

Geotechnical Data Report
US 550 South Connection to US 160
Durango, Colorado
CDOT Region 5
CDOT Project Code - 22420

Yeh Project No.: 217-376

March 11, 2019

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1. PURPOSE AND SCOPE OF STUDY

The Colorado Department of Transportation (CDOT) has proposed to realign a segment of US 550 at its southern intersection with US 160, south of Durango. Yeh and Associates, Inc. (Yeh), as a sub-consultant to Wood, PLC of Denver, Colorado, performed a geotechnical investigation to identify surface and subsurface conditions along the proposed alignment. The purpose of the investigation was to obtain information to be included in this Geotechnical Data Report (GDR), for use in the Design-Build process to construct the proposed roadway alignment.

Planning for the geotechnical investigation was based on the preliminary (Post-FIR) plans provided by CDOT under CDOT Project Code 19378. The subsurface investigation explored conditions at structures shown on the preliminary plans. The Reference Design prepared under CDOT Project Code 22420 changed or eliminated some structures and includes new designations for the proposed retaining walls. This report provides geotechnical data for the preliminary design, presented to address the changes resulting from the Reference Design. Exploratory boring labels throughout the report are consistent with the preliminary plans.

Seventy-four (74) borings and three (3) test pits were drilled/excavated for this investigation within the proposed alignment and at the proposed structure locations. The subsurface exploration was performed between November 2017 and May 2018 within existing CDOT Right-of-Way and on private properties in the proposed project area. Samples of soils and bedrock were recovered from the borings and test pits and returned to the Yeh and Associates Durango and Grand Junction laboratories for testing to classify and evaluate engineering properties of the materials. Selected samples were sent to outside laboratories for specialized testing. A geologic reconnaissance was performed to identify bedrock outcrops, potential landslides and other surface features that could affect the proposed construction.

This report presents the results of the subsurface investigation, including a description of the subsurface conditions encountered and results of the laboratory testing. Logs of the exploratory borings and test pits, site plans showing the locations of subsurface exploration, a geologic map of the area, laboratory test results, photos of recovered core samples and photos of the drilling operations are provided in the appendices. The project site location is shown in Figure 1.

Subsequent to Yeh's completion of the field investigation and laboratory work, CDOT determined that the Design-Build project limits would be extended southward approximately 2.7 miles to connect with the segment of US 550 previously widened near the intersection with La



Plata County Road (CR) 302. A preliminary geotechnical investigation was performed by Yeh in 2008 that included widely spaced borings along this segment. The field and laboratory data for the southern segment has been compiled in a Summary Geotechnical Report that is included in Appendix I of this GDR.

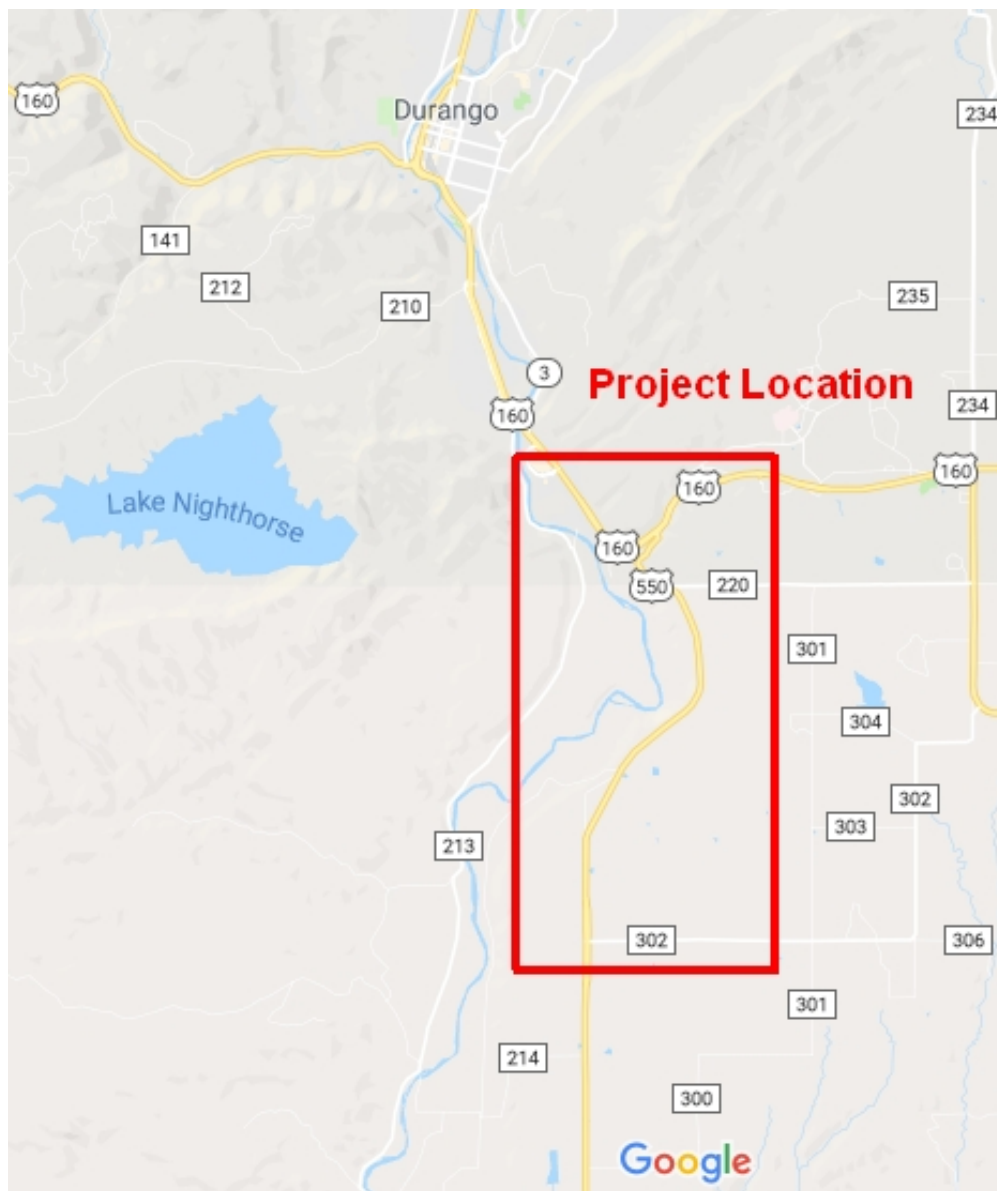


Figure 1 - Project Location Map (Google)

2. PROPOSED CONSTRUCTION

Based on preliminary plans provided by CDOT (Post-FIR dated Dec. 5, 2016, revised January 18, 2019 for the Reference Design), we understand the project will consist of approximately

4.56 miles (24,870 feet) of highway reconstruction and realignment beginning at approximate US 550 Mile Post 12.30 (Station 800+00) at the south and proceeding north to join with an existing bridge (Structure No. P-05-AG) spanning US 160 at approximate Mile Post 16.86 (Station 1040+87). The current two-lane configuration of US 550 will be upgraded to include four lanes with intermittent auxiliary lanes and sections of frontage road for residential and commercial access. Proposed grading consists of relatively shallow cuts and fills of 15 feet or less at the southern end, where the new alignment ties to the existing highway embankment on Florida Mesa, and deep cuts of nearly 150 feet near the north end where the alignment will join the existing bridge in the Wilson Gulch drainage. The proposed realignment of US 550 will transition from a maximum elevation of approximately 6,720 feet on top of the mesa to approximately 6,690 feet at the existing bridge structure P-05-AG.

The realignment of US 550 will incorporate two new bridges: Structure No. P-05-AZ (Bridge 1) and Structure No. P-05-BA (Bridge 2), which cross two unnamed ephemeral drainages that are shown on the plans as Gulches A and B, respectively. Other proposed structures include one wildlife/livestock overpass (Structure No. P-05-BB) and two wildlife underpasses, one of which is located within the Design-Build project extension to the south. As originally conceived, the project would include four cut retaining walls and three fill retaining walls. During preparation of the Reference Design and subsequent to the field investigation and laboratory analysis, two of the cut walls were eliminated. This report provides discussions of all of the walls originally proposed for the preliminary design. Wall locations and designations for the preliminary and Reference designs are summarized in Table 1.

Table 2-1 - Retaining Wall Summary

Wall Designation		Approximate Station			Wall Type
Post-FIR	Reference Design	Begin	End	Lt. or Rt.	Cut or Fill
A	n/a	1018+85	1023+32	Lt.	Cut
B	D (Shortened)	1019+45	1029+42	Rt.	Cut
C	n/a	1025+14	1029+46	Lt.	Cut
D	E	1039+57	1040+74	Lt.	Fill
E	B	984+50	987+00	Lt.	Fill
F	A	980+00	982+00	Lt.	Fill
G	C	1007+82	1011+25	Rt.	Cut

3. GEOLOGIC SETTING

The project is located in La Plata County, Colorado, along the northwestern margin of the San Juan Basin, a regional geologic structure which extends southward into New Mexico. Along the basin margin, sedimentary bedrock strata strike NE-SW, with a southeast dip due to uplifts associated with the San Juan and La Plata Domes to the north and northwest. The angle of dip flattens southward from Durango, and in the project vicinity dips are mild. Project limits lie within the Loma Linda USGS 7.5-minute quadrangle, at the northwestern corner of Florida Mesa, approximately four miles south of downtown Durango. Surficial deposits above the bedrock consist of terrace alluvium overlain by clayey sand and sandy or silty clay soils, much of which was originally derived from windblown sources.

There is currently no published 7.5 minute geologic map that includes the project site. Yeh has prepared a site specific geologic map depicting the general project area that is provided in Appendix A. Surface and subsurface geology is described in greater detail below.

3.1 Surficial Soils

West of the project, the Colorado Geological Survey (CGS) has mapped surficial soils of the type found in the project area as eolian “Loess,” (Qlo) with an estimated age of late and late middle Pleistocene. The Loess is described as, “Reddish-brown to light-brown sandy silt and silty, very fine sand deposited by wind. Deposits may be slightly clayey.” (CGS, Basin Mountain Quadrangle, 2003). Our investigation revealed that this map unit, Qlo, can also contain zones of gravel which has been washed down from higher terrace levels and comingled with the Loess. Results of the subsurface investigation indicate that the thickness of this surficial soil layer varies with the surface topography, increasing as the ground level rises. The contact with the underlying terrace alluvium tends to be locally a relatively smooth, planar surface.

The channel bottoms of Gulches A and B are covered with unconsolidated alluvium and colluvium (Qac), consisting of clay, silt, sand, gravel, cobbles and boulders that have been eroded from higher ground and deposited into the drainage channels below. There are also thin colluvial soils that mantle the steeper slopes of the gulches and mesa edges. The deposits of thin colluvial soils are laterally discontinuous and were not individually mapped along the steeper slopes. This report uses the term, “hillside colluvium” in reference to this material. The hillside colluvial materials were transported by erosion and gravity and are expected to be less stable over the long term than undisturbed materials. The landslides identified within the project limits and shown on the geologic map in Appendix A appear to be composed of the hillside



colluvial deposits that have slid on the underlying bedrock. Ground movements (landslides) may occur at other locations where the hillside colluvial materials are present on steep slopes with relatively shallow bedrock.

The Natural Resources Conservation Service (NRCS) has designated the soil deposit on top of Florida Mesa the “Falfa clay loam”. Areas of this soil type have historically been tapped for agricultural use and tend to be irrigated. Soils on the slopes are described by the NRCS as fine soil mixed with varying amounts of sand, gravel, cobble, and occasional boulders transported by erosion from upper regions of the mesa onto the slopes. Within the project area, these surfaces tend to be vegetated with native pinyon-juniper growth.

3.2 Terrace Alluvium

Underlying the Loess are terrace alluvium deposits, labeled collectively as Qt on the geologic map in Appendix A. The published geologic map for the 7.5-minute quadrangle directly north of the project describes these deposits, Qt₁ through Qt₄, as:

“Chiefly stream alluvium that underlies several terraces... above the Animas River... The unit is poorly sorted, clast-supported, locally bouldery, pebble, and cobble gravel in a sandy matrix...Clasts are mainly subround to round and are composed of varied lithologies that reflect the diverse rock types in drainage basins.” (CGS, Durango East Quadrangle, 1999.)

At a nearby gravel mining operation, the terrace alluvium deposit has been found to include cemented zones which are not easily excavated. Large boulders, approaching 10 cubic yards in size, have also been reported. At some locations, the upper few feet of the alluvium has been infiltrated by fine particles from the overlying Loess deposit.

Within the project limits, there appear to be at least three separate terrace surfaces. At the northern end of the project is a terrace at an elevation of approximately 6820 feet. Between Gulches A and B, the top of the terrace alluvium rises from to 6759 to 6765 feet in elevation. The upper surface of the terrace alluvium south of Gulch A is at an elevation of approximately 6710 feet, and results of our subsurface investigation indicate that the upper surface of this terrace may be generally planar southward toward the intersection with County Road 220.

3.3 Bedrock

The bedrock unit within the project area is mapped as the Tertiary Upper member of the Animas Formation, Ta. Outcrops of the formation are visible on the north- and west-facing cliffs at the edges of Florida Mesa. The Basin Mountain geologic map provides the following description:

“Olive-brown, light-brown, gray-green, and light-reddish-brown shale, sandstone, conglomerate, and minor lithic tuff, tuffaceous sandstone and thin coal and carbonaceous shale... Conglomerate clasts are chiefly of volcanic origin. Siliceous clasts are more abundant in upper part of member.” (CGS, Basin Mountain Quadrangle, 2003.)

The contact with the overlying terrace alluvium is irregular, with significant bedrock surface undulations encountered over relatively short distances.

4. SUBSURFACE INVESTIGATION

Subsurface exploration was performed by drilling at intervals along the alignment (Roadway Borings); where deep excavation is proposed (Excavation Borings); and at proposed structure locations (Structure Borings and Wall Borings). A representative from Yeh obtained necessary access permits, staked the boring locations, arranged underground utility locates at each location, and was on-site to observe drilling operations and log the subsurface conditions encountered in each boring. The locations, total depths drilled, proposed grading and depths to significant subsurface strata are summarized for each boring in Tables 4-1 through 4-10 below. The locations of the borings are shown on the Boring Location Plan and Profile sheets in Appendix B. The subsurface investigation program included of a total of 74 borings. Logs of the borings are provided in Appendix B, Appendix C - Structure Engineering Geology Sheets; and in Appendix D - Legend and Boring Logs. Photographs of drilling operations are provided in Appendix G - Site and Drilling Operations Photos.

Samples of the soils and bedrock encountered were collected from each boring. At selected intervals, a modified California sampler with a 2-inch interior diameter (ID) and 2.5 inch outside diameter (OD), or a standard split spoon sampler with a 1½-inch ID and 2 inch OD were used to record blow counts and obtain samples. The sampler was seated at the bottom of the test hole, then advanced by a 140 pound slide hammer falling a distance of 30 inches. The number of blows required to drive the sampler two 6-inch intervals, or fraction thereof, constitutes the N-value. The N-value, when properly evaluated, is an index of the consistency or relative density

of the material tested. Representative bulk samples of the soils were collected from selected borings. The collected samples were transported to our laboratory where they were examined by the project engineer and a program of laboratory testing was prepared.

The steep terrain, heavy vegetation and avoidance requirements for sensitive archeological sites made access to many proposed boring locations difficult. Borings drilled outside the existing Right-of-Way were advanced with All-Terrain, Track-Mounted, and Portable drilling rigs that were set in place by helicopter. Drilling services were provided by two vendors contracted with Yeh and Associates.

Authentic Drilling, Inc. of Colorado Springs, Colorado utilized three drill rigs for the US 550/160 Connection subsurface investigation. An Acker Renegade track mounted drill rig was used for Roadway Boring R-12; Walls A, B, C, E and F; Animal Overpass “A”; and some of the excavation borings. A CME 750X All-Terrain Buggy rig was used for Roadway borings R-01 through R-11, Wildlife Crossing WX (Station 958+00), and some of the Excavation borings. Additional borings at the south abutment of Bridge 1 and Wildlife Crossing WX2 (Sta.902+50) were drilled with a CME 55/300 track mounted drill rig. Each of Authentic’s drill rigs were capable of advancing continuous flight auger, air rotary auger, down-hole hammer (ODEX) drilling, and wire line coring. Each rig was equipped with a calibrated automatic hammer, used to advance driven samplers. The hammer has a weight of 140 pounds, a 30 inch stroke, and operates between 50 and 55 blows per minute

Salisbury and Associates is a drilling company based out of Spokane, Washington, specializing in difficult access drilling. Salisbury utilized two different types of portable drill rigs to drill the geotechnical borings for Bridge 1, Bridge 2, Roadway Boring R-13 and the Wall D boring. All of their drill rigs arrived on site as separate components to be transported by helicopter to locations in steep terrain, then re-assembled for drilling. Each rig was moved between drill locations by Mountain Air Helicopters of Albuquerque, New Mexico. The drill rigs Salisbury used on the US 550/160 Connection project were referred to as a Viper rig and a Burley rig. The Viper is the smaller rig used in steep terrain, and in areas where bedrock was anticipated to be encountered at shallower depths. The auger head rotation is powered by a hydraulic motor and drill casing is advanced manually with a gear reduced crank. The Burley is the larger of the two, and is powered with a 4 cylinder diesel motor. This rig was used at the abutment locations and for Roadway boring R-13. The drilling capabilities of both rigs is coring only. The core barrel is advanced through the overlying soil and gravel and into the bedrock. Salisbury’s rigs are not equipped with an automatic hammer to advance the samplers. On these rigs, the 140-pound



hammer is hoisted manually with a cat-head winch and rope approximately 30 inches and is then allowed to free fall and strike the head of sample rod.

Hollow stem auger was suitable for drilling through the surficial soils. Bulk samples were obtained for laboratory analysis from various depths.

Downhole hammer (ODEX), air-rotary drilling and wire-line coring was needed to penetrate the cobbles, boulders and gravel of the terrace alluvium. Where bedrock was encountered, air-rotary and wire-line coring methods were used to penetrate the interlayered claystone/shale and sandstone of the Animas Formation. Portable drilling rigs placed by helicopter used wire-line coring to drill at bridge foundations locations on steep slopes. Samples were obtained from the auger, ODEX and air-rotary borings at selected intervals.

Continuous core samples were obtained in the bedrock and partial samples of terrace alluvium were obtained from coring operations by the portable rigs. Photographs of the cores collected are provided in Appendix F, Core Photos.

A backhoe was used to excavate test pits into the terrace alluvium at the north end of the project. The purpose of the pits was to obtain bulk samples more representative of the deposit than what can be recovered from relatively small diameter borings.

4.1 Roadway Borings

Thirteen (13) roadway borings were drilled between November 2017 and March 2018 to evaluate subsurface conditions for the proposed pavement subgrade. Borings R-01 through R-06 were drilled within the travel lanes or shoulders of existing US 550. Traffic control, as required by the CDOT access permits, was provided by Alert Traffic Control as a subcontractor to Yeh. Borings R-07 through R-12 were located along the proposed new alignment on the Webb Ranch property where excavation (cut) is proposed to construct the roadway grade. These borings were located south of Bridge 1. Borings R-10 and R-11 were drilled in the far right of the proposed alignment in anticipation of a possible retaining wall at this location. Wall G is proposed for this site and is described later in this report. Boring R-13 was drilled within the area of deep cut proposed north of Bridge 2. The locations, drilled depths, and a summary of the subsurface conditions encountered in the Roadway Borings are provided in Table 4-1.

Table 4-1 - Summary of Roadway Borings

Boring	Station	Offset	Depth of Boring (ft)	Elev. Top of Boring (ft)	Approx. Proposed Fill(F) / Cut(C) (ft)	Depth to Alluvium (ft)	Elev. Top of Alluvium (ft)	Depth to Bedrock (ft)	Elev. Top of Bedrock (ft)
R-01	954+11	69' LT	20.5	6718.8	3 F	n/a	n/a	n/a	n/a
R-02	964+42	88' LT	20.5	6713.4	3 C	n/a	n/a	n/a	n/a
R-03	969+58	85' LT	20.5	6719.1	8 C	n/a	n/a	n/a	n/a
R-04	974+57	30' LT	20.0	6728.5	15 C	n/a	n/a	n/a	n/a
R-05	979+51	103' RT	20.5	6728.3	8 C	n/a	n/a	n/a	n/a
R-06	984+16	55' RT	20.5	6727.5	8 C	n/a	n/a	n/a	n/a
R-07	991+05	48' RT	14.5	6723.9	3 C	13.0	6710.9	n/a	n/a
R-08	995+13	11' LT	21.5	6733.1	11 C	21.0	6712.1	n/a	n/a
R-09	1002+94	27' LT	23.5	6732.0	20 C	22.0	6710.0	n/a	n/a
R-10	1008+72	129' RT	35.0	6732.0	8 C	20.0	6712.0	n/a	n/a
R-11	1009+60	127' RT	35.0	6734.1	5 C	20.0	6714.1	n/a	n/a
R-12	1009+68	19' LT	30.5	6718.0	10 C	5.0	6713.0	n/a	n/a
R-13	1034+32	35' RT	112.6	6824.7	103 C	0	6824.7	61.5	6763.2

4.2 Excavation Borings

Ten (10) borings were drilled to identify subsurface conditions in the area of the deep cut proposed near the north end of the project between Stations 1035+00 and 1039+50, right of centerline. The boring locations were selected to avoid archeologically sensitive zones. Borings E-04 and E-08 were drilled in the existing cut for the CDOT-Knaggs property driveway where bedrock was exposed at the ground surface. The conditions encountered in the Excavation Borings are summarized in Table 4-2.

Table 4-2 - Summary of Excavation Borings

Boring	Station	Offset	Depth of Boring (ft)	Elev. Top of Boring (ft)	Approx. Proposed Cut (ft)	Depth to Alluvium (ft)	Elev. Top of Alluvium (ft)	Depth to Bedrock (ft)	Elev. Top of Bedrock (ft)
E-01	1035+18	195' RT	119.5	6830.7	100	7.0	6823.7	70.0	6760.7
E-02	1036+88	198' RT	148.0	6828.2	90	7.0	6821.2	55.0	6773.2
E-03	1038+62	200' RT	91.0	6837.2	120	12.0	6825.2	45.0	6792.2
E-04	1039+11	172' RT	69.9	6769.5	60	n/a	n/a	0.0	6769.5
E-05	1036+94	257' RT	69.3	6837.6	90	15.0	6822.6	62.0	6775.6
E-06	1037+92	334' RT	103.0	6842.1	70	20.0	6822.1	55.0	6787.1

E-07	1038+90	403' RT	100.0	6840.9	60	18.0	6822.9	38.0	6802.9
E-08	1039+49	307' RT	69.8	6754.2	65	n/a	n/a	0.0	6754.2
E-09	1039+09	485' RT	80.0	6848.8	35	26.0	6822.8	48.0	6800.8
E-10	1039+45	580' RT	76.5	6857.3	8	35.0	6822.3	46.5	6810.8

4.3 Structure P-05-AZ (Bridge 1) Borings

The preliminary layout for Bridge 1 shows a structure approximately 520 feet long, with north and south abutments and three piers. Borings were drilled at each abutment and each pier. The south abutment borings are located in a proposed roadway cut and the north abutment borings are located on the canyon side slope. The material encountered at the ground surface in Borings B1-03 through B1-12 consists of unconsolidated hillside colluvium. Bridge 1 borings are summarized in Table 4-3.

Table 4-3 - Summary of Bridge 1 Borings

Boring	Station	Offset	Depth of Boring (ft)	Elev. Top of Boring (ft)	Approx. Proposed Cut (ft)	Depth to Alluvium (ft)	Elev. Top of Alluvium (ft)	Depth to Bedrock (ft)	Elev. Top of Bedrock (ft)
B1-01B	1013+18	36' LT	79.1	6733.3	20	16.5	6716.8	66.5	6666.8
B1-02A	1013+38	31' RT	89.2	6741.0	30	27.0	6714.0	79.0	6662.0
B1-01A	1013+80	17' RT	122.0	6731.3	17	18.0	6713.3	100.4	6630.9
B1-01	1013+94	24' LT	106.0	6721.0	9	9.0	6712.0	89.0	6632.0
B1-02	1014+08	29' RT	101.0	6721.8	7	0	6721.8	88.0	6633.8
B1-03	1014+68	24' RT	48.5	6692.0	n/a	15.0	6677.0	35.0	6657.0
B1-04	1015+09	1' RT	55.0	6659.9	n/a	n/a	n/a	1.5	6658.4
B1-05	1015+39	20' LT	45.0	6639.0	n/a	n/a	n/a	9.0	6630.0
B1-06	1015+60	24' RT	32.7	6649.0	n/a	n/a	n/a	10.3	6638.7
B1-07	1015+72	41' LT	40.0	6620.4	n/a	n/a	n/a	21.0	6599.4
B1-08	1016+11	0'	70.0	6621.4	n/a	n/a	n/a	7.0	6614.4
B1-09	1016+55	0'	70.0	6613.1	n/a	n/a	n/a	5.0	6608.1
B1-10	1017+80	1' LT	70.0	6659.8	n/a	n/a	n/a	6.7	6653.1
B1-11	1019+17	21' LT	70.2	6725.2	n/a	0	6725.2	15.2	6710.0
B1-12	1019+20	25' RT	70.4	6723.2	n/a	0	6723.2	13.0	6710.2

4.4 Structure P-05-BA (Bridge 2) Borings

The Post-FIR plans show Bridge 2 as a two-span structure with an overall length of approximately 240 feet. The abutments are located on the canyon side slopes and the single



pier is located in the bottom of the drainage. Borings B2-01, B2-03 and B2-04 were drilled at the south abutment, pier and north abutment, respectively. Boring B2-02 was drilled on the canyon side slope below the south abutment to investigate subsurface conditions at a suspected landslide. The gravel soils encountered in these borings consist of hillside colluvium deposits. Table 4-4 presents a summary of the Bridge 2 borings.

Table 4-4 - Summary of Bridge 2 Borings

Boring	Station	Offset	Depth of Boring (ft)	Elev. Top of Boring (ft)	Approx. Cut (ft)	Depth to Alluvium (ft)	Elev. Top of Alluvium (ft)	Depth to Bedrock (ft)	Elev. Top of Bedrock (ft)
B2-01	1029+55	3' RT	58.8	6722.0	n/a	n/a	n/a	5.0	6717.0
B2-02	1030+32	0'	70.2	6682.0	n/a	n/a	n/a	7.8	6674.2
B2-03	1030+88	3' LT	69.0	6664.1	n/a	n/a	n/a	4.0	6660.1
B2-04	1032+19	2' RT	69.9	6714.2	n/a	n/a	n/a	7.2	6707.0

4.5 Structure P-05-BB (Wildlife/Livestock Overpass) Borings

This structure has been proposed as an overpass of US 550 where roadway profile plans show a cut of approximately 30 feet deep. The plans show two abutments and a single pier near the US 550 centerline. Borings for Structure P-05-BB are summarized below in Table 4-5.

Table 4-5 - Summary of Wildlife/Livestock Overpass (A) Borings

Boring	Station	Offset	Depth of Boring (ft)	Elev. Top of Boring (ft)	Depth to Alluvium (ft)	Elev. Top of Alluvium (ft)	Depth to Bedrock (ft)	Elev. Top of Bedrock (ft)
A-01	999+53	81' LT	70.0	6745.8	32.5	6713.3	67.0	6678.8
A-02	999+74	11' RT	70.5	6742.6	32.0	6710.6	70.3	6672.3
A-03	1000+59	88' RT	69.5	6743.8	37.0	6706.8	n/a	n/a

4.6 Structures P-05-AS and P-05-AT (Wildlife Underpass A) Borings

This crossing is proposed beneath US 550 at approximate Station 902+00. The proposed structure is assumed to be a CBC or similar construction. The borings are summarized below in Table 4-7. The borings were drilled for the portion of the structure in the southbound lane where access was in CDOT right-of way. Access to the proposed northbound lanes was not available.

Table 4-6 - Summary of Wildlife Underpass A (WX2) Borings

Boring	Station	Offset	Depth of Boring (ft)	Elev. Top of Boring (ft)	Depth to Alluvium (ft)	Elev. Top of Alluvium (ft)	Depth to Bedrock (ft)	Elev. Top of Bedrock (ft)
WX2-01	902+22	60' LT	34.5	6676.9	23.0	6653.9	n/a	n/a
WX2-02	902+78	61' LT	38.8	6676.9	23.5	6653.4	35.0	6641.9
WX2-03	902+27	14' LT	29.5	6670.7	19.0	6651.7	n/a	n/a
WX2-04	902+75	14' LT	29.5	6670.1	18.0	6652.1	27.0	6643.1

4.7 Structures P-05-AU and P-05-AV (Wildlife Underpass B) Borings

This series of structures has been proposed to cross beneath US 550 and the Frontage Road near the southern end of the project, at approximate Station 958+00. The structures are shown on the Post-FIR plans as a series of three Concrete Box Culverts (CBCs). The borings are summarized in Table 4-6, below.

Table 4-7 - Summary of Wildlife Underpass B (WX) Borings

Boring	Station	Offset	Depth of Boring (ft)	Elev. Top of Boring (ft)	Depth to Alluvium (ft)	Elev. Top of Alluvium (ft)	Depth to Bedrock (ft)	Elev. Top of Bedrock (ft)
WX-01	957+95	71' RT	31.8	6714.6	30	6684.6	n/a	n/a
WX-02	958+30	4' RT	45.5	6711.9	28	6683.9	n/a	n/a
WX-03	958+37	69' LT	35.0	6712.7	28	6684.7	n/a	n/a
WX-04	958+65	153' LT	34.3	6705.8	22	6683.8	n/a	n/a

4.8 Walls A, B and C Borings

The Post-FIR plans show three walls retaining the proposed deep cut between Gulch A and Gulch B. Walls A and C are located left of centerline and Wall B is located on the right. The walls are intended to retain gravel and claystone/sandstone/shale bedrock materials. Maximum wall heights shown on the Post-FIR plans range from 40 to 67.5 feet. Boring WB-10 did not encounter alluvial gravel but was drilled through slightly gravelly, sandy clay hillside colluvium to encounter bedrock at 4.5 feet. A summary of the borings for Walls A, B and C is presented below in Table 4-8. The Engineering Geology sheet for Wall B (Wall D in the Reference Design) is included in Appendix C.

Table 4-8 - Summary of Walls A, B and C Borings

Boring	Station	Offset	Depth of Boring (ft)	Elev. Top of Boring (ft)	Approx. Cut (ft)	Depth to Alluvium (ft)	Elev. Top of Alluvium (ft)	Depth to Bedrock (ft)	Elev. Top of Bedrock (ft)
WA-01	1019+74	92' LT	64.0	6761.5	42	2.0	6759.5	49.7	6711.8
WA-02	1020+97	86' LT	67.0	6766.5	47	6.0	6760.5	52.0	6714.5
WA-03	1022+07	84' LT	69.6	6765.7	45	3.0	6762.7	52.0	6713.7
WB-01	1020+41	67' RT	69.8	6762.7	43	3.5	6759.2	54.0	6708.7
WB-02	1021+09	96' RT	71.0	6765.0	45	6.5	6758.5	51.5	6713.5
WB-03	1021+81	71' RT	70.0	6771.1	50	11.0	6760.1	54.0	6717.1
WB-04	1023+08	100' RT	70.0	6775.7	56	16.0	6759.7	56.5	6719.2
WB-05	1024+06	82' RT	69.9	6782.0	61	21.0	6761.0	55.0	6727.0
WB-06	1025+09	108' RT	69.0	6787.0	63	24.5	6762.5	56.0	6731.0
WB-07	1026+08	90' RT	69.2	6780.7	58	17.5	6763.2	44.0	6736.7
WB-08	1026+99	93' RT	69.8	6789.2	69	25.0	6764.2	52.0	6737.2
WB-09	1027+88	65' RT	68.2	6790.0	69	25.5	6764.5	49.8	6740.2
WB-10	1029+10	72' RT	50.0	6741.8	23	n/a	n/a	4.5	6737.3
WC-01	1026+24	84' LT	61.8	6766.0	50	1.0	6765.0	33.0	6733.0
WC-02	1027+61	84' LT	53.5	6767.2	49	1.0	6766.2	30.3	6736.9
WC-03	1028+50	74' LT	67.6	6768.6	44	1.5	6767.1	29.0	6739.6

4.9 Walls D, E and F Borings

Wall D has been proposed to retain fill on US 550 near the roundabout at the northern limit of the project. Walls E and F are proposed for retaining the Frontage Road embankment where it abuts two private parcels west of the County Road 220 intersection. Proposed fill wall heights will range from 15 to 20 feet. The Wall D, E and F borings are summarized in Table 4-9.

Engineering Geology sheets for Walls D, E and F (Reference Design Walls E, B and A, respectively) are included in Appendix C.

Table 4-9 - Summary of Walls D, E and F Borings

Boring	Station	Offset	Depth of Boring (ft)	Elev. Top of Boring (ft)	Depth to Alluvium (ft)	Elev. Top of Alluvium (ft)	Depth to Bedrock (ft)	Elev. Top of Bedrock (ft)
WD-01	1039+79	94' LT	39.9	6688.1	n/a	n/a	2.5	6685.6
WE-01	985+25	125' LT	29.5	6707.6	14.5	6693.1	n/a	n/a
WE-02	985+72	125' LT	30.5	6706.2	16.0	6690.2	n/a	n/a
WF-01	979+74	214' LT	33.2	6714.5	24.0	6690.5	n/a	n/a



WF-02	981+74	195' LT	29.3	6706.9	16.0	6690.9	n/a	n/a
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4.10 Wall G Borings

Wall G has been proposed to retain a cut slope on US 550 near an existing well pad on the Webb property. The proposed height of the wall is approximately 15 feet, and it is located 75.5 feet right of US 550 centerline. Three Roadway borings were drilled in the vicinity of Wall G and are summarized in Table 10. The Engineering Geology sheet for Wall G (Reference Design Wall C) is included in Appendix C.

Table 4-10 – Summary of Wall G Borings

Boring	Station	Offset	Depth of Boring (ft)	Elev. Top of Boring (ft)	Depth to Alluvium (ft)	Elev. Top of Alluvium (ft)	Depth to Bedrock (ft)	Elev. Top of Bedrock (ft)
R-10	1008+72	129' RT	35.0	6732.0	20.0	6712.0	n/a	n/a
R-11	1009+60	127' RT	35.0	6734.1	20.0	6714.1	n/a	n/a
R-12	1009+68	19' LT	30.5	6718.0	5.0	6713.0	n/a	n/a

5. LABORATORY TESTING

Samples recovered during the subsurface investigation were transported to Yeh's laboratory in Durango, Colorado. The samples and field logs of the borings and pits were reviewed by the Project Engineer and a program of laboratory testing was assigned. Some samples were forwarded to the Yeh and Associates laboratories in Grand Junction and Denver for testing. Specialized testing for soil corrosivity was performed by Green Analytical Laboratories of Durango, Colorado. Unconfined Compressive Strength tests on bedrock and Point Load tests on cobbles were performed by Advanced Terra Testing of Lakewood, Colorado and Trautner Geotech of Durango, Colorado. R-value tests on samples of the proposed subgrade materials were performed by the CDOT Central Laboratory.

The laboratory tests included sieve analysis, Atterberg limits, natural moisture content, dry density, swell / consolidation, unconfined compressive strength, point load strength and Resistance "R"-value. In addition, selected samples were subjected to chemical analyses to evaluate soil corrosivity: pH, water-soluble sulfate, water-soluble chloride and resistivity. The laboratory test results are included in Appendix E and are shown on the boring logs in Appendix D.

Results from the Atterberg limits determination and sieve analysis were used to classify the soils according to AASHTO and the Unified Soil Classification System (USCS) standards. Atterberg limits were performed in accordance with AASHTO T89 and T90, and sieve analyses were performed in accordance with ASTM D421. Soil classifications are shown on the boring logs in Appendix D and on the summaries in Appendix E.

The moisture content and density of a soil can be useful for characterizing soil consistency, compressibility, and strength. Dry density tests and moisture content tests were performed in accordance with ASTM D2937 and ASTM D2216, respectively.

Twenty (20) swell/consolidation tests were performed to determine the swell or collapse potential of selected samples of the subsurface materials in accordance with ASTM D4546 Procedure B. The swell was measured by applying a surcharge of either 200 pounds per square foot (psf), 500 psf or 1,000 psf to the samples and adding water. Table C-3 in Appendix E presents a summary of the swell/consolidation test results. The test results are also shown on the applicable boring logs in Appendix D, and graphical results of the swell/consolidation tests are presented in Appendix E.

Unconfined compressive strength tests were conducted on 21 rock core samples by Advanced Terra Testing (ATT) of Denver, Colorado. Trautner Geotech of Durango tested the unconfined compressive strength of three (3) core samples. The tests were performed in conformance with ASTM D7012, Method C. ATT also conducted point-load strength testing on ten cobbles collected from the terrace alluvium test pits. Unconfined compressive strength and Point Load test results are provided in Appendix E.

Resistance “R”-value tests were performed by the CDOT Central Laboratory on bulk samples representative of the surficial soils. Appendix E presents the R-value test results as well as their corresponding AASHTO soil classifications. The test results were provided by CDOT.

Water-soluble chloride measurements were performed by Green Analytical Laboratories, Inc. on 28 samples obtained from the borings. The test results are summarized in Appendix E and presented on applicable boring logs in Appendix D.

6. SUBSURFACE CONDITIONS

Subsurface conditions along the proposed alignment generally consist of 0 to 37 feet of surficial soil – eolian Loess (Qlo) or hillside colluvium (unmapped) overlying cobble-rich terrace alluvium



(Qt). Where borings penetrated the full depth of the alluvium, the deposit was found to range in thickness from 5 to 88 feet. Beneath the alluvium lies the claystone and interbedded shale, sandstone and conglomerate of the Upper member of the Animas Formation (Ta). Upper portions of the bedrock tended to be moderately to severely weathered, while at depth the rock was hard to very hard and unweathered. No groundwater was reported on the logs for any of the borings. Because water was used as a drilling fluid, reliable measurements of groundwater levels could not be obtained.

The US 550 project is divided into segments for the sake of discussion of the subsurface conditions. The segment limits roughly correlate to the proposed depth of excavation or structure type and location. Subsurface conditions within each roadway segment are discussed first below, followed by structures. Logs of the exploratory borings are presented in Appendix D. Engineering Geology plan sheets for each major structure are provided in Appendix C. A discussion of the subsurface conditions between station 800+00 and 940+00 is provided in the Summary Report in Appendix I.

6.1 Sta. 940+00 to Sta. 991+00 – Beginning of Connection Alignment to Webb Ranch Boundary

The soils beneath the existing US 550 consist of the Quaternary Loess / Falfa clay loam deposit or clayey gravel fill throughout this section. Borings R-01 through R-05 were drilled through the existing asphalt pavement and base course, while Boring R-06 was located adjacent to the pavement, on the gravel shoulder. Each boring was drilled to a depth of 20.5 feet below the surface, and none encountered the underlying terrace alluvium layer. Penetration Resistance N values in the surficial soils ranged from 8 to 33 blows per foot (bpf), with an average of 19 bpf.

Seven samples of surficial soil were tested for purposes of classification. Gradation test results show the soils have 72 to 87 percent fines (passing the No. 200 standard sieve) with the remaining percentage as sand. Atterberg Limits testing showed Liquid Limits (LL) between 31 and 46 percent and a Plasticity Index (PI) of 15 to 27 percent. Under the AASHTO system, six samples were classified as A-6, with group indices ranging from (9) to (17). One sample from Boring R-04 was classified as A-7-6 (20). All seven samples fell within the Unified Soil Classification System (USCS) classification CL, Lean Clay.

Four soil specimens were collected using a modified California sampler. These were found to have natural moisture contents between 11.9 and 18.1 percent and natural dry densities ranging

from 107.5 to 117.9 pounds per cubic foot (pcf). Swell/consolidation results for these four samples ranged from +0.4 percent (swell) to +3.9 percent (swell).

Chemical properties were evaluated for five soil samples to provide data useful in evaluating soil corrosivity. The pH was slightly alkaline, ranging from 7.6 to 8.8. Water-soluble sulfate was measured for each of the five samples and ranged from 0.002 to 0.020 percent. Water-soluble chloride was detected, with concentrations ranging from 0.00164 to 0.10600 percent, while resistivity values ranged between 340 and 3000 Ohm-cm. The bulk sample from Boring R-06, at 4 to 9 feet depth, had the lowest pH and resistivity and highest sulfate and chloride readings of the four samples tested.

Bulk samples for Hveem Resistance R-value testing were obtained at approximate subgrade depth from Borings R-01 and R-05. The samples were delivered to CDOT for testing and the results are presented in Appendix E. The reported R-value for the surficial soils from Boring R-01 is 10 and from Boring R-05 is 22.

6.2 Sta. 991+00 to Sta. 1014+23 –Webb Ranch Boundary to Gulch A

The proposed US 550/160 Connection alignment diverges from existing CDOT Right-of Way in this section, entering a segment where proposed grading consists of continuous cut as it crosses the Webb Ranch boundary to approach the south side of Gulch A. The mesa surface is capped with the surficial soil throughout this portion of the project. Borings R-07 through R-12 were drilled within this section, to depths ranging from 14.5 to 35 feet. The terrace alluvium deposit was encountered beneath the overlying loess in each of these borings. The depth to alluvial materials ranged from 22 feet at Boring R-09 to just 5 feet at Boring R-12.

Subsurface conditions encountered below the proposed depth of cut indicate that the subgrade soil along the proposed highway alignment will be the surficial sandy clay soil until approximate Station 1000+00, at which point the Reference Design profile grade descends into the terrace alluvium deposit. Bedrock was not encountered in any of the borings for this segment, and bedrock is not expected in the proposed excavation for the roadway in this section.

Penetration resistance N values in the surficial soils ranged from 14 to 40 bpf, with an average of 25 bpf. Penetration resistance in the terrace alluvium was high due to the significant component of coarse materials – gravel, cobbles, and boulders. N values greater than 70 bpf were recorded, but the majority of drive sampling using the split spoon or modified California

samplers advanced only a few inches before refusal was encountered, prohibiting further advancement of the sampler.

Six bulk samples of surficial soil were tested for purposes of classification. Gradation test results show the soils have 34 to 85 percent fines (passing the No. 200 standard sieve) with the remaining percentage as sand and trace amounts of gravel. The soil samples generally become more coarse proceeding north along the alignment, with the measured Plasticity Index also decreasing. AASHTO classifications of the sandy loess ranged from A-7-6 (18) at Boring R-07 to A-2-4 (0) at Boring R-10 and A-4 (0) at Boring R-11. A similar transition was observed in the USCS classifications, with sandy clay (CL) in the south and non-plastic silty sand (SM) to low plasticity silty, clayey sand (SM-SC) further north.

Four relatively undisturbed samples of surficial soil were recovered using a modified California sampler. These samples were found to have natural moisture contents between 8.9 and 13.6 percent and natural dry densities ranging from 93.6 to 107.0 pcf. Swell/consolidation test results for two samples ranged from -1.8 percent (consolidation) to +1.1 percent (swell).

Chemical properties were evaluated for three surficial soil and two alluvium samples. The clayey surficial soil had a slightly alkaline pH, ranging from 8.2 to 8.8. Samples of the alluvial layer had measured pH values of 8.5 and 8.6. Water-soluble sulfate was measured for each of the five samples and ranged from 0.007 to 0.027 percent for the surficial soil and 0.014 to 0.019 percent for the alluvium. Water-soluble chloride was detected in two of the surficial soil samples, with concentrations of 0.00534 and 0.00647 percent. Values of 0.00118 and 0.00576 percent were reported for the alluvium. Resistivity values ranged from 1300 to 2800 Ohm-cm for the surficial soil and 1600 to 2700 Ohm-cm in the alluvium.

Samples of soils from the proposed subgrade depth were provided to CDOT for R-value testing. R-value results are presented in Appendix E and ranged from 9 to 22.

6.3 Sta. 1032+05 to Sta. 1040+87 – Gulch B to End of Project

North of Gulch B (Bridge 2) the ground surface elevation rises and the proposed roadway grading will be a cut with a maximum depth of approximately 100 feet. Boring R-13 was drilled 35 feet right of Sta. 1034+32 to a depth of 113 feet. Borings E-01 through E-10 were located from 172 to 580 feet right of centerline between Stations 1035+18 and 1039+45. Depths of these borings ranged from 69 to 148 feet. Test Pits 1, 2 and 3 were excavated on the CDOT-

Knaggs property, at the north end of this segment, for the purpose of obtaining representative bulk samples of the terrace alluvium deposit that could not be recovered from borings.

The surficial soil layer for this segment, a combination of loess and hillside colluvium, ranges in thickness from 6.5 feet to 35 feet, except at Borings E-04 and E-08, where previous excavation for a driveway exposed the bedrock at the ground surface. The thickness of the terrace alluvium deposit ranged from 11.5 feet to 63 feet, with the thinner deposit near the top of the proposed cut. Depth to bedrock encountered in the borings (other than Borings E-04 and E-08) ranged from 38 feet to 70 feet. The contact between the surficial soil and the alluvial deposit appears to be roughly planar throughout this excavation area. The top surface of the bedrock appears to gradually rise from southwest to northeast, gaining an estimated 50 feet in elevation from Gulch B to the End of Project near Station 1039+50.

Penetration resistance N values in the surficial soils ranged from 15 to 73 bpf, with an average of 32 bpf. Penetration resistance in the terrace alluvium was generally high due to the significant component of coarse materials – gravel, cobbles, and boulders. N values of 40 to 60 bpf were recorded, but the majority of drives made using the split spoon or modified California samplers advanced only a few inches before refusal was encountered, prohibiting further advancement of the samplers.

Five bulk samples of surficial soil were tested to determine soil classification. Gradation test results show the soils have 68 to 84 percent fines (passing the No. 200 standard sieve) with the remaining percentage as sand and trace amounts of gravel. Four of the five samples had AASHTO classifications of A-7-6, with group indices ranging from (23) to (45). One sample was classified as A-6 (9). Using the USCS method, three samples were classified as CH, high-plasticity clay, and the remaining two were CL, low-plasticity or lean clay. The Liquid Limit (LL) of the tested samples ranged from 30 to 72 percent, and the Plasticity Index (PI) ranged from 17 to 50 percent. An ODEX bit was used to advance the borings through the alluvium. As a result, the recovered samples were not suitable for classification purposes because the drilling process caused loss of fines and fragmented larger particles. Sieve analyses were performed on samples of the alluvium from the test pits. The AASHTO classifications are A-1-a (0) and A-1-b (0), and USCS results are GP and GM. Samples of the Animas Formation Bedrock were pulverized to measure plasticity index. The bedrock had Liquid Limit values of 28 to 38 percent and Plasticity Index was found to range from 2 to 17 percent.

Four specimens of surficial soil were collected using a modified California sampler. These were found to have natural moisture contents between 7.9 and 20.4 percent and natural dry densities ranging from 88.3 to 112.5 pcf. Results of swell/consolidation testing on the one sample tested showed -1.7 percent (consolidation). Moisture content of the Animas Formation bedrock ranged from 3.8 to 12.7 percent and dry density of bedrock core samples ranged from 98.7 to 149.1 pcf.

Chemical properties were evaluated for one alluvium and five bedrock samples. The alluvium sample from E-06 had a pH of 8.6 and water-soluble sulfate of 0.007 percent. Water-soluble chlorides of 0.00196 percent were detected, and the resistivity was 4,000 Ohm-cm. The pH values for bedrock ranged from 8.4 to 9.4. Water-soluble sulfate was measured for four of the five bedrock samples and ranged from 0.002 to 0.015 percent. No water-soluble chloride was detected in the bedrock samples. Resistivity values ranged from 1,400 to 2,000 Ohm-cm.

Nine bedrock core samples were selected from these borings for testing of unconfined compressive strength. Measured values ranged from 1,122 to 7,021 psi.

A sample of alluvium from Test Pit 3 was tested by CDOT and found to have an R-value of 79. CDOT also tested a sample of crushed shale bedrock core from Boring E-02 and reported an R-value of 28. The test results are included in Appendix E.

6.4 Sta. 1014+23 to Sta. 1019+00 – Gulch A Bridge Structure P-05-AZ (Bridge 1)

This proposed bridge across Gulch A, will have a total length of approximately 520 feet, and will be a four span structure with 2 abutments and 3 piers. The proposed roadway profile will require cuts to depths ranging from approximately 25 to 40 feet at the abutments.

Fifteen (15) borings were drilled to investigate subsurface conditions at Bridge 1. Subsurface conditions encountered in the borings generally consist of 5 to 20 feet of clayey sand soil (loess) or clayey sand and gravel (alluvium and hillside colluvium) over dense alluvial terrace gravel or claystone/shale bedrock.

Borings B1-01 and B1-02 were drilled at the planned location of Abutment 1 and encountered bedrock at depths of 89 and 88 feet, respectively. The immediate area has been mapped as a landslide, and the bedrock surface elevation is, in general, lower in these borings than in borings made nearby. Boring B1-01A was drilled south of the abutment in an effort to identify the lateral extent of the deeper bedrock. Bedrock was encountered in Boring B1-01A at a depth of approximately 100 feet. Two additional borings were drilled approximately 80 feet south of the

proposed abutment. The depth to bedrock was 50 and 52 feet at Borings B1-1B and B1-2A, respectively. Borings B1-1B and B1-2A encountered clayey surficial soils overlying terrace alluvium that appears to be unaltered by recent erosion. These in-place alluvial materials appear to be outside the landslide extents. Irregular erosion of the bedrock near the proposed location of Abutment 1 may have resulted in a bedrock surface depression that was subsequently infilled with a mixture of clayey soils and terrace deposits that contains cobbles and boulders (hillside colluvium). The hillside colluvium materials, transported by erosion and gravity from their original alluvial deposit, may be less stable in the long term than the undisturbed alluvium.

The landslide identified on the Geologic Map near Abutment 1, and shown on the Engineering Geology sheet, appears to consist of hillside colluvium materials and possibly underlying weathered and fractured bedrock that are slowly moving down the slope. Inclinometers were installed in Borings B1-03, B1-05, B1-06 and B1-07 to measure the rate, direction and depth of slope movement. Data collection from the instrumentation began in early April 2018 and minor movement of less than 0.25 inches had been observed in some of the inclinometers as of December 21, 2018. Inclinometer data is provided in Appendix H. Positive movement shown on the “A” axis plot indicates downhill movement of the slide mass. The upper portion of the materials that form the landslide is expected to be removed during grading for the roadway. The removal may reduce the potential for landslide activation by decreasing the forces that drive movement.

Borings B1-05, B1-06, B1-09 and B1-10 were drilled at proposed pier locations for Bridge 1. These borings encountered approximately 5 to 10 feet of sandy gravel hillside colluvial deposits over highly weathered to unweathered bedrock. The bedrock consists of claystone, sandstone and interbedded claystone/sandstone/shale. Generally, the upper 20 to 30 feet of the bedrock is weathered or weak and should be considered an Intermediate Geo Material (IGM) as defined in the American Association of State Highway and Transportation Officials (AASHTO) LRFD Bridge Design Specifications (AASHTO Specifications). Below the IGM, bedrock consists of hard sandstone and shale. Unconfined compressive strengths of samples from the IGM ranged from 1,072 psi to 1,405 psi. The unconfined compressive strength of samples from the hard sandstone and shale ranged from 2,843 psi to 5,496 psi.

Subsurface conditions at the proposed location of Abutment 5 were investigated by drilling Borings B1-11 and B1-12. The conditions encountered below about 5 feet of hillside colluvium deposit (gravel in a sandy clay matrix, cobbles and boulders) consist of medium dense to dense



terrace alluvium (gravel in a silty sand matrix, cobbles and scattered boulders). Interbedded sandstone and claystone bedrock was encountered below the terrace alluvium at depths ranging from 13 to 15 feet.

6.5 Sta. 1029+68 to Sta. 1032+05 – Gulch B Bridge Structure P-05-BA (Bridge 2)

The proposed Bridge 2, across Gulch B, is a two-span structure with a total length of 264 feet. The bridge will have two abutments and a single center pier. The roadway profile shows the cut depths below existing ground at the approaches ranges from approximately 30 to 40 feet.

The subsurface conditions at Bridge 2 were investigated by drilling four (4) borings: Boring B2-01 at Abutment 1, Boring B2-03 at Pier 2, Boring B2-04 at Abutment 3 and Boring B2-02 on the slope below Abutment 1. The subsurface conditions encountered in the borings generally consisted of about 4 to 8 feet of hillside colluvium deposits of sandy clay soil or sand and gravel, overlying moderately weathered to hard claystone, sandstone and shale of the Animas Formation. The boring locations and logs are shown on the Engineering Geology plan sheet found in Appendix C.

A potential landslide was identified at the location of Abutment 1 as shown on the Geologic Map in Appendix A. The landslide consists of the hillside colluvial deposits encountered at Abutment 1 and in Boring B2-02. The proposed cut for the roadway at this location will effectively remove most of the upper portion of this landslide feature, thereby reducing forces that drive movement and improving the long term stability of this slope. Landslides are also shown on the Geologic Map west of Abutment 3. These features appear to be shallow soil slips of hillside colluvium on the bedrock surface, that can move following seasonal heavy precipitation events or snowmelt runoff.

Unconfined compressive strengths were measured on rock core samples collected at various depths from two of the four borings. Test results show strengths ranging from 2,230 to 5,400 psi.

6.6 Sta 1000+00 – Wildlife/Livestock Crossing Structure P-05-BB

The proposed bridge crosses over the planned realignment of US 550 in the vicinity of Station 1000+00. Post-FIR plans dated December 5, 2016 indicate the bridge will be 207 feet in length with two spans, having abutments at each end and a center pier. The cross-section plans show that US 550 at this location will be in a cut approximately 30 feet in depth. The top of the bridge deck at the abutments will be at or near the existing ground surface.



Subsurface conditions for this structure were investigated by drilling three (3) borings. Boring A-01 was drilled at Abutment 1, Boring A-02 was located at Pier 2, and Boring A-03 was drilled at Abutment 3. The borings encountered 32 to 37 feet of surficial soil; near the base of this layer, the material became more sandy. The surficial soil is underlain by the terrace alluvium deposit. Claystone bedrock was encountered beneath the alluvium in Boring A-01 at a depth of 67 feet and in Boring A-02 at 70 feet. Boring locations and logs are shown on the Engineering Geology sheet provided in Appendix C.

Penetration Resistance N values in the surficial soils ranged from 19 to 53 blows per foot (bpf), with an average of 35 bpf. Penetration resistance in the terrace alluvium was high, as expected, due to the significant component of gravel, cobbles, and boulders. N values greater than 33 bpf were recorded, but the majority of drive sampling using the split spoon or modified California samplers advanced only a few inches before refusal was encountered, prohibiting further advancement of the sampler.

Seven samples of surficial soil were tested in the laboratory for purposes of classification. Gradation test results show the soils have 24 to 89 percent fines (passing the No. 200 standard sieve) with the remaining percentage as sand. Atterberg Limits testing produced Liquid Limits (LL) results between 26 and 43 percent and Plasticity Index (PI) results of 4 to 23 percent. One sample from Boring A-02 was non-plastic. Under the AASHTO system, two samples were classified as A-7-6, with group indices of (17) to (18); two samples were classified as A-6, with group indices of (14) and (18), and one sample was classified as A-4 (5). Each of these five samples fell within the Unified Soil Classification System (USCS) classification CL, Lean Clay. The remaining two samples were collected nearer the base of the surficial soil layer, where the sand content is greater. These samples were classified as A-2-4 (0) and A-4 (0), with a USCS classification of SM, Silty Sand.

Four soil samples collected using a modified California sampler were selected for laboratory testing. These were found to have natural moisture contents between 8.7 and 13.1 percent and natural dry densities ranging from 85.2 to 113.0 pounds per cubic foot (pcf). Swell/consolidation results for one sample tested, at Pier 2, was -3.4 percent (consolidation).

Chemical properties were determined for one soil sample to provide data useful in evaluating soil corrosivity. The pH for the sample tested was 8.5. No water-soluble sulfate was detected, and water-soluble chloride was measured at a concentration of 0.00114 percent. A laboratory

soil resistivity of 3,500 Ohm-cm was measured. Unconfined compressive strengths of 7,063 and 8,357 psf were measured for two soil samples, one from each abutment boring.

CDOT performed R-value testing on a sample of surficial soil from Boring A-02. The results indicate an R-value of 28 and are included in Appendix E.

6.7 Sta. 958+00 Wildlife Underpass A (Structures P-05-AS and P-05-AT)

The Wildlife Crossing designated as “WX2” is located on US 550 near Station 902+50. The Reference Design refers to this structure as Wildlife Underpass A. Four borings, numbered WX2-01 through WX2-04, were drilled near the west side of the proposed location of structure WX2. The east side was inaccessible at the time of our field work. The depths of the borings ranged from approximately 30 to 39 feet. Boring locations and logs are shown on the Engineering Geology sheet provided in Appendix C.

Borings WX2-01 and WX2-02 were drilled in the shoulder of the northbound lane of existing US 550. Below about 1 foot of shoulder gravel, embankment fill consisting of gravel with some sand and clay was encountered to a depth of seven feet in Boring WX2-01 and to a depth of 10 feet in Boring WX2-02. Borings WX2-03 and WX2-04 were located in agricultural land east of the existing roadway. Native surficial soils were encountered at the ground surface in these borings.

Stiff to very stiff native soils consisting of clay with some sand were encountered in the borings to depths ranging from 18 to 23.5 feet. Medium dense to very dense alluvial gravel with occasional sand layers was encountered below the clay surficial soil to depths ranging from 27 to 34.5 feet. Animas Formation claystone bedrock was encountered in Boring WX2-02 at a depth of 35 feet to the bottom of the boring at 38.8 feet and in Boring WX2-04 at a depth of 27 feet to the bottom of the boring at 29.5 feet. Groundwater was not encountered in the borings.

Penetration resistance N values in the surficial soils ranged from 13 to 36 blows per foot (bpf), with an average of 21 bpf. Penetration resistance in the terrace alluvium was high due to the presence of gravel and cobbles. N values ranged from 16 to 41 bpf, with an average of 29 bpf. At several locations, drive sampling using the split spoon sampler advanced only a few inches before refusal was encountered, prohibiting further advancement of the sampler.

Two samples of surficial soil were tested for purposes of classification. Gradation test results show the soils have 80 to 92 percent fines (passing the No. 200 standard sieve) with the remaining percentage as sand. Atterberg Limits testing produced Liquid Limits (LL) results of 40

and 47 percent and Plasticity Index (PI) results of 28 and 31 percent. Under the AASHTO system, the samples were classified as A-6 (25) and A-7-6 (24). Each of the samples fell within the Unified Soil Classification System (USCS) classification CL, Lean Clay.

Four soil samples collected using a modified California sampler were tested in the laboratory. These were found to have natural moisture contents between 15.7 and 17.3 percent and natural dry densities ranging from 105.9 to 111.4 pounds per cubic foot (pcf). The relatively high moisture contents may be due to seasonal fluctuations in groundwater levels or the result of irrigation. Swell/consolidation results ranged from -0.3 percent (consolidation) to -0.1 percent (consolidation). A pH of 8.6 was measured, water-soluble sulfate was present at 0.024 percent, and 0.00543 percent concentration of water-soluble chloride was detected. Resistivity was found to be 1,100 Ohm-cm.

6.8 Sta. 902+50 Wildlife Underpass B (Structures P-05-AU and P-05-AV)

Wildlife Crossing “WX” consists of a proposed series of three underpass structures beneath the US 550 southbound and northbound lanes and the Frontage Road. The crossing is located in the vicinity of US 550 Station 958+00. The Post-FIR plans dated 12/05/2016 show the structures to be a concrete box culverts (CBCs) 23 feet wide and 14 feet high, with an overall length of 241 feet. The bottoms of the CBCs will be 13 to 16 feet below the existing ground surface.

Four borings, designated Boring WX-01 through Boring WX-04, were drilled at the approximate location of proposed wildlife crossing WX. Boring locations and logs are shown on the Engineering Geology sheet provided in Appendix C. The thickness of surficial soil ranged from 22 to 30 feet, and terrace alluvium was encountered directly beneath the soil. Bedrock was not encountered in any of the borings, which ranged in depth from approximately 32 to 45 feet.

Penetration resistance N values in the surficial soils ranged from 8 to 34 blows per foot (bpf), with an average of 21 bpf. Penetration resistance in the terrace alluvium was relatively high due to the presence of gravel and cobbles. N values ranged from 20 to 81 bpf, with an average of 40 bpf. At two locations, drive sampling using the split spoon or modified California samplers advanced only a few inches before refusal was encountered, prohibiting further advancement of the sampler.

Three samples of surficial soil were tested for purposes of classification. Gradation test results show the soils have 81 to 94 percent fines (passing the No. 200 standard sieve) with the

remaining percentage as sand. Atterberg Limits testing produced Liquid Limits (LL) results between 29 and 34 percent and Plasticity Index (PI) results of 13 to 18 percent. Under the AASHTO system, the samples were classified as A-6, with group indices of (9) to (16). Each of the samples fell within the Unified Soil Classification System (USCS) classification CL, Lean Clay.

Four soil samples were collected using a modified California sampler. These were found to have natural moisture contents between 11.2 and 19.3 percent and natural dry densities ranging from 106.2 to 111.4 pounds per cubic foot (pcf). The relatively high moisture contents from Borings WX-02 and WX-03 may be due to seasonal fluctuations in groundwater levels or the result of irrigation. Swell/consolidation results ranged from -0.1 percent (consolidation) to 0.3 percent (swell).

6.9 Sta. 1019+00 to Sta. 1029+68 – Gulch A to Gulch B: Walls A, B and C

Walls A and C were eliminated during preparation of the Reference Design. Wall B was reduced in height and length and renamed Wall D on the Reference Design plans. The existing ground surface in this section is generally 35 to 55 feet above the proposed roadway profile grade. Consequently, the proposed grading for the alignment between Bridge 1 and Bridge 2 is entirely excavation. The Post-FIR plans show three separate retaining walls for this area. Walls A and C are to be located left of centerline and Wall B will be located on the right. The walls are intended to retain cuts in terrace alluvium and claystone/shale bedrock materials. Maximum proposed wall heights range from 25 to 45 feet. Three borings (Boring WA-01 through Boring WA-03) were drilled at the proposed location of Wall A, three at Wall C (Boring WC-01 through Boring WC-03) and ten at Wall B (Boring WB-01 through Boring WB-10). Boring WB-10 was drilled on the side slope of Gulch B, with the top of hole located below the level of the alluvium/bedrock (Qt/Ta) contact. The terrace alluvium, Qt, was encountered near the surface at Wall A, at depths ranging from 1.5 to 3 feet; and Wall C, at depths ranging from 1 to 1.5 feet. The borings at Wall B encountered 11 to 25.5 feet of surficial soils over the alluvial deposit. The thickness of the terrace alluvium deposit, Qt, was approximately 50 feet near the south ends of Walls A and B and thinned to approximately 24 feet at the north ends of Walls B and C, near Gulch B. Bedrock of the Animas Formation (Ta), was encountered in each of the 16 borings drilled at the walls. Depth to bedrock ranged from 44 to 56.5 feet.

Penetration resistance N values in the surficial soils indicate very stiff to hard materials. N values ranged from 23 to 44 with an average of 35 bpf. Resistance to penetration was high in

the terrace alluvium, as expected, due to the prevalence of coarse gravel, cobbles, and boulders. Blows per foot (N values) ranging from 24 to 87 were recorded. Dense materials or cobbles and boulders allowed the driven samplers to advance only a few inches before refusal was encountered.

Six bulk samples of surficial soil were tested to determine soil classifications. Gradation tests showed percent passing the No. 200 Sieve (fines) for samples taken at Wall B ranged from 64 to 90 percent. The fines proportion in the shallow soils at Wall A was 23 to 28 percent, and may be more typical of hillside colluvium material. AASHTO classifications for surficial soils at Wall B were A-7-6 and A-6 with group indices ranging from (10) to (35). The USCS classification for Wall A soils was silty sand (SM) and for Wall B was lean clay (CL). One sample at WB-07 did meet the criteria for high plasticity clay (CH). Bulk samples were taken from the alluvium, but due to the drilling methods, the larger clasts were fragmented and some of the fines were lost. Sieve analyses resulted in AASHTO A-1-a to A-2-4 and A-2-6 classifications for these fragmented materials, and USCS classifications of SP, SM, GP, and GM, poorly sorted or silty sands and gravels. These sieve analysis results are not representative of the in-place alluvium.

Eight relatively undisturbed samples of surficial soil were collected from Wall B borings using a modified California sampler. The samples were found to have natural moisture contents ranging from 7.5 to 14.8 percent and natural dry densities ranging from 94.9 to 117.4 pcf.

Swell/consolidation results for four samples tested ranged from -1.0 percent (consolidation) to +1.5 percent (swell).

The potential for soil corrosivity was evaluated for one sample of surficial soil, one sample of alluvium and six bedrock samples. The values of pH, water-soluble sulfates and chlorides, and resistivity from the surficial soil were consistent with those measured at other borings. The alluvium sample from WB-01 had a pH of 8.5 and water-soluble sulfate of 0.002 percent. No chlorides were detected, and the resistivity was 14,000 Ohm-cm, notably higher than was measured elsewhere for this material. The pH values for bedrock ranged from 8.3 to 8.6, with the exception of WA-03 which measured 9.5. Water-soluble sulfate was measured for each of the six bedrock samples and ranged from 0.010 to 0.018 percent. No water-soluble chloride was detected in the bedrock samples. Resistivity values ranged from 1100 to 2000 Ohm-cm.

Six bedrock core samples were selected from these borings for testing of unconfined compressive strength. Measured values ranged from 263 psi to 7224 psi.

R-value tests were performed by CDOT on subgrade soil samples from Boring WC-01. An R-value of 25 was reported and the results are presented in Appendix E.

6.10 Sta. 1040+00 - Wall D

Wall D is shown as Wall E on the Reference Design plans. Retaining Wall D will support embankment fill to widen for the proposed roundabout and shoulder near Station 1040+00, south of the existing US 160 interchange. The proposed wall is located along approximately 140 feet of the southbound shoulder and has a maximum height of about 21 feet. Subsurface exploration for Wall D consisted of a single wire-line core boring drilled with the portable Viper drilling rig. Boring WD-01 encountered 2.5 feet of sandy clay overlying 24 feet decomposed to moderately weathered claystone. Moderately weathered to very hard sandstone with occasional shale layers was encountered at 26.5 feet to the bottom of the boring at 39.9 feet.

6.11 Sta. 979+00 to Sta. 987+00 - Walls E and F

Walls E and F are shown as Walls B and A respectively, on the Reference Design plans. The two retaining walls are proposed to support embankment fill for the frontage road that is to provide access to commercial and residential properties west of the County Road 220 intersection. Borings WE-01 and WE-02 were drilled near the location of Wall E and Borings WF-01 and WF-02 were drilled near the location of Wall F. The borings encountered 14.5 to 24 feet of stiff to hard clay and silt soils overlying approximately 9 to 15 feet of loose to very dense gravel with sand, cobbles and boulders. Bedrock was not encountered in the borings for the full depth of exploration that ranged from 29.5 to 33.2 feet.

Clay soil encountered in Boring WE-01 had low to medium plasticity, USCS classifications of CL and AASHTO classifications of A-4 with group indices ranging from (4) to (7). A relatively undisturbed Modified California drive sample from a depth of 9 feet had a moisture content of 14.8 percent and a dry density of 107.4 pcf. The sample consolidated 0.2 percent when wetted under light loading. Results of tests to evaluate soil corrosivity were: pH 8.5, water soluble sulfates 0.054 percent, chlorides 0.00784 percent and soil resistivity of 100 Ohm-cm. A sample of clay soil from Boring WE-02 had medium plasticity and classified as CL per the USCS system with an AASHTO classification of A-6 (11).

High plasticity clay soil was encountered in Boring WF-01 to a depth of 24 feet. The soil has a USCS classification of CH and an AASHTO classification of A-7-6 (32). A sample from a depth of 9 feet had a moisture content of 13.1 percent, dry density of 116.6 pcf and swelled 4.3

percent when wetted under light load. Boring WF-02 encountered stiff to hard silt with some sand to a depth of 16 feet. The soil has low plasticity, a USCS classification of ML and an AASHTO classification of A-4 (5). A relatively undisturbed Modified California drive sample from a depth of 3 feet had a moisture content of 13.8 percent, dry density of 101.7 pcf and consolidated 0.8 percent when wetted under a light load.

6.12 Station 1007+82 to Station 1011+25 – Wall G

This wall is shown as Wall C on the Reference Design plans. Wall G is proposed to retain a slope cut into surficial soil and terrace alluvium adjacent to a gas well pad on the Webb property. Roadway borings R-10, R-11 and R-12 were drilled in the vicinity of Wall G. Borings R-10 and R-11, located approximately 50 feet behind the wall, encountered 12 to 16 feet of medium dense silty sand. This layer was underlain by sandy clay or silt to a depth of 20 feet, where sandy gravel of the terrace alluvium deposit was encountered. Boring R-12 was located approximately 95 feet in front of the wall and approximately 15 feet lower in elevation than R-10 and R-11. At R-12, 5 feet of stiff to very stiff clay was encountered above a gravel layer and cobbles were encountered beginning at a depth of 14.5 feet.

Silty sand encountered in R-10 and R-11 had zero to low plasticity. USCS classifications for these soils were SM and SM-SC, and AASHTO classifications were A-2-4 (0) and A-4 (0). Relatively undisturbed Modified California drive samples from depths of 14.5 feet had a moisture contents from 9.4 to 13.6 percent and dry densities of 93.6 to 103.9 pcf. No swell-consolidation tests were conducted at R-10 and R-11. Results of tests to evaluate soil corrosivity were: pH 8.8, water soluble sulfates 0.007 percent, and soil resistivity of 2800 Ohm-cm. No chlorides were detected.

At Boring R-12, tests on a bulk sample from the gravel layer resulted in a USCS classification of GC and an AASHTO classification of A-2-6 (0). Chemical analysis of the gravel sample measured pH 8.5, water soluble sulfates 0.019 percent, chlorides of 0.0018 percent, and soil resistivity of 1600 Ohm-cm. A Hveem Resistance test was performed by CDOT, with a resulting “R” value of 18.

7. GROUNDWATER AND SEEPAGE AREAS

The subsurface investigation was accomplished during the winter months in an unusually dry year. No groundwater was encountered in any of the borings, although water was introduced during the coring process; and as a result, any water already present may have gone unnoticed.



While no groundwater was encountered in the borings, seeps have been observed in previous years on the slopes of Gulch A and Gulch B, and their presence should be anticipated in wetter years and during summer months due to irrigation of the agricultural lands adjacent to the project. The presence of groundwater may contribute to reduced bearing resistance for structure foundations and may create challenges for roadway and structure excavation activities. Seepage at the alluvium/bedrock contact and through hillside colluvial deposits could reactivate or accelerate landslide movements.

8. LIMITATIONS

This report documents the subsurface investigation for the US 550 South Connection with US 160 realignment and was prepared for the exclusive use of Wood and CDOT for specific use on the US 550-US 160 Connection Design-Build project. Within the limitations of the scope, schedule, and budget, the work presented in this report was performed in accordance with generally accepted geotechnical engineering principles and practices in this area at the time this report was prepared. We make no other warranty, either explicit or implied.

The conclusions regarding subsurface conditions presented in this report are based on the data obtained from published maps, reports, laboratory tests, and the widely spaced exploratory borings drilled at the approximate locations shown on the boring location sheets. When assigning laboratory tests, it was assumed that these widely spaced borings are representative of the subsurface conditions throughout the US 550 project alignment discussed in the report and that the subsurface conditions throughout the project alignment are not significantly different from those identified by the borings. The subsurface conditions observed in the borings may not necessarily reflect the field variations in the subsurface conditions and water levels at other locations. The nature and extent of subsurface variations across the project area may not become evident until construction activities are initiated.

The scope of work of this investigation did not include hazardous materials sampling and chemical analyses and evaluation of potential impacts to natural resources, including wetlands, endangered species, or environmentally critical areas.

9. REFERENCES

Colorado Department of Transportation (2017), Standard Specifications for Road and Bridge Construction.

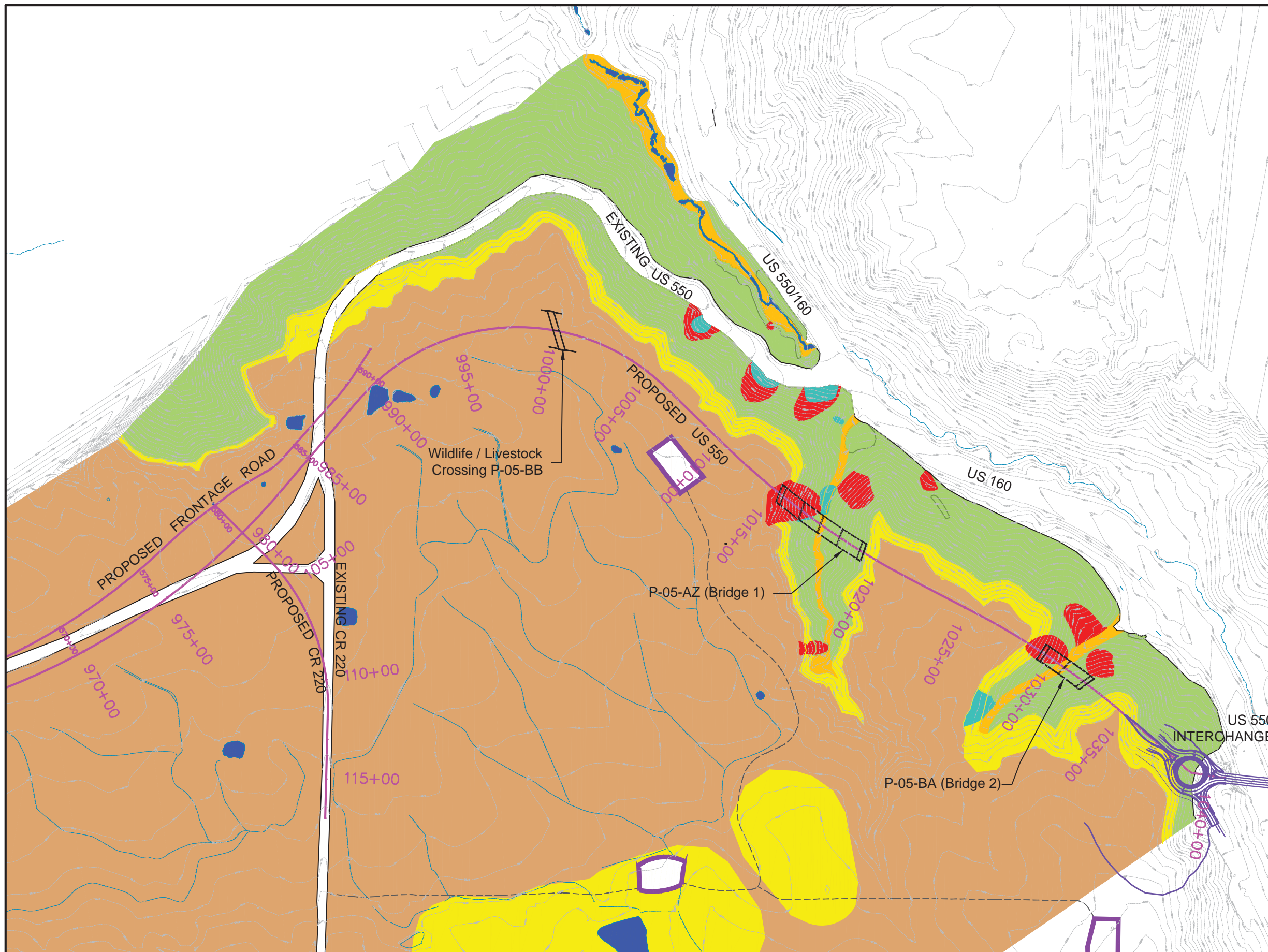
Carroll, C. J., et al. (1999) Geologic Map of the Durango East Quadrangle, La Plata County, Colorado, Colorado Geological Survey, 1:24,000.











Kirkham, R. M. and Navarre, A. K. (2003) Geologic Map of the Basin Mountain Quadrangle, La Plata County, Colorado, Colorado Geological Survey, 1:24,000.

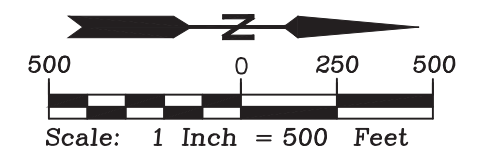
Yeh and Associates, Inc. (2014) Preliminary Geotechnical Evaluation Report US 550 South Connection to US 160: Independent Alternatives Analysis, FSA 5501-021 (19378)
La Plata County, Colorado

Appendix A – Geologic Map

Geologic Map Legend



-  Existing Gravel Roadways
 -  Existing Asphalt Roadway
 -  Water - Streams, irrigations ditches, and stockponds
 -  Seep - Water observed seeping from ground surface or hillside.
 -  Qac - Alluvium and colluvium (Holocene) - stream-channel deposits, poorly sorted, unstratified clayey, silty sand, bouldery sand.
 -  Qls - Landslide Deposits (Holocene and Pleistocene) - Relatively fresh morphological features or vegetation changes, indicating historical movement.
 -  Qlo - Loess (late Pleistocene) - Reddish-brown to light-brown sandy silt, slightly clayey. May include gravel zones of slope wash.
 -  Qt - Terrace alluvium (middle Pleistocene) - underlies terrace surface of Florida Mesa. Cobbles, locally boulders, in gravel and sand matrix.
 -  Ta - Animas Formation - Upper member (Paleocene) - olive to gray weathered claystone overlying gray interbedded shale, sandstone, and conglomerate, medium to very hard.
 -  Well Pad (Existing)

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CHECKED BY: TLA		DATE:	
DESIGNED FOR:			
PROJECT NUMBER: 217-376			
SCALE			
HORIZ: 1:6000		VERT: N/A	

PROJECT:	US 550 South Connection to US 160 Geotechnical Data Report
	Appendix A - Geologic Map

Appendix B – Boring Location Plan and Profile





















B.1	Boring Log Legend
B.2	Boring Location Plan Sheets
B.3	Boring Location Profile Sheets

Appendix B.1 – Boring Log Legend









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LEGEND

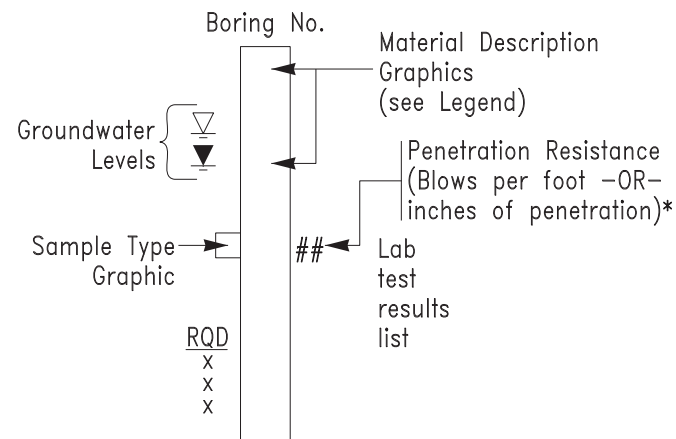
Soil Lithology

 Asphalt	 Fill with Gravel as major soil	 Fill with Clay as major soil	 USCS Low Plasticity Sandy Clay
 USCS Clayey Sand	 USCS Clayey Gravel	 USCS Low Plasticity Sandy Clay	 USCS Poorly-graded Gravel with Clay
 USCS Poorly-graded Sandy Gravel	 USCS Silty Sand	 USCS Low Plasticity Silty Clay	 Boulders and cobbles
 USCS Clayey Sand	 USCS Poorly-graded Gravelly Sand	 USCS Low Plasticity Clay	 USCS Sandy Silt
 USCS Poorly-graded Gravel	 USCS Silt	 USCS Poorly-graded Gravel with Silt	 USCS High Plasticity Clay

Rock Lithology


 Alternating layers of sandstone and shale	 Weathered Bedrock	 Sandstone
 Alternating layers of sandstone and claystone	 CLAYSTONE	 Shale
 Sandy Shale	 Breccia	

TYPICAL BOREHOLE LOG



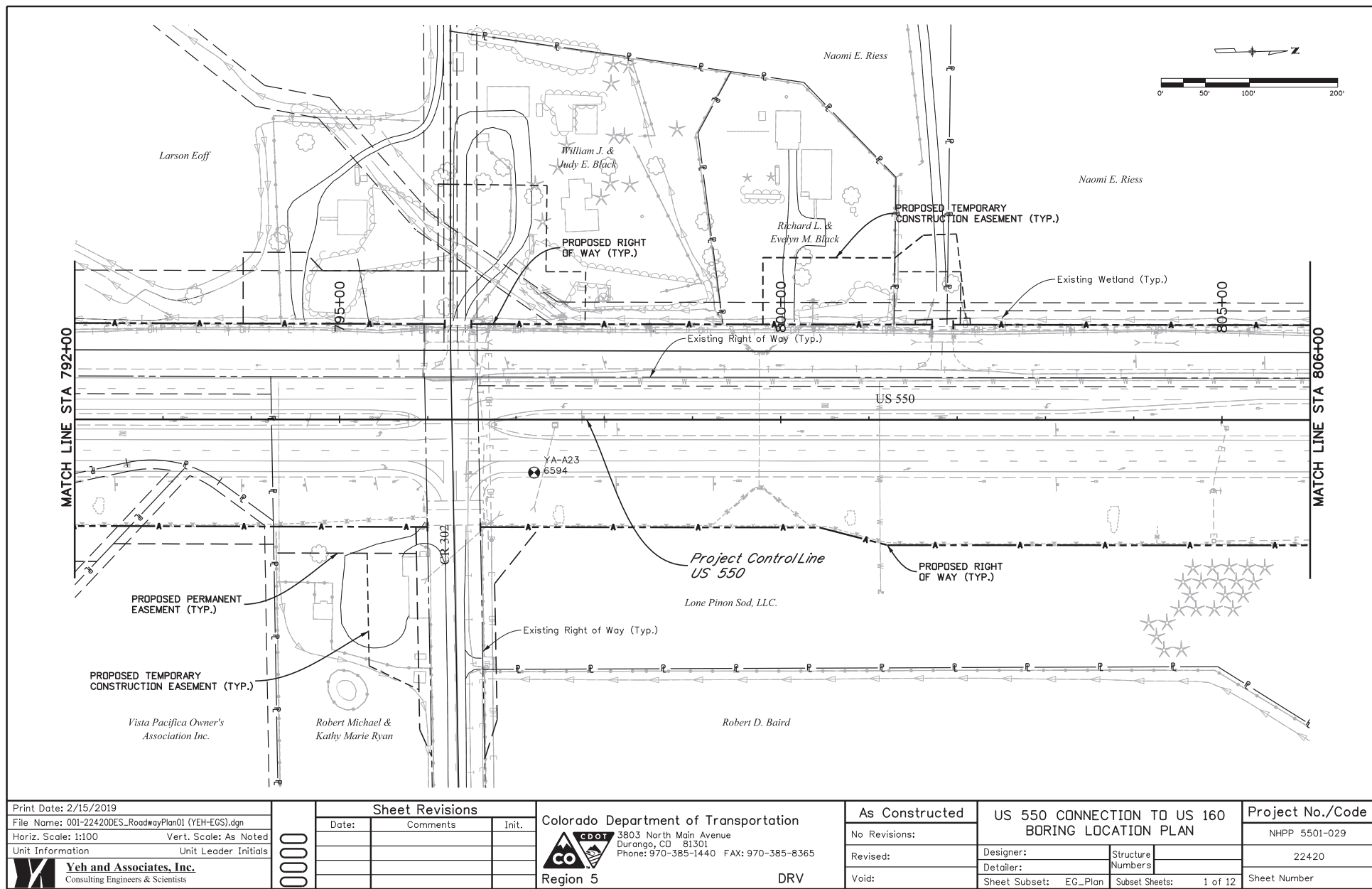
*e.g. A value of 50/3 or 50:3 indicates that 50 blows were applied to the sampler, with a penetration of 3 inches.

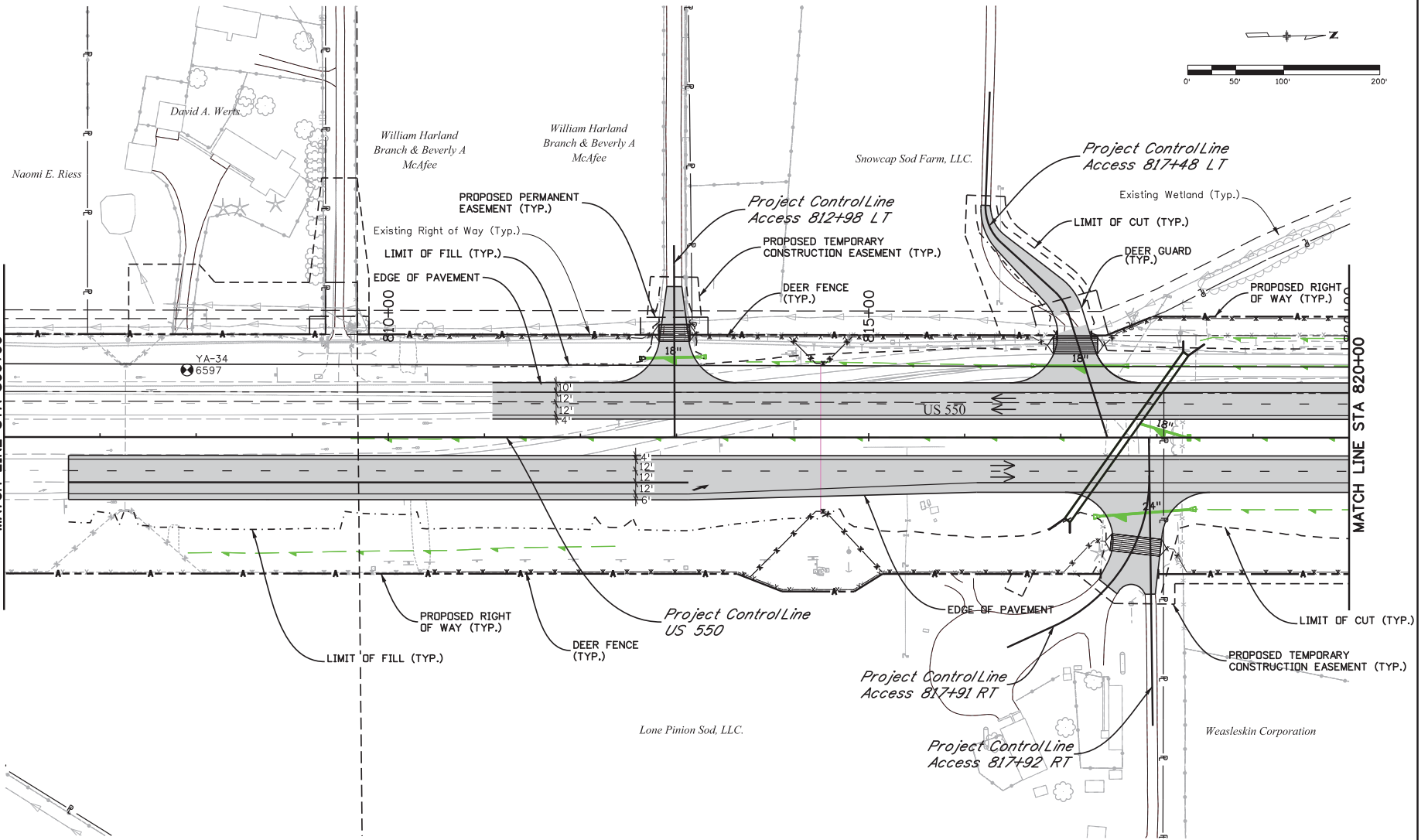
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File Name: 026-22420_Engineering Geology Legend and Typical		Date:	Comments	Init.		No Revisions:				NHPP 5501-029	
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Unit Information Unit Leader Initials						Void:		Detailer:	Sheet Subset:	Sheet Number	

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Appendix B.2 – Boring Log Plan Sheets

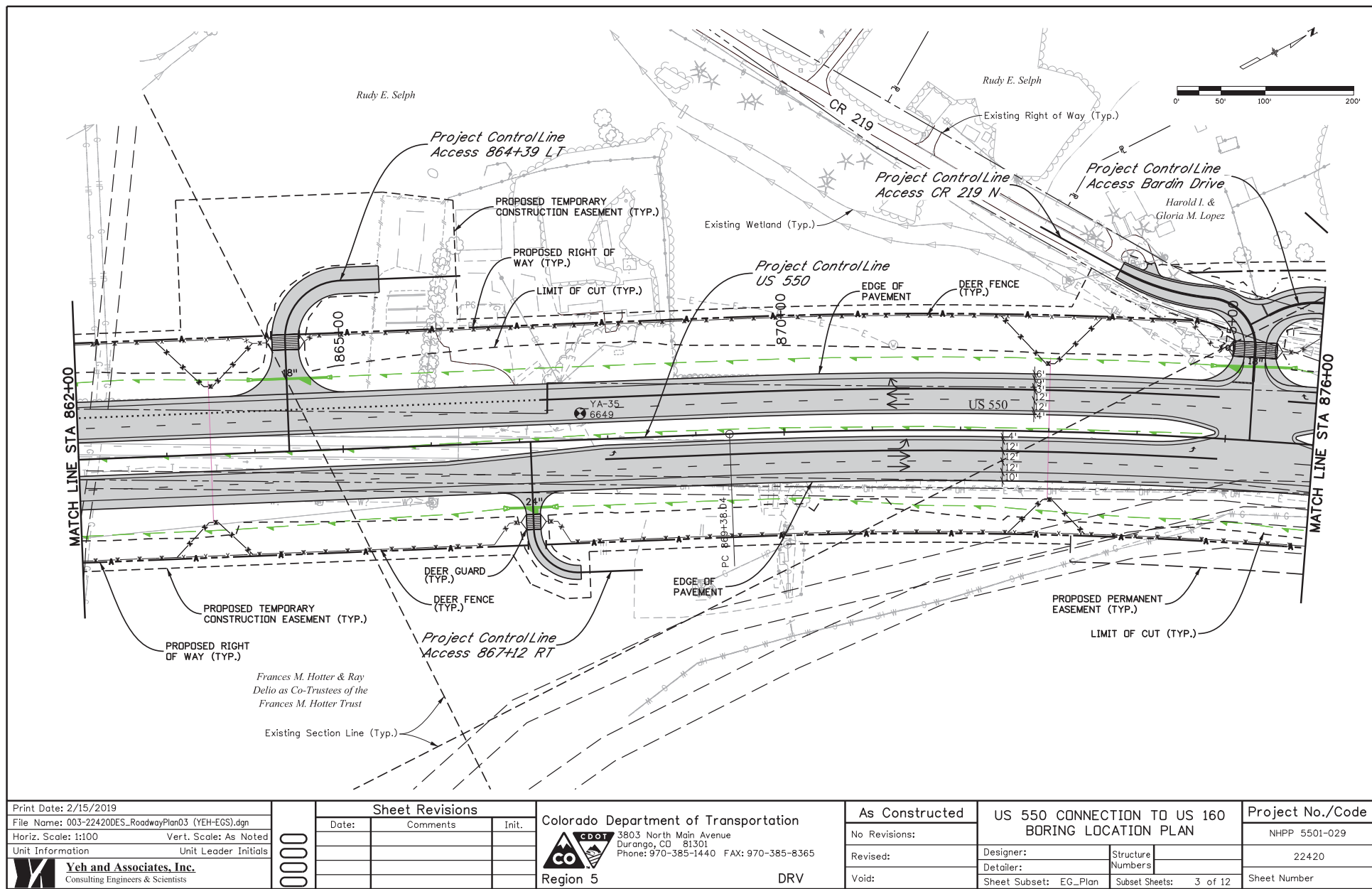
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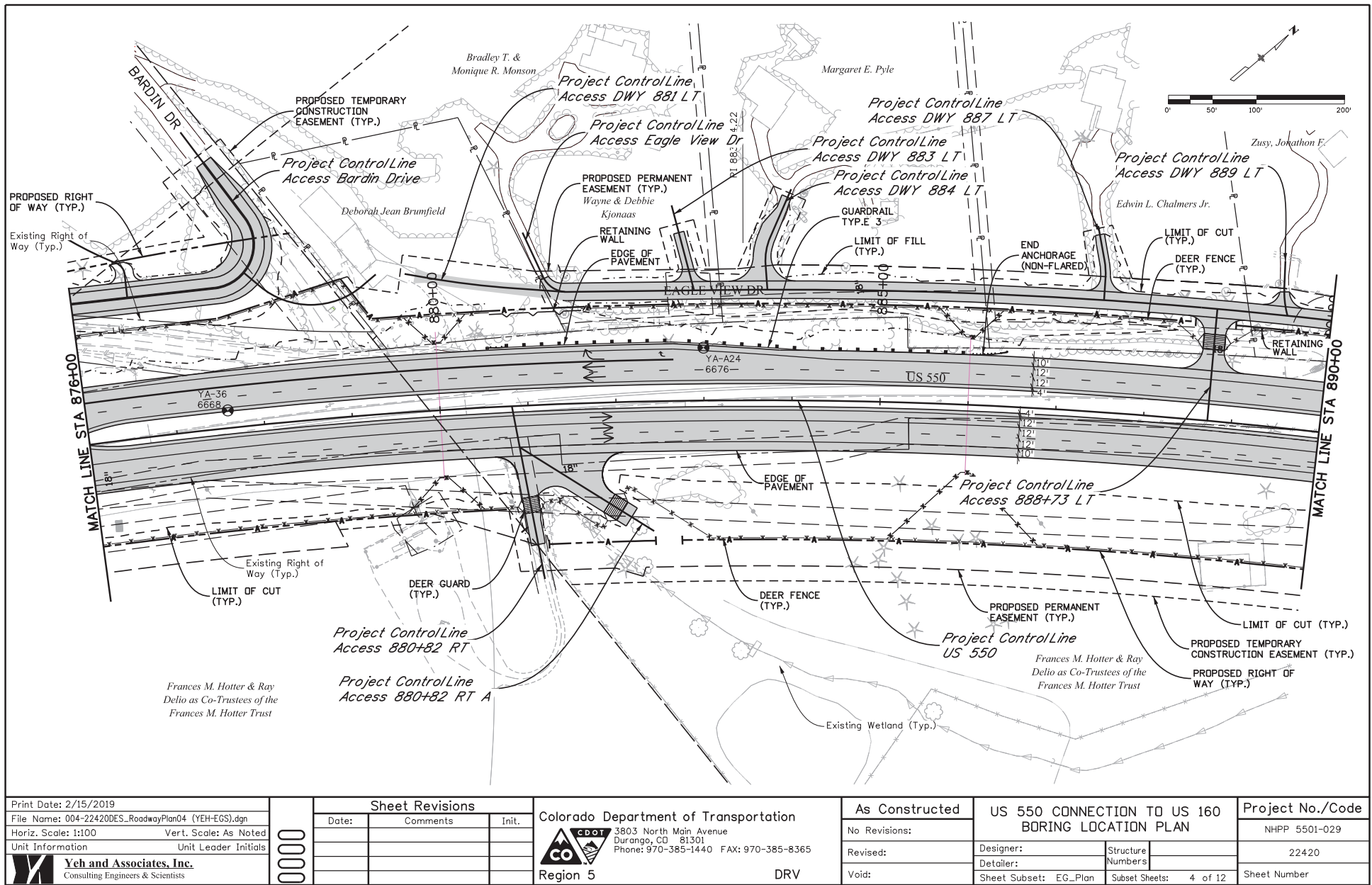


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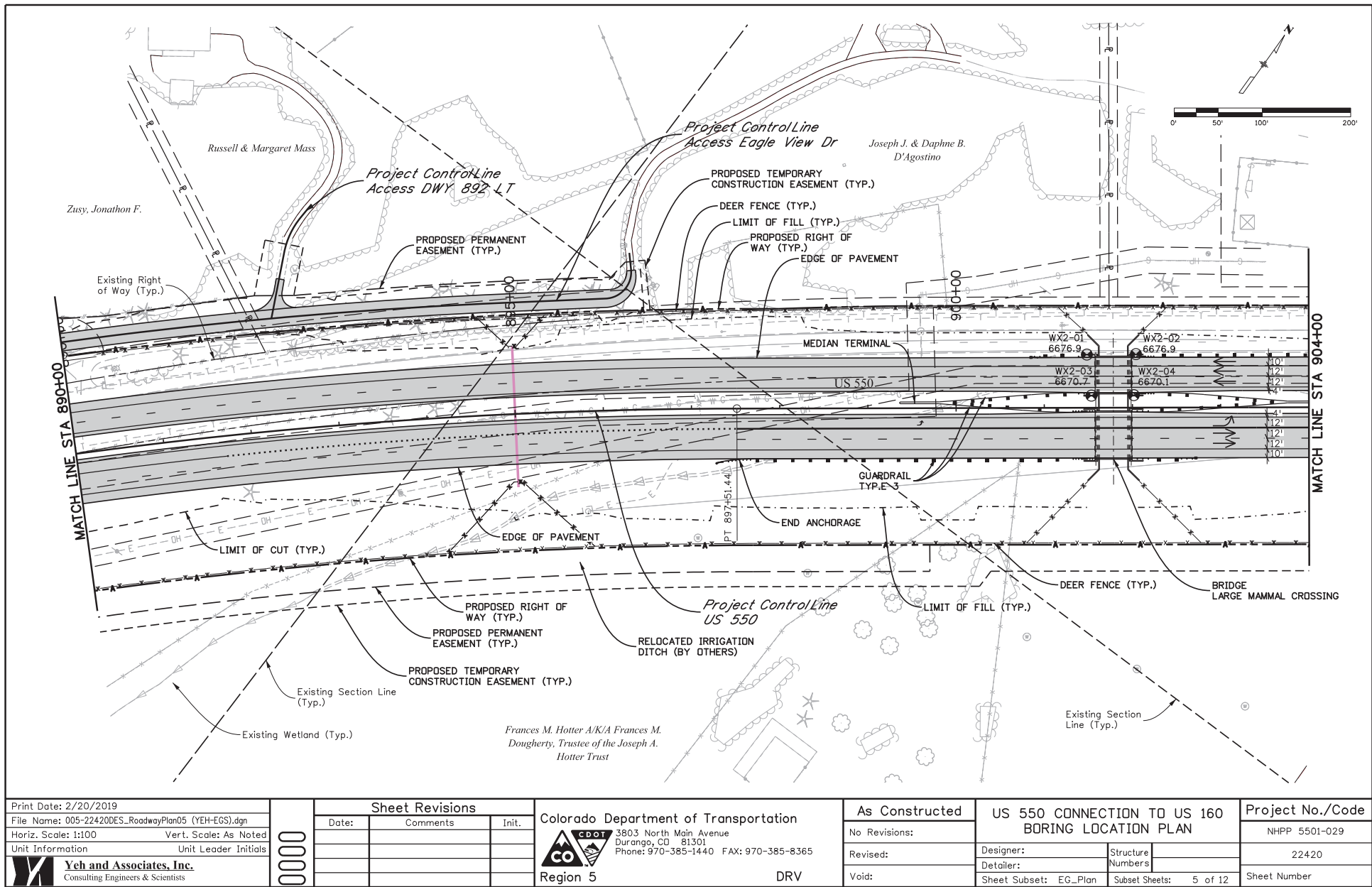
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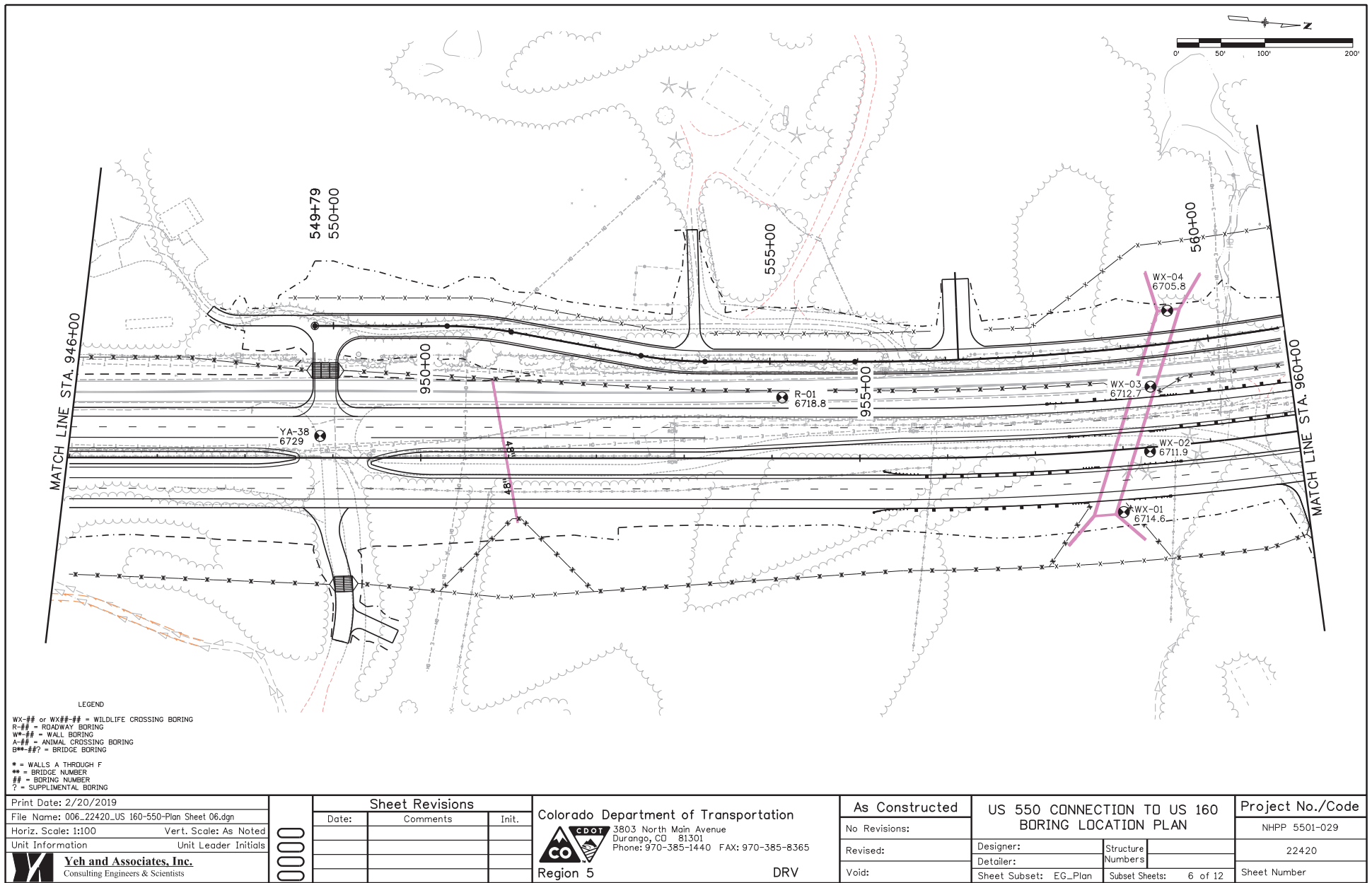
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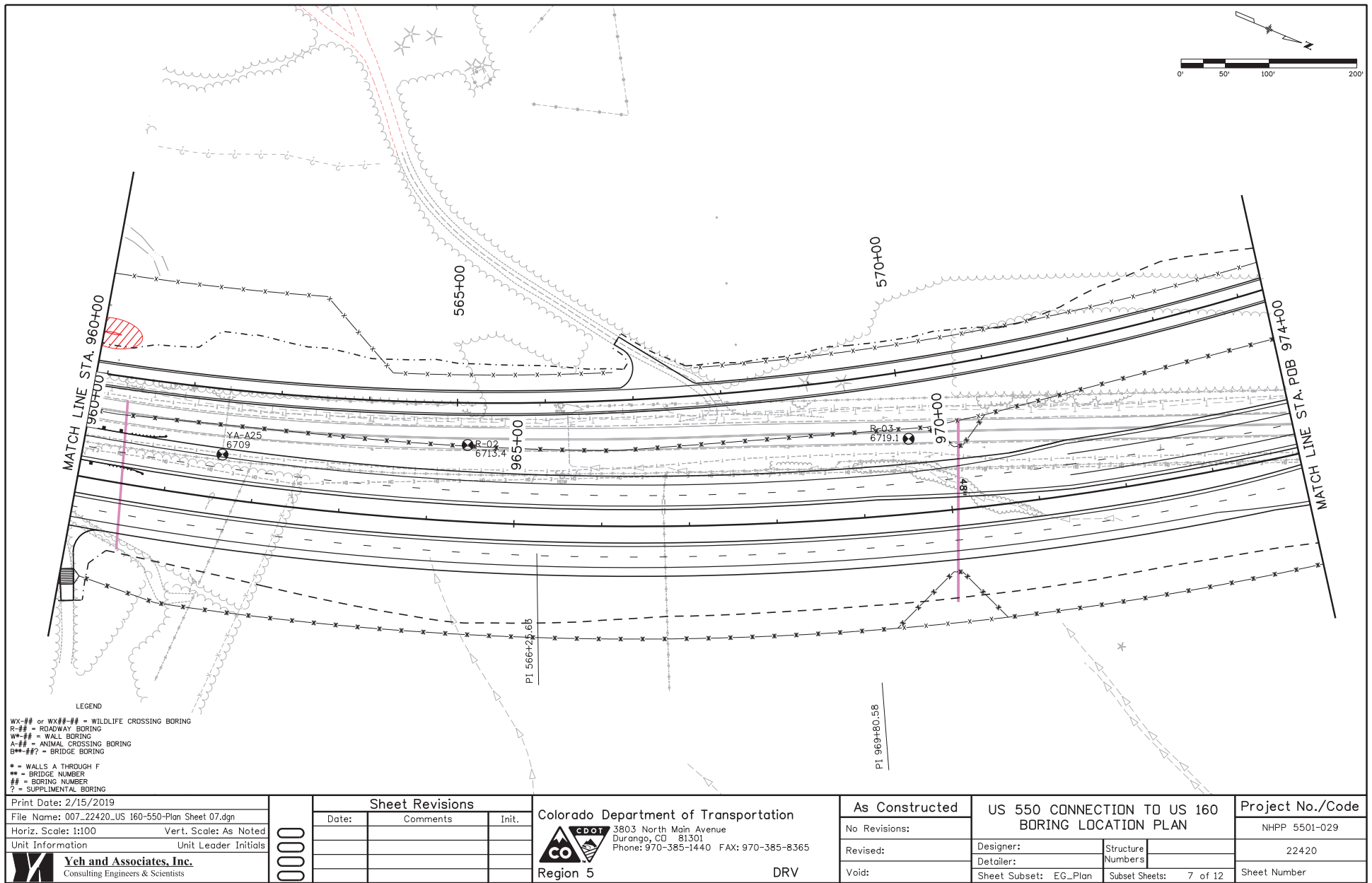
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As Constructed		US 550 CONNECTION TO US 160 BORING LOCATION PLAN		Project No./Code
No Revisions:		Designer:	Structure Numbers	NHPP 5501-029
Revised:		Detailer:		22420
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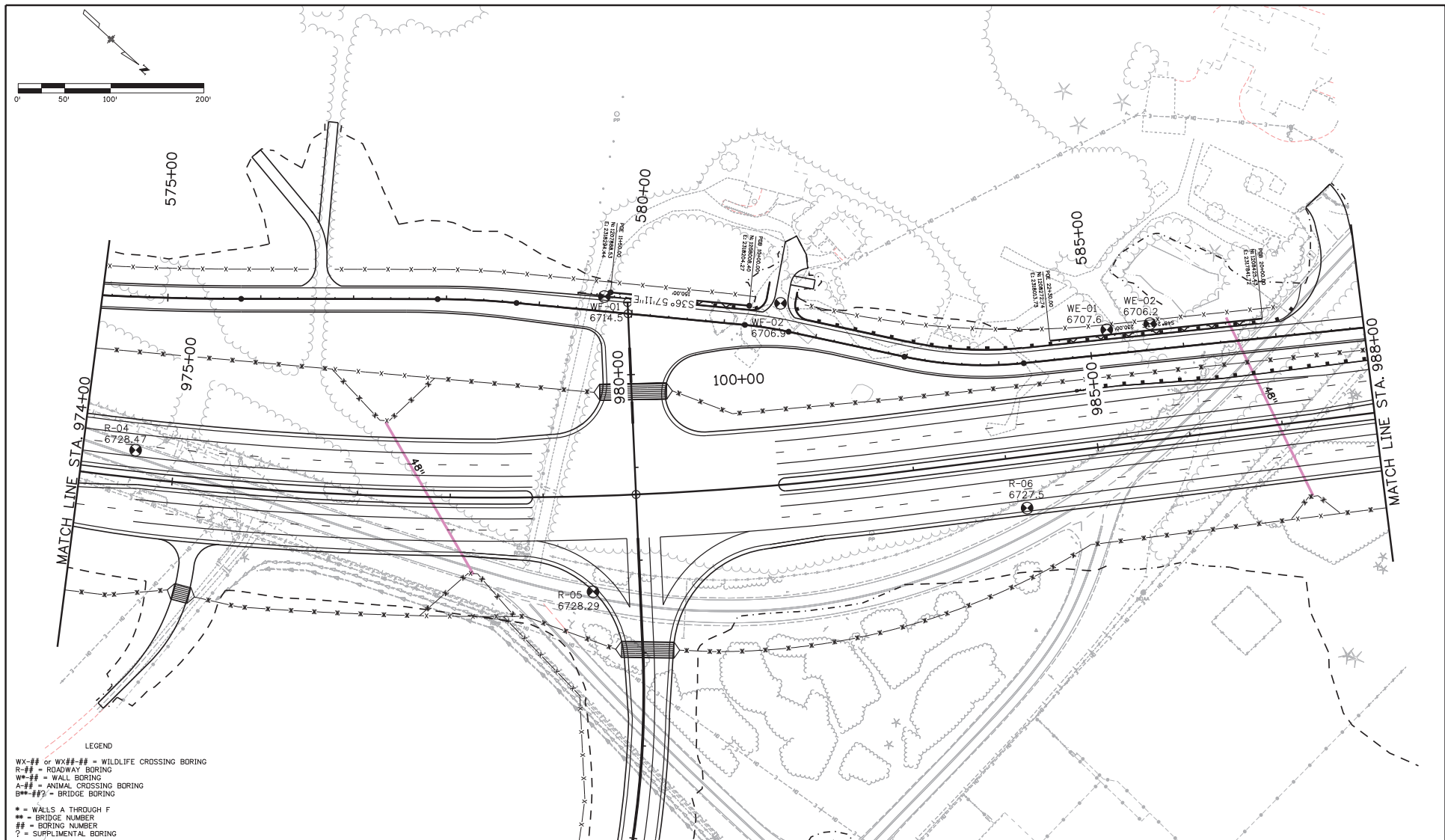
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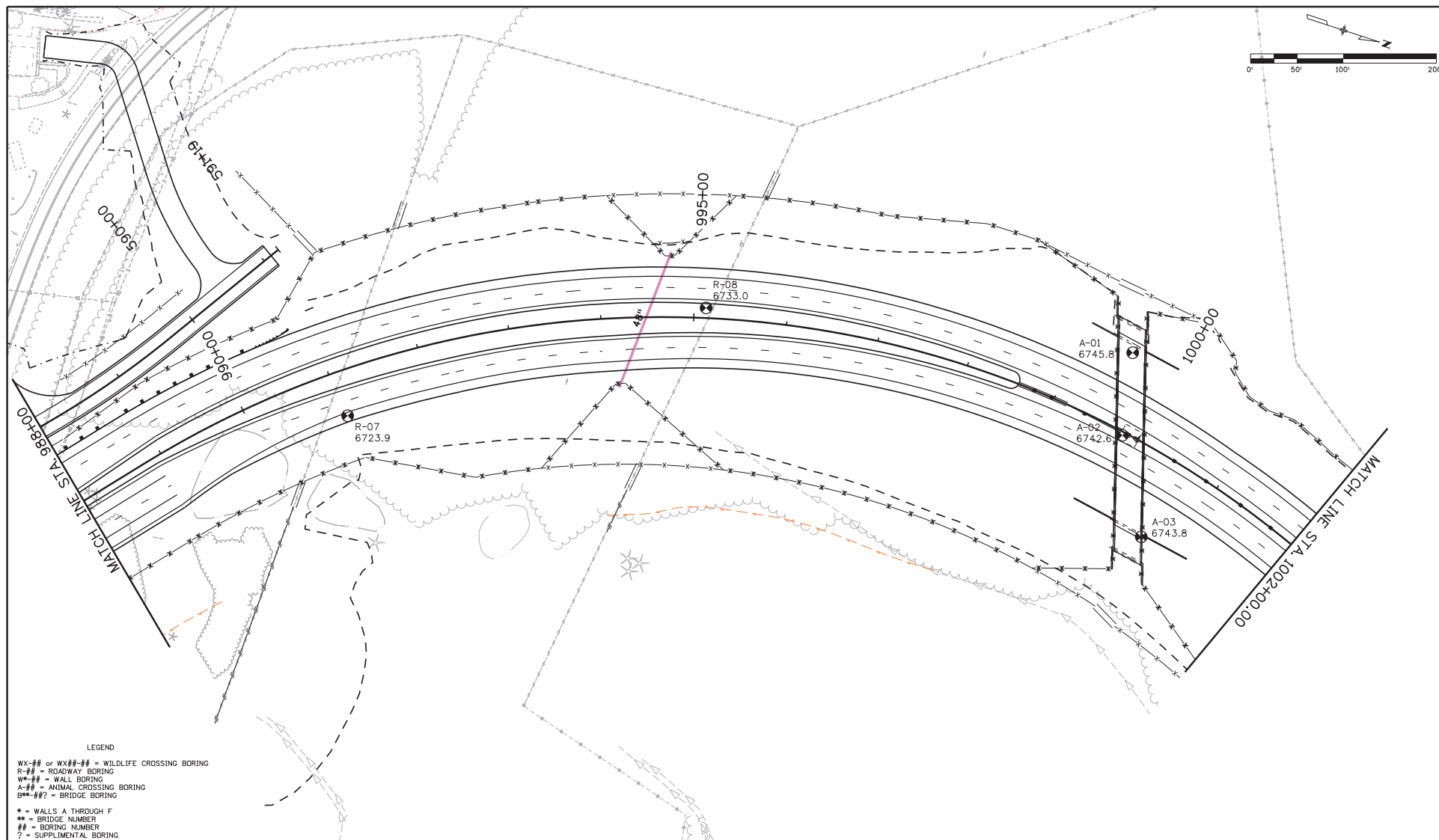


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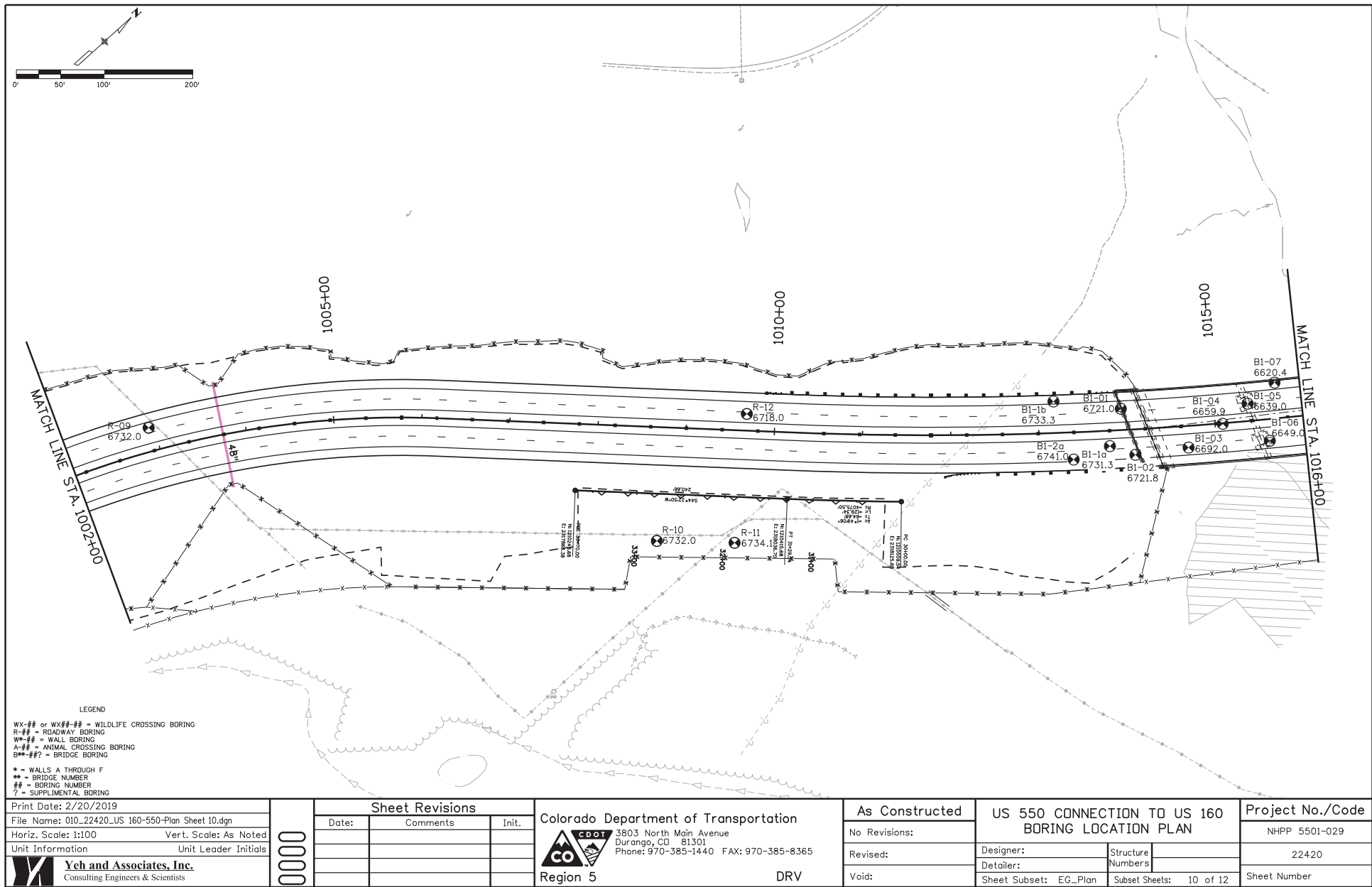
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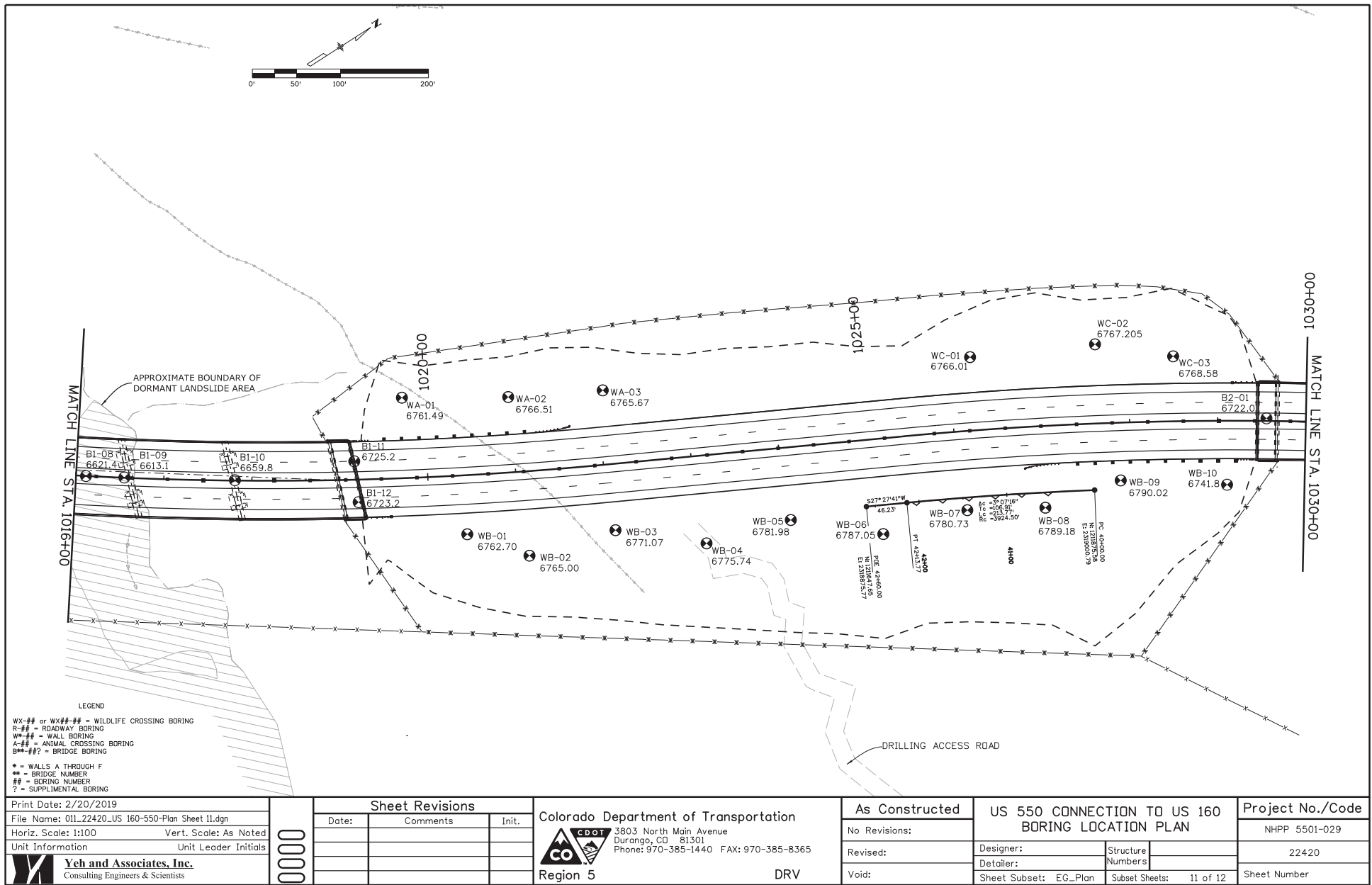
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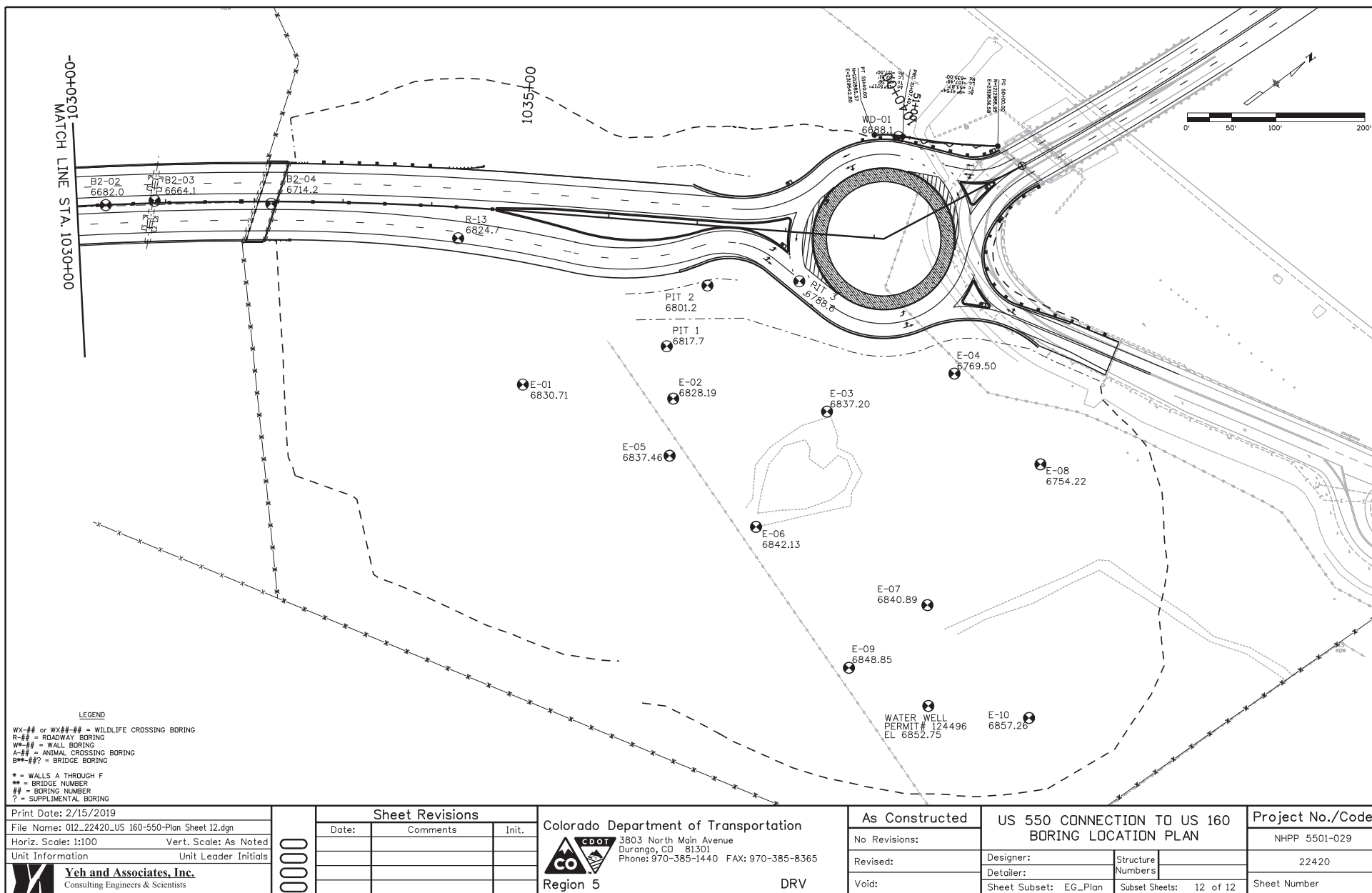
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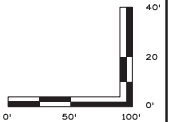
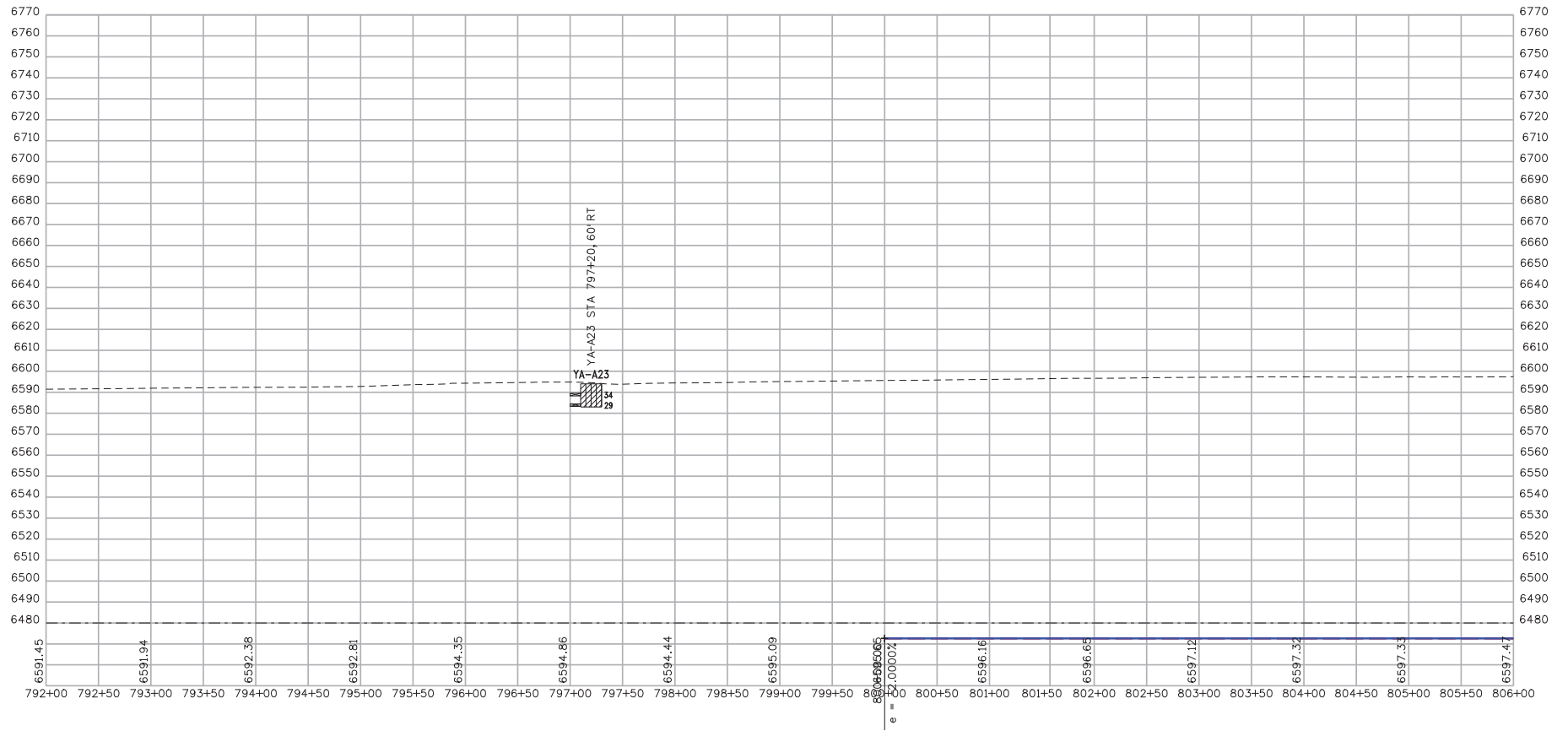


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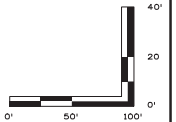
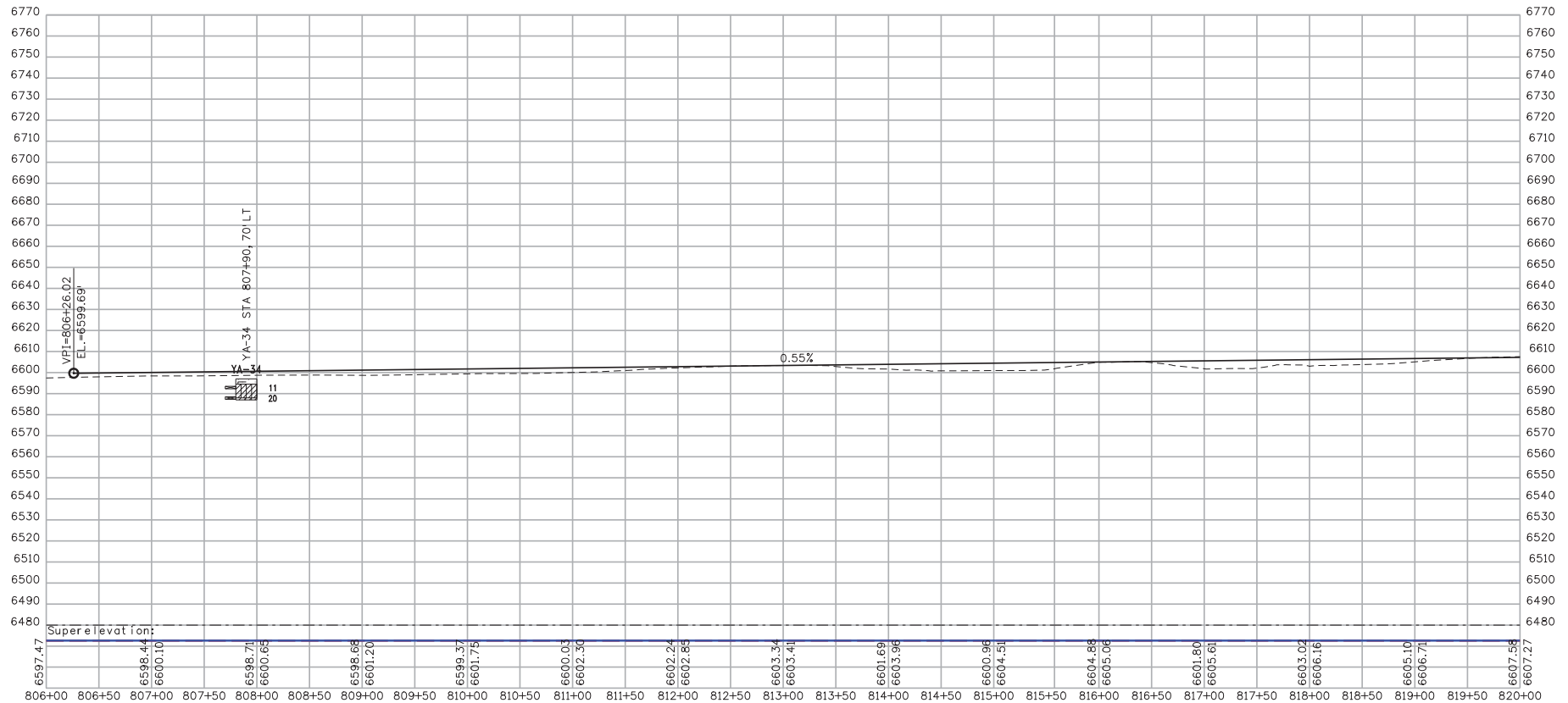
Appendix B.3 – Boring Log Profile Sheets



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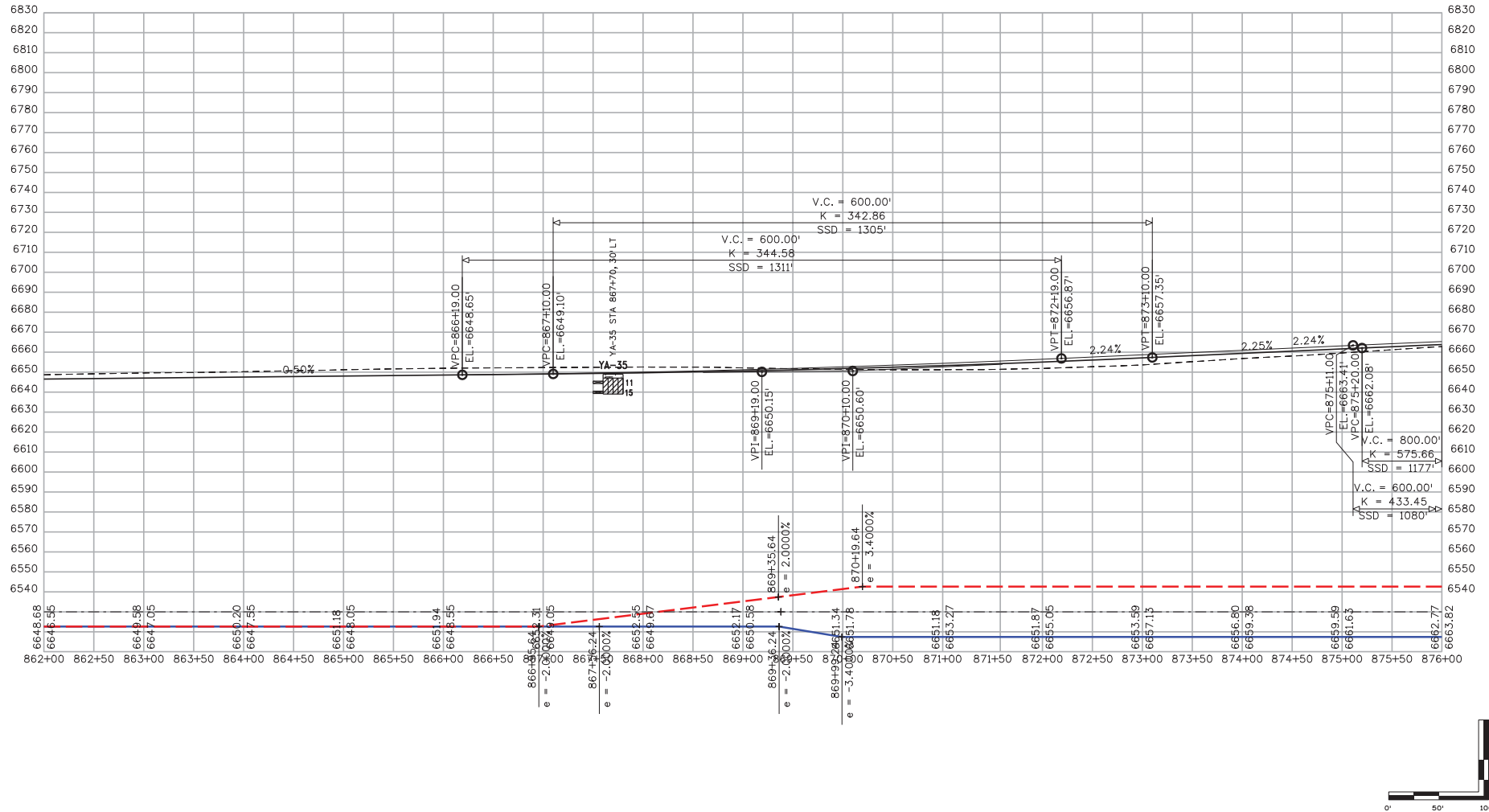


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Date:	Comments	Init.

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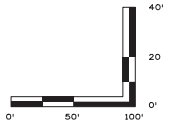
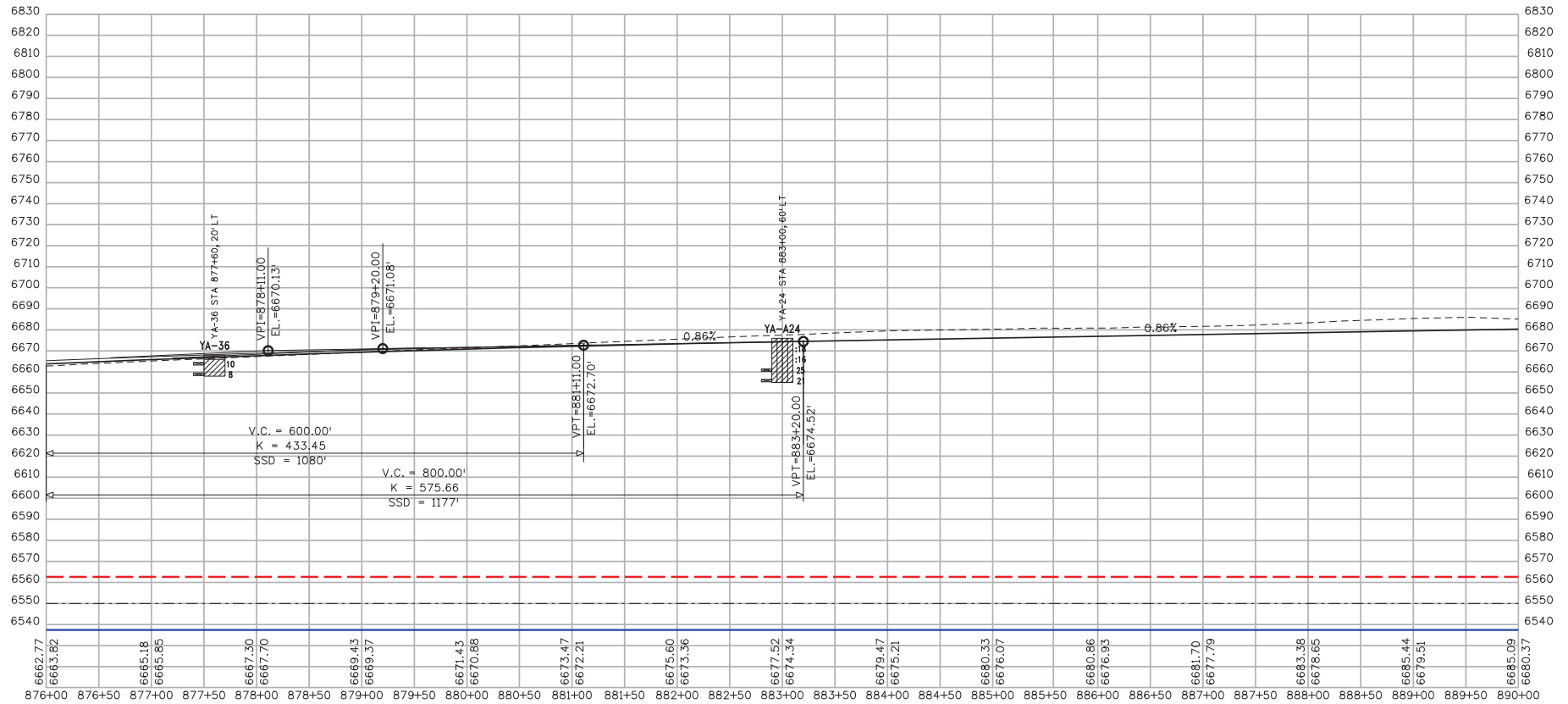
Region 5 **DRV**

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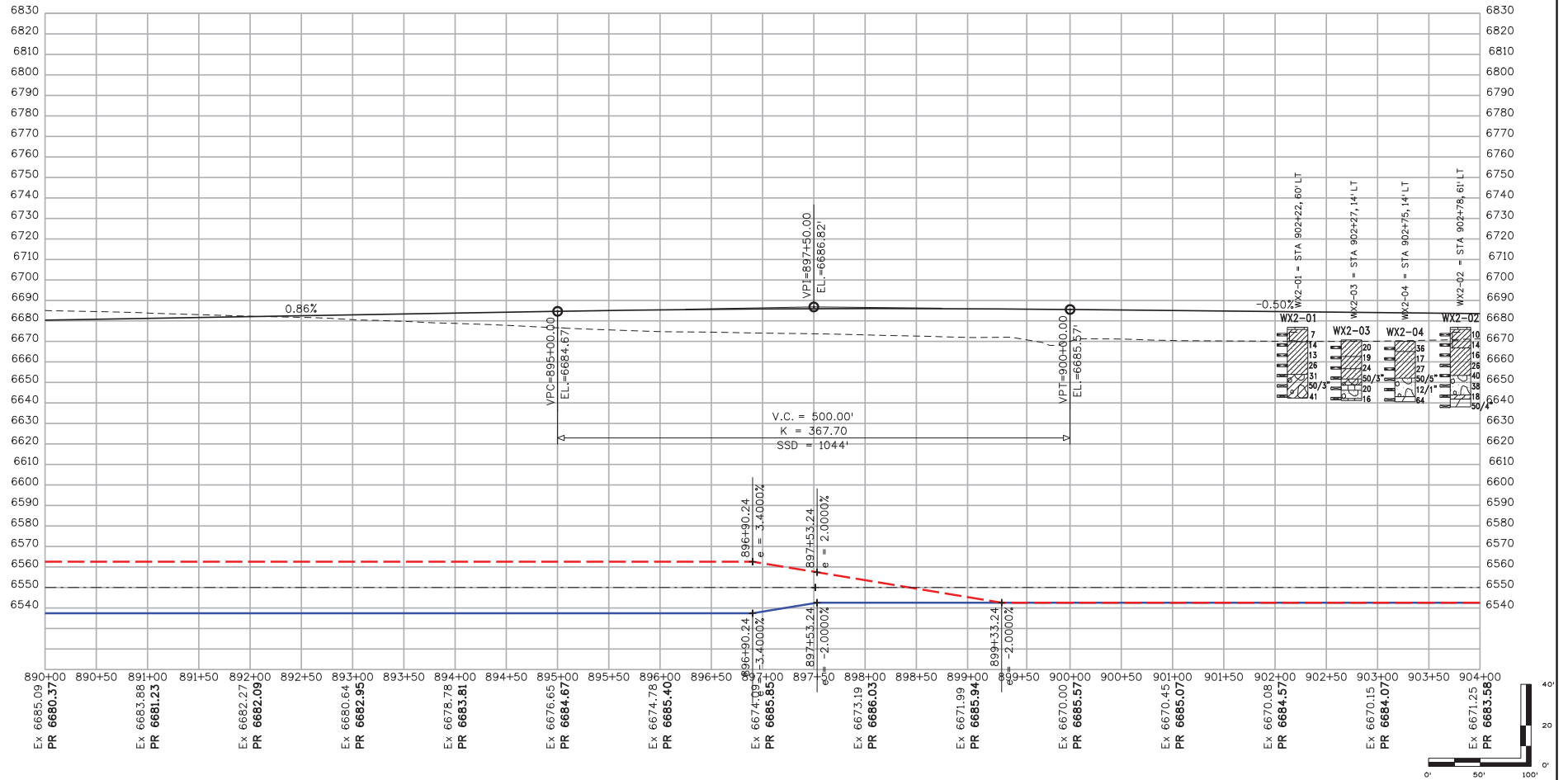
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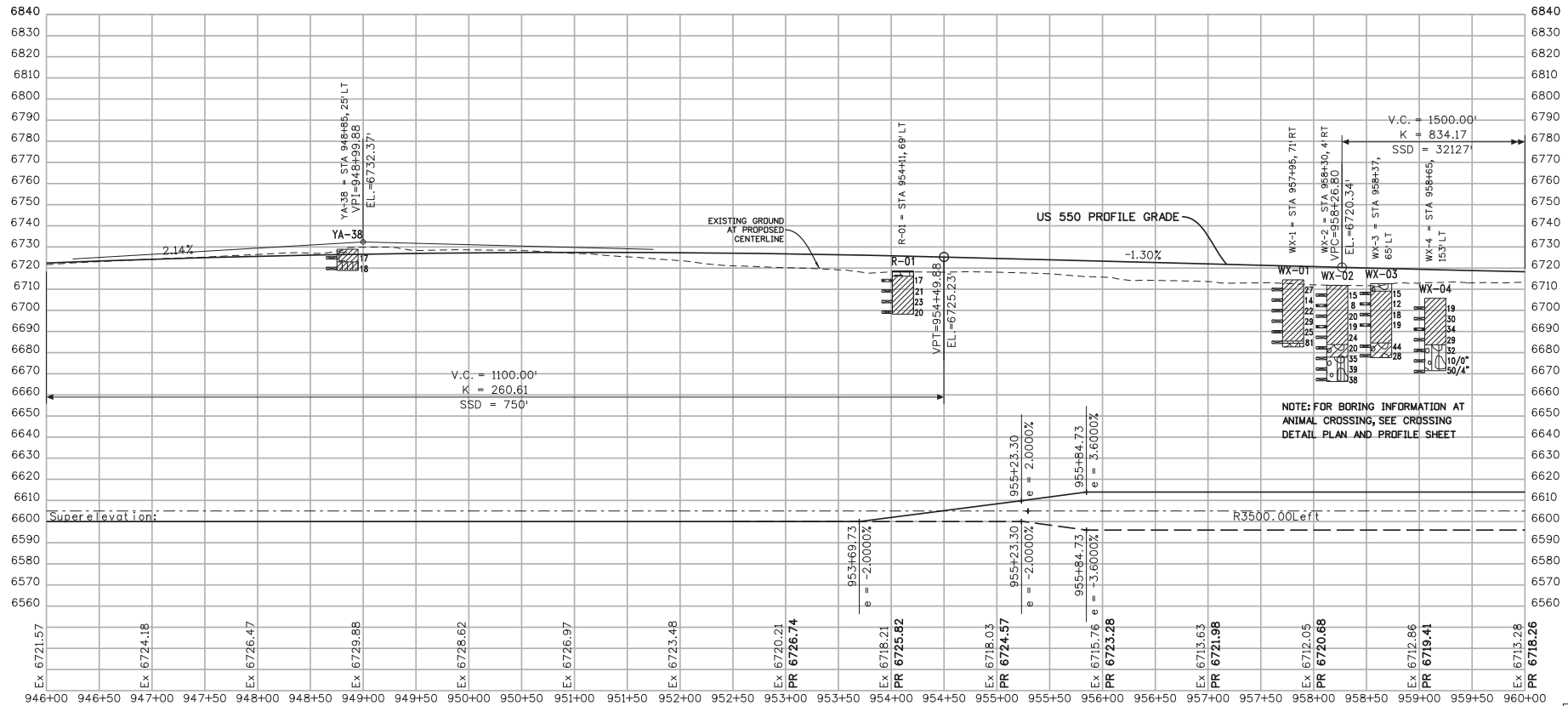


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<div>Yeh and Associates, Inc. Consulting Engineers & Scientists</div>						DRV							



Print Date: 2/20/2019		<div>0000</div>		Sheet Revisions			Colorado Department of Transportation <div> 3803 North Main Avenue Durango, CO 81301 Phone: 970-385-1440 FAX: 970-385-8365 Region 5</div> DRV			As Constructed		US 550 CONNECTION TO US 160 BORING LOCATION PROFILE			Project No./Code	
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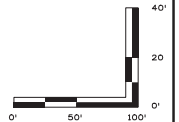
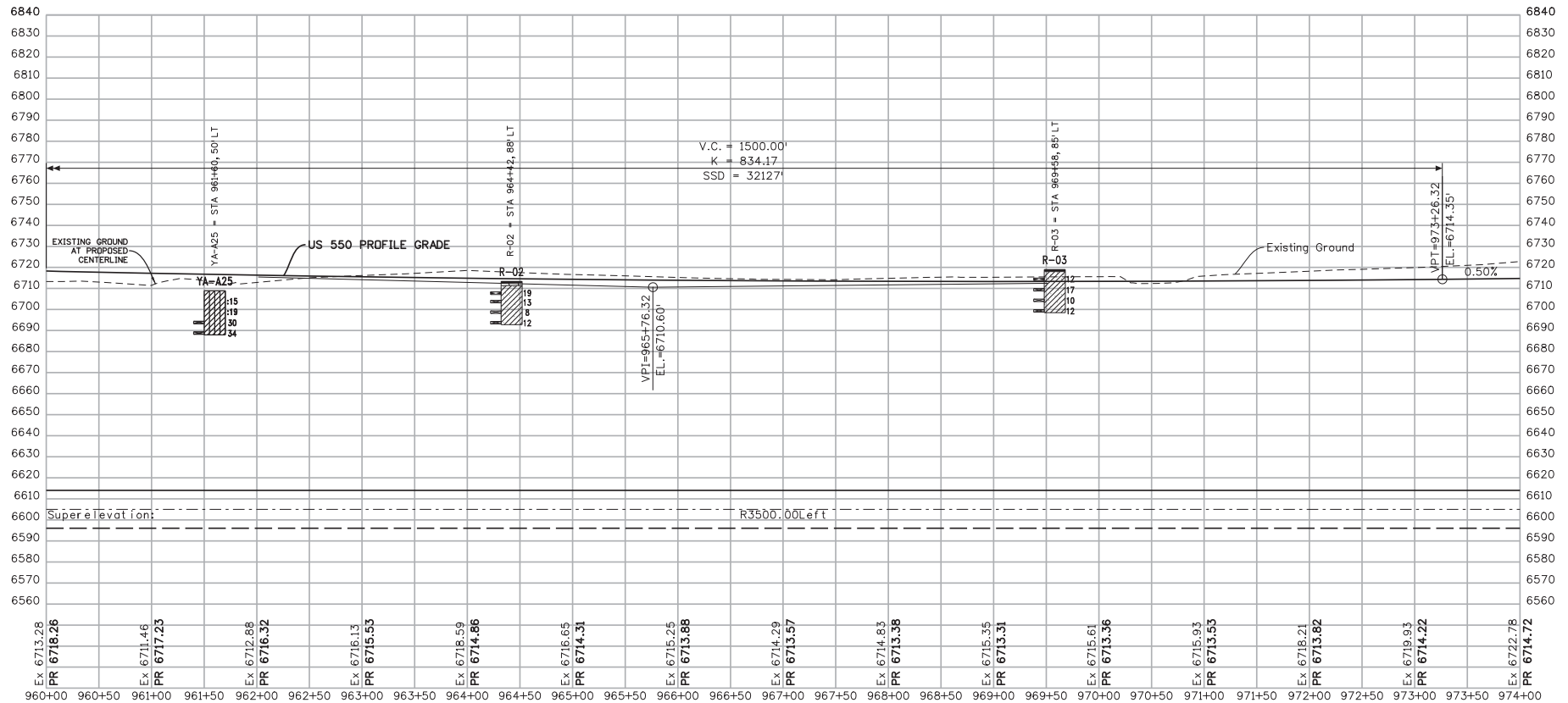
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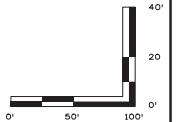
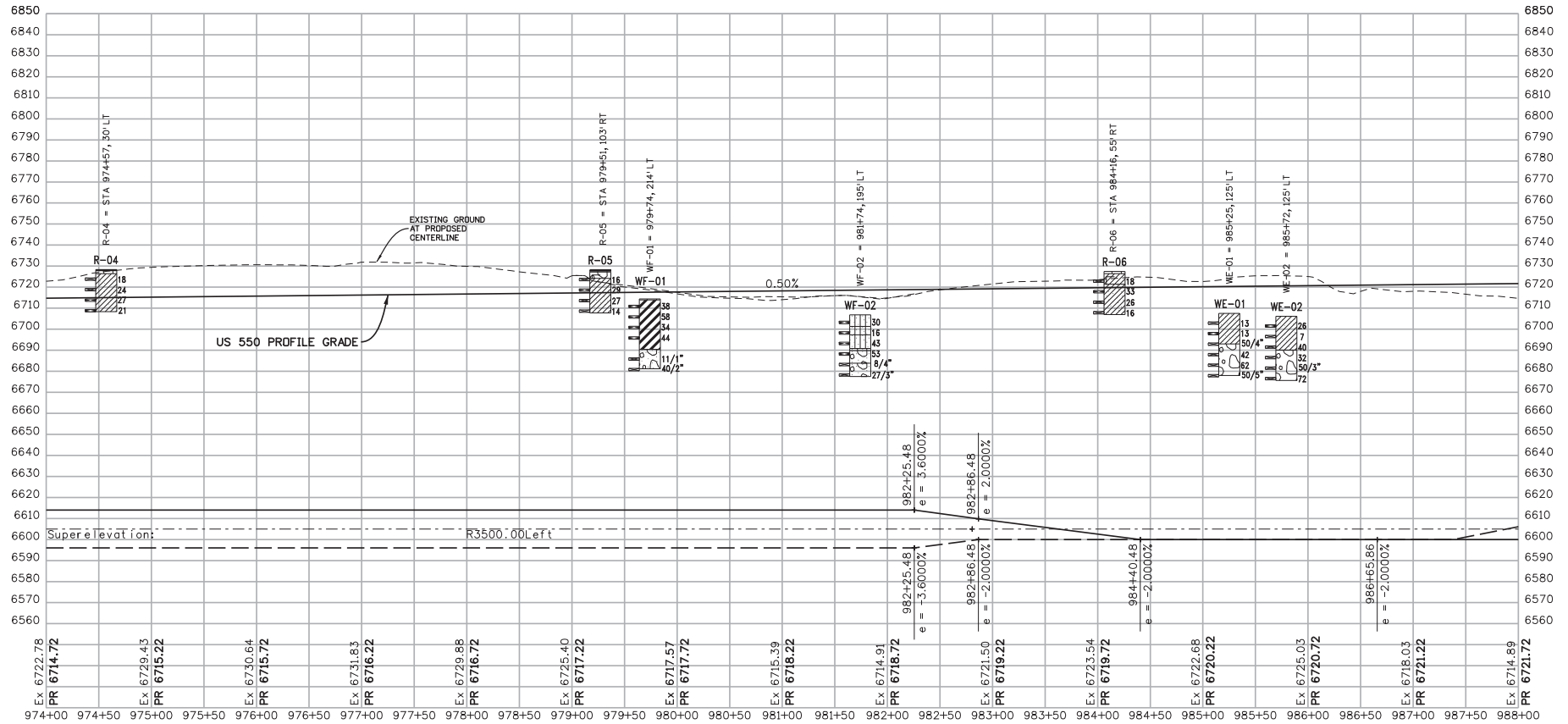
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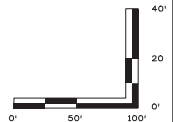
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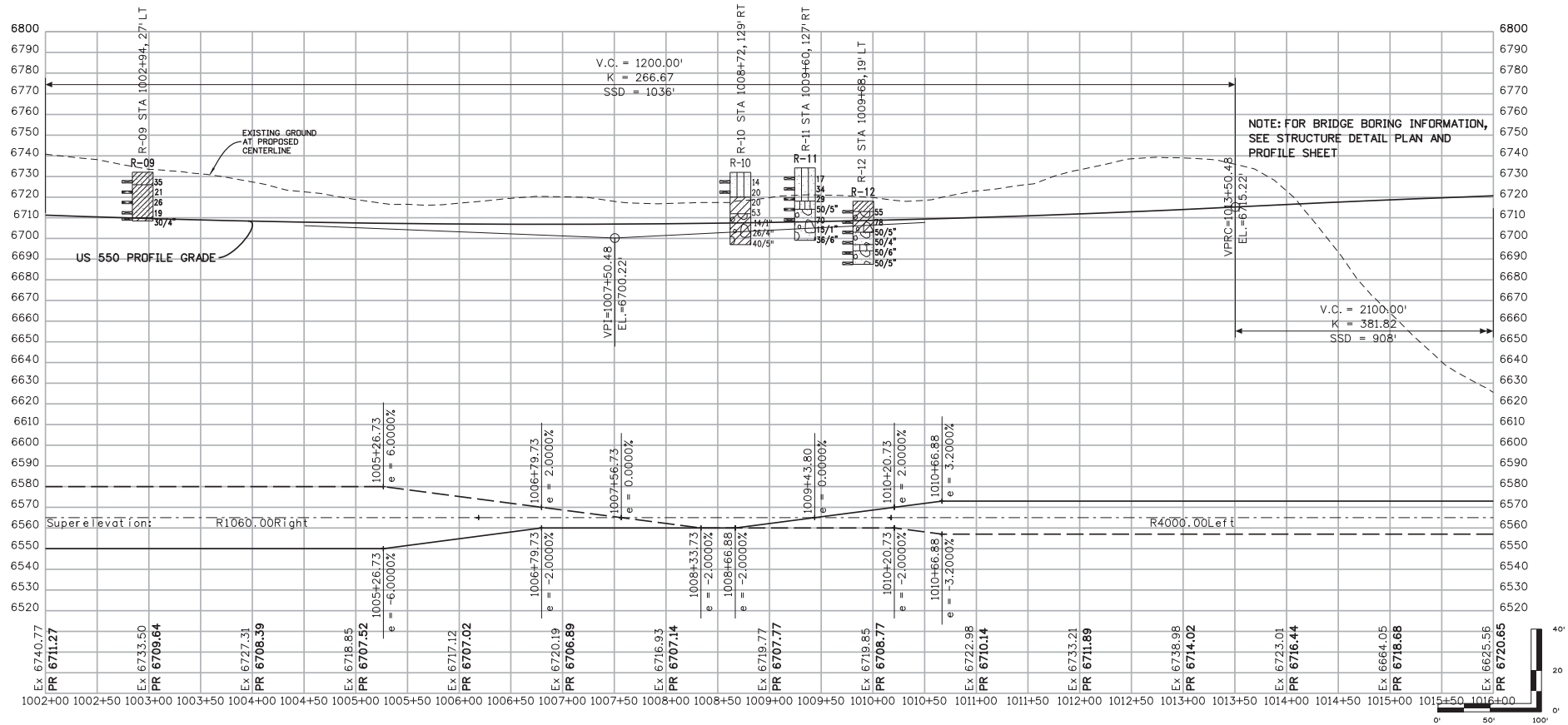
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Yeh and Associates, Inc. Consulting Engineers & Scientists	

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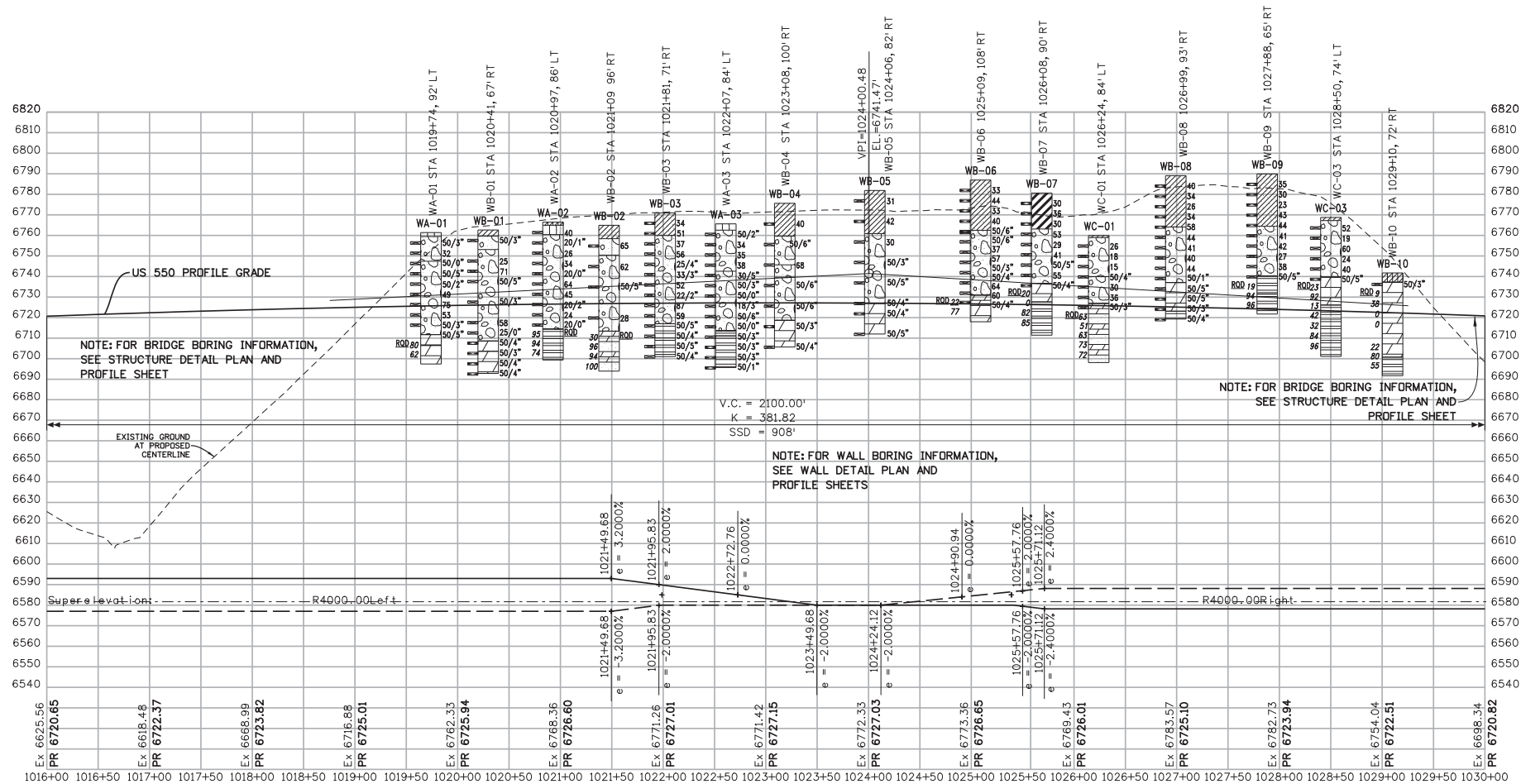
Colorado Department of Transportation

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Durango, CO 81301
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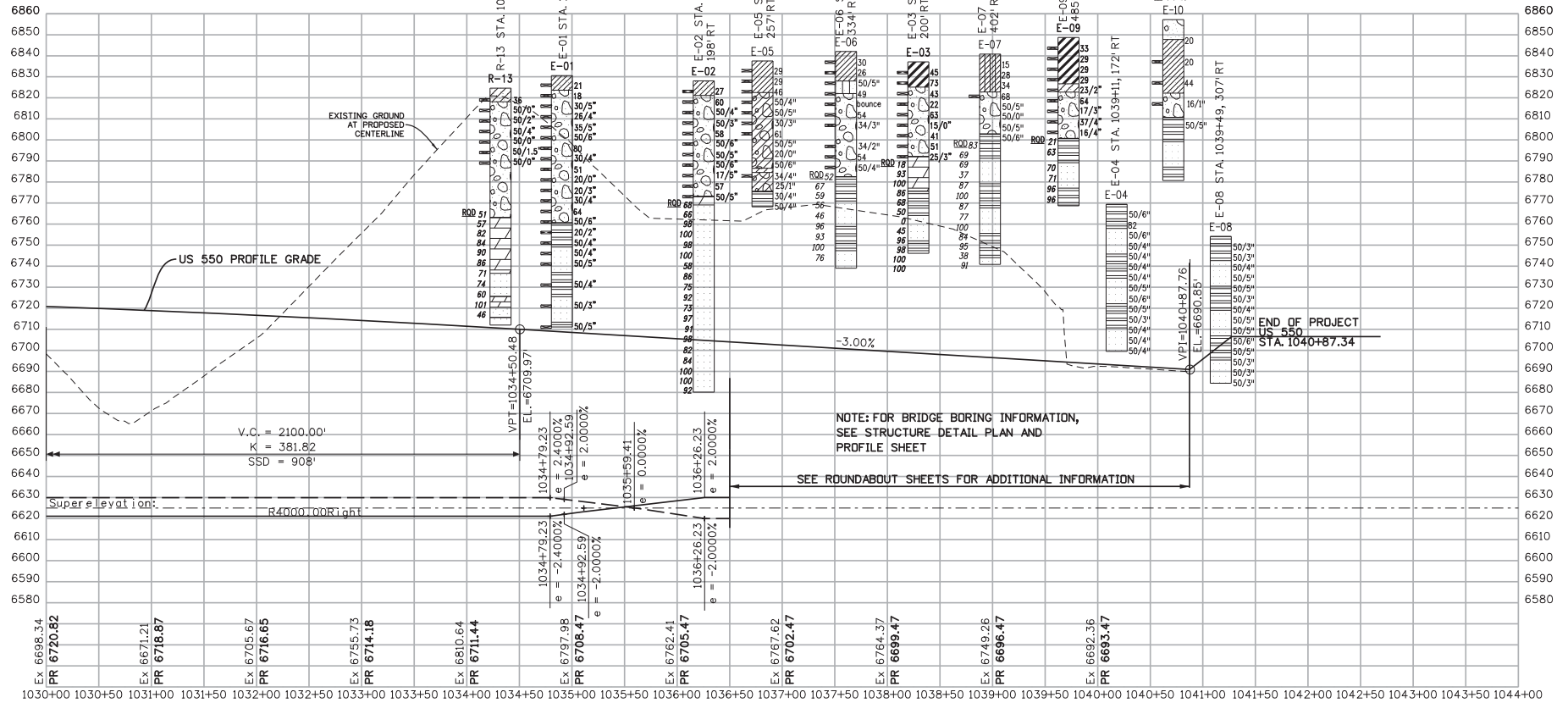
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Date:	Comments	Init.

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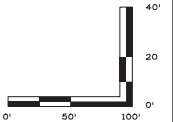
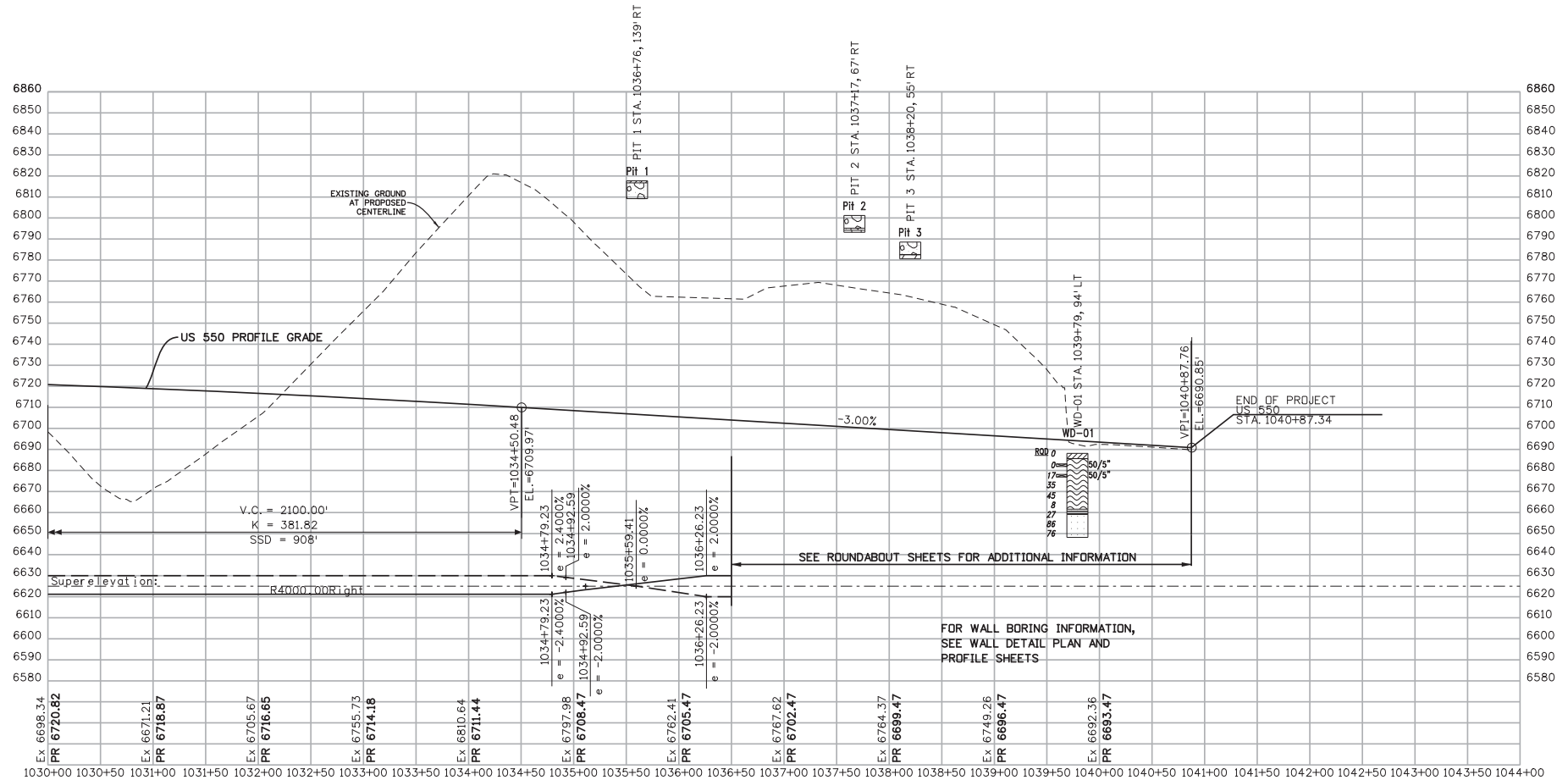
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Appendix C – Structure Engineering Geology Sheets





















C.0	Engineering Geology Legend
C.1	Bridge Engineering Geology Sheets
C.2	Wildlife and Livestock Crossings Engineering Geology Sheets
C.3	Retaining Wall Engineering Geology Sheets

Appendix C.0 – Engineering Geology Legend









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LEGEND

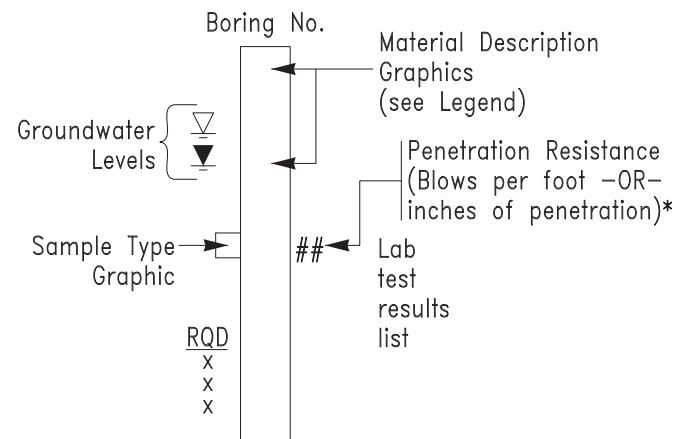
Soil Lithology

 Asphalt	 Fill with Gravel as major soil	 Fill with Clay as major soil	 USCS Low Plasticity Sandy Clay
 USCS Clayey Sand	 USCS Clayey Gravel	 USCS Low Plasticity Sandy Clay	 USCS Poorly-graded Gravel with Clay
 USCS Poorly-graded Sandy Gravel	 USCS Silty Sand	 USCS Low Plasticity Silty Clay	 Boulders and cobbles
 USCS Clayey Sand	 USCS Poorly-graded Gravelly Sand	 USCS Low Plasticity Clay	 USCS Sandy Silt
 USCS Poorly-graded Gravel	 USCS Silt	 USCS Poorly-graded Gravel with Silt	 USCS High Plasticity Clay

Rock Lithology

 Alternating layers of sandstone and shale	 Weathered Bedrock	 Sandstone
 Alternating layers of sandstone and claystone	 CLAYSTONE	 Shale
 Sandy Shale	 Breccia	

TYPICAL BOREHOLE LOG



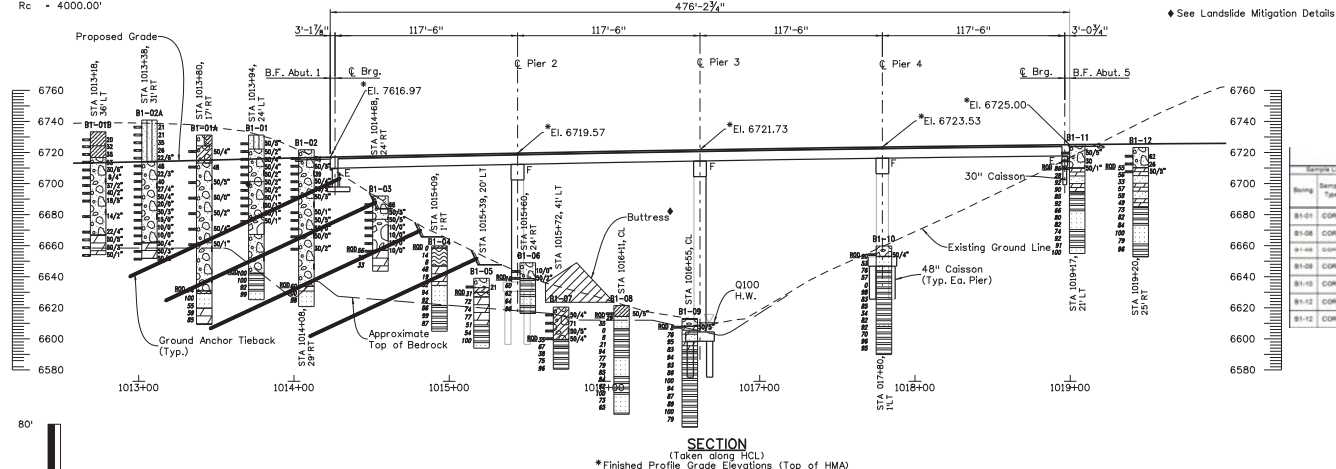
*e.g. A value of 50/3 or 50:3 indicates that 50 blows were applied to the sampler, with a penetration of 3 inches.

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Appendix C.1 – Bridge Engineering Geology Sheets










P.I. = 1016+12.61
Delta = 16° 55' 10" Left
Dc = 1° 25' 57"
Tc = 594.93'
Lc = 1181.19'
Rc = 4000.00'










*Finished Profile Grade Elevations (Top of HMA)

LEGEND

	USCS Silty Sand		USCS Poorly-graded Sandy Gravel		Boulders and cobbles
	USCS Poorly-graded Gravel with Clay		USCS Clayey Gravel		USCS Low Plasticity Sandy Clay
	USCS Clayey Sand				

Rock Lithology

	Alternating layers of sandstone and shale		Weathered bedrock		Sandstone
	CLAYSTONE		Shale		Sandy Shale
	Alternating layers of sandstone and claystone				

Summary of Laboratory Test Results

[illegible]

Print Date: 3/6/2019

File Name: 009_22420_Gulch A_PnP.dgn

Horiz. Scale: 1:80

Staff Bridge Branch - Unit 0221	STW
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Staff Bridge Branch - Unit 0221

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Sheet Revisions

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Date:	Comments	Init.

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BBM

DRV

As Constructed

No Revisions:

Revised:

Void:

STRUCTURE ENGINEERING GEOLOGY
GULCH A BRIDGE

Designer:	TA
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Designer:	TA
Detailer:	LR

Detailer:	LR
Sheet Subset:	EG BRIDGES

Project No./Code

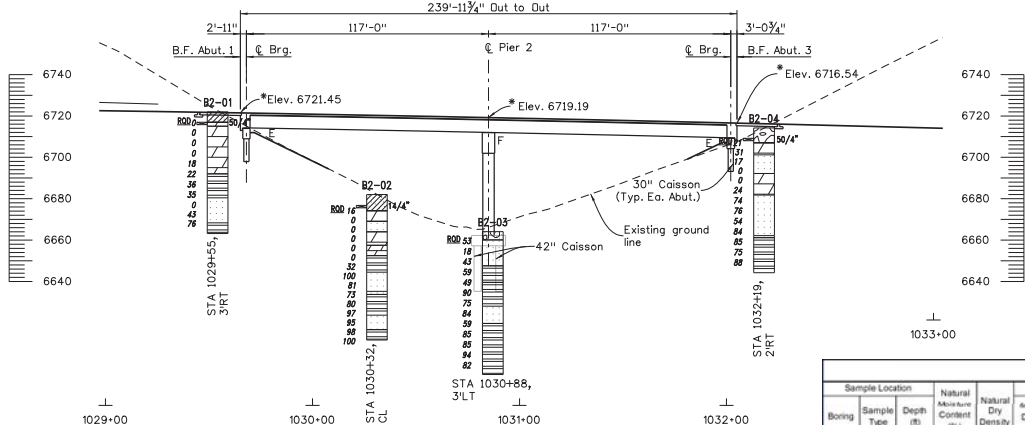
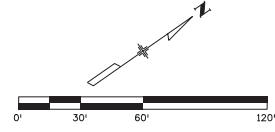
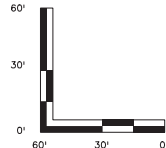
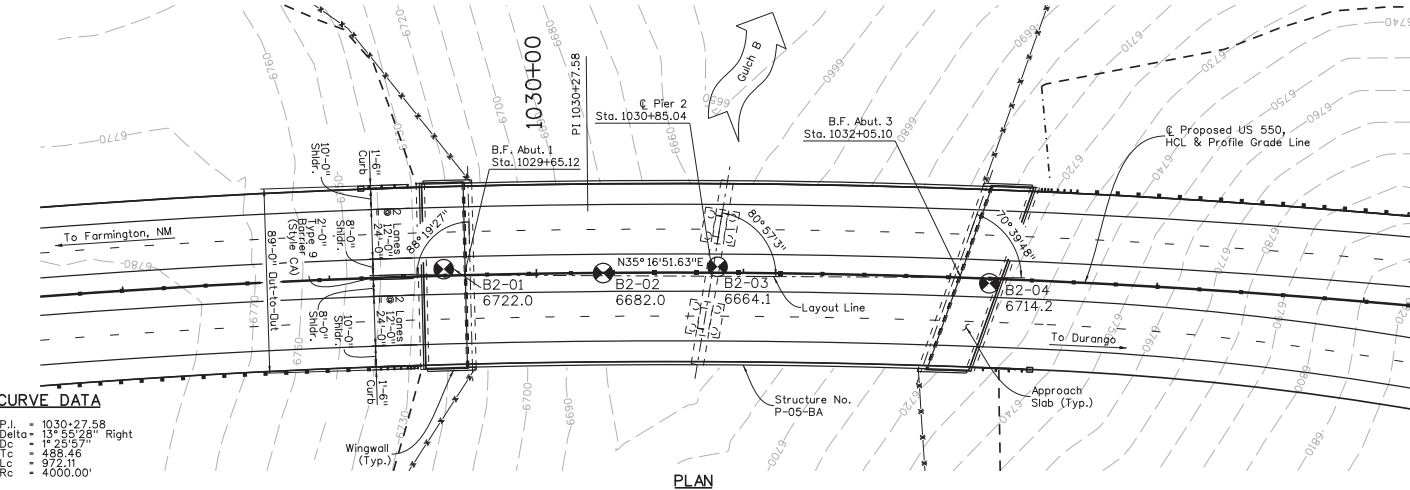
NHPP 5501-029

22420

Sheet Number

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Checked By	MM/YY	MM/YY	MM/YY	MM/YY	MM/YY	MM/YY	MM/YY
Quantity	MM/YY	MM/YY	MM/YY	MM/YY	MM/YY	MM/YY	MM/YY

CURVE DATA
 P.I. = 1030+27.58
 Delta = 13° 54' 26" Right
 P.C. = 1+25+57.9
 P.T. = 1+48+46
 L = 972.11'
 R = 4000.00'



SECTION
 (Taken Along HCL)
 * Finished Profile Grade Elevations (Top of HMA)

LEGEND

	Soil Lithology		
	Rock Lithology		

Summary of Laboratory Test Results																		
Sample Location			Natural Moisture Content (%)	Natural Density (pcf)	AASHTO T99		Gradation		Atterberg		Water	Reactivity	CLASSIFICATION					
Boring	Sample Type	Depth (ft)			Alex. Dry Density (pcf)	Optimum Moisture (%)	Overpass (%)	Sand (%)	Fines #200 (%)	LL	PL	PH	Soluble Sulfate (%)	% Swell (+/-) Consolidation (-)	Uncon-Comp strength (rock-psi)	Uncon-Comp strength (soil-psi)	AASHTO	USCS
B2-01	CORE	25.5-26.0		149.4											2230			
B2-01	CORE	31.5-32.3		151.3											2750			
B2-04	CORE	14.8-15.0		148.3											5400			

Print Date: 3/6/2019
 File Name: 010_22420_Gulch B_PnP.dgn
 Horiz. Scale: 1:60.0002 Vert. Scale: As Noted
 Staff Bridge Branch - Unit 0221 STW

Yeh and Associates, Inc.
 Consulting Engineers & Scientists

Sheet Revisions		
Date:	Comments	Init.

Colorado Department of Transportation
 3803 North Main Avenue
 Durango, CO 81301
 Phone: 970-385-1440 FAX: 970-385-8365
Region 5

As Constructed
 No Revisions:
 Revised:
 Void:

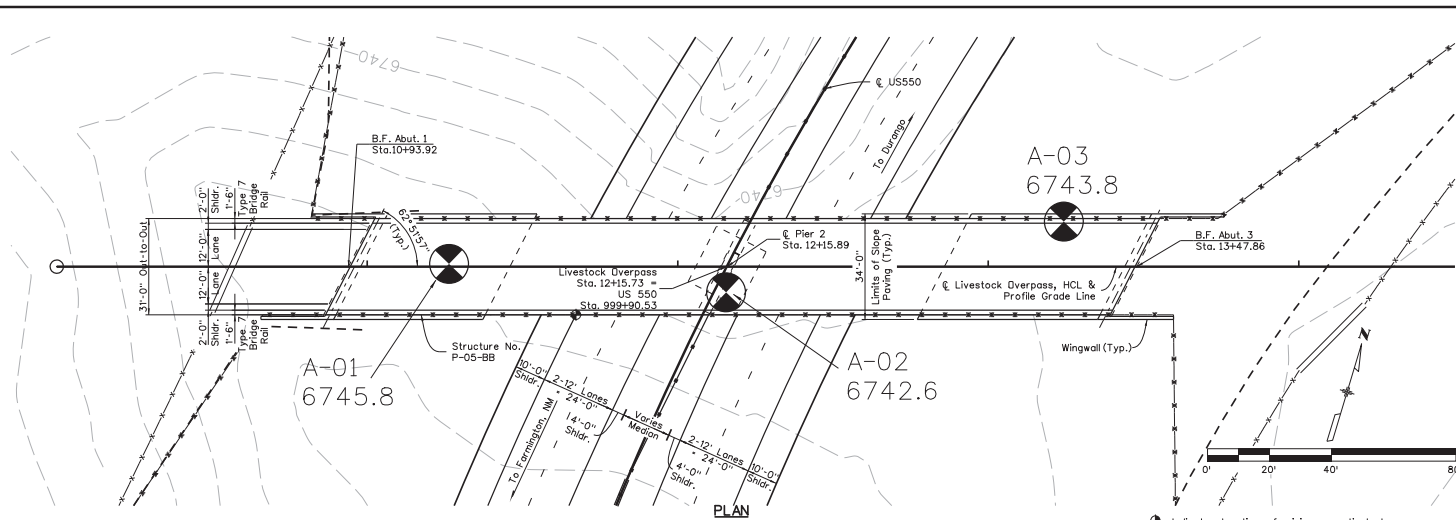
STRUCTURE ENGINEERING GEOLOGY
BRIDGE GULCH B
 Designer: TA
 Detailer: LR
 Sheet Subset: EG_BRIDGE
 Subset Sheets: 10 OF 10

Project No./Code
 NHPP 5501-029
 22420
 Sheet Number



Appendix C.2 – Wildlife and Livestock Crossings Engineering Geology Sheets

Design	Quantity		DATE	INITIAL	DATE	INITIAL
	By	Checked By				
Designed By	XXX	MM/YY	Checked By	XXX	MM/YY	Checked By
Checked By	XXX	MM/YY	Checked By	XXX	MM/YY	Checked By



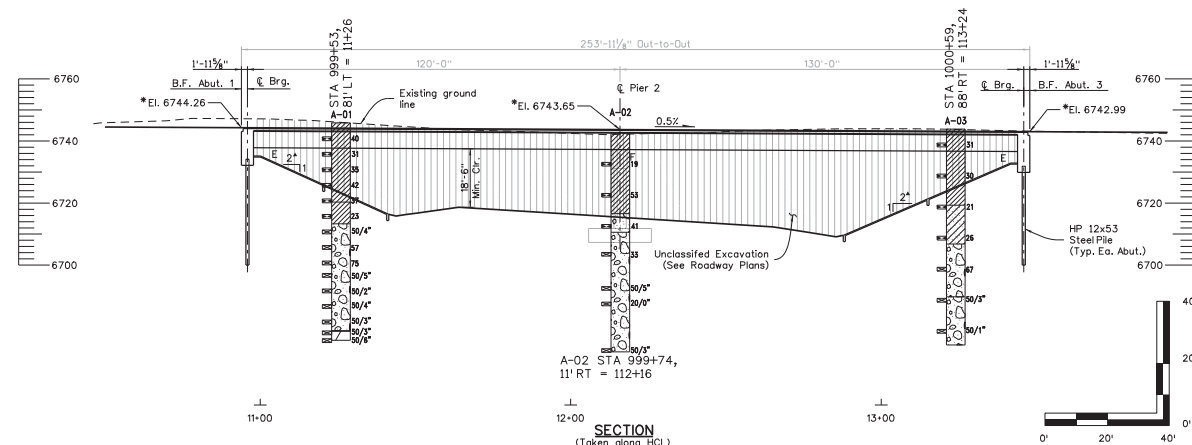
LEGEND

Soil Lithology

- USCS Low Plasticity Clay
- USCS Poorly-graded Sandy Gravel
- USCS Clayey Sand
- USCS Poorly-graded Gravelly Sand

Rock Lithology

- CLAYSTONE



Summary of Laboratory Test Results														
Sample Location		Natural Moisture Content (%)	Natural Dry Density (pcf)	Max Dry Density (pcf)	Optimum Moisture (%)	Gravel (%)	Sand (%)	Fines #200 < 0.075 mm (%)	LL (%)	PL (%)	PI	pH	Water Soluble Sulfate (%)	Chloride (%)
Boring	Sample Type	Depth (ft)												
A-01	bulk	0-9.5	13.1	106.1	19.2	0	20	80	42	21	21			
A-01	MC	9.5	12.2	104.4		0	17	83	40	17	23			
A-01	bulk	10.5-14.5	10.5			0	17	83	40	17	23			
A-01	MC	29.5	8.7	89.2		0	22	78	28	19	9			
A-01	bulk	48.5-53.5	0.6			30	66	4	NV	NP	NP			
A-02	MC	19.5	13.1	85.2		0	11	89	39	24	15			
A-02	bulk	30-32	8.6			5	71	24	NV	NP	NP	8.5	ND	0.0114
A-02	bulk	59.5-64.5	0.4			25	71	4	NV	NP	NP			
A-03	MC	4.5	11.7	113.0										
A-03	bulk	5.5-9.5	11.0			0	19	81	43	20	23			
A-03	bulk	29.5-34.5	7.5			1	56	43	26	22	4			

Print Date: 3/6/2019
File Name: 008.22420.Livestock Overpass.dgn
Horiz. Scale: 1:39,999 Vert. Scale: As Noted
Staff Bridge Branch - Unit 0221 STW

Sheet Revisions		
Date:	Comments	Init.

Colorado Department of Transportation

3803 North Main Avenue
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Region 5

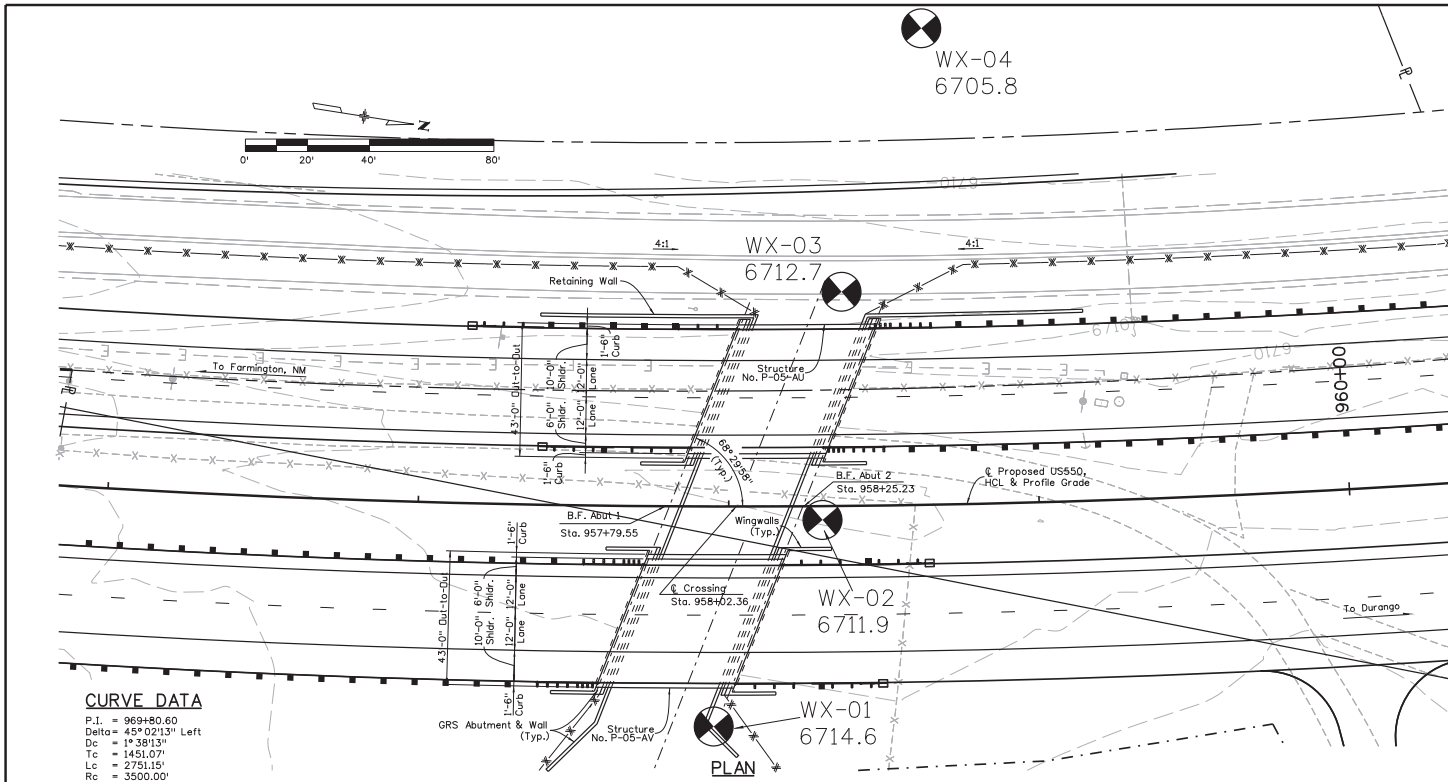
DRV

As Constructed		STRUCTURE ENGINEER GEOLOGY LIVESTOCK OVERPASS		Project No./Code	
No Revisions:		Designer: TA		NHPP 5501-029	
Revised:		Detailer: LR		22420	
Void:		Sheet Subset: EG_XING		Sheet Number	

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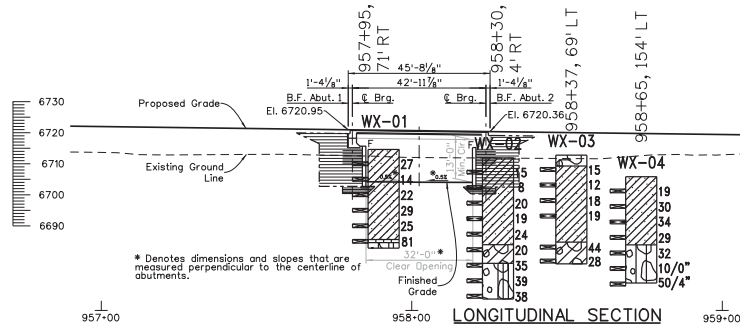


Design	Check	Initial	Date	Quantity	Initial	Date
Designed By	XXX	MM/YY	Checked By	XXX	MM/YY	Checked By
Checked By	XXX	MM/YY	Checked By	XXX	MM/YY	Checked By



CURVE DATA
P.I. = 969+80.60
Delta = 45° 02' 13" Left
Dc = 1° 38' 13"
Tc = 1451.07'
Lc = 2751.15'
Rc = 3500.00'

LEGEND



Summary of Laboratory Test Results														
Sample Location	Soil Type	Natural Moisture Content (%)	Natural Dry Density (pcf)	Max Dry Density (pcf)	Optimum Moisture (%)	Gravel > #4 (%)	Fines < #200 (%)	LL (%)	PL (%)	PI (%)	Water Soluble Sulfate (%)	Chloride (%)	% Swell (1% Consolidation)	Resistivity (Ohm-cm)
WX-01	SS	9.5	8.9		0	12	86	32	19	13				
WX-01	bulk	19-24	11.3		0	19	81	29	15	14				
WX-01	SS	29	13.1		0	39	61	NV	NP	NP				
WX-02	MC	19	17.2	109.3									0.1	
WX-02	bulk	34-39	3.5		56	34	10	NV	NP	NP				
WX-03	MC	9	19.3	106.2		0	6	94	34	16	18			
WX-03	MC	19	17.8	109.5										
WX-04	MC	14	11.2	111.4									0.3	
WX-04	bulk	24-29	3.7		44	42	14	NV	NP	NP				

Print Date: 3/6/2019
File Name: 007_22420_Wildlife Underpass B.dgn
Horiz. Scale: 1:40 Vert. Scale: As Noted
Staff Bridge Branch - Unit 0221 STW

Sheet Revisions		
Date:	Comments	Init.

Colorado Department of Transportation
3803 North Main Avenue
Durango, CO 81301
Phone: 970-385-1440 FAX: 970-385-8365
Region 5 DRV

As Constructed	STRUCTURE ENGINEERING GEOLOGY		Project No./Code
No Revisions:	WILDLIFE UNDERPASS B		NHPP 5501-029
Revised:	Designer: TA	Structure: P-05-AU	22420
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	Sheet Subset: EG_XING	Subset Sheets: 7 OF 10	Sheet Number

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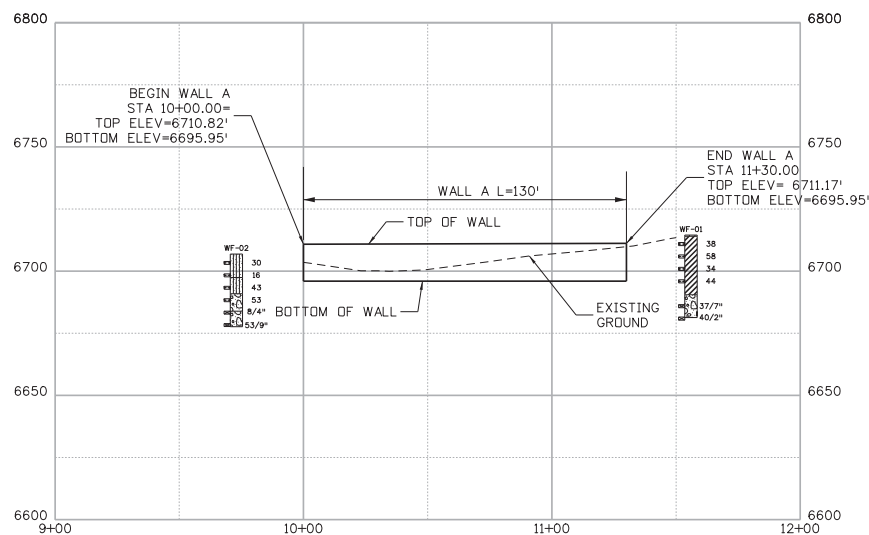
Appendix C.3 – Retaining Wall Engineering Geology Sheets

E:2318-09-44

CR-SEP-2100-ET





Summary of Laboratory Test Results

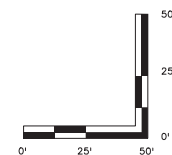
Sample Location		Natural Moisture (%)	Natural Density (pcf)	ANISTO TSP Dry Density (pcf)	Optimum Moisture (%)	Grave Water Content (%)	Standard Deviation	Fines < #200 (%)	L.L.	P.L.	PH	Water Solubility (pcf)	% Bound Chloride (%)	Residual Chloride (%)	Unconf. Comp. strength (psi)	Unconf. Comp. strength (ksi)	CLASSIFICATION	
Group	Sample Type	Depth (ft)															ASTM	USCS
WF-01	MC	6	13.1	1166									4.3					
WF-01	Bulk	8-13	10.8			0	15	85	50	12	38						A-7.6 (32)	OH
WF-02	MC	3	13.8	1017									-0.6					
WF-02	MC	6	9.4			0	24	76	31	23	8						A-4 (5)	M



LEGEND

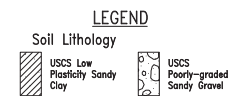
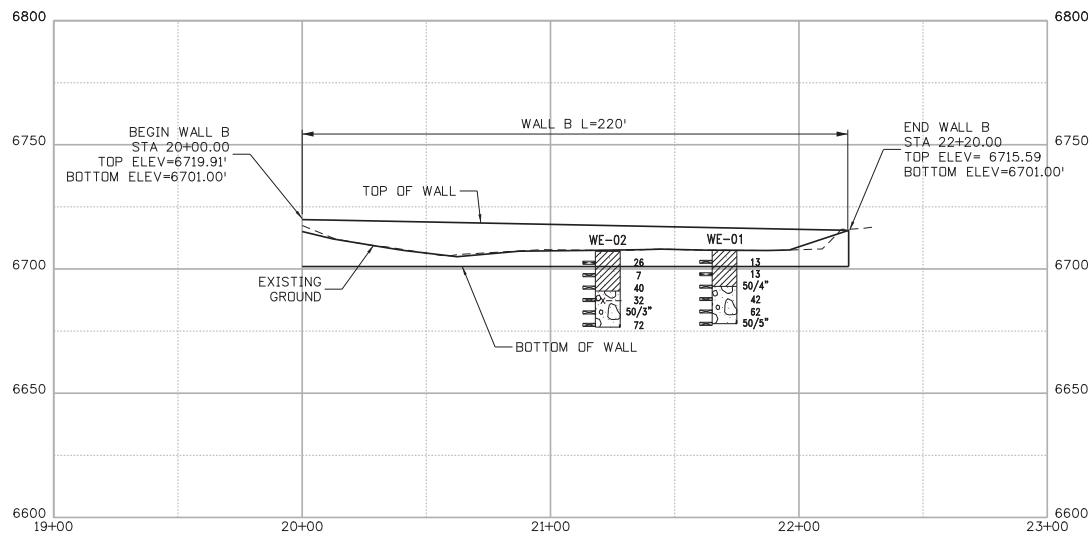
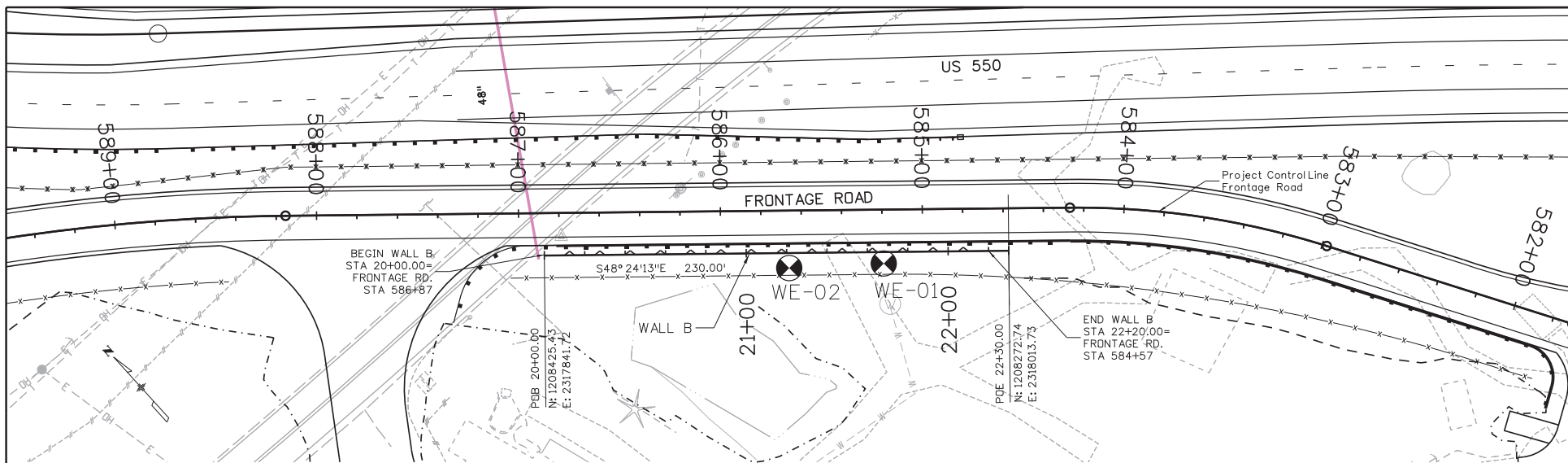
Soil Lithology

	Fill with Gravel as major soil		USCS High Plasticity clay		USCS Poorly-graded Sandy Gravel
	USCS Sandy Silt				

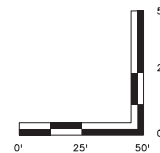


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Designer:	TA	Structure Numbers																																										
Detailer:	LR																																											
Sheet Subset:	EG-WALLS	Subset Sheets: 1 of 10																																										
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Unit Information Unit Leader Initials																																												

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Summary of Laboratory Test Results																
Sample Location		Natural Moisture Content (%)		Atterberg Limits		Gradation		After Sieve		Water Retention		Compaction		Classification		
Boring	Sample Type	Depth (ft)	Natural Moisture Content (%)	Natural Dry Density (pcf)	Max. Dry Density (pcf)	Optimum Moisture (%)	Gravel > #4 (%)	Sand (#4 - #200) (%)	Fines < #200 (%)	LL	PL	PI	pH	Water Retention Surface (%)	Chromate (%)	% Swell (+/-) Consolidation (s)
WE-01	SS	4.0	7.6				0	26	72	26	18	8				
WE-01	bulk	4-9	14.9				0	16	84	29	19	10	8.5	0.004	0.00784	1000
WE-01	MC	9	14.8	107.4											-0.2	
WE-01	bulk	10-24	1.8				58	34	8	NV	NP	NP				
WE-02	bulk	9-14	18.4				0	26	74	33	15	16				
														A-1-a (0)	GP-GM	
														A-6 (11)	CL	



Print Date: 3/6/2019
File Name: 002_22420_Wall_B_Pnp.dgn
Horiz. Scale: 1:50
Unit Information
Unit Leader Initials

Sheet Revisions		
Date:	Comments	Init.

Colorado Department of Transportation

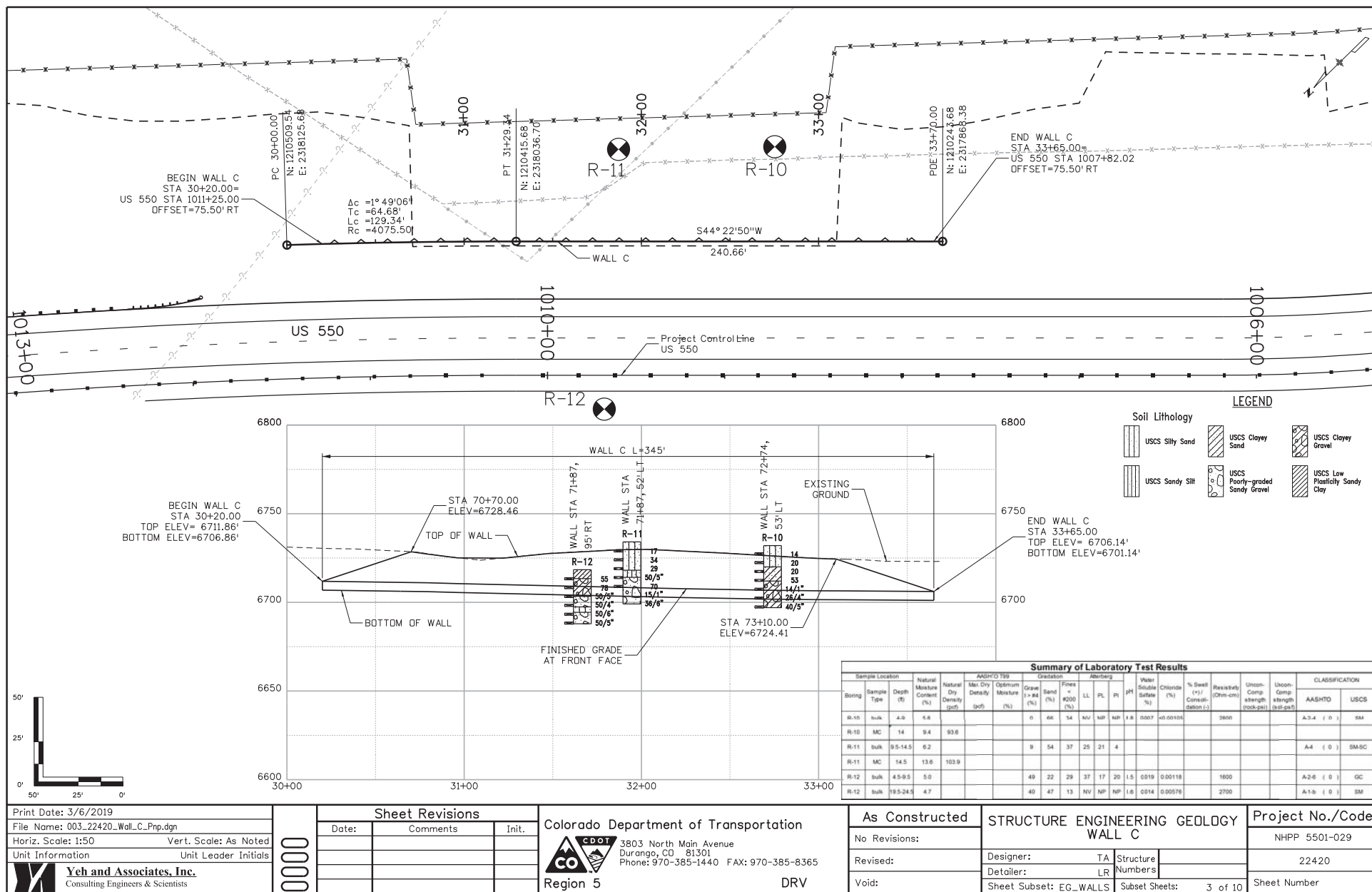
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Durango, CO 81301
Phone: 970-385-1440 FAX: 970-385-8365

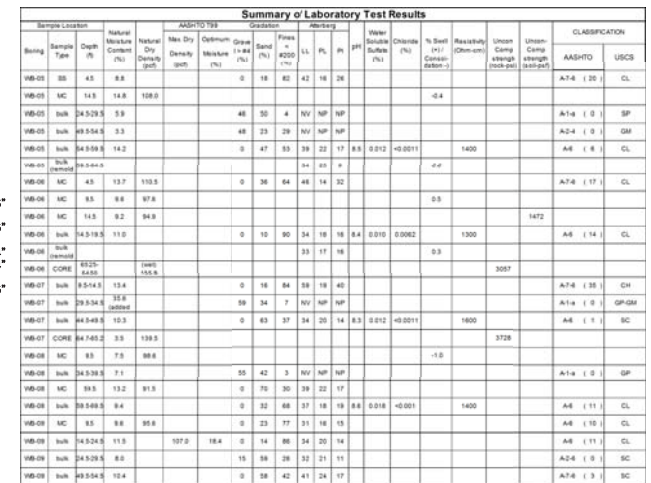
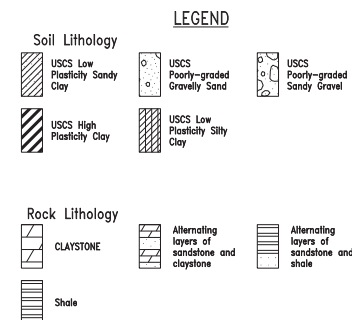
Region 5

DRV

As Constructed	STRUCTURE ENGINEERING GEOLOGY	Project No./Code
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Revised:	Designer: TA	22420
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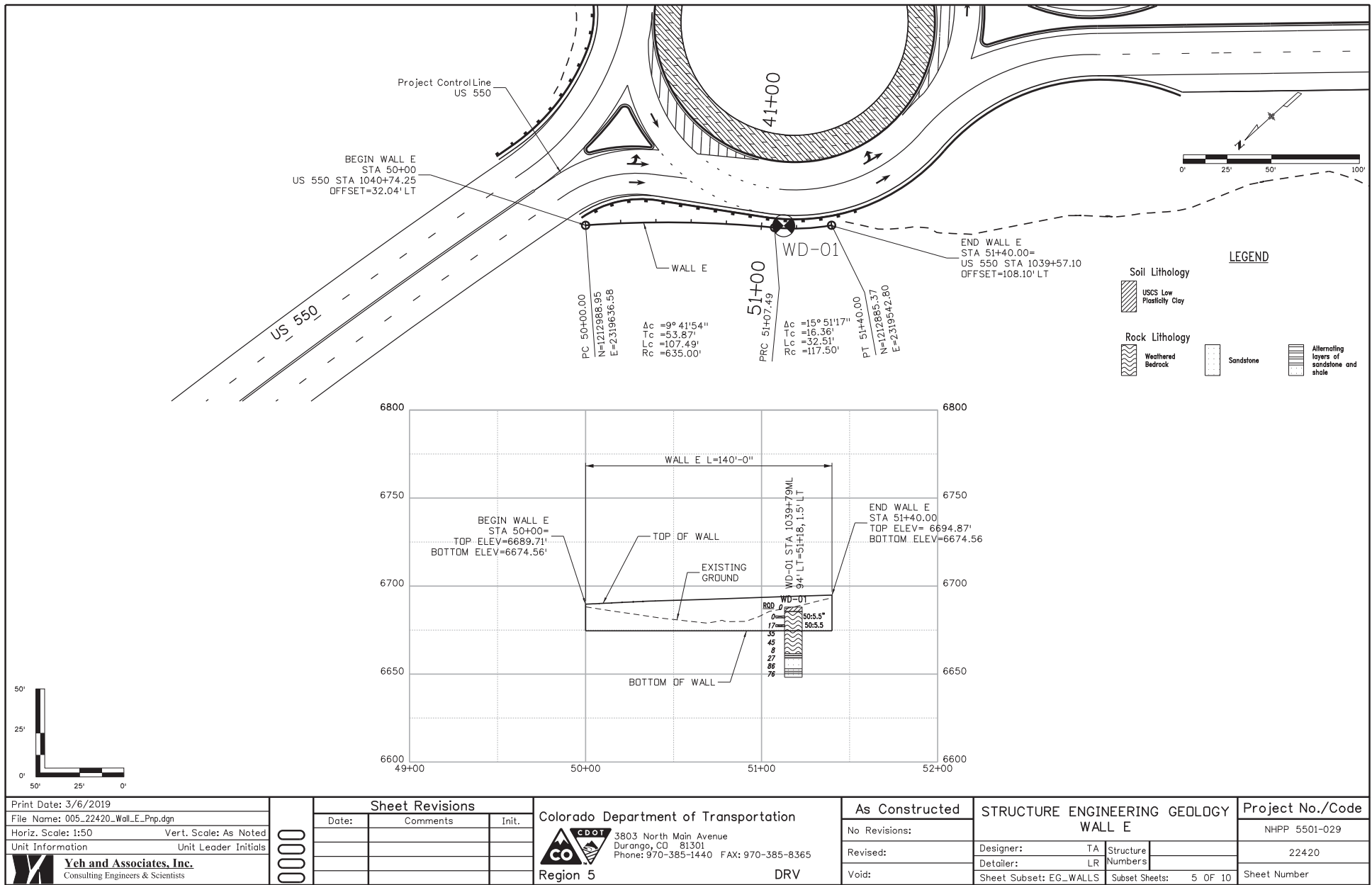
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Project No./Code
NHPP 5501-029
22420
Sheet Number

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Appendix D – Boring Logs

D.0	Boring Log Legend
D.1	Roadway and Excavation Boring Logs
D.2	Gulch A Bridge (Bridge 1) Boring Logs
D.3	Gulch B Bridge (Bridge 2) Boring Logs
D.4	Livestock/Wildlife Overpass (A) Boring Logs
D.5	Wildlife Underpass A (WX2) Boring Logs
D.6	Wildlife Underpass B (WX) Boring Logs
D.7	Retaining Walls A, B, C, D, E, F and G Boring Logs
D.8	Test Pits 1, 2 and 3 Logs

Appendix D.0 – Boring Log Legend

Legend for Symbols Used on Borehole Logs

Sample Types



Auger Cuttings



Standard Penetration Test (ASTM D1586)



Rock Core



Excavator trench or test pit



Modified California Sampler (2.5 inch OD, 2.0 inch ID)



ODEX/Downhole Hammer

Lithology Symbols (see Boring Logs for complete descriptions)



Asphalt



USCS Low Plasticity Silty Clay



USCS Clayey Gravel



USCS Poorly-graded Sandy Gravel



USCS Clayey Sand



Claystone



Sandy Shale



Boulders and cobbles



USCS Low Plasticity Sandy Clay



USCS Silty Gravel



USCS Silt



USCS Silty Sand



Sandstone



Shale



USCS High Plasticity Clay



Fill with Clay as major soil



USCS Poorly-graded Gravel



USCS Sandy Silt



USCS Poorly-graded Gravelly Sand



Interbedded claystone and sandstone



Weathered Bedrock



USCS Low Plasticity Clay



Fill with Gravel as major soil



USCS Poorly-graded Gravel with Silt



Interbedded claystone and sandstone



Alternating layers of sandstone and shale

Lab Test Standards

Moisture Content	ASTM D2216
Dry Density	ASTM D7263
Sand/Fines Content	ASTM D421, ASTM C136, ASTM D1140
Atterberg Limits	ASTM D4318
AASHTO Class.	AASHTO M145, ASTM D3282
USCS Class.	ASTM D2487
(Fines = % Passing #200 Sieve)	
Sand = % Passing #4 Sieve, but not passing #200 Sieve)	

Other Lab Test Abbreviations

pH	Soil pH (AASHTO T289-91)
S	Water-Soluble Sulfate Content (AASHTO T290-91, ASTM D4327)
Chl	Water-Soluble Chloride Content (AASHTO T291-91, ASTM D4327)
S/C	Swell/Consolidation (ASTM D4546)
UCCS	Unconfined Compressive Strength (ASTM D2166)
R-Value	Resistance R-Value (ASTM D2844)
DS (C)	Direct Shear cohesion (ASTM D3080)
DS (phi)	Direct Shear friction angle (ASTM D3080)
Re	Electrical Resistivity (AASHTO T288-91)
PtL	Point Load Strength Index (ASTM D5731)

Notes

- "Penetration Resistance" on the Boring Logs refers to the uncorrected N value for SPT samples only, as per ASTM D1586. For samples obtained with a Modified California sampler, drive depth is 12 inches, and "Penetration Resistance" refers to the sum of all blows. Where blow counts were > 50 for the 3rd increment (SPT) or 2nd increment (MC), "Penetration Resistance" combines the last and 2nd-to-last blows and lengths; for other increments with > 50 blows, the blows for the last increment are reported.
- The Modified California sampler used to obtain samples is a 2.5-inch OD, 2.0-inch ID (1.95-inch ID with liners), split-barrel sampler with internal liners, as per ASTM D3550. Sampler is driven with a 140-pound hammer, dropped 30 inches per blow.
- "ER" for the hammer is the Reported Calibrated Energy Transfer Ratio for that specific hammer, as provided by the drilling company.

Appendix D.1 – Roadway and Excavation Boring Logs



PAGE
1 of 1

Boring No.: **R-01**

Symbol			
Depth	-	-	-
Date	-	-	-

[illegible]



PAGE
1 of 1

Boring No.: R-02

Weather Notes:

Inclination from Horiz.: Vertical

Coordinates: N: E:

Location: Sta. 964+42, 88' L

Night Work: ☐

Drill Rig: CME 750 Buggy Rig

Logged By: B. Bunker

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
--------	-------	------

pro

•

•

[illegible]

Boring Began: 1/16/2017

Total Depth: 20.5 ft

Weather Notes:

Boring Completed: 1/16/2017

Ground Elevation: 6719.1 ft

Inclination from Horiz.: Vertical

Drilling Method(s): Hollow-Stem Auger

Coordinates: N: E:

Driller: Authentic Drilling

Location: Sta. 969+58, 85' L

Night Work: ☐

Drill Rig: CME 750 Buggy Rig

Hammer: Automatic (hydraulic), ER: 97%

Logged By: B. Bunker

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
--------	-------	------

[illegible]

Project Number: 217-376

Boring No.: R-04

Boring Began: 1/16/2018

Total Depth: 20.0 ft

Weather Notes:

Boring Completed: 1/16/2018

Ground Elevation: 6728.5 ft

Inclination from Horiz.: Vertical

Drilling Method(s): Hollow-Stem Auger

Coordinates: N: E:

Driller: Authentic Drilling

Location: Sta. 974+57, 30' L

Night Work: ☐

Drill Rig: CME 750 Buggy Rig

Logged By: B. Bunker

Hammer: Automatic (hydraulic), ER: 97%

Final By: B. Bunker

Groundwater Levels:

Symbol			
Depth	-	-	-
Date	-	-	-

[illegible]



PAGE
1 of 1

Boring No.: R-05

Weather Notes:

Inclination from Horiz.: Vertical

Coordinates: N: E:

Location: Sta. 979+51, 103,R

Night Work: ☐

Drill Rig: CME 750 Buggy Rig

Logged By: B. Bunker

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
1	10	10/10/10
2	20	20/20/20
3	30	30/30/30
4	40	40/40/40
5	50	50/50/50
6	60	60/60/60
7	70	70/70/70
8	80	80/80/80
9	90	90/90/90
10	100	100/100/100

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[illegible]



Boring Began: 1/17/2018

Total Depth: 20.5 ft

Weather Notes:

Boring Completed: 1/17/2018

Ground Elevation: 6727.5 ft

Inclination from Horiz.: Vertical

Drilling Method(s): Hollow-Stem Auger

Coordinates: N: E:

Driller: Authentic Drilling

Location: Sta. 984+16, 55' R

Night Work: ☐

Drill Rig: CME 750 Buggy Rig

Hammer: Automatic (hydraulic), ER: 97%

Logged By: B. Bunker

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6725	5		5-8-10	18		0.0 - 1.0 ft. Shouldering material.	15.5		0	15	85	38	21	A-6 (17) CL	pH=7.6 S=0.02% Chl=0.106% Re=340ohm-cm S/C=3.9% Calcium deposits at 10 ft More sand content at 17 ft
						1.0 - 6.0 ft. CLAY with some sand, dark brown, moist, very stiff.									
6720	10		11-22	33		6.0 - 20.5 ft. CLAY with some sand, red-brown, moist, very stiff.	13.5	117.9							
6715	15		10-12-14	26											
6710	20		7-8-8	16											
Bottom of Hole at 20.5 ft.															
6705															
6700															
6695															



Boring Began: 11/16/2017

Total Depth: 21.5 ft

Weather Notes:

Boring Completed: 11/16/2017

Ground Elevation: 6733.1 ft

Inclination from Horiz.: Vertical

Drilling Method(s): Hollow-Stem Auger

Coordinates: N: E:

Driller: Authentic Drilling

Location: Sta. 995+13, 11' L

Night Work: ☐

Drill Rig: CME 750 Buggy Rig

Hammer: Automatic (hydraulic), ER: 97%

Logged By: B. Bunker

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6730	5		8-10-12	22		0.0 - 21.0 ft. CLAY with some sand, tan, damp, very stiff to hard.									
6725	10		14-16	30											
6720	15		16-24	40			6.6		1	20	79	38	22	A-6 (16) CL	R-Value Sample: 15'-20' R-Value=18 Calcite Vening at 12 ft S/C=1.1%
6715	20		15-26/5"	26/5"			9.8	107.0							
6710						21.0 - 21.5 ft. clayey GRAVEL, brown, damp, very dense. Bottom of Hole at 21.5 ft.									No movement in final 10 blows. Drive terminated
6705															
6700															



Boring Began: 11/16/2017

Total Depth: 23.5 ft

Weather Notes:

Boring Completed: 11/16/2017

Ground Elevation: 6732.0 ft

Inclination from Horiz.: Vertical

Drilling Method(s): Hollow-Stem Auger

Coordinates: N: E:

Driller: Authentic Drilling

Location: Sta. 1002+94, 27' L

Night Work: ☐

Drill Rig: CME 750 Buggy Rig

Hammer: Automatic (hydraulic), ER: 97%

Logged By: B. Bunker

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6730	5	X	15-18-17	35		0.0 - 6.0 ft. CLAY with some sand, red-brown to white-brown, damp, hard.									Calcite Veining at 3 ft
6725	10	X	10-11	21		6.0 - 22.0 ft. CLAY with some sand, tan, dry to moist, very stiff.									
6720	15	X	15-11	26											
6715	20	X	8-10-9	19			4.4		1	28	71	27	10	A-4 (5) CL	R-Value Sample: 9'-19' R-Value=22 pH=8.4 S=0.027% Chl=0.00647% Re=1300ohm·cm
6710		X	37-30/4"	30/4"		22.0 - 23.5 ft. clayey SAND with some gravel, very dense.	6.4		22	37	41	32	17	A-6 (3) SC	No movement in final 10 blows. Drive terminated
Bottom of Hole at 23.5 ft.															
6705															
6700															



Boring Began: 11/16/2017

Total Depth: 35.0 ft

Weather Notes:

Boring Completed: 11/17/2017

Ground Elevation: 6732.0 ft

Inclination from Horiz.: Vertical

Drilling Method(s): Hollow-Stem Auger

Coordinates: N: E:

Driller: Authentic Drilling

Location: Sta. 1008+72, 129' R

Night Work: ☐

Drill Rig: CME 750 Buggy Rig

Hammer: Automatic (hydraulic), ER: 97%

Logged By: B. Bunker

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6730						0.0 - 12.0 ft. silty SAND, tan, damp, medium dense.									
	5		7-8-6	14											
6725							5.8		0	66	34	NV	NP	A-2-4 (0) SM	pH=8.8 S=0.007% Re=2800ohm·cm
	10		11-10-10	20											
6720						12.0 - 20.0 ft. sandy CLAY, brown, damp, very stiff to hard.									
	15		8-12	20			9.4	93.6							
6715															
	20		18-35	53											
6710						20.0 - 35.0 ft. clayey GRAVEL sandy, gray brown, moist, very dense.									
	25		44-14/1"	14/1"											
6705															
	30		26/4"	26/4"											
6700															
			17-40/5"	40/5"											

Bottom of Hole at 35.0 ft.



Boring Began: 11/18/2017

Total Depth: 35.0 ft

Weather Notes:

Boring Completed: 11/18/2017

Ground Elevation: 6734.1 ft

Inclination from Horiz.: Vertical

Drilling Method(s): Hollow-Stem Auger

Coordinates: N: E:

Driller: Authentic Drilling

Location: Sta. 1009+60, 127' R

Night Work: ☐

Drill Rig: CME 750 Buggy Rig

Hammer: Automatic (hydraulic), ER: 97%

Logged By: B. Kunz

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6730	5		8-8-9	17		0.0 - 16.0 ft. silty SAND trace gravel, brown, dry, medium dense.									
6725	10		10-15-19	34											
6720	15		16-13	29			6.2		9	54	37	25	4	A-4 (0) SM-SC	
6715	20		50/5"	50/5"		16.0 - 20.0 ft. SILT with some sand, dark brown, dry, very dense.	13.6	103.9							
6710	25		47-36-34	70		20.0 - 35.0 ft. sandy GRAVEL with some cobbles, gray, dry, very dense.									
6705	30		15/1"	15/1"											No movement in 10 blows. Drive terminated
6700			36/6"	36/6"											No movement in 10 blows. Drive terminated

Bottom of Hole at 35.0 ft.

Boring Began: 12/1/2017

Total Depth: 30.5 ft

Weather Notes:

Boring Completed: 12/1/2017

Ground Elevation: 6718.0 ft

Inclination from Horiz.: Vertical

Drilling Method(s): Hollow-Stem Auger /

Coordinates: N: E:

ODEX

Location: Sta. 1009+68, 19' L

Night Work: ☐

Driller: Authentic Drilling

Logged By: E. Pickerill

Drill Rig: Acker Renegade Track

Hammer: Automatic (hydraulic), ER: 96%

Final By: B. Bunker

Groundwater Levels:

Symbol			
Depth	-	-	-
Date	-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6715	5					5.0		49	22	29	37	20	A-2-6 (0) GC	pH=8.5 S=0.019% Chl=0.00118% Re=1600ohm·cm	
6710		27-33-22	55												
6705	10		24-44-34	78		4.7		40	47	13	NV	NP	R-Value Sample: 5'-18' R-Value=18		
6700		18-50/5"	50/5"												
6695	20		50/4"	50/4"		21.0 - 24.0 ft. gravelly SAND with some silt, brown, moist.							Switched to ODEX at 18.5 ft		
6690		50/6"	50/6"												
6685	30		45-50/5"	50/5"		Bottom of Hole at 30.5 ft.									



Boring Began: 3/21/2018

Boring Completed: 3/24/2018

Drilling Method(s): HQ Coring /
NX Coring

Driller: Salisbury & Associates

Drill Rig: Burly 4000

Hammer: Cathead and rope, ER: %

Total Depth: 112.6 ft

Ground Elevation: 6824.7 ft

Coordinates: N: E:

Location: 1034+32, 35' R

Weather Notes:

Inclination from Horiz.: Vertical

Night Work: ☐

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6820	5				29-20-16	36		0.0 - 6.5 ft. clayey SAND with gravel, reddish brown, moist, dense, well graded, angular to rounded gravel, organics- roots. 1.0' Boulder @ 2.5'.							
6815	10				50/0"	50/0"		6.5 - 61.5 ft. sandy GRAVEL with cobbles and boulders, brown, very dense, rounded to subangular.							
6810	15				50/2"	50/2"									
6805	20				37-50/4"	50/4"		Greater density of gravel.							
6800	25				50/0"	50/0"									
6795	30				50/1.5"	50/1.5"		Large gravel and cobble grain size.							
6790															



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6785	40				50/0"	50/0'		6.5 - 61.5 ft. sandy GRAVEL with cobbles and boulders, brown, very dense, rounded to subangular.							
6780	45														
6775	50														
6770	55														
6765	60							61.5 - 88.0 ft. SANDY CLAYSTONE , brown to gray, predominantly decomposed to slightly weathered, medium hard to hard, joint, clay and iron oxide infilling, lignite stringers, (ANIMAS FORMATION).							
6760	65		62	52											
6755	70		96	57											
6750	75		91	82											
			108	84											

1.0' Boulder @ 50.0'.



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6745	80		99	90											
6740	85		101	86				Evaporite infilling, (ANIMAS FORMATION).							
6735	90		98	71				88.0 - 99.0 ft. CLAYEY SANDSTONE, blue-grey, slightly weathered to fresh, hard, joint, clay and iron oxide infilling, iron oxide staining, (ANIMAS FORMATION).							
6730	95		103	75				~.5" coal seam, (ANIMAS FORMATION).							
6725	100		86	60				99.0 - 109.0 ft. SANDSTONE INTERBEDDED WITH CLAYSTONE, blue-grey with brown, moderately weathered to slightly weathered, medium hard to hard, joint, clay and gravel infilling, lignite stringers and seams, (ANIMAS FORMATION).							
6720	105		111	101											
6715	110		100	47				109.0 - 112.6 ft. CONGLOMERATE, gray, slightly weathered, very hard, (ANIMAS FORMATION).							
Bottom of Hole at 112.6 ft.															
6710															
6705															



Boring Began: 1/22/2018
Boring Completed: 1/23/2018
Drilling Method(s): ODEX /
Air Rotary
Driller: Authentic Drilling
Drill Rig: Acker Renegade
Hammer: Automatic (hydraulic), ER: 96%

Total Depth: 119.5 ft
Ground Elevation: 6830.7
Coordinates: N: E:
Location: Sta. 1035+18, 195' R

Weather Notes:
Inclination from Horiz.: Vertical
Night Work: ☐

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6830						0.0 - 7.0 ft. CLAY with some sand, brown, high plasticity, moist, very stiff.	17.9		0	16	84	72	50	A-7-6 (45) CH	
6825	5		10-9-12	21											
6820	10		7-9-9	18		7.0 - 70.0 ft. GRAVEL with some cobbles, sand and clay, brown-tan, moist, medium dense to very dense.	1.8		68	27	5	NV	NP	A-1-a (0) GP	Recovered drill cuttings Driller began adding water at 24 ft
6815	15		29-30/5"	30/5"											
6810	20		26/4"	26/4"											
6805	25		23-35/5"	35/5"											
6800	30		50/6"	50/6"											
			26-36-44	80											



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6795						7.0 - 70.0 ft. GRAVEL with some cobbles, sand and clay, brown-tan, moist, medium dense to very dense.									
	40		30/4"	30/4"											
6790															
	45		24-25-26	51											
6785															
	50		20/0"	20/0"											
6780															
	55		34-20/3"	20/3"											
6775															
	60		30/4"	30/4"											
6770															
	65		29-26-38	64											
6765															
	70		50/6"	50/6"		70.0 - 119.5 ft. SANDSTONE INTERBEDDED WITH SHALE LAYERS, blue-gray, medium hard to hard, (ANIMAS FORMATION).									
6760															
	75		37-20/2"	57/8"											
6755							11.8		0	67	33	38	17		Drill cuttings: Fragmented bedrock

BORING LOG 2015 - SPT CDOT STYLE 217-376 US 550 CONNECTOR, CURRENT-KEVIN.GPJ 2015 YEH ASSOCIATES TEMPLATE.GDT 2015 LIBRARY.GLB 12/18/18

70.0 ft - Switch to
air rotary



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6750	80		32-50/4"	50/4"								30	9		Drill cuttings: Fragmented bedrock pH=9 S=0.011% Chl=0% Re=1500ohm·cm
6745	85		50/4"	50/4"											
6740	90		50/5"	50/5"											
6735	95														
6730	100		50/4"	50/4"											Drill cuttings: Fragmented bedrock pH=9.4 S=0.015% Chl=0% Re=1500ohm·cm
6725	105														
6720	110		50/3"	50/3"											
6715	115											28	9		
			50/5"	50/5"											
Bottom of Hole at 119.5 ft.															



Boring Began: 1/17/2018
Boring Completed: 1/19/2018
Drilling Method(s): ODEX /
HQ Coring
Driller: Authentic Drilling
Drill Rig: Acker Renegade
Hammer: Automatic (hydraulic), ER: 96%

Total Depth: 148.0 ft
Ground Elevation: 6828.2
Coordinates: N: E:
Location: Sta. 1036+88, 198' R
Logged By: K. Moran
Final By: B. Bunker

Weather Notes:
Inclination from Horiz.: Vertical
Night Work: ☐

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6825	5	X			13-14	27		0.0 - 7.0 ft. CLAY with some sand, red-brown, dry to moist, very stiff.	7.9	97.3							
6820	10	X			26-39-21	60		7.0 - 55.0 ft. GRAVEL with some sand, cobbles and boulders, trace clay, gray brown, dry to moist, very dense.	3.5		26	61	13	22	4		Drill cuttings: fragmented gravel and cobbles
6815	15	X			50/4"	50/4"											
6810	20	X			23-50/3"	50/3"											
6805	25	X			28-41-17	58											
6800	30	X			50/6"	50/6"											
6795																	



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifications	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6790					42-50/5"	50/5"		7.0 - 55.0 ft. GRAVEL with some sand, cobbles and boulders, trace clay, gray brown, dry to moist, very dense.									Boulders
40					50/6"	50/6"											
45					17/5"	17/5"											
50					12-23-34	57											
55					31-50/5"	50/5"		55.0 - 59.0 ft. CLAYSTONE, yellow, moderately weathered, (ANIMAS FORMATION).									Switch to Coring at 59 ft UCCS=3100psi
60			97	68				59.0 - 148.0 ft. SHALE, blue-gray, interbedded with sandstone, (ANIMAS FORMATION).	3.8	139.6							
65			100	66													
70			99	99					6.4	138.1							
75			100	100													UCCS=1526psi



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3 of 4

Boring No.: E-02

[illegible]

3BORING LOG 2015 - SPT CDOT STYLE 217-376 US 550 CONNECTOR_CURRENT-KEVIN.GPJ 2015 YEH ASSOCIATES TEMPLATE.GDT 2015 LIBRARY.GLB 12/18/18



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
			99	91													
6705	125		100	98					3.9	141.6							UCCS=2427psi
6700	130		95	82													
6695	135		100	84													Conglomerate (Volcaniclastic) layer from 134' to 136'
6690	140		100	100													
6685	145		100	100				4.4	149.1								UCCS=7021psi
6680			100	93													
Bottom of Hole at 148.0 ft.																	
6675																	
6670																	



Boring Began: 1/17/2018
Boring Completed: 1/18/2018
Drilling Method(s): ODEX /
HQ Coring
Driller: Authentic Drilling
Drill Rig: CME 750 Buggy Rig
Hammer: Automatic (hydraulic), ER: 97%

Total Depth: 91.0 ft
Ground Elevation: 6837.2
Coordinates: N: E:
Location: Sta. 1038+62, 200' R
Logged By: E. Pickerill
Final By: B. Bunker

Weather Notes:
Inclination from Horiz.: Vertical
Night Work: ☐

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6835	5	X			21-24	45	CLAY	0.0 - 12.0 ft. CLAY with some sand, trace gravel, light brown, high plasticity, damp, hard to very hard.	14.0	112.5							
6830	10	X			48-25	73			11.5		5	20	75	50	32	A-7-6 (23) CH	
6825	15	X			39-30-13	43		12.0 - 45.0 ft. GRAVEL with some sand, boulders and cobbles, light gray and yellowish brown, dry, medium dense to dense.									
6820	20	X			14-12-10	22	GRAVEL										
6815	25	X			12-21-42	63											
6810	30	X			32-15/0"	15/0"											
6805		X															



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6800		X			16-17-24	41		12.0 - 45.0 ft. GRAVEL with some sand, boulders and cobbles, light gray and yellowish brown, dry, medium dense to dense.									
40		X			20-26-25	51											
6795		X															
45		X			41-25/3"	25/3"		45.0 - 61.5 ft. CLAYSTONE, yellowish brown, moderately weathered, sandy, (ANIMAS FORMATION).									
6790		X															
50			55	18													
6785			100	94				61.5 - 91.0 ft. SHALE INTERBEDDED WITH SANDSTONE, blue-gray, very hard, (ANIMAS FORMATION).									
55																	
6780			100	100													
60																	
6775			98	87													
65																	
6770			97	69													
70																	
6765			100	50													
			0	0													
75			95	45													
6760																	



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6" in	Penetration Resistance								Liquid Limit	Plasticity Index		
			98	96													
80																	
6755			98	98													
85																	
6750			100	100													
90			100	100													
Bottom of Hole at 91.0 ft.																	
6745																	
6740																	
6735																	
6730																	
6725																	
6720																	

Boring Began: 1/20/2018
Boring Completed: 1/20/2018

Total Depth: 69.9 ft
Ground Elevation: 6769.5
Coordinates: N: E:
Location: Sta. 1039+11, 172' R

Weather Notes:

Inclination from Horiz.: Vertical

Drilling Method(s): ODEX

Driller: Authentic Drilling

Drill Rig: Acker Renegade

Hammer: Automatic (hydraulic), ER: 96%









Logged By: E. Pickerill

Final By: B. Bunker

Night Work: ☐

Groundwater Levels:

Symbol			
Depth	-	-	-
Date	-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6765	5		50/6"	50/6"		0.0 - 69.9 ft. SILTY SHALE , yellowish brown to olive gray, hard, slightly moist, (ANIMAS FORMATION).	12.7	110.3					
6760	10		36-46	82									
6755	15		50/6"	50/6"									
6750	20		37-50/4"	87/10"									
6745	25		50/4"	50/4"									
6740	30		50/4"	50/4"									
6735			50/4"	50/4"									



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6730	40		50/5"	50/5"									
6725	45		37-50/6"	50/6"									
6720	50		50/5"	50/5"									
6715	55		50/3"	50/3"									
6710	60		50/4"	50/4"									
6705	65		50/4"	50/4"						29	10		Drill cuttings: Fragmented bedrock pH=8.7 S=0.002% Chl=0.00109% Re=4000ohm-cm
6700			50/4"	50/4"		Bottom of Hole at 69.9 ft.							
6695													



Boring Began: 1/19/2018
Boring Completed: 1/19/2018

Total Depth: 69.3 ft
Ground Elevation: 6837.6
Coordinates: N: E:
Location: Sta. 1036+94, 257' R

Weather Notes:
Inclination from Horiz.: Vertical

Drilling Method(s): ODEX
Driller: Authentic Drilling
Drill Rig: Acker Renegade

Logged By: B. Bunker
Final By: B. Bunker

Night Work: ☐

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6835	5	X	8-12-17	29		0.0 - 15.0 ft. CLAY with some sand, brown, moist, very stiff.									
6830	10	X	15-15-14	29											
6825	15	X	21-24-22	46		15.0 - 19.0 ft. GRAVEL with clay and sand, brown, damp, dense to very dense.									
6820	20	X	20-50/4"	50/4"		19.0 - 51.0 ft. GRAVEL with cobbles and boulders, some clayey sand, brown, moist, very dense.									
6815	25	X	31-50/5"	50/5"											
6810	30	X	48-30/3"	30/3"			2.2		48	44	8	NV	NP		Drill cuttings: Fragmented gravel
6805		X	19-29-32	61											



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6800						19.0 - 51.0 ft. GRAVEL with cobbles and boulders, some clayey sand, brown, moist, very dense.									
	40		50/5"	50/5"											
6795															
	45		20/0"	20/0"											
6790															
	50		50/6"	50/6"											
6785						51.0 - 53.0 ft. SAND with some silt, brown, moist, medium dense.	2.6		49	46	5	NV	NP		Drill cuttings: Fragmented gravel and cobble
	55		48-34/4"	34/4"		53.0 - 62.0 ft. GRAVEL with cobbles, some sand and clay, brown, damp, very dense.									
6780															
	60		25/1"	25/1"											
6775						62.0 - 68.0 ft. SANDSTONE, tan-yellow, (ANIMAS FORMATION).									
	65		30/4"	30/4"											
6770						68.0 - 69.3 ft. SANDSTONE, gray, hard, (ANIMAS FORMATION).									
			50/4"	50/4"		Bottom of Hole at 69.3 ft.									
6765															



Boring Began: 11/20/2017

Total Depth: 103.0 ft

Weather Notes:

Boring Completed: 11/21/2017

Ground Elevation: 6842.1

Inclination from Horiz.: Vertical

Drilling Method(s): Air Rotary/ODEX /

Coordinates: N: E:

Night Work: ☐

HQ Coring

Location: Sta. 1037+92, 334' R

Driller: Authentic Drilling

Groundwater Levels:

Drill Rig: CME 750 Buggy Rig

Logged By: B. Kunz

Hammer: Automatic (hydraulic), ER: 97%

Final By: B. Bunker

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6840	5				12-13-17	30		0.0 - 14.0 ft. CLAY with some sand, red-brown, dry, very stiff.	13.1		0	24	76	46	32	A-7-6 (23) CL	Air Rotary at 6 ft to 15 ft
6835	10				11-15	26											
6830	15				47-50/5"	50/5"		14.0 - 20.0 ft. SAND with some gravel, trace silt, red-brown, dry, very dense.	1.7		19	68	13	NV	NP		Cobbles at 20 ft to 59.5 ft
6825	20				20-26-23	49		20.0 - 55.0 ft. GRAVEL with cobbles, some sand, brown to red, dry, very dense.									
6820	25				bounce bounce												Drill cuttings: Fragmented gravel and cobble
6815	30				44-22-32	54											
6810									1.8		27	64	9	NV	NP		



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6805					38-34/3"	34/3"		20.0 - 55.0 ft. GRAVEL with cobbles, some sand, brown to red, dry, very dense.									
40					22/3"	22/3"											
6800																	
45					28-34/2"	34/2"											
6795																	
50					41-31-23	54											
6790																	
55					42-50/4"	50/4"		55.0 - 73.0 ft. SANDSTONE, olive-brown, moderately weathered, medium hard to hard, (ANIMAS FORMATION).									
6785																	
60			76	52													
6780																	
65			97	68													
6775																	
70			98	59													
6770																	
75			95	57				73.0 - 103.0 ft. SHALE, gray, slightly weathered, hard, (ANIMAS FORMATION).									
6765																	

59.5 ft - Switched
to coring



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6760	80		100	47													
6755	85		100	97													Vertical fractures at 83 ft
6750	90		100	93													
6745	95		100	100													
6740	100		100	77													
Bottom of Hole at 103.0 ft.																	
6735																	
6730																	
6725																	



Boring Began: 1/16/2018

Total Depth: 100.0 ft

Weather Notes:

Boring Completed: 1/17/2018

Ground Elevation: 6840.9

Inclination from Horiz.: Vertical

Drilling Method(s): ODEX /

Coordinates: N: E:

HQ Coring

Location: Sta. 1038+90, 403' R

Night Work: ☐

Driller: Authentic Drilling

Drill Rig: Acker Renegade

Logged By: E. Pickerill

Hammer: Automatic (hydraulic), ER: 96%

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6840								0.0 - 18.0 ft. CLAY with some sand, red-brown, damp, stiff to very stiff.									
	5				7-8	15											
6835																	
	10				13-15	28											
6830																	
	15				14-20	34			20.4	99.7			81				
6825																	
	20				43-35-33	68		18.0 - 38.0 ft. GRAVEL with some sand, cobbles and boulders, brown, dry, very dense.	7.5		19	45	36	35	20		Drill cuttings: Fragmented gravel and cobble
6820																	
	25				25-50/5"	50/5"											
6815																	
	30				50/0"	50/0"											
6810																	33.0 ft - Water added by driller



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6805					22-50/5"	50/5"		18.0 - 38.0 ft. GRAVEL with some sand, cobbles and boulders, brown, dry, very dense.									
6800	40				50/6"	50/6"		38.0 - 47.4 ft. SHALE, olive-yellow, moderately weathered, hard, (ANIMAS FORMATION).									
6795	45		100	83					5.6	135.1							UCCS=1297psi
6790	50		99	69				47.4 - 100.0 ft. SANDSTONE INTERBEDDED WITH SHALE LAYERS, blue-gray, slightly weathered, hard to very hard, fine grained, (ANIMAS FORMATION).									
6785	55		99	69													
6780	60		98	37													
6775	65		100	88													
6770	70		100	100													
6765	75		100	87													



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6760	80		89	77													
6755	85		100	100					6.7	136.6							UCCS=1122psi
			100	85													
6750	90		98	95													
6745	95		100	39													
			93	91					5.0	138.7							UCCS=1538psi
6740	100							Bottom of Hole at 100.0 ft.									
6735																	
6730																	
6725																	



Boring Began: 1/20/2018
Boring Completed: 1/20/2018
Drilling Method(s): ODEX /
Air Rotary
Driller: Authentic Drilling
Drill Rig: Acker Renegade
Hammer: Automatic (hydraulic), ER: 96%

Total Depth: 69.8 ft
Ground Elevation: 6754.2
Coordinates: N: E:
Location: Sta. 1039+49, 307" R
Logged By: E. Pickerill
Final By: B. Bunker

Weather Notes:
Inclination from Horiz.: Vertical
Night Work: ☐

Groundwater Levels:

Symbol			
Depth	-	-	-
Date	-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6750	5		44-50/3"	94/9"		0.0 - 29.5 ft. SILTY SHALE , olive-brown, hard to very hard, (ANIMAS FORMATION).							
6745	10		37-50/3"	87/9"									
6740	15		50/4"	50/4"						36	11		pH=8.4 Re=1700ohm-cm
6735	20		50/5"	50/5"									
6730	25		50/5"	50/5"									
6725	30		50/3"	50/3"		29.5 - 69.8 ft. SANDSTONE INTERBEDDED WITH SHALE LAYERS , blue-gray, hard to very hard, fine grained, (ANIMAS FORMATION).							
6720			50/4"	50/4"									



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6715	40		50/5"	50/5"									
6710	45		50/5"	50/5"						30	8		pH=9.4 S=0.009% Re=1400ohm·cm
6705	50		50/6"	50/6"									
6700	55		50/5"	50/5"									
6695	60		50/3"	50/3"									
6690	65		50/3"	50/3"									
6685			50/3"	50/3"		Bottom of Hole at 69.8 ft.							
6680													



Boring Began: 11/18/2017

Total Depth: 80.0 ft

Weather Notes:

Boring Completed: 11/18/2017

Ground Elevation: 6848.8

Inclination from Horiz.: Vertical

Drilling Method(s): ODEX /

Coordinates: N: E:

HQ Coring

Location: Sta. 1039+09, 485' R

Night Work: ☐

Driller: Authentic Drilling

Drill Rig: CME 750 Buggy Rig

Logged By: B. Kunz

Hammer: Automatic (hydraulic), ER: 97%

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6845	5	X			12-15-18	33		0.0 - 22.0 ft. CLAY with some sand, red-brown to brown, high plasticity, dry, very stiff to hard.	11.8		0	20	80	52	35	A-7-6 (28) CH	Air Rotary at 8.5 ft to 24.5 ft
6840	10	X			11-10-19	29											
6835	15	X			17-17-12	29											
6830	20	X			12-14-15	29											
6825	25	X			27-23/2"	23/2"		22.0 - 26.0 ft. SAND with some clay, brown, dry, very dense.									Trace Gravel at 20 ft to 22 ft
6820	30	X			25-31-33	64		26.0 - 48.0 ft. GRAVEL with sand and cobbles, red to gray, dry, very dense.									Cobbles at 22 ft to 48 ft
6815		X			17/3"	17/3"											



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6810	40							26.0 - 48.0 ft. GRAVEL with sand and cobbles, red to gray, very dense.	1.2		26	67	7	NV	NP		Drill Cuttings: Fragmented gravel and cobble
					27-37/4"	37/4"											
6805	45							26.0 - 48.0 ft. GRAVEL with sand and cobbles, red to gray, very dense.	1.2		26	67	7	NV	NP		Drill Cuttings: Fragmented gravel and cobble
					42-16/4"	16/4"											
6800	50							48.0 - 80.0 ft. SANDSTONE INTERBEDDED WITH SHALE LAYERS, (ANIMAS FORMATION).	4.5	98.7	0	59	41	35	2		Shale/bedrock core. Slaking test performed. Degrades into a pile of flakes or mud.
			43	22													
6795	55							48.0 - 80.0 ft. SANDSTONE INTERBEDDED WITH SHALE LAYERS, (ANIMAS FORMATION).	4.5	98.7	0	59	41	35	2		Shale/bedrock core. Slaking test performed. Degrades into a pile of flakes or mud.
			98	63													
6790	60							48.0 - 80.0 ft. SANDSTONE INTERBEDDED WITH SHALE LAYERS, (ANIMAS FORMATION).	4.5	98.7	0	59	41	35	2		Shale/bedrock core. Slaking test performed. Degrades into a pile of flakes or mud.
6785	65							48.0 - 80.0 ft. SANDSTONE INTERBEDDED WITH SHALE LAYERS, (ANIMAS FORMATION).	4.5	98.7	0	59	41	35	2		Shale/bedrock core. Slaking test performed. Degrades into a pile of flakes or mud.
			96	71													
6780	70							48.0 - 80.0 ft. SANDSTONE INTERBEDDED WITH SHALE LAYERS, (ANIMAS FORMATION).	4.5	98.7	0	59	41	35	2		Shale/bedrock core. Slaking test performed. Degrades into a pile of flakes or mud.
			98	72													
6775	75							48.0 - 80.0 ft. SANDSTONE INTERBEDDED WITH SHALE LAYERS, (ANIMAS FORMATION).	4.5	98.7	0	59	41	35	2		Shale/bedrock core. Slaking test performed. Degrades into a pile of flakes or mud.
			100	97													



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6770	80		96	96													
Bottom of Hole at 80.0 ft.																	
6765																	
6760																	
6755																	
6750																	
6745																	
6740																	
6735																	
6730																	



Boring Began: 11/21/2017

Total Depth: 76.5 ft

Weather Notes:

Boring Completed: 11/21/2017

Ground Elevation: 6857.3

Inclination from Horiz.: Vertical

Drilling Method(s): ODEX /

Coordinates: N: E:

Air Rotary

Location: Sta. 1039+45, 580' R

Night Work: ☐

Driller: Authentic Drilling

Drill Rig: CME 750 Buggy Rig

Logged By: B. Kunz

Hammer: Automatic (hydraulic), ER: 97%

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6855	5							0.0 - 9.5 ft. SAND with some gravel and clay, light brown, dry, (Colluvium).									
6850	10				11-9	20		9.5 - 35.0 ft. CLAY with some sand, yellow red, dry, very stiff to hard.	13.0	88.3							Switch to Air Rotary at 9.5' S/C=-1.7%
6845	15																
6840	20				9-10-10	20											
6835	25																
6830	30				14-21-23	44			12.1		3	29	68	30	17	A-6 (9) CL	
6825																	Trace cobbles at 29.5 ft to 35 ft Switch to ODEX at 34.5"



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6820								35.0 - 46.5 ft. sandy GRAVEL with boulders and cobbles, gray - brown, dry, very dense.									Cobbles at 39.5 ft to 42 ft
	40				45-16/1"	16/1"											
6815								46.5 - 76.5 ft. SANDSTONE INTERBEDDED WITH SHALE LAYERS, (ANIMAS FORMATION).									Drilling terminated 11/21/17 at 44.5 ft Drilling resumed 01/10/18
	45																
6810																	
	50				50/5"	50/5"											
6805																	
	55		64	30													
6800																	
	60		100	65													
6795																	
	65		100	96													
6790																	
	70		100	74													
6785																	
	75		100	77													
6780								Bottom of Hole at 76.5 ft.									

Appendix D.2 – Gulch A Bridge (Bridge 1) Boring Logs



Boring Began: 3/6/2018

Total Depth: 106.0 ft

Weather Notes:

Boring Completed: 3/7/2018

Ground Elevation: 6721.0

Inclination from Horiz.: Vertical

Drilling Method(s): HQ Coring

Coordinates: N: E:

Driller: Salisbury & Associates

Location: Sta. 1013+94, 24' L

Night Work: ☐

Drill Rig: Burly 4000

Hammer: Cathead and rope, ER: %

Logged By: K. Dye

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6720								0.0 - 9.0 ft. SAND with some silt, trace gravel, brown, very dense.							6-inches of top soil
6715	5				50/5"	50/5"									Water continuously added for coring
6710	10				24-50/2"	50/2"		9.0 - 30.0 ft. GRAVEL with some sand, trace silt, brown and green, very dense.							
6705	15				30-50/4"	50/4"									
6700	20				22-50/4"	50/4"									
6695	25				50/2"	50/2"									
6690	30				50/2"	50/2"		30.0 - 53.0 ft. GRAVEL with some sand and cobbles, very dense.							



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Project
Name:

US 550 Connector

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Project Number: 217-376

Boring No.: B1-01

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6685		X			50/2"	50/2"		30.0 - 53.0 ft. GRAVEL with some sand and cobbles, very dense.							
40		X			50/1"	50/1"									
45		X			50/1"	50/1"									
50		X			50/1"	50/1"									
55		X			50/1"	50/1"		53.0 - 64.0 ft. GRAVEL with some sand, cobbles and boulders, very dense.							Single boulder 53 ft to 54.5 ft
60															
65								64.0 - 89.0 ft. GRAVEL with some sand and cobbles, very dense.							Single boulder 58.5 ft to 60 ft
70															
75															Switch from HQ to NQ core

BORING LOG 2015 - SPT CDOT STYLE 217-376 US 550 CONNECTOR_CURRENT-KEVIN.GPJ 2015 YEH ASSOCIATES TEMPLATE.GDT 2015 LIBRARY.GLB 12/18/18



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6640 															



Boring Began: 3/26/2018

Total Depth: 122.0 ft

Weather Notes:

Boring Completed: 3/29/2018

Ground Elevation: 6731.3

Inclination from Horiz.: Vertical

Drilling Method(s): HQ Coring /

Coordinates: N: E:

NX Coring

Location: Sta. 1013+80, 17' R

Night Work: ☐

Driller: Salisbury & Associates

Drill Rig: Burly 4000

Logged By: R. Borst and K. Moran

Hammer: Cathead and rope, ER: %

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6730								0.0 - 7.0 ft. GRAVEL with some clay, cobbles and boulders, brown, moist, (Colluvium).							
6725	5							7.0 - 18.0 ft. GRAVEL with some sand and clay, brown, very dense.							
6720	10	X			24-50/4"	50/4"									
6715	15														
6710	20	X			24-23-25	48		18.0 - 100.4 ft. GRAVEL and COBBLES with some sand, boulders, clay lenses, red-brown, very dense, subangular to rounded.							
6705	25														
6700	30	X			50/5"	50/5"									



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Project
Name:

US 550 Connector

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Project Number: 217-376

Boring No.: B1-01A

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6695								18.0 - 100.4 ft. GRAVEL and COBBLES with some sand, boulders, clay lenses, red-brown, very dense, subangular to rounded.							
	40				50/0"	50/0"									
6690															
	45														
6685															
	50				50/2"	50/2"									
6680															
	55														
6675															
	60				50/4"	50/4"									
6670															
	65														
6665															
	70				50/1"	50/1"									
6660															
	75														
6655															



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Project
Name:

US 550 Connector

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Project Number: 217-376

Boring No.: B1-01A

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6650	80							18.0 - 100.4 ft. GRAVEL and COBBLES with some sand, boulders, clay lenses, red-brown, very dense, subangular to rounded.							
6645	85														
6640	90														
6635	95														
6630	100							100.4 - 102.0 ft. SANDY CLAYSTONE, brown to blue-grey, predominantly decomposed to moderately weathered, (ANIMAS FORMATION).							
6625	105		93	74											
6620	110							102.0 - 111.5 ft. SANDSTONE, blue-gray, slightly weathered to fresh, hard, joint, clay infilling, medium to very coarse grained sand granules with some conglomerate layers, (ANIMAS FORMATION).							
6615	115		100	100											
			99	55				111.5 - 122.0 ft. SANDY CLAYSTONE, blue-gray, moderately weathered to fresh, joint, clay and gravel infilling, (ANIMAS FORMATION).							
			98	59											
			100	85											

BORING LOG 2015 - SPT CDOT STYLE 217-376 US 550 CONNECTOR, CURRENT-KEVIN.GPJ 2015 YEH ASSOCIATES TEMPLATE.GDT 2015 LIBRARY.GLB 12/18/18



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6610															
Bottom of Hole at 122.0 ft.															
6605															
6600															
6595															
6590															
6585															
6580															
6575															
6570															

Boring Began: 4/19/2018

Total Depth: 79.1 ft

Weather Notes:

Boring Completed: 4/19/2018

Ground Elevation: 6733.3 ft

Inclination from Horiz.: Vertical

Drilling Method(s): ODEX

Coordinates: N: E:

Driller: Authentic Drilling

Location: Sta. 1013+18, 36' L

Night Work: ☐

Drill Rig: CME 55 Rubber Track

Hammer: Automatic (hydraulic), ER: 95%

Logged By: E. Pickerill

Final By: B. Bunker

Groundwater Levels:

Symbol
Depth
Date

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Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifications	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6730	5		9-11	20		0.0 - 9.0 ft. CLAY with some sand, brown-tan, dry, very stiff.							
6725	10		15-17	32		9.0 - 16.5 ft. CLAY with some sand, red-brown gray, moist, very stiff.							
6720	15		15-20	35									
6715	20		17-25-28	53		16.5 - 66.5 ft. GRAVEL with some sand, Cobbles and Boulders, multi-colored, dry, very dense.							
6710	25		30/6"	30/6"									
6705	30		8/4"	8/4"									
6700			28-32-37/2"	69/8"									32.0 ft - 1.5' Boulder



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6695	40		40/2"	40/2"		16.5 - 66.5 ft. GRAVEL with some sand, Cobbles and Boulders, multi-colored, dry, very dense.							
6690	45		18/5"	18/5"									
6685	50												
6680	55		14/2"	14/2"									
6675	60												
6670	65		22/4"	22/4"		66.5 - 79.1 ft. CLAYSTONE, olive-brown, moderately weathered, hard to very hard, (ANIMAS FORMATION).							
6665	70		50/5"	50/5"									
6660	75		36-50/3"	86/9"									



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6655													
			50/1"	50/1"		Bottom of Hole at 79.1 ft.							
6650													
6645													
6640													
6635													
6630													
6625													
6620													
6615													



PAGE
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Boring No.: B1-02

Weather Notes:

Inclination from Horiz.: Vertical

Night Work: ☐

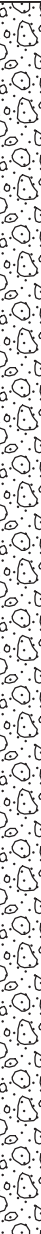
Location: Sta. 1014+08, 29' R

Groundwater Levels:

Final By: B. Bunker

Hammer: Cathead and rope, ER: %

Groundwater Levels:			
Symbol			
Depth	-	-	-
Date	-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6720								0.0 - 88.0 ft. GRAVEL and Cobbles in sandy matrix, multi-colored, very dense.							Cobble on surface Water added by driller
	5	X			18-40-34	74									
6715															
	10	X			25-50/3"	50/3"									
6710															
	15	X			17-19-20	39									
6705															
	20	X			50/4"	50/4"									
6700															
	25	X			50/5"	50/5"									
6695															
	30	X			50/3"	50/3"									
6690															

BOHRING LOG 2015 - SPT CDOT STYLE 217-376 US 550 CONNECTOR CURRENT-KEVIN.GPJ 2015 YEH ASSOCIATES TEMPLATE.GDT 2015 LIBRARY.GLB 12/18/18



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6685								0.0 - 88.0 ft. GRAVEL and Cobbles in sandy matrix, multi-colored, very dense.							
	40				50/1"	50/1"									
6680															
	45				50/5"	50/5"									
6675															
	50				50/0"	50/0"									
6670															
	55				50/0"	50/0"									
6665															
	60														
6660															
	65				30/2"	30/2"									
6655															
	70														
6650															
	75														
6645															

Switch to NQ
Coring at 70 feet



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6640	80							0.0 - 88.0 ft. GRAVEL and Cobbles in sandy matrix, multi-colored, very dense.							
6635	85														
6630	90		83	60				88.0 - 91.0 ft. CLAYSTONE, blue-gray, predominantly decomposed, soft to medium hard, (ANIMAS FORMATION).							
6625	95		100	100				91.0 - 101.0 ft. SANDSTONE, blue-gray, slightly weathered, medium hard to hard, (ANIMAS FORMATION).							
6620	100		98	98											
Bottom of Hole at 101.0 ft.															



Boring Began: 4/20/2018

Total Depth: 89.2 ft

Weather Notes:

Boring Completed: 4/20/2018

Ground Elevation: 6741.0

Inclination from Horiz.: Vertical

Drilling Method(s): ODEX

Coordinates: N: E:

Driller: Authentic Drilling

Location: Sta. 1013+38, 31' R

Night Work: ☐

Drill Rig: CME 55 Rubber Track

Hammer: Automatic (hydraulic), ER: 95%

Logged By: E. Pickerill

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

BORING LOG 2015 - SPT CDOT STYLE 217-376 US 550 CONNECTOR_CURRENT-KEVIN.GPJ 2015 YEH ASSOCIATES TEMPLATE.GDT 2015 LIBRARY.GLB 12/18/18

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6740						0.0 - 27.0 ft. SAND with some silt, occasional gravel and cobbles, light brown, dry to moist, medium dense.							
	5		9-12	21									
6735													
	10		10-11	21									
6730													
	15		11-24	35		27.0 - 79.0 ft. GRAVEL with some sand, boulders and cobbles, multi-colored, dry, dense to very dense.							
6725													
	20		11-15	26									
6720													
	25		22/6"	22/6"									
6715													
	30		15-20-28	48									
6710													
			27-31-22/3"	53/9"									

Cobble at 24 ft



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6705						27.0 - 79.0 ft. GRAVEL with some sand, boulders and cobbles, multi-colored, dry, dense to very dense.							
	40		8-12-28	40									
6700													
	45		9-27/4"	27/4"									
6695													
	50		31-50/4"	50/4"									
6690													
	55		20/0"	20/0"									
6685													
	60		30/3"	30/3"									
6680													
	65		15/0"	15/0"									
6675													
	70		10/0"	10/0"									
6670													
	75		10/0"	10/0"									
6665													



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6660	80		39-50/4"	50/4"		27.0 - 79.0 ft. GRAVEL with some sand, boulders and cobbles, multi-colored, dry, dense to very dense.							
6655	85		29-50/3"	50/3"		79.0 - 89.2 ft. CLAYSTONE, olive to reddish brown, hard to very hard, (ANIMAS FORMATION).							
6650			50/2"	50/2"		Bottom of Hole at 89.2 ft.							
6645													
6640													
6635													
6630													
6625													



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Boring No.: **B1-03**

Weather Notes:

Inclination from Horiz.: Vertical

Night Work: ☐

Logged By: E. Pickerill
Final By: B. Bunker

Groundwater Levels:			
Symbol			
Depth	-	-	-
Date	-	-	-

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2015 BORING LOG 2015 - SPT CDOT STYLE 217-376 US 550 CONNECTOR CURRENT-KEVIN.GPJ 2015 YEH ASSOCIATES TEMPLATE.GDT 2015 LIBRARY.GLB 12/18/18



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Project
Name:

US 550 Connector

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Project Number: 217-376

Boring No.: B1-03

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6655			100	57	10/0"	10/0"		35.0 - 48.5 ft. CLAYSTONE, blue-gray, slightly weathered to fresh, hard to very hard, silty, (ANIMAS FORMATION).							39.5 ft - Switch to NX core
40			78	36											
6650			76	34											
45															
6645															
Bottom of Hole at 48.5 ft.															
6640															
6635															
6630															
6625															
6620															
6615															

BORING LOG 2015 - SPT CDOT STYLE 217-376 US 550 CONNECTOR_CURRENT-KEVIN.GPJ 2015 YEH ASSOCIATES TEMPLATE.GDT 2015 LIBRARY.GLB 12/18/18



Boring Began: 3/14/2018

Total Depth: 55.0 ft

Weather Notes:

Boring Completed: 3/15/2018

Ground Elevation: 6659.9

Inclination from Horiz.: Vertical

Drilling Method(s): HQ Coring

Coordinates: N: E:

Driller: Salisbury & Associates

Location: Sta. 1015+09, 1' R

Night Work: ☐

Drill Rig: GH-5 Viper

Hammer: Cathead and rope, ER: %

Logged By: E. Pickerill

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6655	5		86	0				0.0 - 1.5 ft. CLAY with gravel, red-brown, (Colluvium).							
			82	14				1.5 - 13.0 ft. WEATHERED SANDSTONE, light brown, medium grained, well cemented with highly weathered bedding planes, (ANIMAS FORMATION).							
6650	10		78	8				13.0 - 25.5 ft. CLAYSTONE, olive, moderately weathered, hard to very hard, (ANIMAS FORMATION).							
6645	15		92	48											
6640	20		70	20				25.5 - 38.5 ft. SANDSTONE, blue-gray, very hard, (ANIMAS FORMATION).							
6635	25		99	83											
6630	30		94	94											



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
			100	92				38.5 - 55.0 ft. SHALE, blue-gray, fresh, very hard, (ANIMAS FORMATION).							Conglomerate layer from 35-36'
6620	40		100	86											
6615	45		99	99											
6610	50		99	88											
6605	55	Bottom of Hole at 55.0 ft.													
						</									



Boring Began: 3/12/2018
Boring Completed: 3/13/2018
Drilling Method(s): HQ Coring
Driller: Salisbury & Associates
Drill Rig: GH-5 Viper
Hammer: Cathead and rope, ER: %

Total Depth: 45.0 ft
Ground Elevation: 6639.0
Coordinates: N: E:
Location: Sta. 1015+39, 20' L

Logged By: E. Pickerill
Final By: B. Bunker

Weather Notes:
Inclination from Horiz.: Vertical

Night Work: ☐

Groundwater Levels:

Symbol			
Depth	-	-	-
Date	-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6635	5				6-9-12	21		0.0 - 6.0 ft. GRAVEL with cobble, some sand, trace clay, multicolored, (Colluvium).							Water added by driller
6630	10							6.0 - 9.0 ft. SAND with some clay, brown-tan, medium dense.							
6625	15		94	31				9.0 - 12.0 ft. SANDSTONE , olive, predominantly decomposed, soft to medium hard.							
6620	20		94	72				12.0 - 30.0 ft. CLAYSTONE , olive-brown, predominantly decomposed to fresh, medium hard to hard, (ANIMAS FORMATION).							
6615	25		92	75											
6610	30		99	77											Conglomerate 33 ft to 34 ft
6605			99	52				30.0 - 45.0 ft. SANDSTONE INTERBEDDED WITH SHALE LAYERS , blue-gray, moderately weathered to fresh, hard to very hard, well cemented, (ANIMAS FORMATION).							



Ci u l h g E a a e . s l A a r & . S
Y e h a n d A s h o c h o s h i i t a , I . s i h A s a A a

**Project
Name:**

US 550 Connector

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Project Number: 217-376

Boring No.: B1-05

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6600	40		100	54											
6595	45		100	100											
Bottom of Hole at 45.0 ft.															
6590															
6585															
6580															
6575															
6570															
6565															

BORING LOG 2015 - SPT CDOT STYLE 217-376 US 550 CONNECTOR_CURRENT-KEVIN.GPJ 2015 YEH ASSOCIATES TEMPLATE.GDT 2015 LIBRARY.GLB 12/18/18



Boring Began: 3/13/2018

Total Depth: 32.7 ft

Weather Notes:

Boring Completed: 3/14/2018

Ground Elevation: 6649.0

Inclination from Horiz.: Vertical

Drilling Method(s): HQ Coring

Coordinates: N: E:

Driller: Salisbury & Associates

Location: Sta. 1015+60, 24' R

Night Work: ☐

Drill Rig: GH-5 Viper

Hammer: Cathead and rope, ER: %

Logged By: E. Pickerill

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6645	5				10/0"	10/0"		0.0 - 10.3 ft. GRAVEL with some sand and cobbles, light brown to olive-brown, dense to very dense, (Colluvium).							Water added by driller
6640	10				50/2"	50/2"		10.3 - 27.7 ft. SANDSTONE INTERBEDDED WITH SHALE LAYERS, olive, moderately weathered, (ANIMAS FORMATION).							
6635	15		83	16											Conglomerate layer from 21-22.5'
6630	20		98	60											
6625	25		100	62											
6620	30		92	64				27.7 - 32.7 ft. SHALE, blue-gray, fresh, hard, (ANIMAS FORMATION).							
6615	32.7		100	97				Bottom of Hole at 32.7 ft.							



Boring Began: 3/8/2018

Total Depth: 40.0 ft

Weather Notes:

Boring Completed: 3/10/2018

Ground Elevation: 6620.4

Inclination from Horiz.: Vertical

Drilling Method(s): HQ Coring /

Coordinates: N: E:

NQ Coring

Location: Sta. 1015+72, 41' L

Night Work: ☐

Driller: Salisbury & Associates

Logged By: E. Pickerill

Drill Rig: GH-5 Viper

Final By: B. Bunker

Hammer: Cathead and rope, ER: %

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

BORING LOG 2015 - SPT CDOT STYLE 217-376 US 550 CONNECTOR_CURRENT-KEVIN.GPJ 2015 YEH ASSOCIATES TEMPLATE.GDT 2015 LIBRARY.GLB 12/18/18

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6620								0.0 - 21.0 ft. GRAVEL with some sand, cobbles and boulders, trace clay, brown, very dense, (Colluvium).							
6615	5	X			36-50/4"	50/4"									
6610	10	X			30-39-33	72									
6605	15	X			39-50/5"	50/5"									
6600	20	X			30-50/4"	50/4"									
6595	25		76	36				21.0 - 25.5 ft. SANDY SHALE, olive gray, predominantly decomposed, soft to medium hard, very fractured, (ANIMAS FORMATION).							
6590	30		94	67				25.5 - 40.0 ft. SHALE, blue-gray, slightly weathered, hard, (ANIMAS FORMATION).							
			74	38											Switch to NQ Coring at 29.7 ft



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Project
Name:

US 550 Connector

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Project Number: 217-376

Boring No.: B1-07

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6585			96	75											
6580	40		97	97				Bottom of Hole at 40.0 ft.							
6575															
6570															
6565															
6560															
6555															
6550															
6545															

BORING LOG 2015 - SPT CDOT STYLE 217-376 US 550 CONNECTOR_CURRENT-KEVIN.GPJ 2015 YEH ASSOCIATES TEMPLATE.GDT 2015 LIBRARY.GLB 12/18/18



Boring Began: 3/6/2018

Boring Completed: 3/7/2018

Drilling Method(s): HQ Coring

Driller: Salisbury & Associates

Drill Rig: GH-5 Viper

Hammer: Cathead and rope, ER: %

Total Depth: 70.0 ft

Ground Elevation: 6621.4

Coordinates: N: E:

Location: Sta. 1016+11, 0' R

Weather Notes:

Inclination from Horiz.: Vertical

Night Work: ☐

Logged By: E. Pickerill

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6620	5	X			26-50/5"	50/5"		0.0 - 7.0 ft. CLAY with some sand, boulders and cobbles, red-brown, stiff, (Colluvium).							Water added by driller
6615	10		100	30				7.0 - 15.0 ft. SANDSTONE, olive-brown, and conglomerate, well cemented, fractured, (ANIMAS FORMATION).							
6610	15		100	35											
6605	20		100	0				15.0 - 22.0 ft. SILTY SHALE, olive-brown, fractured, (ANIMAS FORMATION).							
6600	25		82	22				22.0 - 70.0 ft. SANDSTONE INTERBEDDED WITH SHALE LAYERS, blue-gray, fresh, hard, well cemented, (ANIMAS FORMATION).							
6595	30		100	94					8.0	141.0					UCCS=2843psi
6590			98	77											



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6585			96	80											
40															
6580			100	85											
45															
6575			99	84											Some conglomerate at 47 ft
50															
6570			96	93											
55															
6565			100	100					6.5	143.3					UCCS=5496psi
60															
6560			95	74											
65															
6555			100	66											
70															
Bottom of Hole at 70.0 ft.															
6550															
6545															



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Boring No.: **B1-09**

Weather Notes:

Inclination from Horiz.: Vertical

Coordinates: N: E:

Location: Sta. 1016+55, 0' R

Night Work: ☐

Logged By: K. Dye and B. Bunker

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
1	100	10/10/10
2	200	11/11/11
3	300	12/12/12
4	400	13/13/13
5	500	14/14/14
6	600	15/15/15
7	700	16/16/16
8	800	17/17/17
9	900	18/18/18
10	1000	19/19/19

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DRORING LOG 2015 - SPT CDOT STYLE 217-376 US 550 CONNECTOR CURRENT-KEVIN.GPJ 2015 YEH ASSOCIATES TEMPLATE.GDT 2015 LIBRARY.GLB 12/18/18



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6575	40		100	86											
6570	45		100	100											
6565	50		100	94											
6560	55		100	87											
6555	60		100	90											
6550	65		100	100											Conglomerate layer from 62'-65'
6545	70		99	79											
Bottom of Hole at 70.0 ft.															
6540															



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6620	40		98	85											
6615	45		95	34											
6610	50		99	82											
6605	55		98	92				50.3 - 52.0 ft. CONGLOMERATIC SANDSTONE, blue-gray, very hard, volcaniclastic. 52.0 - 70.0 ft. SHALE, gray, very hard.							
6600	60		100	70											
6595	65		100	97											
6590	70		100	95											
6585															

Thin coal seams at
41 ft and 44 ft

Bottom of Hole at 70.0 ft.



Boring Began: 2/27/2018

Total Depth: 70.2 ft

Weather Notes:

Boring Completed: 2/28/2018

Ground Elevation: 6725.2

Inclination from Horiz.: Vertical

Drilling Method(s): HQ Coring

Coordinates: N: E:

Driller: Salisbury & Associates

Location: Sta. 1019+17, 21' L

Night Work: ☐

Drill Rig: Burly 4000

Hammer: Cathead and rope, ER: %

Logged By: K. Moran and E. Pickerill

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6720	5				50/5"	50/5"		0.0 - 15.2 ft. GRAVEL Cobbles and Boulders in a sandy matrix, multi-colored, medium dense to very dense.							Water added by driller
6715	10				24-17-13	30									
6710	15				21-50/1"	50/1"		15.2 - 31.3 ft. SANDSTONE INTERBEDDED WITH CLAYSTONE, gray - brown, moderately weathered to fresh, (ANIMAS FORMATION).							
6705	20		100	87											
6700	25		72	28											
6695	30		100	92											
			100	91											
			100	86				31.3 - 70.2 ft. SANDSTONE INTERBEDDED WITH SHALE LAYERS, blue-grey, (ANIMAS FORMATION).							



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**Project
Name:**

US 550 Connector

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Project Number: 217-376

Boring No.: B1-11

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
			100	92											
6685	40		100	66											
6680	45		100	80											
6675	50		82	82											
6670	55		100	74											
6665	60		100	93											
6660	65		91	91											
6655	70		100	100											
Bottom of Hole at 70.2 ft.															
6650															

BORING LOG 2015 - SPT CDOT STYLE 217-376 US 550 CONNECTOR_CURRENT-KEVIN.GPJ 2015 YEH ASSOCIATES TEMPLATE.GDT 2015 LIBRARY.GLB 12/18/18



Boring Began: 3/2/2018

Total Depth: 70.4 ft

Weather Notes:

Boring Completed: 3/5/2018

Ground Elevation: 6723.2

Inclination from Horiz.: Vertical

Drilling Method(s): HQ Coring

Coordinates: N: E:

Driller: Salisbury & Associates

Location: Sta. 1019+20, 25' R

Night Work: ☐

Drill Rig: Burly 4000

Hammer: Cathead and rope, ER: %

Logged By: K. Dye and B. Bunker

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6720	5	X			15-25-37	62		0.0 - 13.0 ft. GRAVEL with some sand, cobbles and boulders, multi-colored, medium dense to very dense.							Water added by driller
6715	10	X			18-14-12	26									
6710	15	X	100	55	50/5"	50/5"		13.0 - 38.5 ft. SANDSTONE INTERBEDDED WITH CLAYSTONE, green-gray, moderately weathered, soft to hard, Some fractured zones, (ANIMAS FORMATION).							
6705	20		96	56					8.5	137.9					
6700	25		93	33											
6695	30		100	58											
6690			100	59											



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6685			96	49				38.5 - 70.4 ft. SANDSTONE INTERBEDDED WITH SHALE LAYERS, blue-grey, moderately weathered, soft to hard, Some fractured zones with iron staining, (ANIMAS FORMATION).	7.8	137.5				UCCS=1405psi	
	40		100	73											
6680															
	45		100	83											
6675															
	50														
6670			94	84											
	55														
6665			100	100											
	60														
6660			100	80											
	65														
6655			100	96											
	70														
Bottom of Hole at 70.4 ft.															
6650															

Appendix D.3 – Gulch B Bridge (Bridge 2) Boring Logs



Boring Began: 3/20/2018

Total Depth: 58.8 ft

Weather Notes:

Boring Completed: 3/21/2018

Ground Elevation: 6722.0

Inclination from Horiz.: Vertical

Drilling Method(s): HQ Coring

Coordinates: N: E:

Driller: Salisbury & Associates

Location: Sta. 1029+55, 3' R

Night Work: ☐

Drill Rig: GH-5 Viper

Hammer: Cathead and rope, ER: %

Logged By: E. Pickerill and A. Hotchkiss

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6720	5				50/4"	50/4"		0.0 - 5.0 ft. CLAY with some sand, reddish brown, medium stiff.							Water added by driller
6715	10		93	0				5.0 - 7.0 ft. CLAYSTONE, olive to yellowish brown, decomposed to predominantly decomposed, soft, (ANIMAS FORMATION).							
6710	15		75	0				7.0 - 30.0 ft. CLAYSTONE, olive, predominantly decomposed to fresh, medium hard, (ANIMAS FORMATION).							
6705	20		95	0											
6700	25		89	0						149.4					
6695	30		100	19											
6690			100	23				30.0 - 58.8 ft. SANDSTONE INTERBEDDED WITH SHALE LAYERS, blue-gray, fresh, medium hard to hard, well cemented, fractured zones with some iron staining, (ANIMAS FORMATION).							UCCS=2230psi



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6685			100	37											
40															
6680			95	35											
45															
6675			100	0											
50															
6670			100	43					151.3						UCCS=2750psi
55															
6665			98	77											
Bottom of Hole at 58.8 ft.															
6660															
6655															
6650															
6645															



Boring Began: 3/21/2018

Total Depth: 70.2 ft

Weather Notes:

Boring Completed: 3/23/2018

Ground Elevation: 6682.0

Inclination from Horiz.: Vertical

Drilling Method(s): HQ Coring /

Coordinates: N: E:

NQ Coring

Location: Sta. 1030+32, 0' R

Night Work: ☐

Driller: Salisbury & Associates

Logged By: E. Pickerill and A. Hotchkiss

Drill Rig: GH-5 Viper

Final By: B. Bunker

Hammer: Cathead and rope, ER: %

Groundwater Levels:

Symbol			
Depth	-	-	-
Date	-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6680	5				14/4"	14/4"		0.0 - 7.8 ft. CLAY some sand, Cobbles and Boulders, reddish brown, (Colluvium).							Water added by driller
6675	10		100	16				7.8 - 13.0 ft. CLAYSTONE, olive-brown, predominantly decomposed to moderately weathered, medium hard, silty, blocky, (ANIMAS FORMATION).							
6670	15		87	0				13.0 - 18.0 ft. SANDSTONE, olive, predominantly decomposed to moderately weathered, medium hard, very fine grained, (ANIMAS FORMATION).							
6665	20		75	0				18.0 - 24.5 ft. CLAYSTONE, olive, predominantly decomposed to moderately weathered, medium hard, minor coal inclusions, (ANIMAS FORMATION).							
6660	25		80	0											
6655	30		87	0											
6650			20	0				24.5 - 29.5 ft. SANDSTONE INTERBEDDED WITH CLAYSTONE, moderately weathered, hard, (ANIMAS FORMATION).							Switch to NQ Coring at 24.5
			75	33				29.5 - 37.5 ft. SHALE, dark gray, slightly weathered, hard, 3" thick coal stringer at 37.2 feet, (ANIMAS FORMATION).							
			100	100											



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Boring No.: **B2-02**

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6645			91	82				37.5 - 46.7 ft. SANDSTONE , Iron staining in occasional fractures, (ANIMAS FORMATION).							
40															
6640			84	73											
45															
6635			100	80			46.7 - 48.2 ft. CONGLOMERATE , blue-gray, (ANIMAS FORMATION).								
50							48.2 - 58.2 ft. SHALE , dark gray, fresh, hard, well cemented, (ANIMAS FORMATION).								
6630			97	97											
55															
6625			100	95											
60							58.2 - 65.2 ft. SANDSTONE , tan to gray, interbedded with gray shale, (ANIMAS FORMATION).								
6620			100	98											
65															
6615			100	100				65.2 - 70.2 ft. SHALE , dark gray, slightly weathered to fresh, occasional sandstone lenses, (ANIMAS FORMATION).							
70	Bottom of Hole at 70.2 ft.														
6610															
6605															



Boring Began: 3/24/2018

Total Depth: 69.0 ft

Weather Notes:

Boring Completed: 3/26/2018

Ground Elevation: 6644.1

Inclination from Horiz.: Vertical

Drilling Method(s): HQ Coring /

Coordinates: N: E:

NQ Coring

Location: Sta. 1030+88, 3'L

Night Work: ☐

Driller: Salisbury & Associates

Drill Rig: GH-5 Viper

Logged By: A. Hotchkiss

Hammer: Cathead and rope, ER: %

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6640	5		93	53				0.0 - 4.0 ft. GRAVEL and Cobbles with some sand, multi-colored, (Colluvium).							Water added by driller
6635	10		80	18				4.0 - 16.5 ft. SILTY SANDSTONE, tan to gray, slightly weathered, medium hard, (ANIMAS FORMATION).							
6630	15		86	43				16.5 - 24.5 ft. SANDSTONE INTERBEDDED WITH SHALE LAYERS, blue-gray, fresh, medium hard, fine grained, some fractures, (ANIMAS FORMATION).							
6625	20		86	59				24.5 - 36.0 ft. SHALE, blue-gray, hard to very hard, (ANIMAS FORMATION).							
6620	25		98	49											24.5 ft - Switch to NQ
6615	30		100	90											
6610															



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Project
Name:

US 550 Connector

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Project Number: 217-376

Boring No.: B2-03

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6605	40		100	76				36.0 - 44.3 ft. SANDSTONE, blue-gray, very hard, coarse grained, (ANIMAS FORMATION).							
6600	45		99	84				44.3 - 69.0 ft. SHALE, gray, fresh, very hard, occasional iron staining in fractures, (ANIMAS FORMATION).							
6595	50														
6590	55		99	85											
6585	60														
6580	65		100	94											
6575			100	82											
Bottom of Hole at 69.0 ft.															
6570															

BORING LOG 2015 - SPT CDOT STYLE 217-376 US 550 CONNECTOR_CURRENT-KEVIN.GPJ 2015 YEH ASSOCIATES TEMPLATE.GDT 2015 LIBRARY.GLB 12/18/18



Boring Began: 3/28/2018

Total Depth: 69.9 ft

Weather Notes:

Boring Completed: 3/29/2018

Ground Elevation: 6714.2

Inclination from Horiz.: Vertical

Drilling Method(s): HQ Coring

Coordinates: N: E:

Driller: Salisbury & Associates

Location: Sta. 1032+19, 2' R

Night Work: ☐

Drill Rig: GH-5 Viper

Hammer: Cathead and rope, ER: %

Logged By: E. Pickerill

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6710	5				19-50/4"	50/4"		0.0 - 7.2 ft. COBBLES and BOULDERS in sand and clay matrix, multi-colored.							Water added by driller
6705	10		98	22				7.2 - 13.0 ft. CLAYSTONE, dark gray, predominantly decomposed, fractured, (ANIMAS FORMATION).							
6700	15		98	31				13.0 - 22.0 ft. SANDSTONE, moderately weathered to predominantly decomposed, medium hard to hard, occasional fractured zones with iron staining, (ANIMAS FORMATION).	148.3						UCCS=5400psi
6695	20		99	18											
6690	25		100	0				22.0 - 32.4 ft. CLAYSTONE, tan, predominantly decomposed, medium hard, (ANIMAS FORMATION).							
6685	30		86	0											
6680			79	24				32.4 - 52.0 ft. SANDSTONE, blue-gray, fresh, hard to very hard, occasional fractured zones with iron staining, (ANIMAS FORMATION).							



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Project
Name:

US 550 Connector

PAGE
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Project Number: 217-376

Boring No.: B2-04

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6675	40		98	74											
6670	45		92	76											
6665	50		98	54											
6660	55		95	84				52.0 - 53.0 ft. CONGLOMERATE, blue-gray, fresh, very hard, (ANIMAS FORMATION).							
6655	60		92	86				53.0 - 69.9 ft. SHALE, blue-gray to dark gray, fresh, very hard, (ANIMAS FORMATION).							
6650	65		100	76											
6645			100	89											
Bottom of Hole at 69.9 ft.															
6640															

BORING LOG 2015 - SPT CDOT STYLE 217-376 US 550 CONNECTOR_CURRENT-KEVIN.GPJ 2015 YEH ASSOCIATES TEMPLATE.GDT 2015 LIBRARY.GLB 12/18/18

Appendix D.4 – Livestock/Wildlife Overpass (A) Boring Logs



PAGE
1 of 2

Boring No.: A-01

Weather Notes:

Inclination from Horiz.: Vertical

Coordinates: N: E:

Location: Sta. 999+53, 81' L

Night Work: ☐

Logged By: E. Pickerill

Hammer: Automatic (hydraulic), ER: 96%

Final By: B. Bunker

Groundwater Levels:

















Symbol	Depth	Date
1	100	10/10/10
2	200	11/11/11
3	300	12/12/12
4	400	13/13/13
5	500	14/14/14
6	600	15/15/15
7	700	16/16/16
8	800	17/17/17
9	900	18/18/18
10	1000	19/19/19

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AASHTO
& USCS
Classifi-
cations

Field Notes and Other Lab Tests

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology
			Blows per 6 in	Penetration Resistance	
6745					
	5		17-23	40	
6740					
	10		16-15	31	
6735					
	15		15-20	35	
6730					
	20		18-24	42	
6725					
	25		17-20	37	
6720					
	30		10-13	23	
6715					
			50/4"	50/4"	

Material Description

0.0 - 25.5 ft. CLAY with some sand, red-brown to tan, damp to dry, very stiff to very hard.

25.5 - 32.5 ft. CLAY with some sand, tan, damp, medium dense to dense.

32.5 - 67.0 ft. GRAVEL with cobbles, dry, very dense.

[illegible]

Atterberg Limits	
Liquid Limit	Plasticity Index
42	21
40	23
28	9

AASHTO & USCS Classifications
A-7-6 (17) CL
A-6 (18) CL
A-4 (5) CL

Field Notes and Other Lab Tests
<p>T99A Proctor Performed. Max density 106.1 pcf, optimum moisture 19.2%</p> <p>UCCS=7063psf</p> <p>Calcite veining at 21.5 ft to 25.5 ft</p>

DRILLING LOG 2015 - SPT CDOT STYLE 217-376 US 550 CONNECTOR CURRENT-KEVIN.GPJ 2015 YEY ASSOCIATES TEMPLATE.GDT 2015 LIBRARY.GLB 12/18/18



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6710						32.5 - 67.0 ft. GRAVEL with cobbles, dry, very dense.									
6705	40		18-22-35	57											Moist chips last 1 ft of drive at 40 ft
6700	45		27-33-42	75											
6695	50		22-50/5"	50/5"											
6690	55		16-50/2"	50/2"		67.0 - 70.0 ft. CLAYSTONE, olive gray, moderately weathered, (ANIMAS FORMATION).	0.6		30	66	4	NV	NP		Drill Cuttings: Fragmented gravel and cobble
6685	60		50/4"	50/4"											
6680	65		50/3"	50/3"											
6675	70		50/6"	50/6"		Bottom of Hole at 70.0 ft.									
6670															



Boring Began: 11/29/2017

Total Depth: 70.5 ft

Weather Notes:

Boring Completed: 11/29/2017

Ground Elevation: 6742.6

Inclination from Horiz.: Vertical

Drilling Method(s): Air Rotary /

Coordinates: N: E:

ODEX

Location: Sta. 999+74, 11' R

Night Work: ☐

Driller: Authentic Drilling

Drill Rig: Acker Renegade

Logged By: E. Pickerill

Hammer: Automatic (hydraulic), ER: 96%













Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6740	5					0.0 - 26.0 ft. CLAY , trace sand, red-brown, dry to damp, very stiff to hard.									
6735	10		9-10	19											
6730	15														
6725	20		16-37	53			13.1	85.2	0	11	89	39	15	A-6 (14) CL	R-Value Sample: 10'-25' R-Value=28
6720	25														
6715	30		15-26	41		26.0 - 32.0 ft. SAND with some gravel, orange - brown, damp, dense.									
6710						32.0 - 70.5 ft. GRAVEL with some sand, gray, damp, very dense.	6.6		5	71	24	NV	NP	A-2-4 (0) SM	pH=8.5 S=0% ChI=0.00114% Re=3500ohm-cm



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6705						32.0 - 70.5 ft. GRAVEL with some sand, gray, damp, very dense.	0.4		25	71	4	NV	NP		Drill Cuttings: Fragmented gravel and cobble
	40		20-17-16	33											
6700															
6695	45														
	50		22-50/5"	50/5"											
6690															
	55		20/0"	20/0"											
6685	60														
6680	65														
6675															
	70		30-50/3"	50/3"											
	Bottom of Hole at 70.5 ft.														Claystone in tip of sampler at 70.5 ft
6670															



PAGE
1 of 2

Boring No.: A-03

Weather Notes:

Inclination from Horiz.: Vertical

Coordinates: N: E:

Location: Sta. 1000+59, 88' R

Night Work: ☐

Logged By: E. Pickerill

Hammer: Automatic (hydraulic), ER: 96%

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
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[illegible]

Atterberg Limits	
Liquid Limit	Plasticity Index

AASHTO
& USCS
Classifi-
cations

Field Notes and Other Lab Tests

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology
			Blows per 6 in	Penetration Resistance	
6740					
	5		14-17	31	
6735	10				
6730	15		14-16	30	
6725	20				
6720	25		10-11	21	
6715	30				
6710					

Material Description

0.0 - 24.5 ft. CLAY with some sand, brown red-brown, damp to dry, stiff to very stiff.

24.5 - 37.0 ft. silty SAND, brown to beige, dry, medium dense.

7.5	11.0	11.7	Moisture Content (%)
		113.0	
1	0		Gravel Content (%)
56	19		Sand Content (%)
43	81		Fines Content (%)

Atterberg Limits	
Liquid Limit	Plasticity Index
43	23
26	4

AASHTO & USCS Classifications	
A-7-6 (18) CL	

Field Notes and Other Lab Tests
<p>UCCS=8357psf</p> <p>Calcite Veining at 17 ft to 19 ft</p>

DRORING LOG 2015 - SPT CDOT STYLE 217-376 US 550 CONNECTOR CURRENT-KEVIN.GPJ 2015 YEH ASSOCIATES TEMPLATE.GDT 2015 LIBRARY.GLB 12/18/18



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
			11-15	26		24.5 - 37.0 ft. silty SAND, brown to beige, dry, medium dense.									
6705	40					37.0 - 54.0 ft. GRAVEL in sandy matrix, multi-colored, dry, very dense.									
6700	45		10-32-35	67											
6695	50														
6690	55		50/3"	50/3"		54.0 - 69.5 ft. GRAVEL and COBBLE in sandy matrix, gray, dry, very dense.									
6685	60														
6680	65		50/1"	50/1"											
6675															
6670															

Bottom of Hole at 69.5 ft.

Water added by
driller 42 ft to 69 ft

Appendix D.5 – Wildlife Underpass A (WX2) Boring Logs



Boring Began: 4/24/2018
Boring Completed: 4/24/2018

Total Depth: 34.5 ft

Weather Notes:

Drilling Method(s): ODEX

Ground Elevation: 6676.9 ft

Inclination from Horiz.: Vertical

Driller: Authentic Drilling

Coordinates: N: E:

Location: Sta. 902+24, 17' R of CL (measured in field from

Night Work: ☐

Drill Rig: CME 55 Rubber Track

existing CL and survey lath)

Hammer: Automatic (hydraulic), ER: 95%

Logged By: B. Bunker

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
						0.0 - 1.0 ft. sandy GRAVEL mixed with asphalt millings, gray and black, dry, loose, Shouldering material.									
			3-4	7		1.0 - 7.0 ft. CLAY with some sand, brown, moist, medium stiff, Embankment fill.									
6670															
	10		5-9	14		7.0 - 23.0 ft. CLAY with some sand, reddish brown, moist, stiff to very stiff.	19.2		0	8	92	40	28	A-6 (25) CL	pH=8.6 S=0.024% ChI=0.00543% Re=1100ohm-cm S/C=-0.3%
			6-7	13			17.3	105.9							
6660															
	20		10-16	26											
6650			19-15-16	31		23.0 - 34.5 ft. GRAVEL with some sand and cobbles, trace clay, brown, moist, dense to very dense.									
			37-50/3"	50/3"											
	30														
			16-16-25	41											
6640						Bottom of Hole at 34.5 ft.									



Boring Began: 4/24/2018
Boring Completed: 4/24/2018

Total Depth: 38.8 ft

Weather Notes:

Drilling Method(s): ODEX

Ground Elevation: 6676.9 ft

Inclination from Horiz.: Vertical

Driller: Authentic Drilling

Coordinates: N: E:

Location: Sta. 902+77, 16' R CL (measured in field from

Night Work: ☐

Drill Rig: CME 55 Rubber Track

existing CL and survey lath)

Hammer: Automatic (hydraulic), ER: 95%

Logged By: B. Bunker

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
						0.0 - 1.0 ft. GRAVEL with some sand, gray, dry, loose, Shouldering material.									
			5-5	10		1.0 - 10.0 ft. CLAY with some sand, brown, moist, stiff, Embankment fill.									
6670															
			6-8	14											
	10														
			7-9	16		10.0 - 23.5 ft. CLAY with some sand, red-brown, moist, very stiff.	19.7		0	20	80	47	31	A-7-6 (24) CL	
6660															
			9-10-16	26											
	20														
			12-28	40		23.5 - 33.0 ft. GRAVEL with sand and cobbles, trace clay, brown, damp, medium dense to very dense.									
6650															
			28-19-19	38											
	30														
			15-8-10	18		33.0 - 35.0 ft. SAND with some clay, brown rust, dry, medium dense.									
6640						35.0 - 38.8 ft. CLAYSTONE, greenish gray, moderately weathered, medium hard to very hard, (ANIMAS FORMATION).									
			47-50/4"	50/4"											
Bottom of Hole at 38.8 ft.															



Boring Began: 4/24/2018

Total Depth: 29.5 ft

Weather Notes:

Boring Completed: 4/24/2018

Ground Elevation: 6670.7 ft

Inclination from Horiz.: Vertical

Drilling Method(s): ODEX

Coordinates: N: E:

Driller: Authentic Drilling

Location: Sta. 902+25, 21' East of ROW (measured in field

Night Work: ☐

Drill Rig: CME 55 Rubber Track

from ROW fence and survey lath)

Hammer: Automatic (hydraulic), ER: 95%

Logged By: B. Bunker

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6670						0.0 - 8.0 ft. CLAY with some sand, dark brown, damp to moist, very stiff.									
			9-11	20											
			9-10	19		8.0 - 14.0 ft. CLAY with some sand, red-brown, moist, very stiff.									
6660	10														
			12-12	24			15.7	106.8							
						14.0 - 19.0 ft. CLAY with some sand, trace gravel, red-brown, moist, very stiff.									
			50/3"	50/3"											
						19.0 - 22.0 ft. GRAVEL with some sand, trace clay, brown, moist, dense.									
6650	20														
			11-8-12	20		22.0 - 24.5 ft. SAND trace silt, dark brown, moist, medium dense.	5.1		22	64	14	NV	NP	A-1-b (0) SM	
						24.5 - 28.5 ft. GRAVEL with some sand, Cobbles and Boulders, multi-colored, damp, very dense.									
			14-9-7	16		28.5 - 29.5 ft. SAND trace silt, dark brown, moist, medium dense.									
6640						Bottom of Hole at 29.5 ft.									



Boring Began: 4/24/2018

Total Depth: 29.5 ft

Weather Notes:

Boring Completed: 4/24/2018

Ground Elevation: 6670.1 ft

Inclination from Horiz.: Vertical

Drilling Method(s): ODEX

Coordinates: N: E:

Driller: Authentic Drilling

Location: Sta. 902+73, 21' East of ROW (measured in field

Night Work: ☐

Drill Rig: CME 55 Rubber Track

from ROW fence and survey lath)

Hammer: Automatic (hydraulic), ER: 95%

Logged By: B. Bunker

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6660	10		17-19	36		0.0 - 5.0 ft. CLAY with some sand, dark brown, moist, very stiff.									
			7-10	17		5.0 - 18.0 ft. CLAY with some sand, brown, moist, very stiff.	16.3	111.4							
			11-16	27			17.3	111.3							
6650	20		50/5"	50/5"		18.0 - 27.0 ft. GRAVEL with some sand, cobbles, and boulders, multi-colored, damp, dense to very dense.								A-1-b (0) SM	Drill cuttings: Fragmented gravel, cobbles, and boulders
							5.2		33	52	15	NV	NP		
			30-12/1"	12/1"											
6640			22-27-37	64		27.0 - 29.5 ft. CLAYSTONE, greenish gray, moderately weathered, medium hard to hard, (ANIMAS FORMATION).									
						Bottom of Hole at 29.5 ft.									

Appendix D.6 – Wildlife Underpass B (WX) Boring Logs

Boring Began: 1/15/2018
Boring Completed: 1/15/2018
 Drilling Method(s): Air Rotary /
 ODEX

Total Depth: 45.5 ft
Ground Elevation: 6711.9 ft
Coordinates: N: E:
Location: Sta. 958+30, 4' R

Weather Notes:

Inclination from Horiz.: Vertical

Night Work: ☐

Driller: Authentic Drilling
Drill Rig: CME 750 Buggy Rig
Hammer: Automatic (hydraulic), ER: 97%

Logged By: B. Bunker
Final By: B. Bunker

Groundwater Levels:			
Symbol			
Depth	-	-	-
Date	-	-	-

[illegible]



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6675						34.0 - 45.5 ft. GRAVEL with some sand and cobbles, trace silt, brown, moist, dense to very dense.	3.5		56	34	10	NV	NP	A-1-a (0) GP-GM	Drill Cuttings: Fragmented gravel and cobbles
	40		16-15-24	39											
6670															
	45		28-18-20	38											
Bottom of Hole at 45.5 ft.															
6665															
6660															
6655															
6650															
6645															
6640															
6635															



Boring Began: 1/15/2018
Boring Completed: 1/15/2018
Drilling Method(s): Air Rotary /
ODEX
Driller: Authentic Drilling
Drill Rig: CME 750 Buggy Rig
Hammer: Automatic (hydraulic), ER: 97%

Total Depth: 35.0 ft
Ground Elevation: 6712.7 ft
Coordinates: N: E:
Location: Sta. 958+37, 69' L
Logged By: B. Bunker
Final By: B. Bunker

Weather Notes:
Inclination from Horiz.: Vertical
Night Work: ☐

Groundwater Levels:

Symbol			
Depth	-	-	-
Date	-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6710						0.0 - 3.5 ft. GRAVEL with some sand, trace clay, brown, moist, medium dense, Embankment Fill.									
	5		5-6-9	15		3.5 - 28.0 ft. CLAY with trace sand, red-brown, moist to wet, stiff to very stiff.									
6705															
	10		6-6	12			19.3	106.2	0	6	94	34	18	A-6 (16) CL	
6700															
	15		4-7-11	18											
6695															
	20		6-13	19			17.8	109.5							
6690															
	25														
6685															
	30		15-21-23	44		28.0 - 35.0 ft. GRAVEL with some sand, trace clay, brown, moist to wet, dense.									
6680															
			42-13-15	28											

Bottom of Hole at 35.0 ft.

BORING LOG 2015 - SPT CDOT STYLE 217-376 US 550 CONNECTOR_CURRENT - BARNEY.GPJ 2015 YEH ASSOCIATES TEMPLATE.GDT 2015 LIBRARY.GLB 12/18/18

Very Moist to Wet
at 14 ft



Cui Lhg Eaae. s l Aar & S
YehandAshochoshiita, I. si hAsaAa

Project
Name:

U.S. 550 South Connection to U.S. 160

PAGE
1 of 1

Project Number: 217-376

Boring No.: **WX-04**

Boring Began: 1/16/2018

Total Depth: 34.3 ft

Weather Notes:

Boring Completed: 1/16/2018

Ground Elevation: 6705.8 ft

Inclination from Horiz.: Vertical

Drilling Method(s): Air Rotary /

Coordinates: N: E:

ODEX

Location: Sta. 958+65, 153' L

Night Work: ☐

Driller: Authentic Drilling

Drill Rig: CME 750 Buggy Rig

Logged By: B. Bunker

Hammer: Automatic (hydraulic), ER: 97%

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6705						0.0 - 22.0 ft. CLAY with some sand, brown, moist, very stiff to hard.									
	5		8-9-10	19											
6700															
	10		11-15-15	30											
6695															
	15		12-22	34			11.2	111.4							S/C=0.3%
6690															
	20		12-14-15	29											
6685															
	25		13-18-14	32		22.0 - 34.3 ft. GRAVEL with some sand, trace silt, brown, moist, dense to very dense.									
6680							3.7		44	42	14	NV	NP	A-1-a (0) GM	Drill cuttings: Fragmented gravel.
	30		32-10/0"	10/0"											
6675															
			50/4"	60/4"		Bottom of Hole at 34.3 ft.									

BORING LOG 2015 - SPT CDOT STYLE 217-376 US 550 CONNECTOR CURRENT - BARNEY.GPJ 2015 YEH ASSOCIATES TEMPLATE.GDT 2015 LIBRARY.GLB 12/18/18

Appendix D.7 - Walls A, B, C, D, E, F and G Boring Logs



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6725		X			12-31-44	75		14.0 - 49.7 ft. GRAVEL with some cobbles, trace sand, scattered boulders encountered.									
40		X			23-25-28	53											
45		X			42-50/3"	50/3"											
50		X			50/5"	50/5"		49.7 - 55.0 ft. CLAYSTONE INTERBEDDED WITH SANDSTONE, gray, medium hard, (ANIMAS FORMATION).	8.6		2	65	33	25	3		
55			98	81													
60			74	62				55.0 - 64.0 ft. CLAYSTONE INTERBEDDED WITH SANDSTONE, blue-gray, slightly weathered, hard, (ANIMAS FORMATION).									
Bottom of Hole at 64.0 ft.																	



Project
Name:

U.S. 550 South Connection to U.S. 160

PAGE
1 of 2

Project Number: 217-376

Boring No.: **WA-02**

Boring Began: 1/11/2018

Total Depth: 67.0 ft

Weather Notes:

Boring Completed: 1/11/2018

Ground Elevation: 6766.5 ft

Inclination from Horiz.: Vertical

Drilling Method(s): ODEX /

Coordinates: N: E:

HQ Coring

Location: 1020+97, 86' L

Night Work: ☐

Driller: Authentic Drilling

Drill Rig: Acker Renegade

Logged By: E. Pickerill

Hammer: Automatic (hydraulic), ER: 96%

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6765	5	X			18-17-23	40		0.0 - 1.5 ft. silty CLAY, red-brown, damp. 1.5 - 6.0 ft. SAND with some silt and gravel, gray, damp, medium dense.	4.8		19	53	28	NV	NP	A-2-4 (0) SM	
6760	10	X			20/1"	20/1"		6.0 - 52.0 ft. sandy GRAVEL, gray and brown-gray, dry to damp, medium dense to very dense.									
6755	15	X			6-10-16	26											
6750	20	X			14-18-16	34											
6745	25	X			16-20/0"	20/0"			11.5		61	36	3	NV	NP	A-1-a (0) GP	Driller began adding water Fragmented cobbles and gravel
6740	30	X			24-42-22	64											
6735																	

BORING LOG 2015 - SPT CDOT STYLE 217-376 US 550 CONNECTOR - CURRENT - BARNEY.GPJ 2015 YEH ASSOCIATES TEMPLATE.GDT 2015 LIBRARY.GLB 12/18/18



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Boring No.: **WA-02**

[illegible]



Boring Began: 1/12/2018

Total Depth: 69.6 ft

Weather Notes:

Boring Completed: 1/13/2018

Ground Elevation: 6765.7 ft

Inclination from Horiz.: Vertical

Drilling Method(s): ODEX /

Coordinates: N: E:

Air Rotary

Location: 1022+07, 84' L

Night Work: ☐

Driller: Authentic Drilling

Drill Rig: Acker Renegade Track

Logged By: E. Pickerill

Hammer: Automatic (hydraulic), ER: 96%

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

BORING LOG 2015 - SPT CDOT STYLE 217-376 US 550 CONNECTOR_CURRENT - BARNEY.GPJ 2015 YEH ASSOCIATES TEMPLATE.GDT 2015 LIBRARY.GLB 12/18/18

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6765						0.0 - 3.0 ft. SAND with some silt and gravel, red-brown, damp.	4.7		19	58	23	NV	NP	A-1-b (0) SM	
	5		21-50/2"	50/2"		3.0 - 23.0 ft. GRAVEL with sand and cobbles, gray and brown-gray, dry to damp, dense to very dense.									
6760															
	10		13-16-18	34											
6755															
	15		15-17-18	35											
6750															
	20		10-15-23	38			2.8		53	38	9	NV	NP		
6745															
	25		25-30/5"	30/5"		23.0 - 52.0 ft. GRAVEL with sand, cobbles and boulders, gray and brown-gray, dry to damp, dense to very dense.									
6740															
	30		50/3"	50/3"											
6735															
			50/0"	50/0"											

Driller began adding water

Boulders at 23 ft to 52 ft



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6730						23.0 - 52.0 ft. GRAVEL with sand, cobbles and boulders, gray and brown-gray, dry to damp, dense to very dense.									
	40		18/3"	18/3"											
6725															
	45		20-50/6"	50/6"											
6720															
	50		50/0"	50/0"											
6715															
	55		50/3"	50/3"											
6710															
	60		50/3"	50/3"											
6705															
	65		50/3"	50/3"											
6700															
			50/1"	50/1"											
6695			Bottom of Hole at 69.6 ft.												
6690															



Boring Began: 12/7/2017

Total Depth: 69.8 ft

Weather Notes:

Boring Completed: 1/13/2018

Ground Elevation: 6762.7 ft

Inclination from Horiz.: Vertical

Drilling Method(s): ODEX /

Coordinates: N: E:

Air Rotary

Location: 1020+41, 67' R

Night Work: ☐

Driller: Authentic Drilling

Drill Rig: Acker Renegade Track

Logged By: E. Pickerill

Hammer: Automatic (hydraulic), ER: 96%

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6760	5	X	22-50/3"	50/3"		0.0 - 3.0 ft. sandy CLAY trace gravel, light brown, dry to damp, stiff.									
6755	10					3.0 - 9.5 ft. gravelly SAND trace silt, light brown, dry to moist, very dense.	1.4		40	48	12	20	2	A-1-a (0) SM	Drill cuttings: fragmented gravel and cobbles
6750	15	X	9-11-14	25		9.5 - 54.0 ft. GRAVEL with sand, cobbles and boulders, light brown and light gray, dry, medium dense to very dense.									
6745	20	X	11-38-33	71											
6740	25	X	15-50/5"	50/5"											
6735	30														
6730			50/3"	50/3"											



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6725	40					9.5 - 54.0 ft. GRAVEL with sand, cobbles and boulders, light brown and light gray, dry, medium dense to very dense.	0.5		38	60	2	NV	NP		Drill cuttings: fragmented gravel and cobbles pH=8.5 S=0.002% Re=14000ohm-cm
6720	45		27-25-33	58											
6715	50		25/0"	25/0"		54.0 - 59.0 ft. SANDY CLAYSTONE , olive-brown, moderately weathered, hard, (ANIMAS FORMATION).									Resumed drilling on 01/12/2018 Boulders at 49 to 54 feet
6710	55		50/4"	50/4"											
6705	60		50/3"	50/3"		59.0 - 69.8 ft. CLAYSTONE , blue-gray, slightly weathered, hard, (ANIMAS FORMATION).									Switch to Air Rotary at 54.5 ft
6700	65		50/4"	50/4"											
6695			50/4"	50/4"		Bottom of Hole at 69.8 ft.									
6690															



Project Name:

U.S. 550 South Connection to U.S. 160

Project Number: 217-376

Boring No.: WB-02

Boring Began: 12/5/2017
Boring Completed: 12/6/2017
Drilling Method(s): ODEX /
HQ Coring

Total Depth: 71.0 ft
Ground Elevation: 6765.0 ft
Coordinates: N: E:
Location: 1021+09, 96' R

Weather Notes:
Inclination from Horiz.: Vertical
Night Work: ☐

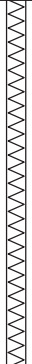


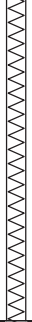





Driller: Authentic Drilling
Drill Rig: Acker Renegade
Hammer: Automatic (hydraulic), ER: 96%

Logged By: E. Pickerill
Final By: B. Bunker

Groundwater Levels:			
Symbol			
Depth	-	-	-
Date	-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6760	5							0.0 - 6.5 ft. sandy CLAY, tan, dry, stiff.									
6755	10				33-32	65		6.5 - 14.5 ft. gravelly SAND trace clay, light brown, dry to damp, dense.									
6750	15							14.5 - 51.5 ft. GRAVEL with sand and cobbles, gray light brown, dry to damp, medium dense to very dense.									
6745	20				20-25-37	62			0.5		51	46	3	NV	NP	A-1-a (0) GP	Drill cuttings: Fragmented gravel and cobble
6740	25																
6735	30				50/5"	50/5"											



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests	
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index			
6725	40							14.5 - 51.5 ft. GRAVEL with sand and cobbles, gray light brown, dry to damp, medium dense to very dense.	1.3		43	49	8	NV	NP		Driller started adding water Drill cuttings: Fragmented gravel and cobble	
6720	45				12-12-16	28												
6715	50																	
6710	55		96	31				51.5 - 71.0 ft. CLAYSTONE INTERBEDDED WITH SANDSTONE, blue-gray, slightly weathered, soft to very hard, (ANIMAS FORMATION).	4.5	135.4						55.0 ft - loss of circulation indicating fractures UCCS=1162psi		
6705	60		100	96														
6700	65		98	94														
6695	70		100	100														
Bottom of Hole at 71.0 ft.																		
6690																		

Boring Began: 12/4/2017

Total Depth: 70.0 ft

Weather Notes:

Boring Completed: 12/4/2017

Ground Elevation: 6771.1 ft

Inclination from Horiz.: Vertical

Drilling Method(s): ODEX

Coordinates: N: E:

Driller: Authentic Drilling

Location: Sta. 1021+81, 71' R

Night Work: ☐

Drill Rig: Acker Renegade

Logged By: B. Bunker

Hammer: Automatic (hydraulic), ER: %




















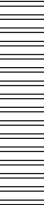


Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
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[illegible]



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6735			17-18-34	52		11.0 - 54.0 ft. GRAVEL with some sand and cobbles, brown and gray, moist, very dense.									
															
40			20-22/2"	22/2"											
															
45			18-40-47	87											
6725															
															
50			16-24-35	59											
															
55			50/5"	50/5"											
6715						54.0 - 70.0 ft. SHALE , gray, slightly weathered, hard, (ANIMAS FORMATION).	19.0		0	40	60	32	11		Drill Cuttings: Fragmented bedrock pH=8.5 S=0.014% Re=1100ohm-cm
															
60			50/4"	50/4"											
															
65			50/5"	50/5"											
6705															
															
70			50/4"	50/4"											
Bottom of Hole at 70.0 ft.															
6700															
6695															

Boring Began: 12/2/2017

Total Depth: 70.0 ft

Weather Notes:

Boring Completed: 12/2/2017

Ground Elevation: 6775.7 ft

Inclination from Horiz.: Vertical

Drilling Method(s): ODEX /

Coordinates: N: E:

Air Rotary

Location: Sta. 1023+08, 100' R

Night Work: ☐

Driller: Authentic Drilling

Logged By: E. Pickerill

Drill Rig: Acker Renegade Track

Hammer: Automatic (hydraulic), ER: %

Final By: B. Bunker

Groundwater Levels:			
Symbol			
Depth	-	-	-
Date	-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifications	Field Notes and Other Lab Tests	
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index			
6775						0.0 - 16.0 ft. CLAY with trace sand, light brown, damp, very stiff to hard.										
6770	5															
6765	10	✕	17-23	40			12.9	117.4								
6760	15						14.3		0	12	88	45	24	A-7-6 (22) CL		
6755	20		50/6"	50/6"												
6750	25															
6745	30	✕	17-41-27	68		30.0 - 36.0 ft. GRAVEL with some sand, multi-colored, dry to damp, loose to medium dense.										



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6740						36.0 - 57.0 ft. GRAVEL with some sand, trace cobbles, multi-colored, very dense.	5.6		65	32	3	NV	NP	A-1-a (0) GP	Cobble at 44.5 ft
6735	40		50/6"	50/6"											
6730	45														
6725	50		21-50/6"	50/6"		57.0 - 70.0 ft. CLAYSTONE, dark gray grades to light gray, slightly weathered, hard, (ANIMAS FORMATION).	5.6		65	32	3	NV	NP	A-1-a (0) GP	Drill Cuttings: Fragmented cobbles and gravel
6720	55														
6715	60		50/3"	50/3"											
6710	65														
6705	70		50/4"	50/4"		Bottom of Hole at 70.0 ft.									Switched to Air Rotary at 60 ft
6700															



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Boring No.: WB-05

Weather Notes:

Inclination from Horiz.: Vertical

Coordinates: N: E:

Location: Sta. 1024+06, 82' R

Night Work: ☐

Logged By: E. Pickerill

Hammer: Automatic (hydraulic), ER: 96%

Final By: B. Bunker

Groundwater Levels:

Symbol			
Depth	-	-	-
Date	-	-	-

[illegible]



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6745			30-50/3"	50/3"		21.0 - 55.0 ft. GRAVEL with cobbles and some sand, gray, damp, dense to very dense.									
6740	40														
6735	45		50/5"	50/5"											
6730	50					55.0 - 69.9 ft. CLAYSTONE , blue-gray, slightly weathered, hard, (ANIMAS FORMATION).	3.3		48	23	29	NV	NP		Drill Cuttings: Fragmented gravel and cobbles
6725	55		50/4"	50/4"											
6720	60		50/4"	50/4"			14.2		0	47	53	39	17		Drill Cuttings: Fragmented bedrock pH=8.5 S=0.012% Re=1400ohm·cm Swell / Consolidation test on remolded cuttings S/C=0.6%
6715	65														
6710			50/5"	50/5"		Bottom of Hole at 69.9 ft.									
6705															

Boring Began: 12/13/2017

Total Depth: 69.0 ft

Weather Notes:

Boring Completed: 12/13/2017

Ground Elevation: 6787.0 ft

Inclination from Horiz.: Vertical

Drilling Method(s): ODEX /

Coordinates: N: E:

HQ Coring

Location: Sta. 1025+09, 108' R

Night Work: ☐

Driller: Authentic Drilling

Logged By: E. Pickerill

Drill Rig: Acker Renegade Track

Hammer: Automatic (hydraulic), ER: 96%

















Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
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Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests	
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index			
6785								0.0 - 24.5 ft. CLAY with some sand, red-brown, damp, very stiff to hard.										
	5				15-18	33			13.7	110.5	0	36	64	46	32	A-7-6 (17) CL	Calcite veining at 5 ft to 10 ft	
6780																		
	10				19-25	44			9.6	97.6								S/C=0.5%
6775																		
	15				15-18	33			9.2	94.9								UCCS=1472psf
6770								11.0		0	10	90	34	16	A-6 (14) CL	pH=8.4 S=0.01% ChI=0.00623% Re=1300ohm·cm		
	20				17-23	40												
6765																		
	25				50/6" 30-50/6"	50/6" 50/6"		24.5 - 56.0 ft. GRAVEL with some sand and cobbles, brown-gray, dry, dense to very dense.										
6760																		
	30				13-21-16	37												
6755																	Water added by driller	



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Project
Name:

U.S. 550 South Connection to U.S. 160

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Project Number: 217-376

Boring No.: **WB-06**

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6750		X			19-23-34	57		24.5 - 56.0 ft. GRAVEL with some sand and cobbles, brown-gray, dry, dense to very dense.									
40		X			50/3"	50/3"											
6745		X															
45		X			50/4"	50/4"											
6740		X															
50		X			49-26-38	64											
6735		X															
55		X			32-26-34	60											
6730		X						56.0 - 61.0 ft. SANDSTONE INTERBEDDED WITH CLAYSTONE, tan-brown, medium hard, (ANIMAS FORMATION).									
60		X			50/4"	50/4"											
6725			63	22				61.0 - 69.0 ft. CLAYSTONE, olive to gray, hard, (ANIMAS FORMATION).									
65																	
6720			100	78													
Bottom of Hole at 69.0 ft.																	
6715																	
6710																	

Swell /
Consolidation test
on remolded
cuttings
S/C=0.3%

Wet Density
=155.8 pcf
UCCS=3057psi

BORING LOG 2015 - SPT CDOT STYLE 217-376 US 550 CONNECTOR_CURRENT - BARNEY.GPJ 2015 YEH ASSOCIATES TEMPLATE.GDT 2015 LIBRARY.GLB 12/18/18



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Project
Name:

U.S. 550 South Connection to U.S. 160

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Project Number: 217-376

Boring No.: **WB-07**

Boring Began: 12/14/2017

Total Depth: 69.2 ft

Weather Notes:

Boring Completed: 12/14/2017

Ground Elevation: 6780.7 ft

Inclination from Horiz.: Vertical

Drilling Method(s): ODEX /

Coordinates: N: E:

HQ Coring

Location: Sta. 1026+08, 90' R

Night Work: ☐

Driller: Authentic Drilling

Drill Rig: Acker Renegade Track

Logged By: E. Pickerill

Hammer: Automatic (hydraulic), ER: 96%

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6780								0.0 - 17.5 ft. CLAY with some sand, red-brown, high plasticity, damp, very stiff.	13.4		0	16	84	59	40	A-7-6 (35) CH	
	5				15-15	30											
6775																	
	10				15-21	36											
6770								17.5 - 44.0 ft. GRAVEL with some sand and cobbles, brown, dry, medium dense to very dense.									
	15				12-18	30											
6765																	
	20				14-23-30	53											
6760																	Water added by driller
	25				11-13-16	29											
6755																	
	30				13-25-16	41											
6750											59	34	7	NV	NP	A-1-a (0) GP-GM	Drill cuttings: Fragmented gravel and cobbles



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6745					17-50/5"	50/5"		17.5 - 44.0 ft. GRAVEL with some sand and cobbles, brown, dry, medium dense to very dense.									
6740	40				18-34-21	55											
6735	45				47-50/4"	97/10"		44.0 - 53.0 ft. CLAYSTONE, olive to gray, moderately weathered, medium hard, (ANIMAS FORMATION).	10.3		0	63	37	34	14		
6730	50		76	21													
6725	55		24	0				53.0 - 69.2 ft. SHALE, blue-gray, slightly weathered, hard, (ANIMAS FORMATION).	3.5	139.5							
6720	60		92	82													
6715	65		96	86													UCCS=3728psi
6710								Bottom of Hole at 69.2 ft.									
6705																	

Boring Began: 12/15/2017

Total Depth: 69.8 ft

Weather Notes:

Boring Completed: 12/15/2017

Ground Elevation: 6789.2 ft

Inclination from Horiz.: Vertical

Drilling Method(s): ODEX

Coordinates: N: E:

Driller: Authentic Drilling

Location: Sta. 1026+99, 93' R

Night Work: ☐

Drill Rig: Acker Renegade Track

Hammer: Automatic (hydraulic), ER: 96%

Logged By: E. Pickerill

Final By: B. Bunker

Groundwater Levels:


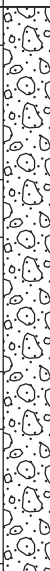



















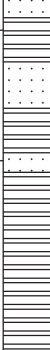




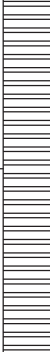




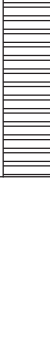








Symbol	Depth	Date
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Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6785	5		20-20	40		0.0 - 25.0 ft. CLAY with some sand, light brown, damp to moist, very stiff to hard.	7.5	98.6			49				Calcite veining
6780	10		15-19	34											
6775	15		12-14	26											
6770	20		16-18	34											
6765	25		18-40	58		25.0 - 52.0 ft. GRAVEL with some sand and cobbles, light gray brown, dry, dense to very dense.									
6760	30		17-19-25	44											
6755															



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
			16-19-22	41		25.0 - 52.0 ft. GRAVEL with some sand and cobbles, light gray brown, dry, dense to very dense.	7.1		55	42	3	NV	NP	A-1-a (0) GP	Drill cuttings: Fragmented cobbles and gravel
6750	40														
			14-18-22	40											
6745	45					52.0 - 66.0 ft. CLAYSTONE INTERBEDDED WITH SANDSTONE , olive gray, moderately weathered, medium hard to hard, (ANIMAS FORMATION).									
			15-19-25	44											
6740	50		50/1"	50/1"											
6735	55		33-50/5"	50/5"		66.0 - 69.8 ft. SHALE , blue-gray, slightly weathered, hard.	13.2	91.5	0	70	30	39	17		Drill cuttings: Fragmented bedrock pH=8.6 S=0.018% Re=1400ohm·cm
6730	60		50/5"	50/5"											
6725	65		50/3"	50/3"											
6720			50/4"	50/4"		Bottom of Hole at 69.8 ft.	9.4		0	32	68	37	19		
6715															



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6750	40				16-19-23	42		25.5 - 49.8 ft. sandy GRAVEL, brown gray, damp to dry, medium dense to dense.									Water added by driller
																	
																	
																	
6745	45				12-13-14	27											
																	
																	
																	
6740	50				14-15-23	38											
																	
																	
																	
6735	55				37-50/5"	50/5"		49.8 - 58.5 ft. SANDSTONE INTERBEDDED WITH SHALE LAYERS, tan-brown, moderately weathered, medium hard, (ANIMAS FORMATION).	10.4		0	58	42	41	17		Drill cuttings: Fragmented bedrock
																	
																	
																	
6730	60		88	19				58.5 - 68.2 ft. SHALE, blue-gray, slightly weathered, hard, (ANIMAS FORMATION).									Switch to coring at 54.8 ft
																	
																	
																	
6725	65		100	95													
																	
																	
																	
6720			100	96													
																	
																	
																	
6715																	
																	
																	
																	
Bottom of Hole at 68.2 ft.																	



Boring Began: 3/27/2018

Total Depth: 50.0 ft

Weather Notes:

Boring Completed: 3/28/2018

Ground Elevation: 6741.8 ft

Inclination from Horiz.: Vertical

Drilling Method(s): HQ Coring /

Coordinates: N: E:

NQ Coring

Location: Sta. 1029+10, 72' R

Night Work: ☐

Driller: Salisbury & Associates

Logged By: E. Pickerill

Drill Rig: GH-5 Viper

Final By: B. Bunker

Hammer: Cathead and rope, ER: %

Groundwater Levels:

Symbol			
Depth	-	-	-
Date	-	-	-

BORING LOG 2015 - SPT CDOT STYLE 217-376 US 550 CONNECTOR CURRENT - BARNEY.GPJ 2015 YEH ASSOCIATES TEMPLATE.GDT 2015 LIBRARY.GLB 12/18/18

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6740								0.0 - 4.5 ft. silty CLAY with sand and cobbles, some organics, soft.							water added by driller
	5	X			30-50/3"	50/3"		4.5 - 41.0 ft. CLAYSTONE, yellow to olive, predominantly decomposed to moderately weathered, soft to hard, Fractured, (ANIMAS FORMATION).							
6735															
	10														
6730			76	9											
	15														
6725			96	38											
	20														
6720			90	0											
	25														
6715			92	0											
	30														
6710															Core sample from 30 to 36 ft was lost due to core barrel being locked in the casing



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6705			80	22				41.0 - 50.0 ft. SANDSTONE INTERBEDDED WITH SHALE LAYERS, blue-gray, slightly weathered, hard, some infilled fractures, (ANIMAS FORMATION).							Switch to NQ Coring at 35 ft
6700	40		98	80											
6695	45		97	56											
	50							Bottom of Hole at 50.0 ft.							
6690															
6685															
6680															
6675															
6670															
6665															



Boring Began: 1/8/2018

Total Depth: 61.8 ft

Weather Notes:

Boring Completed: 1/9/2018

Ground Elevation: 6766.0 ft

Inclination from Horiz.: Vertical

Drilling Method(s): ODEX /

Coordinates: N: E:

HQ Coring

Location: Sta. 1026+24, 84' L

Night Work: ☐

Driller: Authentic Drilling

Drill Rig: Acker Renegade Track

Logged By: E. Pickerill

Hammer: Automatic (hydraulic), ER: 96%

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6765								0.0 - 1.0 ft. CLAY with some sand, reddish brown, damp.									
	5				15-15-11	26		1.0 - 20.0 ft. GRAVEL with some sand, and cobbles, gray light brown, damp to dry, medium dense.									Cobble at 1 ft to 33 ft
6760									0.9		38	58	4	NV	NP	A-1-a (0) SP	Drill Cuttings: Fragmented gravel
	10				6-8-10	18											
6755																	
	15				8-7-8	15											
6750																	
	20				20-50/4"	50/4"		20.0 - 33.0 ft. GRAVEL with some sand, cobbles and boulders, multi-colored, damp to dry, dense to very dense.									
6745																	
	25				7-14-16	30											
6740																	
	30				12-20-16	36											
6735								33.0 - 61.8 ft. CLAYSTONE INTERBEDDED WITH SANDSTONE, yellowish									Swell / Consolidation test on remolded sample S/C=0.3%
					50/3"	50/3"											



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6730								brown grades to gray, hard, (ANIMAS FORMATION).									
	40								8.7		15	51	34	37	21		Drill Cuttings: Fragmented bedrock
6725			100	63					7.8	122.3	0	52	48	35	10		Shale/bedrock core. Slaking test performed. Breaks slowly, and forms several fractures
	45		90	52													
6720																	
	50		100	63													R-Value Sample: 39'-55' R-Value=25
6715																	
	55		100	73													
6710																	
	60		100	72													
6705																	
Bottom of Hole at 61.8 ft.																	
6700																	
6695																	
6690																	



Boring Began: 12/19/2017

Total Depth: 53.5 ft

Weather Notes:

Boring Completed: 12/20/2017

Ground Elevation: 6767.2 ft

Inclination from Horiz.: Vertical

Drilling Method(s): ODEX /

Coordinates: N: E:

HQ Coring

Location: Sta. 1027+61, 84' L

Night Work: ☐

Driller: Authentic Drilling

Drill Rig: Acker Renegade Track

Logged By: E. Pickerill

Hammer: Automatic (hydraulic), ER: 96%

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6765	5	X			27-34-34	68		0.0 - 1.0 ft. CLAY with some sand, light brown, dry. 1.0 - 30.3 ft. GRAVEL with sand and cobbles, light gray, dry, medium dense to very dense.									
6760	10	X			85-50/5"	50/5"											
6755	15	X			9-15-14	29			1.0		46	50	4	NV	NP	A-1-a (0) SP	Drill Cuttings: Fragmented gravel and cobbles
6750	20	X			13-24-21	45											
6745	25	X			21-30-26	56											
6740	30	X			35-50/4"	50/4"											
6735								30.3 - 42.0 ft. SANDSTONE INTERBEDDED WITH SHALE LAYERS, tan-brown-rust, moderately weathered, medium hard to hard, (ANIMAS FORMATION).									



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6730	40		100	87				42.0 - 53.5 ft. SANDY SHALE , blue-grey, slightly weathered to fresh, hard to very hard, (ANIMAS FORMATION).	0.5	159.3						UCCS=7224psi	
			100	90													
			100	96													
			96	89													
6715																	
Bottom of Hole at 53.5 ft.																	
6710																	
6705																	
6700																	
6695																	
6690																	



Boring Began: 12/18/2017

Total Depth: 67.6 ft

Weather Notes:

Boring Completed: 12/19/2017

Ground Elevation: 6768.6 ft

Inclination from Horiz.: Vertical

Drilling Method(s): ODEX /

Coordinates: N: E:

Night Work: ☐

HQ Coring

Location: Sta. 1028+50, 74' L

Driller: Authentic Drilling

Groundwater Levels:

Drill Rig: Acker Renegade Track

Logged By: E. Pickerill

Hammer: Automatic (hydraulic), ER: 96%

Final By: B. Bunker

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
								0.0 - 1.5 ft. CLAY with some sand, light brown, dry.									
6765	5				35-26-26	52		1.5 - 29.0 ft. GRAVEL with some sand and cobble, light brown to light gray, dry, medium dense to very dense.	3.8		23	54	23	27	8	A-2-4 (0) SC	Drill Cuttings: Fragmented gravel and cobbles
6760	10				6-7-12	19											
6755	15				27-42-18	60											
6750	20				21-12-12	24											
6745	25				8-14-26	40											
6740	30				50/5"	50/5"		29.0 - 42.6 ft. CLAYSTONE , olive gray, moderately weathered, medium hard to very hard, (ANIMAS FORMATION).	12.1	109.2	0	82	18	40	18		
6735									9.5		1	56	43	35	16		Drill Cuttings: Fragmented bedrock pH=8.5 S=0.002% Re=2000ohm-cm



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
			81	24													
6730	40		96	92													
6725	45		34	13				42.6 - 67.6 ft. SHALE, blue-gray, slightly weathered, soft to hard, (ANIMAS FORMATION).									
6720	50		50	42													
6715	55		58	32													
6710	60		96	84													
6705	65		100	96													
6700								Bottom of Hole at 67.6 ft.									
6695																	

Wet Density
=153.1 pcf
UCCS=1675psi



Cuihgeae. s Aar & S
YehandAshochoshiita, I. si hAsaAa

Project
Name:

U.S. 550 South Connection to U.S. 160

PAGE
1 of 2

Project Number: 217-376

Boring No.: **WD-01**

Boring Began: 3/30/2018

Total Depth: 39.9 ft

Weather Notes:

Boring Completed: 3/31/2018

Ground Elevation: 6688.1 ft

Inclination from Horiz.: Vertical

Drilling Method(s): HQ Coring /

Coordinates: N: E:

NX Coring

Location: Sta. 1039+79, 94' L

Night Work: ☐

Driller: Salisbury & Associates

Drill Rig: Burly 4000

Logged By: R. Borst

Hammer: Cathead and rope, ER: %

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6685	5		100	0				0.0 - 2.5 ft. sandy CLAY , dark brown, moist, very fine grained sand, organics- roots.							
6680	10		33	0	50/5"	50/5"		2.5 - 26.5 ft. CLAYSTONE , brown and tan, predominantly decomposed to moderately weathered, very hard, organics- roots, lignite stringers, moist, (ANIMAS FORMATION).							
6675	15		100	18											
6670	20		94	35											
6665	25		95	45											
6660	30		100	8											
6655	35		100	27				26.5 - 27.5 ft. SANDSTONE , brown and blue-grey, moderately weathered, hard, very fine grained sand granules.							
	37.5							27.5 - 29.0 ft. SANDSTONE INTERBEDDED WITH SHALE LAYERS , blue-grey, slightly weathered, hard, joint, iron oxide infilling, lignite stringers,.							
	39.9		100	86				29.0 - 39.9 ft. CONGLOMERATIC SANDSTONE , blue-grey, slightly weathered to fresh, hard to very hard, with conglomerate lenses.							

BORING LOG 2015 - SPT CDOT STYLE 217-376 US 550 CONNECTOR, CURRENT - BARNEY.GPJ 2015 YEH ASSOCIATES TEMPLATE.GDT 2015 LIBRARY.GLB 12/18/18



Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Rock		Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Recovery (%)	RQD (%)	Blows per 6 in	Penetration Resistance						Liquid Limit	Plasticity Index		
6650			88	77											
Bottom of Hole at 39.9 ft.															
6645															
6640															
6635															
6630															
6625															
6620															
6615															



Boring Began: 3/14/2018
Boring Completed: 3/14/2018

Total Depth: 29.5 ft
Ground Elevation: 6707.6 ft
Coordinates: N: E:
Location: Sta. 985+25, 125' L

Weather Notes:
Inclination from Horiz.: Vertical

Drilling Method(s): ODEX
Driller: Authentic Drilling
Drill Rig: Acker Renegade
Hammer: Automatic (hydraulic), ER: 96%

Logged By: K. Moran
Final By: B. Bunker

Night Work: ☐

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6705						0.0 - 14.5 ft. CLAY with some sand, brown, moist, stiff.									pH=8.5 S=0.054% Chl=0.00784% Re=1000ohm-cm S/C=-0.2%
	5		8-7-6	13			7.6	0	28	72	26	8	A-4 (4) CL		
6700							14.9	0	16	84	29	10	A-4 (7) CL		
	10		6-7	13			14.8	107.4							
6695						14.5 - 29.5 ft. GRAVEL with sand, Cobbles and Boulders, multi-colored, dry to damp, dense to very dense.									A-1-b (0) GP-GM Drill cuttings: Fragmented gravel and cobbles
	15		50/4"	50/4"											
6690															
	20		23-23-19	42											
6685								1.8	58	34	8	NV	NP	A-1-b (0) GP-GM	
	25		40-35-27	62											
6680						Bottom of Hole at 29.5 ft.									
			50/5"	50/5"											
6675															



Boring Began: 3/14/2018
Boring Completed: 3/14/2018

Total Depth: 30.5 ft
Ground Elevation: 6706.2 ft
Coordinates: N: E:
Location: Sta. 985+72, 125' L

Weather Notes:
Inclination from Horiz.: Vertical

Drilling Method(s): ODEX

Driller: Authentic Drilling

Drill Rig: Acker Renegade

Hammer: Automatic (hydraulic), ER: 96%

Logged By: K. Moran

Final By: B. Bunker

Night Work: ☐

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6705						0.0 - 16.0 ft. CLAY with some sand, red-brown, moist, medium stiff to hard.	18.4		0	26	74	33	18	A-6 (11) CL	
	5		12-14	26											
6700															
	10		4-3-4	7		16.0 - 30.5 ft. GRAVEL with some sand, cobbles and boulders, multi-colored, dry to damp, dense to very dense.									
6695															
	15		7-21-19	40											
6690															
	20		7-20-12	32											
6685															
	25		50/3"												
6680															
	30		25-33-39	72		Bottom of Hole at 30.5 ft.									
6675															

Boring Began: 4/18/2018

Total Depth: 33.2 ft

Weather Notes:

Boring Completed: 4/18/2018

Ground Elevation: 6714.5 ft

Inclination from Horiz.: Vertical

Drilling Method(s): ODEX

Coordinates: N: E:

Driller: Authentic Drilling

Location: Sta. 979+74, 214' L

Night Work: ☐

Drill Rig: CME 55 Rubber Track

Hammer: Automatic (hydraulic), ER: 95%

Logged By: E. Pickerill

Final By: B. Bunker

Groundwater Levels:

Symbol			
Depth	-	-	-
Date	-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifications	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6710 															



Boring Began: 4/18/2018

Total Depth: 29.3 ft

Weather Notes:

Boring Completed: 4/18/2018

Ground Elevation: 6706.9 ft

Inclination from Horiz.: Vertical

Drilling Method(s): ODEX

Coordinates: N: E:

Driller: Authentic Drilling

Location: Sta. 981+74, 195' L

Night Work: ☐

Drill Rig: CME 55 Rubber Track

Hammer: Automatic (hydraulic), ER: 95%

Logged By: E. Pickerill

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6705						0.0 - 9.5 ft. SILT with some sand, red-brown, dry to moist, very stiff.									
	5		15-15	30			13.8	101.7							S/C=-0.8%
6700															
	10		8-8	16		9.5 - 16.0 ft. SILT with some sand, brown, moist, very stiff to hard.	9.4		0	24	76	31	8	A-4 (5) ML	
6695															
	15		15-28	43											
6690						16.0 - 23.0 ft. GRAVEL with some sand, and cobbles, light brown and gray, dry, medium dense to dense.									
	20		37-16	53											
6685															
	25		8/4"	8/4"		23.0 - 29.3 ft. GRAVEL with some sand, cobbles and boulders, multi-colored, dry, dense to very dense.									Sample barrel not advancing (bouncing). Drive terminated.
6680															
			30-26-27/3"	53/9"											No movement in final 10 blows. Drive terminated
Bottom of Hole at 29.3 ft.															
6675															



Boring Began: 11/16/2017

Total Depth: 35.0 ft

Weather Notes:

Boring Completed: 11/17/2017

Ground Elevation: 6732.0 ft

Inclination from Horiz.: Vertical

Drilling Method(s): Hollow-Stem Auger

Coordinates: N: E:

Driller: Authentic Drilling

Location: Sta. 1008+72, 129' R

Night Work: ☐

Drill Rig: CME 750 Buggy Rig

Hammer: Automatic (hydraulic), ER: 97%

Logged By: B. Bunker

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6730						0.0 - 12.0 ft. silty SAND, tan, damp, medium dense.									
	5		7-8-6	14											
6725							5.8		0	66	34	NV	NP	A-2-4 (0) SM	pH=8.8 S=0.007% Re=2800ohm·cm
	10		11-10-10	20											
6720						12.0 - 20.0 ft. sandy CLAY, brown, damp, very stiff to hard.									
	15		8-12	20			9.4	93.6							
6715															
	20		18-35	53											
6710						20.0 - 35.0 ft. clayey GRAVEL sandy, gray brown, moist, very dense.									
	25		44-14/1"	14/1"											
6705															
	30		26/4"	26/4"											
6700															
			17-40/5"	40/5"											

Bottom of Hole at 35.0 ft.



Boring Began: 11/18/2017

Total Depth: 35.0 ft

Weather Notes:

Boring Completed: 11/18/2017

Ground Elevation: 6734.1 ft

Inclination from Horiz.: Vertical

Drilling Method(s): Hollow-Stem Auger

Coordinates: N: E:

Driller: Authentic Drilling

Location: Sta. 1009+60, 127' R

Night Work: ☐

Drill Rig: CME 750 Buggy Rig

Hammer: Automatic (hydraulic), ER: 97%

Logged By: B. Kunz

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6730	5		8-8-9	17		0.0 - 16.0 ft. silty SAND trace gravel, brown, dry, medium dense.									
6725	10		10-15-19	34											
6720	15		16-13	29			6.2		9	54	37	25	4	A-4 (0) SM-SC	
6715	20		50/5"	50/5"		16.0 - 20.0 ft. SILT with some sand, dark brown, dry, very dense.	13.6	103.9							
6710	25		47-36-34	70		20.0 - 35.0 ft. sandy GRAVEL with some cobbles, gray, dry, very dense.									
6705	30		15/1"	15/1"											No movement in 10 blows. Drive terminated
6700			36/6"	36/6"											No movement in 10 blows. Drive terminated

Bottom of Hole at 35.0 ft.

Boring Began: 12/1/2017

Total Depth: 30.5 ft

Weather Notes:

Boring Completed: 12/1/2017

Ground Elevation: 6718.0 ft

Inclination from Horiz.: Vertical

Drilling Method(s): Hollow-Stem Auger /

Coordinates: N: E:

ODEX

Location: Sta. 1009+68, 19' L

Night Work: ☐

Driller: Authentic Drilling

Logged By: E. Pickerill

Drill Rig: Acker Renegade Track

Hammer: Automatic (hydraulic), ER: 96%

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
--------	-------	------

10

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6715	5					0.0 - 5.0 ft. CLAY with some sand, tan, damp, stiff to very stiff.	5.0		49	22	29	37	20	A-2-6 (0) GC	pH=8.5 S=0.019% Chl=0.00118% Re=1600ohm·cm
6710		27-33-22	55	5.0 - 15.0 ft. GRAVEL with some clay and sand, red-brown to gray, damp to moist, very dense.											
6705	10		24-44-34	78			4.7		40	47	13	NV	NP		R-Value Sample: 5'-18' R-Value=18
6700		18-50/5"	50/5"	15.0 - 21.0 ft. GRAVEL with some sand and cobbles, gray, dry, dense.											
6695	20		50/4"	50/4"			4.7		40	47	13	NV	NP		Switched to ODEX at 18.5 ft
6690		50/6"	50/6"	21.0 - 24.0 ft. gravelly SAND with some silt, brown, moist.											
6685	25		50/6"	50/6"		24.0 - 30.5 ft. GRAVEL with some sand and cobbles, gray, dry, very dense.									pH=8.6 S=0.014% Chl=0.00576% Re=2700ohm·cm
		45-50/5"	50/5"												
Bottom of Hole at 30.5 ft.															

Appendix D.8 – Test Pit Logs



Boring Began: 3/2/2018

Total Depth: 8.5 ft

Weather Notes:

Boring Completed: 3/2/2018

Ground Elevation: 6817.7 ft

Inclination from Horiz.: Vertical

Drilling Method(s): Test Pit - excavator

Coordinates: N: E:

Driller:

Location: Sta. 1036+76, 139' R

Night Work: ☐

Drill Rig: Rubber tire Backhoe



Hammer: , ER: %

Logged By: E. Pickerill

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6815	5					0.0 - 1.0 ft. CLAY with some sand, reddish brown.	3.6		65	25	10	27	6	A-1-a (0) GP	
						1.0 - 8.5 ft. COBBLES in a gravel and sand matrix, trace clay, multi-colored.									
					Bottom of Hole at 8.5 ft.										



Boring Began: 3/2/2018

Total Depth: 8.0 ft

Weather Notes:

Boring Completed: 3/2/2018

Ground Elevation: 6801.2 ft

Inclination from Horiz.: Vertical

Drilling Method(s): Test Pit - excavator

Coordinates: N: E:

Driller:

Location: Sta. 1037+17, 67' R

Night Work: ☐

Drill Rig: Rubber tire Backhoe

Hammer: , ER: %

Logged By: E. Pickerill

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6800						0.0 - 6.0 ft. COBBLES in a gravel and sand matrix, multi-colored.									
	5						1.3		76	21	3	NV	NP	A-1-a (0) GP	
6795						6.0 - 7.0 ft. silty SAND , orange to brown.									
						7.0 - 8.0 ft. COBBLES in a gravel and sand matrix, multi-colored.									
Bottom of Hole at 8.0 ft.															



Boring Began: 3/2/2018

Total Depth: 8.0 ft

Weather Notes:

Boring Completed: 3/2/2018

Ground Elevation: 6788.6 ft

Inclination from Horiz.: Vertical

Drilling Method(s): Test Pit - excavator

Coordinates: N: E:

Driller:

Location: Sta. 1038+20, 55' R

Night Work: ☐

Drill Rig: Rubber tire Backhoe

Hammer: , ER: %

Logged By: E. Pickerill

Final By: B. Bunker

Groundwater Levels:

Symbol	Depth	Date
-	-	-
-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples		Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits		AASHTO & USCS Classifi- cations	Field Notes and Other Lab Tests
			Blows per 6 in	Penetration Resistance								Liquid Limit	Plasticity Index		
6785	5					0.0 - 6.0 ft. COBBLES in a gravel and sand matrix, some silt, red-brown.	3.3		61	21	18	29	12	A-1-b (0) GM	
6780						6.0 - 8.0 ft. SANDSTONE INTERBEDDED WITH CLAYSTONE , olive-brown, moderately weathered, medium hard, (ANIMAS FORMATION).									R-Value=23
Bottom of Hole at 8.0 ft.															

Appendix E – Laboratory Test Results

E.1	Roadway and Excavation Laboratory Test Results
E.2	Bridges Laboratory Test Results
E.3	Wildlife and Livestock Crossings Laboratory Test Results
E.4	Retaining Wall Laboratory Test Results
E.5	Test Pits 1, 2 and 3 Laboratory Test Results
E.6	Outside Laboratory Test Results
E.7	Summary of Chemical Test Results

Appendix E.1 – Roadway and Excavation Laboratory Test Results



YEH & ASSOCIATES, INC

Summary of Laboratory Test Results

Project No: 217-376 Project Name: 22420: US 550 S Connection to US 160 Roadway and Excavtion Test Results Date: 7/10/2018

Sample Location			Natural Moisture Content (%)	Natural Dry Density (pcf)	AASHTO T99		Gradation			Atterberg			pH	Water Soluble Sulfate (%)	Chloride (%)	% Swell (+) / Consolidation (-)	Resistivity (Ohm-cm)	Uncon-Comp strength (rock-psi)	Uncon-Comp strength (soil-psf)	CLASSIFICATION	
Boring	Sample Type	Depth (ft)			Max. Dry Density (pcf)	Optimum Moisture (%)	Gravel > #4 (%)	Sand (%)	Fines < #200 (%)	LL	PL	PI								AASHTO	USCS
R-01	MC	4	15.3	107.8												1.0					
R-01	SS	9	14.0				2	13	85	32	14	18								A-6 (14)	CL
R-01	bulk	9-14	15.1				0	13	87	34	18	16	8.3	0.005	0.00788		730			A-6 (13)	CL
R-02	bulk	1-2	2.2				47	40	13	NV	NP	NP	8.8	0.002	0.00433		3000			A-1-a (0)	GM
R-02	bulk	14-19	16.2				0	25	75	31	16	15								A-6 (9)	CL
R-03	MC	4	18.1	107.5												0.4					
R-03	bulk	9-14	18.5				0	28	72	40	17	23	8.2	0.016	0.00164		1200			A-6 (15)	CL
R-04	bulk	9-14	17.4				0	24	76	46	19	27	8.1	0.019	0.00292		1060			A-7-6 (20)	CL
R-04	MC	14	11.9	115.6												1.6					
R-05	bulk	9-14	12.2				0	19	81	35	17	18	8.8	0.012	0.0029		1200			A-6 (13)	CL
R-06	bulk	4-9	15.5				0	15	85	38	17	21	7.6	0.020	0.1060		340			A-6 (17)	CL
R-06	MC	9	13.5	117.9												3.9					
R-07	bulk	5-10	11.0				0	28	72	47	20	27	8.2	0.026	0.0053		1300			A-7-6 (18)	CL
R-07	MC	10	8.9	97.8			0	54	46	31	14	17				-1.8				A-6 (4)	SC
R-08	bulk	10-15	6.6				1	20	79	38	16	22								A-6 (16)	CL
R-08	MC	15	9.8	107.0												1.1					
R-09	bulk	14-19	4.4				1	28	71	27	17	10	8.4	0.027	0.0065		1300			A-4 (5)	CL
R-09	SS	22	6.4				22	37	41	32	15	17								A-6 (3)	SC

bulk - indicates drill cuttings sample
MC - indicates Modified California sample
CORE - indicates rock core sample
SS - indicates Split Spoon sample
NV - indicates no value
NP - indicates no plasticity



YEH & ASSOCIATES, INC

Summary of Laboratory Test Results

Project No: 217-376 Project Name: 22420: US 550 S Connection to US 160 Roadway and Excavtion Test Results Date: 7/10/2018

Sample Location			Natural Moisture Content (%)	Natural Dry Density (pcf)	AASHTO T99		Gradation			Atterberg			pH	Water Soluble Sulfate (%)	Chloride (%)	% Swell (+) / Consolidation (-)	Resistivity (Ohm-cm)	Uncon-Comp strength (rock-psi)	Uncon-Comp strength (soil-psf)	CLASSIFICATION	
Boring	Sample Type	Depth (ft)			Max. Dry Density (pcf)	Optimum Moisture (%)	Gravel > #4 (%)	Sand (%)	Fines < #200 (%)	LL	PL	PI								AASHTO	USCS
R-10	bulk	4-9	5.8				0	66	34	NV	NP	NP	8.8	0.007	≤0.00105		2800			A-2-4 (0)	SM
R-10	MC	14	9.4	93.6																	
R-11	bulk	9.5-14.5	6.2				9	54	37	25	21	4								A-4 (0)	SM-SC
R-11	MC	14.5	13.6	103.9																	
R-12	bulk	4.5-9.5	5.0				49	22	29	37	17	20	8.5	0.019	0.0012		1600			A-2-6 (0)	GC
R-12	bulk	19.5-24.5	4.7				40	47	13	NV	NP	NP	8.6	0.014	0.0058		2700			A-1-b (0)	SM
E-01	bulk	0-4	17.9				0	16	84	72	22	50								A-7-6 (45)	CH
E-01	bulk	19-24	1.8				68	27	5	NV	NP	NP								A-1-a (0)	GP
E-01	bulk	74-79	11.8				0	67	33	38	21	17								crushed BR	
E-01	bulk	79-84								30	21	9	9.0	0.011	<0.00110		1500			crushed BR	
E-01	bulk	114.0-119.0								28	19	9	9.4	0.015	<0.00110		1500			crushed BR	
E-02	MC	4.5	7.9	97.3																	
E-02	bulk	4.5-9.5	3.5				26	61	13	22	18	4								A-1-b (0)	SC-SM
E-02	CORE	59.5-59.9	3.8	139.6														3100			
E-02	CORE	70.9-71.4	6.4	138.1														1526			
E-02	CORE	91.0-91.5	6.4	144.6														3298			
E-02	CORE	106.3-106.7	3.6	143.7														3392			
E-02	CORE	128.0-128.3	3.9	141.6														2427			

bulk - indicates drill cuttings sample
MC - indicates Modified California sample
CORE - indicates rock core sample
SS - indicates Split Spoon sample
NV - indicates no value
NP - indicates no plasticity



YEH & ASSOCIATES, INC

Summary of Laboratory Test Results

Project No: 217-376 Project Name: 22420: US 550 S Connection to US 160 Roadway and Excavtion Test Results Date: 7/10/2018

Sample Location			Natural Moisture Content (%)	Natural Dry Density (pcf)	AASHTO T99		Gradation			Atterberg			pH	Water Soluble Sulfate (%)	Chloride (%)	% Swell (+) / Consolida-tion (-)	Resistivity (Ohm-cm)	Uncon-Comp strength (rock-psi)	Uncon-Comp strength (soil-psf)	CLASSIFICATION	
Boring	Sample Type	Depth (ft)			Max. Dry Density (pcf)	Optimum Moisture (%)	Gravel > #4 (%)	Sand (%)	Fines < #200 (%)	LL	PL	PI								AASHTO	USCS
E-02	CORE	143.0-143.7	4.4	149.1														7021			
E-03	MC	4.5	14.0	112.5																	
E-03	bulk	4.5-9.5	11.5				5	20	75	50	18	32								A-7-6 (23)	CH
E-04	MC	9.5	12.7	110.3																	
E-04	bulk	59.5-64.5								29	19	10	8.7	0.002	<0.00109		2000				
E-05	bulk	24-29	2.2				48	44	8	NV	NP	NP								A-1-a (0)	GP-GM
E-05	bulk	49-54	2.6				49	46	5	NV	NP	NP								A-1-a (0)	GP
E-06	SS	4.5	13.1				0	24	76	46	14	32								A-7-6 (23)	CL
E-06	bulk	14.5-19.5	1.7				19	68	13	NV	NP	NP	8.6	0.007	0.0020		4000			A-1-b (0)	SM
E-06	bulk	29.5-34.5	1.8				27	64	9	NV	NP	NP								A-1-b (0)	SP-SM
E-07	MC	14.5	20.4	99.7					81												
E-07	bulk	14.5-19.5	7.5				19	45	36	35	15	20								A-6 (2)	SC
E-07	CORE	47.0-47.4	5.6	135.1														1297			
E-07	CORE	84.5-85.0	6.7	136.6														1122			
E-07	CORE	98.7-99.2	5.0	138.7														1538			
E-08	bulk	9.5-14.5								36	25	11	8.4	ND	<0.00113		1700				
E-08	bulk	44.5-49.5								30	22	8	9.4	0.009	<0.00110		1400				
E-09	bulk	0-4.5	11.8				0	20	80	52	17	35								A-7-6 (28)	CH

bulk - indicates drill cuttings sample
MC - indicates Modified California sample
CORE - indicates rock core sample
SS - indicates Split Spoon sample
NV - indicates no value
NP - indicates no plasticity



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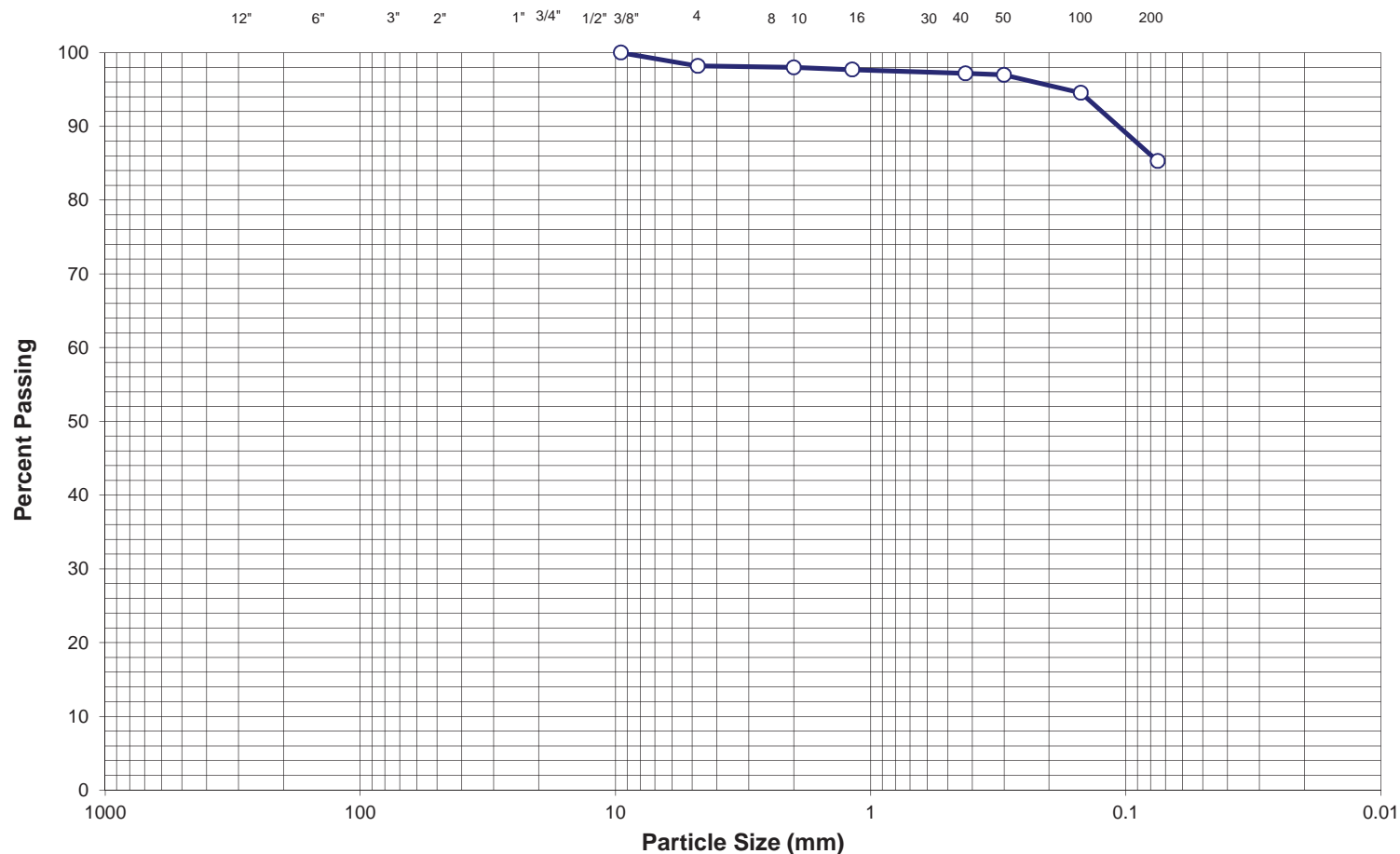
Summary of Laboratory Test Results

Project No: 217-376 Project Name: 22420: US 550 S Connection to US 160 Roadway and Excavtion Test Results Date: 7/10/2018


Sample Location			Natural Moisture Content (%)	Natural Dry Density (pcf)	AASHTO T99		Gradation			Atterberg			pH	Water Soluble Sulfate (%)	Chloride (%)	% Swell (+) / Consoli- dation (-)	Resistivity (Ohm-cm)	Uncon- Comp strength (rock-psi)	Uncon- Comp strength (soil-psf)	CLASSIFICATION	
Boring	Sample Type	Depth (ft)			Max. Dry Density (pcf)	Optimum Moisture (%)	Gravel > #4 (%)	Sand (%)	Fines < #200 (%)	LL	PL	PI								AASHTO	USCS
E-09	bulk	39.5-44.5	1.2				26	67	7	NV	NP	NP								A-1-b (0)	SP-SM
E-09	CORE (slaking)	63.5-64.0	4.5	98.7			0	59	41	35	33	2									bedrock, Shale
E-10	MC	9.5-10	13.0	88.3												-1.7					
E-10	SPT	29.5	30.0	12.1			3	29	68	30	13	17								A-6 (9)	CL

bulk - indicates drill cuttings sample
MC - indicates Modifies California sample
CORE - indicates rock core sample
SS - indicates Split Spoon sample
NV - indicates no value
NP - indicates no plasticity

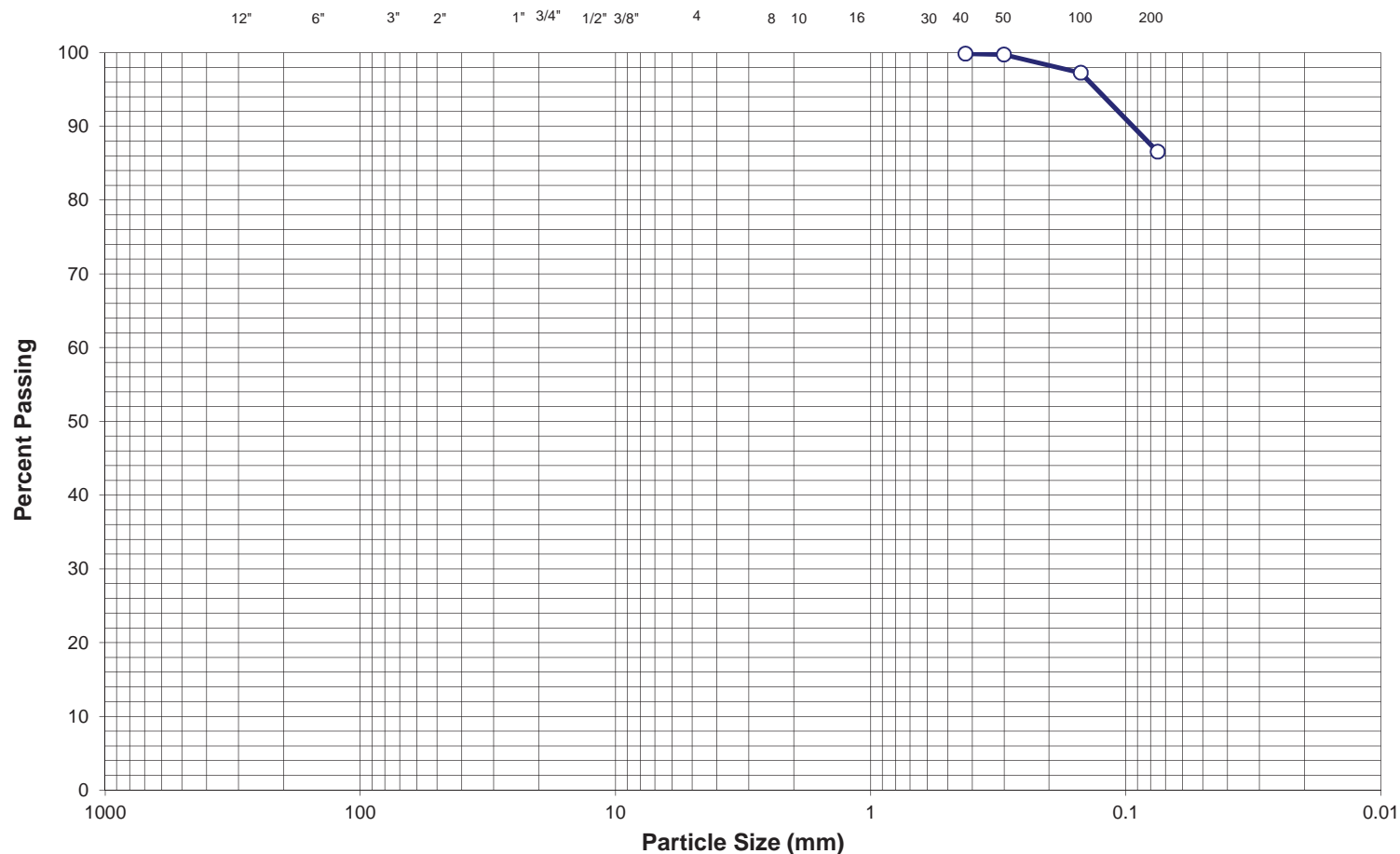
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	100
#4	98
#10	98
#40	97
#200	85.3

Gravel (%)	2	LL	32	Project Name:	US 550 S / US 160 Connector		
Sand (%)	13	PL	14	Boring:	R-01		
Fines (%)	85	PI	18	Sample Depth (ft):	9		
Sample Classification:	sandy CLAY		USCS: CL	AASHTO: A-6 (14)		<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>	
<div>SIEVE ANALYSIS</div>							
				Drawn By:	KM	Project No.:	217-376
				Checked By:	BB	Figure No.:	-
				Date:	02/20/18		

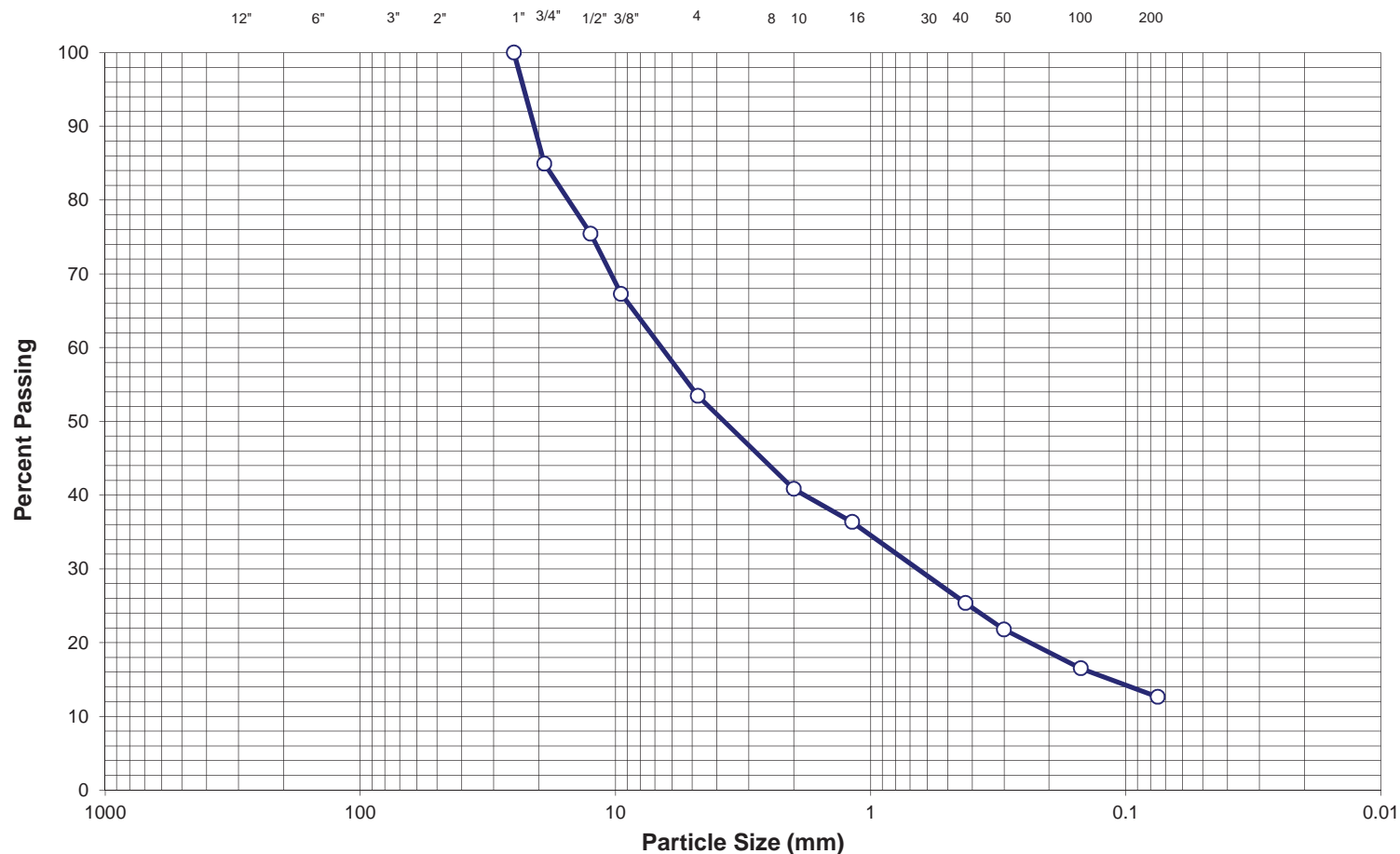
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	-
#40	100
#200	86.6

Gravel (%)	0	LL	34	Project Name:	US 550 S / US 160 Connector		
Sand (%)	13	PL	18	Boring:	R-01		
Fines (%)	87	PI	16	Sample Depth (ft):	9-14		
Sample Classification:	sandy CLAY		USCS: CL	AASHTO: A-6 (13)		<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>	
SIEVE ANALYSIS							
				Drawn By:	KM	Project No.:	217-376
				Checked By:	BB	Figure No.:	-
				Date:	02/13/18		

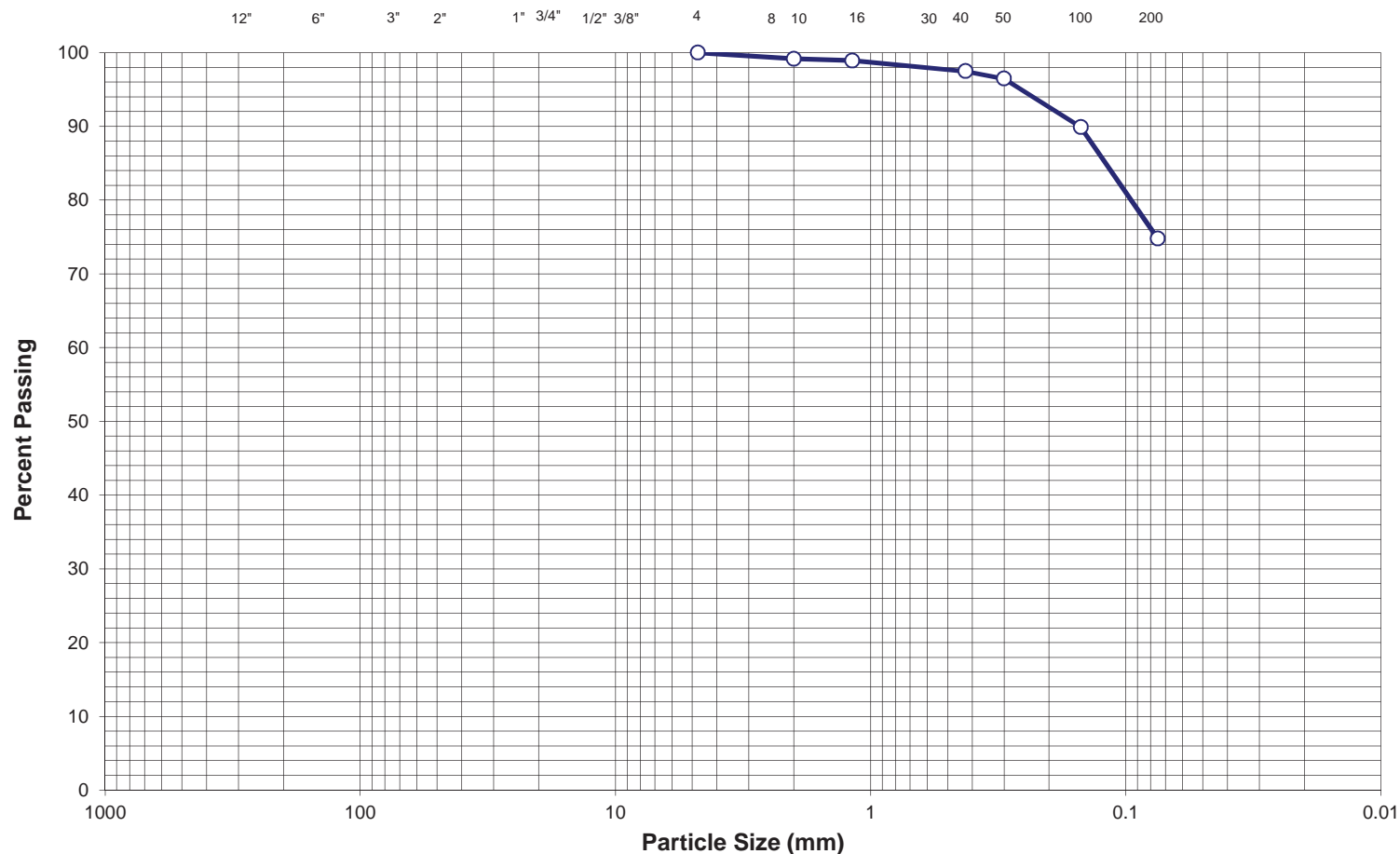
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	100
3/4 "	85
1/2"	75
3/8"	67
#4	53
#10	41
#40	25
#200	12.6

Gravel (%)	47	LL	NV	Project Name:	US 550 S / US 160 Connector		
Sand (%)	40	PL	NP	Boring:	R-02		
Fines (%)	13	PI	NP	Sample Depth (ft):	1-2		
Sample Classification:	silty GRAVEL w/ sand		USCS: GM	AASHTO: A-1-a (0)		<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>	
<div>SIEVE ANALYSIS</div>							
				Drawn By:	KM	Project No.:	217-376
				Checked By:	BB	Figure No.:	-
				Date:	02/13/18		

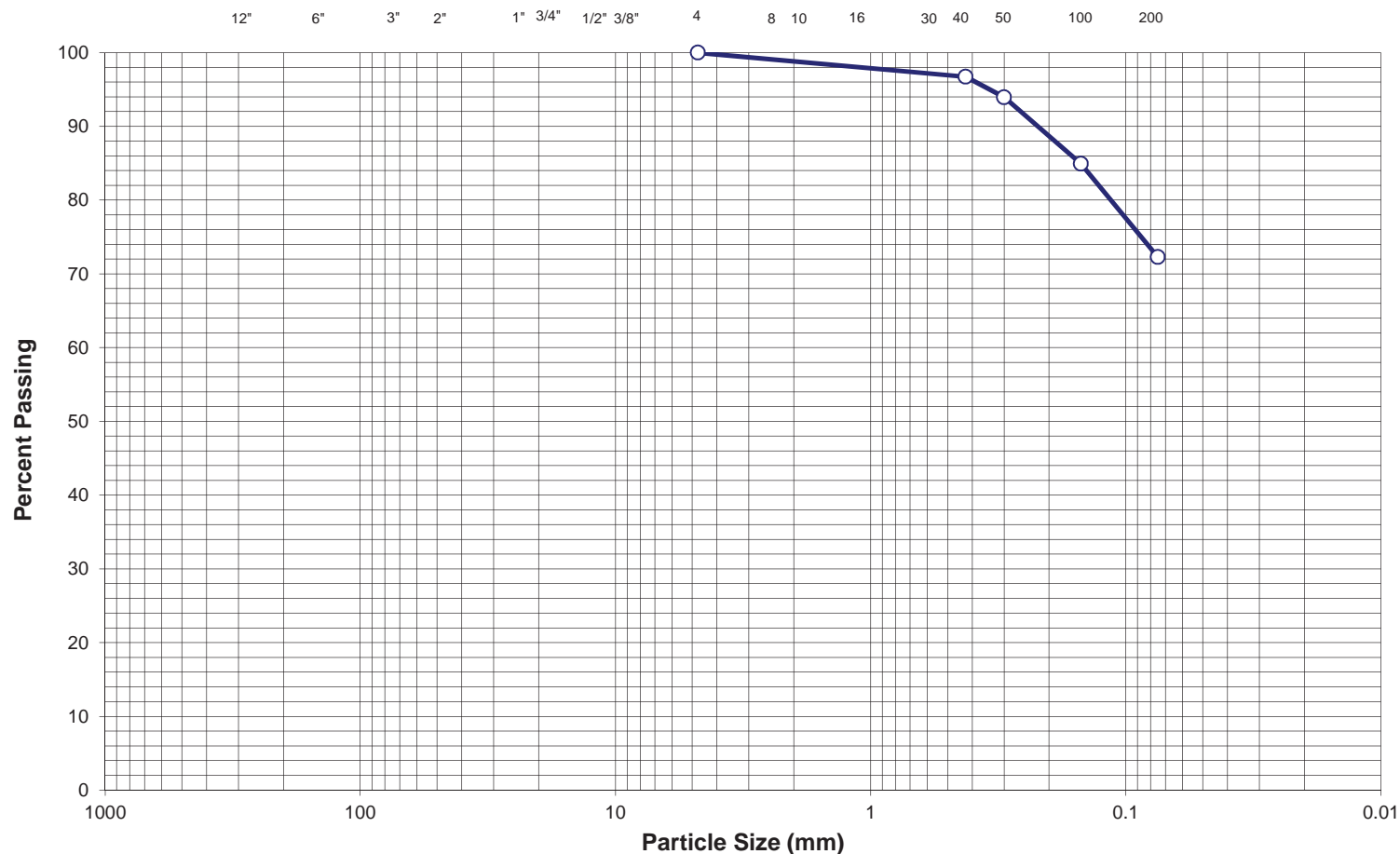
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	99
#40	97
#200	74.8

Gravel (%)	0	LL	31	Project Name:	US 550 S / US 160 Connector	<div><div>Yeh & Associates, Inc. Geotechnical Engineering Consultants</div></div>			
Sand (%)	25	PL	16	Boring:	R-02				
Fines (%)	75	PI	15	Sample Depth (ft):	14-19	SIEVE ANALYSIS			
Sample Classification:	sandy CLAY	USCS: CL	AASHTO: A-6 (9)	Drawn By:	KM	Project No.:	217-376		
				Checked By:	BB				
				Date:	02/20/18	Figure No.:	-		

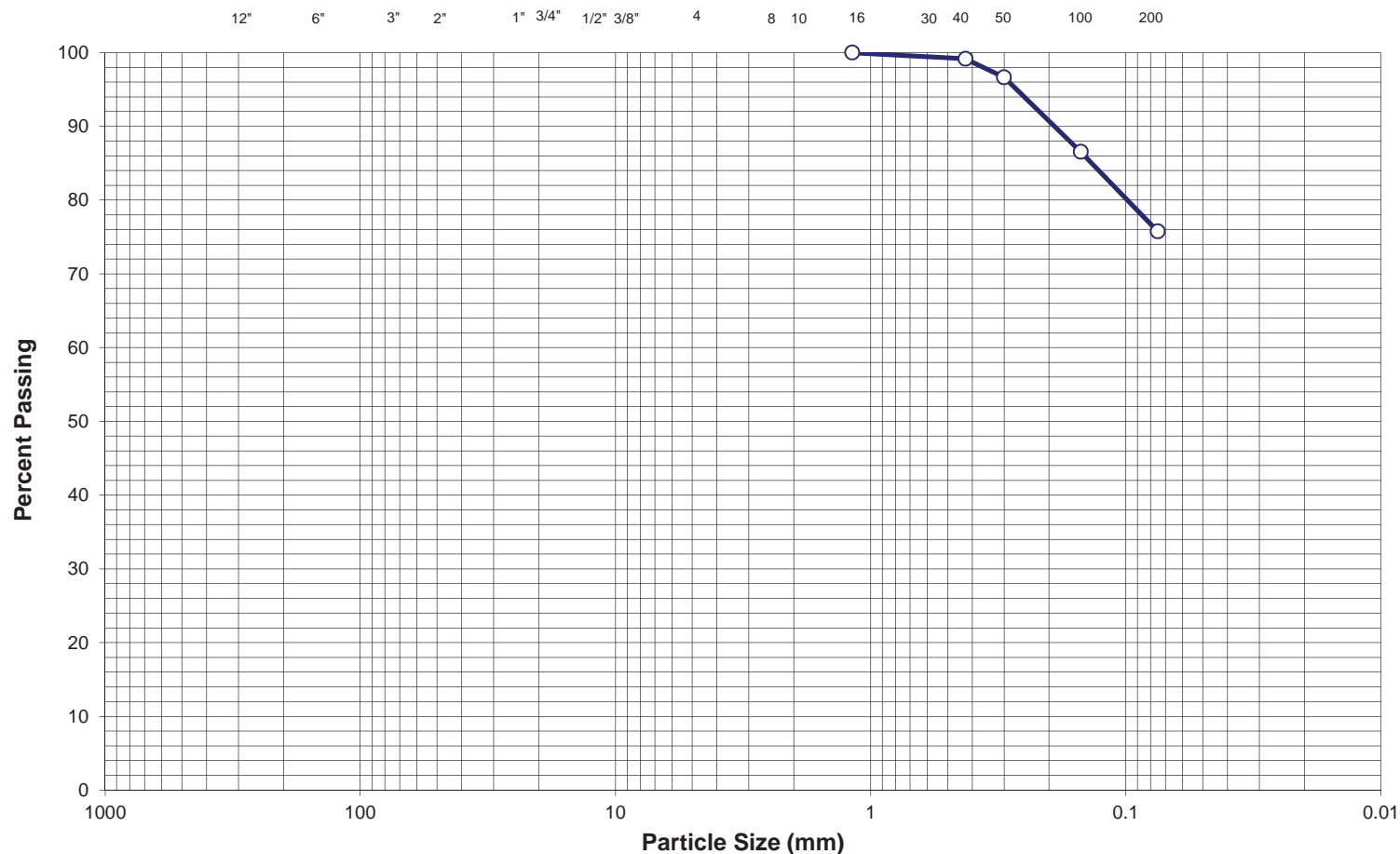
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	-
#40	97
#200	72.3

Gravel (%)	0	LL	40	Project Name:	US 550 S / US 160 Connector		
Sand (%)	28	PL	17	Boring:	R-03		
Fines (%)	72	PI	23	Sample Depth (ft):	9-14		
Sample Classification:	sandy CLAY		USCS: CL	AASHTO: A-6 (15)			
				<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>			
				SIEVE ANALYSIS			
				Drawn By:	KM	Project No.:	217-376
				Checked By:	BB	Figure No.:	-
				Date:	02/13/18		

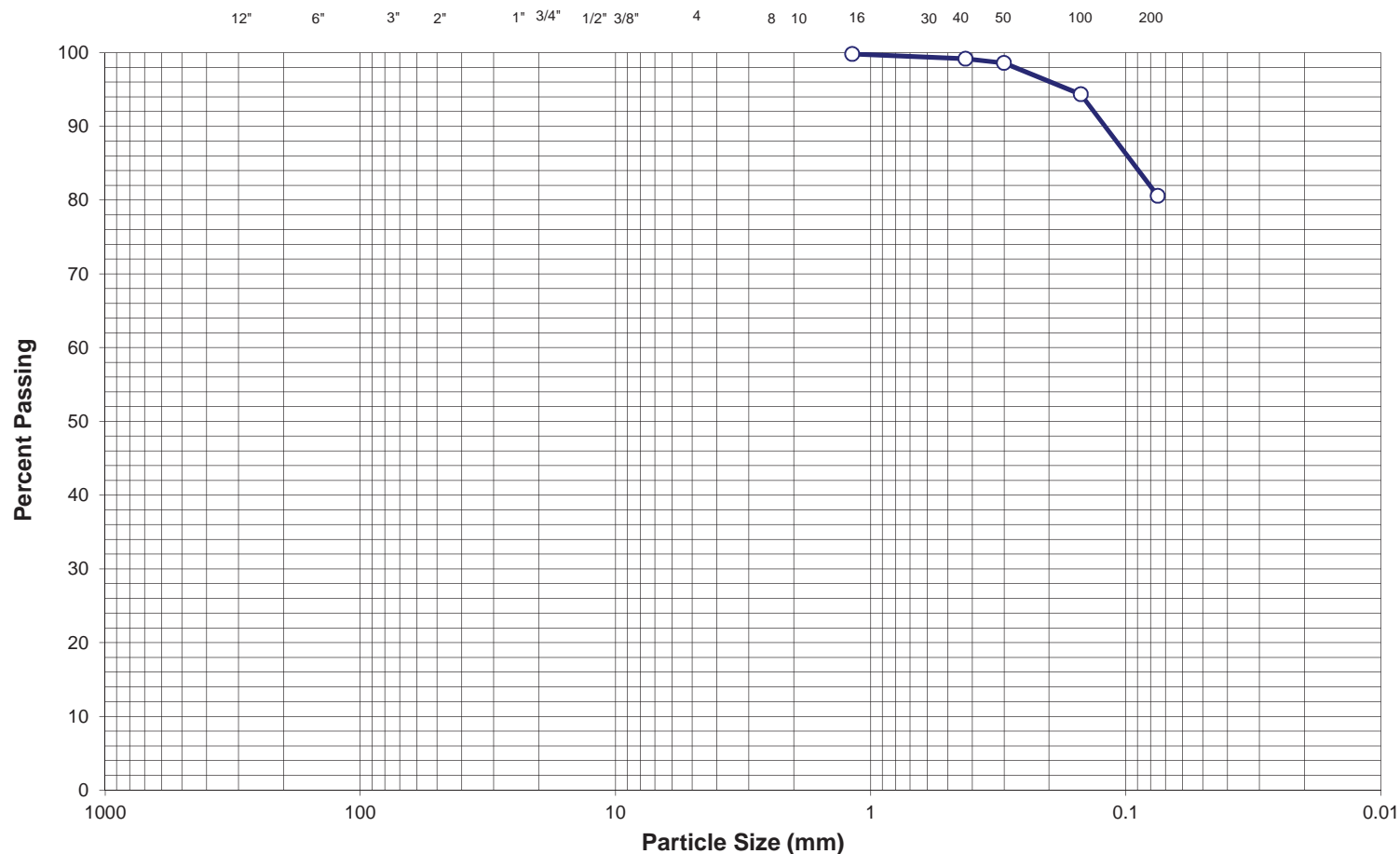
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	-
#40	99
#200	75.7

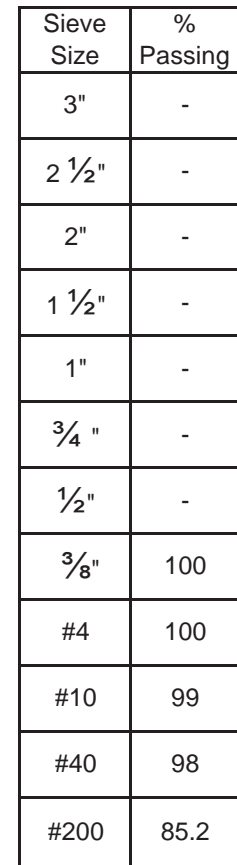
Gravel (%)	0	LL	46	Project Name:	US 550 S / US 160 Connector	<div> Yeh & Associates, Inc. Geotechnical Engineering Consultants</div>			
Sand (%)	24	PL	19	Boring:	R-04	SIEVE ANALYSIS			
Fines (%)	76	PI	27	Sample Depth (ft):	9-14				
Sample Classification:	sandy CLAY		USCS: CL	AASHTO: A-7-6 (20)		Drawn By: KM	Project No.: 217-376		
						Checked By: BB			
						Date: 02/13/18	Figure No.:	-	


Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm



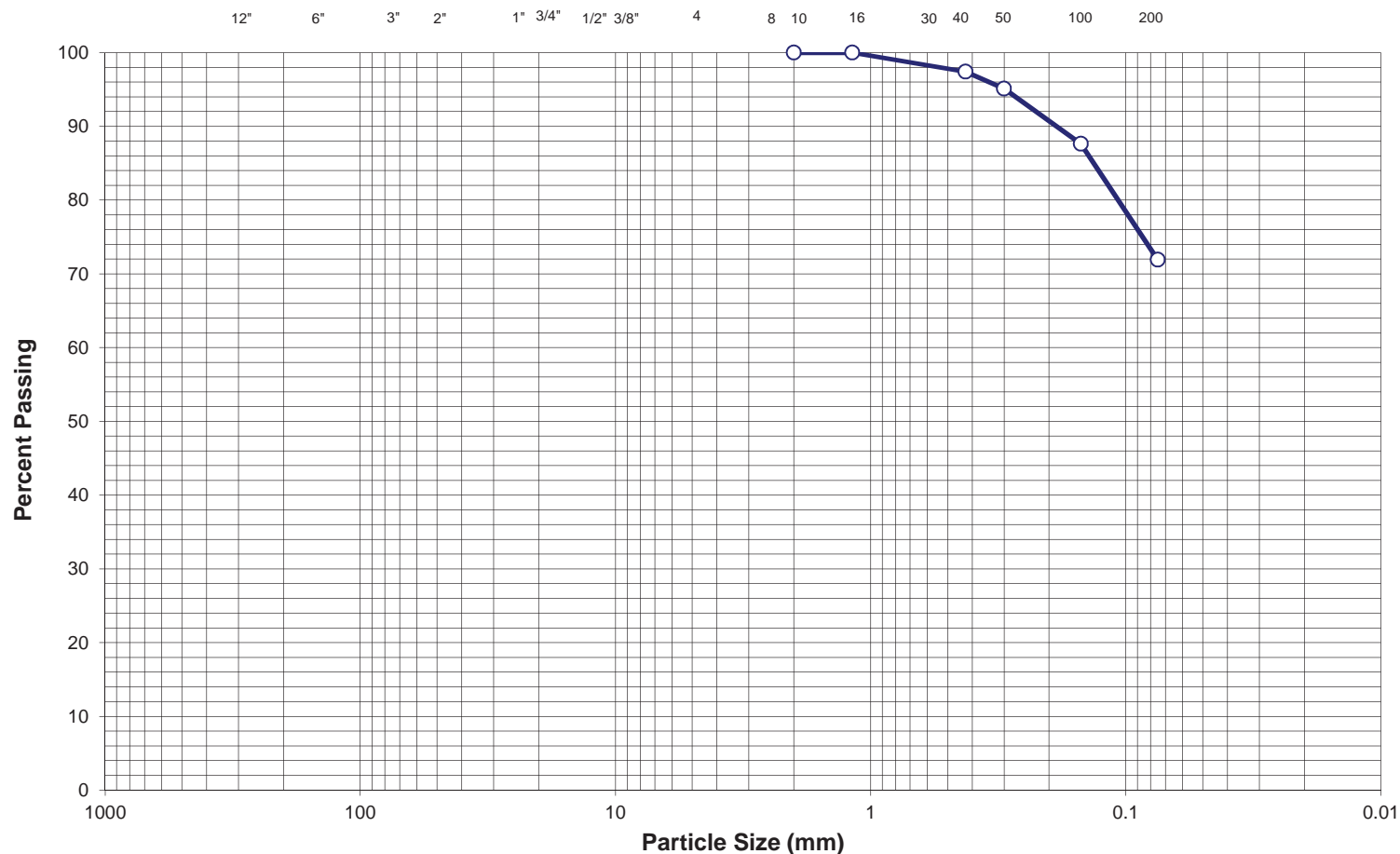
Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	-
#40	99
#200	80.6

Gravel (%)	0	LL	35	Project Name:	US 550 S / US 160 Connector		
Sand (%)	19	PL	17	Boring:	R-05		
Fines (%)	81	PI	18	Sample Depth (ft):	9-14		
Sample Classification:	sandy CLAY		USCS: CL	AASHTO: A-6 (13)			
				<div><div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div></div>			
				SIEVE ANALYSIS			
				Drawn By:	KM	Project No.:	217-376
				Checked By:	BB	Figure No.:	-
				Date:	02/13/18		



Gravel (%)	0	LL	38	Project Name:	US 550 S / US 160 Connector	 <div>Yeh & Associates, Inc. Geotechnical Engineering Consultants</div>		
Sand (%)	15	PL	17	Boring:	R-06			
Fines (%)	85	PI	21	Sample Depth (ft):	4-9			
Sample Classification:	sandy CLAY		USCS: CL	AASHTO: A-6 (17)				
						Drawn By: KM	Project No.:	217-376
						Checked By: BB		
						Date: 02/15/18	Figure No.:	-

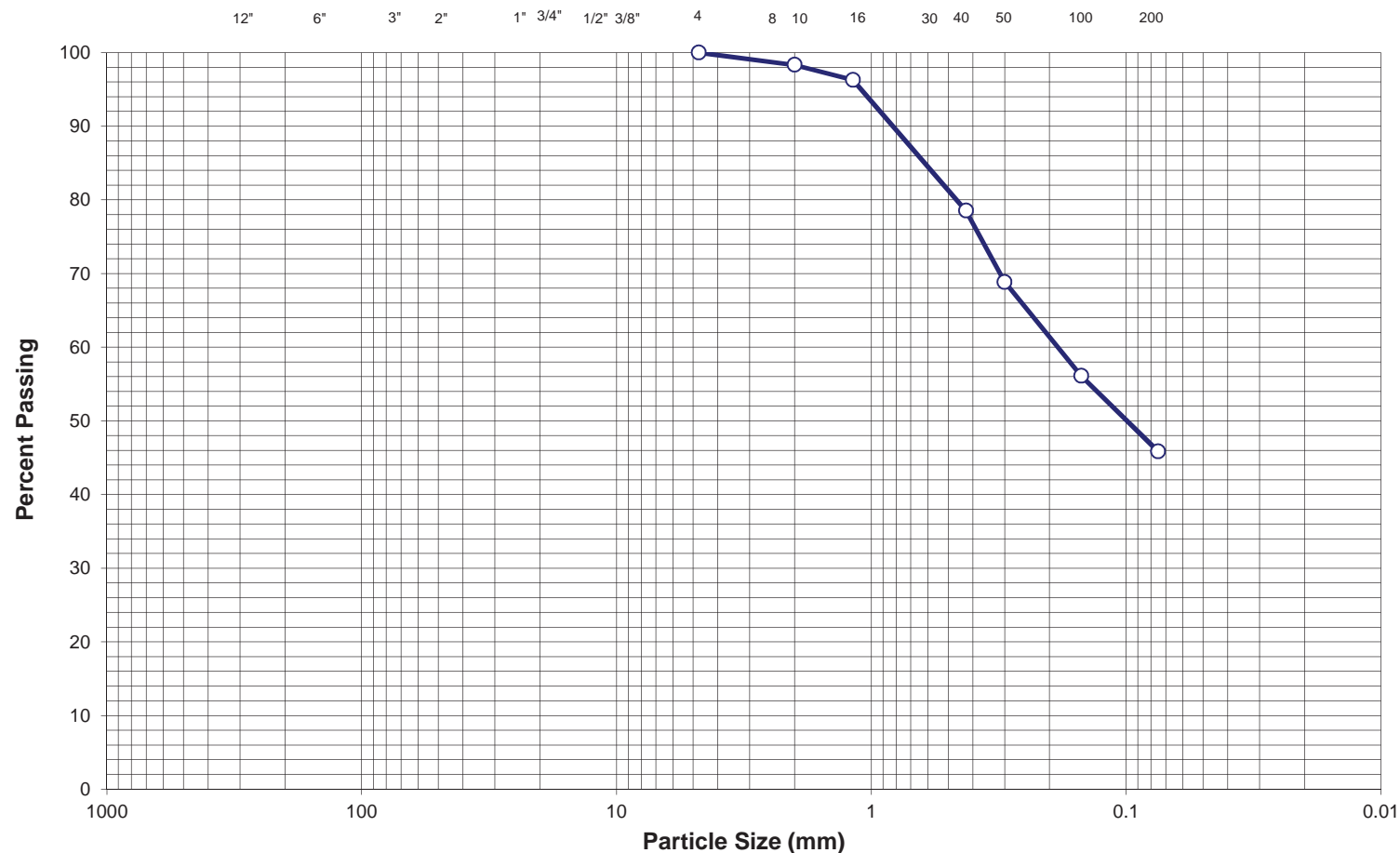
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	100
#40	97
#200	71.9

Gravel (%)	0	LL	47	Project Name:	US 550 S / US 160 Connector			
Sand (%)	28	PL	20	Boring:	R-07			
Fines (%)	72	PI	27	Sample Depth (ft):	5-10			
Sample Classification:	sandy CLAY		USCS: CL	AASHTO: A-7-6 (18)		Yeh & Associates, Inc. Geotechnical Engineering Consultants		
						SIEVE ANALYSIS		
						Drawn By: KM	Project No.:	217-376
						Checked By: AH	Figure No.:	-
						Date: 12/05/17		

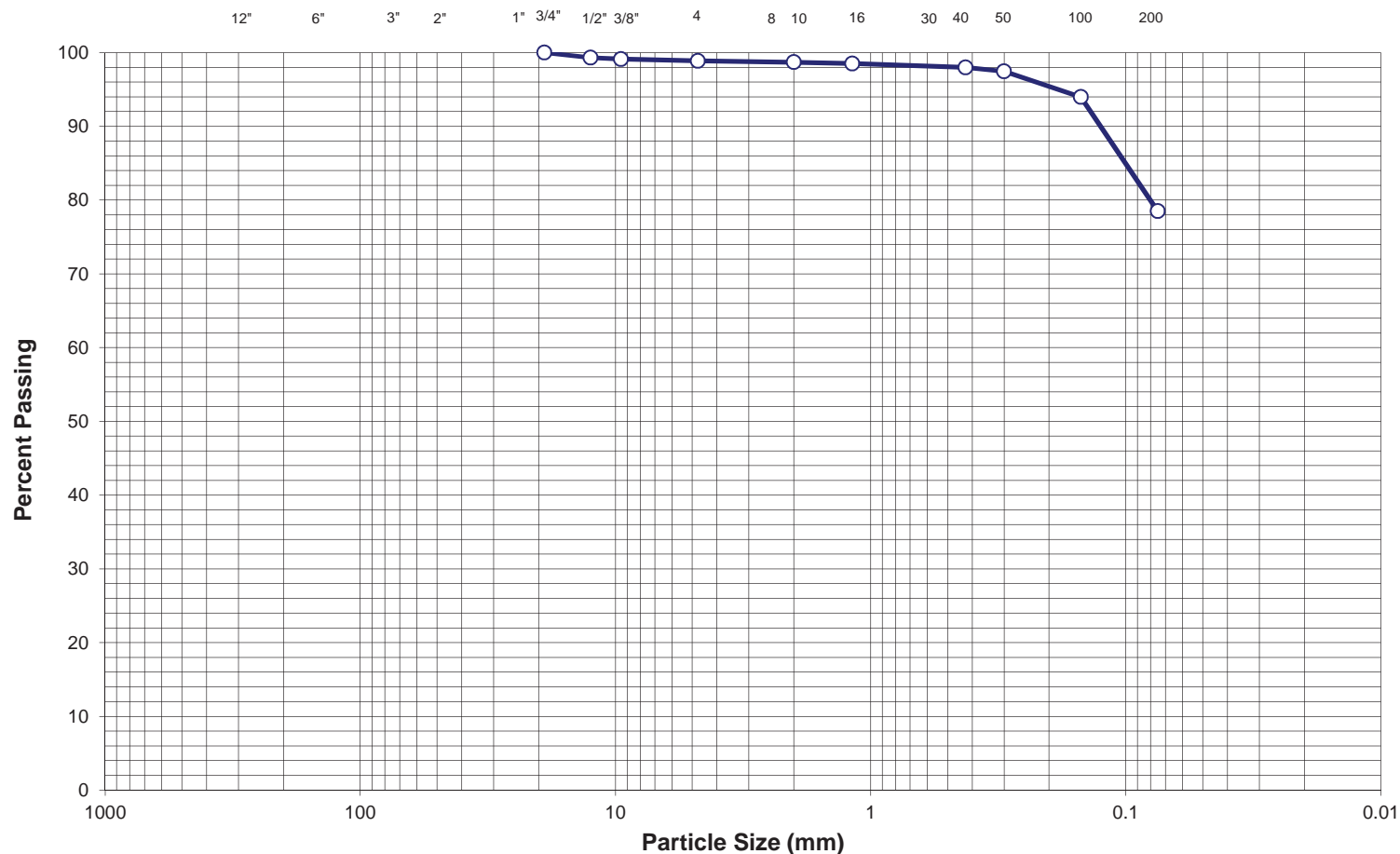
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	98
#40	79
#200	45.9

Gravel (%)	0	LL	31	Project Name:	US 550 S / US 160 Connector		
Sand (%)	54	PL	14	Boring:	R-07		
Fines (%)	46	PI	17	Sample Depth (ft):	10		
Sample Classification:	clayey SAND		USCS: SC	AASHTO: A-6 (4)		<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>	
<div>SIEVE ANALYSIS</div>						Drawn By: KM	Project No.: 217-376
						Checked By: LQ	
						Date: 12/06/17	Figure No.: -

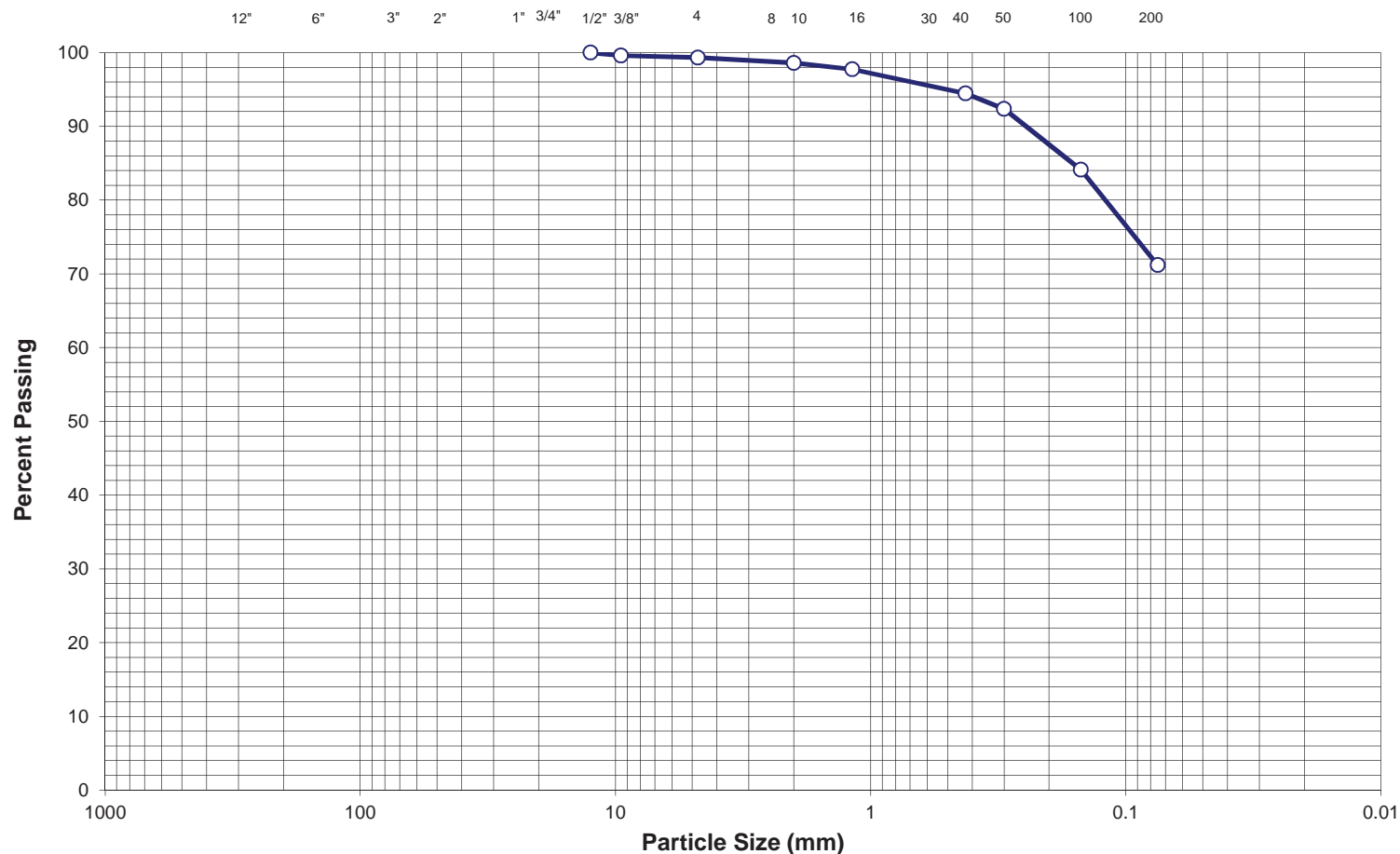
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	100
1/2"	99
3/8"	99
#4	99
#10	99
#40	98
#200	78.5

Gravel (%)	1	LL	38	Project Name:	US 550 S / US 160 Connector			
Sand (%)	20	PL	16	Boring:	R-08			
Fines (%)	79	PI	22	Sample Depth (ft):	10-15			
Sample Classification:	sandy CLAY		USCS: CL	AASHTO: A-6 (16)		<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div> <div>SIEVE ANALYSIS</div> <div><div>Drawn By: KM</div><div>Checked By: LQ</div><div>Date: 12/06/17</div></div> <div><div>Project No.: 217-376</div><div>Figure No.: -</div></div>		

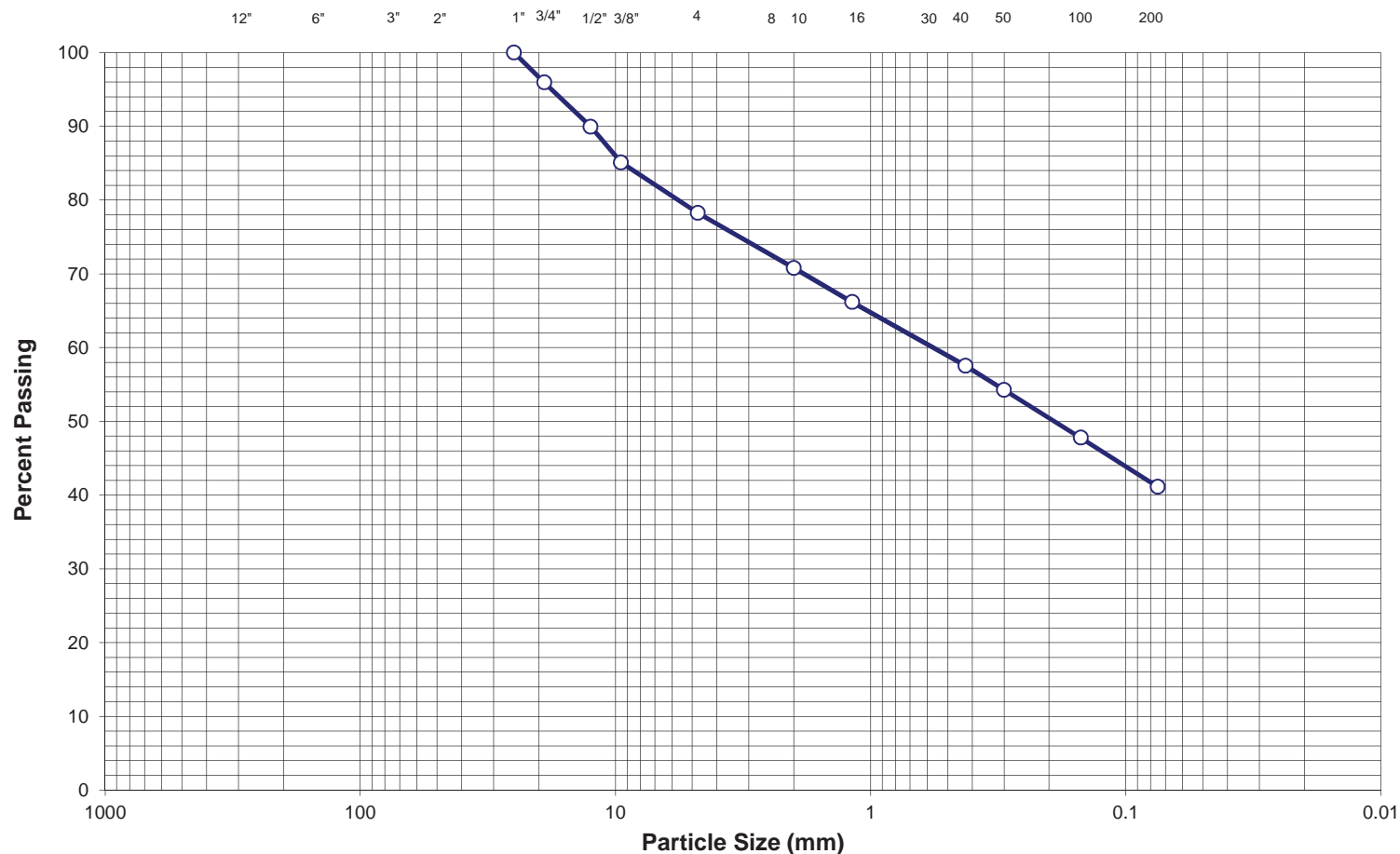
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4"	-
1/2"	100
3/8"	100
#4	99
#10	99
#40	94
#200	71.2

Gravel (%)	1	LL	27	Project Name:	US 550 S / US 160 Connector	<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>			
Sand (%)	28	PL	17	Boring:	R-09				
Fines (%)	71	PI	10	Sample Depth (ft):	14-19	SIEVE ANALYSIS			
Sample Classification:	sandy CLAY	USCS: CL	AASHTO: A-4 (5)	Drawn By:	KM	Project No.:	217-376		
				Checked By:	AH				
				Date:	11/30/17	Figure No.:	-		

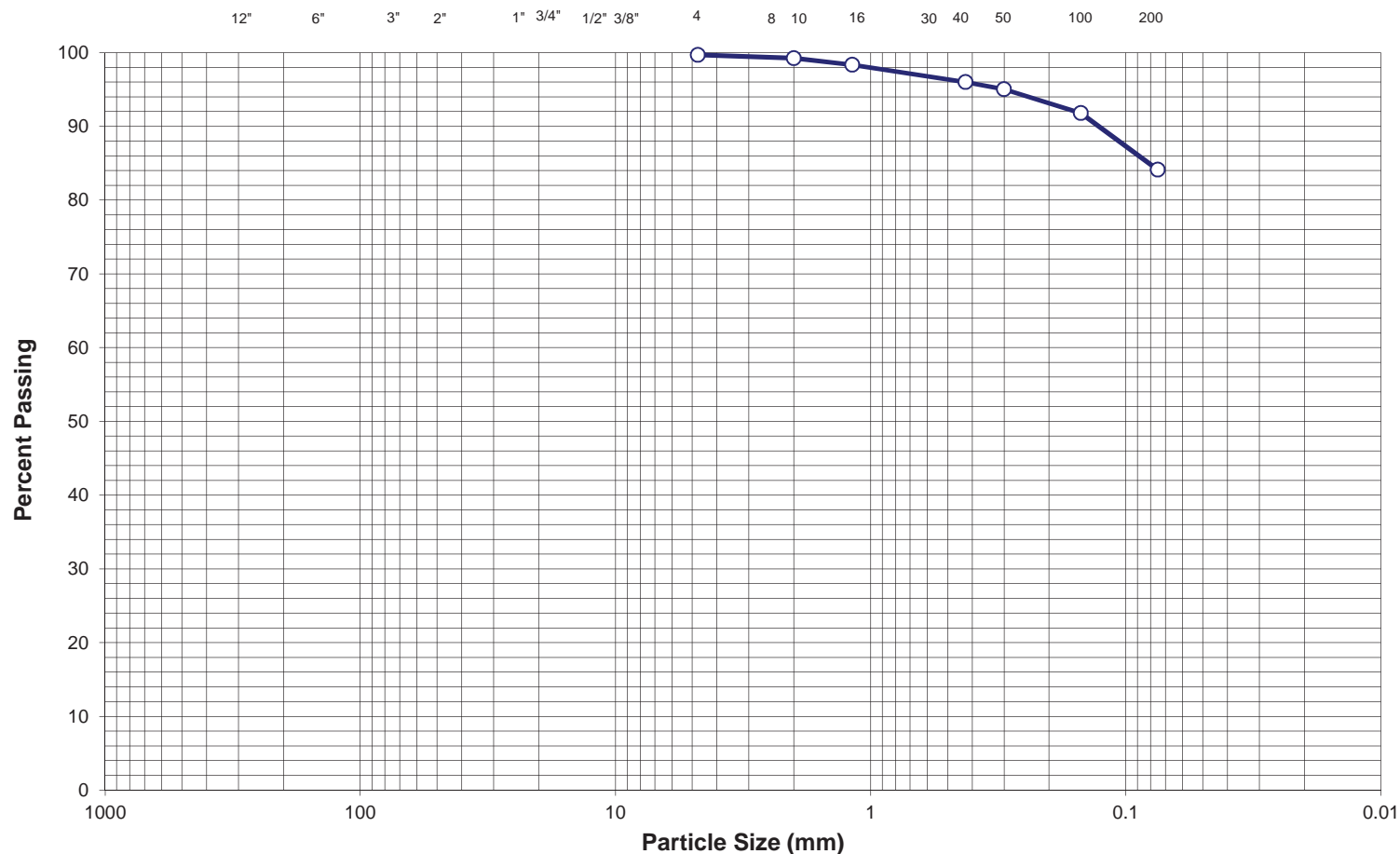
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	100
1"	100
3/4 "	96
1/2"	90
3/8"	85
#4	78
#10	71
#40	58
#200	41.1

Gravel (%)	22	LL	32	Project Name:	US 550 S / US 160 Connector		
Sand (%)	37	PL	15	Boring:	R-09		
Fines (%)	41	PI	17	Sample Depth (ft):	22		
Sample Classification:	clayey SAND w/ gravel		USCS: SC	AASHTO: A-6 (3)			
				<div><div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div><div>SIEVE ANALYSIS</div><div><div><div>Drawn By: KM</div><div>Checked By: KM</div><div>Date: 12/05/17</div></div><div><div>Project No.: 217-376</div><div>Figure No.: -</div></div></div></div>			

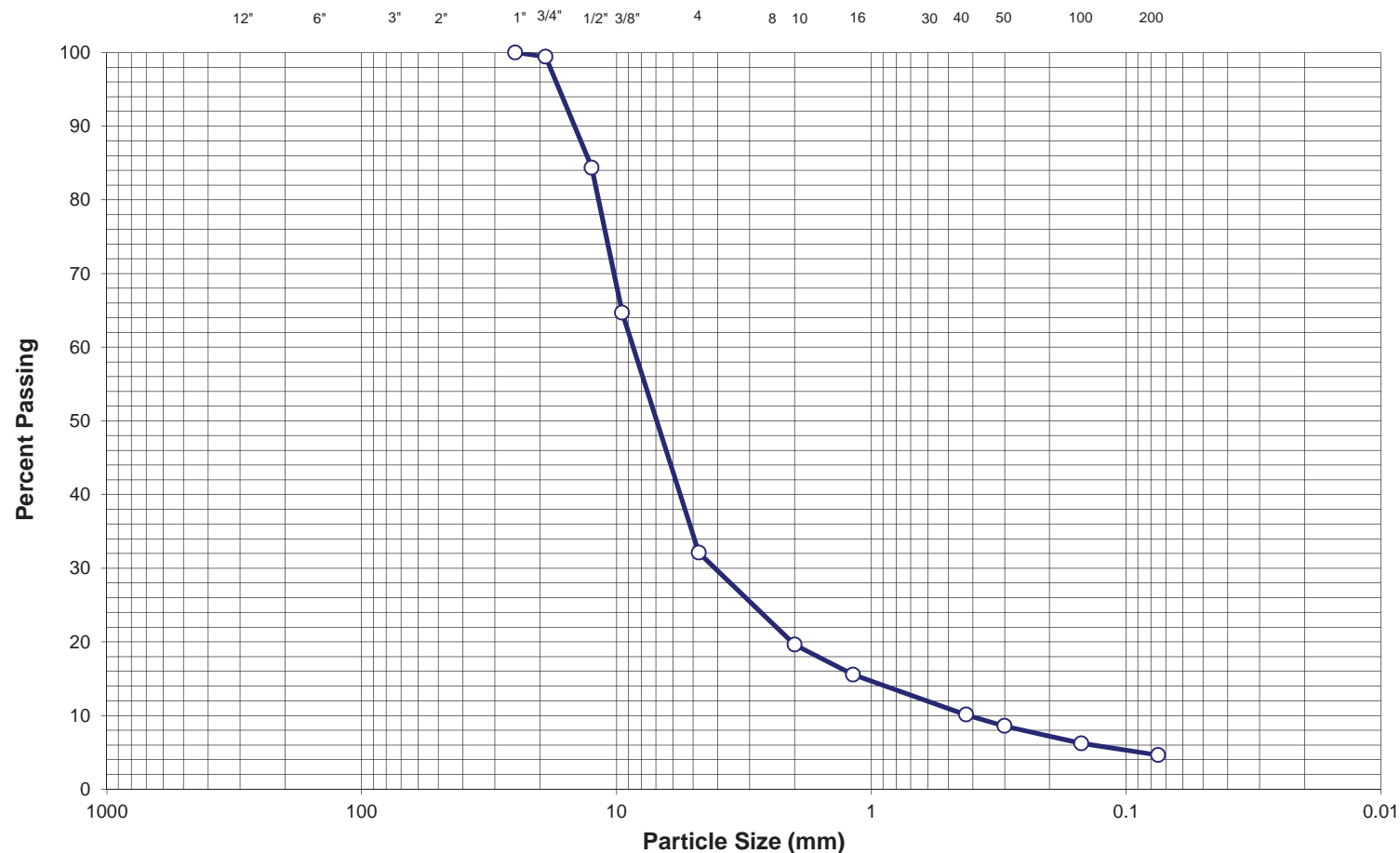
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	100
#4	100
#10	99
#40	96
#200	84.1

Gravel (%)	0	LL	72	Project Name:	US 550 S / US 160 Connector		
Sand (%)	16	PL	22	Boring:	E-01		
Fines (%)	84	PI	50	Sample Depth (ft):	0-4		
Sample Classification:	high plasticity CLAY, trace sand		USCS: CH	AASHTO: A-7-6 (45)		<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>	
<div>SIEVE ANALYSIS</div>						Drawn By: KM	Project No.: 217-376
						Checked By: AH	
						Date: 02/26/18	Figure No.: -

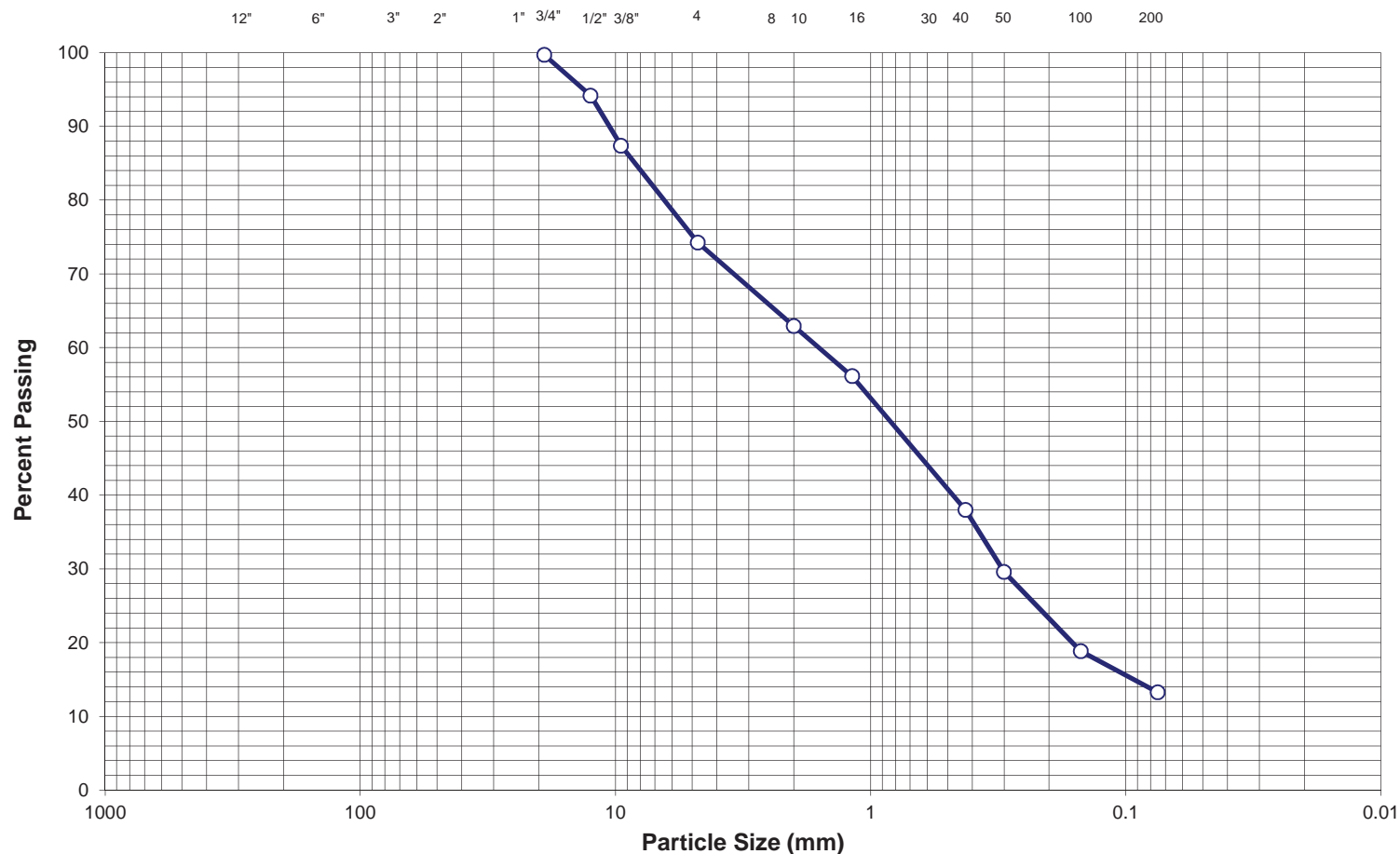
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	100
3/4 "	99
1/2"	84
3/8"	65
#4	32
#10	20
#40	10
#200	4.6

Gravel (%)	68	LL	NV	Project Name:	US 550 S / US 160 Connector		
Sand (%)	27	PL	NP	Boring:	E-01		
Fines (%)	5	PI	NP	Sample Depth (ft):	19-24		
Sample Classification:	Poorly graded GRAVEL w/ sand		USCS: GP	AASHTO: A-1-a (0)		<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>	
SIEVE ANALYSIS						Drawn By: KM	Project No.: 217-376
						Checked By: AH	
						Date: 02/26/18	Figure No.: -

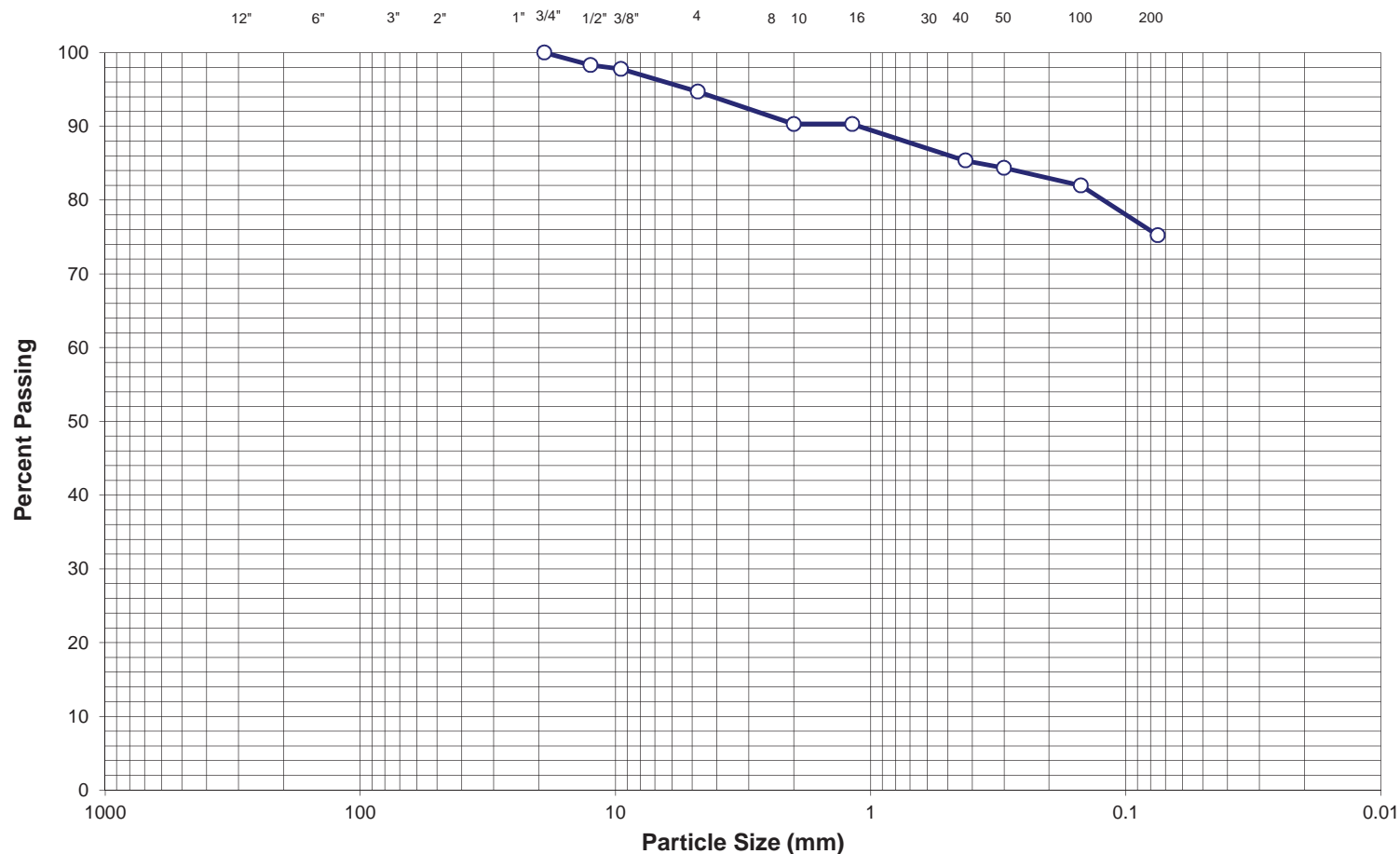
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4"	100
1/2"	94
3/8"	87
#4	74
#10	63
#40	38
#200	13.3

Gravel (%)	26	LL	22	Project Name:	US 550 S / US 160 Connector	<div><div>Yeh & Associates, Inc. Geotechnical Engineering Consultants</div></div>			
Sand (%)	61	PL	18	Boring:	E-02				
Fines (%)	13	PI	4	Sample Depth (ft):	4.5-9.5	SIEVE ANALYSIS			
Sample Classification:	silty-clayey SAND w/ gravel	USCS: SM-SC	AASHTO: A-1-b (0)	Drawn By:	KM	Project No.:	217-376		
				Checked By:	KM				
				Date:	02/27/18	Figure No.:	-		

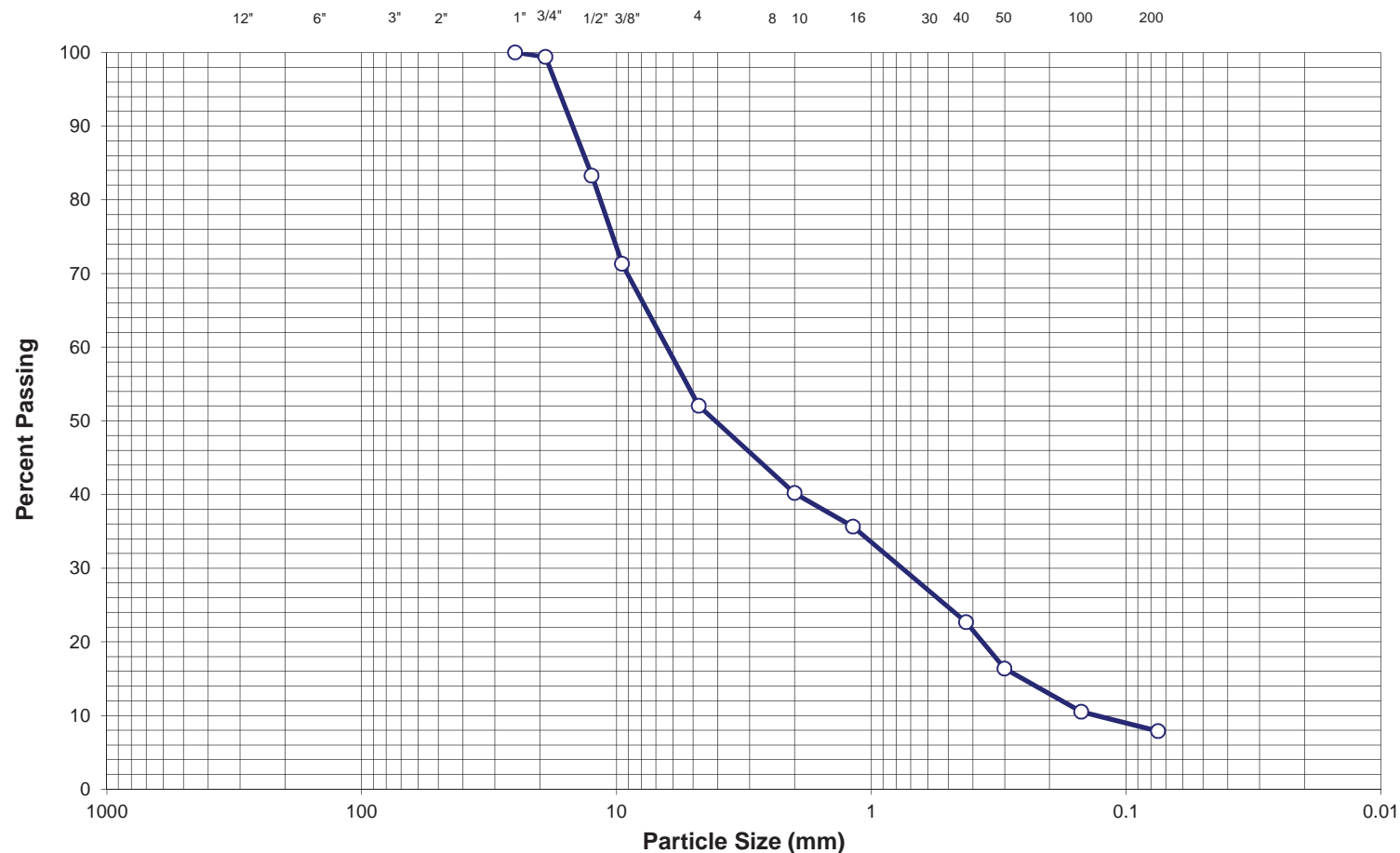
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	100
1/2"	98
3/8"	98
#4	95
#10	90
#40	85
#200	75.2

Gravel (%)	5	LL	50	Project Name:	US 550 South / US 160 Connector		
Sand (%)	20	PL	18	Boring:	E-03		
Fines (%)	75	PI	32	Sample Depth (ft):	4.5-9.5		
Sample Classification:	high plasticity sandy CLAY, trace gravel		USCS: CH	AASHTO: A-7-6 (23)		<div><div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div><div>SIEVE ANALYSIS</div><div><div>Drawn By: KM</div><div>Checked By: BB</div><div>Date: 02/27/18</div></div><div><div>Project No.: 217-376</div><div>Figure No.: -</div></div></div>	

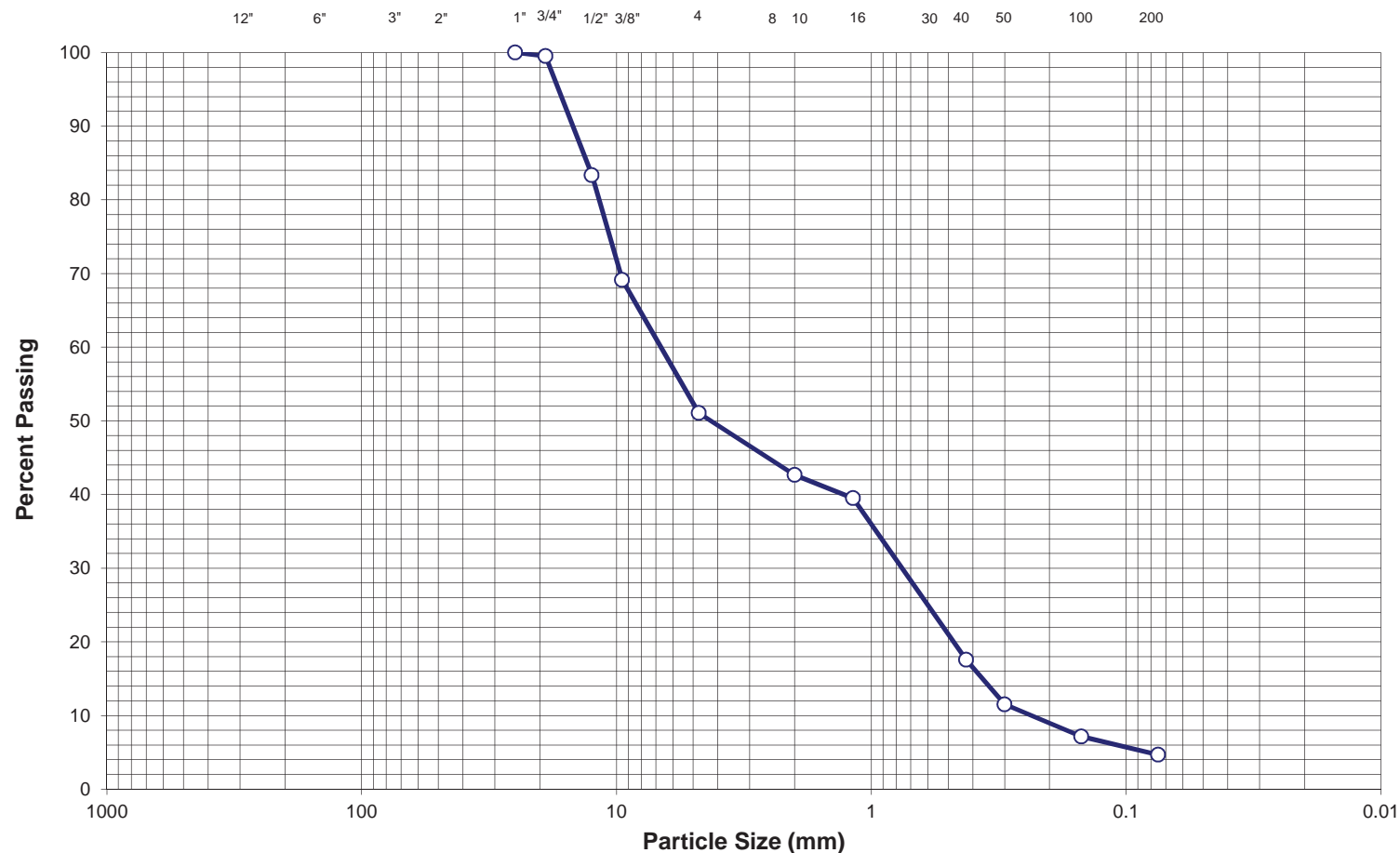
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm



Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	100
3/4 "	99
1/2"	83
3/8"	71
#4	52
#10	40
#40	23
#200	7.9

Gravel (%)	48	LL	NV	Project Name:	US 550 S / US 160 Connector		
Sand (%)	44	PL	NP	Boring:	E-05		
Fines (%)	8	PI	NP	Sample Depth (ft):	24-29		
Sample Classification:	Poorly graded GRAVEL w/ silt and sand		USCS: GP-GM	AASHTO: A-1-a (0)		<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>	
<div>SIEVE ANALYSIS</div>						Drawn By: KM	Project No.: 217-376
						Checked By: BB	
						Date: 02/27/18	Figure No.: -

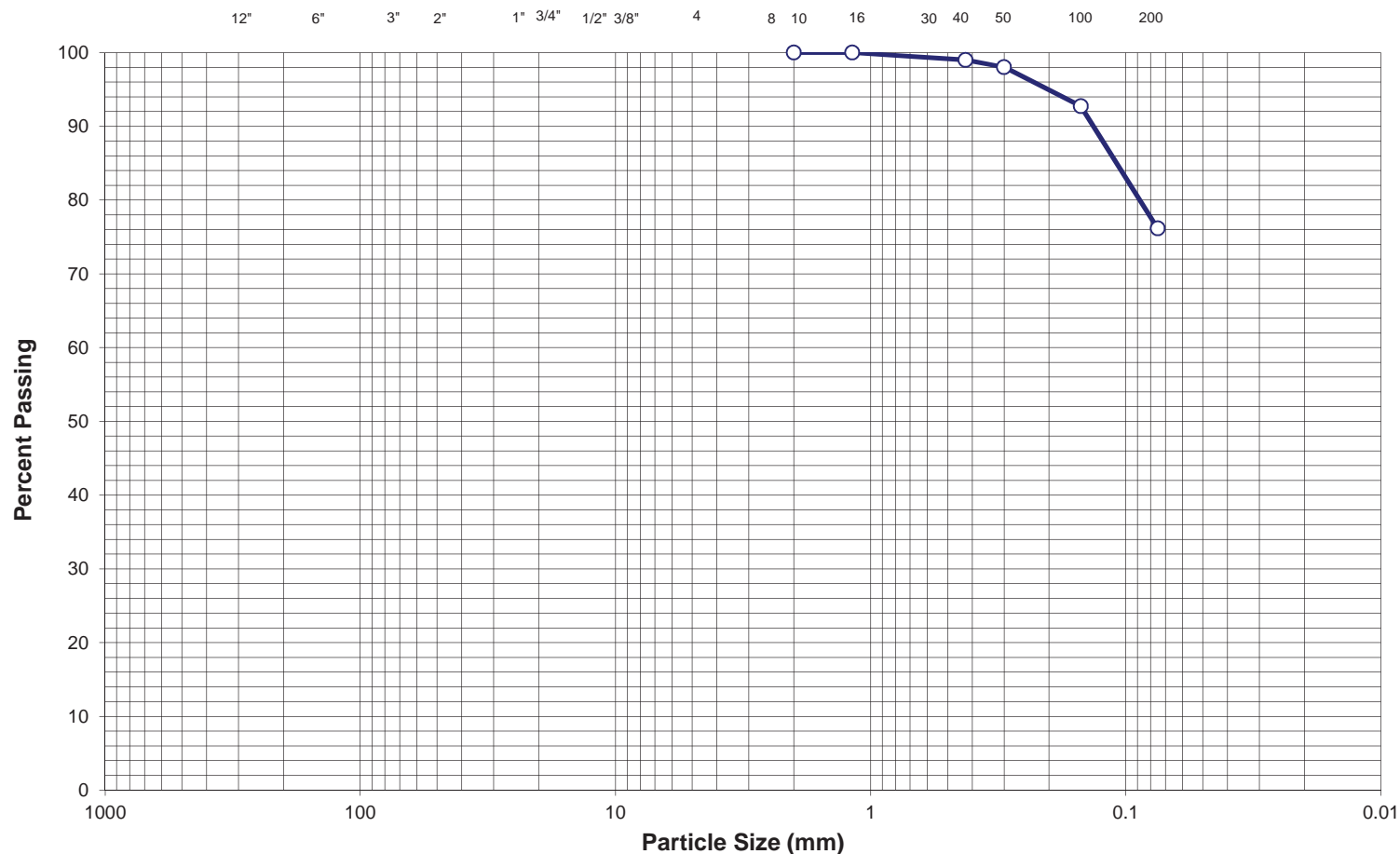
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	100
3/4 "	100
1/2"	83
3/8"	69
#4	51
#10	43
#40	18
#200	4.7

Gravel (%)	49	LL	NV	Project Name:	US 550 S / US 160 Connector		
Sand (%)	46	PL	NP	Boring:	E-05		
Fines (%)	5	PI	NP	Sample Depth (ft):	49-54		
Sample Classification:	Poorly graded GRAVEL w/ sand		USCS: GP	AASHTO: A-1-a (0)		Yeh & Associates, Inc. Geotechnical Engineering Consultants	
						SIEVE ANALYSIS	
				Drawn By:	KM	Project No.:	217-376
				Checked By:	KM	Figure No.:	-
				Date:	02/27/18		

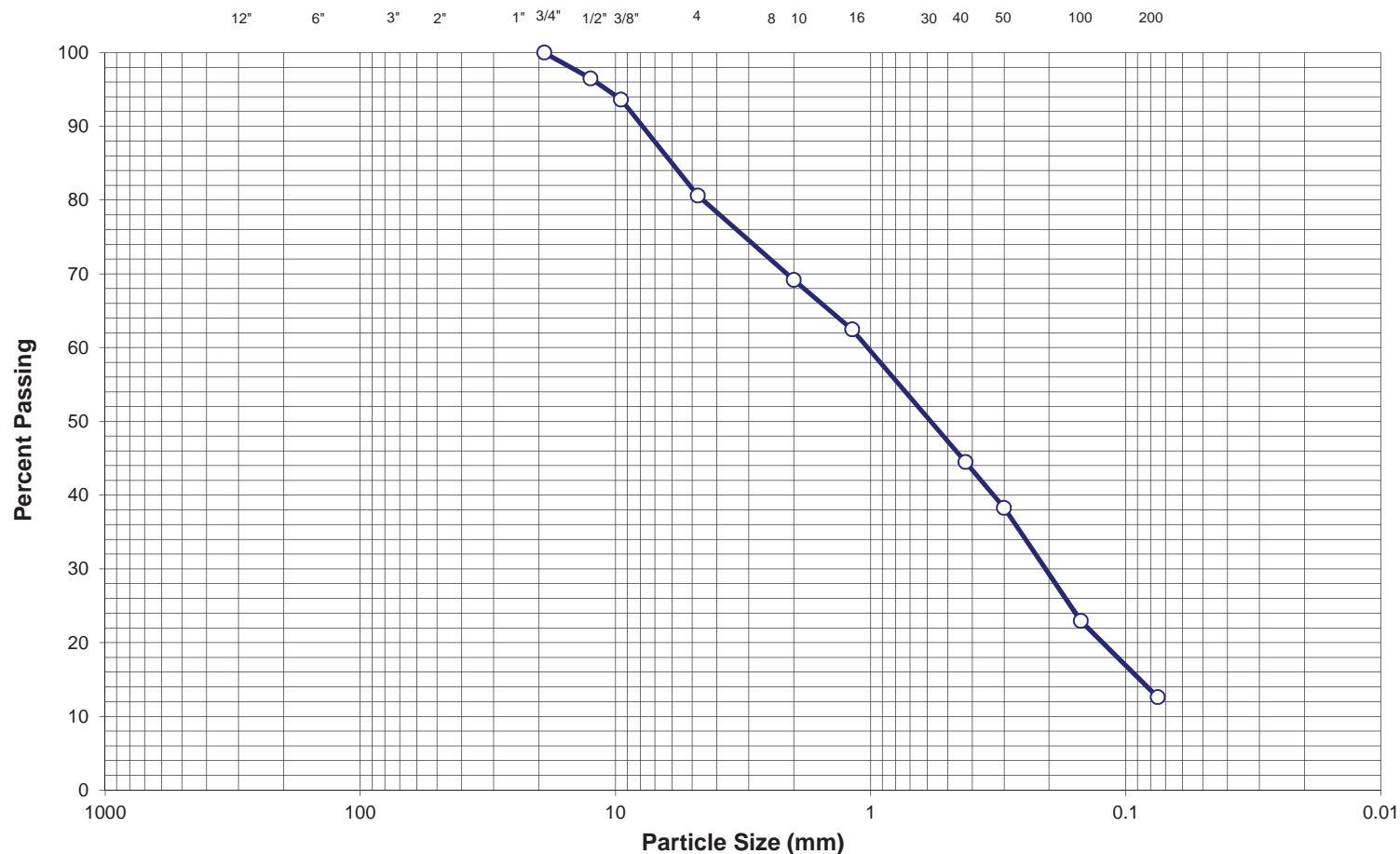
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	100
#40	99
#200	76.1

Gravel (%)	0	LL	46	Project Name:	US 550 South / US 160 Connector		
Sand (%)	24	PL	14	Boring:	E-06		
Fines (%)	76	PI	32	Sample Depth (ft):	4.5		
Sample Classification:	sandy CLAY		USCS: CL	AASHTO: A-7-6 (23)			
				<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>			
				SIEVE ANALYSIS			
				Drawn By:	KM	Project No.:	217-376
				Checked By:	BB	Figure No.:	-
				Date:	12/04/17		

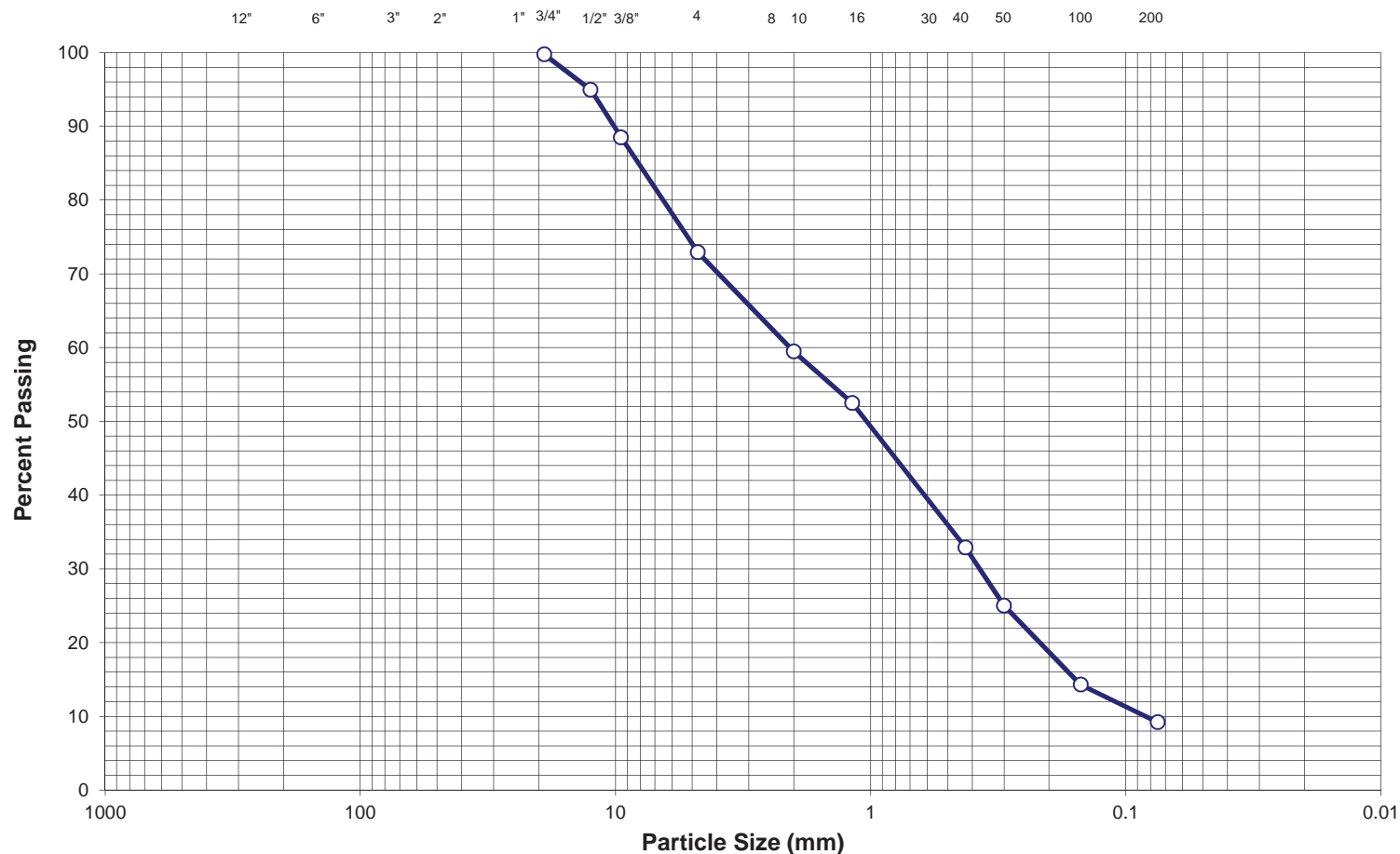
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4"	100
1/2"	96
3/8"	94
#4	81
#10	69
#40	45
#200	12.6

Gravel (%)	19	LL	NV	Project Name:	US 550 S / US 160 Connector	<div><div>Yeh & Associates, Inc. Geotechnical Engineering Consultants</div></div>		
Sand (%)	68	PL	NP	Boring:	E-06			
Fines (%)	13	PI	NP	Sample Depth (ft):	14.5-19.5	SIEVE ANALYSIS		
Sample Classification:	silty SAND, w / gravel	USCS: SM	AASHTO: A-1-b (0)	Drawn By:	KM	Project No.:	217-376	
				Checked By:	AH	Figure No.:	-	
				Date:	11/30/17			

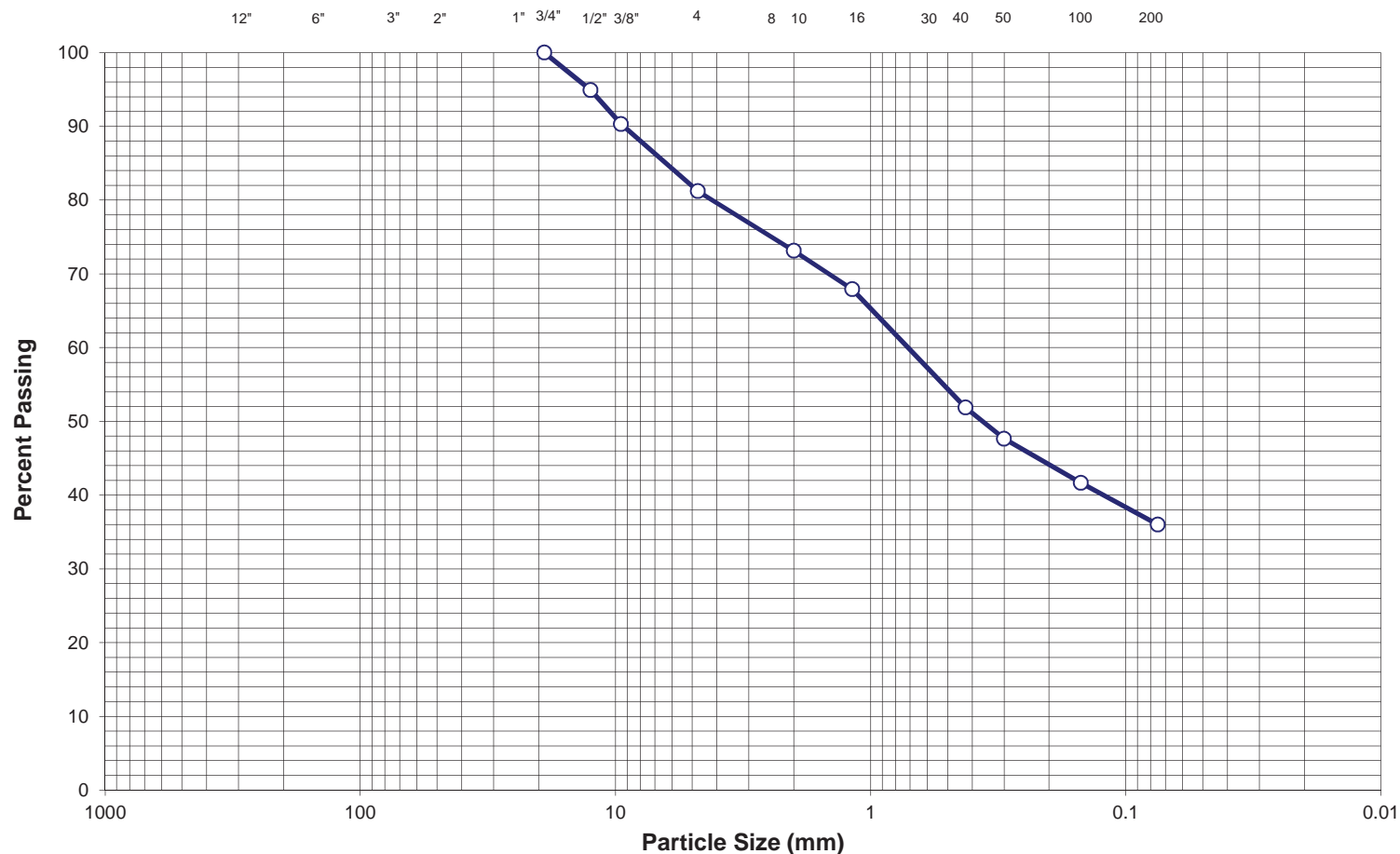
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	100
3/4 "	100
1/2"	95
3/8"	88
#4	73
#10	59
#40	33
#200	9.2

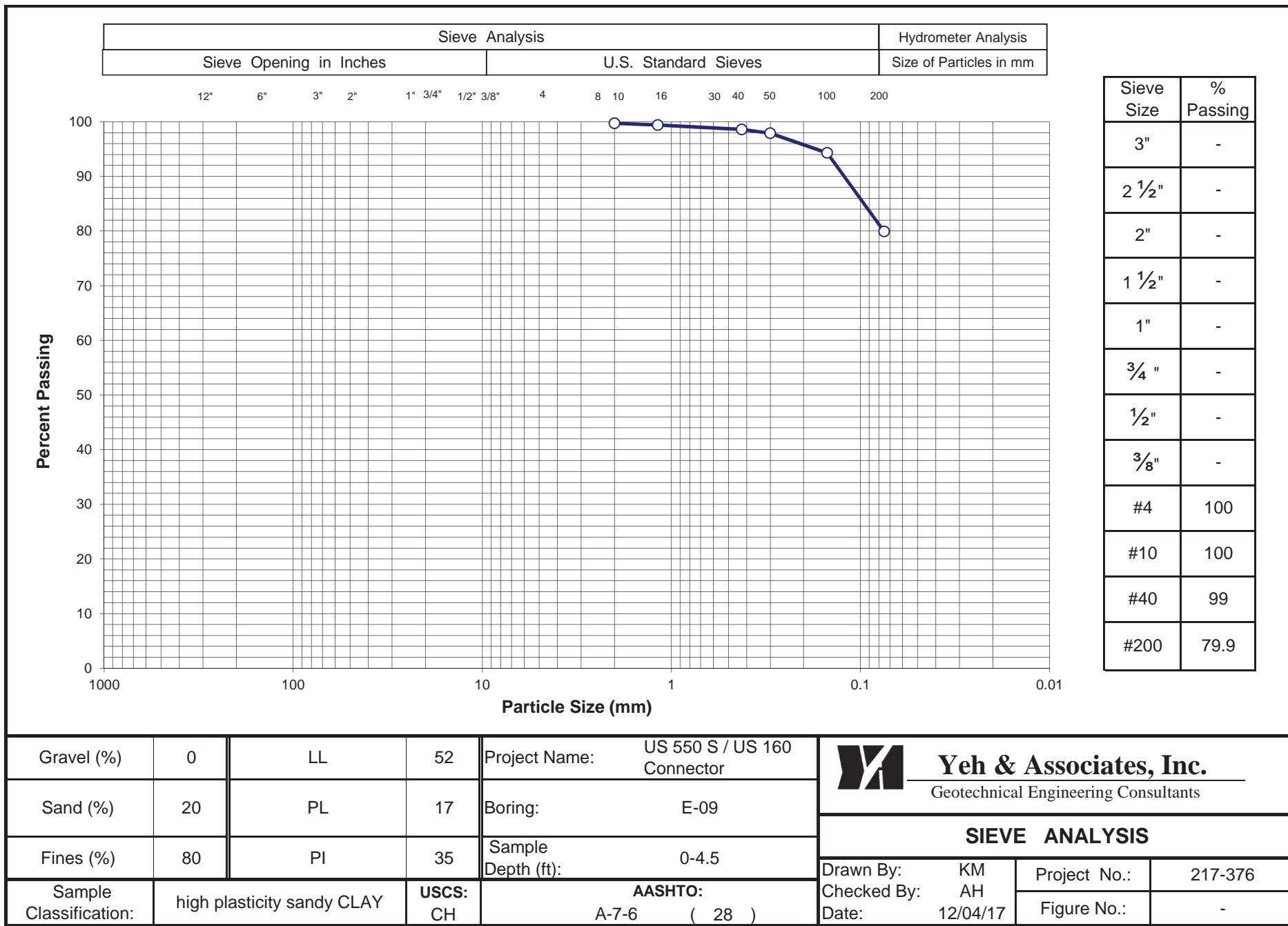
Gravel (%)	27	LL	NV	Project Name:	US 550 S / US 160 Connector	<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>			
Sand (%)	64	PL	NP	Boring:	E-06				
Fines (%)	9	PI	NP	Sample Depth (ft):	29.5-34.5	SIEVE ANALYSIS			
Sample Classification:	Poorly graded SAND w/ silt and gravel	USCS: SP-SM	AASHTO: A-1-b (0)	Drawn By:	KM	Project No.:	217-376		
				Checked By:	AH				
				Date:	12/06/17	Figure No.:	-		

Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm

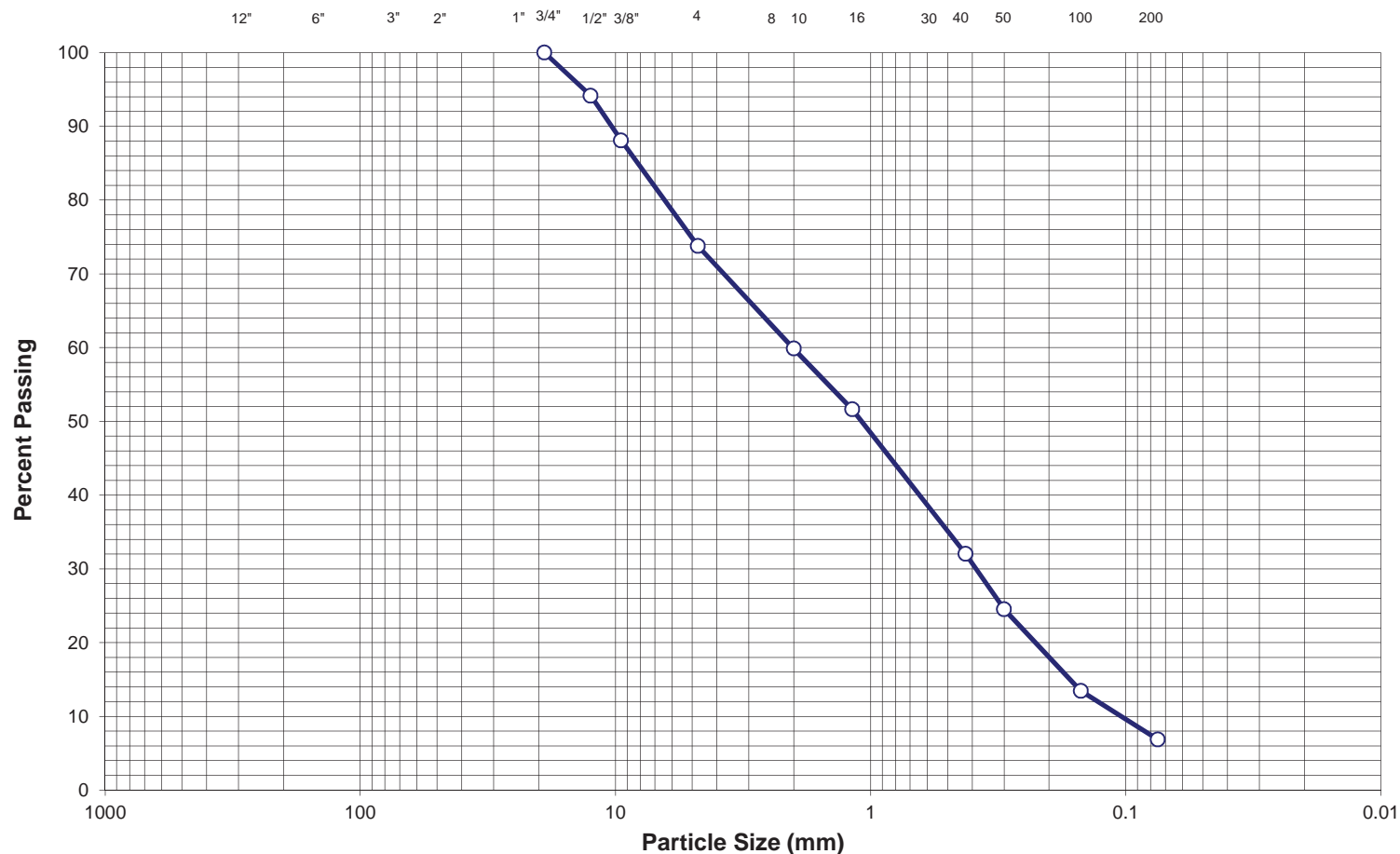


Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4"	100
1/2"	95
3/8"	90
#4	81
#10	73
#40	52
#200	36.0


Gravel (%)	19	LL	35	Project Name:	US 550 S / US 160 Connector	<div><div>Yeh & Associates, Inc. Geotechnical Engineering Consultants</div></div>			
Sand (%)	45	PL	15	Boring:	E-07				
Fines (%)	36	PI	20	Sample Depth (ft):	14.5-19.5	SIEVE ANALYSIS			
Sample Classification:	clayey SAND w / gravel	USCS: SC	AASHTO: A-6 (2)	Drawn By:	KM	Project No.:	217-376		
				Checked By:	KM				
				Date:	02/27/18	Figure No.:	-		



Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm



Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	100
3/4"	100
1/2"	94
3/8"	88
#4	74
#10	60
#40	32
#200	6.9

Gravel (%)	26	LL	NV	Project Name:	US 550 S / US 160 Connector	<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>			
Sand (%)	67	PL	NP	Boring:	E-09				
Fines (%)	7	PI	NP	Sample Depth (ft):	39.5-44.5	SIEVE ANALYSIS			
Sample Classification:	poorly graded SAND w/ silt and gravel	USCS: SP-SM	AASHTO: A-1-b (0)	Drawn By:	KM	Project No.:	217-376		
				Checked By:	BB				
				Date:	12/05/17	Figure No.:	-		

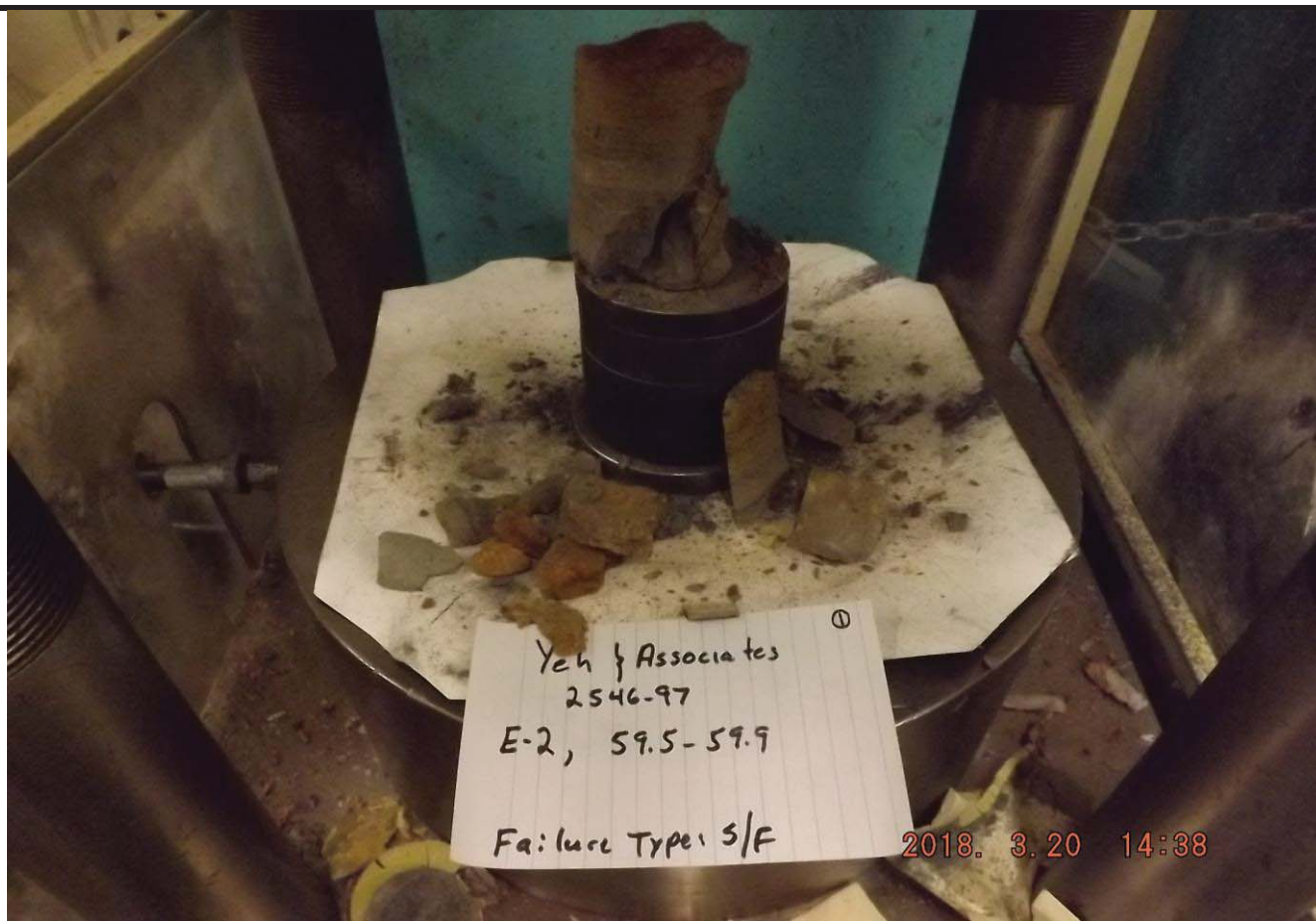


ADVANCED TERRA TESTING

Image Attachment

CLIENT Yeh & Associates
JOB NO. 2546-97
PROJECT ES US 550 S. / 160 Contractor
PROJECT NO. 217-376
LOCATION --

BORING NO. E-2
DEPTH 59.5-59.9
SAMPLE NO.
DATE SAMPLED
DESCRIPTION



NOTES

File name: 2546_97_Image_18_03_21_08_09_47



ADVANCED TERRA TESTING

Image Attachment

CLIENT Yeh & Associates
JOB NO. 2546-97
PROJECT ES US 550 S. / 160 Contractor
PROJECT NO. 217-376
LOCATION --

BORING NO. E-2
DEPTH 70.9-71.4
SAMPLE NO.
DATE SAMPLED
DESCRIPTION



NOTES

File name: 2546_97_Image_18_03_21_08_14_55



ADVANCED TERRA TESTING

Image Attachment

CLIENT Yeh & Associates
JOB NO. 2546-97
PROJECT ES US 550 S. / 160 Contractor
PROJECT NO. 217-376
LOCATION --

BORING NO. E-2
DEPTH 91.0-91.5
SAMPLE NO.
DATE SAMPLED
DESCRIPTION



NOTES

File name: 2546_97_Image_18_03_23_07_49_09



ADVANCED TERRA TESTING

Image Attachment

CLIENT Yeh & Associates
JOB NO. 2546-97
PROJECT ES US 550 S. / 160 Contractor
PROJECT NO. 217-376
LOCATION --

BORING NO. E-2
DEPTH 106.3-106.7
SAMPLE NO.
DATE SAMPLED
DESCRIPTION



NOTES

File name: 2546_97_Image_18_03_21_08_11_54



ADVANCED TERRA TESTING

Image Attachment

CLIENT Yeh & Associates
JOB NO. 2546-97
PROJECT ES US 550 S. / 160 Contractor
PROJECT NO. 217-376
LOCATION --

BORING NO. E-2
DEPTH 128.0-128.3
SAMPLE NO.
DATE SAMPLED
DESCRIPTION



NOTES

File name: 2546_97_Image_18_03_21_08_11_02



ADVANCED TERRA TESTING

Image Attachment

CLIENT Yeh & Associates
JOB NO. 2546-97
PROJECT ES US 550 S. / 160 Contractor
PROJECT NO. 217-376
LOCATION --

BORING NO. E-2
DEPTH 143.0-143.7
SAMPLE NO.
DATE SAMPLED
DESCRIPTION



NOTES

File name: 2546_97_Image_18_03_23_07_50_17

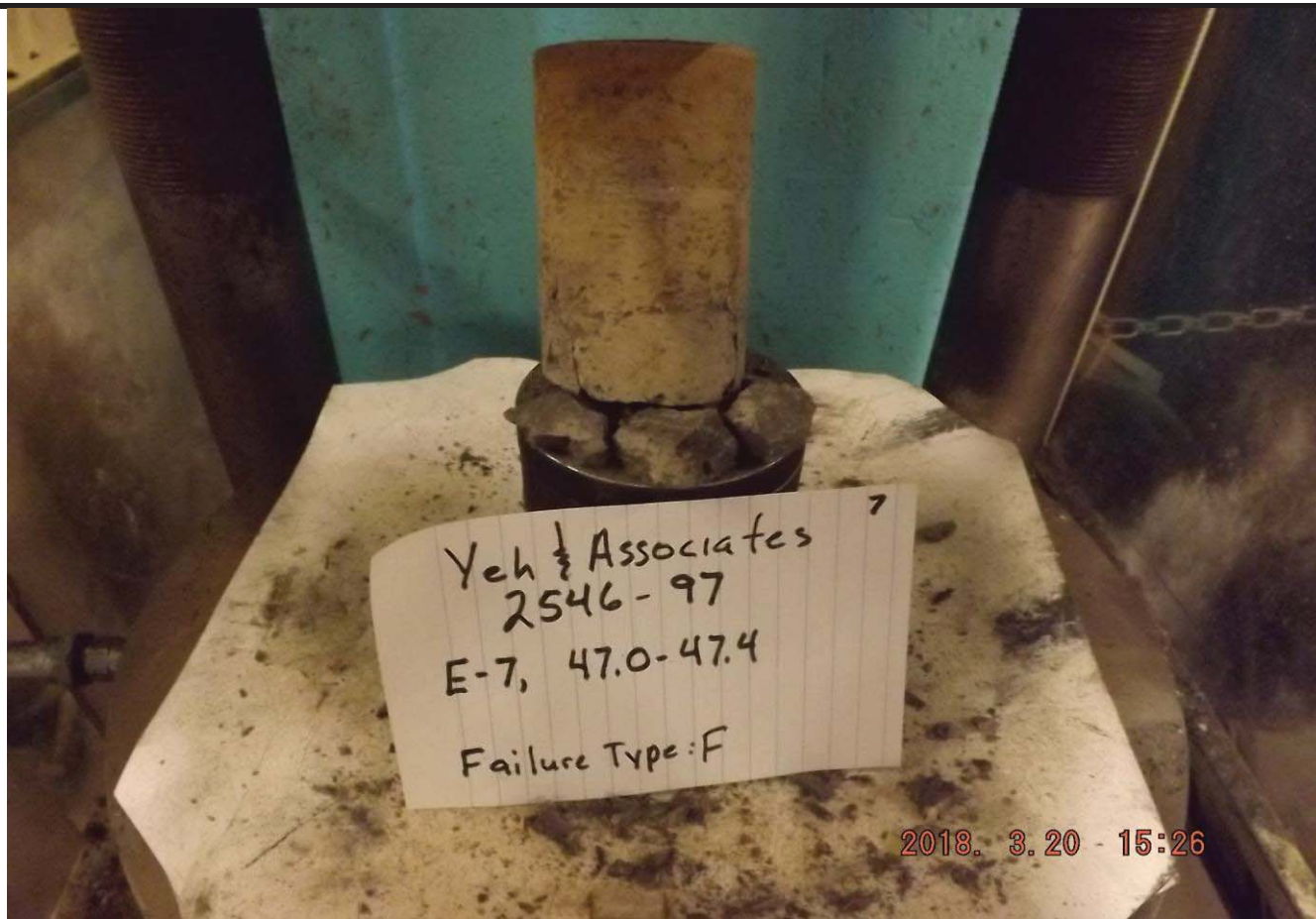


ADVANCED TERRA TESTING

Image Attachment

CLIENT Yeh & Associates
JOB NO. 2546-97
PROJECT ES US 550 S. / 160 Contractor
PROJECT NO. 217-376
LOCATION --

BORING NO. E-7
DEPTH 47.0-47.4
SAMPLE NO.
DATE SAMPLED
DESCRIPTION



NOTES

File name: 2546_97_Image_18_03_21_08_13_22



ADVANCED TERRA TESTING

Image Attachment

CLIENT Yeh & Associates
JOB NO. 2546-97
PROJECT ES US 550 S. / 160 Contractor
PROJECT NO. 217-376
LOCATION --

BORING NO. E-7
DEPTH 84.5-85.0
SAMPLE NO.
DATE SAMPLED
DESCRIPTION



NOTES

File name: 2546_97_Image_18_03_23_07_53_48



ADVANCED TERRA TESTING

Image Attachment

CLIENT Yeh & Associates
JOB NO. 2546-97
PROJECT ES US 550 S. / 160 Contractor
PROJECT NO. 217-376
LOCATION --

BORING NO. E-7
DEPTH 98.7-99.2
SAMPLE NO.
DATE SAMPLED
DESCRIPTION



NOTES

File name: 2546_97_Image_18_03_23_07_56_37

Appendix E.2 – Bridges - Laboratory Test Results



YEH & ASSOCIATES, INC

Summary of Laboratory Test Results

Project No: 217-376 Project Name: 22420: US 550 S Connection to US 160 Bridge Laboratory Test Results Date: 7/10/2018

Sample Location			Natural Moisture Content (%)	Natural Dry Density (pcf)	AASHTO T99		Gradation			Atterberg			pH	Water Soluble Sulfate (%)	Chloride (%)	% Swell (+) / Consoli- dation (-)	Resistivity (Ohm-cm)	Uncon- Comp strength (rock-psi)	Uncon- Comp strength (soil-psf)	CLASSIFICATION	
Boring	Sample Type	Depth (ft)			Max. Dry Density (pcf)	Optimum Moisture (%)	Gravel > #4 (%)	Sand (%)	Fines < #200 (%)	LL	PL	PI								AASHTO	USCS
B1-01	CORE	92	4.7	153.2														9964			
B1-08	CORE	27	8.0	141.0														2843			
B1-08	CORE	56	6.5	143.3														5496			
B1-09	CORE	18	8.5	140.9														1180			
B1-10	CORE	11	5.9	145.7														3907			
B1-12	CORE	21	8.5	137.9														1072			
B1-12	CORE	40	7.8	137.5														1405			
B2-01	CORE	25.5-26.0		149.4														2230			
B2-01	CORE	51.5-52.3		151.3														2750			
B2-04	CORE	14.6-15.0		148.3														5400			

bulk - indicates drill cuttings sample
MC - indicates Modified California sample
CORE - indicates rock core sample
SS - indicates Split Spoon sample
NV - indicates no value
NP - indicates no plasticity

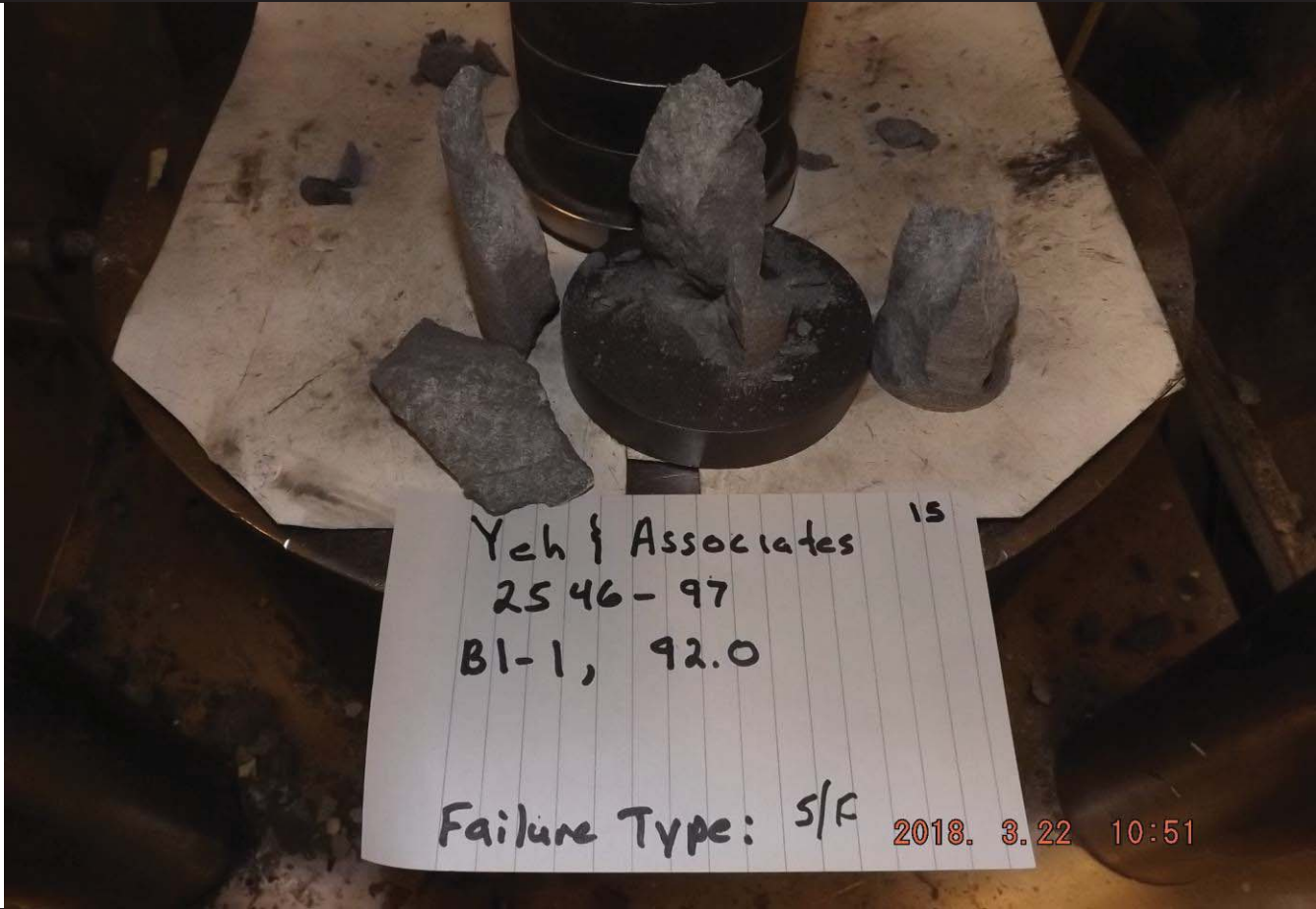


Image Attachment

ADVANCED TERRA TESTING

CLIENT Yeh & Associates
JOB NO. 2546-97
PROJECT ES US 550 S. / 160 Contractor
PROJECT NO. 217-376
LOCATION --

BORING NO. B1-1
DEPTH 92
SAMPLE NO.
DATE SAMPLED
DESCRIPTION



NOTES

File name: 2546_97_Image_18_03_23_08_04_48



ADVANCED TERRA TESTING

Image Attachment

CLIENT Yeh & Associates
JOB NO. 2546-97
PROJECT ES US 550 S. / 160 Contractor
PROJECT NO. 217-376
LOCATION --

BORING NO. B1-8
DEPTH 27
SAMPLE NO.
DATE SAMPLED
DESCRIPTION



NOTES

File name: 2546_97_Image_18_03_23_08_03_25



ADVANCED TERRA TESTING

Image Attachment

CLIENT Yeh & Associates
JOB NO. 2546-97
PROJECT ES US 550 S. / 160 Contractor
PROJECT NO. 217-376
LOCATION --

BORING NO. B1-8
DEPTH 56
SAMPLE NO.
DATE SAMPLED
DESCRIPTION



NOTES

File name: 2546_97_Image_18_03_23_08_04_08



ADVANCED TERRA TESTING

Image Attachment

CLIENT Yeh & Associates
JOB NO. 2546-97
PROJECT ES US 550 S. / 160 Contractor
PROJECT NO. 217-376
LOCATION --

BORING NO. B1-9
DEPTH 18
SAMPLE NO.
DATE SAMPLED
DESCRIPTION



NOTES

File name: 2546_97_Image_18_03_23_08_05_45



ADVANCED TERRA TESTING

Image Attachment

CLIENT Yeh & Associates
JOB NO. 2546-97
PROJECT ES US 550 S. / 160 Contractor
PROJECT NO. 217-376
LOCATION --

BORING NO. B1-10
DEPTH 11
SAMPLE NO.
DATE SAMPLED
DESCRIPTION



NOTES

File name: 2546_97_Image_18_03_23_08_07_14



ADVANCED TERRA TESTING

Image Attachment

CLIENT Yeh & Associates
JOB NO. 2546-97
PROJECT ES US 550 S. / 160 Contractor
PROJECT NO. 217-376
LOCATION --

BORING NO. B1-12
DEPTH 21
SAMPLE NO.
DATE SAMPLED
DESCRIPTION



NOTES

File name: 2546_97_Image_18_03_23_08_08_10



ADVANCED TERRA TESTING

Image Attachment

CLIENT Yeh & Associates
JOB NO. 2546-97
PROJECT ES US 550 S. / 160 Contractor
PROJECT NO. 217-376
LOCATION --

BORING NO. B1-12
DEPTH 40
SAMPLE NO.
DATE SAMPLED
DESCRIPTION



NOTES

File name: 2546_97_Image_18_03_23_08_09_00

Appendix E.3 – Wildlife and Livestock Crossings - Laboratory Test Results



YEH & ASSOCIATES, INC

Summary of Laboratory Test Results

Project No: 217-376

Project Name: 22420: US 550 S Connection to US 160 Wildlife and Livestock Crossings

Date: 7/10/2018

Sample Location			Natural Moisture Content (%)	Natural Dry Density (pcf)	AASHTO T99		Gradation			Atterberg			pH	Water Soluble Sulfate (%)	Chloride (%)	% Swell (+) / Consolidation (-)	Resistivity (Ohm-cm)	Uncon-Comp strength (rock-psi)	Uncon-Comp strength (soil-psi)	CLASSIFICATION	
Boring	Sample Type	Depth (ft)			Max. Dry Density (pcf)	Optimum Moisture (%)	Gravel > #4 (%)	Sand (%)	Fines < #200 (%)	LL	PL	PI								AASHTO	USCS
A-01	bulk	0-9.5	13.1		106.1	19.2	0	20	80	42	21	21								A-7-6 (17)	CL
A-01	MC	9.5	12.2	104.4														7063			
A-01	bulk	10.5-14.5	10.5				0	17	83	40	17	23								A-6 (18)	CL
A-01	MC	29.5	8.7	89.2			0	22	78	28	19	9								A-4 (5)	CL
A-01	bulk	48.5-53.5	0.6				30	66	4	NV	NP	NP								A-1-a (0)	SP
A-02	MC	19.5	13.1	85.2			0	11	89	39	24	15				-3.4				A-6 (14)	CL
A-02	bulk	30-32	6.6				5	71	24	NV	NP	NP	8.5	ND	0.0011		3500			A-2-4 (0)	SM
A-02	bulk	59.5-64.5	0.4				25	71	4	NV	NP	NP								A-1-a (0)	SP
A-03	MC	4.5	11.7	113.0														8357			
A-03	bulk	5.5-9.5	11.0				0	19	81	43	20	23								A-7-6 (18)	CL
A-03	bulk	29.5-34.5	7.5				1	56	43	26	22	4								A-4 (0)	SM
WX-01	SS	9.5	8.9				0	12	88	32	19	13								A-6 (11)	CL
WX-01	bulk	19-24	11.3				0	19	81	29	15	14								A-6 (9)	CL
WX-01	SS	29	13.1				0	39	61	NV	NP	NP								A-4 (0)	ML
WX-02	MC	19	17.2	109.3												-0.1					
WX-02	bulk	34-39	3.5				56	34	10	NV	NP	NP								A-1-a (0)	GP-GM
WX-03	MC	9	19.3	106.2			0	6	94	34	16	18								A-6 (16)	CL
WX-03	MC	19	17.8	109.5																	

bulk - indicates drill cuttings sample

MC - indicates Modified California sample

CORE - indicates rock core sample

SS - indicates Split Spoon sample

NV - indicates no value

NP - indicates no plasticity



YEH & ASSOCIATES, INC

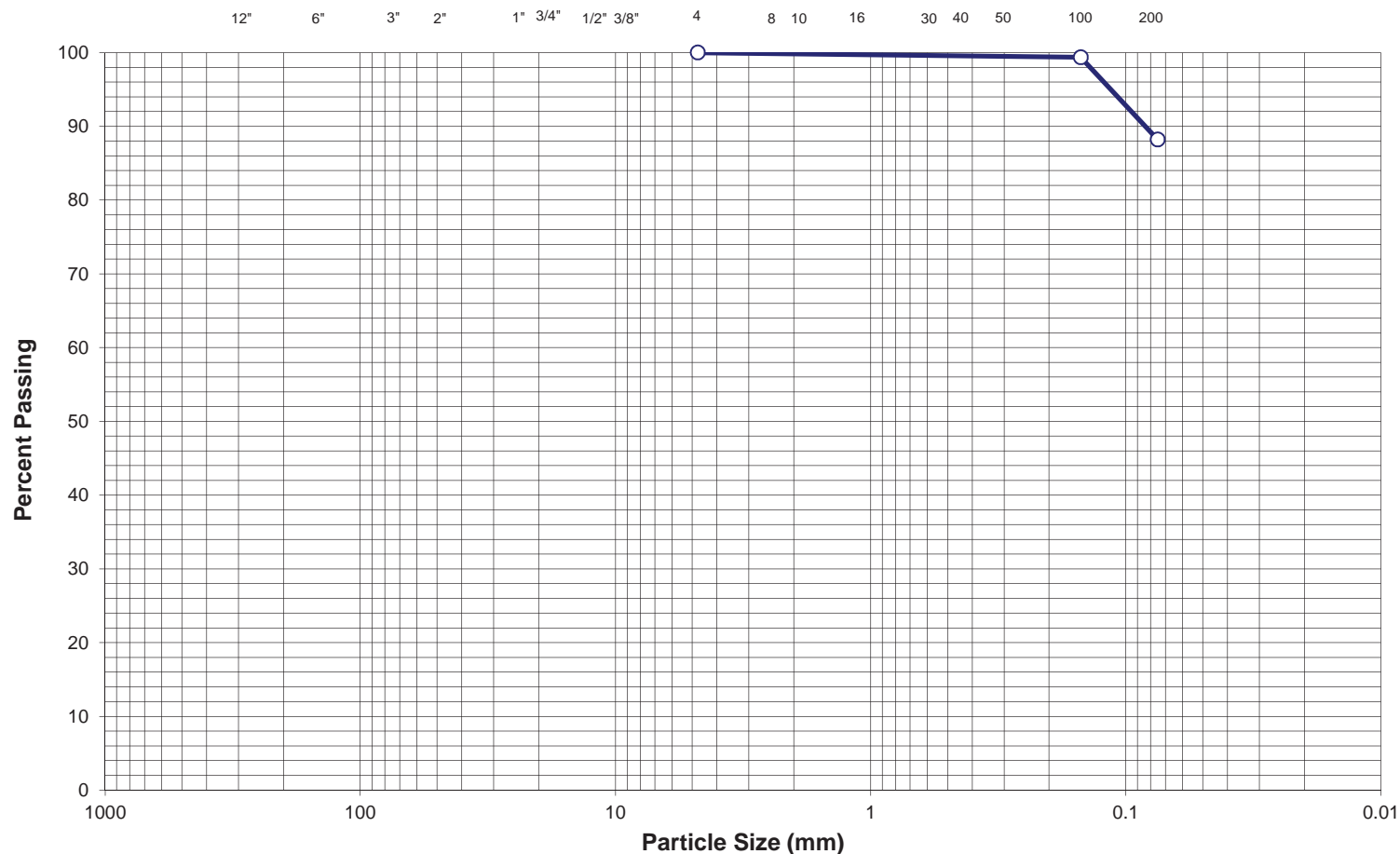
Summary of Laboratory Test Results

Project No: 217-376 Project Name: 22420: US 550 S Connection to US 160 Wildlife and Livestock Crossings Date: 7/10/2018


Sample Location			Natural Moisture Content (%)	Natural Dry Density (pcf)	AASHTO T99		Gradation			Atterberg			pH	Water Soluble Sulfate (%)	Chloride (%)	% Swell (+) / Consolidation (-)	Resistivity (Ohm-cm)	Uncon-Comp strength (rock-psi)	Uncon-Comp strength (soil-psf)	CLASSIFICATION	
Boring	Sample Type	Depth (ft)			Max. Dry Density (pcf)	Optimum Moisture (%)	Gravel > #4 (%)	Sand (%)	Fines < #200 (%)	LL	PL	PI								AASHTO	USCS
WX-04	MC	14	11.2	111.4												0.3					
WX-04	bulk	24-29	3.7				44	42	14	NV	NP	NP								A-1-a (0)	GM
WX2-01	bulk	8-13	19.2				0	8	92	40	12	28	8.6	0.024	0.0054		1100			A-6 (25)	CL
WX2-01	MC	13	17.3	105.9												-0.3					
WX2-02	bulk	8-13	19.7				0	20	80	47	16	31								A-7-6 (24)	CL
WX2-03	MC	13	15.7	106.8												-0.2					
WX2-03	SS	23	5.1				22	64	14	NV	NP	NP								A-1-b (0)	SM
WX2-04	MC	8	16.3	111.4																	
WX2-04	MC	13	17.3	111.3												-0.1					
WX2-04	bulk	18-23	5.2				33	52	15	NV	NP	NP								A-1-b (0)	SM

bulk - indicates drill cuttings sample
MC - indicates Modified California sample
CORE - indicates rock core sample
SS - indicates Split Spoon sample
NV - indicates no value
NP - indicates no plasticity

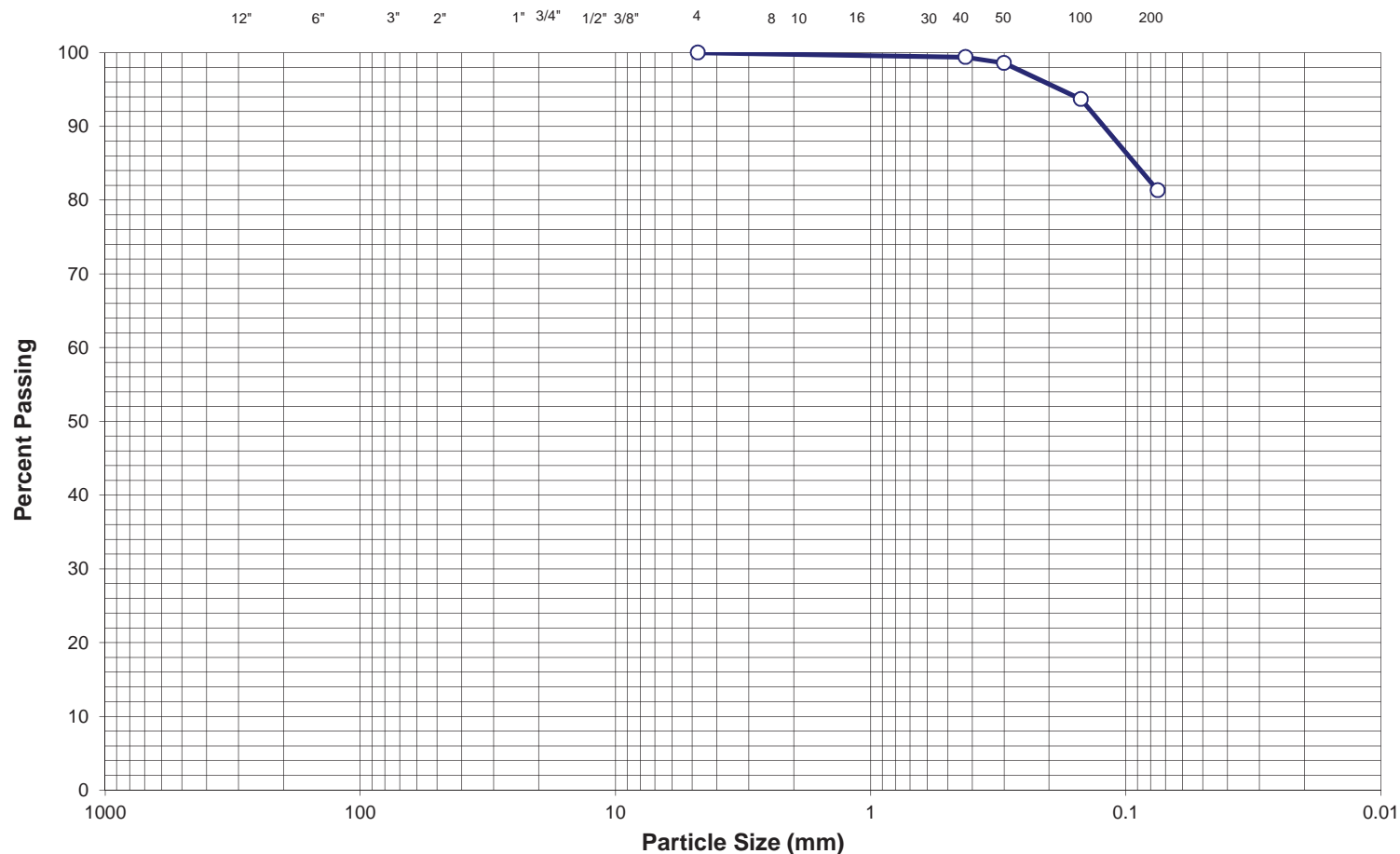
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
#4	100
#10	-
#40	-
#100	99
#200	88.2

Gravel (%)	0	LL	32	Project Name:	US 550 S / US 160 Connector	<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>			
Sand (%)	12	PL	19	Boring:	WX-01				
Fines (%)	88	PI	13	Sample Depth (ft):	9	SIEVE ANALYSIS			
Sample Classification:	Medium plasticity CLAY, brown	USCS: CL	AASHTO: A-6 (11)	Drawn By:	KM	Project No.:	217-376		
				Checked By:	BB				
				Date:	02/21/18	Figure No.:	-		

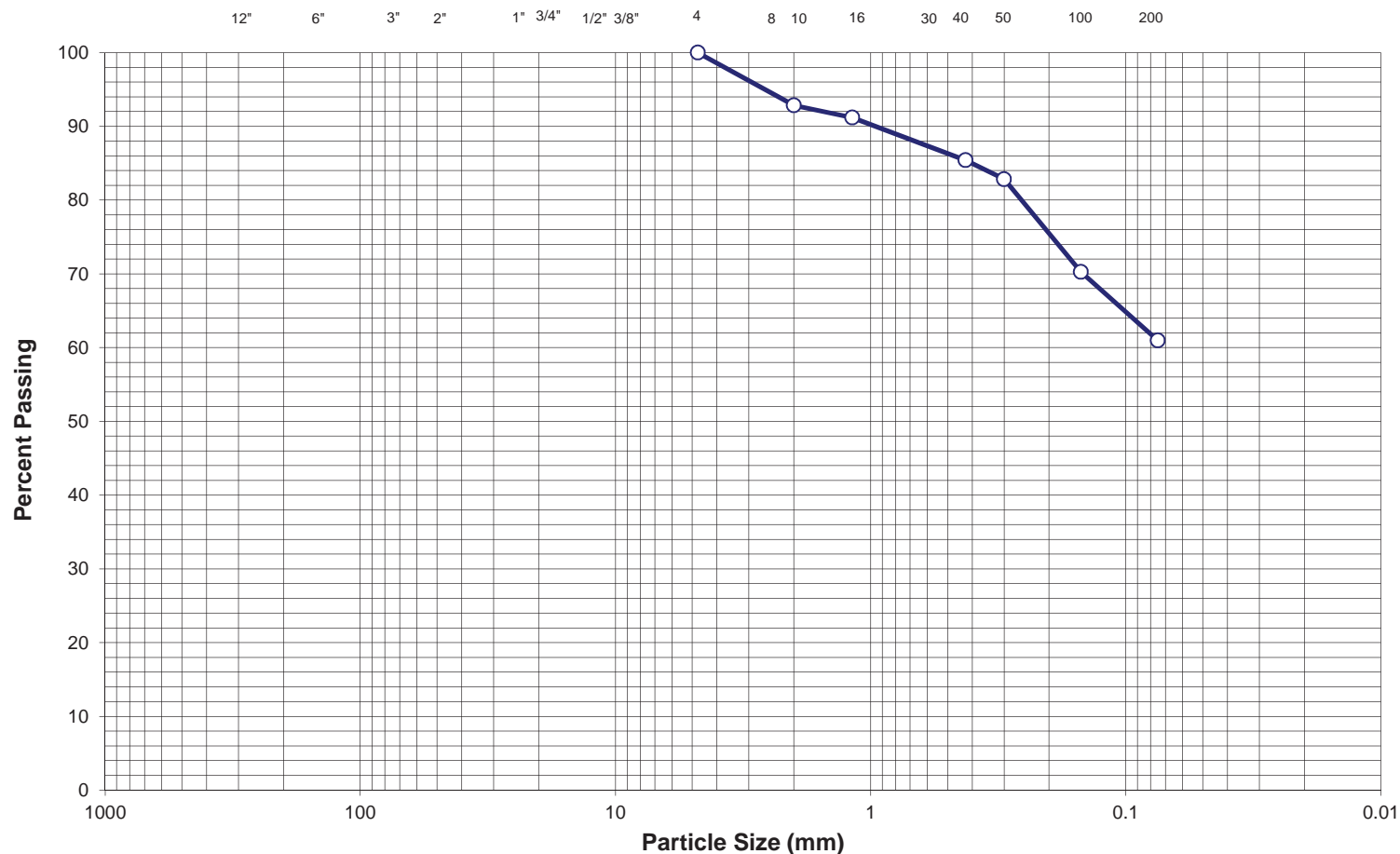
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm



Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	-
#40	99
#200	81.3

Gravel (%)	0	LL	29	Project Name:	US 550 S / US 160 Connector	<div><div>Yeh & Associates, Inc. Geotechnical Engineering Consultants</div></div>			
Sand (%)	19	PL	15	Boring:	WX-01				
Fines (%)	81	PI	14	Sample Depth (ft):	19-24	SIEVE ANALYSIS			
Sample Classification:	Medium plasticity CLAY w/ sand	USCS: CL	AASHTO: A-6 (9)	Drawn By:	KM	Project No.:	217-376		
				Checked By:	BB				
				Date:	02/21/18	Figure No.:	-		

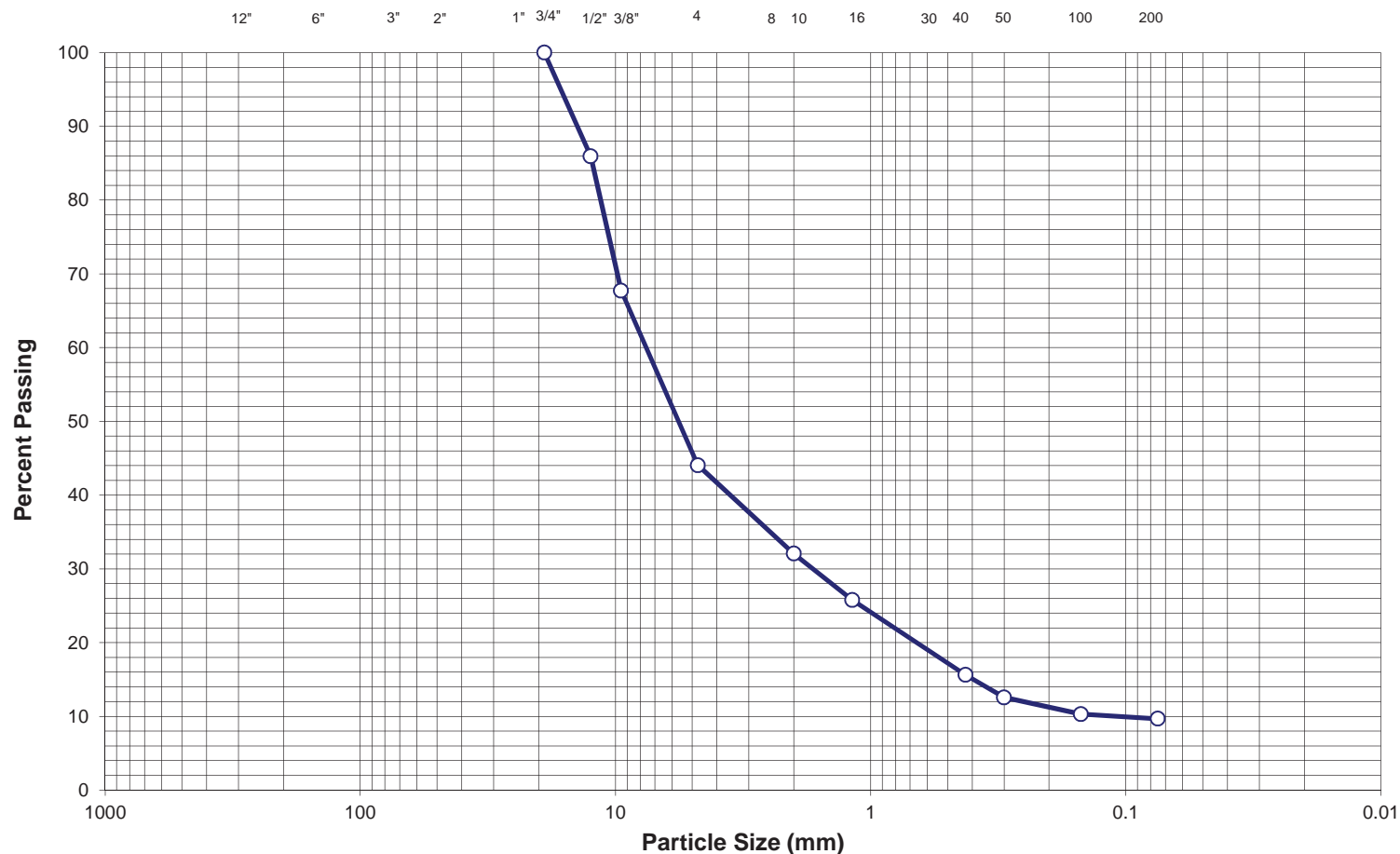
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	93
#40	85
#200	61.0

Gravel (%)	0	LL	NV	Project Name:	US 550 S / US 160 Connector			
Sand (%)	39	PL	NP	Boring:	WX-01			
Fines (%)	61	PI	NP	Sample Depth (ft):	29			
Sample Classification:	Sandy SILT, brown		USCS: ML	AASHTO: A-4 (0)		SIEVE ANALYSIS		
						Drawn By: KM	Project No.:	217-376
						Checked By: BB	Figure No.:	-
						Date: 02/21/18		

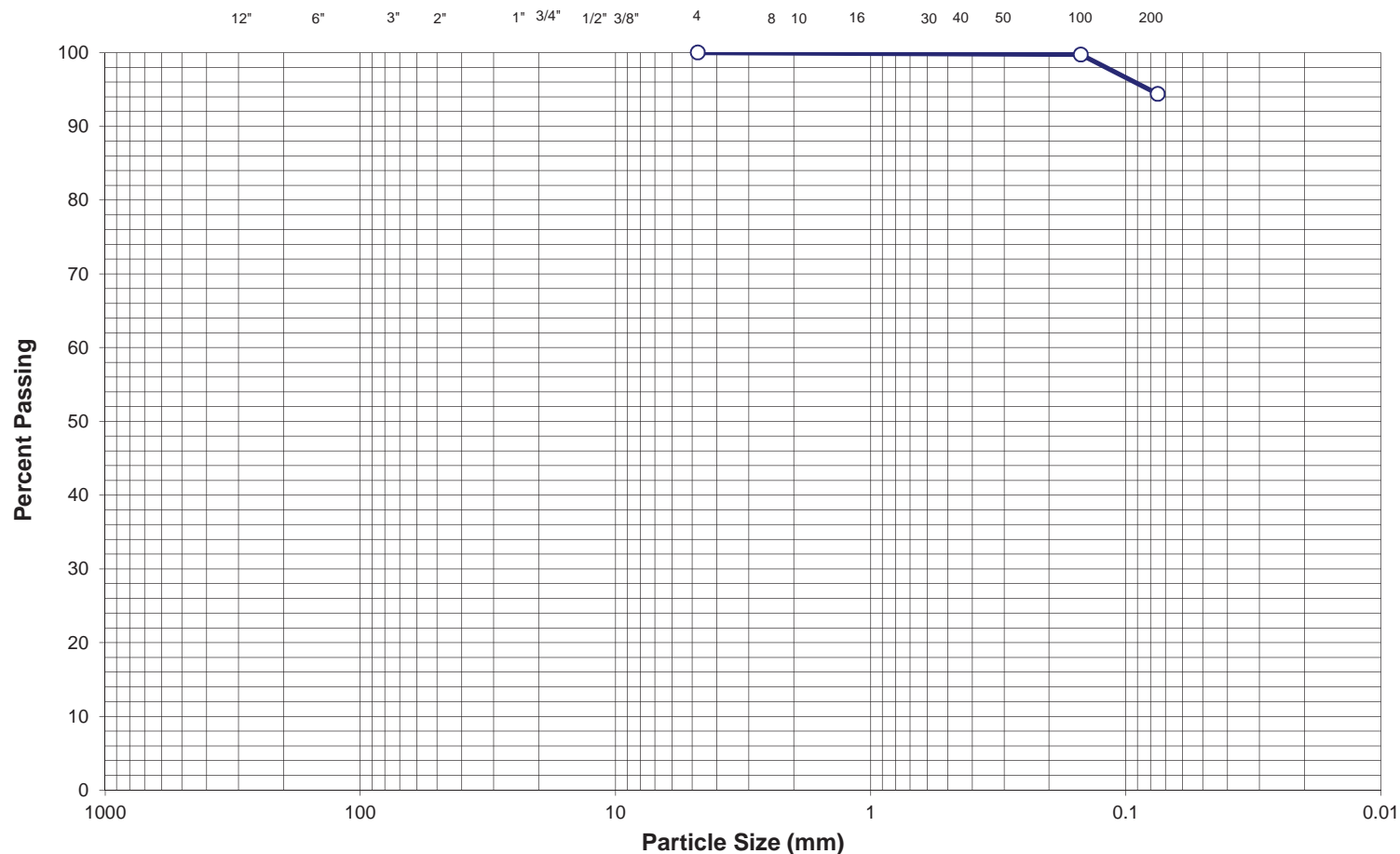
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4"	100
1/2"	86
3/8"	68
#4	44
#10	32
#40	16
#200	9.7

Gravel (%)	56	LL	NV	Project Name:	 Yeh & Associates, Inc. Geotechnical Engineering Consultants		
Sand (%)	34	PL	NP	Boring:			
Fines (%)	10	PI	NP	Sample Depth (ft):			
Sample Classification:	Poorly graded GRAVEL w/ sand		USCS: GP-GM	AASHTO: A-1-a (0)	Drawn By: KM	Project No.:	217-376
					Checked By: BB	Figure No.:	-
					Date: 02/21/18		

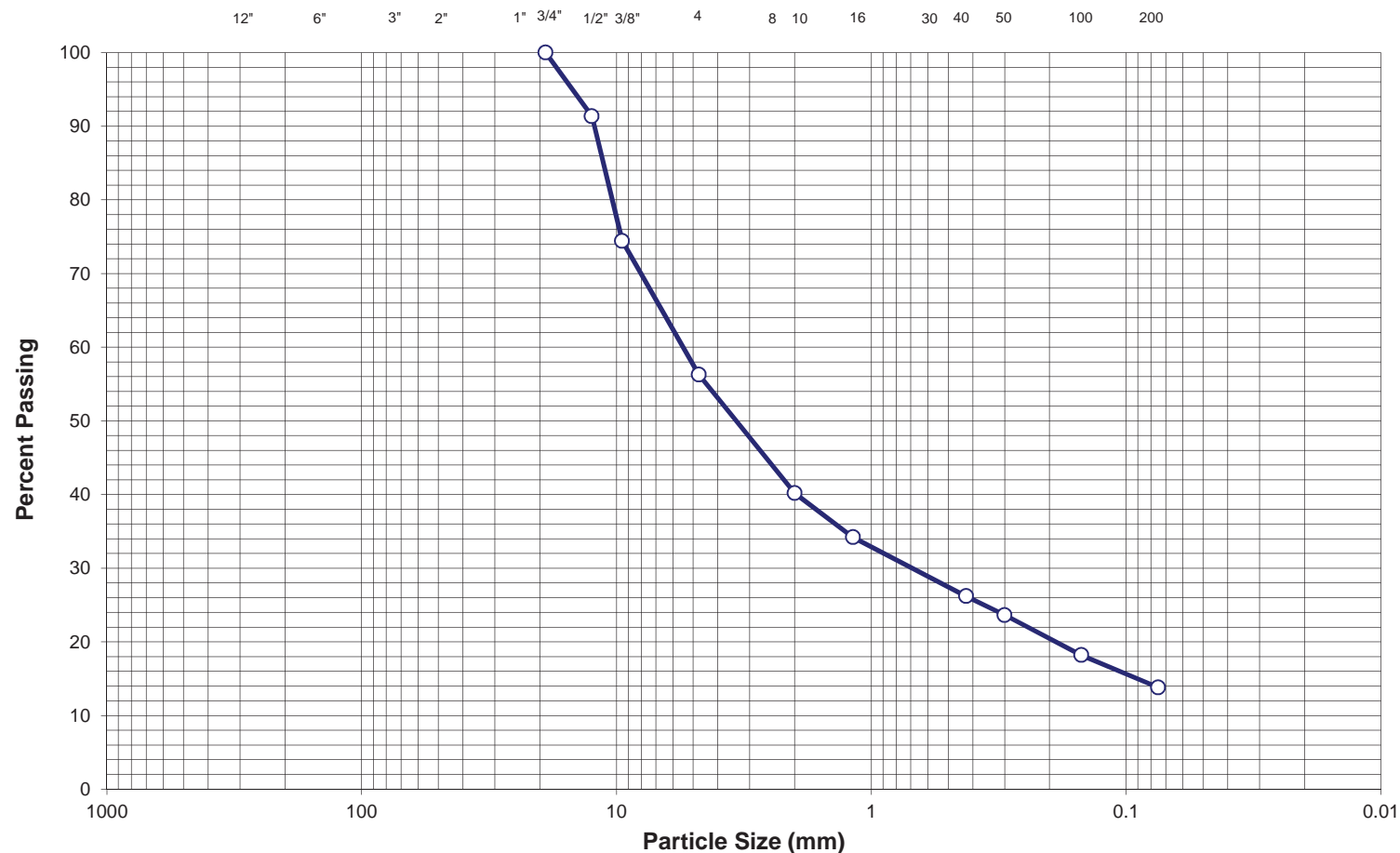
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	-
#40	-
#200	94.4

Gravel (%)	0	LL	34	Project Name:	US 550 S / US 160 Connector		
Sand (%)	6	PL	16	Boring:	WX-03		
Fines (%)	94	PI	18	Sample Depth (ft):	9		
Sample Classification:	Medium plasticity CLAY, dark brown		USCS: CL	AASHTO: A-6 (16)			
				<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>			
				SIEVE ANALYSIS			
				Drawn By:	KM	Project No.:	217-376
				Checked By:	BB	Figure No.:	-
				Date:	02/20/18		

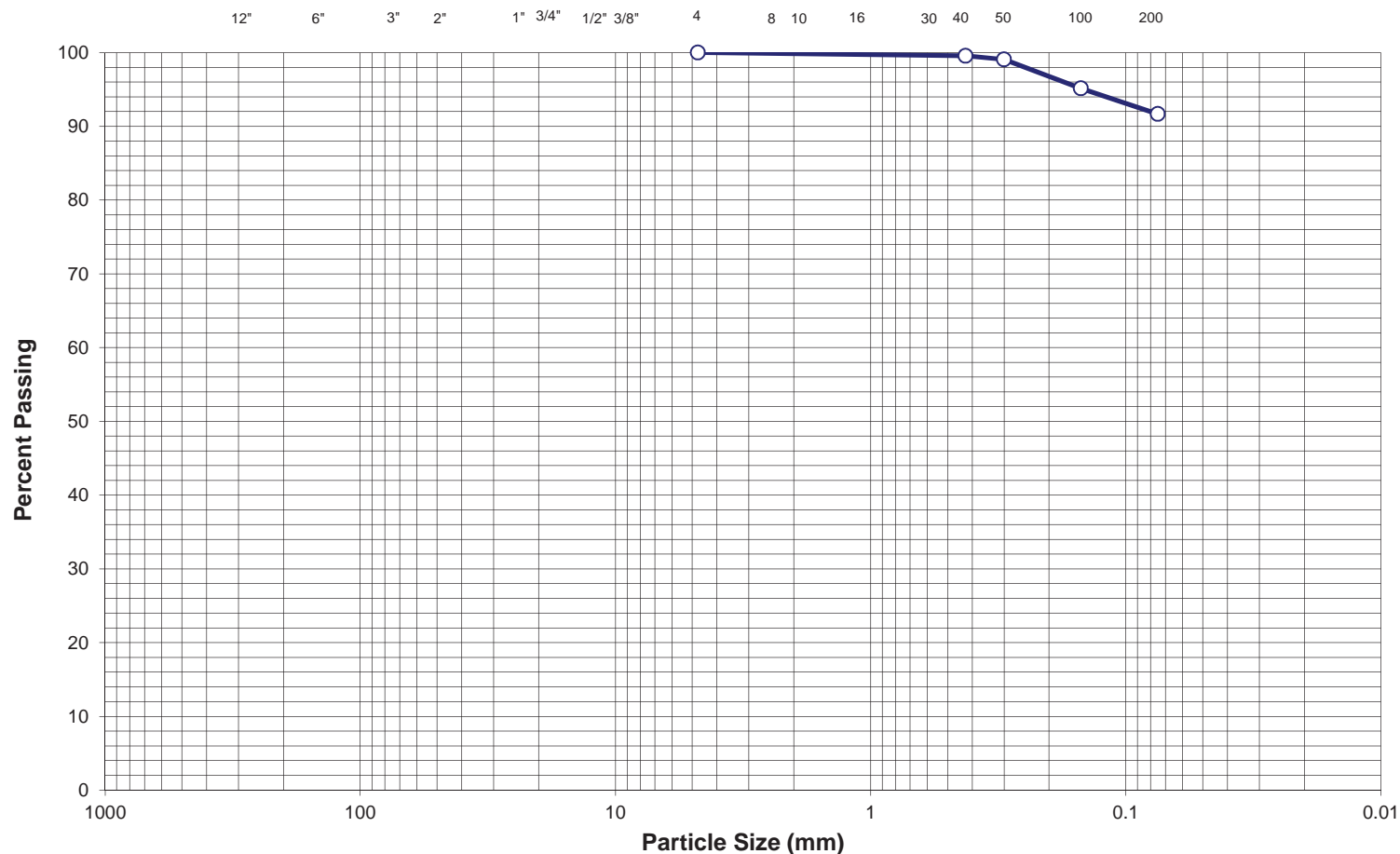
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4"	100
1/2"	91
3/8"	74
#4	56
#10	40
#40	26
#200	13.8

Gravel (%)	44	LL	NV	Project Name:	US 550 S / US 160 Connector	 Yeh & Associates, Inc. Geotechnical Engineering Consultants		
Sand (%)	42	PL	NP	Boring:	WX-04			
Fines (%)	14	PI	NP	Sample Depth (ft):	24-29			
Sample Classification:	Silty GRAVEL w/ sand		USCS: GM	AASHTO: A-1-a (0)		Drawn By: KM	Project No.:	217-376
						Checked By: BB	Figure No.:	-
						Date: 02/21/18		

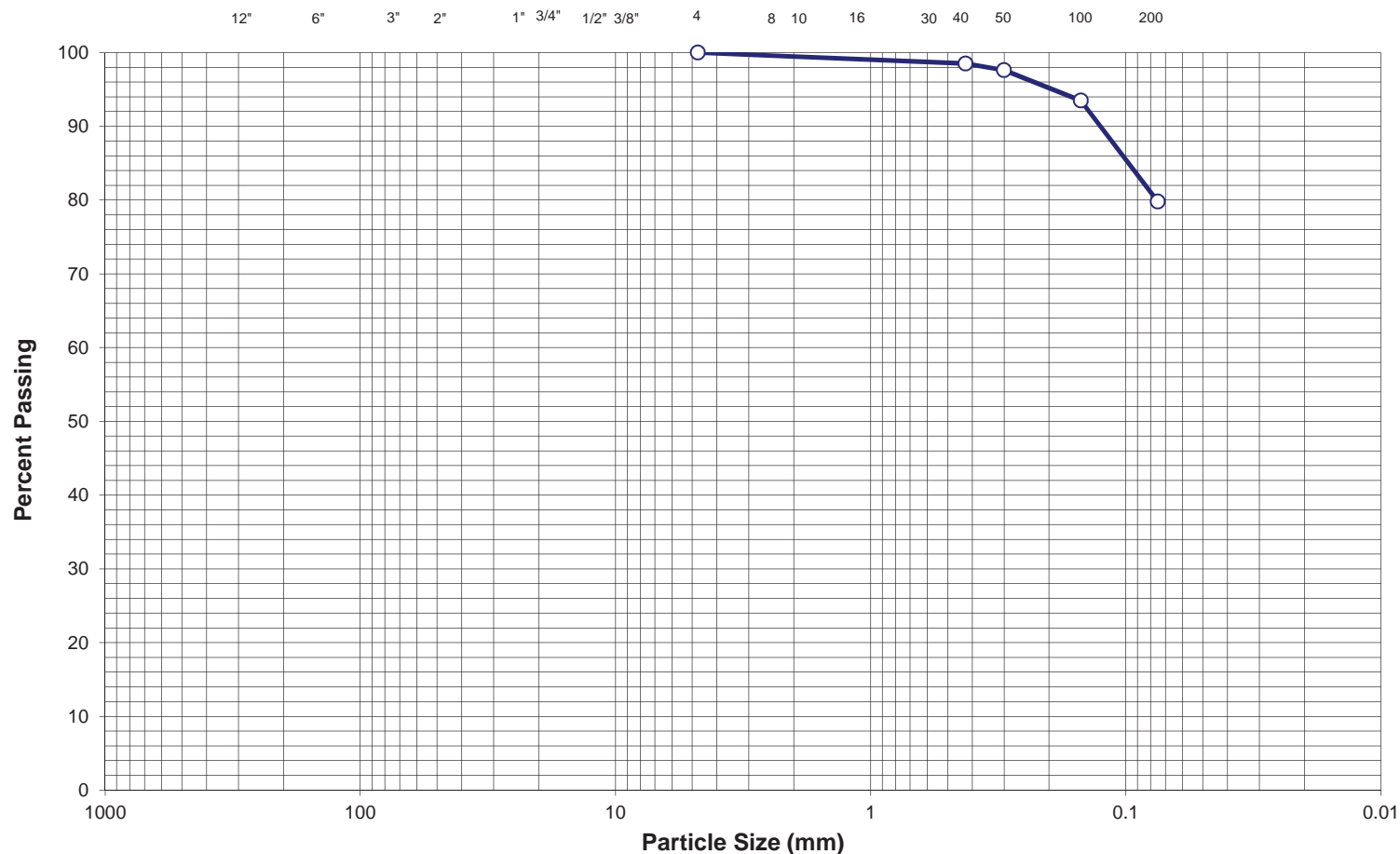
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	-
#40	100
#200	91.7

Gravel (%)	0	LL	40	Project Name:	US 550 S / US 160 Connector				
Sand (%)	8	PL	12	Boring:	WX2-01				
Fines (%)	92	PI	28	Sample Depth (ft):	8-13				
Sample Classification:	Medium plasticity CLAY, trace sand		USCS: CL	AASHTO: A-6 (25)		<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>			
<div>SIEVE ANALYSIS</div>						Drawn By: KM		Project No.:	217-376
						Checked By: BB		Figure No.:	-
						Date: 05/04/18			

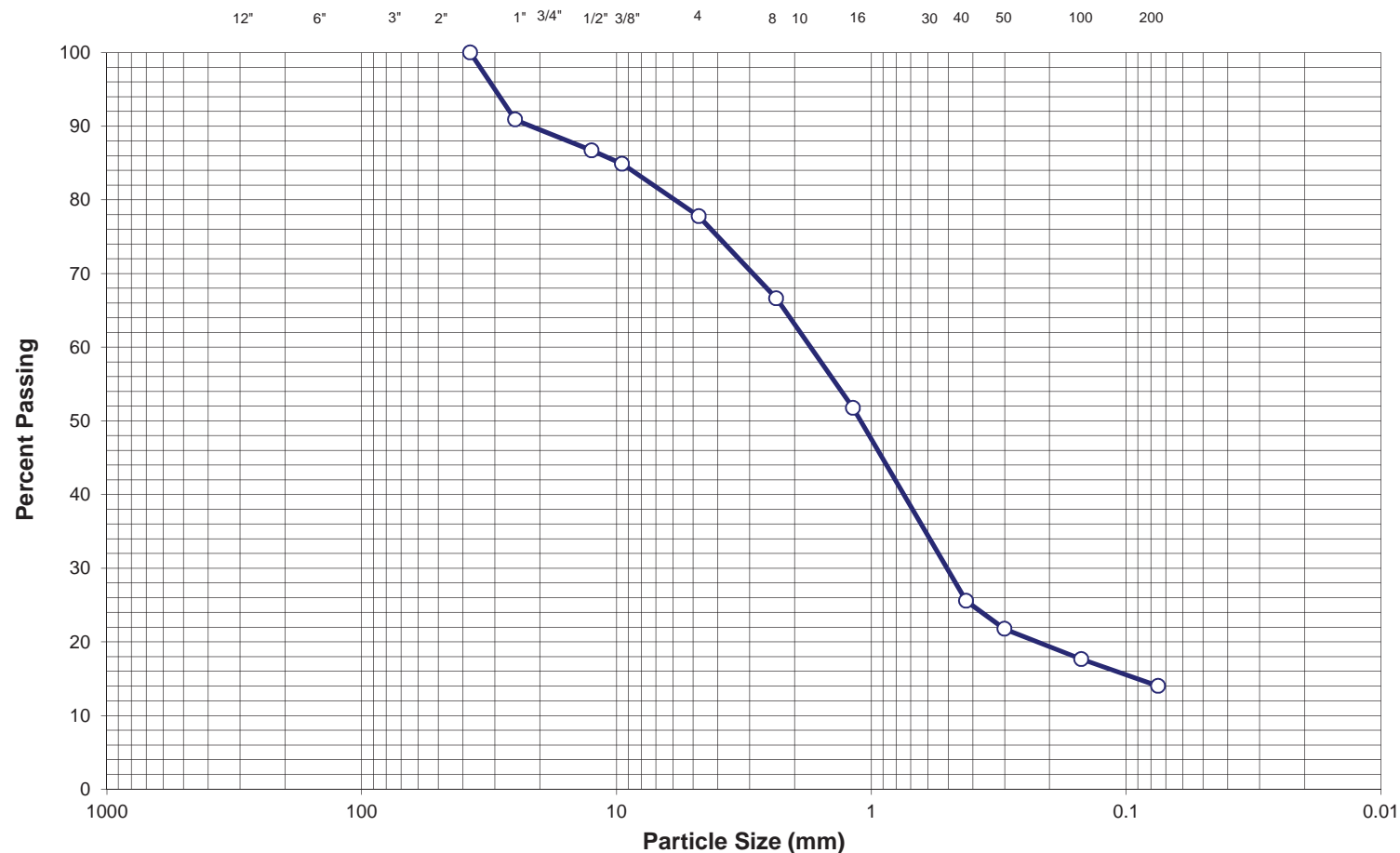
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	-
#40	99
#200	79.8

Gravel (%)	0	LL	47	Project Name:	 Yeh & Associates, Inc. Geotechnical Engineering Consultants		
Sand (%)	20	PL	16	Boring:			
Fines (%)	80	PI	31	Sample Depth (ft):	8-13		
Sample Classification:	Medium plasticity Clay with some sand		USCS:	AASHTO:		Drawn By: KM Checked By: BB Date: 05/04/18	
			CL	A-7-6 (24)		Project No.:	217-376
						Figure No.:	-

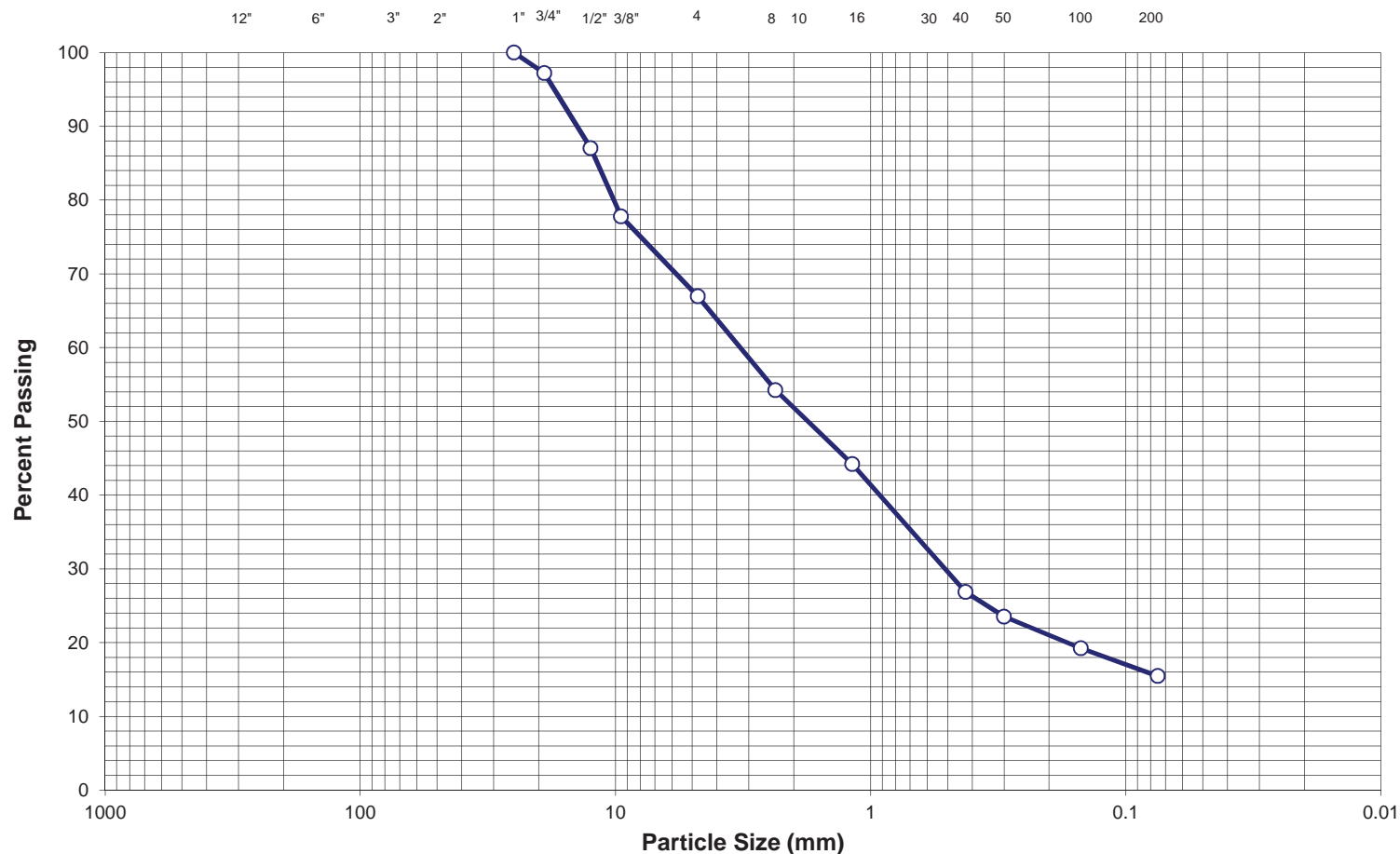
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	100
1"	91
3/4 "	-
1/2"	87
3/8"	85
#4	78
#10	67
#40	26
#200	14.0

Gravel (%)	22	LL	NV	Project Name:	US 550 S / US 160 Connector	 <div>Yeh & Associates, Inc. Geotechnical Engineering Consultants</div>	SIEVE ANALYSIS		
Sand (%)	64	PL	NP	Boring:	WX2-03				
Fines (%)	14	PI	NP	Sample Depth (ft):	23				
Sample Classification:	silty SAND with some gravel		USCS: SM	AASHTO: A-1-b (0)		Drawn By: KM	Project No.: 217-376	Figure No.: -	
					Checked By: BB				
					Date: 05/04/18				

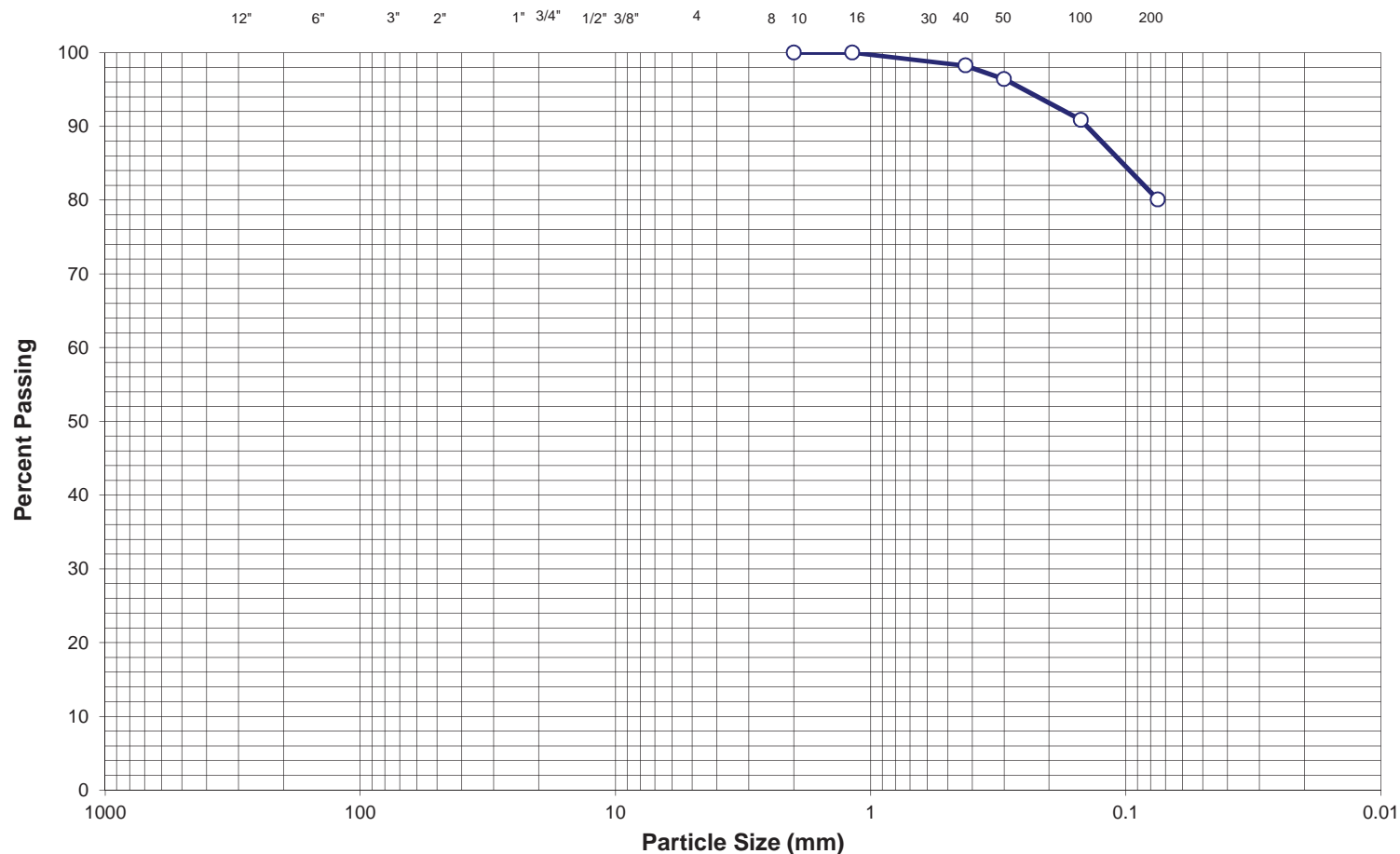
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	100
3/4 "	97
1/2"	87
3/8"	78
#4	67
#10	54
#40	27
#200	15.5

Gravel (%)	33	LL	NV	Project Name:	US 550 S / US 160 Connector		
Sand (%)	52	PL	NP	Boring:	WX2-04		
Fines (%)	15	PI	NP	Sample Depth (ft):	18-23		
Sample Classification:	silty SAND with some gravel		USCS: SM	AASHTO: A-1-b (0)		<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>	
SIEVE ANALYSIS							
				Drawn By:	KM	Project No.:	217-376
				Checked By:	BB	Figure No.:	-
				Date:	05/04/18		

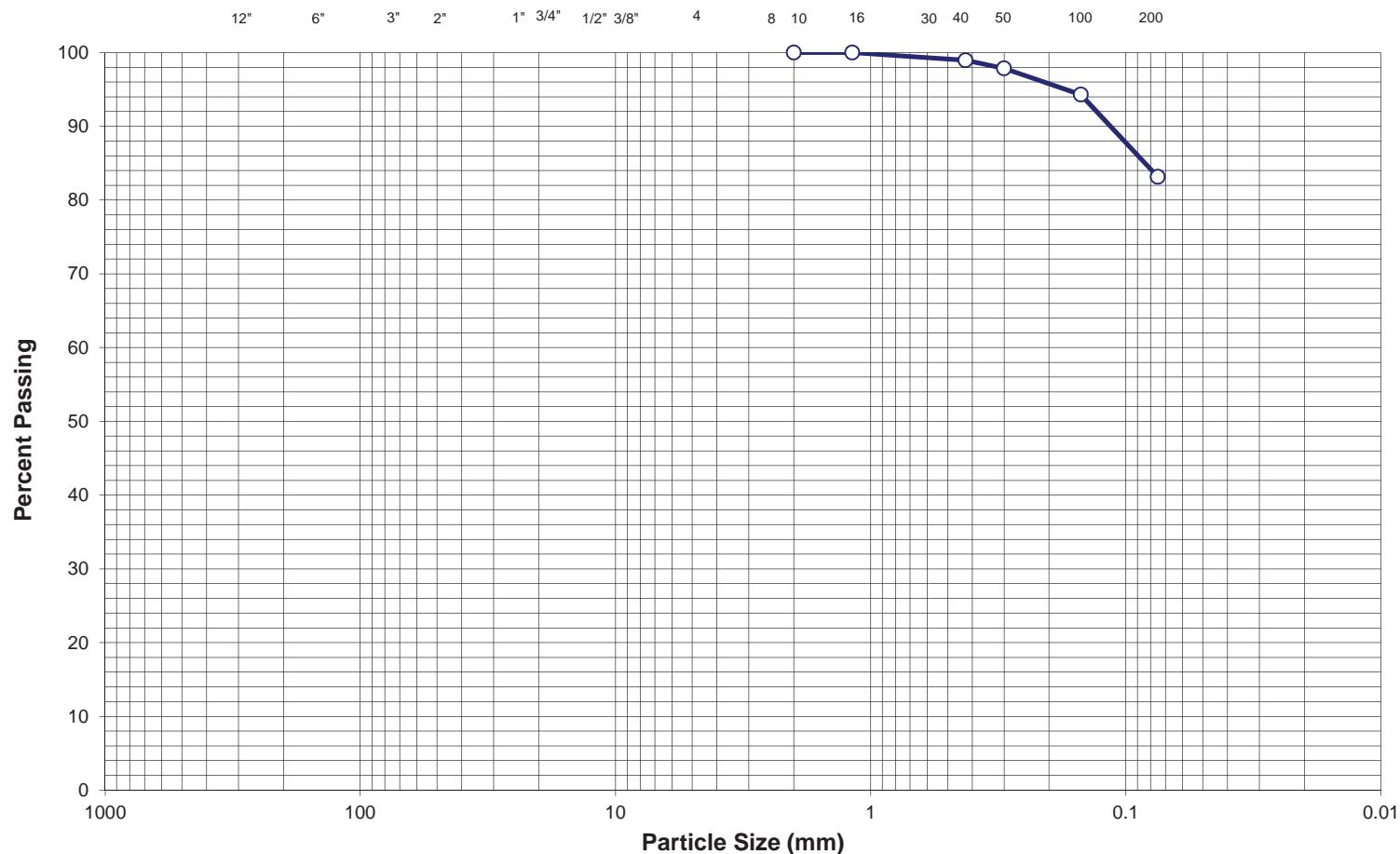
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	100
#40	98
#200	80.1

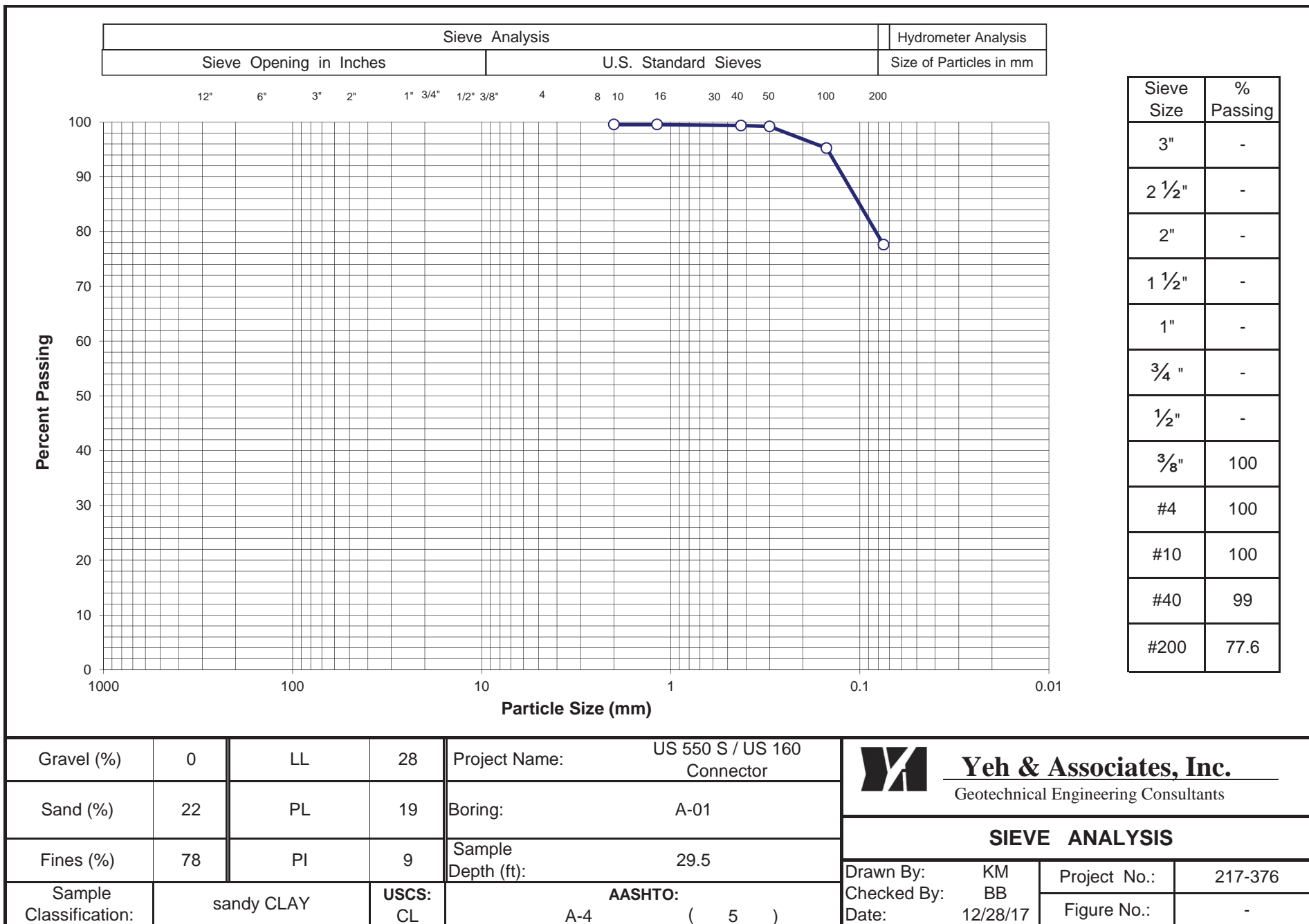
Gravel (%)	0	LL	42	Project Name:	US 550 S / US 160 Connector		
Sand (%)	20	PL	21	Boring:	A-01		
Fines (%)	80	PI	21	Sample Depth (ft):	0-9.5		
Sample Classification:	sandy CLAY		USCS: CL	AASHTO: A-7-6 (17)		<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>	
SIEVE ANALYSIS							
				Drawn By:	KM	Project No.:	217-376
				Checked By:	BB	Figure No.:	-
				Date:	12/28/17		

Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm

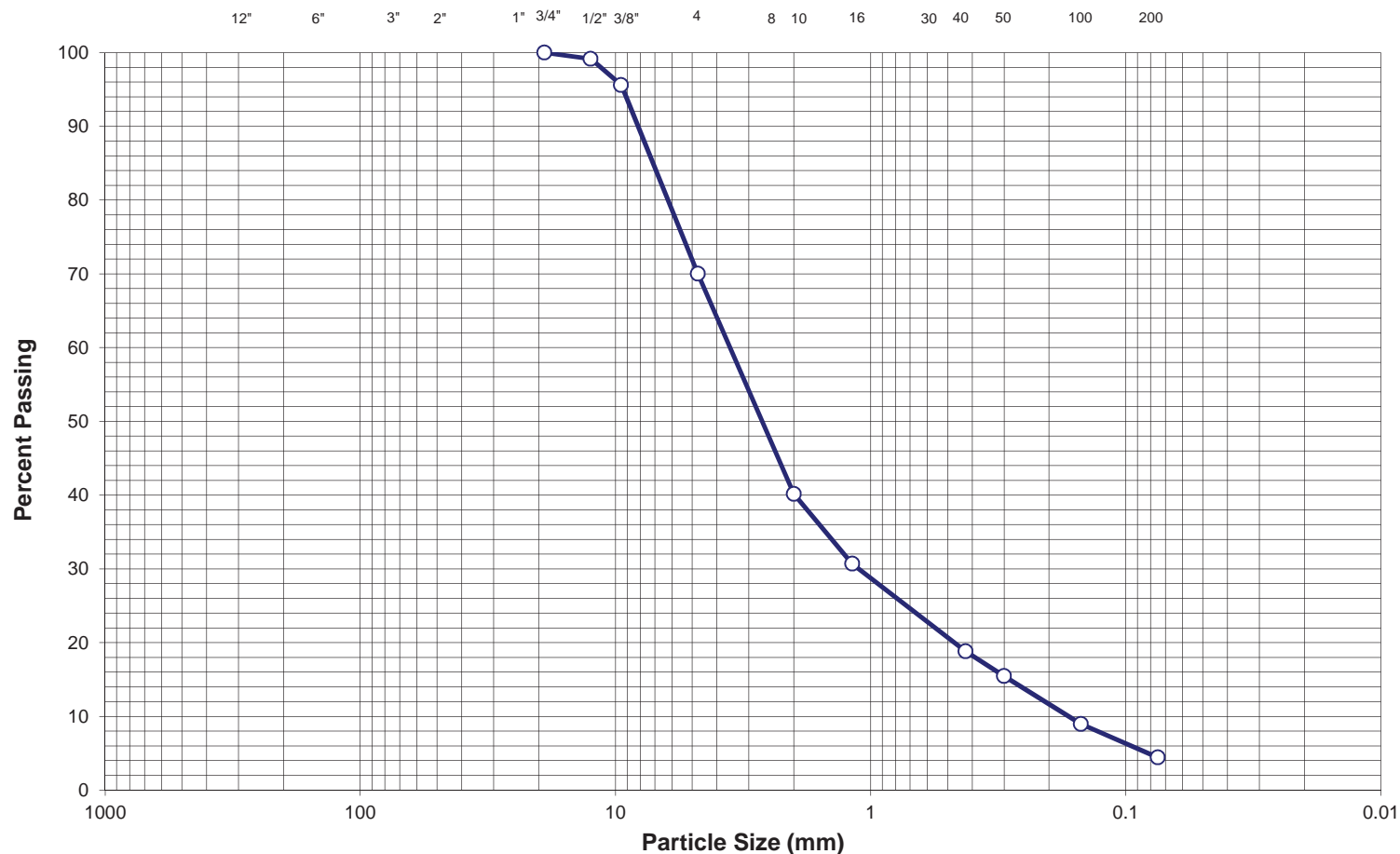


Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	-
#10	100
#40	99
#200	83.2

Gravel (%)	0	LL	40	Project Name:	US 550 S / US 160 Connector		
Sand (%)	17	PL	17	Boring:	A-01		
Fines (%)	83	PI	23	Sample Depth (ft):	9.5-14.5		
Sample Classification:	sandy CLAY		USCS: CL	AASHTO: A-6 (18)		<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>	
<div>SIEVE ANALYSIS</div>							
				Drawn By:	KM	Project No.:	217-376
				Checked By:	LQ	Figure No.:	-
				Date:	12/19/17		

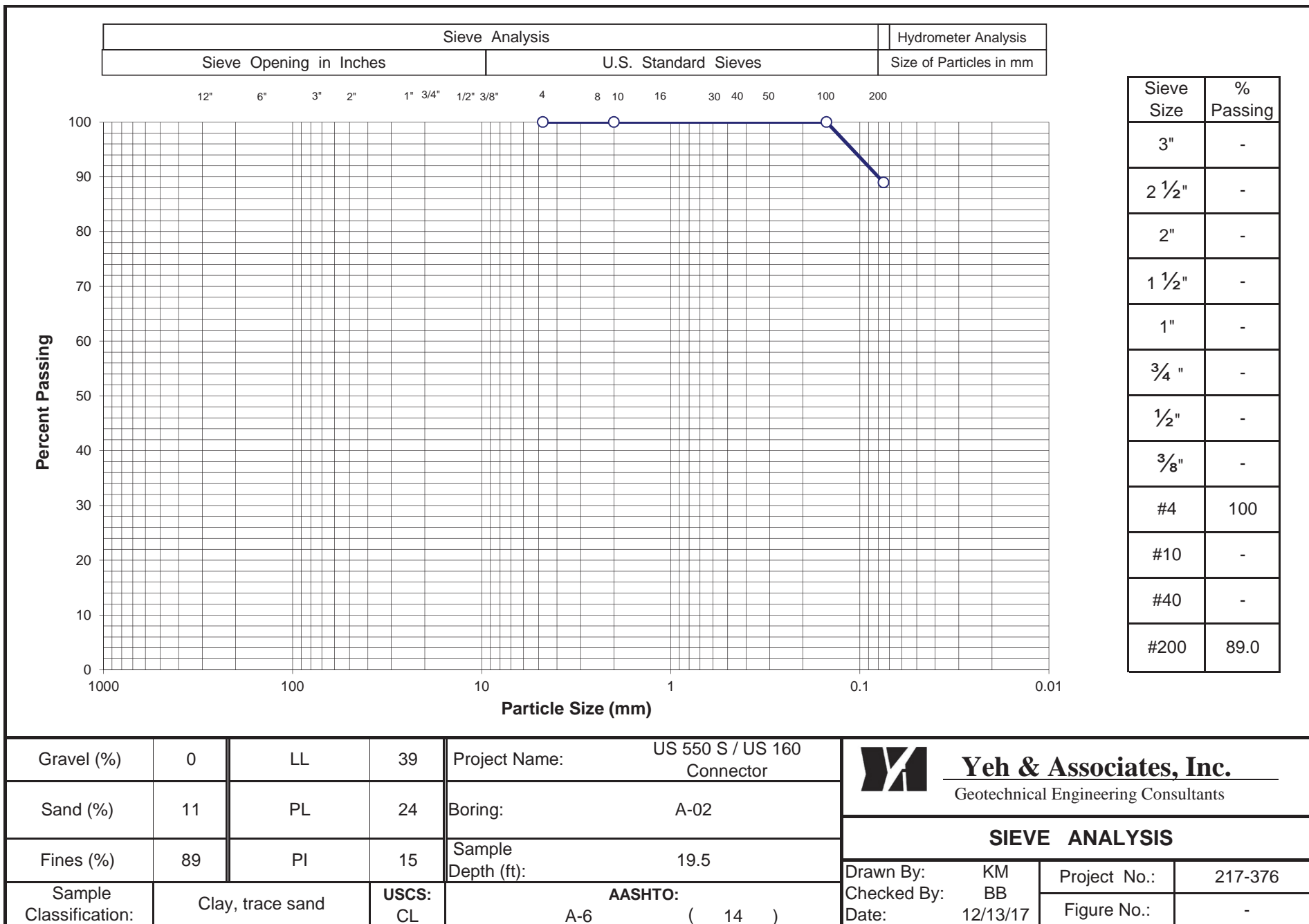


Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm

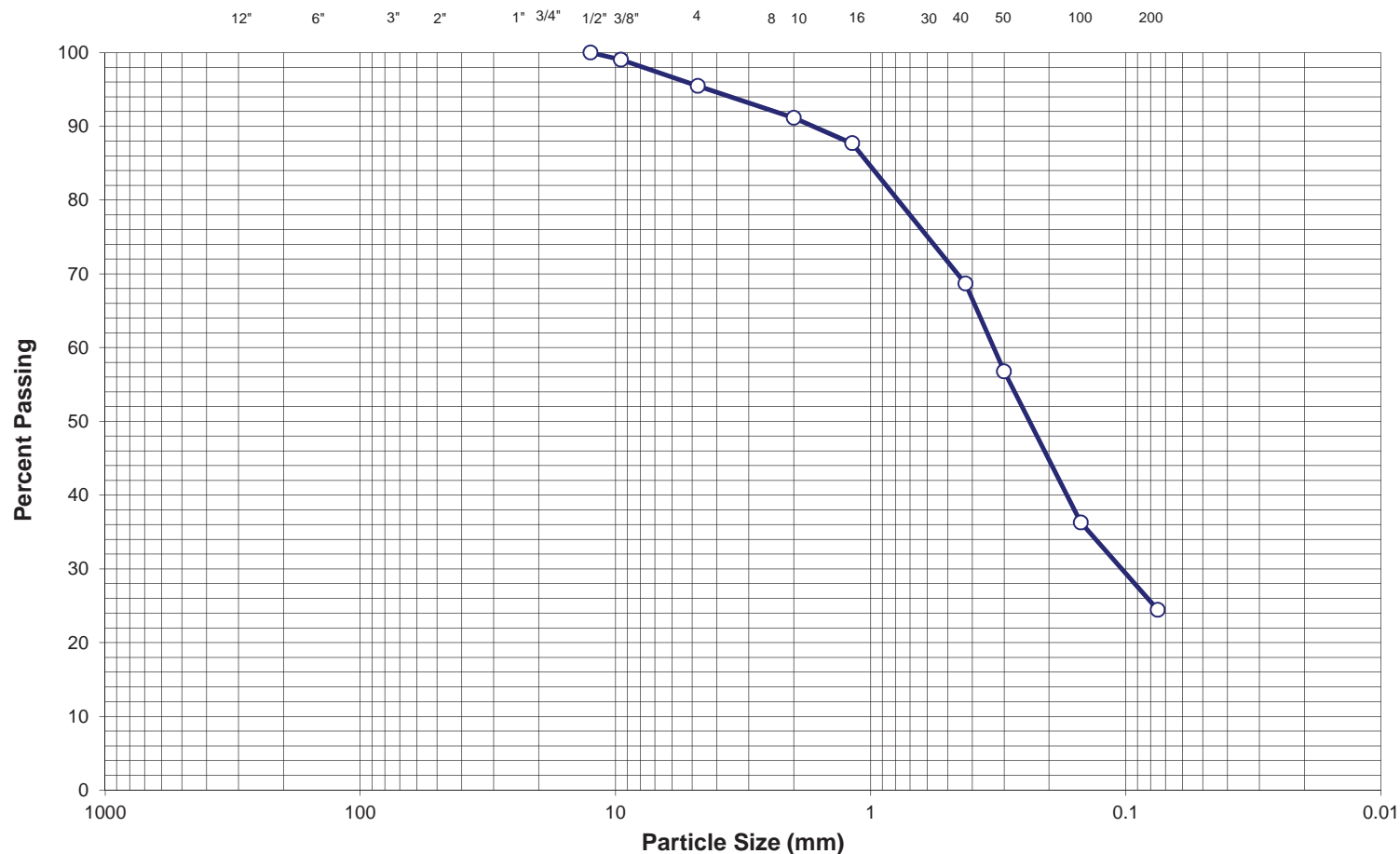


Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	100
1/2"	99
3/8"	96
#4	70
#10	40
#40	19
#200	4.4


Gravel (%)	30	LL	NV	Project Name:	US 550 S / US 160 Connector		
Sand (%)	66	PL	NP	Boring:	A-01		
Fines (%)	4	PI	NP	Sample Depth (ft):	48.5-53.5		
Sample Classification:	Poorly graded SAND w/ gravel		USCS: SP	AASHTO: A-1-a (0)		Yeh & Associates, Inc. Geotechnical Engineering Consultants	
						SIEVE ANALYSIS	
				Drawn By:	KM	Project No.:	217-376
				Checked By:	BB	Figure No.:	-
				Date:	12/11/17		



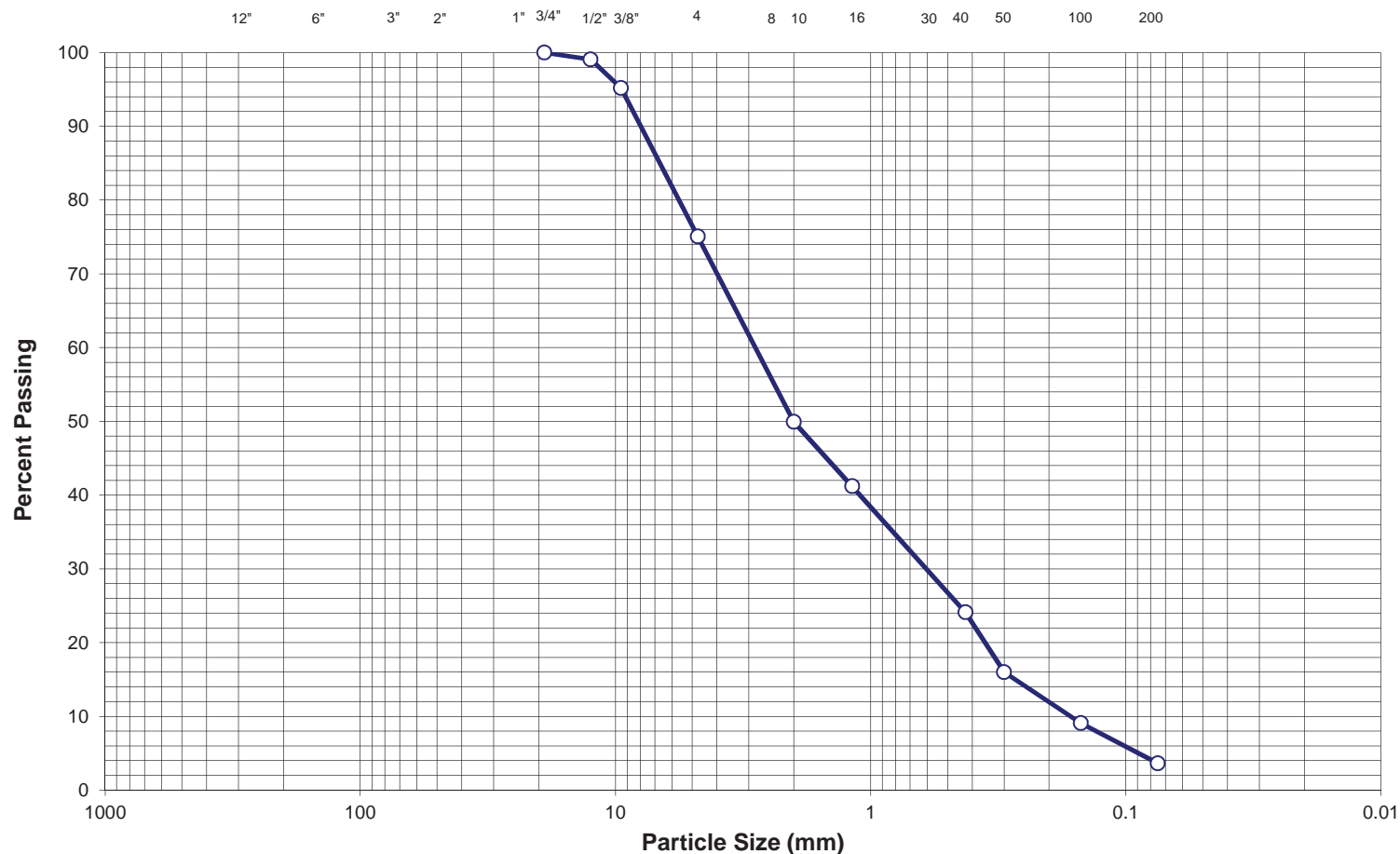
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm



Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4"	-
1/2"	100
3/8"	99
#4	95
#10	91
#40	69
#200	24.5

Gravel (%)	5	LL	NV	Project Name:	US 550 S / US 160 Connector	<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>			
Sand (%)	71	PL	NP	Boring:	A-02				
Fines (%)	24	PI	NP	Sample Depth (ft):	30-32	SIEVE ANALYSIS			
Sample Classification:	Silty SAND, trace gravel	USCS: SM	AASHTO: A-2-4 (0)	Drawn By:	KM	Project No.:	217-376		
				Checked By:	AH				
				Date:	12/13/17	Figure No.:	-		

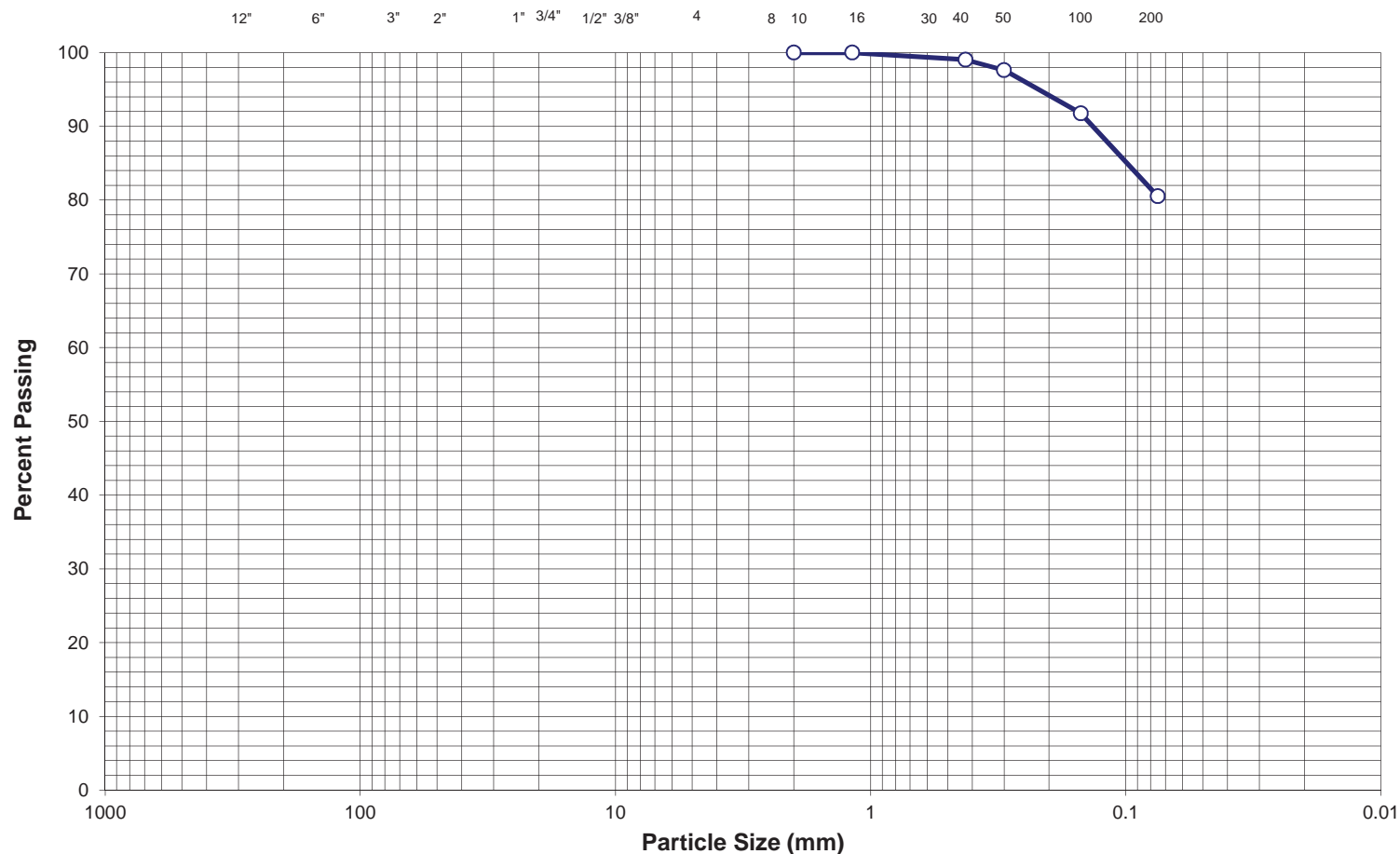
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4"	100
1/2"	99
3/8"	95
#4	75
#10	50
#40	24
#200	3.6

Gravel (%)	25	LL	NV	Project Name:	US 550 S / US 160 Connector			
Sand (%)	71	PL	NP	Bornig:	A-02			
Fines (%)	4	PI	NP	Sample Depth (ft):	59.5-64.5			
Sample Classification:	Poorly graded SAND w/gravel	USCS: SP	AASHTO: A-1-a (0)		SIEVE ANALYSIS			
					Drawn By:	KM	Project No.:	217-376
					Checked By:	LQ	Figure No.:	-
					Date:	12/11/17		

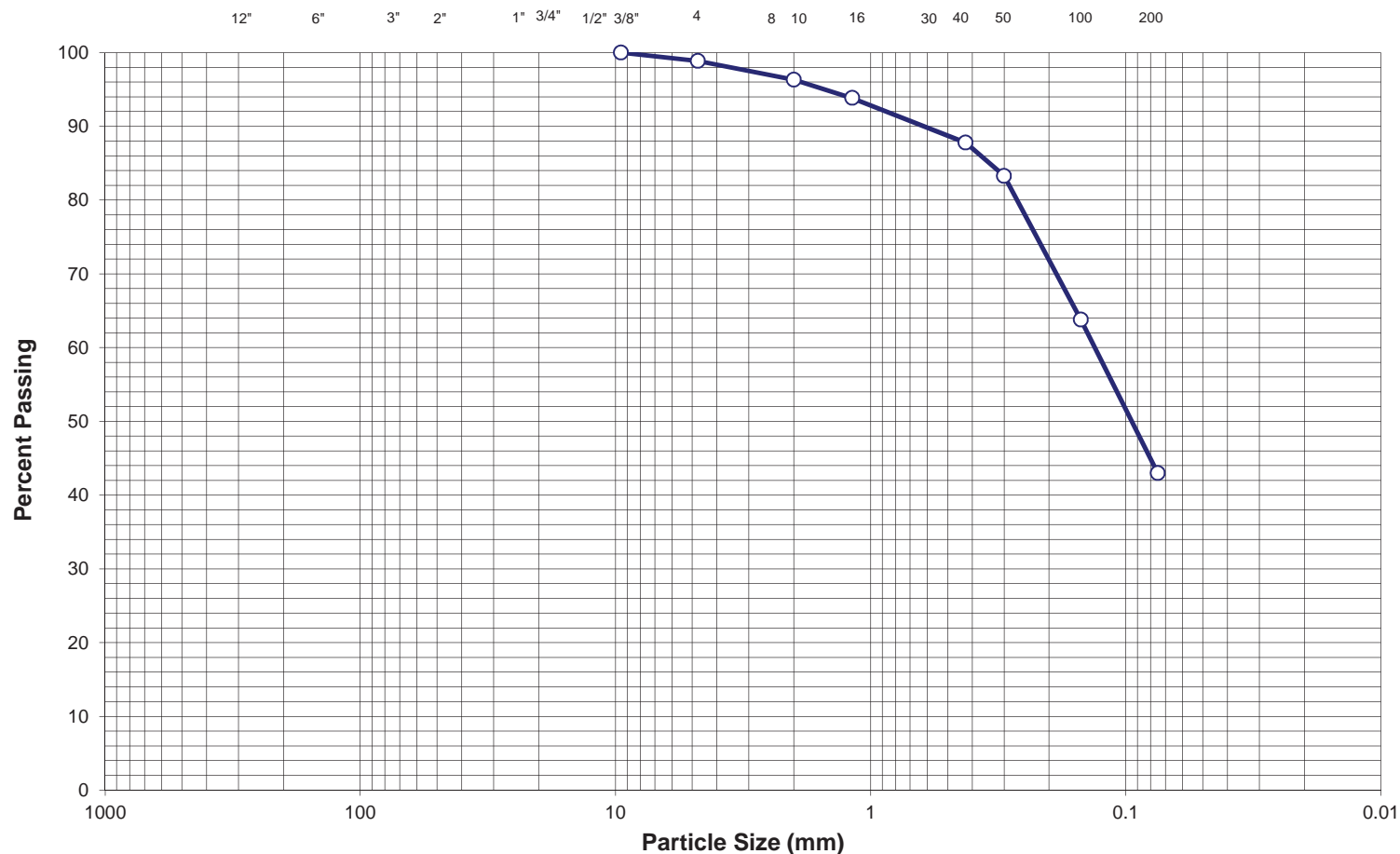
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	100
#40	99
#200	80.5

Gravel (%)	0	LL	43	Project Name:	US 550 S / US 160 Connector		
Sand (%)	19	PL	20	Boring:	A-03		
Fines (%)	81	PI	23	Sample Depth (ft):	4.5-9.5		
Sample Classification:	sandy CLAY		USCS: CL	AASHTO: A-7-6 (18)			
				<div><div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div></div>			
				SIEVE ANALYSIS			
				Drawn By:	KM	Project No.:	217-376
				Checked By:	BB	Figure No.:	-
				Date:	12/27/17		

Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm



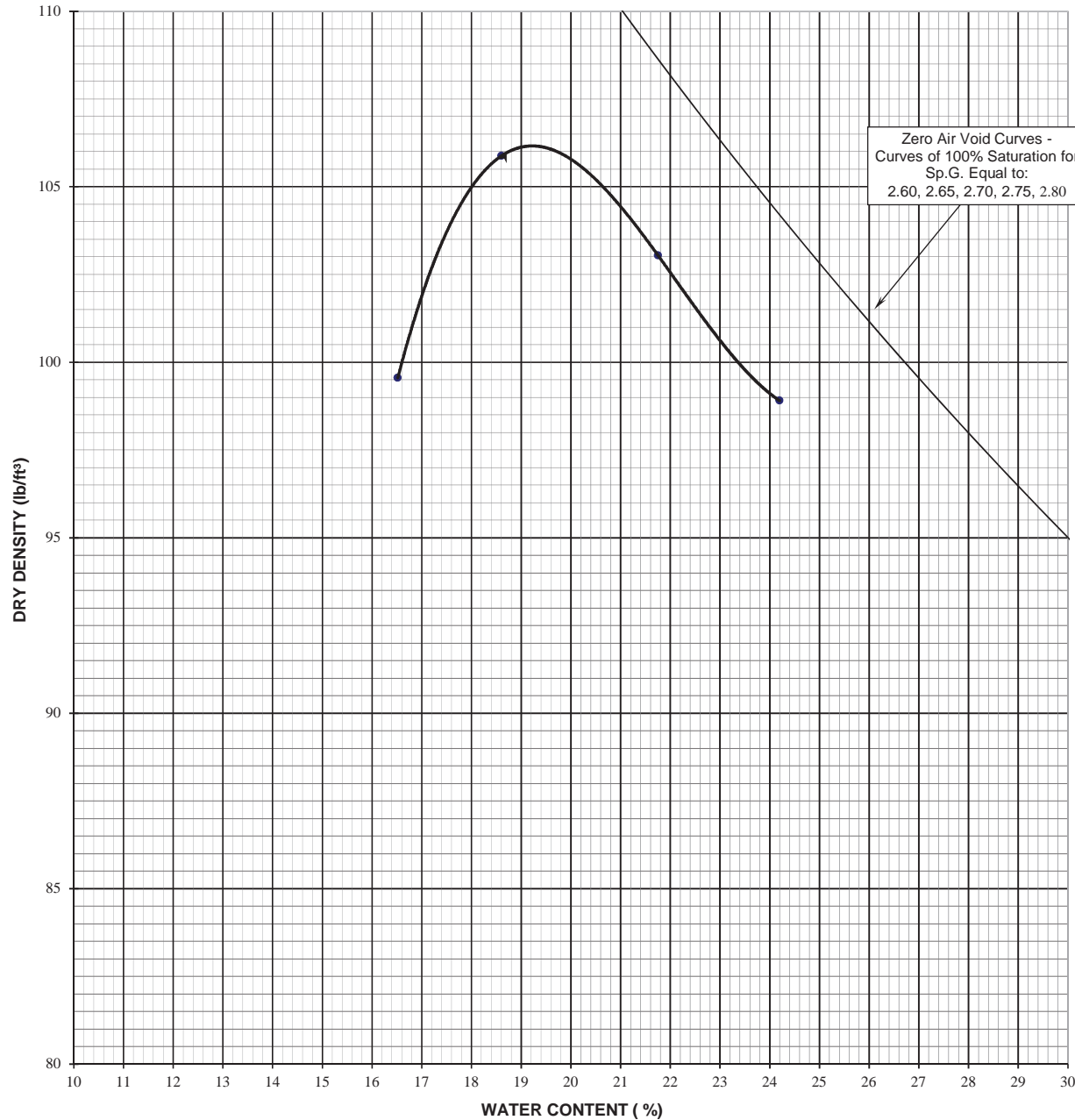
Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	100
#4	99
#10	96
#40	88
#200	43.0

Gravel (%)	1	LL	26	Project Name:	US 550 S / US 160 Connector		
Sand (%)	56	PL	22	Boring:	A-03		
Fines (%)	43	PI	4	Sample Depth (ft):	29.5-34.5		
Sample Classification:	silty SAND		USCS: SM	AASHTO: A-4 (0)			
				<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>			
				SIEVE ANALYSIS			
				Drawn By:	KM	Project No.:	217-376
				Checked By:	AH	Figure No.:	-
				Date:	12/27/17		

MOISTURE - DENSITY RELATIONSHIP



Yeh & Associates, Inc.
Geotechnical Engineering Consultants



Project No:		217-376	
Job name:		US 550 S/US 160 Connector	
Maximum Dry Density (pcf):			106.1
Optimum Moisture Content(%):			19.2
Sampled by: Barney Bunker			
Boring #:		A-01	
Depth :		0-9.5'	
Soil Description:		Silty CLAY, tan	
USCS Group Name:		CL	
AASHTO Group Symbol:		A-7-6	
AASHTO Group Index:		17	
Specific Gravity		n/a	
Atterberg (ASTM D - 4318)			
LL:		42	
PL:		21	
PI:		21	
Gradation (ASTM D-422, D-136)			
#4		100	
#10		100	
#40		98	
#200		80.1	
AASHTO Designation:		T99	
Method:		A	
Preparation Method:		Wet	
Mold Size:		4"	
Hammer Type:		Manual	
Sampled By:		B. Bunker	
Date sampled:		11/29/17	
Tested By:		K. Moran	
Date:		12/29/17	
Reviewed By:		A. Hotchkiss	
Date:		12/29/17	

Appendix E.4 – Retaining Walls - Laboratory Test Results



YEH & ASSOCIATES, INC

Summary of Laboratory Test Results

Project No: 217-376

Project Name: 22420: US 550 S Connection to US 160 Retaining Wall Laboratory Results

Date: 7/10/2018

Sample Location			Natural Moisture Content (%)	Natural Dry Density (pcf)	AASHTO T99		Gradation			Atterberg			pH	Water Soluble Sulfate (%)	Chloride (%)	% Swell (+) / Consolidation (-)	Resistivity (Ohm-cm)	Uncon-Comp strength (rock-psi)	Uncon-Comp strength (soil-psf)	CLASSIFICATION	
Boring	Sample Type	Depth (ft)			Max. Dry Density (pcf)	Optimum Moisture (%)	Gravel > #4 (%)	Sand (%)	Fines < #200 (%)	LL	PL	PI								AASHTO	USCS
WA-01	bulk	9.5-14.5	1.1				42	54	4	NV	NP	NP								A-1-a (0)	SP
WA-01	bulk	49.5-54.5	8.6				2	65	33	25	22	3								A-2-4 (0)	SM
WA-02	bulk	0-4.5	4.8				19	53	28	NV	NP	NP								A-2-4 (0)	SM
WA-02	bulk	19.5-24.5	11.5				61	36	3	NV	NP	NP								A-1-a (0)	GP
WA-02	bulk	39.5-44.5	5.4				61	37	2	NV	NP	NP								A-1-a (0)	GP
WA-03	bulk	0-4.5	4.7				19	58	23	NV	NP	NP								A-1-b (0)	SM
WA-03	SS	19.5	2.8				53	38	9	NV	NP	NP								A-1-a (0)	GP-GM
WA-03	bulk	54.5-59.5	9.3				0	44	56	27	21	6	9.5	0.011	<0.00106		1400			A-4 (1)	ML-CL

bulk - indicates drill cuttings sample
MC - indicates Modified California sample
CORE - indicates rock core sample
SS - indicates Split Spoon sample
NV - indicates no value
NP - indicates no plasticity



YEH & ASSOCIATES, INC

Summary of Laboratory Test Results

Project No: 217-376 Project Name: 22420: US 550 S Connection to US 160 Retaining Wall Laboratory Results Date: 7/10/2018

Sample Location			Natural Moisture Content (%)	Natural Dry Density (pcf)	AASHTO T99		Gradation			Atterberg			pH	Water Soluble Sulfate (%)	Chloride (%)	% Swell (+) / Consolida-tion (-)	Resistivity (Ohm-cm)	Uncon-Comp strength (rock-psi)	Uncon-Comp strength (soil-psf)	CLASSIFICATION	
Boring	Sample Type	Depth (ft)			Max. Dry Density (pcf)	Optimum Moisture (%)	Gravel > #4 (%)	Sand (%)	Fines < #200 (%)	LL	PL	PI								AASHTO	USCS
WB-01	bulk	4.5-9.5	1.4				40	48	12	20	18	2								A-1-a (0)	SM
WB-01	bulk	34.5-44.5	0.5				38	60	2	NV	NP	NP	8.5	0.002	<0.00100		14000			A-1-a (0)	SP
WB-02	bulk	19.5-24.5	0.5				51	46	3	NV	NP	NP								A-1-a (0)	GP
WB-02	bulk	44.5-49.5	1.3				43	49	8	NV	NP	NP								A-1-a (0)	SP-SM
WB-02	CORE	55.25-55.75	4.5	135.4														1162			
WB-02	CORE	67.2-67.7	3.4	132.2														263			
WB-03	MC	9.5	13.9	102.9												1.5					
WB-03	bulk	19.5-24.5	0.7				28	70	2	NV	NP	NP								A-1-a (0)	SP
WB-03	bulk	54.5-59.5	19.0				0	40	60	32	21	11	8.5	0.014	≤0.00117		1100			A-6 (4)	CL
WB-04	MC	9.5	12.9	117.4															11/4, sample crumbled		
WB-04	bulk	9.5-14.5	14.3				0	12	88	45	21	24								A-7-6 (22)	CL
WB-04	bulk	49.5-54.5	5.6				65	32	3	NV	NP	NP								A-1-a (0)	GP
WB-05	SS	4.5	8.8				0	18	82	42	16	26								A-7-6 (20)	CL
WB-05	MC	14.5	14.8	108.0												-0.4					
WB-05	bulk	24.5-29.5	5.9				46	50	4	NV	NP	NP								A-1-a (0)	SP
WB-05	bulk	49.5-54.5	3.3				48	23	29	NV	NP	NP								A-2-4 (0)	GM
WB-05	bulk	54.5-59.5	14.2				0	47	53	39	22	17	8.5	0.012	<0.00106		1400			A-6 (6)	CL
WB-05	bulk (remold)	59.5-64.5								34	25	9				0.6					

bulk - indicates drill cuttings sample
MC - indicates Modified California sample
CORE - indicates rock core sample
SS - indicates Split Spoon sample
NV - indicates no value
NP - indicates no plasticity



YEH & ASSOCIATES, INC

Summary of Laboratory Test Results

Project No: 217-376 Project Name: 22420: US 550 S Connection to US 160 Retaining Wall Laboratory Results Date: 7/10/2018

Sample Location			Natural Moisture Content (%)	Natural Dry Density (pcf)	AASHTO T99		Gradation			Atterberg			pH	Water Soluble Sulfate (%)	Chloride (%)	% Swell (+) / Consolida-tion (-)	Resistivity (Ohm-cm)	Uncon-Comp strength (rock-psi)	Uncon-Comp strength (soil-psf)	CLASSIFICATION	
Boring	Sample Type	Depth (ft)			Max. Dry Density (pcf)	Optimum Moisture (%)	Gravel > #4 (%)	Sand (%)	Fines < #200 (%)	LL	PL	PI								AASHTO	USCS
WB-06	MC	4.5	13.7	110.5			0	36	64	46	14	32								A-7-6 (17)	CL
WB-06	MC	9.5	9.6	97.6												0.5					
WB-06	MC	14.5	9.2	94.9														1472			
WB-06	bulk	14.5-19.5	11.0				0	10	90	34	18	16	8.4	0.010	0.00623		1300			A-6 (14)	CL
WB-06	bulk (remold)									33	17	16				0.3					
WB-06	CORE	65.25-64.50		(wet) 155.8														3057			
WB-07	bulk	9.5-14.5	13.4				0	16	84	59	19	40								A-7-6 (35)	CH
WB-07	bulk	29.5-34.5	33.0 (added dilution)				59	34	7	NV	NP	NP								A-1-a (0)	GP-GM
WB-07	bulk	44.5-49.5	10.3				0	63	37	34	20	14	8.3	0.012	<0.00105		1600			A-6 (1)	SC
WB-07	CORE	64.7-65.2	3.5	139.5														3728			
WB-08	MC	9.5	7.5	98.6												-1.0					
WB-08	bulk	34.5-39.5	7.1				55	42	3	NV	NP	NP								A-1-a (0)	GP
WB-08	MC	59.5	13.2	91.5			0	70	30	39	22	17									
WB-08	bulk	59.5-69.5	9.4				0	32	68	37	18	19	8.6	0.018	<0.00108		1400			A-6 (11)	CL
WB-09	MC	9.5	9.6	95.6			0	23	77	31	16	15								A-6 (10)	CL
WB-09	bulk	14.5-24.5	11.5		107.0	18.4	0	14	86	34	20	14								A-6 (11)	CL
WB-09	bulk	24.5-29.5	8.0				15	59	26	32	21	11								A-2-6 (0)	SC
WB-09	bulk	49.5-54.5	10.4				0	58	42	41	24	17								A-7-6 (3)	SC

bulk - indicates drill cuttings sample
MC - indicates Modified California sample
CORE - indicates rock core sample
SS - indicates Split Spoon sample
NV - indicates no value
NP - indicates no plasticity



YEH & ASSOCIATES, INC

Summary of Laboratory Test Results

Project No: 217-376 Project Name: 22420: US 550 S Connection to US 160 Retaining Wall Laboratory Results Date: 7/10/2018

Sample Location			Natural Moisture Content (%)	Natural Dry Density (pcf)	AASHTO T99		Gradation			Atterberg			pH	Water Soluble Sulfate (%)	Chloride (%)	% Swell (+) / Consolida-tion (-)	Resistivity (Ohm-cm)	Uncon-Comp strength (rock-psi)	Uncon-Comp strength (soil-psf)	CLASSIFICATION	
Boring	Sample Type	Depth (ft)			Max. Dry Density (pcf)	Optimum Moisture (%)	Gravel > #4 (%)	Sand (%)	Fines < #200 (%)	LL	PL	PI								AASHTO	USCS
WC-01	SS (remold)									28	16	12				0.3					
WC-01	bulk	4.5-9.5	0.9				38	58	4	NV	NP	NP								A-1-a (0)	SP
WC-01	bulk	34.5-39.5	8.7				15	51	34	37	16	21								A-2-6 (2)	SC
WC-01	CORE (slaking)	39.5-43.5	7.8	122.3			0	52	48	35	25	10									bedrock, Shale
WC-02	bulk	9.5-14.5	1.0				46	50	4	NV	NP	NP								A-1-a (0)	SP
WC-02	CORE	43.9-44.6	0.5	159.3													7224				
WC-03	bulk	0-4.5	3.8				23	54	23	27	19	8								A-2-4 (0)	SC
WC-03	MC	29.5	12.1	109.2			0	82	18	40	22	18								A-2-6 (0)	SC
WC-03	bulk	29.5-34.5	9.5				1	56	43	35	19	16	8.5	0.002	<0.00108		2000			A-6 (3)	SC
WC-03	CORE	48.3-48.8		(wet) 153.1														1675			
WE-01	SS	4.0	7.6				0	28	72	26	18	8								A-4 (4)	CL
WE-01	bulk	4-9	14.9				0	16	84	29	19	10	8.5	0.054	0.00784		1000			A-4 (7)	CL
WE-01	MC	9	14.8	107.4												-0.2					
WE-01	bulk	19-24	1.8				58	34	8	NV	NP	NP								A-1-a (0)	GP-GM
WE-02	bulk	9-14	18.4				0	26	74	33	15	18								A-6 (11)	CL
WF-01	MC	8	13.1	116.6												4.3					
WF-01	bulk	8-13	10.8				0	15	85	50	12	38								A-7-6 (32)	CH
WF-02	MC	3	13.8	101.7												-0.8					

bulk - indicates drill cuttings sample
MC - indicates Modified California sample
CORE - indicates rock core sample
SS - indicates Split Spoon sample
NV - indicates no value
NP - indicates no plasticity



YEH & ASSOCIATES, INC

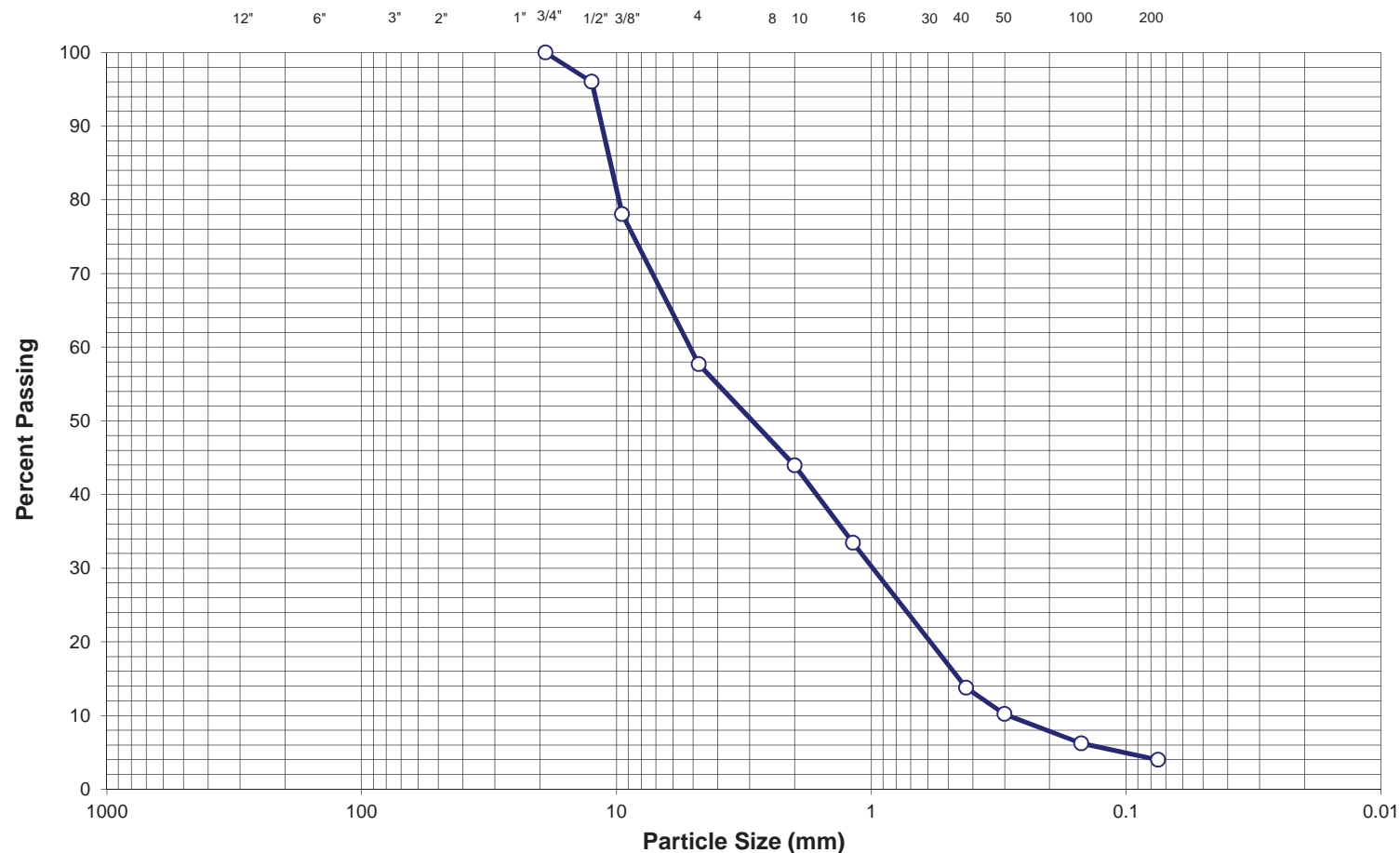
Summary of Laboratory Test Results

Project No: 217-376 Project Name: 22420: US 550 S Connection to US 160 Retaining Wall Laboratory Results Date: 7/10/2018


Sample Location			Natural Moisture Content (%)	Natural Dry Density (pcf)	AASHTO T99		Gradation			Atterberg			pH	Water Soluble Sulfate (%)	Chloride (%)	% Swell (+) / Consolidation (-)	Resistivity (Ohm-cm)	Uncon-Comp strength (rock-psi)	Uncon-Comp strength (soil-psi)	CLASSIFICATION	
Boring	Sample Type	Depth (ft)			Max. Dry Density (pcf)	Optimum Moisture (%)	Gravel > #4 (%)	Sand (%)	Fines < #200 (%)	LL	PL	PI								AASHTO	USCS
WF-02	MC	8	9.4				0	24	76	31	23	8								A-4 (5)	ML
R-10	bulk	4-9	5.8				0	66	34	NV	NP	NP	8.8	0.007	≤0.00105		2800			A-2-4 (0)	SM
R-10	MC	14	9.4	93.6																	
R-11	bulk	9.5-14.5	6.2				9	54	37	25	21	4								A-4 (0)	SM-SC
R-11	MC	14.5	13.6	103.9																	
R-12	bulk	4.5-9.5	5.0				49	22	29	37	17	20	8.5	0.019	0.00118		1600			A-2-6 (0)	GC
R-12	bulk	19.5-24.5	4.7				40	47	13	NV	NP	NP	8.6	0.014	0.00576		2700			A-1-b (0)	SM

bulk - indicates drill cuttings sample
MC - indicates Modified California sample
CORE - indicates rock core sample
SS - indicates Split Spoon sample
NV - indicates no value
NP - indicates no plasticity

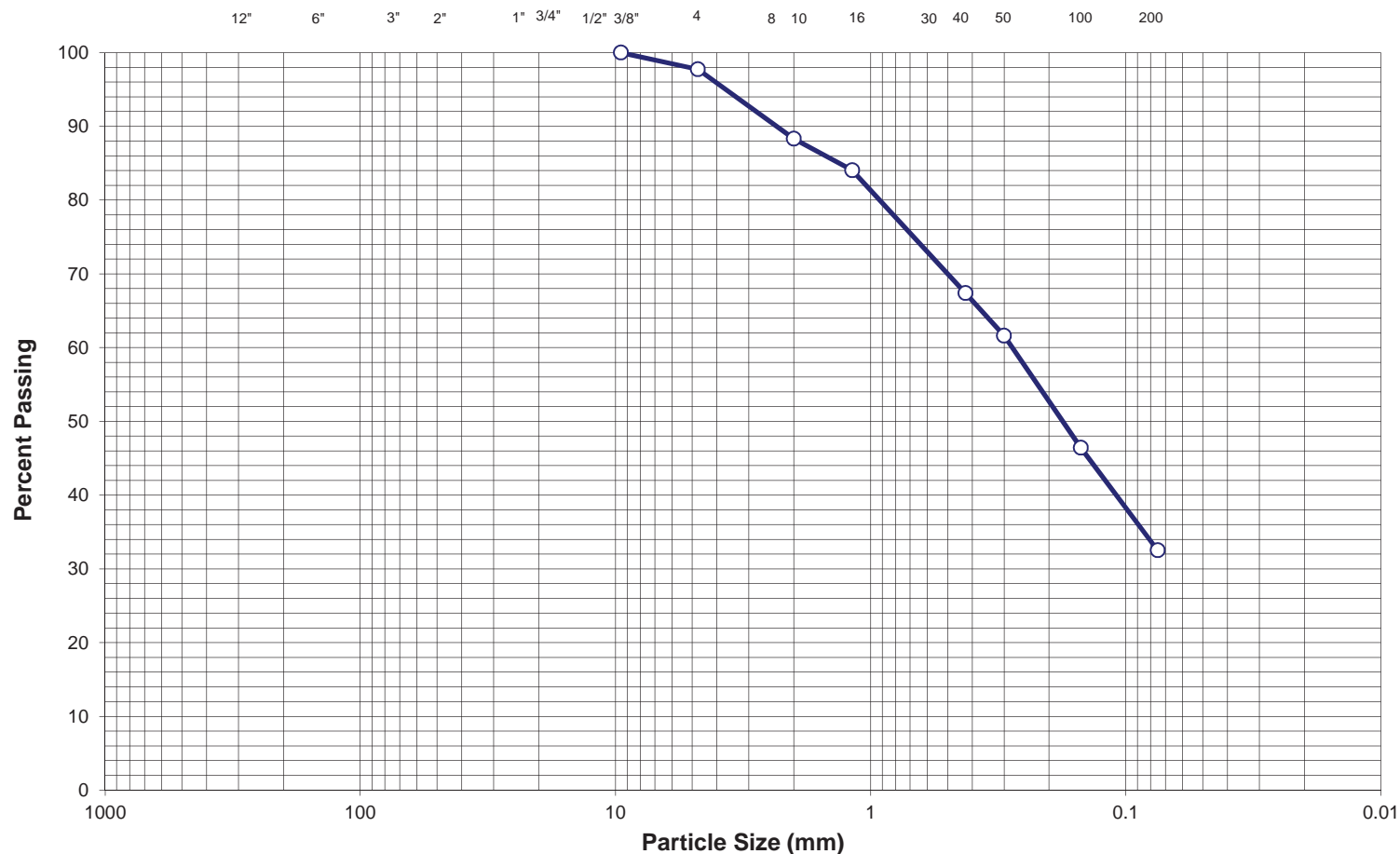
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm



Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4"	100
1/2"	96
3/8"	78
#4	58
#10	44
#40	14
#200	4.0

Gravel (%)	42	LL	NV	Project Name:	US 550 S / US 160 Connector	 <div>Yeh & Associates, Inc. Geotechnical Engineering Consultants</div>	<div>SIEVE ANALYSIS</div> <table><tr><td>Drawn By:</td><td>KM</td><td>Project No.:</td><td>217-376</td></tr><tr><td>Checked By:</td><td>BB</td><td>Figure No.:</td><td>-</td></tr><tr><td>Date:</td><td>02/01/18</td><td colspan="2"></td></tr></table>			Drawn By:	KM	Project No.:	217-376	Checked By:	BB	Figure No.:	-	Date:	02/01/18		
Drawn By:	KM	Project No.:	217-376																		
Checked By:	BB	Figure No.:	-																		
Date:	02/01/18																				
Sand (%)	54	PL	NP	Boring:	WA-01																
Fines (%)	4	PI	NP	Sample Depth (ft):	9.5-14.5																
Sample Classification:	poorly graded SAND, w/ gravel		USCS: SP	AASHTO: A-1-a (0)																	

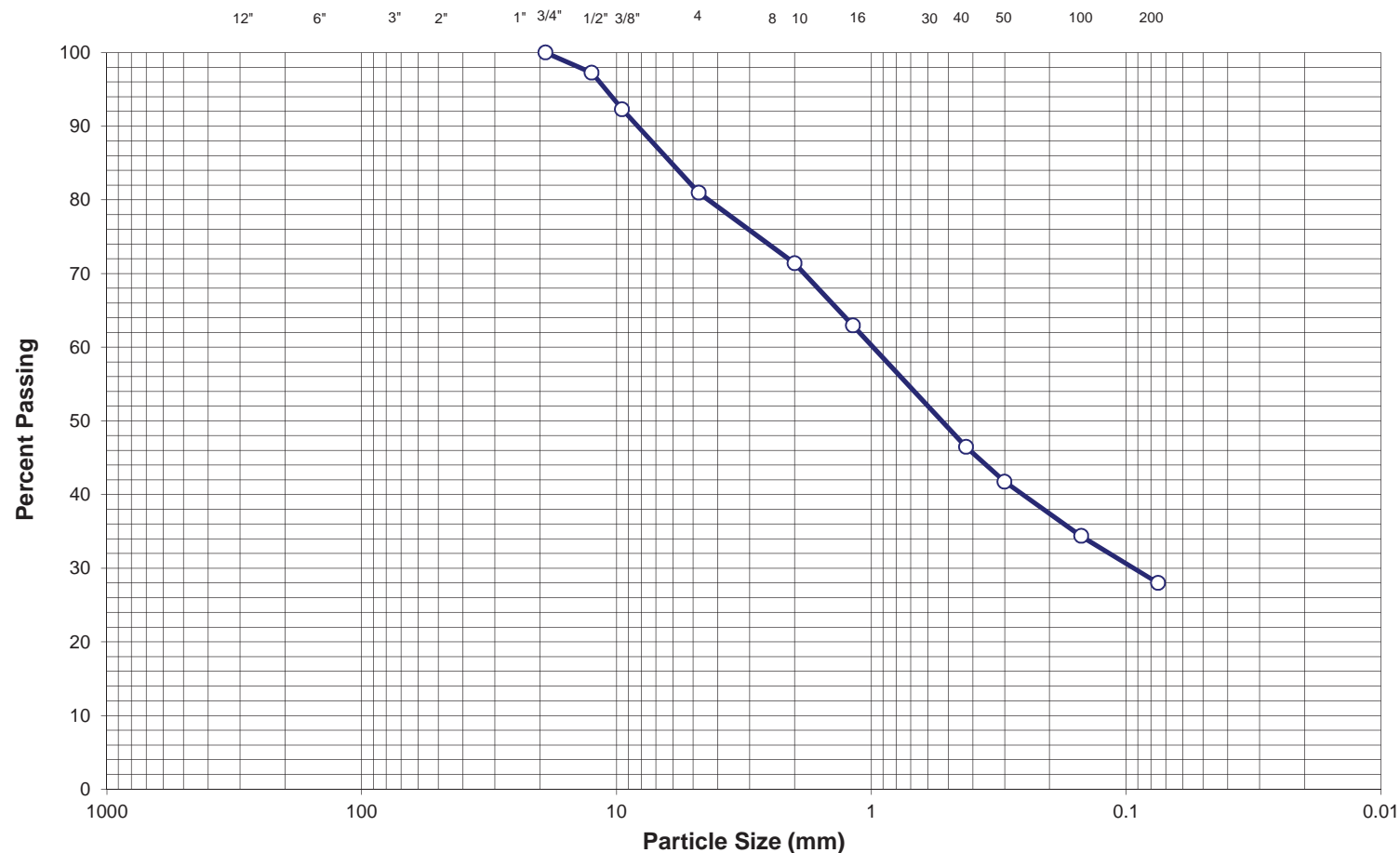
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	100
#4	98
#10	88
#40	67
#200	32.5

Gravel (%)	2	LL	25	Project Name:	US 550 S / US 160 Connector				
Sand (%)	65	PL	22	Boring:	WA-01				
Fines (%)	33	PI	3	Sample Depth (ft):	49.5-54.5				
Sample Classification:	silty SAND (crushed bedrock)		USCS: SM	AASHTO: A-2-4 (0)		SIEVE ANALYSIS			
						Drawn By:	KM	Project No.:	217-376
						Checked By:	BB	Figure No.:	-
						Date:	02/06/18		

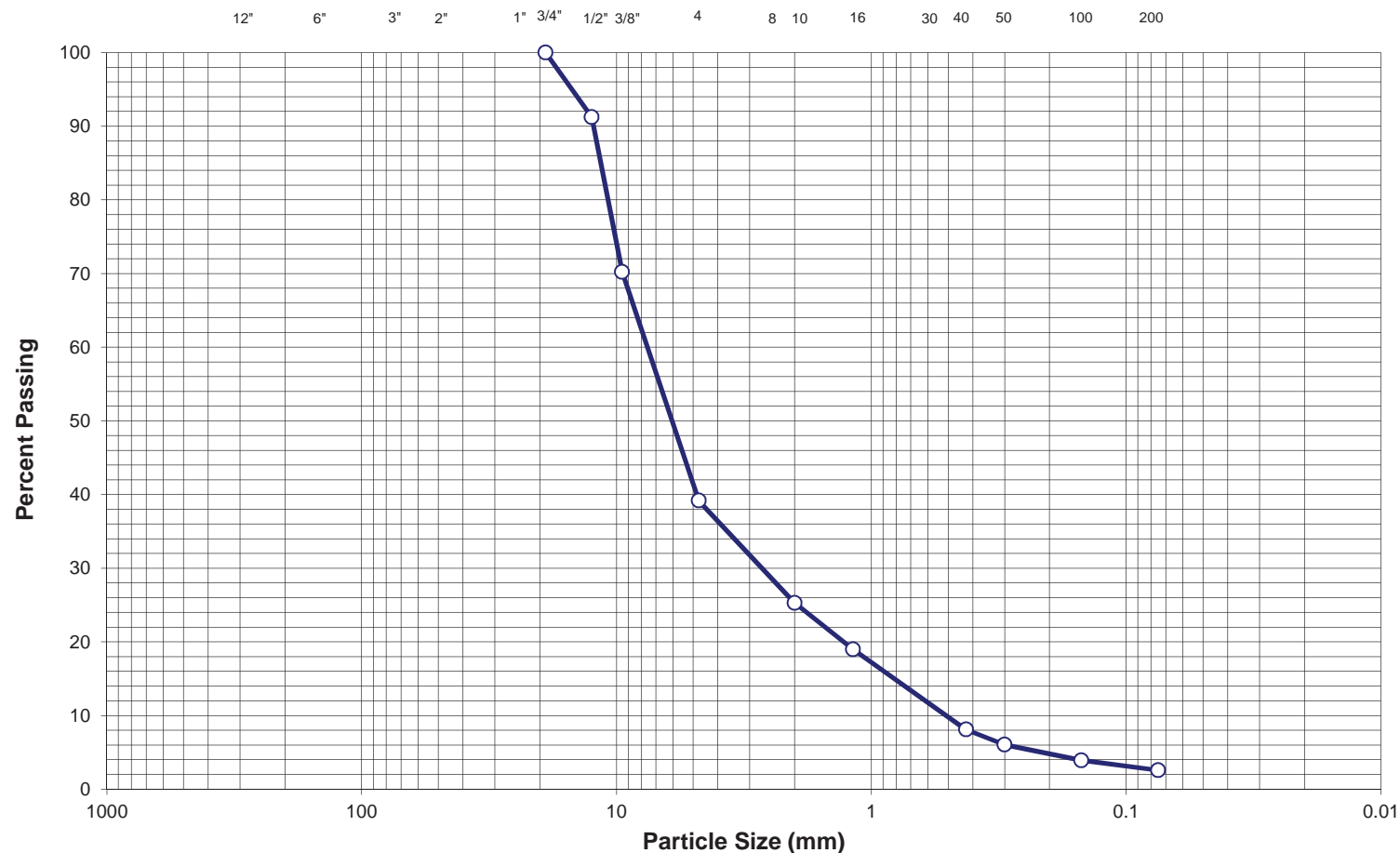
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4"	100
1/2"	97
3/8"	92
#4	81
#10	71
#40	46
#200	28.0

Gravel (%)	19	LL	NV	Project Name:	US 550 S / US 160 Connector			
Sand (%)	53	PL	NP	Boring:	WA-02			
Fines (%)	28	PI	NP	Sample Depth (ft):	0-4.5			
Sample Classification:	silty SAND w/ gravel		USCS: SM	AASHTO: A-2-4 (0)			<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>	
SIEVE ANALYSIS								
				Drawn By: KM	Project No.:		217-376	
				Checked By: BB				
				Date: 02/06/18	Figure No.:		-	

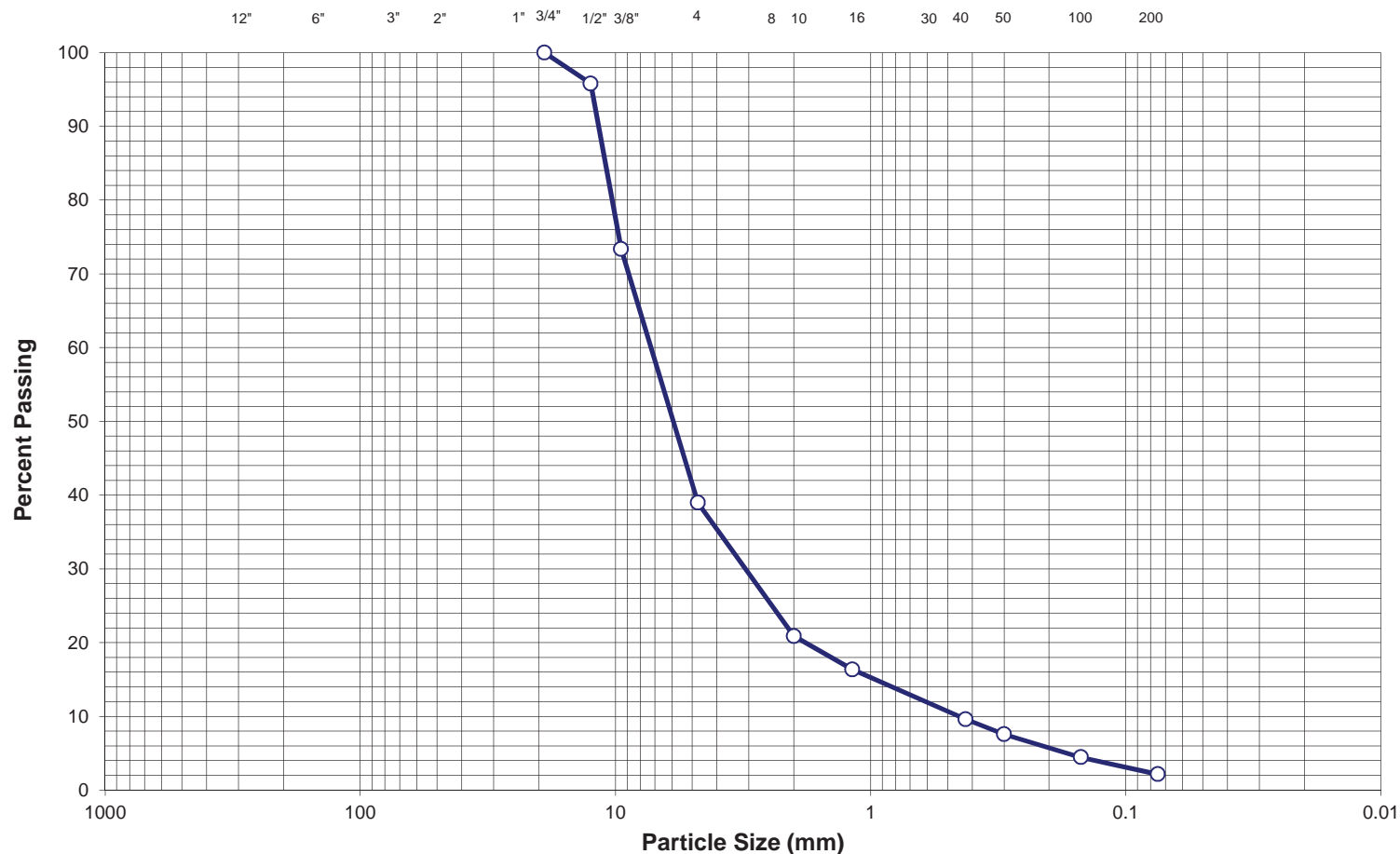
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	100
1/2"	91
3/8"	70
#4	39
#10	25
#40	8
#200	2.6

Gravel (%)	61	LL	NV	Project Name:	US 550 S / US 160 Connector	 <div>Yeh & Associates, Inc. Geotechnical Engineering Consultants</div>			
Sand (%)	36	PL	NP	Boring:	WA-02				
Fines (%)	3	PI	NP	Sample Depth (ft):	19.5-24.5				
Sample Classification:	poorly graded GRAVEL w/sand		USCS: GP	AASHTO: A-1-a (0)		Drawn By: KM Checked By: BB Date: 02/07/18		Project No.:	217-376
							Figure No.:	-	

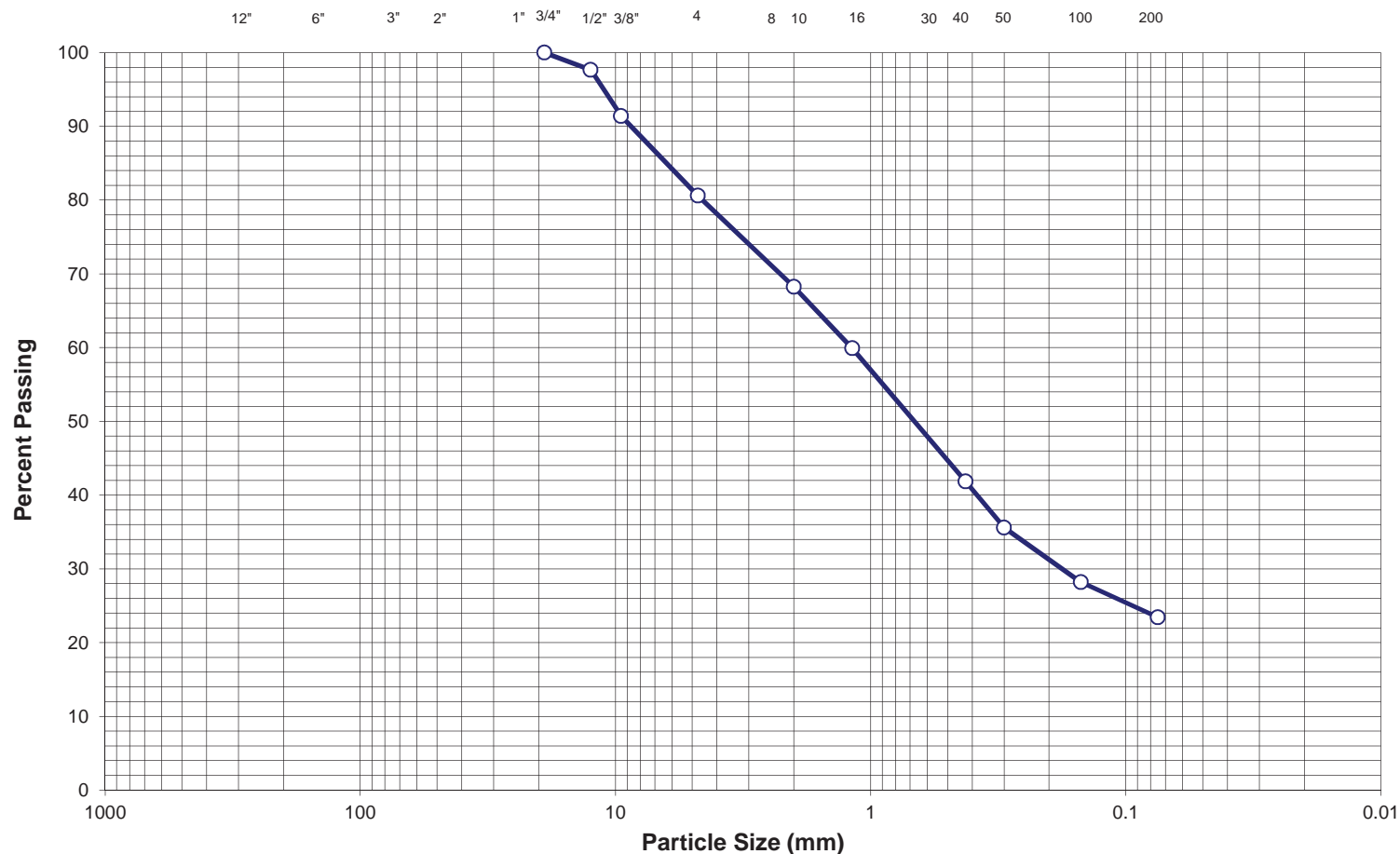
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	100
1/2"	96
3/8"	73
#4	39
#10	21
#40	10
#200	2.2

Gravel (%)	61	LL	NV	Project Name:	 Yeh & Associates, Inc. Geotechnical Engineering Consultants		
Sand (%)	37	PL	NP	Boring:			
Fines (%)	2	PI	NP	Sample Depth (ft):	SIEVE ANALYSIS		
Sample Classification:	poorly graded GRAVEL, w/ sand	USCS: GP	AASHTO: A-1-a (0)	Drawn By: KM	Checked By: BB	Project No.:	217-376
				Date: 02/07/18		Figure No.:	-

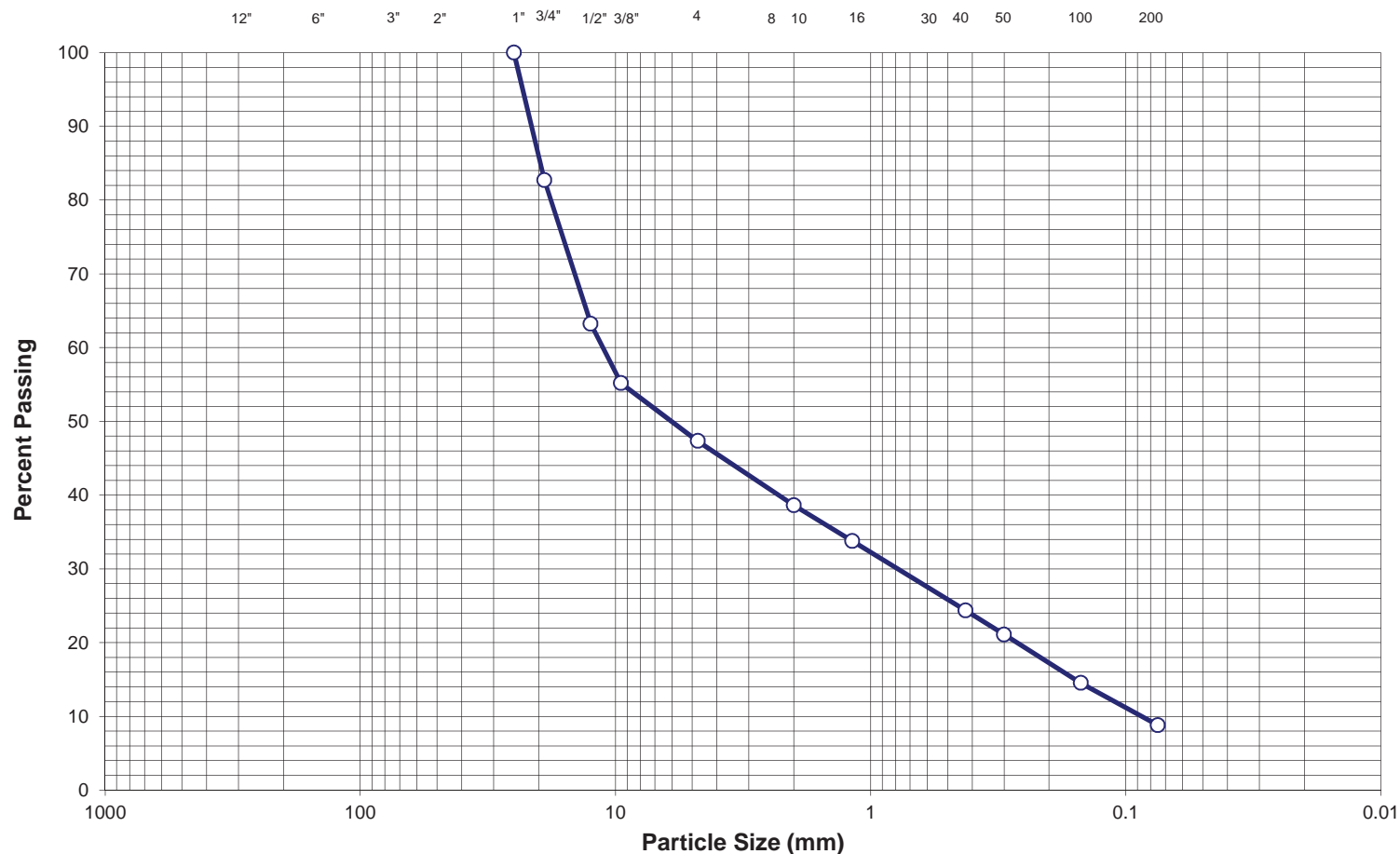
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	100
1/2"	98
3/8"	91
#4	81
#10	68
#40	42
#200	23.4

Gravel (%)	19	LL	NV	Project Name:	 Yeh & Associates, Inc. Geotechnical Engineering Consultants		
Sand (%)	58	PL	NP	Boring:			
Fines (%)	23	PI	NP	Sample Depth (ft):			
Sample Classification:	silty SAND w/ gravel		USCS: SM	AASHTO: A-1-b (0)	Drawn By: KM	Project No.:	217-376
					Checked By: BB	Figure No.:	-
					Date: 02/08/18		

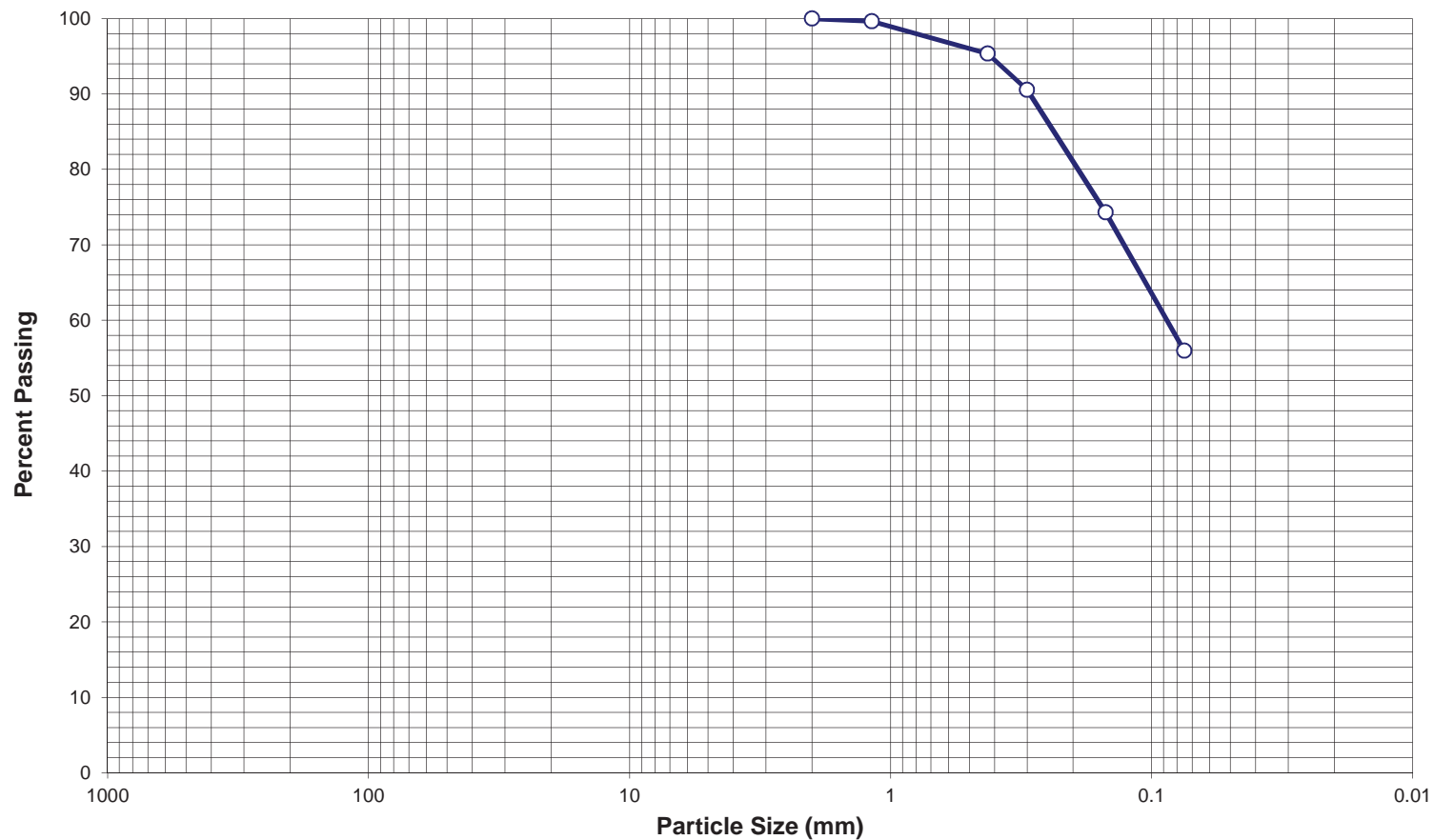
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm



Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	100
3/4 "	83
1/2"	63
3/8"	55
#4	47
#10	39
#40	24
#200	8.8

Gravel (%)	53	LL	NV	Project Name:	US 550 S / US 160 Connector		
Sand (%)	38	PL	NP	Boring:	WA-03		
Fines (%)	9	PI	NP	Sample Depth (ft):	19.5		
Sample Classification:	poorly graded GRAVEL w/ sand		USCS: GP-GM	AASHTO: A-1-a (0)		<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>	
<div>SIEVE ANALYSIS</div>						Drawn By: KM	Project No.: 217-376
						Checked By: BB	
						Date: 02/08/18	Figure No.: -

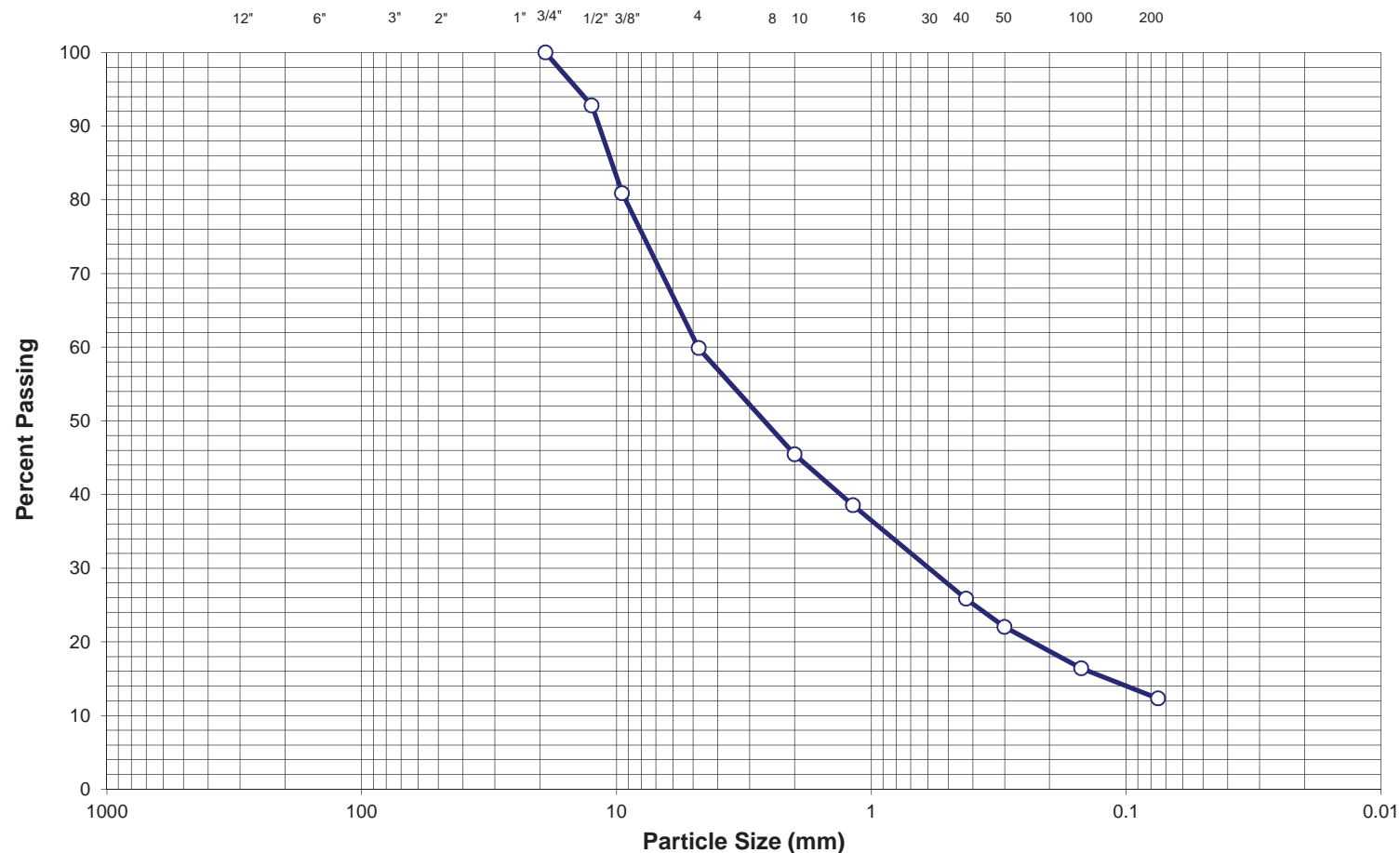
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm
12" 6" 3" 2" 1" 3/4" 1/2" 3/8" 4	8 10 16 30 40 50 100 200	




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	100
#40	95
#200	56.0

Gravel (%)	0	LL	27	Project Name:	US 550 S / US 160 Connector			
Sand (%)	44	PL	21	Boring:	WA-03			
Fines (%)	56	PI	6	Sample Depth (ft):	54.5-59.5			
Sample Classification:	sandy - silty CLAY (crushed bedrock)		USCS: ML-CL	AASHTO: A-4 (1)		SIEVE ANALYSIS		
					Drawn By: KM	Project No.:	217-376	
					Checked By: BB			
					Date: 01/30/18	Figure No.:	-	

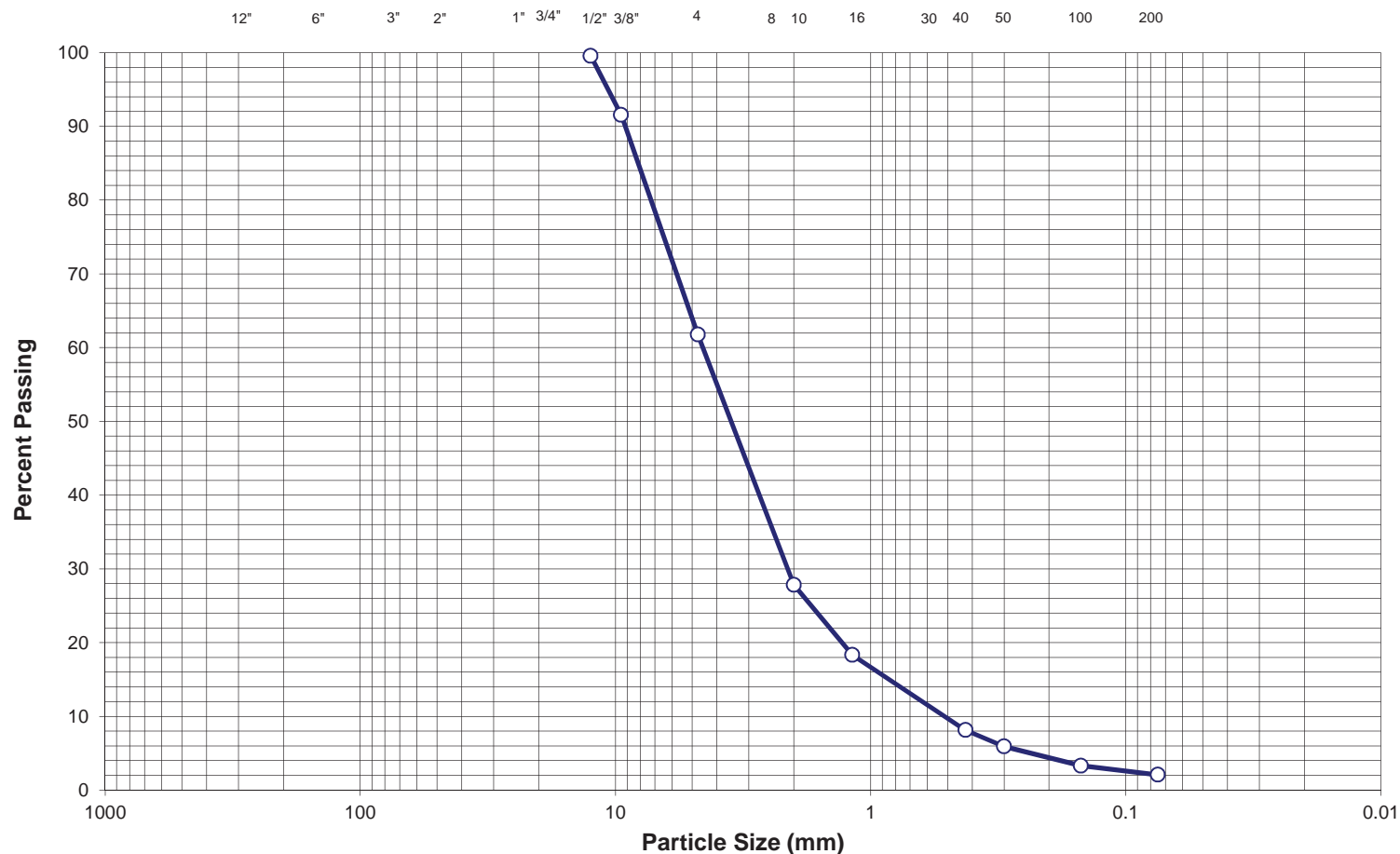
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	100
3/4"	100
1/2"	93
3/8"	81
#4	60
#10	45
#40	26
#200	12.3

Gravel (%)	40	LL	20	Project Name:	US 550 S / US 160 Connector	 <div>Yeh & Associates, Inc. Geotechnical Engineering Consultants</div>	<div>SIEVE ANALYSIS</div> <div><div>Drawn By: KM</div><div>Checked By: KM</div><div>Date: 01/02/18</div></div> <div><div>Project No.: 217-376</div><div>Figure No.: -</div></div>		
Sand (%)	48	PL	18	Boring:	WB-01				
Fines (%)	12	PI	2	Sample Depth (ft):	4.5-9.5				
Sample Classification:	silty SAND w/ gravel		USCS: SM	AASHTO: A-1-a (0)					

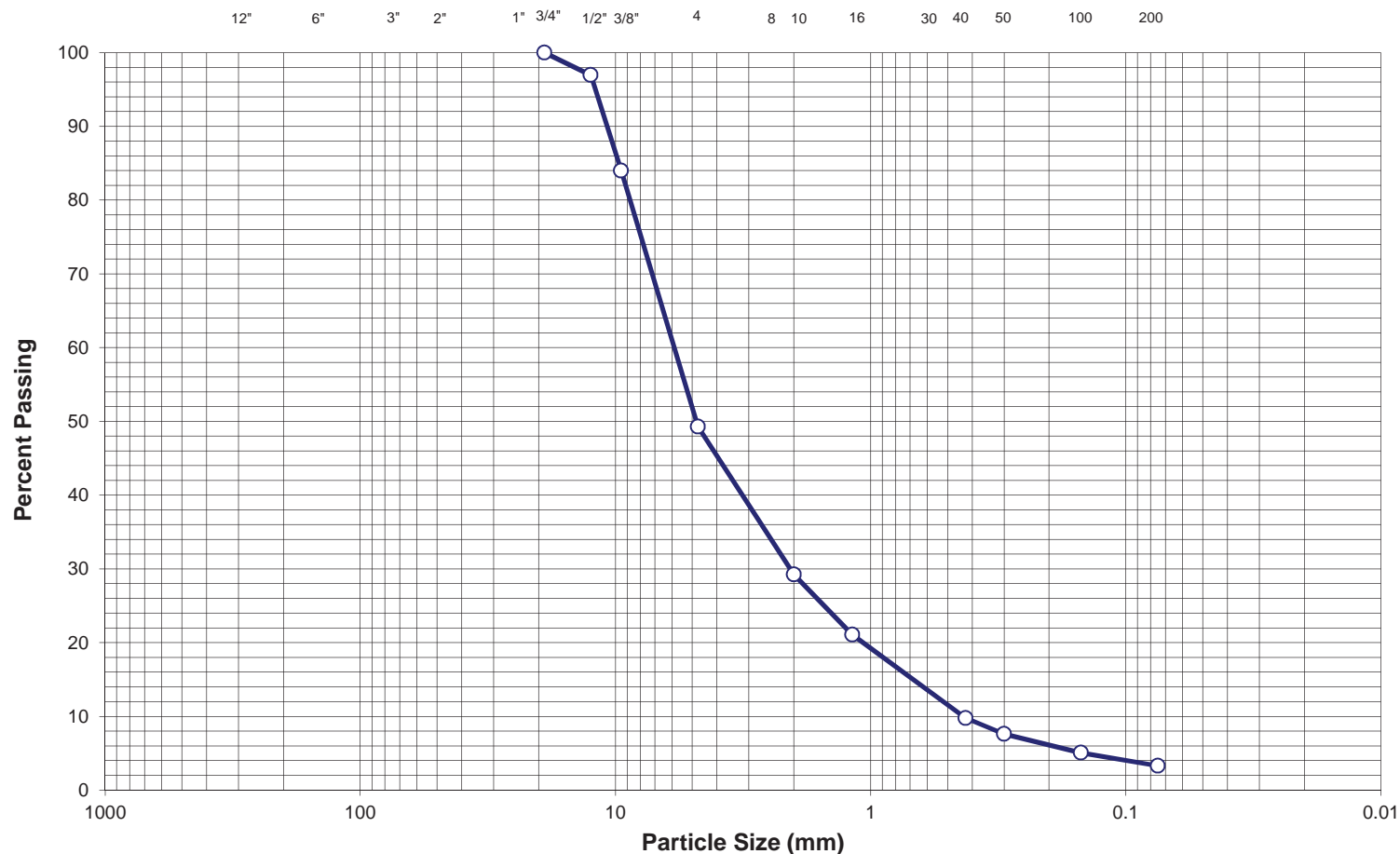
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	100
1/2"	100
3/8"	92
#4	62
#10	28
#40	8
#200	2.1

Gravel (%)	38	LL	NV	Project Name:	US 550 S / US 160 Connector	<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>			
Sand (%)	60	PL	NP	Boring:	WB-01				
Fines (%)	2	PI	NP	Sample Depth (ft):	34.5-44.5	SIEVE ANALYSIS			
Sample Classification:	poorly graded SAND w/ gravel	USCS: SP	AASHTO: A-1-a (0)	Drawn By:	KM	Project No.:	217-376		
				Checked By:	KM				
				Date:	01/18/18	Figure No.:	-		

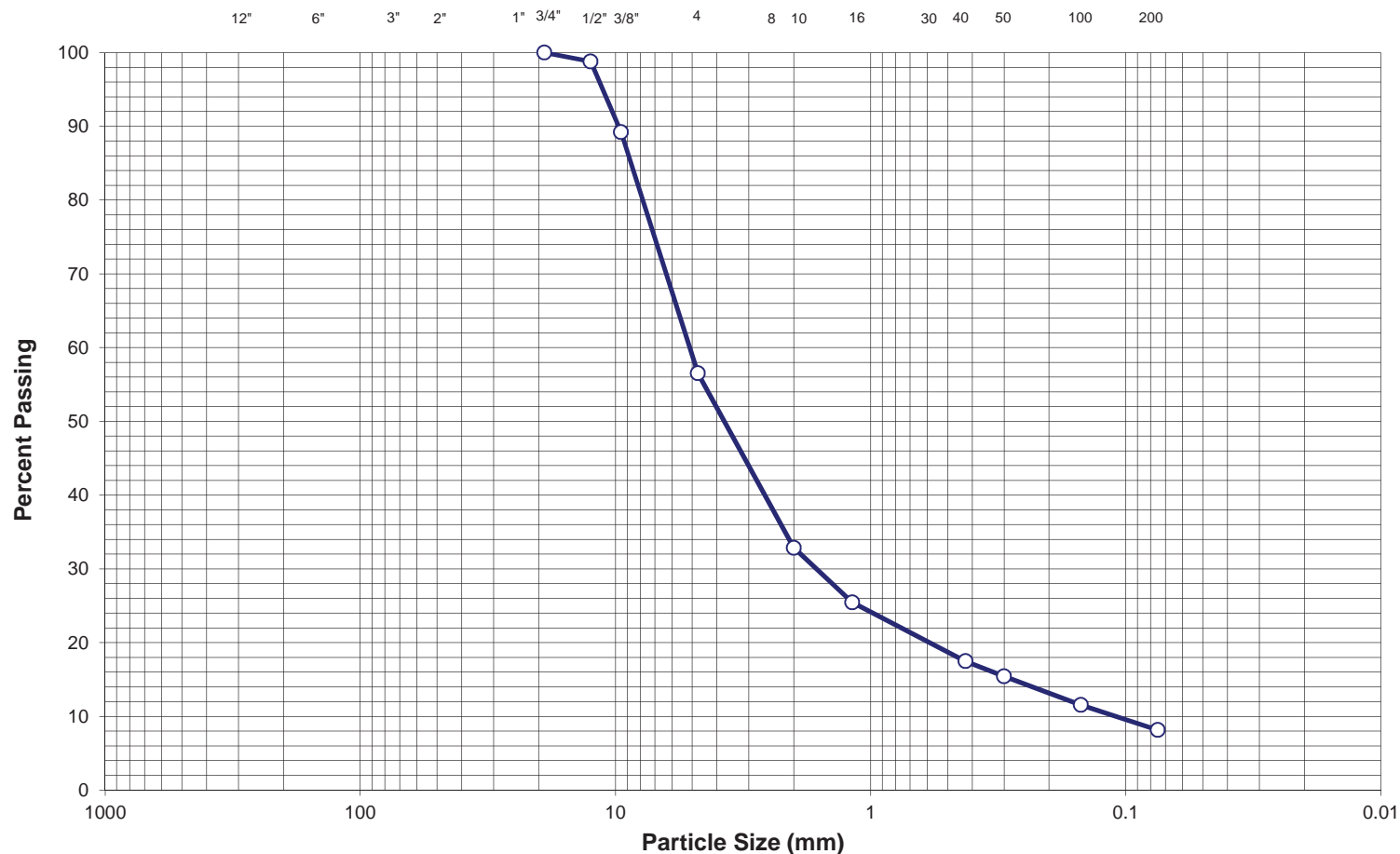
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	100
1/2"	97
3/8"	84
#4	49
#10	29
#40	10
#200	3.3

Gravel (%)	51	LL	NV	Project Name:	US 550 S / US 160 Connector		
Sand (%)	46	PL	NP	Boring:	WB-02		
Fines (%)	3	PI	NP	Sample Depth (ft):	19.5-24.5		
Sample Classification:	poorly graded GRAVEL w/ sand		USCS: GP	AASHTO: A-1-a (0)		<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>	
SIEVE ANALYSIS							
				Drawn By:	KM	Project No.:	217-376
				Checked By:	BB	Figure No.:	-
				Date:	01/02/18		

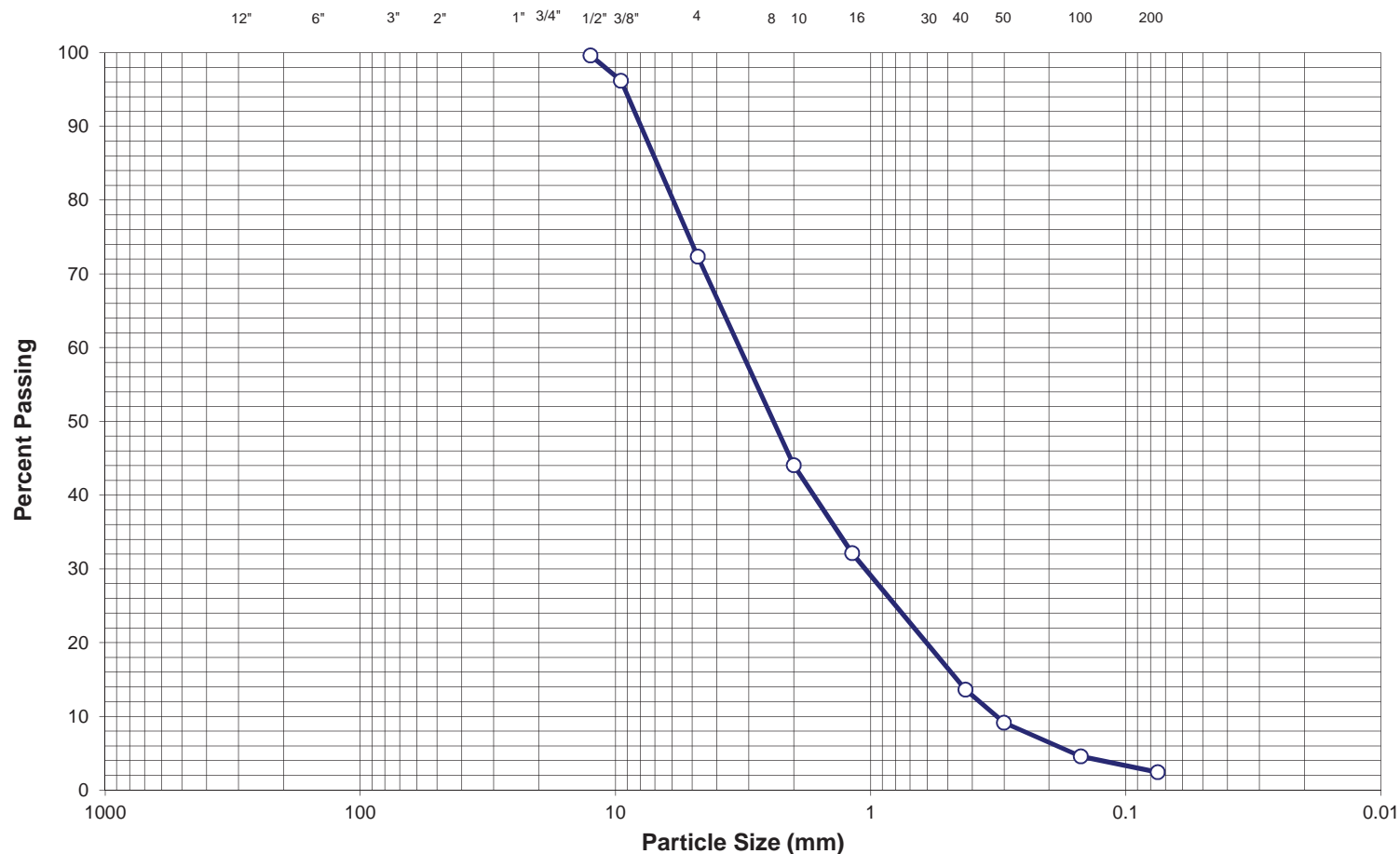
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	100
3/4 "	100
1/2"	99
3/8"	89
#4	57
#10	33
#40	17
#200	8.2

Gravel (%)	43	LL	NV	Project Name:	US 550 S / US 160 Connector	<div><div>Yeh & Associates, Inc. Geotechnical Engineering Consultants</div></div>		
Sand (%)	49	PL	NP	Boring:	WB-02			
Fines (%)	8	PI	NP	Sample Depth (ft):	44.5-49.5	SIEVE ANALYSIS		
Sample Classification:	poorly graded SAND, w/ silt and gravel	USCS: SP-SM	AASHTO: A-1-a (0)	Drawn By:	KM	Project No.:	217-376	
				Checked By:	KM	Figure No.:	-	
				Date:	01/02/18			

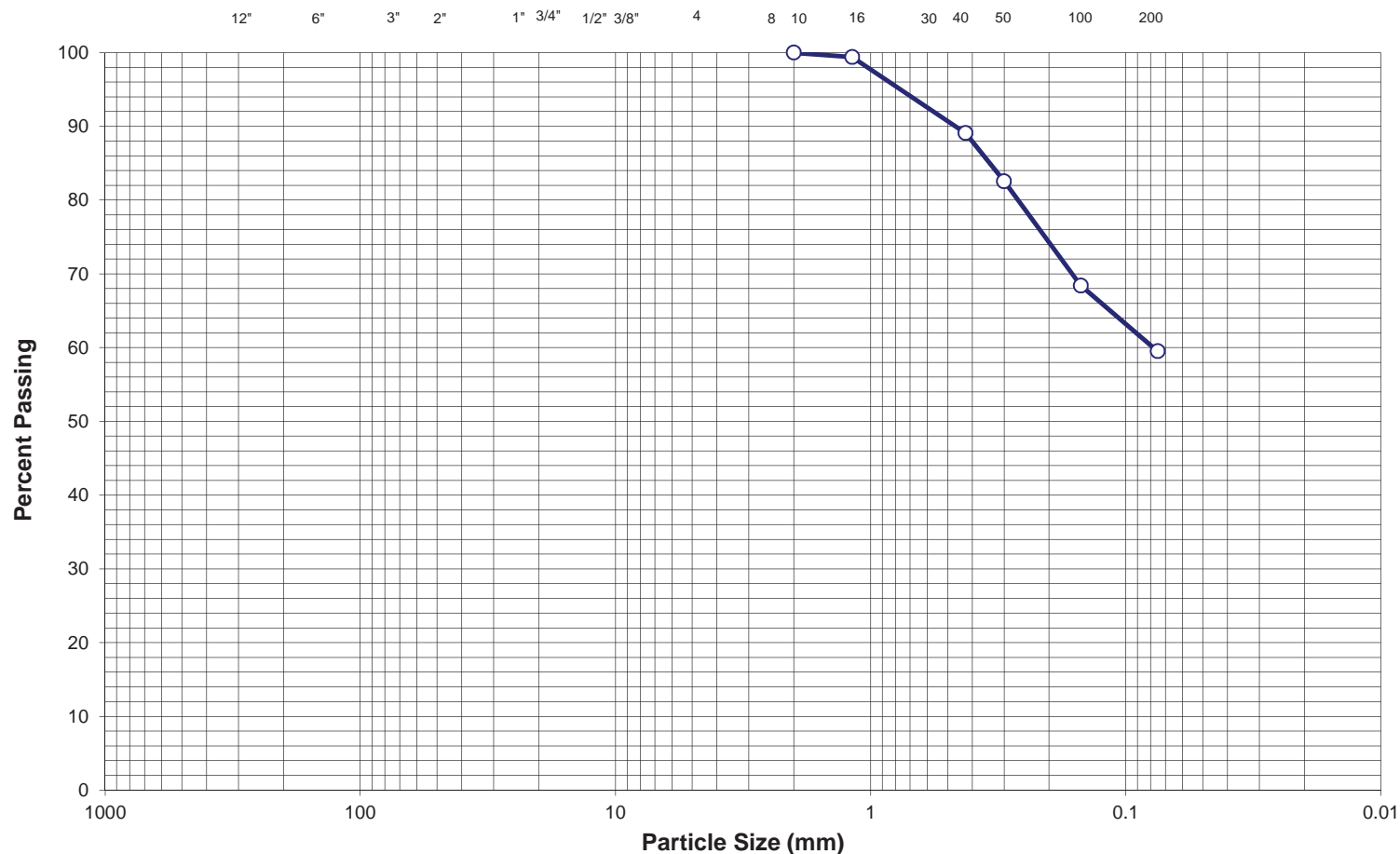
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4"	100
1/2"	100
3/8"	96
#4	72
#10	44
#40	14
#200	2.4

Gravel (%)	28	LL	NV	Project Name:	US 550 S / US 160 Connector	<div><div>Yeh & Associates, Inc. Geotechnical Engineering Consultants</div></div>			
Sand (%)	70	PL	NP	Boring:	WB-03				
Fines (%)	2	PI	NP	Sample Depth (ft):	19.5-24.5	SIEVE ANALYSIS			
Sample Classification:	poorly graded SAND w/ gravel	USCS: SP		AASHTO:	A-1-a (0)	Drawn By:	KM	Project No.:	217-376
						Checked By:	LQ	Figure No.:	-
						Date:	12/13/17		

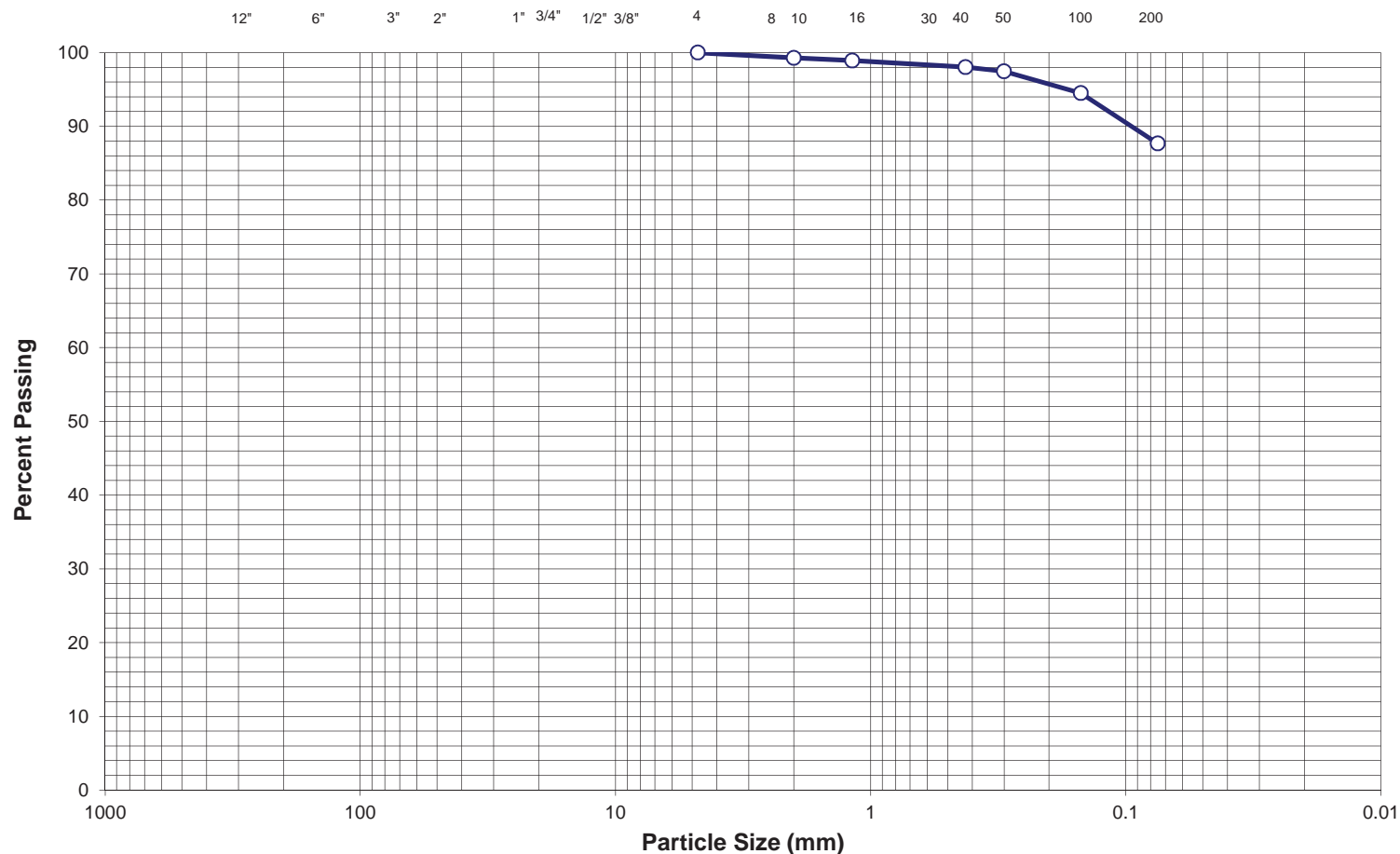
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	100
#40	89
#200	59.5

Gravel (%)	0	LL	32	Project Name:	US 550 S / US 160 Connector		
Sand (%)	40	PL	21	Boring:	WB-03		
Fines (%)	60	PI	11	Sample Depth (ft):	54.5-59.5		
Sample Classification:	sandy CLAY (weathered bedrock)		USCS: CL	AASHTO: A-6 (4)		<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>	
<div>SIEVE ANALYSIS</div>						Drawn By: KM	Project No.: 217-376
						Checked By: LQ	
						Date: 12/13/17	Figure No.: -

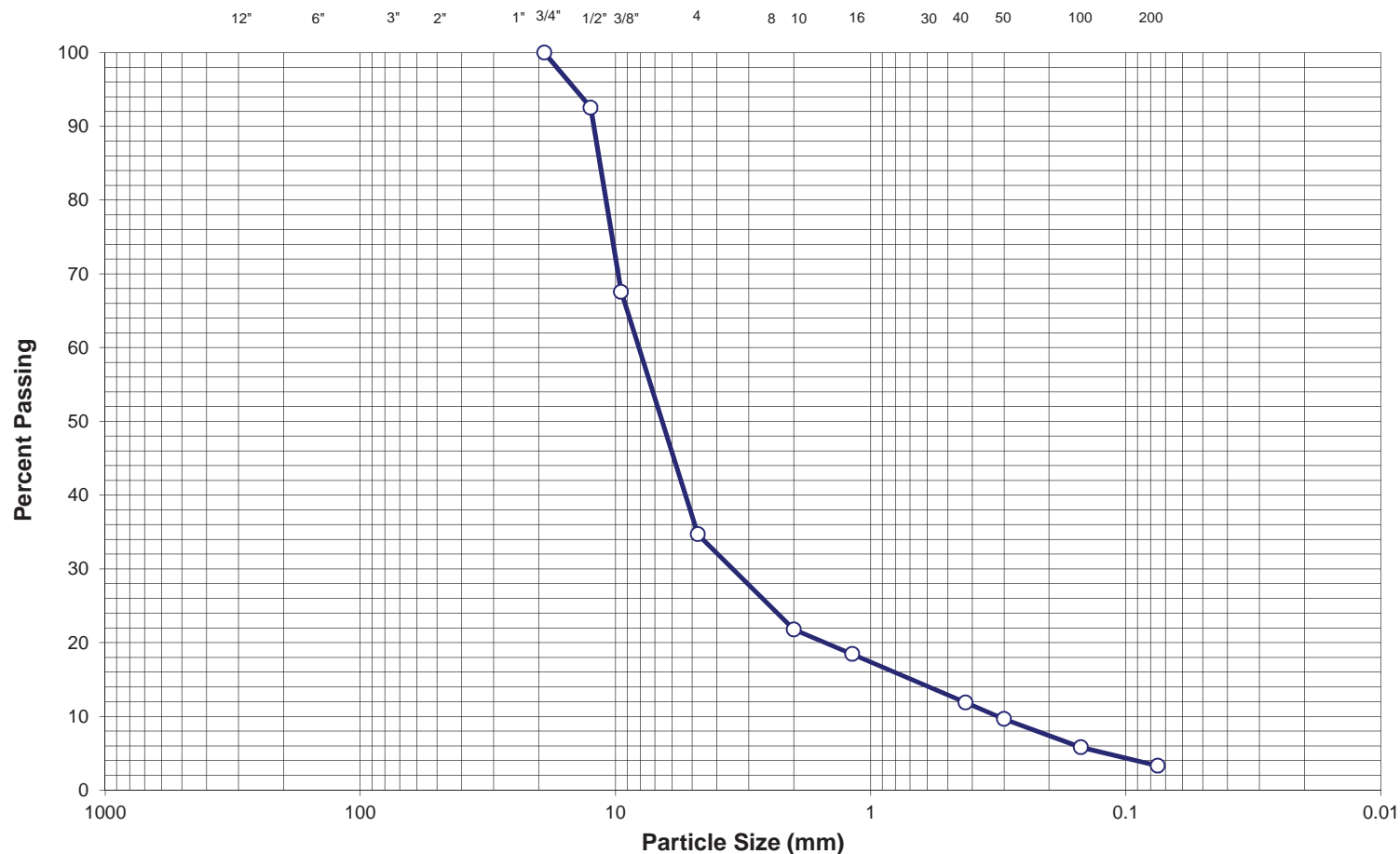
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	99
#40	98
#200	87.7

Gravel (%)	0	LL	45	Project Name:	US 550 S / US 160 Connector	<div><div>Yeh & Associates, Inc. Geotechnical Engineering Consultants</div></div>			
Sand (%)	12	PL	21	Boring:	WB-04				
Fines (%)	88	PI	24	Sample Depth (ft):	9.5-14.5	SIEVE ANALYSIS			
Sample Classification:	sandy CLAY	USCS: CL	AASHTO: A-7-6 (22)	Drawn By:	KM	Project No.:	217-376		
				Checked By:	LQ				
				Date:	12/27/17	Figure No.:	-		

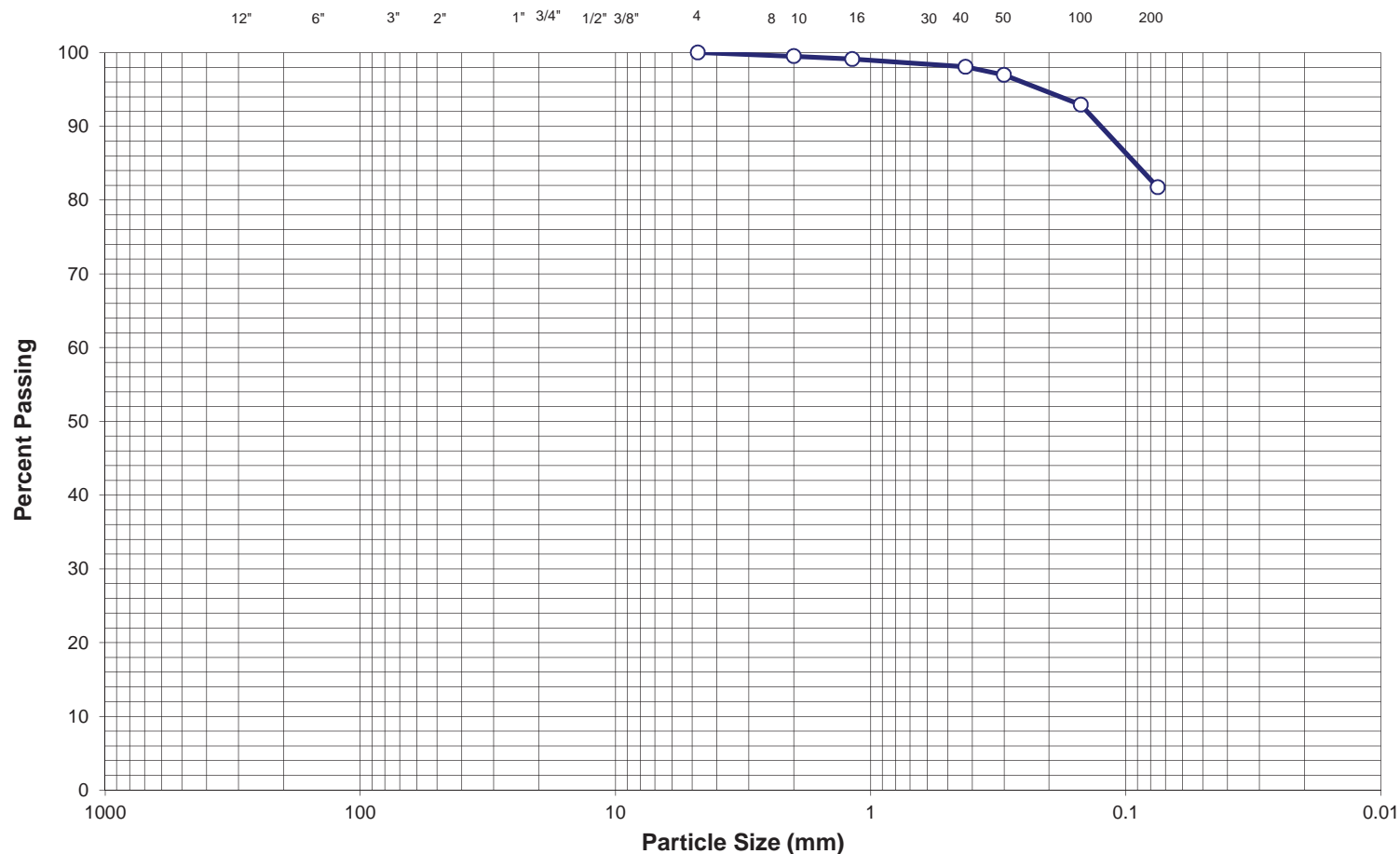
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	100
3/4 "	100
1/2"	93
3/8"	68
#4	35
#10	22
#40	12
#200	3.3

Gravel (%)	65	LL	NV	Project Name:	US 550 S / US 160 Connector		
Sand (%)	32	PL	NP	Boring:	WB-04		
Fines (%)	3	PI	NP	Sample Depth (ft):	49.5-54.5		
Sample Classification:	poorly graded GRAVEL, with sand		USCS: GP	AASHTO: A-1-a (0)		<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div> <div>SIEVE ANALYSIS</div> <div><div>Drawn By: KM</div><div>Checked By: BB</div><div>Date: 12/27/17</div></div> <div><div>Project No.: 217-376</div><div>Figure No.: -</div></div>	

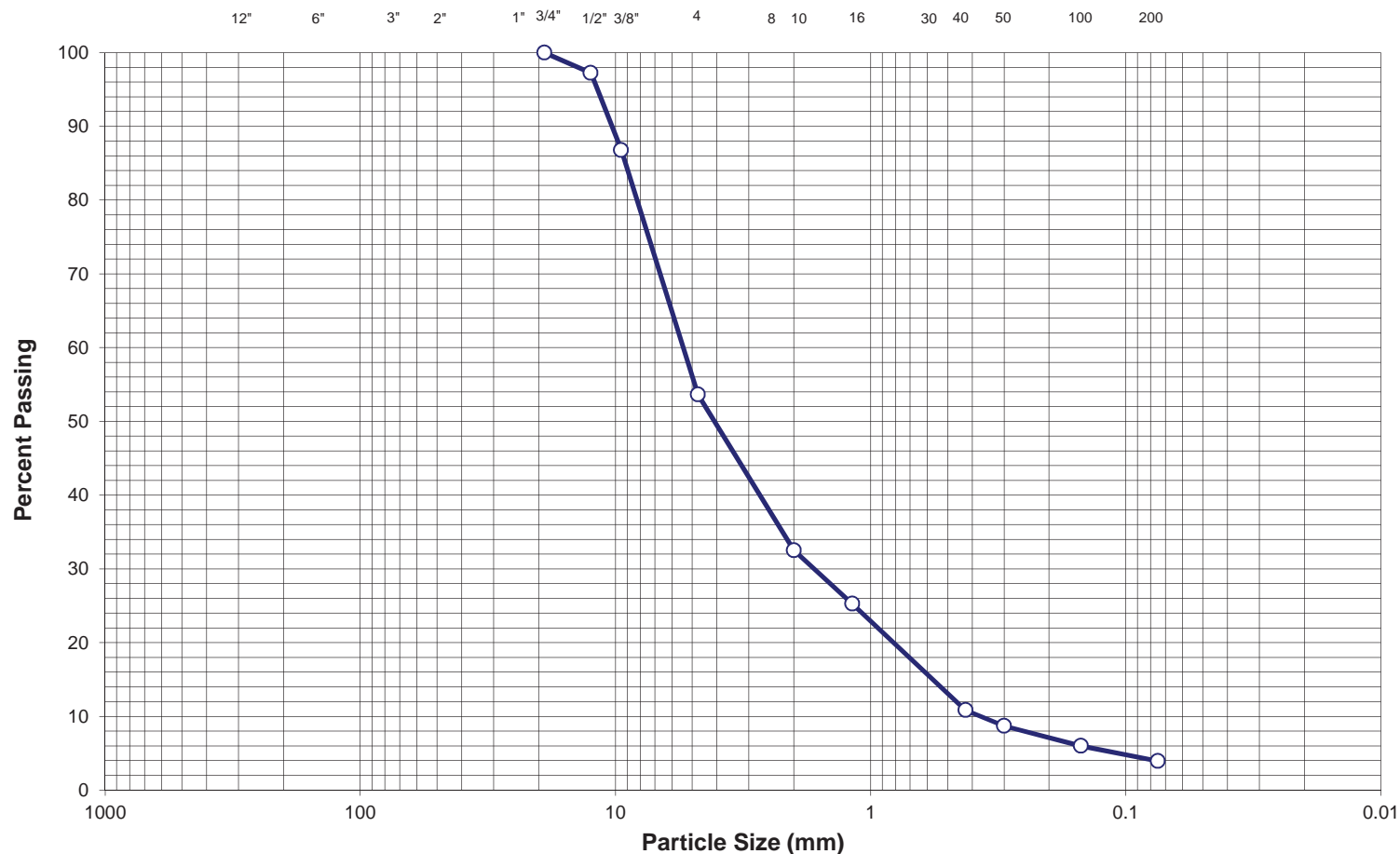
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	99
#40	98
#200	81.7

Gravel (%)	0	LL	42	Project Name:	US 550 S / US 160 Connector		
Sand (%)	18	PL	16	Boring:	WB-05		
Fines (%)	82	PI	26	Sample Depth (ft):	4.5		
Sample Classification:	sandy CLAY		USCS: CL	AASHTO: A-7-6 (20)		<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>	
SIEVE ANALYSIS							
				Drawn By:	KM	Project No.:	217-376
				Checked By:	KM	Figure No.:	-
				Date:	01/02/18		

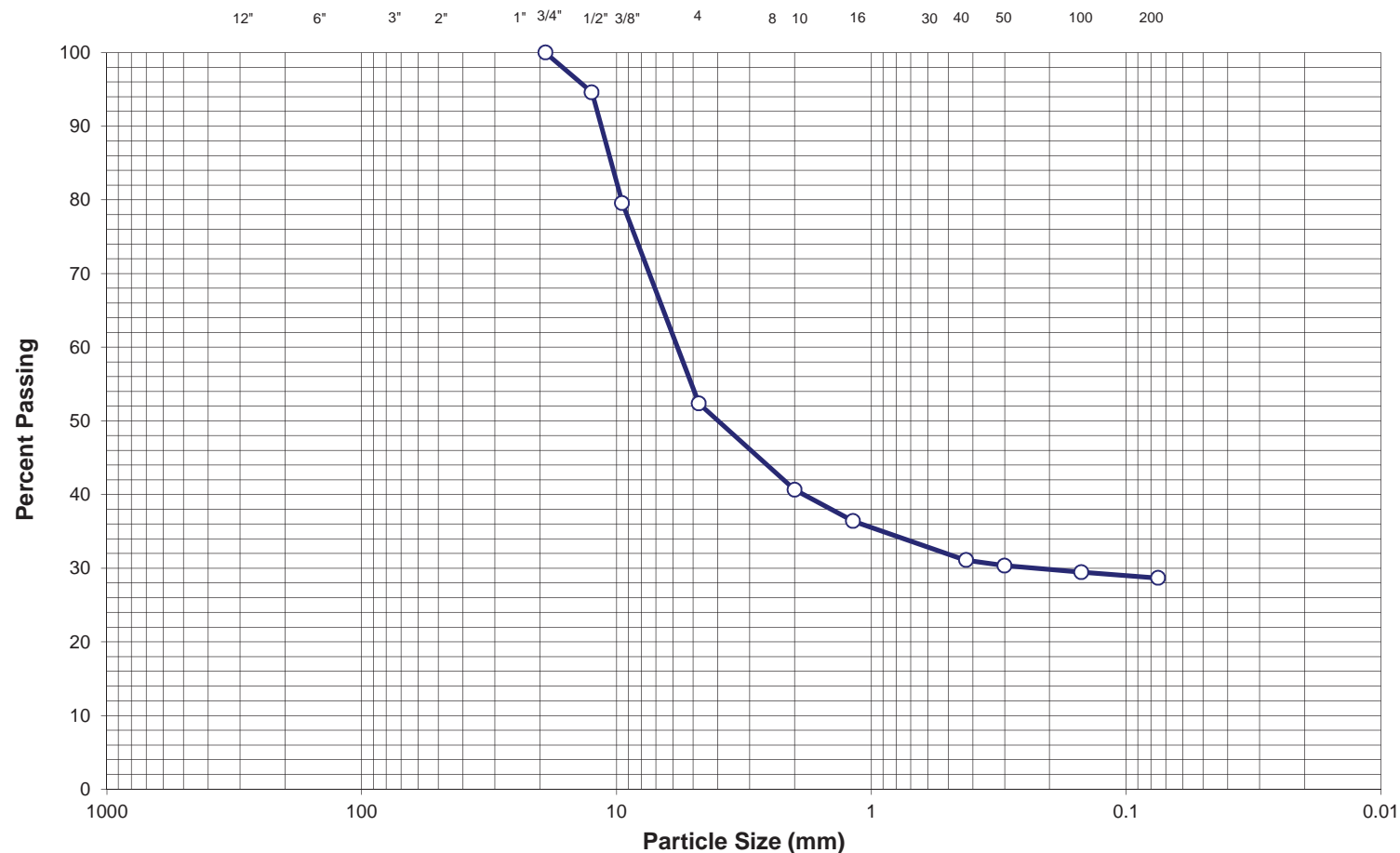
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	100
3/4 "	100
1/2"	97
3/8"	87
#4	54
#10	33
#40	11
#200	4.0

Gravel (%)	46	LL	NV	Project Name:	US 550 S / US 160 Connector		
Sand (%)	50	PL	NP	Boring:	WB-05		
Fines (%)	4	PI	NP	Sample Depth (ft):	24.5-29.5		
Sample Classification:	poorly graded SAND w/gravel		USCS: SP	AASHTO: A-1-a (0)		<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>	
<div>SIEVE ANALYSIS</div>						<div><div><div>Drawn By: KM</div><div>Checked By: BB</div><div>Date: 01/02/18</div></div><div><div>Project No.: 217-376</div><div>Figure No.: -</div></div></div>	

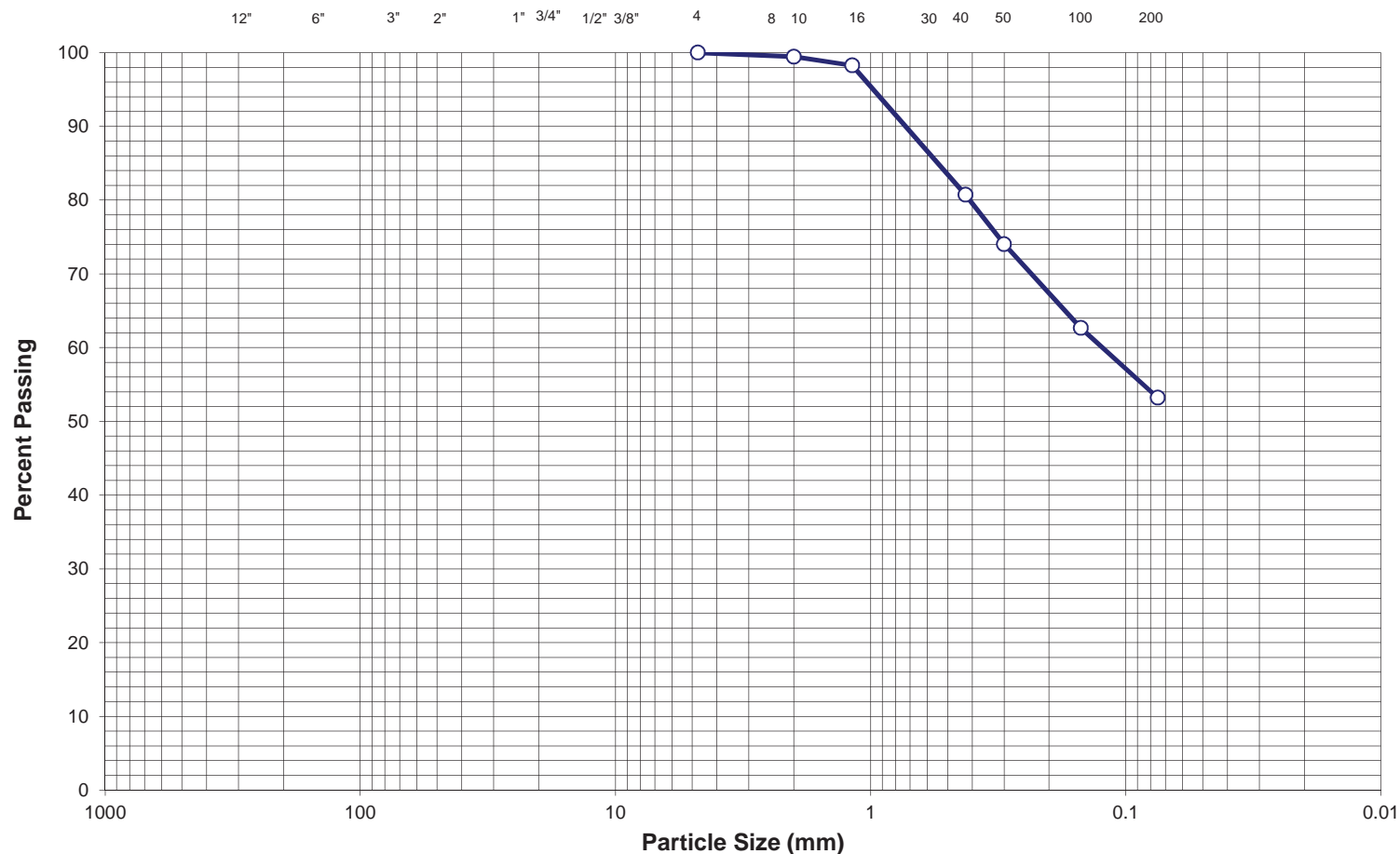
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	100
1/2"	95
3/8"	80
#4	52
#10	41
#40	31
#200	28.7

Gravel (%)	48	LL	NV	Project Name:	 Yeh & Associates, Inc. Geotechnical Engineering Consultants		
Sand (%)	23	PL	NP	Boring:			
Fines (%)	29	PI	NP	Sample Depth (ft):			
Sample Classification:	silty GRAVEL w/ sand		USCS: GM	AASHTO: A-2-4 (0)	Drawn By: KM	Project No.:	217-376
					Checked By: KM	Figure No.:	-
					Date: 01/04/18		

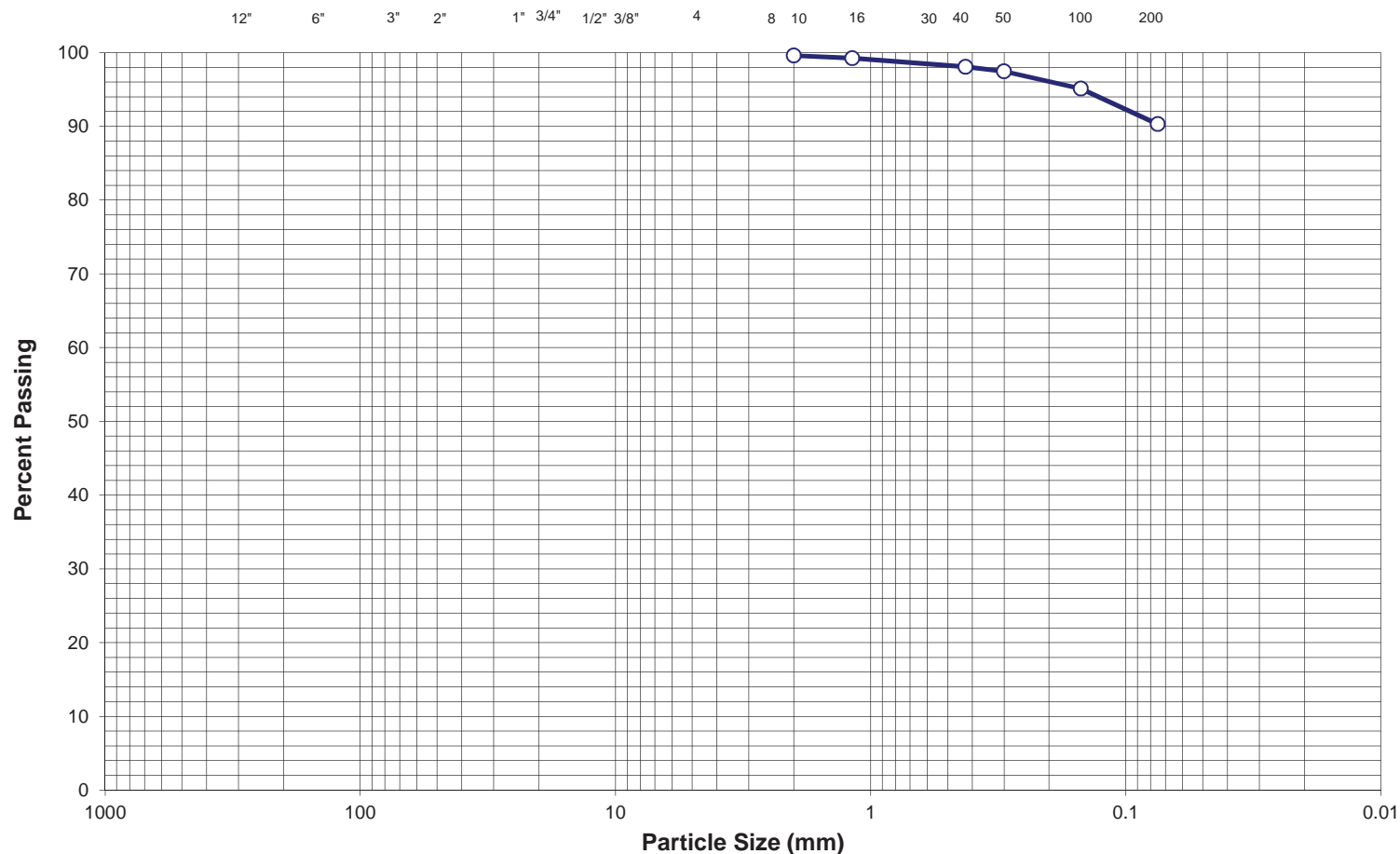
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	99
#40	81
#200	53.2

Gravel (%)	0	LL	39	Project Name:	US 550 S / US 160 Connector		
Sand (%)	47	PL	22	Boring:	WB-05		
Fines (%)	53	PI	17	Sample Depth (ft):	54.5-59.5		
Sample Classification:	sandy CLAY (crushed bedrock)		USCS: CL	AASHTO: A-6 (6)		<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>	
<div>SIEVE ANALYSIS</div>						Drawn By: KM	Project No.: 217-376
						Checked By: AH	
						Date: 01/16/18	Figure No.: -

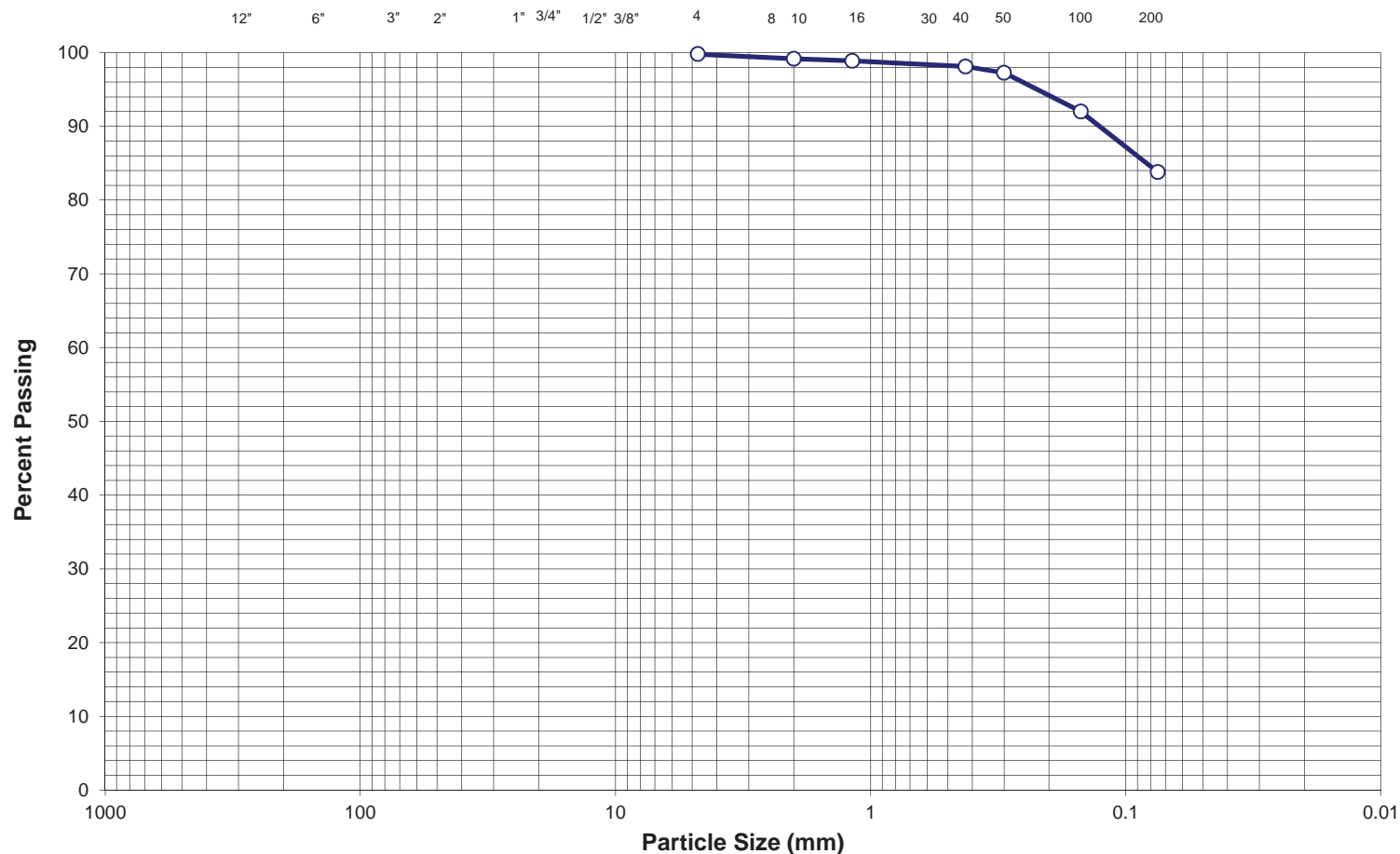
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	100
#40	98
#200	90.3

Gravel (%)	0	LL	34	Project Name:	US 550 S / US 160 Connector	<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>			
Sand (%)	10	PL	18	Boring:	WB-06				
Fines (%)	90	PI	16	Sample Depth (ft):	14.5-19.5	SIEVE ANALYSIS			
Sample Classification:	CLAY, trace sand	USCS: CL	AASHTO: A-6 (14)	Drawn By:	KM	Project No.:	217-376		
				Checked By:	AH				
				Date:	01/16/18	Figure No.:	-		

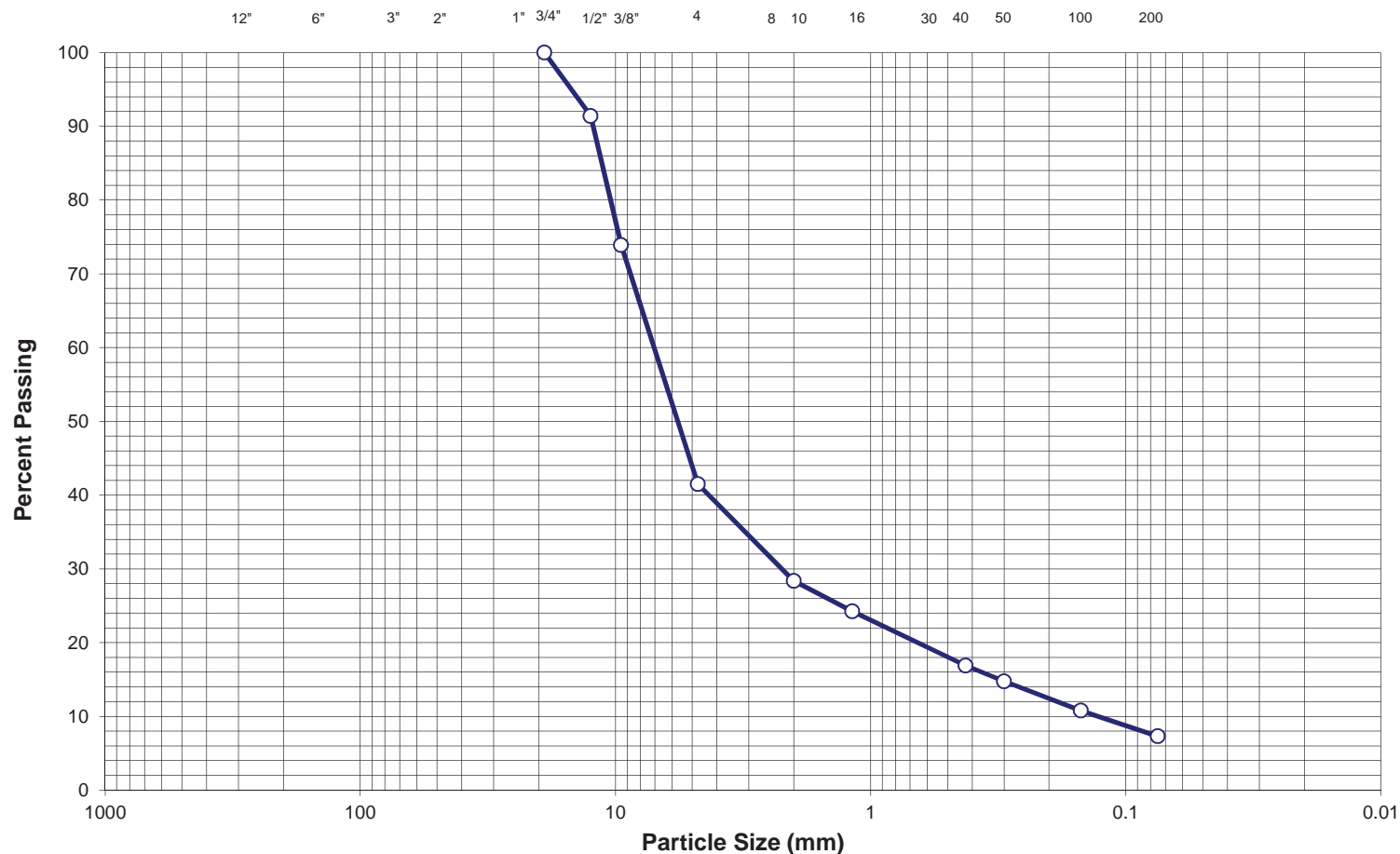
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	100
#4	100
#10	99
#40	98
#200	83.8

Gravel (%)	0	LL	59	Project Name:	US 550 S / US 160 Connector		
Sand (%)	16	PL	19	Boring:	WB-07		
Fines (%)	84	PI	40	Sample Depth (ft):	9.5-14.5		
Sample Classification:	high plasticity sand CLAY		USCS: CH	AASHTO: A-7-6 (35)		<div><div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div><div>SIEVE ANALYSIS</div><div><div>Drawn By: KM</div><div>Checked By: KM</div><div>Date: 01/04/18</div></div><div><div>Project No.: 217-376</div><div>Figure No.: -</div></div></div>	

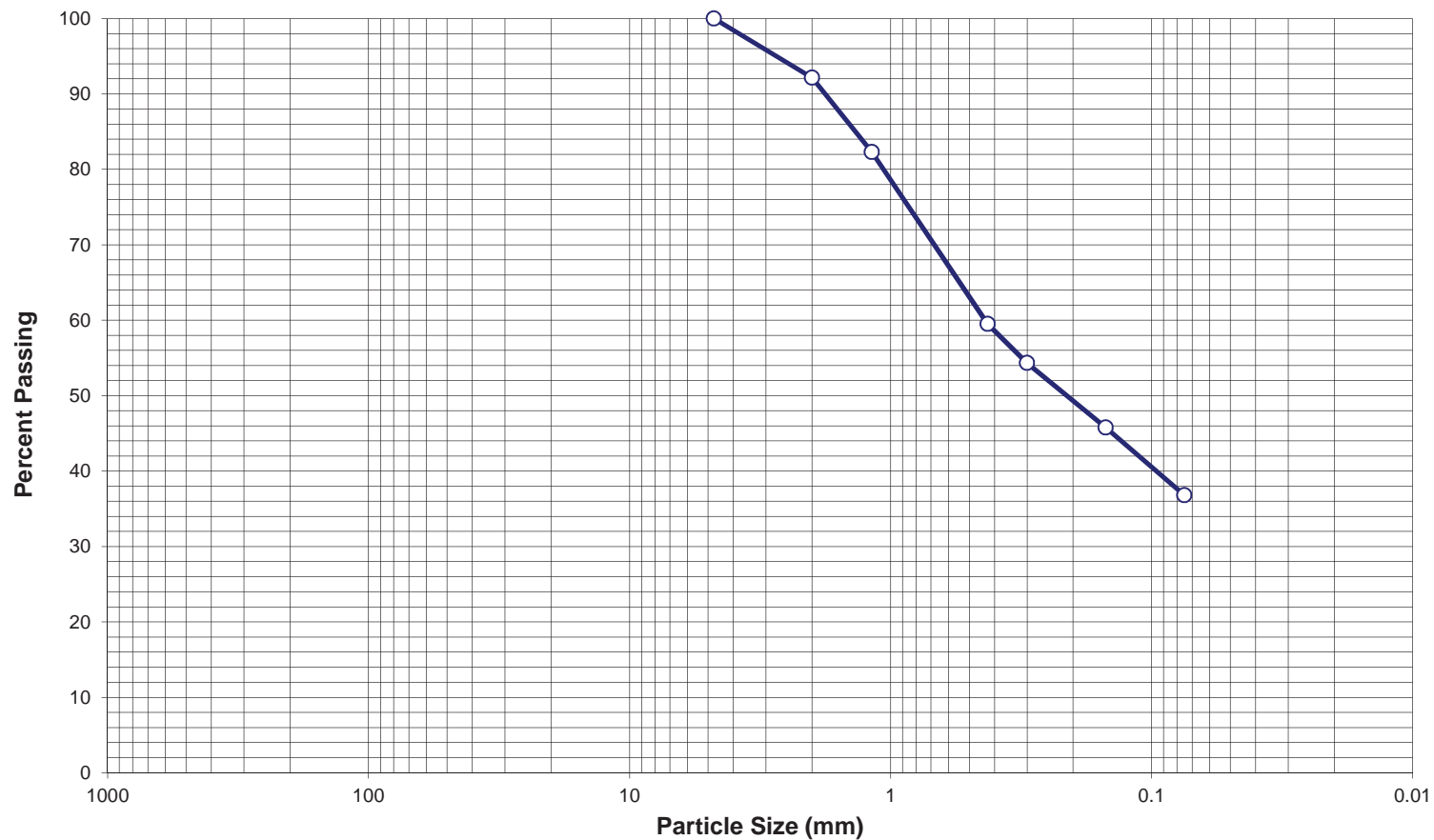
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm



Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	100
1/2"	91
3/8"	74
#4	41
#10	28
#40	17
#200	7.3

Gravel (%)	59	LL	NV	Project Name:	 Yeh & Associates, Inc. Geotechnical Engineering Consultants		
Sand (%)	34	PL	NP	Boring:			
Fines (%)	7	PI	NP	Sample Depth (ft):	SIEVE ANALYSIS Drawn By: KM Checked By: KM Date: 01/04/18		
Sample Classification:	poorly graded GRAVEL w/ silt and sand	USCS: GP-GM	AASHTO: A-1-a (0)			Project No.:	217-376
						Figure No.:	-

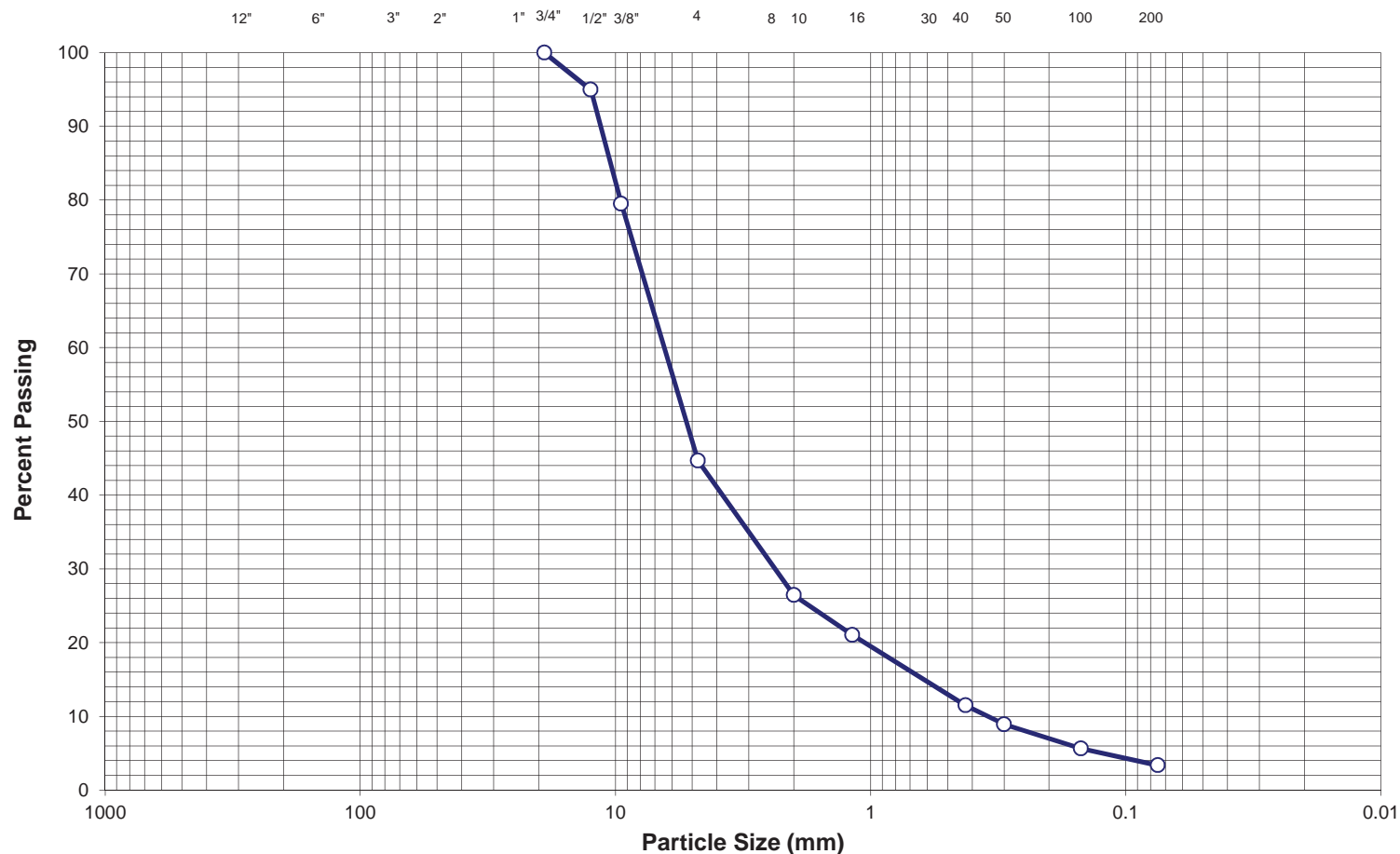
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm
12" 6" 3" 2" 1" 3/4" 1/2" 3/8"	4 8 10 16 30 40 50 100 200	




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	92
#40	60
#200	36.8

Gravel (%)	0	LL	34	Project Name:	US 550 S / US 160 Connector			
Sand (%)	63	PL	20	Boring:	WB-07			
Fines (%)	37	PI	14	Sample Depth (ft):	44.5-49.5			
Sample Classification:	clayey SAND (crushed bedrock)		USCS: SC	AASHTO: A-6 (1)		Yeh & Associates, Inc. Geotechnical Engineering Consultants		
						SIEVE ANALYSIS		
						Drawn By: KM	Project No.:	217-376
						Checked By: BB	Figure No.:	-
						Date: 01/18/18		

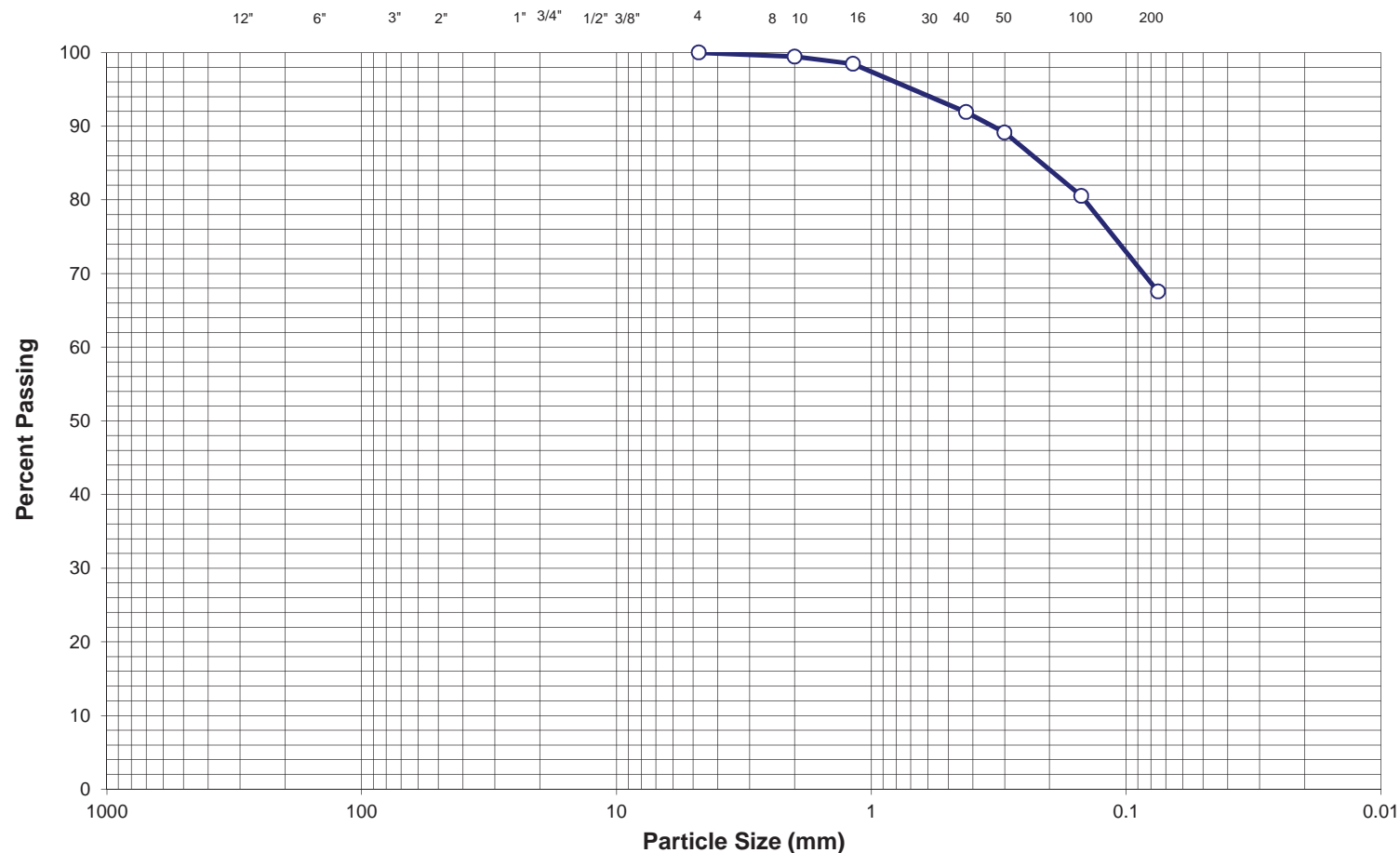
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	100
1/2"	95
3/8"	80
#4	45
#10	26
#40	11
#200	3.4

Gravel (%)	55	LL	NV	Project Name:	 Yeh & Associates, Inc. Geotechnical Engineering Consultants		
Sand (%)	42	PL	NP	Boring:			
Fines (%)	3	PI	NP	Sample Depth (ft):			
Sample Classification:	poorly graded GRAVEL w/ Sand		USCS: GP	AASHTO: A-1-a (0)	Drawn By: KM	Project No.:	217-376
					Checked By: AH	Figure No.:	-
					Date: 01/16/18		

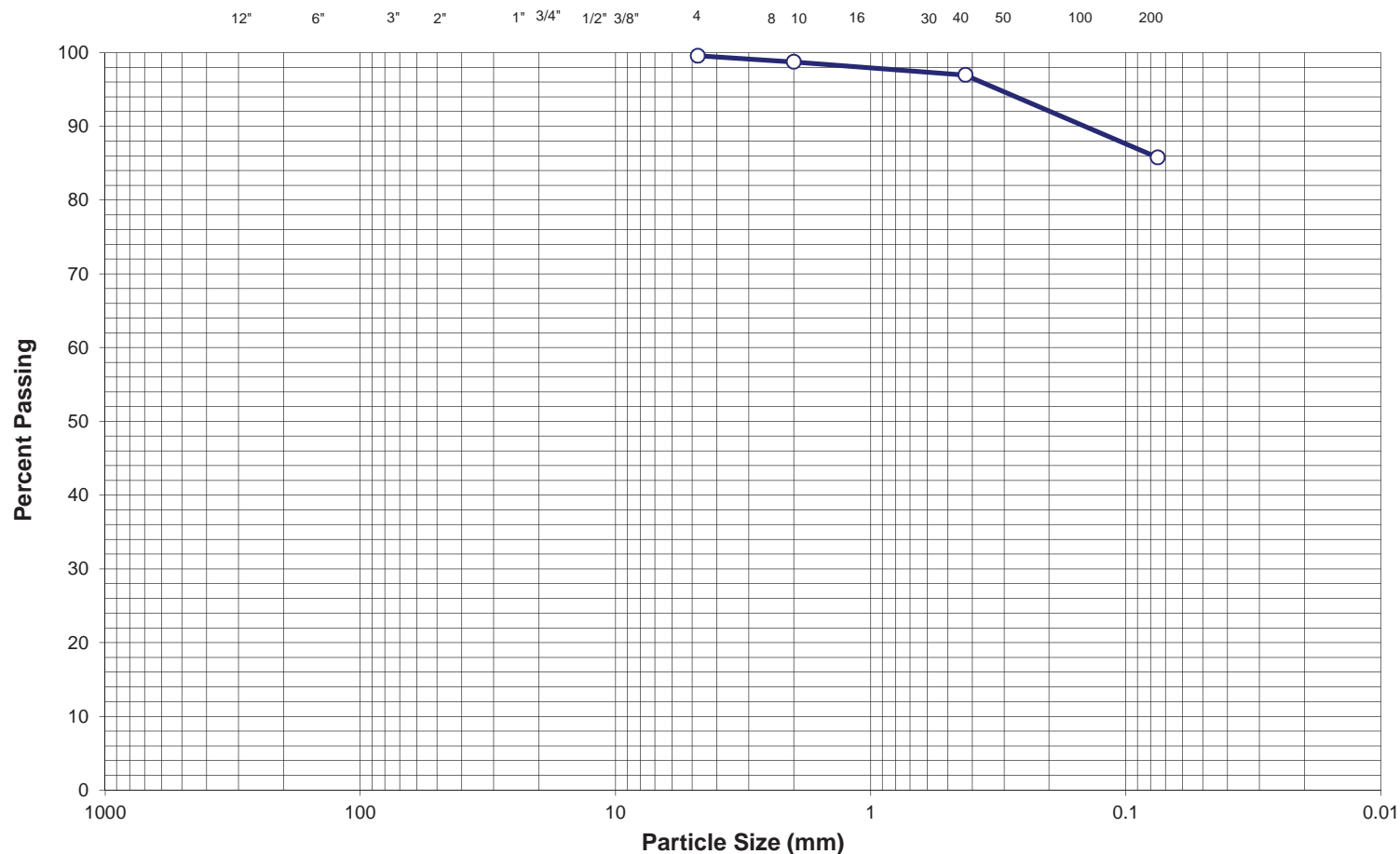
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	99
#40	92
#200	67.5

Gravel (%)	0	LL	37	Project Name:	US 550 S / US 160 Connector		
Sand (%)	32	PL	18	Boring:	WB-08		
Fines (%)	68	PI	19	Sample Depth (ft):	59.5-69.5		
Sample Classification:	sandy CLAY (weathered bedrock)		USCS: CL	AASHTO: A-6 (11)		<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>	
<div>SIEVE ANALYSIS</div>						Drawn By: KM	Project No.: 217-376
						Checked By: BB	
						Date: 01/18/18	Figure No.: -

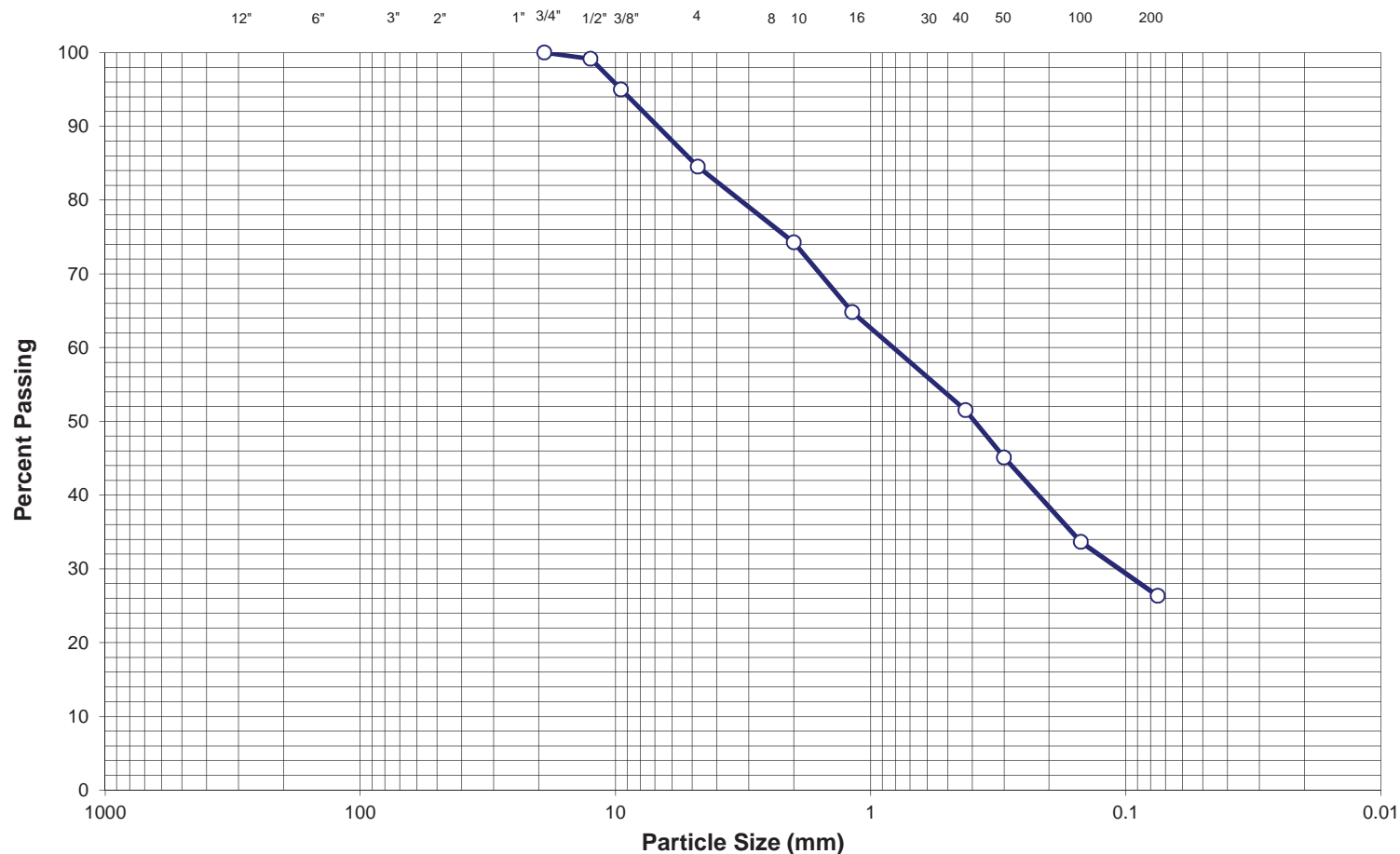
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	99
#40	97
#200	85.8

Gravel (%)	0	LL	34	Project Name:	US 550 S / US 160 Connector				
Sand (%)	14	PL	20	Boring:	WB-09				
Fines (%)	86	PI	14	Sample Depth (ft):	14.5-24.5				
Sample Classification:	sandy CLAY		USCS: CL	AASHTO: A-6 (11)		<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>			
<div>SIEVE ANALYSIS</div>						<div><div>Drawn By: KM</div><div>Checked By: AH</div><div>Date: 01/26/18</div></div>		<div>Project No.: 217-376</div>	
						<div>Figure No.: -</div>			

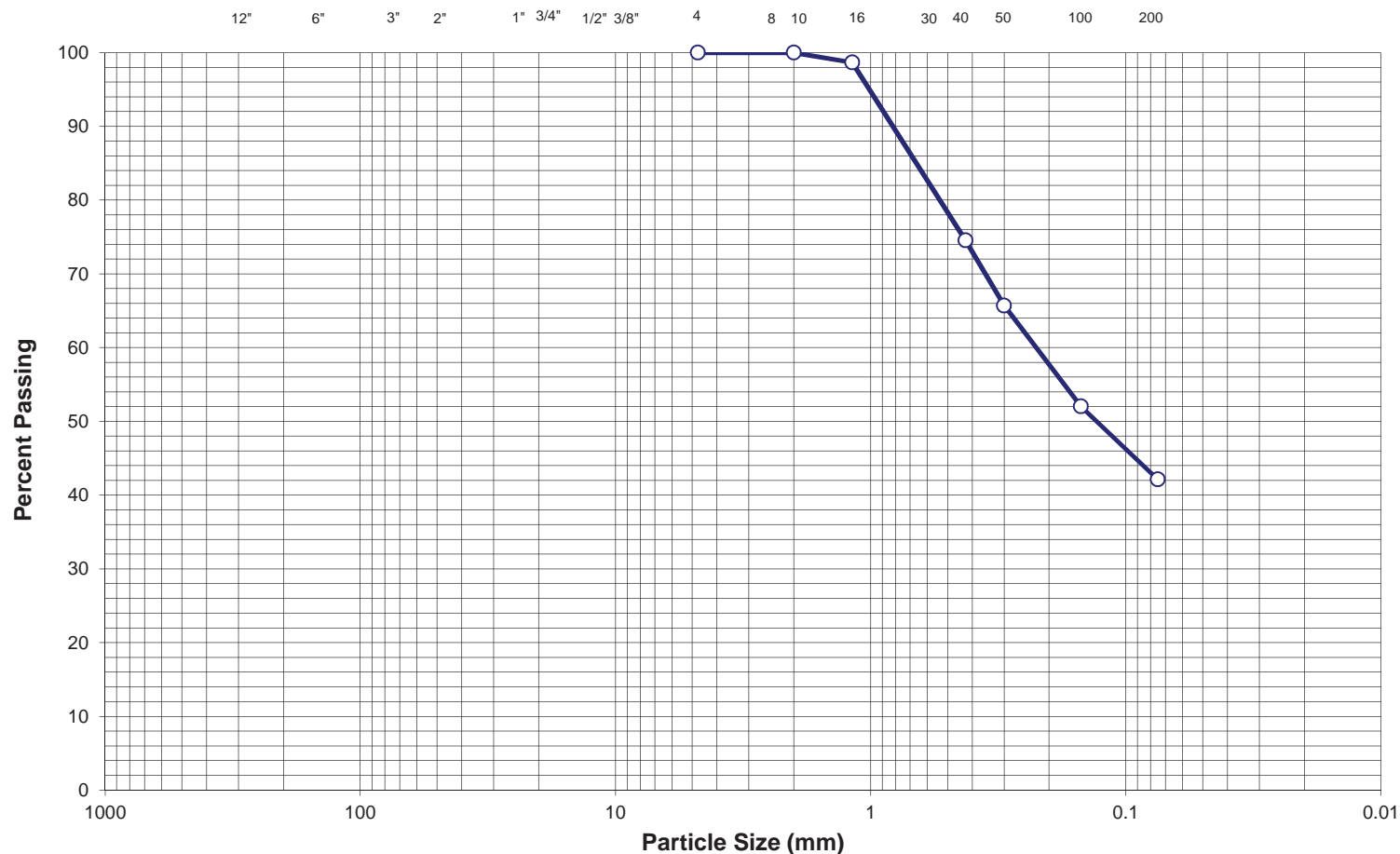
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	100
1/2"	99
3/8"	95
#4	85
#10	74
#40	52
#200	26.3

Gravel (%)	15	LL	32	Project Name:	US 550 S / US 160 Connector	<div><div>Yeh & Associates, Inc. Geotechnical Engineering Consultants</div></div>			
Sand (%)	59	PL	21	Boring:	WB-09				
Fines (%)	26	PI	11	Sample Depth (ft):	24.5-29.5	SIEVE ANALYSIS			
Sample Classification:	clayey SAND w/ gravel	USCS: SC	AASHTO: A-2-6 (0)	Drawn By:	KM	Project No.:	217-376		
				Checked By:	BB	Figure No.:	-		
				Date:	01/19/18				

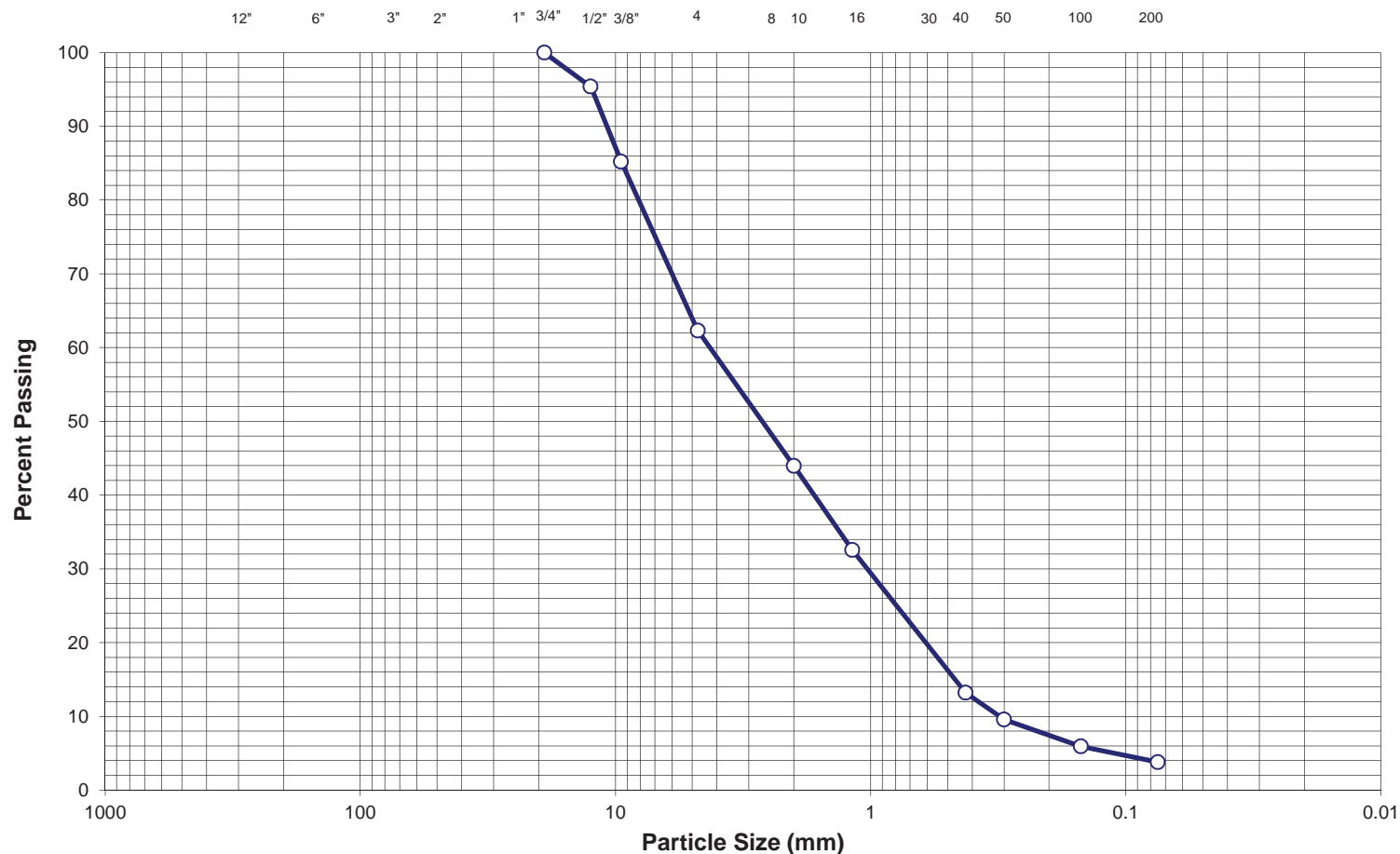
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	100
#40	75
#200	42.1

Gravel (%)	0	LL	41	Project Name:	US 550 S / US 160 Connector		
Sand (%)	58	PL	24	Boring:	WB-09		
Fines (%)	42	PI	17	Sample Depth (ft):	49.5-54.5		
Sample Classification:	clayey SAND		USCS: SC	AASHTO: A-7-6 (3)		<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>	
<div>SIEVE ANALYSIS</div>						Drawn By: KM	Project No.: 217-376
						Checked By: AH	
						Date: 01/19/18	Figure No.: -

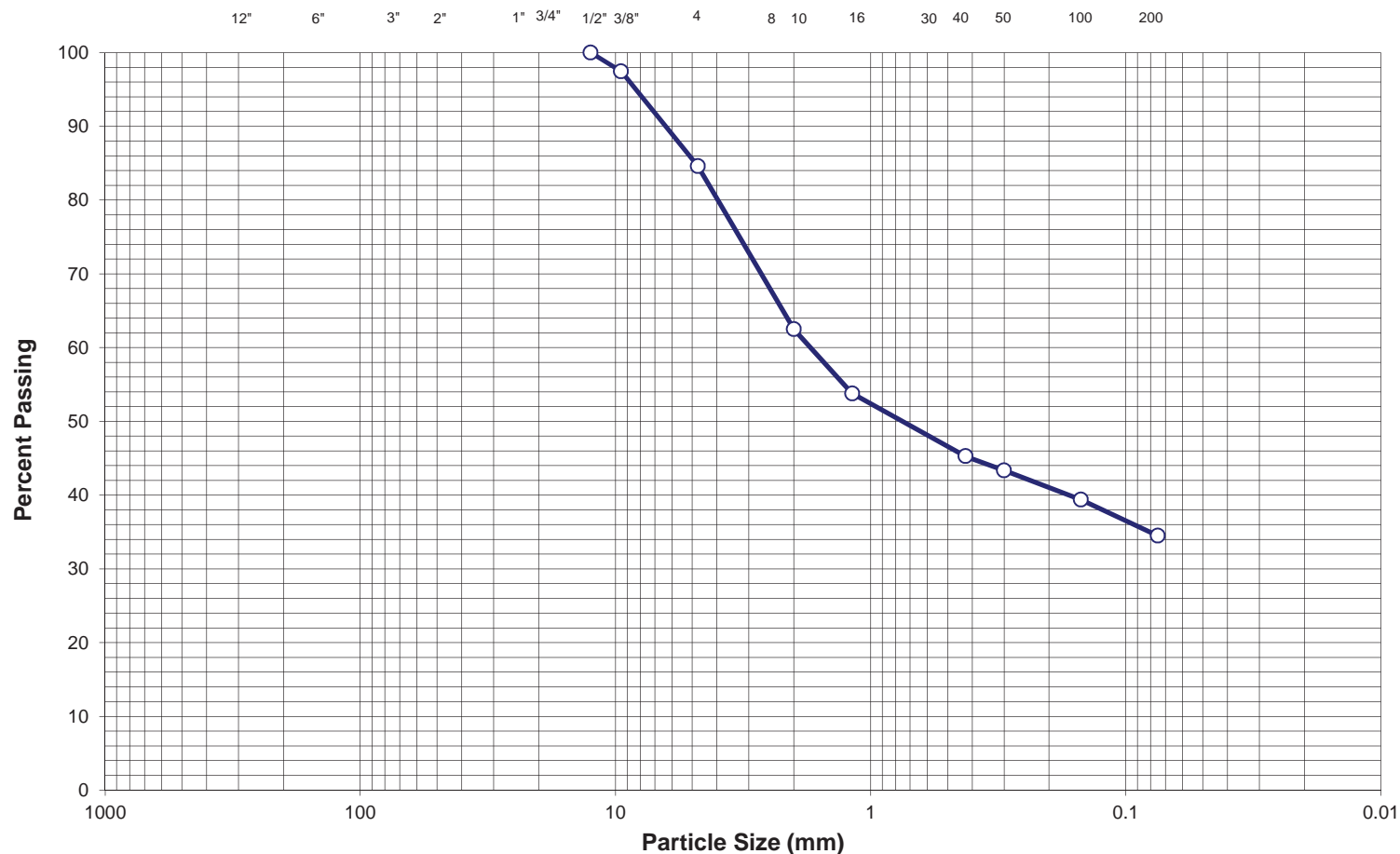
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4"	100
1/2"	95
3/8"	85
#4	62
#10	44
#40	13
#200	3.8

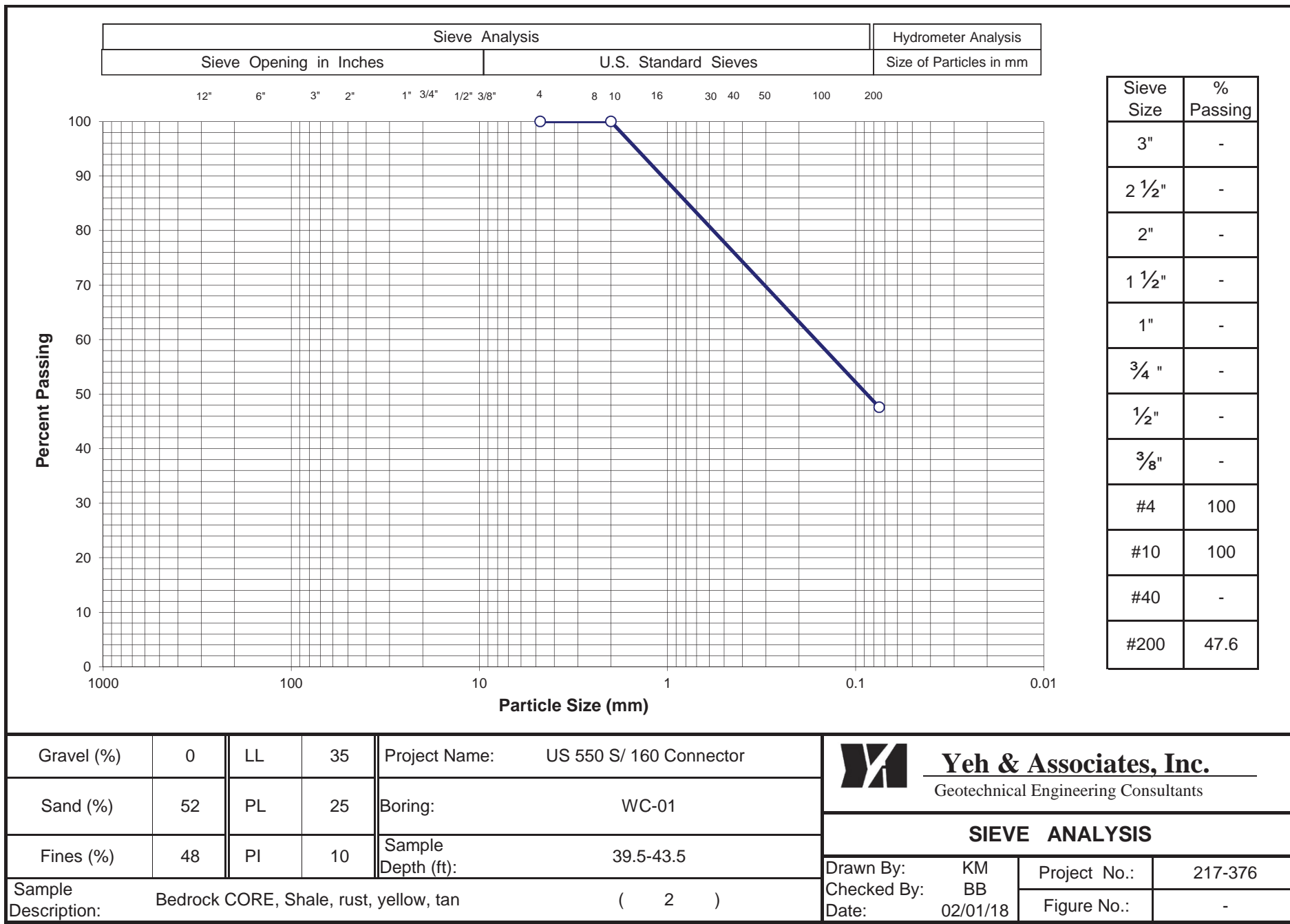
Gravel (%)	38	LL	NV	Project Name:	US 550 S / US 160 Connector	<div><div>Yeh & Associates, Inc. Geotechnical Engineering Consultants</div></div>		
Sand (%)	58	PL	NP	Boring:	WC-01			
Fines (%)	4	PI	NP	Sample Depth (ft):	4.5-9.5	SIEVE ANALYSIS		
Sample Classification:	poorly graded SAND w/ gravel	USCS: SP	AASHTO: A-1-a (0)	Drawn By:	KM	Project No.:	217-376	
				Checked By:	KM	Figure No.:	-	
				Date:	01/17/18			

Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm

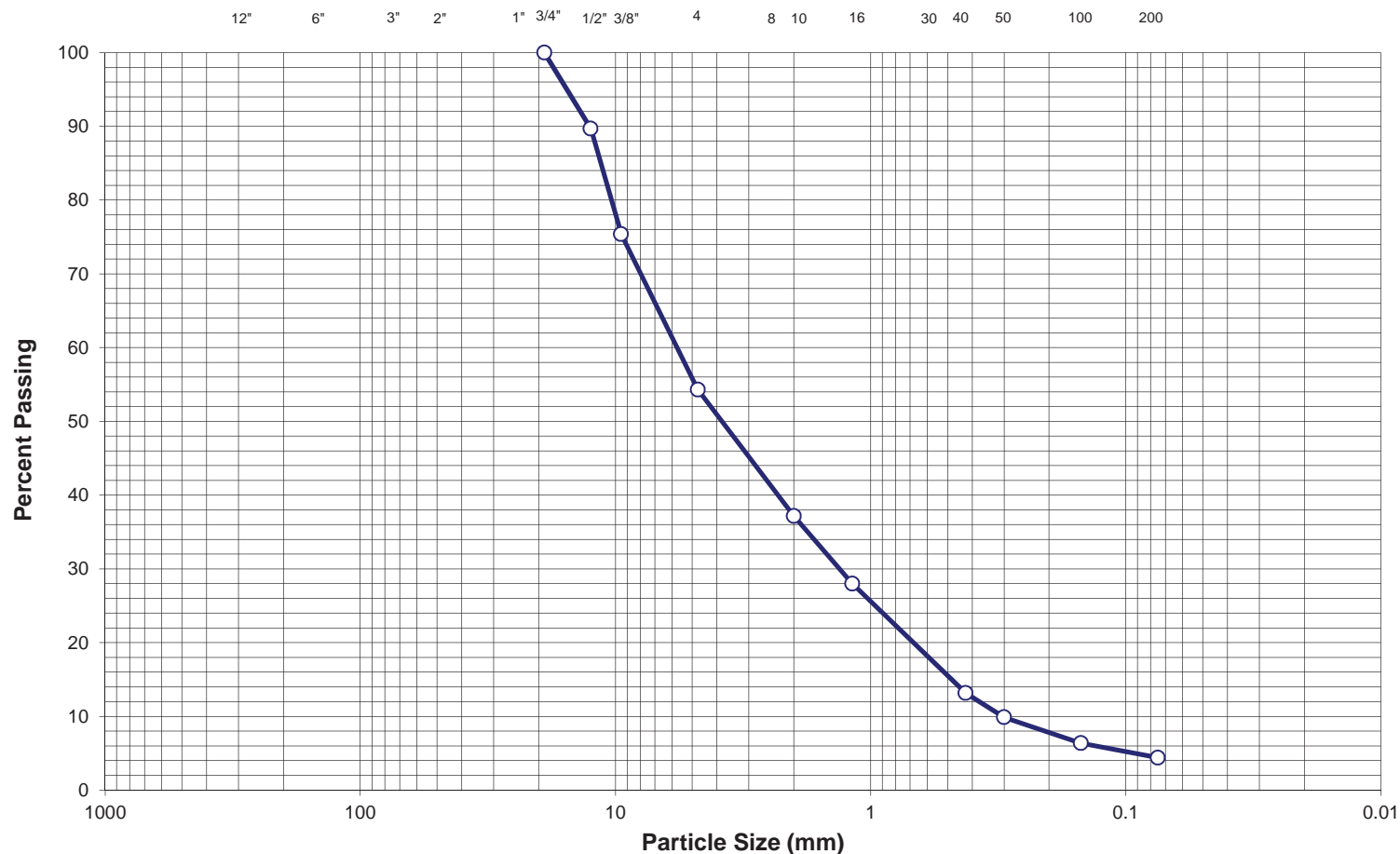


Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	100
3/8"	97
#4	85
#10	63
#40	45
#200	34.5


Gravel (%)	15	LL	37	Project Name:	US 550 S / US 160 Connector		
Sand (%)	51	PL	16	Boring:	WC-01		
Fines (%)	34	PI	21	Sample Depth (ft):	34.5-39.5		
Sample Classification:	clayey SAND w/ gravel (crushed bedrock)		USCS: SC	AASHTO: A-2-6 (2)		<div><div></div><div>Yeh & Associates, Inc. Geotechnical Engineering Consultants</div></div>	
						SIEVE ANALYSIS	
				Drawn By:	KM	Project No.:	217-376
				Checked By:	KM	Figure No.:	-
				Date:	01/17/18		



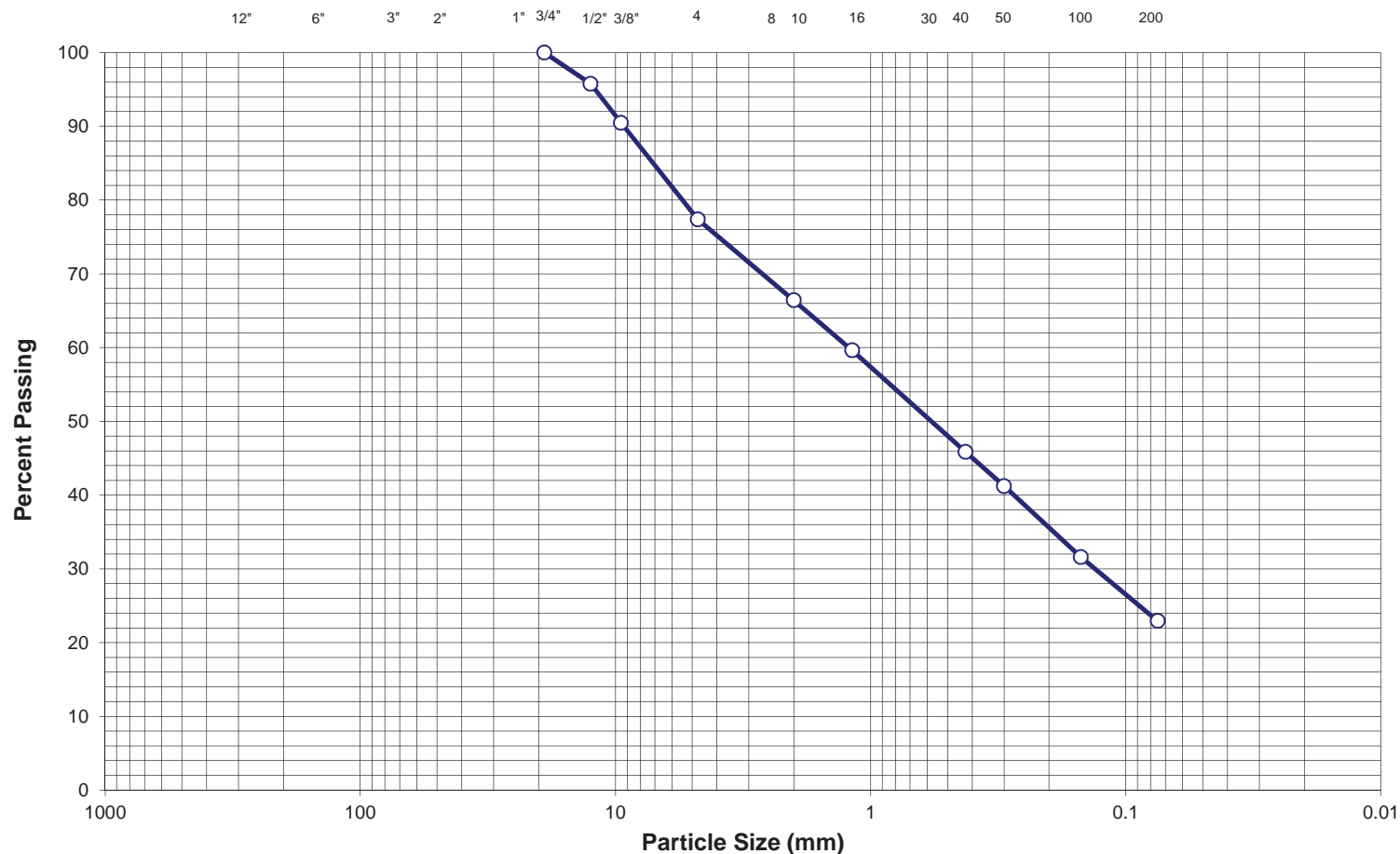
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4"	100
1/2"	90
3/8"	75
#4	54
#10	37
#40	13
#200	4.4

Gravel (%)	46	LL	NV	Project Name:	US 550 S / US 160 Connector		
Sand (%)	50	PL	NP	Boring:	WC-02		
Fines (%)	4	PI	NP	Sample Depth (ft):	9.5-14.5		
Sample Classification:	poorly graded SAND w/ gravel	USCS: SP	AASHTO: A-1-a (0)		<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div> <div>SIEVE ANALYSIS</div> <div><div>Drawn By: KM</div><div>Checked By: BB</div><div>Date: 02/08/18</div></div> <div><div>Project No.: 217-376</div><div>Figure No.: -</div></div>		

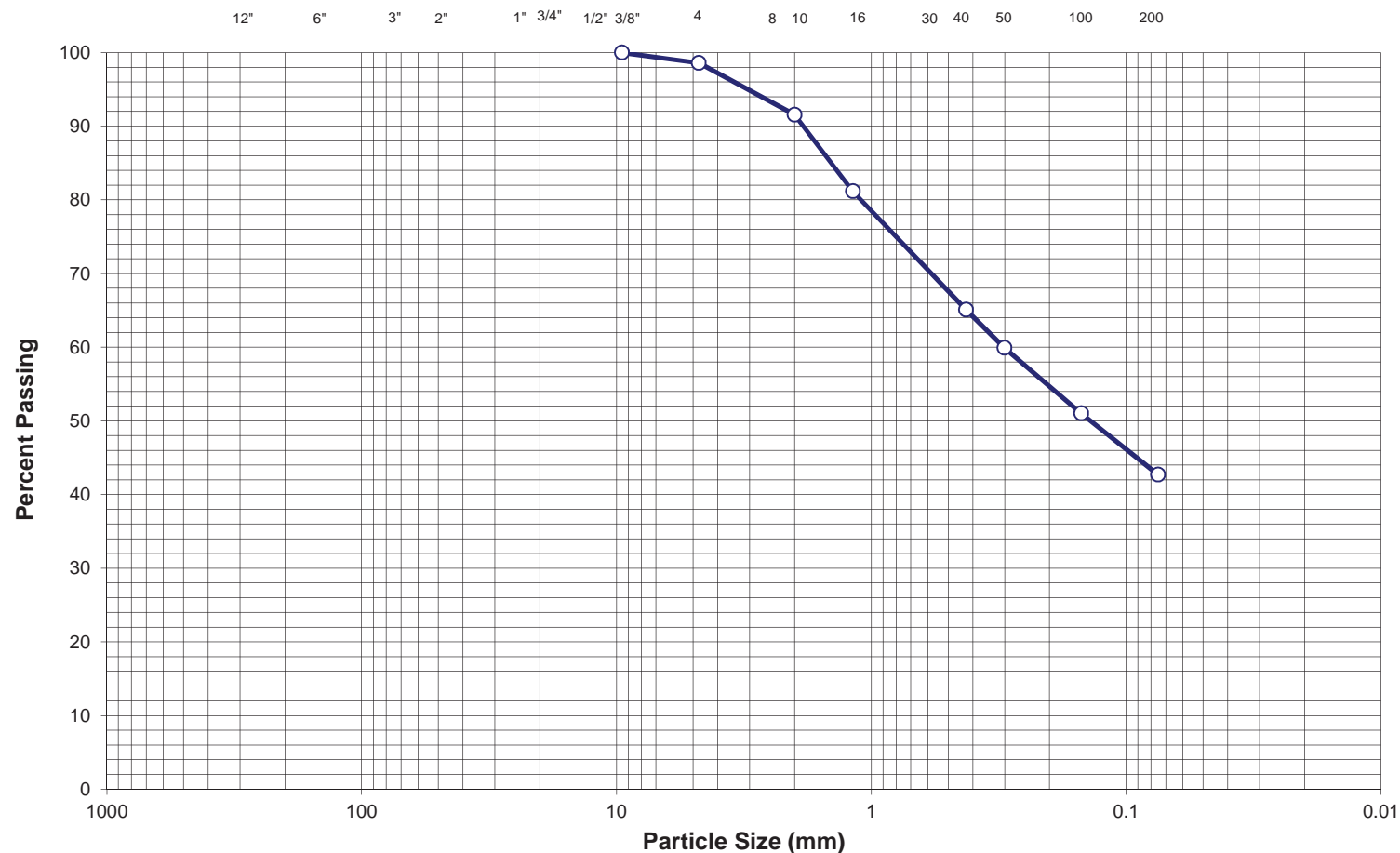
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	100
1/2"	96
3/8"	90
#4	77
#10	66
#40	46
#200	22.9

Gravel (%)	23	LL	27	Project Name:	US 550 S / US 160 Connector	<div><div>Yeh & Associates, Inc. Geotechnical Engineering Consultants</div></div>			
Sand (%)	54	PL	19	Boring:	WC-03				
Fines (%)	23	PI	8	Sample Depth (ft):	0-4.5	SIEVE ANALYSIS			
Sample Classification:	clayey SAND w/ gravel	USCS: SC	AASHTO: A-2-4 (0)	Drawn By:	KM	Project No.:	217-376		
				Checked By:	KM	Figure No.:	-		
				Date:	01/17/18				

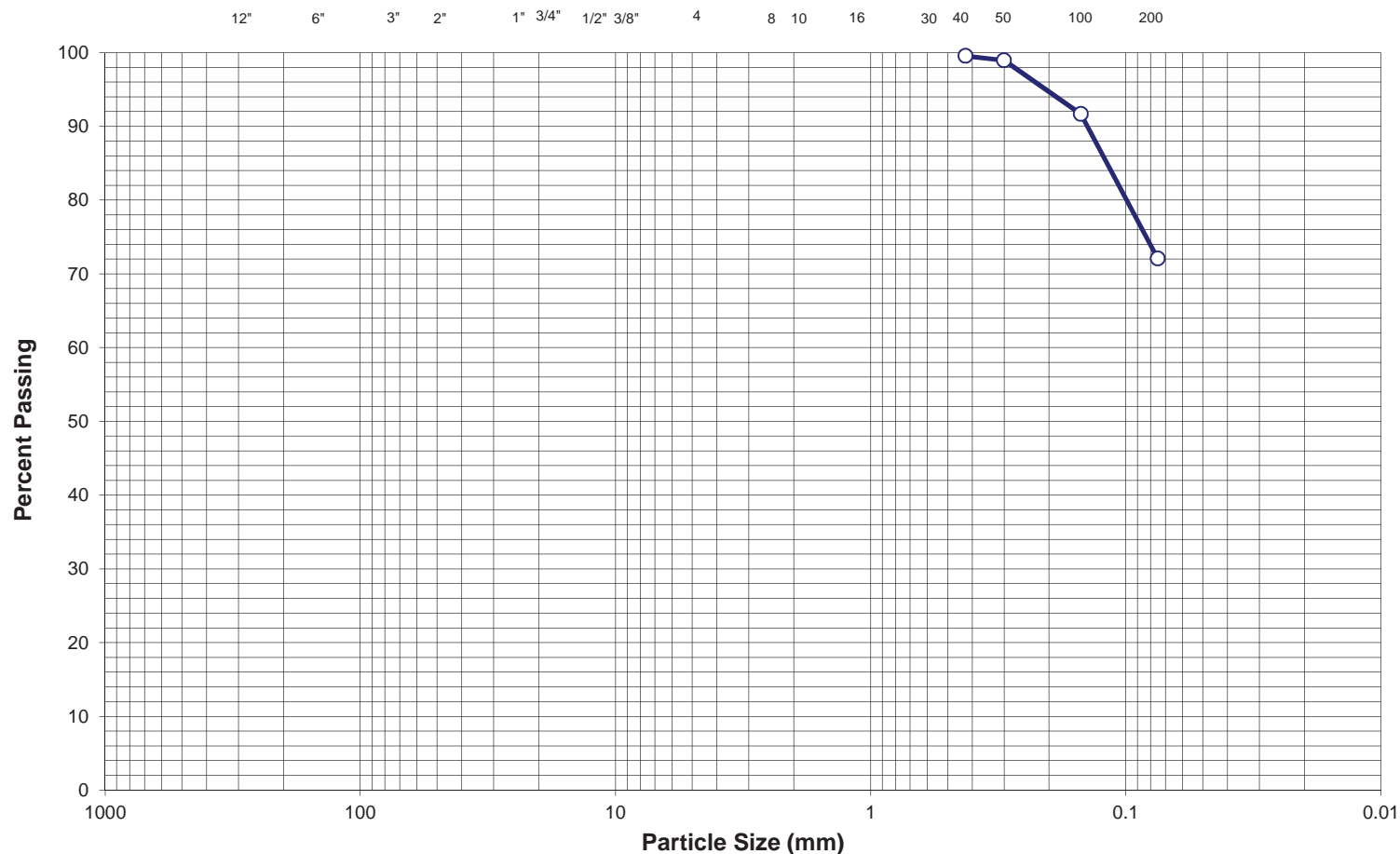
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	100
#4	99
#10	92
#40	65
#200	42.7

Gravel (%)	1	LL	35	Project Name:	US 550 S / US 160 Connector		
Sand (%)	56	PL	19	Boring:	WC-03		
Fines (%)	43	PI	16	Sample Depth (ft):	29.5-34.5		
Sample Classification:	clayey SAND (crushed bedrock)		USCS: SC	AASHTO: A-6 (3)		<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>	
<div>SIEVE ANALYSIS</div>						Drawn By: KM	Project No.: 217-376
						Checked By: BB	
						Date: 01/16/18	Figure No.: -

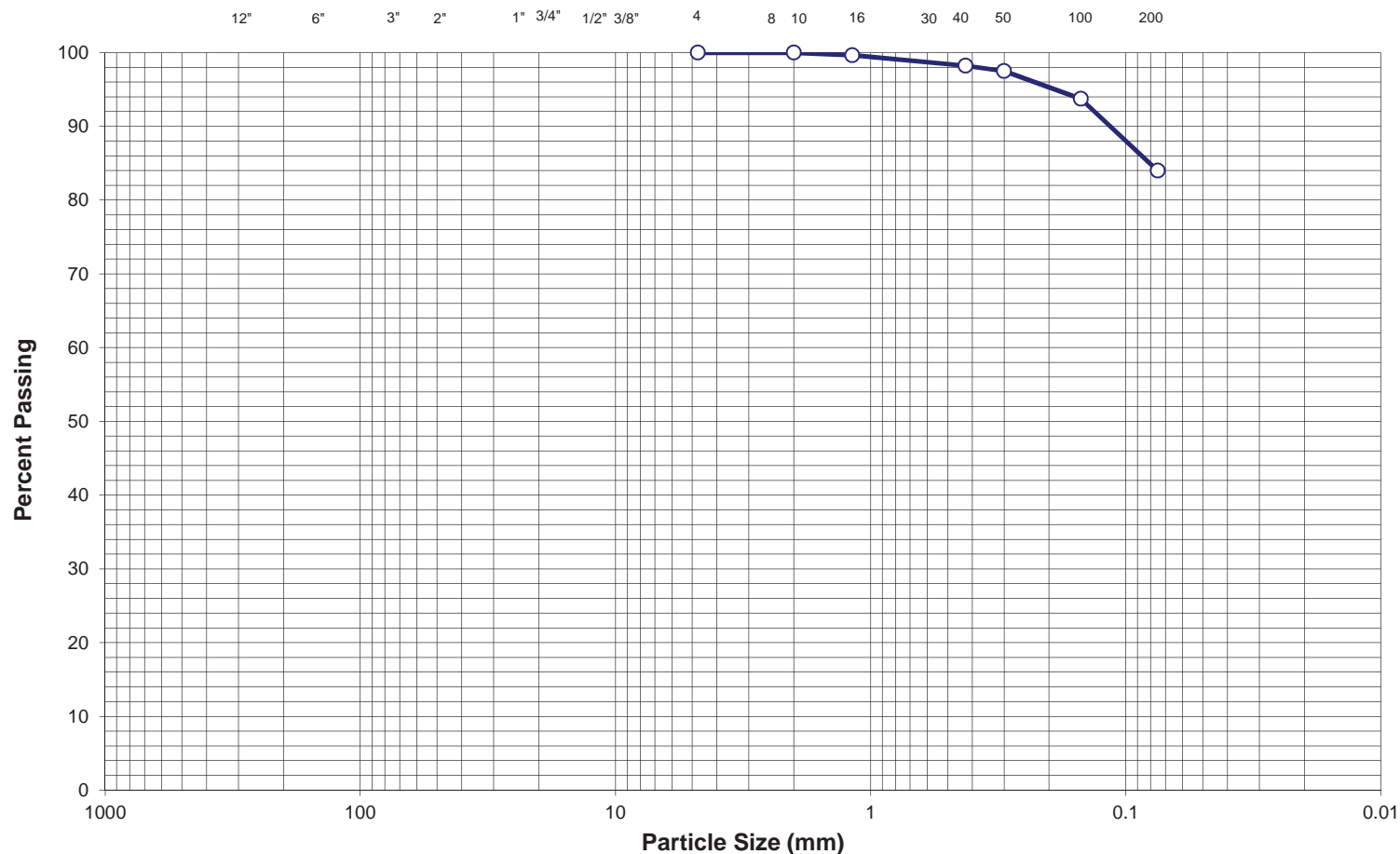
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm



Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	-
#40	100
#200	72.1

Gravel (%)	0	LL	26	Project Name:	US 550 S / US 160 Connector		
Sand (%)	28	PL	18	Boring:	WE-01		
Fines (%)	72	PI	8	Sample Depth (ft):	4		
Sample Classification:	Low plasticity CLAY w/ sand, tan		USCS: CL	AASHTO: A-4 (4)		<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>	
<div>SIEVE ANALYSIS</div>						<div><div><div>Drawn By: KM</div><div>Checked By: BB</div><div>Date: 05/03/18</div></div><div><div>Project No.: 217-376</div><div>Figure No.: -</div></div></div>	

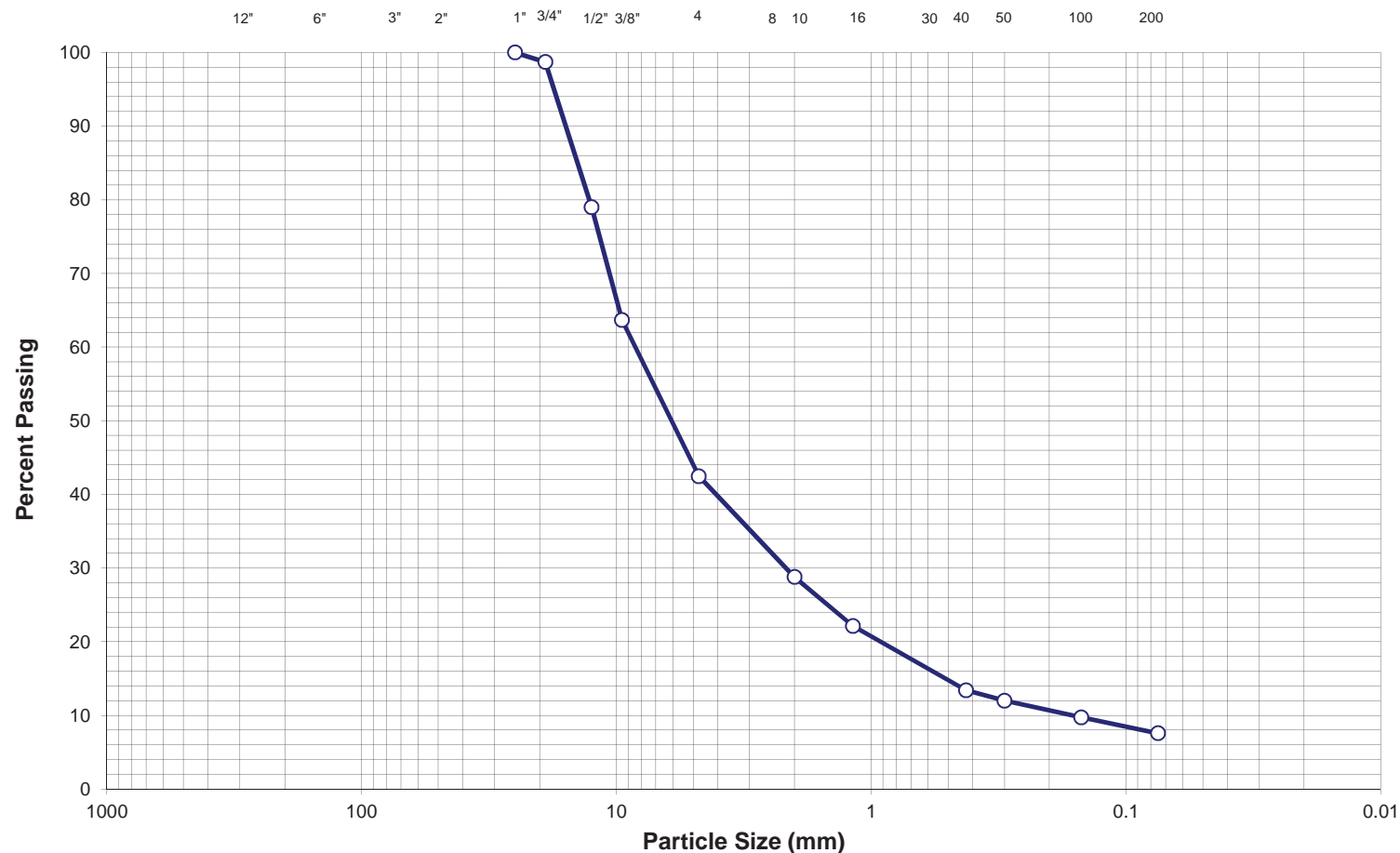
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	100
#40	98
#200	84.0

Gravel (%)	0	LL	29	Project Name:	US 550 S / US 160 Connector				
Sand (%)	16	PL	19	Boring:	WE-01				
Fines (%)	84	PI	10	Sample Depth (ft):	4-9				
Sample Classification:	Medium plasticity CLAY w/ sand, brown		USCS: CL	AASHTO: A-4 (7)		SIEVE ANALYSIS			
						Drawn By:	KM	Project No.:	217-376
						Checked By:	BB	Figure No.:	-
						Date:	05/15/18		

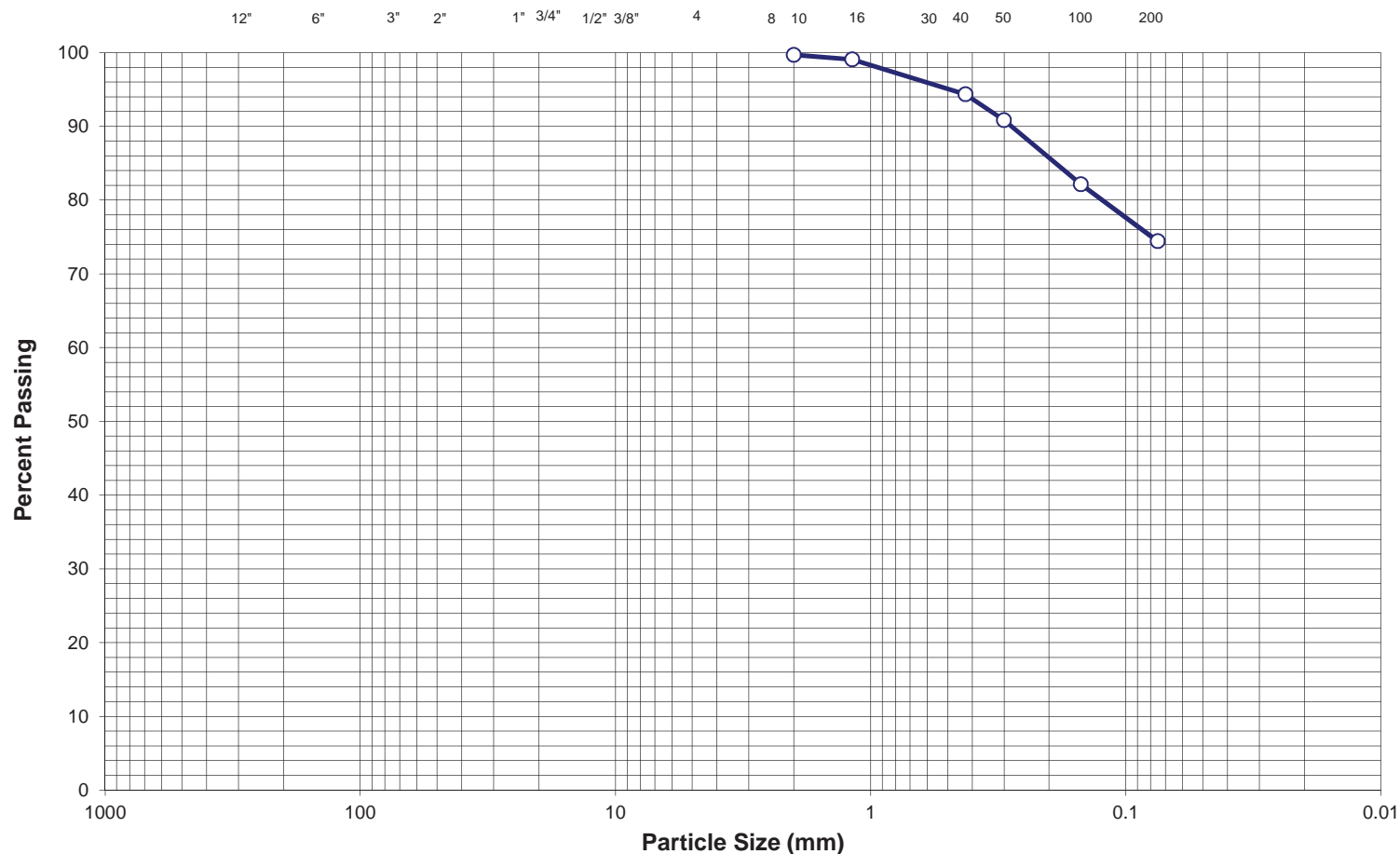
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	100
3/4 "	99
1/2"	79
3/8"	64
#4	42
#10	29
#40	13
#200	7.6

Gravel (%)	58	LL	NV	Project Name:	US 550 S / US 160 Connector		
Sand (%)	34	PL	NP	Boring:	WE-01		
Fines (%)	8	PI	NP	Sample Depth (ft):	19-24		
Sample Classification:	Poorly graded GRAVEL w/ sand		USCS: GP-GM	AASHTO: A-1-a (0)		<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>	
<div>SIEVE ANALYSIS</div>						Drawn By: KM	Project No.: 217-376
						Checked By: BB	
						Date: 05/03/18	Figure No.: -

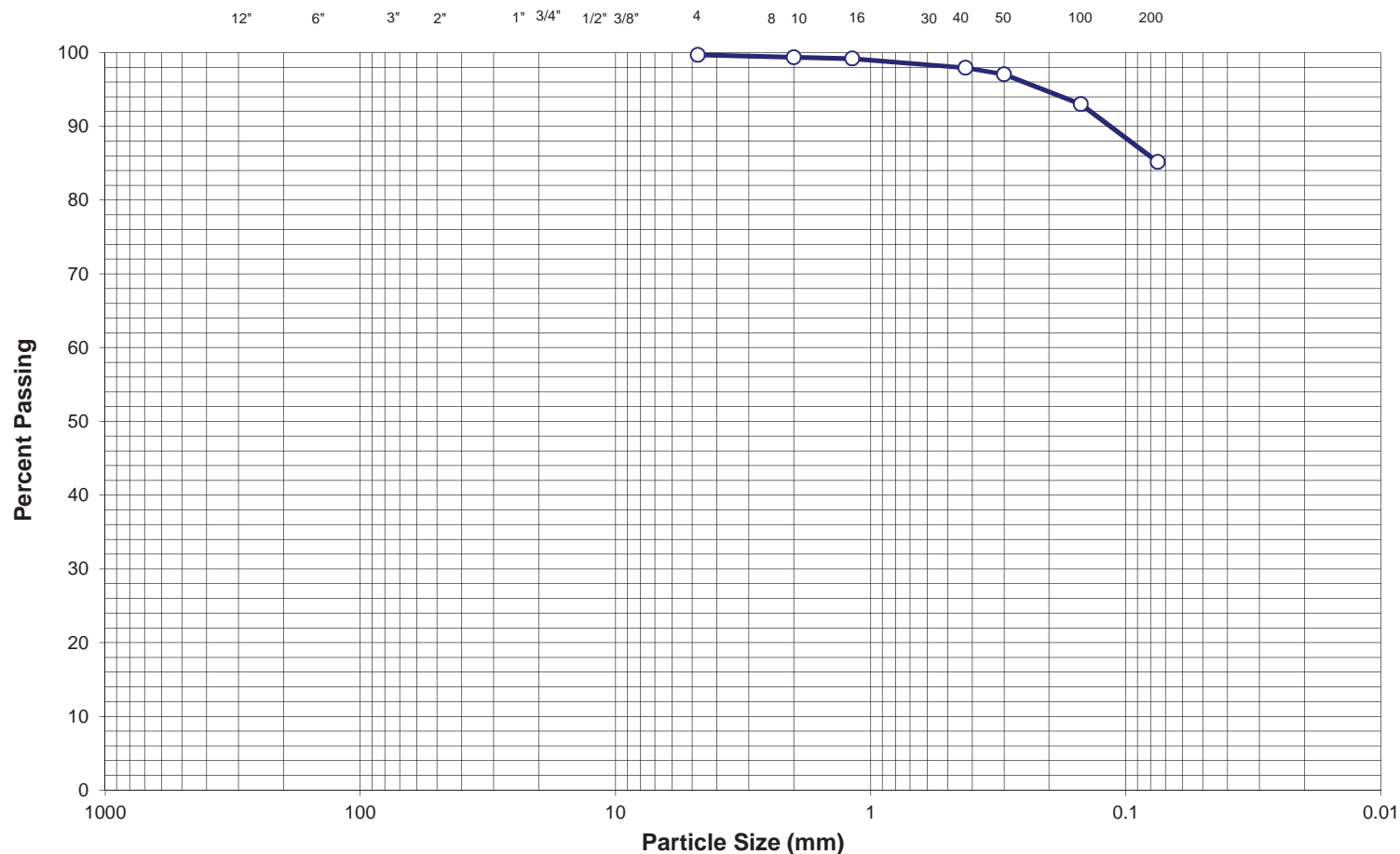
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	100
#40	94
#200	74.4

Gravel (%)	0	LL	33	Project Name:	US 550 S / US 160 Connector		
Sand (%)	26	PL	15	Boring:	WE-02		
Fines (%)	74	PI	18	Sample Depth (ft):	9-14		
Sample Classification:	Medium plasticity CLAY w/ sand, brown		USCS: CL	AASHTO: A-6 (11)		<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>	
SIEVE ANALYSIS							
				Drawn By:	KM	Project No.:	217-376
				Checked By:	BB	Figure No.:	-
				Date:	05/03/18		

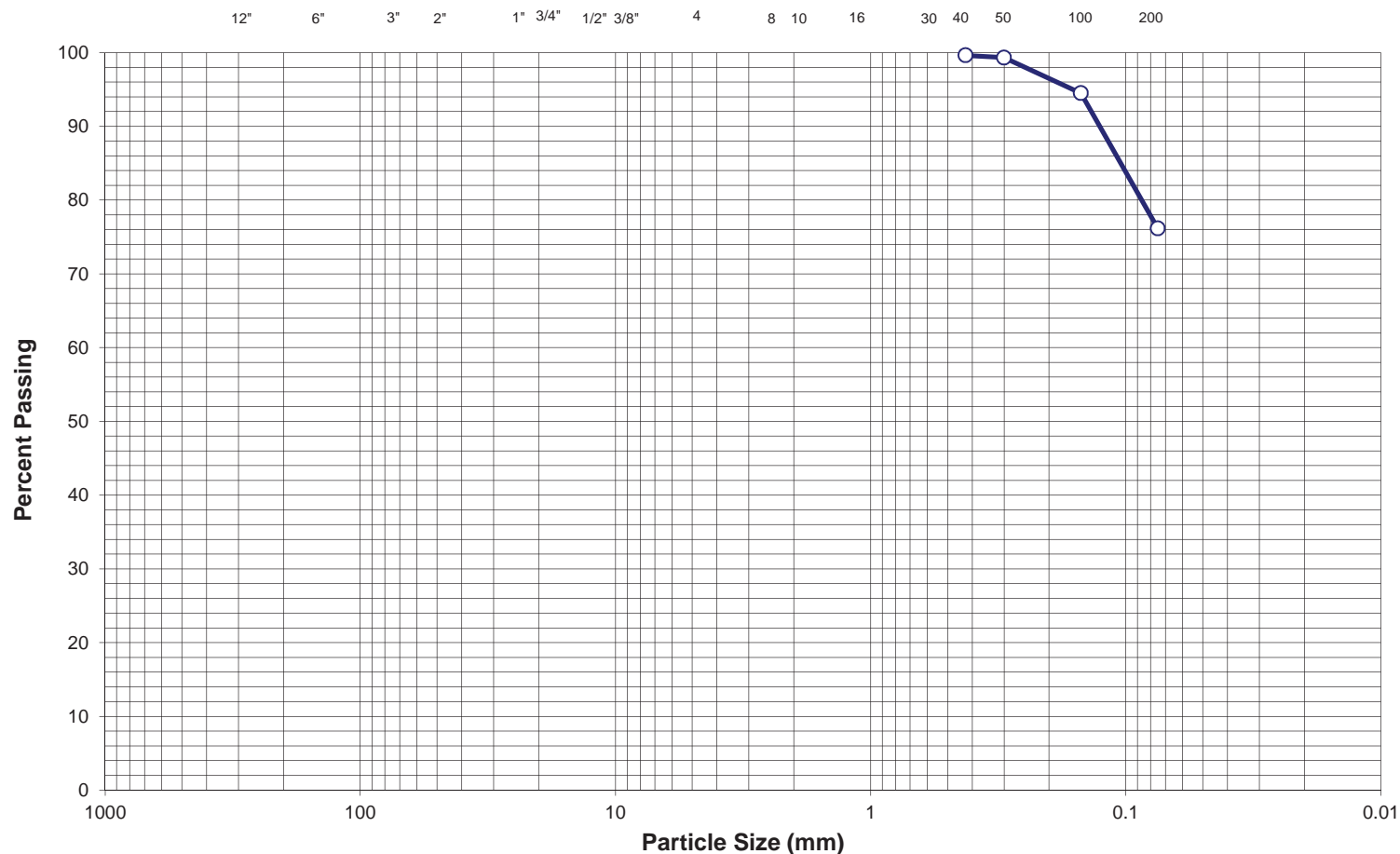
Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm




Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	99
#40	98
#200	85.2

Gravel (%)	0	LL	50	Project Name:	US 550 S / US 160 Connector		
Sand (%)	15	PL	12	Boring:	WF-01		
Fines (%)	85	PI	38	Sample Depth (ft):	8-13		
Sample Classification:	High plasticity CLAY, trace sand		USCS: CH	AASHTO: A-7-6 (32)		<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>	
SIEVE ANALYSIS							
				Drawn By:	KM	Project No.:	217-376
				Checked By:	BB	Figure No.:	-
				Date:	05/04/18		

Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm



Sieve Size	% Passing
3"	-
2 1/2"	-
2"	-
1 1/2"	-
1"	-
3/4 "	-
1/2"	-
3/8"	-
#4	100
#10	-
#40	100
#200	76.2

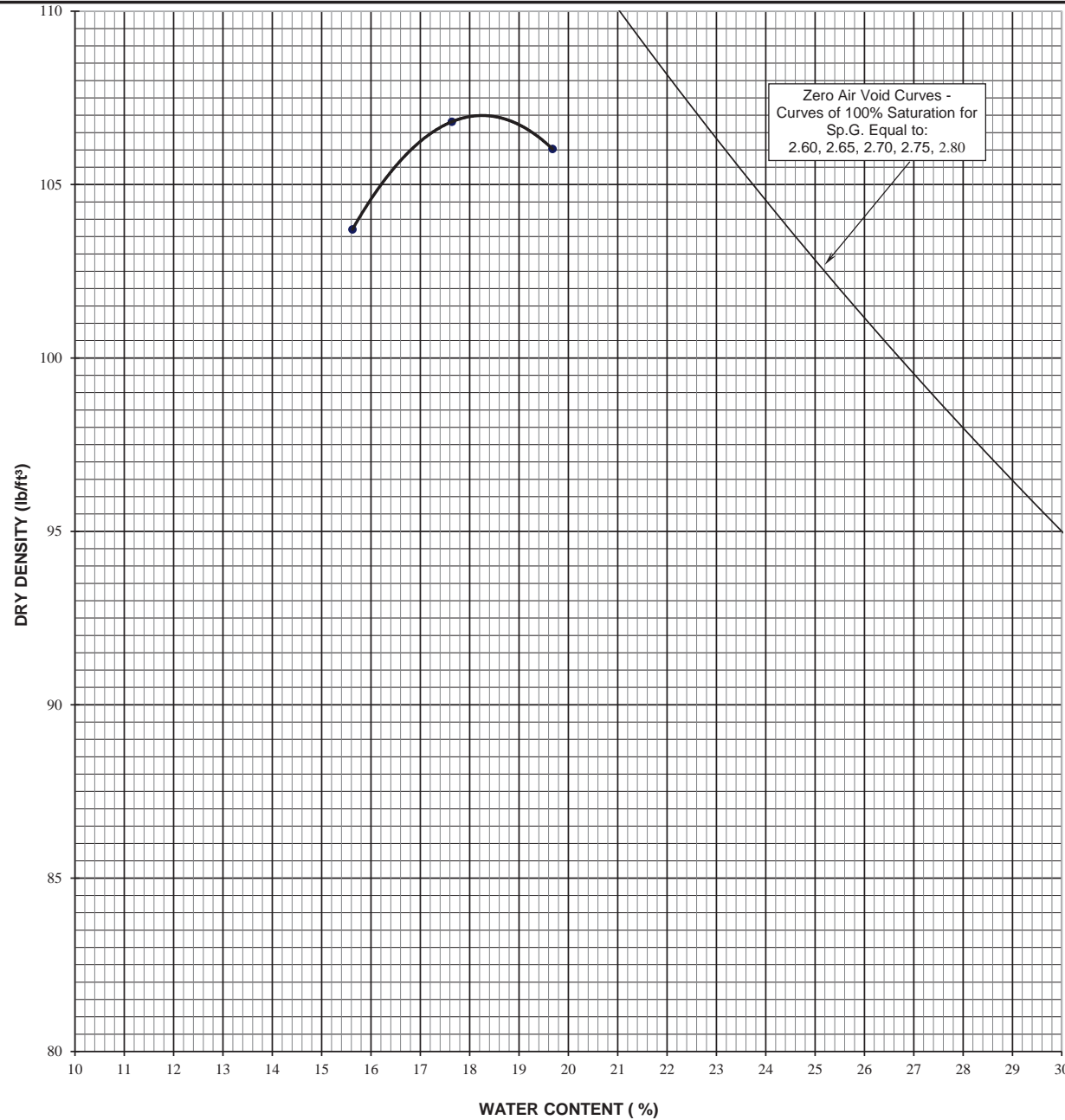
Gravel (%)	0	LL	31	Project Name:	US 550 S / US 160 Connector		
Sand (%)	24	PL	23	Boring:	WF-02		
Fines (%)	76	PI	8	Sample Depth (ft):	8		
Sample Classification:	SILT with some sand		USCS: ML	AASHTO: A-4 (5)		<div><div></div><div><div>Yeh & Associates, Inc.</div><div>Geotechnical Engineering Consultants</div></div></div>	
SIEVE ANALYSIS							
				Drawn By:	KM	Project No.:	217-376
				Checked By:	BB	Figure No.:	-
				Date:	05/04/18		

MOISTURE - DENSITY RELATIONSHIP



Yeh & Associates, Inc.
Geotechnical Engineering Consultants

Project No:	217-376	
Job name:	US 550 S/US 160 Connector	
Maximum Dry Density (pcf):	107.0	
Optimum Moisture Content(%):	18.4	
Sampled by:	Eric Pickerill	
Boring #:	WB-09	
Depth :	14.5-24.5	
Soil Description:	Lean CLAY, rust	
USCS Group Name:	CL	
AASHTO Group Symbol:	A-6	
AASHTO Group Index:	11	
Specific Gravity	n/a	
Atterberg (ASTM D - 4318)		
LL:	34	
PL:	20	
PI:	14	
Gradation (ASTM D-422, D-136)		
#4	100	
#10	99	
#40	97	
#200	85.8	
AASHTO Designation:	T99	
Method:	A	
Preparation Method:	Wet	
Mold Size:	4"	
Hammer Type:	Manual	
Sampled By:	E. Pickerill	
Date sampled:	12/19/17	
Tested By:	K. Moran	
Date:	01/26/17	
Reviewed By:	A. Hotchkiss	
Date:	01/26/17	





ADVANCED TERRA TESTING

Image Attachment

CLIENT Yeh & Associates
JOB NO. 2546-97
PROJECT ES US 550 S. / 160 Contractor
PROJECT NO. 217-376
LOCATION --

BORING NO. WB-2
DEPTH 67.2-67.7
SAMPLE NO.
DATE SAMPLED
DESCRIPTION



NOTES

File name: 2546_97_Image_18_03_23_07_57_52

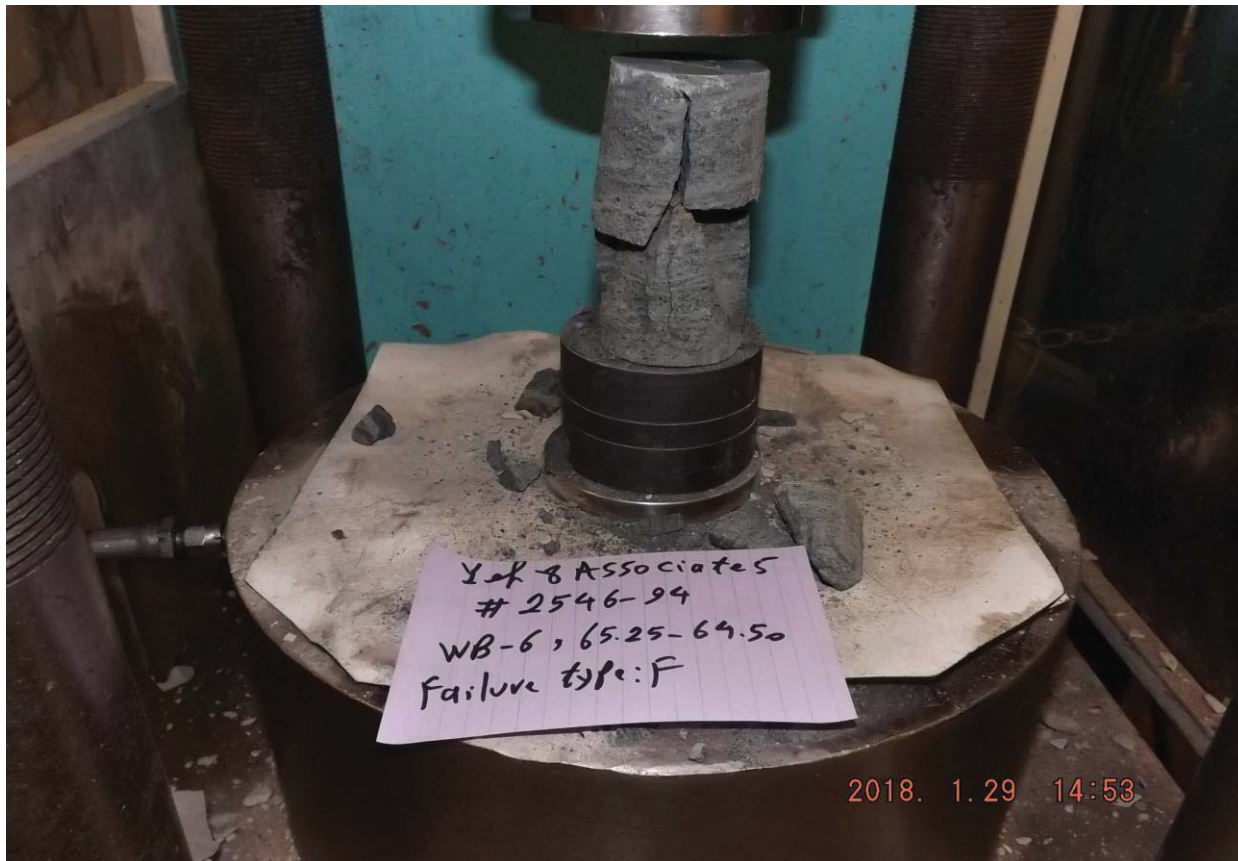


ADVANCED TERRA TESTING

Image Attachment

CLIENT Yeh & Associates
JOB NO. 2546-94
PROJECT ES US 550 South Connection to US 160
PROJECT NO. 217-376
LOCATION --

BORING NO. WB-6
DEPTH 65.25-64.50
SAMPLE NO.
DATE SAMPLED
DESCRIPTION



NOTES

File name: 2546_94_Image_18_01_29_15_30_53



ADVANCED TERRA TESTING

Image Attachment

WB-7

CLIENT Yeh & Associates
JOB NO. 2546-97
PROJECT ES US 550 S. / 160 Contractor
PROJECT NO. 217-376
LOCATION --

BORING NO. WB-2
DEPTH 64.7-65.2
SAMPLE NO.
DATE SAMPLED
DESCRIPTION



NOTES

File name: 2546_97_Image_18_03_23_07_59_14

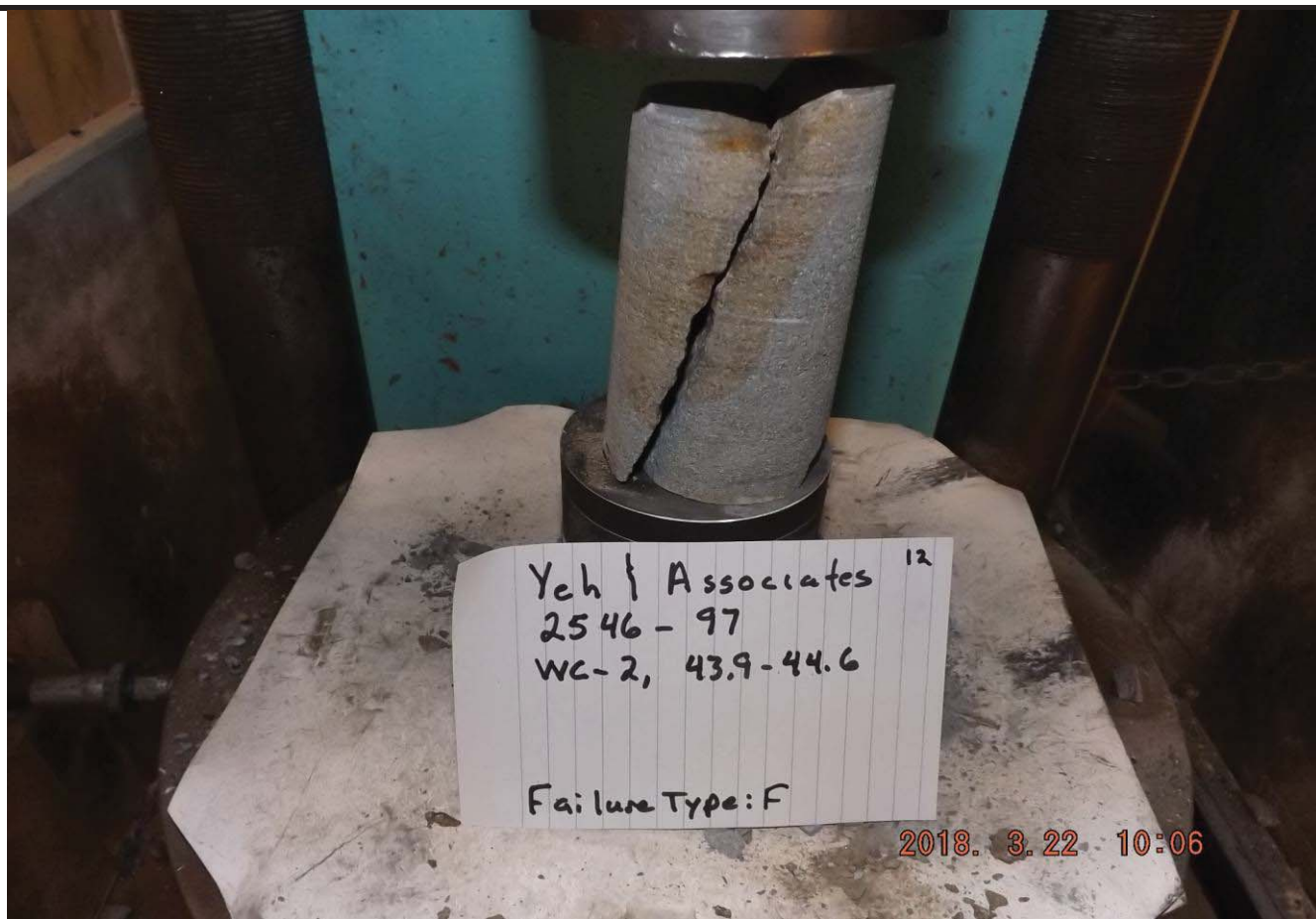


ADVANCED TERRA TESTING

Image Attachment

CLIENT Yeh & Associates
JOB NO. 2546-97
PROJECT ES US 550 S. / 160 Contractor
PROJECT NO. 217-376
LOCATION --

BORING NO. WC-2
DEPTH 43.9-44.6
SAMPLE NO.
DATE SAMPLED
DESCRIPTION



NOTES

File name: 2546_97_Image_18_03_23_08_00_14

Appendix E.5 – Test Pits 1, 2 and 3 - Laboratory Test Results



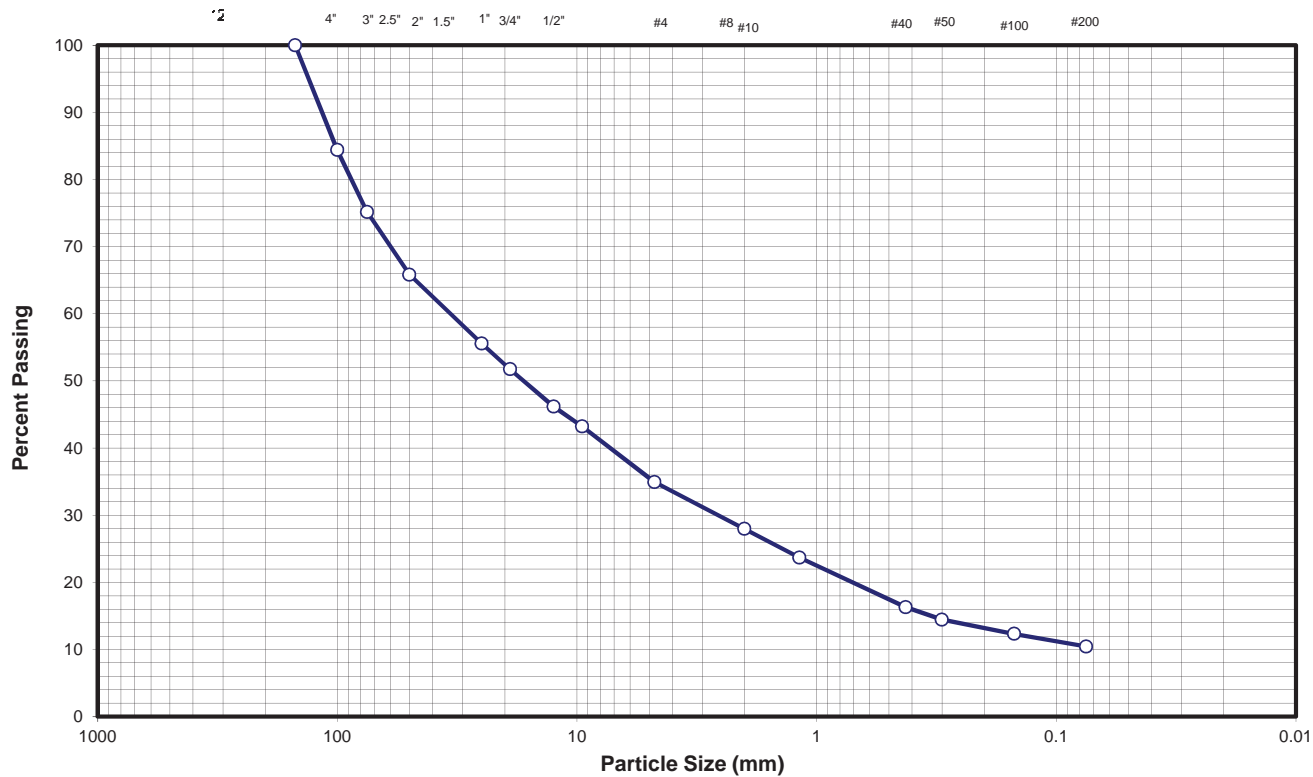
YEH & ASSOCIATES, INC

Summary of Laboratory Test Results

Project No: 217-376 Project Name: 22420: US 550 S Connection to US 160 Test Pits 1,2 and 3 Laboratory Test Results Date: 7/10/2018

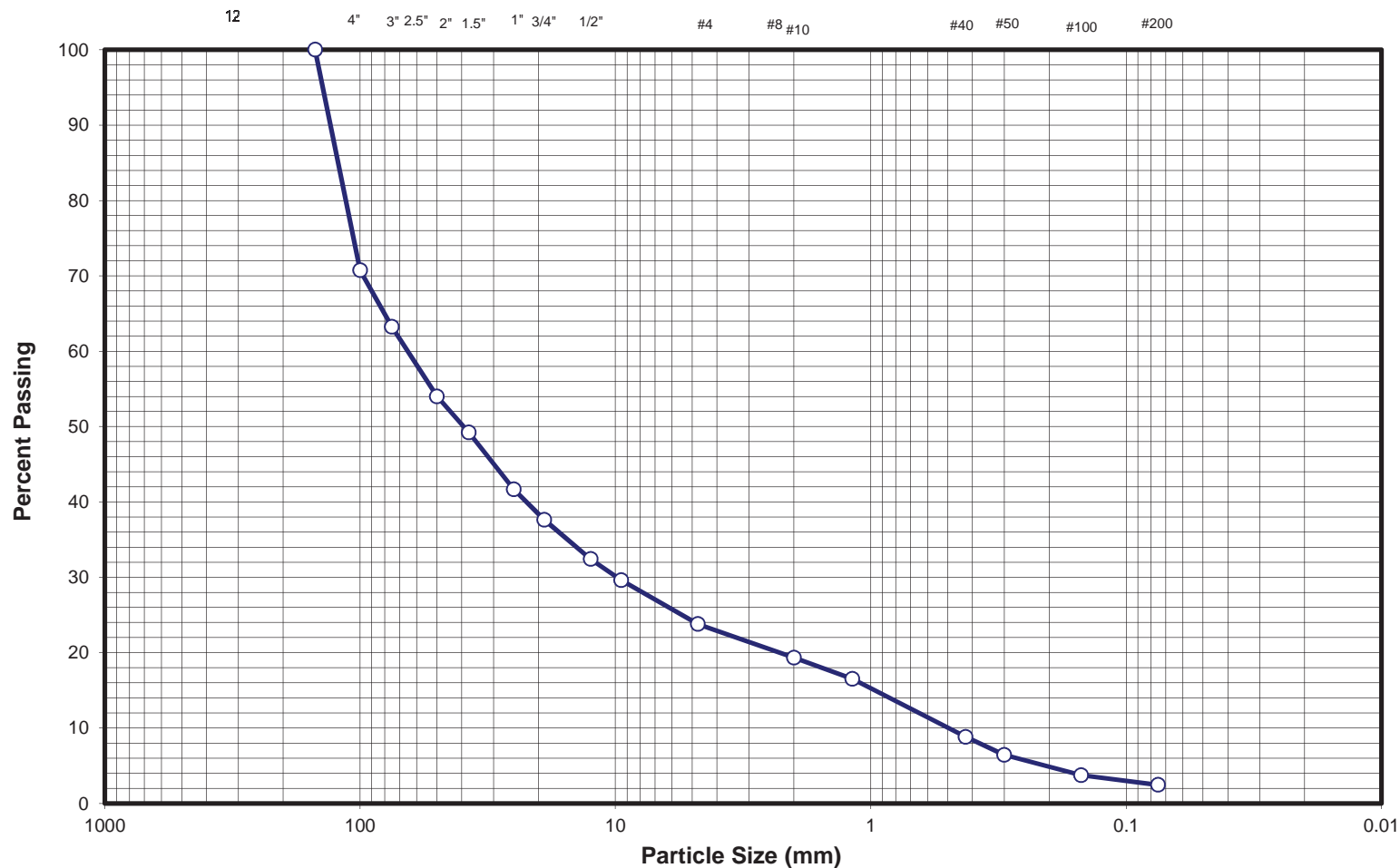
Sample Location			Natural Moisture Content (%)	Natural Dry Density (pcf)	AASHTO T99		Gradation			Atterberg			pH	Water Soluble Sulfate (%)	Chloride (%)	% Swell (+) / Consoli- dation (-)	Resistivity (Ohm-cm)	Uncon- Comp strength (rock-psi)	Uncon- Comp strength (soil-psf)	CLASSIFICATION	
Boring	Sample Type	Depth (ft)			Max. Dry Density (pcf)	Optimum Moisture (%)	Gravel > #4 (%)	Sand (%)	Fines < #200 (%)	LL	PL	PI								AASHTO	USCS
Pit #1	bulk	0-8	3.6				65	25	10	27	21	6								A-1-a (0)	GP
Pit #2	bulk	0-8	1.3				76	21	2	NV	NP	NP								A-1-a (0)	GP
Pit #3	bulk	0-6	3.3				61	21	18	29	17	12								A-1-b ((0))	GM

bulk - indicates drill cuttings sample
MC - indicates Modified California sample
CORE - indicates rock core sample
SS - indicates Split Spoon sample
NV - indicates no value
NP - indicates no plasticity



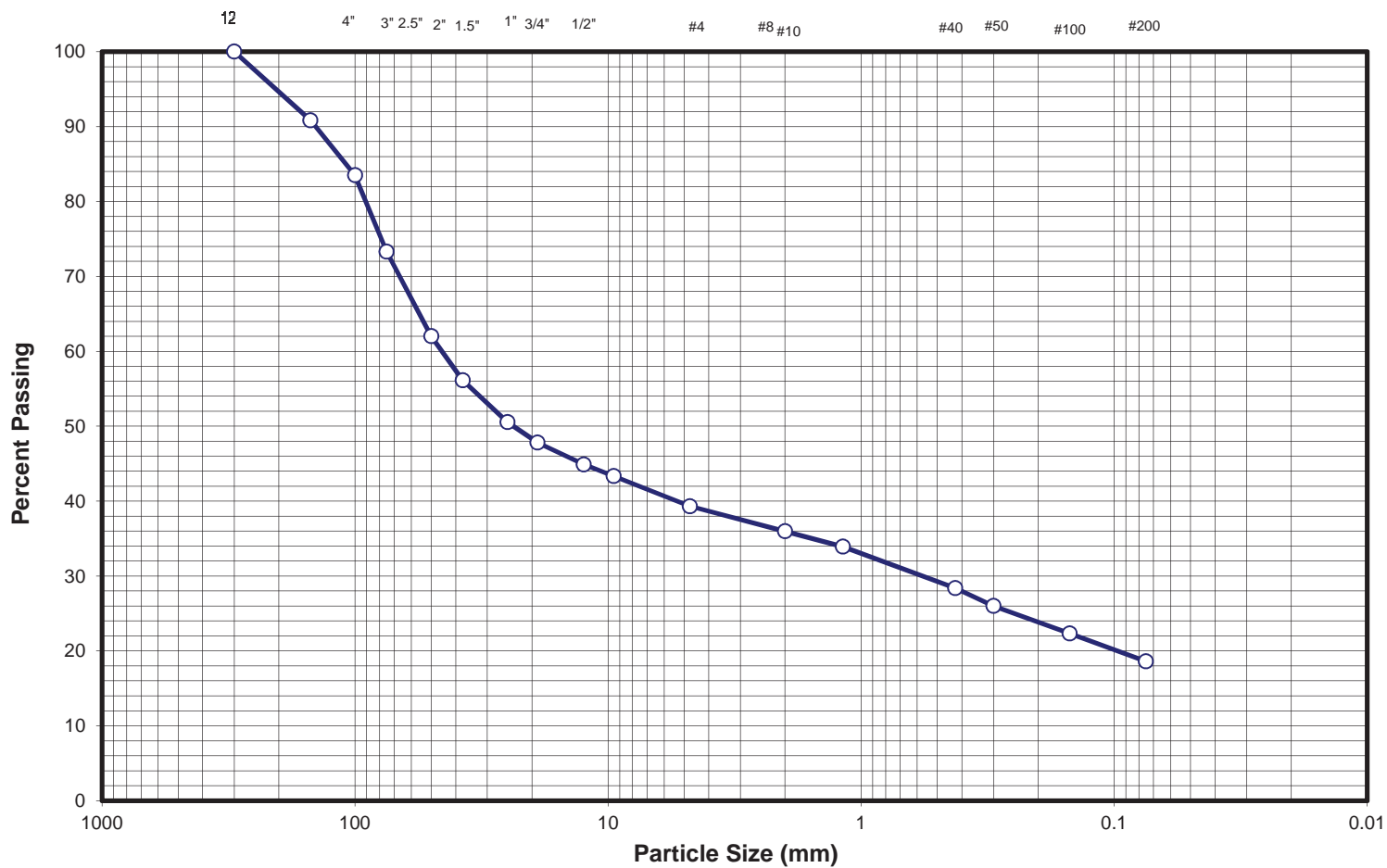
Sieve Size	% Passing
6"	100
4"	84
3"	75
2"	66
1"	56
3/4"	52
1/2"	46
3/8"	43
#4	35
#10	28
#40	16
#200	10

Gravel (%)	65	LL	27	Project Name:	US 550/160 South Connector			Yeh & Associates, Inc. Geotechnical Engineering Consultants		
Sand (%)	25	PL	21	Sample ID:	Pit #1					
Fines (%)	10	PI	6	Sample Depth (ft.):				SIEVE ANALYSIS		
Sample Description:	Poorly graded GRAVEL w/ sand	USCS:		AASHTO: A-1-a (0)			Drawn By:	KM	Project No.:	217-376
		GP					Checked By:	BB		
							Date:	03/07/18	Figure No.:	-



Sieve Size	% Passing
6"	100
4"	71
3"	63
2"	54
1"	42
3/4 "	38
1/2"	32
3/8"	30
#4	24
#10	19
#40	9
#200	2.5

Gravel (%)	76	LL	NV	Project Name:	US 550/160 South Connector	Yeh & Associates, Inc.			
Sand (%)	21	PL	NP	Sample ID:	Pit #2	Geotechnical Engineering Consultants			
Fines (%)	3	PI	NP	Sample Depth (ft.):		SIEVE ANALYSIS			
Sample Description:	Poorly graded GRAVEL w/ sand	USCS:		AASHTO: A-1-a (0)		Drawn By:	KM	Project No.:	217-376
		GP				Checked By:	BB	Figure No.:	-
							Date:	03/07/18	



Sieve Size	% Passing
6"	100
4"	83
3"	73
2"	62
1"	51
3/4 "	48
1/2"	45
3/8"	43
#4	39
#10	36
#40	28
#200	18.6

Gravel (%)	61	LL	29	Project Name:	US 550/160 South Connector			<div>Yeh & Associates, Inc.</div> <div>Geotechnical Engineering Consultants</div>		
Sand (%)	21	PL	17	Sample ID:	Pit #3					
Fines (%)	19	PI	12	Sample Depth (ft.):	0-8'			SIEVE ANALYSIS		
Sample Description:	Silty GRAVEL w/ sand; some bedrock		USCS: GM	AASHTO: A-1-b (0)			Drawn By:	KM	Project No.:	217-376
							Checked By:	BB		
							Date:	03/07/18	Figure No.:	-

Appendix E.6 – Outside Laboratory Test Results

Core Worksheet

Project: Yeh Misc. 2018, US 550 S./US 160 Connector

Project No. 55166MT

Technician: G. Jadrych

Lab No. 5739- A,B,C

Field Test Results

Core Location:

Sample #A 217 - 376 B24 @ 14.'6 to 15'.0
Sample #B 217 - 376 B21 @ 25.'5 to 26'.0
Sample #3 217 - 376 B21 @ 51.'5 to 52'.3
Sample #4 217 - 376 B24 @ 8.'0 to 8'.5 (Not Tested)

ASTM D7012 - 14

Unit Designation	A	B	C	D
Date tested	6/18/18	6/18/18	6/18/18	
Diameter (in.)	2.39	2.36	2.36	
Area (sq. in.)	4.52	4.36	4.36	
Length (in.)	4.69	4.75	4.82	
Length Capped (in.)	4.84	4.86	4.83	
Weight (lbs.)	1.82	1.79	1.84	
Volume (ft ³)	0.01227	0.01198	0.01216	
Unit Weight (pcf)	148.3	149.4	151.3	
Total Load (lbs.)	25,340	9,730	12,010	
Calculated Strength (psi)	5,400	2,230	2,750	
L/D Ratio	1.96	2.01	2.04	
Correction Factor	N/A	N/A	N/A	
Corrected Strength (psi)				

Note: Core Samples submitted by K. Moran

**UNCONFINED COMPRESSIVE STRENGTH
ASTM D7012, Method C (previously ASTM D2938)**

CLIENT: Yeh & Associates

JOB NO: 2546-97

PROJECT NO.: 217-376

DATE TESTED: 3/20/2018

PROJECT: ES US 550 S. / 160 Connector

TECHNICIAN: BKL

LOCATION:

Specimen ID Boring, Depth (ft), Geologic Unit	Diameter (in)	Length (in)	Mass (gm)	Wet Density (pcf)	Failure Load (lb)	Failure Type *	Compressive Strength (psi)
E-2, 59.5-59.9	2.387	5.023	855.5	145.0	13,871	S/F	3,100
E-2, 70.9-71.4	2.392	5.478	949.6	147.0	6,859	F	1,526
E-2, 91.0-91.5	2.382	5.064	911.2	153.8	14,696	F	3,298
E-2, 106.3-106.7	2.397	5.562	981.3	148.9	15,309	F/S	3,392
E-2, 128.0-128.3	2.397	5.133	894.8	147.2	10,953	F	2,427
E-2, 143.0-143.7	2.392	5.105	936.9	155.6	31,553	F/S	7,021
E-7, 47.0-47.4	2.384	5.107	853.5	142.6	5,790	F	1,297
E-7, 84.5-85.0	2.390	5.374	922.7	145.8	5,034	F	1,122
E-7, 98.7-99.2	2.375	5.567	942.6	145.6	6,815	F	1,538
WB-2, 67.2-67.7	2.374	5.498	872.5	136.6	1,165	F	263
WB-7, 64.7-65.2	2.355	5.086	839.9	144.4	16,240	F	3,728
WC-2, 43.9-44.6	2.389	4.929	927.9	160.0	32,384	F	7,224
B1-8, 27.0	2.367	5.034	885.5	152.3	12,509	F	2,843
B1-8, 56.0	2.387	4.992	894.8	152.6	24,596	F	5,496
B1-1, 92.0	1.752	3.720	377.7	160.4	24,021	S/F	9,964
B1-9, 18.0	2.374	4.988	886.3	152.9	5,221	F	1,180
B1-10, 11.0	2.384	5.018	907.3	154.3	17,440	F	3,907
B1-12, 21.0	2.371	4.667	809.3	149.6	4,740	F	1,072 **
B1-12, 40.0	2.380	5.039	872.0	148.2	6,253	F	1,405

Notes and Comments:

* Failure type = S: Shear Failure, M: Matrix Failure, F: Fracture/Bedding Failure, V: Void Failure, C: Combination

** Regardless of ASTM D7012 method D, any short sample with L/D < 2.0 was tested and a correction factor was applied to the $C = Ca / [0.88 + 0.24b/h]$
 Ca = Failure Load/surface Area
 b = Sample Diameter
 h = Sample Length

Data Entered By: BKL

Date: 3/22/2018

Data Checked By: HN

Date: 3/27/2018

Filename: 2546_97_UCS ASTM D7012 Method C-R0_0.xls



ADVANCED TERRA TESTING

**Moisture and Density
ASTM D 2216 and ASTM D 7263**

CLIENT	Yeh & Associates	JOB NO.	2546-97	
PROJECT	ES US 550 S. / 160 Connector	PAGE:	1 of 3	
PROJECT NO.	217-376			

BORING NO.	E-2	E-2	E-2	E-2
DEPTH	59.5-59.9	70.9-71.4	91.0-91.5	106.3-106.7
SAMPLE NO.				
DATE SAMPLED				
DATE TESTED	03/20/18	03/16/18	03/16/18	03/20/18
TECHNICIAN	BKL	BKL	BKL	BKL
DESCRIPTION				

Mass of Wet Pan and Soil (g):	147.16	44.76	141.62	118.63
Mass of Dry Pan and Soil (g):	141.83	42.24	133.31	114.60
Mass of Pan (g):	3.12	3.14	3.13	3.14
Moisture (%):	3.8	6.4	6.4	3.6
Diameter (in):	2.387	2.392	2.382	2.397
Height (in):	5.023	5.478	5.064	5.562
Mass of Wet Soil and Ring (g):	855.5	949.6	911.2	981.3
Mass of Ring (g):	0.00	0.00	0.00	0.00
Wet Density (lbs/ft³):	145.0	147.0	153.8	148.9
Dry Density (lbs/ft³):	139.6	138.1	144.6	143.7
Wet Density (kg/m³):	2323	2354	2464	2386
Dry Density (kg/m³):	2237	2211	2316	2303

BORING NO.	E-2	E-2	E-7	E-7
DEPTH	128.0-128.3	143.0-143.7	47.0-47.4	84.5-85.0
SAMPLE NO.				
DATE SAMPLED				
DATE TESTED	03/20/18	03/16/18	03/20/18	03/20/18
TECHNICIAN	BKL	BKL	BKL	BKL
DESCRIPTION				

Mass of Wet Pan and Soil (g):	128.04	218.58	148.04	112.63
Mass of Dry Pan and Soil (g):	123.32	209.56	140.34	105.75
Mass of Pan (g):	3.11	3.11	3.14	3.11
Moisture (%):	3.9	4.4	5.6	6.7
Diameter (in):	2.397	2.392	2.384	2.390
Height (in):	5.133	5.105	5.107	5.374
Mass of Wet Soil and Ring (g):	894.8	936.9	853.5	922.7
Mass of Ring (g):	0.00	0.00	0.00	0.00
Wet Density (lbs/ft³):	147.2	155.6	142.6	145.8
Dry Density (lbs/ft³):	141.6	149.1	135.1	136.6
Wet Density (kg/m³):	2357	2492	2285	2335
Dry Density (kg/m³):	2268	2388	2163	2189

NOTES				
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Data entry by:	BKL	Date:	3/16-22/2018	
Checked by:	<u>Hu</u>	Date:	<u>3/27/2018</u>	
File name:	2546_97_Moisture and Density ASTM D7236_0.xls			



Moisture and Density ASTM D 2216 and ASTM D 7263

ADVANCED TERRA TESTING

CLIENT	Yeh & Associates		JOB NO.	2546-97
PROJECT	ES US 550 S. / 160 Connector		PAGE :	2 of 3
PROJECT NO.	217-376			

BORING NO.	E-7	WB-2	WB-7	WC-2
DEPTH	98.7-99.2	67.2-67.7	64.7-65.2	43.9-44.6
SAMPLE NO.				
DATE SAMPLED				
DATE TESTED	03/19/18	03/19/18	03/19/18	03/16/18
TECHNICIAN	MLW	MLW	MLW	BKL
DESCRIPTION				

Mass of Wet Pan and Soil (g):	116.09	104.02	187.10	218.59
Mass of Dry Pan and Soil (g):	110.74	100.75	180.84	217.59
Mass of Pan (g):	3.14	3.16	3.15	3.12
Moisture (%):	5.0	3.4	3.5	0.5
Diameter (in):	2.375	2.374	2.355	2.389
Height (in):	5.567	5.498	5.086	4.929
Mass of Wet Soil and Ring (g):	942.6	872.5	839.9	927.9
Mass of Ring (g):	0.00	0.00	0.00	0.00
Wet Density (lbs/ft³):	145.6	136.6	144.4	160.0
Dry Density (lbs/ft³):	138.7	132.2	139.5	159.3
Wet Density (kg/m³):	2332	2188	2314	2563
Dry Density (kg/m³):	2222	2117	2235	2551

BORING NO.	B1-8	B1-8	B1-1	B1-9
DEPTH	27.0	56.0	92.0	18.0
SAMPLE NO.				
DATE SAMPLED				
DATE TESTED	03/16/18	03/16/18	03/16/18	03/16/18
TECHNICIAN	BKL	BKL	BKL	BKL
DESCRIPTION				

Mass of Wet Pan and Soil (g):	97.94	95.68	105.71	207.55
Mass of Dry Pan and Soil (g):	90.89	90.07	101.06	191.47
Mass of Pan (g):	3.15	3.11	3.14	3.14
Moisture (%):	8.0	6.5	4.7	8.5
Diameter (in):	2.367	2.387	1.752	2.374
Height (in):	5.034	4.992	3.720	4.988
Mass of Wet Soil and Ring (g):	885.5	894.8	377.7	886.3
Mass of Ring (g):	0.00	0.00	0.00	0.00
Wet Density (lbs/ft³):	152.3	152.6	160.4	152.9
Dry Density (lbs/ft³):	141.0	143.3	153.2	140.9
Wet Density (kg/m³):	2439	2444	2570	2450
Dry Density (kg/m³):	2258	2296	2454	2257

NOTES	
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Data entry by:	BKL	Date:	3/16-22/2018
Checked by:	<u>HN</u>	Date:	<u>3/22/2018</u>
File name:	2546_97_Moisture and Density ASTM D7236_1.xls		



ADVANCED TERRA TESTING

Moisture and Density
ASTM D 2216 and ASTM D 7263

CLIENT	Yeh & Associates	JOB NO.	2546-97
PROJECT	ES US 550 S. / 160 Connector	PAGE	3 of 3
PROJECT NO.	217-376		

BORING NO.	B1-10	B1-12	B1-12
DEPTH	11.0	21.0	40.0
SAMPLE NO.			
DATE SAMPLED			
DATE TESTED	03/16/18	03/16/18	03/16/18
TECHNICIAN	BKL	BKL	BKL
DESCRIPTION			

Mass of Wet Pan and Soil (g):	114.03	95.71	115.69
Mass of Dry Pan and Soil (g):	107.82	88.44	107.57
Mass of Pan (g):	3.16	3.12	3.13
Moisture (%):	5.9	8.5	7.8
Diameter (in):	2.384	2.371	2.380
Height (in):	5.018	4.667	5.039
Mass of Wet Soil and Ring (g):	907.3	809.3	872.0
Mass of Ring (g):			
Wet Density (lbs/ft³):	154.3	149.6	148.2
Dry Density (lbs/ft³):	145.7	137.9	137.5
Wet Density (kg/m³):	2472	2397	2374
Dry Density (kg/m³):	2333	2209	2202

BORING NO.			
DEPTH			
SAMPLE NO.			
DATE SAMPLED			
DATE TESTED			
TECHNICIAN			
DESCRIPTION			

Mass of Wet Pan and Soil (g):			
Mass of Dry Pan and Soil (g):			
Mass of Pan (g):			
Moisture (%):			
Diameter (in):			
Height (in):			
Mass of Wet Soil and Ring (g):			
Mass of Ring (g):			
Wet Density (lbs/ft³):			
Dry Density (lbs/ft³):			
Wet Density (kg/m³):			
Dry Density (kg/m³):			

NOTES	
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Data entry by: BKL	Date: 3/16/2018
Checked by: <u> <i>JK</i> </u>	Date: <u> 3/27/2018 </u>
File name: 2546_97_Moisture and Density ASTM D7236_2.xls	

IRREGULAR LUMP POINT LOAD TEST
ASTM D 5731

CLIENT: Yeh & Associates
LOCATION: ES US 550 S. / 160 Connector
PROJECT: 217-376

JOB NO.: 2546-97
DATE TESTED: 3/27/18 BL

Specimen ID	Width (in.)	Diameter (in.)	De ² (in ²)	Gauge Failure Load (psig)	P (lb)	Is	F	Is(50)	C	Compressive Strength (psi)	Loading with respect to Fracture/Bedding	Failure Mode
1	2.718	0.928	3.211	1841	3810.9	1186.6	1.0	1129.4	18.0	20,370	Parallel	S
2	3.697	1.361	6.406	4961	10269.3	1603.0	1.1	1782.2	20.1	35,760	Perpendicular	S
3	3.425	1.676	7.309	3816	7899.1	1080.8	1.1	1237.8	21.5	26,670	Perpendicular	C
4	2.561	1.224	3.991	1821	3769.5	944.5	1.0	944.0	19.4	18,340	Perpendicular	C
5	2.072	1.610	4.247	2504	5183.3	1220.3	1.0	1236.9	21.2	26,270	N/A	S
6	2.941	1.711	6.407	1324	2740.7	427.8	1.1	475.6	21.7	10,330	Perpendicular	C
7	2.170	1.347	3.722	793	1641.5	441.1	1.0	434.0	20.0	8,680	Parallel	C
8	3.386	1.664	7.174	4100	8487.0	1183.1	1.1	1349.2	21.5	28,990	N/A	S
9	3.570	1.926	8.755	4575	9470.3	1081.7	1.2	1290.2	22.7	29,310	N/A	S
10	4.161	1.968	10.426	1284	2657.9	254.9	1.2	316.2	22.9	7,250	Perpendicular	C

Notes: W: Shortest distance perpendicular to loading direction
D: Sample Thickness between platens
De²: Equivalent Diameter = $4 \cdot L \cdot D / \pi$
Piston Area (in²): 2.07
P: Gauge Failure Load * Piston area (in²)
Is: Point Load Index Strength = P / De^2
F: Size Correction Factor to 2.0 in = $(De / 2.0)^{0.45}$
Is(50): Size Corrected Index Strength = $F \cdot Is$
C: Factor to Estimate Compressive Strength related to Core Diameter
Compressive Strength in psi = $C \cdot Is(50)$

Failure Modes:
F: Fracture/Bedding Controlled
S: Substance Controlled
C: Combination Substance & Fracture

Data Entered By: BKL Date: 03/27/2018
Data Checked By: HV Date: 3/27/2018
Filename: YHPI97P1



COLORADO DEPARTMENT OF TRANSPORTATION
PRELIMINARY SOIL SURVEY

Note 1: If samples are submitted leave sieve analysis section blank.
 Note 3: Sulfate content expressed as percent (dry soil), or ppm in water.
 Note 2: Comments should be placed in the description column of the form.
 Note 4: R-values referenced are noted 'Survey by Group Class' portion of this report.

Form #157 No.	Form #554 No.	Date:
	N/A	02/02/18
Project No.		
Project location	US 160-550 S Connection	
Project code (SA#)	19378	

STATION AND LOG	TEST NO.	DESCRIPTION	SULFATE CONTENT (SO ₄)	R-VAL REF	Per CP 24, Section 4						LIQUID LIMIT	PLASTIC INDEX	CLASSIFICATION AND GROUP INDEX	MOIST. %	
					3/4"	3/8"	#4	#10	#40	#200					
Boring location R1															
4-9'	R1	Light Grey/Brown Clay (Sample) (MURPHYP1821135741)		10		100	99	98	94	81	44	27	A-7-6 (21)	3.7	
Boring location R2															
4-9'	R2	Dark Tan Clay (Sample) (MURPHYP1821140335)		*		100	99	99	97	82	38	23	A-6 (18)	4.1	
		* Sample untestable, to be resampled													
Boring location R3															
4-9'	R3	Dark Grey/Brown Clay (Sample) (MURPHYP1821140554)		*		100	99	99	96	78	43	27	A-7-6 (20)	3.5	
		* Sample untestable, to be resampled													
Boring location R4															
14-19'	R4	Similar to R2													
Boring location R5															
4-9'	R5	Light Red Clay (Sample) (MURPHYP1821140717)		22	98	97	97	96	95	88	34	26	A-6 (21)	4.3	
Boring location R6															
9-14'	R6	Similar to R5													
Boring location R7															
5-13'	R7	Light Red Sandy Clay (Sample) (MURPHYP17CB075332)		11				100	97	77	41	23	A-7-6 (17)	6.8	
		(Resampled, See ensuing 555)													
Boring location R8															
10-15'	R8a	Tan Sandy/Rocky Clay (Sample)(MURPHYP17CB080726)		*			100	99	99	90	40	24	A-6 (22)	2.4	
15-20'	R8b	Tan Sandy Clay (Sample)(MURPHYP17CB081624)		18		100	99	99	97	79	32	16	A-4 (0)	2.9	
		(Resampled, See ensuing 555) *Sample Untestable													
Boring location R9															
9-19'	R9	Light Tan Fine Clay (Sample - combine 2)(MURPHYP17CB081948)		22	100	99	99	97	91	57	27	11	A-6 (3)	2.8	
		(Resampled, See ensuing 555)													
Boring location R12 5-18'	R12	Rocky Cobbles w/Tan Clay (Sample) (MURPHYP1818104045)		18	78	57	41	37	32	25	39	23	A-2-6 (1)	4.7	
Boring location A2 10-25'	A2	Reddish Sandy/Rocky Clay (Sample) (MURPHYP1818104454)		28		100	97	91	72	48	24	6	A-4 (0)	3.2	

- ☐ Materials and Geotechnical
☐ Region Materials Engineer
☐ Resident Engineer

Appendix E.7 – Chloride Content - GAL Test Results



75 Suttle Street
Durango, CO 81303
970.247.4220 Phone
970.247.4227 Fax
www.greenanalytical.com

20 December 2017

Barney Bunker
Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango, CO 81303
RE: Soil: Cl

Enclosed are the results of analyses for samples received by the laboratory on 12/05/17 11:50.
If you need any further assistance, please feel free to contact me.

Sincerely,

A handwritten signature in black ink that reads 'Debbie Zufelt'.

Debbie Zufelt
Reports Manager

All accredited analytes contained in this report are denoted by an asterisk (*). For a complete list of accredited analytes please do not hesitate to contact us via any of the contact information contained in this report. All of our certifications can be viewed at <http://greenanalytical.com/certifications/>

Green Analytical Laboratories is NELAP accredited through the Texas Commission on Environmental Quality. Accreditation applies to drinking water and non-potable water matrices for trace metals and a variety of inorganic parameters. Green Analytical Laboratories is also accredited through the Colorado Department of Public Health and Environment and EPA region 8 for trace metals, Cyanide, Fluoride, Nitrate, and Nitrite in drinking water.

Our affiliate laboratory, Cardinal Laboratories, is also NELAP accredited through the Texas Commission on Environmental Quality for a variety of organic constituents in drinking water, non-potable water and solid matrices. Cardinal is also accredited for regulated VOCs, TTHM, and HAA-5 in drinking water through the Colorado Department of Public Health and Environment and EPA region 8.



Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango CO, 81303

Project: Soil: Cl
Project Name / Number: US 550/160, 217-376
Project Manager: Barney Bunker

Reported:
12/20/17 15:56

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
217-376 R10 @ 4'-9'	1712040-01	Solid	11/16/17 13:00	12/05/17 11:50
217-376 R9 @14'-19'	1712040-02	Solid	11/16/17 13:00	12/05/17 11:50
217-376 R7 @ 5'-10'	1712040-03	Solid	11/16/17 13:00	12/05/17 11:50
217-376 E-6 @ 14.5'-19.5'	1712040-04	Solid	11/20/17 13:00	12/05/17 11:50

Green Analytical Laboratories

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Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango CO, 81303

Project: Soil: CI
Project Name / Number: US 550/160, 217-376
Project Manager: Barney Bunker

Reported:
12/20/17 15:56

217-376 R10 @ 4'-9'**1712040-01 (Solid)**

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
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General Chemistry

% Dry Solids	94.9			%	1	12/12/17	EPA160.3/1684	H1	LLG
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Soluble (DI Water Extraction)

Chloride	<10.5	10.5	1.51	mg/kg dry	10	12/18/17	EPA300.0		JDA
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217-376 R9 @ 14'-19'**1712040-02 (Solid)**

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
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General Chemistry

% Dry Solids	95.7			%	1	12/12/17	EPA160.3/1684	H1	LLG
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Soluble (DI Water Extraction)

Chloride	64.7	10.4	1.50	mg/kg dry	10	12/18/17	EPA300.0		JDA
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217-376 R7 @ 5'-10'**1712040-03 (Solid)**

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
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General Chemistry

% Dry Solids	90.0			%	1	12/12/17	EPA160.3/1684	H1	LLG
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Soluble (DI Water Extraction)

Chloride	53.4	11.1	1.59	mg/kg dry	10	12/18/17	EPA300.0		JDA
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217-376 E-6 @ 14.5'-19.5'**1712040-04 (Solid)**

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
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General Chemistry

% Dry Solids	98.5			%	1	12/12/17	EPA160.3/1684	H1	LLG
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Soluble (DI Water Extraction)

Chloride	19.6	10.1	1.45	mg/kg dry	10	12/18/17	EPA300.0		JDA
----------	------	------	------	-----------	----	----------	----------	--	-----

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dzufelt@greenanalytical.com p: 970.247.4220 f: 970.247.4227 75 Suttle Street Durango, CO 81303

www.GreenAnalytical.com

Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango CO, 81303

Project: Soil: Cl
Project Name / Number: US 550/160, 217-376
Project Manager: Barney Bunker

Reported:
12/20/17 15:56

General Chemistry - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B712076 - General Prep - Wet Chem

Duplicate (B712076-DUP1) Source: 1712040-01 Prepared: 12/11/17 Analyzed: 12/12/17

% Dry Solids	94.8		%		94.9			0.0538	20	
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Soluble (DI Water Extraction) - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B712123 - General Prep - Wet Chem

Blank (B712123-BLK1) Prepared: 12/15/17 Analyzed: 12/18/17

Chloride	ND	1.00	mg/kg wet							
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LCS (B712123-BS1) Prepared: 12/15/17 Analyzed: 12/18/17

Chloride	244	10.0	mg/kg wet	250		97.7	85-115			
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LCS Dup (B712123-BSD1) Prepared: 12/15/17 Analyzed: 12/18/17

Chloride	245	10.0	mg/kg wet	250		97.9	85-115	0.184	20	
----------	-----	------	-----------	-----	--	------	--------	-------	----	--

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Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango CO, 81303

Project: Soil: Cl
Project Name / Number: US 550/160, 217-376
Project Manager: Barney Bunker

Reported:
12/20/17 15:56

Notes and Definitions

H1 Sample was received several days after collected and subsequently analyzed past hold time.

DET Analyte DETECTED

ND Analyte NOT DETECTED at or above the reporting limit

NR Not Reported

dry Sample results reported on a dry weight basis
*Results reported on as received basis unless designated as dry.

RPD Relative Percent Difference

LCS Laboratory Control Sample (Blank Spike)

RL Report Limit

MDL Method Detection Limit

Green Analytical Laboratories

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(970) 247-4220
Fax: (970) 247-4227

service@greenanalytical.com or dzufelt@greenanalytical.com
75 Suttle St Durango, CO 81303

Company Name: <u>Yeh & Associates</u>				Bill to (if different):				ANALYSIS REQUEST										
Project Manager: <u>Barney Bunker</u>				P.O. #:														
Address: <u>570 Turner Dr. Ste D</u>				Company:														
City: <u>Durango</u> State: <u>CO</u> Zip: <u>81301</u>				Attn:														
Phone #: <u>970-382-9590</u> Email: <u>Bbunker@yeh-eng.com</u>				Address:														
Additional Report To:				City:														
Project Name: <u>US 550/160</u>				State: Zip:														
Project Number: <u>217-376</u>				Phone #:														
Sampler Name (Print): <u>B. Bunker</u>				Fax or Email:														
FOR LAB USE ONLY		Sample Name or Location		Collected		Matrix (check one)						# of containers						
Lab I.D. <u>1712-040-</u>				Date	Time	GROUNDWATER	SURFACEWATER	WASTEWATER	PRODUCEDWATER	SOIL	OTHER :	No preservation (general)	HNO ₃	HCl	H ₂ SO ₄	Other:	Other:	Other:
<u>217-376 01</u>	<u>R10 @ 4'-9'</u>	<u>11/16/17</u>	<u>13:00</u>					1			1							<u>chloride</u>
<u>217-376 02</u>	<u>R9 @ 14'-19'</u>	<u>11/16/17</u>	<u>13:00</u>					1			1							
<u>217-376 03</u>	<u>R7 @ 5'-10'</u>	<u>11/16/17</u>	<u>13:00</u>					1			1							
<u>217-376 04</u>	<u>E-6 @ 14.5'-19.5'</u>	<u>11/20/17</u>	<u>13:00</u>					1			1							

PLEASE NOTE: GAL's liability and client's exclusive remedy for any claim arising whether based in contract or tort, shall be limited to the amount paid by the client for the analyses. All claims including those for negligence and any other cause whatsoever shall be deemed waived unless made in writing and received by GAL within 30 days after completion. In no event shall GAL be liable for incidental or consequential damages, including without limitation, business interruptions, loss of use, or loss of profits incurred by client, its subsidiaries, affiliates or successors arising out of or related to the performance of services hereunder by GAL, regardless of whether such claim is based upon any of the above stated reasons or otherwise.

Relinquished By: <u>Kristin Moran</u>		Date: <u>12/5/17</u>	Received By: <u>Daniel Zuffelt</u>	ADDITIONAL REMARKS: Report to State? (Circle) Yes No	
Relinquished By:		Time: <u>11:50 am</u>	Received By:		
Relinquished By:		Date:	Received By:		
Relinquished By:		Time:	Received By:		
Delivered By: (Circle One)		Temperature at receipt: <u>#1</u>		CHECKED BY: <u>DZ</u>	
Sampler - UPS - FedEx - Kangaroo - Other:		<u>17.4/17.6 °C</u>			

† GAL cannot always accept verbal changes. Please fax or email written change requests.
* Chain of Custody must be signed in "Relinquished By:" as an acceptance of services and all applicable charges.



75 Suttle Street
Durango, CO 81303
970.247.4220 Phone
970.247.4227 Fax
www.greenanalytical.com

02 January 2018

Barney Bunker
Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango, CO 81303
RE: Soil: Cl

Enclosed are the results of analyses for samples received by the laboratory on 12/15/17 10:35.
If you need any further assistance, please feel free to contact me.

Sincerely,

A handwritten signature in black ink that reads 'Debbie Zufelt'. The script is cursive and fluid, with the first name 'Debbie' and last name 'Zufelt' clearly legible.

Debbie Zufelt
Reports Manager

All accredited analytes contained in this report are denoted by an asterisk (*). For a complete list of accredited analytes please do not hesitate to contact us via any of the contact information contained in this report. All of our certifications can be viewed at <http://greenanalytical.com/certifications/>

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Our affiliate laboratory, Cardinal Laboratories, is also NELAP accredited through the Texas Commission on Environmental Quality for a variety of organic constituents in drinking water, non-potable water and solid matrices. Cardinal is also accredited for regulated VOCs, TTHM, and HAA-5 in drinking water through the Colorado Department of Public Health and Environment and EPA region 8.



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www.GreenAnalytical.com

Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango CO, 81303

Project: Soil: Cl
Project Name / Number: US 550 S./US 160 Connector, 217-376
Project Manager: Barney Bunker

Reported:
01/02/18 13:17

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
217-376 A-2 @ 30'-32'	1712145-01	Solid	11/29/17 13:00	12/15/17 10:35
217-376 WB-3 @ 54.5'-59.5'	1712145-02	Solid	12/04/17 13:00	12/15/17 10:35
217-376 R-12 @ 4.5'-9.5'	1712145-03	Solid	12/01/17 13:00	12/15/17 10:35
217-376 R-12 @ 19.5'-24.5'	1712145-04	Solid	12/01/17 13:00	12/15/17 10:35

Green Analytical Laboratories

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www.GreenAnalytical.com

Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango CO, 81303

Project: Soil: CI
Project Name / Number: US 550 S./US 160 Connector, 217-376
Project Manager: Barney Bunker

Reported:
01/02/18 13:17

217-376 A-2 @ 30'-32'

1712145-01 (Solid)

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
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General Chemistry

% Dry Solids	94.4			%	1	12/20/17	EPA160.3/1684	H1	LLG
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Soluble (DI Water Extraction)

Chloride	11.4	10.6	1.52	mg/kg dry	10	12/29/17	EPA300.0		JDA
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217-376 WB-3 @ 54.5'-59.5'

1712145-02 (Solid)

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
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General Chemistry

% Dry Solids	85.7			%	1	12/20/17	EPA160.3/1684	H1	LLG
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Soluble (DI Water Extraction)

Chloride	<11.7	11.7	1.67	mg/kg dry	10	12/29/17	EPA300.0		JDA
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217-376 R-12 @ 4.5'-9.5'

1712145-03 (Solid)

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
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General Chemistry

% Dry Solids	92.5			%	1	12/20/17	EPA160.3/1684	H1	LLG
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Soluble (DI Water Extraction)

Chloride	11.8	10.8	1.55	mg/kg dry	10	12/29/17	EPA300.0		JDA
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217-376 R-12 @ 19.5'-24.5'

1712145-04 (Solid)

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
---------	--------	----	-----	-------	----------	----------	--------	-------	---------

General Chemistry

% Dry Solids	95.1			%	1	12/20/17	EPA160.3/1684	H1	LLG
--------------	------	--	--	---	---	----------	---------------	----	-----

Soluble (DI Water Extraction)

Chloride	57.6	10.5	1.51	mg/kg dry	10	12/29/17	EPA300.0		JDA
----------	------	------	------	-----------	----	----------	----------	--	-----

Green Analytical Laboratories

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www.GreenAnalytical.com

Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango CO, 81303

Project: Soil: Cl
Project Name / Number: US 550 S./US 160 Connector, 217-376
Project Manager: Barney Bunker

Reported:
01/02/18 13:17

General Chemistry - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B712148 - General Prep - Wet Chem

Duplicate (B712148-DUP1) Source: 1712132-01 Prepared: 12/19/17 Analyzed: 12/20/17

% Dry Solids	95.6		%		95.4			0.205	20	
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Duplicate (B712148-DUP2) Source: 1712143-06 Prepared: 12/19/17 Analyzed: 12/20/17

% Dry Solids	70.7		%		70.3			0.617	20	
--------------	------	--	---	--	------	--	--	-------	----	--

Soluble (DI Water Extraction) - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
---------	--------	--------------------	-------	----------------	------------------	------	----------------	-----	--------------	-------

Batch B712210 - General Prep - Wet Chem

Blank (B712210-BLK1) Prepared: 12/27/17 Analyzed: 12/29/17

Chloride	ND	1.00	mg/kg wet							
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LCS (B712210-BS1) Prepared: 12/27/17 Analyzed: 12/29/17

Chloride	249	10.0	mg/kg wet	250		99.8	85-115			
----------	-----	------	-----------	-----	--	------	--------	--	--	--

LCS Dup (B712210-BSD1) Prepared: 12/27/17 Analyzed: 12/29/17

Chloride	249	10.0	mg/kg wet	250		99.6	85-115	0.169	20	
----------	-----	------	-----------	-----	--	------	--------	-------	----	--

Green Analytical Laboratories

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Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango CO, 81303

Project: Soil: Cl
Project Name / Number: US 550 S./US 160 Connector, 217-376
Project Manager: Barney Bunker

Reported:
01/02/18 13:17

Notes and Definitions

H1 Sample was received several days after collected and subsequently analyzed past hold time.

DET Analyte DETECTED

ND Analyte NOT DETECTED at or above the reporting limit

NR Not Reported

dry Sample results reported on a dry weight basis
*Results reported on as received basis unless designated as dry.

RPD Relative Percent Difference

LCS Laboratory Control Sample (Blank Spike)

RL Report Limit

MDL Method Detection Limit

Green Analytical Laboratories

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(970) 247-4220
Fax: (970) 247-4227

service@greenanalytical.com or dzufelt@greenanalytical.com
75 Suttle St Durango, CO 81303

Company Name: Yeh & Associates				Bill to (if different):				ANALYSIS REQUEST													
Project Manager: Barney Bunker				P.O. #:																	
Address: 570 Turner Dr. Ste D				Company:																	
City: Durango State: CO Zip: 81303				Attn:																	
Phone #: 970-382-9580 Email: bbunker@yeh-eng.com				Address:																	
Additional Report To:				City:																	
Project Name: US 550S / US 160 Connector				State: Zip:																	
Project Number: 217-376				Phone #:																	
Sampler Name (Print): Kristin Moran				Fax or Email:				Chloride													
FOR LAB USE ONLY		Collected		Matrix (check one)														# of containers			
Lab I.D.		Sample Name or Location		GROUNDWATER SURFACEWATER WASTEWATER PRODUCEDWATER SOIL OTHER:														No preservation (general) HNO ₃ HCl H ₂ SO ₄ Other: Other: Other:			
		Date Time																			
217-376		A-2 @ 30'-32' -01 11-29-17 13:00pm																			
217-376		WB-3 @ 54.5'-59.5'-02 12-4-17 13:00																			
217-376		R-12 @ 4.5'-9.5' -03 12-1-17 13:00																			
217-376		R-12 @ 19.5'-24.5' -04 12-1-17 13:00																			

PLEASE NOTE: GAL's liability and client's exclusive remedy for any claim arising whether based in contract or tort, shall be limited to the amount paid by the client for the analyses. All claims including those for negligence and any other cause whatsoever shall be deemed waived unless made in writing and received by GAL within 30 days after completion. In no event shall GAL be liable for incidental or consequential damages, including without limitation, business interruptions, loss of use, or loss of profits incurred by client, its subsidiaries, affiliates or successors arising out of or related to the performance of services hereunder by GAL, regardless of whether such claim is based upon any of the above stated reasons or otherwise.

Relinquished By: Kristin Moran		Date: 12-15-17		Received By: [Signature]		ADDITIONAL REMARKS:		Report to State? (Circle)	
Relinquished By:		Time: 1035		Received By:				Yes No	
Relinquished By:		Date:		Received By:					
		Time:							
Delivered By: (Circle One)		Temperature at receipt:		CHECKED BY:					
Sampler - UPS - FedEx - Kangaroo - Other:		#1 no ic 18.6 / 18.8C		ke					

† GAL cannot always accept verbal changes. Please fax or email written change requests.
* Chain of Custody must be signed in "Relinquished By:" as an acceptance of services and all applicable charges.



75 Suttle Street
Durango, CO 81303
970.247.4220 Phone
970.247.4227 Fax
www.greenanalytical.com

18 January 2018

Barney Bunker
Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango, CO 81303
RE: Soil: Cl

Enclosed are the results of analyses for samples received by the laboratory on 01/05/18 16:10.
If you need any further assistance, please feel free to contact me.

Sincerely,

A handwritten signature in black ink that reads 'Debbie Zufelt'. The script is cursive and fluid.

Debbie Zufelt
Reports Manager

All accredited analytes contained in this report are denoted by an asterisk (*). For a complete list of accredited analytes please do not hesitate to contact us via any of the contact information contained in this report. All of our certifications can be viewed at <http://greenanalytical.com/certifications/>

Green Analytical Laboratories is NELAP accredited through the Texas Commission on Environmental Quality. Accreditation applies to drinking water and non-potable water matrices for trace metals and a variety of inorganic parameters. Green Analytical Laboratories is also accredited through the Colorado Department of Public Health and Environment and EPA region 8 for trace metals, Cyanide, Fluoride, Nitrate, and Nitrite in drinking water.

Our affiliate laboratory, Cardinal Laboratories, is also NELAP accredited through the Texas Commission on Environmental Quality for a variety of organic constituents in drinking water, non-potable water and solid matrices. Cardinal is also accredited for regulated VOCs, TTHM, and HAA-5 in drinking water through the Colorado Department of Public Health and Environment and EPA region 8.



dzufelt@greenanalytical.com p: 970.247.4220 f: 970.247.4227 75 Suttle Street Durango, CO 81303

www.GreenAnalytical.com

Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango CO, 81303

Project: Soil: Cl
Project Name / Number: US 550 S. 160 Connector 217-376
Project Manager: Barney Bunker

Reported:
01/18/18 12:31

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
217-376 WB-1 @ 34.5-44.5	1801045-01	Solid	12/04/17 13:00	01/05/18 16:10
217-376 WB-5 @ 54.5-59.5	1801045-02	Solid	12/04/17 13:00	01/05/18 16:10
217-376 WB-6 @ 14.5-19.5	1801045-03	Solid	12/04/17 13:00	01/05/18 16:10
217-376 WB-7 @ 44.5-49.5	1801045-04	Solid	12/04/17 13:00	01/05/18 16:10
217-376 WB-8 @ 59.5-69.5	1801045-05	Solid	12/04/17 13:00	01/05/18 16:10

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www.GreenAnalytical.com

Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango CO, 81303

Project: Soil: CI
Project Name / Number: US 550 S. 160 Connector 217-376
Project Manager: Barney Bunker

Reported:
01/18/18 12:31

217-376 WB-1 @ 34.5-44.5

1801045-01 (Solid)

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
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General Chemistry

% Dry Solids	99.9			%	1	01/15/18	EPA160.3/1684	H1	LLG
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Soluble (DI Water Extraction)

Chloride	<10.0	10.0	1.43	mg/kg dry	10	01/17/18	EPA300.0		JDA
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217-376 WB-5 @ 54.5-59.5

1801045-02 (Solid)

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
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General Chemistry

% Dry Solids	94.8			%	1	01/15/18	EPA160.3/1684	H1	LLG
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Soluble (DI Water Extraction)

Chloride	<10.6	10.6	1.51	mg/kg dry	10	01/17/18	EPA300.0		JDA
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217-376 WB-6 @ 14.5-19.5

1801045-03 (Solid)

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
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General Chemistry

% Dry Solids	96.7			%	1	01/15/18	EPA160.3/1684	H1	LLG
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Soluble (DI Water Extraction)

Chloride	62.3	10.3	1.48	mg/kg dry	10	01/17/18	EPA300.0		JDA
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217-376 WB-7 @ 44.5-49.5

1801045-04 (Solid)

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
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General Chemistry

% Dry Solids	95.0			%	1	01/15/18	EPA160.3/1684	H1	LLG
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Soluble (DI Water Extraction)

Chloride	<10.5	10.5	1.51	mg/kg dry	10	01/17/18	EPA300.0		JDA
----------	-------	------	------	-----------	----	----------	----------	--	-----

Green Analytical Laboratories

Debbie Zufelt

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Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango CO, 81303

Project: Soil: Cl
Project Name / Number: US 550 S. 160 Connector 217-376
Project Manager: Barney Bunker

Reported:
01/18/18 12:31

217-376 WB-8 @ 59.5-69.5

1801045-05 (Solid)

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
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General Chemistry

% Dry Solids	92.5			%	1	01/15/18	EPA160.3/1684	H1	LLG
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Soluble (DI Water Extraction)

Chloride	<10.8	10.8	1.55	mg/kg dry	10	01/17/18	EPA300.0		JDA
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General Chemistry - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B801071 - General Prep - Wet Chem

Duplicate (B801071-DUP1)

Source: 1801043-01 Prepared: 01/10/18 Analyzed: 01/15/18

% Dry Solids	83.2		%		82.8			0.434	20	
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Soluble (DI Water Extraction) - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B801097 - General Prep - Wet Chem

Blank (B801097-BLK1)

Prepared: 01/15/18 Analyzed: 01/17/18

Chloride	ND	10.0	mg/kg wet							
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LCS (B801097-BS1)

Prepared: 01/15/18 Analyzed: 01/17/18

Chloride	241	10.0	mg/kg wet	250		96.5	85-115			
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LCS Dup (B801097-BSD1)

Prepared: 01/15/18 Analyzed: 01/17/18

Chloride	241	10.0	mg/kg wet	250		96.3	85-115	0.245	20	
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Debbie Zufelt

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Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango CO, 81303

Project: Soil: CI
Project Name / Number: US 550 S. 160 Connector 217-376
Project Manager: Barney Bunker

Reported:
01/18/18 12:31

Notes and Definitions

H1 Sample was received several days after collected and subsequently analyzed past hold time.

DET Analyte DETECTED

ND Analyte NOT DETECTED at or above the reporting limit

NR Not Reported

dry Sample results reported on a dry weight basis
*Results reported on as received basis unless designated as dry.

RPD Relative Percent Difference

LCS Laboratory Control Sample (Blank Spike)

RL Report Limit

MDL Method Detection Limit

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75 Suttle St Durango, CO 81303

Page 6 of 6

Relinquished By:		Date:		Received By:		ADDITIONAL REMARKS:		Report to State? (Circle)	
		Time:						Yes No	
Relinquished By:		Date:		Received By:					
Kristin Moran		1/5/18 4:10 pm		Deliver Zupka					
Relinquished By:		Date:		Received By:					
		Time:							
Delivered By: (Circle One)				Temperature at receipt:		CHECKED BY:			
Sampler - UPS - FedEx - Kangaroo - Other:				20.1/20.3°C		Dr			

* Chain of Custody must be signed in "Relinquished By:" as an acceptance of services and all applicable charges.



75 Suttle Street
Durango, CO 81303
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970.247.4227 Fax
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27 February 2018

Barney Bunker
Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango, CO 81303
RE: Soil: Cl

Enclosed are the results of analyses for samples received by the laboratory on 02/13/18 16:30.
If you need any further assistance, please feel free to contact me.

Sincerely,

A handwritten signature in black ink that reads 'Debbie Zufelt'.

Debbie Zufelt
Reports Manager

All accredited analytes contained in this report are denoted by an asterisk (*). For a complete list of accredited analytes please do not hesitate to contact us via any of the contact information contained in this report. All of our certifications can be viewed at <http://greenanalytical.com/certifications/>

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Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango CO, 81303

Project: Soil: CI
Project Name / Number: US 550 South / US 160 Connector
Project Manager: Barney Bunker

Reported:
02/27/18 12:15

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
WA-3 @ 54.5 - 59.5	1802113-01	Solid	01/12/18 13:00	02/13/18 16:30
WC-3 @ 29.5 - 34.5	1802113-02	Solid	01/12/18 13:00	02/13/18 16:30
R-1 @ 9'-14'	1802113-03	Solid	01/16/18 09:00	02/13/18 16:30
R-2 @ 1' - 2'	1802113-04	Solid	01/16/18 10:00	02/13/18 16:30
R-3 @ 9' - 14'	1802113-05	Solid	01/16/18 10:00	02/13/18 16:30
R-4 @ 9' - 14'	1802113-06	Solid	01/16/18 12:00	02/13/18 16:30
R-5 @ 9' - 14'	1802113-07	Solid	01/17/18 09:00	02/13/18 16:30
R-6 @ 4' - 9'	1802113-08	Solid	01/17/18 10:00	02/13/18 16:30

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Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango CO, 81303

Project: Soil: CI
Project Name / Number: US 550 South / US 160 Connector
Project Manager: Barney Bunker

Reported:
02/27/18 12:15

WA-3 @ 54.5 - 59.5

1802113-01 (Solid)

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
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General Chemistry

% Dry Solids	94.5			%	1	02/22/18	EPA160.3/1684	H1	LLG
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Soluble (DI Water Extraction)

Chloride	<10.6	10.6	1.52	mg/kg dry	10	02/26/18	EPA300.0		JDA
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WC-3 @ 29.5 - 34.5

1802113-02 (Solid)

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
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General Chemistry

% Dry Solids	93.0			%	1	02/22/18	EPA160.3/1684	H1	LLG
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Soluble (DI Water Extraction)

Chloride	<10.8	10.8	1.54	mg/kg dry	10	02/26/18	EPA300.0		JDA
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R-1 @ 9'-14'

1802113-03 (Solid)

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
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General Chemistry

% Dry Solids	87.6			%	1	02/22/18	EPA160.3/1684	H1	LLG
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Soluble (DI Water Extraction)

Chloride	78.8	11.4	1.64	mg/kg dry	10	02/26/18	EPA300.0		JDA
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R-2 @ 1' - 2'

1802113-04 (Solid)

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
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General Chemistry

% Dry Solids	96.4			%	1	02/22/18	EPA160.3/1684	H1	LLG
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Soluble (DI Water Extraction)

Chloride	43.3	10.4	1.49	mg/kg dry	10	02/26/18	EPA300.0		JDA
----------	------	------	------	-----------	----	----------	----------	--	-----

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Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango CO, 81303

Project: Soil: CI
Project Name / Number: US 550 South / US 160 Connector
Project Manager: Barney Bunker

Reported:
02/27/18 12:15

R-3 @ 9' - 14'

1802113-05 (Solid)

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
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General Chemistry

% Dry Solids	84.2			%	1	02/22/18	EPA160.3/1684	H1	LLG
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Soluble (DI Water Extraction)

Chloride	16.4	11.9	1.70	mg/kg dry	10	02/26/18	EPA300.0		JDA
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R-4 @ 9' - 14'

1802113-06 (Solid)

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
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General Chemistry

% Dry Solids	85.8			%	1	02/22/18	EPA160.3/1684	H1	LLG
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Soluble (DI Water Extraction)

Chloride	29.2	11.7	1.67	mg/kg dry	10	02/26/18	EPA300.0		JDA
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R-5 @ 9' - 14'

1802113-07 (Solid)

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
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General Chemistry

% Dry Solids	89.5			%	1	02/22/18	EPA160.3/1684	H1	LLG
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Soluble (DI Water Extraction)

Chloride	29.0	11.2	1.60	mg/kg dry	10	02/26/18	EPA300.0		JDA
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R-6 @ 4' - 9'

1802113-08 (Solid)

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
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General Chemistry

% Dry Solids	86.5			%	1	02/22/18	EPA160.3/1684	H1	LLG
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Soluble (DI Water Extraction)

Chloride	1060	57.8	8.28	mg/kg dry	50	02/26/18	EPA300.0		JDA
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Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango CO, 81303

Project: Soil: Cl
Project Name / Number: US 550 South / US 160 Connector
Project Manager: Barney Bunker

Reported:
02/27/18 12:15

General Chemistry - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B802143 - General Prep - Wet Chem

Duplicate (B802143-DUP1) Source: 1802113-01 Prepared: 02/20/18 Analyzed: 02/26/18

% Dry Solids	94.5		%		94.5			0.00741	20	
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Soluble (DI Water Extraction) - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
---------	--------	--------------------	-------	----------------	------------------	------	----------------	-----	--------------	-------

Batch B802165 - General Prep - Wet Chem

Blank (B802165-BLK1) Prepared: 02/22/18 Analyzed: 02/23/18

Chloride	ND	1.00	mg/kg wet							
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LCS (B802165-BS1) Prepared: 02/22/18 Analyzed: 02/23/18

Chloride	243	10.0	mg/kg wet	250		97.4	85-115			
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LCS Dup (B802165-BSD1) Prepared: 02/22/18 Analyzed: 02/23/18

Chloride	245	10.0	mg/kg wet	250		98.2	85-115	0.839	20	
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Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango CO, 81303

Project: Soil: Cl
Project Name / Number: US 550 South / US 160 Connector
Project Manager: Barney Bunker

Reported:
02/27/18 12:15

Notes and Definitions

H1 Sample was received several days after collected and subsequently analyzed past hold time.

DET Analyte DETECTED

ND Analyte NOT DETECTED at or above the reporting limit

NR Not Reported

dry Sample results reported on a dry weight basis
*Results reported on as received basis unless designated as dry.

RPD Relative Percent Difference

LCS Laboratory Control Sample (Blank Spike)

RL Report Limit

MDL Method Detection Limit

Green Analytical Laboratories

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(970) 247-4220
Fax: (970) 247-4227

service@greenanalytical.com or dzufelt@greenanalytical.com
75 Suttle St Durango, CO 81303

Company Name: Yeh & Associates		Bill to (if different):		ANALYSIS REQUEST										
Project Manager: Barney Bunker		P.O. #:												
Address: 570 Turner Dr. Ste D.		Company:												
City: Durango State: CO Zip: 81301		Attn:												
Phone #: 970-382-9590 Email: bbunker@yeh-eng.com		Address:												
Additional Report To: Kmoran@yeh-eng.com		City:												
Project Name: US 550 South / I-60 Connector		State: Zip:												
Project Number: 217-376		Phone #:												
Sampler Name (Print): Eric Pickerill		Fax or Email:												
FOR LAB USE ONLY		Collected	Matrix (check one)	# of containers										
1802-113			GROUNDWATER SURFACEWATER WASTEWATER PRODUCEDWATER SOIL OTHER:	No preservation (general)	HNO ₃	HCl	H ₂ SO ₄	Other:	Other:	Other:				
Lab I.D.	Sample Name or Location	Date	Time											
217-376	WA-3 @ 54.5-59.5	1/12/18	13:00											
217-376	WC-3 @ 29.5-34.5	1/12/18	13:00											
217-376	R-1 @ 9'-14'	1/14/18	09:00											
217-376	R-2 @ 1'-2'	1/16/18	10:00											
217-376	R-3 @ 9'-14'	1/16/18	10:00											
217-376	R-4 @ 9'-14'	1/16/18	12:00											
217-376	R-5 @ 9'-14'	1/17/18	9:00											
217-376	R-6 @ 4-9'	1/17/18	10:00											

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Relinquished By: Kristin Moran	Date: 2/13/18	Received By: Daniel Zupf	ADDITIONAL REMARKS:	Report to State? (Circle) Yes No
Relinquished By:	Date:	Received By:		
Relinquished By:	Date:	Received By:		
Relinquished By:	Date:	Received By:		
Delivered By: (Circle One)	Temperature at receipt: #1	CHECKED BY: DZ		
Sampler - UPS - FedEx - Kangaroo - Other:		22.0 / 21.8 °C		

† GAL cannot always accept verbal changes. Please fax or email written change requests.
* Chain of Custody must be signed in "Relinquished By:" as an acceptance of services and all applicable charges.



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09 March 2018

Barney Bunker
Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango, CO 81303
RE: Soil: Cl

Enclosed are the results of analyses for samples received by the laboratory on 02/28/18 15:52.
If you need any further assistance, please feel free to contact me.

Sincerely,

A handwritten signature in black ink that reads 'Debbie Zufelt'. The script is fluid and cursive, with the first name 'Debbie' and last name 'Zufelt' clearly legible.

Debbie Zufelt
Reports Manager

All accredited analytes contained in this report are denoted by an asterisk (*). For a complete list of accredited analytes please do not hesitate to contact us via any of the contact information contained in this report. All of our certifications can be viewed at <http://greenanalytical.com/certifications/>

Green Analytical Laboratories is NELAP accredited through the Texas Commission on Environmental Quality. Accreditation applies to drinking water and non-potable water matrices for trace metals and a variety of inorganic parameters. Green Analytical Laboratories is also accredited through the Colorado Department of Public Health and Environment and EPA region 8 for trace metals, Cyanide, Fluoride, Nitrate, and Nitrite in drinking water.

Our affiliate laboratory, Cardinal Laboratories, is also NELAP accredited through the Texas Commission on Environmental Quality for a variety of organic constituents in drinking water, non-potable water and solid matrices. Cardinal is also accredited for regulated VOCs, TTHM, and HAA-5 in drinking water through the Colorado Department of Public Health and Environment and EPA region 8.



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www.GreenAnalytical.com

Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango CO, 81303

Project: Soil: Cl
Project Name / Number: US 550 South/US 160 Connector, 217-376
Project Manager: Barney Bunker

Reported:
03/09/18 17:09

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
217-376 E-8 @ 44.5-49.5	1803003-01	Solid	01/20/18 14:00	02/28/18 15:52
217-376 E-8 @ 9.5-14.5	1803003-02	Solid	01/20/18 12:00	02/28/18 15:52
217-376 E-4 @ 59.5-64.5	1803003-03	Solid	01/20/18 14:00	02/28/18 15:52
217-376 E-1 @ 114'-119'	1803003-04	Solid	01/22/18 14:00	02/28/18 15:52
217-376 E-1 @ 79'-84'	1803003-05	Solid	01/22/18 14:00	02/28/18 15:52

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Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango CO, 81303

Project: Soil: CI
Project Name / Number: US 550 South/US 160 Connector, 217-376
Project Manager: Barney Bunker

Reported:
03/09/18 17:09

217-376 E-8 @ 44.5-49.5

1803003-01 (Solid)

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
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General Chemistry

% Dry Solids	91.0			%	1	03/08/18	EPA160.3/1684	H1	LLG
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Soluble (DI Water Extraction)

Chloride	<11.0	11.0	1.57	mg/kg dry	10	03/06/18	EPA300.0		JDA
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217-376 E-8 @ 9.5-14.5

1803003-02 (Solid)

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
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General Chemistry

% Dry Solids	88.6			%	1	03/08/18	EPA160.3/1684	H1	LLG
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Soluble (DI Water Extraction)

Chloride	<11.3	11.3	1.62	mg/kg dry	10	03/06/18	EPA300.0		JDA
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217-376 E-4 @ 59.5-64.5

1803003-03 (Solid)

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
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General Chemistry

% Dry Solids	92.0			%	1	03/08/18	EPA160.3/1684	H1	LLG
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Soluble (DI Water Extraction)

Chloride	<10.9	10.9	1.56	mg/kg dry	10	03/06/18	EPA300.0		JDA
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217-376 E-1 @ 114'-119'

1803003-04 (Solid)

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
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General Chemistry

% Dry Solids	91.3			%	1	03/08/18	EPA160.3/1684	H1	LLG
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Soluble (DI Water Extraction)

Chloride	<11.0	11.0	1.57	mg/kg dry	10	03/06/18	EPA300.0		JDA
----------	-------	------	------	-----------	----	----------	----------	--	-----

Green Analytical Laboratories

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www.GreenAnalytical.com

Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango CO, 81303

Project: Soil: Cl
Project Name / Number: US 550 South/US 160 Connector, 217-376
Project Manager: Barney Bunker

Reported:
03/09/18 17:09

217-376 E-1 @ 79'-84'

1803003-05 (Solid)

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
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General Chemistry

% Dry Solids	91.3			%	1	03/08/18	EPA160.3/1684	H1	LLG
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Soluble (DI Water Extraction)

Chloride	<11.0	11.0	1.57	mg/kg dry	10	03/06/18	EPA300.0		JDA
----------	-------	------	------	-----------	----	----------	----------	--	-----

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Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango CO, 81303

Project: Soil: Cl
Project Name / Number: US 550 South/US 160 Connector, 217-376
Project Manager: Barney Bunker

Reported:
03/09/18 17:09

General Chemistry - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B803012 - General Prep - Wet Chem

Duplicate (B803012-DUP1) Source: 1802159-01 Prepared: 03/02/18 Analyzed: 03/08/18

% Dry Solids	80.1		%		80.7			0.796	20	
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Soluble (DI Water Extraction) - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B803021 - General Prep - Wet Chem

Blank (B803021-BLK1) Prepared: 03/05/18 Analyzed: 03/06/18

Chloride	ND	10.0	mg/kg wet							
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LCS (B803021-BS1) Prepared: 03/05/18 Analyzed: 03/06/18

Chloride	236	10.0	mg/kg wet	250		94.3	85-115			
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LCS Dup (B803021-BSD1) Prepared: 03/05/18 Analyzed: 03/06/18

Chloride	238	10.0	mg/kg wet	250		95.2	85-115	0.963	20	
----------	-----	------	-----------	-----	--	------	--------	-------	----	--

Green Analytical Laboratories

Debbie Zufelt

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Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango CO, 81303

Project: Soil: CI
Project Name / Number: US 550 South/US 160 Connector, 217-376
Project Manager: Barney Bunker

Reported:
03/09/18 17:09

Notes and Definitions

H1 Sample was received several days after collected and subsequently analyzed past hold time.

DET Analyte DETECTED

ND Analyte NOT DETECTED at or above the reporting limit

NR Not Reported

dry Sample results reported on a dry weight basis
*Results reported on as received basis unless designated as dry.

RPD Relative Percent Difference

LCS Laboratory Control Sample (Blank Spike)

RL Report Limit

MDL Method Detection Limit

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Fax: (970) 247-4227

service@greenanalytical.com or dzufelt@greenanalytical.com
75 Suttle St Durango, CO 81303

Company Name: <u>Yeh & Associates</u>				Bill to (if different):				ANALYSIS REQUEST											
Project Manager: <u>Barney Bunker</u>				P.O. #:															
Address: <u>570 Turner Dr. Ste D.</u>				Company:															
City: <u>Durango</u> State: <u>CO</u> Zip: <u>81303</u>				Attn:															
Phone #: <u>970-382-9590</u> Email: <u>Bbunker@yeh-eng.com</u>				Address:															
Additional Report To: <u>Kmoran@yeh-eng.com</u>				City:															
Project Name: <u>US 550 South / US 160 Connector</u>				State: Zip:															
Project Number: <u>217-376</u>				Phone #:															
Sampler Name (Print): <u>Eric Pickrell</u>				Fax or Email:															
FOR LAB USE ONLY		Collected		Matrix (check one)				# of containers											
Lab I.D.		Sample Name or Location		GROUNDWATER	SURFACEWATER	WASTEWATER	PRODUCEDWATER	SOIL	OTHER :	No preservation (general)	HNO ₃								
<u>1803-003</u>		<u>1803-003</u>																	
<u>217-376</u>		<u>E-8 @ 44.5-49.5</u>																	
<u>217-376</u>		<u>E-8 @ 9.5-14.5</u>																	
<u>217-376</u>		<u>E-4 @ 59.5-64.5</u>																	
<u>217-376</u>		<u>E-1 @ 114'-119'</u>																	
<u>217-376</u>		<u>E-1 @ 79'-84'</u>																	

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Relinquished By: <u>Kristin Moran</u>		Date: <u>02-28-18</u>	Received By: <u>[Signature]</u>	ADDITIONAL REMARKS:		Report to State? (Circle)
Relinquished By:		Date:	Received By:			Yes No
Relinquished By:		Date:	Received By:			
Delivered By: (Circle One)		Temperature at receipt: <u>19.8/19.6°C</u>	CHECKED BY: <u>[Signature]</u>			
Sampler - UPS - FedEx - Kangaroo - Other:						

† GAL cannot always accept verbal changes. Please fax or email written change requests.
* Chain of Custody must be signed in "Relinquished By:" as an acceptance of services and all applicable charges.



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Durango, CO 81303
970.247.4220 Phone
970.247.4227 Fax
www.greenanalytical.com

21 May 2018

Barney Bunker
Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango, CO 81303
RE: Soil: Cl

Enclosed are the results of analyses for samples received by the laboratory on 05/07/18 14:35.
If you need any further assistance, please feel free to contact me.

Sincerely,

A handwritten signature in black ink that reads 'Debbie Zufelt'.

Debbie Zufelt
Reports Manager

All accredited analytes contained in this report are denoted by an asterisk (*). For a complete list of accredited analytes please do not hesitate to contact us via any of the contact information contained in this report. All of our certifications can be viewed at <http://greenanalytical.com/certifications/>

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www.GreenAnalytical.com

Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango CO, 81303

Project: Soil: Cl
Project Name / Number: US 550 S/160 Connector 217-376
Project Manager: Barney Bunker

Reported:
05/21/18 09:08

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
217-376 WE-01 @ 4'-9'	1805064-01	Solid	04/19/18 00:00	05/07/18 14:35
217-376 WX2-01 @ 8'-13'	1805064-02	Solid	04/19/18 00:00	05/07/18 14:35

Green Analytical Laboratories

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Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango CO, 81303

Project: Soil: Cl
Project Name / Number: US 550 S/160 Connector 217-376
Project Manager: Barney Bunker

Reported:
05/21/18 09:08

217-376 WE-01 @ 4'-9'

1805064-01 (Solid)

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
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General Chemistry

% Dry Solids	97.0			%	1	05/11/18	EPA160.3/1684	H1	LLG
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Soluble (DI Water Extraction)

Chloride	78.4	10.3	1.48	mg/kg dry	10	05/17/18	EPA300.0		JDA
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217-376 WX2-01 @ 8'-13'

1805064-02 (Solid)

Analyte	Result	RL	MDL	Units	Dilution	Analyzed	Method	Notes	Analyst
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General Chemistry

% Dry Solids	94.8			%	1	05/11/18	EPA160.3/1684	H1	LLG
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Soluble (DI Water Extraction)

Chloride	54.3	10.5	1.51	mg/kg dry	10	05/17/18	EPA300.0		JDA
----------	------	------	------	-----------	----	----------	----------	--	-----

Green Analytical Laboratories

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Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango CO, 81303

Project: Soil: Cl
Project Name / Number: US 550 S/160 Connector 217-376
Project Manager: Barney Bunker

Reported:
05/21/18 09:08

General Chemistry - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B805062 - General Prep - Wet Chem

Duplicate (B805062-DUP1) Source: 1805055-01 Prepared: 05/08/18 Analyzed: 05/11/18

% Dry Solids	98.3		%		98.3			0.0448	20	
--------------	------	--	---	--	------	--	--	--------	----	--

Soluble (DI Water Extraction) - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
---------	--------	--------------------	-------	----------------	------------------	------	----------------	-----	--------------	-------

Batch B805121 - General Prep - Wet Chem

Blank (B805121-BLK1) Prepared: 05/16/18 Analyzed: 05/17/18

Chloride	ND	10.0	mg/kg wet							
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LCS (B805121-BS1) Prepared: 05/16/18 Analyzed: 05/17/18

Chloride	232	10.0	mg/kg wet	250		92.8	85-115			
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LCS Dup (B805121-BSD1) Prepared: 05/16/18 Analyzed: 05/17/18

Chloride	235	10.0	mg/kg wet	250		93.9	85-115	1.23	20	
----------	-----	------	-----------	-----	--	------	--------	------	----	--

Green Analytical Laboratories

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Yeh and Associates, Inc
570 Turner Dr. Suite D
Durango CO, 81303

Project: Soil: Cl
Project Name / Number: US 550 S/160 Connector 217-376
Project Manager: Barney Bunker

Reported:
05/21/18 09:08

Notes and Definitions

H1 Sample was received several days after collected and subsequently analyzed past hold time.

DET Analyte DETECTED

ND Analyte NOT DETECTED at or above the reporting limit

NR Not Reported

dry Sample results reported on a dry weight basis
*Results reported on as received basis unless designated as dry.

RPD Relative Percent Difference

LCS Laboratory Control Sample (Blank Spike)

RL Report Limit

MDL Method Detection Limit

Green Analytical Laboratories

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service@greenanalytical.com or dzufelt@greenanalytical.com
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Page 6 of 6

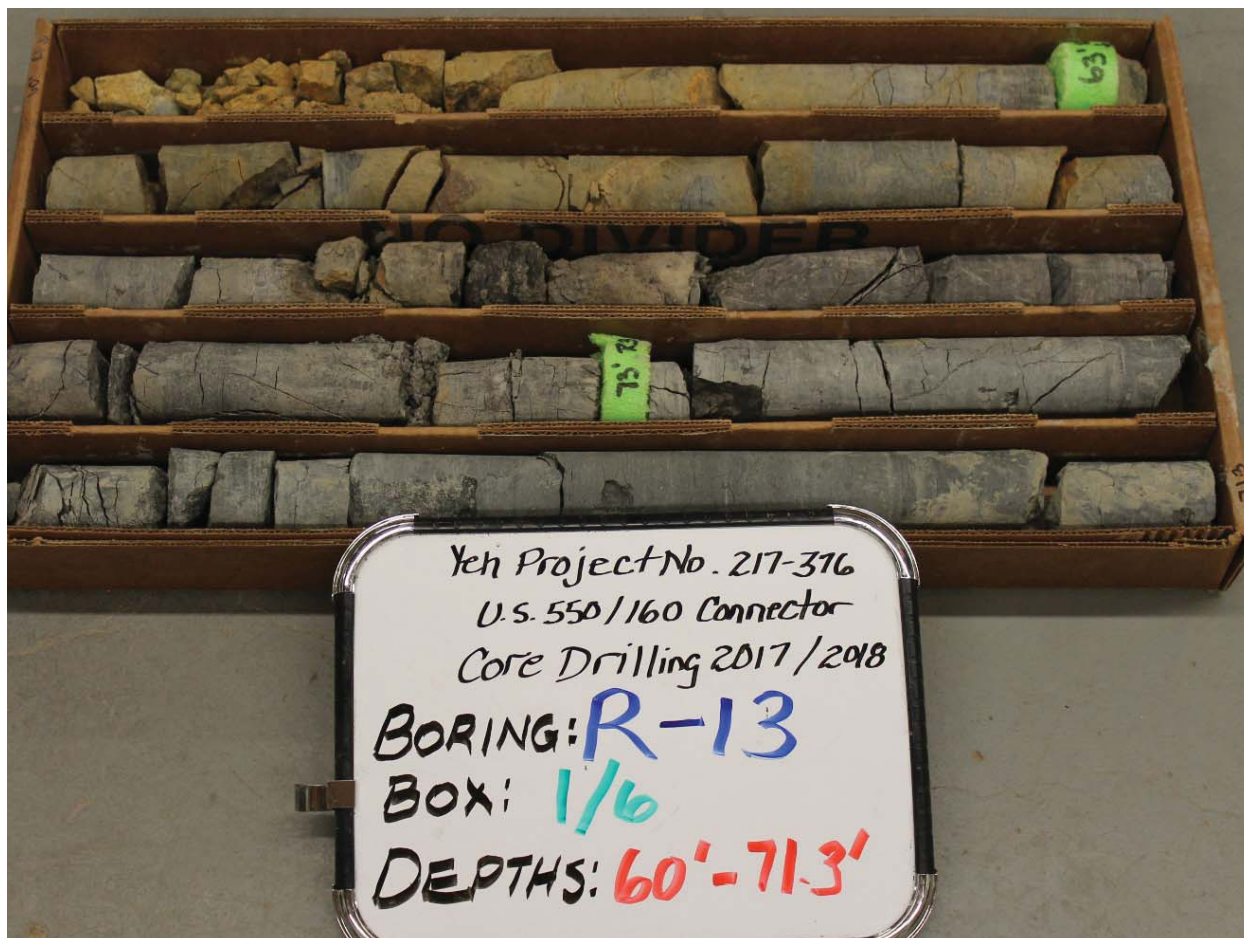
Relinquished By: <u>Kristin Moran</u> Date: <u>5/7/18</u> Time: <u>2:35</u>		Received By: <u>[Signature]</u> Date: <u>5/7/18</u> Time: <u>2:35</u>		ADDITIONAL REMARKS: Report to State? (Circle) Yes No <u>pc 5-7</u>
Relinquished By: _____ Date: _____ Time: _____		Received By: _____ Date: _____ Time: _____		
Relinquished By: _____ Date: _____ Time: _____		Received By: _____ Date: _____ Time: _____		
Relinquished By: _____ Date: _____ Time: _____		Received By: _____ Date: _____ Time: _____		
Delivered By: (Circle One) Sampler - UPS - FedEx - Kangaroo - Other: _____		Temperature at receipt: <u>27.3 / 27.1 C</u>		CHECKED BY: <u>pc</u>

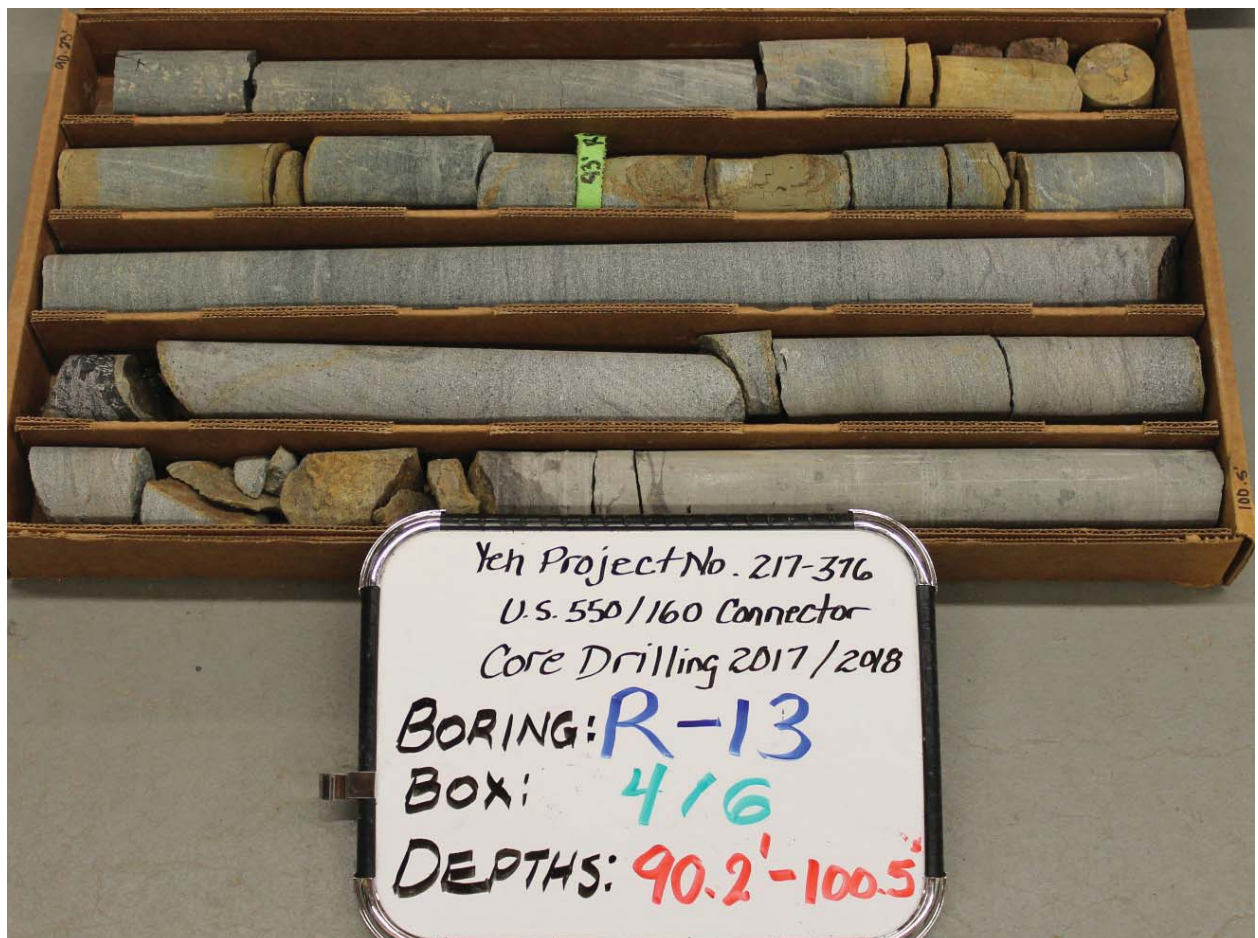
* Chain of Custody must be signed in "Relinquished By:" as an acceptance of services and all applicable charges.

Appendix F – Core Photos

F.1	Roadway and Excavation Borings – Core Photos
F.2	Bridge 1 (P-05-AZ) Borings – Core Photos
F.3	Bridge 2 (P-05-BA) Borings – Core Photos
F.4	Retaining Walls Borings – Core Photos

Appendix F.1 – Roadway and Excavation Borings – Core Photos

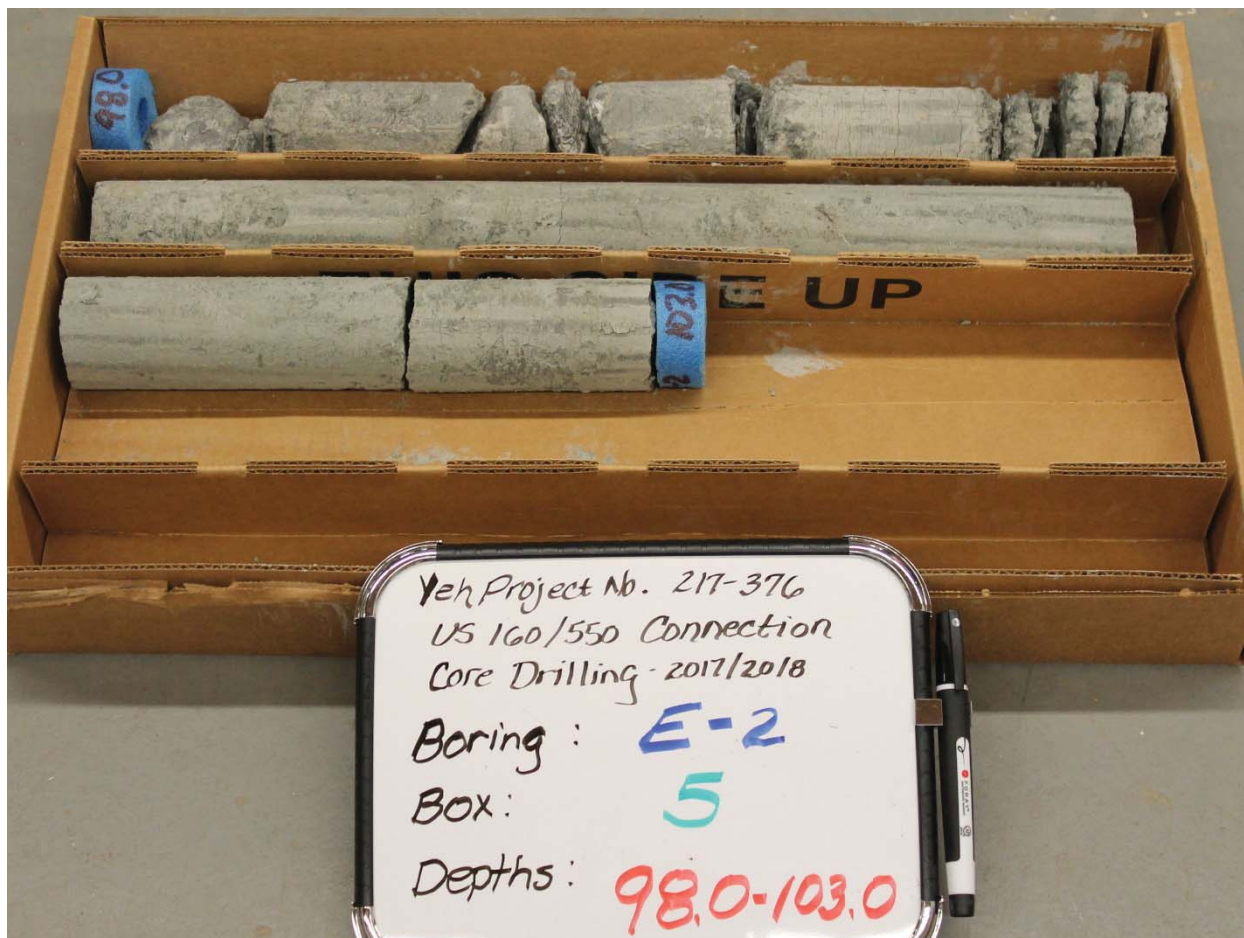






















Yeh Project No. 217-376
US 160/550 Connection
Core Drilling - 2017/2018

Boring : E-3

Box: 5

Depths: 86.0-91.0







Yeh Project No. 217-376
US 550/160 Connection
Core Drilling 2017/2018

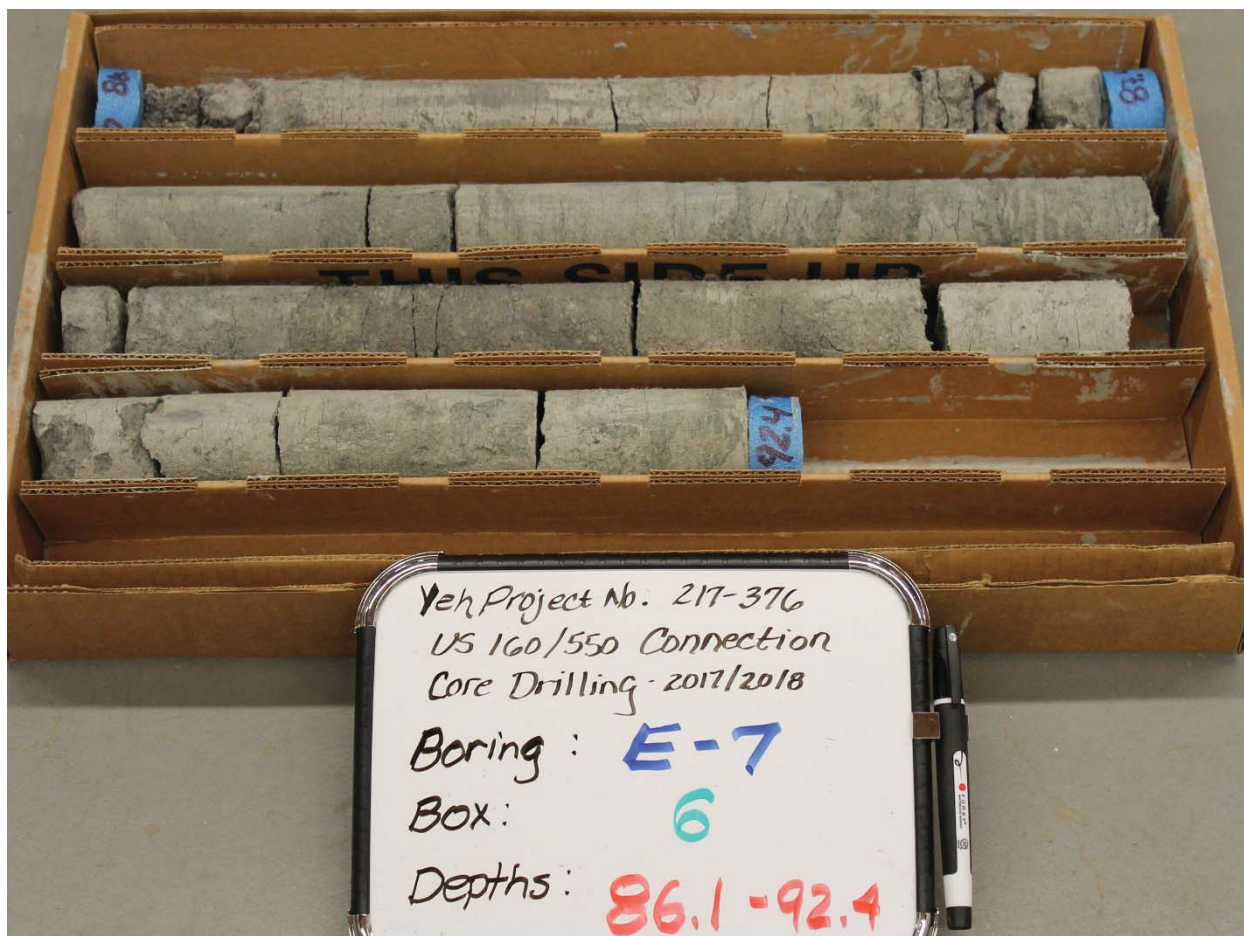
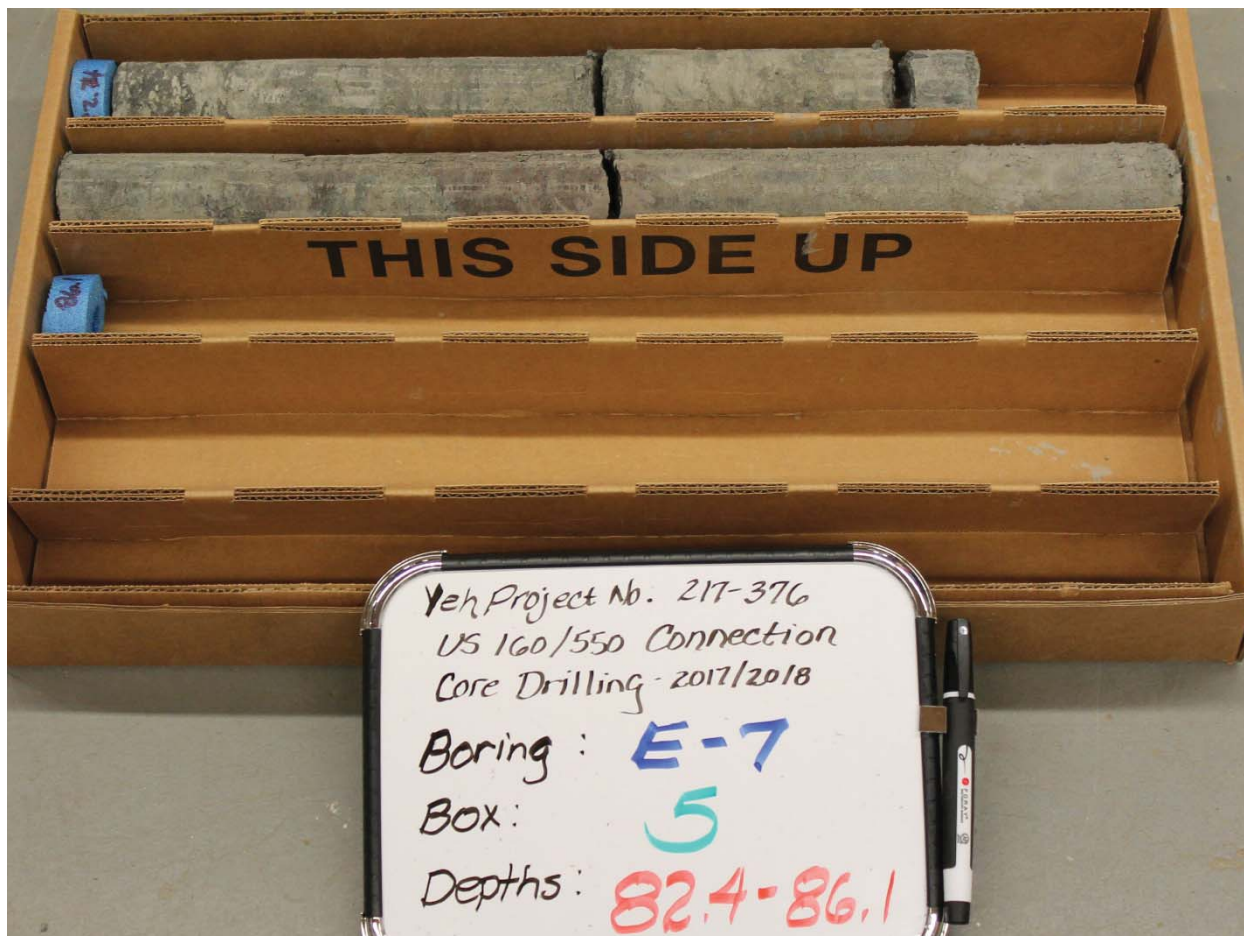
BORING: E-6

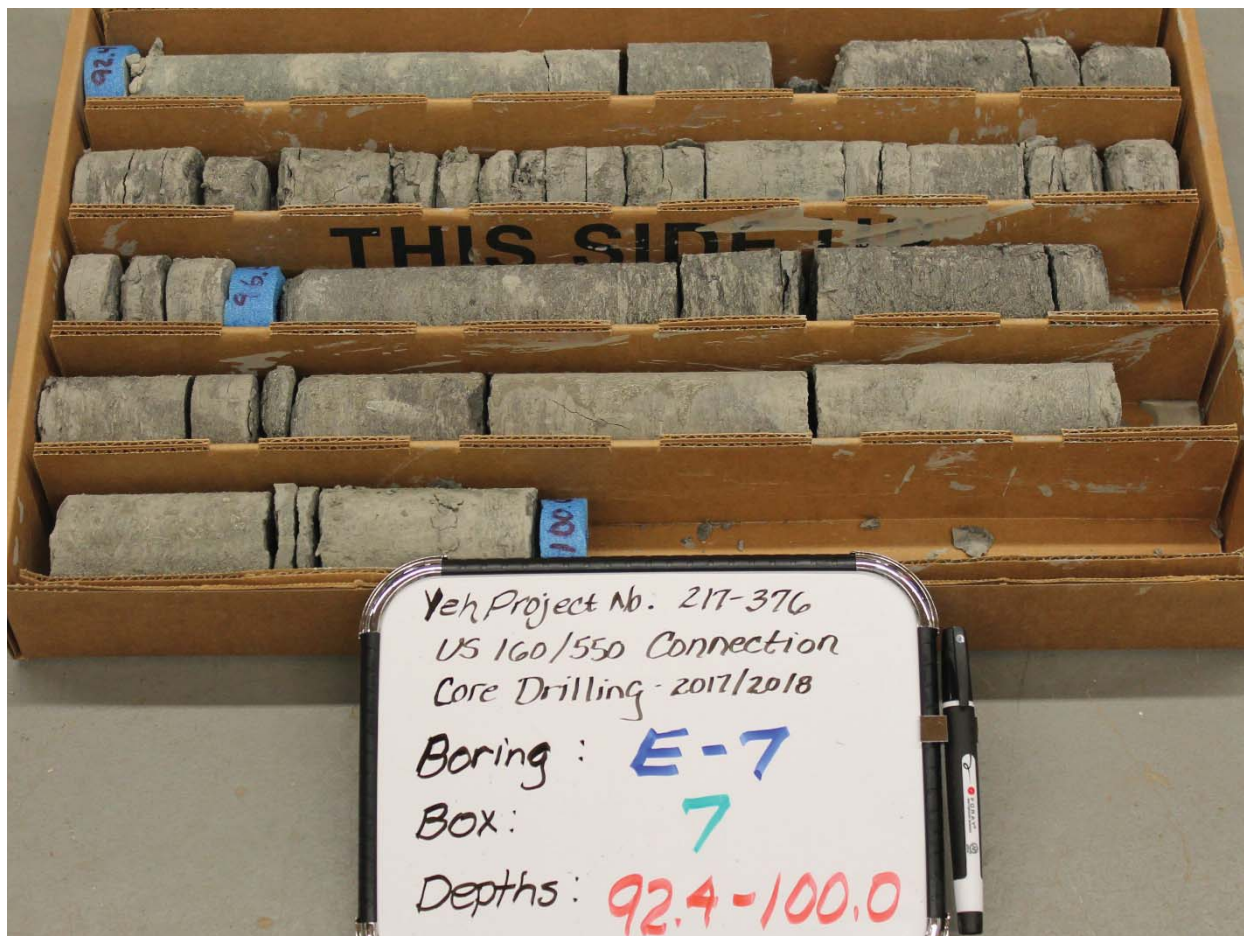
Box: 5

DEPTHS: 96.0-103.0

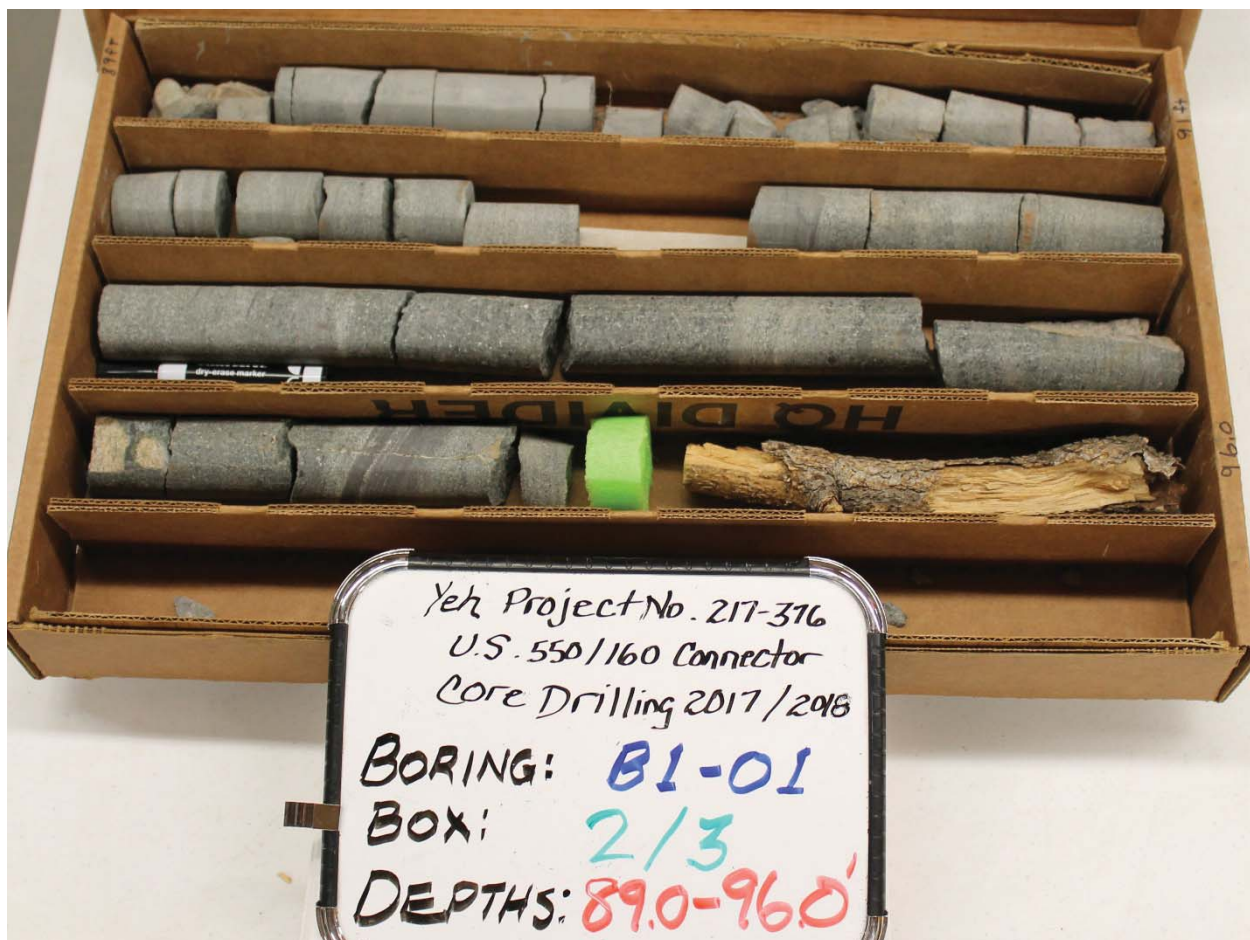








Appendix F.2 – Bridge 1 (P-05-AZ) Borings – Core Photos



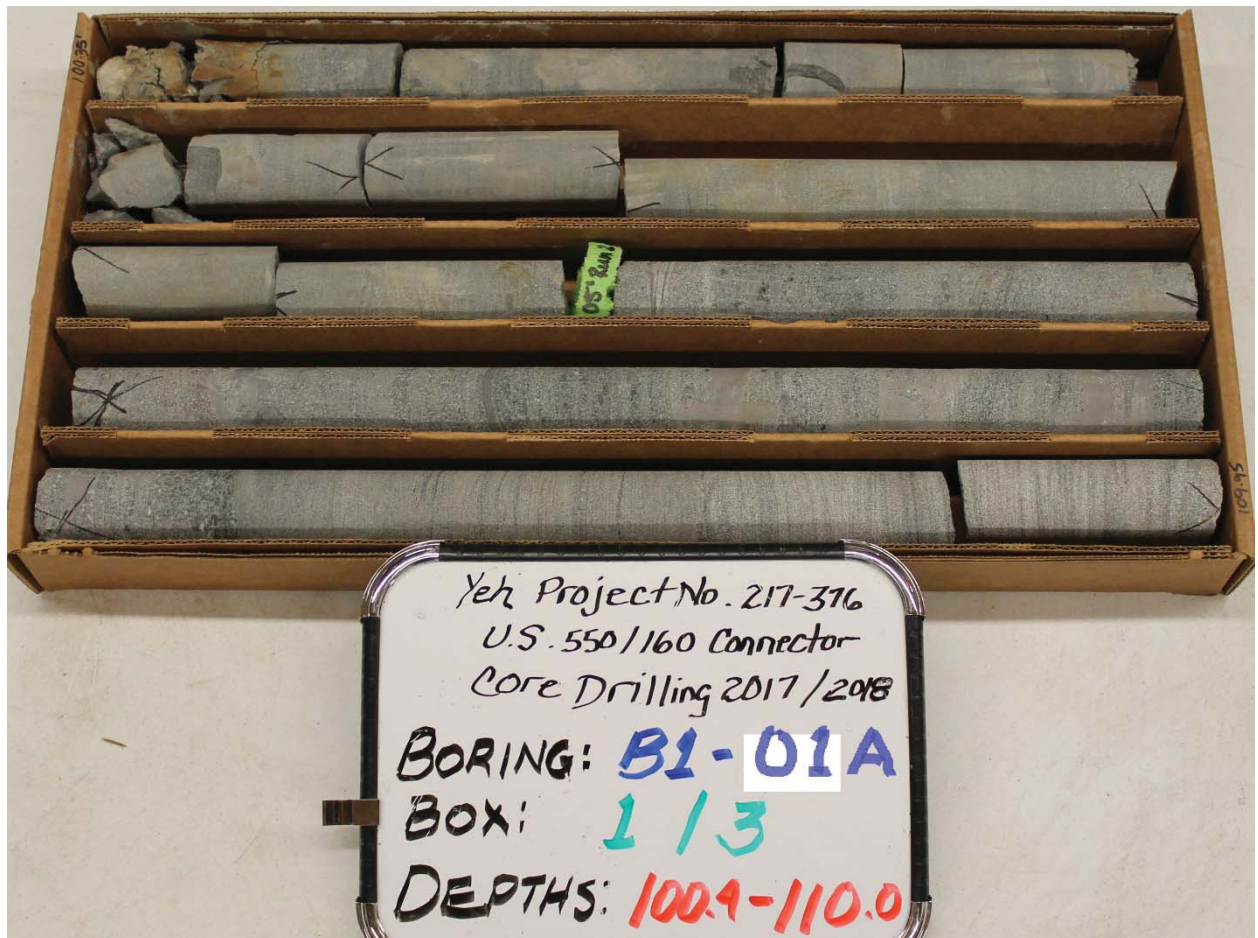


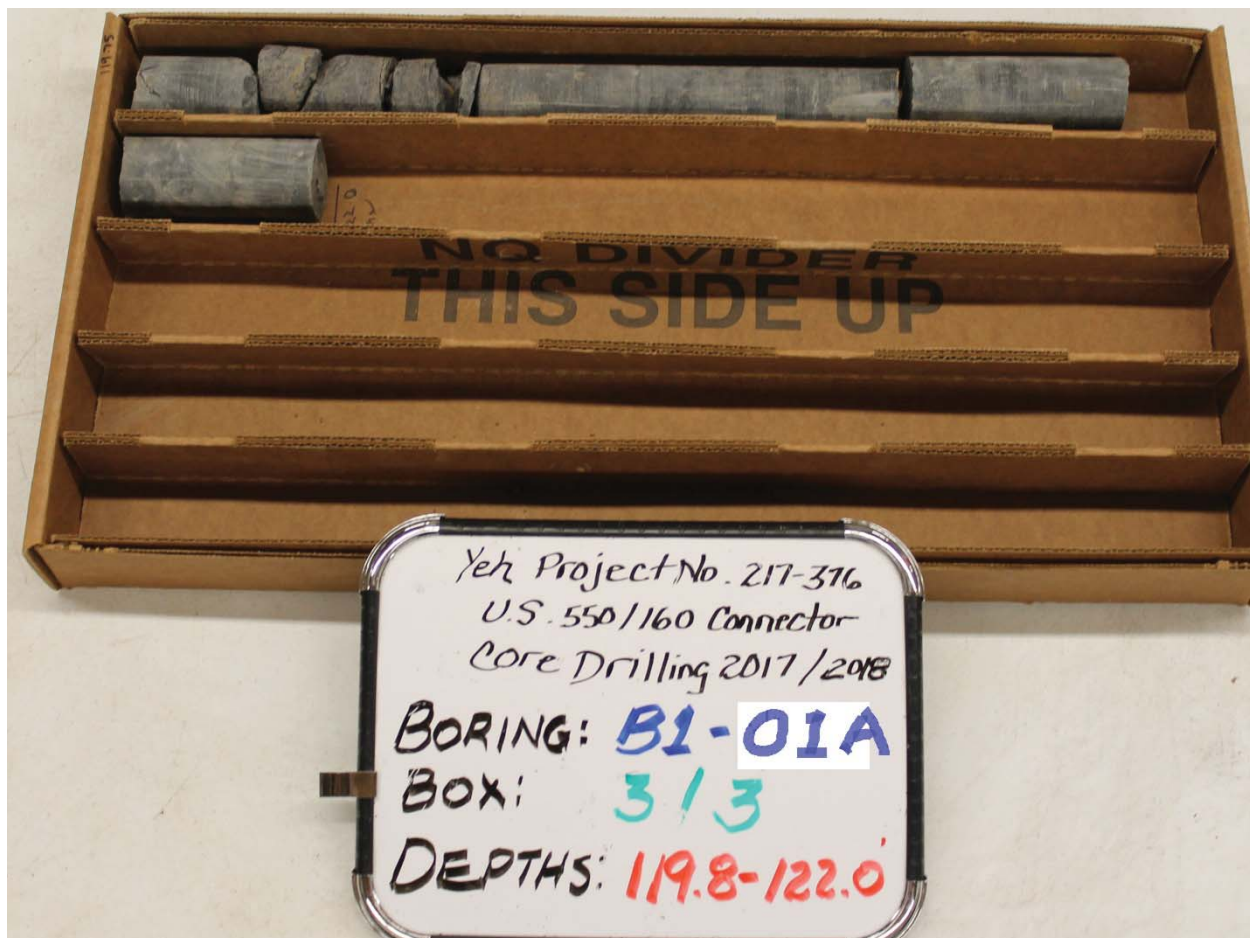
Yeh Project No. 217-376
U.S. 550/160 Connector
Core Drilling 2017/2018

BORING: B1-01

BOX: 3/3

DEPTHS: 96.0-106.0'









Yeh Project No. 217-316

U.S. 550/160 Connector

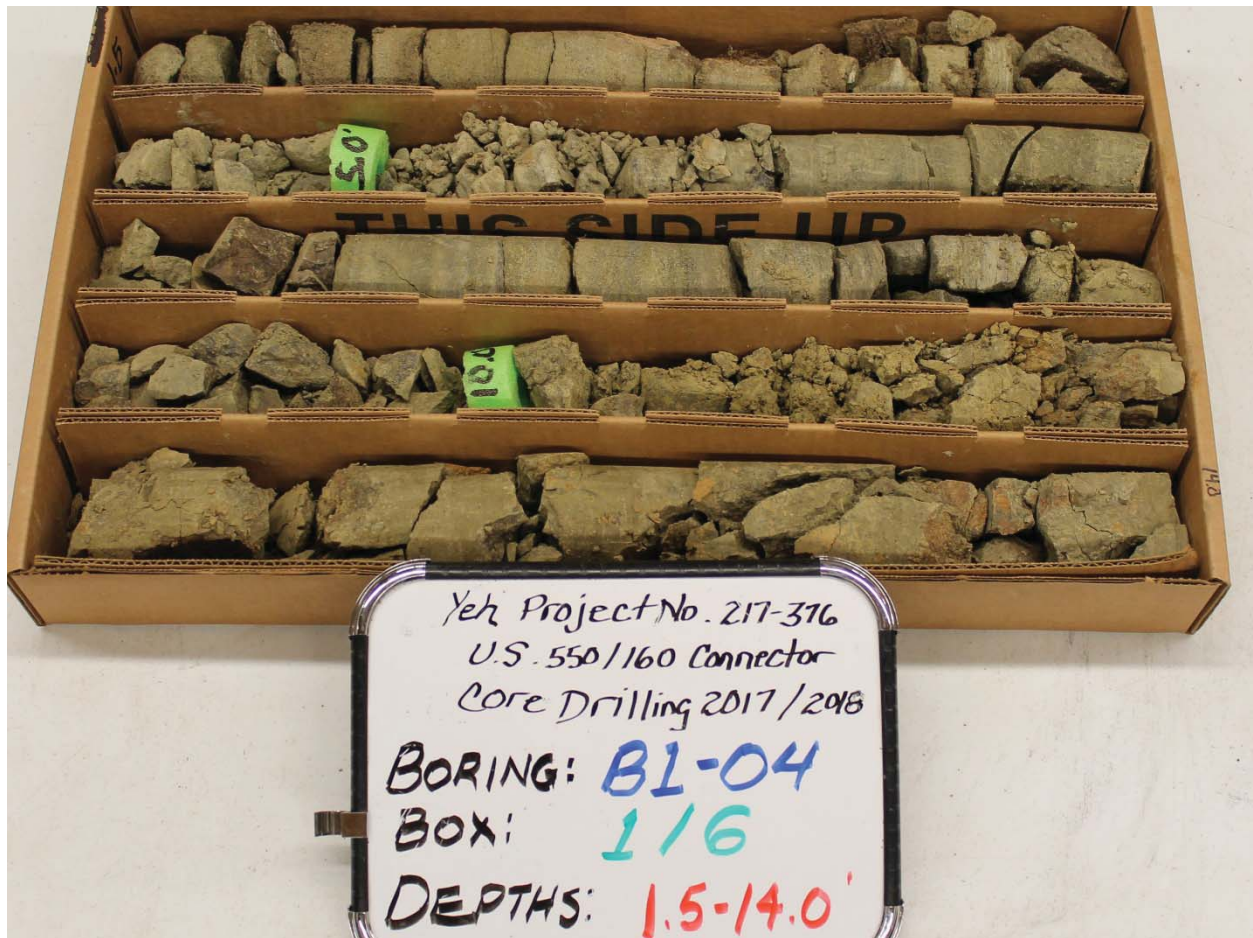
Core Drilling 2017/2018

BORING: B1-02

BOX: 3/3

DEPTHS: 96.0-101.0'

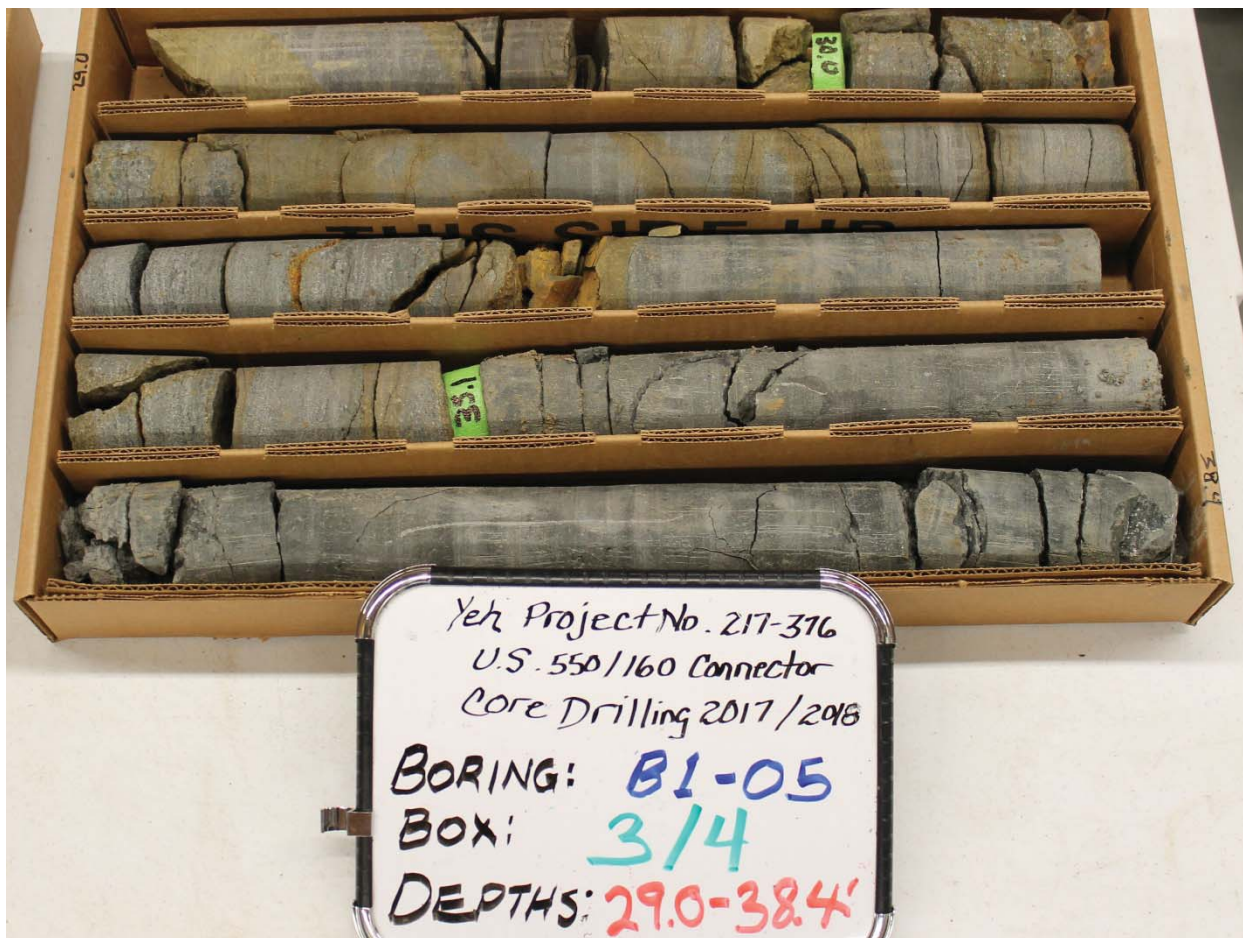








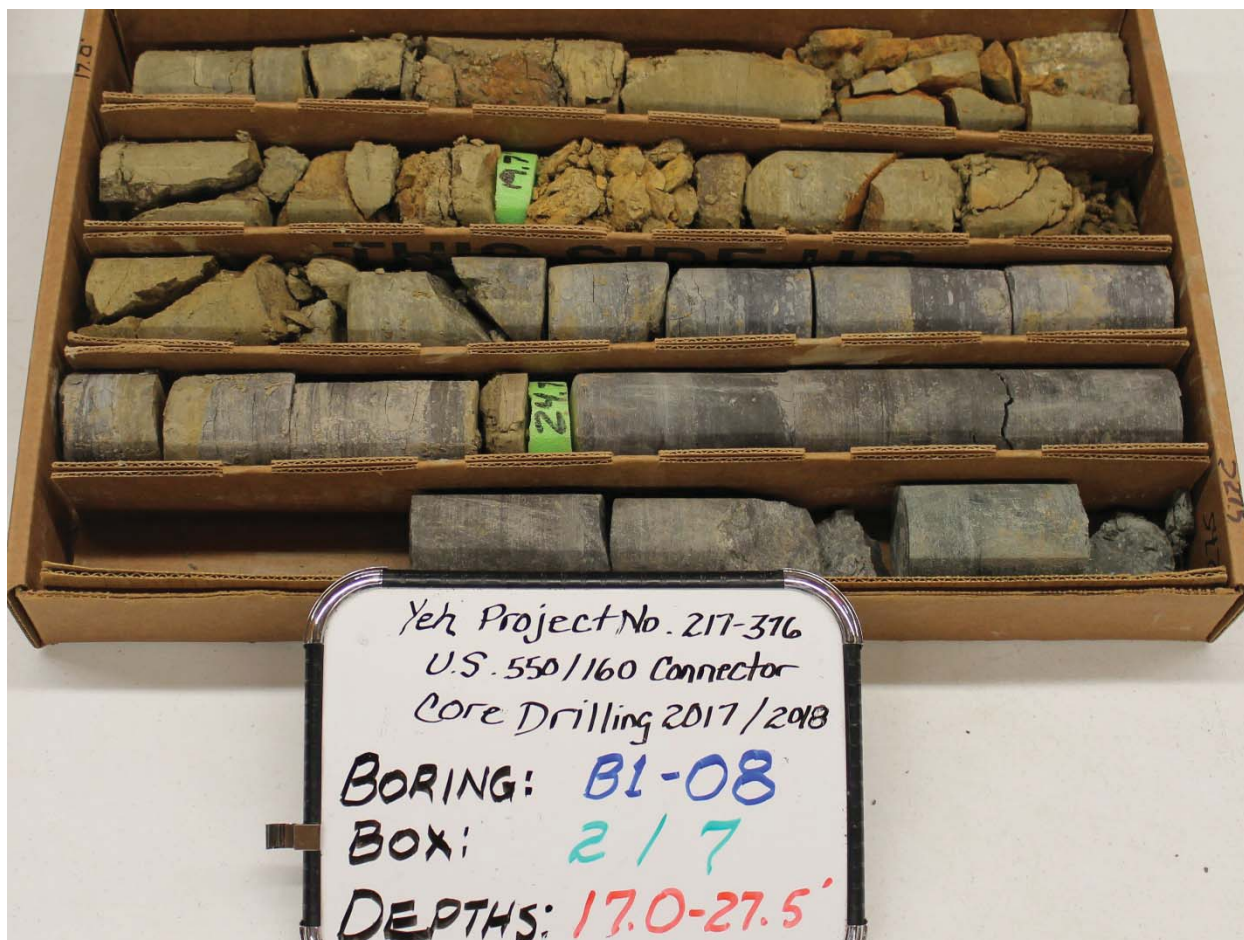


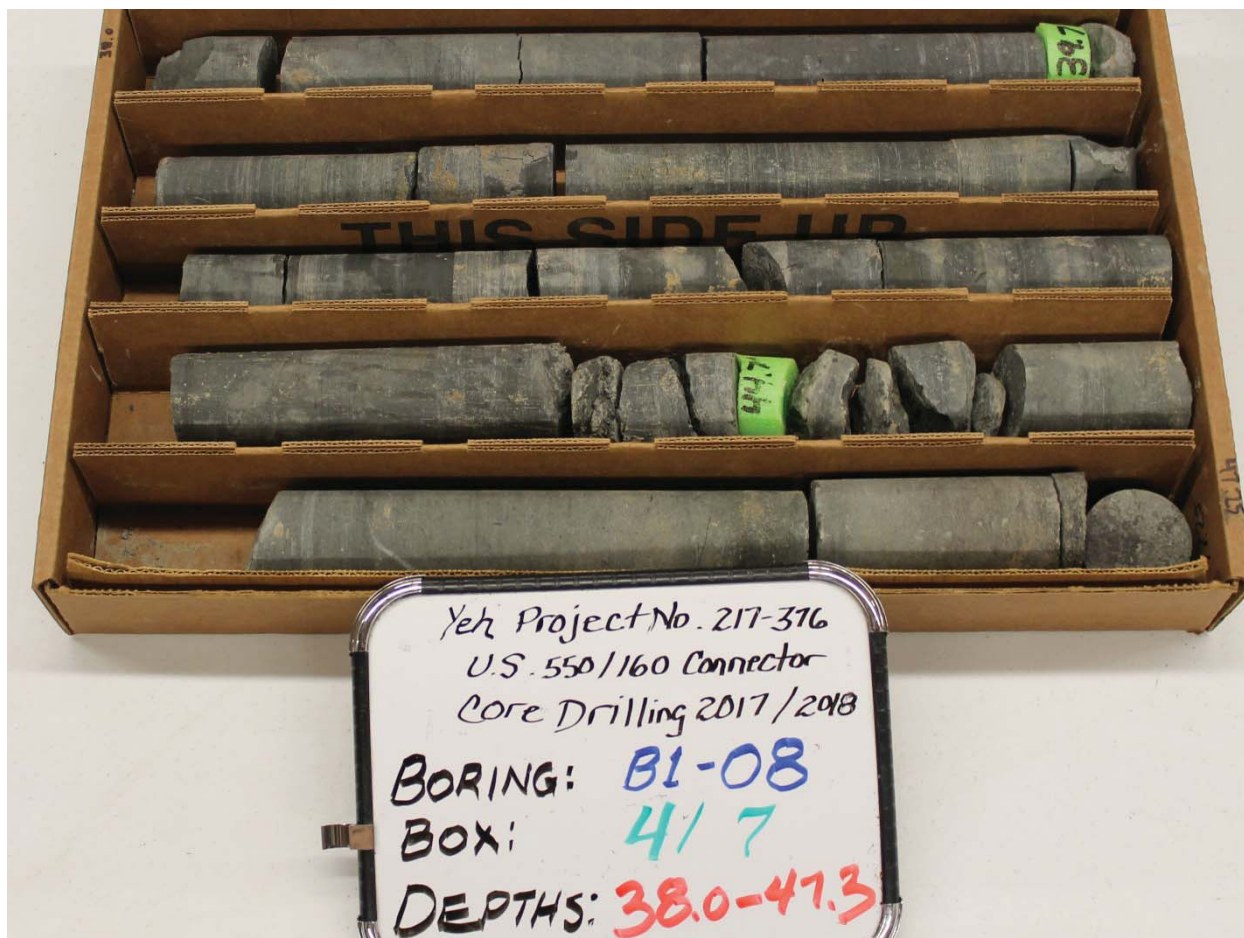
















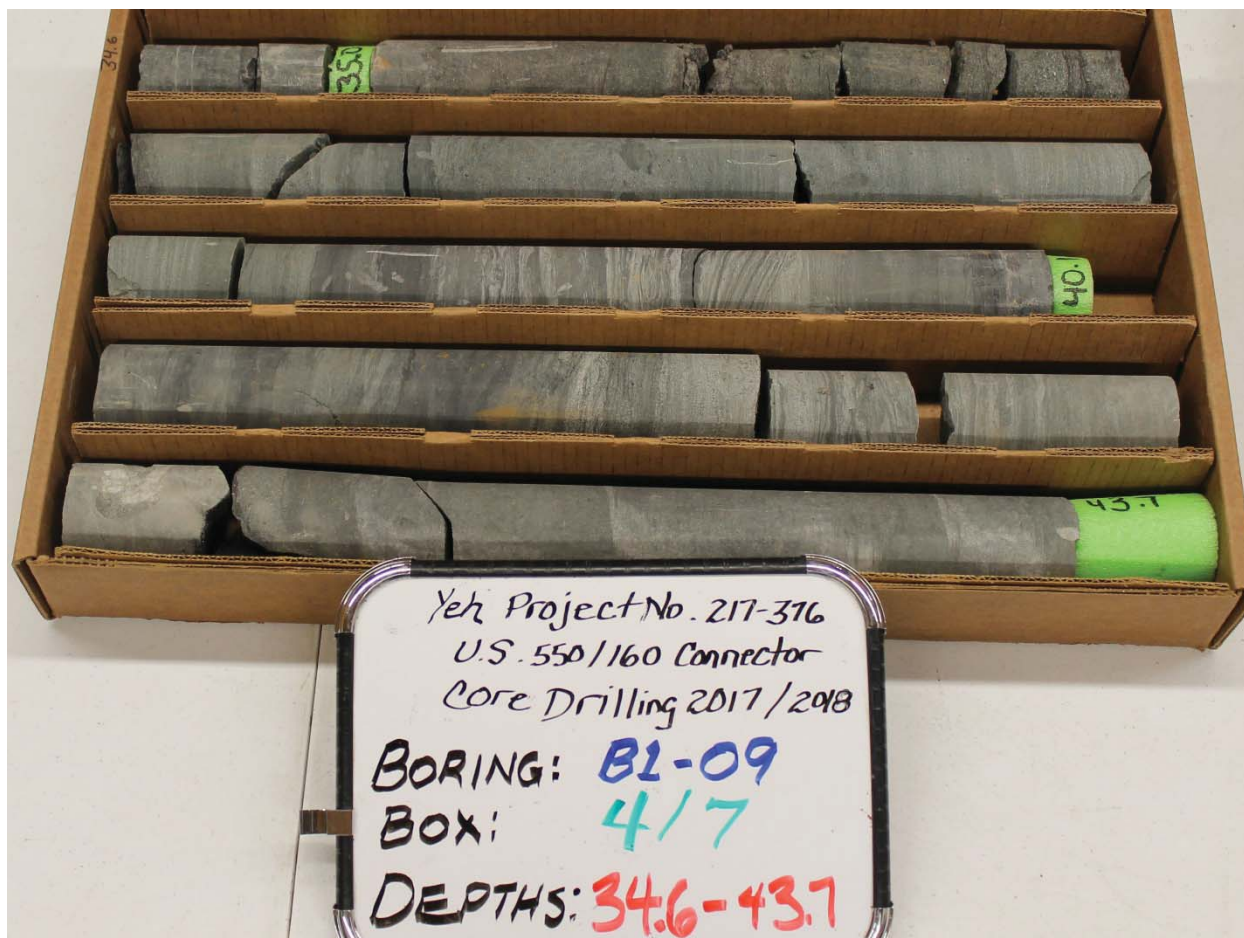
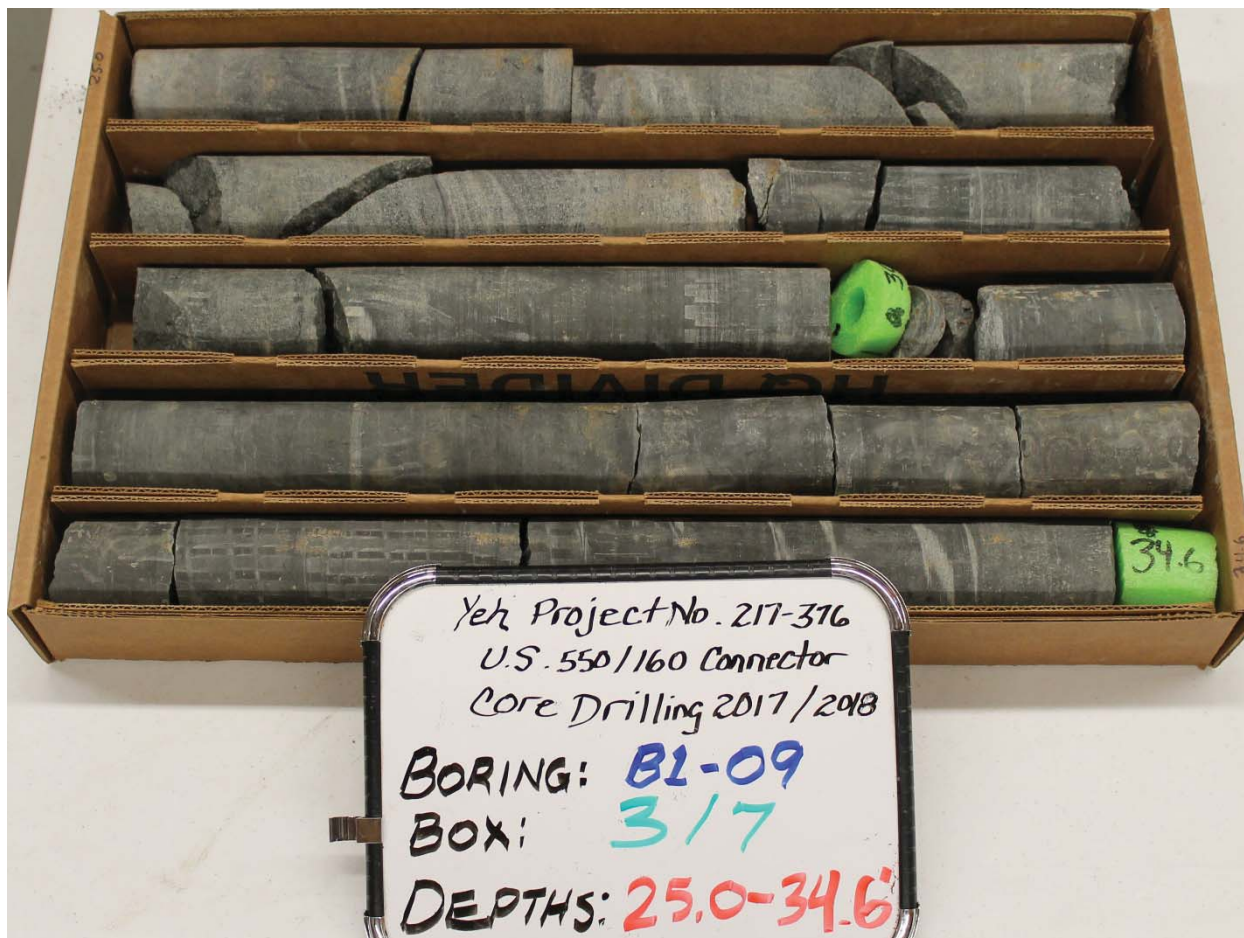
Yeh Project No. 217-376
U.S. 550/160 Connector
Core Drilling 2017/2018

BORING: B1-08

BOX: 717

DEPTHS: 64.9-70.0'









Yeh Project No. 217-316
U.S. 550/160 Connector
Core Drilling 2017/2018

BORING: **B1-09**

BOX: **7/7**

DEPTHS: **62.2-70.0'**

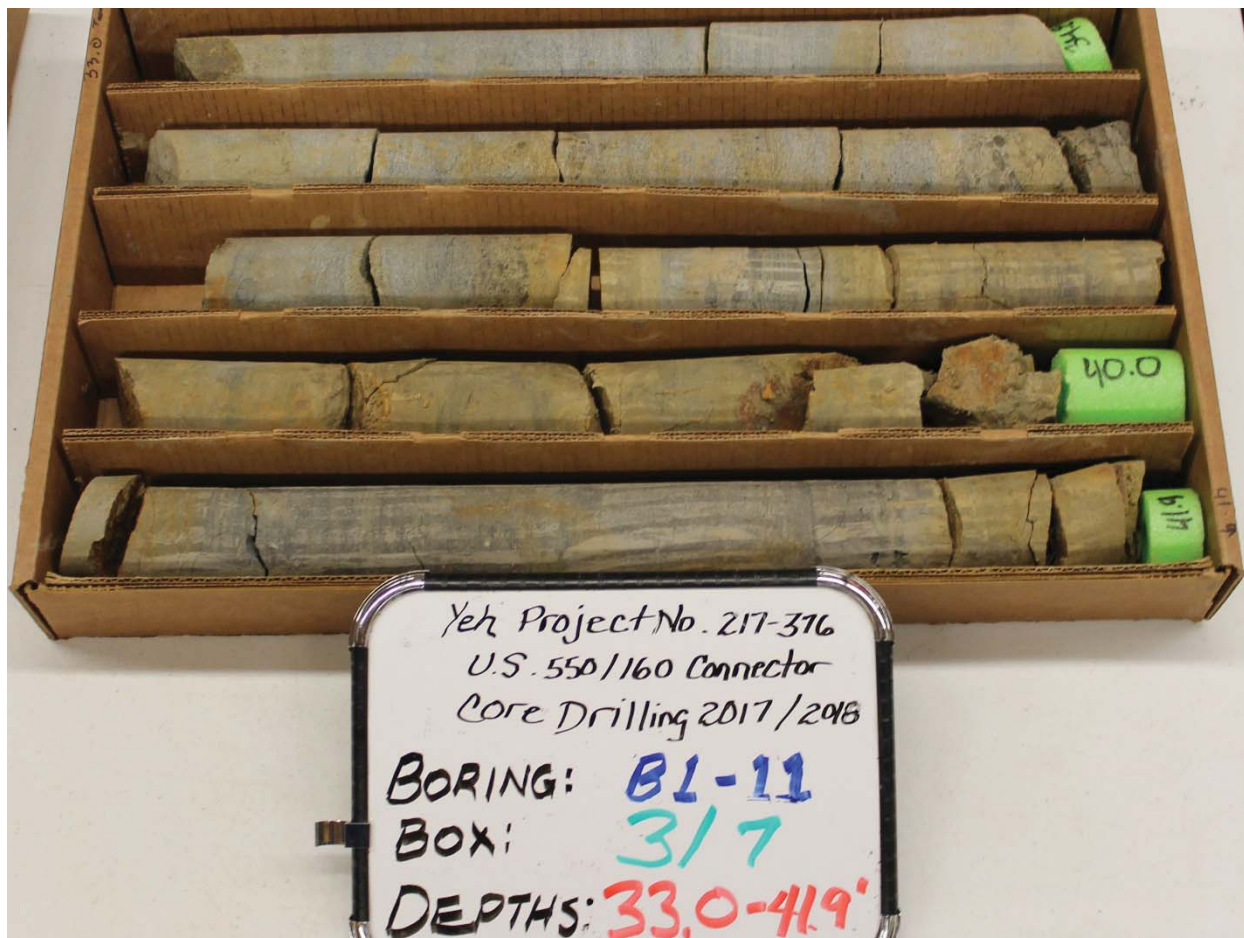




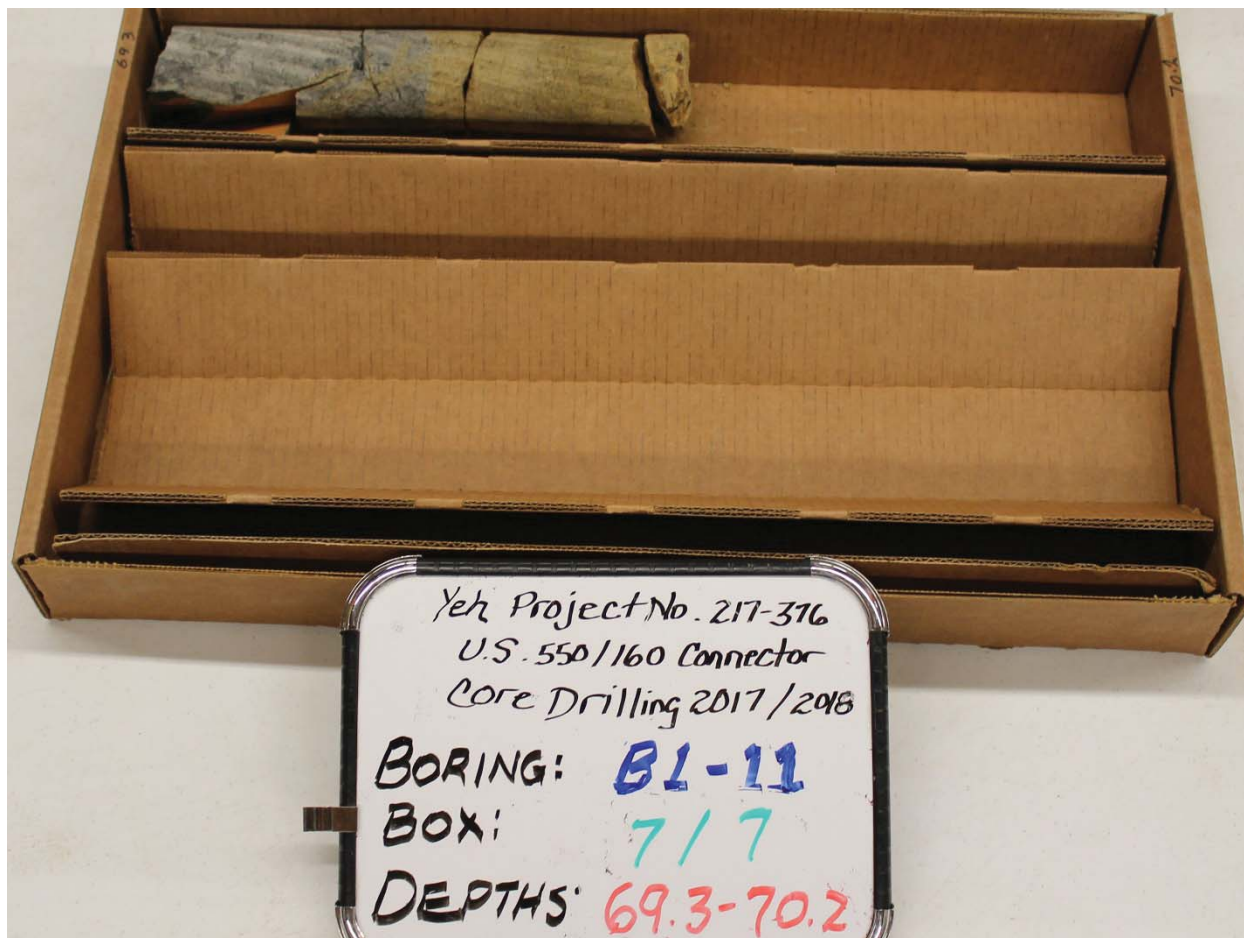






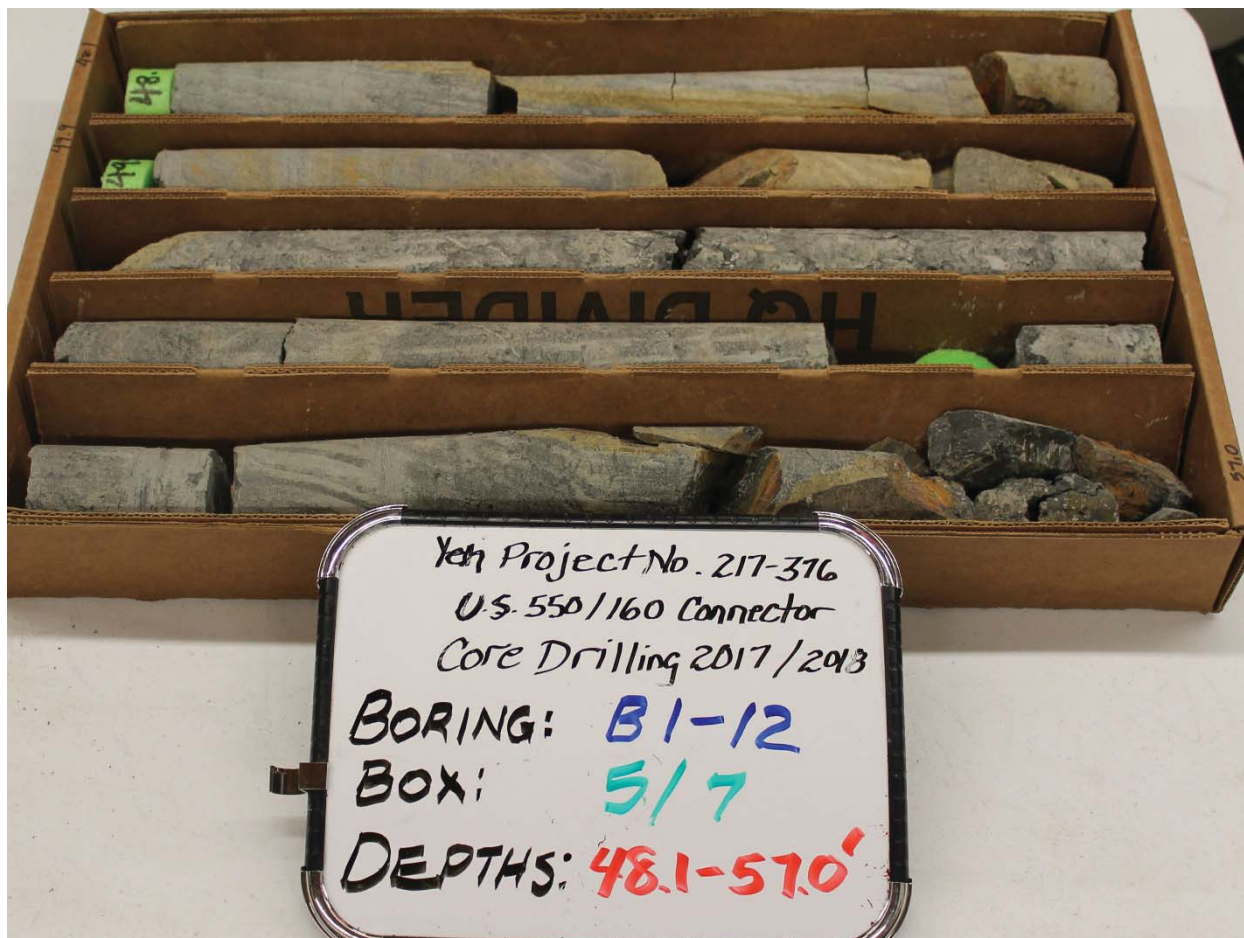














Yeh Project No. 217-376

U.S. 550/160 Connector

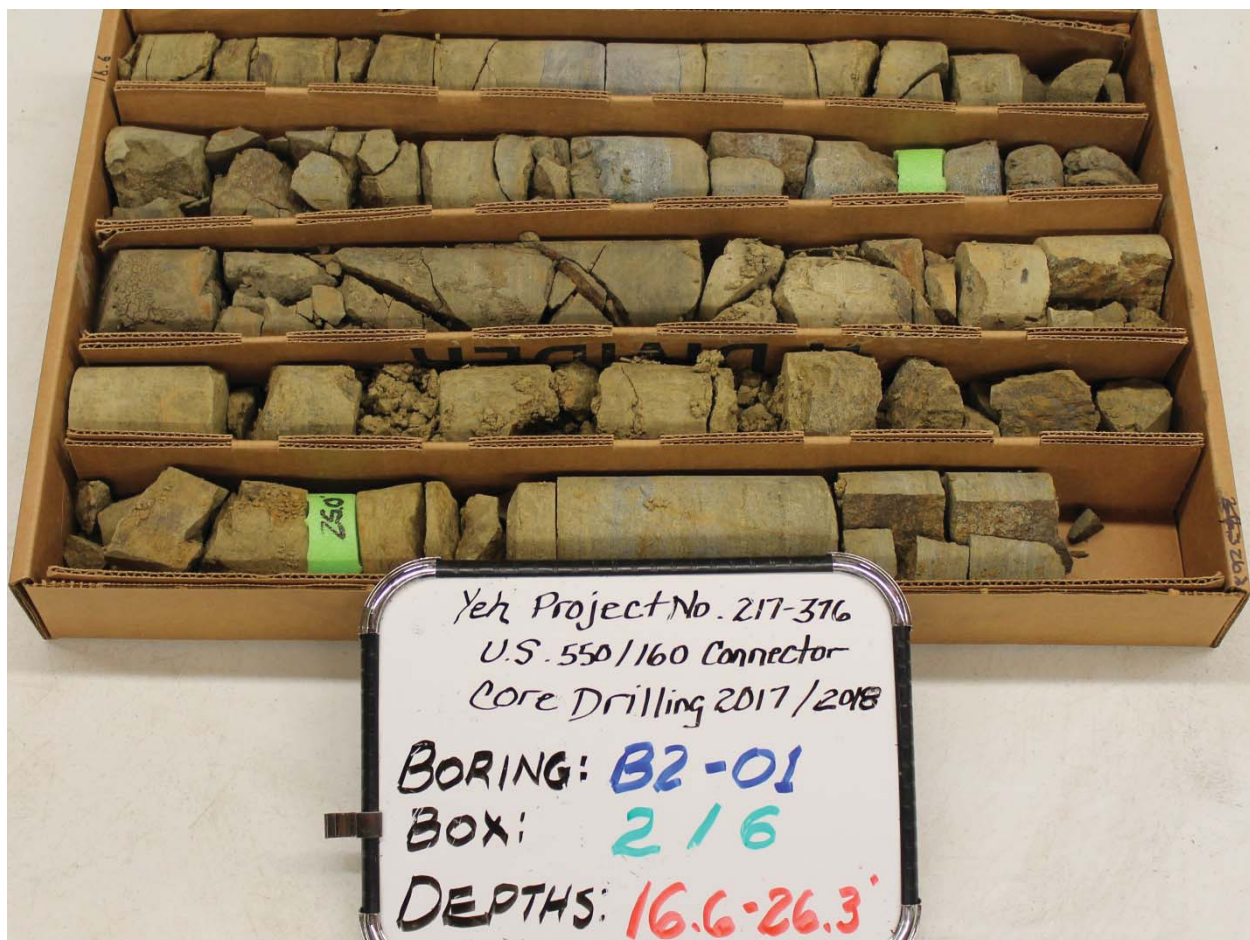
Core Drilling 2017/2013

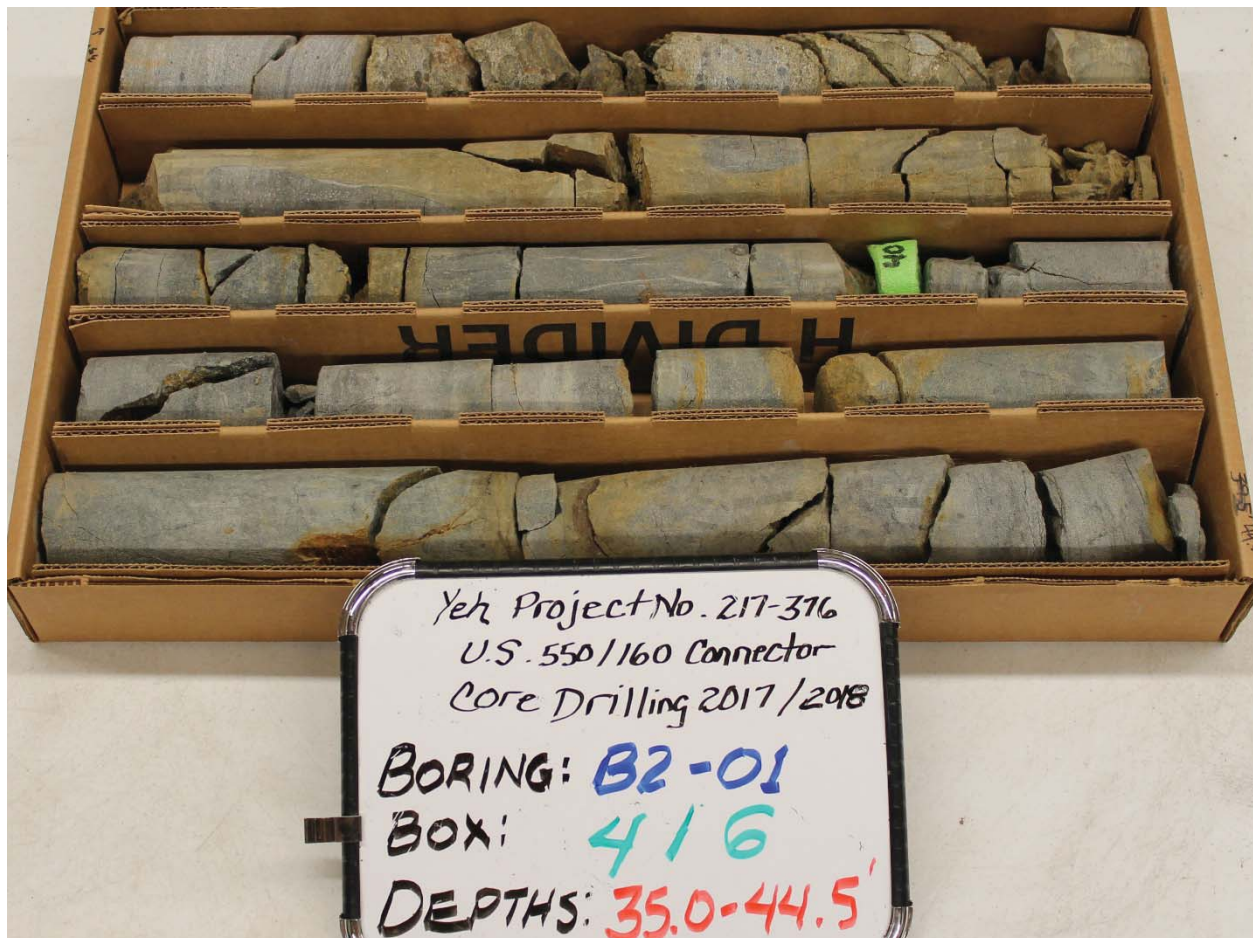
BORING: B1-12

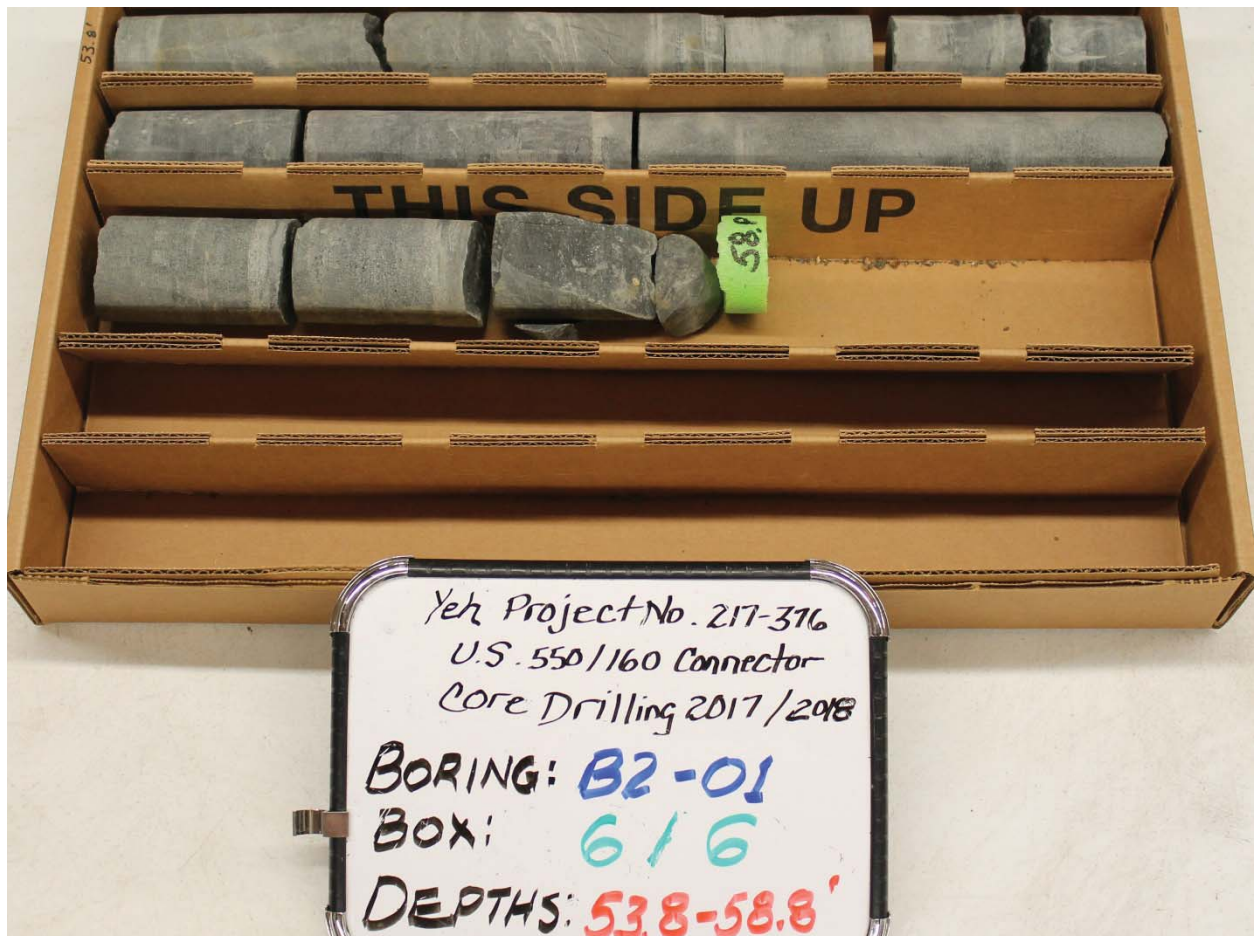
BOX: 7/7

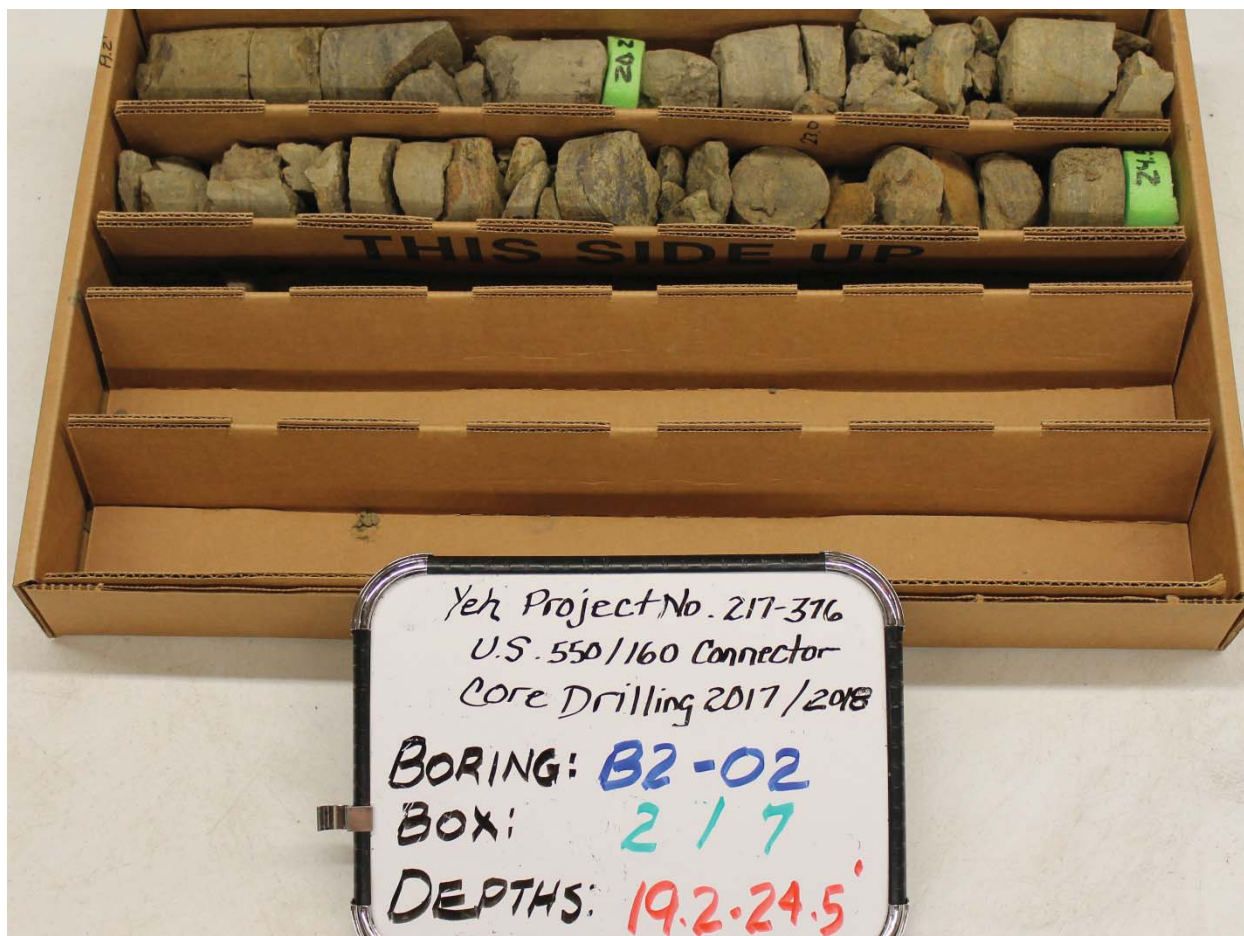
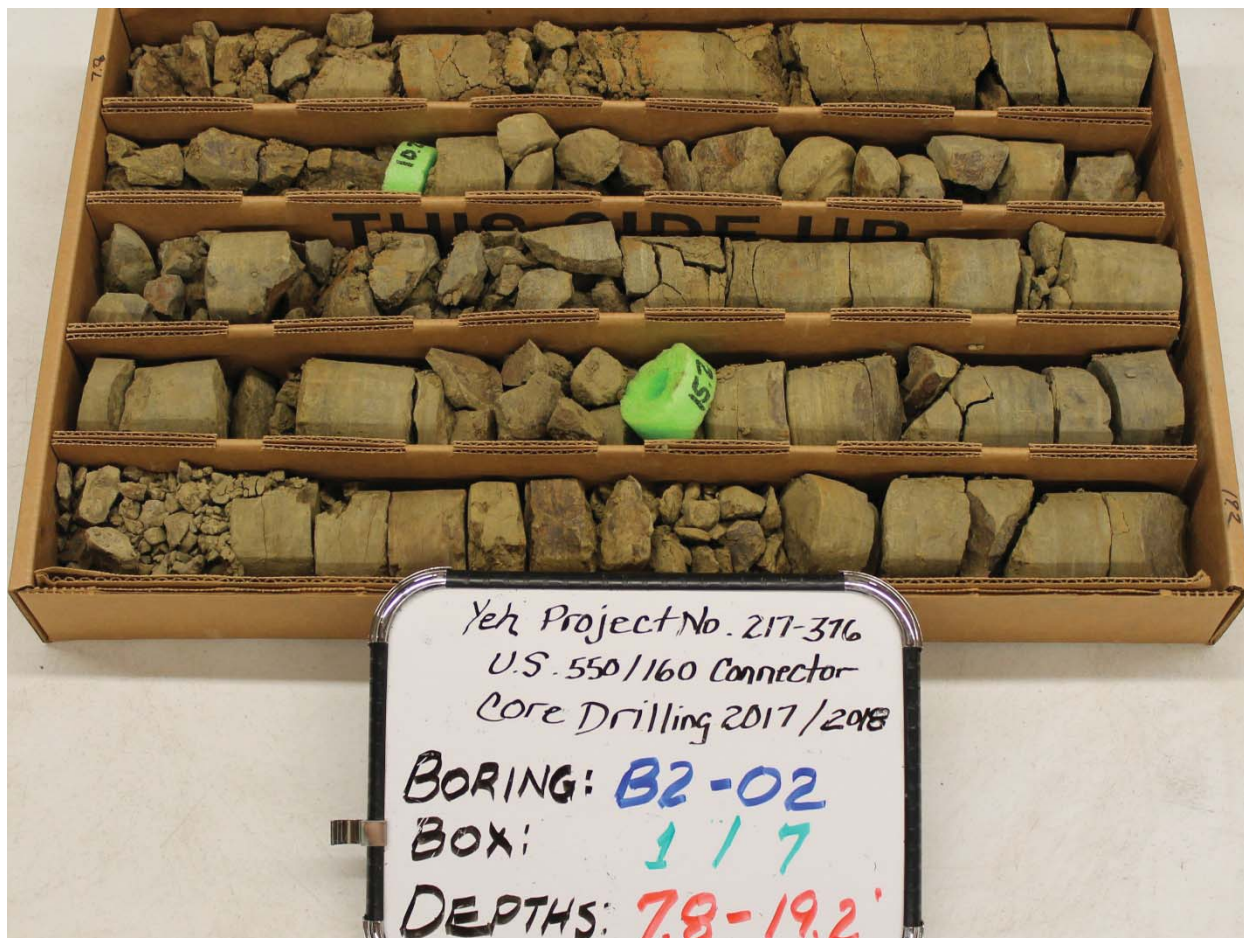
DEPTHS: 65.4-70.4

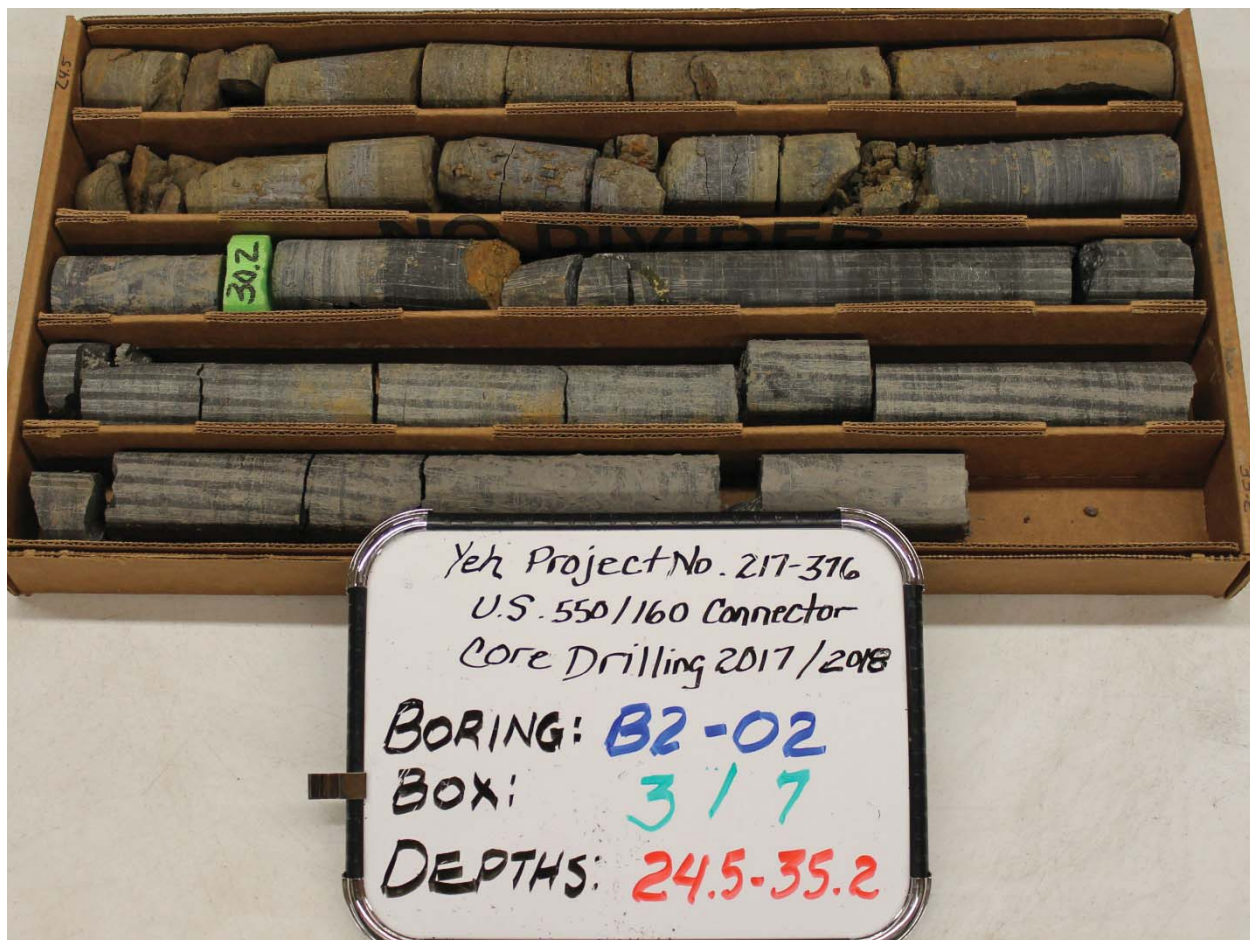
Appendix F.3 – Bridge 2 (P-05-BA) Borings – Core Photos



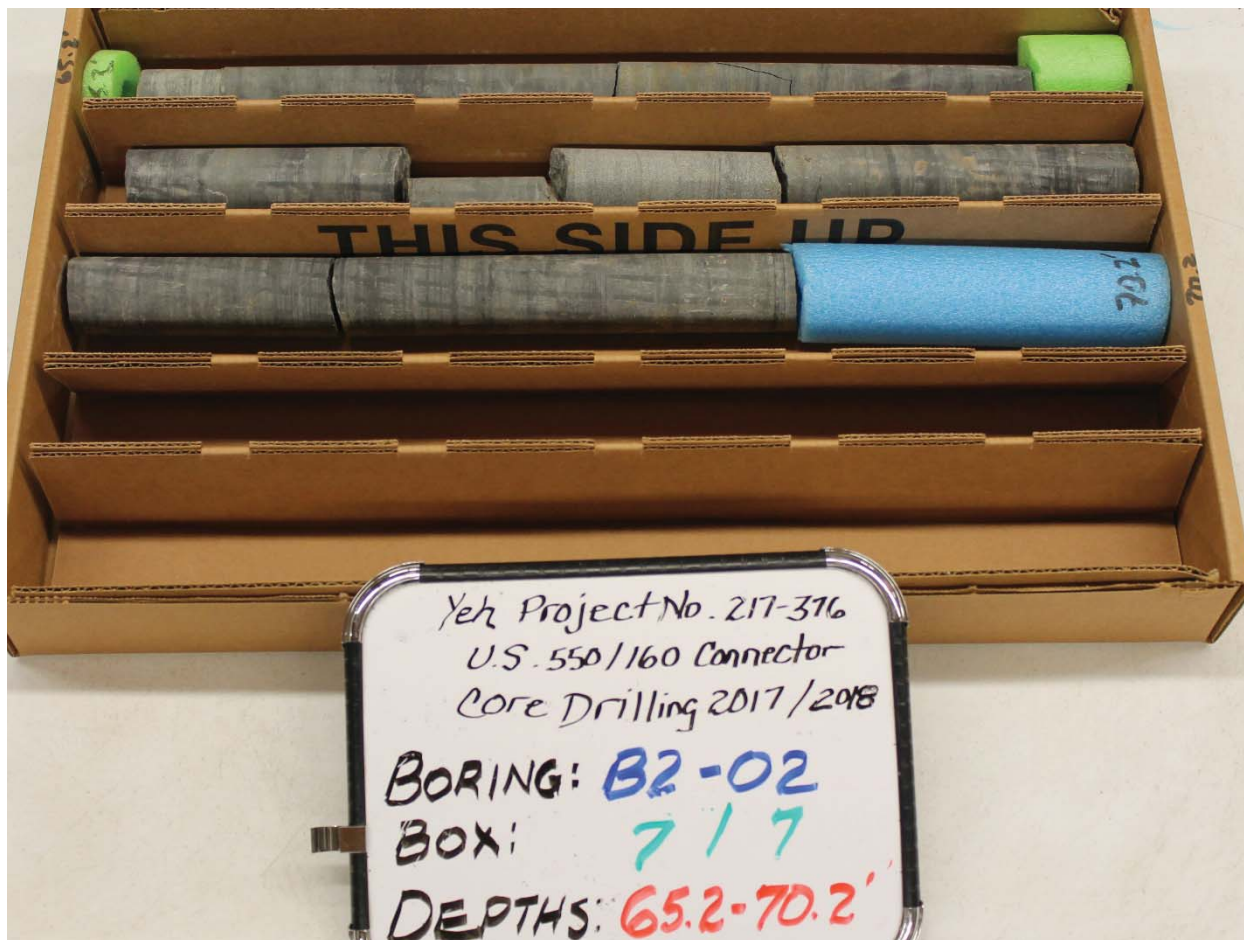






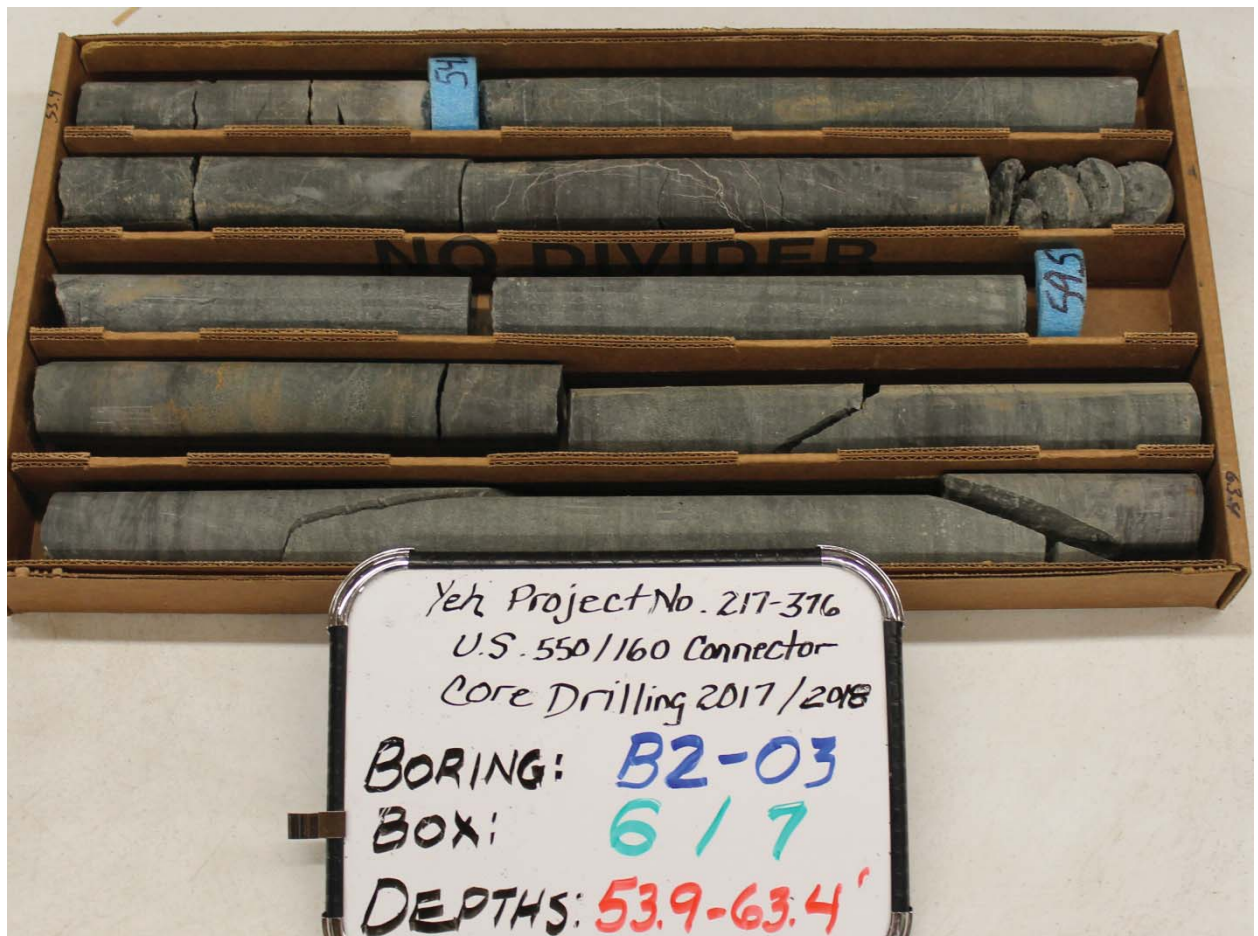












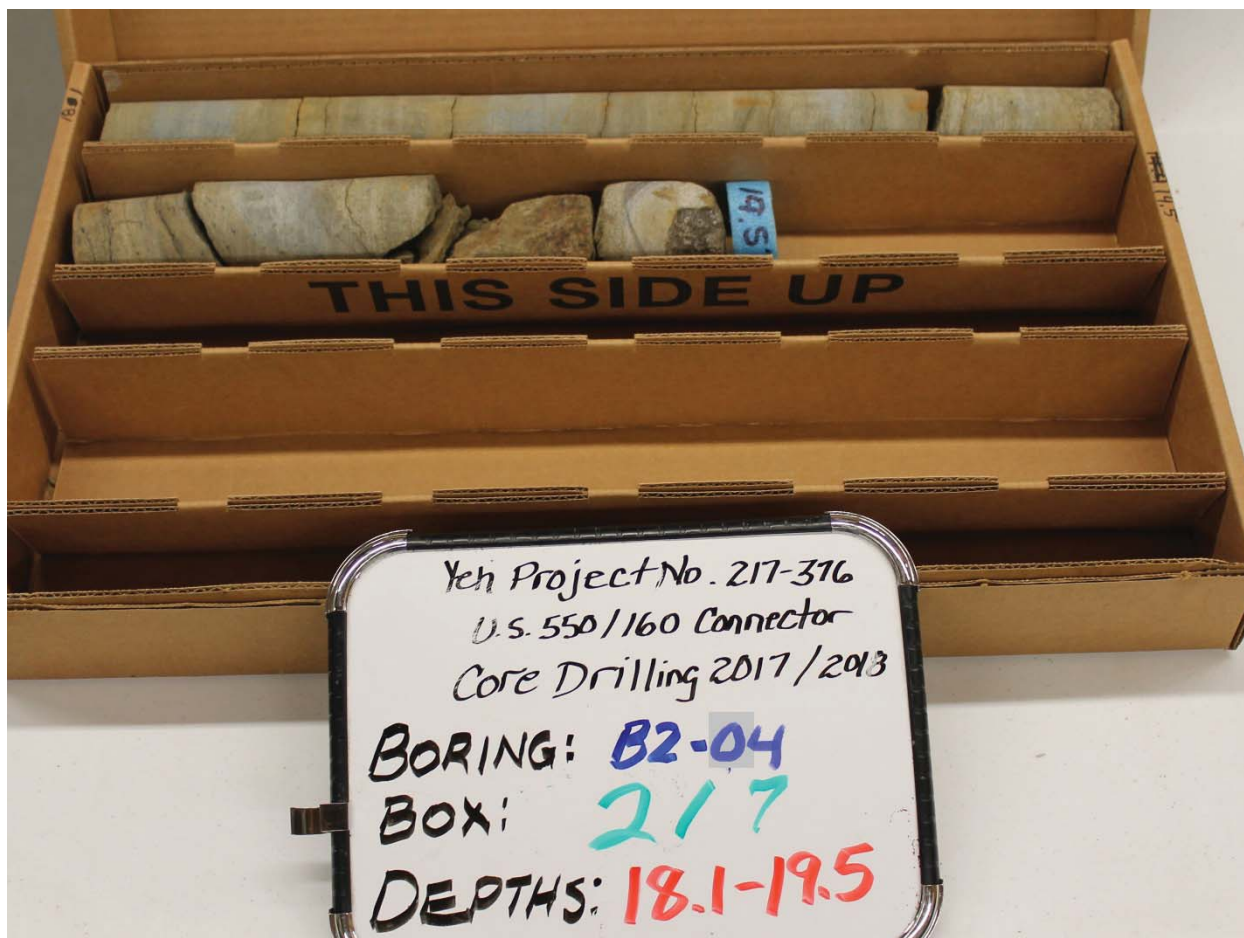


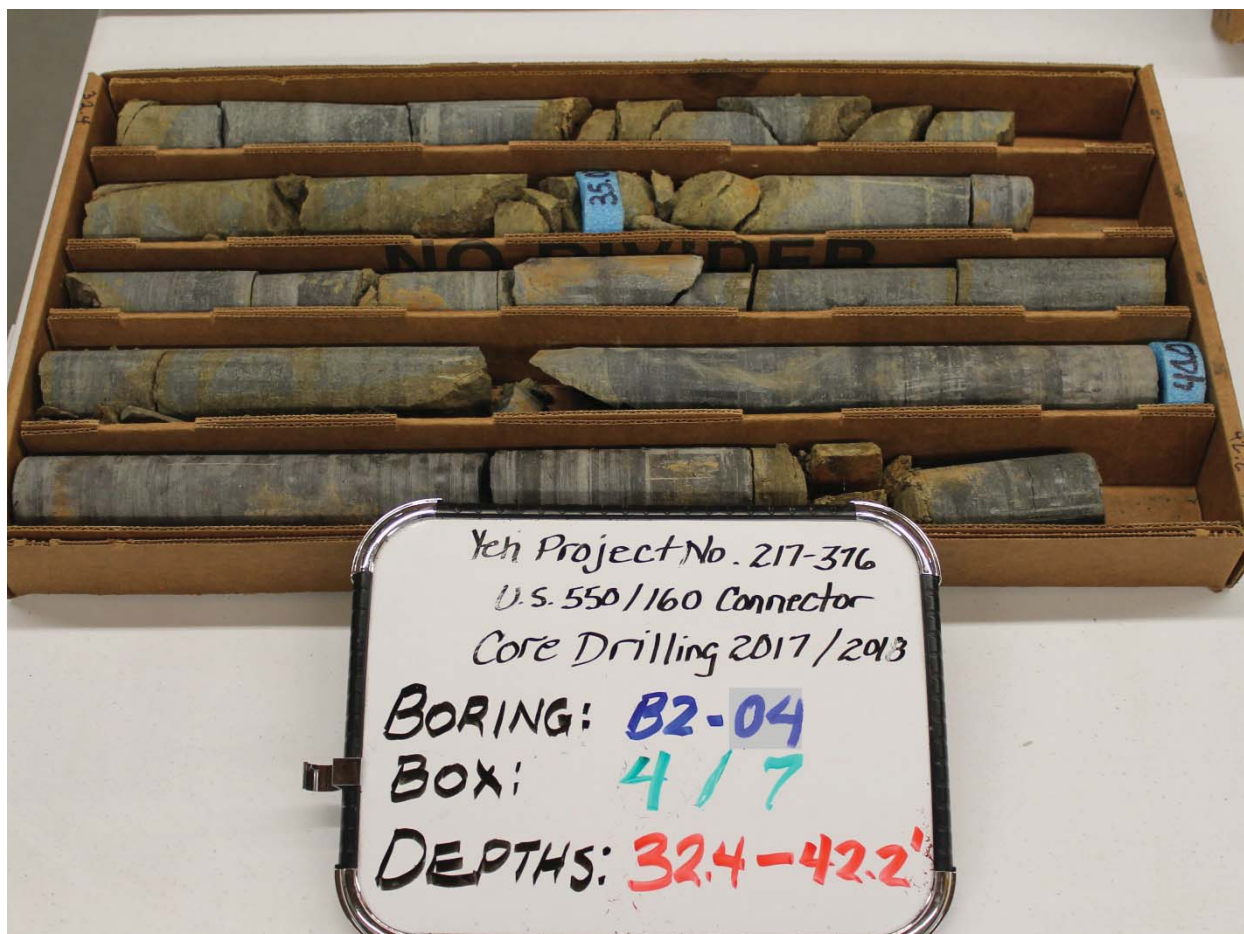
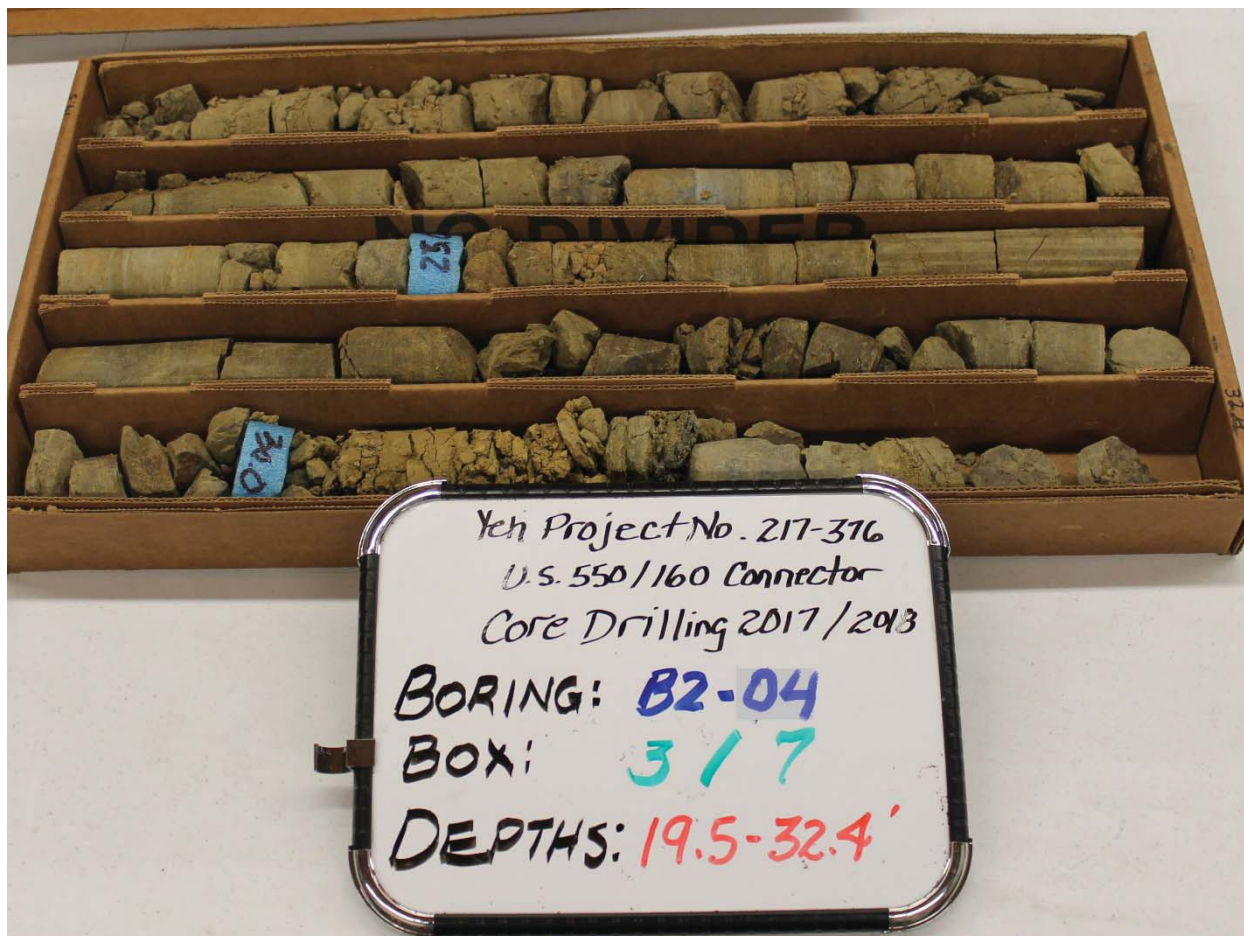
Yeh Project No. 217-316
U.S. 550/160 Connector
Core Drilling 2017/2018

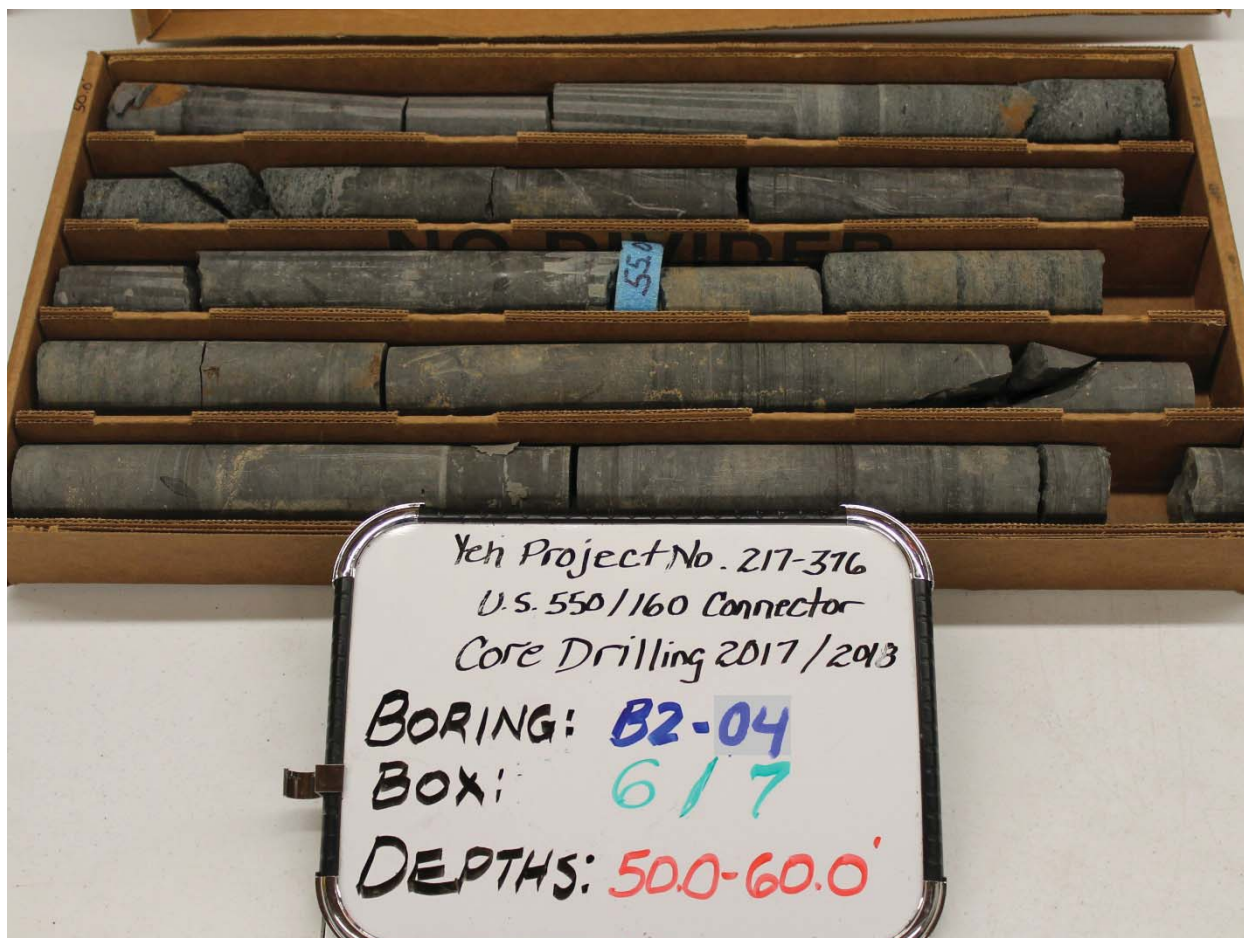
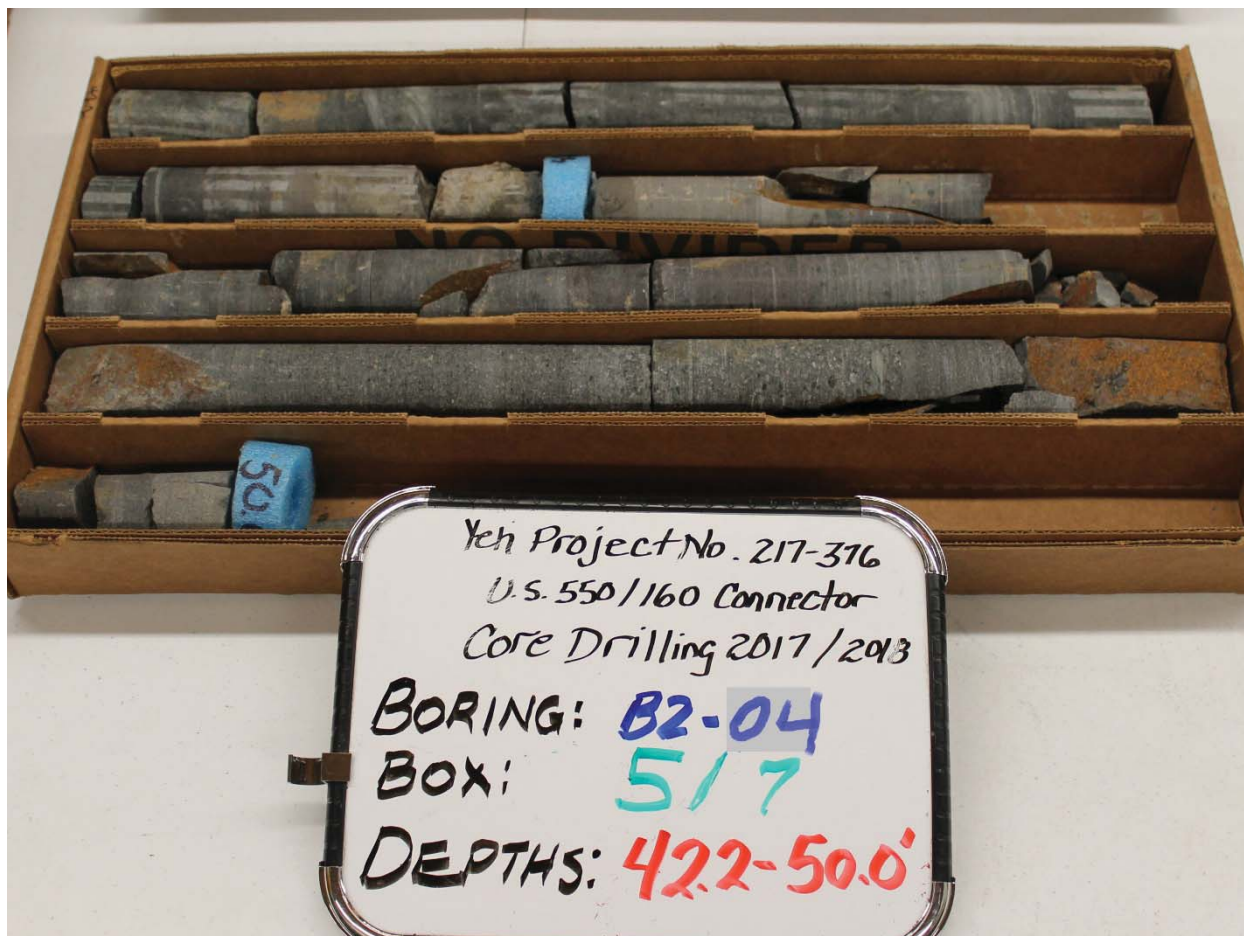
BORING: B2-03

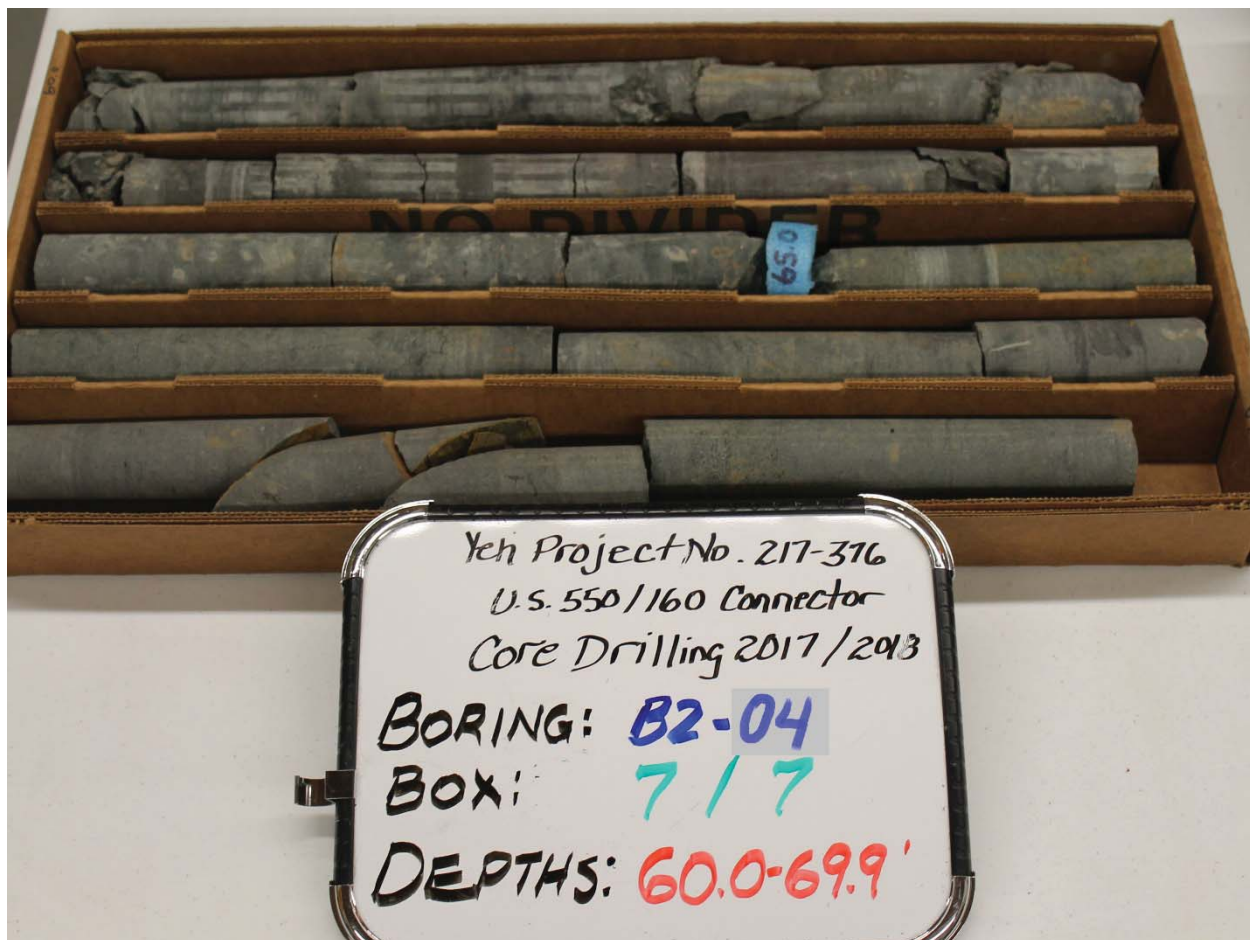
BOX: 7 / 7

DEPTHS: 634-69.0'





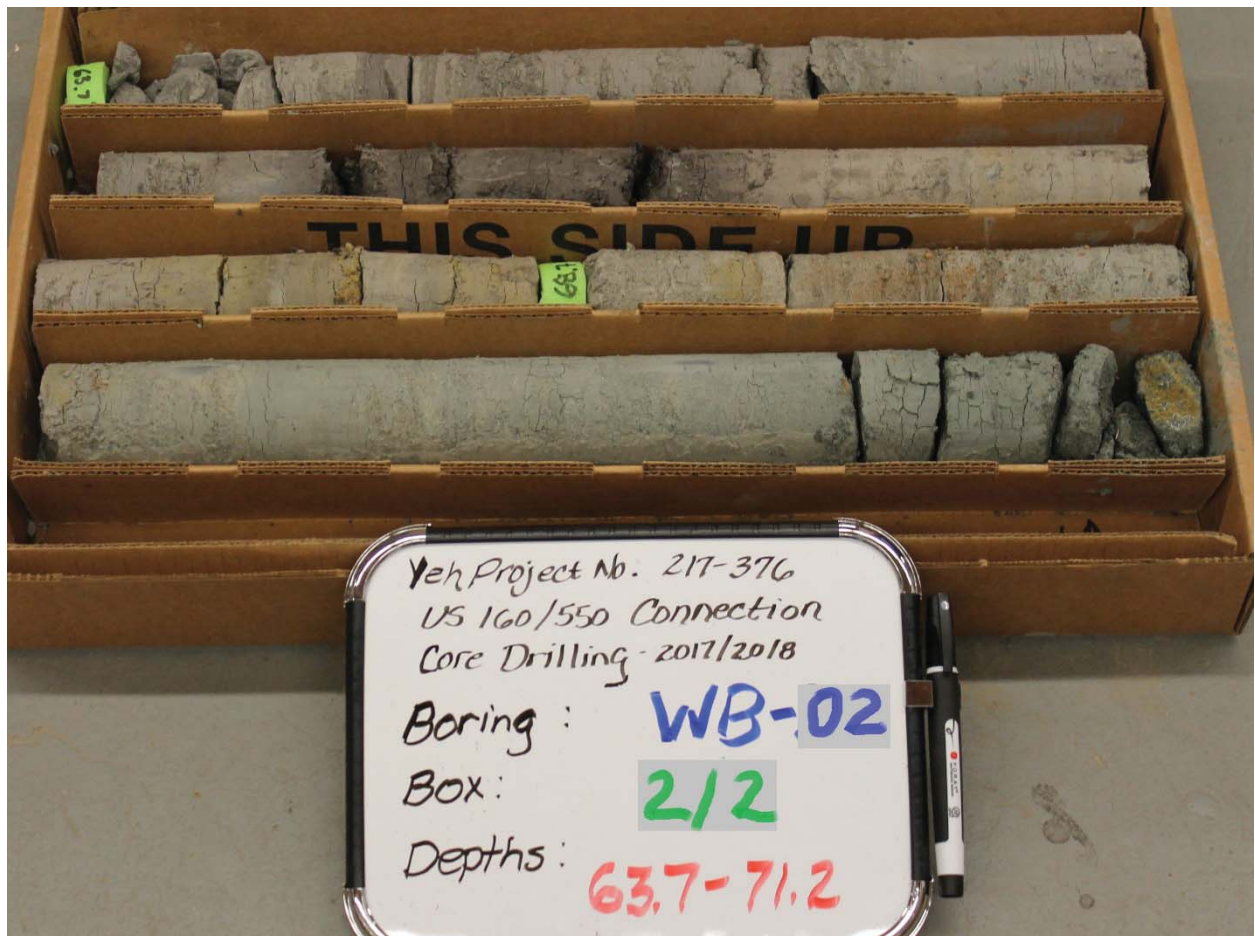




Appendix F.4 – Retaining Walls Borings – Core Photos









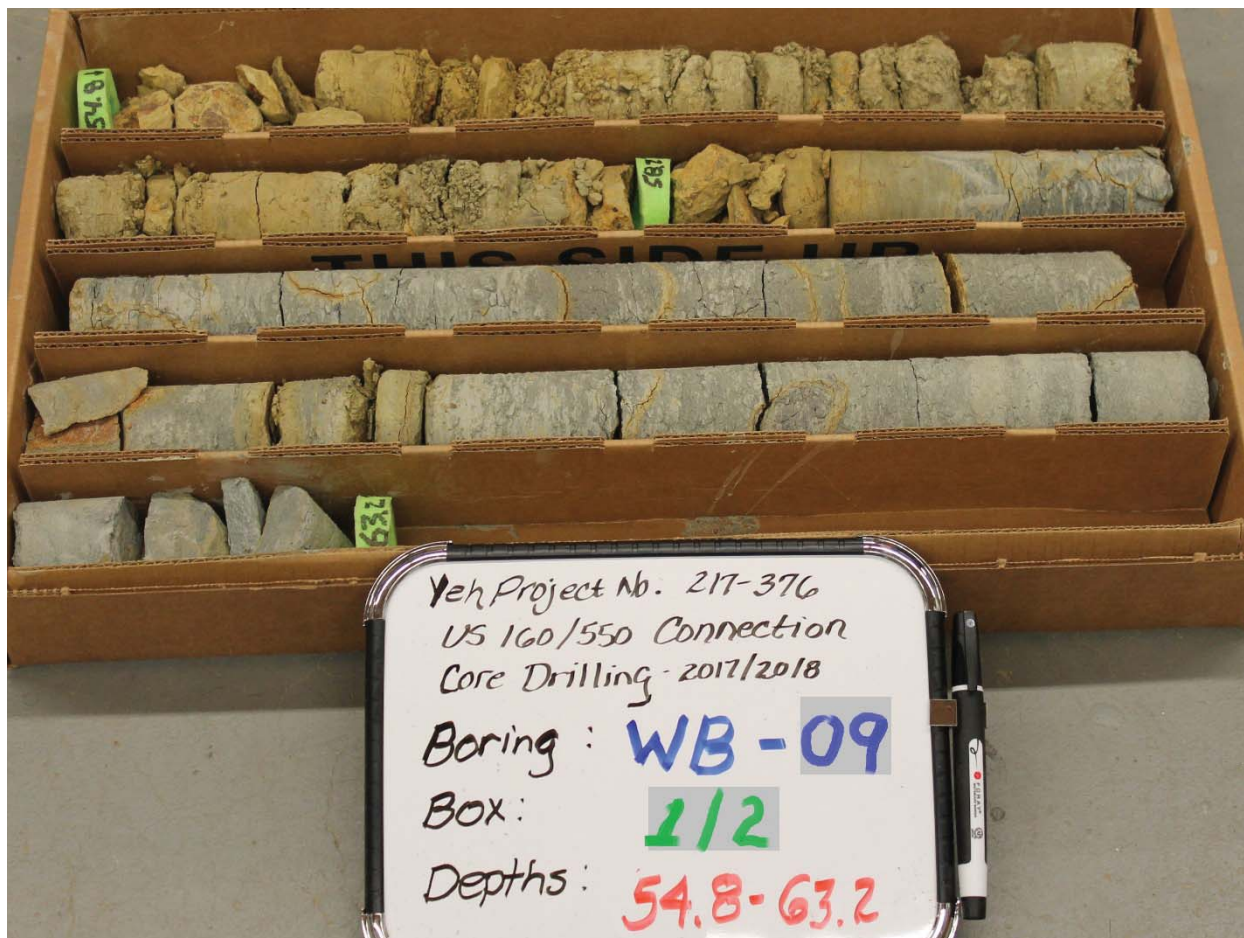
Yeh Project No. 217-376
US 550/160 Connection
Core Drilling 2017/2018

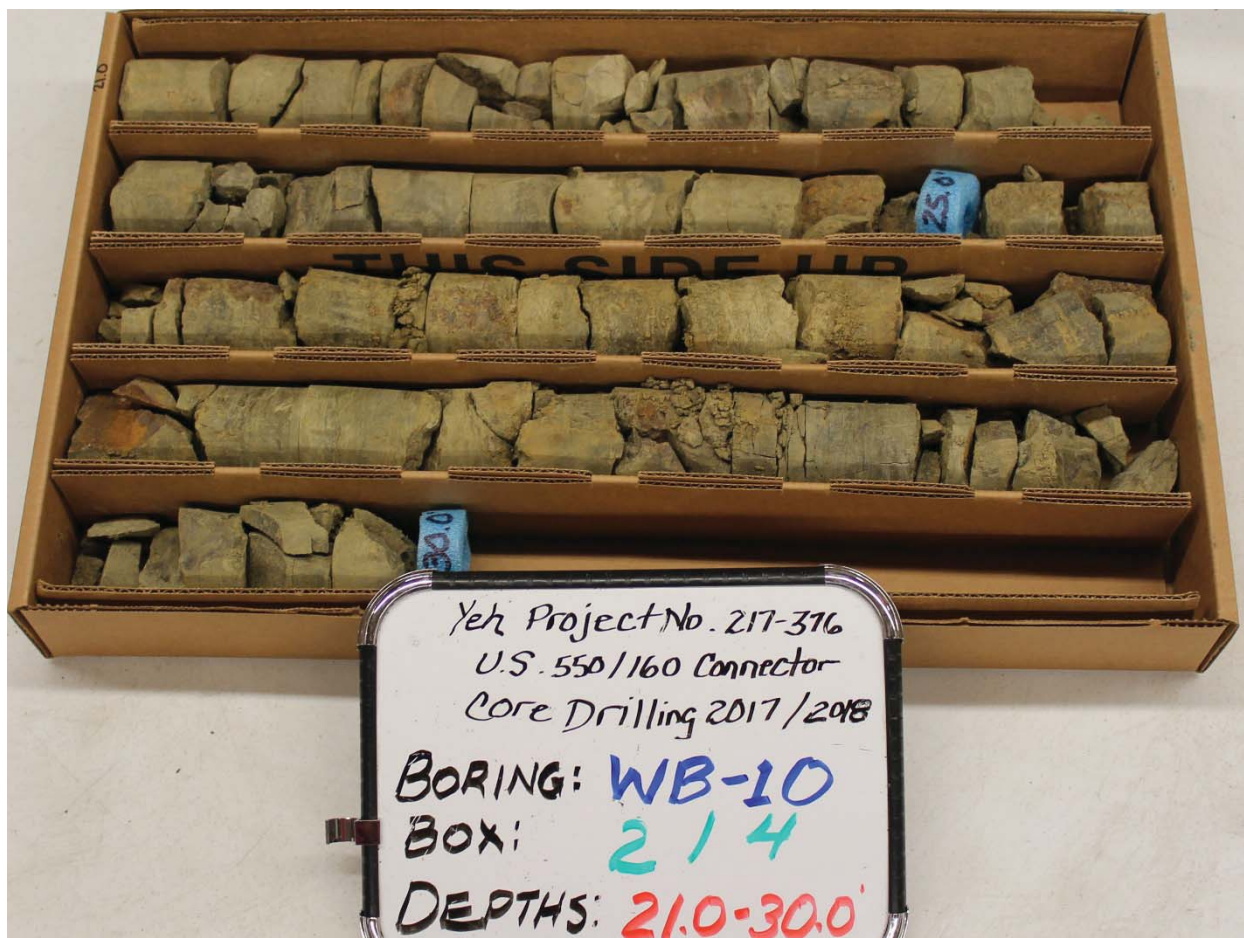
BORING: WB-06

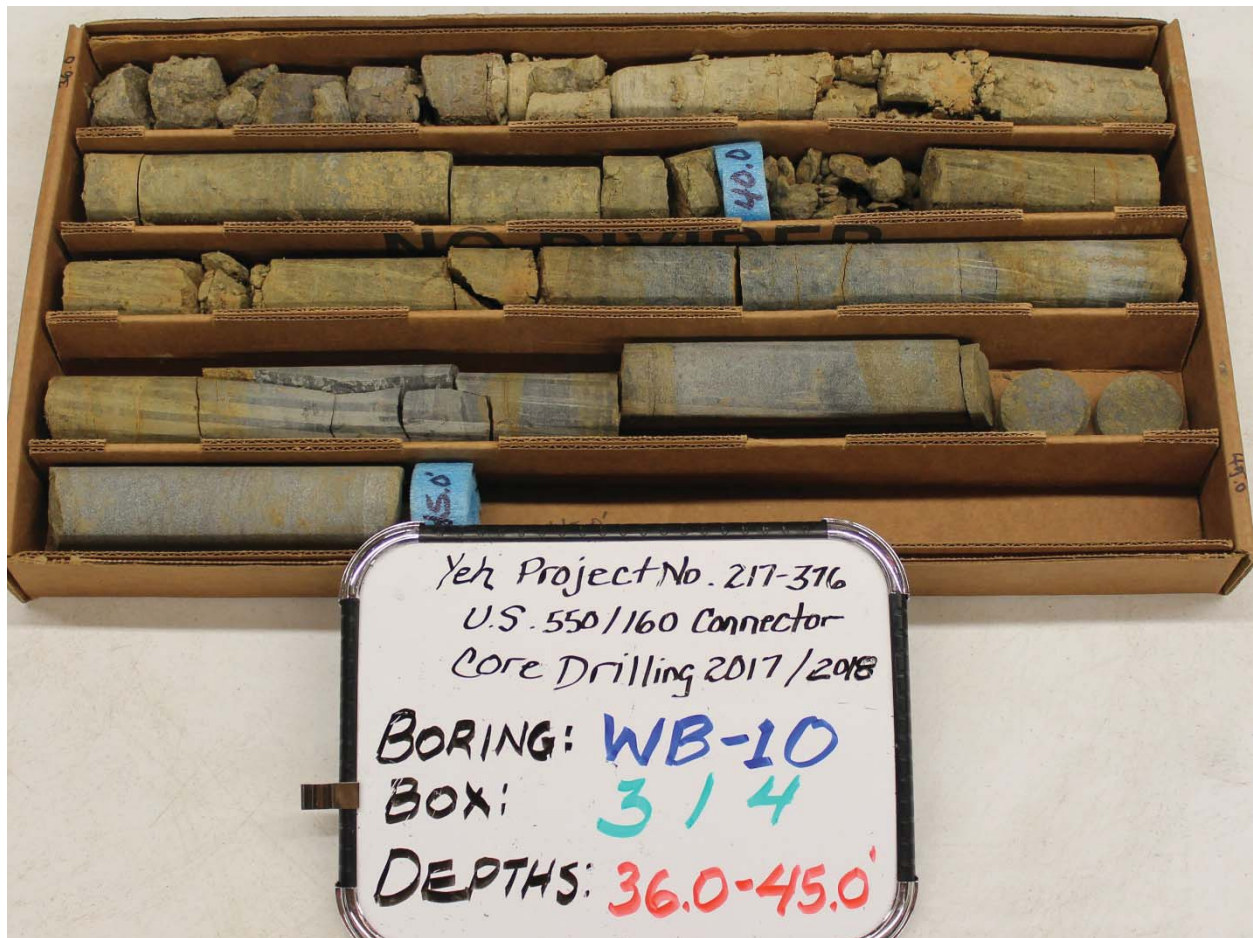
Box: 1/1

DEPTHS: 59.5-69.0













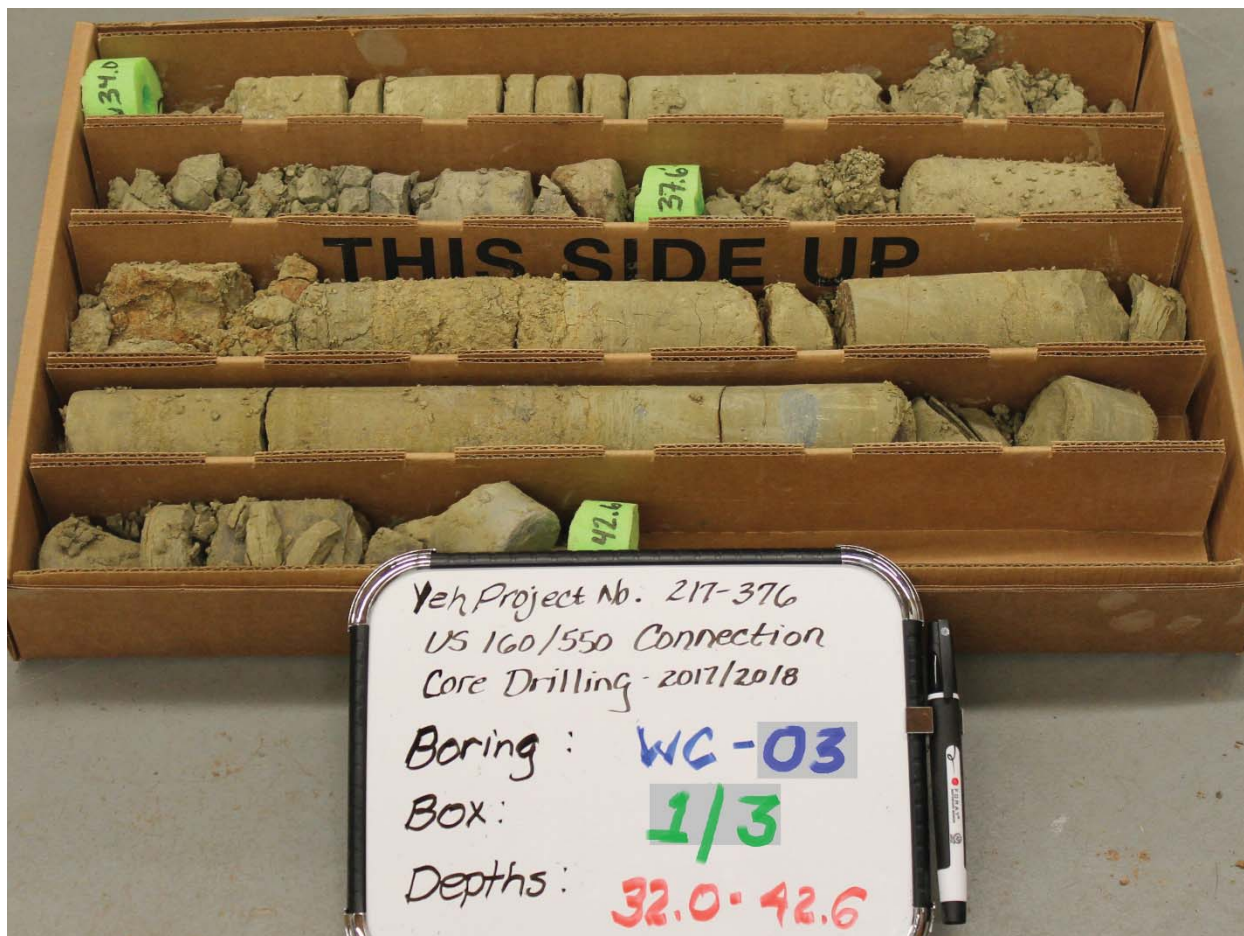
Yeh Project No. 217-376
US 550/160 Connection
Core Drilling 2017/2018

BORING: WC-01

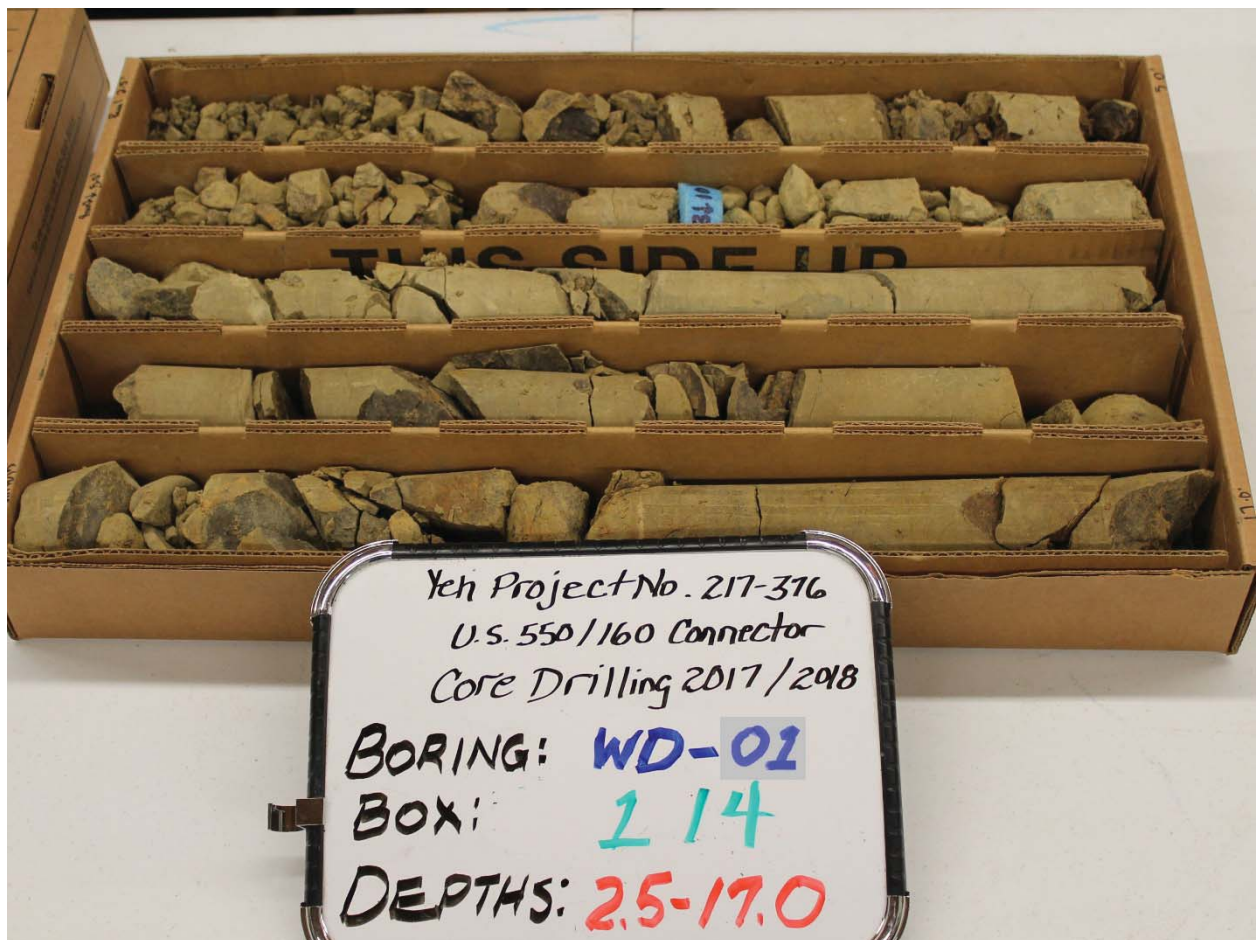
Box: 3/3

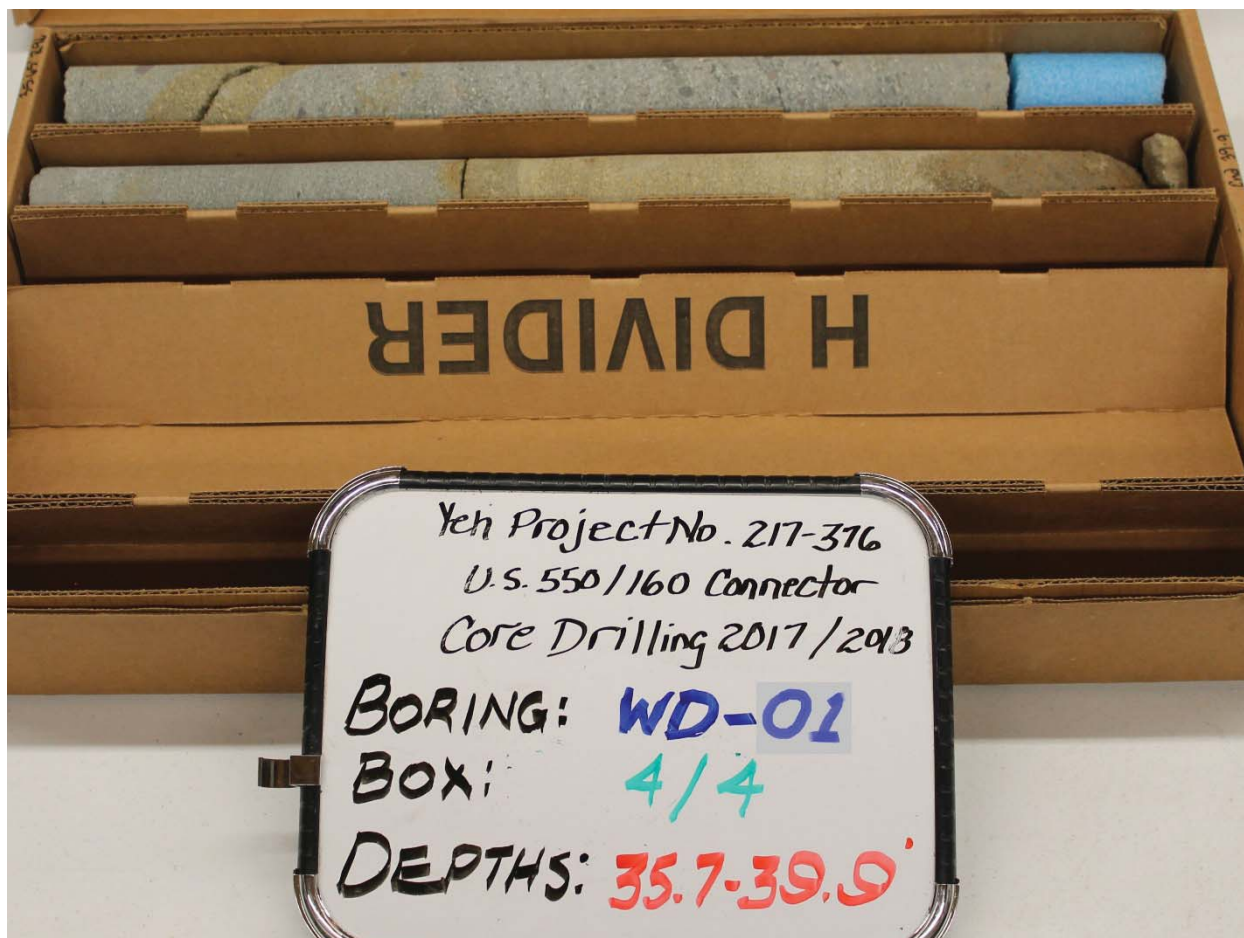
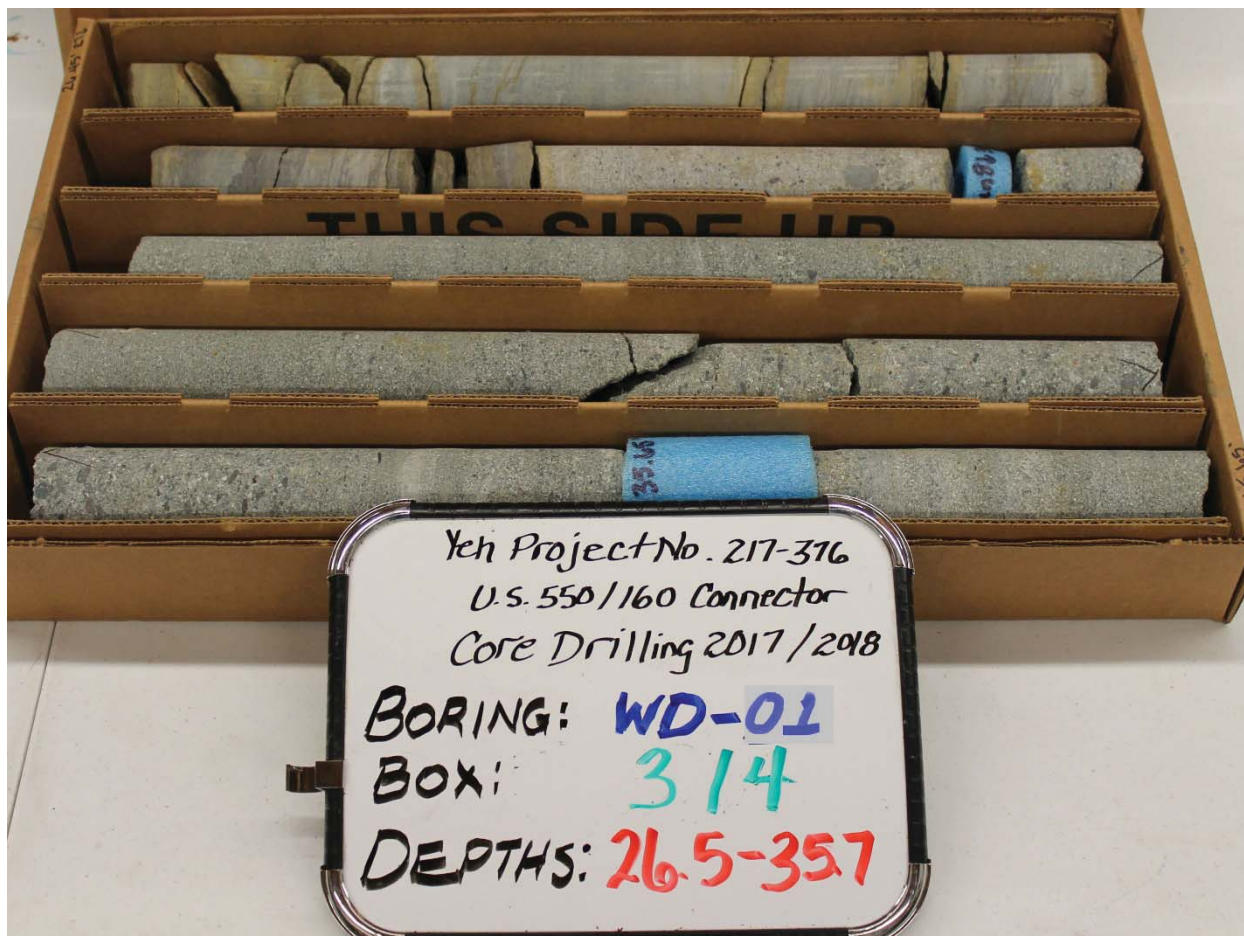
DEPTHS: 58.9-61.8











Appendix G – Site and Drilling Operations Photos



CME ATV Rig at Boring R-04



Helicopter Placing Portable Rig at Boring D-01



Portable Viper Rig at Boring B1-04



CME ATV Rig at Boring R-07



Portable Burley Rig at Boring B1-12



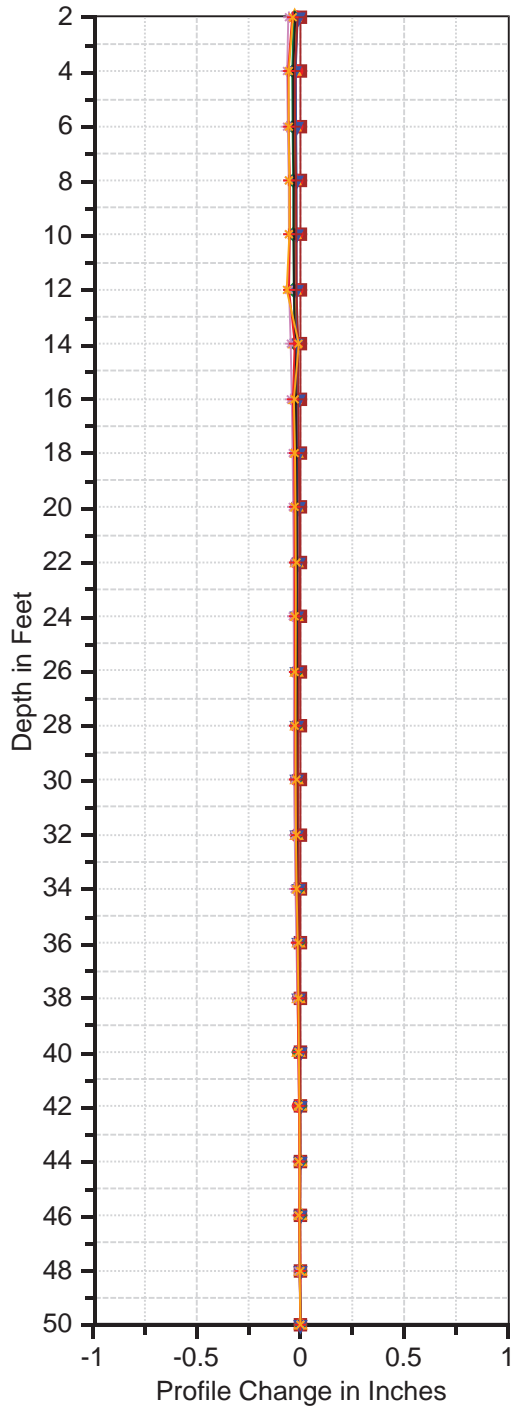
Acker Track Rig at Boring A-1



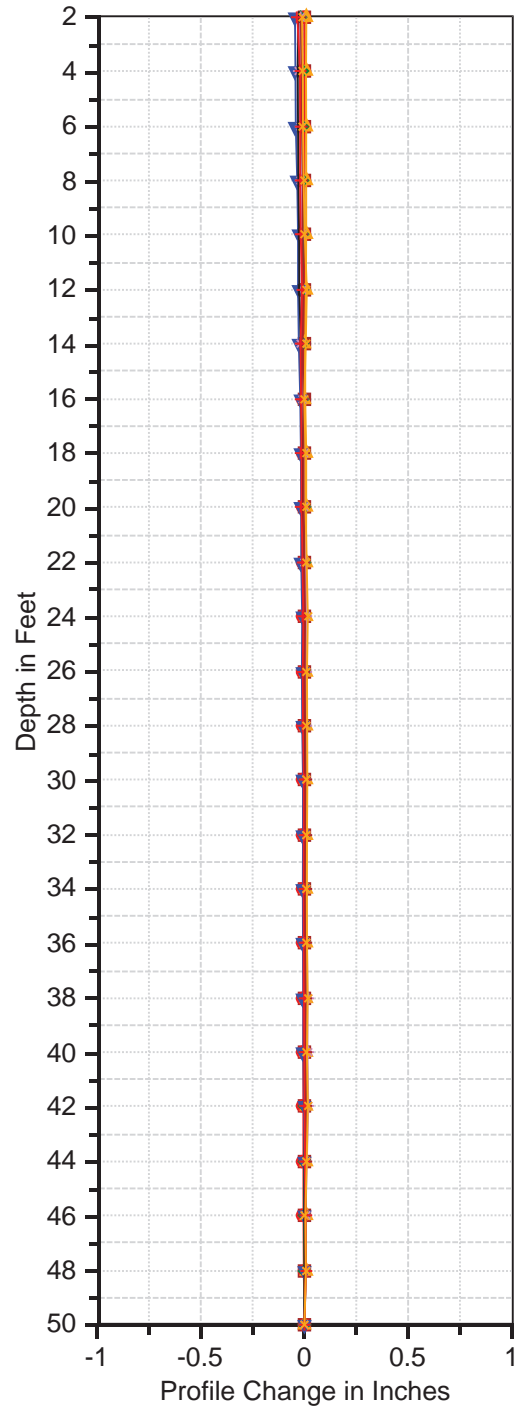
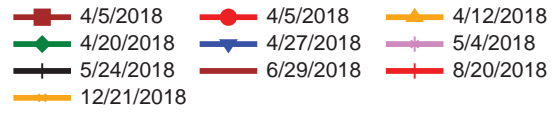
Portable Viper Rig at Boring B1-10

Appendix H – Inclinometer Data

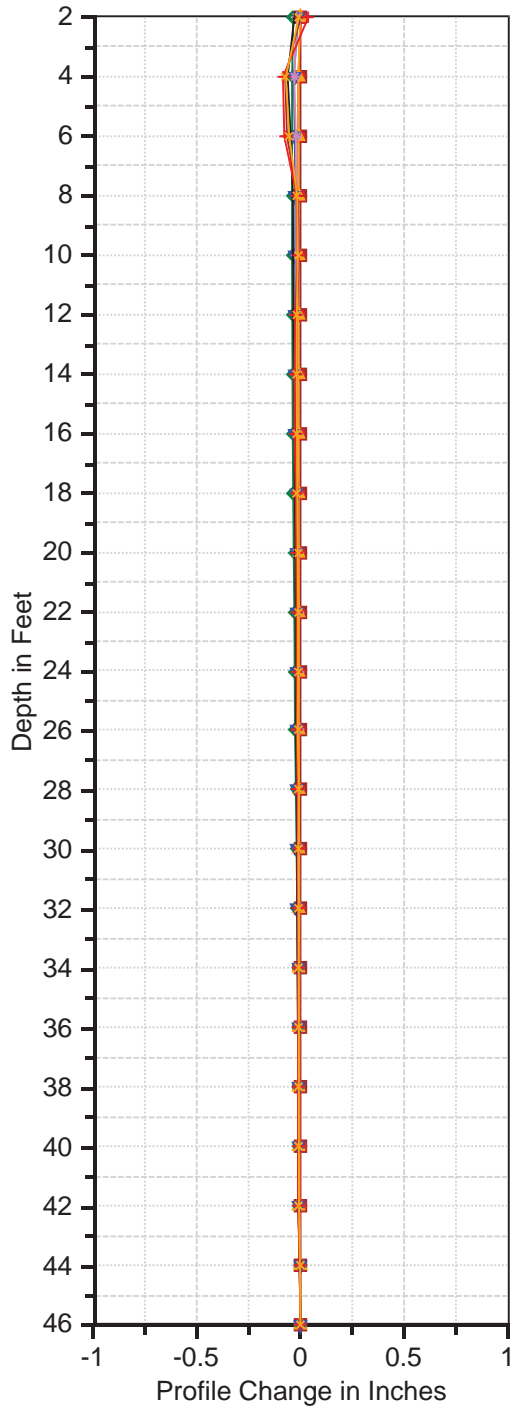
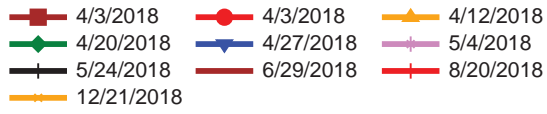
550160 B1_3 A



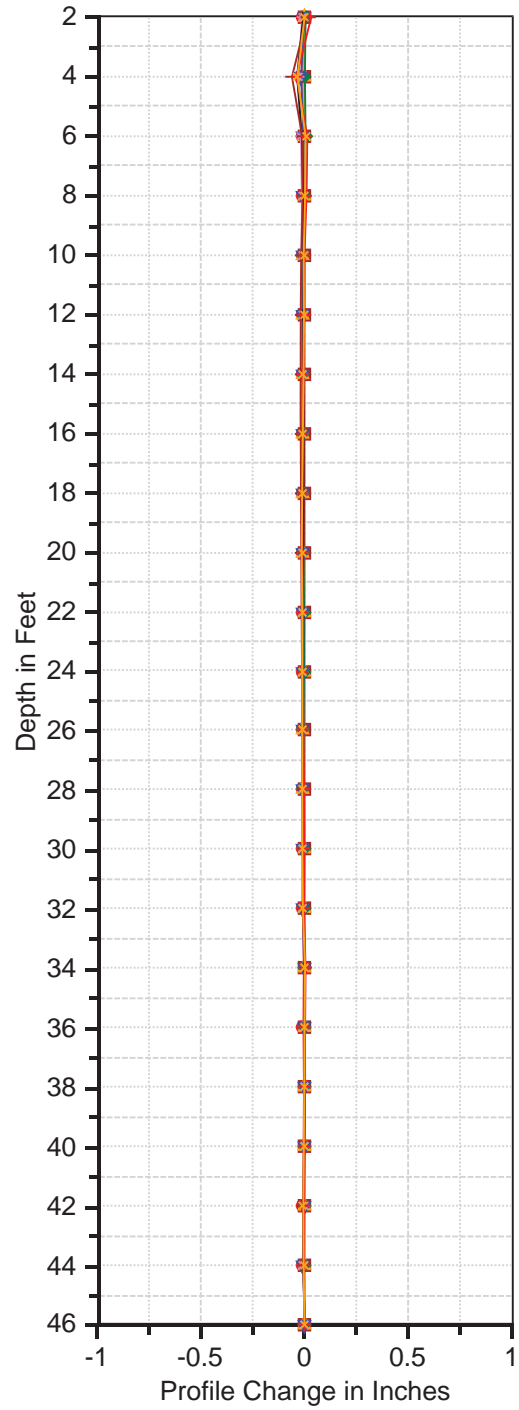
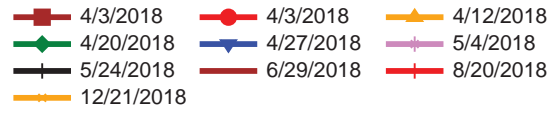
550160 B1_3 B



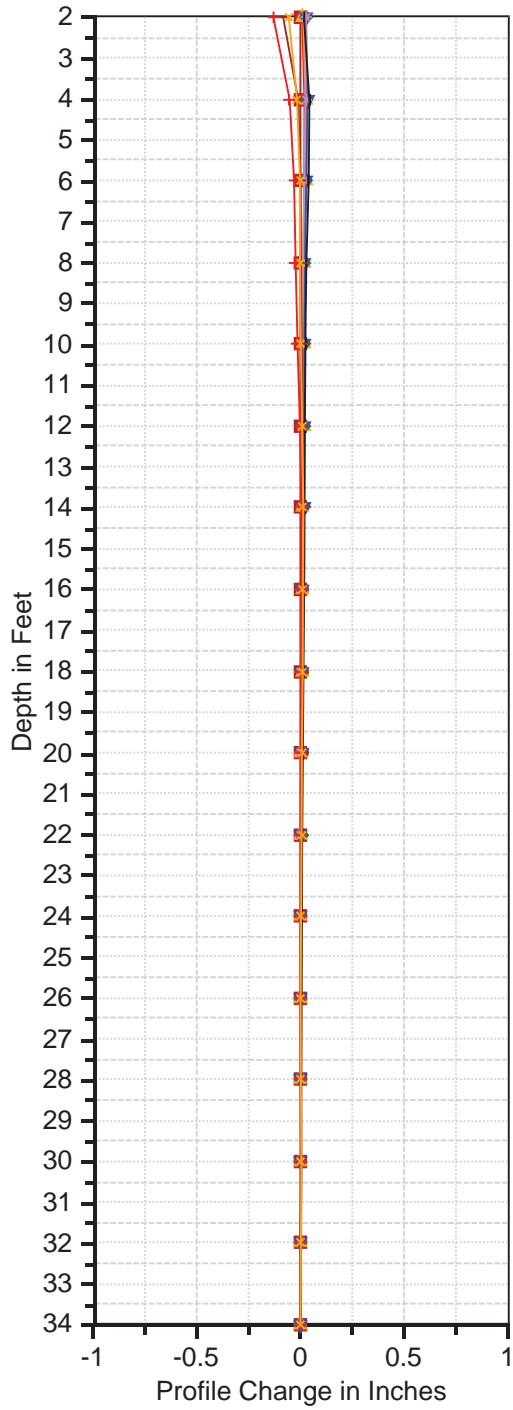
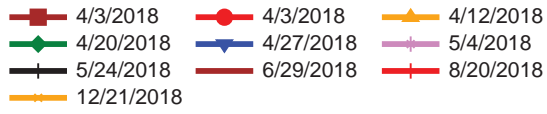
550160 B1_5 A



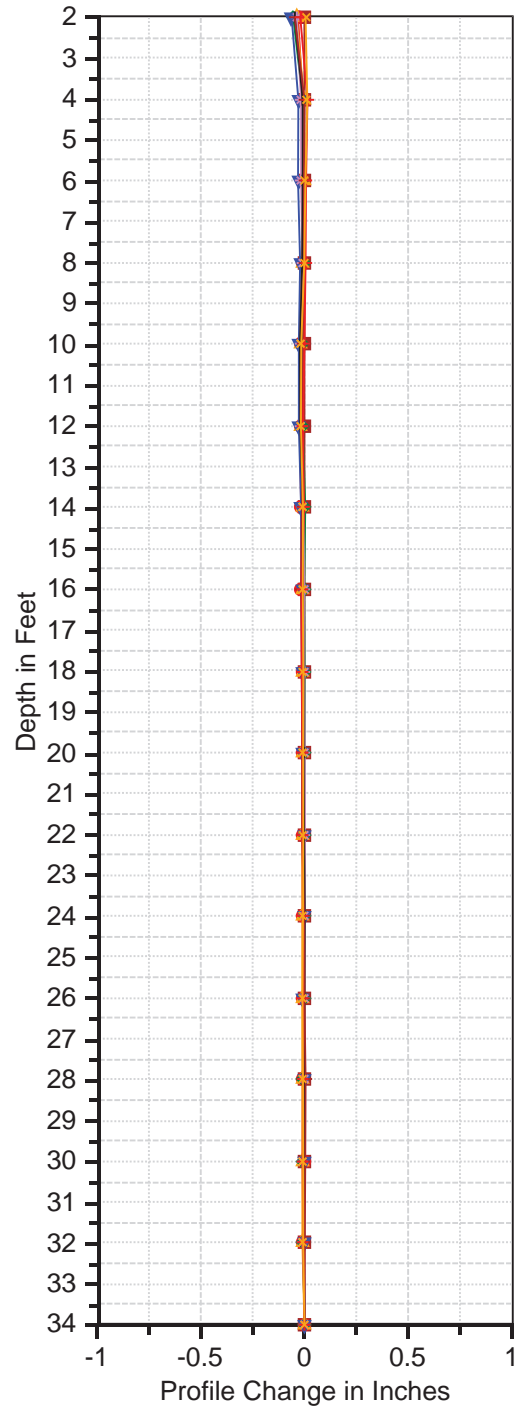
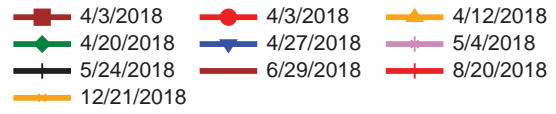
550160 B1_5 B



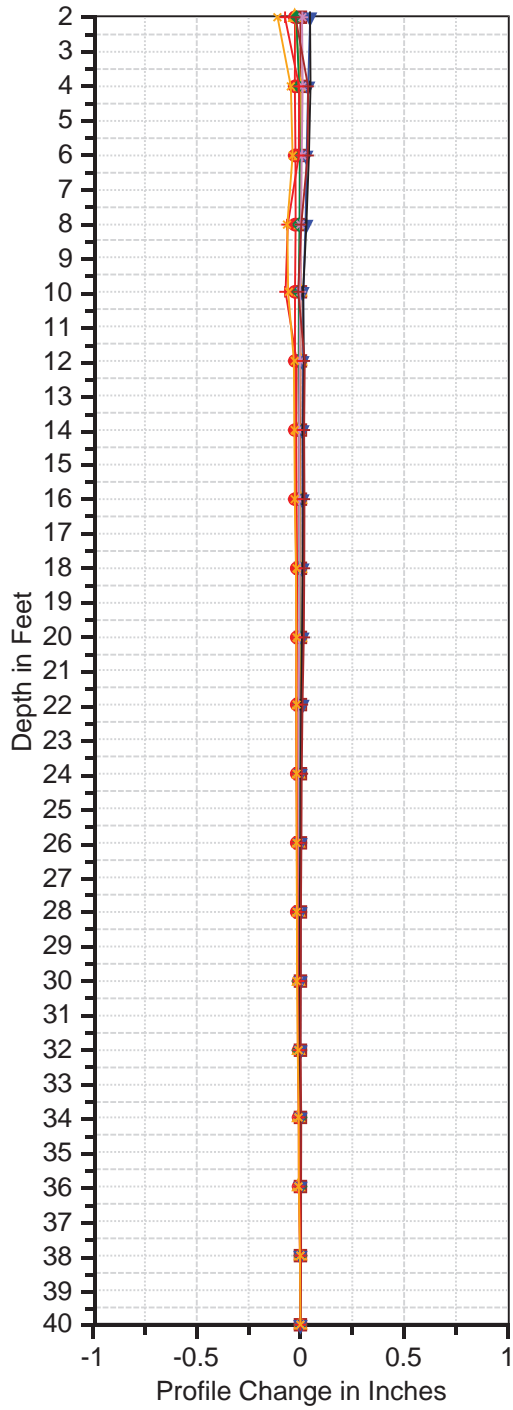
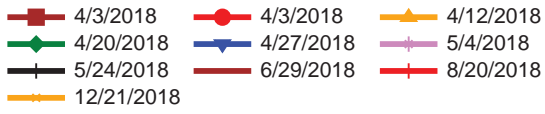
550160 B1_6 A



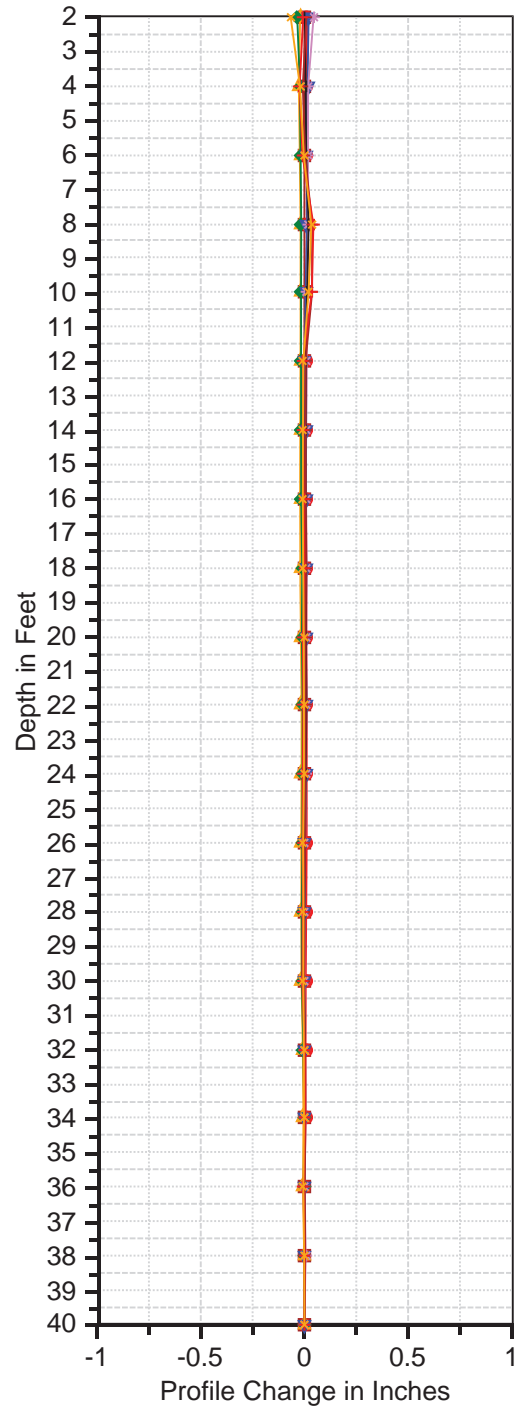
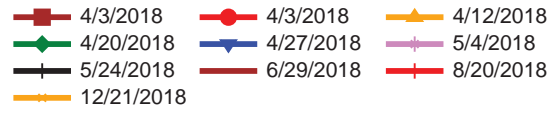
550160 B1_6 B



550160 B1_7 A



550160 B1_7 B



Appendix I Summary Geotechnical Data Report – MM 12.3 to MM 15.0



February 7, 2019

Yeh Project No. 217-376

Don Connors, P.E.
Vice President
Wood, PLC
600 17th Street, Suite 500 – South Tower
Denver, Colorado 80202

**Re: 22420 US 550 South Connection to US 160
Summary Geotechnical Data Report – MM 12.3 to MM 15.0**

Dear Mr. Connors:

A preliminary geotechnical investigation was performed by Yeh and Associates, Inc. (Yeh) in 2007 for the proposed reconstruction of US Highway 550 from Milepost 2.76 (Station 245+85) to Milepost 15.24 (Station 971+93). The purpose of the investigation was to provide recommendations to be used in preliminary design. Results and recommendations were presented to HDR, Inc. in Yeh's April 7, 2008 "Draft Geotechnical Investigation Report for Preliminary Design" for CDOT Project No. NH 5501-011 (Project Code 12979). Borings drilled north of the intersection with County Road (CR) 302 (approximate MM 12.3) and south of the intersection with CR 220 (approximate MM 15.0) for the 2007 investigation can supplement information on subsurface conditions that may be encountered south of the limits addressed in Yeh's 2019 Geotechnical Data Report (GDR). Pertinent excerpts from the 2007 investigation, amended as necessary, are provided below.

GEOLOGIC SETTING

Surficial deposits on the Florida Mesa consist of alluvium and terrace gravels. The near surface soils are predominantly sandy clay and clayey sand ("surficial soils" in the GDR) overlying dense sandy gravel containing cobbles and boulders ("terrace alluvium" in the GDR).

SUBSURFACE INVESTIGATION

The 2007 preliminary soils investigation was performed to evaluate subsurface conditions related to pavement design. The borings were drilled to depths ranging from 10 to 21 feet below existing grade. A truck-mounted CME 75 drill rig using Hollow-stem augers drilled borings located within the roadway embankment prism, and a track-mounted Diedrich D-50 drill rig using solid stem augers was

employed for borings outside the roadway prism. The borings were logged by a representative of Yeh and Associates.

Soil samples from the auger borings were obtained using Penetration Tests (PT) at selected depths. To perform the PT, a 1.5-inch inside diameter split spoon sampler was seated at the bottom of the bore hole, then driven up to 18 inches with blows from an automatic standard hammer weighing 140 pounds and falling a distance of 30 inches. The number of blows required to drive the sampler the final 12 inches or a fraction thereof, constitutes the penetration resistance (N). The N value, as described in ASTM D 1586, when properly evaluated, is an index to the consistency or relative density of the material tested. Bulk samples of the solid auger cuttings were also obtained from the borings.

Due to the preliminary nature of the 2007 investigation and limitations of right-of-way, the borings were spaced at greater distances than are required by the CDOT Geotechnical Design Manual. The locations, total depth, and depths to subsurface strata are summarized in Table 1. Boring logs are provided in Attachment 1 to this document.

Table 1 - Summary of Borings

Boring Number	US 550 Station	Offset	Depth of Boring (ft)	Elev. Top of Boring (ft)	Depth to Surficial Soil (ft)	Depth to Alluvium (ft)	Elev. Top of Alluvium (ft)
YA-A23	797+20	60' Rt.	11.0	6594	0.0	n/a	n/a
YA-34	807+90	70' Lt.	10.0	6597	2.5	9.0	6588
YA-35	867+70	30' Lt.	10.0	6649	2.0	n/a	n/a
YA-36	877+60	20' Lt.	10.0	6688	2.0	n/a	n/a
YA-A24	883+00	60' Lt.	21.0	6676	0.0	n/a	n/a
YA-38	948+85	25' Lt.	10.0	6729	6.0	n/a	n/a
YA-A25	961+60	50' Lt.	21.0	6709	0.0	n/a	n/a

Borings ranged in depth from 10 to 21 feet. The four "YA" borings were drilled in May 2007 and were located within the existing highway embankment prism. Thicknesses of the fill ranged from 2 to 6 feet. Native surficial soil material was encountered beneath the fill and at the ground surface for the remaining borings ("YA-A"), which were drilled in September 2007 outside the existing fill.

LABORATORY TESTING

Laboratory tests were performed on selected samples from the preliminary soil investigation. The tests included natural moisture content and dry density, gradation, Atterberg limits (AASHTO T 89 and



T 90), R-value (AASHTO T 190), pH (AASHTO T 289), resistivity (AASHTO T 288) and sulfate content (AASHTO T 290). Results of the laboratory testing are shown on the boring logs and presented in Attachment 2 to this document. Sieve analyses and swell/consolidation graphs are provided in Attachments 3 and 4, respectively.

SUBSURFACE CONDITIONS

The existing highway is constructed on an embankment. Borings that were drilled in the existing roadway embankment encountered 2 to 6 feet of fill consisting of sand and gravel containing silt and clay. Below the fill, and in borings drilled outside the existing roadway prism, the soils encountered generally consist of silty clay, with sand contents ranging from 10 to 32 percent. The percent fines (passing the #200 sieve) ranged from 68 to 90 percent, while the Plasticity Index (PI) ranged from 17 to 28. Using the Unified Soil Classification System (USCS), the soils were classified as CL, lean clay. Under the AASHTO system, soil classifications of A-6 (group indices ranging from 9 to 17) and A-7-6 (group indices of 24 to 25) were determined. Natural moisture contents fell between 7.1 and 19.5 percent and the natural dry density ranged between 94.8 and 107.6 pounds per cubic foot (pcf). Swell/consolidation tests were run on two samples from outside the roadway prism; values of -4.4% and -3.7% (consolidation) were reported. The pH of the surficial soils was slightly alkaline, between 7.8 and 8.1. Water soluble sulfate was measured for four samples and ranged from 0.001 to 0.028 percent. Two samples were tested for resistivity, and found to have levels of 725 and 1600 Ohm-cm. Bulk samples for Hveem Resistance R-value testing were obtained from two borings. The reported R-values were 7 and 10. Groundwater was not encountered in the borings.

LIMITATIONS

This study has been conducted in accordance with generally accepted geotechnical engineering practices in this area for use by the client for preliminary design purposes. The nature and extent of subsurface variations across the site may not become evident until excavation is performed. The data presented in this Summary Report is intended to supplement the data in the GDR for specific use on the US 550-US 160 Connection Design-Build project. Within the limitations of the scope, schedule, and budget, the work presented in this report was performed in accordance with generally accepted geotechnical engineering principles and practices in this area at the time this report was prepared. We make no other warranty, either explicit or implied.

The conclusions regarding subsurface conditions presented in this report are based on the data obtained from published maps, reports, laboratory tests, and the widely spaced exploratory borings drilled at the approximate locations shown on the boring location sheets. When assigning laboratory



tests, it was assumed that these widely spaced borings are representative of the subsurface conditions throughout the US 550 project alignment discussed in the report and that the subsurface conditions throughout the project alignment are not significantly different from those identified by the borings. The subsurface conditions observed in the borings may not necessarily reflect the field variations in the subsurface conditions and water levels at other locations. The nature and extent of subsurface variations across the project area may not become evident until construction activities are initiated.

The scope of work of this investigation did not include hazardous materials sampling and chemical analyses and evaluation of potential impacts to natural resources, including wetlands, endangered species, or environmentally critical areas.

If you have any questions, please contact me (970) 382-9590.

Sincerely,

YEH AND ASSOCIATES, INC.



Thomas L. Allen, P.E.
Senior Project Manager

Attachments (4)

- 1) Boring Logs
- 2) Summary of Laboratory Test Results
- 3) Sieve Analyses
- 4) Swell/Consolidation Graphs



YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: US 550 seg 2

Project Number: 27-095

Date: 9/14/07

Boring: **YA-A23**

Sheet 1 of 1

Boring Began: 9/12/2007

Drilling Method: Solid-Stem Auger

Drill: D50 T

Driller: DA Smith Drilling - Roger

Logged By: RF

Final By: T. Allen

Inclination: Vertical

Completed: 9/12/2007

Drill Bit:

Casing:

Weather:

Total Depth: 11.0 ft

Ground Elevation:

Location: Station 797+20, 60 ft Rt of Centerline

Coordinates: N: E:

Ground Water Notes:

Depth
Date
Time

-
-
-

-
-
-

-
-
-

-
-
-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples		Lithology	Material Description	Field Notes and Lab Tests
					Blows per 6 in	N			
								0.0 - 11.0 ft. silty CLAY , reddish brown, medium plasticity, moist, very stiff to hard.	#200= 84% LL= 37 PL= 16 PI= 21 R-Value= 10 AASHTO: A-6 (17) USCS: CL pH= 8.1 S= 0.009%
					8/12/22	34		Gravels, cobbles, small bentonite seams.	
	10				8/14/15	29			
								Bottom of Hole at 11.0 ft.	



YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: US 550

Project Number: 27-095

Date:

Boring: **YA-34**

Sheet 1 of 1

Boring Began: 5/30/2007

Drilling Method: Hollow-Stem Auger

Drill: CME 75

Driller: Envirotech - Danny

Logged By: RF

Final By: T. Allen

Inclination: Vertical

Completed: 5/30/2007

Drill Bit:

Casing:

Weather:

Total Depth: 10.0 ft

Ground Elevation:

Location: Station 807+90, 70 ft Lt of Centerline

Coordinates: N: E:

Ground Water Notes:







Depth
Date
Time

-
-
-

-
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Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples		Lithology	Material Description	Field Notes and Lab Tests
					Blows per 6 in	N			
								0.0 - 2.5 ft. gravelly SAND slightly clayey and silty, moist, embankment FILL.	MC= 19.5% #200= 90% LL= 42 PL= 15 PI= 27 AASHTO: A-7-6(24) USCS: CL
	5				5/4/7	11		2.5 - 9.0 ft. silty CLAY , brown, medium plasticity, moist, stiff.	
	10				5/9/11	20		9.0 - 10.0 ft. gravelly CLAY , brown, moist, medium dense, very stiff.	
								Bottom of Hole at 10.0 ft.	



YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: US 550

Project Number: 27-095

Date:

Boring: **YA-35**

Sheet 1 of 1

Boring Began: 5/31/2007

Drilling Method: Hollow-Stem Auger

Drill: CME 75

Driller: Envirotech - Danny

Logged By: RF

Final By: T. Allen

Inclination: Vertical

Completed: 5/31/2007

Drill Bit:

Casing:

Weather:

Total Depth: 10.0 ft

Ground Elevation:

Location: Station 867+70, 30 ft Lt of Centerline

Coordinates: N: E:

Ground Water Notes:

Depth
Date
Time

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Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples		Lithology	Material Description	Field Notes and Lab Tests
					Blows per 6 in	N			
								0.0 - 2.0 ft. gravelly SAND clayey, silty, brown, moist, FILL.	MC= 19% #200= 88% LL= 43 PL= 15 PI= 28 AASHTO: A-7-6(25) USCS: CL
								2.0 - 10.0 ft. silty CLAY , brown, medium plasticity, moist, stiff.	
	5				5/4/7	11			
	10				1/6/9	15		Bottom of Hole at 10.0 ft.	
	15								



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Project: US 550

Project Number: 27-095

Date:

Boring: **YA-36**

Sheet 1 of 1

Boring Began: 5/31/2007

Drilling Method: Hollow-Stem Auger

Drill: CME 75

Driller: Envirotech - Danny

Logged By: RF

Final By: T. Allen

Inclination: Vertical

Completed: 5/31/2007

Drill Bit:

Casing:

Weather:

Total Depth: 10.0 ft

Ground Elevation:

Location: Station 877+60, 20 ft Lt of Centerline

Coordinates: N: E:

Ground Water Notes:

Depth
Date
Time

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Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples		Lithology	Material Description	Field Notes and Lab Tests
					Blows per 6 in	N			
								0.0 - 2.0 ft. gravelly SAND slightly clayey, silty, brown, moist, FILL.	<p>MC= 7.1% #200= 69% LL= 40 PL= 17 PI= 23 pH= 7.8 S= 0.007% R-Value= 7 Re= 725ohms-cm AASHTO: A-6 (14) USCS: CL</p>
								2.0 - 10.0 ft. sandy CLAY , brown, medium plasticity, moist, soft to stiff.	
	5				3/3/7	10			
	10				3/4/4	8			
								Bottom of Hole at 10.0 ft.	

Boring Began: 9/12/2007

Drilling Method: Solid-Stem Auger

Drill: D50 T

Driller: DA Smith Drilling - Roger

Logged By: RF

Final By: T. Allen

Inclination: Vertical

Completed: 9/12/2007

Drill Bit:

Casing:

Weather:

Total Depth: 21.0 ft

Ground Elevation:

Location: Station 883+00, 60 ft Lt of Centerline

Coordinates: N: E:

Ground Water Notes:

Depth
Date
Time

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Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock	Soil Samples		Lithology	Material Description	Field Notes and Lab Tests
				RQD	Blows per 6 in	N			
								0.0 - 21.0 ft. silty CLAY sandy, brown to reddish brown, medium plasticity, moist to dry, very stiff.	#200= 68% LL= 35 PL= 18 PI= 17 pH= 7.9 S= 0.001% Re= 1600ohms-cm AASHTO: A-6 (9) USCS: CL MC= 14% DD= 103.5pcf S/C= -4.4%
					12/9	21			
	10				10/12	22			
					11/13/12	25			
	20				12/11/10	21			
								Bottom of Hole at 21.0 ft.	
	30								
	40								



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GEOTECHNICAL ENGINEERING CONSULTANTS

Project: US 550

Project Number: 27-095

Date:

Boring: **YA-38**

Sheet 1 of 1

Boring Began: 5/30/2007

Drilling Method: Hollow-Stem Auger

Drill: CME 75

Driller: Envirotech - Danny

Logged By: RF

Final By: T. Allen

Inclination: Vertical

Completed: 5/30/2007

Drill Bit:

Casing:

Weather:

Total Depth: 10.0 ft

Ground Elevation:

Location: Station 948+85, 25 ft Lt of Centerline

Coordinates: N: E:

Ground Water Notes:

Depth
Date
Time

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Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples		Lithology	Material Description	Field Notes and Lab Tests
					Blows per 6 in	N			
	5				5/8/9	17		0.0 - 6.0 ft. gravelly CLAY silty, sandy, brown-gray, moist, FILL.	
								6.0 - 10.0 ft. silty CLAY , brown, medium plasticity, moist, stiff.	
	10				4/7/11	18		Bottom of Hole at 10.0 ft.	MC= 15.6% #200= 90% LL= 42 PL= 14 PI= 28 AASHTO: A-7-6(25) USCS: CL
	15								



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Project: US 550 seg 2

Project Number: 27-095

Date: 9/14/07

Boring: **YA-A25**

Sheet 1 of 1

Boring Began: 9/12/2007

Drilling Method: Solid-Stem Auger

Drill: D50 T

Driller: DA Smith Drilling - Roger

Logged By: RF

Final By: T. Allen

Inclination: Vertical

Completed: 9/12/2007

Drill Bit:

Casing:

Weather:

Total Depth: 21.0 ft

Ground Elevation:

Location: Station 961+60, 50 ft Lt of Centerline

Coordinates: N: E:

Ground Water Notes:

Depth
Date
Time

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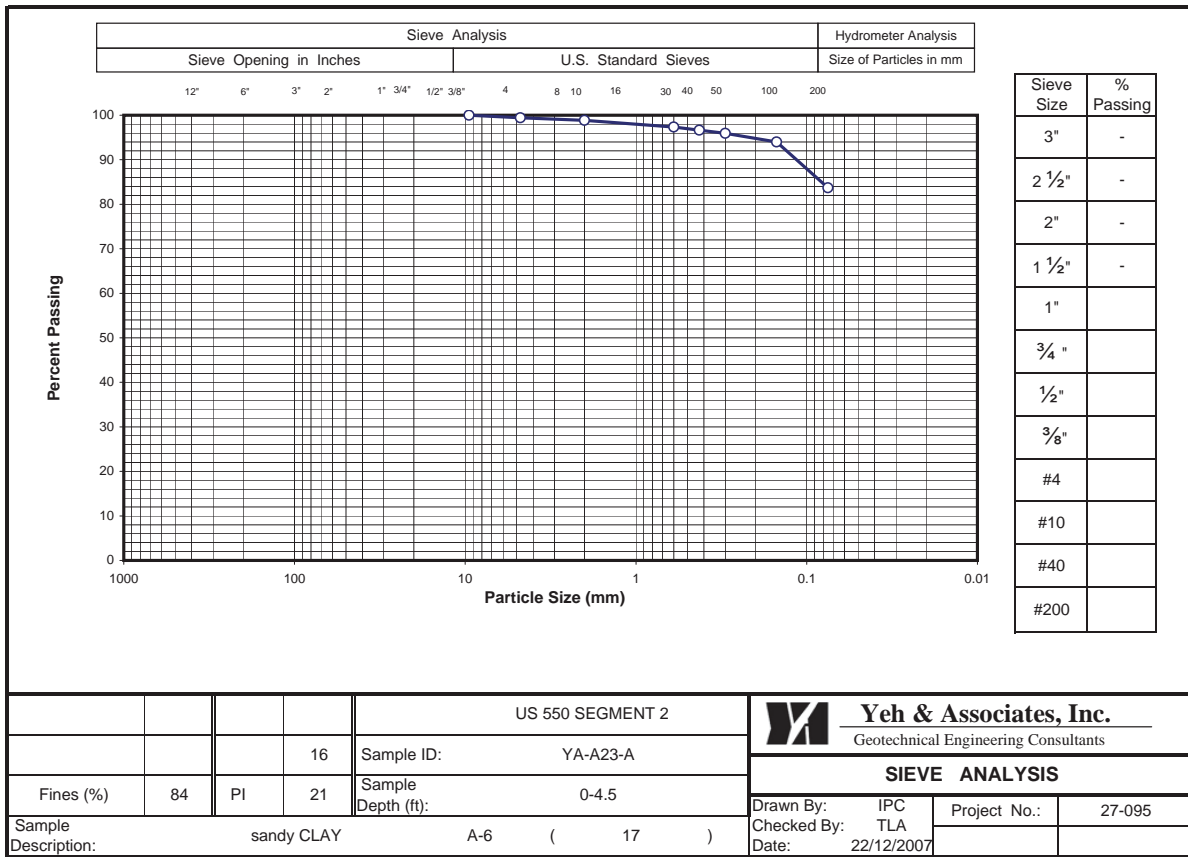
Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples		Lithology	Material Description	Field Notes and Lab Tests
					Blows per 6 in	N			
								0.0 - 21.0 ft. silty CLAY , brown grades to reddish brown, dry to moist, stiff to hard.	MC= 10.2% DD= 94.8pcf S/C= -3.7% MC= 12.3% DD= 107.6pcf pH= 8 S= 0.028%
					9/7	16			
	10				13/18	31			
					7/13/17	30			
	20				10/14/20	34			
								At 17 ft, grades to reddish brown.	
								Bottom of Hole at 21.0 ft.	
	30								
	40								



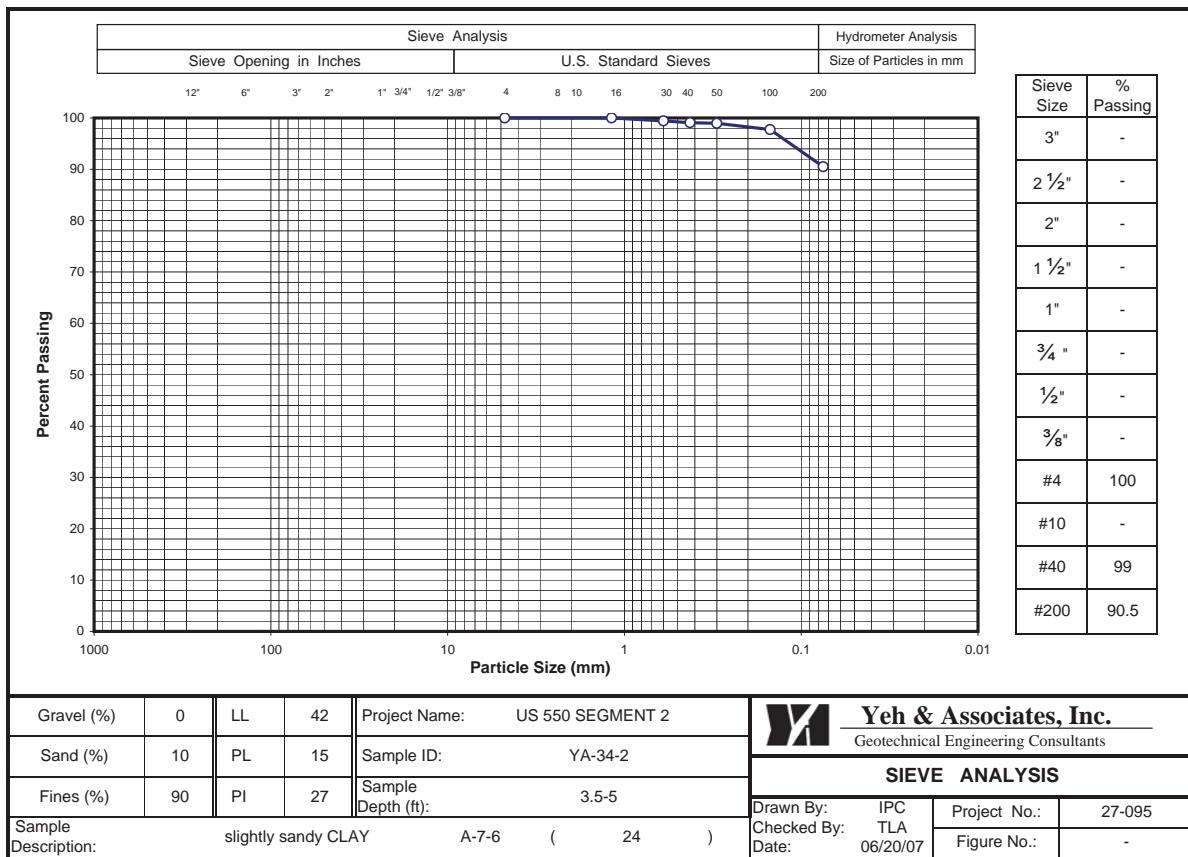
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Summary of Laboratory Test Results

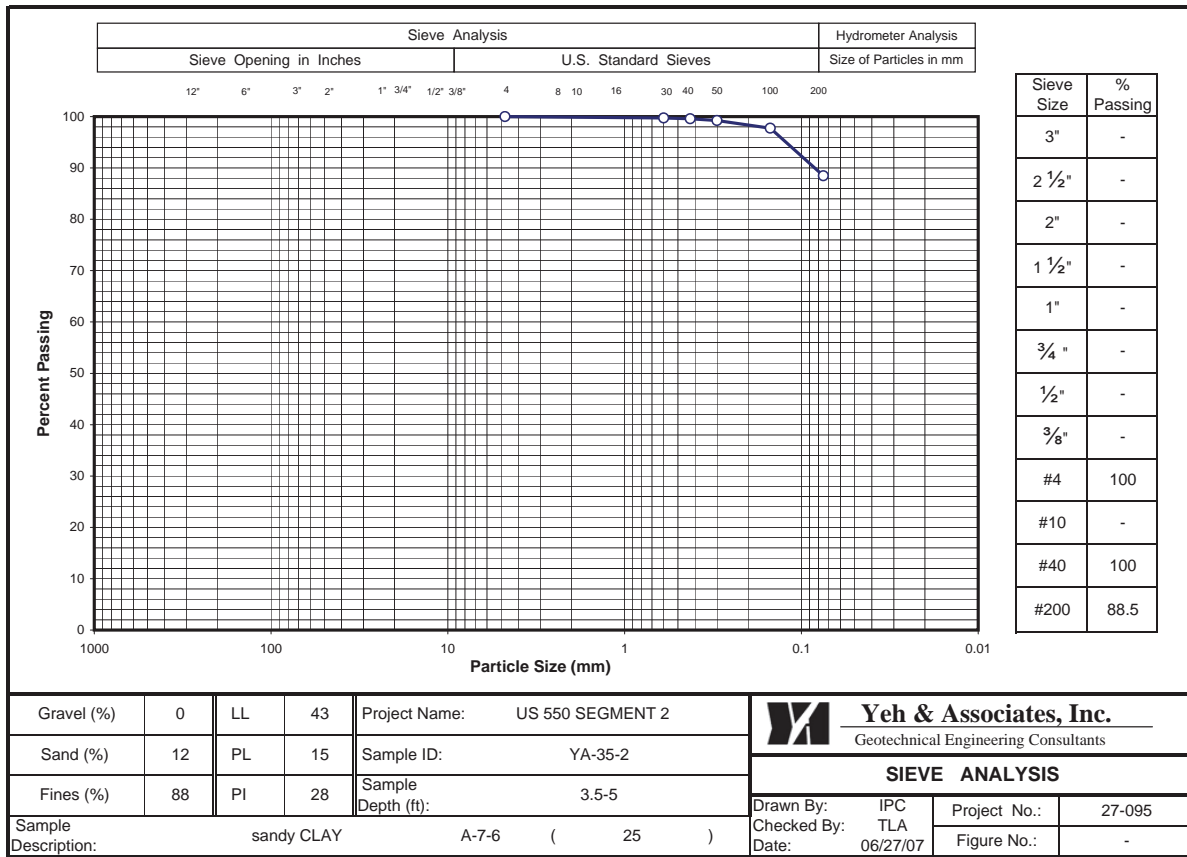
Project No: 27-095				Project Name: US 550 SEG 2								Date: 3/31/08						
Sample Location				Natural Moisture Content (%)	Natural Dry Density (pcf)	Gradation			Atterberg Limits			pH	Water Soluble Sulfate %	% Swell (+) / Consoli- dation (-)	Resistivity (ohms-cm)	R- VALUE	CLASSIFICATION	
Sample No.	Station	Depth (ft)	Sample Type			Gravel > #4 (%)	Sand (%)	Fines < #200 (%)	LL	PL	PI						AASHTO	USCS
YA-A23-A	797+20, 60' R	0-4.5	Bulk			1	16	84	37	16	21					10	A-6 (17)	CL
YA-A23-B	797+20, 60' R	5	SPT									8.1	0.009					CL
YA-34-2	807+90, 70' L	4	SS	19.5		0	10	90	42	15	27						A-7-6 (24)	CL
YA-35-2	867+70, 30' L	4	SS	19.0		0	12	88	43	15	28						A-7-6 (25)	CL
YA-36-3	877+60, 20' L	5-8.5	Bulk	7.1		1	30	69	40	17	23	7.8	0.007		725	7	A-6 (14)	CL
YA-A24-A	883+00, 60' L	0-4.5	Bulk			0	32	68	35	18	17	7.9	0.001		1600		A-6 (9)	CL
YA-A24-B	883+00, 60' L	5	CAL	14.0	103.5									-4.4				CL
YA-38-4	948+85, 25' L	9	SS	15.6		0	10	90	42	14	28						A-7-6 (25)	CL
YA-A25-B	961+60, 50' L	5	CAL	10.2	94.8									-3.7				CL
YA-A25-D	961+60, 50' L	10	CAL	12.3	107.6							8.0	0.028					CL



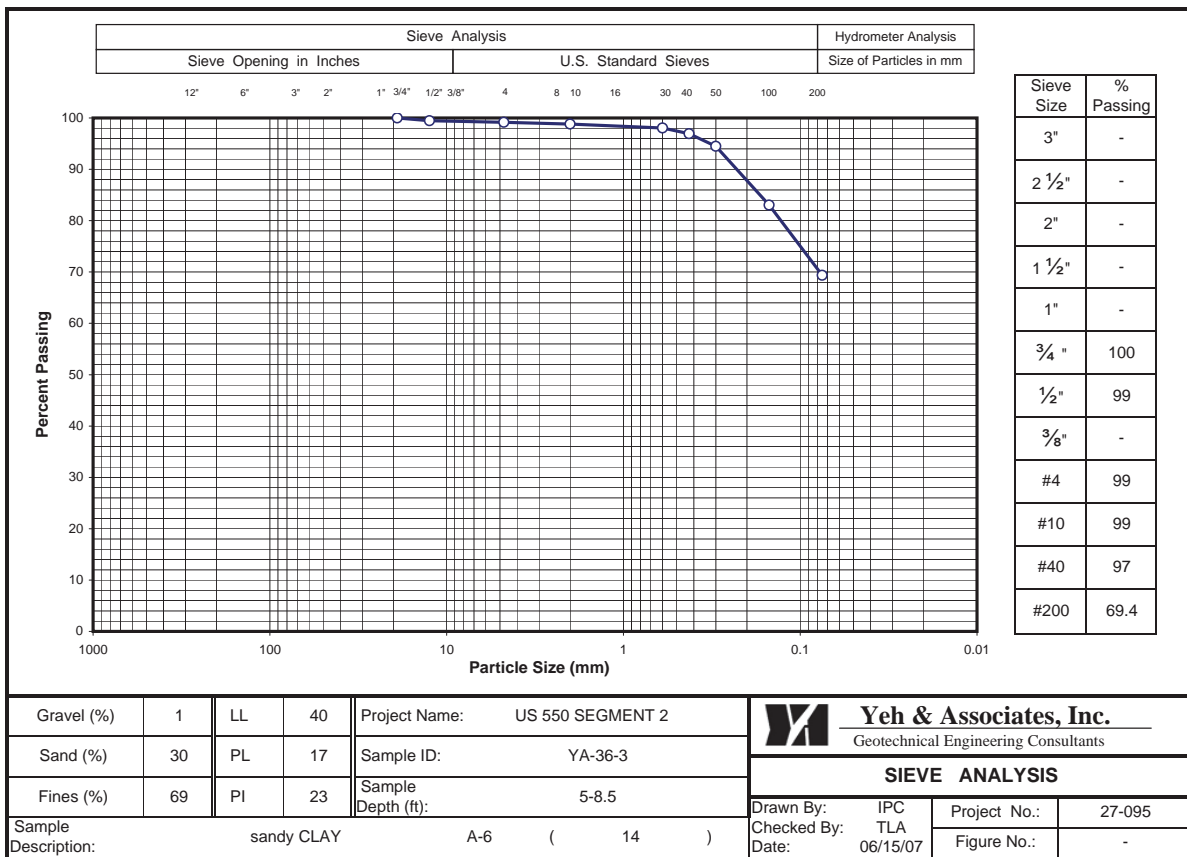
Revised 04/27/2004



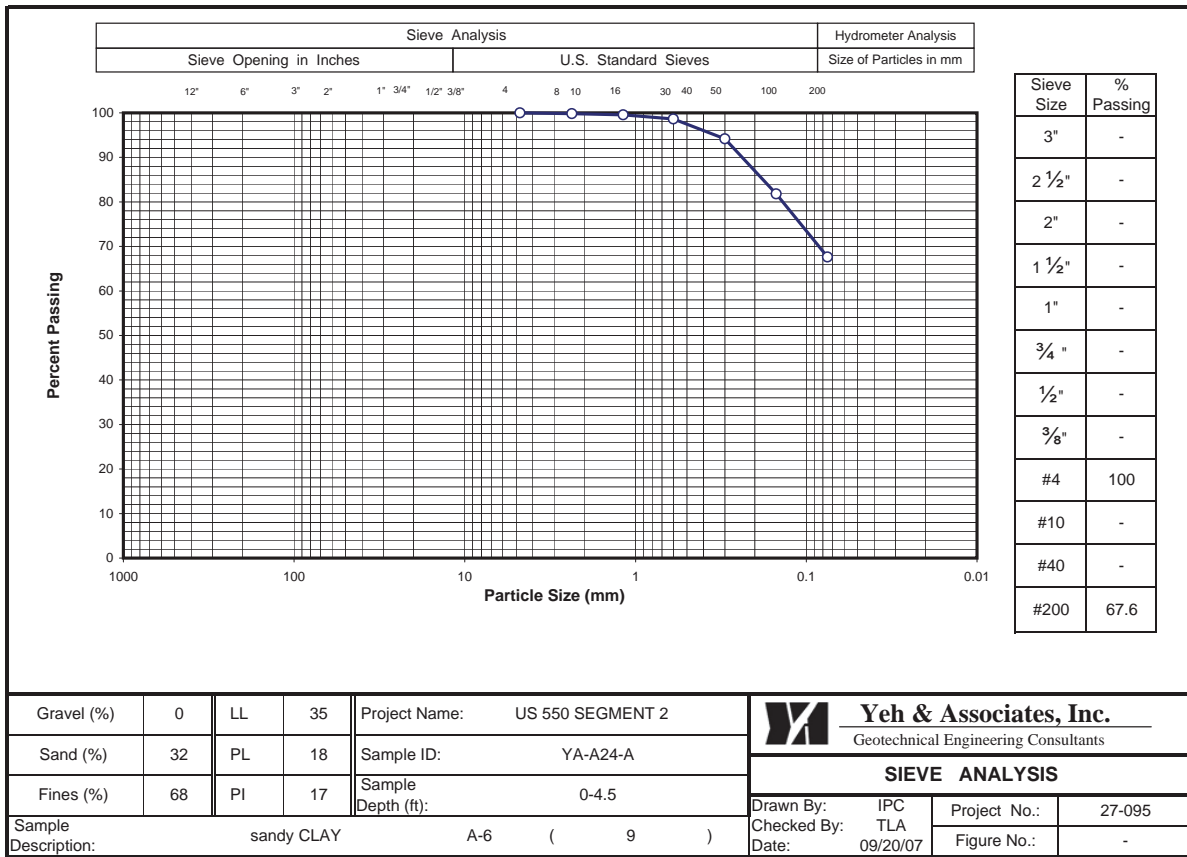
Revised 04/27/2004



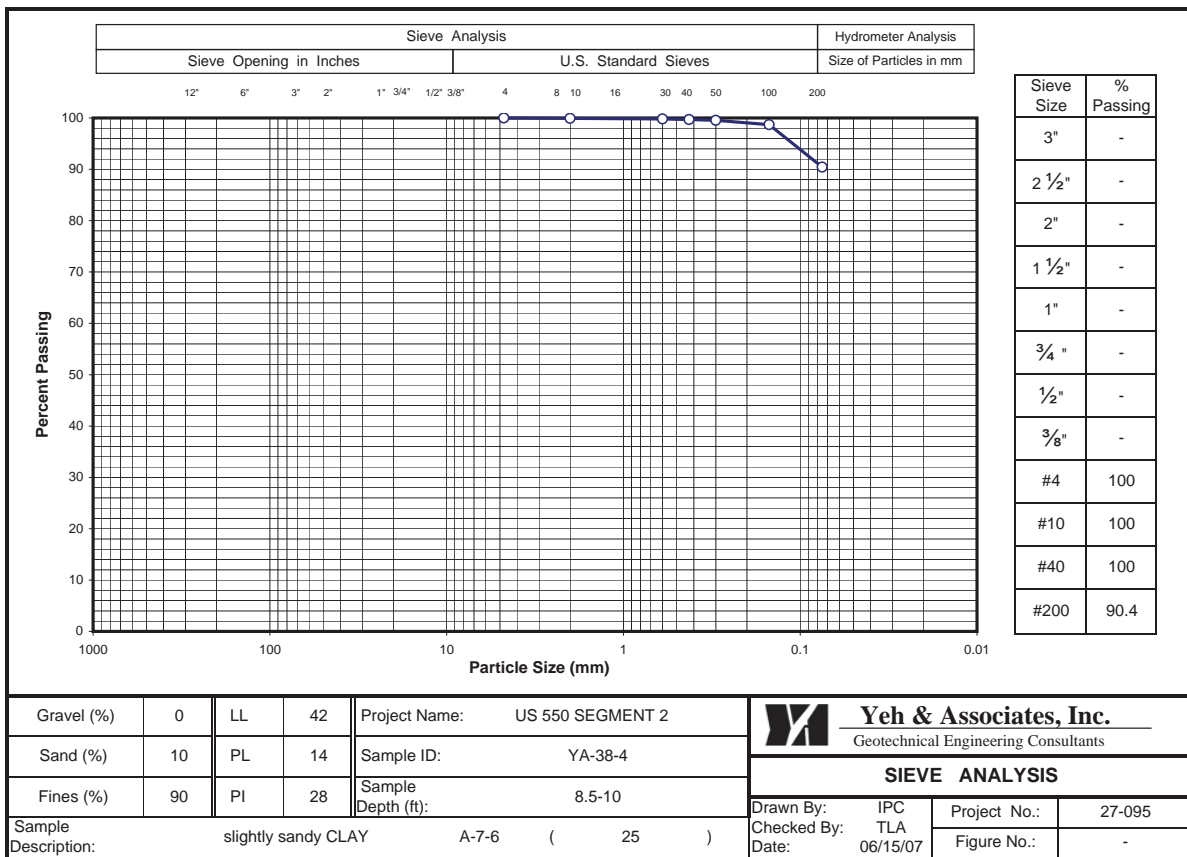
Revised 04/27/2004



Revised 04/27/2004



Revised 04/27/2004



Revised 04/27/2004



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