GEO HYDRO ENGINEERS

Report of Subsurface Exploration

Dallas Highway 36-Inch Parallel Water Main
Mars Hill Road to Friendship Church Road
CCMWA Project Number 9005-02-62-0000

Prepared for Engineering Strategies, Inc.
January 15, 2016

Mr. Pedro Rosello, P.E., President
Engineering Strategies, Inc. (ESI)
3855 Shallowford Road, Suite 525
Marietta, Georgia 30062

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Report of Subsurface Exploration
Dallas Highway 36-Inch Parallel Water Main
Mars Hill Road to Friendship Church Road
Cobb County, Georgia
CCMWA Project Number 9005-02-62-0000
Geo-Hydro Project Number 150811.20

Dear Mr. Rosello:

Geo-Hydro Engineers, Inc. has completed the authorized subsurface exploration for the above referenced project. The scope of services for this project was outlined in our revised proposal number 18377.2 dated October 13, 2015. This report describes our understanding of the project and the subsurface conditions encountered and contains our conclusions and recommendations regarding the geotechnical aspects of the proposed design and construction.

PROJECT INFORMATION

Proposed Water Main Replacement

Our understanding of the project is based on our telephone conversations with you and our review of 75 percent review project drawings prepared by ESI. The project will consist of about 10,000 feet of new ductile iron pipe water main. The alignment will begin at an existing 30-inch diameter water main on the west side of Mars Hill Road just north of its intersection with Dallas Highway. The alignment generally heads east along the north shoulder of Dallas Highway to the intersection of Dallas Highway and Friendship Church Road, where the proposed water main alignment will tie into the West Side Loop (CCMWA Project No. 9005-90-61-0000) that is currently under construction. The alignment includes a 350-foot long lateral connecting the planned water main to the recently constructed CCMWA water tank at the Lost Mountain Water Storage Tank Site. Figure 1 in the Appendix shows the approximate proposed alignment. The new water line will be a 36-inch diameter pipe. The majority of the new water line will be located within the right-of-way for the existing roadways. The water line will generally have a minimum of 6 feet of soil cover and will be deeper in several areas due to existing topography, utilities, and other factors.

Existing Site Conditions

The project alignment includes primarily commercial areas, a police station, and some residential properties and neighborhoods. Topography along the alignment is typical for the Atlanta area with rolling upland areas separated by creeks and intermittent wet weather drainage features. No creek crossings will be required along the planned alignment. The right-of-way along Dallas Highway has numerous underground and overhead utilities.

EXPLORATORY PROCEDURES

Field Exploration

The subsurface exploration consisted of 25 machine-drilled borings performed at the approximate locations shown on Figures 2.1 through 2.8 included in the Appendix. The borings were located in the field by Geo-Hydro based on existing site features and survey stakes placed by others marking the new water line alignment. The elevations shown on the test boring records were interpolated from topographic site plans provided to us. In general, the locations and elevations of the borings should be considered approximate. Stationing is included on the test boring records and was estimated from the drawings.

Standard penetration testing, as provided for in ASTM Dl586, was performed at select intervals in the borings. Soil samples obtained from the drilling operation were examined and classified in general accordance with ASTM D-2488 (Visual-Manual Procedure for Description of Soils). Soil classifications include the use of the Unified Soil Classification System described in ASTM D2487 (Classification of Soils for Engineering Purposes). The soil classifications also include our evaluation of the geologic origin of the soils. Evaluations of geologic origin are based on our experience and may be subject to some degree of interpretation.

Laboratory Testing

Samples for laboratory testing related to the corrosive properties of the soils were obtained from the auger cuttings at nine boring locations. Corrosion laboratory testing included pH (ASTM G51), reduction/oxidation (ASTM G200), and resistivity testing using the soil-box method (ASTM G187). Bulk samples of representative soils were obtained at six locations for standard Proctor compaction testing (ASTM D698). Moisture content tests (ASTM D2216) were performed on select split-spoon samples obtained during the drilling operations. Test results are included in the Appendix.

REGIONAL GEOLOGY

The project site is located in the Northern Piedmont Geologic Province of Georgia. Published geologic literature indicates that the site is underlain by an un-named unit consisting of intermixed amphibolite, hornblende gneiss, and felsic gneiss. Soils in this area have been formed by the in-place weathering of the underlying crystalline rock, which accounts for their classification as "residual" soils. Residual soils near the ground surface, which have experienced advanced weathering, frequently consist of red brown clayey silt (ML) or silty clay (CL). The thickness of this surficial clayey zone may range up to roughly 6 feet. For various reasons, such as erosion or local variation of mineralization, the upper clayey zone is not always present.

With increased depth, the soil becomes less weathered, coarser grained, and the structural character of the underlying parent rock becomes more evident. These residual soils are typically classified as sandy

micaceous silt (ML) or silty micaceous sand (SM). With a further increase in depth, the soils eventually become quite hard and take on an increasing resemblance to the underlying parent rock. When these materials have a standard penetration resistance of 100 blows per foot or greater, they are referred to as partially weathered rock. The transition from soil to partially weathered rock is usually a gradual one, and may occur at a wide range of depths. Lenses or layers of partially weathered rock are not unusual in the soil profile.

Partially weathered rock represents the zone of transition between the soil and the indurated metamorphic rocks from which the soils are derived. The subsurface profile is, in fact, a history of the weathering process which the crystalline rock has undergone. The degree of weathering is most advanced at the ground surface, where fine grained soil may be present. And, the weathering process is in its early stages immediately above the surface of relatively sound rock, where partially weathered rock may be found.

The thickness of the zone of partially weathered rock and the depth to the rock surface have both been found to vary considerably over relatively short distances. The depth to the rock surface may frequently range from the ground surface to 80 feet or more. The thickness of partially weathered rock, which overlies the rock surface, may vary from only a few inches to as much as 40 feet or more.

Stream valleys in the Piedmont Region may contain alluvial (water deposited) soils, depending on ground surface topography, stream flow characteristics, and other factors. By nature, alluvial soils can be highly variable depending upon the energy regime at the time of deposition. Coarse materials such as sand or gravel are deposited in higher energy environments, while fine grained materials such as silt and clay are deposited in low energy environments. Alluvial soils may also contain significant organic materials, and are frequently in a loose, saturated condition. In many cases, fine grained alluvial soils will be highly compressible and have relatively low shear strength.

Overall geologic conditions along sections of the water main alignment have been modified by previous grading activities for the roadways, utilities, residential lots, etc., and alluvial deposition.

TEST BORING SUMMARY

The majority of test borings were performed in landscaped and grassed areas on the north shoulder of Dallas Highway. Topsoil thicknesses encountered at the boring locations ranged from 2 to about 16 inches. Borings B-20 and B-23 were performed in turn lanes and encountered about 1 to 2 inches of asphalt underlain by 3 to 4 inches of graded aggregate base. The thickness of surface materials should be expected to vary along the alignment and detailed measurements necessary for quantity estimation were not performed for this exploration. For planning purposes, we recommend an arbitrary thickness of 12 inches for surface materials.

In general, the overburden soils (fill, alluvium, and residuum) consisted mostly of clayey silts, sandy silts, and silty sands typical of the Piedmont region. Fill materials were encountered in 17 of the 25 borings.

The fill materials extended to depths ranging from about 3 to 12 feet. Standard penetration resistances recorded in the fill ranged from 3 to 22 blows per foot.

Beneath the fill material, alluvial sands were encountered in boring B-22 extending to a depth of about 18 feet. A standard penetration resistance of 8 blows per foot was recorded in the alluvium.

Beneath fill materials or alluvial soils, all of the borings encountered residual soil typical of the Piedmont Region. The residual soils were generally classified as clayey silt, sandy silt, and silty sand. Standard penetration resistances recorded in the residuum ranged from 2 to 51 blows per foot.

Borings B-10 and B-22 encountered partially weathered rock beginning at depths ranging from about 6 and 28 feet, respectively, which corresponds to approximate elevations 1150 and 1084, respectively. Partially weathered rock is locally defined as residual material having a standard penetration resistance of 100 blows per foot or greater.

Conditions causing auger refusal were encountered in boring B-10 at a depth of 17 feet, which corresponds to an elevation of approximately 1139. Auger refusal is the condition that prevents further advancement of the boring using conventional soil drilling techniques. The remaining borings were extended to their planned termination depths without encountering auger refusal.

Groundwater was encountered in nine of the soil test borings. The depth to groundwater varied from about 7 to 17 feet below the ground surface. For safety reasons, several borings were backfilled immediately after drilling. Where feasible, groundwater was checked in the borings at least 24 hours after drilling. It is important to note that groundwater levels will fluctuate depending on seasonal variations of precipitation and other factors, and may occur at higher elevations in the future.

Boring Number	Approximate Station	Depth to Groundwater (feet)	Approximate Groundwater Elevation (feet)
B-6	17+50	7	1147
B-7	22+50	10	1153
B-8	27+50	16	1155
B-9	32+50	14	1155
B10	37+50	9	1147
B-21	80+25	14	1114
B-22	84+70	15	1097
B-23	85+80	16	1095
B-24	90+00	17	1087

For more detailed descriptions of subsurface conditions, please refer to the test boring records and summary table included in the Appendix.

LABORATORY TESTING

Laboratory testing was performed on 6 bulk soil samples and 50 split spoon samples obtained during field operations to assist in evaluating the soils for reuse as structural fill. Standard Proctor compaction tests (ASTM D698) and moisture content tests (ASTM D2216) were performed on the bulk samples and moisture content testing was performed on the split spoon samples. Standard Proctor test data sheets and a table of moisture content test results are included in the Appendix. The following table summarizes the results of the Proctor tests.

Boring	Station	Maximum Dry Density (pcf)	Optimum Moisture Content (%)	Natural Moisture Content (%)
B-1	1+50	102.5	22.0	22.8
B-7	22+50	101.0	21.5	30.3
B-11	41+50	101.0	21.0	20.9
B-17	61+75	109.0	17.0	20.9
B-21	80+25	107.5	15.5	23.1
B-25	94+00	105.5	20.0	30.0

CORROSION TESTING

Laboratory testing for corrosion characteristics was performed on bulk samples obtained from 9 boring locations. Measured pH readings ranged from 4.6 to 6.5. Oxidation/reduction potential ranged from 321 to 382 mV. Resistivity readings ranged from 4,550 to 36,000 ohms-cm. The table below summarizes the corrosion laboratory test results. Complete test results are included in the Appendix.

Boring	Station	Sample Depth (feet)	pH	ORP (mV)	Resistivity (ohms-cm)
B-1	1+50	17	4.6	351	36,000
B-5	12+50	10	6.6	321	4,550
B-7	22+50	13	5.4	348	22,000
B-9	32+50	15	4.9	382	16,800
B-13	51+50	10	4.7	37	24,600
B-17	61+75	10	5.3	361	28,200
B-19	71+50	10	5.0	345	14,800
B-21	80+25	12	6.0	381	9,010
B-24	90+00	15	5.0	322	23,000

EVALUATIONS AND RECOMMENDATIONS

The following evaluations are based on the information available on the proposed water main alignment, the data obtained from the exploratory borings and laboratory testing, and our experience with soils and subsurface conditions similar to those encountered at the explored locations. Because the subsurface exploration represents a statistically small sampling of subsurface conditions, it is possible that conditions between the test borings may be substantially different from those indicated by the borings.

Excavation Characteristics

Boring B-10 encountered partially weathered rock at a depth of about 6 feet, which corresponds to approximate elevation 1150; approximately 8 feet above the planned invert elevation. Boring B-10 also encountered conditions causing auger refusal at a depth of 17 feet, which corresponds to an elevation of approximately 1139; approximately 3 feet below the planned invert elevation. Based on the soil test boring data, difficult excavation conditions should be expected in this area (STA 37+50). Partially weathered rock may also be encountered along unexplored portions of the alignment. Partially weathered rock can typically be removed with adequate equipment. However, larger boulders, rock lenses, and dense seams within partially weathered rock can hinder excavation. A budget contingency should be included for rock excavation.

Partially weathered rock was also encountered in boring B-22 at a depth of 18 feet; approximately 11 feet below the planned invert elevation. Based on the proposed water line profiles provided to us, we do not expect difficult excavation conditions in this area because we do not expect construction activities to extend to the depth where denser materials were encountered.

It is important to note that the geology of the Piedmont is characterized by variable subsurface conditions. Due to the widely-spaced nature of the borings, it is likely that subsurface conditions intermediate of the borings will be different. Weathered rock, mass rock, boulders, and rock seams may all be encountered at locations intermediate of the borings along the alignment.

For construction bidding and field verification purposes it is common to provide a verifiable definition of rock in the project specifications. The following is a typical definition of trench rock:

- Trench Rock: Material occupying an original volume of at least one-half cubic yard which cannot be excavated with a hydraulic excavator having a minimum flywheel power rating of 123 kW (165 hp); such as a Caterpillar 322C L, John Deere 230C LC, or a Komatsu PC220LC-7; equipped with a short tip radius bucket not wider than 42 inches.

Crossings

Based on the results of the test borings, we do not anticipate that the planned jack-and-bore crossings will be significantly hindered by partially weathered rock or rock as long as excavation for installation of the water main does not extend deeper than the depths explored.

Groundwater will be a concern for the jack-and-bore crossing at County Road (Approximate station 85+00). We provide additional discussion regarding temporary groundwater control in the *Construction Dewatering* section below. In addition to the pipe trench, driving and receiving pits for jack-and-bore crossings will have to be adequately shored and dewatered to allow construction.

Earth Slopes

Temporary construction slopes should be designed in strict compliance with OSHA regulations. The exploratory borings indicate that most soils along the alignment are Type B or C as defined in 29 CFR 1926.650 (1994 Edition). In general, we recommend that temporary construction slopes be no steeper than 1.5H:1V for excavation depths of 20 feet or less. However, temporary excavation slopes in firm residual soils above the groundwater level can have a gradient of 1H:1V. Temporary construction slopes should be closely observed on a daily basis by the contractor's "competent person" for signs of mass movement: tension cracks near the crest, bulging at the toe of the slope, etc. The responsibility for excavation safety and stability of temporary slopes should lie solely with the contractor.

We recommend that extreme caution be observed in trench excavations. Several cases of loss of life due to trench collapses in Georgia point out the lack of attention given to excavation safety on some projects. We recommend that applicable local and federal regulations regarding temporary slopes, and shoring and bracing of trench excavations be closely followed.

Temporary Excavation Bracing

If at a given location a sloped excavation is not feasible, trench boxes or other temporary excavation bracing will be required. The most appropriate type of excavation bracing will be dictated by subsurface conditions at the specific excavation or pit location. Typically, the contractor will design and implement temporary excavation bracing as part of means and methods.

Construction Dewatering

Based on the groundwater levels in the borings, groundwater will be encountered in several sections of the water main alignment. The main areas that will be affected are between stations 15+00 and 40+00 and between stations 78+00 and 92+00. However, groundwater may be encountered in other low-lying areas along the alignment. Dewatering should be performed to maintain the groundwater level approximately 2 to 3 feet below the lowest prevailing excavation depth. In most cases we expect that direct pumping from the excavation will provide satisfactory temporary construction dewatering. However, the actual

dewatering approach will be dictated by conditions at the time of excavation. Sand layers or other more permeable soil layers may significantly increase the amount of water inflow into open excavations.

The amount of temporary dewatering actually required during construction is related not only to the prevailing weather conditions, but also the contractor's sequencing of construction activities. Construction specifications should include performance guidelines for temporary dewatering. Performance guidelines allow the contractor to select the actual means and methods of construction dewatering. The following sample specification[1] could be used as a guide for development of actual specifications.

> *Control of groundwater shall be accomplished in a manner that will preserve the strength of the foundation soils, will not cause instability of the excavation slopes, and will not result in damage to existing structures. Where necessary to these purposes, the water level shall be lowered in advance of excavation, utilizing trenches, sumps, wells, well points, or similar methods. The water level, as measured in piezometers, shall be maintained a minimum of 3 feet below the prevailing excavation level. Open pumping from sumps and ditches, if it results in boils, loss of soil fines, softening of the ground, or instability of slopes, will not be permitted. Wells and well points shall be installed with suitable screens and filters so that continuous pumping of soil fines does not occur. The discharge shall be arranged to facilitate collection of samples by the Engineer.*

We recommend that pipe bedding be used where groundwater is encountered. This will provide a level, stable base for pipe installation. We recommend #57 or #78 crushed stone meeting Georgia DOT specifications as pipe bedding. The bedding stone should be wrapped in non-woven, needle-punched geotextile fabric meeting the requirements of AASHTO M288 for Class 2 Geotextiles.

Structural Fill Placement

Materials selected for use as structural fill should be free of organic matter, waste construction debris, and other deleterious materials. In general, the material should not contain rocks having diameters over 4 inches. It is our opinion that the following soils represented by their USCS group symbols will typically be suitable for use as structural fill and are commonly found in abundance in the Piedmont region: (CL), (SM), and (ML). The following soil types are typically suitable but are not abundant in the Piedmont region: (SW), (SP), (SC), (SP-SM), and (SP-SC). The following soil types are considered unsuitable: (MH), (CH), (OL), (OH), and (Pt).

Laboratory Proctor compaction tests should be performed on representative samples of proposed fill materials to provide data necessary to determine acceptability and for quality control. The moisture content of suitable borrow soils should generally be no more than 3 percentage points above or below their optimum moisture contents at the time of compaction. Tighter moisture limits may be necessary with certain soils.

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[1] The sample specification was adapted from Construction Dewatering - A Guide to Theory and Practice, John Wiley and Sons, and is not intended for direct use as a construction specification without modifications to reflect specific project conditions.

Suitable fill material should be placed in thin lifts. Lift thickness depends on type of compaction equipment; but in general lifts of 8 inches loose measurement are recommended. The soil should be compacted by heavy compaction equipment such as a self-propelled sheepsfoot roller. Within confined areas, such as around the pipe or manhole structures, we recommend the use of "wacker packers" or "Rammax" compactors to achieve the specified compaction. Loose lift thicknesses of 4 to 6 inches are recommended in small area fills.

In general, we recommend that structural fill be compacted to at least 95 percent of the standard Proctor maximum dry density (ASTM D698). Following Georgia DOT guidelines, the upper 12 inches of pavement subgrade soils should be compacted to at least 100 percent of the standard Proctor maximum dry density. Geo-Hydro should perform density tests during fill placement.

Soils excavated from elevations approaching and extending below the groundwater level will have moisture contents that will be too high to allow proper compaction. As most of the water main alignment will be outside the travel lanes, the compaction criteria can possibly be adjusted to allow the reuse of soils with higher moisture contents than those typically required for structural fill. However, proper compaction must be achieved beneath any roadways and other areas where pavements or other hardscapes will be supported by the fill.

Air-drying can be performed in the warmer, drier periods of the year but drying soil is typically only practical on larger grading sites. We expect that the most practical option will be to use a chemical agent, such as lime, to dry the soils but areas to spread soils are still needed. One or more staging areas near the project alignment could be used to dry wet soils. The contractor should be prepared to dry soils on this project. We can provide further guidance concerning the use of lime once a contractor is selected and a plan for addressing wet backfill soils is developed. Budget planning should consider the need to dry or replace wet soils (haul off wet soil and import drier soil).

Pipe Support

Based on the results of the test borings and our observations, it is likely that conditions varying from loose fill to partially weathered rock or rock will be exposed at invert elevation for the water main. In order to limit potential differential settlement and stress concentrations at the interface of dissimilar bearing materials, soft soils should be removed and pipe bedding consisting of crushed stone should be placed as necessary. Bedding will likely be needed in conjunction with dewatering as discussed above. This approach will also provide a stable and relatively level working surface during installation of pipe sections.

We recommend that project plans require at least 6 inches of #57 or #78 crushed stone meeting Georgia DOT specifications for gradation as bedding for the pipe. This approach should result in satisfactory removal of the upper portion of loose soils, where present, and would establish a relatively uniform bearing surface. In areas where groundwater is present or expected to fluctuate within the pipe interval, pipe bedding stone should be wrapped using non-woven, needle-punched geotextile fabric meeting the requirements of AASHTO M288 for Class 2 Geotextiles.

Subsurface conditions will vary, and we recommend that a qualified geotechnical engineer be present during preparation of bearing surfaces for the pipeline.

Thrust Block Design

At the time of this report, locations along the alignment that will require a thrust block had not been provided to us. Once final locations are determined for any thrust blocks along the alignment, please allow us to revise our recommendations. The following paragraphs outline general thrust block recommendations that can be used for planning purposes. Depending on the actual thrust block locations, more favorable parameters and recommendations may be possible.

Passive earth pressure may be evaluated using the following equation:

$$p_h = K_p (D_w Z + q_s) + W_w(Z-d)$$

where: p_h = horizontal earth pressure at any depth below the ground surface (Z)
W_w = unit weight of water
Z = depth to any point below the ground surface
d = depth to groundwater surface
D_w = partially saturated unit weight of the soil backfill (depending on borrow sources). The partially saturated unit weight of most residual soils may be expected to range from approximately 115 to 125 pcf. Below the groundwater level, D_w must be the buoyant weight.
q_s = uniform, permanent surcharge load
K = earth pressure coefficient as follows:

Earth Pressure Condition	Coefficient
Active (K_a)	0.33
Passive (K_p)	3.0

For analysis of sliding resistance at the base of the block, the coefficient of friction may be taken as 0.4 for residual soils in contact with the bottom of the block. This is an ultimate value and an adequate safety factor should be used in design. Full development of the frictional force could require deflection of roughly 0.1 to 0.3 inches.

The base of the thrust block should bear on relatively firm soils. Provided that a stable bearing surface is available, an allowable bearing pressure of 2,000 psf can be used in design of support for the block. The thrust block subgrade must be evaluated by Geo-Hydro to verify that the recommended bearing pressure is available. Also, the block location must be properly dewatered to reduce disturbance to the block subgrade. If the subgrade soils become water-softened, undercutting may be required to remove soft soils. If friction at the base of the block is used to resist sliding, lean concrete must be used to backfill any undercut areas.

* * * * * *

Geo-Hydro Engineers, Inc. has appreciated the opportunity to work with you on this phase of the project, and we look forward to providing any additional services you may require. If you have any questions concerning this report or any of our services, please call us.

Sincerely,

GEO-HYDRO ENGINEERS, INC.

A. Marty Peninger, P.E.
Senior Geotechnical Engineer

Luis E. Babler, P.E.
Chief Engineer

AMP/LEB/150811.20 - Dallas Highway 36-Inch Parallel Water Main - Geotechnical Report

APPENDIX

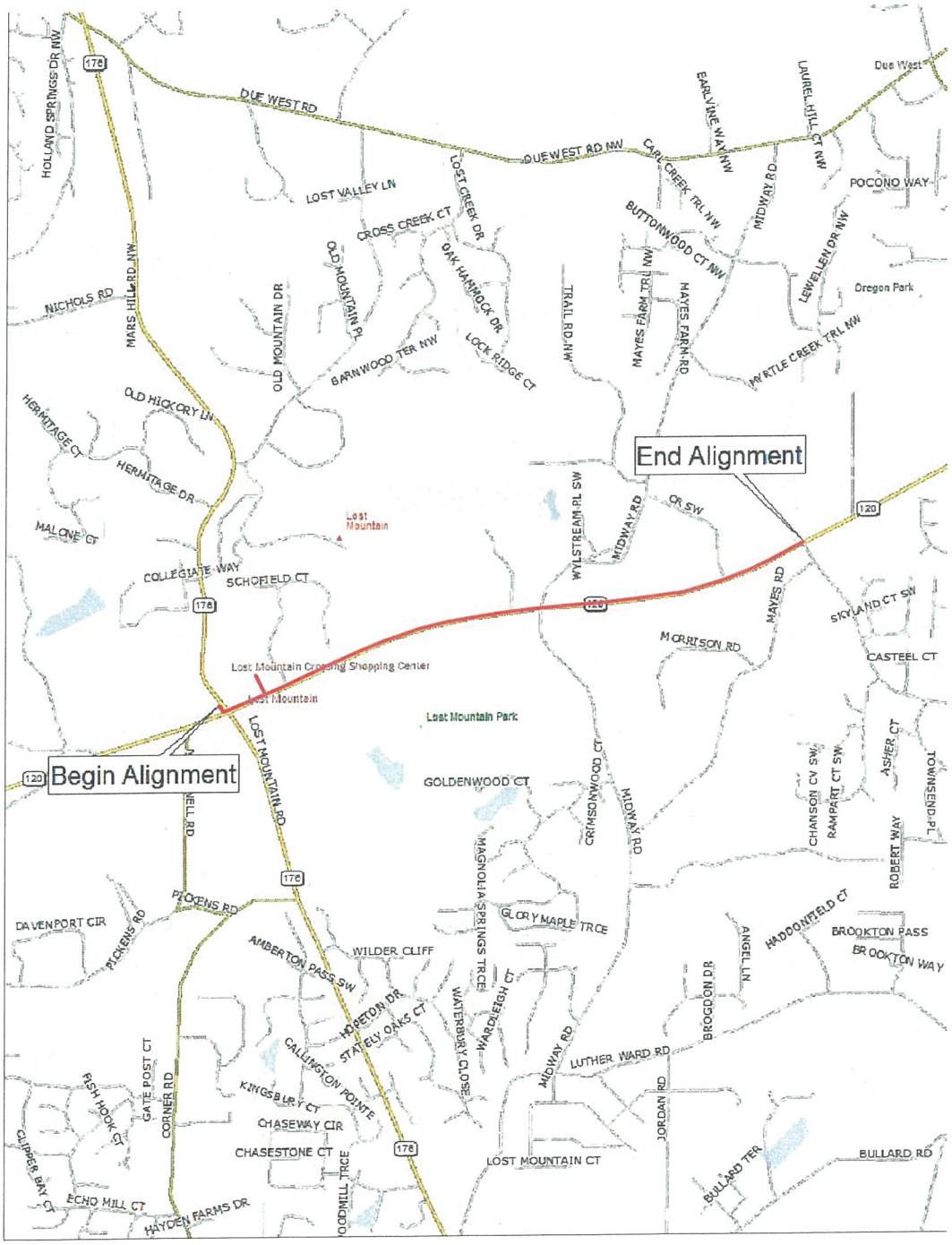

Figure 1: Site Location Plan

Dallas Highway 36-Inch Parallel Water Main
Mars Hill Road to Friendship Church Road
Cobb County, Georgia
Geo-Hydro Project Number 150811.20

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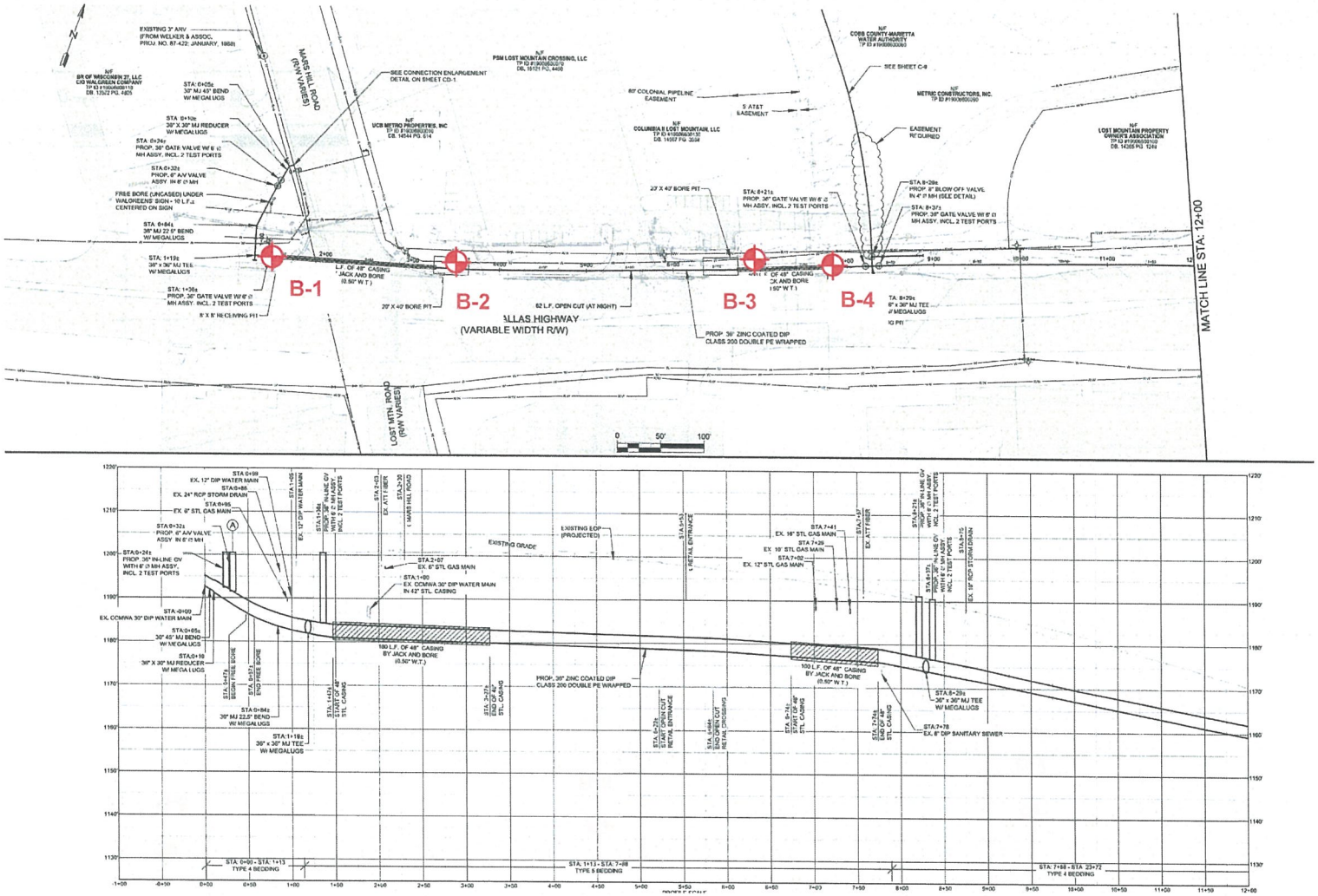


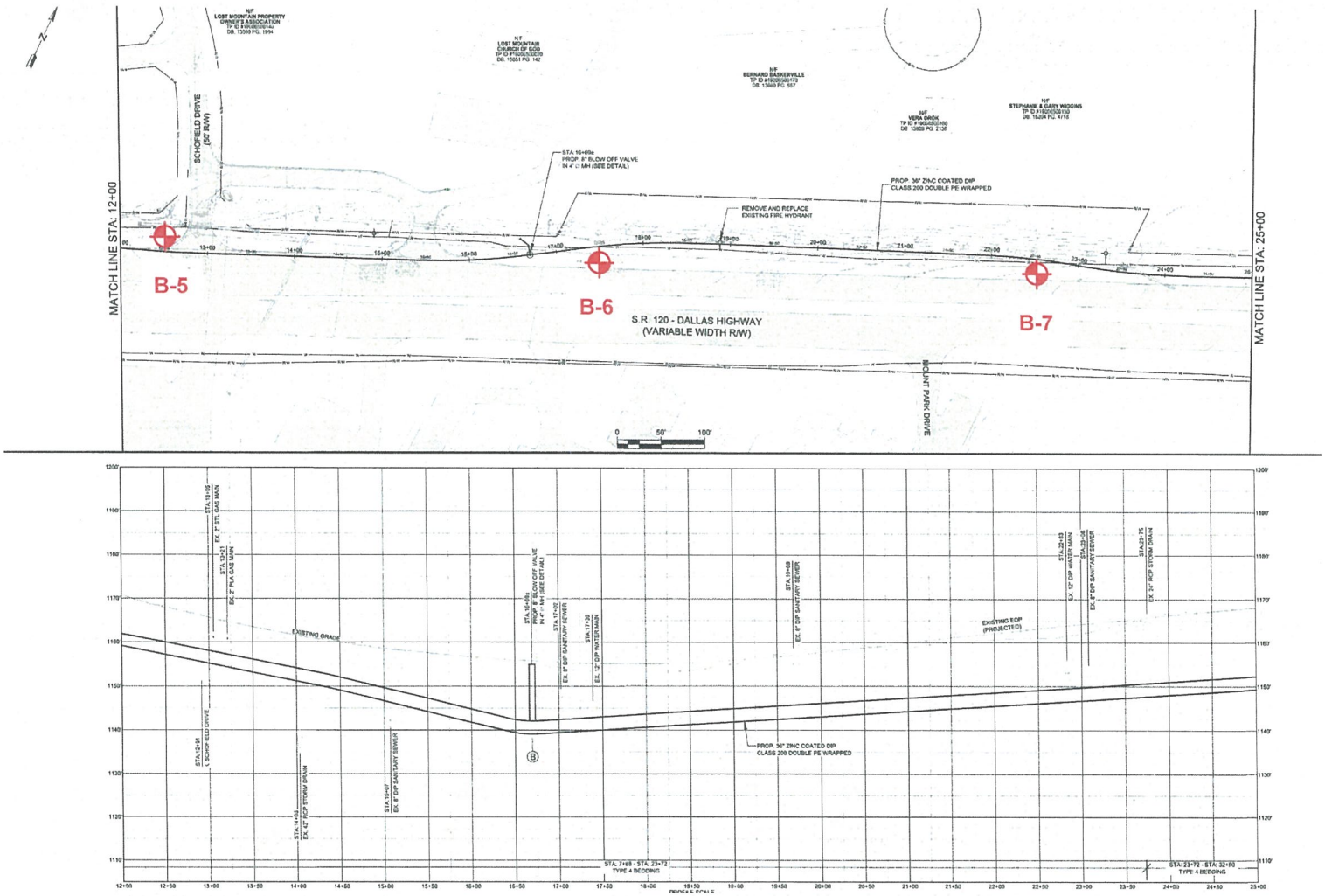
0 90 180 360 540

Approximate Scale: 1"=180'

LEGEND: Soil Test Boring

Figure 2.1: Boring Location Plan

Dallas Highway 36-Inch Parallel Water Main
Mars Hill Road to Friendship Church Road
Cobb County, Georgia
Geo-Hydro Project Number 150811.20



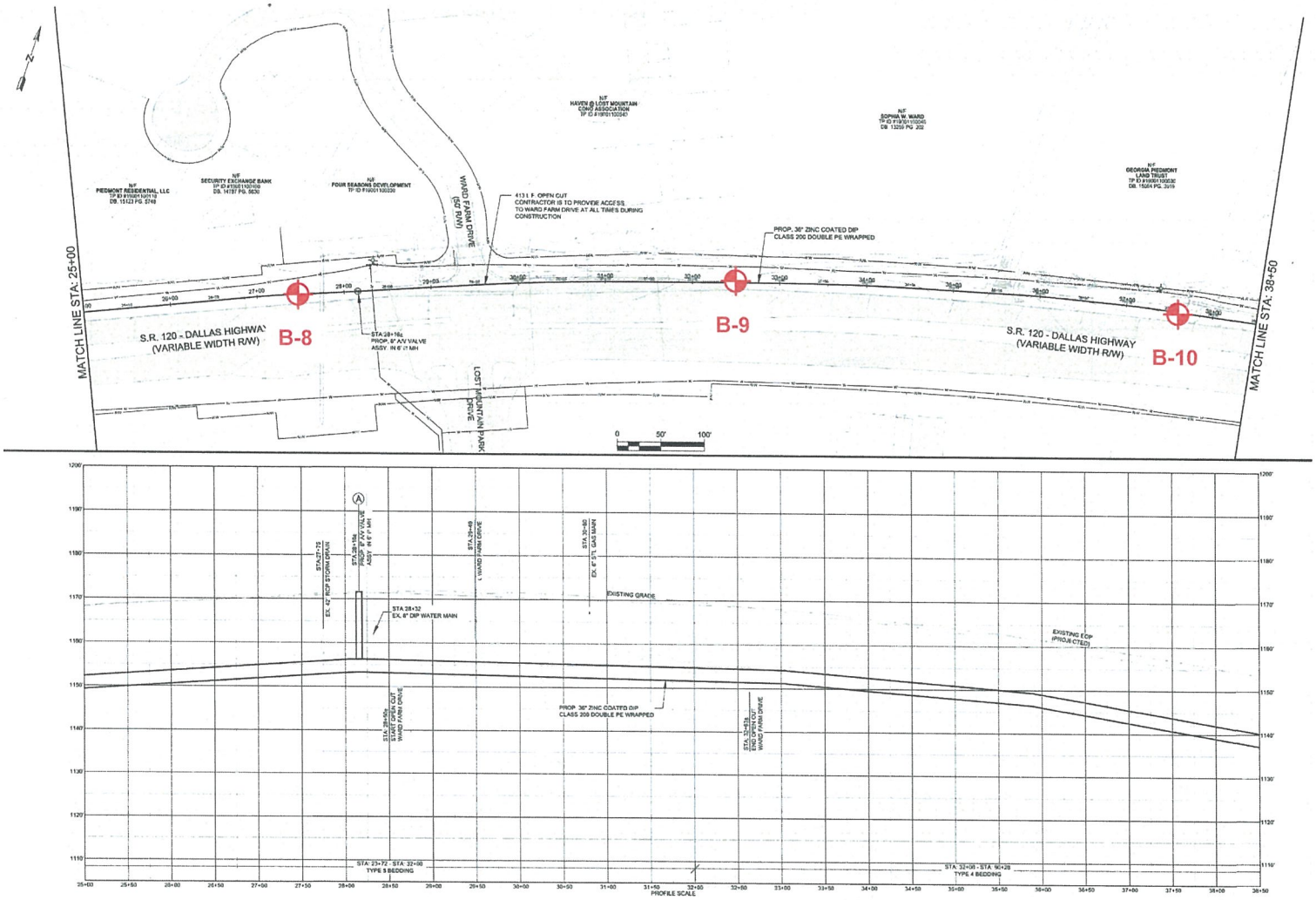
0 90 180 360 540

Approximate Scale: 1"=180'

LEGEND: Soil Test Boring

Figure 2.2: Boring Location Plan

Dallas Highway 36-Inch Parallel Water Main
Mars Hill Road to Friendship Church Road
Cobb County, Georgia
Geo-Hydro Project Number 150811.20



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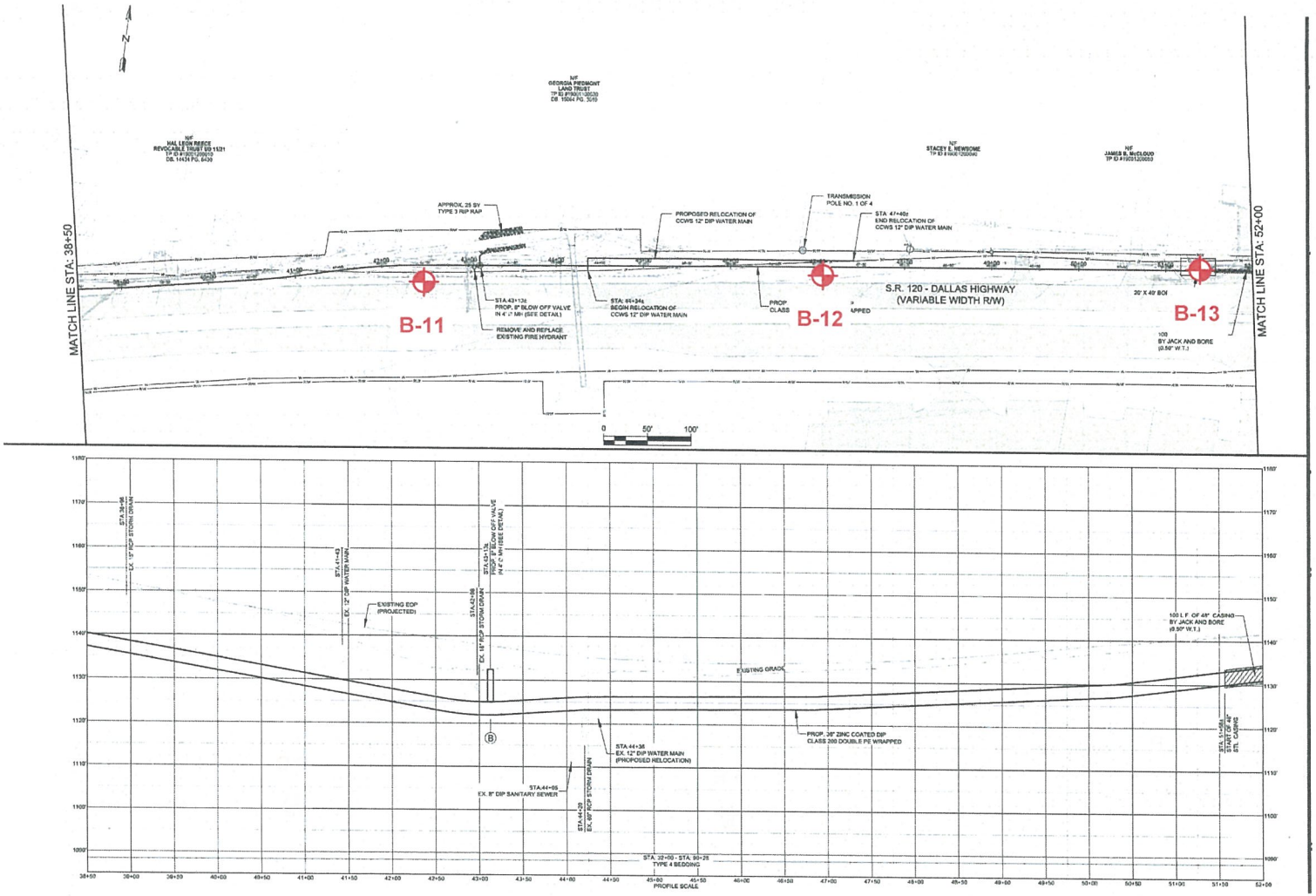
Approximate Scale: 1"=180'

LEGEND: Soil Test Boring

Figure 2.3: Boring Location Plan

Dallas Highway 36-Inch Parallel Water Main
Mars Hill Road to Friendship Church Road
Cobb County, Georgia
Geo-Hydro Project Number 150811.20



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Approximate Scale: 1"=180'

LEGEND: Soil Test Boring

Figure 2.4: Boring Location Plan

Dallas Highway 36-Inch Parallel Water Main
Mars Hill Road to Friendship Church Road
Cobb County, Georgia
Geo-Hydro Project Number 150811.20

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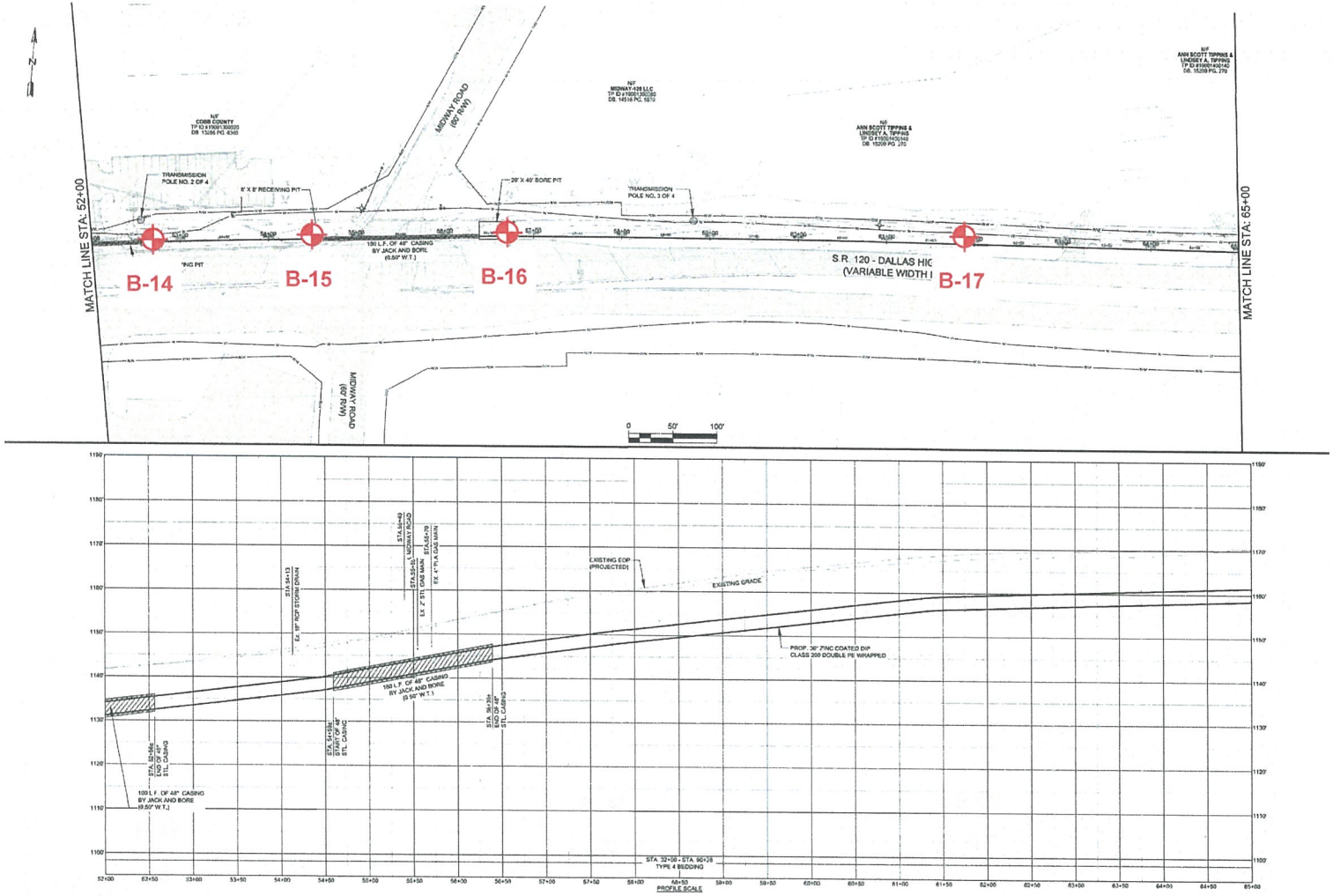

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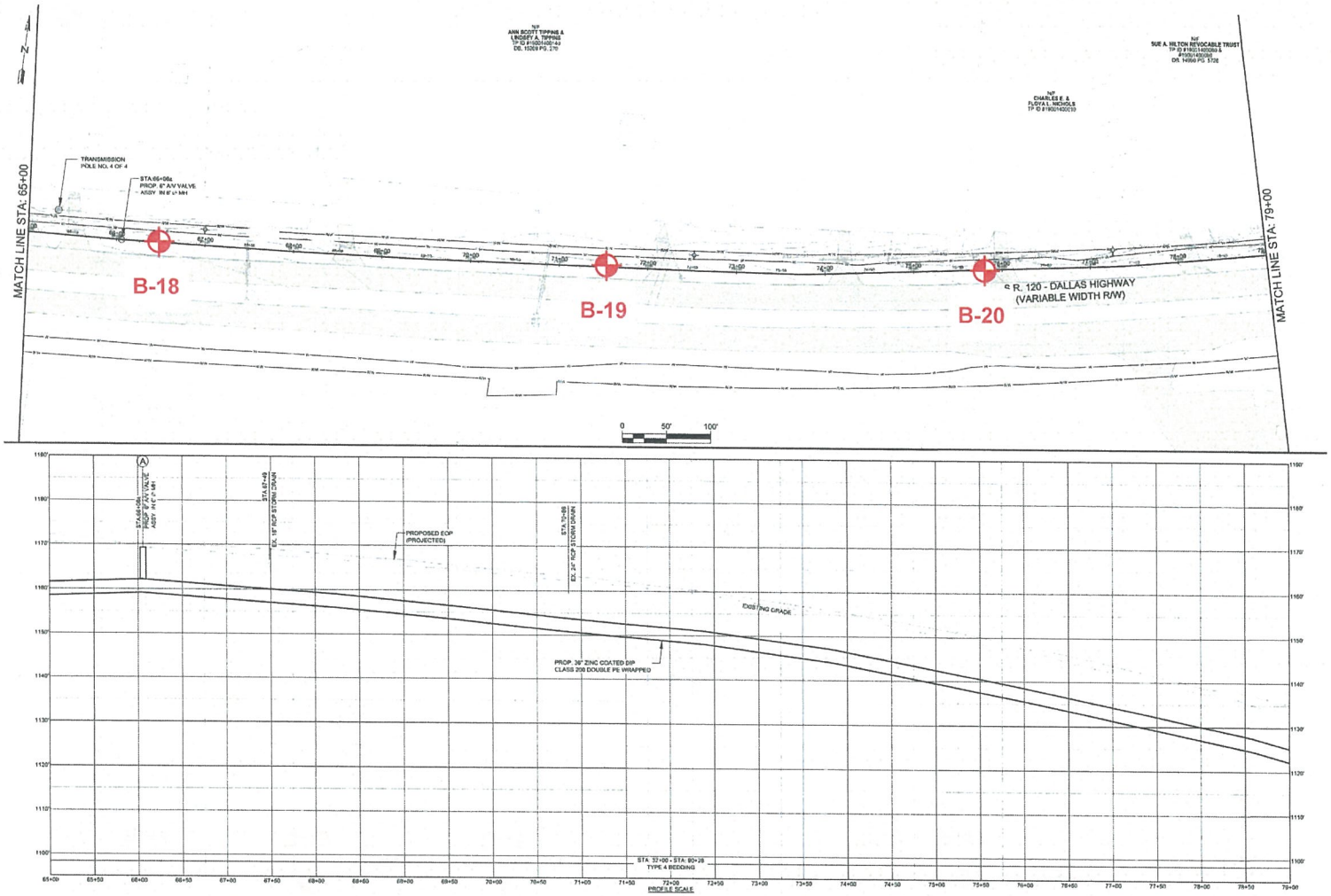
Approximate Scale: 1"=180'

LEGEND: Soil Test Boring

Figure 2.5: Boring Location Plan

Dallas Highway 36-Inch Parallel Water Main
Mars Hill Road to Friendship Church Road
Cobb County, Georgia
Geo-Hydro Project Number 150811.20



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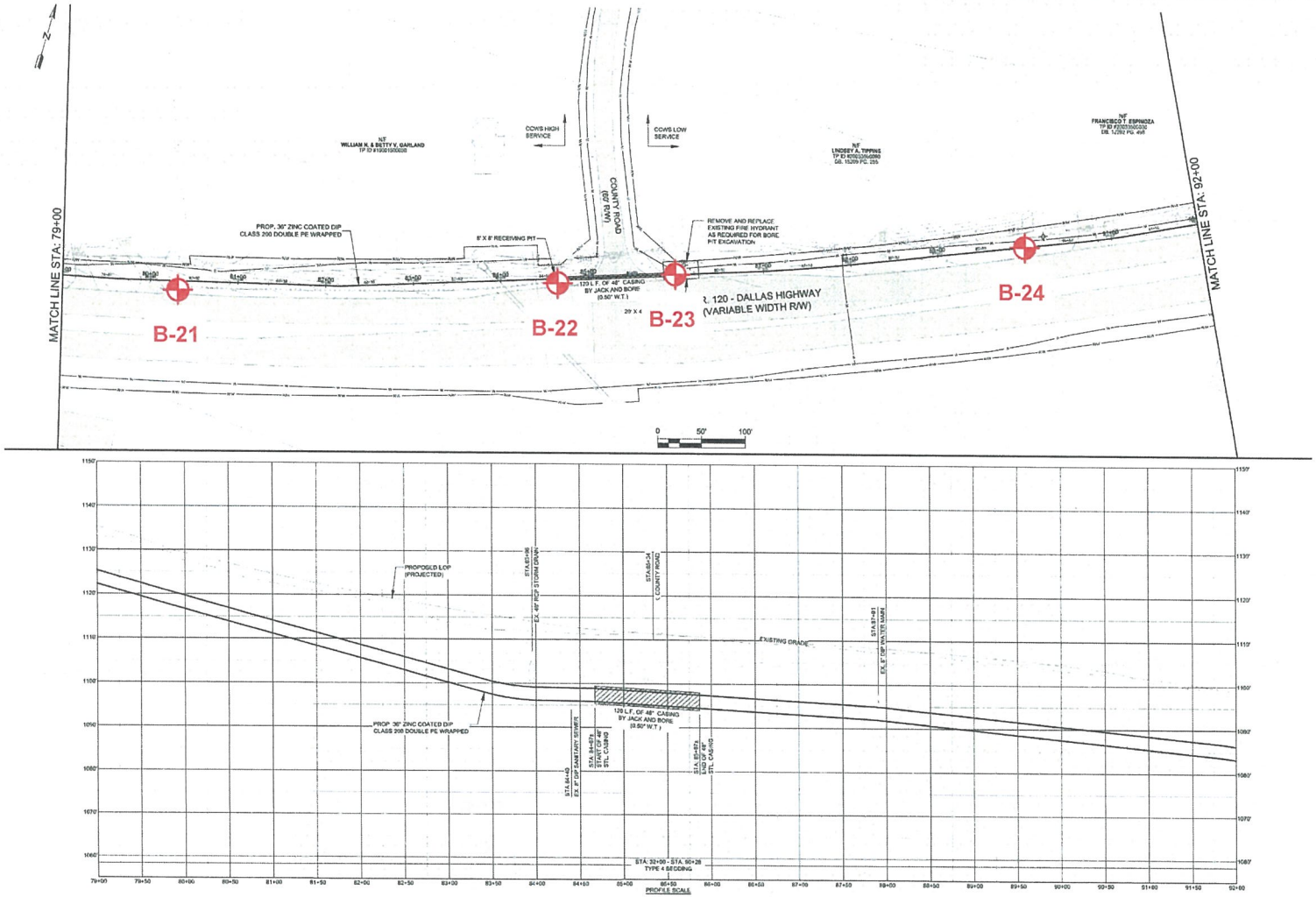
Approximate Scale: 1"=180'

LEGEND: Soil Test Boring

Figure 2.6: Boring Location Plan

Dallas Highway 36-Inch Parallel Water Main
Mars Hill Road to Friendship Church Road
Cobb County, Georgia
Geo-Hydro Project Number 150811.20



LEGEND: Soil Test Boring

Figure 2.7: Boring Location Plan

Dallas Highway 36-Inch Parallel Water Main
Mars Hill Road to Friendship Church Road
Cobb County, Georgia
Geo-Hydro Project Number 150811.20

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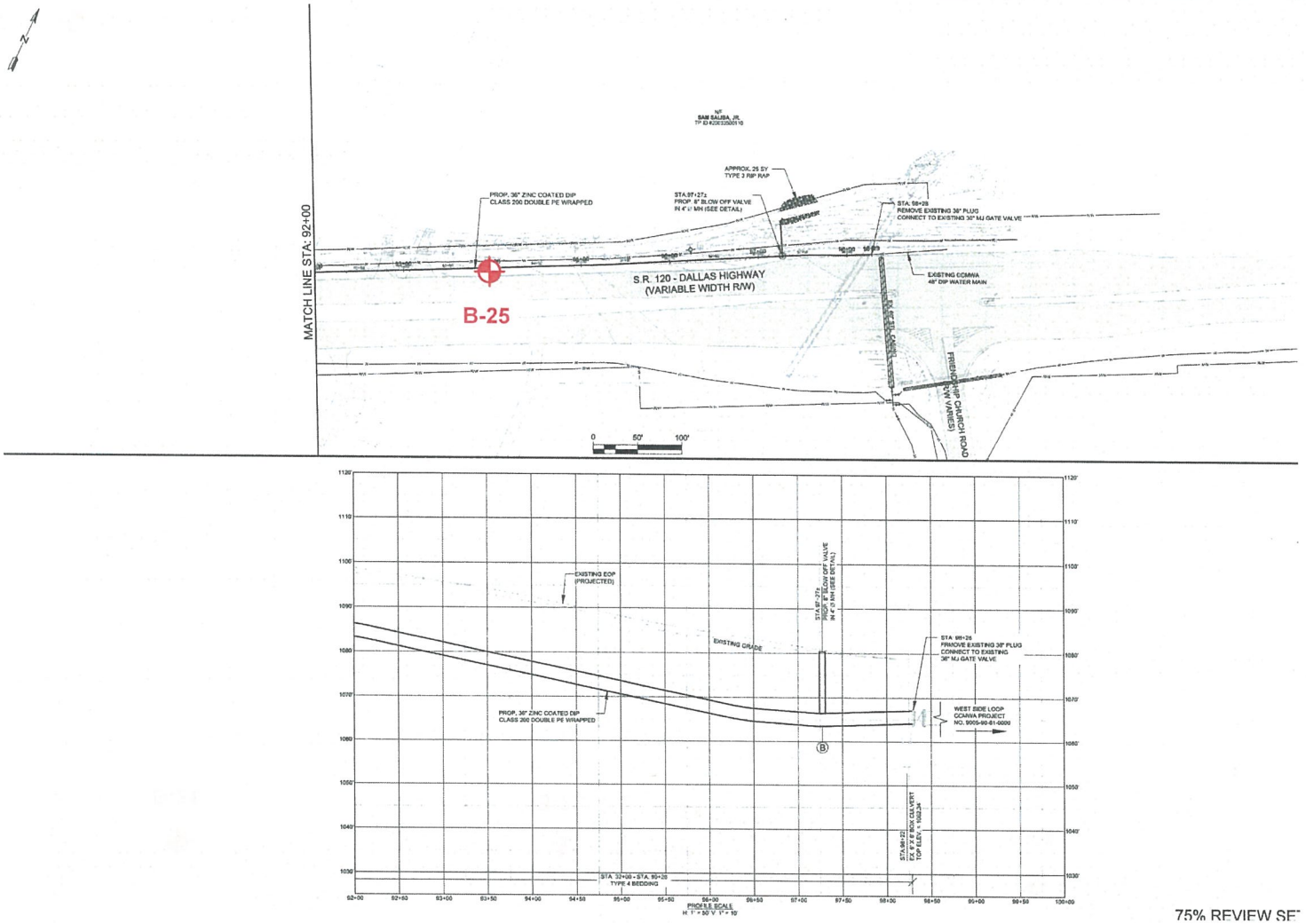


75% REVIEW SET

0 90 180 360 540

Approximate Scale: 1"=180'

LEGEND: Soil Test Boring

Figure 2.8: Boring Location Plan

Dallas Highway 36-Inch Parallel Water Main
Mars Hill Road to Friendship Church Road
Cobb County, Georgia
Geo-Hydro Project Number 150811.20

Table 1: Summary of Soil Test Borings
Dallas Highway 36-Inch Parallel Water Main
Mars Hill Road to Friendship Church Road
Cobb County, Georgia
Project Number 150811.20

Boring	Approx. Station	Approx. Ground Elevation	Approx. Invert Elevation	Groundwater		Bottom of Fill		Bottom of Alluvium		Top of PWR		Auger Refusal		Boring Termination	
				Depth (feet)	Approx. Elevation	Depth (feet)	Approx. Elevation	Depth (feet)	Approx. Elevation	Depth (feet)	Approx. Elevation	Depth (feet)	Approx. Elevation	Depth (feet)	Approx. Elevation
B-1	1+50	1201	1181	n.e.	-	8	1193	n.e.	-	n.e.	-	n.e.	-	35	1166
B-2	3+25	1203	1179	n.e.	-	3	1200	n.e.	-	n.e.	-	n.e.	-	35	1168
B-3	6+75	1195	1177	n.e.	-	3	1192	n.e.	-	n.e.	-	n.e.	-	35	1160
B-4	7+75	1194	1175	n.e.	-	3	1191	n.e.	-	n.e.	-	n.e.	-	30	1164
B-5	12+50	1168	1157	n.e.	-	12	1156	n.e.	-	n.e.	-	n.e.	-	15	1153
B-6	17+50	1154	1140	***7***	***1147***	6	1148	n.e.	-	n.e.	-	n.e.	-	20	1134
B-7	22+50	1163	1146	***10***	***1153***	3	1160	n.e.	-	n.e.	-	n.e.	-	30	1133
B-8	27+50	1171	1153	***16***	***1155***	12	1159	n.e.	-	n.e.	-	n.e.	-	25	1146
B-9	32+50	1169	1152	***14***	***1155***	n.e.	-	n.e.	-	n.e.	-	n.e.	-	25	1144
B-10	37+50	1156	1142	***9***	***1147***	n.e.	-	n.e.	-	***6***	***1150***	17	1139	17	1139
B-11	42+50	1139	1123	n.e.	-	8	1131	n.e.	-	n.e.	-	n.e.	-	20	1119
B-12	47+00	1133	1123	n.e.	-	n.e.	-	n.e.	-	n.e.	-	n.e.	-	15	1118
B-13	51+50	1141	1129	n.e.	-	6	1135	n.e.	-	n.e.	-	n.e.	-	25	1116
B-14	52+50	1143	1132	n.e.	-	3	1140	n.e.	-	n.e.	-	n.e.	-	25	1118
B-15	54+60	1147	1137	n.e.	-	3	1144	n.e.	-	n.e.	-	n.e.	-	25	1122
B-16	56+40	1155	1143	n.e.	-	3	1152	n.e.	-	n.e.	-	n.e.	-	25	1130
B-17	61+75	1168	1156	n.e.	-	n.e.	-	n.e.	-	n.e.	-	n.e.	-	15	1153
B-18	66+50	1168	1158	n.e.	-	n.e.	-	n.e.	-	n.e.	-	n.e.	-	15	1153
B-19	71+50	1162	1149	n.e.	-	3	1159	n.e.	-	n.e.	-	n.e.	-	15	1147
B-20	75+75	1147	1137	n.e.	-	n.e.	-	n.e.	-	n.e.	-	n.e.	-	15	1132
B-21	80+25	1128	1114	***14***	***1114***	8	1120	n.e.	-	n.e.	-	n.e.	-	25	1103
B-22	84+70	1112	1095	***15***	***1097***	12	1100	18	1094	28	1084	n.e.	-	30	1082
B-23	85+80	1111	1094	***16***	***1095***	8	1103	n.e.	-	n.e.	-	n.e.	-	30	1081
B-24	90+00	1104	1087	***17***	***1087***	n.e.	-	n.e.	-	n.e.	-	n.e.	-	20	1084
B-25	94+00	1093	1075	n.e.	-	6	1087	n.e.	-	n.e.	-	n.e.	-	20	1073

n.e.: Not Encountered PWR: Partially Weathered Rock

GEO HYDRO ENGINEERS

Symbols and Nomenclature

Symbols

▮	Thin-walled tube (TWT) sample recovered
▯	Thin-walled tube (TWT) sample not recovered
●	Standard penetration resistance (ASTM D1586)
50/2"	Number of blows (50) to drive the split-spoon a number of inches (2)
65%	Percentage of rock core recovered
RQD	Rock quality designation - % of recovered core sample which is 4 or more inches long
GW	Groundwater
▼	Water level at least 24 hours after drilling
▽	Water level one hour or less after drilling
ALLUV	Alluvium
TOP	Topsoil
PM	Pavement Materials
CONC	Concrete
FILL	Fill Material
RES	Residual Soil
PWR	Partially Weathered Rock
SPT	Standard Penetration Testing

Penetration Resistance Results

	Number of Blows, N	Approximate Relative Density
Sands	0-4	very loose
	5-10	loose
	11-20	firm
	21-30	very firm
	31-50	dense
	Over 50	very dense

	Number of Blows, N	Approximate Consistency
Silts and Clays	0-1	very soft
	2-4	soft
	5-8	firm
	9-15	stiff
	16-30	very stiff
	31-50	hard
	Over 50	very hard

Drilling Procedures

Soil sampling and standard penetration testing performed in accordance with ASTM D 1586. The standard penetration resistance is the number of blows of a 140-pound hammer falling 30 inches to drive a 2-inch O.D., 1.4-inch I.D. split-spoon sampler one foot. Rock coring is performed in accordance with ASTM D 2113. Thin-walled tube sampling is performed in accordance with ASTM D 1587.

GEO HYDRO ENGINEERS

B-1 Test Boring Record

GEO HYDRO ENGINEERS

Project: **Dallas Highway 36-Inch Parallel Water Main**		Project No: **150811.20**
Location: **Mars Hill Road to Friendship Church Road, Cobb County, Georgia**		Date: **12/8/15**
Method: **HSA- ASTM D1586**	GWT at Drilling: **Not Encountered**	G.S. Elev: **1201**
Driller: **B&C (Autohammer)**	GWT at 24 hrs: **Not Encountered**	Logged By: **JTR**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
1200	0			Topsoil (Approximately 5 inches)	
				Firm to soft brown silty clay (CL) with organics (FILL)	8
	5				4
1195				Loose brown silty fine to medium sand (SM) (FILL)	6
				Firm red-orange clayey silt (ML) (RESIDUUM)	6
	10				
1190				Firm to loose brown silty fine to medium sand (SM)	
	15				11
1185					
	20				9
1180					
				Firm to very firm brown silty fine to medium sand (SM)	
	25				14
1175					
	30				26
1170					
				Stiff brown and tan fine sandy silt (ML)	
	35				14
1165				Boring Terminated at 35 feet	
	40				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks: Approximate Station 1+50

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 1/15/16

B-2

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Dallas Highway 36-Inch Parallel Water Main**		Project No: **150811.20**
Location: **Mars Hill Road to Friendship Church Road, Cobb County, Georgia**		Date: **12/8/15**
Method: **HSA- ASTM D1586**	GWT at Drilling: **Not Encountered**	G.S. Elev: **1203**
Driller: **B&C (Autohammer)**	GWT at 24 hrs: **Not Encountered**	Logged By: **JTR**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
1200	0			Topsoil (Approximately 6 inches)	
				Loose brown clayey fine sand (SC) with rock fragments (FILL)	7
	5			Firm red fine sandy silt (ML) (RESIDUUM)	5
1195				Loose brown silty fine to coarse sand (SM)	10
	10			Very stiff orange-brown fine sandy silt (ML)	22
1190				Firm brown fine sandy silt (ML)	7
	15				
1185					6
	20				
1180				Very stiff red-brown fine sandy silt (ML)	26
	25				
1175				Firm tan and red fine sandy silt (ML)	6
	30				
1170				Dense brown silty fine to coarse sand (SM)	38
	35			Boring Terminated at 35 feet	
1165					
	40				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks: Approximate Station 3+25

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 1/15/16

B-3

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Dallas Highway 36-Inch Parallel Water Main**		Project No: **150811.20**
Location: **Mars Hill Road to Friendship Church Road, Cobb County, Georgia**		Date: **12/9/15**
Method: **HSA- ASTM D1586**	GWT at Drilling: **Not Encountered**	G.S. Elev: **1195**
Driller: **B&C (Autohammer)**	GWT at 24 hrs: **Not Encountered**	Logged By: **JTR**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
				Topsoil (Approximately 4 inches)	
				Stiff dark red clayey silt (ML) (FILL)	10
1190	5			Hard to very stiff light brown to dark brown fine sandy silt (ML) (RESIDUUM)	39
					26
				Stiff brown clayey silt (ML)	
1185	10				10
				Firm tan fine sandy silt (ML)	
1180	15				7
1175	20				10
1170	25				10
				Dense red-brown silty fine sand (SM)	
1165	30				41
1160	35			Boring Terminated at 35 feet	34
1155	40				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks: Approximate Station 6+75

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 1/15/16

B-4

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Dallas Highway 36-Inch Parallel Water Main**		Project No: **150811.20**
Location: **Mars Hill Road to Friendship Church Road, Cobb County, Georgia**		Date: **12/9/15**
Method: **HSA- ASTM D1586**	GWT at Drilling: **Not Encountered**	G.S. Elev: **1194**
Driller: **B&C (Autohammer)**	GWT at 24 hrs: **Not Encountered**	Logged By: **JTR**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
				Topsoil (Approximately 3 inches)	
				Loose brown clayey fine sand (SC) (FILL)	9
1190	5			Stiff to firm red clayey silt (ML) (RESIDUUM)	9
					14
1185	10				6
				Firm brown silty fine to medium sand (SM)	
1180	15				20
1175	20			Very dense brown silty fine to coarse sand (SM) with rock fragments	51
				Firm brown silty fine to medium sand (SM)	
1170	25				19
1165	30			Boring Terminated at 30 feet	14
1160	35				
1155	40				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks: Approximate Station 7+75

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 1/15/16

B-5

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Dallas Highway 36-Inch Parallel Water Main**		Project No: **150811.20**
Location: **Mars Hill Road to Friendship Church Road, Cobb County, Georgia**		Date: **12/9/15**
Method: **HSA- ASTM D1586**	GWT at Drilling: **Not Encountered**	G.S. Elev: **1168**
Driller: **B&C (Autohammer)**	GWT at 24 hrs: **N/A (Boring Backfilled)**	Logged By: **JTR**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
1168	0			Topsoil (Approximately 4 inches)	
				Stiff red-brown silty clay (CL) with rock fragments (FILL)	11
1165	5			Soft to firm red-brown silty clay (CL) with rock fragments (FILL)	3
					4
1160	10				6
1155	15			Firm brown clayey silt (ML) (RESIDUUM)	7
				Boring Terminated at 15 feet	
1150	20				
1145	25				
1140	30				
1135	35				
1130	40				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks: Approximate Station 12+50

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 1/15/16

B-6

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Dallas Highway 36-Inch Parallel Water Main**		Project No: **150811.20**
Location: **Mars Hill Road to Friendship Church Road, Cobb County, Georgia**		Date: **12/9/15**
Method: **HSA- ASTM D1586**	GWT at Drilling: **16.5 feet**	G.S. Elev: **1154**
Driller: **B&C (Autohammer)**	GWT at 24 hrs: **7 feet**	Logged By: **JTR**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
1154	0			Topsoil (Approximately 3 inches)	
				Firm to soft red-brown clayey silt (ML) (FILL)	5
1150	5				3
		▼		Loose to firm brown silty fine to medium sand (SM) with rock fragments (RESIDUUM)	8
1145	10				18
1140	15				19
		▽			
1135	20			Boring Terminated at 20 feet	12
1130	25				
1125	30				
1120	35				
1115	40				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks: Approximate Station 17+50

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 1/15/16

B-7

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Dallas Highway 36-Inch Parallel Water Main**		Project No: **150811.20**
Location: **Mars Hill Road to Friendship Church Road, Cobb County, Georgia**		Date: **12/9/15**
Method: **HSA- ASTM D1586**	GWT at Drilling: **14.5 feet**	G.S. Elev: **1163**
Driller: **B&C (Autohammer)**	GWT at 24 hrs: **10 feet**	Logged By: **JTR**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N	Standard Penetration Test (Blows/Foot)
1163	0			Topsoil (Approximately 2 inches)		
				Very firm red-brown silty fine sand (SM) (FILL)	22	
1160	5			Dense red-brown silty fine sand (SM) (RESIDUUM)	35	
					45	
1155	10	▼			38	
1150	15	▽		Soft to firm light brown fine sandy silt (ML)	4	
1145	20			Boring Terminated at 30 feet	7	
1140	25					
1135	30					
1130	35					
1125	40					

0 10 20 30 40 50 60 70 80 90 100

Remarks: Approximate Station 22+50

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 1/15/16

B-8

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Dallas Highway 36-Inch Parallel Water Main**		Project No: **150811.20**
Location: **Mars Hill Road to Friendship Church Road, Cobb County, Georgia**		Date: **12/9/15**
Method: **HSA- ASTM D1586**	GWT at Drilling: **18.5 feet**	G.S. Elev: **1171**
Driller: **B&C (Autohammer)**	GWT at 24 hrs: **16.5 feet**	Logged By: **JTR**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
1170	0			Topsoil (Approximately 3 inches)	
				Stiff to firm red-brown silty clay (CL) with rock fragments (FILL)	14
1165	5				9
					7
				Loose brown silty fine sand (SM) (FILL)	
1160	10				8
				Loose to firm tan-brown to black silty fine to medium sand (SM) (RESIDUUM)	
1155	15	▼			8
		▽			
	20				8
1150					
1145	25			Boring Terminated at 25 feet	17
	30				
1140					
	35				
1135					
	40				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks: Approximate Station 27+50

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 1/15/16

B-9

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Dallas Highway 36-Inch Parallel Water Main**		Project No: **150811.20**
Location: **Mars Hill Road to Friendship Church Road, Cobb County, Georgia**		Date: **12/9/15**
Method: **HSA- ASTM D1586**	GWT at Drilling: **17 feet**	G.S. Elev: **1169**
Driller: **B&C (Autohammer)**	GWT at 24 hrs: **14 feet**	Logged By: **JTR**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
				Topsoil (Approximately 6 inches)	
				Stiff red silty clay (CL) (RESIDUUM)	14
1165	5			Firm tan-brown silty fine sand (SM)	14
					11
1160	10				12
		▼		Loose to firm tan-brown silty fine sand (SM)	
1155	15	▽			6
1150	20				9
1145	25			Boring Terminated at 25 feet	12
1140	30				
1135	35				
1130	40				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks: Approximate Station 32+50

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 1/15/16

B-10

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Dallas Highway 36-Inch Parallel Water Main**		Project No: **150811.20**
Location: **Mars Hill Road to Friendship Church Road, Cobb County, Georgia**		Date: **12/9/15**
Method: **HSA- ASTM D1586**	GWT at Drilling: **Not Encountered**	G.S. Elev: **1156**
Driller: **B&C (Autohammer)**	GWT at 24 hrs: **9 feet**	Logged By: **JTR**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
1155	0			Topsoil (Approximately 1 inch)	
				Hard red fine sandy silt (ML) (RESIDUUM)	28
	5				47
1150				Partially weathered rock sampled as red and black fine sandy silt (ML)	50/6"
		▼		Hard red-brown fine sandy silt (ML)	
	10				38
1145					
				Partially weathered rock sampled as gray fine to medium sandy silt (ML)	
	15				50/6"
1140				Auger Refusal at 17 feet	
	20				
1135					
	25				
1130					
	30				
1125					
	35				
1120					
	40				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks: Approximate Station 37+50

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 1/15/16

B-11

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Dallas Highway 36-Inch Parallel Water Main**		Project No: **150811.20**
Location: **Mars Hill Road to Friendship Church Road, Cobb County, Georgia**		Date: **12/10/15**
Method: **HSA- ASTM D1586**	GWT at Drilling: **Not Encountered**	G.S. Elev: **1139**
Driller: **B&C (Autohammer)**	GWT at 24 hrs: **Not Encountered**	Logged By: **JTR**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
				Topsoil (Approximately 4 inches)	
1135	5			Loose to firm red and brown clayey fine sand (SC) (FILL)	6 15 12
1130	10			Loose red and brown clayey fine sand (SC) (RESIDUUM)	8
1125	15			Firm brown silty clay (CL)	6
1120	20			Firm tan silty clay (CH)	8
				Boring Terminated at 20 feet	
1115	25				
1110	30				
1105	35				
1100	40				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks: Approximate Station 42+50

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 1/15/16

B-12

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Dallas Highway 36-Inch Parallel Water Main**		Project No: **150811.20**
Location: **Mars Hill Road to Friendship Church Road, Cobb County, Georgia**		Date: **12/10/15**
Method: **HSA- ASTM D1586**	GWT at Drilling: **Not Encountered**	G.S. Elev: **1133**
Driller: **B&C (Autohammer)**	GWT at 24 hrs: **N/A (Boring Backfilled)**	Logged By: **JTR**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
1133	0			Topsoil (Approximately 4 inches)	
1130	5			Stiff to firm red-brown to brown fine sandy silt (ML) (RESIDUUM)	12 7
1125	10			Very firm to firm red-brown silty fine sand (SM) with rock fragments	21 13
1120	15			Boring Terminated at 15 feet	20
1115	20				
1110	25				
1105	30				
1100	35				
1095	40				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks: Approximate Station 47+00

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 1/15/16

B-13

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Dallas Highway 36-Inch Parallel Water Main**		Project No: **150811.20**
Location: **Mars Hill Road to Friendship Church Road, Cobb County, Georgia**		Date: **12/10/15**
Method: **HSA- ASTM D1586**	GWT at Drilling: **Not Encountered**	G.S. Elev: **1141**
Driller: **B&C (Autohammer)**	GWT at 24 hrs: **Not Encountered**	Logged By: **JTR**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
1140	0			Topsoil (Approximately 3 inches)	
				Firm brown silty clay (CL) (FILL)	7
				Firm tan-brown silty fine sand (SM) (FILL)	13
1135	5			Stiff to firm tan-brown to red fine sandy silt (ML) (RESIDUUM)	11
					6
1130	10				
					8
1125	15				
					7
1120	20				
					7
1115	25			Boring Terminated at 25 feet	
1110	30				
1105	35				
	40				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks: Approximate Station 51+50

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 1/15/16

B-14

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Dallas Highway 36-Inch Parallel Water Main**		Project No: **150811.20**
Location: **Mars Hill Road to Friendship Church Road, Cobb County, Georgia**		Date: **12/11/15**
Method: **HSA- ASTM D1586**	GWT at Drilling: **Not Encountered**	G.S. Elev: **1143**
Driller: **B&C (Autohammer)**	GWT at 24 hrs: **N/A (Boring Backfilled)**	Logged By: **JTR**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
1143	0			Topsoil (Approximately 3 inches)	
				Loose brown clayey fine sand (SC) (FILL)	6
1140				Stiff red silty clay (CL) (RESIDUUM)	
	5				12
				Firm brown fine sandy silt (ML)	7
1135				Firm brown silty fine to medium sand (SM)	
	10				13
				Firm to stiff red-brown fine sandy silt (ML)	
1130					
	15				5
1125					
	20				13
1120				Firm black and tan silty fine sand (SM)	
	25			Boring Terminated at 25 feet	13
1115					
	30				
1110					
	35				
1105					
	40				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks: Approximate Station 52+50

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 1/15/16

B-15

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Dallas Highway 36-Inch Parallel Water Main**		Project No: **150811.20**
Location: **Mars Hill Road to Friendship Church Road, Cobb County, Georgia**		Date: **12/11/15**
Method: **HSA- ASTM D1586**	GWT at Drilling: **Not Encountered**	G.S. Elev: **1147**
Driller: **B&C (Autohammer)**	GWT at 24 hrs: **N/A (Boring Backfilled)**	Logged By: **JTR**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
1145	0			Topsoil (Approximately 4 inches)	
				Loose brown silty fine sand (SM) with rock fragments (FILL)	10
	5			Very stiff to stiff orange-brown fine sandy silt (ML) (RESIDUUM)	29
1140					10
	10				12
1135					
	15				13
1130					
	20				12
1125					
	25			Very stiff orange-brown fine sandy silt (ML)	17
				Boring Terminated at 25 feet	
1120					
	30				
1115					
	35				
1110					
	40				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks: Approximate Station 54+60

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 1/15/16

B-16

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Dallas Highway 36-Inch Parallel Water Main**		Project No: **150811.20**
Location: **Mars Hill Road to Friendship Church Road, Cobb County, Georgia**		Date: **12/10/15**
Method: **HSA- ASTM D1586**	GWT at Drilling: **Not Encountered**	G.S. Elev: **1155**
Driller: **B&C (Autohammer)**	GWT at 24 hrs: **Not Encountered**	Logged By: **JTR**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
				Topsoil (Approximately 5 inches)	
				Stiff brown silty clay (CL) with rock fragments (FILL)	9
				Stiff red silty clay (CL) (RESIDUUM)	9
1150	5				
				Very stiff red-orange fine sandy silt (ML)	12
				Loose red and tan to black silty fine sand (SM)	8
1145	10				
1140	15				6
1135	20				7
1130	25			Boring Terminated at 25 feet	8
1125	30				
1120	35				
1115	40				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks: Approximate Station 56+40

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 1/15/16

B-17

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Dallas Highway 36-Inch Parallel Water Main**		Project No: **150811.20**
Location: **Mars Hill Road to Friendship Church Road, Cobb County, Georgia**		Date: **12/11/15**
Method: **HSA- ASTM D1586**	GWT at Drilling: **Not Encountered**	G.S. Elev: **1168**
Driller: **B&C (Autohammer)**	GWT at 24 hrs: **N/A (Boring Backfilled)**	Logged By: **JTR**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
1168	0			Topsoil (Approximately 4 inches)	
				Firm to very firm red and brown to black silty fine to medium sand (SM) (RESIDUUM)	11
1165	5				15
					25
1160				Loose black silty fine sand (SM)	
	10				10
1155				Very firm black silty fine to medium sand (SM)	
	15				23
				Boring Terminated at 15 feet	
1150	20				
1145					
	25				
1140					
	30				
1135					
	35				
1130					
	40				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks: Approximate Station 61+75

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 1/15/16

B-18

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Dallas Highway 36-Inch Parallel Water Main**		Project No: **150811.20**
Location: **Mars Hill Road to Friendship Church Road, Cobb County, Georgia**		Date: **12/11/15**
Method: **HSA- ASTM D1586**	GWT at Drilling: **Not Encountered**	G.S. Elev: **1168**
Driller: **B&C (Autohammer)**	GWT at 24 hrs: **N/A (Boring Backfilled)**	Logged By: **JTR**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
1168	0			Topsoil (Approximately 4 inches)	
				Firm brown to red and tan fine sandy silt (ML) (RESIDUUM)	6
1165	5				7
				Loose to firm red and brown silty fine sand (SM)	10
1160	10				14
				Firm brown fine sandy silt (ML)	
1155	15			Boring Terminated at 15 feet	8
1150	20				
1145	25				
1140	30				
1135	35				
1130	40				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks: Approximate Station 66+50

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 1/15/16

B-19

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Dallas Highway 36-Inch Parallel Water Main**		Project No: **150811.20**
Location: **Mars Hill Road to Friendship Church Road, Cobb County, Georgia**		Date: **12/11/15**
Method: **HSA- ASTM D1586**	GWT at Drilling: **Not Encountered**	G.S. Elev: **1162**
Driller: **B&C (Autohammer)**	GWT at 24 hrs: **N/A (Boring Backfilled)**	Logged By: **JTR**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
1160	0			Topsoil (Approximately 2 inches)	
				Firm brown silty clay (CL) (FILL)	5
	5			Stiff to firm red-brown to tan fine sandy silt (ML) (RESIDUUM)	10
1155					10
	10				5
1150					
	15			Boring Terminated at 15 feet	6
1145					
	20				
1140					
	25				
1135					
	30				
1130					
	35				
1125					
	40				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks: Approximate Station 71+50

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 1/15/16

B-20

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Dallas Highway 36-Inch Parallel Water Main**		Project No: **150811.20**
Location: **Mars Hill Road to Friendship Church Road, Cobb County, Georgia**		Date: **12/11/15**
Method: **HSA- ASTM D1586**	GWT at Drilling: **Not Encountered**	G.S. Elev: **1147**
Driller: **B&C (Autohammer)**	GWT at 24 hrs: **N/A (Boring Backfilled)**	Logged By: **JTR**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
1145	0			Asphalt (Approximately 2 inches)	
				Graded Aggregate Base (Approximately 3 inches)	8
				Firm brown fine sandy silt (ML) (RESIDUUM)	
	5			Firm to loose tan-brown to brown silty fine to medium sand (SM)	11
1140					16
	10				7
1135					
	15			Boring Terminated at 15 feet	7
1130					
	20				
1125					
	25				
1120					
	30				
1115					
	35				
1110					
	40				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks: Approximate Station 75+75

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 1/15/16

B-21 Test Boring Record

GEO HYDRO ENGINEERS

Project: **Dallas Highway 36-Inch Parallel Water Main**		Project No: **150811.20**
Location: **Mars Hill Road to Friendship Church Road, Cobb County, Georgia**		Date: **12/8/15**
Method: **HSA- ASTM D1586**	GWT at Drilling: **16 feet**	G.S. Elev: **1128**
Driller: **B&C (Autohammer)**	GWT at 24 hrs: **14 feet**	Logged By: **JTR**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N	Standard Penetration Test (Blows/Foot) 0 10 20 30 40 50 60 70 80 90 100
1128	0			Topsoil (Approximately 2 inches)		
				Firm brown clayey silt (ML) with organics and rock fragments (FILL)	5	●
1125	5				7	●
				Very stiff brown clayey silt (ML) with organics and rock fragments (FILL)	16	●
1120				Loose to very loose orange-brown to white and brown micaceous silty fine sand (SM) (RESIDUUM)	6	●
	10					
1115		▼			4	●
	15	▽				
1110				Very loose to loose brown and white highly micaceous silty fine sand (SM)	2	●
	20					
1105						
	25			Boring Terminated at 25 feet	6	●
1100						
	30					
1095						
	35					
1090						
	40					

Remarks: Approximate Station 80+25

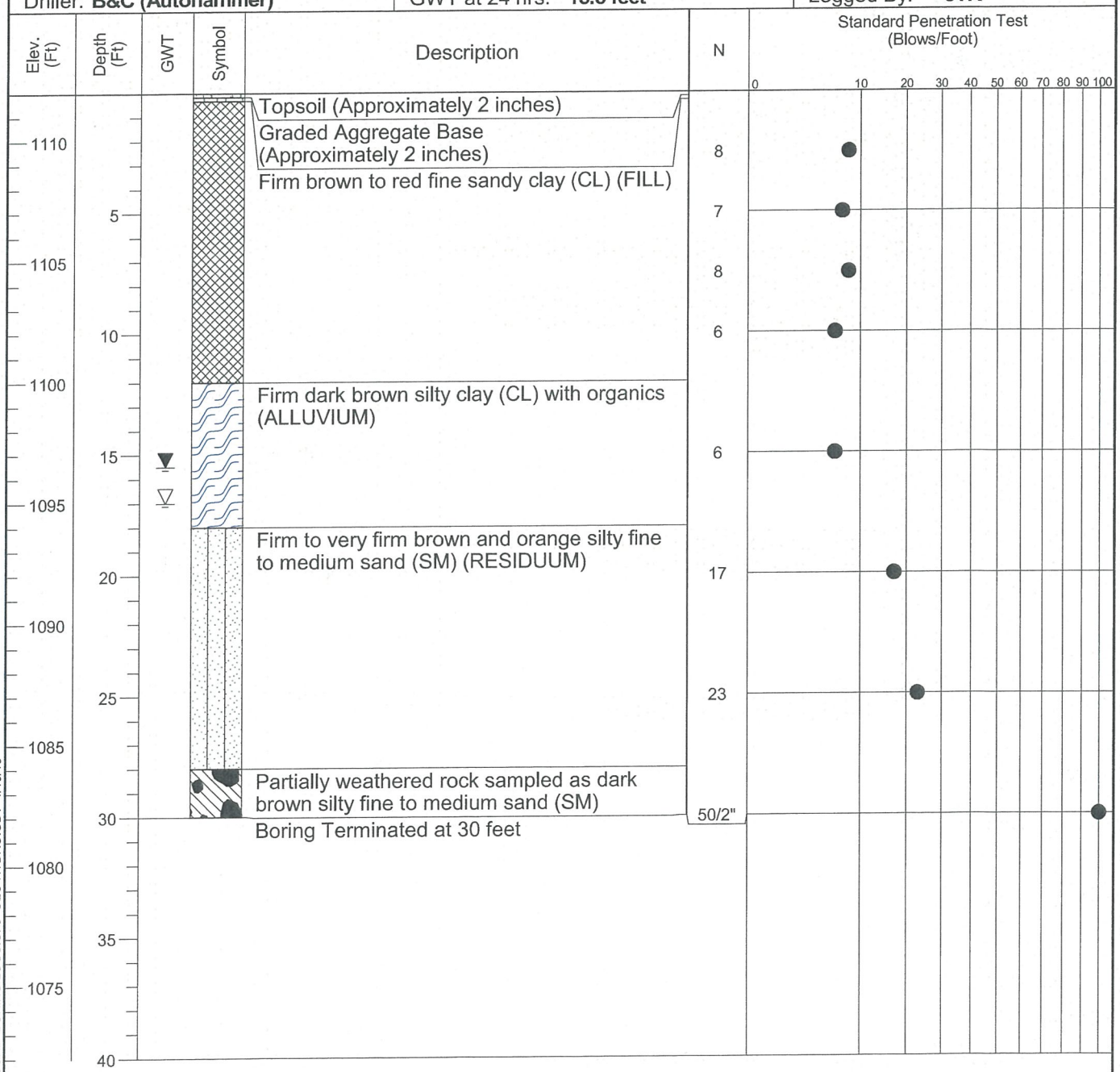
TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 1/15/16

B-22

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Dallas Highway 36-Inch Parallel Water Main**		Project No: **150811.20**
Location: **Mars Hill Road to Friendship Church Road, Cobb County, Georgia**		Date: **12/8/15**
Method: **HSA- ASTM D1586**	GWT at Drilling: **17 feet**	G.S. Elev: **1112**
Driller: **B&C (Autohammer)**	GWT at 24 hrs: **15.5 feet**	Logged By: **JTR**



Remarks: Approximate Station 84+70

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 1/15/16

B-23

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Dallas Highway 36-Inch Parallel Water Main**		Project No: **150811.20**
Location: **Mars Hill Road to Friendship Church Road, Cobb County, Georgia**		Date: **12/7/15**
Method: **HSA- ASTM D1586**	GWT at Drilling: **17 feet**	G.S. Elev: **1111**
Driller: **B&C (Autohammer)**	GWT at 24 hrs: **16 feet**	Logged By: **JTR**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
1110	0			Asphalt (Approximately 1 inch)	
				Graded Aggregate Base (Approximately 4 inches)	21
	5			Brown silty fine to medium sand (SM) with rock fragments (FILL) *	8
1105				Firm to stiff brown to red-orange fine sandy clay (CL) (FILL)	13
	10			Very firm to dense brown silty fine to medium sand (SM) (RESIDUUM)	24
1100					
	15	▼			26
1095		▽			
	20				37
1090					
	25				44
1085				Firm brown silty fine to medium sand (SM)	
	30			Boring Terminated at 30 feet	15
1080					
	35				
1075					
	40				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks: Approximate Station 85+80

*Penetration resistances amplified due to rock fragments in fill materials

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 1/15/16

B-24

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Dallas Highway 36-Inch Parallel Water Main**		Project No: **150811.20**
Location: **Mars Hill Road to Friendship Church Road, Cobb County, Georgia**		Date: **12/7/15**
Method: **HSA- ASTM D1586**	GWT at Drilling: **Not Encountered**	G.S. Elev: **1104**
Driller: **B&C (Autohammer)**	GWT at 24 hrs: **17 feet**	Logged By: **JTR**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
1100	0			Topsoil (Approximately 2 inches)	
				Very loose to loose pink and white micaceous silty fine sand (SM) (RESIDUUM)	4
	5				7
					5
1095				Very loose white micaceous silty fine sand (SM)	
	10				2
				Firm brown silty fine sand (SM)	
1090					
	15	▼			13
1085					
	20			Boring Terminated at 20 feet	12
1080					
	25				
1075					
	30				
1070					
	35				
1065					
	40				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks: Approximate Station 90+00

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 1/15/16

B-25

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Dallas Highway 36-Inch Parallel Water Main**		Project No: **150811.20**
Location: **Mars Hill Road to Friendship Church Road, Cobb County, Georgia**		Date: **12/7/15**
Method: **HSA- ASTM D1586**	GWT at Drilling: **Not Encountered**	G.S. Elev: **1093**
Driller: **B&C (Autohammer)**	GWT at 24 hrs: **Not Encountered**	Logged By: **JTR**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
1093	0			Topsoil (Approximately 5 inches)	
				Firm brown silty clay (CL) with rock fragments (FILL)	8
1090	5				6
				Loose brown silty fine sand (SM) (RESIDUUM)	7
1085	10				9
				Firm orange-brown fine sandy silt (ML)	
1080	15				5
1075					
1073	20			Boring Terminated at 20 feet	7
1070	25				
1065					
	30				
1060					
	35				
1055					
	40				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks: Approximate Station 94+00

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 1/15/16

LABORATORY TEST RESULTS

GEO HYDRO ENGINEERS

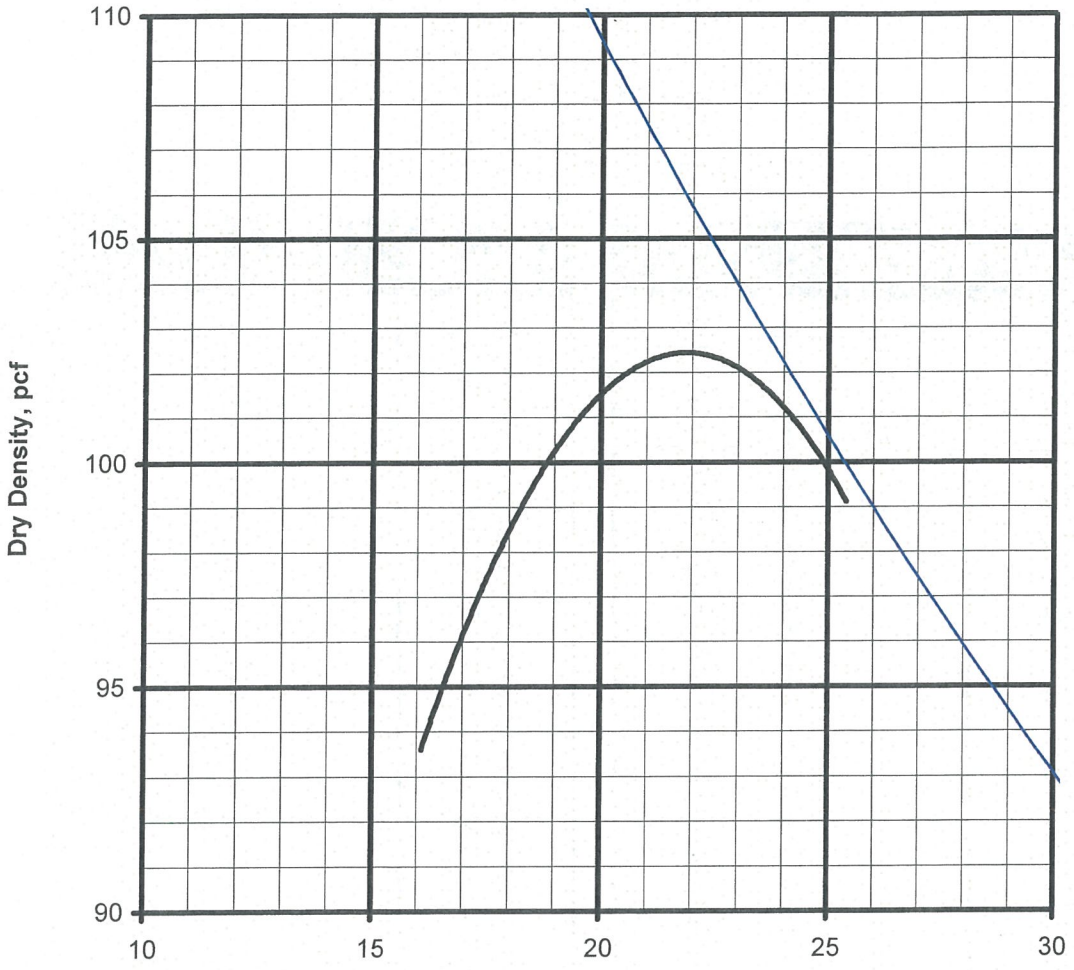
Table 2: Moisture Content Test Results
Split Spoon Soil Samples
Dallas Highway 36-Inch Parallel Water Main
Mars Hill Road to Friendship Church Road
Cobb County, Georgia
Geo-Hydro Project Number 150811.20

Boring	Depth (feet)	Moisture Content (%)
B-1	10	22.8
B-1	20	27.6
B-2	15	28.8
B-2	20	47.9
B-3	5	20.5
B-3	15	45.7
B-4	10	27.5
B-4	15	33.5
B-5	5	28.1
B-5	10	32.1
B-6	5	33.1
B-6	15	29.7
B-7	5	30.3
B-7	15	50.9
B-8	7½	22.6
B-8	15	72.9
B-9	10	28.5
B-9	15	46.9
B-10	5	26.3
B-10	10	17.8
B-11	10	20.9
B-11	15	22.9
B-12	5	39.5
B-12	7½	22.9
B-13	7½	47.5
B-13	10	50.8

Boring	Depth (feet)	Moisture Content (%)
B-14	7½	42.9
B-14	10	48.4
B-15	5	28.2
B-15	10	29.1
B-16	7½	28.0
B-16	10	32.4
B-17	5	18.0
B-17	10	32.7
B-18	7½	28.3
B-18	10	30.3
B-19	7½	32.2
B-19	10	37.9
B-20	5	30.7
B-20	10	41.7
B-21	5	23.1
B-21	10	39.2
B-22	10	26.1
B-22	15	35.7
B-23	7½	24.1
B-23	15	45.4
B-24	10	44.0
B-24	15	56.7
B-25	7½	42.0
B-25	15	48.4

GEO HYDRO ENGINEERS

Dry Density vs. Moisture Content



SAMPLE NO.:	B-1	ASTM Spec.	Blows/ Layer	No. of Layers:	Wt. of Hammer; lbs	Mold Dia., in.	Location
Natural Moisture Content, %	22.8	D698	25	3	5.5	4	STA 1+50
Optimum Moisture Content, %	22.0						
Maximum Dry Density, pcf	102.5						

Depth/ Elev.	Classification	LL	PL	PI	% < #200 sieve	% < 3/4" sieve
0'-10'	Brown silty fine sand (SM)					

GEO HYDRO ENGINEERS

Project:
Dallas Highway 36-Inch Parallel Water Main

Geo-Hydro Project No.:	Contract No.:	Date:
150811.20		12/16/2015

Compaction Test Report

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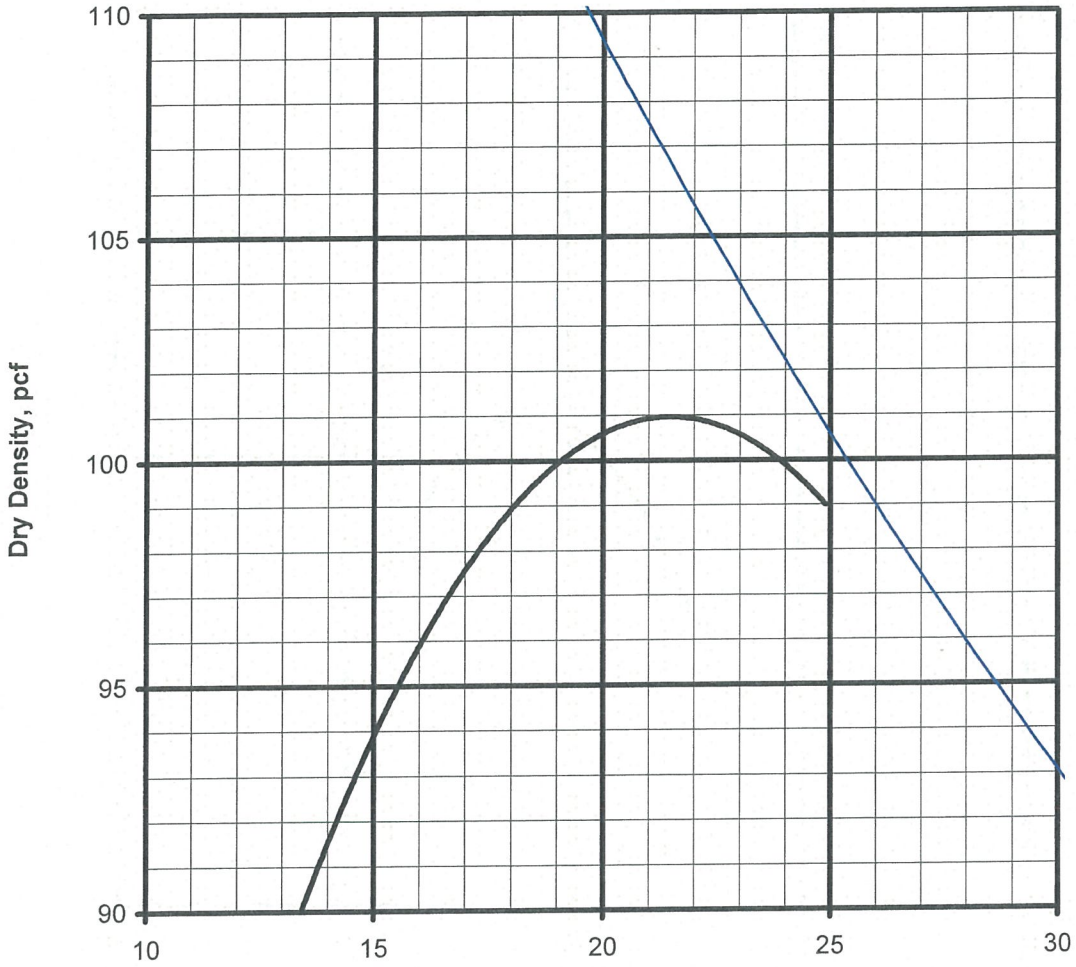
Dry Density vs. Moisture Content



SAMPLE NO.:	B-7	ASTM Spec.	Blows/ Layer	No. of Layers:	Wt. of Hammer; lbs	Mold Dia., in.	Location
Natural Moisture Content, %	30.3	D698	25	3	5.5	4	STA 22+50
Optimum Moisture Content, %	21.5						
Maximum Dry Density, pcf	101.0						

Depth/ Elev.	Classification	LL	PL	PI	% < #200 sieve	% < 3/4" sieve
0'-10'	Red-brown silty fine sand (SM)					

GEO HYDRO ENGINEERS

Project:
Dallas Highway 36-Inch Parallel Water Main

Geo-Hydro Project No.:	Contract No.:	Date:
150811.20		12/16/2015

Compaction Test Report

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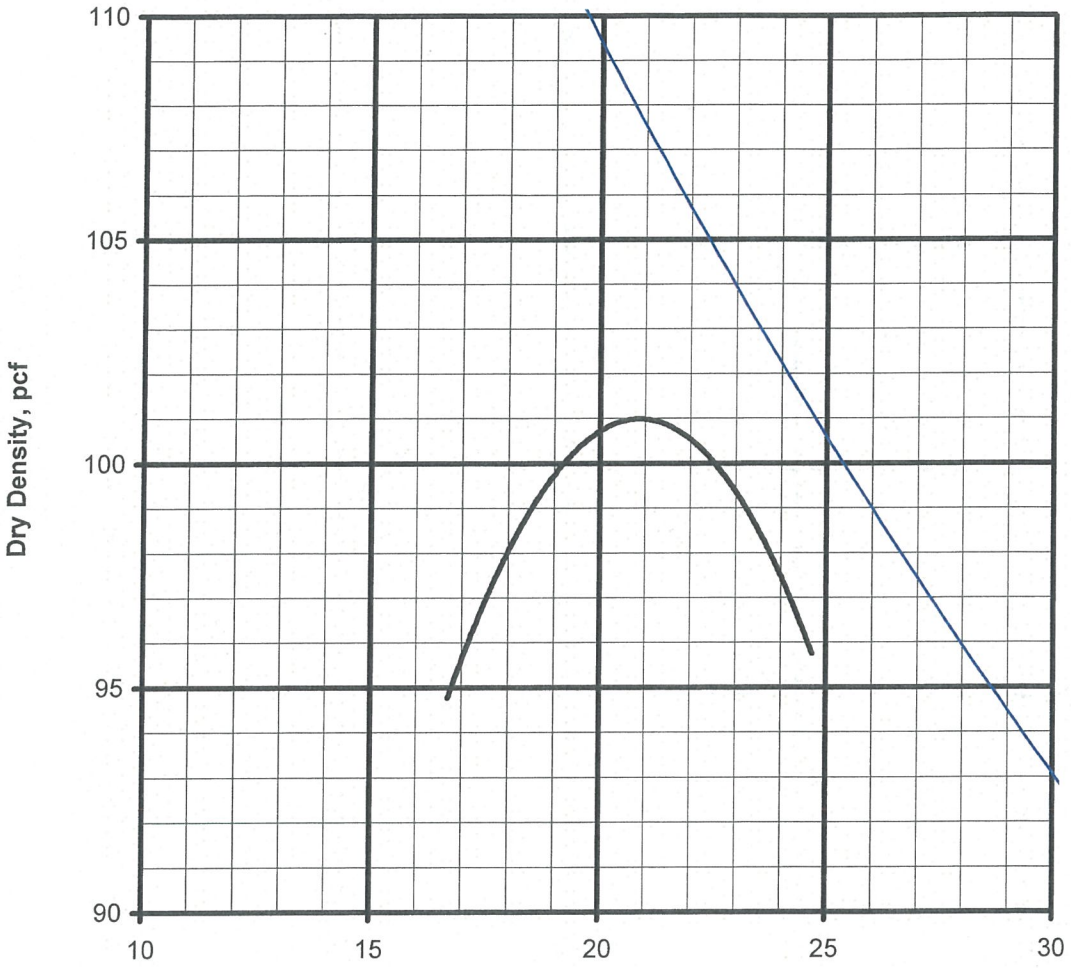
Dry Density vs. Moisture Content



SAMPLE NO.:	B-11	ASTM Spec.	Blows/ Layer	No. of Layers:	Wt. of Hammer; lbs	Mold Dia., in.	Location
Natural Moisture Content, %	20.9	D698	25	3	5.5	4	STA 42+50
Optimum Moisture Content, %	21.0						
Maximum Dry Density, pcf	101.0						

Depth/ Elev.	Classification	LL	PL	PI	% < #200 sieve	% < 3/4" sieve
0'-10'	Red and brown clayey fine sand					

GEO HYDRO ENGINEERS

Project:
Dallas Highway 36-Inch Parallel Water Main

Geo-Hydro Project No.:	Contract No.:	Date:
150811.20		12/16/2015

Compaction Test Report

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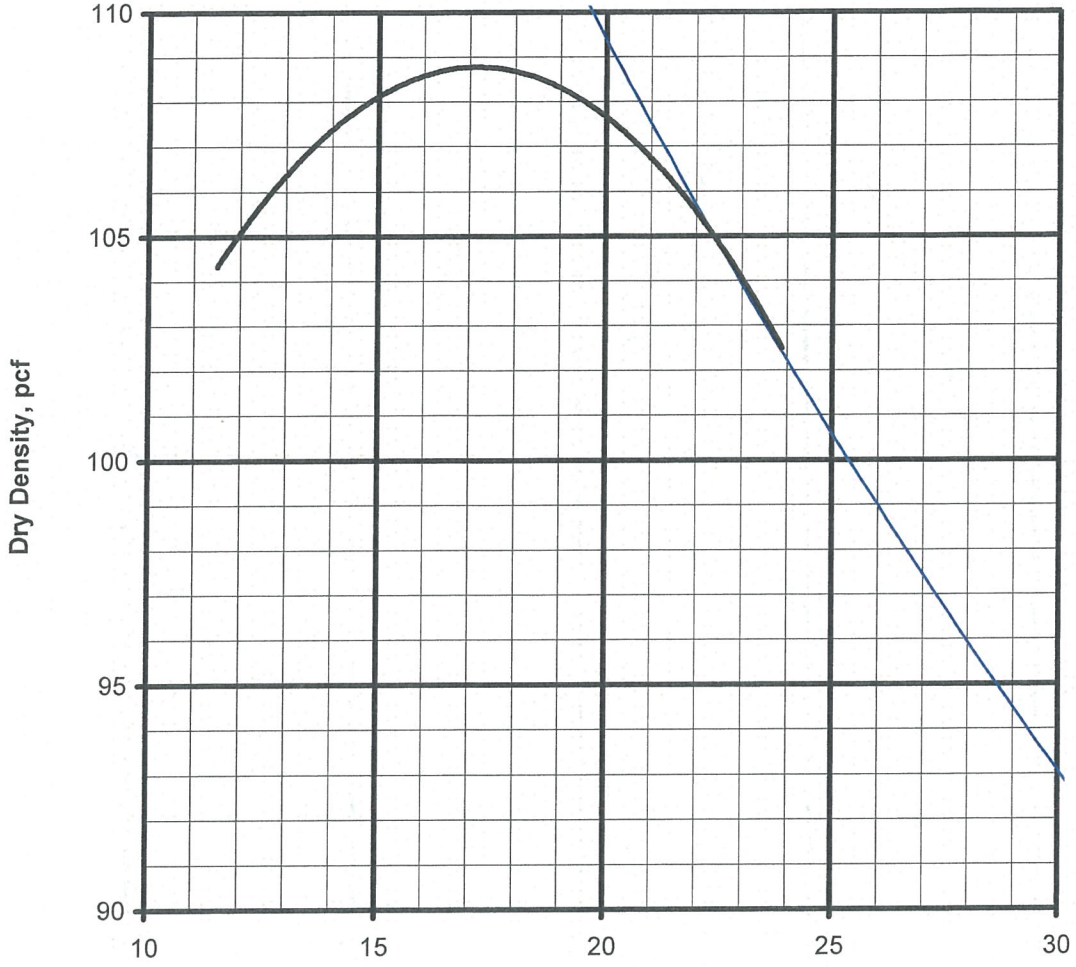
Dry Density vs. Moisture Content



SAMPLE NO.:	B-17	ASTM Spec.	Blows/ Layer	No. of Layers:	Wt. of Hammer; lbs	Mold Dia., in.	Location
Natural Moisture Content, %	20.9	D698	25	3	5.5	4	STA 61+75
Optimum Moisture Content, %	17.0						
Maximum Dry Density, pcf	109.0						

Depth/ Elev.	Classification	LL	PL	PI	% < #200 sieve	% < 3/4" sieve
0'-10'	Black silty sand (SM)					

GEO HYDRO ENGINEERS

Project:
Dallas Highway 36-Inch Parallel Water Main

Geo-Hydro Project No.:	Contract No.:	Date:
150811.20		12/14/2015

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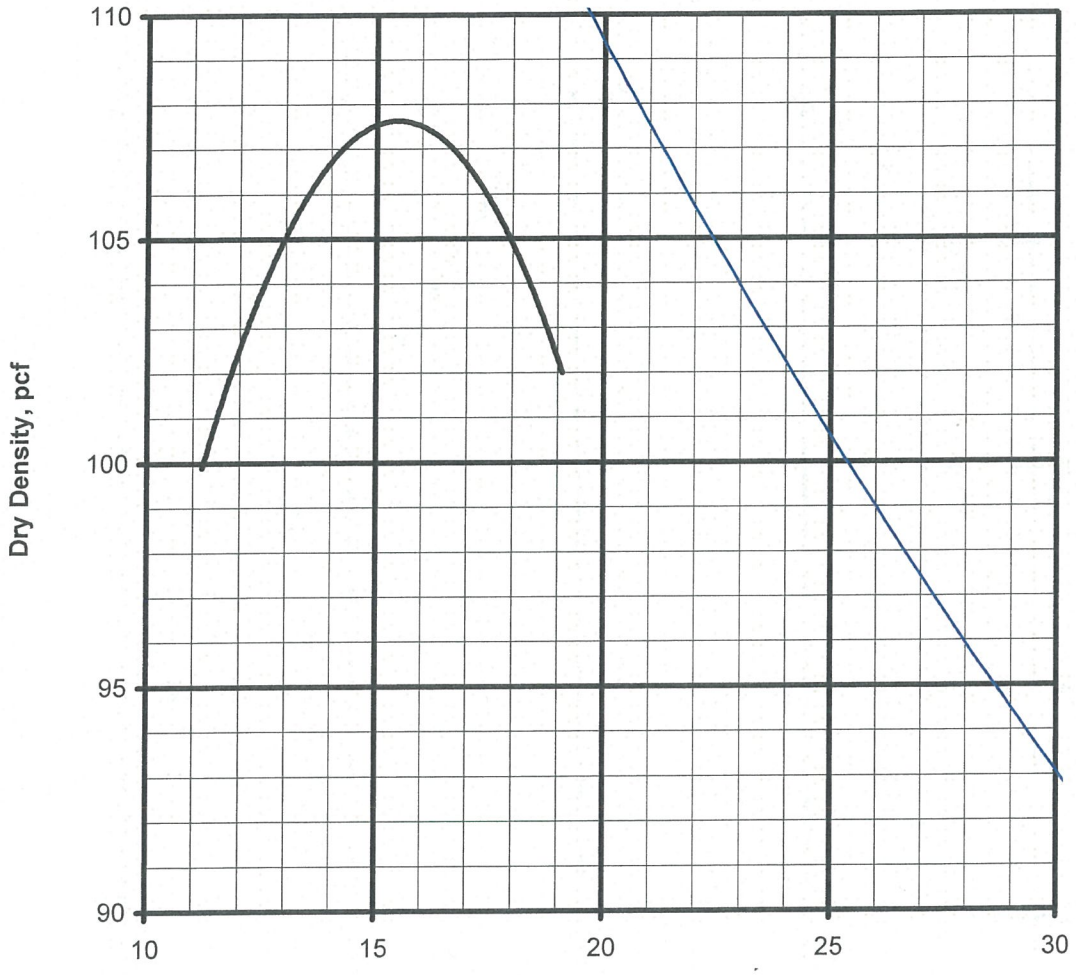
Dry Density vs. Moisture Content



SAMPLE NO.:	B-21	ASTM Spec.	Blows/ Layer	No. of Layers:	Wt. of Hammer; lbs	Mold Dia., in.	Location
Natural Moisture Content, %	23.1	D698	25	3	5.5	4	STA 80+25
Optimum Moisture Content, %	15.5						
Maximum Dry Density, pcf	107.5						

Depth/ Elev.	Classification	LL	PL	PI	% < #200 sieve	% < 3/4" sieve
0'-10'	Brown clayey silt (ML)					

GEO HYDRO ENGINEERS

Project:
Dallas Highway 36-Inch Parallel Water Main

Geo-Hydro Project No.:	Contract No.:	Date:
150811.20		12/16/2015

Compaction Test Report

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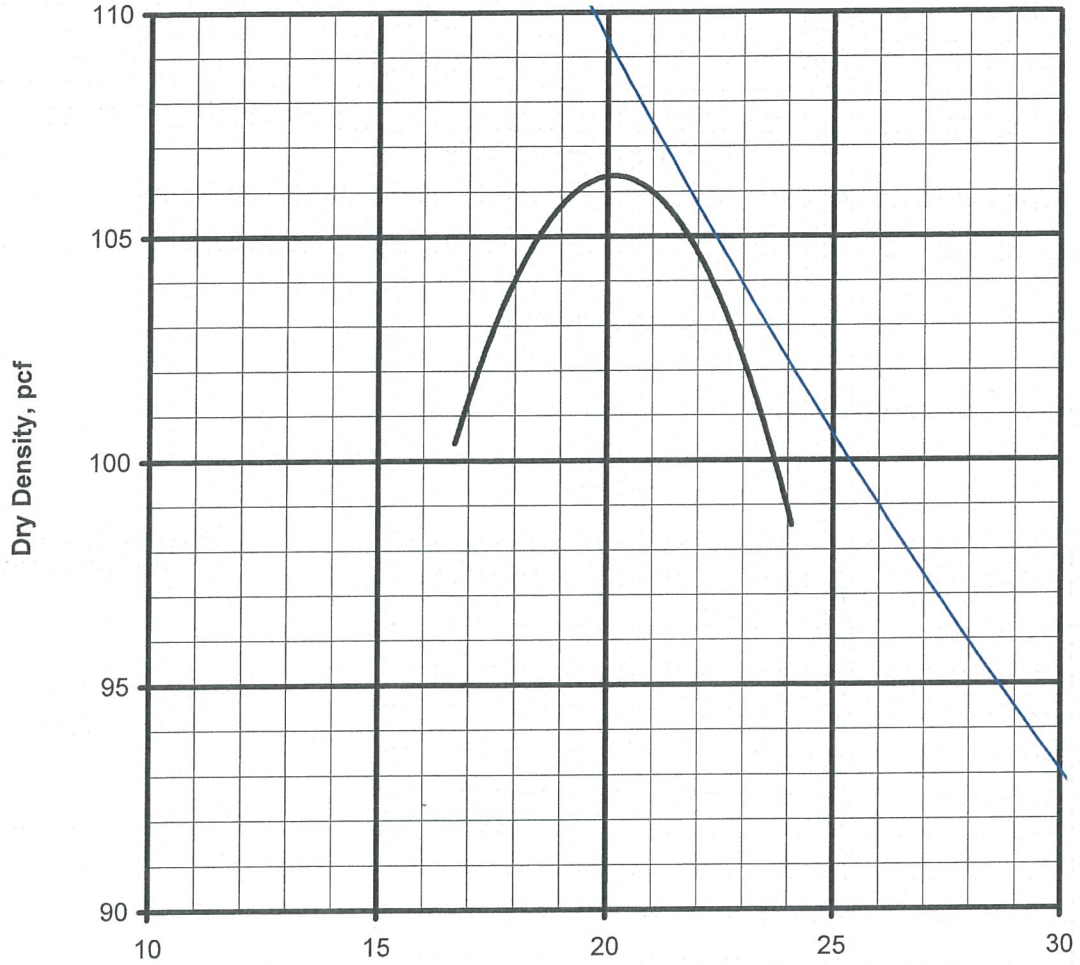
Dry Density vs. Moisture Content



SAMPLE NO.:	B-25	ASTM Spec.	Blows/ Layer	No. of Layers:	Wt. of Hammer; lbs	Mold Dia., in.	Location
Natural Moisture Content, %	30.0	D698	25	3	5.5	4	STA 94+00
Optimum Moisture Content, %	20.0						
Maximum Dry Density, pcf	105.5						

Depth/ Elev.	Classification	LL	PL	PI	% < #200 sieve	% < 3/4" sieve
0'-10'	Brown silty fine sand (SM)					

GEO HYDRO ENGINEERS

Project:
Dallas Highway 36-Inch Parallel Water Main

Geo-Hydro Project No.:	Contract No.:	Date:
150811.20		12/16/2015

Compaction Test Report

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TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	EB
Date	12/10/15
Checked By	VB

Client Pr. #	150811.2	Lab. PR. #	1507A-24-1
Pr. Name	DallasHwy 36-inch Parallel Water Main	S. Type	Bag
Sample ID	21051/B-1	Depth/Elev.	-
Location	17'	Add. Info	-

ASTM G51/AASHTO T289

Standard Test Method for Determining pH of Soil for Use in Corrosion Testing

SAMPLE PREPARATION

Air dried Material passing #10 sieve was used for testing.

TEST DATA

T.E.S.T. Sample ID	Client Sample ID	pH meter Reading	Reported pH
21051	B-1	4.56	**4.6**

Standard buffer solutions used to standardize pH meter:

4.0 pH

7.0 pH

10.0 pH

pH Meter ID 375

REMARKS

TIMELY ENGINEERING SOIL TESTS, LLC

1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	EB
Date	12/10/15
Checked By	LB

Client Pr. #	150811.2	Lab. PR. #	1507A-24-1
Pr. Name	DallasHwy 36-inch Parallel Water Main	S. Type	Bag
Sample ID	21051/B-1	Depth/Elev.	-
Location	17'	Add. Info	-

ASTM G 57/G187/AASHTO T 288

Standard Test Method for Determining Minimum Laboratory Soil Resistivity

Determination of Resistivity at as-received moisture content

As-received Moisture Content	
Mass of Wet Sample & Tare, g	
Mass of Dry Sample & Tare, g	
Mass of Tare, g	
Moisture Content, %	NA

Remarks

		TEST DATA	
Mass of Soil Box, g	-	Meter Dial Reading, ohms	-
Mass of Soil Box + Soil, g	-	Reading of Meter Range Multiplier	-
Mass of Soil, g	-	Measured Resistance, ohms	-
Calibrated Volume of Soil Box, ft^3	0.0027	Calibrated Soil Box Multiplier, cm	1.0
Wet Density of as-placed Soil, pcf	-		
Dry Density of as-placed Soil, pcf	-	**Reported Soil Resistivity, ohms-cm**	**NA**

Determination of Minimum Soil Resistivity

TEST DATA

	Trials at Various Moisture Content								
TRIAL #	1	2	3	4	5	6	7	8	9
Meter Dial Reading, ohms	44	39	38.1	37	36	36			
Reading of Meter Range Multiplier	K	K	K	K	K	K			
Measured Resistance, ohms	44000	39000	38100	37000	36000	36000			
Calibrated Soil Box Multiplier, cm	1.0	1.0	1.0	1.0	1.0	1.0			
Measured Resistivity, ohms-cm	44000	39000	38100	37000	36000	36000			

Reported Soil Minimum Resistivity, ohms-cm **36000**

Note: Material passed # 10 sieve used for testing

Oven ID #	496/610
Balance ID #	563/700
Soil Box ID #	612/613/707
Resistivity Meter ID #	706

Description

NA

USCS (D2487; D2488)	NA
AASHTO (M145)	NA

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Tested By	EB
Date	12/10/15
Checked By	

Client Pr. #	150811.2	Lab. PR. #	1507A-24-1
Pr. Name	DallasHwy 36-inch Parallel Water Main	S. Type	Bag
Sample ID	21051/B-1	Depth/Elev.	-
Location	17'	Add. Info	-

ASTM G200

Standard Test Method for Measurement of Oxidation Reduction Potential (ORP) of Soil

SAMPLE PREPARATION

Roots, Stones, Gravel and other deleterious material was removed prior to testing

Measurements performed ar room temperature condition: 19.3 °C

TEST DATA

T.E.S.T. Sample ID	Client Sample ID	ORP meter Reading #1, mV	ORP meter Reading #2, mV	ORP meter Reading #3, mV	**Reported ORP value, mV**
21051	B-1	334.0	358.0	361.0	**351**

Standard ORP calibration solution (420+/-mV) used to standardize ORP meter: P.D.1/21/15 Exp.10/16

REMARKS

ORP Meter ID	375
ORP Probe ID	417

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Tested By	EB
Date	12/11/15
Checked By	LB

Client Pr. #	150811.2	Lab. PR. #	1507A-24-1
Pr. Name	DallasHwy 36-inch Parallel Water Main	S. Type	Bag
Sample ID	21060/B-5	Depth/Elev.	-
Location	10'	Add. Info	-

ASTM G51/AASHTO T289

Standard Test Method for Determining pH of Soil for Use in Corrosion Testing

SAMPLE PREPARATION

Air dried Material passing #10 sieve was used for testing.

TEST DATA

T.E.S.T. Sample ID	Client Sample ID	pH meter Reading	Reported pH
21060	B-5	6.55	**6.6**

Standard buffer solutions used to standardize pH meter:

4.0 pH

7.0 pH

10.0 pH

pH Meter ID 375

REMARKS

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Tested By	AV
Date	12/11/15
Checked By	LB

Client Pr. #	150811.2	Lab. PR. #	1507A-24-1
Pr. Name	DallasHwy 36-inch Parallel Water Main	S. Type	Bag
Sample ID	21060/B-5	Depth/Elev.	-
Location	10'	Add. Info	-

ASTM G 57/G187/AASHTO T 288

Standard Test Method for Determining Minimum Laboratory Soil Resistivity

Determination of Resistivity at as-received moisture content

As-received Moisture Content	
Mass of Wet Sample & Tare, g	
Mass of Dry Sample & Tare, g	
Mass of Tare, g	
Moisture Content, %	NA

Remarks

TEST DATA

Mass of Soil Box, g	-	Meter Dial Reading, ohms	-
Mass of Soil Box + Soil, g	-	Reading of Meter Range Multiplier	-
Mass of Soil, g	-	Measured Resistance, ohms	-
Calibrated Volume of Soil Box, ft^3	0.0027	Calibrated Soil Box Multiplier, cm	1.0
Wet Density of as-placed Soil, pcf	-		
Dry Density of as-placed Soil, pcf	-	**Reported Soil Resistivity, ohms-cm**	**NA**

Determination of Minimum Soil Resistivity

TEST DATA

	Trials at Various Moisture Content								
TRIAL #	1	2	3	4	5	6	7	8	9
Meter Dial Reading, ohms	5.2	4.82	4.55	4.55					
Reading of Meter Range Multiplier	K	K	K	K					
Measured Resistance, ohms	5200	4820	4550	4550					
Calibrated Soil Box Multiplier, cm	1.0	1.0	1.0	1.0					
Measured Resistivity, ohms-cm	5200	4820	4550	4550					

Reported Soil Minimum Resistivity, ohms-cm **4550**

Note: Material passed # 10 sieve used for testing

Oven ID #	496/610
Balance ID #	563/700
Soil Box ID #	612/613/707
Resistivity Meter ID #	706

Description

NA

USCS (D2487; D2488)	NA
AASHTO (M145)	NA

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Tested By	EB
Date	12/11/15
Checked By	LB

Client Pr. #	150811.2	Lab. PR. #	1507A-24-1
Pr. Name	DallasHwy 36-inch Parallel Water Main	S. Type	Bag
Sample ID	21060/B-5	Depth/Elev.	-
Location	10'	Add. Info	-

ASTM G200

Standard Test Method for Measurement of Oxidation Reduction Potential (ORP) of Soil

SAMPLE PREPARATION

Roots, Stones, Gravel and other deleterious material was removed prior to testing

Measurements performed ar room temperature condition: 20.3 °C

TEST DATA

T.E.S.T. Sample ID	Client Sample ID	ORP meter Reading #1, mV	ORP meter Reading #2, mV	ORP meter Reading #3, mV	**Reported ORP value, mV**
21060	B-5	298.0	331.0	334.0	**321**

Standard ORP calibration solution (420+/-mV) used to standardize ORP meter: P.D.1/21/15 Exp.10/16

REMARKS

ORP Meter ID	375
ORP Probe ID	417

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Tested By	EB
Date	12/11/15
Checked By	JB

Client Pr. #	150811.2	Lab. PR. #	1507A-24-1
Pr. Name	DallasHwy 36-inch Parallel Water Main	S. Type	Bag
Sample ID	21061/B-7	Depth/Elev.	-
Location	13'	Add. Info	-

ASTM G51/AASHTO T289

Standard Test Method for Determining pH of Soil for Use in Corrosion Testing

SAMPLE PREPARATION

Air dried Material passing #10 sieve was used for testing.

TEST DATA

T.E.S.T. Sample ID	Client Sample ID	pH meter Reading	Reported pH
21061	B-7	5.44	**5.4**

Standard buffer solutions used to standardize pH meter:

4.0 pH

7.0 pH

10.0 pH

pH Meter ID 375

REMARKS

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Tested By	AV
Date	12/11/15
Checked By	

Client Pr. #	150811.2	Lab. PR. #	1507A-24-1
Pr. Name	DallasHwy 36-inch Parallel Water Main	S. Type	Bag
Sample ID	21061/B-7	Depth/Elev.	-
Location	13'	Add. Info	-

ASTM G 57/G187/AASHTO T 288

Standard Test Method for Determining Minimum Laboratory Soil Resistivity

Determination of Resistivity at as-received moisture content

As-received Moisture Content	
Mass of Wet Sample & Tare, g	
Mass of Dry Sample & Tare, g	
Mass of Tare, g	
Moisture Content, %	NA

Remarks

TEST DATA

Mass of Soil Box, g	-	Meter Dial Reading, ohms	-
Mass of Soil Box + Soil, g	-	Reading of Meter Range Multiplier	-
Mass of Soil, g	-	Measured Resistance, ohms	-
Calibrated Volume of Soil Box, ft^3	0.0027	Calibrated Soil Box Multiplier, cm	1.0
Wet Density of as-placed Soil, pcf	-		
Dry Density of as-placed Soil, pcf	-	**Reported Soil Resistivity, ohms-cm**	**NA**

Determination of Minimum Soil Resistivity

TEST DATA

	Trials at Various Moisture Content								
TRIAL #	1	2	3	4	5	6	7	8	9
Meter Dial Reading, ohms	30.6	28.6	26.3	24	22	22			
Reading of Meter Range Multiplier	K	K	K	K	K	K			
Measured Resistance, ohms	30600	28600	26300	24000	22000	22000			
Calibrated Soil Box Multiplier, cm	1.0	1.0	1.0	1.0	1.0	1.0			
Measured Resistivity, ohms-cm	30600	28600	26300	24000	22000	22000			

Reported Soil Minimum Resistivity, ohms-cm **22000**

Note: Material passed # 10 sieve used for testing

Oven ID #	496/610
Balance ID #	563/700
Soil Box ID #	612/613/707
Resistivity Meter ID #	706

Description

NA

USCS (D2487; D2488)	NA
AASHTO (M145)	NA

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Tested By	EB
Date	12/11/15
Checked By	

Client Pr. #	150811.2	Lab. PR. #	1507A-24-1
Pr. Name	DallasHwy 36-inch Parallel Water Main	S. Type	Bag
Sample ID	21061/B-7	Depth/Elev.	-
Location	13'	Add. Info	-

ASTM G200

Standard Test Method for Measurement of Oxidation Reduction Potential (ORP) of Soil

SAMPLE PREPARATION

Roots, Stones, Gravel and other deleterious material was removed prior to testing

Measurements performed ar room temperature condition: 20.3 °C

TEST DATA

T.E.S.T. Sample ID	Client Sample ID	ORP meter Reading #1, mV	ORP meter Reading #2, mV	ORP meter Reading #3, mV	**Reported ORP value, mV**
21061	B-7	356.0	347.0	341.0	**348**

Standard ORP calibration solution (420+/-mV) used to standardize ORP meter: P.D.1/21/15, Exp.10/16

REMARKS

ORP Meter ID	375
ORP Probe ID	417

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Tested By	EB
Date	12/11/15
Checked By	

Client Pr. #	150811.2	Lab. PR. #	1507A-24-1
Pr. Name	DallasHwy 36-inch Parallel Water Main	S. Type	Bag
Sample ID	21062/B-9	Depth/Elev.	-
Location	15'	Add. Info	-

ASTM G51/AASHTO T289

Standard Test Method for Determining pH of Soil for Use in Corrosion Testing

SAMPLE PREPARATION

Air dried Material passing #10 sieve was used for testing.

TEST DATA

T.E.S.T. Sample ID	Client Sample ID	pH meter Reading	Reported pH
21062	B-9	4.94	**4.9**

Standard buffer solutions used to standardize pH meter:

4.0 pH

7.0 pH

10.0 pH

pH Meter ID 375

REMARKS

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Tested By	AV
Date	12/11/15
Checked By	

Client Pr. #	150811.2	Lab. PR. #	1507A-24-1
Pr. Name	DallasHwy 36-inch Parallel Water Main	S. Type	Bag
Sample ID	21062/B-9	Depth/Elev.	-
Location	15'	Add. Info	-

ASTM G 57/G187/AASHTO T 288

Standard Test Method for Determining Minimum Laboratory Soil Resistivity

Determination of Resistivity at as-received moisture content

As-received Moisture Content	
Mass of Wet Sample & Tare, g	
Mass of Dry Sample & Tare, g	
Mass of Tare, g	
Moisture Content, %	NA

Remarks

TEST DATA

Mass of Soil Box, g	-	Meter Dial Reading, ohms	-
Mass of Soil Box + Soil, g	-	Reading of Meter Range Multiplier	-
Mass of Soil, g	-	Measured Resistance, ohms	-
Calibrated Volume of Soil Box, ft^3	0.0027	Calibrated Soil Box Multiplier, cm	1.0
Wet Density of as-placed Soil, pcf	-		
Dry Density of as-placed Soil, pcf	-	**Reported Soil Resistivity, ohms-cm**	**NA**

Determination of Minimum Soil Resistivity

TEST DATA

	Trials at Various Moisture Content								
TRIAL #	1	2	3	4	5	6	7	8	9
Meter Dial Reading, ohms	24	21	19.3	18.2	16.8	16.8			
Reading of Meter Range Multiplier	K	K	K	K	K	K			
Measured Resistance, ohms	24000	21000	19300	18200	16800	16800			
Calibrated Soil Box Multiplier, cm	1.0	1.0	1.0	1.0	1.0	1.0			
Measured Resistivity, ohms-cm	24000	21000	19300	18200	16800	16800			

Reported Soil Minimum Resistivity, ohms-cm **16800**

Note: Material passed # 10 sieve used for testing

Oven ID #	496/610
Balance ID #	563/700
Soil Box ID #	612/613/707
Resistivity Meter ID #	706

Description

NA

USCS (D2487; D2488)	NA
AASHTO (M145)	NA

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Tested By	EB
Date	12/11/15
Checked By	LB

Client Pr. #	150811.2	Lab. PR. #	1507A-24-1
Pr. Name	DallasHwy 36-inch Parallel Water Main	S. Type	Bag
Sample ID	21062/B-9	Depth/Elev.	-
Location	15'	Add. Info	-

ASTM G200

Standard Test Method for Measurement of Oxidation Reduction Potential (ORP) of Soil

SAMPLE PREPARATION

Roots, Stones, Gravel and other deleterious material was removed prior to testing

Measurements performed ar room temperature condition: 20.3 °C

TEST DATA

T.E.S.T. Sample ID	Client Sample ID	ORP meter Reading #1, mV	ORP meter Reading #2, mV	ORP meter Reading #3, mV	**Reported ORP value, mV**
21062	B-9	386.0	376.0	385.0	**382**

Standard ORP calibration solution (420+/-mV) used to standardize ORP meter: P.D.1/21/15 Exp.10/16

REMARKS

ORP Meter ID	375
ORP Probe ID	417

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Tested By	EB
Date	12/11/15
Checked By	JB

Client Pr. #	150811.2	Lab. PR. #	1507A-24-1
Pr. Name	DallasHwy 36-inch Parallel Water Main	S. Type	Bag
Sample ID	21068/B-13	Depth/Elev.	-
Location	10'	Add. Info	-

ASTM G51/AASHTO T289

Standard Test Method for Determining pH of Soil for Use in Corrosion Testing

SAMPLE PREPARATION

Air dried Material passing #10 sieve was used for testing.

TEST DATA

T.E.S.T. Sample ID	Client Sample ID	pH meter Reading	Reported pH
21068	B-13	4.65	**4.7**

Standard buffer solutions used to standardize pH meter:

4.0 pH

7.0 pH

10.0 pH

pH Meter ID 375

REMARKS

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Tested By	AV
Date	12/11/15
Checked By	

Client Pr. #	150811.2	Lab. PR. #	1507A-24-1
Pr. Name	DallasHwy 36-inch Parallel Water Main	S. Type	Bag
Sample ID	21068/B-13	Depth/Elev.	-
Location	10'	Add. Info	-

ASTM G 57/G187/AASHTO T 288

Standard Test Method for Determining Minimum Laboratory Soil Resistivity

Determination of Resistivity at as-received moisture content

As-received Moisture Content	
Mass of Wet Sample & Tare, g	
Mass of Dry Sample & Tare, g	
Mass of Tare, g	
Moisture Content, %	NA

Remarks

TEST DATA

Mass of Soil Box, g	-	Meter Dial Reading, ohms	-
Mass of Soil Box + Soil, g	-	Reading of Meter Range Multiplier	-
Mass of Soil, g	-	Measured Resistance, ohms	-
Calibrated Volume of Soil Box, ft^3	0.0027	Calibrated Soil Box Multiplier, cm	1.0
Wet Density of as-placed Soil, pcf	-		
Dry Density of as-placed Soil, pcf	-	**Reported Soil Resistivity, ohms-cm**	**NA**

Determination of Minimum Soil Resistivity

TEST DATA

	Trials at Various Moisture Content								
TRIAL #	1	2	3	4	5	6	7	8	9
Meter Dial Reading, ohms	30.1	27.3	25.6	24.6	24.6				
Reading of Meter Range Multiplier	K	K	K	K	K				
Measured Resistance, ohms	30100	27300	25600	24600	24600				
Calibrated Soil Box Multiplier, cm	1.0	1.0	1.0	1.0	1.0				
Measured Resistivity, ohms-cm	30100	27300	25600	24600	24600				

Reported Soil Minimum Resistivity, ohms-cm **24600**

Note: Material passed # 10 sieve used for testing

Oven ID #	496/610
Balance ID #	563/700
Soil Box ID #	612/613/707
Resistivity Meter ID #	706

Description

NA

USCS (D2487; D2488)	NA
AASHTO (M145)	NA

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Tested By	EB
Date	12/11/15
Checked By	[illegible]

Client Pr. #	150811.2	Lab. PR. #	1507A-24-1
Pr. Name	DallasHwy 36-inch Parallel Water Main	S. Type	Bag
Sample ID	21068/B-13	Depth/Elev.	-
Location	10'	Add. Info	-

ASTM G200

Standard Test Method for Measurement of Oxidation Reduction Potential (ORP) of Soil

SAMPLE PREPARATION

Roots, Stones, Gravel and other deleterious material was removed prior to testing

Measurements performed ar room temperature condition: 21.7 °C

TEST DATA

T.E.S.T. Sample ID	Client Sample ID	ORP meter Reading #1, mV	ORP meter Reading #2, mV	ORP meter Reading #3, mV	**Reported ORP value, mV**
21068	B-13	349.0	388.0	381.0	**373**

REMARKS

Standard ORP calibration solution (420+/-mV) used to standardize ORP meter: P.D.1/21/15, Exp.10/16

ORP Meter ID	375
ORP Probe ID	417

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Tested By	EB
Date	12/14/15
Checked By	16

Client Pr. #	150811.2	Lab. PR. #	1507A-24-1
Pr. Name	DallasHwy 36-inch Parallel Water Main	S. Type	Bag
Sample ID	21085/B-17	Depth/Elev.	-
Location	10'	Add. Info	-

ASTM G51/AASHTO T289

Standard Test Method for Determining pH of Soil for Use in Corrosion Testing

SAMPLE PREPARATION

Air dried Material passing #10 sieve was used for testing.

TEST DATA

T.E.S.T. Sample ID	Client Sample ID	pH meter Reading	Reported pH
21085	B-17	5.30	**5.3**

Standard buffer solutions used to standardize pH meter:

4.0 pH

7.0 pH

10.0 pH

pH Meter ID 375

REMARKS

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Tested By	EB
Date	12/14/15
Checked By	

Client Pr. #	150811.2	Lab. PR. #	1507A-24-1
Pr. Name	DallasHwy 36-inch Parallel Water Main	S. Type	Bag
Sample ID	21085/B-17	Depth/Elev.	-
Location	10'	Add. Info	-

ASTM G 57/G187/AASHTO T 288

Standard Test Method for Determining Minimum Laboratory Soil Resistivity

Determination of Resistivity at as-received moisture content

As-received Moisture Content	
Mass of Wet Sample & Tare, g	
Mass of Dry Sample & Tare, g	
Mass of Tare, g	
Moisture Content, %	NA

Remarks

TEST DATA

Mass of Soil Box, g	-	Meter Dial Reading, ohms	-
Mass of Soil Box + Soil, g	-	Reading of Meter Range Multiplier	-
Mass of Soil, g	-	Measured Resistance, ohms	-
Calibrated Volume of Soil Box, ft^3	0.0027	Calibrated Soil Box Multiplier, cm	1.0
Wet Density of as-placed Soil, pcf	-		
Dry Density of as-placed Soil, pcf	-	**Reported Soil Resistivity, ohms-cm**	**NA**

Determination of Minimum Soil Resistivity

TEST DATA

	Trials at Various Moisture Content								
TRIAL #	1	2	3	4	5	6	7	8	9
Meter Dial Reading, ohms	40.4	36.8	32.4	29.1	28.2	28.2			
Reading of Meter Range Multiplier	K	K	K	K	K	K			
Measured Resistance, ohms	40400	36800	32400	29100	28200	28200			
Calibrated Soil Box Multiplier, cm	1.0	1.0	1.0	1.0	1.0	1.0			
Measured Resistivity, ohms-cm	40400	36800	32400	29100	28200	28200			

Reported Soil Minimum Resistivity, ohms-cm **28200**

Note: Material passed # 10 sieve used for testing

Oven ID #	496/610
Balance ID #	563/700
Soil Box ID #	612/613/707
Resistivity Meter ID #	706

Description

NA

USCS (D2487; D2488)	NA
AASHTO (M145)	NA

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Tested By	EB
Date	12/11/15
Checked By	LB

Client Pr. #	150811.2	Lab. PR. #	1507A-24-1
Pr. Name	DallasHwy 36-inch Parallel Water Main	S. Type	Bag
Sample ID	21085/B-17	Depth/Elev.	-
Location	10'	Add. Info	-

ASTM G200

Standard Test Method for Measurement of Oxidation Reduction Potential (ORP) of Soil

SAMPLE PREPARATION

Roots, Stones, Gravel and other deleterious material was removed prior to testing

Measurements performed ar room temperature condition: 20.8 °C

TEST DATA

T.E.S.T. Sample ID	Client Sample ID	ORP meter Reading #1, mV	ORP meter Reading #2, mV	ORP meter Reading #3, mV	**Reported ORP value, mV**
21085	B-17	368.0	352.0	364.0	**361**

Standard ORP calibration solution (420+/-mV) used to standardize ORP meter: P.D.1/21/15, Exp.10/16

REMARKS

ORP Meter ID	375
ORP Probe ID	417

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Tested By	EB
Date	12/14/15
Checked By	LB

Client Pr. #	150811.2	Lab. PR. #	1507A-24-1
Pr. Name	DallasHwy 36-inch Parallel Water Main	S. Type	Bag
Sample ID	21086/B-19	Depth/Elev.	-
Location	10'	Add. Info	-

ASTM G51/AASHTO T289

Standard Test Method for Determining pH of Soil for Use in Corrosion Testing

SAMPLE PREPARATION

Air dried Material passing #10 sieve was used for testing.

TEST DATA

T.E.S.T. Sample ID	Client Sample ID	pH meter Reading	Reported pH
21086	B-19	4.97	**5.0**

Standard buffer solutions used to standardize pH meter:

4.0 pH

7.0 pH

10.0 pH

pH Meter ID 375

REMARKS

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Tested By	EB
Date	12/14/15
Checked By	LB

Client Pr. #	150811.2	Lab. PR. #	1507A-24-1
Pr. Name	DallasHwy 36-inch Parallel Water Main	S. Type	Bag
Sample ID	21086/B-19	Depth/Elev.	-
Location	10'	Add. Info	-

ASTM G 57/G187/AASHTO T 288

Standard Test Method for Determining Minimum Laboratory Soil Resistivity

Determination of Resistivity at as-received moisture content

As-received Moisture Content	
Mass of Wet Sample & Tare, g	
Mass of Dry Sample & Tare, g	
Mass of Tare, g	
Moisture Content, %	NA

Remarks

TEST DATA

Mass of Soil Box, g	-	Meter Dial Reading, ohms	-
Mass of Soil Box + Soil, g	-	Reading of Meter Range Multiplier	-
Mass of Soil, g	-	Measured Resistance, ohms	-
Calibrated Volume of Soil Box, ft^3	0.0027	Calibrated Soil Box Multiplier, cm	1.0
Wet Density of as-placed Soil, pcf	-		
Dry Density of as-placed Soil, pcf	-	**Reported Soil Resistivity, ohms-cm**	**NA**

Determination of Minimum Soil Resistivity

TEST DATA

	Trials at Various Moisture Content								
TRIAL #	1	2	3	4	5	6	7	8	9
Meter Dial Reading, ohms	22.4	18.7	16.9	15.3	14.8	14.8			
Reading of Meter Range Multiplier	K	K	K	K	K	K			
Measured Resistance, ohms	22400	18700	16900	15300	14800	14800			
Calibrated Soil Box Multiplier, cm	1.0	1.0	1.0	1.0	1.0	1.0			
Measured Resistivity, ohms-cm	22400	18700	16900	15300	14800	14800			

Reported Soil Minimum Resistivity, ohms-cm **14800**

Note: Material passed # 10 sieve used for testing

Oven ID #	496/610
Balance ID #	563/700
Soil Box ID #	612/613/707
Resistivity Meter ID #	706

Description

NA

USCS (D2487; D2488)	NA
AASHTO (M145)	NA

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Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	EB
Date	12/11/15
Checked By	

Client Pr. #	150811.2	Lab. PR. #	1507A-24-1
Pr. Name	DallasHwy 36-inch Parallel Water Main	S. Type	Bag
Sample ID	21086/B-19	Depth/Elev.	-
Location	10'	Add. Info	-

ASTM G200

Standard Test Method for Measurement of Oxidation Reduction Potential (ORP) of Soil

SAMPLE PREPARATION

Roots, Stones, Gravel and other deleterious material was removed prior to testing

Measurements performed ar room temperature condition: 20.8 °C

TEST DATA

T.E.S.T. Sample ID	Client Sample ID	ORP meter Reading #1, mV	ORP meter Reading #2, mV	ORP meter Reading #3, mV	**Reported ORP value, mV**
21086	B-19	346.0	353.0	335.0	**345**

Standard ORP calibration solution (420+/-mV) used to standardize ORP meter: P.D.1/21/15, Exp.10/16

REMARKS

ORP Meter ID	375
ORP Probe ID	417

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Tested By	EB
Date	12/10/15
Checked By	LB

Client Pr. #	150811.2	Lab. PR. #	1507A-24-1
Pr. Name	DallasHwy 36-inch Parallel Water Main	S. Type	Bag
Sample ID	21052/B-21	Depth/Elev.	-
Location	12'	Add. Info	-

ASTM G51/AASHTO T289

Standard Test Method for Determining pH of Soil for Use in Corrosion Testing

SAMPLE PREPARATION

Air dried Material passing #10 sieve was used for testing.

TEST DATA

T.E.S.T. Sample ID	Client Sample ID	pH meter Reading	Reported pH
21052	B-21	5.95	**6.0**

Standard buffer solutions used to standardize pH meter:

4.0 pH

7.0 pH

10.0 pH

pH Meter ID 375

REMARKS

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Tested By	EB
Date	12/10/15
Checked By	

Client Pr. #	150811.2	Lab. PR. #	1507A-24-1
Pr. Name	DallasHwy 36-inch Parallel Water Main	S. Type	Bag
Sample ID	21052/B-21	Depth/Elev.	-
Location	12'	Add. Info	-

ASTM G 57/G187/AASHTO T 288

Standard Test Method for Determining Minimum Laboratory Soil Resistivity

Determination of Resistivity at as-received moisture content

As-received Moisture Content	
Mass of Wet Sample & Tare, g	
Mass of Dry Sample & Tare, g	
Mass of Tare, g	
Moisture Content, %	NA

Remarks

TEST DATA

Mass of Soil Box, g	-	Meter Dial Reading, ohms	-
Mass of Soil Box + Soil, g	-	Reading of Meter Range Multiplier	-
Mass of Soil, g	-	Measured Resistance, ohms	-
Calibrated Volume of Soil Box, ft^3	0.0027	Calibrated Soil Box Multiplier, cm	1.0
Wet Density of as-placed Soil, pcf	-		
Dry Density of as-placed Soil, pcf	-	**Reported Soil Resistivity, ohms-cm**	**NA**

Determination of Minimum Soil Resistivity

TEST DATA

	Trials at Various Moisture Content								
TRIAL #	1	2	3	4	5	6	7	8	9
Meter Dial Reading, ohms	10.7	10	9.4	9.3	9.11	9.01	9.01		
Reading of Meter Range Multiplier	K	K	K	K	K	K	K		
Measured Resistance, ohms	10700	10000	9400	9300	9110	9010	9010		
Calibrated Soil Box Multiplier, cm	1.0	1.0	1.0	1.0	1.0	1.0	1.0		
Measured Resistivity, ohms-cm	10700	10000	9400	9300	9110	9010	9010		

Reported Soil Minimum Resistivity, ohms-cm **9010**

Note: Material passed # 10 sieve used for testing

Oven ID #	496/610
Balance ID #	563/700
Soil Box ID #	612/613/707
Resistivity Meter ID #	706

Description

NA

USCS (D2487; D2488)	NA
AASHTO (M145)	NA

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Tested By	EB
Date	12/10/15
Checked By	

Client Pr. #	150811.2	Lab. PR. #	1507A-24-1
Pr. Name	DallasHwy 36-inch Parallel Water Main	S. Type	Bag
Sample ID	21052/B-21	Depth/Elev.	-
Location	12'	Add. Info	-

ASTM G200

Standard Test Method for Measurement of Oxidation Reduction Potential (ORP) of Soil

SAMPLE PREPARATION

Roots, Stones, Gravel and other deleterious material was removed prior to testing

Measurements performed ar room temperature condition: 19.3 °C

TEST DATA

T.E.S.T. Sample ID	Client Sample ID	ORP meter Reading #1, mV	ORP meter Reading #2, mV	ORP meter Reading #3, mV	**Reported ORP value, mV**
21052	B-21	368.0	385.0	390.0	**381**

Standard ORP calibration solution (420+/-mV) used to standardize ORP meter: P.D.1/21/15, Exp.10/16

REMARKS

ORP Meter ID	375
ORP Probe ID	417

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Tested By	EB
Date	12/08/15
Checked By	JB

Client Pr. #	150811.20	Lab. PR. #	1507A-24-1
Pr. Name	Dallas Hwy 36-inch Parallel Water Main	S. Type	Bag
Sample ID	21042/B-24	Depth/Elev.	-
Location	15	Add. Info	-

ASTM G51/AASHTO T289

Standard Test Method for Determining pH of Soil for Use in Corrosion Testing

SAMPLE PREPARATION

Air dried Material passing #10 sieve was used for testing.

TEST DATA

T.E.S.T. Sample ID	Client Sample ID	pH meter Reading	Reported pH
21042	B-24	4.95	**5.0**

Standard buffer solutions used to standardize pH meter:

4.0 pH

7.0 pH

10.0 pH

pH Meter ID 375

REMARKS

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Web: www.test-llc.com

Tested By	EB
Date	12/08/15
Checked By	

Client Pr. #	150811.20	Lab. PR. #	1507A-24-1
Pr. Name	Dallas Hwy 36-inch Parallel Water Main	S. Type	Bag
Sample ID	21042/B-24	Depth/Elev.	-
Location	15	Add. Info	-

ASTM G 57/G187/AASHTO T 288

Standard Test Method for Determining Minimum Laboratory Soil Resistivity

Determination of Resistivity at as-received moisture content

As-received Moisture Content	
Mass of Wet Sample & Tare, g	
Mass of Dry Sample & Tare, g	
Mass of Tare, g	
Moisture Content, %	NA

Remarks

TEST DATA

Mass of Soil Box, g	-	Meter Dial Reading, ohms	-
Mass of Soil Box + Soil, g	-	Reading of Meter Range Multiplier	-
Mass of Soil, g	-	Measured Resistance, ohms	-
Calibrated Volume of Soil Box, ft^3	0.0027	Calibrated Soil Box Multiplier, cm	1.0
Wet Density of as-placed Soil, pcf	-		
Dry Density of as-placed Soil, pcf	-	**Reported Soil Resistivity, ohms-cm**	**NA**

Determination of Minimum Soil Resistivity

TEST DATA

	Trials at Various Moisture Content								
TRIAL #	1	2	3	4	5	6	7	8	9
Meter Dial Reading, ohms	32	28.5	24.6	23.4	23	23			
Reading of Meter Range Multiplier	K	K	K	K	K	K			
Measured Resistance, ohms	32000	28500	24600	23400	23000	23000			
Calibrated Soil Box Multiplier, cm	1.0	1.0	1.0	1.0	1.0	1.0			
Measured Resistivity, ohms-cm	32000	28500	24600	23400	23000	23000			

Reported Soil Minimum Resistivity, ohms-cm **23000**

Note: Material passed # 10 sieve used for testing

Oven ID #	496/610
Balance ID #	563/700
Soil Box ID #	612/613/707
Resistivity Meter ID #	706

Description

NA

USCS (D2487; D2488)	NA
AASHTO (M145)	NA

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Tested By	EB
Date	12/08/15
Checked By	

Client Pr. #	150811.20	Lab. PR. #	1507A-24-1
Pr. Name	Dallas Hwy 36-inch Parallel Water Main	S. Type	Bag
Sample ID	21042/B-24	Depth/Elev.	-
Location	15	Add. Info	-

ASTM G200

Standard Test Method for Measurement of Oxidation Reduction Potential (ORP) of Soil

SAMPLE PREPARATION

Roots, Stones, Gravel and other deleterious material was removed prior to testing

Measurements performed ar room temperature condition: 18.6 °C

TEST DATA

T.E.S.T. Sample ID	Client Sample ID	ORP meter Reading #1, mV	ORP meter Reading #2, mV	ORP meter Reading #3, mV	**Reported ORP value, mV**
21042	B-24	297.0	333.0	336.0	**322**

Standard ORP calibration solution (420+/-mV) used to standardize ORP meter: P.D.1/21/15, Exp.10/16

REMARKS

ORP Meter ID	375
ORP Probe ID	417