Bid No. RPU-7464

Magnolia Avenue and Ramona Drive Water Distribution Main Replacement Project

ADDENDUM NO. 1

03/09/2017

Refer to the attached pages for any questions/changes.

*** ACKNOWLEDGEMENT OF THIS ADDENDUM IS REQUIRED. Please acknowledge all addenda manually by signing and submitting all addenda cover pages as part of your final submittal before the deadline. Failure to acknowledge an addendum, unless the requirement to acknowledge has been waived, will immediately cause your bid to be deemed non-responsive.

Authorized Signature____

(Sign here to acknowledge receipt of this addendum)

ADDENDUM NO. 1

BID NO. RPU-7464

CITY OF RIVERSIDE PUBLIC UTILITIES DEPARTMENT

WATER ENGINEERING DIVISION

SPECIFICATION NO. 870, CONSTRUCTION DRAWINGS D5-1107917

MAGNOLIA AVENUE AND RAMONA DRIVE WATER DISTRIBUTION MAIN REPLACEMENT PROJECT

Date: 3/8/17 Authorized: ______________________
Simon K. Lee, RCE 73040

ALL ADDENDA MUST BE ACKNOWLEDGED: BIDDER SHALL ACKNOWLEDGE RECEIPT OF THIS ADDENDUM ON THE PROPOSAL FORMS. ADDENDA SHALL BECOME AN INTEGRAL PART OF THE SPECIFICATIONS AND PLANS.

Construction Plans D5-1107917:

1) **The bid due date and time has been extended to Tuesday, March 14, 2017 before 2:00 PM.**

Construction Plans D5-1107917:

2) **The note "CONSTRUCTION ON MAGNOLIA AVNEUE SHALL TAKE PLACE DURING JUNLY 1 THROUGH AUGUST 18, 2017" on Sheet 12 and Sheet 13 has been modified as follow:**

   CONSTRUCTION ON MAGNOLIA AVNEUE SHALL TAKE PLACE DURING JUNE 9 THROUGH JULY 21, 2017

3) **General Note 26 on Sheet 2 has been modified as follow:**

   SEWER LATERAL LOCATIONS ARE APPROXIMATED AS SHOWN IN THE PLAN. CONTRACTOR SHALL LOCATE VIA POTHOLING A MINIMUM OF 5 SEWER LATERALS CROSSING THE PROPOSED WATER MAINS FOR EACH BLOCK OF STREET (I.E. BETWEEN STREET INTERSECTIONS), AND SHALL NOTIFY THE WATER INSPECTOR OF ANY GRADE CONFLICTS PRIOR TO

WATER MAIN TRENCHING. CONTRACOTR MAY OBTAIN PERMISSION FROM THE CITY'S PUBLIC WORK DEPARTMENT, AND VIDEO SEWER MAINLINES TO DETERMINE SEWER LATERAL LOCATIONS AT NO ADDITIONAL COST TO THE CITY. CONTRACTOR SHALL BE RESPONSIBLE FOR ADJUSTING WATER PIPELINE PROFILE OR REMODELING SEWER LATERALS AS NEEDED.

4) **Potholing for sewer laterals shall follow requirements as specified in General Note 26.**

5) **Traffic loops are not shown in the plans. Contractor shall field verify locations and quantities for traffic loop. Contractor shall include price for Traffic loop replacement in the contract price and no additional cost will be allowed.**

6) **Incorporate the attached "Concrete Concrete Street Repair" detail as part of the construction plans.**

Special Provisions:

1) **APPENDIX II – APPROVED MATERIALS LIST has been modified as attached in this addendum.**

2) **APPENDIX V – SOIL INVESTIGATION REPORT has been modified as attached in this addendum.**

3) **APPENDIX VII – DIPRA POLYETHYLENE ENCASEMENT GUIDE has been modified as attached in this addendum.**

4) **APPENDIX VIII – MANHOLE REPORT has been added as attached in this addendum. The report provides sewer manhole information such as location (street centerline stations as shown in plans), offset from street centerline, manhole rim elevation and depth of manhole.**

5) **APPENDIX IX – STATE OF CALIFORNIA PUBLIC CONTRACT CODE SECTION 9204 has been added as attached in this addendum.**

Bid Schedules:

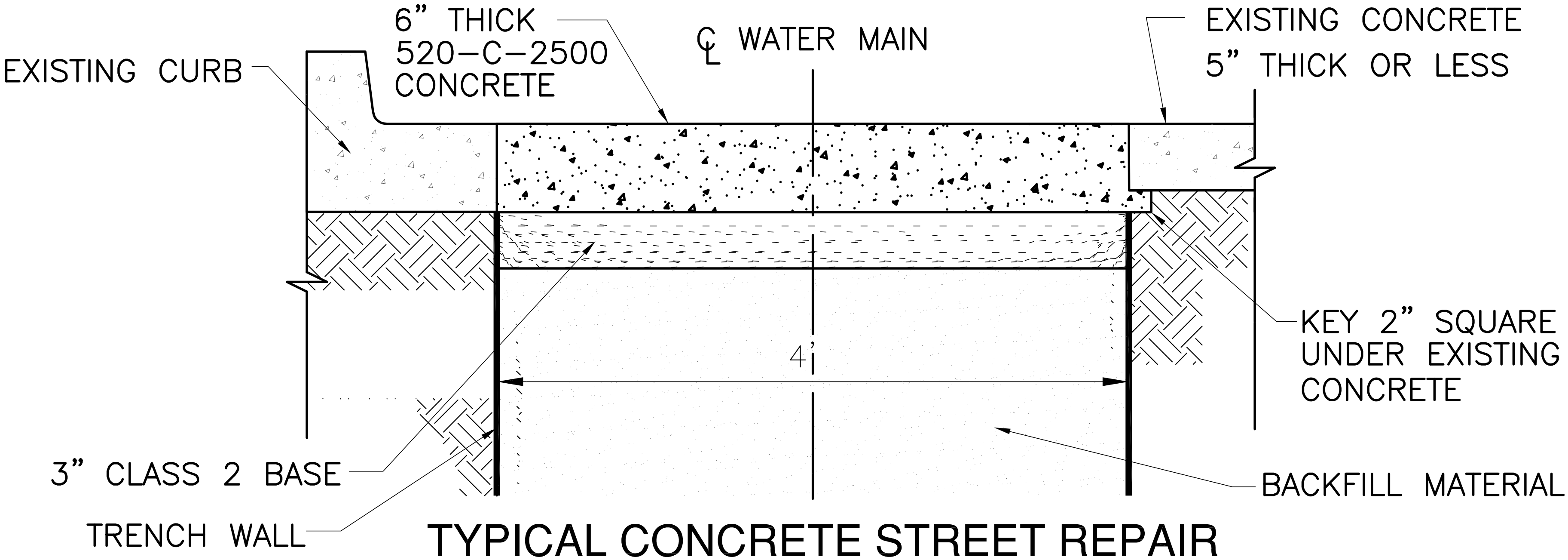
1) **Bid Item 38 has been added to the Bid Schedule as follows and as reflected in the electronic bidding sheet:**

Descriptions:	Furnish and Install 2-inch Combination Air Valve Assembly Complete per CWD-451.
Estimated Quantity:	10
Unit:	EA

2) **Bid Item 39 has been added to the Bid Schedule as follows and as reflected in the electronic bidding sheet:**

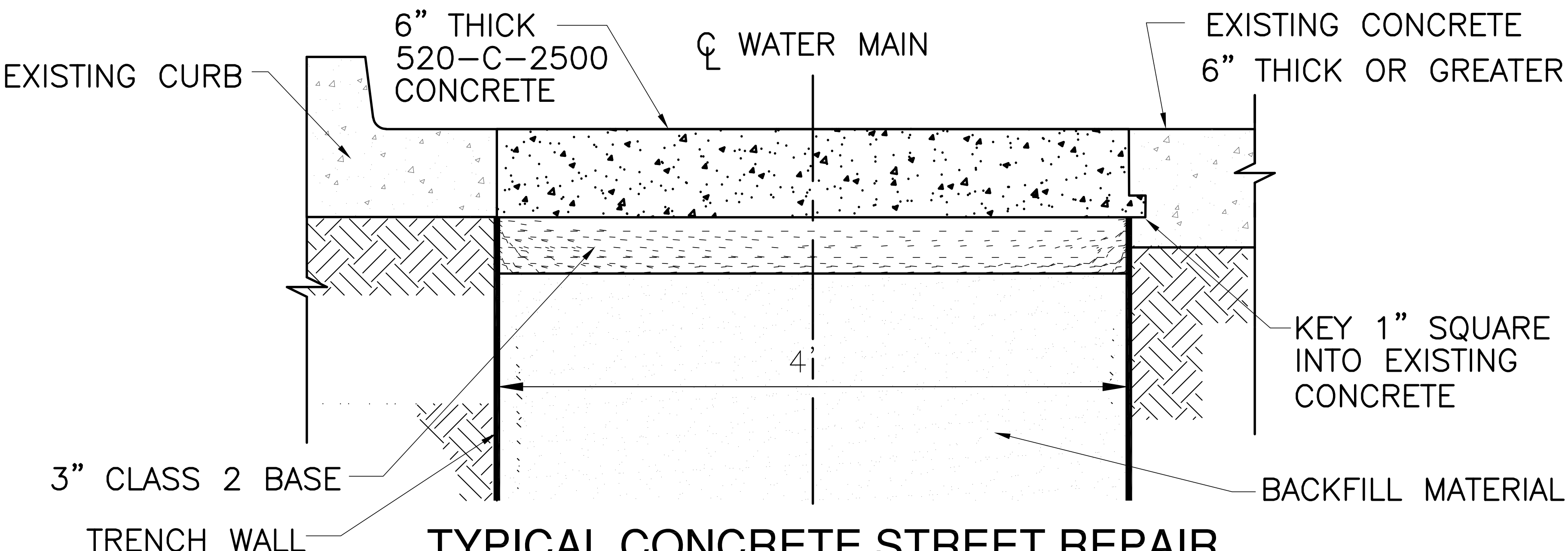
Descriptions:	Excavate and Backfill Waterline Trench up to Additional 3 Feet in Depth. This bid item applies to trench work at least 1 foot greater than the minimum depth specified in the plan to avoid utility conflicts as directed by the engineer. Payment for this bid item will be released based on actual quantity at the bid unit price, which shall include all related cost such as, but not limited to, shoring equipment, rock removal, etc.
Estimated Quantity:	8,200
Unit:	L.F.

END



TYPICAL CONCRETE STREET REPAIR

WHERE EXISTING CONCRETE IS 5" THICK OR LESS



TYPICAL CONCRETE STREET REPAIR

WHERE EXISTING CONCRETE IS 6" THICK OR GREATER

APPENDIX II

Appendix II - Approved Materials List

Section 207 - Pipe		
207-9	**Ductile Iron Pipe**	
207-9.2.2 (4)	Restrained Pipe Joints	"Field-LOK 350" Gaskets, for use with "Tyton" joint pipe only, manufactured by U.S. Pipe and Foundry Company.
		"Sure Stop 350" Gaskets, manufactured by McWane, for use with "Tyton" joint pipe only, manufactured by McWane Ductile.
		"Fast-Grip" Gaskets, for use with "Fastite" joint pipe only, manufactured by American Cast Iron Pipe Company.
		"Grip Ring", as manufactured by Romac Industries, Inc., for use with Mechanical Joint Pipe and/or Fittings.
		"Megalug Series 1100", as manufactured by EBAA Iron, for use with Mechanical Joint Pipe and/or Fittings.
		"RomaGrip", as manufactured by Romac Industries, for use with Mechanical Joint Pipe and/or Fittings.
		"Gripper Gaskets" by the Gripper Gasket Company are not permitted.
207-9.5	Pipe Manufacturers	McWane Ductile
		United States Pipe and Foundry Company
		American Cast Iron Pipe Company
207-9.6	Fittings Manufacturers	Star
		Sigma/Nappco
		Tyler/Union
		SIP Industries
207-10	**Steel Pipe**	
207-10.4.2.2	Pipe and Fittings Manufacturers	Ameron Pipe Products Group
		Imperial Pipe Services, LLC
		Kelly Pipe Company
		Northwest Pipe and Casting Company
		Southland Pipe Corp.
		West Coast Pipe Linings Inc.
207-25	**Miscellaneous Pipe**	
207-25.1.1	Copper Tubing or Pipe	J.W. Harris Company
		Stay Safe 50
		Stay Safe Bridget
207-30	**Polyvinyl Chloride Pipe**	
207-30.1.5	Fittings Manufacturers	Star
		Sigma/Nappco
		Tyler/Union
		SIP Industries
Section 210 - Paint and Protective Coatings		
210-1.5	Primer and Paint	Primer:
		Rust-Oleum
		Dunn Edwards
		Devoe
		Paint:
		Rust-Oleum
		Dunn Edwards
		Devoe
210-1.5 (i)	Paint Suppliers	Dunn Edwards, Riverside – (951) 784-1758
		Vista Paint, Riverside – (951) 689-2501
		Glidden Professional, Riverside – (951) 274-7888
Section 250 - Valving, Appurtenances and Miscellaneous Material		
250-2	**Gaskets**	Style 50 by Garlock Rubber Technologies
		Style AB-619 by TRIPAC
250-3	**Insulation Gaskets**	PSI Products, Inc., Burbank, California
		Central Plastics Company, Shawnie, Oklahoma
		CALPICO Inc., San Francisco, California
250-4.1.1	**Butterfly Valves**	Pratt - Groundhog, Triton XR-70
		Mueller – Lineseal III
		De Zurick – BAW
		Krispin K-Flow 500 series - 3" to 20"
250-5	**Gate Valves**	
250-5.1	2-inch to 3-inch Gate Valves	Mueller Co. A-2360
250-5.2.3	Resilient Seat Gate Valves	American Flow Control Series 2500
		Clow Series 6100
		AVK Series 25
		Mueller Model- 2360 or 2362
		M & H Style 4067 NRS
250-5.3	Tapping Sleeves	Stainless Steel Sleeve:
		Smith-Blair 662 and 663
		Romac SST or Romac FTS 420
		Powerseal 3490-AS
		Mechanical Type Joint:
		Mueller-Mechanical Joint Tapping Sleeve
		Clow-Mechanical Joint Tapping Sleeve
		American Flow Control - Mechanical Joint Tapping Sleeve

250-6	**Valve Box Caps**	South Bay Foundry, San Diego, CA
250-7	**Air Valves**	Crispin, 2-inch - UL20.1-Universal Air Release Valve.
		Crispin, 4-inch – UL41.1-Universal Air Release Valve.
		Crispin, 6-inch – C61-Combination Air Valve.
		Crispin, 8-inch – C81-Combination Air Valve.
		A.R.I., 2-INCH THRU 10-INCH – D-060-C HF.
		A.R.I., 2-INCH – D-040 (interior use only).
		Crispin 2-inch Model DL20 - Deep well air valve
250-10	**Flow Meter**	
250-11.2.1	Service Saddles (Service Clamps)	Mueller Cat. No. BR 2 B 0474 IP, BR 2 B 0684 IP, BR 2 B 0899 IP, BR 2 B 1104 IP, BR 2 B 1314 IP
		Smith-Blair Cat. No. 323-0510 thru 323-1426
		R.H. Baker Cat. No. 183-413 TAP thru 183-1426 TAP
		Jones Cat. No. J-979
		McDonald No. 3826
		Ford - 202B
		Cambridge Cat. No. 810
		Rockwell Cat. No. 323-0510 thru 323-
250-13.1	Fire Hydrants/Blowoff Assemblies	<u>Regular Hydrant</u>:
		CLOW CORP., Corona, California, 800 Series, Model 850.
		CLOW CORP., Corona, California, 900 Series, Model 950.
		AMERICAN AVK CO., Fresno, California, Model 2472
		<u>Super Hydrant</u>:
		CLOW CORP., Corona, California, 800 Series, Model 860
		CLOW CORP., Corona, California, 900 Series, Model 960.
		AMERICAN AVK CO., Fresno, California, Model 2492
250-14	**Bolted, Sleeve-Type Couplings**	
250-14.1.1	Flexible Couplings	Baker Series 200
		Dresser Style 38
		Smith-Blair 411 and 441
		Romac Style 501
		Ford Style FC1 and FC2
250-14.2.1	Flanged Coupling Adapters	Baker Series 601
		Smith-Blair 912, 913, and 914
		Ford Style FFCA
		Romac FCA 501
250-15	**Meter Boxes**	<u>1" Services (3/4" or 1" Meters)</u>:
		Armorcast, A6000485 (Polymer Concrete Box & Cover)
		J & R Concrete Products, P-W4½ Series (Fiberglass Box W/Polymer Concrete Ring & 2 pc. Polymer Concrete Cover)
		<u>2" Services (1 ½" or 2" Meters)</u> :
		Armorcast, A6001640PCX12 (Polymer Concrete Box W/Polymer Concrete Cover and Drop-In Lid)
		J & R Concrete Products, P-W5½ Series (Fiberglass Box W/Polymer Concrete Ring & 2 pc. Polymer Concrete Cover)

APPENDIX V

December 24, 2012

Project No. 12069-01

TO: City Of Riverside
Public Utilities Department
3750 University Avenue, 3rd Floor
Riverside, California 52501

ATTENTION: Mr. Kevin Munns

SUBJECT: Preliminary Geotechnical Investigation Report, Magnolia/Ramona Drive Water Main Replacement Project, City of Riverside, California

Introduction

In accordance with your authorization, GeoMat Testing Laboratories, Inc. has conducted a preliminary geotechnical investigation for the subject project alignment. The purpose of these services was to address geotechnical issues for the preliminary design of the proposed water line. This report summarizes the findings of the subsurface exploration and the preliminary geotechnical study.

Scope of Work

- Review soils, groundwater data and maps in our files,
- Subsurface exploration utilizing hollow stem augers,
- Logging borehole, sampling of select soils, and observe drilling characteristics,
- Laboratory testing of a select soil sample,
- Performing engineering analyses to develop design guidelines and recommendations,
- Seismic design criteria for project areas,
- Recommended foundation types for structures and/or subgrade considerations for the pipe,
- Recommended shoring type(s) and temporary excavation slopes,

Site Conditions

The site area located within the boundaries of the drilled boreholes is residential except for the area on Magnolia Avenue north of Ramona Drive where it is institutional. The boreholes were drilled in paved streets as shown on the provided borehole location map. For site vicinity refer to Figure 1.

Present underground utilities include but not limited to sewer, water, storm drain, gas, and dry utilities. Overhead telephone and electric drops were also noted.

Proposed Development

We understand that the existing water line will be replaced with new line. The new 7500 feet 8-inch and 12-inch ductile iron pipe line will be installed in the upper ten feet from ground surface. No other details are available for the water line or appurtenances.

Subsurface Exploration

Five exploratory boreholes were drilled on December 22, 2012, to a maximum depth of 10 feet below existing ground surface utilizing a CME 45 equipped with 6-inch hollows stem augers. The borehole locations were provided to us and are depicted on Plate 1. The pavement was cored at all the boring locations prior to drilling and pavement thickness information was obtained. All boreholes were backfilled with native cutting and patched at the surface with cold asphalt patch.

It is worth noting here that concrete obstructions were encountered at borehole B-2. Three attempts were made to drill. The obstructions were encountered at two drilling locations; at 1.5 and 3 feet below ground surface. The obstruction was not encountered at the third drilling attempt. The three attempts were made approximately five to ten feet from west bound curb (north-side of street).

Sampling Method

Relatively undisturbed sample was obtained with the California Ring Sampler (ASTM D 1587). This sampler has three inches external diameter, 2.5 inches inside diameter, and is lined with one inch high brass rings, with an inside diameter of 2.41-inches. The sample barrel is driven into the ground at the bottom of the boring with 140-pound hammer with a free fall of approximately 30-inches. Sampler driving resistance, expressed as blows per six inches of penetration, is presented on the boring logs at the respective sampling depths. Blow counts required to drive the samplers 18-inches are recorded on the boring logs. The sum of the number of blows for the last 12 inches on an 18-inch penetration represents the SPT count. Ring samples were retained in close-fitting, moisture tight canisters for transport to our laboratory for testing.

Bulk samples were also collected from the auger cuttings during drilling. These samples are collected in plastic bags tied and tagged for the location and depth.

The geotechnical boring logs are presented in Appendix B and may include a description and classification of each stratum, sample locations, blow counts, groundwater conditions, results from selected types of laboratory tests, and drilling information.

Subsurface Findings

The subsurface materials encountered at the boring locations are briefly described below. Detailed descriptions are provided in the boring logs, which are presented in Appendix B.

According to the Geologic map of City of Riverside and the preliminary geologic map for Riverside West Quadrangle (Plate 2) the soil units at the site are as follows:

Borehole	Street	Soil Unit	Blow Count in upper 5'	Compactness
B-1	Magnolia Avenue	Very Old Alluvial fan deposits	21	Medium dense
B-2	Ramona Drive East	Old Alluvial fan deposits	29	Medium dense
B-3	Ramona Drive West	Very Old Alluvial fan deposits	25	Medium dense
B-4	Larchwood Place	Old Alluvial fan deposits	21	Medium dense
B-5	Ramona Drive South	Old Alluvial fan deposits	33	Dense

Man Made Material (af)

The surface material at boreholes was asphalt concrete over various types of base material. The following is a summary of the structural sections at the exploratory borehole locations.

Borehole	Street	Asphalt Concrete (in)	Base Material (in)	Base Material Type
B-1	Magnolia Avenue	15	8	Aggregate Base
B-2	Ramona Drive East	4	5	Mcadam
B-3	Ramona Drive West	10	0	No base
B-4	Larchwood Place	2.5	2	DG
B-5	Ramona Drive South	4	2	DG

Older Alluvial Fan Deposits (Qof)

This material is indurated, sandy, and slightly cemented. Most of unit is slightly to moderately dissected and reddish brown. Some Qof includes thin, discontinuous surface layer of younger alluvial fan material. The ASTM classification of this material is Silty Sand (USCS "SM"), Clayey sand (USCS "SC"), and sandy Silt (USCS "ML"). Boreholes B-2, B-4, and B-5 were drilled in this material. Based on the Standard Blow Count (SPT) the soils were found to be mostly medium dense to dense.

Very Old Alluvial Fan Deposits

This material is is well dissected, well indurated sand deposits. The ASTM classification of this material is Silty Sand (USCS "SM") and Clayey sand (USCS "SC"). Boreholes B-1 and B-3 were drilled in this material. Based on the Standard Blow Count (SPT) the soils were found to be moderately dense and.

Groundwater

Groundwater study is not within the scope of this work. Groundwater was not encountered in our exploratory borings at the time this work was performed.

Highest historical groundwater depth is available from Western Municipal Water District's Well Measuring Program. Two data points were located near the proposed alignment. Based on the data groundwater is not expected to interfere with project development.

Well No.	Surface Elevation	Highest Historical Depth to Water (ft)	Date	Well Location
2S5W22R002S	788	14	5/24/99	Evan Park
2S5W26M001S	811	37	5/26/98	Near B-5

Laboratory Testing

Laboratory testing was performed on soil samples collected during our subsurface exploration. The geotechnical testing program was provided by the City of Riverside. Included are the following tests:

Test	ASTM Designation
Classification	Soils were classified in accordance with the Unified Soil Classification System (USCS) in general accordance with ASTM 2488. Soil classifications are indicated on the borehole logs in Appendix B and graphically represented in Appendix C.

Test	ASTM Designation
In Place Moisture Content and Dry Density	The results of these tests can be used to compute the overburden pressure, to correlate strength data and to aid in evaluating soil properties. The moisture content and dry density of relatively undisturbed samples obtained from the exploratory borings were evaluated in general accordance with ASTM D2216 and D2937. The test results are presented on the borehole logs in Appendix B.
Sand Equivalent	The sand equivalent test provides a measure of the relative proportions presented in empirical value of detrimental fine dust or clay-like material in soil. The test was conducted in accordance with ASTM D2419 method.
Direct Shear Strength	Consolidated drained (saturated) direct shear tests were performed to evaluate the shear strength parameters of the site soils. The direct shear test was performed in accordance with ASTM 3080. The samples were inundated during shearing to represent adverse field condition. The sample was re-sheared to determine the residual shear strength of the material. Peak and residual shear strength are provided in this report.
R-Value	California Test 301 This test measures the lateral response of a compacted sample of soil or aggregate to a vertically applied pressure under specific conditions. This test is used by Caltrans for pavement design, replacing the California bearing ratio test.
Resistivity	The electrical resistivity of each soil specimen is conducted in a two-stage process using the soil box method. The first stage measures the resistivity of the soil in its as-received condition and the second stage records the value after saturation with distilled water. The results are presented in Appendix C.
Sulfate	A sample of dry soil is mixed with distilled water and allowed to stand overnight. The top aliquot is mixed with distilled water and a conditioning agent. The solution is then placed in a graduated cylinder and the value recorded based on the clarity of the solution. The results are presented in Appendix C.
Chloride	A sample of dry soil is mixed with distilled water and allowed to stand overnight. The top aliquot of the sample is mixed with chloride indicator and titrated over silver nitrate solution. The chloride content is determined by the difference of the volumes required to complete titration. The results are presented in Appendix C.
Ph	A sample of dry soil and distilled water are placed in a flask and allowed to stand for approximately an 24 hour to stabilize. The pH is measured using a pH meter that has been compensated for temperature. The results are presented in Appendix C.

The moisture content, dry density, and sand equivalent test results are presented at the corresponding sample depths on the boring logs in Appendix B. The results of the other laboratory tests and graphical presentation of the test results is presented in Appendix C.

A list of sample obtained during the subsurface work and corresponding tests performed for this study is as follows:

Boring	Depth (ft)	Moisture	Density	Sieve Analysis	Direct Shear	Sand Equivalent	R-value	Resistivity	Sulfate	Chloride	pH
B-1	5	X	X	X		X	X				
B-1	10	X	X								
B-2	3-4	X				X		X	X	X	X
B-2	5	X	X	X							
B-2	10	X	X			X					
B-3	3-4	X				X		X	X	X	X
B-3	5	X	X	X							
B-3	10	X	X	X	X						
B-4	5	X	X		X	X		X	X	X	X
B-4	10	X	X	X							
B-5	5	X	X	X	X	X	X				
B-5	10	X	X	X							

<u>Shear Strength</u>

Based on direct shear test results, the cohesion intercept (c) and friction angle (φ) representing the effective residual shear strength of the onsite alluvium range from 17to 369 psf and 23 to 32 degrees, respectively. A graphical representation of the test results can be found in Appendix C. The strength test results are summarized in the following table.

Sample	Average Density	Average Moisture	Saturated Moisture	Cohesion	Friction Angle	Total Unit Weight	Allowable Soil Bearing (psf)	Active EFP*	At Rest EFP*	Passive EFP*,**	Soil Friction
				Ultimate	Ultimate						
B-3 @ 10'	109 pcf	12%	23%	233 psf	23°	122 pcf	1800	53	74	186	0.28
B-4 @ 5'	115 pcf	16%	24%	369 psf	29°	133 pcf	4000	46	69	256	0.37
B-5 @ 5'	102 pcf	12%	26%	171 psf	32°	114 pcf	3200	35	54	247	0.42

**Based on In-place Unit Weigh . **Maximum Passive EFP is limited to 8 times the tabulated value.*

The values shown in the above table represent our interpretation of the soil properties based on the available laboratory and field test data. Use of the soil properties shown above may or may not be appropriate for a particular analysis, since choice of design parameters often depends on whether total or effective stress analysis is used, rate of loading, duration of loading, geometry of loaded area, and other factors. The total unit weight values shown above represent our interpretation of soil unit weight at natural moisture content. The allowable bearing pressures include a factor of safety of three

Sand Equivalent

One laboratory sand equivalent test was conducted for select soil samples to estimate the soils ability to self-compact. Test results show that the sand equivalent value ranges from 12 to 45. A value greater than 30 indicates that the soil are considered self-compact when wet. Clean soils with SE value of greater than 30 may be used as bedding or shading material.

Site Geology

This is a fully developed neighborhood. The area is nearly level except for the area east of borehole B-2. The native ground is underlain by late to early Pleistocene old and very old alluvial fan deposits. Refer to Plate 2 for geologic material distribution.

Active Faults

Based on the Regional Fault Zone map presented in City of Riverside General Plan, there are no faults known to transverse the site.

Liquefaction Potential

The City of Riverside General Plan shows the intersections of Ramona Drive at Brockton Avenue and at Olivewood are mapped as subject to moderate potential for liquefaction. The rest of the subject area surrounding exploratory boreholes is mapped as subject to low potential for liquefaction. Refer to Plate 3.

In our opinion, areas geologically mapped as old and very old alluvial deposits, where the soil unit is relatively dense or firm, are typically considered resistant to liquefaction.

Ground Motion

The CGS Probabilistic Seismic Hazards Mapping Ground Motion Page provides an overall Pga in alluvium, here, of 0.501g to 0.508g (10% probability of being exceeded in 50 years).

Seismic Design Parameters:

The CBC seismic design parameters are presented in the following table.

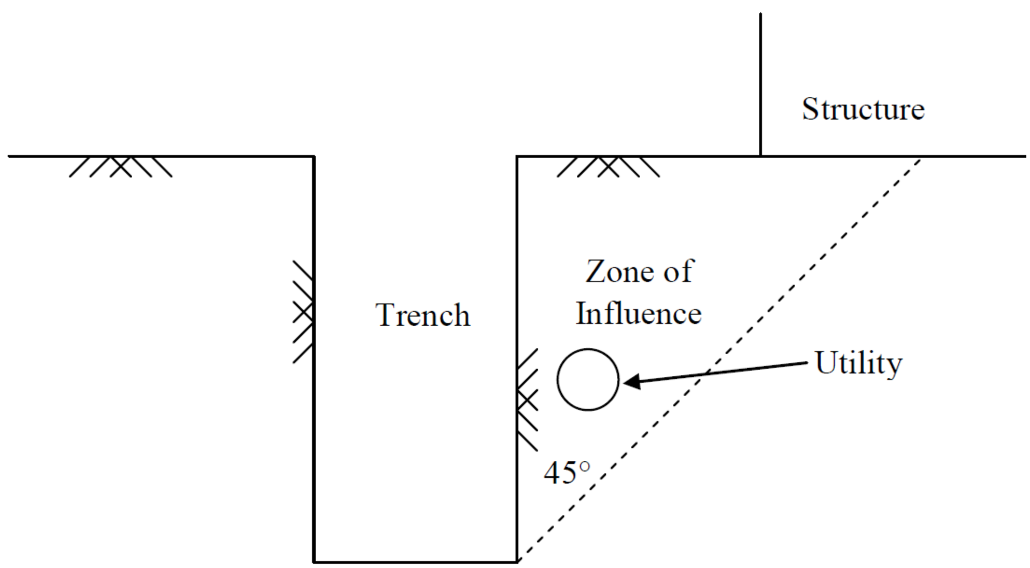
Parameter	Design Value
Site Class	D
0.2 second Spectral Response Acceleration, S_s	1.500
1.0 second Spectral Response Acceleration, S_1	0.600
Site Coefficient, F_A	1.0
Site Coefficient, F_V	1.5
Maximum considered earthquake spectral response accelerations for short periods, S_{MS}	1.500
Maximum considered earthquake spectral response accelerations for 1-second periods, S_{M1}	0.900
Design Spectral Response Acceleration at Short Periods, S_{DS}	1.000
Design Spectral Response Acceleration at 1-Second Periods, S_{D1}	0.600
Long-Period Transition Period in Seconds, T_L	8

Temporary Cut Slopes

The stability of temporary cut slopes made during site work is a function of many factors, including, but not limited to, the following considerations: 1) the presence and abundance of groundwater; 2) type and density of the various soil strata; 3) the depth of the cut; 4) surcharge loadings adjacent to the excavations; and 5) the length of time the excavation remains open. Consequently, it is exceedingly difficult to establish a safe and maintenance-free cut slope angle in advance of construction. Cut slope stability should, therefore, be the responsibility of the contractor, since he is continuously at the job site, able to observe the nature and condition of the subsurface materials encountered, monitor the cut performance, and control the scheduling of site activities.

We recommend that excavations greater than 4 feet in vertical height be adequately sloped or braced to prevent injury to workmen from localized sloughing and spalling. All excavations should be accomplished in accordance with applicable local, State or Federal safety provisions. Construction site safety generally is the sole responsibility of the Contractor, who should also be solely responsible for the means, methods, and sequencing of construction operations. The site soils encountered in the boreholes is classified as Type B soils.

No surcharge loads should be permitted within a horizontal distance equal to the height of cut or 5 feet, whichever is greater from the top of the cut, unless the cut is shored appropriately. Excavations that extend below an imaginary plane inclined at 45 degrees below the edge of any adjacent existing site foundation should be properly shored to maintain support of the adjacent structure.



Where settlement sensitive facilities are within the zone of influence, additional analysis should be done to determine both the amount of movement that is expected at the location of the facility, as well as the amount of movement that is acceptable. In the event that the movement anticipated at the location of the facility is unacceptable, the project plans and specifications should require support systems that restrict the movement of the sides of the trenches. Support systems should be designed for the specific situation by a registered professional engineer.

During construction, the soil conditions should be regularly evaluated to verify that conditions are as anticipated. The contractor shall be responsible for providing the “competent person” required by OSHA standards to evaluate soil conditions. Close coordination between the competent person and the geotechnical engineer should be maintained to facilitate construction while providing safe excavations.

Based on the material encountered in the exploratory borings, minimum temporary construction cut slopes should be as follows:

Maximum Depth of Cut (ft)	Maximum Slope Ratio (Horizontal : Vertical)
0-4	Vertical
4-8	1:1
8+	1.5:1

Under adverse weather conditions, temporary slopes should be draped with plastic sheeting or other means to protect them from the elements and minimize sloughing and erosion.

Precaution for Trench Excavations

The planned construction will be performed along alignments near existing utility installations (either crossing or paralleling the new alignments). The contractors should be aware of potential excavation stability problems while working in the vicinity of old trenches and the excavation system should be designed to accommodate this weak material (trench backfill).

The Contractor should be aware that unsupported excavation depths beyond the recommended safe cut and inclination should in no case exceed those specified in local, state, and/or federal safety regulations (e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations).

Such regulations are strictly enforced and, if they are not followed, the Owner, Contractor, and/or earthwork and utility subcontractors could be liable for substantial penalties.

Excavation Characteristics

Difficult excavation is not anticipated when utilizing appropriate equipment in good working condition. Sheepsfoot wheel may be used for compaction. Some of the older alluvium is indurated and may be considered cemented. This material may exhibit hard excavation resistance for small equipment.

Clean dry sand was encountered in boreholes B-4 and B-5 as shallow as 6 feet below ground surface and may be encountered at other locations and depths. This material can easily unravel and cave-in. This may undermine upper soil layers and existing utilities. The contractor should have appropriate equipment to support/brace excavation and protect existing utilities, and structures, etc.

Temporary Shoring

General

Trench excavations, especially when they are above groundwater table, may be supported by methods such as trench shields, speed shoring, soldier piles, Slide Rail^{TM}, cross-braced hydraulic shoring or conventional shields or other forms of shoring may be used where appropriate throughout the project provided Cal OSHA regulations are met.

The choice should be left to the contractor's judgment since economic considerations and/or the individual contractor's construction experience may determine which method is more economical and/or appropriate. The contractor and shoring designer may perform additional geotechnical studies as necessary to refine the means-and-methods of shoring construction. Shoring may be desired or even necessary to reduce excavation quantities and/or to protect existing adjacent utilities or other improvements. Support of all adjacent existing structures without distress is the contractor's responsibility. Shoring systems should be designed by a California licensed civil or structural engineer.

Design Consideration

The design of the shoring system may be controlled by or additional load may result from local soils and geologic conditions. In addition to the lateral forces due to retained earth, surcharge due to improvements, such as the loads from the adjacent footings of an adjacent structure and traffic, should be considered in the design of the earth retain system. Loads applied within a 1:1 projection from the surcharging structure on the stem of the wall shall be considered as lateral surcharge. For lateral surcharge conditions, we recommend utilizing a horizontal pressure equal to 30 percent and 50 percent of the vertical load for active and at-rest conditions, respectively. This horizontal pressure should be applied below the 1:1 projection plane as a uniform distribution. As an alternative, the surcharge pressure may be calculated using Boussinesq stress distribution.

Earth Pressure

In general, it is our opinion that the pressure distribution (for braced walls) should be used for design of sheeting or trench boxes. To reduce the potential for ground movement adjacent to the top of the excavation, the bracing should be preloaded in stages as the excavation is deepened. The detailed earth pressure diagrams are presented on Plates 4 and 5. The average unit weights of soil layers should be determined, and the pressure envelope can be used for the design.

Dynamic Earth Pressure

The seismic load due to lateral earth pressure may be defined in accordance with NAVAC.

Dynamic Component, Yielding Condition $\Delta P_{AE} = 3/8(k_h)\Upsilon H^2$
Dynamic Component, Non-Yielding Condition $\Delta P_{AE} = k_h \Upsilon H^2$

ΔP_{AE} is in lb/linear foot of wall
K_h is equal to $S_{DS}/2.5$
H is height of wall in feet
Υ is equal to the maximum unit weight of the backfill in pcf
The resultant dynamic force acts at a distance of 0.6H

Dynamic forces are short term loading. A one-third increase in bearing pressure and passive resistance may be allowed for dynamic analysis.

Estimated Settlement Adjacent to Open Cuts

Because lateral yield of braced excavation in cohesionless soil is usually small, the loss of ground is also usually small. However, loss of ground due to densification of loose cohesionless deposits may be estimated to be on the order of 1.5 percent of the depth of cut. Settlement due to flow or migration of sands into a cut can also cause loss of ground. This settlement is difficult to estimate because it is dependent on construction techniques and local soil conditions, and whether groundwater is present.

Lateral yield occurs in cuts in soft clays, the surface settlement associated with such cuts may be substantial. The magnitude and extent of these surface settlements may be estimated using the relationships shown in Plate 6.

To reduce the potential for distress to adjacent structures, we recommend that the shoring system be designed to limit the ground settlement behind the shoring to 1/2 inch or less.

Seismically-induced settlement is anticipated if liquefaction occurs during a strong earthquake. The areas near the intersections of Ramona Drive at Brockton Avenue and Olivewood Avenue are zoned as having moderate potential for liquefaction. This settlement should be considered in the design of structures within these areas of the project. Additionally, this settlement will impact underground structures that extend to the ground surface such as manholes and metering station. As the soils settle around these structures as a result of liquefaction, the soils tend to drag these structures down and exert downdrag friction at the contact surface of the soils and the structures. The downdrag friction is estimated as 450 psf and should be incorporated in the seismic design of these structures.

Earthwork

General

This section is intended to address issues that might arise during construction. Our recommendations are intended for use as guidelines in dealing with particular soil conditions. The topics addressed in this section include trench excavation stability and open-cut construction.

The recommendations contained herein are not intended to dictate construction methods or sequences. Instead they are provided solely to assist designers in identifying potential construction problems related to excavation, based upon findings derived from sampling. Depending upon the final design chosen for the project, the recommendations may also be useful to personnel who observe construction activity.

Prospective contractors for the project must evaluate potential construction problems on the basis of their review of the contract documents, their own knowledge of and experience in the local area, and on the basis of similar projects in other localities, taking into account their own proposed methods and procedures.

All earthwork should be performed in accordance with the recommendations presented in the attached General Earthwork and Grading Specifications in Appendix D, unless specifically revised or amended below.

Excavation Considerations

Excavations should satisfy two requirements. First, the soils above final grade must be removed without disturbing the soil below excavation grade, which will support constructed facilities. Second, the sides of the excavation must be stable to prevent damage to adjacent streets and facilities as a result of either vertical or lateral movements of the soil. Although groundwater seepage is not expected, a satisfactory excavation procedure must include, if necessary, an adequate construction dewatering system to lower and maintain the water level at least a few feet below the lowest excavation grade.

Site Preparation

Efforts should be made to locate any existing utility lines and underground obstructions within the proposed alignment. Those lines or obstructions should be removed or rerouted if they interfere with the proposed construction, and the resulting cavities should be properly backfilled and compacted. Utility lines that cannot be relocated should be properly protected in-place to preserve their function which may require shoring or bracing of the excavation to prevent lateral displacement or undermining of the existing utility conduits.

Subgrade Preparation

We recommend that the exposed surfaces at the bottom of the excavations for the pipeline trenches, at-grade and below grade structures be competent and uniform in composition and free of loose soil or debris. Any loose and/or unsuitable materials encountered at the pipe invert should be removed and replaced with adequate bedding material. Refer to the following section “Pipe Bedding” for additional recommendations. If wet or pumping soils are encountered, the excavation bottoms may need to be stabilized by working crushed and broken rock in 12- to 18-inch layers into the soil until a firm base is established on which fill can be placed. The minimum recommended thickness of crushed and broken rock layer is 12 inches to stabilize the wet and pumping soils. The wet soils will need to be air dried and/or mixed with dry material prior to placement as compacted fill. Field evaluation of the stability and support characteristics of the subgrade is recommended to be performed by the geotechnical consultant prior to pipe installation and concrete placement and the proposed at-grade and below-grade structures.

Pipe Bedding.

The water line may be installed according to City of Riverside Standard Drawing Nos. CWD 040-1 and CWD 040-2. The standard detail shows bedding to be at least sandy loam, sand, or sandy gravel with Sand Equivalent value of at least 30. Where clean crushed rock material is to be used for subgrade stabilization, we recommend the rock material should be surrounded by a non-woven filter fabric to prevent migration of soil fines into the rock voids. Some of the onsite soils are characterized by high fine content.

The excavations should be performed with equipment capable of providing a relatively clean bearing area. Stable soils are essential to provide a strong base during construction. In addition, stable soils enhance trench bottom stability, support for bedding compaction, and minimize possible pipe settlement. Whenever soft foundation soils are encountered during trench excavation, we recommend over excavating at least 1 foot, or more to stabilize subgrade, below the base of the foundation or to firm ground and replacing the additional excavation with crushed rock compacted to at least 90% of maximum dry density.

The modulus of soil reaction (E) is used to characterize the stiffness of soil backfill placed at the sides of buried flexible pipes for the purpose of evaluating deflection caused by the weight of-the backfill over the pipe. The soil reaction modulus may be obtained from the US Bureau of Reclamation table for onsite soils classified as silty sand with fines content greater than 25%.

General Fill Placement and Compaction

The soils encountered at the boring locations are generally suitable for use as compacted fill, provided that they are free of organic material, debris and oversized material. Soils to be placed as fill, whether onsite or import material, should be approved by the geotechnical engineer. All fill soils should be placed in thin, loose lifts, with each lift properly moisture conditioned to slightly above the optimum moisture contents and compacted to a minimum of 90 percent relative compaction (ASTM D 1557). The aggregate base should be compacted to a minimum of 95 percent relative compaction (ASTM D 1557).

Pipeline trenches should be backfilled with compacted fill in accordance with the *Standard Specifications for Public Works Construction* (Greenbook). Prior to backfilling the trench, pipes should be embedded and covered with granular material as indicated in City of Riverside Standard Drawing CWD 040-1 and CWD 040-2. Granular material should exhibit a Sand Equivalent value (per ASTM D 2419) of 30 or greater. Based on our laboratory test results, onsite soils have sand equivalent values above and below 30. Pipe bedding should extend to a depth below the pipe as shown on the above mentioned City of Riverside Standard Drawings.

Above the bedding zone, trenches can be backfilled with the onsite material, provided it is free of debris, organic and oversized material greater than 3 inches in largest dimension. Oversized rock (cobbles and/or boulders) should either be removed from the alignment or pulverized for use in backfill. Gravel larger than 3/4 inches in diameter should be mixed with at least 80 percent soil by weight passing the No. 4 sieve.

Backfill should be placed in thin lifts, loose lift thickness being compatible with the earthwork equipment but not exceeding 18 inches, moisture conditioned, as necessary, and mechanically compacted to a minimum 90 percent relative compaction (ASTM D 1557). The aggregate base in pavement areas should be compacted to a minimum 95 percent relative compaction.

Construction Monitoring

The most significant impact of dewatering on the surrounding environments will be the potential for ground subsidence. Ground subsidence may cause damage to roadways, existing underground utilities, and other improvements within the zone of influence of construction. Prior to the start of construction activities, a preconstruction survey with benchmarks, video tapes, and photographs of the site and its vicinity may be performed to document its conditions. The site conditions should also be monitored during the course of construction.

Allowable Soil Bearing Capacity

For below-grade structures where the foundation level is deeper than 5 feet below the finished grade, a net allowable bearing capacity of 1,800 psf may be used. The foundation should be supported on undisturbed soils with a minimum embedment depth of 12 inches below the lowest adjacent grade. The bearing capacity may be increased by one-third for wind or seismic loading.

Modulus of Subgrade Reaction

A modulus of subgrade reaction of 150 pounds per cubic inch (pci) may be used for competent soils to a depth of 10 feet below the existing grade. The modulus of subgrade reaction may be increased to 250 pounds-per-cubic-inch (pci) for soils below 10 feet.

Soil Corrosively

To evaluate the corrosion potential of the surficial soils at the site we tested a sample collected during our subsurface investigation for soluble sulfate, chloride, pH, and resistivity. The results are shown in Appendix C and summarized below.

Depth (ft)	Sulfate (ppm)	Chloride (ppm)	pH	Minimum Resistivity (Ohm-cm)	Estimated Corrosivity Based on Resistivity	Estimated Sulfate Attack on Concrete	Estimated Chloride Attack on Metal
B2@3-4’	<50	60	7.38	2100	Severe Corrosive	Negligible	Negligible
B3@3-4’	<50	120	7.28	1600	Severe Corrosive	Negligible	Negligible
B4@5’	<50	36	7.00	1600	Severe Corrosive	Negligible	Negligible

Many factors can affect the corrosion potential of soil including soil moisture content, resistivity, permeability, and pH, as well as chloride and sulfate concentration. In general, soil resistivity, which is a measure of how easily electrical current flows through soils, is the most influential factor. Based on test results and the correlation table in Appendix C the soils may be classified as very severely corrosive.

Sulfate ion concentrations, and pH appear to play a roles in affecting corrosion potential. Sulfate ions in the soil can lower the soil resistivity and can be highly aggressive to Portland cement concrete by combining chemically with certain constituents of the concrete, principally tricalcium aluminate. This reaction is accompanied by expansion and eventual disruption of the concrete matrix. Potentially high sulfate content could also cause corrosion of the reinforcing steel in concrete. California Building Code (CBC) provides requirements for concrete exposed to sulfate-containing solutions as shown on the sulfate test form in Appendix C.

Acidity is an important factor of soil corrosivity. The lower the pH (the more acidic the environment), the higher the soil corrosivity with respect to buried metallic structures. As soil pH increases above 7 (the neutral value), the soil is increasingly more alkaline and less corrosive to buried steel structures due to protective surface films which form on steel in high pH environments. A pH between 5 and 8.5 is generally considered relatively passive from a corrosion standpoint.

From the CBC guidelines, sulfate exposure to Portland Cement Concrete (PCC) may be considered negligible for the sampled materials. Accordingly we recommend Type II cement for all concrete in contact with earth material.

Pavement Recommendations

On the basis of observations and laboratory classification of onsite soils, we are of the opinion that the tentative pavement design may be based on an R-value on the order of 10 corresponding to near surface soils. Considering this the recommended pavement sections is outlined below. Asphalt pavement should conform to City of Riverside Public Works Standard Drawing 453. Minimum replaced asphalt thickness is 5 inches or one inch greater than existing pavement.

TRAFFIC INDEX	ASPHALT CONCRETE	CLASS 2 AGGREGATE BASE
9.5	5.5”	21.0”
8.5	5.0”	18.0”
8.0	4.5”	17.0”
6.0	3.0”	12.5”
5.0	2.5”	10.0”

The subgrade soils below aggregate base should be scarified, watered as necessary, and compacted to at least 90 percent relative compaction. Class 2 base should conform to section 200-2 of the Standard Specifications for Public Works Construction and should be compacted to at least 95 percent of the maximum dry density. Maximum dry densities should be determined by the Standard Test Method designated ASTM D1557. All subgrade and base must be firm and unyielding prior to placement of asphalt concrete. Final pavement design may be based on sand equivalent test results of representative subgrade soils upon completion of grading.

Conclusions

Based on the results of our geotechnical investigation of the site, it is our opinion that the proposed improvements are feasible from a geotechnical standpoint, provided the following conclusions and recommendations are incorporated into the project plans and specifications.

- Vegetation, buried irrigation lines, old foundations, roots, utility lines may be encountered throughout the project area.

- The onsite soils exclusive of deleterious may be used as compacted fill materials. Some of the onsite soils with sand equivalent greater than 30 are suitable for new pipe bedding or shading.

- Adequate measures should be taken to protect any structural foundations and utilities adjacent to any excavations.

- Based on our subsurface exploration and laboratory testing, the onsite soils are indurated and moderately dense to dense, and firm to hard.

- Sheet pile driving is not considered applicable shoring system in dense indurated soils. Designer of shoring should note that driven or vibrated installation methods may cause densification of loose granular soil, which may result in the settlement or distress of adjacent structures or other existing improvements, such as piping and manholes.

- Highest historical groundwater indicates that dewatering may not be required during construction. However the site may be subject to storm flooding or surface water sheet flow from elevated areas in rainy season, or rise in groundwater elevation may take place. Therefore groundwater seepage should not be precluded. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

- Active or potentially active faults are not known to exist on or in the immediate vicinity of the site.

- Liquefaction potential of onsite material is low to moderate.

Additional Services

Variations in soil types and conditions are possible and may be encountered during construction. To permit correlation between the soil data obtained during this investigation and the actual soil conditions encountered during construction, we recommend that GeoMat be retained to provide observation and testing services during site earthwork and foundation construction. This will allow us the opportunity to compare actual conditions exposed during construction with those encountered in our investigation and to provide supplemental recommendations if warranted by the exposed conditions. Earthwork should be performed in accordance with the recommendations presented in this report, or as recommended by GeoMat during construction.

GeoMat should review geotechnical portions of the final plans and specifications to evaluate how the recommendations presented in this report were implemented into the designs. If GeoMat is not retained for these services, the client will assume our responsibility for any potential claims that may arise.

We should also provide consultation during construction to assist in the observation of how key parts of the design are implemented, answering questions from the designers or contractors, and looking for subsurface conditions that might differ from the design assumptions or that might require modification of the design. This review provides an opportunity to detect misinterpretation or misunderstandings prior to the start of construction.

Final Report of Compaction

A final report of compaction control should be prepared subsequent to the completion of grading. The report should include a summary of work performed, laboratory test results, and the results and locations of field density tests performed during grading.

GEOTECHNICAL RISK

The concept of risk is an important aspect of the geotechnical evaluation. The primary reason for this is that the analytical methods used to develop geotechnical recommendations do not comprise an exact science. The analytical tools which geotechnical engineers use are generally empirical and must be used in conjunction with engineering judgment and experience. Therefore, the solutions and recommendations presented in the geotechnical evaluation should not be considered risk-free and, more importantly, are not a guarantee that the interaction between the soils and the proposed structure will perform as planned.

The engineering recommendations presented in the preceding sections constitute GeoMat Testing Laboratories professional estimate of those measures that are necessary for the proposed sewer line to perform according to the proposed design based on the information generated and referenced during this evaluation, and GeoMat Testing Laboratories experience in working with these conditions.

LIMITATION OF INVESTIGATION

This report was prepared for the exclusive use on the new addition. The use by others, or for the purposes other than intended, is at the user's sole risk. This work is meant for the new sewer line construction.

Our investigation was performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable Geotechnical Engineers practicing in this or similar locations within the limitations of scope, schedule, and budget. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report.

The field and laboratory test data are believed representative of the site; however, soil conditions can vary significantly. As in most projects, conditions revealed during construction may be at variance with preliminary findings. If this condition occurs, the possible variations must be evaluated by the Project Geotechnical Engineer and adjusted as required or alternate design recommended.

This report is issued with the understanding that it is the responsibility of the owner, or his representative, to ensure that the information and recommendations contained herein are brought to the attention of the engineer for the addition and incorporated into the plans, and the necessary steps are taken to see that the contractor and subcontractor carry out such recommendations in the field.

This firm does not practice or consult in the field of safety engineering. We do not direct the contractor's operations, and we cannot be responsible for other than our own personnel on the site; therefore, the safety of others is the responsibility of the contractor. The contractor should notify the owner if he considers any of the recommended actions presented herein to be unsafe.

The findings, conclusions, and recommendations presented herein are based on our understanding of the addition and on subsurface conditions observed during our site work, and are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. In additions, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge.

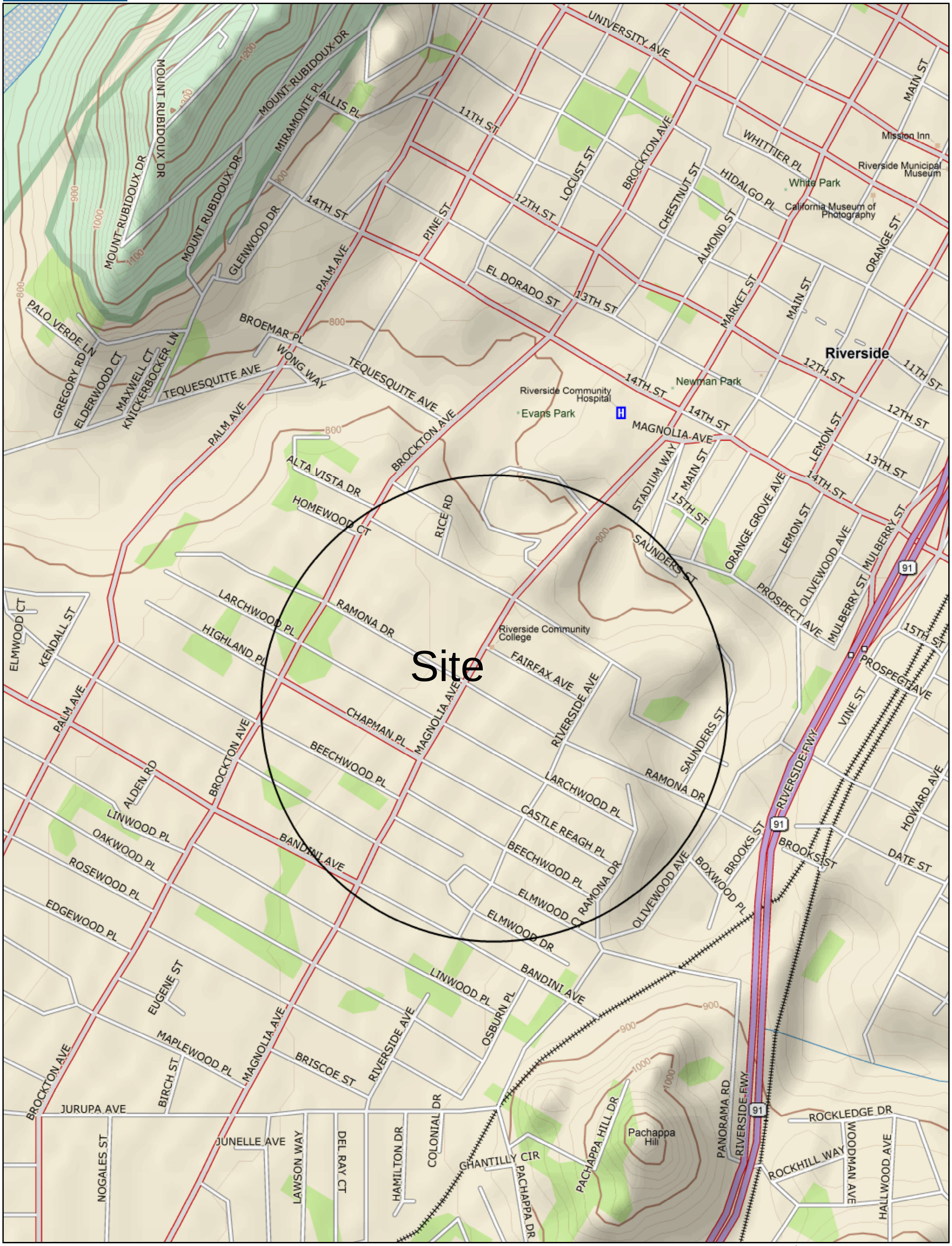
The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. In additions, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge.

If you should have any questions regarding this report, please do not hesitate to call our office. We appreciate this opportunity to be of service.

Submitted for GeoMat Testing Laboratories, Inc.

Haytham Nabilsi, GE 2375
Project Engineer

Distribution:	[3] Addressee	
Attachments:	Figure 1	Site Location Map
	Plate 1	Exploratory Boring Location Map
	Plate 2	Regional Geologic Map
	Plate 3	Liquefaction Zones
	Plate 4	Earth Pressures for Cantilever Shoring
	Plate 5	Earth Pressures for Braced Excavations
	Plate 6	Guide for Estimating Settlement Adjacent to Open Cuts
	Appendix A	References
	Appendix B	Geotechnical Boring Log
	Appendix C	Laboratory Test Results
	Appendix D	General Earthwork and Grading Specifications



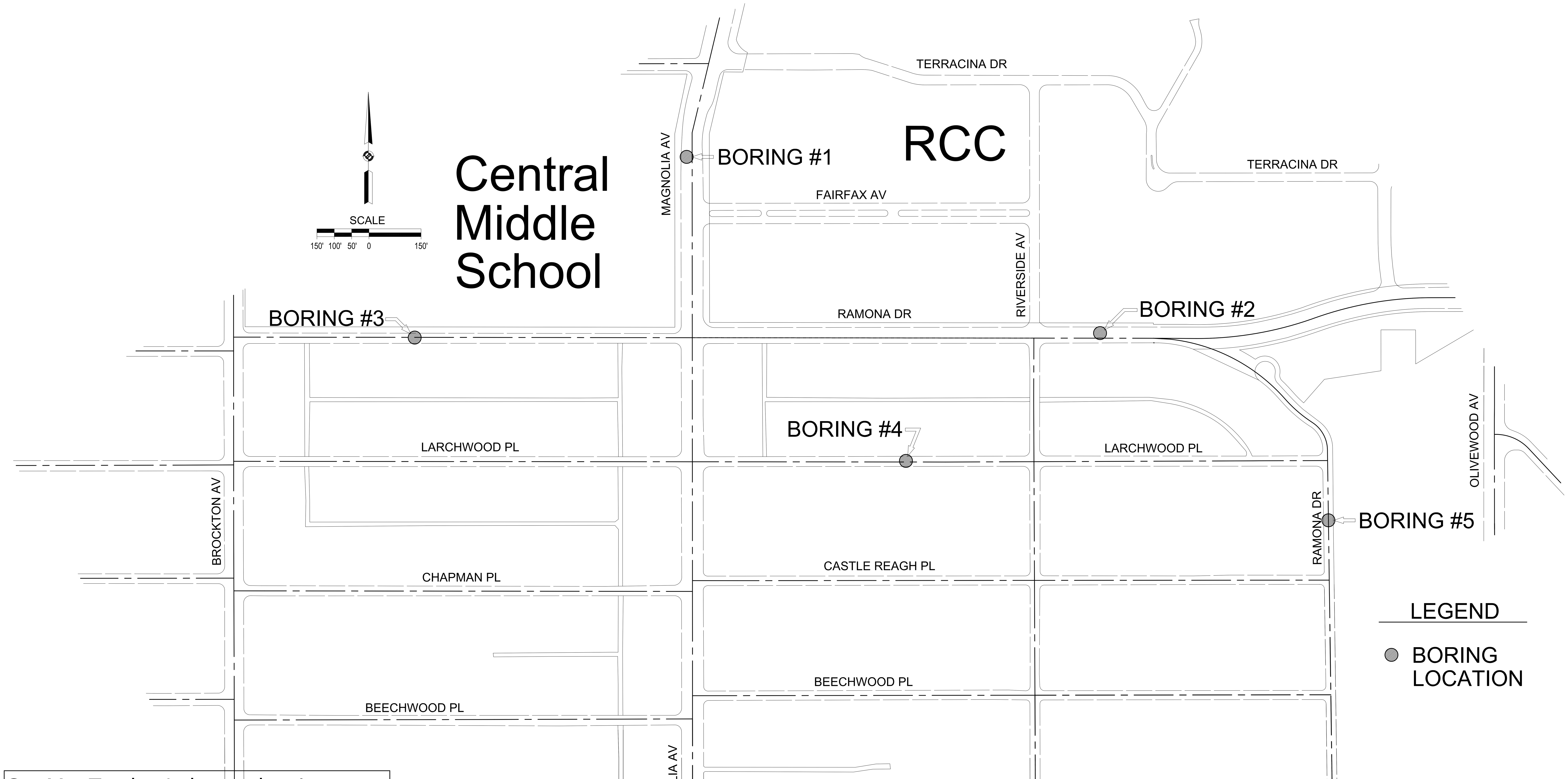
TN
MN (12.3°E)

Scale 1 : 12,800

0 200 400 600 800 1000 ft
0 100 200 300 400 500 m

1" = 1,066.7 ft

Data Zoom 14-0



GeoMat Testing Laboratories, Inc.
Exploratory Borehole Location Map
Plate 1
Project No. 12069-01
December 24, 2012

IMPORTANT NOTICE

Section 4216/4217 of the Government Code requires a Dig Alert Identification Number to be issued before a "Permit to Excavate" will be valid. For your Dig Alert I.D. Number call

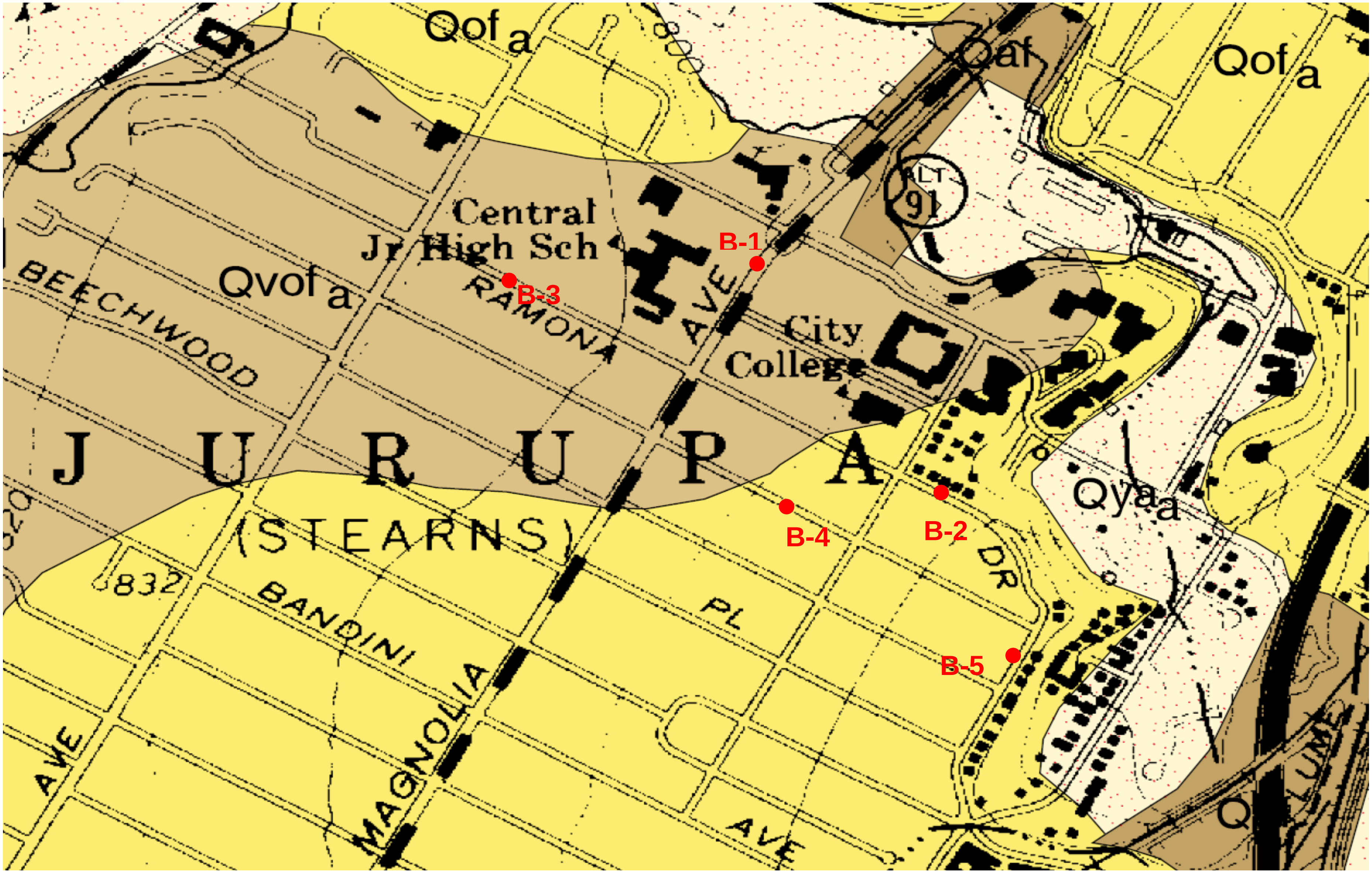
CALL TOLL FREE
48 HOURS BEFORE YOU DIG
UNDERGROUND SERVICE ALERT
1-800-227-2600

MARK	REVISION	APPR.	DATE

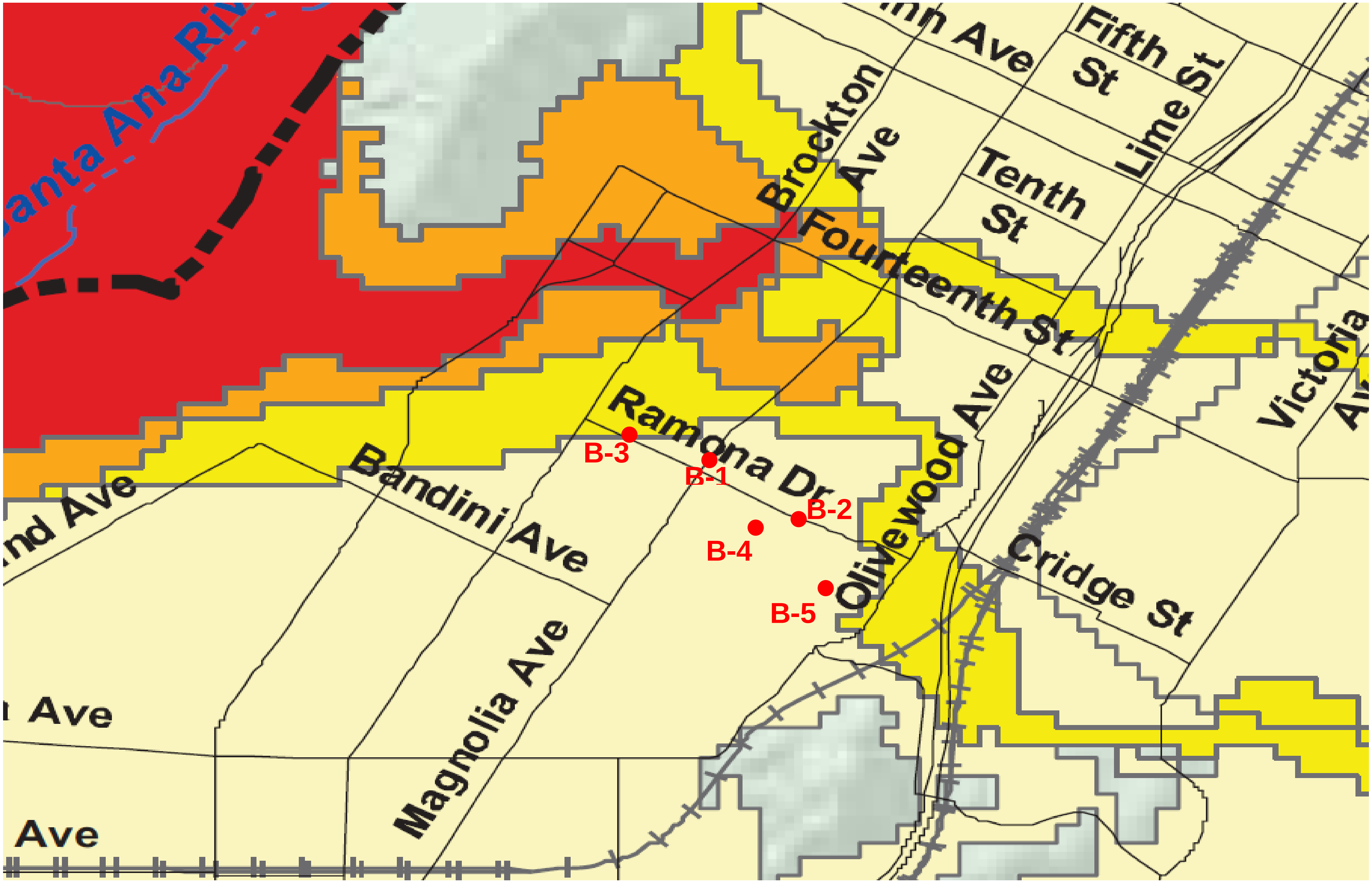
MAGNOLIA/RAMONA DISTRIBUTION MAIN
REPLACEMENT PROJECT
BORING LOCATION MAP

SCALE: AS SHOWN	DRAWN: S. KIM
DATE: OCTOBER 2012	CHECKED: D. KRELL
W.O. NO.: 1107917	CADME PG.: 39-3 & 5

CITY OF RIVERSIDE
DEPARTMENT OF PUBLIC UTILITIES
W DIV
DRAWING NO. D5-1107917-01
SHEET 01 OF 01



Geologic Legend: Qya: Young Axial Channel Deposits Qof: Old Alluvial Fan Deposits Qvof: Very Old Alluvial fan deposits	**Regional Geologic Map** **Magnolia-Ramona Water Line** **Replacement Project**	**Project No:** 12069-01 **Date:** 12/24/12 **Plate:** **2**	GeoMat



Legend:

- VERY LOW
- LOW
- MODERATE
- HIGH
- VERY HIGH

Liquefaction Zones
Magnolia-Ramona Water Line Replacement Project

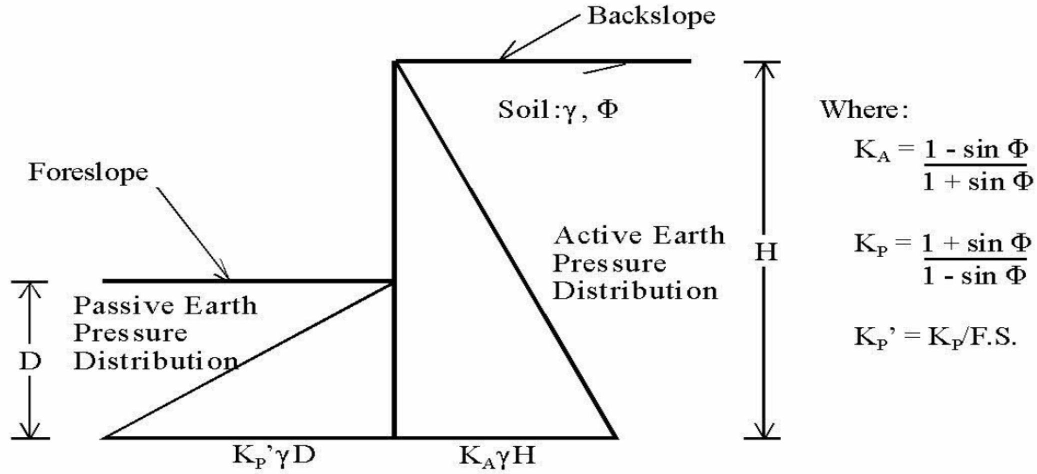
Project No: 12069-01

Date: 12/24/12

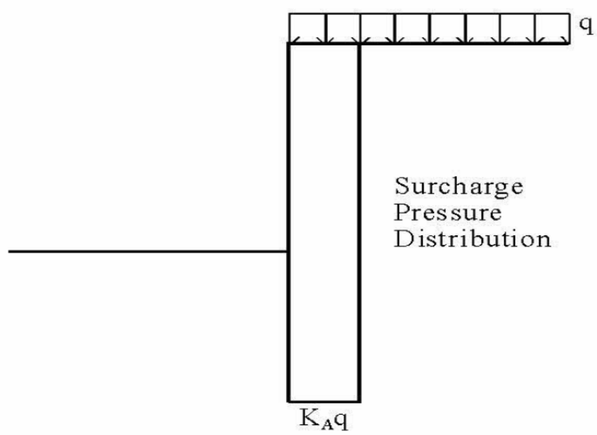
Plate: 3

GeoMat

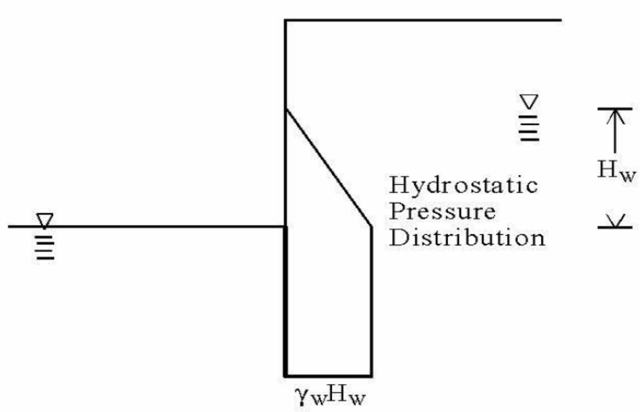
Earth Pressures



Surcharge Loads



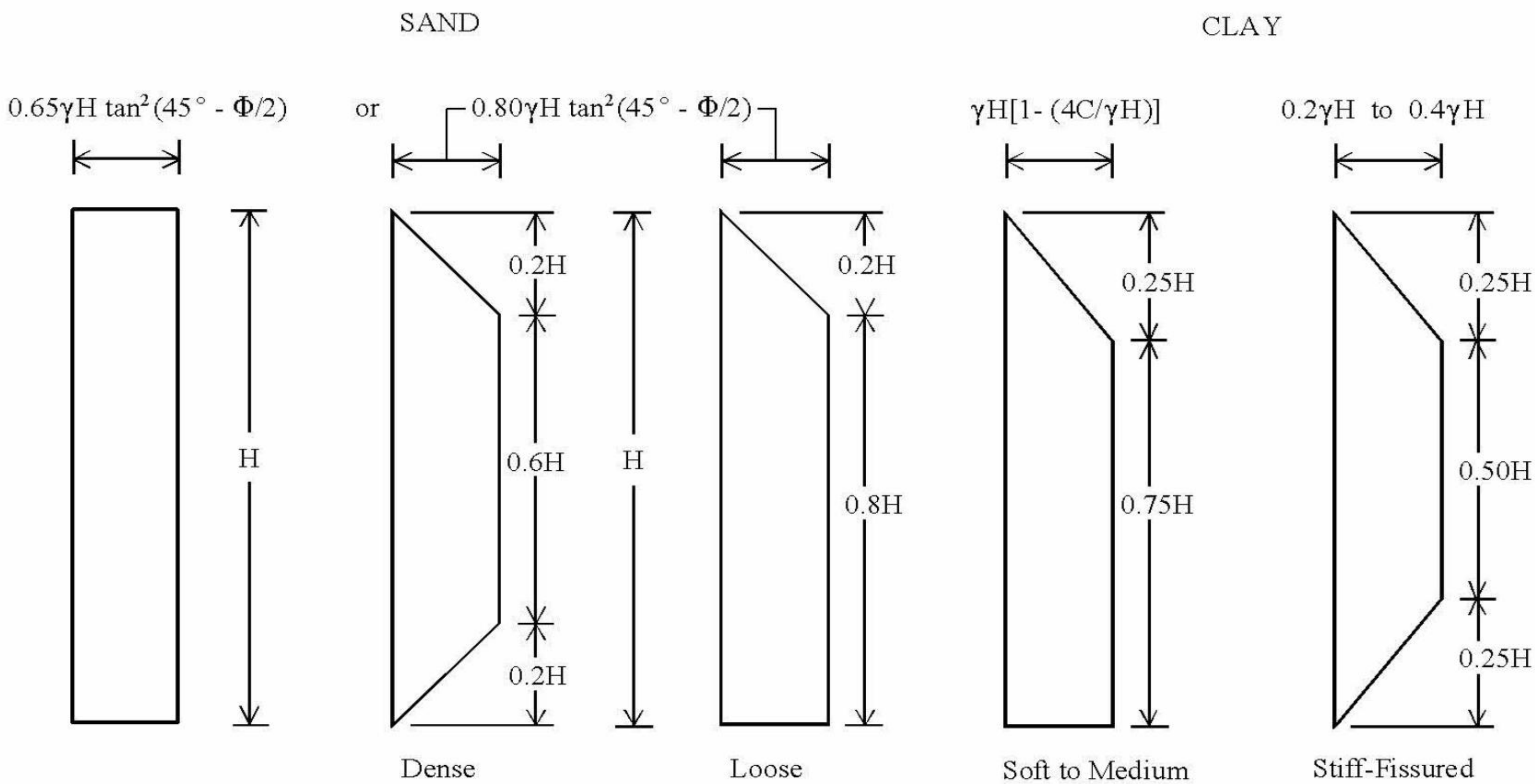
Hydrostatic Loads



Assumptions: No safety factor included in soil parameters, No dynamic loading, No loading from heavy equipment. For passive earth pressure to develop, wall must move horizontally to mobilize resistance. For active pressure, wall must rotate about base, with top lateral movements of about 0.002H to 0.004H.

Earth Pressures for Cantilever Shoring Magnolia-Ramona Drive Water Line	**Project No:** 12069-01 **Date:** **11**/24/12 **Plate:** **4**	GeoMat

Earth Pressures For Braced Excavations

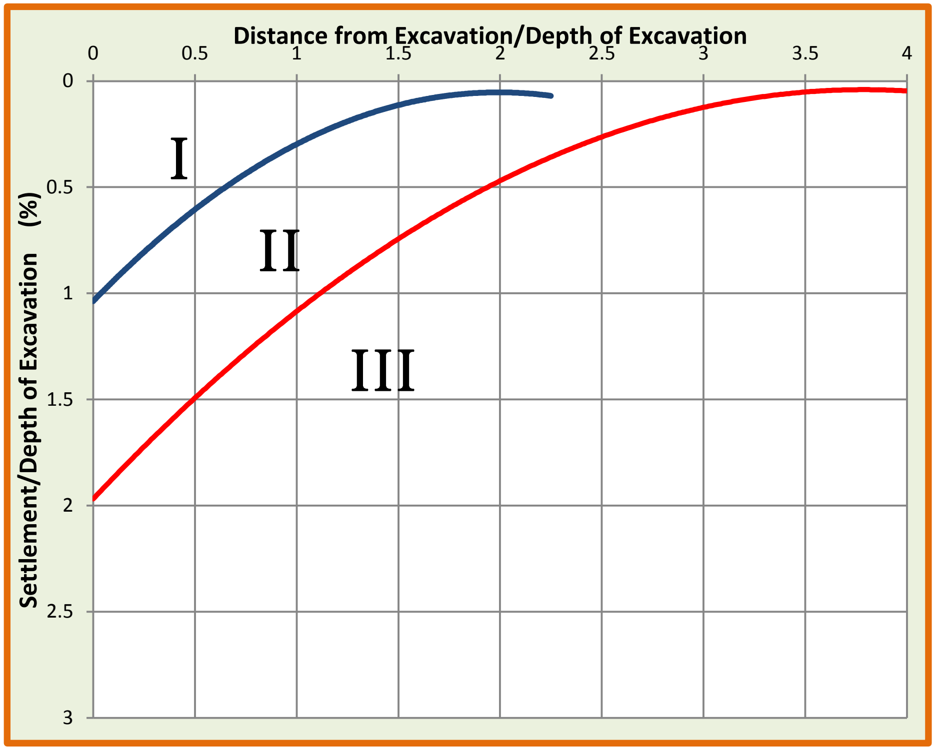


Soft to Medium Clay: ϒH/C > 4, Stiff-Fissured Clay: ϒH/C ≤ 4

Soft to Medium Clay: The term 4C/ϒH is multiplied by a factor of m=1 when much more resistant layer exists at or near the base of excavation. If there is a great depth of soft clay below the base of excavation, the term 4C/ϒH is multiplied by a factor of m=0.4.

Earth Pressures for Braced Excavation **Magnolia-Ramona Drive Water Line**	**Project No:** 12069-01 **Date:** **11**/24/12 **Plate:** **5**	GeoMat

Guide to Settlement Adjacent Open Cuts (Peck, 1969)



Reference: Geotechnical Engineering, 1997, Braced and Strutted Excavations by G.P. Raymond

ZONE I

Sand and Soft Clay to Hard Clay, [Cu > 25 kPa (500 psf)]

ZONE II

Very Soft Clay to Soft Clay, [Cu < 25 kPa (500 psf)]

1. Limited Depth of clay belwo base of excavation
2. Significant Depth of clay below base of excavation wher Fb > 1.3

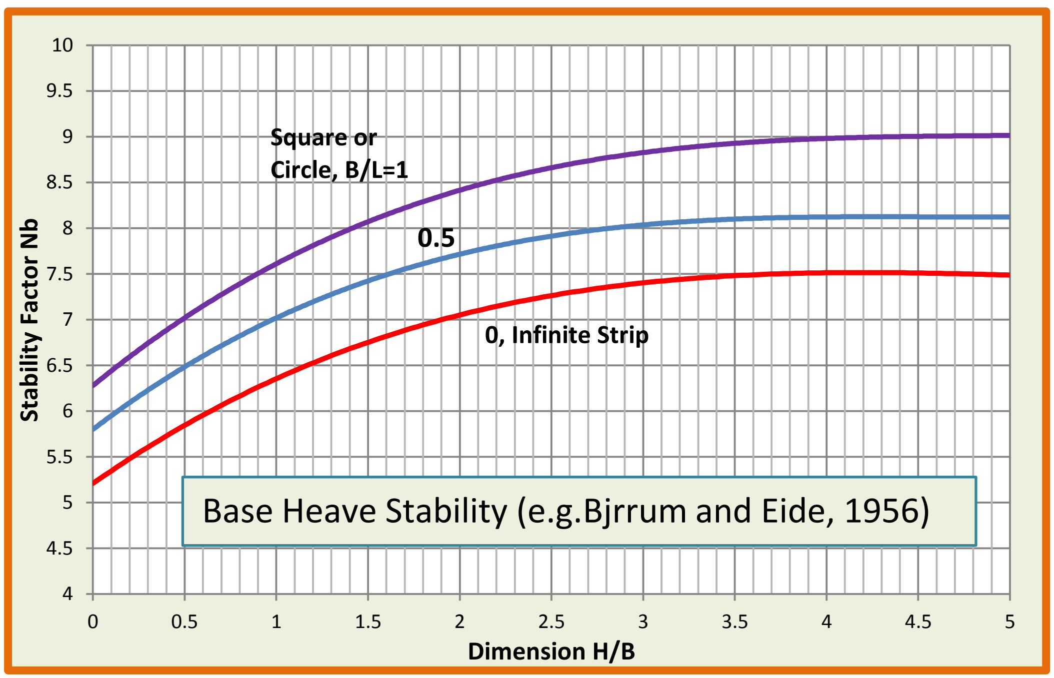
ZONE III

Very Soft to Soft Clay, [Cu < 25 kPa (500 psf)]

1. Significant Depth of clay belwo base of excavation and where Fb < 1.3

Where F_b = Factor of safety against base failure

Method is emperical and not a theoretical expression



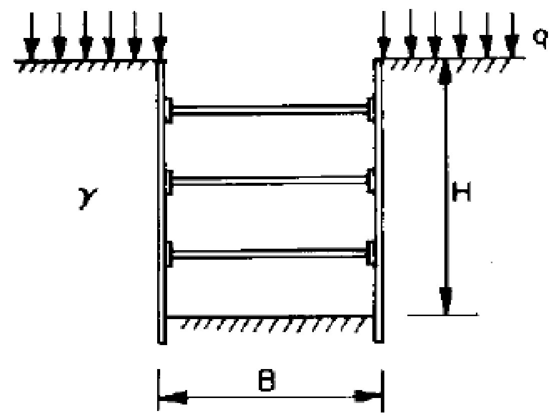


Plate 6

$$F_b = \frac{N_b C_u}{Y H + q}$$

Appendix A

REFERENCES

City of Riverside, Borehole Location Map

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Preliminary Geologic Map of Riverside West 71/2 Min Quadrangle.

City of Riverside General Plan

Websites: CDMG, USGS

Appendix B

DRILLING NOTES

WATER LEVEL MEASUREMENTS

Water levels indicated on the boring logs are levels measured in the borings at the times indicated. In permeable materials, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels is not possible with short-term observations.

WATER LEVEL OBSERVATION DESIGN

W.D.	While Drilling
A.B.	After Boring
B.C.R.	Before Casing Removal
A.C.R.	After Casing Removal
24 hr.	Water level taken approximate... hrs. after boring completion

DRILLING AND SAMPLING SYMBOLS

AS	Auger Sample
CS	Continuous Sampler
DB	Diamond Bit -NX unless otherwise noted
HA	Hand Auger
HS	Hollow Stem Auger
PA	Power Auger
RB	Rock Bit
SS*	Split-Barrel
ST	Shelby Tube - 2" (51mm) unless otherwise noted
WB	Wash Bo...
CS	California Ring Sampler 3" O.D., Lined with 2.5"X1" Rings
CR	

*The Standard Penetration Test is conducted in conjunction with the split-barrel sampling procedure. The "N" value corresponds to the number of blows required to drive the last 1 foot (0.3m) of an 18 in. (0.46m) long, 2 in. (51mm) O.D. split-barrel sampler with a 140 lb. (63.5 kg) hammer falling a distance of 30 in. (0.76m). The Standard Penetration Test is carried out according to ASTM D-1586. (See "N" Value below.)

Cohessive Soils Consistency	"N" value
Very Soft	<2
Soft	2-4
Medium	4-8
Stiff (Firm)	8-15
Very Stiff (Very Firm)	15-30
Hard	>30

SOIL PROPERTIES & DES...

TEXTURE

PARTICLE	SIZE	
Clay	< 0.002 mm	(< 0.002 ...
Silt	< #200 Sieve	(0.075 ...
Sand	#4 to #200 Sieve	(4.75 to ... mm)
Gravel	3 in. to #4 Sieve	(75 mm ... mm)
Cobbles	12 in. to 3 in.	(300 mm ... mm)
Boulders	> 12 in.	(300 mm ...

COMPOSITION

SAND & GRAVEL

Description	% by Dry Weight
trace	< 15
with	15 - 29
modifer	> 30

FINES

Description	% by Dry Weight
trace	< 5
with	5 - 12
modifier	> 12

Soil c... nified Soil Classification System (USCS) as outlined in AS... D-2488. The USCS group symbol shown on the boring logs ... listed below. The description includes soil constituents, consisten... ative density, color and other appropriate descriptive terms. Geologic description of bedrock, when encountered, also is shown in the description column.

GROUP SYMBOL	GROUP NAME	GROUP SYMBOL	GROUP NAME
GW	Well Graded Gravel	CL	Lean Clay
GP	Poorly Graded Gravel	ML	Silt
GM	Silty Gravel	OL	Organic Clay or Silt
GC	Clayey Gravel	CH	Fat Clay
SW	Well Graded Sand	MH	Elastic Silt
SP	Poorly Graded Sand	OH	Organic Clay or Silt
SM	Silty Sand	PT	Peat
SC	Clayey Sand	CL-CH	Lean to Fat Clay

COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (Qu) (psf)	(kPa)
Very Soft	< 500	(< 24)
Soft	500 - 1000	(24 - 48)
Medium	1001 - 2000	(48 - 96)
Stiff	2001 - 4000	(96 - 192)
Very Stiff	4001 - 8000	(192 - 383)
Hard	> 8001	(> 383)

PLASTICITY

Description	Liquid Limit (%)
Lean	< 45%
Lean to Fat	45 to 49%
Fat	≥ 50%

COHESIONLESS SOILS

RELATIVE DENSITY	"N" VALUE*
Very Loose	0 - 3
Loose	4 - 9
Medium Dense	10 - 29
Dense	30 - 49
Very Dense	≥ 50

BEDROCK PROPERTIES & DESCRIPTIONS

ROCK QUALITY DESIGNATION (RQD)**

DESCRIPTION OF ROCK QUALITY	RQD (%)
Very Poor	0 - 25
Poor	25 - 50
Fair	50 - 75
Good	75 - 90
Excellent	90 - 100

**RQD is defined as the total length of sound core pieces, 4 inches (102mm) or greater in length, expressed as a percentage of the total length cored. RQD provides an indication of the integrity of the rock mass and relative extent of seams and bedding planes.

DEGREE OF WEATHERING

Slightly Weathered	Slight decomposition of parent material in joints and seams.
Weathered	Well-developed and decomposed joints and seams.
Highly Weathered	Rock highly decomposed, may be extremely broken.

SOLUTION AND VOID CONDITIONS

Solid	Contains no voids.
Vuggy	Containing small pits or cavities < 1/2" (13mm).
Porous	Containing numerous voids which may be interconnected.
Cavernous	Containing cavities, sometimes quite large.

When classification of rock materials has been estimated from disturbed samples, core samples and petrographic analysis may reveal other rock types.

HARDNESS & DEGREE OF CEMENTATION

LIMESTONE

Hard	Difficult to scratch with knife.
Moderately Hard	Can scratch with knife but not with fingernail.
Soft	Can be scratched with fingernail.

SHALE

Hard	Can scratch with knife but not with fingernail.
Moderately Hard	Can be scratched with fingernail.
Soft	Can be molded easily with fingers.

SANDSTONE

Well Cemented	Capable of scratching a knife blade.
Cemented	Can be scratched with knife.
Poorly Cemented	Can be broken apart easily with fingers.

BEDDING CHARACTERISTICS

TERM	THICKNESS (inches)	THICKNESS (mm)
Very Thick Bedded	> 36	> 915
Thick Bedded	12 - 36	305 - 915
Medium Bedded	4 - 12	102 - 305
Thin Bedded	1 - 4	25 - 102
Very Thin Bedded	0.4 - 1	10 - 25
Laminated	0.1 - 0.4	2.5 - 10
Thinly Laminated	< 0.1	< 2.5

Bedding Planes	Planes dividing the individual layers, beds or strata of rocks.
Joint	Fracture in rock, generally more or less vertical or transverse to the bedding.
Seam	Applies to bedding plane with an unspecified degree of weathering.

BORHOLE LOG — BH-1

Project No.	12069-01	Sheet	1 OF 1
Project	Magnolia And Ramona Drive Water Main	Date	22-Dec-12
Client	City of Riverside	Drilling Co.	GeoMat
Location	Magnolia Avenue, 25' south of Terracina Dr.	Rig	CME 45
Coodinate		Drill Method	Hollow Stem
Notes		Hammer Type	Auto
		Surface Elev.	Pavement Eelv.
		Total Depth (ft	10
	Surface: 15" asphalt concrete over 8" aggregate base		

Type/Symbol	Casing	Split Spoon	Ring Sampler	Cutting
I.D.		S	R	C
O.D.				
Length				
Hammer Wt.	140 lb			
Hammer Fall	30"			

Date	Time	Water Depth (ft)	Casing Size (in)	Casing Depth (ft)	Hole Depth (ft)	Symbol
12/22/2012		No GW				

Depth Below Surface (ft)	Elevation (ft)	Graphic	Type	Number	Symbol	Depth	0-152.4 mm	152.4-304.8 mm	304.8-457.2 mm	N-Value	N60	(N1)60	VISUAL MATERIAL CLASSIFICATION AND REMARKS	Moisture (%)	Dry Density (pcf)	Test
0													SILTY SAND (SM)			
1													Reddish brown, fine to medium grained			
2																
3																
4																
5					R	5	11	13	20	21	17	29	% Passing No. 200 Sieve = 31, medium dense	15	114	GS
6													At 6' becoaming fine to coarse grained, friable			SE
7													Sand Equivalent = 12			
8																
9																
10					R	10	10	17	25	27	21	26	Medium dense	10	124	
11																
12																
13																
14																
15																
16																
17																
18																
19																
20																
21																
22																
23																
24																
25																

The stratification lines represent the approximate boundary lines between soil types.
In-situ, the transition may be gradual.

BORHOLE LOG BH-2

Project No.	12069-01	Sheet	1 OF 1
		Date	22-Dec-12
Project	Magnolia And Ramona Drive Water Main	Drilling Co.	GeoMat
Client	City of Riverside	Rig	CME 45
Location	3585 Ramona Drive	Drill Method	Hollow Stem
Coodinate		Hammer Type	Auto
Notes		Surface Elev.	Pavement Eelv.
		Total Depth (ft	10
	Surface: 4" asphalt concrete over 5" Mcadam		

Type/Symbol	Casing	Split Spoon	Ring Sampler	Cutting	Date	Time	Water Depth (ft)	Casing Size (in)	Casing Depth (ft)	Hole Depth (ft)	Symbol
I.D.		S	R	C							
O.D.					12/22/2012		No GW				
Length											
Hammer Wt.	140 lb										
Hammer Fall	30"										

Depth Below Surface (ft)	Elevation (ft)	Graphic	Soil Sample: Type	Number	Symbol	Depth	Blows: 0-152.4 mm	152.4-304.8 mm	304.8-457.2 mm	N-Value	N60	(N1)60	VISUAL MATERIAL CLASSIFICATION AND REMARKS	Moisture (%)	Dry Density (pcf)	Test
0													SILTY SAND (SM)			
1													Orange brown, fine to medium grained			
2																
3													Sand Equivalent = 20	5		SE
4																
5						5	10	19	25	29	23	41	% Passing No. 200 Sieve = 24, medium dense	4	119	GS
6																
7																
8																
9													very sandy, uniformly grained with occasional coarse			
10						10	8	15	19	22	17	22	non cohesive, SE=45, medium dense	4	121	SE
11																
12																
13																
14																
15																
16																
17																
18																
19																
20																
21																
22																
23																
24																
25																

The stratification lines represent the approximate boundary lines between soil types.
In-situ, the transition may be gradual.

BORHOLE LOG — BH-3

Project No.	12069-01	Sheet	1 OF 1
		Date	22-Dec-12
Project	Magnolia And Ramona Drive Water Main	Drilling Co.	GeoMat
Client	City of Riverside	Rig	CME 45
Location	between 3980 and 4022 Ramona Drive	Drill Method	Hollow Stem
Coodinate		Hammer Type	Auto
Notes		Surface Elev.	Pavement Eelv.
		Total Depth (ft	10
	Surface: 10" asphalt concrete over sungrade soil		
	Lower 4' caved in		

Type/Symbol	Casing	Split Spoon	Ring Sampler	Cutting	Date	Time	Water Depth (ft)	Casing Size (in)	Casing Depth (ft)	Hole Depth (ft)	Symbol
I.D.		S	R	C							
O.D.					12/22/2012		No GW				
Length											
Hammer Wt.	140 lb										
Hammer Fall	30"										

Depth Below Surface (ft)	Elevation (ft)	Graphic	Soil Sample Type	Number	Symbol	Depth	Blows 0-152.4 mm	152.4-304.8 mm	304.8-457.2 mm	N-Value	N60	(N1)60	VISUAL MATERIAL CLASSIFICATION AND REMARKS	Moisture (%)	Dry Density (pcf)	Test
0													CLAYEY SAND (SC)			
1													Reddish brown, cohesive			
2																
3					C								SILTY SAND (SM)	12		
4					C								Medium brown, fine to coarse grained			
5					R	5	10	18	20	25	20	35	% Passing No. 200 Sieve = 14	11	117	GS
6													Sand Equivalent = 31			SE
7													Medium dense			
8																
9																
10					R	10	9	14	23	24	19	24	CLAYEY SAND (SC)	12	109	GS
11													Orange brown, fine unifromly grained with trace of			DS
12													medium grain sand. Appears sandy but sticky when wet			
13													% Passing No. 200 Sieve = 73, very firm			
14																
15																
16																
17																
18																
19																
20																
21																
22																
23																
24																
25																

The stratification lines represent the approximate boundary lines between soil types.
In-situ, the transition may be gradual.

BORHOLE LOG — BH-4

Project No.	12069-01	Sheet	1 OF 1
		Date	22-Dec-12
Project	Magnolia And Ramona Drive Water Main	Drilling Co.	GeoMat
Client	City of Riverside	Rig	CME 45
Location	3674 Larchwood Place	Drill Method	Hollow Stem
Coodinate		Hammer Type	Auto
		Surface Elev.	Pavement Eelv.
Notes		Total Depth (ft	10
	Surface: 2.5" asphalt concrete over 2" DG		
	Lower 3' caved in		

Type/Symbol	Casing	Split Spoon	Ring Sampler	Cutting
I.D.		S	R	C
O.D.				
Length				
Hammer Wt.	140 lb			
Hammer Fall	30"			

Date	Time	Water Depth (ft)	Casing Size (in)	Casing Depth (ft)	Hole Depth (ft)	Symbol
12/22/2012		No GW				

Depth Below Surface (ft)	Elevation (ft)	Graphic	Soil Sample Type	Soil Sample Number	Soil Sample Symbol	Soil Sample Depth	Blows 0-152.4 mm	Blows 152.4-304.8 mm	Blows 304.8-457.2 mm	N-Value	N60	(N1)60	VISUAL MATERIAL CLASSIFICATION AND REMARKS	Moisture (%)	Dry Density (pcf)	Test
0													CLAYEY SAND (SC)			
1													Yellow brown, cohesive, very firm			
2																
3																
4													SILTY SAND (SM)			
5					R	5	9	15	17	21	17	29	Medium brown, fine to coarse grained, medium dense	16	115	DS
6													Sand Equivalent = 37			SE
7													POORLY GRADED SAND (SP)			
8													Tan brown, uniformly grained, clean			
9																
10					R	10	11	16	22	25	20	24	% Passing No. 2002 Sieve = 1, medium dense	3	127	GS
11																
12																
13																
14																
15																
16																
17																
18																
19																
20																
21																
22																
23																
24																
25																

The stratification lines represent the approximate boundary lines between soil types.
In-situ, the transition may be gradual.

BORHOLE LOG — BH-5

Project No.	12069-01	Sheet	1 OF 1
Project	Magnolia And Ramona Drive Water Main	Date	22-Dec-12
Client	City of Riverside	Drilling Co.	GeoMat
Location	3475 Ramona Drive	Rig	CME 45
Coodinate		Drill Method	Hollow Stem
Notes		Hammer Type	Auto
		Surface Elev.	Pavement Eelv.
		Total Depth (ft	10
	Surface: 4" asphalt concrete over 2" DG		
	Lower 3' caved in		

Type/Symbol	Casing	Split Spoon	Ring Sampler	Cutting
I.D.		S	R	C
O.D.				
Length				
Hammer Wt.	140 lb			
Hammer Fall	30"			

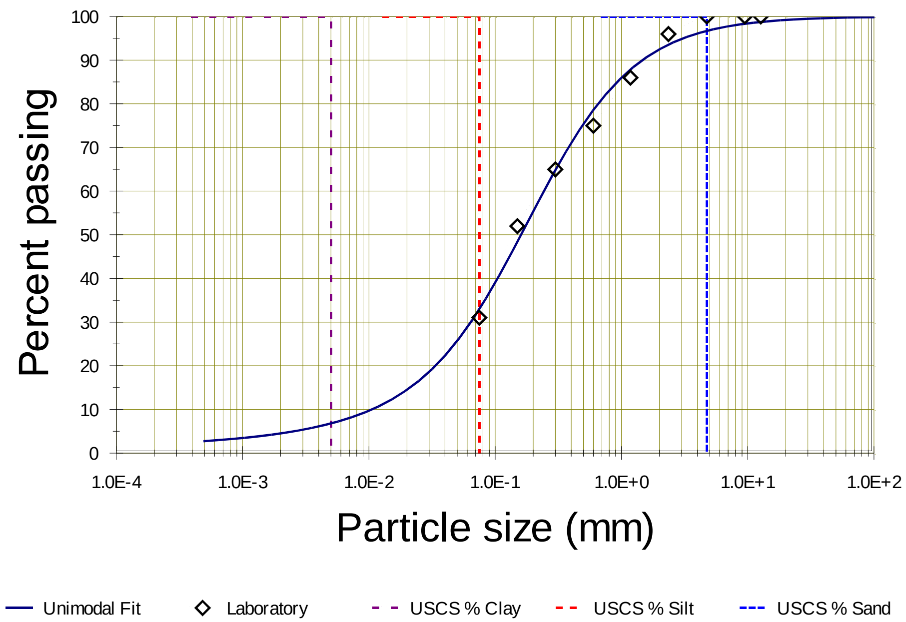
Date	Time	Water Depth (ft)	Casing Size (in)	Casing Depth (ft)	Hole Depth (ft)	Symbol
12/22/2012		No GW				

Depth Below Surface (ft)	Elevation (ft)	Graphic	Soil Sample Type	Soil Sample Number	Soil Sample Symbol	Soil Sample Depth	Blows 0-152.4 mm	Blows 152.4-304.8 mm	Blows 304.8-457.2 mm	N-Value	N60	(N1)60	VISUAL MATERIAL CLASSIFICATION AND REMARKS	Moisture (%)	Dry Density (pcf)	Test
0													SANDY SILT (ML)			
1													Yellow brown, poudary, not cohesive, dry			
2																
3																
4													SILTY SAND (SM)			
5						5	17	25	25	33	26	49	Yellow brown, fine to coarse grained, dense	12	102	GS
6													% Passing No. 200 Sieve = 22			DS
7													Sand Equivalent = 14			SE
8																
9													POORLY GRADED SAND (SP)			
10						10	15	34	48	53	42	55	SANDY SILT (ML)	5	114	GS
11													Yellow brown, dry, poundery			
12													% Passing No. 200 Sieve = 59, hard			
13																
14																
15																
16																
17																
18																
19																
20																
21																
22																
23																
24																
25																

The stratification lines represent the approximate boundary lines between soil types.
In-situ, the transition may be gradual.

Appendix C

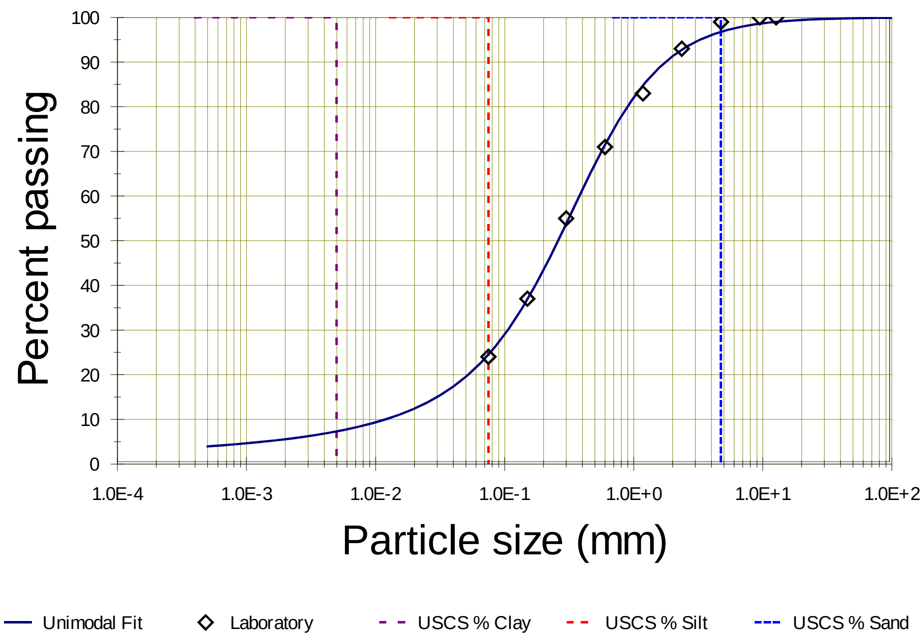
LABORATORY TEST RESULTS



D_{10}	D_{30}	D_{50}	D_{60}
0.0286	0.0586	0.1462	0.2233

SAMPLE LOCATION	% FIELD MOISTURE	Cu	Cc	% Clay	% Silt	% Sand	% Coarse	PERCENT PASSING No 200	USCS
B-1 @ 5'	15	7.8	0.8	0.4	31.2	67	1.3	31 ASTM 422-63 (2002)	SM

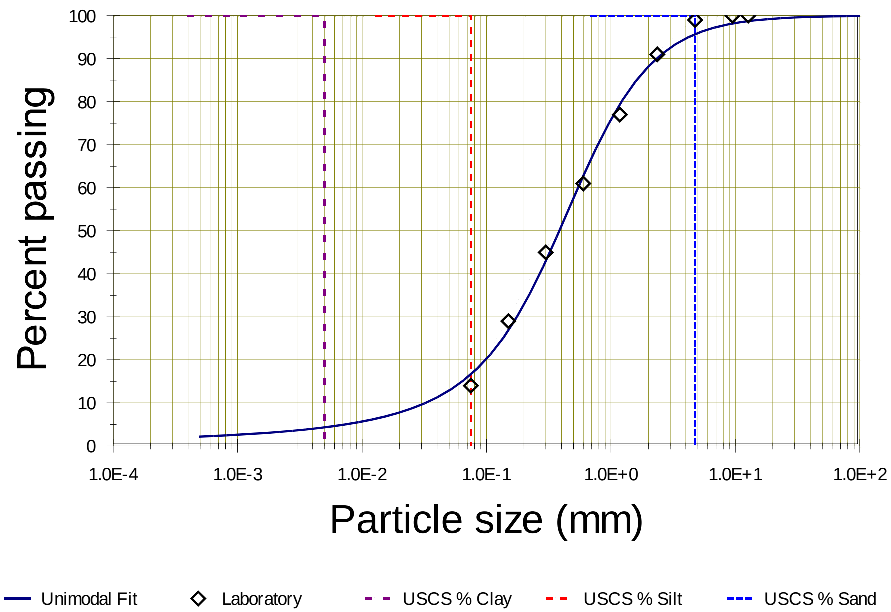
LABORATORY TEST RESULTS



D_{10}	D_{30}	D_{50}	D_{60}
0.0342	0.1057	0.2310	0.3594

SAMPLE LOCATION	% FIELD MOISTURE	Cu	Cc	% Clay	% Silt	% Sand	% Coarse	PERCENT PASSING No 200	USCS	GeoMat
B-2 @ 5'	4	10.5	0.9	1.6	20.6	75.6	2.2	24 ASTM 422-63 (2002)	SM	

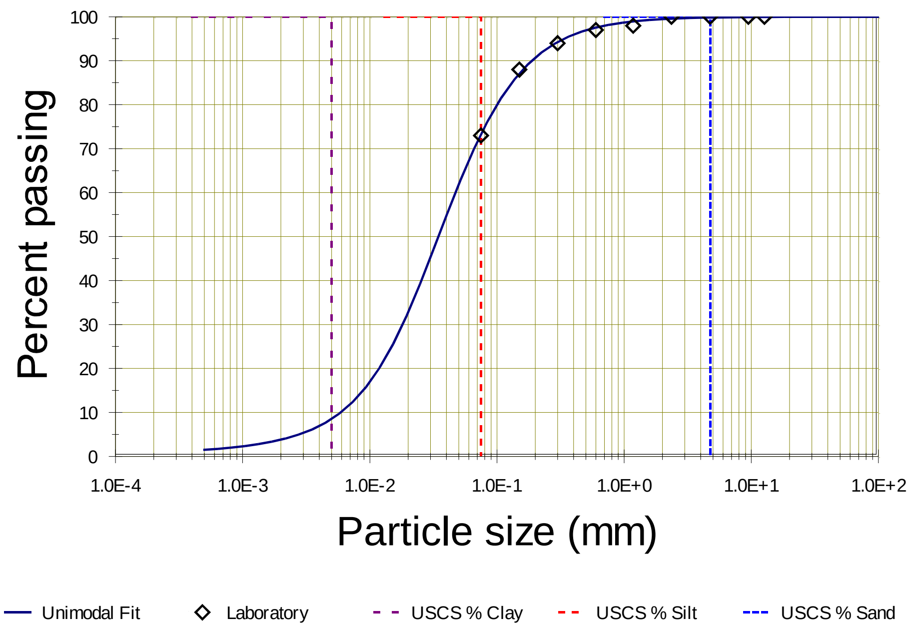
LABORATORY TEST RESULTS



D_{10}	D_{30}	D_{50}	D_{60}
0.0597	0.1566	0.3549	0.6064

SAMPLE LOCATION	% FIELD MOISTURE	Cu	Cc	% Clay	% Silt	% Sand	% Coarse	PERCENT PASSING No 200	USCS
B-3 @ 5'	11	10.2	0.7	0.2	13.4	83.5	2.8	14 ASTM 422-63 (2002)	SM

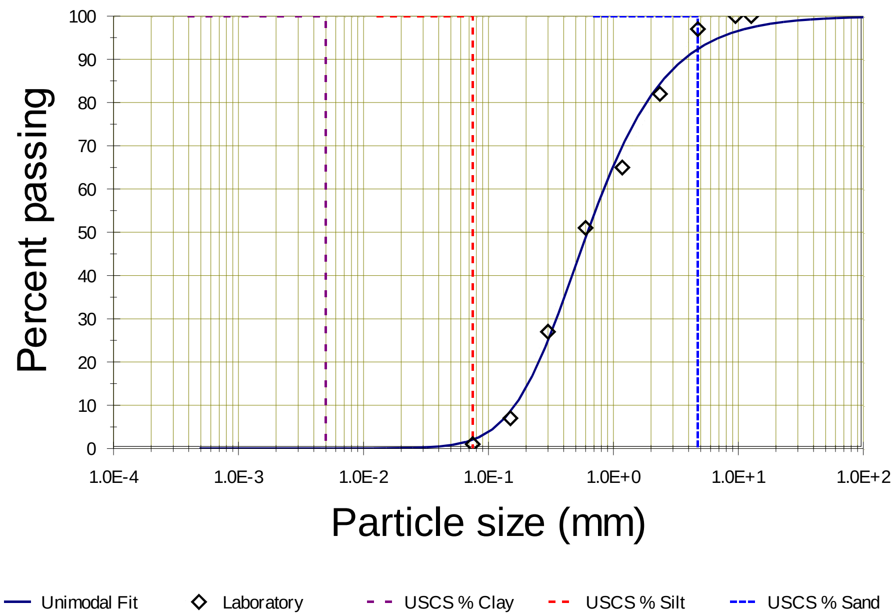
LABORATORY TEST RESULTS



D_{10}	D_{30}	D_{50}	D_{60}
0.0059	0.0181	0.0347	0.0472

SAMPLE LOCATION	% FIELD MOISTURE	Cu	Cc	% Clay	% Silt	% Sand	% Coarse	PERCENT PASSING No 200	USCS	GeoMat
B-3 @ 10'	12	8	1.2	8.5	64.8	26.5	0.2	73 ASTM 422-63 (2002)	SC	

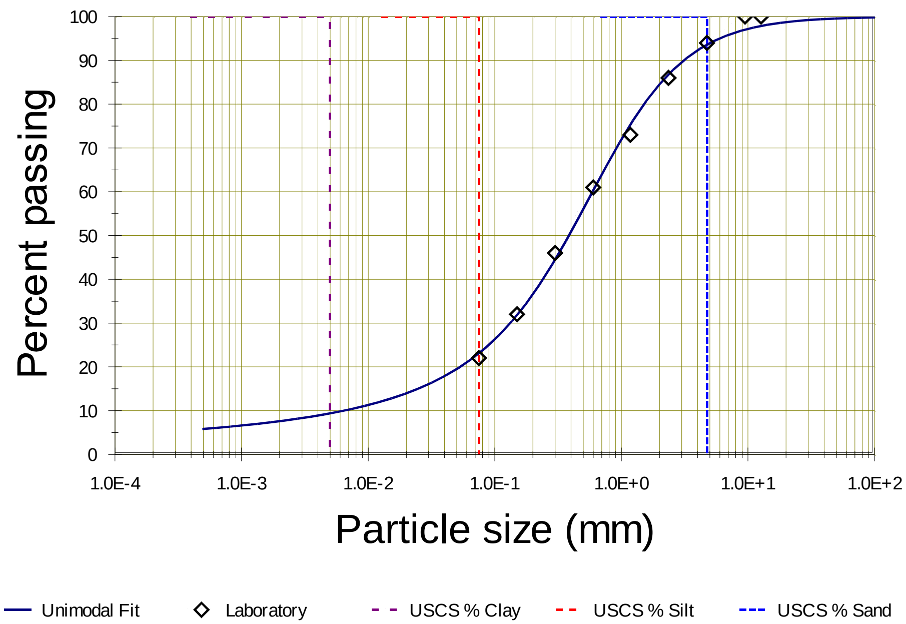
LABORATORY TEST RESULTS



D_{10}	D_{30}	D_{50}	D_{60}
0.1769	0.3226	0.5795	1.0312

SAMPLE LOCATION	% FIELD MOISTURE	Cu	Cc	% Clay	% Silt	% Sand	% Coarse	PERCENT PASSING No 200	USCS
B-4 @ 10'	3	5.8	0.6	0	1.2	95.8	2.9	1 ASTM 422-63 (2002)	SP

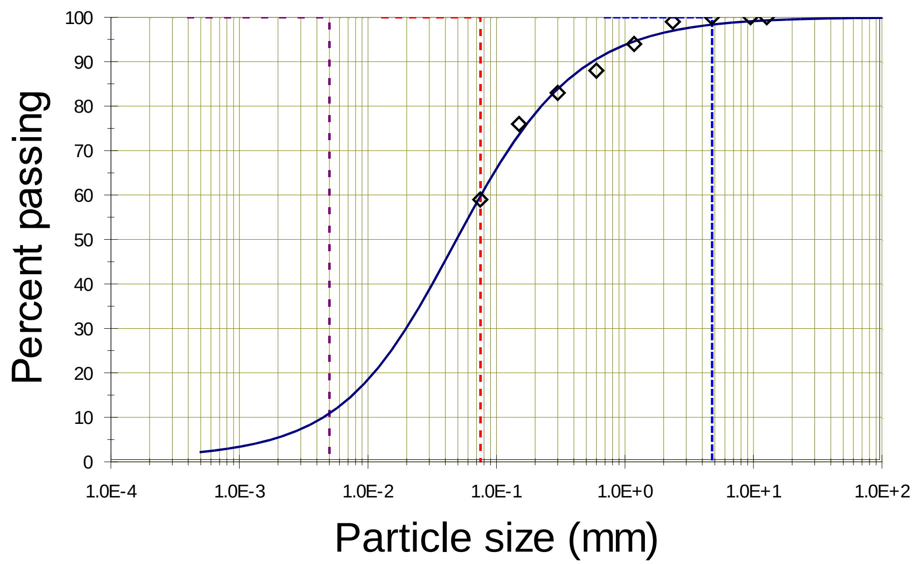
LABORATORY TEST RESULTS



D_{10}	D_{30}	D_{50}	D_{60}
0.0330	0.1228	0.4384	0.8439

SAMPLE LOCATION	% FIELD MOISTURE	Cu	Cc	% Clay	% Silt	% Sand	% Coarse	PERCENT PASSING No 200	USCS
B-5 @ 5'	12	25.5	0.5	1.7	19.5	73.1	5.7	22 ASTM 422-63 (2002)	SM

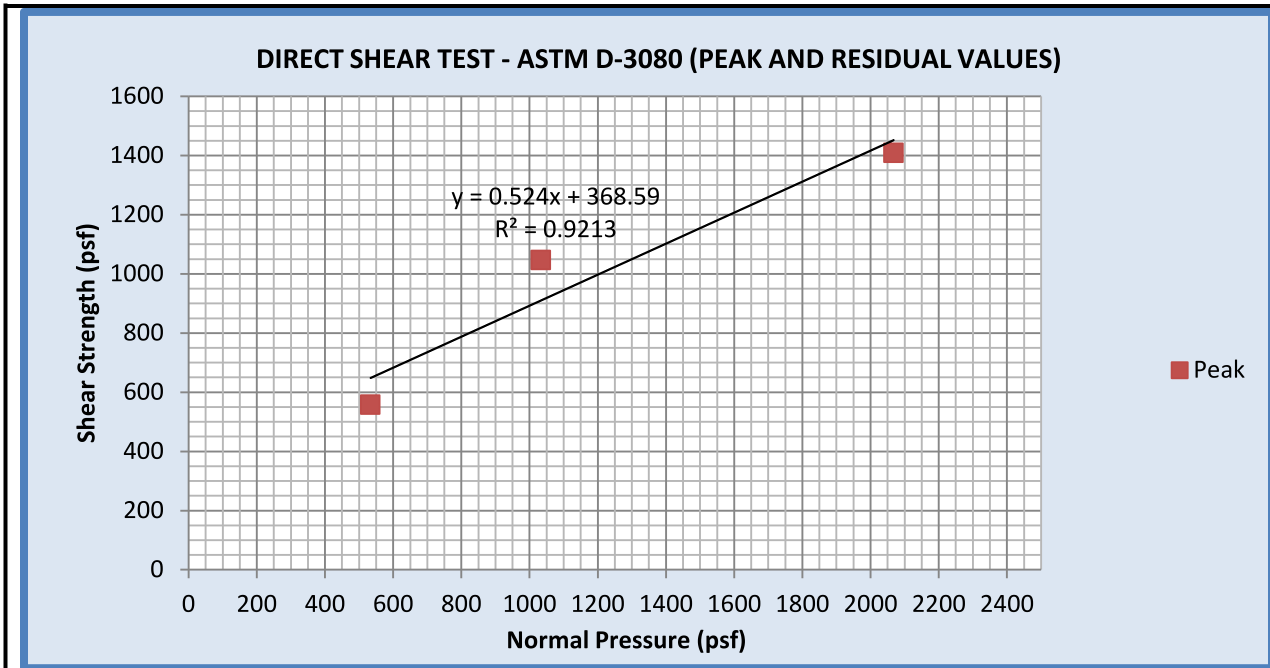
LABORATORY TEST RESULTS



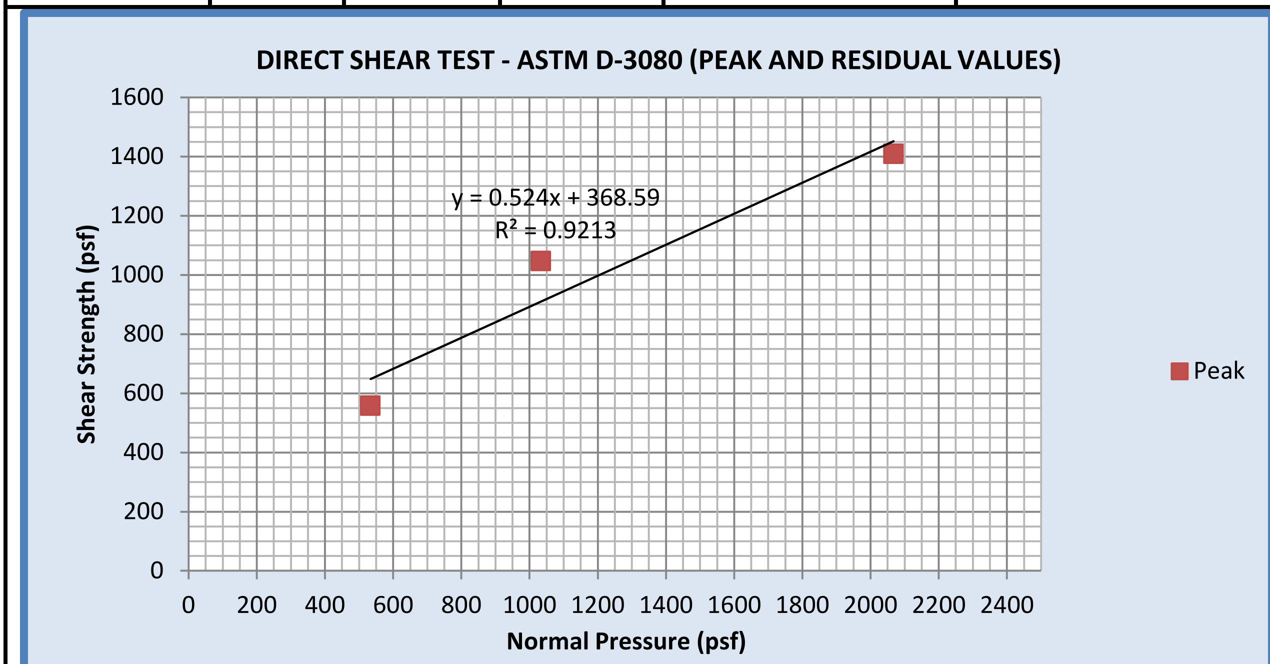
D_{10}	D_{30}	D_{50}	D_{60}
0.0164	0.0339	0.0576	0.0773

SAMPLE LOCATION	% FIELD MOISTURE	Cu	Cc	% Clay	% Silt	% Sand	% Coarse	PERCENT PASSING No 200	USCS
B-5 @ 10'	5	4.7	0.9	1.2	57.9	40.8	0.2	59 ASTM 422-63 (2002)	ML

LABORATORY TEST RESULTS

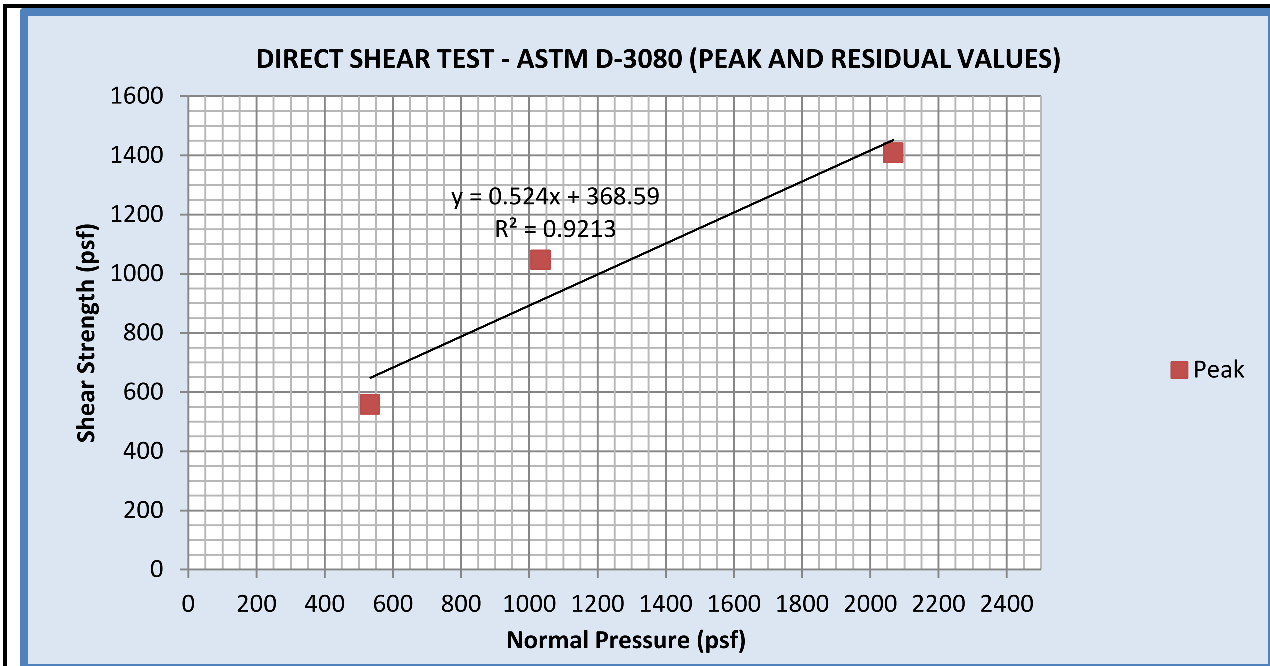


Sample	Average Density	Average Moisture	Saturated Moisture	Cohesion	Friction Angle
				Ultimate	Ultimate
B-3 @ 10'	109 pcf	12%	23%	233 psf	23°



Sample	Average Density	Average Moisture	Saturated Moisture	Cohesion	Friction Angle
				Ultimate	Ultimate
B-4 @ 5'	115 pcf	16%	24%	369 psf	29°

LABORATORY TEST RESULTS



Sample	Average Density	Average Moisture	Saturated Moisture	Cohesion	Friction Angle
				Ultimate	Ultimate
B-5 @ 5'	102 pcf	12%	26%	171 psf	32°

Sample	Sand Equivalent
B-1 @ 5'	12
B-2 @ 3-4'	20
B-2 @ 10'	45
B-3 @ 3-4'	31
B-4 @ 5'	37
B-5 @ 5'	14

GeoMat Testing Laboratories, Inc.
Soil Engineering, Environmental Engineering, Materials Testing, Geology

RESISTIVITY TEST RESULTS

Project Name	Ramona Magnolia Water Line Replacement	**Test Date**	12/23/12
Project No.	12069-01	**Date Sampled**	12/22/12
Project Location	City of Riverside	**Sampled By**	HMN
Sample Location	B-2 @ 3-4'	**Sample Type**	Bulk
Sample Classification	Silty Sand (SM)	**Tested By**	HMN

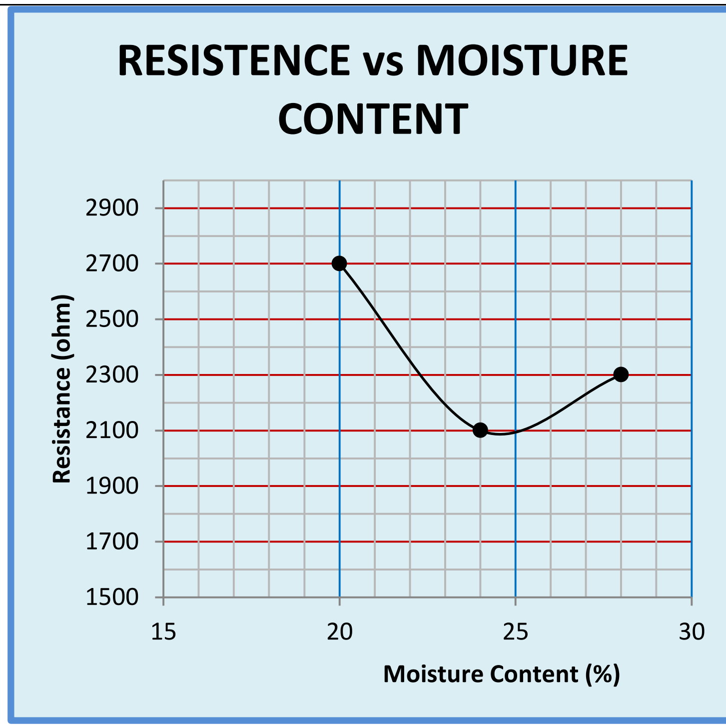
Definition	Soil Resistivity is a measure of how easily electrical current flows through soils				
Sample Preparation	Sieve sample through No. 8 sieve and split out ±130 for small soil box or 1300grm for large soil box.				
Sample Weight before Drying	427.8 grm	**Sample Weight after Drying (45°C±15°)**	405.8	**Sample Weight Passing No. 8 Sieve**	250 grm
Moist Weight (g)	427.8	**Dry Weight (g)**	405.8	**Initial Moisture Content**	5.4%

	Trial 1	Trial 2	Trial 3	
Soil Box Constant (cm)	1	1	1	
Water Added (ml)	50	60	70	
Moisture (%)	20	24	28	
Meter Dial Reading	2.7	2.1	2.3	
Multiplier Setting (Ohm)	1K	1K	1K	
Resistance (Ohms)	2700	2100	2300	
Min. Resistivity (Ohm-cm)	2100			
Temperature (°C)	19°C			
$R_{min\ 15.5} = [R_{min-T}\ (24.5+T)]/40$	2284			

Water increment : 100-150 ml for large box and 5-15 ml for small box
Resistivity = Resistance X Soil Box Constant.
Large Soil Box Constant = 6.67 cm
Small Soil Box Constant = 1 cm
$R_{min\ 15.5}$ Corrected Minimum Resistivity to Standard Ground Temperature of 15.5°C

Soil Corrosivness	**Resistivity (Ohm-cm)**
Very Severe Corrosion	0-900
Severely Corrosive	900-2300
Moderately Corrosive	2300-5000
Mildly Corrosive	5000-10,000
Very mildly Corrosive	10,000-100,000

Reference: ASTM STP 1013 titled "Effects of Soil Characteristics on Corrosion" (February, 1989).



Comments: Type II cement is recommended

The information in this form is not intended for corrosion engineering design. If corrosion is critical, a corrosion specialist should be contacted to provide further recommendations.

Signature Date

Print Name Title

GeoMat Testing Laboratories, Inc.

Soil Engineering, Environmental Engineering, Materials Testing, Geology

RESISTIVITY TEST RESULTS

Project Name	Ramona Magnolia Water Line Replacement	**Test Date**	12/23/12
Project No.	12069-01	**Date Sampled**	12/22/12
Project Location	City of Riverside	**Sampled By**	HMN
Sample Location	B-3 @ 3-4'	**Sample Type**	Bulk
Sample Classification	Clayey Sand (SC)	**Tested By**	HMN

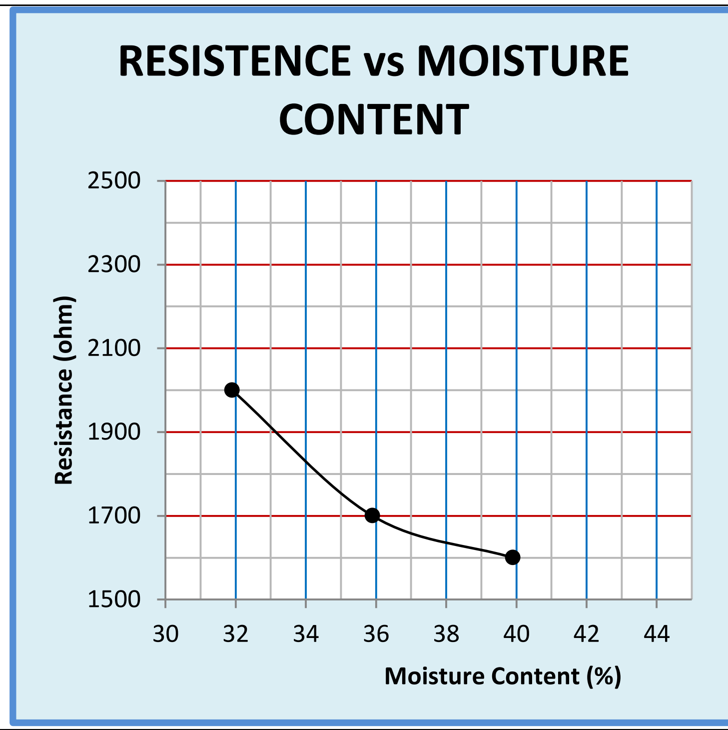
Definition	Soil Resistivity is a measure of how easily electrical current flows through soils				
Sample Preparation	Sieve sample through No. 8 sieve and split out ±130 for small soil box or 1300grm for large soil box.				
Sample Weight before Drying	452.2 grm	**Sample Weight after Drying (45°C±15°)**	404.1 g	**Sample Weight Passing No. 8 Sieve**	250 grm
Moist Weight (g)	452.2	**Dry Weight (g)**	404.1	**Initial Moisture Content**	11.9%

	Trial 1	Trial 2	Trial 3	
Soil Box Constant (cm)	1	1	1	
Water Added (ml)	50	60	70	
Moisture (%)	31;9	35.9	39.9	
Meter Dial Reading	2.0	1.7	1.6	
Multiplier Setting (Ohm)	1K	1K	1K	
Resistance (Ohms)	2000	1700	1600	
Min. Resistivity (Ohm-cm)	1600			
Temperature (°C)	19°C			
$R_{min\ 15.5} = [R_{min\text{-}T}\ (24.5+T)]/40$	1740			

Water increment : 100-150 ml for large box and 5-15 ml for small box
Resistivity = Resistance X Soil Box Constant.
Large Soil Box Constant = 6.67 cm
Small Soil Box Constant = 1 cm
$R_{min\ 15.5}$ Corrected Minimum Resistivity to Standard Ground Temperature of 15.5°C

Soil Corrosivness	**Resistivity (Ohm-cm)**
Very Severe Corrosion	0-900
Severely Corrosive	900-2300
Moderately Corrosive	2300-5000
Mildly Corrosive	5000-10,000
Very mildly Corrosive	10,000-100,000

Reference: ASTM STP 1013 titled "Effects of Soil Characteristics on Corrosion" (February, 1989).



Comments: Type II cement is recommended

The information in this form is not intended for corrosion engineering design. If corrosion is critical, a corrosion specialist should be contacted to provide further recommendations.

Signature   Date

Print Name   Title

9980 Indiana Avenue • Suite 14 • Riverside • California • 92503 • Phone (951) 688-5400 • Fax (951) 688-5200
www.geomatlabs.com, contact: e-mail: geomatlabs@sbcglobal.net

GeoMat Testing Laboratories, Inc.

Soil Engineering, Environmental Engineering, Materials Testing, Geology

RESISTIVITY TEST RESULTS

Project Name	Ramona Magnolia Water Line Replacement	**Test Date**	12/23/12
Project No.	12069-01	**Date Sampled**	12/22/12
Project Location	City of Riverside	**Sampled By**	HMN
Sample Location	B-4 @ 5'	**Sample Type**	Bulk
Sample Classification	Clayey Sand (SC)	**Tested By**	HMN

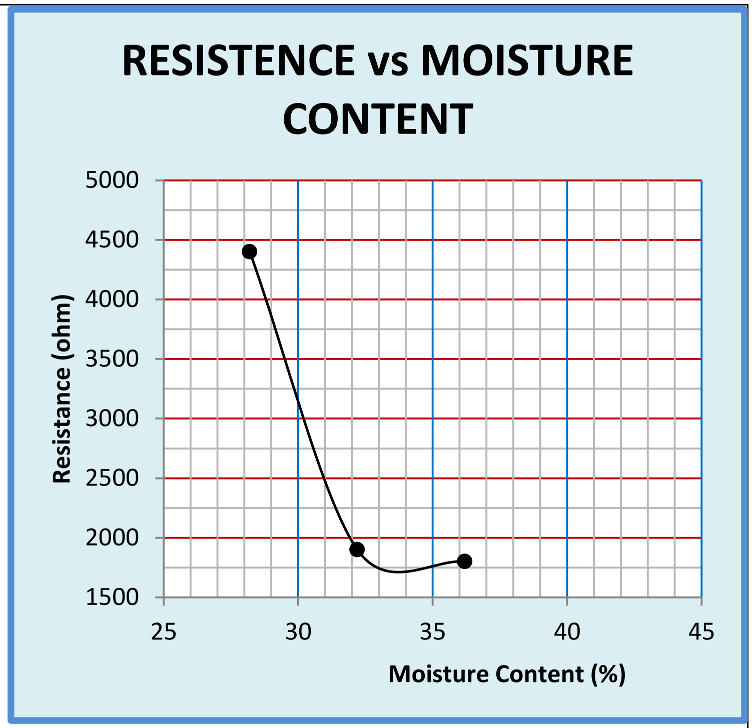
Definition	Soil Resistivity is a measure of how easily electrical current flows through soils				
Sample Preparation	Sieve sample through No. 8 sieve and split out ±130 for small soil box or 1300grm for large soil box.				
Sample Weight before Drying	408 grm	**Sample Weight after Drying (45°C±15°)**	363.5	**Sample Weight Passing No. 8 Sieve**	250 grm
Moist Weight (g)	408	**Dry Weight (g)**	363.5	**Initial Moisture Content**	12.2%

	Trial 1	Trial 2	Trial 3	
Soil Box Constant (cm)	1	1	1	
Water Added (ml)	40	50	60	70
Moisture (%)	28.2	32.2	36.2	40.2
Meter Dial Reading	4.4	1.9	1.8	1.7
Multiplier Setting (Ohm)	1K	1K	1K	1K
Resistance (Ohms)	4400	1900	1800	1700
Min. Resistivity (Ohm-cm)	1600			
Temperature (°C)	19°C			
$R_{min\ 15.5}$ = [R_{min-T} (24.5+T)]/40	1740			

Water increment : 100-150 ml for large box and 5-15 ml for small box
Resistivity = Resistance X Soil Box Constant.
Large Soil Box Constant = 6.67 cm
Small Soil Box Constant = 1 cm
$R_{min\ 15.5}$ Corrected Minimum Resistivity to Standard Ground Temperature of 15.5°C

Soil Corrosivness	**Resistivity (Ohm-cm)**
Very Severe Corrosion	0-900
Severely Corrosive	900-2300
Moderately Corrosive	2300-5000
Mildly Corrosive	5000-10,000
Very mildly Corrosive	10,000-100,000

Reference: ASTM STP 1013 titled "Effects of Soil Characteristics on Corrosion" (February, 1989).



Comments: Type II cement is recommended

The information in this form is not intended for corrosion engineering design. If corrosion is critical, a corrosion specialist should be contacted to provide further recommendations.

Signature Date

Print Name Title

SOLUBLE SULFATE AND CHLORIDE TEST RESULTS

Project Name	Magnolia Ramona Dr Water Line Replacement	**Test Date**	12/24/12
Project No.	12069-01	**Date Sampled**	12/22/12
Project Location	City of Riverside	**Sampled By**	HMN
Location in Structure	B-2 @ 3-4'	**Sample Type**	Bulk
Sampled Classification	Silty Sand (SM)	**Tested By**	HMN

TESTING INFORMATION

Sample weight before drying	grams
Sample weight after drying	Not recorded
Sample Weight Passing No. 10 Sieve	100 grams

Mixing Ratio	Dilution Factor	Sulfate Reading (ppm)	Sulfate Content (ppm)	Sulfate Content (%)	Chloride Reading (ppm)	Chloride Content (ppm)	Chloride Content (%)	pH
3	1	<50	<50	<0.005	20	60	0.006	7.38
		Average			Average			Average

ACI 318-05 Table 4.3.1 Requirements for Concrete Exposed to Sulfate-Containing Solutions

Sulfate Exposure	Water-Soluble Sulfate (SO_4) In Soil, % by Mass	Sulfate (SO_4) In Water ppm	Cement Type	Maximum w/cm by Mass	Minimum Design Compressive Strength fc, MPa (psi)
Negligible	< 0.10	< 150	No Special Type	--	--
Moderate (see water)	0.10 to 0.20	150 to 1500	II IP(MS), IS(MS), P(MS), I(PM)(MS), I(SM)(MS)	0.50	28 (4000)
Severe	0.20 to 2.00	1500 to 10,000	V	0.45	31 (4500)
Very Severe	> 2.00	>10,000	V + pozz	0.45	31 (4500)

Caltrans classifies a site as corrosive to structural concrete as an area where soil and/or water contains >500pp chloride, >2000ppm sulfate, or has a pH <5.5. A minimum resistivity of less than 1000 ohm-cm indicates the potential for corrosive environment requiring testing for the above criteria.

The 2007 CBC Section 1904A references ACI 318 for material selection and mix design for reinforced concrete dependant on the onsite corrosion potential, soluble chloride content, and soluble sulfate content in soil

Comments: Sec 4.3 of ACI 318 (2005) Soil environment is detrimental to concrete if it has soluble sulfate >1000ppm and/or pH<5.5. Soil environment is corrosive to reinforcement and steel pipes if Chloride ion >500ppm or pH <4.0.

The information in this form is not intended for corrosion engineering design. If corrosion is critical, a corrosion specialist should be contacted to provide further recommendations.

Signature Date

Print Name Title

SOLUBLE SULFATE AND CHLORIDE TEST RESULTS

Project Name	Magnolia Ramona Dr Water Line Replacement	**Test Date**	12/24/12
Project No.	12069-01	**Date Sampled**	12/22/12
Project Location	City of Riverside	**Sampled By**	HMN
Location in Structure	B-3 @ 3-4'	**Sample Type**	Bulk
Sampled Classification	Clayey Sand (SC)	**Tested By**	HMN

TESTING INFORMATION

Sample weight before drying	grams
Sample weight after drying	Not recorded
Sample Weight Passing No. 10 Sieve	100 grams

Mixing Ratio	Dilution Factor	Sulfate Reading (ppm)	Sulfate Content (ppm)	Sulfate Content (%)
3	1	<50	<50	<0.005
		Average		

Chloride Reading (ppm)	Chloride Content (ppm)	Chloride Content (%)
40	120	0.012
Average		

pH	
7.28	
Average	

ACI 318-05 Table 4.3.1 Requirements for Concrete Exposed to Sulfate-Containing Solutions

Sulfate Exposure	Water-Soluble Sulfate (SO_4) In Soil, % by Mass	Sulfate (SO_4) In Water ppm	Cement Type	Maximum w/cm by Mass	Minimum Design Compressive Strength fc, MPa (psi)
Negligible	< 0.10	< 150	No Special Type	--	--
Moderate (see water)	0.10 to 0.20	150 to 1500	II IP(MS), IS(MS), P(MS), I(PM)(MS), I(SM)(MS)	0.50	28 (4000)
Severe	0.20 to 2.00	1500 to 10,000	V	0.45	31 (4500)
Very Severe	> 2.00	>10,000	V + pozz	0.45	31 (4500)

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Signature Date

Print Name Title

GeoMat Testing Laboratories, Inc.

Soil Engineering, Environmental Engineering, Materials Testing, Geology

SOLUBLE SULFATE AND CHLORIDE TEST RESULTS

Project Name	Magnolia Ramona Dr Water Line Replacement	**Test Date**	12/24/12
Project No.	12069-01	**Date Sampled**	12/22/12
Project Location	City of Riverside	**Sampled By**	HMN
Location in Structure	B-4 @ 5'	**Sample Type**	Bulk
Sampled Classification	Clayey Sand (SC)	**Tested By**	HMN

TESTING INFORMATION

Sample weight before drying	grams
Sample weight after drying	Not recorded
Sample Weight Passing No. 10 Sieve	100 grams

Mixing Ratio	Dilution Factor	Sulfate Reading (ppm)	Sulfate Content (ppm)	Sulfate Content (%)
3	1	<50	<50	<0.005
		Average		

Chloride Reading (ppm)	Chloride Content (ppm)	Chloride Content (%)
12	36	0.0036
Average		

pH	
7.00	
Average	

ACI 318-05 Table 4.3.1 Requirements for Concrete Exposed to Sulfate-Containing Solutions

Sulfate Exposure	Water-Soluble Sulfate (SO_4) In Soil, % by Mass	Sulfate (SO_4) In Water ppm	Cement Type	Maximum w/cm by Mass	Minimum Design Compressive Strength fc, MPa (psi)
Negligible	< 0.10	< 150	No Special Type	--	--
Moderate (see water)	0.10 to 0.20	150 to 1500	II IP(MS), IS(MS), P(MS), I(PM)(MS), I(SM)(MS)	0.50	28 (4000)
Severe	0.20 to 2.00	1500 to 10,000	V	0.45	31 (4500)
Very Severe	> 2.00	>10,000	V + pozz	0.45	31 (4500)

Caltrans classifies a site as corrosive to structural concrete as an area where soil and/or water contains >500pp chloride, >2000ppm sulfate, or has a pH <5.5. A minimum resistivity of less than 1000 ohm-cm indicates the potential for corrosive environment requiring testing for the above criteria.

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Comments: Sec 4.3 of ACI 318 (2005) Soil environment is detrimental to concrete if it has soluble sulfate >1000ppm and/or pH<5.5. Soil environment is corrosive to reinforcement and steel pipes if Chloride ion >500ppm or pH <4.0.

The information in this form is not intended for corrosion engineering design. If corrosion is critical, a corrosion specialist should be contacted to provide further recommendations.

Signature Date

Print Name Title

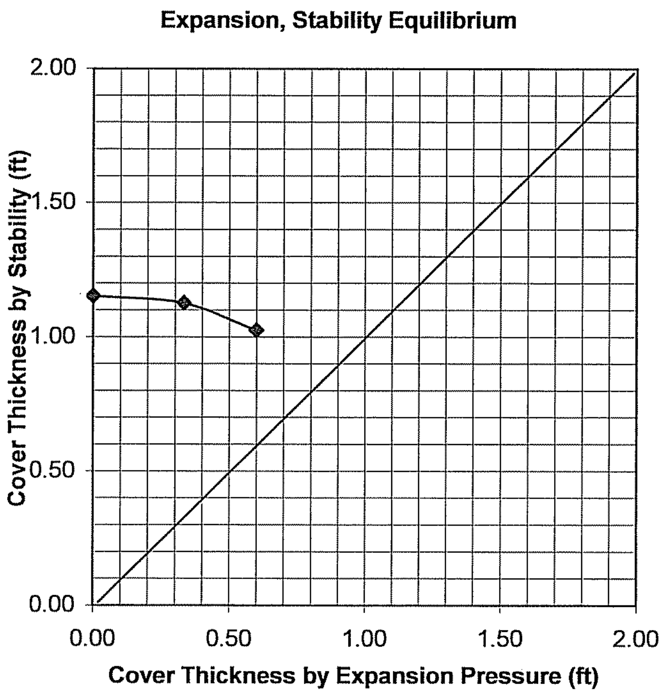
TEST SPECIMEN		A	B	C	D
Compactor air pressure	PSI	240	130	100	
Water added	%	3.4	5.4	6.4	
Moisture at compaction	%	13.0	15.0	16.0	
Height of sample	IN	2.52	2.59	2.59	
Dry density	PCF	120.6	112.6	112.6	
R-Value by exudation		20	12	10	
R-Value by exudation, corrected		20	12	10	
Exudation pressure	PSI	477	319	191	
Stability thickness	FT	1.02	1.13	1.15	
Expansion pressure thickness	FT	0.60	0.33	0.00	

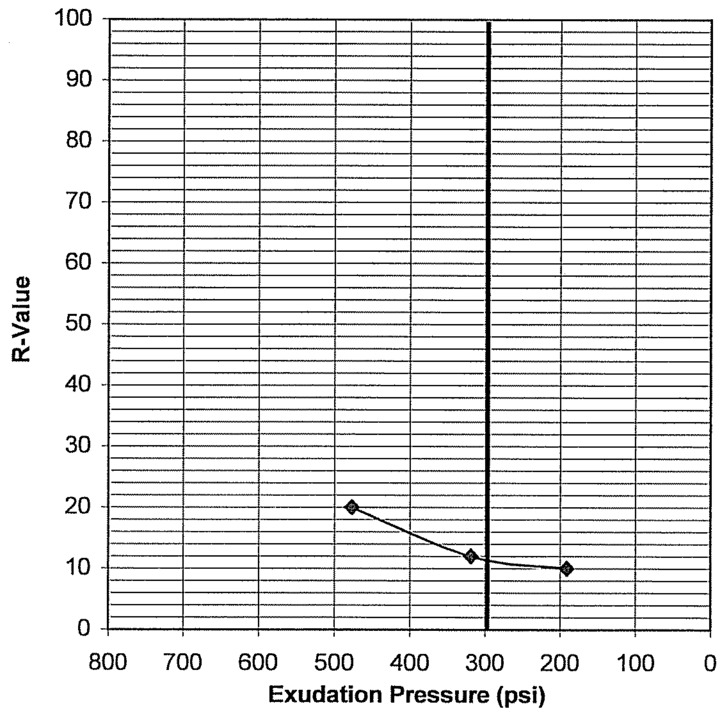
DESIGN CALCULATION DATA

Traffic index, assumed	5.0
Gravel equivalent factor, assumed	1.25
Expansion, stability equilibrium	0
R-Value by expansion	NA
R-Value by exudation	12
R-Value at equilibrium	**12**

SAMPLE INFORMATION

Sample Location: B-5, Ramona Dr.
Sample Description: Yellow Brown Silty Sand
Notes:
0% Retained on 3/4 inch sieve
Test Method: Cal-Trans Test 301





GeoSoils, Inc.
5741 Palmer Way
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Telephone: (760) 438-3155
Fax: (760) 931-0915

R - VALUE TEST RESULTS

Project: GEOMAT

Number: 5514.28-A-SC

Date: December 2012 Figure: 1

TEST SPECIMEN

		A	B	C	D
Compactor air pressure	PSI	350	300	200	
Water added	%	0.0	0.7	1.7	
Moisture at compaction	%	11.3	12.0	13.0	
Height of sample	IN	2.44	2.43	2.5	
Dry density	PCF	124.0	121.2	118.6	
R-Value by exudation		53	24	16	
R-Value by exudation, corrected		50	23	16	
Exudation pressure	PSI	621	382	281	
Stability thickness	FT	0.60	0.97	1.08	
Expansion pressure thickness	FT	1.03	0.60	0.40	

DESIGN CALCULATION DATA

Traffic index, assumed	5.0
Gravel equivalent factor, assumed	1.25
Expansion, stability equilibrium	0.8
R-Value by expansion	38
R-Value by exudation	18
R-Value at equilibrium	**18**

SAMPLE INFORMATION

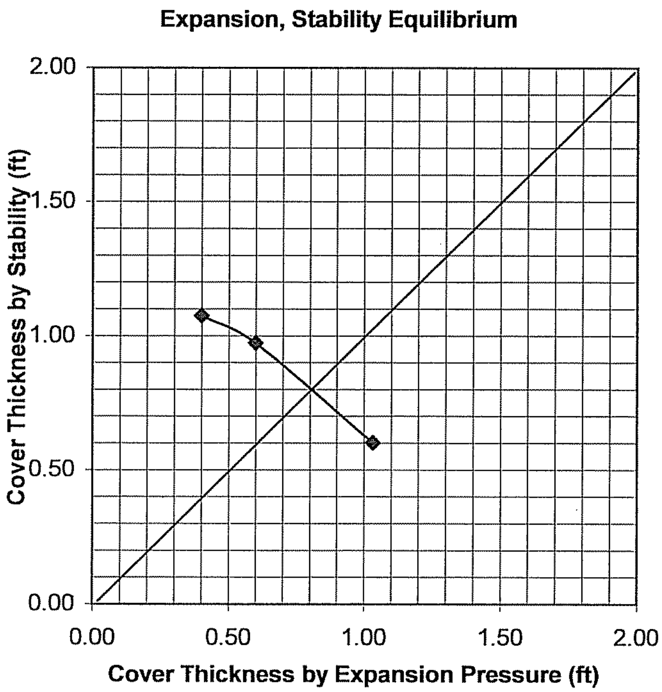
Sample Location: B-1, Magnolia Av.

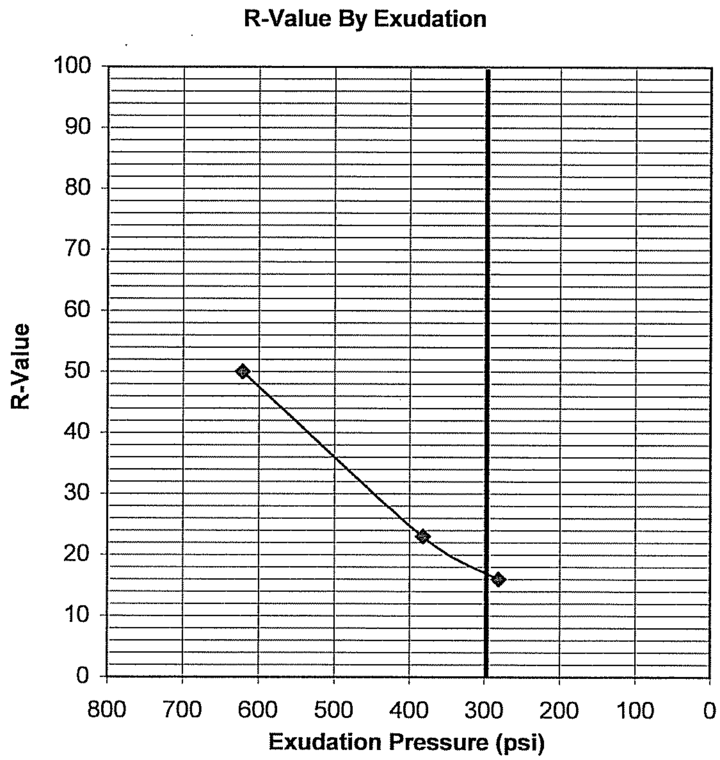
Sample Description: Brown Silty Sand

Notes:

4% Retained on 3/4 inch sieve

Test Method: Cal-Trans Test 301





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R - VALUE TEST RESULTS

Project: GEOMAT

Number: 5514.28-A-SC

Date: December 2012 Figure: 2

Appendix D

GENERAL EARTHWORK AND GRADING PECIFICATIONS

1.0 GENERAL INTENT

These specifications present general procedures and requirements for grading and earthwork as shown on the approved grading plans, including preparation of areas to be filled, placement of fill, installations of subdrains, and excavations. The recommendations contained in the geotechnical report are a part of the earthwork and grading specifications and shall supersede the provisions contained hereinafter in the case of conflict. Evaluations performed by the consultant during the course of grading may result in new recommendations which could supersede these specifications or the recommendations of the geotechnical report.

2.0 EARTHWORK OBSERVATIONS AND TESTING

Prior to the commencement of grading, a qualified geotechnical consultant (soils engineer and engineering geologist, and their representatives) shall be employed for the purpose of observing earthwork procedures and testing the fills for conformance with the recommendations of the geotechnical report and these specifications. It will be necessary that the consultant provide adequate testing and observations so that he may determine that the work was accomplished as specified. It shall be the responsibility of the contractor to assist the consultant and keep him apprised of work schedules and changes so that he may schedule his personnel accordingly.

It shall be the sole responsibility of the contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications and approved grading plans. If, in the opinion of the consultant, unsatisfactory conditions, such as questionable soil, poor moisture conditions, inadequate compaction, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the consultant will be empowered to reject the work and recommend that construction be stopped until the unsatisfactory conditions are rectified. Maximum dry density tests used to determine the degree of compaction will be performed in accordance with ASTM D1557-00 test method.

3.0 PREPARATION OF AREAS TO BE FILLED

3.1 Clearing and Grubbing

All brush, vegetation, and debris shall be removed or piled and otherwise disposed of.

3.2 Processing

The existing ground which is determined to be satisfactory for support of fill shall be scarified to a minimum depth of 6 inches. Existing ground which is not satisfactory shall be overexcavated as specified in the following section. Scarification shall continue until the soils are broken down and free of large clay lumps or clods and until the working surface is reasonably uniform and free of uneven features which would inhibit uniform compaction.

3.3 Overexcavation

Soft, dry, spongy, highly fractured or otherwise unsuitable ground, extending to such depth that surface processing cannot adequately improve the condition, shall be overexcavated down to firm ground, approved by the consultant.

3.4 Moisture Conditioning

Overexcavated and processed soils shall be watered, dried-back, blended, and/or mixed, as required to attain a uniform moisture content near optimum.

3.5 Recompaction

Overexcavation and processed soils which have been properly mixed and moisture-conditioned shall be recompacted to a minimum relative compaction of 90 percent.

3.6 Benching

Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal : vertical), the ground shall be stepped or benched. The lowest bench shall be a minimum of 15 feet wide, shall be at least 2 feet deep, shall expose firm materials, and shall be approved by the consultant. Other benches shall be excavated in firm materials for a minimum width of 4 feet. Ground sloping flatter than 5:1 (horizontal : vertical) shall be benched or otherwise overexcavated when considered necessary by the consultant.

3.7 Approval

All areas to receive fill, including processed areas, removal areas and toe-of-fill benches shall be approved by the consultant prior to fill placement.

4.0 FILL MATERIAL

4.1 General

Material to be placed as fill shall be free of organic matter and other deleterious substances, and shall be approved by the consultant. Soils of poor gradation, expansion, or strength characteristics shall be placed in areas designated by consultant or shall be mixed with other soils to serve as satisfactory fill material.

4.2 Oversize

Oversize materials defined as rock, or other irreducible material with maximum dimension greater than 12 inches, shall not be buried or placed in fills, unless the location, materials, and disposal methods are specifically approved by the consultant. Oversize disposal operations shall be such that nesting of oversize material does not occur, and such that the oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 feet vertically of finish grade or within the range of future utilities or underground construction, unless specifically approved by the consultant.

4.3 Import

If importing fill material is required for grading; import material shall meet the requirements of Section 4.1.

5.0 FILL PLACEMENT and COMPACTION

5.1 Fill Lifts

Approved fill material shall be placed in areas prepared to receive fill in near-horizontal layers not exceeding 6 inches in compacted thickness. The consultant may approve thicker lifts if testing indicates the grading procedures are such that adequate compaction is being achieved with lifts of greater thickness. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to attain uniformity of material and moisture in each layer.

5.2 Fill Moisture

Fill layers at a moisture content less than optimum shall be watered and mixed, and wet fill layers shall be aerated by scarification or shall be blended with drier material. Moisture conditioning and mixing of fill layers shall continue until the fill material is at a uniform moisture content at or near optimum.

5.3 Compaction of Fill

After each layer has been evenly spread, moisture-conditioned, and mixed, it shall be uniformly compacted to not less than 90 percent of maximum dry density. Compaction equipment shall be adequately sized and shall be either specifically designed for soil compaction or of proven reliability, to efficiently achieve the specified degree of compaction.

5.4 Fill Slopes

Compacting of slopes shall be accomplished, in addition to normal compacting procedures, by backrolling of slopes with sheepsfoot rollers at frequent increments of 2 to 3 feet in fill elevation gain, or by other methods producing satisfactory results. At the completion of grading, the relative compaction of the slope out to the slope face shall be at least 90 percent.

5.5 Compaction Testing

Field-tests to check the fill moisture and degree of compaction will be performed by the consultant. The location and frequency of tests shall be at the consultant's discretion. In general, the tests will be taken at intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of embankment.

6.0 SUBDRAIN INSTALLATION

Subdrain systems, if required, shall be installed in approved ground to conform to the approximate alignment and details shown on the plans or herein. The subdrain location or materials shall not be changed or modified without the approval of the consultant. The consultant, however, may recommend and upon approval, direct changes in subdrain line, grade or material. All subdrains should be surveyed for line and grade after installation and sufficient time shall be allowed for the surveys, prior to commencement of filling over the subdrain.

7.0 EXCAVATION

Excavations and cut slopes will be examined during grading. If directed by the consultant, further excavation or overexcavation and refilling of cut areas shall be performed, and/or remedial grading of cut slopes shall be performed. Where fill-over-cut slopes are to be graded, unless otherwise approved, the cut portion of the slope shall be made and approved by the consultant prior to placement of materials for construction of the fill portion of the slope.

8.0 TRENCH BACKFILLS

Trench excavations for utility pipes shall be backfilled under engineering supervision.

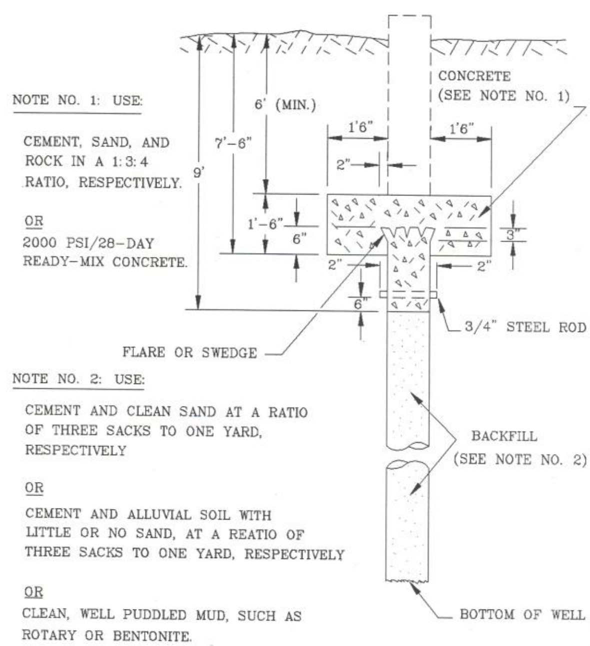
After the utility pipe has been laid, the space under and around the pipe shall be backfilled with clean sand or approved granular soil to a depth of at least one foot over the top of the pipe. The sand backfill shall be uniformly jetted into place before the controlled backfill is placed over the sand.

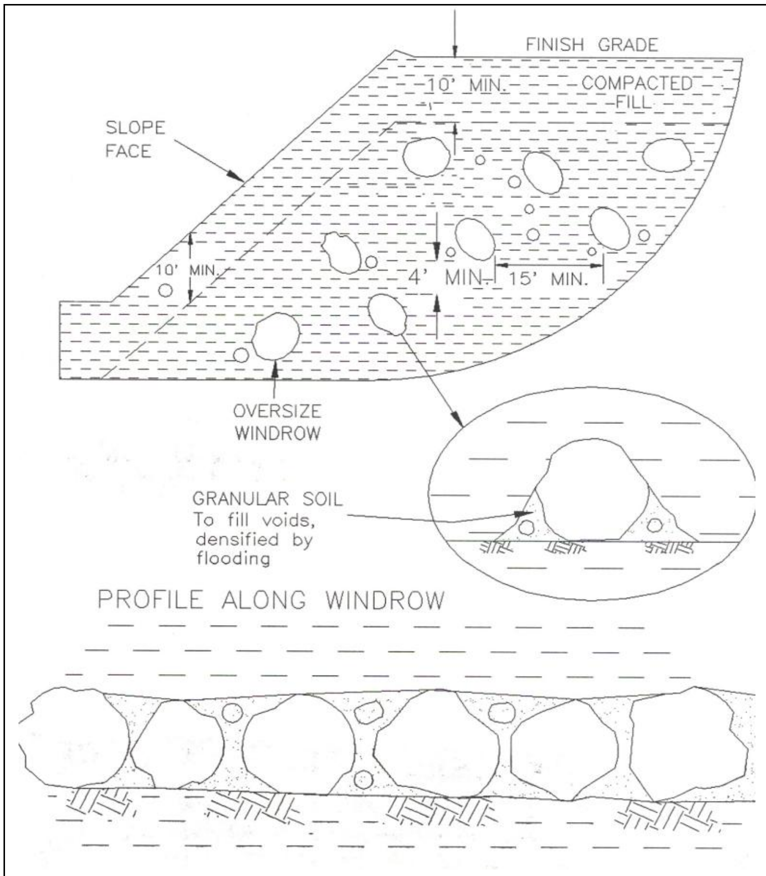
The onsite materials, or other soils approved by the soil engineer, shall be watered and mixed as necessary prior to placement in lifts over the sand backfill.

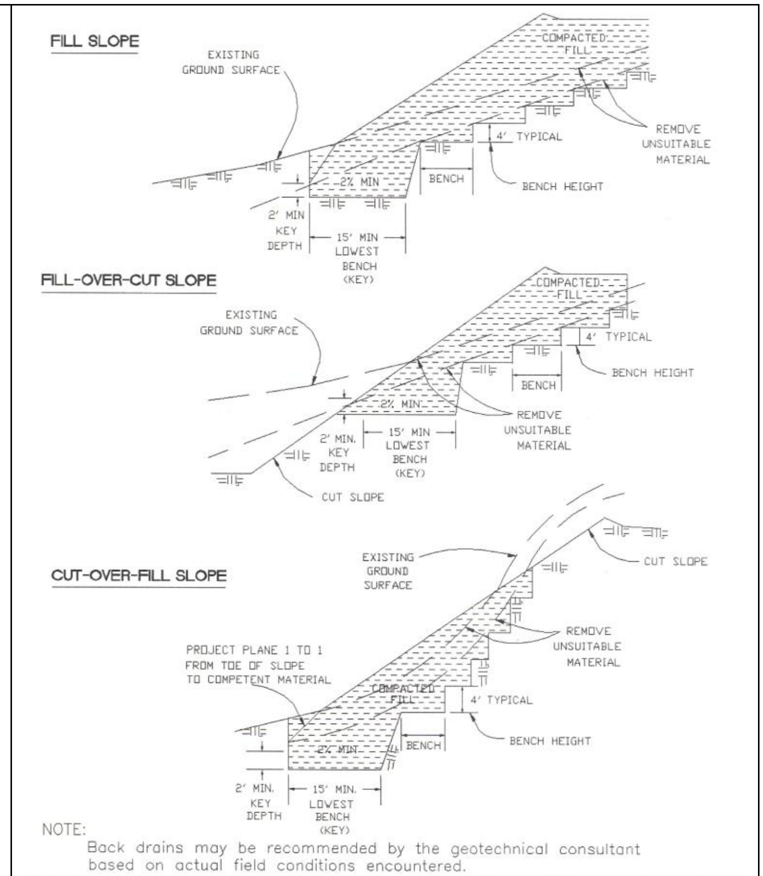
The controlled backfill shall be compacted to at least 90 percent of the maximum dry density as determined by the ASTM D1557-00 test method.

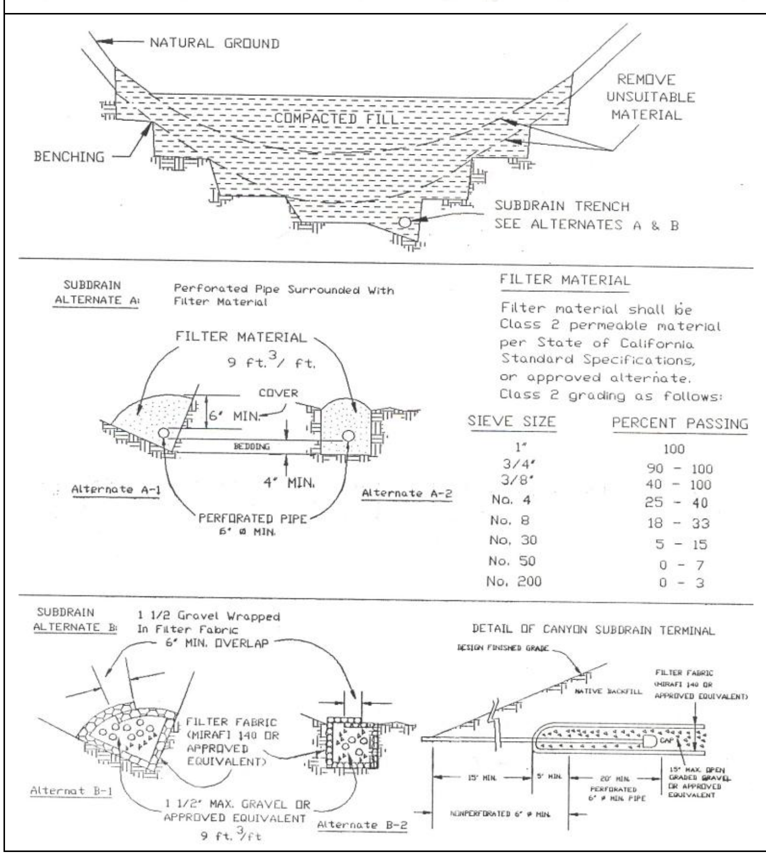
Field density tests and inspection of the backfill procedures shall be made by the soil engineer during backfilling to see that proper moisture content and uniform compaction is being maintained. The contractor shall provide test holes and exploratory pits as required by the soil engineer to enable sampling and testing.

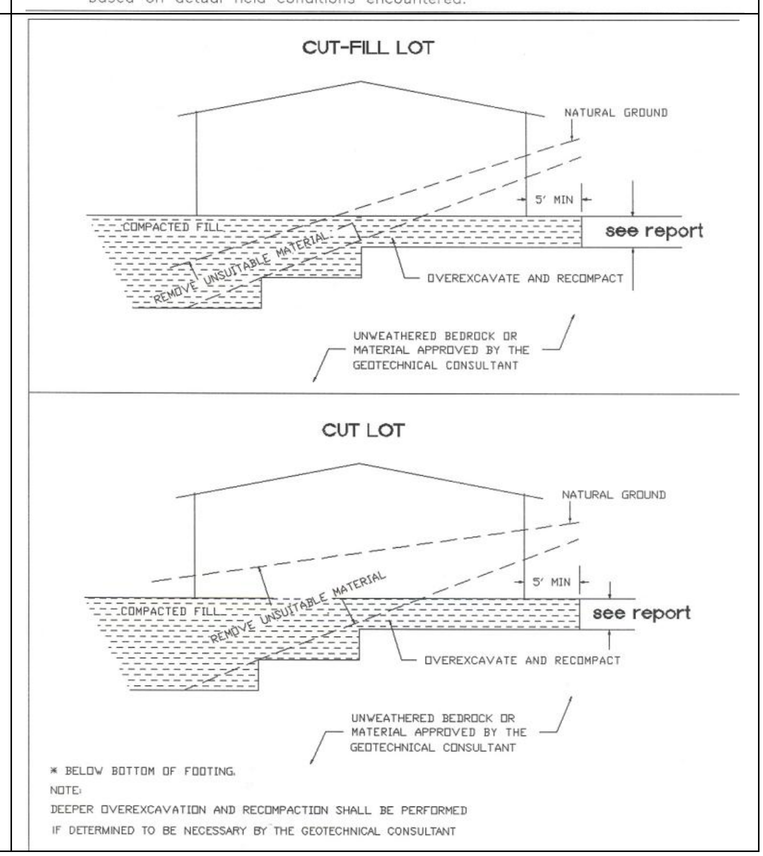
9.0 DETAILS




FINISH GRADE
10' MIN.
COMPACTED FILL
SLOPE FACE
10' MIN.
4' MIN.
15' MIN.
OVERSIZE WINDROW
GRANULAR SOIL
To fill voids, densified by flooding
PROFILE ALONG WINDROW


FILL SLOPE
EXISTING GROUND SURFACE
COMPACTED FILL
4' TYPICAL
REMOVE UNSUITABLE MATERIAL
2% MIN
BENCH
BENCH HEIGHT
2' MIN KEY DEPTH
15' MIN LOWEST BENCH (KEY)
FILL-OVER-CUT SLOPE
EXISTING GROUND SURFACE
COMPACTED FILL
4' TYPICAL
BENCH HEIGHT
BENCH
2% MIN
REMOVE UNSUITABLE MATERIAL
2' MIN. KEY DEPTH
15' MIN LOWEST BENCH (KEY)
CUT SLOPE
EXISTING GROUND SURFACE
CUT SLOPE
CUT-OVER-FILL SLOPE
REMOVE UNSUITABLE MATERIAL
PROJECT PLANE 1 TO 1 FROM TOE OF SLOPE TO COMPETENT MATERIAL
COMPACTED FILL
4' TYPICAL
BENCH
BENCH HEIGHT
2% MIN
2' MIN. KEY DEPTH
15' MIN. LOWEST BENCH (KEY)
NOTE:
Back drains may be recommended by the geotechnical consultant based on actual field conditions encountered.


NATURAL GROUND
REMOVE UNSUITABLE MATERIAL
COMPACTED FILL
BENCHING
SUBDRAIN TRENCH SEE ALTERNATES A & B
SUBDRAIN ALTERNATE A:
Perforated Pipe Surrounded With Filter Material
FILTER MATERIAL
9 ft.3/ft.
COVER
6" MIN.
BEDDING
4" MIN.
Alternate A-1
Alternate A-2
PERFORATED PIPE 6" Ø MIN.
FILTER MATERIAL
Filter material shall be Class 2 permeable material per State of California Standard Specifications, or approved alternate. Class 2 grading as follows:
SIEVE SIZE / PERCENT PASSING
1" / 100
3/4" / 90 - 100
3/8" / 40 - 100
No. 4 / 25 - 40
No. 8 / 18 - 33
No. 30 / 5 - 15
No. 50 / 0 - 7
No. 200 / 0 - 3
SUBDRAIN ALTERNATE B:
1 1/2 Gravel Wrapped In Filter Fabric
6" MIN. OVERLAP
FILTER FABRIC (MIRAFI 140 OR APPROVED EQUIVALENT)
Alternat B-1
1 1/2" MAX. GRAVEL OR APPROVED EQUIVALENT 9 ft.3/ft
Alternate B-2
DETAIL OF CANYON SUBDRAIN TERMINAL
DESIGN FINISHED GRADE
NATIVE BACKFILL
FILTER FABRIC (MIRAFI 140 OR APPROVED EQUIVALENT)
15' MIN.
5' MIN.
20' MIN. PERFORATED 6" Ø MIN. PIPE
15' MAX. OPEN GRADED GRAVEL OR APPROVED EQUIVALENT
NONPERFORATED 6" Ø MIN.


CUT-FILL LOT
NATURAL GROUND
5' MIN
COMPACTED FILL
see report
REMOVE UNSUITABLE MATERIAL
OVEREXCAVATE AND RECOMPACT
UNWEATHERED BEDROCK OR MATERIAL APPROVED BY THE GEOTECHNICAL CONSULTANT
CUT LOT
NATURAL GROUND
5' MIN
COMPACTED FILL
REMOVE UNSUITABLE MATERIAL
see report
OVEREXCAVATE AND RECOMPACT
UNWEATHERED BEDROCK OR MATERIAL APPROVED BY THE GEOTECHNICAL CONSULTANT
* BELOW BOTTOM OF FOOTING.
NOTE:
DEEPER OVEREXCAVATION AND RECOMPACTION SHALL BE PERFORMED IF DETERMINED TO BE NECESSARY BY THE GEOTECHNICAL CONSULTANT

APPENDIX VII

For a pocket-size version of this Guide, please contact your local DIPRA Regional Engineer, or visit the DIPRA web site at http://www.dipra.org to order your copy.

POLYETHYLENE ENCASEMENT INSTALLATION GUIDE

Effective, Economical Protection for Ductile Iron Pipe In Corrosive Environments

DIPRA DIPRA DIPRA DIPRA®

A STEP-BY-STEP GUIDE FOR INSTALLING POLYETHYLENE ENCASEMENT ON DUCTILE IRON PIPE

THIS POLYETHYLENE SLEEVE (polywrap) is placed on Ductile Iron pipe to prevent corrosion. It does not have to be sealed watertight, but it should be installed so that no dirt or bedding material comes in contact with the pipe. All lumps of clay, mud, cinders, etc., on the pipe surface should be removed before the pipe is covered with polyethylene. If the polyethylene is damaged, it must be repaired before the trench is backfilled.

Small holes or tears can be repaired with a piece of tape placed over the hole. Large holes or tears should be repaired by taping another piece of polyethylene over the hole.

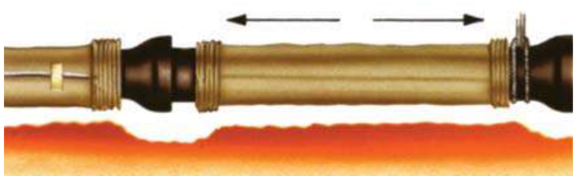
Overlaps, ends, and repairs can be held in place with tape or plastic tie straps until the trench is backfilled.

Other general tips for proper installation include: • When lifting polywrapped pipe with a backhoe, use a fabric-type "sling" or padded cable to protect the polyethylene. • When installing polywrap below the water table or in areas subject to tidal action, seal as thoroughly as possible both ends of each polyethylene tube with adhesive tape or plastic tie straps at the joint overlap. Also, place tape or plastic tie straps around the pipe at two (2) foot intervals. • Quality of installation is more important than the actual sequence followed.

FOLLOW THESE STEPS FOR EASY INSTALLATION

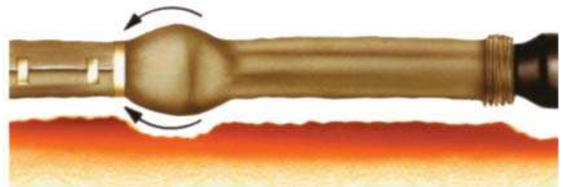
STEP 1
Clean all dirt, cinders, etc., from the surface of the pipe. Cut polyethylene two (2) feet longer than the pipe. Slip polyethylene over spigot end and bunch as shown above.

STEP 2
Dig bell holes at joint locations, lower pipe into trench and make up joint.

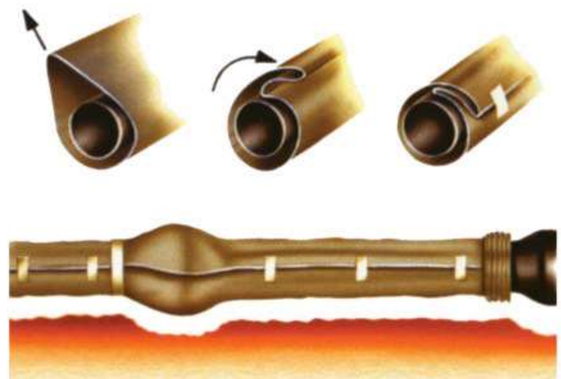


STEP 3
Move cable hoist to bell end of pipe and lift enough to slip polyethylene along pipe as shown above.

STEP 4
Pull polyethylene forward from previous joint over the bell and secure in place as shown.



STEP 5
Pull polyethylene from new pipe over this same bell, providing a double layer of polyethylene and secure in place as shown.



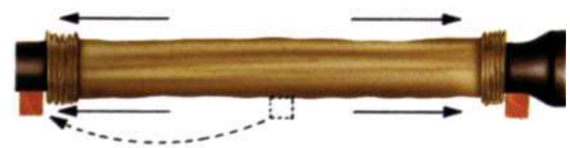
STEP 6
Take up slack in the tube along the pipe barrel, making a snug but not tight fit. Fold over on top of pipe and secure in place about every three (3) feet as shown.

STEP 7
Make sure any tears in the polyethylene are repaired with tape or another piece of polyethylene secured over the damaged area.

STEP 8
Backfill the trench according to specifications, being careful not to damage the polyethylene while tamping around pipe. Backfill should not contain material that might damage the polyethylene.

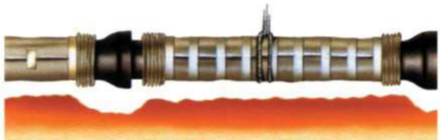
Wet Trench Installation

STEP 1
Cut the polyethylene tube two (2) feet longer than pipe and slip over pipe as shown above.



STEP 2
Spread the polyethylene tube as shown so that enough is left to provide a one (1) foot overlap at each end of pipe.

STEP 3
Take up slack in the tube to make a snug but not tight fit and secure every two (2) feet with tape or plastic tie straps completely around the pipe.



STEP 4
Lower pipe into trench, being sure that the polywrap is not damaged, and make up joint. Make overlap at joints as shown before. Be sure to secure the ends of the polyethylene with tape or plastic tie straps.

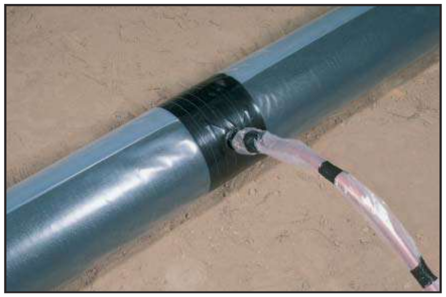
Tapping Polywrapped Pipe

When tapping polywrapped Ductile Iron pipe, the following procedure is recommended.

STEP 1
Wrap two or three layers of tape completely around the pipe where the tapping machine will be placed.

STEP 2
Mount the tapping machine on the taped area and make the tap directly through the tape and polywrap. Install corporation stop.

STEP 3
Inspect the entire area for damage and repair if necessary.



STEP 4
Wrap any connected copper service line within three (3) feet of the pipe with polyethylene.

STEP 5
Backfill trench as described before.

Remember: If you have any problems or questions about installing polyethylene encasement, contact DIPRA or one of its member companies.

DIPRA MEMBER COMPANIES

American Cast Iron Pipe Company
P.O. Box 2727
Birmingham, Alabama 35202-2727

Atlantic States Cast Iron Pipe Company
183 Sitgreaves Street
Phillipsburg, New Jersey 08865-3000

Canada Pipe Company, Ltd.
1757 Burlington Street East
Hamilton, Ontario L8N 3R5 Canada

Clow Water Systems Company
P.O. Box 6001
Coshocton, Ohio 43812-6001

McWane Cast Iron Pipe Company
1201 Vanderbilt Road
Birmingham, Alabama 35234

Pacific States Cast Iron Pipe Company
P.O. Box 1219
Provo, Utah 84603-1219

United States Pipe and Foundry Company
P.O. Box 10406
Birmingham, Alabama 35202-0406

DUCTILE IRON PIPE RESEARCH ASSOCIATION

An association of quality producers dedicated to highest pipe standards through a program of continuing research.
245 Riverchase Parkway East, Suite O
Birmingham, Alabama 35244-1856
Telephone 205 402-8700 FAX 205 402-8730
http://www.dipra.org

DUCTILE IRON PIPE
THE RIGHT DECISION

Manufactured from recycled materials.

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Published 12-95
Rev. 2-99

APPENDIX VIII

Manhole Report

Public Works-Engineering
City of Riverside

Date: **03/08/2017**
Computed by: **Curt**
Checked by:
Page: **1 of 1**

Street or Improvement: **MAGNOLIA AVE/RAMONA DRIVE WATERMAIN**

Station		Offset	Rim Elev.	Depth	Topo Point No.
		RAMONA DRIVE			
12 +	26.00	1' LT	722.16	4.85	773
16 +	37.60	1' LT	824.00	4.65	945
21 +	21.70	0.30' LT	827.69	6.00	307
		LARCHWOOD PLACE			
29 +	56.60	C.L.	819.75	LOCKED	1724
29 +	67.50	C.L.	819.88	6.25	1664
36 +	2.60	0.30' RT	822.43	4.80	1419
41 +	37.40	0.30' RT	726.96	6.00	1073
		BROCKTON AVENUE			
		NO MANHOLES IN TOPO			
		MAGNOLIA AVENUE			
		NO MANHOLES IN TOPO			
		FAIRFAX AVENUE			
22 +	8.20	18.4' LT	845.37	4.45	2269
25 +	80.00	19.2' LT	850.26	11.45	2245

APPENDIX IX

State of California

PUBLIC CONTRACT CODE

Section 9204

9204. (a) The Legislature finds and declares that it is in the best interests of the state and its citizens to ensure that all construction business performed on a public works project in the state that is complete and not in dispute is paid in full and in a timely manner.

(b) Notwithstanding any other law, including, but not limited to, Article 7.1 (commencing with Section 10240) of Chapter 1 of Part 2, Chapter 10 (commencing with Section 19100) of Part 2, and Article 1.5 (commencing with Section 20104) of Chapter 1 of Part 3, this section shall apply to any claim by a contractor in connection with a public works project.

(c) For purposes of this section:

(1) "Claim" means a separate demand by a contractor sent by registered mail or certified mail with return receipt requested, for one or more of the following:

(A) A time extension, including, without limitation, for relief from damages or penalties for delay assessed by a public entity under a contract for a public works project.

(B) Payment by the public entity of money or damages arising from work done by, or on behalf of, the contractor pursuant to the contract for a public works project and payment for which is not otherwise expressly provided or to which the claimant is not otherwise entitled.

(C) Payment of an amount that is disputed by the public entity.

(2) "Contractor" means any type of contractor within the meaning of Chapter 9 (commencing with Section 7000) of Division 3 of the Business and Professions Code who has entered into a direct contract with a public entity for a public works project.

(3) (A) "Public entity" means, without limitation, except as provided in subparagraph (B), a state agency, department, office, division, bureau, board, or commission, the California State University, the University of California, a city, including a charter city, county, including a charter county, city and county, including a charter city and county, district, special district, public authority, political subdivision, public corporation, or nonprofit transit corporation wholly owned by a public agency and formed to carry out the purposes of the public agency.

(B) "Public entity" shall not include the following:

(i) The Department of Water Resources as to any project under the jurisdiction of that department.

(ii) The Department of Transportation as to any project under the jurisdiction of that department.

(iii) The Department of Parks and Recreation as to any project under the jurisdiction of that department.

(iv) The Department of Corrections and Rehabilitation with respect to any project under its jurisdiction pursuant to Chapter 11 (commencing with Section 7000) of Title 7 of Part 3 of the Penal Code.

(v) The Military Department as to any project under the jurisdiction of that department.

(vi) The Department of General Services as to all other projects.

(vii) The High-Speed Rail Authority.

(4) "Public works project" means the erection, construction, alteration, repair, or improvement of any public structure, building, road, or other public improvement of any kind.

(5) "Subcontractor" means any type of contractor within the meaning of Chapter 9 (commencing with Section 7000) of Division 3 of the Business and Professions Code who either is in direct contract with a contractor or is a lower tier subcontractor.

(d) (1) (A) Upon receipt of a claim pursuant to this section, the public entity to which the claim applies shall conduct a reasonable review of the claim and, within a period not to exceed 45 days, shall provide the claimant a written statement identifying what portion of the claim is disputed and what portion is undisputed. Upon receipt of a claim, a public entity and a contractor may, by mutual agreement, extend the time period provided in this subdivision.

(B) The claimant shall furnish reasonable documentation to support the claim.

(C) If the public entity needs approval from its governing body to provide the claimant a written statement identifying the disputed portion and the undisputed portion of the claim, and the governing body does not meet within the 45 days or within the mutually agreed to extension of time following receipt of a claim sent by registered mail or certified mail, return receipt requested, the public entity shall have up to three days following the next duly publicly noticed meeting of the governing body after the 45-day period, or extension, expires to provide the claimant a written statement identifying the disputed portion and the undisputed portion.

(D) Any payment due on an undisputed portion of the claim shall be processed and made within 60 days after the public entity issues its written statement. If the public entity fails to issue a written statement, paragraph (3) shall apply.

(2) (A) If the claimant disputes the public entity's written response, or if the public entity fails to respond to a claim issued pursuant to this section within the time prescribed, the claimant may demand in writing an informal conference to meet and confer for settlement of the issues in dispute. Upon receipt of a demand in writing sent by registered mail or certified mail, return receipt requested, the public entity shall schedule a meet and confer conference within 30 days for settlement of the dispute.

(B) Within 10 business days following the conclusion of the meet and confer conference, if the claim or any portion of the claim remains in dispute, the public entity shall provide the claimant a written statement identifying the portion of the claim that remains in dispute and the portion that is undisputed. Any payment due on an undisputed portion of the claim shall be processed and made within 60 days after the public entity issues its written statement. Any disputed portion of the claim, as identified by the contractor in writing, shall be submitted to nonbinding mediation, with the public entity and the claimant sharing the associated costs equally. The public entity and claimant shall mutually agree to a mediator within 10 business days after the disputed portion of the claim has been identified in writing. If the parties cannot agree upon a mediator, each party shall select a mediator and those mediators shall select a qualified neutral third party to mediate with regard to the disputed portion of the claim. Each party shall bear the fees and costs charged by its respective mediator in connection with the selection of the neutral mediator. If mediation is unsuccessful, the parts of the claim remaining in dispute shall be subject to applicable procedures outside this section.

(C) For purposes of this section, mediation includes any nonbinding process, including, but not limited to, neutral evaluation or a dispute review board, in which an independent third party or board assists the parties in dispute resolution through negotiation or by issuance of an evaluation. Any mediation utilized shall conform to the timeframes in this section.

(D) Unless otherwise agreed to by the public entity and the contractor in writing, the mediation conducted pursuant to this section shall excuse any further obligation under Section 20104.4 to mediate after litigation has been commenced.

(E) This section does not preclude a public entity from requiring arbitration of disputes under private arbitration or the Public Works Contract Arbitration Program, if mediation under this section does not resolve the parties' dispute.

(3) Failure by the public entity to respond to a claim from a contractor within the time periods described in this subdivision or to otherwise meet the time requirements of this section shall result in the claim being deemed rejected in its entirety. A claim that is denied by reason of the public entity's failure to have responded to a claim, or its failure to otherwise meet the time requirements of this section, shall not constitute an adverse finding with regard to the merits of the claim or the responsibility or qualifications of the claimant.

(4) Amounts not paid in a timely manner as required by this section shall bear interest at 7 percent per annum.

(5) If a subcontractor or a lower tier subcontractor lacks legal standing to assert a claim against a public entity because privity of contract does not exist, the contractor may present to the public entity a claim on behalf of a subcontractor or lower tier subcontractor. A subcontractor may request in writing, either on his or her own behalf or on behalf of a lower tier subcontractor, that the contractor present a claim for work which was performed by the subcontractor or by a lower tier subcontractor on behalf of the subcontractor. The subcontractor requesting that the claim be presented to the public entity shall furnish reasonable documentation to support the claim. Within 45 days of receipt of this written request, the contractor shall notify the subcontractor in writing as to whether the contractor presented the claim to the public entity and, if the original contractor did not present the claim, provide the subcontractor with a statement of the reasons for not having done so.

(e) The text of this section or a summary of it shall be set forth in the plans or specifications for any public works project that may give rise to a claim under this section.

(f) A waiver of the rights granted by this section is void and contrary to public policy, provided, however, that (1) upon receipt of a claim, the parties may mutually agree to waive, in writing, mediation and proceed directly to the commencement of a civil action or binding arbitration, as applicable; and (2) a public entity may prescribe reasonable change order, claim, and dispute resolution procedures and requirements in addition to the provisions of this section, so long as the contractual provisions do not conflict with or otherwise impair the timeframes and procedures set forth in this section.

(g) This section applies to contracts entered into on or after January 1, 2017.

(h) Nothing in this section shall impose liability upon a public entity that makes loans or grants available through a competitive application process, for the failure of an awardee to meet its contractual obligations.

(i) This section shall remain in effect only until January 1, 2020, and as of that date is repealed, unless a later enacted statute, that is enacted before January 1, 2020, deletes or extends that date.

(Added by Stats. 2016, Ch. 810, Sec. 1. (AB 626) Effective January 1, 2017. Repealed as of January 1, 2020, by its own provisions.)