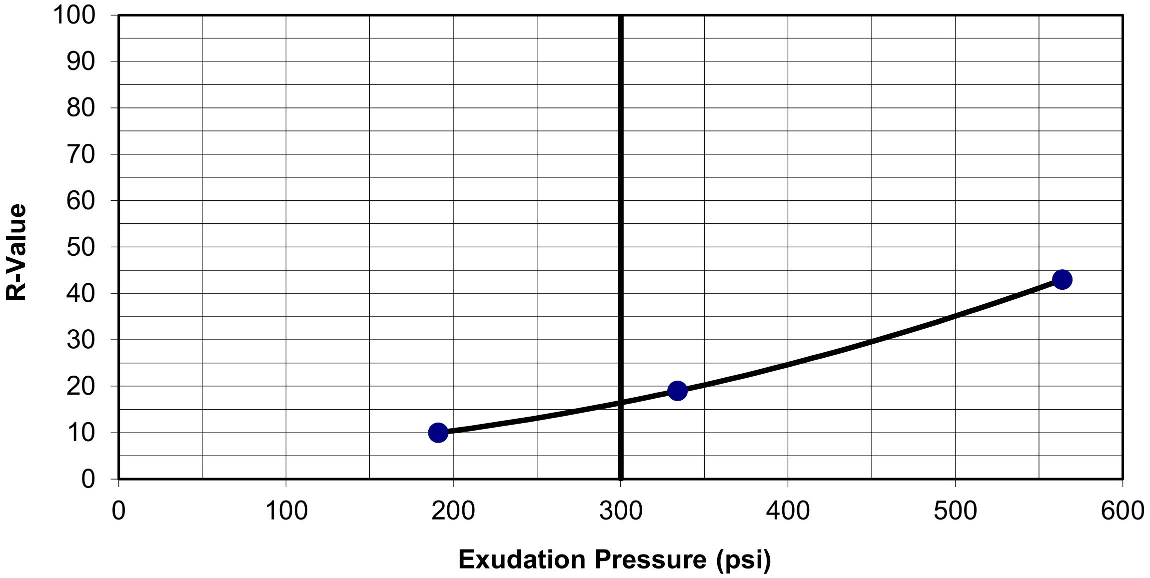
Client: Materra Farming Company LLC
Project: Tract 941 Unit 5 Gateway - Infrastructure Development
Project No.: LE22078
Date: 04/27/22

R-Value By Exudation Pressure (ASTM D2844/CAL 301)

Description: Silty Clay (CL)
Sample Location: B-2
Sample Depth: 0-3 ft.

Sample	**A**	**B**	**C**
Moisture Content, %:	15.5%	14.0%	13.0%
Dry Density, pcf:	115.5	118.6	120.4
Compaction foot pressure, psi:	300	350	350
Specimen Height, in.:	2.51	2.50	2.49
Stabilometer, Ph @ 1000 lb:	62	52	34
Stabilometer, Ph @ 2000 lb:	138	122	82
Displacement:	3.48	3.26	3.09
Expansion pressure, psf:	13	105	258
Exudation pressure, psi:	191	334	564
Equilibrum R Value:	10	19	43

R-Value **16**



Geo-Engineers and Geologists

Project No.: LE22078

R-Value Test

Plate

C-5

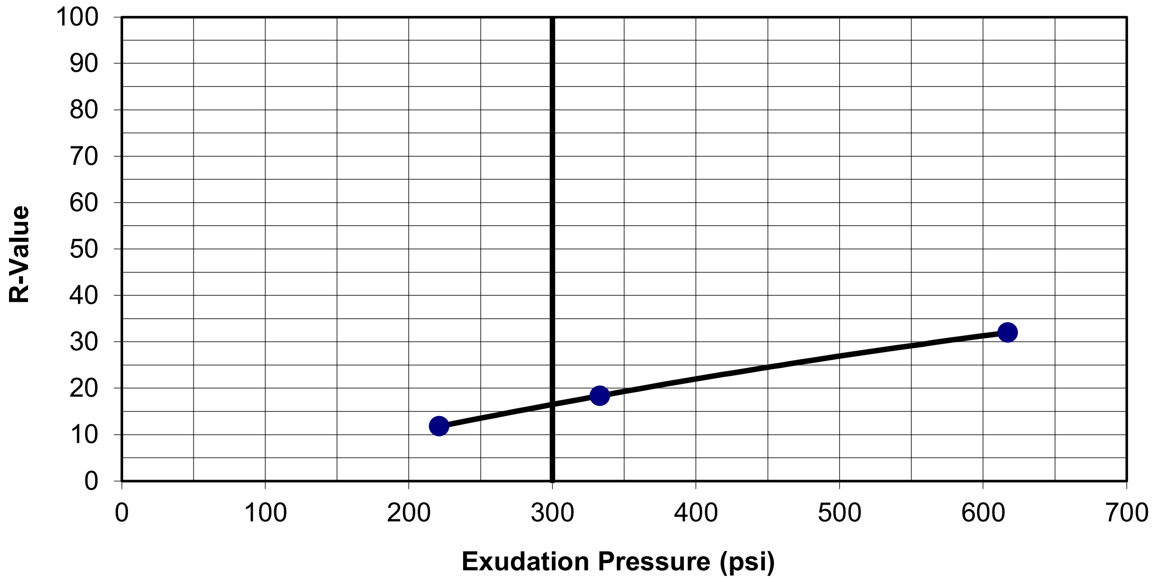
LANDMARK CONSULTANTS, INC.

Client: Materra Farming Company LLC
Project: Tract 941 Unit 5 Gateway - Infrastructure Development
Project No.: LE22078
Date: 04/27/22

R-Value By Exudation Pressure (ASTM D2844/CAL 301)

Description: Silty Clay (CL) w/some fine sand
Sample Location: B-4
Sample Depth: 0-3 ft.

Sample	A	B	C
Moisture Content, %:	15.0%	14.0%	13.0%
Dry Density, pcf:	116.7	119.0	120.7
Compaction foot pressure, psi:	250	350	350
Specimen Height, in.:	2.45	2.53	2.50
Stabilometer, Ph @ 1000 lb:	62	58	43
Stabilometer, Ph @ 2000 lb:	135	125	100
Displacement:	3.28	3.23	3.17
Expansion pressure, psf:	4	22	135
Exudation pressure, psi:	221	333	617
Equilibrum R Value:	12	18	32
	R-Value	**17**	



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Geo-Engineers and Geologists

Project No.: LE22078

R-Value Test

Plate

C-6

LANDMARK CONSULTANTS, INC.

CLIENT: Materra Farming Company LLC
PROJECT: Tract 941 Unit 5 Gateway - Infrastructure Development
JOB No.: LE22078
DATE: 04/27/22

CHEMICAL ANALYSIS

Boring:	B-2	B-4	B-6	**Caltrans**
Sample Depth, ft:	0-3	0-3	0-3	**Method**
pH:	7.16	6.62	6.97	**643**
Electrical Conductivity (mmhos):	--	--	--	**424**
Resistivity (ohm-cm):	830	820	710	**643**
Chloride (Cl), ppm:	280	220	220	**422**
Sulfate (SO4), ppm:	504	660	1,116	**417**

General Guidelines for Soil Corrosivity

Material Affected	Chemical Agent	Range of Values	Degree of Corrosivity
Concrete	Soluble Sulfates (ppm)	0 - 1,000	Low
		1,000 - 2,000	Moderate
		2,000 - 20,000	Severe
		> 20,000	Very Severe
Normal Grade Steel	Soluble Chlorides (ppm)	0 - 200	Low
		200 - 700	Moderate
		700 - 1,500	Severe
		> 1,500	Very Severe
Normal Grade Steel	Resistivity (ohm-cm)	1 - 1,000	Very Severe
		1,000 - 2,000	Severe
		2,000 - 10,000	Moderate
		> 10,000	Low

LANDMARK
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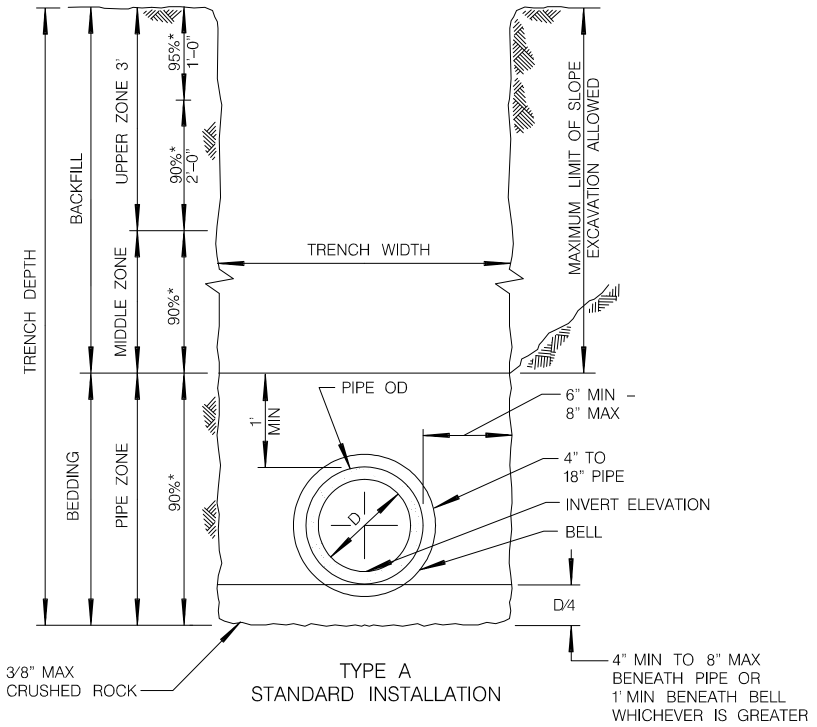
Project No.: LE22078

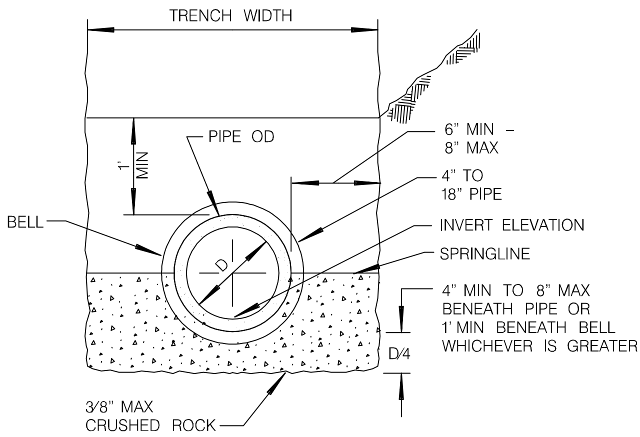
Selected Chemical Test Results

Plate
C-7

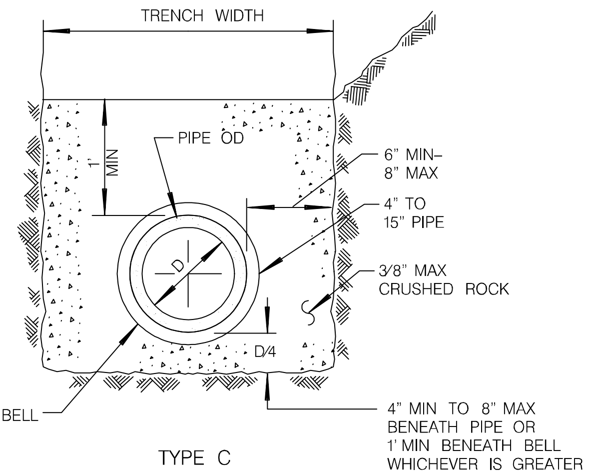
APPENDIX D



TYPE A
STANDARD INSTALLATION



TYPE B
ROCK TO SPRINGLINE



TYPE C
ROCK ENVELOPE

NOTES

1. FOR TRENCH RESURFACING IN IMPROVED STREETS, SEE STANDARD DRAWINGS SDG–107 AND SDG–108.
2. (*) INDICATES MINIMUM RELATIVE COMPACTION.
3. MINIMUM DEPTH OF COVER FROM THE TOP OF PIPE TO FINISH GRADE FOR PVC SDR 35 SEWER MAIN SHALL BE 5'. FOR SHALLOWER DEPTH, SPECIAL DESIGN IS REQUIRED. SEE SDS–101.
4. SEE TYPE A INSTALLATION FOR DETAILS NOT SHOWN FOR TYPES B AND C.
5. FOR PIPE SIZE ENCASEMENT LARGER THAN 15", MAXIMUM SIDE WALL CLEARANCE SHALL BE 12" OR AS SHOWN ON THE PLANS.
6. 6" METAL TAPE SHALL BE INSTALLED ABOVE PIPE 4" BELOW TRENCH CAP AND 12" BELOW FINISH GRADE IN UNIMPROVED STREETS.
7. 1' SAND CUSHION OR A 6" MINIMUM SAND CUSHION WITH 1" NEOPRENE PAD SHALL BE PLACED FOR CROSSINGS UTILITIES WHEN VERTICAL CLEARANCE IS 1' OR LESS. THE NEOPRENE PAD SHALL BE PLACED ON THE MOST FRAGILE UTILITY.

From: City of San Diego Standard Drawing SDS-110 (2016)

LANDMARK
Geo-Engineers and Geologists
Project No.: LE22078

Pipe Bedding and Trench Backfill Recommendations

Plate D-1