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File: St. Anthony Mine 233001076 Date: August 9, 2018

Reference: St. Anthony Mine Geotechnical Investigation 2018

# Introduction and Background

This memo presents information collected during the geotechnical drilling and field sampling specific to the waste rock piles and proposed borrow areas at the St. Anthony Mine Site ("Site"). Field notes, boring logs, and laboratory testing results are included in the attachments. Information presented will be used to supplement a previous field investigation conducted by MWH, described in the *Materials Characterization Report, Saint Anthony Mine Site* (MWH, 2007), and to advance the design of the closeout plan.

The St. Anthony Mine was an open pit and underground shaft uranium mine located on the Cebolleta Land Grant in Cibola County, New Mexico, approximately 40 miles west of Albuquerque and 4.6 miles southeast of Seboyeta. The Site is in a remote, sparsely populated area with difficult access. United Nuclear Corporation (UNC) operated the St. Anthony Mine from 1975 to 1981, pursuant to a mineral lease with the Cebolleta Land Grant, the current surface and mineral rights owner. The original lease covered approximately 2,560 acres. This lease was obtained on February 10, 1964 and was surrendered by a Release of Mineral Lease dated October 24, 1988. UNC has access to the Site through access agreements with the Cebolleta Land Grant and an adjacent landowner.

The Site includes underground workings comprising one mine shaft and several vent shafts that are now sealed at the surface, two open pits (one containing groundwater), seven piles of non-economic mine materials (now revegetated), numerous smaller piles of non-economical mine materials, and three topsoil and/or overburden piles. No perennial streams occur within the Site, but an arroyo (Meyer Gulch) passes through the Site. The two open pits at the Site are located in Sections 19 and 30, Township 11 North, Range 4 West, and the entrance to the underground mine is located in Section 24, Township 11 North, Range 5 West. Area disturbed during mining encompasses approximately 430 acres and includes roads, building and shaft pads, and former settling ponds along with the open pits and non-economic mine material piles.

# **Site Geology**

As described in the *St. Anthony Mine Site Closeout Plan* (MWH, 2010), the Site is located on the Colorado Plateau physiographic province, broadly characterized by plateaus of stratified sedimentary rock overlying tectonically stable Precambrian basement. The relatively high relief and dramatic topography of the Colorado Plateau formed as canyons were incised within thick sedimentary sequences. Within the southeastern portion of the Colorado Plateau lies the San Juan Basin, a structural depression encompassing most of northwestern New Mexico and adjoining parts of Colorado and Utah. The strata of the San Juan Basin dip gently to the north (approximately 2 degrees), although small faults and folds alter the dip of the strata locally. The San Juan Basin is truncated on its southeastern margin by the Jemez lineament, a northeasterly trending structural boundary between the Colorado Plateau to the northwest and the Rio Grande Rift to the south and east. The Site is within the Grants uranium district that lies on this transitional margin amidst many prominent Late Cenozoic volcanic fields that demarcate the Jemez lineament and the southeast margin of the San Juan Basin.



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Sediments in the Grants area were deposited in various continental environments. During late Permian time, the area now defined by the San Juan basin was an active seaway connecting the central New Mexico Sea with the Paradox basin in Utah. During this time, the Glorieta sandstone and San Andreas limestone were deposited. The region was subsequently uplifted in Laramide time and fluvial, lacustrine, and aolian sediments of the respective Chinle Formation, San Rafael Group, and Morrison Formation were deposited. Upper Cretaceous strata consist of marine shorezone sandstones, marine shales, and various continental deposits. In ascending order, these are represented by the Dakota Sandstone, Mancos Shale, and the Mesaverde Group.

Stratigraphy of interest at the Site includes the Mancos Formation (Late Cretaceous), the Dakota Formation (Early and Late Cretaceous) and the Morrison Formation (Late Jurassic). The surficial geologic unit at the Site is the Mancos Formation consisting of three sandstone units and interbedded shale units with a maximum thickness of 465 feet. The upper sandstone caps Gavilan Mesa to the south of the pits. The Dakota Formation sandstone is 6 to 20 feet thick in the Site area. The Morrison Formation is approximately 600 feet thick and is comprised of the Jackpile Member (sandstone), the Brushy Basin Member (interlayered mudstone and sandstone), the Westwater Canyon Member (sandstone), and the Recapture member (interbedded claystone and sandstone).

Uranium production at the Site was from the Jackpile Member with each pit penetrating approximately 75 feet into this unit. The Jackpile sandstone varies in thickness in the Site area from 80 to 120 feet and is representative of deposition in a braided stream environment.

# **Geotechnical Investigation**

Field work for the current St. Anthony geotechnical investigation took place during March and April 2018 following client approval of the *St. Anthony Supplemental Investigations Work Plan* (Stantec, 2018). Field activities included drilling and soil sampling of select non-economic waste rock piles and potential borrow areas around the Site. The objective of the field investigation was to collect subsurface information to characterize soil and rock in the piles and evaluate the suitability of potential borrow sources as cover materials. This information was necessary to develop a material balance, grading plan, and cover design for reclamation of the Site.

Activities were conducted in accordance with the work plan and applicable SOPs. Some minor changes to drilling locations were implemented due to field conditions. Additionally, some proposed boreholes were not drilled due to safety, access, or other concerns as determined by the Field Engineer. Details of activities conducted and any variations from the Work Plan are described in the following sections.

Fifty-one boreholes were completed using the hollow-stem auger drilling technique (see Table 1 and Figure A1 for a complete list and plan view, respectively, of the borings): 12 in the Lobo Tract borrow area, 5 in the Borrow South area, 4 in the Borrow West area, 2 in the Topsoil North pile, 6 in the Topsoil/Overburden (T/O) pile, 4 in the Topsoil South pile, 6 in Shale Piles 1 and 2, 6 in Pile 3, and 6 in Pile 4. Drilling was performed by Cascade Drilling, LP ("Cascade") using a CME LAR 75 track-mounted drill rig and a CME 85 truck-mounted drill rig. The track-mounted rig was used during initial drilling. Due to mechanical failure of the track-mounted rig, the truck-mounted rig was used to complete the work. Boreholes completed by the track-mounted rig included the L1 boreholes in the Lobo Tract borrow area, four of the T/O pile boreholes (T/O-2, T/O-4 through 6), and a portion of one additional borehole (T/O-3) where the mechanical failure occurred.

Soil borings in the borrow areas (Lobo Tract, Borrow South, and Borrow West) were advanced either to anticipated excavation depths (generally 20-40 feet below ground surface (bgs)) or until encountering bedrock.



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Borings in the topsoil piles (T/O, Topsoil North, and Topsoil South) were advanced to native, undisturbed alluvial soils or bedrock to evaluate depths to the base of each pile. Drilling in Piles 1, 2, and 3 was also intended to locate the base of the piles; however, safety concerns related to the unexpected detection of hydrogen sulfide (H<sub>2</sub>S) and methane within the boreholes resulted in final drilled depths less than those originally proposed for most boreholes. Pile 4 drilling depths originally were proposed to coincide with the anticipated excavation depths (approximately 70 feet bgs) based on a preliminary material balance, but due to the continued detection of subsurface gases the boreholes were advanced to depths of only 10 to 40 feet bgs. Drilling was stopped at these locations on Piles 1 through 4 upon measuring gas concentrations at, or greater than, the permissible exposure limits (PEL) (e.g., 1.0 ppm H<sub>2</sub>S and 5.0% by volume of the lower explosive limit (LEL) of methane) as outlined in Stantec's Site-Specific Health and Safety Plan (HASP). Following drilling at each boring, the drilling crew backfilled the hole with drill cuttings to the original ground surface. Stantec then placed a wooden stake and surveyed the borehole location with a handheld GPS unit.

Five of the originally proposed borehole locations outlined in the Work Plan were not drilled. Borehole location BS-4 in the Borrow South area contained exposed bedrock at the ground surface, with no suitable borrow material (i.e., alluvial soils) apparent in the immediate area, and therefore was abandoned. Borehole location TN-3 in the Topsoil North area was located in close proximity to unstable slopes and the highwall of the main pit (Pit 1), and was not drilled due to drill rig access and safety concerns. Work on Pile 4 was stopped prior to drilling boreholes P4-1, P4-2, and P4-4 due to safety concerns regarding gas emissions at nearby boreholes (described above).

The Borrow West area (just south of Pit 1) was not originally included as a potential borrow source and no boreholes were proposed in this area prior to drilling operations at the Site. However, on-site observations of this area supported its potential as a source of additional borrow material, with the close proximity to Site facilities also indicative of potential cost savings in material transport during construction. As a result, four boreholes were proposed and completed in the Borrow West area during the final days of field work at the Site.

The total depth drilled during the investigation was 1,374 feet, including 429 feet of continuous core sampling using a five-foot-long, 4.25-inch inner diameter (I.D.) core barrel. Standard penetration test (SPT) sampling was performed at each five-foot interval (unless otherwise directed by the Field Engineer) using a 24-inch-long, 2.0-inch outer diameter (O.D.) Modified California (MC) sampler containing three 6-inch brass liners. Samplers were driven 18 inches by an automatic, 140-pound hammer falling 30 inches, with blow counts recorded for each successive 6-inch increment. Brass liner samples were logged, capped with plastic end caps, and stored at the staging area before being transported to Daniel B. Stephens & Associates, Inc. (DB Stephens), a geotechnical testing laboratory in Albuquerque. The recovered soil cores were logged, placed in labeled core boxes and photographed. Core boxes were temporarily stored at the staging area near the Site entrance and later transported to the UNC Mill Site office area at the Northeast Church Rock Site (near Gallup, NM). Borehole logs and core photographs are provided in Attachments B and C. Daily reports detailing the drilling activities are included in Attachment D.

Additional samples were collected from boreholes in Piles 1, 2, 4, and the Borrow West area for analytical testing of Radium-226, Uranium, Thorium-230, and Gross-Alpha concentrations. Prior to sampling, the MC sampler and liners were decontaminated using a cleaning solution (mixed on-site) to remove any remaining material from previous sampling drives. Samples were collected as bulk bag samples of material extracted from the MC brass liner samples, with sampling depths chosen to supplement results from the 2007 characterization and provide a more complete assessment of the general radiological contamination profile in each area. Samples from Piles 1, 2, and 4 were selected for analytical testing because these piles are expected to be used



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as backfill sources for Pit 1. Borrow West area samples were also tested to confirm this potential cover material did not contain elevated levels of radiological contamination. ALS Environmental laboratory in Fort Collins, CO performed the analytical testing of the samples.

**Table 1. Summary of Proposed and Completed Boreholes** 

	Area	Borehole ID	Proposed Depth (ft bgs)	Actual Depth (ft bgs)	Continuous Core
1	Lobo Tract (W of arroyo)	L1-1	20	20	Х
2	Lobo Tract (W of arroyo)	L1-2	20	20	
3	Lobo Tract (W of arroyo)	L1-3	20	20	
4	Lobo Tract (W of arroyo)	L1-4	20	20	
5	Lobo Tract (W of arroyo)	L1-5	20	20	Х
6	Lobo Tract (E of arroyo)	L2-1	20	20	
7	Lobo Tract (E of arroyo)	L2-2	20	15	
8	Lobo Tract (E of arroyo)	L2-3	20	15	
9	Lobo Tract (E of arroyo)	L2-4	20	20	Х
10	Lobo Tract (E of arroyo)	L2-5	20	20	
11	Lobo Tract (E of arroyo)	L2-6	20	20	Х
12	Lobo Tract (E of arroyo)	L2-7	20	20	
13	Borrow Area South	BS-1	20	15	
14	Borrow Area South	BS-2	20	20	
15	Borrow Area South	BS-3	20	15	Х
16	Borrow Area South	BS-4 <sup>*</sup>	20	N/A	
17	Borrow Area South	BS-5	20	5	Х
18	Borrow Area South	BS-6	20	20	Х
19	Topsoil North	TN-1	15	15	
20	Topsoil North	TN-2	25	30	
21	Topsoil North	TN-3 <sup>*</sup>	15	N/A	
22	Topsoil/Overburden	T/O-1	75	70	
23	Topsoil/Overburden	T/O-2	25	25	
24	Topsoil/Overburden	T/O-3	75	80	Х
25	Topsoil/Overburden	T/O-4	45	35	
26	Topsoil/Overburden	T/O-5	30	29	Х
27	Topsoil/Overburden	T/O-6	20	15	
28	Topsoil South	TS-1	60	35	
29	Topsoil South	TS-2	60	35	Х
30	Topsoil South	TS-3	60	30	
31	Topsoil South	TS-4	25	25	



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	Area	Borehole ID	Proposed Depth (ft bgs)	Actual Depth (ft bgs)	Continuous Core
32	Pile 1	P1-1	60	20	Х
33	Pile 1	P1-1A	60	35	Х
34	Pile 1	P1-2	120	65	
35	Pile 1	P1-3	40	40	
36	Pile 2	P2-1	120	30	
37	Pile 2	P2-2	60	20	
38	Pile 3	P3-1	25	15	
39	Pile 3	P3-2	50	45	Х
40	Pile 3	P3-3	100	40	
41	Pile 3	P3-4	100	40	
42	Pile 3	P3-5	75	15	
43	Pile 3	P3-6	75	55	
44	Pile 4	P4-1*	70	N/A	
45	Pile 4	P4-2*	70	N/A	
46	Pile 4	P4-3	70	15	
47	Pile 4	P4-4*	70	N/A	
48	Pile 4	P4-5	70	20	
49	Pile 4	P4-6	70	10	
50	Pile 4	P4-7	70	30	Χ
51	Pile 4	P4-8	70	20	
52	Pile 4	P4-9	70	40	
53	Borrow Area West	BW-1 <sup>†</sup>	40	35	Χ
54	Borrow Area West	BW-2 <sup>†</sup>	20	20	
55	Borrow Area West	BW-3 <sup>†</sup>	20	15	
56	Borrow Area West	BW-4 <sup>†</sup>	20	20	

bgs = below ground surface, ft = feet

# **Laboratory Testing**

DB Stephens in Albuquerque, NM performed geotechnical laboratory testing of the soil samples. Laboratory testing of the brass liner samples included sieve analysis with hydrometer, Atterberg limits, moisture and density, and triaxial shear (consolidated undrained) of select samples. Laboratory testing of the bulk auger cutting samples included standard Proctor compaction. Analytical testing performed by ALS Environmental included testing for Radium-226 (Ra-226), Uranium, Thorium-230, and Gross-Alpha concentrations of select samples. Geotechnical and analytical test results are summarized in Tables E-1 through E-6 in Attachment E. Laboratory testing reports are included in Attachment F (DB Stephens) and Attachment G (ALS).

 $<sup>^{\</sup>star}$  Indicates borehole was not drilled due to safety, access, or other concerns.

<sup>†</sup> Indicates borehole was not included in original proposed (work plan) drilling locations.



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# **Soil Classification and Material Descriptions**

Material encountered at the Site generally can be classified into two broad categories: (1) native alluvial soils, and (2) disturbed waste materials placed in piles following excavation from the two pits. The latter comprised mixtures of soil and rock with substantial variation between piles and, in some cases, considerable disparity within a given pile. The alluvial soils were generally more consistent both spatially and with depth throughout the borrow areas. Detailed descriptions of the materials found in each specific area are provided in the following sections.

#### **Borrow Sources**

The Lobo Tract borrow area contained alluvial deposits of silt, sand and clay. Most of the material encountered contained greater than 50 percent fine-grained soils and was dominated by silt-sized particles with varying levels of clay and sand. Sandy silt (ML) and silty sand (SM) were the most common classifications given for these materials, although several deposits of lean clay (CL) were also encountered. Silt-sized particles generally encompassed more than one-third of the particle size distributions for materials encountered in the Lobo Tract, including those classified as sand or clay. The material was slightly moist with moisture contents ranging from about 4 percent to 8 percent by weight, except for some areas with greater clay content containing moisture contents between approximately 10 and 15 percent. Silts and sands were medium dense to dense, except for some small pockets of loose and poorly-graded sand, and clayey materials ranged from very stiff to very hard. Clay was mostly encountered in lower elevation areas near the arroyo in the center of the alluvial "valley" and was often found in the upper 10 to 15 feet of the alluvium with silt and sand-dominated materials below. In areas near the edge of the borrow area, and closer to the sandstone mesas that surround the area, materials were sandy with less clay and lower moisture contents. Along the easternmost extents of the borrow area, bedrock was encountered at a depth of approximately 10 feet owing to the closer proximity of these boreholes (e.g., L2-2, L2-3, and L2-4) to the sandstone outcroppings.

The Topsoil North pile was relatively homogenous throughout its area and profile compared to the Lobo Tract, though the pile did contain similar alluvial soils. Material in this pile was classified as a slightly moist silty sand (SM) with few to little clay, and was loose to medium dense with similar blow counts recorded for most of the sampling intervals.

Located just off the southern edge of Pit 1, the Borrow West area contained similar soils (SM) as the Topsoil North pile but with slightly increased variability. Two main types of SM topsoil were identified, one being nearly the same as the Topsoil North pile material and the other having a slightly higher clay content with a coarse fraction less than 50 percent. The latter was identifiable based on darker brown coloring and slightly increased moisture compared to the former, and was found at depths greater than approximately 10 to 15 feet. This stratification was consistent with an observable color change with depth in the exposed topsoil along the western Pit 1 highwall.

Material in the Borrow South area was more comparable to the Lobo Tract soils than to the Topsoil North and Borrow West soils, with greater silt content relative to sand content and classified as ML. Soil encountered in this borrow area was slightly moist and loose to medium dense. Due to the area's proximity to a rock outcropping, weathered sandstone bedrock was encountered in each Borrow South borehole except BS-6. Depth to bedrock ranged from 5 to 20 feet, with the exception of the BS-4 location which, as previously discussed, was not drilled due to exposed bedrock at the ground surface.



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The T/O and Topsoil South piles contained similar mixtures of topsoil and waste rock from the pit excavations. The piles were highly heterogeneous with no explicit stratigraphy of soil and/or rock. Although the piles were covered in a thin layer of alluvium characteristic of the topsoil throughout the Site, the interior of each pile comprised a highly variable mixture of weathered bedrock (gray/brown sandstone and black/gray shale) and sandy silt. Most material was dominated by fine-grained silt and clay particles, except for some portions of the Topsoil South pile in which a silty sand was encountered. Fines were classified as either CL or ML. Soils were slightly moist with occasional moist areas and were generally medium dense to dense.

# **Waste Piles**

Shale Piles 1 and 2 contained mixtures of weathered sandstone and shale. All material encountered was colored gray to black, though scattered iron and sulfur staining (red, orange, and yellow) also was observed. Samples were slightly moist to moist, with the wettest areas comprising mostly shale and black, possibly organic material. Most material contained a coarse fraction greater than 50 percent, including up to 20 percent gravel in samples from Pile 1. Some cobbles or boulders were encountered while drilling in Pile 1, resulting in damage to several augers. Samples from Pile 2 contained trace amounts of gravel, with higher sand, silt, and clay contents relative to Pile 1. Pile 2 samples also exhibited higher densities and moisture contents, possibly due to greater clay and/or organics content. Fines in Pile 1 were classified as ML, whereas fines in select Pile 2 samples were classified as CL. The northwestern portion of Pile 1 (near borehole location P1-3) contained numerous large, sandstone boulders, as indicated by frequent grinding on rock by the augers followed by sudden drops through large void spaces. Brass liner samples also contained mostly broken rock pieces.

Pile 3 material was largely composed of poorly-graded and fine- to medium-grained sand with trace amounts of gravel and sandstone pieces scattered throughout the profile. The majority of samples contained greater than 60 percent sand-sized particles, including amounts greater than 90 percent at depths of 30 to 40 feet in borehole P3-4. Some sand was characteristic of the Jackpile sandstone formation due to primarily gray and white coloring with areas of green and purple. Other areas contained brown or gray weathered sandstone and shale, frequently with traces of orange or yellow oxidation. Poorly-graded sands were generally moist and loose, whereas materials with improved gradation were medium-dense and slightly moist. Overall, moisture content appeared to increase with depth towards the center of the pile. Fine-grained soils usually comprised less than 30 to 40 percent of the material and were classified as ML. Minimal clay content or evidence of plasticity was observed.

Although borehole depths in Pile 4 were relatively shallow compared to the total depth of the pile, considerable variability was observed in the sampled material. Some variability was evident based on visual assessment of the surface of the pile, as material ranged from brown topsoil in the northern and southern extents of the pile, to gray and white sand and gravel (i.e., weathered and broken sandstone) in the central areas. Dark gray/black, weathered shale also was evident in the numerous drainage rivulets cutting across the pile surface. In the northern area of the pile at higher elevations, topsoil extended no more than approximately 5 to 10 feet bgs before grading into sand and broken rock mixtures. Lower elevations toward the central portion of the pile contained mixtures of sand, gravel, and highly weathered shale, ranging from light gray to black in color. Some areas contained almost exclusively broken sandstone pieces, whereas others contained poorly-graded sand similar to that encountered in Pile 3, but with higher gravel content. The latter presented traces of green and purple coloration characteristic of the Jackpile sandstone formation and was especially prevalent near borehole P4-5. Higher moisture content was noted in these sands compared to other sand and rock mixtures in the pile, which was consistent with the conditions observed in Pile 3 material. Sandy silt topsoil was the driest material observed in the pile, with moisture contents similar to those observed in the native borrow areas. Several of the



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boreholes (P4-3, P4-5, P4-6, and P4-8) appeared to extend into zones of higher shale content prior to being stopped due to elevated gas concentration levels.

# **Analytical Testing Results**

Seventeen soil samples were subjected to analytical testing for metals concentrations, including six from Shale Piles 1 and 2, five from Pile 4, and six from the Borrow West area. Overall, soil concentrations of Ra-226 in samples collected during the 2018 investigation ranged from 0.73 to 29.5 pCi/g. The lowest values were reported for the Borrow West area in which all samples contained concentrations below 1.15 pCi/g, similar to background and borrow area readings reported by MWH (2007). Values in Piles 1 and 2 generally were near background levels (0.91 to 3.85 pCi/g), except for one isolated sample (from borehole P1-2, 20 feet bgs) with a concentration of 16.1 pCi/g. In Pile 4, the highest soil concentrations were measured in borehole P4-5 and ranged from 18.6 to 29.5 pCi/g. All other samples from Pile 4 contained concentrations below 3.14 pCi/g. The results listed in Table E-6 were used in conjunction with analytical testing results from MWH (2007) to evaluate radon activity levels throughout the Site, including areas that were not sampled for analytical testing during the 2018 investigation.

# Groundwater

Groundwater was not encountered in any boreholes during drilling operations, mainly because the drilling was performed either in waste piles located above the native ground surface or in native borrow areas with relatively deep groundwater levels compared to the shallow (generally 15 to 20 feet) borehole depths. According to the Stage I Abatement Plan Investigation Report (INTERA, 2006), the minimum depth to groundwater was more than 50 feet (in the vicinity of the arroyo) based on data collected during August, September, and December of 2004 from six monitoring wells located throughout the Site.

# **Summary and Conclusions**

A total of 51 boreholes were drilled in waste piles and native borrow areas in and near the Site for this investigation. Several borings in the piles were not completed and many others only partially completed due to the presence of potentially harmful gases. However, Stantec expects the information to be sufficient for the intended purposes of the investigation, including the use of data for the reclamation design and closeout plan. Soil samples were collected using Modified California sampling methods as part of standard penetration tests and were delivered to testing laboratories for geotechnical and analytical testing. Results included index properties, gradations, compaction properties, and strength parameters from geotechnical testing, as well as metals concentrations from analytical testing.

Each borrow area was found to contain similar alluvial materials with varying combinations of silt, sand, and clay. Based on results for particle-size gradations and Ra-226 soil concentrations, these soils appear acceptable for use as cover material during Site reclamation. However, careful consideration of slopes will be necessary due to the material's susceptibility to erosion, as indicated by its relatively high fines content and by the numerous drainage gullies and rivulets observed on pile surfaces and in other areas with relatively high slope angles. The proximity of the Borrow West area to Pit 1 will be beneficial as material from this area will be easily accessible for potential use as cover material following the anticipated backfilling of Pit 1. The Borrow South area, although significantly smaller in area than Borrow West, is in relatively close proximity to Site facilities and will provide convenient access to cover materials. The Lobo Tract borrow area is located farther from Site facilities but is expected to provide a considerable contingency volume of cover material as needed during closeout. Portions of the borrow areas nearest to rock outcroppings and cliff bands generally exhibited



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shallower deposits of alluvium above the bedrock, with deeper deposits and greater potential borrow volumes in areas further from the cliffs (e.g., closer to the arroyo in the Lobo Tract and the center of the valley in which the Borrow West area is located).

Variable mixtures of topsoil and weathered rock overburden were encountered in the piles throughout the Site. The T/O and Topsoil South piles contained significantly less topsoil and more rock than was anticipated, suggesting that these piles may be more suitable as fill material for backfilling the pits than for use as cover material. Piles 1 through 4 also will likely be used as pit backfill material. Based on analytical testing results from this investigation and MWH (2007), Stantec anticipates materials from Piles 1 through 4 and T/O (i.e., materials with relatively low Ra-226 activities) will be deposited at upper elevations (near the cover) or lower elevations in the pit, below the expected groundwater rebound elevation (5966 feet above sea level (fasl)). For materials containing more elevated Ra-226 activities (e.g., west disturbance area, crusher/stockpile, and piles 5-7; see MWH, 2007), efforts will be made to place these materials near, or above elevation, 5966 fasl to reduce the future potential for contact with the groundwater. Relatively low-activity material (e.g., T/O pile) could be used as subsoil for cover material to enhance plant growth and provide additional buffer against the surface release of radon. Any residual pile material not used as backfill is expected to require additional cover material from borrow areas to facilitate revegetation, while also being regraded to reduce erosion of the topsoil.

Due to the presence of potentially harmful gases encountered during drilling, Stantec recommends additional safety precautions be taken during future earthwork at the Site. Special considerations during construction may include the use of personal H<sub>2</sub>S detectors by personnel near the earthwork, as well as the use of a 4-gas meter to routinely monitor the work area for elevated gas concentrations. Additional personal protective equipment (PPE) and/or engineering controls may be required under certain circumstances and conditions should be reevaluated prior to the start of earthwork.

Attachments: Attachment A - Figure A1. 2018 Geotechnical Investigation Borehole Locations

Attachment B – Borehole Logs

Attachment C - Photos

Attachment D - Daily Field Reports

Attachment E - Table E-1. Laboratory Results - Initial Properties

Table E-2. Laboratory Results – Particle-size Analyses Table E-3. Laboratory Results – Atterberg Limits

Table E-4. Laboratory Results – Proctor Compaction Table E-5. Laboratory Results – Triaxial Shear

Table E-6. Laboratory Results – Analytical Testing

Attachment F – Geotechnical Laboratory Testing Report Attachment G – Analytical Laboratory Testing Reports



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# References

INTERA, 2006. Stage I Abatement Plan Investigation Report. INTERA. October 26.

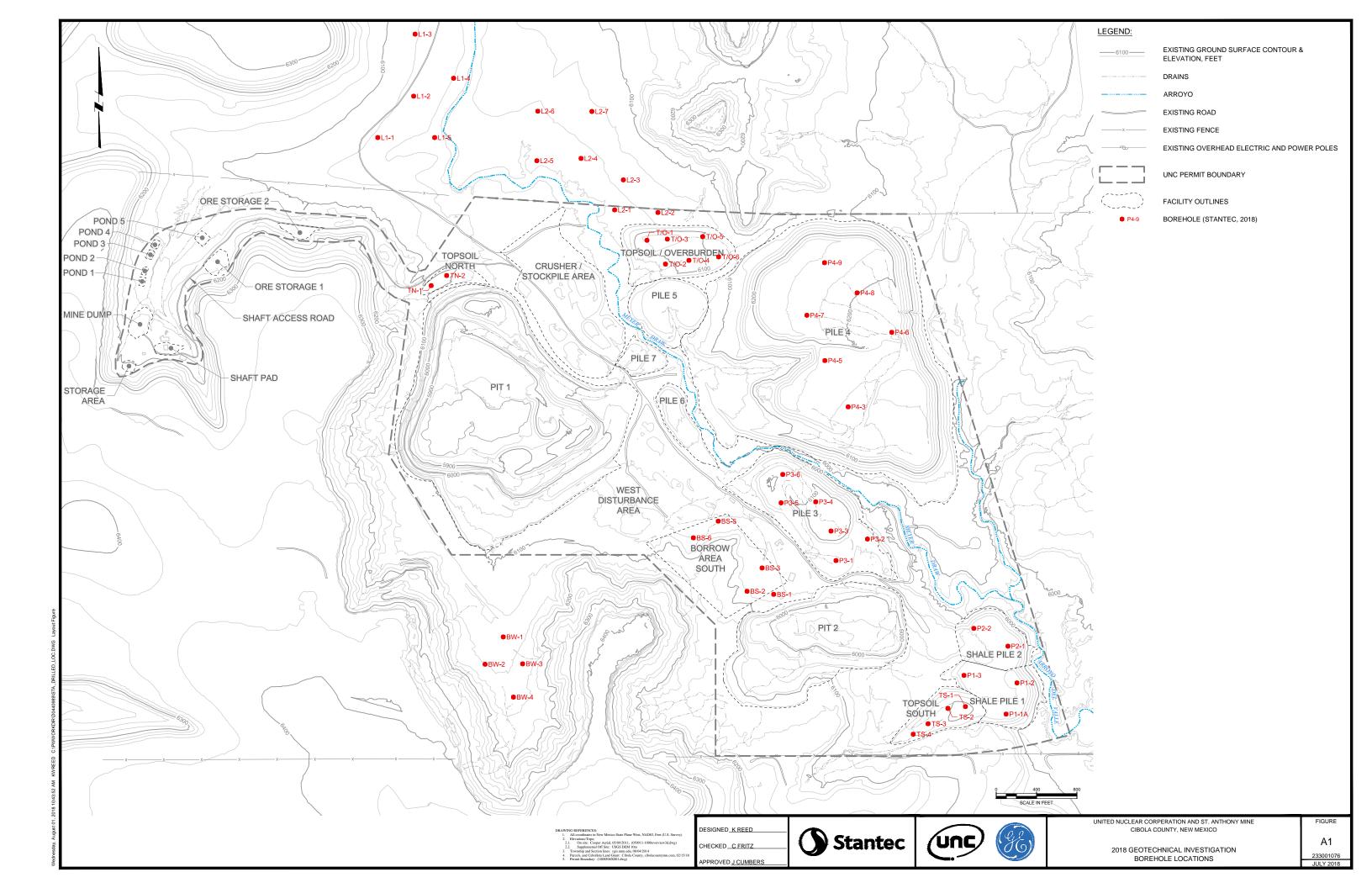
MWH, 2007. Materials Characterization Report: Saint Anthony Mine Site. MWH. October 26.

MWH, 2010. St. Anthony Mine Site Closeout Plan. MWH. July 2010.

Stantec, 2018. St. Anthony Supplemental Investigations Work Plan. Stantec. February 23.



# **Attachment A. 2018 Geotechnical Investigation Borehole Locations**





# **Attachment B. Borehole Logs**

rillers (day) night): S. Li eld Representitive (day	om, A. Rodrig / night):		Drilling Method: Hollow Stem Auger Logged by: C. Fritz  Core Diameter: A		Finish Date:
Depth Sample Number	Blow Count Recovery (in.)	qu (tsf) Lithology / Symbol	Description	Graphic	Remarks
		SWS	ilty sand with little clay (SM), rediction clense, weakly comented and brown, stightly moist	104	
5'A 5'B	13	SM S	ame as above		
10'A	9 12 10	SM S	ncreased carbonate content, and material, slightly darker		
15'Ba	3 20/2"	22 0	andstone bedrock (SS), highly to simpletely weathered, orange tyellow chemic	Sal T	
GRAVELS  450% coarse  15 450%  15 5400%  SANOS  SANOS  SANOS	Sity gravats, poor Citywy gravats, poor	all, grave sace micronic me, grave sace micro grave species micro grave sace sace of grave sace	Term (3P1) 1.4*[D 20*[D 2.5*[D 1 3P1] 1.4*[D	0-7 G D Cobbles	Bus (mm)   Sits (inches)

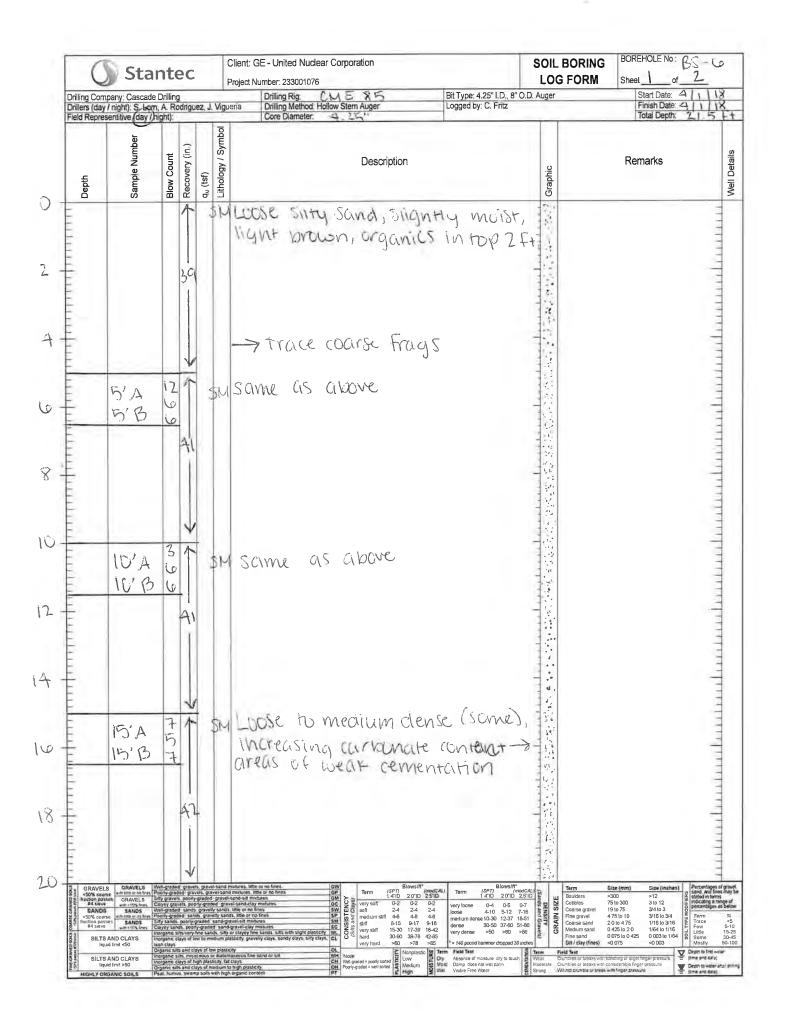
illing Company: C illers (day) night): eld Representitive	S. Lom, A.	Rodrigo		Core Diameter: N I A	O.D. Auger	Start Date: 4
Depth	Sample Number	Recovery (in.)			Graphic	Remarks
			24	Silty sand (SM), fairly well-graded, light brown, slightly moist, inedium dense, trace organics (roots)		ata tendena da tasa
क्षे ज		0 4	51	Scime as above.		
10,	A	0+0	50	Same as above,	anderedamente entre e	Township or the configuration of the configuration
15	'A \	081	54	silty sand (SM), coarser a poorly graded than above, slightly darker light brown		
SANUS <50% coarse fraction passes	WELS Sity or	vers, poor	ty-graded gra	d mushures, lettile or no fones.  OP	0-7 7-18 Cobbles Coarse gravel 18-51 Coarse gravel	Size (nim)

Description  That Description (a) right.  The Proposition (b) right.  The Proposition
Description (tst)   Sign Court   National Court   Nationa
20' A Fight the transitioning into broken rock. Highing well-weed shale, durk into which prey we orange a yellow discoloration.  EUB @ 20.775'
Wy orange a yellow discoloration/ E013 @ 20.715?

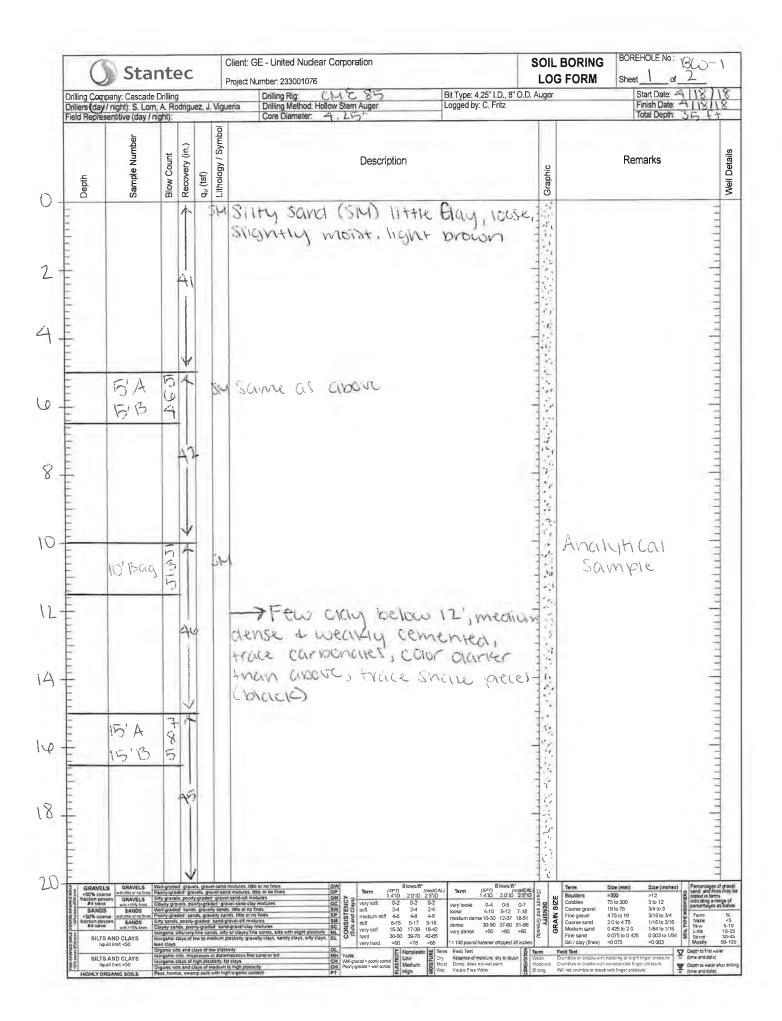
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Depth	Sample Number	ŧ	Recovery (in.)	q <sub>u</sub> (tsf) Lithology / Symbol	Core Diameter: 4.25"  Description	Graphic	Remarks
			1 1 1 1		Losse 571ty sand (SN), trace clay trace carbonates, few organics (roots), well-graded, trace sandstone.	4 14 1	
	5'A 5'B	334	<b>ソ</b> 木	51	same as above		
	10°G	9 90		SA	Moderate Cementation.  From clay.  Medium dense Stity sand, tracted discoveration, trace carbonate trace Sand Stone, weakly Cement Soil.	C	
		\$1/E	·V	53	Sandstone evident.  Wecknered Schudstone	**	
					£013@ 15.4'	And the second s	
GRAVE <50% coa fraction pa #4 slev	SSES GRAVELS	barrir arasas	grave notrhy-g	raded grave y-graded grave	Term   SPT   Blows/ft   Term   SPT   Term   SPT   Term   SPT   Blows/ft   Term   SPT   Blows/ft   Term   SPT   Term   SPT   Blows/ft   Term   SPT   Term   SPT   Term   SPT   Blows/ft   Term   SPT   Term   Term   SPT   Term   SPT   Term   Term   SPT   Term   Term   SPT   Term   Term   Term   SPT   Term   Term   Term   Term   Term   Term   Term	odCAL Term  Boulders  O-7  7,10  Coarse g	Size (nrm) Size (inches) Percentage 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2

Description  Descr	Sheet of Start Date: 4/1/1	SOIL BOR LOG FOF B" O.D. Auger	Bit Type: 4.25" I.D.,	Number: 233001076	F		ante	Company Cascadi	illing
5 SM Silty sand, Slightly moist, light brown, trace carbonates, weak to moderate cementation (SM)	Finish Date: A/1/1 Total Depth (6.5)	O.B. Augus		Drilling Method: Hollow Stern Auger	ez, J. Vigu	odrigue	om, A. Ro y / night):	(day / night) S. Lor Representitive (day /	llers Id R
5M Silty sand, slightly moist, light brown, trace carbonates, weak to moderate cementation (SM)	Remarks	Graphic		Description	q <sub>u</sub> (tsf) Lithology / Symbol	Recovery (in.)	Blow Count	Sample Number	Depth
5'13 10 SS Miderately weathered sandstone		50	noist, light nates, weak ration (Si	Ity sand, slightly rown, trace carbo maderate cemen		A-A-			
		ne-			55		5 10	5'B	
		and the same							
		recorder and a second							
## ## Charge grants poorly proced grant sand day motions   DC 9   very solt 02 02 02   very loose 0.4 0.5 0.7   S 9 N	loukders >300 >12 stated in term	0-7 G N Cobbles	2 0-2 very loose 0-4 0-5		eis gravel-sand graded gravel rty-graded grav	ded grave in poony- event poor	Sity gravel Clayey grave	On coorse with latte or no force ton parties GRAVELS	Naci



Drilling Co	Sta mpany: Cascade	e Drilling	_		Project Number: : Drillin	a Ria:				Bit	Type: 4.25	5" I.D., 8"		OG FORM er	Shee	EHOLE No :  t of  Start Date:  Finish Date:	2 ESN
Drillers (di Field Repr Page 1	ay / night): S. Lor esentitive (day / mper Namber Samble S. Lor (day /	night):	-	q <sub>u</sub> (tsf) Lithology / Symbol	eña Drillin Core	g Method: H Diameter:	follow Stem	Descrip	tion	Log	ged by: C	. Fritz			1	Total Depth	
	20'A 20'B	579	œ	5M	Same	CIS	CVX	)VC					13.63				
						2	OB	@	21	,5'							
													and the same				-
1111111111													array france				
													Annahama				4
athereda													. harralen				
													alminite.				
													The state of the state of				
													the state of the state of				
													- Internation				
GRAVE <50% co fraction p #4 se SANI <50% co	erse GRAVILS	Poerly-grade Lifty gravels Cizyey grave Wild-graded Poorly-grade	priority-gri priority-gri its, poority- tands, gr disands,	gravel sand adod gravel- graded grave svelly sands, gravelly sand	mistures. Little or no fines mistures. Ittle or no fines band-oil mistures el-acid-oily mostures talks or no fines is, talks or no fines		STENCY STENCY	soft 2	Blowshit* 10 2010 12 02 14 24 18 48	2-4 loos	y loose 0-se 4-1	4 0-5 0 10 5-12 7	17 DEN	Term Boulders Cobbles Coarse gravel Fine gravel	>300 75 to 300 19 to 75 4.75 to 19	Size (inches) >12 3 to 12 3/4 to 3 3/16 to 3/4	Percentage sand, and is stated in to indicating a percentage.
fraction p #4 se	S AND CLAYS quid limit <50	bidy sands, j Clayey sand: nerganic sid nerganic cla lean clays	s poorly gra- sivery fine lys of low t	ded sand-gra varied sand- sands salty	present mixtures graves clay mixtures or clayey fine sands, cits assety, gravelly clays, sor	with slight plastic ady clays, sidy cla		stiff 8- vary stiff 15 hard 30 vary hard >  ded = poorly sorted raded = well sorted	15 9-17 -30 17-39 -60 39-78 50 >78	9-18 der 18-42 ver 42-85 >85	rse 30-	50 37-80 51 60 >60 >	Srave(s)	Fine gravel Coense send Medium send Fine sand Sift / clay (fine	2.0 to 4 75 0 425 to 2.0 0 075 to 0 425	1/16 to 3/16 1/64 to 1/16 0 003 to 1/64 <0 003	Trace Few Little Some Mostly



	(	Sta	ntec		Client: GE - United Nuclear Corporation Project Number: 233001076			BORING FORM	BOREHOLE No.: 2	2
D	nllers (da	npany: Cascade y / night): S. Lon esenttive (day / r	n, A. Rodrigu	ez, J. Vig	Drilling Rig:	Bit Type: 4.25" I.D., 8" Logged by: C. Fritz			Start Date: Consists Date Total Depth:	e Shee
	Depth	Sample Number	Blow Count Recovery (in.)	q <sub>u</sub> (tsf) Lithology / Symbol			Graphic		Remarks	Moll Details
1111		20' A 20' B	370	SH	Same as above		14			11111
11111		LUP	4							
			48				45.73			1111
										2010
-								, ll a	range of a New	
		25' A	5	51-	same as above			liners	(no densi	147=
21111		25'B	0							3
1111			Ara							1
										1
1111										11.0
		30' A	54	50	same as above					d
- 11		30'13	4	256	00000					777
-			02				ا ا	00 -		and a
					(Additional moistur water down hole to	ć	1 1 2 2 2	H2S=5	1066m	THE PERSON NAMED IN
-					(Additional moistur	e Hom pourir	1 - C	LEL=	21%	1
1			V		E00 @	35'				
111							. Trans			7
1111							a train			11.1
-							The state of			
11111							-			
E SOUR	GRAVE 450% cor				no mixtures, little or no firms GP Term (SP7)	OWSIR* (SPT) 16 (SPT) 16 (SPT) 2010 2510	2510 (San L		Size (inches)   Size (inches	Percentages of gran sand, and fines may stated in terms
SAME ORANG	SAND SAND SAND SAND SAND SAND SAND	S SANOS	Well-greded sands Peerly-graded sand 5-by sands, poorby- Clavey sands, booth	gravety can b. gravety sa yaded cand-	15. If the period from	0-2 0-2 very loose 0-4 0-5 loose 4-10 5-12 modum dates 10-30 12-37 loose 17-39 18-42 very dates 30-50 37-60 1	15-51 0 3	Cobbles 75 Coarse gravel 15 Fine gravel 4 Coarse sand 2 Medium sand 0	5 to 300 3 to 12 9 to 75 3/4 to 3 75 to 19 3/16 to 3/4 0 to 4 75 1/16 to 3/16 425 to 2 0 1/64 to 1/16	recording a range of percentages at bell from % Trace <5 Few 5-1

	esenutive (day / n	Count	Recovery (in.)	q <sub>u</sub> (tsf) Lithology / Symbol	Core Diameter: N A  Description	hic		Total Depth: 211
Depth	Sam	Blow	Reco	4) "t)	Stiffy Sand willittle clay (sind few carbonates (esp in weak cemented clods), trace organics (roots, grasses), light brown, Slightly moist, medium den	Graphic		
	5'340	19103		54	Same as above		Anally Court	itical Samp From A.B.(
	10'A 10'B	920		SM	Same as above, trace cla	Annahaman Maranahaman Maranahaman		
	15' A 15' B	9717		ζН	Same as above	A Section of the Sect		
GRAV 450% of fraction p 55 apr	onse white a mites P	oerly-grad ty grave's	ed gray	els, gravel san draded preve	Term   CPT   Ter	2010 521D	Boulders > Cobbles 7	iise (mm)

O St	antec	Client: GE - United Nuclear Corporation Project Number: 233001076		SOIL BORING LOG FORM	Sheet 2 of 2
Orilling Company: Casc Orillers (day / night): S. Field Representitive (da	Lom, A. Rodriguez, J	Drilling Rig:   Viguena   Drilling Method: Hollow Stem Auger   Core Diameter: N / A	Bit Type: 4.25" l.D., 8" O.D Logged by: C. Fritz	. Auger	Start Date See S Finish Date Total Depth
Depth Sample Number	Blow Count Recovery (in.) q <sub>u</sub> (tsf)	Descripti	on	Graphic	Remarks
12,8	111	SHENSE STITY SANOT(S SHENCES + WHITE WI SHELLE PIECES, STIGNE	H), few consonous		from A.B. C
		E013@20+			
				alterial property of the second	
				received to the second	
	1 1 1				
				Table of the same	
				Linear Lands	

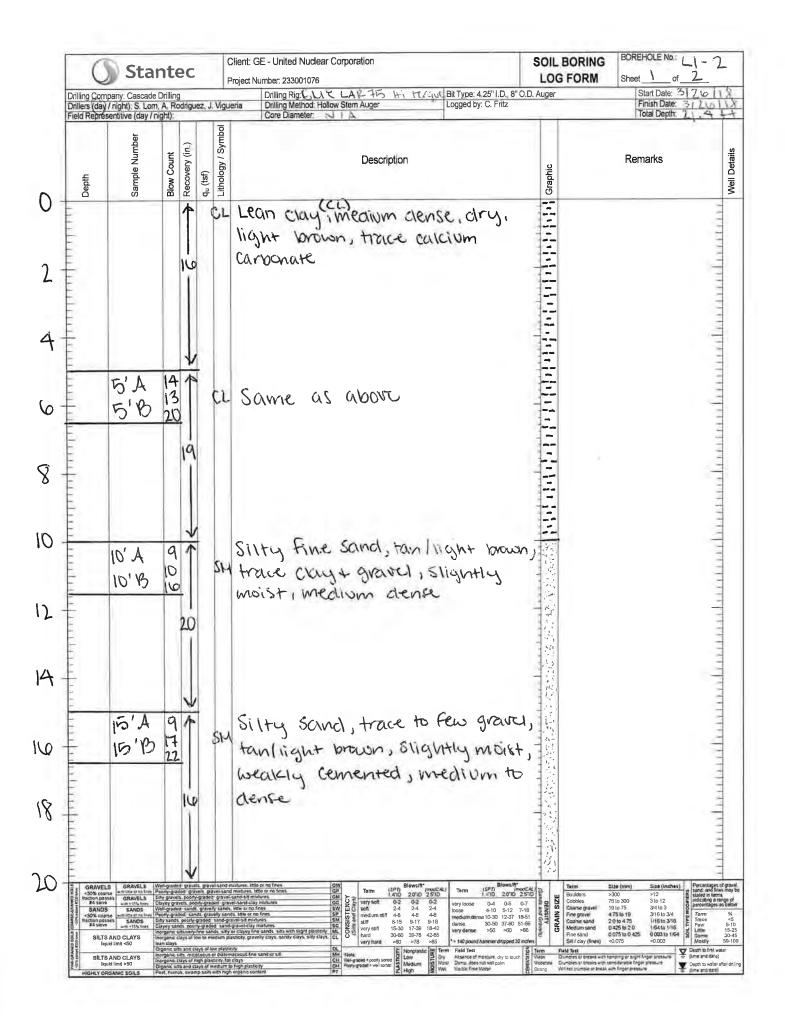
BOREHOLE No: BW-3 Client: GE - United Nuclear Corporation SOIL BORING **Stantec LOG FORM** Project Number: 233001076 Bit Type: 4.25" I.D., 8" O.D. Auger Logged by: C. Fritz Start Date: 4/18/18 Drilling Company; Cascade Drilling Drillers (day / night): S. Lom, A. Rodriguez, J. Vigueria Field Representitive (day / night): Drilling Rig: しいと分与 Drilling Method: Hollow Stem Auger Core Diameter: レ/A Lithology / Symbol Sample Number Recovery (in.) Details Remarks Description q<sub>u</sub> (tsf) Graphic Well 0 SM Silty Scind (SM) WI Few chags, Slightly moist, brown, trace organics, measur dense Sul same as above 5'A 0 51B 8 10 Analytical Sample same as above, witrain broken 10' Bag sandstone, few carbonates COUTE From A.B.C liners) 12 14 Fighly weathered shak + Sandistone, some chunks solid + less-weathers 15' A Scindstone 10 E013 @ 15.9' 18 20 Cobbles
Coarse gravel
Fine gravel
Coarse sand
Medium sand
Fine sand
Siticaly (Aner SILTS AND CLAYS SILTS AND CLAYS

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf) Lithology / Symbol	Description	Graphic	Remarks
	S	В	Ľ	0 -	LOOSE Silty Sand, light brown, siightly moist, some weekly cemented closs	0 (382) (484)	
	5 Bag	5050		20	Same as above	A Comment of the Comm	Alianjfical Savigoli (A,B,C livers-Hour
	10'A	440		SM	same as above, trace fine graves		
	15 Bug	ルバイ		\$12	Silty Sand without Clay, Shighting danger bown than also weeding dense & weak cementation		Analytical sample (Bunk from A.B. II MEYE)
GRAVI	GRAVELS	orly-gradi Ty gravels ayay grav	poorty ers, poo	els, gravel-san gradod i gravel	multiples. Liftle or no finate OWY    multiples Liftle or no finate OWY   multiples Liftle or no finate OWY   multiples Liftle or no finate OWY   Term (\$P\$) Blows/ft (mod/CAL)   Term (\$P\$) Blows/ft (mod/CAL)	0-7	Term   Gize (mm)   Gize (inches)   Boulders   >300   >12   Cobbles   75 io 300   3 io 12   Coarse grant   19 io 75   34 to 3   6   6   6   6   6   6   6   6   6

(	Sta	nt	ec			ient: GE - Unite oject Number: 23			ration					LO	_ BORIN G FORM	Sheet	HOLE No: (2	2	
Inlers (da	mpany: Cascade y / night): S. Lomesentitive (day / r	LA R	g odrigu	ez, J.	Viguer	Drilling Final Drilling Final Core Dia	Viethod: h	Hollow Ster	n Auger		Bit Log	Type: 4.2 ged by: 0	5" I.D., 8" C ). Fritz	).D. Auger		F	Start Date: 30 inish Date: otal Depth:	le Sine	e.
Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol				Descrip	tion				Graphic		Rer	narks		
	20'A 20'B	1087			Ni.	Scime	CIS	alo	ove					74 104 104 104				CEPTAGE	
							2	100	@ 2	1.5	)							The Party	
Turali														transfer of				edimen	
rite la ri														444444				meater	
True b														Leavester				Political Particular P	
milin.														and or				The State of	
r branch														design				director.	
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														Alberta				Arraed &	
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														Internet				P. F. F. F. F. F.	
=	1													and the same				hardan.	
																		111111	
GRAVE 450% to the con particular SAND SON to hacton particular hacton particular particular supplies SAND	GRAVELS  GRA	Neil-grade Peorly-gra- liky grave Chayev gra Neil-grade Serly-gra Lity sand Chayey sand	ed gravel ded grav is poody- ivers, poo- ed sames ded sames a poody- ruts, poor	t. grave graded graded graded graded by graded	refleand mix gravel-sa ea gravel w sands, life elly sands, sens-grav d sand-grav	sures, little of no foot nivitures, little of no funes rud-sell mixtures stand-clay mixtures. like of no fines stelle of no fines et-self mixtures assel-clay mixtures clayey fine sands, sittle wit		OC MO OC NO	very self self medium stiff stiff	### Blows/#* 2010 2010 202 202 204 204 408 408 315 9-17 5-30 17-39	2-4 loca 4-8 me 9-16 dei	y loose se 4 dium dense 1 se 3	I-10 5-12 7- 0-30 12-37 16 0-50 37-60 51	17 S P	Boulders Cobbles Coarse gravel Fine gravel Coarse sand Medrum sand	4 75 to 19 2 0 to 4 75		Percentages of sand and fined stated in terms of sand and fined stated in terms of sand sand sand sand sand sand sand sand	
		constant t	coys of in	rate bank	es. sity or	CREWEY FORD SAINCE, SIES WIT	er angre perste	-T 145   O 0	hard 2	0-60 39-78		, worldc -	>50 >60 >	5	Fine sand	0 075 to 0 425	0 003 to 1/64	g Little Some	4

<b>Sta</b>	ntec	Client: GE - United Nuclear Corporation Project Number: 233001076	SOIL BORING BOREHOLE No.: 1 Sheet 1 of 2
niling Company: Cascade nilers (day/ night): S. Lorr leld Representitive (day / r	n, A. Rodriguez, J. V		25" I.D., 8" O.D. Auger         Start Date: 2. ] 2           . C. Fritz         Finish Date: 3. ] 2           Total Depth: 3. ]         1. ]
Depth Sample Number	Blow Count Recovery (in.) q <sub>u</sub> (tsf)	Description	Remarks Figure 1 194 195 197 197 197 197 197 197 197 197 197 197
	\$ B	M Dense silvy scively the cia eng, light process, trule of (roots), weak to maderche cerrentation.	
5'A	17 7 5	Clayed savid (SC), dark br	Duble blees on 3th blow
10°.A	<u> </u>	M Dense Silty Song (SM), are singrally meist, light brow the calcium currence to the concernite com	noite,
	<b>多</b> 2 万\	1 200,110 012 6000	
15' A 15' B	14 / S	m sanne as above	
1 450% coorse   Miniatia or no frage	Wingsased gravels gravels for programming gravels gravels, good gravels,	and minimums. Male or no floors GW and Male of the GP 1 4 (ID 201D 251D 251D)	Torm   Size (mm)   Gite (inches)   Porce   Size (mm)   Company   Company
SANDS SANDS	Cuyey gravets, poorly-graded Well-graded sands, gravety	or very soft 0-2 0-2 very soft 0-2 very soft 0-2 0	0-4 0-5 0-7

	ntec	Client: GE - United Nuclear Corporation Project Number: 233001076	LOG	FORM Sheet 2 of 2
Orilling Company: Cascad Orillers (day / night): S. Lor Field Representitive (day /	m, A. Rodriguez, J.	Orilling Rig: Vigueria Drilling Method: Hollow Stem Auger Core Diameter: 4.25	Bit Type: 4.25" I.D., 8" O.D. Auger Logged by: C. Fritz	Start Date: See Sin Finish Date: Total Depth:
Depth Sample Number	Blow Count Recovery (in.) q <sub>u</sub> (tsf)	Description	Graphic	Remarks
20' A 20' B	8 15	or same as above	500	
		EOB @ 21	.5'	
			3	
			1	
			1	
			3	
GRAVELS GRAVEL	Web-graded graves, graves Paint graded graves, grave	tand invalues. Him or no lines OP   OW		Term Size (mm) Dise (inches) Soutions >300 >12 Cobbles 75 io 300 3 to 12 Cobbles 75 io 304 53 to 12 Intermediate in the color of the co



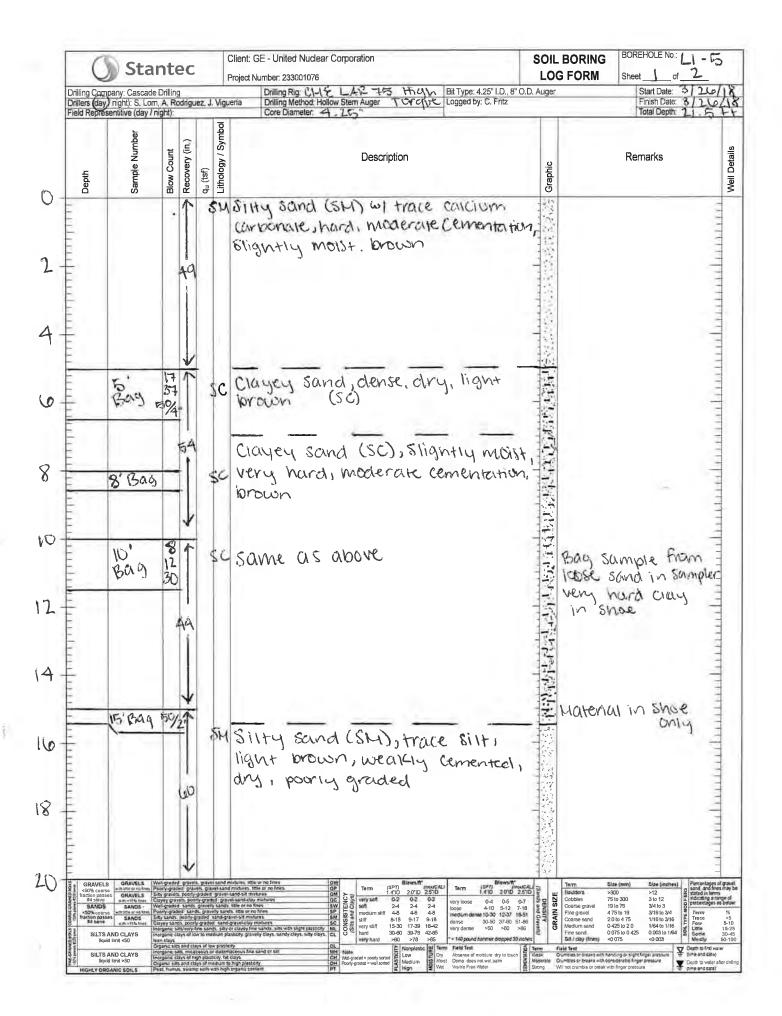
Drilling Company: Cascade Drilling Drillers (day / night): S. Lorr, A. Rodriguez, J. V. Field Representitive (day / night):	igueria Drilling Method: Hollow Stem Auger Lo Core Diameter, N. A.	Type: 4.25" I.D., 8" O.D. Auger gged by: C. Fritz  LOG FORM  Sheet 2 of 2  Start Date: 3-2 Sh-2  Finish Date: Total Depth:
Sample Number  Blow Count  Recovery (in.)	Description	Graphic Semarks
20'A 13 50 20'B 5%	A+B liners -> clay(crotar very nerd, slightly moi	ik brown, =
	cementation EOB@ 21.4'	, wear
200		

_	Sample Number	Count	Recovery (in.)	qu (tsf) Lithology / Symbol	Description	Shic	Remarks
Depth	Sam	Blow	Reco		Silty sand (SM), few to little clay, light brown I tan, slightly	Graphic	
					moist, medium dense		
	5'A 5'B	0117		SM	same as above	A STATE OF THE STA	Slightly improved Structure in samples compare to previous holes
							to prevos mores
	10'A	570		2h	same as above		
	15'A 15'B	1587		5H	same as above		
GRAV	outse with the me these Pre	DOITY-DITE	Sod Gra	vels, grzyef-san	Minutest late or or firms	(S)	Term

Delling C	Sta ompany: Cascade					nt: GE - United Nuclear Corporation ct Number: 233001076  Drilling Rig:	Ī.	it Type: 4.25" l.D., 8" O	LO	G FORM	FORM  BOREHOLE No.: L1 - 3 Sheet 2 of 2  Start Date: See Sm		
Drillers (c	ompany: Cascade lay / night): S. Lon presentitive (day /	n, A. Ro	a odrigur	22, J.	Viguena	Drilling Method: Hollow Stem Auger Core Diameter: V / A		ogged by: C. Fritz	D. Auger		Finish Date: Total Depth:	2 31	
Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Descriptio			Graphic		Remarks		
4111111	20' A 20' B	8 22			Sly 8	ame as allove, tr arbonate, increase		calcium mentation					
1						8013 @ 21	·5'						
									A Transfer				
									take the state				
1011111									Terrett				
									1			1	
True Tr									T. T.				
randara.													
1000									[				
111									and later				
drant									la contra				
									*******				
									Transfer				
GRAV	/ELS GRAVELS	West grades	o graveis led grave	gravel els grave	sand mixture	i little or no fines	20'10 25'1D	Term (SPT) Blows/ft* (most) 1.410 2.010 2.5	Size	m - 11	ize (mm) Gize (inches)	Percentage sand and fi stated in to	

Depth Sample Number Blow Count Recovery (in.) q <sub>u</sub> (tsf) Lithology / Symbol				Graphic	Remarks		
	S,				Silty sand (SM), few to little clay, light brown, Slightly moist medium dense	183	
	5' A 5' B	8 11 13		SI	4 same as allowe		
	10'A 10'B	5 13 20		SI	brown, trace calcium carbond	te	
	3			S	Clean Sand, 1008e, light brown wi grey Silica crystals visible, slightly wishte moist, medium	000000000000000000000000000000000000000	Driller noted Change @ 13'
*	15'A 15'B	257		8	Sand		
GRAVI	LS GRAVELS W	HS-qraded cony-grade	gravels	gravel sa	d modures, time or no fuers	705.0	Term   Size (mm)   Size (inches)   Bouders   >300   >12   State   Size (inches)   Size (inch

Drillers (da	mpany: Cascade ay / night): S, Lorr esentitive (day / r	1, A. R	g odrígue	ez, J.		Drilling Rig ria Drilling Met Core Diam	thod: Hollow,Stem Au neter. N/A	ger	Bit Type Logged	e: 4,25" L.D., 8" O.D. by: C. Fritz	Auger		Start Date: 5 Finish Date: Total Depth:	ee s
Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol		Dr	escription			Graphic		Remarks	
	20' Bay	8		4	5P	Same	as abo					bay s	ample liviers combine	ivil d
							E0B (	21.1	5'					
											aced cont			
											1			
17171111											Translate I			
											Transfer of			
											Total Control			
GRAVE	artic minimum refres P	Vell-grade 'sorly-grad	d graven	grave 95. grav	sand mo	nues: little or bo feets nutures, title or no hale no-set minutes	OW PP. Terr	m (SP7) Blows/R* 1.4*ID 20*ID	(modCAL) Term	(SPT) Blows/h* (SPT) 1.4*ID 20*ID 25*D	[8]		lze (mm) Dize (inches) 300 >12	Percentr g sand ar
SANC SANC SANC SANC SANC SANC SANC SANC	S SANOS V	Veli-grade	sands.	grave?	d gravel- r sands, id ou sands	no-se metures the or no times tale or no	GM A T Very	soit 0-2 0-2 2-4 2-4 num stiff 4-8 4-8	0-2 very loose loose		DENSITY and Savet	Cobbles 7	5 to 300 3 to 12 9 to 75 3/4 to 3 75 to 19 3/16 to 3/4 0 to 475 1/16 to 3/16	Percents sand an stand in mounts of the percents of the percent of



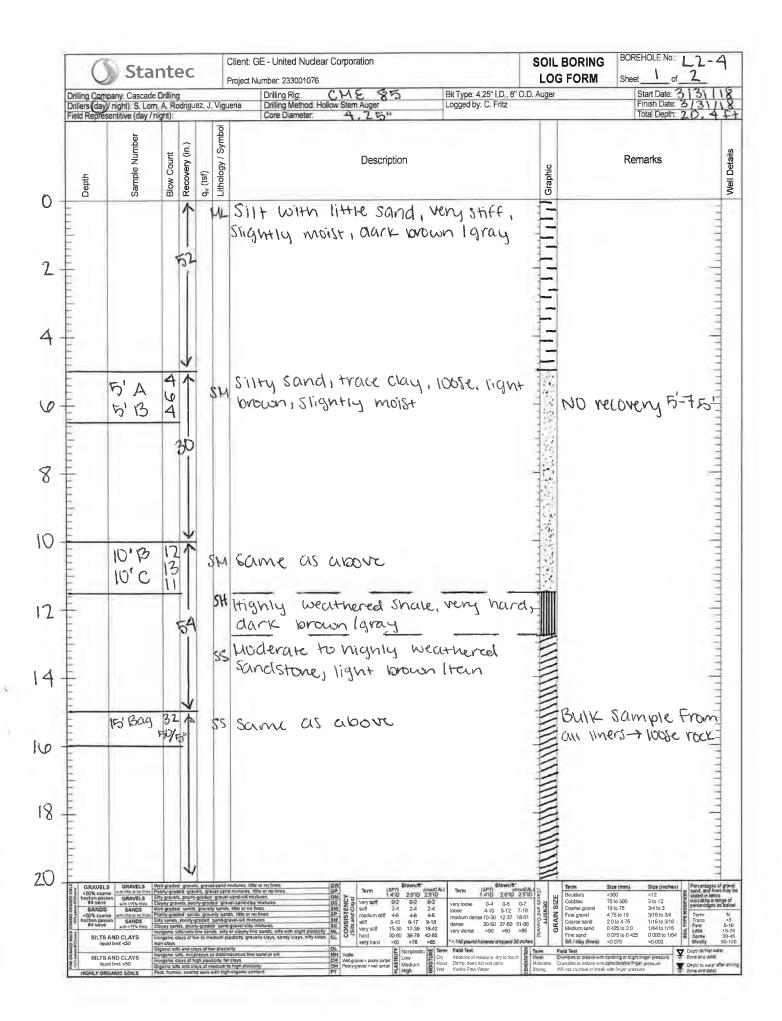
(	Sta	nte	;C		Client: GE - I		dear Corporation					BORING FORM	BOREHOLE Sheet 2		
Drilling Co	ompany: Cascade lay / night): S. Lom	Drilling	40.00		Drii	lina Ria:			Bit Type: 4.25" I,D.,				Start Da	ate Tex :	She
Field Rep	ay / night): S. Lom resentitive (day / n	, A. Ro	angue	-	Co	re Diameter	d: Hollow Stem Auger		Logged by: C Fritz	-			Total De	epih:	3
Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	29 / Year of the control of the cont		Descript	ion			Graphic		Remarks		
111111	20' A 20' B 20' C	11 17 17		51	Same	e as	above								17.7
							E013@	21.5		and a second					
										1					
111111										a trade					100
11111										A Land College					1
										41111					
										414614					
1										there's					
and an										200					
Troub		ly II								Leevely					
riteria.										a transfer					
100										and the					
G to the										. Bernard					
										1					
										-					100
GRAV 95% c 50% c 5	passes GRAVELS S	dy gravels layey grave layey grave	es grave pours-g ers poors	raded gra y-graded gravely sa	nd mixtures. Utility or no fir spand mixtures. Utility or no spiral-band-city mixtures gravel-band-city mixture spiral-band-city mixture spiral-band-city mixtures spiral-band-city mixtures spiral-band-city mixtures spiral-band-city mixtures.		Own   Ferm   15P	2 02 02 4 24 24	Term (5-7) Blown (4-70) 20° vsry loose 0-4 0-5 loose 4-10 5-11 medium dense 10-30 12-3	0-7 2 7-18	l w l	Boulders > Cobbles 7: Coarse gravel 1:	lize (mm) Size (mm) 300 >12 510 300 3 10 11 75 374 10 75 19 376 10 75 10 10 75 10 10 10 10 10 10 10 10 10 10 10 10 10	3 5 1100	centaget et and fr ed in ter con ger con lag es

id Repr	ay) night): S. Lom esentitive (day / r	ight):	odngu		eria Drilling Method: Hollow Stem Auger Logged by: C. Fritz Core Diameter: A A		Finish Date: 5 3 Total Depth: 21.
Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf) Lithology / Symbol	Description	Graphic	Remarks
				SH	Dense silty sand (SM), slightly moist, light brown lgray, poorly graded, trace carbonates, some weakly cemented cum trace organics	PS,	
	ち' A ち' B	248 28		SM	Same as above		
	10' A 10' B	12 14 17		SM	Same material, medium dense, Slightly finer		
	15' A 15' B	91215		<b>У</b> М	Silty sand (SM), Few clay (scatter Small smale pieces), slightly coarser Increased cementation possibly due to higher carbonate conten		
GRAVE +50% co +actor ±4 say SAND +50% co	GRAVELS CO	ooly-grade ty gravels ayey grave wil-graded	poomy poomy is poor	es, gravel-sand graded gravel- ly-graded grave gravely sands,	Comparison   Com	7 Cobblet	gravel 19 to 75 3/4 to 3

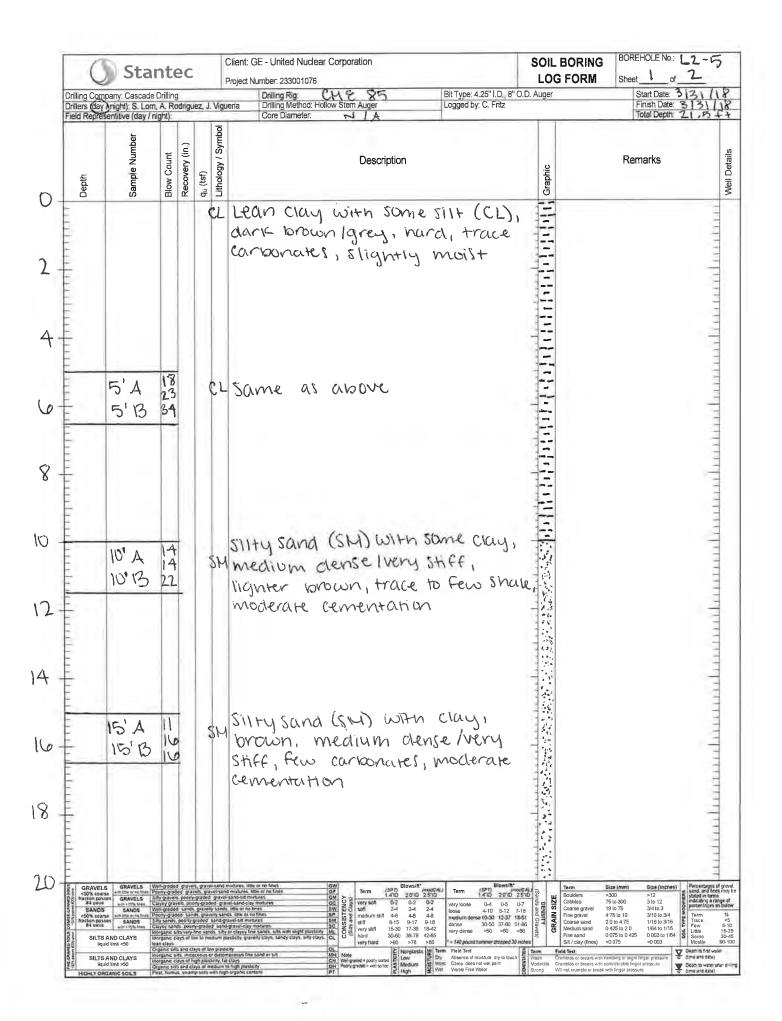
Drilling Co	Sta  mpany: Cascade	nte	С	Project Num	- United Nuclea nber: 233001076 Drilling Rig:			Bit Type: 4 25		LOG F	ORING ORM	Sheet 2 or	1_2
Drillers (da	mpany: Cascade ay / night): S. Lorr resentitive (day / r	, A. Rodn		/iguena (	Drilling Method: Hi Core Diameter:	ollow Stem Auger		Logged by: C.	. Fritz	udei		Finish Date: Total Depth:	
Depth	Sample Number	Blow Count	q <sub>u</sub> (tsf)	Lithology / Symbol		Descr	iption			Graphic		Remarks	
	20' A 20' B	1125	1		ne as	abor	e			44 13 13			
					2	.0B@	21.5	_	- 19				
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111111													
111													
a francis													
Marke									2000				
		54							and the contract of the contra				
offugr									21-1-1-1		#-		
Truck													
o adbar									The state of the s				-
orbore									to the first				
Trans.									1				
									-				- ,
=													
(dran		_ 1 _ 1				low) /	Blows/R*	1	Blows/fi*	Ter	m Br	se (mm) Dize (inche)	
GRAVE <50% co traction pi #4 ski SANU <50% co	arso ussee GRAVELS ve SANDS	odily-graded g ity gravels, poo layey gravels, p well-graded san both-graded san	ravets, gravet dy-graded gr obity graded ds, gravetly s	and mixtures. Iffie or re- sand mixtures. Iffie or swel-sand-sid mixtures gravel-sand-clay mixtures ands. Iffie or no fines sands. Iffie or no fines	P. On Fire's P. Oures	or Se very soft soft	0-2 0-2 0-2 2-4 2-4 2-4	very loose 0-4 loose 4-11 medium dense 10-3	2010 2510 4 0-5 0-7 0 5-12 7-16	SIZE	bbles 75 arse graval 19	00 >12 10 300 3 to 12 10 75 3/4 to 3 75 to 19 3/16 to 3/4	Percentages sand and fine states in term

Stantec	Client: GE - United Nuclear Corporation Project Number: 233001076	SOIL BORING BOREHOLE No: L 2 - LOG FORM Sheet of
ling Company: Cascade Drilling lers (da) / night): S. Lom, A. Rodriguez, . ld Representitive (day / night):		Start Date: 3 / 3 \ Fritz Start Date: 3 / 3 \ Total Depth 15 . 4
Depth Sample Number Blow Count Recovery (in.)	Description	Graphic Remarks
	Silf (ML) with little sand, few of Slightly moist, brown, Cement- medium dense, Significant can	clay, = ed + = = = = = = = = = = = = = = = = = =
5' A 10 5' B 27	ul same as above	
10° A 5960"	Sandstone bedrock, very du sslight brown larey, slightly moderately weathered	ense, to
NONE TOP	NO Sample Collected EOB @ 15.4'	

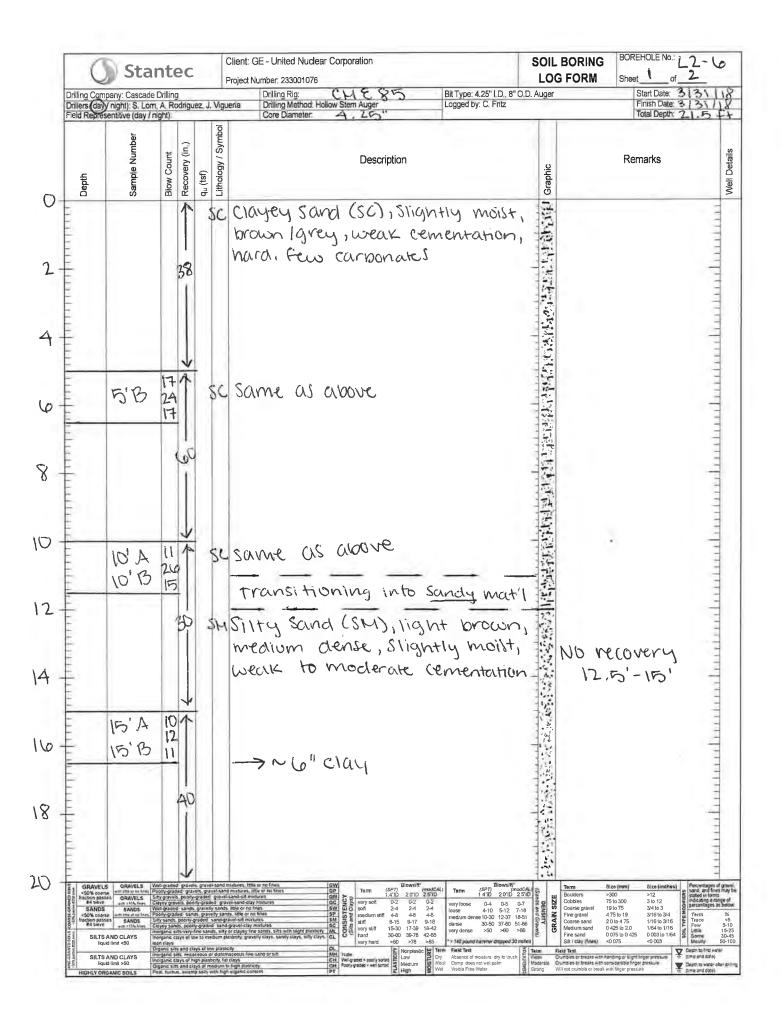
Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf) Litholoav / Svmbol	Description	Graphic	Remarks
				51-	Silty Sand (SM), Sligntly moist, light brown, medium dense, few roots/organics	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
				8		· (4)	
	5'A 5'B	994		Sk	same as above		
	10'B	3A 50	5"	89	weathered sandstone bedrock		
					S. S	MANA	
	Mone	502	2./		EOB @ 15.2'		
						The state	
			Ш				



(	Sta	nte	ec			E - United N mber: 233001		orporation					L BORING OG FORM	Sheet 2 of	2
Drillers (day	pany: Cascad / night): S. Lor	n. A. Ro	g odrigu	ez, J. Viç	guena	Drilling Rig: Drilling Metho Core Diamet	od: Hollov	Stem Auger			e: 4.25" I.D., 8" by: C. Fritz	O D. Auge	r	Start Date: Finish Date:	eesheet
Field Repre	sentitive (day /	night):		loge		Core Diamet	er.	7.75		-				Total Depth:	
Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf) Litholoav / Svmbol				Desc	cription			Graphic		Remarks	( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( )
	NR	90		55		ne as	sa	9000							
							G	0B @	20.	4,		4			=
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3					1										3
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	5.											1			=
	1											-			=
	S GRAVELS	Without	place.	t muyelson	d mixturos, létin cr	ro lines	l pour		Blows/fit		Blows A*	1	1.	Oler (early)	- I Downton
GRAVEL <50% coar fraction pas #4 server 5ANDS	GRAVELS GRAVELS SANDS	Poorty-grad Sary gravels Caryty grav Web-grades	ed grav b poorly wis, pos b sands	en gravelsa graded grav ny graded gr gravely san	ind mixtures. Ittle wildung old mixtur ravel sand clay mi ds. Ittle or no fine	or so fines es intures	GP GN GC	Term Wity set	(\$\tilde{\pi}\) 1410 2010 25 0-2 0-2 0-2 2-4 2-4 2-	very loose	1.4°ID 20°ID	0-7	Boulders Cobbles Coarse gravel	Size (mm)   Size (inches)     >300   >12     75 to 300   3 to 12     19 to 75   3/4 to 3	Percentages of graves and, and fines may stated in terms indicating a range of bent aritages as better
450% coar fraction pos	SANOS SANOS SANOS	Poorty grad Sity sands Curyly sand increases	promy s	ni gravely so raised sand y grasses san ne sands	ands little or no fir gravel-sit meture nd-gravel-city min ty or city we have	or no fines  es  triums  e  triums  e  tre  s  triums  triums	SP SM SC PUUSW H	S sliff very stiff	IIT 4-8 4-8 4-1 8-15 9-17 9-1 15-30 17-39 18-	medum di dense very dense	30-50 37-60 5	0-7 7-18 Ind Gravery 51-86	Fine gravel Coarse sand Medium sand	475 to 19 3/16 to 3/4 20 to 475 1/16 to 3/16 0 425 to 2.0 1/64 to 1/16	Term % Trace <5 Few 5-1
## SILTS	AND CLAYS	insiganc es	ays of lo	w to modium	plantery gravity	ctays, sandy clays, s	OL OL OH OH OH OH	hard early hard	30-60 39-78 42- >60 >78 >8	5	nd hammer arrapped 30		Fine sand	0 075 to 0 425	Some 30-4 Mostly 50-1



Compared Cities   Compared C
Description  Bell by September (1) A Company
Description  Description  Description  Remarks
25' A 14 SC CRAYEY SAND (SC), SITTY, Few Carachael Stigntly most brown, 15 moderate cementation 4 medium dense.  FOB @ 21.5'
6 Term (SPT) IMMOCAL Term (SPT) IMMOCAL CO. Term (SPT) IMMOCAL CO. Term (SPT)
15 T STORY TO THE PROPERTY OF
10 T John Carlot Pending realized Column Carlot Sand Impact of Carlot Ca
10 T Term (SPT) Imma(SAL) Term (SPT) Imma(SAL) Term (SPT)
15 T STORY TO THE PROPERTY OF
10 Torres (SPT)   Term (SPT)
Term (SPT) Imma(CAL) Term (SPT) Imma(CAL) Term (SPT)
THE PARTY OF THE P



(	<b>Sta</b>	nte	<b>e</b> C			5E - Unite lumber: 23	ed Nudear C 3001076	corporation						BORING FORM	Sheet	OLE No : [	2
Drilling Cor Drillers (da	npany: Cascade y / night): S. Lom esentitive (day / n	Drilling A. Ro	drigue	ez, J.	_	Drilling F	Ria:	w Stem Auger		Bit Type Logged	e: 4.25" l D. by: C. Fnt	., 8" O.D. A z	Auger		SI Fi	art Date 3 2 nish Date:	e sv
Depth Depth	Sample Number	Blow Count	ry (in.)	-	Lithology / Symbol	Core Dia	ameter.	Descr	iption				Graphic		Rem	arks	
	20' A 20' B	10 DU	œ			149	Sar										
							2	LOBE	21	,5'							
GRAVE  SO% cor  fraction pa  #4 siev  SAND  SO% cor  fraction pa	S SANDS W	borly grade by gradel by by grade only grade only grade	ed grave i poorly-g rels poor d sands ed sand poorly-dr	graded by grade gravelly is grave raded to	I sand invitures, letti as sand merbure, letti gravel sand-sitt mi di gravel-sand-sitt er no sanda, titte er ni sanda, titte er ni sand gravel-sitt mor	tures mistures nos sines ures	0 0 0 0 0 5 5 2 2	Very soft soft medium slift	14'ID 20'ID 2 0-2 0-2 2-4 2-4 4-8 4-8	very loose loose medium d	e 0-4 0 4-10 5- dense 10-30 12	NS/R* OTD 2510 NS 0-7 12 7-18 2-37 18-51	ALIGHED ALIGHED GRAIN SIZE	Cobbles 7 Coarse gravel 1	5 to 300 9 to 75 75 lo 19 0 lo 4 75	3 to 12 3/4 to 3 3/16 to 3/4 1/16 to 3/16	Percent sand a stated a moderate percent Term Trace
#4 siev	B work to here I C	CONTRACT	ds. pourty	r-graded	s sand-gravel-clay	mintures o sands, sits with	h signi plasticity M clays, sirty clays. C	Very stiff	15-30 17-39 1 30-60 39-78 4	3-42 very dens		-80 51-86 60 >85	Spare	Medium sand C	425 to 2 0 075 to 0 425	1/64 to 1/16	Few Little Some

rillers (d	mpany: Cascade ay night): S. Lorr esentitive (day / r	A. Rodrig	uez, J. Viguera	Drilling Rig: CM & 85 Drilling Method: Hollow Stern Auger Core Diarneter: N A	Bit Type: 4.25" LD., 8" O.D Logged by: C. Fritz	) Auger	Start Date: 3   3 Finish Date: 3   3 Total Depth: 21
Depth	Sample Number	Blow Count Recovery (in.)	q <sub>u</sub> (tsf) Lithology / Symbol	Description		Graphic	Remarks
			-	ilty sand (SIU), trace eathered stand stan	some	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	
	5' A 5' B	9337	Siu S	iame as above			
	A,01	2000		same as above, less trace (arbonates	organics,		
		13					
	15'A	20	SM	same as above, posi- greater clay conte	silory ent		
1	GRAVELS CONTROL OF THE PROPERTY OF THE PROPERT	rech graded grainty gravels, pool in the process of	ils, gravet kand mich weis gravet kand mich grande gravet kan gravet gravet kann in gravet kannt. His be, gravet kannt. His be, gravet kannt. His gravet kannt	### (1972 or no Enteres   1972) ### (1972 or no Enteres   1972 or no Ent	very lose 0-4 0-5 0-7 1636 dense 30-50 37-60 51-85 2 7-85	Cobbles Coarse gravel Fine gravel Coarse sand Medium sand Fine sand Six / ctay (Medium	3/12 (mm) Size (minhes)   2-300 ×12   3-101

(	<b>Sta</b>	nte	ec.		Client: GE - United Nuclear Corpor Project Number: 233001076	ation		LOG	BORING FORM	Sheet 2 of	2
Drillers (da	ompany: Cascade ay / night): S. Lor	n, A. Ro	driguez	J. Vig	Drilling Rig: ueria Drilling Method: Hollow Sten	n Auger	Bit Type: 4 25" I D. 8' Logged by: C. Fritz	O.D. Auger		Start Date: Se Finish Date:	esn
Field Repr	esentitive (day /	Blow Count	ny (in.)	y / Symbol	Core Diameter:	Description	1	Graphic		Total Depth:	
Depth	20'A	T SO D Blow	Rec		same as above coarser, medic	shightly o	clarker 4 e to clens	***			
					EOB	0 21.	5'				
								and I amount			
								and lines			
								nest Tribut			3
								La terre l'action			
Transform								Trong Cont			
r branch a								41			
Carteria.											
natra											
GRAV	MATERIAL GRAVELS	Poorty-grad Sity gravel Cityoy grav	ed gravets s poorly gr ets. poorly	gravelisa aded grav graded gr	trinshules, little of no lines. GW on or street. It is or no lines. GW of exchange, little or no lines. GP, gP, grission-little misures. GM, gP, grission-little misures. GP, gP, grission-little misures. GP, g		0-2 very loose 0-4 0-5	2510 0-7 8IZE	Boulders >3 Cobbles 75	200 >12 3 to 300 3 to 12 10 75 3/4 to 3	Percentage sand and fi stated in tel indicating a percentage
SAN SON of Maction 1	server with the personal servers.	Peoply grad Sity sands Clayey sand inorganic si	poorly-gra ds, puorly-gra ds, puorly-g	gravely su ded sand yaded san sands sa	unds, tolk or he lines gravet-tol mixbuilts gravet-tol mixbuilts gravet-tol mixbuilts gravet-tolk mixbuilts gr	medium stiff 4-8 4-8 4 stiff 8-15 9-17 9 very stiff 15-30 17-39 16 hard 30-60 39-78 42	H8 medium dense 10-30 12-37 dense 30-50 37-60 very dense >50 >60	18-51 51-86 >86 N	Fine gravel 4 Coarse send 2 Medium sand 0 Fine sand 0	75 to 19 3/16 to 3/4 0 to 4 75 1/16 to 3/16 425 to 2 0 1/64 to 1/16 075 to 0 425 0 003 to 1/64	Term Trace Few

() Stant	ec	Client: GE - United Nuclear Corporation Project Number: 233001076	SOIL BORING LOG FORM	Sheet 1 of 2
Drilling Company: Cascade Drillin Drillers (day) night): S. Lom, A. F Field Representative (day / night)	Rodriguez, J. Vig		25" i.D., 8" O.D. Auger C. Frītz	Start Date: 4 3 8 Finish Date: 4 3 8 Total Depth: 30 ff
Depth Sample Number Blow Count	very (in.)	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Graphic	Remarks
	\$M		to	
5'A 6 5'B 6		Same as above, medium dense, slightly mais	4	
	1 1 1	-> chunter weathered sandstone		Tree Living
10'A 5		Same as above		edina transla
	36			
15' B 13		Some as above		en la constante
	30 55	-> Mostly brotzen sandstone pieces, strong an moderately hard, gray whome orange, high weathered		milmini
SANDS	adde graves, gravel-sa des poort-graded grav ravels, poort-graded grav poort sands, gravesy sand good sands, gravesy sand poort-graded sands, governy sa sa, poorty-graded sands satteriory first sands, ac- clays of low for modums.	Transcription   Company   Company	4:10 2 0715 2 570 4 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1	Gize (mm)  Gize (inches) 3000  >17 75 lo 300  310 12 19 lo 75 3/4 lo 3 4 75 lo 19 3/4 lo 3 4 75 lo 19 3/4 lo 3 4 75 lo 20 1/6 lo 3/4 0 0/75 lo 0 4/5 0 0/75 lo

rilling Comp	any: Cascade night): S. Lorn	Drilling	1			oject Number: 233001076  Drilling Rig: CME 85 Truck Rig Drilling Method: Hollow Stem Auger	Bit Type: 4.25" I.D., 8" O. Logged by: C. Fritz		Finish Date:	•
eld Represe	entative (day /	night):	gu		-	Core Diameter: 4.25 In ch	55		Total Depth:	
Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description		Graphic	Remarks	
		14			1	same as above			No sample collected Stoppi after auger bent upon hittin boulder	ولم ا
		T			1	EDB @ 21.51				-
								1		1111
								to a		
								44.44		
								1		111
								1		1111
								1		100
								1		1111
								1111		1111
										11.01
								11111		rrit
								-		L. P.
								1		1
										D-F-I
								1111		
								1		
										1
								1		T. I. I.
								1111		TIL
GRAVELS <50% coarse						urns, little or no face GW supers time or no face GP Term (SPT) Blowshift assures, time or no face GP 14/10 26/10	modCALI Term (SPT)   modC 25'10 14'10 20'10 25	AL 15	Term Size (mm) Size (inches) Boulders >300 >12 Stated in	
fraction passes #4 sieve SANDS	SANDS W	ayey grav lea-graded	e's poor sands ed sand	y-gradeo gravely s. gravel	d grave sands y sands	and-clay mistures GC V very soft 0-2 0-2 soft 2-4 2-4 indic or no three FP G medium stiff 4-8 4-8	0-7 very loose 0-4 0-5 0-7 2-4 loose 4-10 5-12 7-18 4-8 medium dense 10-30 12-37 18-5	New TON	Cobbles 75 to 300 3 to 12 Coarse gravel 19 to 75 3/4 to 3	ng a ran agen ar
<50% coarse fraction passes #4 sleve	SANDS S	By sance	positive gi	grades	Sec.	Veli-City matures 5.0 SC 2 Stiff 8-15 9-17 Very stiff 15-30 17-39		8 2 K	Coarse sand 2 0 to 4 75 1/16 to 3/16 Trace Madium sand 0 425 to 2 0 1/64 to 1/16	

(	) Sta	nte	9C		Client: GE - United Nuclear Corporation Project Number: 233001076		LO	BORING FORM	BOREHOLE No : Sheet of	1	
Drillers (da	mpany: Cascade y/ night): S. Lom esentative (day / r	A. Ro	drigue	z, J. Vig	Drilling Rig: CME 85 Truck Rig ueria Drilling Method: Hollow Stem Auger Core Diameter: 4, 35 Inch	Bit Type: 4.25" I.D., 8" O.D. Logged by: C. Fritz	). Auger		Start Date: Finish Date: Total Depth:	4/9/1	8
Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf) Lithology / Symbol	Description		Graphic		Remarks		Well Details
			1	CL.	Highly to completely weathered silt + sand, stiff and weak moist to moist, black/dark; little gravel	shale (CL) with ly cemented, slightly growy wlsome brown	444444	Drilled st then be coring	raight down gan sampli	to 20';	
			41				HILLIG				111111111
-			X	\$5	Moderately weathered shale + w/white carbonates, shightly	sandstone, gray mosst	111111				
	25' A	26					11111111				11111111
			માં   								
	30' A	7 6 3	*		Same as above						
arlanalar			42	M	Topsoil, sandy silt to silty so (native)	nd, (ML), leght brown	1.1.1				
	aci a	20	¥	SS		outu zo*	1111111			1000	
	35' Bag	15			EOB @ 36.5'	~		1			
GRAVE	ELS GRAVELS V	Voll-graded	gravels	. gravel-surv		es/ft* Blows/ft*		Term 8	ize (mmi) Size (inches	Hercentages	of gran
450% to brackler by the country of t	militar or other Possession of the Possession of	certy-grace my graves lay-graded conty-graded dy sands layey cands layey cands layey cand torgand di man claye layer all my and claye layers all my and clayers layers l	od grave poerty- sis, poer sande, ed sand poerty-grave talvery-fra ays of lov	in gravet sa graded grav by gravely san s gravely san s gravely san ded sand -graded san he sands so he sands sand he sands sands	not instances. Inflice or no lines. OP- likewished mixtures OSA vertication of SAM vertic	010 2510 1,410 2010 2510 02 0,2 0,2 very loose 0-4 0.5 0,7 1 0,0 0,0 0,0 0,0 0,0 0,0 0,0 0,0 0,0 0	Cillanus pun spuns Alisnad GRAIN SIZE	Boubers Cobbles 7 Coarse gravel 1 Fine gravel 4 Coarse sand 2 Medium sand 5 Ilt / clay (fines)  Coarse sand 0 Coar	5900 > 16 16 900 3 16 12 3 16 75 3/4 60 3 75 16 19 3/4 60 3/4 0 16 4 75 1/4 60 3/4 425 16 2 0 1/64 16 1/46 0/5 16 0 425 0 003 16 1/64 0 075 4 0 003	Torm Trace Few Little Some Mastly Depth to first wa Little Depth to wall at the second	% <5 5-1 15-2 30-4 50-1

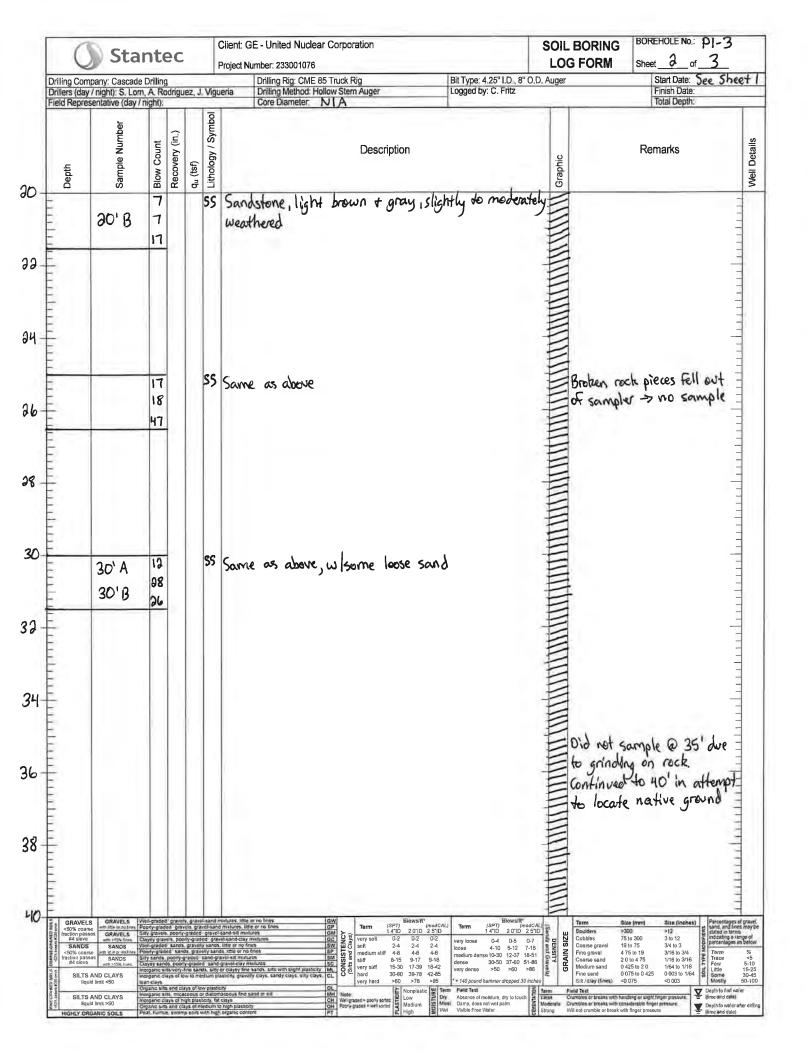
	C	Sta	nte	ec		Client: GE - United Nuclear Corporation Project Number: 233001076	SOIL BORING BOREHOLE No.: P! - 2  LOG FORM Sheet 1 of 4
D	hillers day	npany: Cascade 7 night): S. Lom sentative (day /	, A. Ro		ez, J. Vig	Drilling Rig: CME 85 Truck Rig  Bit Type: 4.25" I.D  ueria Drilling Method: Hollow Stem Auger  Core Diameter: N A	
	Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf) Lithology / Symbol	Description	Remarks Remarks
					SM	Silty sand (SM) with growel + clay, bla gray, trace iron stalning + carbonates, v stiff to hard fines, slightly moist to mo	ack/ iery
		5'A 5'B	99 18.		SM	Same as above, dense sand	
THE PERSON NAMED IN TAXABLE PARTY AND PARTY AN		\©\ A	13 6		Sy	isame as above, but loose to medium dense	
		151 A 181 B	5 9 13		SM	Same as above, medium dense	
SOUTH COMBIT CHANGE SOUTH		GRAVELS SANDS WAS SANDS	eny gravels  ayoy gravels  ayoy gravels  ophy-gradoc  ophy-gradoc  layoy sands  layoy sands	no graves, poorly on sands poorly of sands poorly of sands poorly of the	graded graver- graded gravery sand gravery sand is gravery sa graded sand- ty-graded sand fine sands, sit	Agricultures   Series   GPF   Company   Comp	37-80 51-86 8-80 >86 Set 20 Set 20 1/64 to 1/16 Few Little 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

hillers (d	ompany: Cascade ay / night): S. Lom	, A. Rodriguez,	Client: GE - United Nuclear Corpora Project Number: 233001076  Drilling Rig: CME 85 Truck Ri J. Viguena Drilling Method: Hollow Stern	ig Bit Ty	SOIL I LOG pe: 4.25"   D., 8" O.D. Auger ed by: C. Fritz	FORM Sheet 2 of 4 Start Date: See 3/ Finish Date:
Depth Depth	Sample Number Sa	Blow Count (in.)	Core Diameter: NA	Description	Graphic	Total Depth:
	ac Bag	3 4 4	SM Same as above		\$15 \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\	Inalytical sample from A,B,&C liners
	as'a	5%.	5M Same as above, slight	thy less weathered	1000 1000 1000 1000 1000 1000 1000 100	
	30' B		SM Same as above, highly	, to completely wea	thered	lissing A liner In sample Blow counts not recorded
	35' A 35' B	8 6	SM Sandy wlfewer fines stallming, trace eng	, significant red t anics	yellow yellow	
	OFFICE OF AND SANDS SAND	configuration gravels, in gravels, and gravels, poorly gravels poorly gravels gravels gravely graded sands, gravely graded sands, gravels poorly graded sands, gravels grades gravels, poorly graded gravels, poorly gravels,	refly sands, title or no lines SW III 50 state() sands. Slife or no lines SP 150 state() sands. Slife or no lines SP 150 state() sands slife or no lines SP 150 state() sand sparse-list methyres SP 150 state() sand sparse-list methyres SP 150 state() sand sparse-list methyres SP 150 state() sands slife with slight plastocty ML 00 state() sands slife sands slife with slight plastocty ML 00 state() slife sli	stiff 8-15 9-17 9-18 dense very stiff 15-30 17-39 18-42 hard 30-80 39-78 42-85	ose 0-4 0.5 0-7 and one 10-30 12-37 lb one m dense 10-30 12-37 lb-51 and one 10-30 lb-51 a	Term

llers (d	ompany: Cascade lay / night): S. Lom	Dilling in			Drilling Rig: CME 85 Truck Rig	Bit Type: 4.25" I.D., 8"	O.D. Auger	Start Date: See 5
	resentative (day / r	, A. Ro	drigue	z, J. Vigu		Logged by: C. Fritz	O.D. / lager	Finish Date: Total Depth
Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf) Lithology / Symbol	Description		Graphic	
	40' Bag			SM	Same as above		でなったのではなるのかから	Analytical sample from A + B liners
	45'A	8 15 14		SM	weathered sandstone of shale m black (respectively), trace kaol gray material	nixture, orange of in (or other soft, f	ine .	
	50' A 50' B	10 14 14		SM	Same as above, trace sulfur (y	ellow)		
		50/8	ŗ	SM	Same as above			
	OBJECT OF THE PROPERTY OF THE	conty-gradi dly graves severy grav- sen graded postry-gradi dly sands sayey sand borganic sil- serganic siles organic siles organic siles organic siles organic siles	oil grave, poorly grave, sands, local sands, local sands, poorly grave, bravery fra poorly fra very fra poorly fra very fra poorly f	is, gravel-san praded gravel y glassed gra y averty sand control sand- gravely sand or sands, silvy r to medium p	of Sask-city metates SW LD C Swap soft D-2 C S	Marco CAL   Term   1471   2010   2010   2 51	25 D DENSITY VOC	Term   Size (mm)   Size (minhes)   Boulders   >300   >12

Drillers (da	mpany: Cascade ly / night): S. Lom.	A. Ro	drigue		Project Number: 233001076  Drilling Rig: CME 85 Truck Rig  Jena Drilling Method: Hollow Stem Auger	Bit Type: 4.25" I.D., 8" Logged by: C. Fritz		Finish Date:
Depth	esentative (day / r		Recovery (in.)	q <sub>u</sub> (tsf) Lithology / Symbol	Core Diameter: N. [A		Graphic	Total Depth:
	60' Bag	4 9 11		SM	Same material as above, but presence black organic mater black look grow, trace orange	ot w/increased that (possible coal?), it t yellow		Analytical sample from A.B. & C liners
							1.16.25.67.62	Drilled to 65 before Stapping due to Has
		Ħ		T	E0B @ 65			Making one is the
							. Herester and a	
							بنيداعينهاس	
							مسلكسيملكية	
							ماله وروايهم	
							dimilia	
							ياسيدا بسيدي	
GRAVE +50% co fraction pa #4 pict	stos GRAVELS Si	ofly-grade	poorty-	raded grave	remarkation of the form (SPI)		2510 DE	Term   Size (mm)   Size (inches)   Procedages   Baudiers   >300   >12

Stantec	Client: GE - United Nuclear Corporation Project Number: 233001076	SOIL BORING BOREHOLE No.: P1-3 LOG FORM Sheet 1 of 3
illing Company: Cascade Drilling illers (day)/ night): S. Lom, A. Rodriguez, J. Vig	Drilling Rig: CME 85 Truck Rig Bit Type: 4.25" I.D., 8" O Drilling Method: Hollow Stern Auger Logged by: C. Fritz	Finish Date: 4 /3 / 18
Sample Number Sample Number Blow Count Recovery (in.)  Qu (tsf) Lithology / Symbol	Core Diameter: N A  Description	Remarks
SM	Silty sand 4 sandstone boulders	Large boulders on ground surface in vicinity
21 A 38 39 SM	Very dense silty sand (SM). Possibly sands done boulder, light brownlyray	
10' A Sola	Silty sand wifew day (SM), few broken rock piece dense to very dense, slightly moist, brown	
15'A 26 17 15'B 10	Same as above	
GRAVELS of CAVELS with graded gravets, grave san that the passes at least the passes a	directive   life of no finate   QP	7



~	nte		Client: GE - United Nuclear Corporation Project Number: 233001076		SOIL BORING LOG FORM	Sheet 3 of 3
lling Company: Cascad llers (day / night): S. Lo ld Representative (day	m, A. Rodric	juez, J. Viç	Drilling Rig: CME 85 Truck Rig ueria Drilling Method: Hollow Stem Auger Core Diameter. N A	Bit Type: 4.25" I.D., 8" ( Logged by: C. Fritz	D.D. Auger	Start Date: See Shee Finish Date: Total Depth:
Depth Sample Number	Blow Count Recovery (in.)	q <sub>u</sub> (tsf) Lithology / Symbol	Description		Graphic	Remarks
40'8	26 47 27	SS	Sandstone, slightly to moderat (broken rock in sampler)	ely weathered	Stopped abrasive to auge	drilling due to rock + damage
			EOB @ 41.5'			18
					Access	
					1	
		Н				
					1	
					7	
						2
<50% coarse fraction passes #4 sieve CHAVELS	Poorly-graded gr Siny gravels, poor Clayey gravels, po Worl-graded sand Poorly-graded sand	avela, gravel-sa ty-graded: grave sorty-graded: grave ts, gravelly sand mos, gravelly sa	directives   UP   Term   Cap   Term   Cap	wsin* (modCAL) Tem (SPT) Blowsin* (modCAL) 2.5°ID 2 0°10 2.0°ID 2	Boulders Cobbles Coarse gravel	Size (men)   Size (mehes)   Fercentages and and fine   Fercentages and and and fine   Fercentages and
fraction passes #4 sleve	Clayey sands no	orly-gradest asse	-gravel-clay martitles SC SC very sliff 15-30 1	7-39 18-42 dense 30-50 37-60 51-	51 CBAIN 86 COarse send Medium sand	2 0 to 4 75 1/16 to 3/16 Trace D 425 to 2 0 1/64 to 1/16 Few

rilling Co	Stal ompany: Cascade ayy night): S. Lom	Drilling			Project Number: 233001076  Drilling Rig: CME 85 Truck Rig eria  Drilling Method: Hollow Stem Auger	Bit Type: 4.25" I.D., 8" O.D. Logged by: C. Fritz		Sheet of Start Date: 4   14	
Depth Depth	Resentative (day / I	night):	ery (in.)	q <sub>u</sub> (tsr) Lithology / Symbol	Core Diameter: N A  Description		Graphic	Total Depth: 30	£
				SM	Silty sand (SM), little day (weath trace grave), slightly moist, grave black of yellowlorange	hered shale) of y witrace	が多いなななないできる		
	5' A 5' B 5' C	15 15 18		SM	Same as above, medium denso		A THE	VOC = 17.2 ppm	
	10' Bag	10 8 7		SM	Same as above, but softer 4 more	e weathered		Analytical sample from A.B. & C liners	
	12, V	4 6 5		SM	Same as above, loose		The state of the s		
GRAVE SSO% co Irraction p. Ad sle SAN SO% cc Fraction p. Ad sle	Darse CANDS SANDS	opty-graded ty gravets; dyey gravet graded botty-graded dy sands, po ayny sands organic sits organic Clay	i gravels. poerly-gra s. poerly- sands, gra corly-grad poorly-grad poorly-grad	gravel-sand ided gravel- grappd grav avely sands gravely sand led sand-pi raded sand- sands salty	Vertical Life or no lines	very laase 0-4 0-5 0-7 loose 4-10 25*16 very laase 4-10 5-12 7-18 medium dense 10-30 12-37 18-51 dense 30-50 37-60 51-86 very dense >50 >80 >86	DENSITY lands and Gravely	Telm   Size (men)   Size (inehes)     Proceedings   Proc	or integrating
SILT	TS AND CLAYS In Included Irruit >50	in clays iganic sits a organic sits organic clay iganic sits a	rncaseo s of high	of low plants	very hard >60 >78 >85  CL Account fine sand or set	Moist Damp, does not wet palm	Term Virak	Sitt clay (fines) <0.075 <0.003 Mobe Field fiet Countries or breaks with handling or light finger pressure Countries or breaks with handling or light finger pressure Will not complete or break with considerable finger pressure Up Doph I.	to firs

Stantec	Project Number: 233001076	SOIL BORING BOREHOLE No.: P3 - 1  LOG FORM Sheet 3 of 3
ling Company: Cascade Drilling lers (day / night): S. Lom, A. Rodriguez ld Representative (day / night):	Drilling Rig: CME 85 Truck Rig Bit Type: 4.25" I.D., 8" O.D  Vigueria Drilling Method: Hollow Stem Auger Logged by: C. Fritz  Core Diameter. N A	D. Auger Start Date: See Shee Finish Date: Total Depth:
Sample Number Blow Count Recovery (in.)	Description	Remarks
30' Bay 30/5"	SM Same as above, except w/some sandstone (gray)	Analytical sample from A+B liners
25'A 5 25'B 7 25'C 7	SM Same as above	Has=1.0 ppm, co=80 ppm LEL=4% (outside top of hole)
	EOB @ 30'	After drilling to 30 ft:  LEL = 14 eto (outside hole)  Hg5= 4.5 ppm (outside hole)  Hg 5 = 16.5 ppm (4' down hole)  LEL = 56 eto (4' down hole)  Both cases: cD > 500 ppm  VOC = 17.6 ppm
SSI) conne Inclion passes #4 aleve SANDS SANDS SAY glavet, poeth-yer SANDS SANDS SANDS Clayer practee, poeth-yer score passes, factor passes, factor passes, solver, solver sands sands, or solver s	Section   Sect	D S Gouldens 3000 12 cathed in terms 2000 3 to 12 cathed in terms 2000 3 t

	0	Stai	nte	ec		Client: GE - United Nuclear Corporation Project Number: 233001076		BORING FORM	BOREHOLE No.: P3 - 3 Sheet of 13	
Dri	illers (day	pany: Cascade night): S. Lorn	, A. Ro		ez, J. Viç	Drilling Rig: CME 85 Truck Rig Bit Typ ueria Drilling Method: Hollow Stem Auger Logged	e: 4.25" I.D., 8" O.D. Auger I by: C, Fritz		Start Date: 4/15/ Finish Date: 4/15/ Total Depth: 30 Ff	18
	Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf) Lithology / Symbol	Core Diameter: N A  Description	Graphic		Remarks	Meil Detaile
Treatment from					SC	Clayey sand (SC) whome silt & trace growners very black whorganics, brown in	sardier stats			
may and an open of the same		5'A 5'B	8 8 11		S	Same as above, medium dense, slightly	moist to moist	KA liner	has very black threat in bottom	
thought market by		10' Bag	7 11 20		sc	Same as above, considerable weathered st + black witrace orange, few souths in bl clayey spots	114577515	Analytical A,B,&C li tas=O,L	sample (bulk from ners BL=0, (07500 ppm	
mountmentered			3 7 18	NP	s sc	No recovery. Librdy similar to above. Driller it was perhaps clayey material that sl fell out of sampler.	thought and arounds and	4,5=0.4 p CO>500 p	ipm (outside hole)	
TITLE THE PERSON						EOB @ 20'	The Part Later	020'; H2S 02500 p 005000ll	=4 ppm (outside hole) pm, LEL = 28%  Ag 80' Percentages	<b>)</b>
FRIEGRAND SPILS TOAKHE CHANED SOLD	SILTS liqui	SANDS	cony-gradity glavely grade or	setti gravas, secony des poor santa con poor santa poor des motors des motors des motors des motors des motors des motors des and con poor des and con poor des motors des motors des motors des motors des motors des and con poor des motors de mot	relic gravel-sa- cended grav- rry graded gravely as gravely as and the gravely as a paded sand- y-graded sand- fine sands as a two to medium ays of low pla- ticous or distri- ging playheats, type of medium	Section   Sect	(SFT) 14*1D 25*1D	20   20   20   20   20   20   20   20	30 30 310 12 15 15 15 15 15 15 15 15 15 15 15 15 15	% <5 5-11 15-2 30-4

	y/ night); S. Lorr esentative (day /		odrigu		Drilling Method: Hollow Stem Auger Logged by: C. Fritz  Core Diameter: N A	7	Finish Date: 4 (18 Total Depth: 16-5
Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf) Lithology / Symbol	Description	Graphic	Remarks
				SM	Silty sand (SM) with grove, trace sandstone colobles, light gray witrace darker gray in more comented spots, trace iron exidention, trace green discoloration	(a)	
	5' A 5' B	2 29		SM	Same as above, slightly moist, dense (though possibly just due to cobbles)		Hit neig Erst en quine
	10' B	4 5 8		SM	Same material as above, medium-growned sand, loose + moist, light brown + gray wilgreen		co = 300 ppm
	15' A 15' B	5 7 12		SP SC	Top of sampler (C): poorly-graded medium sand, light group white with some green tinge  A liner & part of B liner: clayey sand (SC) & wenthered shale, silty, dark gray black which gray, orange & yellow	Then the state of	Has = 0 ppm , LEL = 5% CO=140 ppm (and still rising)
GRAVE <50% co. fraction ps #4 slev SANIC <50% co. fraction ps #4 slev	BIS SANDS with title or no times GRAVELS	Poorly grave Sizy grave Clayey grade Well grade Poorly grad Siry sands	ded gra is poorly yels poorly disand- ged san poorly	vols. gravel-sa y-graded grav erry-graded g s. gravely san as, gravely san graded sand	Term (SFT) Blows/ft* (mod/AL) (all called SFT) (mod/AL) (all called SF	7 ds and	Term   Size (rmm)   Size (inches)   Size (in

llers day	pany: Cascade V night); S. Lor sentative (day /	n, A. Ro	drigu	-	Drilling Rig: CME 85 Truck Rig Bit Type: 4.25" I.D., 8" O.D eria Drilling Method: Hollow Stem Auger Logged by: C. Fritz  Core Diameter: 4.35 inch	. Auger	Finish Date: 4 11 Total Depth: 4
Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf) Lithology / Symbol	Description	Graphic	Remarks
			<u> </u>	SM	Silty sound (SM), little fines (~20%), trace cobbles, slightly moist, light gray lishite with green tinge to trace brown, loose to medium donse, medium grain-size sand	V-12-4-12-12-12-12-12-12-12-12-12-12-12-12-12-	
	5'B	90 99 18	*	SM	Same as above		Higher blow counts likely due to cobbles
	10' A	8 7 9	*	SM	Same as above	A Section of the sect	
	15¹B	Ч 5 3	***************************************	SM	Same material as above, but moist ulderher green coloring in wettest spots		
GRAVEL: <50% coars fraction pass #4 alove SANDS <50% coars fraction pass #4 alove	GRAVELS SANDS SANDS SANDS	Poory-grad Sity gravely Ctayey grad Well-gradeo Poory-grad Sity sands Clayey sand	ed gravi poorly- els poor sands, ed sand poorly-g	nis graver-san graded grave ly-graded gra gravelly sand s-gravelly sand- raded sand-graded sand- graded sand-graded sand-	Term (SPT) 2010 2510 Term (SPT) 2510 Term (SPT	DENSITY Sends and Gr	Term   Size (rum)   Size (indhes)   Builders   >300   >12   College   75 to 300   31 to 12   College   75 to 300   31

Stantec	Client: GE - United Nuclear Corporation Project Number: 233001076	SOIL BORING LOG FORM	Sheet 2 of 3
brilling Company: Cascade Drilling Drillers (day/ night): S. Lom, A. Rodriguez, J. Vi ield Representative (day / night):	Drilling Rig: CME 85 Truck Rig  Bit Type: 4.25" I.D  ueria  Drilling Method: Hollow Stem Auger  Logged by: C. Frit  Core Diameter: 4.25 Inch		Start Date: See Shee Finish Date: Total Depth:
Sample Number Sample Number Blow Count Recovery (in.) q <sub>u</sub> (tsf)		Graphic	Remarks
90'A 7 57	1 Same as above		
երկ 			
35 X 54	Same as above, trace cobbles		
44			
30'B 9 7	Same as above		
44			
35'B 5 4	Same as above, with increased shale/some fire dark gray/green	7e5,	
44			
GRAVELS  GRA	directures   GP   Farm	Boulders   Cobbles   Cob	Dize (mm)

rilling Con	npany: Cascade	nte Drilling		P	Client: GE - United Nuclear Corporation roject Number: 233001076 Drilling Rig: CME 85 Truck Rig	Bit Type: 4,25" I.D., 8"	LO	BORING FORM	Sheet of Start Date: See Finish Date:	<u> </u>
rillers (da eld Repre	y night): S. Lor esentative (day	n, A. Rod night):	riguez, .	_	Prilling Method: Hollow Stem Auger Core Diameter: 4.25 inch	Logged by: C. Fritz			Finish Date: Total Depth:	
Depth	Sample Number	Blow Cou	Recovery (in.) q <sub>u</sub> (tsf)	4	Description		Graphic		Remarks	1
	40° A	569		SM	Same as above		V. 2.8. 2.17			information.
		ų	ių   		<b>V</b> EII					a conference of
	451B	21	<b>V</b>		Sandy silt to stilty sand (ML), bri Sandstone bedrock	wast. N	ottro	Auger D	notiveal	
		~//			EOB @ 46'			,y-, P	- 17 PT	
							1			100
							i de la constante de la consta			1
							4			1
							1			- 2
							4			
							100			1
							1			0.00
							cities .			1
							1			000
							1			1
							4			2.44
							1			3
										9500
GRAVE	LS GRAVELS	Well-graded o	ravets, prav	ret-sarig m	whires, little or no lines. GSW Tarm (SPT) Blowest Tarm (SPT) 14/10 2 0/1	(modCAL) Term (SPT) Blows 11	odCAL)	Term	Size (rnm) Size (inches)	Percentages sand and for stated in form
SAND: SON cos proctor pe SA sec SAND: SON cos proctor pa Bé siev	S SANDS	Clayey graves Well-graded s Poony-graded	poorly-gra ande grave sande gra	ided grave bly sands. excelly sand	September   Color   Color	0 2 5 1D 1 4 1D 2 0 1D 0 2 very louse 0-4 0-5 2-4 loose 4-10 5-12	0-7 7-18 8-51	Cobbles Coarse gravel	75 to 300 12 15 to 12 16 to 75 3/4 to 3 475 to 19 3/18 to 3/4 2 0 to 4 75 1/18 to 3/16	Term Trace
SILT	S AND CLAYS guid limit <50	Clayey sans. Inorganic situ morganic clays lean clays Organic sits s	poorly-grad very-line sai at low to m	nds saidy o nedium pla low plastic	very hard >60 >76	9 18-42 3 42-85 >85 = 140 pound hammer or speed 30	>86 E U	Fine sand Sitt / clay (firmes)	0 425 to 2 0 1/64 to 1/16 0 0.075 to 0 425 0 0.003 to 1/64 0 0.075 0 0.003 \tag{5}	Few Little Some Mostly epith to first wa me and date)
§ lic	guld limit >50	Organic sitts a	nd clays of r	michy, fat o	Says CH   Well graded a poorly surfed   E	Dry Absence of moislure, dry to touch Moist Damp, does not well palm Wel Visible Froe Water	Moderate C	Trumbles or breaks with the Trumbles or breaks with on Vill not crumble or break Vill not crumble or break	andling or slight linger pressure onsiderable finger pressure with finger pressure	opth to water a mic and date)

illers (da	mpany: Cascade  // night): S. Lor esentative (day /	n, A. Ro		ez, J. Vigu		4.25" I.D., 8" O.D. Auger by: C. Fritz	Start Date: 4 / Finish Date: 4 / Total Depth: 4	141
Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf) Lithology / Symbol	Description	Graphic	Remarks	
					Silty sand (SM), trace weathered shale moist, light brown without black 4 oran grained sand	Iclay, ge, medium		
	51A 51B	11 5 7		SM	Same as above, loose to medium dense		Н25=Оррт, СО=Орр	m
	10' A	5 3 5		sm	Same as above, Fine to medium sand, moist, now includes trace green coloring	shightly	HaS=Oppm, co=Oppr	n
	15' A 15' B	9 3 4		ŞM	Same as above, medium sand, moist, brown widerle gray	1.1	H&S=Oppm, CO=Opp	m
GRAVE 50% co. fraction ps 41-0-0 SAND <50% co. fraction ps 44 slov	GRAVELS S SANDS	Posity gravel Sitty gravel Ctayery grav Well-grade Profity-grav Sitty sands Clayey san	te priority reis, poor disance fed san poorly- ds, poor	ots gravel-sand- graded gravel- orly-graded grav- gravelly sands de gravelly sand- praced sand-gravelly-graded sand- ty-graded sand-graded sand-	Section   Control   Cont	16-7) Workship	Cobbles 75 to 300 3 to 12 Coarse gravel 19 to 75 3/4 to 3 Fine gravel 475 to 19 3/16 to 3/4	Percent and a stated index- percent Term Trace Few Little

nllers (c	ompany: Cascade ay / night): S. Lor	n, A. Rodr	guez, J. V	Project Number: 233001076  Drilling Rig: CME 85 Truck Rig  Vigueria Drilling Method: Hollow Stem Auger	Bit Type: 4.25" I.D., 8" C Logged by: C. Fritz		Sheet 2 of 3  Start Date: See 5h  Finish Date:
ped Reg	resentative (day )	night):	(411)	Core Diameter: N A  Descrip	otion	Graphic	Total Depth:
	90,8	366		5M Same as above, brownstan + orange, trace gravel	with trace gray, blace	A. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.	
	30, 8 30, v	3 5 5	V.	im same as above, increased p	resence green material		H25= Оррт, CO= Оррт
	30' A	3 4 7	V.	SM Same as above, trace to s	Few gravel		Has = Oppm, co = 9 ppm (material getting darker)
	35'A 35'B	3 4 3	c	5M Same as above, few sandsto	one chunts	**************************************	CO= 2 ppm, HoS= Oppm
						4.5.2.2.2.3.3.3.3.3.3.3.3.3.3.3.3.3.3.3.3	
GRAV <50% of fraction; #4 si SAN <50% of fraction; #4 si	Darse Dasesos DS DS SANDS SAND	Poorly-graced Stry gravels, so Clayery gravels. West-graded su Poorly-grades Siry sands, poor Clayery sands, p increases estab- increases estab- increases curva lean claye Organic sitts an	gravels, grave onr-graded of poorly graded of notice gravels the graded sa lootly-graded ery-fine sands of low to media	provides and self mixtures GC Yes your same state of the self mixtures GC Yes your same state or to find the Self mixtures SC Yes you should not graved an arrature Science graved for mixtures and graved for mixtures graved for mixture	Pri	ALISNAG GRAIN SIZE	Fine gravel 4 75 to 19 3/16 to 3/4 Term Trace Coarse sand 2 0 to 4 75 1/16 to 3/16 Few

(	Sta	nte	ec		Client: GE - United Nu Project Number: 2330010					BORING G FORM	BOREHOLE No	
rillers (da	mpany: Cascade by / night): S. Lon esentative (day /	n, A. Ro	drigue	z, J. Vig	Drilling Rig: C jueria Drilling Metho Core Diamete	ME 85 Truck Rig od: Hollow Stem Auger er. N/A	Bit Typ Logge	oe: 4.25" I.D., 8" O. d by: C. Fritz	D. Auger		Start Date: Finish Date Total Depth	
Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf) Lithology / Symbol		Descriptio			Graphic		Remarks	
Ī	40' A 40' B	5 7 12		SM	(>40%), trace	day (SM), incre gravel, maist,	ased fines brown wltr	ace black shale		CO=500 LEL = 12°	ppm, Has=	2 ppm
		10				EOB @ 41.5'				Stopped dincreasing Possibly ; that coursed at previous	rilling due g Hg3, c0, d just above sed issues u us holes.	to LEL. material sigas
									transfer esta			Towns lawns
									بيداعيينين			į
												100000
												1
									1.000000000			
10	SANDS SAND CLAYS quild limit <50	Poorly-grades  Layer or average  Poorly-grades  Poorly-grades  Layer sand  Lay	od grave posity con sands soon sands soon od sands posity gr sands posity sands posity sands of soon sys of low	is gravel-sa troodd gravel y gravelly sand i, gravelly sand i, gravelly sa graded sand graded san y to middium i	Institutes. Itile or no fines or messays, little or on times of-land-sid mutures well-sand-sid mutures well-sand-olay mutures is, ettle or no fines president mutures oc-president president mutures oc-president president sides yor catager for earning, with with storil or plasticity, gravelly clays, sandry clays, is being muserous from sand or sid.	OP	9-17 9-18 dense very der 39-78 42-85 ** 140 pc	4-10 5-12 7-18 dense 10-30 12-37 18-5 30-50 37-60 51-84 mse >50 >60 >86 ound hammer dropped 30 inch	DENSITY SAUCE AND GRANNED	Boulders >: Cobbles 7: Coarse gravel 1! Fine gravel 4 Coarse sand 2 Medium sand 0 Fine sand 0 Sik / clay (fines) </td <td>  Size (nam)   Size (incha)    </td> <td>stand in term indicating a ri percentages.  Term Trace Few Little</td>	Size (nam)   Size (incha)	stand in term indicating a ri percentages.  Term Trace Few Little

Find Day (1987)  Set Special State A 100  Sh Same as above, trace green three a shale pieces  15' A 3  15' B 3  15' B 1  Same as above, trace green three a shale pieces  Same as above, trace green three a shale pieces  Same as above, trace green three a shale pieces  Same as above, trace green three a shale pieces  Same as above, trace green three a shale pieces  Same as above, trace green three a shale pieces  Same as above, trace green three a shale pieces  Same as above, trace green three a shale pieces  Same as above, trace green three a shale pieces  Same as above, trace green three a shale pieces  Same as above, trace green three a shale pieces  Same as above, trace green three a shale pieces	Drilling Co	ompany: Cascade	nte Drilling		-	Project Number: 233001076  Drilling Rig: CME 85 Truck Rig	Bit Type: 4.25" I.D., 8" C	LOG FORM D.D. Auger	Start Date: 4   12	
SM Sity sand (SM), medium grain-size, trace to Few gravel & colobles, few shale pieces, brown with trace aronge & yellow exclooklan, maist  SM Same as above, medium dense  SB 7  SM Same as above, medium dense  SB 7  DO'B 4  ID'B 4  ISIA 3				drigu	ez, J. Vigi	lena Drilling Method: Hollow Stern Auger Core Diameter: N A	Logged by: C. Fritz			
gravel & colobles, few shale pieces, brown with trace orange & yellow excloation, maist  5' A 10 5M Source as above, medium dense  5' B 7  10' A 3 10' B 4  151 A 3 151 A 3 151 B 1  SAME as above, trace green fines & shale pieces  5M Source as above, trace green fines & shale pieces	Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf) Lithology / Symbol	Description		Graphic	Remarks	
10' A 3 10' B 4  15' A 3 15' B 3 15' B 1  SP-Same as above, trace green fines + shale pieces					SM	Silty sand (SM), medium grain gravel + cobbles, few shale trace orange + yellow exclu	n-size, trace to fer pieces, brown with ladton, moist			andamen.
151 A 3 151 B 1  SP-Same as above, trace green fines & shale pieces			6		SM	Same as above, medium de	wse	NESS (1450年)		throughtening
151 A 3 151 B 1			9		SP- SM	Poorly-graded sand with silt medium sand, trace gravel, li green, and orange spots, me	(SP-SM), loose, ight brown wlgray, ist			budining franting
					SP-	Same as above, trace green	fines + shale piece			don London Lines
										milimi

rillers (da	mpany: Cascad ay / night): S. Lor	m, A. Rod	riguez,			Bit Type: 4.25" I,D., 8" C Logged by: C. Fritz	LO D.D. Auger	Start Date: See 5
Depth Depth	Sample Number		Recovery (in.)		Core Diameter: N (A  Description		Graphic	Total Depth:
	20'B	13 9		-	Same as above, trace course dense	gravel, medium		
	95'A	50/6"		SP- SM	Same as above, fine to medive coarse gravel	n sand, trace		ave to coopies
	30'8	17 15 11		SP- SM	Same as above			
	35' A 35' B	10		SP- SM	Same as above, brown widork (black); trace yellow, orange, t	gray, tew shale light gray		
GRAVE 50% co fraction pa #4 to- 50% co fraction pa #4 to-	GRAVELS  GRAVELS  S SANDS  SANDS  SANDS  ME SANDS  ME SANDS  ME SANDS  ME SANDS  ME SANDS  ME SANDS	Puorly graded 5 dy gravets, s Clayey gravets Well-graded is Poorly graded Sitty sands, po Clayey sands, Inorganic sitts	gravels, g conty-grade poorty-gra ands, grav- sands, gra- orty-grades poorty-grades yeny-fine sa	ravel-sand of gravel- aded grave ery sands every sand sand-gra ted sand- ends with c	### A Property Company	Term   1410   2010 25	DENSITY ALISNAG	Term Size (mm) Size (inches) Percer Sand

rillers (da	mpany: Cascad y / night): S. Lor	n, A. Ro	) odrigu	ez, J. V	диепа	Drilling Me		ruck Rig w Stem Aug	er	Logged	e: 4,25" I. d by: C. Fr	D., 8" O.D. Itz	. Auger		F	tart Date: See nish Date:	She
Depth	Sample Number	Blow Count	Recovery (in.)	qu (tsf)	6	Core Dian			scription				Graphic		Total Depth:		
	40' A	7 42 38			L San	ly silt Ito ve	wlfew ry har	clay (	ML), moi	st, blac	k + 91	-ay,	11111111		red Har From 4	s while 0's stoppe	.d
	10 0	30		T			E	୦୫ ଭ	41.51				-		-		-
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GRAVE <50% co fraction pa #4 sien	GRAVELS  With little or no fines  SSOS  GRAVELS  With 215% fines  S SANDS	Well-grader Poony-grader Edy gravels Clayey grav Well-grader	graves ed gravi poorly- els poor	gravel-sar els. gravel-s graded- gra ty-graded is gravely sa	n matures, little and metures, little rei-sand-silt mut ravei-sand-clay du, little or no fr	or no lines e or no lines utos matures es fines fines sands, sits with al ly clays, sandy cla		Term  NO N	(SPT) 1.4"ID 2.0"ID 1.4" C-2 C-2 2-4 2-4	0-2 very loos	1.4"ID		Sands and (	Boulders Cobbles Coarse gravel	91ze (mm) >300 75 to 300 19 to 75		ercentage and and taled in te speating a ercentage
<50% co fraction po #4 sie	SANDS	Poorty-grad Lifty sames Clayby sam Inorganic s	poorty-g	aped sand orased sa	ands. little or no gravel-sit mixtu nd-gravel-clay m	fines res istures	S S	medium sliff very sti	8-15 9-17	9-18 medium	dense 10-30 1	7-60 51-86	NSITY NSITY	Fine gravel Coarse sand Medium sand	4 75 to 19 2 0 to 4 75 0 425 to 2 0	3/16 to 3/4 1/16 to 3/16	Term Trace Few Little

0	Stan	ite	eC		Client: GE - United Nuclear Corporation Project Number: 233001076			L BORING   BOREHOLE No.: P3 - Sheet   of
nilling Company nilers (Cay) / nig eld Representa	ht): S. Lam, A	A. Roc	drigu	ez, J. Vig	Drilling Rig: CME 85 Truck Rig ueria Drilling Method: Hollow Stem Auger Core Diameter: N (A	Bit Type: 4.25" I.D., 8" O.L Logged by: C. Fritz	D. Auger	Start Date: 4 / 14 / Finish Date: 4 / 14 / Total Depth: 16.5
Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf) Lithology / Symbol	Description		Graphic	Remarks
				SM	Silty sand (SM) wigrowel + few stightly moist, tan I gray witrace o	shale pieces, range	7. C.	
	10	7 27 31		SM	Same as above, medium dense	to dense	ある。何から、写文意を行る	Oppm gas readings
	,,	10 39 14		SM	. Silty sand (SM) witrace day, a dense, some brange stowning	gray & black,	The state of the s	Has=3.9 ppm (eutside hole) Has=3.9 ppm (4' down hole) CO=500 ppm LEL=19%
19		11 39 10		SM	Silty sand (SM) w/gravel + trace brown w/black + gray. EOB @ 16.51	e cobbles, light	X87X 30 XX 3	HoS=4.7 ppm (4' down hole LEL=14% CO=499 ppm -> Stopped work
450% coarse traction passes (	RAVELS Sity Clayer	graded graded graded	poorly-g n, poorl sands.	Ns. gravel-sar graded grave ly-graded gra gravely sand	Term	very loose 0-4 0-5 0-7 loose 4-10 5-12 7-18	DEN Sands at	
fraction passes.	SANDS Sity Clays  **STANDS Clays  LAYS Inory  **SO (Const.)	sands, po ny sands paric sits paric clay clays no sits a	poorly poorly very for so of low and clay	raded sand-g graded sand ne sands sitt v to medium p ys of low plate	baticity, graveby drays, sarray crays, sity clays, GL Hard 30-60 39-78 4	>85 1= 140 pound hammer dropped 30 inche	Turm	Fine grave  4.75 to 19 3.76 to 24

lers (da	mpany: Cascade  y night); S. Lon  esentative (day /	n, A. R	odrigu			.D., 8" O.D. Auger ritz		Start Date: 4   14 Finish Date: 4   14 Total Depth: 55 f
Depth	Sample Number	Blow Count	Recovery (in.)	qu (tsf) Lithology / Symbol	Description	Graphic	Rer	marks
				SM	Silty sand (SM), fine to medium-gravned so trace growel + sandstone drunks, light bro + grow, trace orange, slightly moist	and, awn		
	5'A 5'B	10	<u>j</u> )••	SM	Same as above, trace cobbles	74.75.75.75.75	H25=0 ppm , 0	C0=0 ppm
	10'A 10'B	11 S S		SN	Same as above, but mostly dust brown u light brown, gray, and brange, slightly me loose to medium dense	olsome adst,	Oppm gas re	eadings
	151 A 15' B	356		SM	Sand with silt (SM), loss silty than above, medium-grained, moist, brown + tan wifee little black + gray	loose,		
GRAVE  SAND  SON CO.  Fraction p.  Fraction p.  #4 see  SILT	GRAVELS GRAVELS SANDS ASSOS SANDS SANDS SANDS SANDS SANDS	Poorly grave Gity grave Crayey grad Well-grade Poorly-grad Sity sands Clayey san morganic s	ded gravis, poemy vels, poe d sands ded san poetly a ds, poet	rate gravel-sai graded gravel rly-graded gravely sand as gravely sand graded sand- y-graded sand- ry-graded sand- free sands sat	dissurance   GP   Land   Lan	HOWER 25 TO 25 TO 3 TO	Coarse gravel 19 to 75 Fine gravel 475 to 19 Coarse sand 20 to 475	Size (Inohes) >12 31o 12 34 lo 3/4 1/16 lo 3/45 1/84 lo 1/16 0 003 to 1/64 <0 003

(	Sta				Client: GE - United Nuclear Corporation  Project Number: 233001076	DATE ASSUED OF S	SOIL BORING	Sheet 2 of 3	
llers (da	mpany: Cascade y / night): S. Lorr esentative (day /	n, A. Ro	drigue	z, J. Vigu	Drilling Rig: CME 85 Truck Rig  eria Drilling Method: Hollow Stem Auger  Core Diameter: NA	Bit Type: 4.25" I.D., 8" O. Logged by: C. Fritz	.D. Auger	Start Date: See 5 Finish Date: Total Depth:	160
Depth	Sample Number	Blow Count		q <sub>u</sub> (tsf) Lithology / Symbol	Description		Graphic	Remarks	
	20' A	3 4 4		SM	Same as above, trace growel, t	race green coloring			A Contractor
				CM	Same as above, trace shale + s	and clare of a cos			Tank Toron
	25' A 25' B	2 5 12		3/1	some as above, trace shall as	andistant biccos			A CONTRACTOR AND A CONTRACTOR
	30'A 30'B	23	S	SM	Medium to coarse sand with s' moist to moist, gray + dark + trace black shale, lose to	ilt (SM), slightly brown w/orange			Contract Con
	30 0	10			& trace black shale, loose to	meatinn gense			large of property of the
	35' A	446		SM	Same as above, when day t	few gravel, loose	学院の意志を		the pollogical program
							XX-XX		OLCONO LAYER
GRAVE  = 50% cost traction paid  #4 services  \$4 services  \$50% cost traction paid  #50% cost tr	GRAVELS SANDS V SANDS V SANDS	loody grade in graveta layey grave vet graded loony grade by sanda layey sand norganic ell norganic cu	poorly-gra- propries poorly- sands, gra- propries poorly-gra- sands, poorly-gra- propries poorly-gra-	gravel-sam aced gravel graded grav avery sands gravelly san dod sand-graded graded sand-graded		Term   1,470   2010   25   20   20   20   20   20   20   2	DENSITY DENSIT	Dire (mm)   Size (inches)   Second   Second	ages i
SILT	S AND CLAYS quid limit >50	norganic sit norganic sits organic sits	is, micacoc iya al high and clays	of modum t	accous fine sand of set MH Note: Nonpi	astic 2 Term Field Test  Ton Absence of moisture, dry to touch Damp, does not well palm Viel ble Free Waler	Tarm Field Test	handing or sight linger pressure	ent vest

1 100	Stant	toc	- 11	Client: GE - United Nuclear Corporation		SOIL BOR		
0				Project Number: 233001076		LOG FOR		
ing Company: ( ers (day / night)	S. Lom, A.	Rodrigu	ez, J. Vig	Drilling Rig: CME 85 Truck Rig Jeria Drilling Method: Hollow Stem Auger	Bit Type: 4.25" I.D., 8" O Logged by: C. Fritz	.D. Auger	Start Date: Sec Finish Date:	Sheer
d Representativ	e (day / nigh	(1):	5	Core Diameter:	1		Total Depth:	
Depth	Sample Number		q <sub>u</sub> (tsf) Lithology / Symbol	Description		Graphic	Remarks	
40'	^  -	7	SC	(layey sand (SC) with gravel, me trace black weathered shale, few weathered sandstone, medium d	w orange			Treated to see Contra
45' 45'	``  c		SM	Sand with silt (SM) and gravel, coal, brown a gray wlfew erarge slightly moist to moist, medium	trace Hack	e CO ET	12 ppm , H <sub>3</sub> 5= Ө рр1	3 
50' 50'	. 4		SM	Sand with silt (SM), few gravel, gray + brown, trace black + yellow to medium dense	moist, darti Vorange, loose	CO = 1	65 ppm , LEL = 5 0/0 : 0 ppm	harmolin and
				EOB @ 55'		HaS=L	1.2 ppm, c0=500ppm 500 *Stopped wor	tk
								corrector
#50% coarse with little fraction passes GRA	VELS Siny gra-	raded grave vels. poerly- playels, poor	tis, gravel-sand praded gravel ty-graded grav gravely sanda	Section   Sect	14°ID 20°ID 25° very loose 0-4 0-5 0-7	Cobbles	75 to 300 3 to 12 vel 19 to 75 3/4 to 3	escentages o und ano favor aled or terms dealing a re- rectinges e

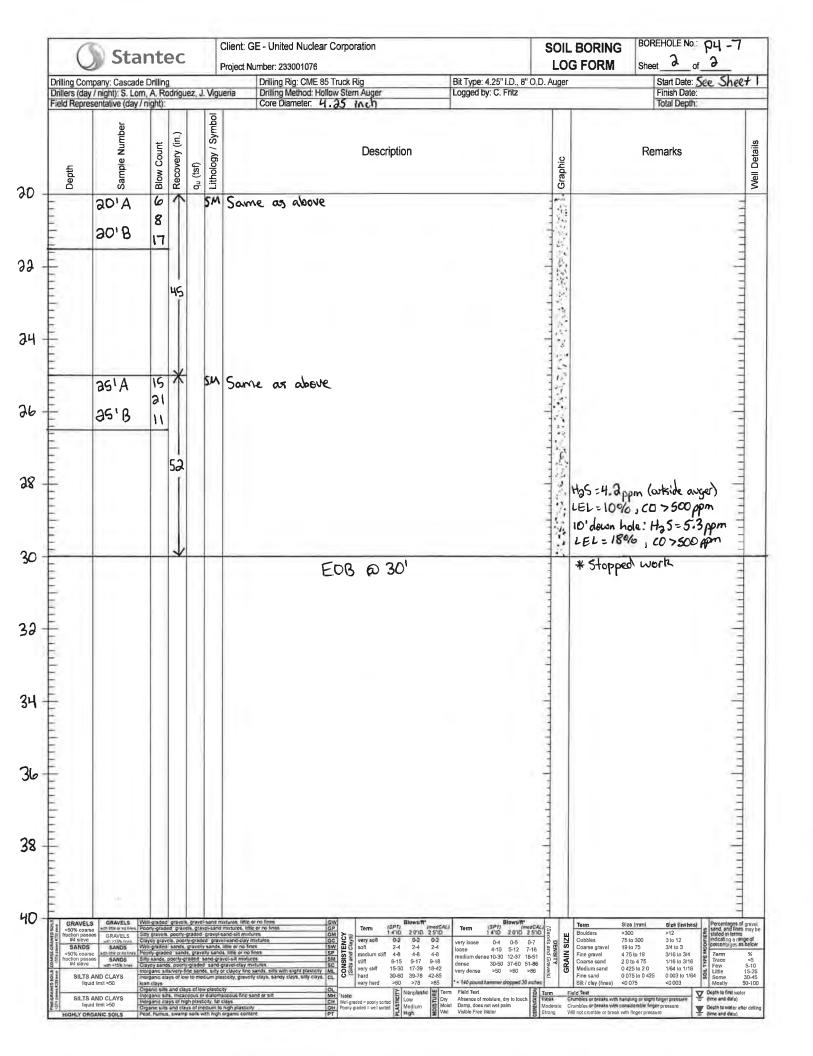
Dilling Romery Cascade Dilling of Dilling Right Struck Right Commission (1987) to M. A Rogaguez, Waguers Dilling Right Struck Right Commission (1987) to M. A Rogaguez, Waguers Dilling Right State Hanger Commission (1987) to M. A Rogaguez, Waguers Dilling Right State Hanger Commission (1987) to M. A Rogaguez, Waguers Dilling Right State Hanger Commission (1987) to M. A Rogaguez, Waguers Dilling Right State Hanger Commission (1987) to M. A Rogaguez, Waguers Dilling Right State Hanger Commission (1987) to M. A Rogaguez, Waguers Dilling Right State Hanger Commission (1987) to M. A Rogaguez, Waguers Dilling Right State Hanger Commission (1987) to M. A Rogaguez, Waguers Dilling Right State Hanger Commission (1987) to M. A Rogaguez, Waguers Dilling Right State Hanger Commission (1987) to M. A Rogaguez, Waguers Dilling Right State Hanger Commission (1987) to M. A Rogaguez, Waguers Dilling Right State Hanger Commission (1987) to M. A Rogaguez, Waguers Commission (1987) to M. A Rogague	Total Detection of A lines and Solar Solar Sand with little to some silt (SM)  10' A 20 10' B 12 10' C Silt and clay wlargeness to saits (CL), black, slightly moist, slightly
SM Sand with sit (SM) and gove (weathered sandstone + shale), gray, slightly moist to moist  S' Bag 506"  SM Sand with little to some sit (SM)  10' B 13  10' C 14  CL Sitt and clay wlorgants + salts (CL), black, slightly worst, trace to few gray sand  4 84 down hole: Ha 5= 6.5 ppm,	SM Sand with sit (SM) and gove (weathered sandstone + shale), gray, slightly moist to moist  SM Sand with little to some sit (SM)  10' B 13  10' C 14  CL Sitt and clay wlorgants + salts (CL), black, slightly moist, track to few gray sand  4 84 down hole: Has= 6.5 ppm,
5' Bag 50/5" SM Sand with little to some silt (SM) 10' B 13 10' C 14  CL Sitt and clay wlorganics + salts (CL), black, slightly black clay woist, trace to few gray sand  4 ft down hole: Has=6.5 ppm, LEL=170/0, c0>500 ppm	5' Bag 50% SM Sand with little to some silt (SM) 10' B 13 10' C 14  CL Sitt and clay wlorganics + salts (CL), black, slightly black clay worst, track to few gray sand  4 ft decon hele: Has= 6.5 ppm, LEL=170,00>500ppm
10' A 20 10' B 12 10' C 14  CL Silt and clay wlorganics + salts (CL), black, slightly == Bottom of A liner har black clay moist, trace to few gray sand == black clay == 6.5 ppm, == LEL=170/0,007500ppm	SM Sand with little to some silt (SM)  10'B 12 10'C 14  CL Silt and clay wlorganies + salts (CL), black, slightly moist, trace to few gray sand
10'C 14  CL Silt and clay wlorganies + salts (CL), black, slightly = Bottom of A liner has black clay moist, trace to few gray sand = 4 ft down hole: Has= 6.5 ppm, - LEL=170/0, CO>500 ppm	10'C 14  CL Silt and clay wlorganics + salts (CL), black, slightly = Bottom of A liner has black clay moist, trace to few gray sand = 4 ft down hole! Has= 6.5 ppm, - LEL=170/0, CO>500 ppm
4 87 down hole: Has= 6.5 ppm, - LEL=170/0, CO>500ppm	4 87 down hole: Has= 6.5 ppm, LEL=170/0, CO>500ppm

Co	Star	nte	) C		Project Number: 23	ed Nuclear Corporation				BORING G FORM	Sheet	of 2	5
rilling Compan nilers (day)/ nic	ghl): S. Lom,	A. Ro	drigue	ez, J. Vi	Drilling guena Drilling	Rig: CME 85 Truck Rig Method: Hollow Stern Auger		Bit Type: 4.25" l. Logged by: C. Fr	D., 8" O.D. Auger		Start D	Date: 4/16	118
eld Represent	Sample Number	Blow Count (146)	Recovery (in.)	q <sub>u</sub> (tsf)	1	iameter: N [A Description	on		Graphic		Remarks	Depth: 31.5	Ħ
				S	1 Sand with w/some g to dense	th silt (SM), trace. Green 4 purple, me	shale pi dium di	ieces, brown ense (lig	35				Tring Oren Paris
5	'Bog	10 21 24		Si	1 Same as a	above, slightly mod	sd ·			Analytical A,B,&C	l sample Viners (	From (bulk)	or of total de same of the or
	0'A 0'B	3 4 5	X	S	1 Same Mad green, tro	terial, but loose, m ice growel	d chioist	nown w/so	me				I was the contract of the state
) i	6'Bog	5 5 2		s	1 Same as of sampl	above.Blach shale er	. + orga	antes in t	δ	Analytice A,B,7 C LEL = 3°	d sample Uners (b 0/0 (no o	from oulla) ther readt	was:
GRAVELS  50% coarse  15 solve  55 solve  55 solve  55 solve  55 solve  65 so	GRAVELS BET CO SANDS WAS SANDS GO SANDS	orly-grad- ry gravets eyey grav- sir-graded orly-grad- ty sands.	ed grav poorly- els, poo- sands oit sand poorly-g	chi gravel- graded gravity graded gravely sa te, gravely raded san y-graded s	nd minitures. Little or no fines and minitures. Little or no fines with anth of minitures and or no provided and clay minitures and title or no fines. In the control of the control in control of the control of the including and control of the minitures and control of the control of the minitures and control of the minitures and contr	GW   GP   Term   (5F7)	0-2 0-2 2-4 2-4 4-8 4-8 5 9-17 9-18 0 17-39 18-42	very loose 0-4 loose 4-10 medium dense 10-30 dense 30-50	00% In the CAU 2010 2510 0.5 0.7 18 and 0 are 12-37 18-51 37-60 61-86 37-60 61-86	Boulders 7 Cobbles 7 Coarse gravel 1 Fine gravel 4 Coarse sand 2 Medium sand 0	300 >12 5 to 300 3 to 9 to 75 3/4 to 75 to 19 3/16 0 to 4 75 1/16 425 to 2 0 1/64	12 E indust	e

(	) Sta	nte	<b>e</b> C		Client: GE - United Nuclear Corporation Project Number: 233001076				EHOLE No: PH-5
Drillers (da	mpany: Cascade sy / night): S. Lorr esentative (day /	1, A. Ro	drigue	ez, J. Vi	Drilling Rig: CME 85 Truck Rig ueria Drilling Method: Hollow Stem Auger Core Diameter: N (A	Bit Type: 4.25" I.D., 8" O. Logged by: C. Fritz	D. Auge		Start Date: See Shee Finish Date: Total Depth:
Depth	Sample Number		Recovery (in.)	q <sub>u</sub> (tsf) Lithology / Symbol			Graphic	Re	emarks
	30,8 30,4	7 7 9			. Same as above, also with so	ome orange statning		LEL=10%, ( *Stopped wo	H <sub>8</sub> S=2.2 ppm CO>500 ppm
					EOB @ 21.5	2)		1 1 (c)   C	i=
							معملته متنه الممهم الت		
							and the same		
							ووميا المهوما		
							مومعة معمم		
							terrelier.		1
							ما بم بما بم		
							and and		3
							1		

In Company, Cascade Drilling  The Company, Cascade Drilling  The Company, Cascade Drilling  The Company, Cascade Drilling  The Case of Company, Cascade Drilling  The Company, Cascade Dri	Thing Gorpany: Cascade Drilling  Thing Right Called ES Truck Rig  Thing Date: 4 [16]  Thing Right Called ES Truck Rig  Thing Date: 4 [16]  Thing Da	( Stantec	Client: GE - United Nuclear Corporation	SOIL BORING BOREHOLE NO.: P4-
The series of th	SM Sandy silt to silty sand, lease, slightly most, light brown  SM Sold gray turned daria gray block @ 7 A  Cottings turned daria gray block @ 7 A  LEL=1806 (just Inshe top  Sandy silt (ML), Fow to little highly weathered  Sandy siltle weathered	0		
Description  Remarks  Description  Remarks  SM Sandy silt to silly sand, lease, slightly moist, light brown, light gray  SM Silty sand (SM), with weathered sandstone dunks, lease, slightly moist, light brown  Cuttings turned dark gray   block @ 7 Fl  101 A 7  101 B 37  101 B	Description  Remarks  Remarks  Description  Remarks	llers (day) night): S. Lom, A. Rodriguez, J. Vi	ueria Drilling Method: Hollow Stem Auger Logged by: C. Fritz	Finish Date: 4 / 16
SM Sitty sand (SM), with weathered sandstone chunks, CO=20 ppm, HbS=0, LEL=1  S'B 14  Cuttings turned derit gray I black @ 7 Fl  Cuttings turned derit gray I black @ 7 Fl  WL Sandy sitt (ML), Few to little highly weathered shale, moist, brown + dork gray weathered trace salts	SI Sity sand (SM), with weathered sandstone downtes, CO = 20 ppm, HgS=0, LEL=0  SIB 14  Cuttings turned derit gray black @ 7 Fl  Cuttings turned derit gray black @ 7 Fl  WL Sandy sitt (ML), Few to little highly weathered that you weathered the shale, moist, brown & dort gray werange stanting, ELL=18% (just inside top of augus)  To B 14  *Driller moted sudden	mber (n.)		Remarks
Cuttings turned dark gray I black @ 7 Fl  10' A 7  ML Sandy silt (ML), few to little highly weathered  Shale, moist, brown & dork gray wlorange stowning,  TEL=18% (just inside top  trace salts	Cuttings turned derte gray   black @ 7 Fl  101 A 7  ML Sandy silt (ML), few to little highly weathered Shale, moist, brown + dort gray wlorange stowning, trace solts  EOB @ 11 S1  * Driller noted sudden		1 Sandy silt to silty sand, loose, slightly moist, his	tht .
10'B 14 trace salts	10'B 14 trace salts = of auger)	5'A 3 8'B 14		25, CO=20 ppm, Has=0, LEL=0
EOB @ 11.5"  * Drilles notes succes  > stopped work		116).17	trace salts	* Neiller nated subtren

	esentative (day /	Count	Recovery (in.)	qu (tsf) Lithology / Symbol	Core Diameter: 4.35 Inch  Description	Graphic	Total Depth: 30 F1
Depth	Sarr	Blow	<b>V</b> Rec	-		Gra	
			42	<i>S#</i>	Silty sand topsoil, brown, slightly maist, few clay Broken + weathered sandstone whilt (SM), few clay, brown + gray who range iron staining		
	5' A 5' B	12 6	*		Same as above		
			46		-> ~6" gray weathered sandstone -> tan & gray		
	/0'A	202	* *		-> trace brown sand	一	Poor sample recovery
			91		-strace brown sand		
	158	1 3 4	45	SM	Moderately to completely weathered sandstone with little silf (SM), trace black shale, gray witrace green & purple, some areas loose & sandy, others solid rock		Has = Oppm, co = 40 ppm LEL = 4% Poor CA sample recovery
GRAVE <50% coa fraction pa #4 stev  SAND  <50% coa fraction pa #4 stev	GRAVELS  MAN > 15% lines  SANDS  SANDS  SANDS  Wh > 15% lines  Wh > 15% lines	Poorly grade Safy gravely Clayey grade West-grade Poorly-grad Safy sands Clayey san	poorly of poorly of poorly of poorly of the	ore gravel-sa graded gravely- ly-graded gr gravely sand e gravely sa raded sand- y graded sand-	Tem   SP7   Blows   Tem	WSITY PIG Gran	Term   Size (mm)   Size (inches)     Percenta



orilling Company: Casca orillers (day) night): S. L ield Representative (da	om, A. Rodrigu		Drilling Rig: CME 85 Truck Rig Bit Type: 4.25" l.D., 8" O  Brilling Method: Hollow Stem Auger  Core Diameter: N A  Bit Type: 4.25" l.D., 8" O  Logged by: C. Fritz	D. Auger	Start Date: 4 [15 Finish Date: 4 [15 Total Depth: 30 F
Depth Sample Number	Blow Count Recovery (in.)	q <sub>u</sub> (tsf) Lithology / Symbol	Description	Graphic	Remarks
		ŞC	Clayey sand (SC) whilt a weathered shale, brown + dorte gray/black, trace iron staining, slightly moist	<b>10363143143144</b>	
51A 51B 51C	13 13	sc	Same as above, medium dense	ACCEPTANTIFIED SE	
10' B	7 8 9	SM	Silty sand (SM) when to little day + trace gravel (weathered sandstone pieces), black + gray, medium dense	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	
15'A 15'B	5 6	SM	Same as above, black whome gray & orange		
GRAVELS SOR CORNEL SOR	Poony-graded gra- Sity gravets, poorly Clayey gravets, poo Web-graced sands Poorty-graded san Sity sands, poorly- Clayer sands, poorly-	veix gravel-sand graded gravel-s arry-graded gravel-s gravely sands, dx gravely sand- graded sand-gra- ly-graded sand-sand-sand-sand-sand-sand-sand-sand-		TEL H-S TEL H-	gravel 475 to 190 316 12 32 to 13 avel 475 to 19 3/16 to 3/4 sand 2 0 to 4 75 1/16 to 3/16 to 3/4 to

() Stant	Client: GE - United Nuclear Corporation  Project Number: 233001076	SOIL BORING BOREHOLE No.: P4 - 9 LOG FORM Sheet 1 or 2
illing Company: Cascade Drillin illers (ax) night): S. Lom, A. R	lodriguez, J. Vigueria Drilling Method: Hollow Stem Auger	Bit Type: 4.25" I.D., 8" O.D. Auger   Start Date: 4   15   18   Logged by: C. Fritz   Finish Date: 4   15   18
Representative (day / night):  Sample Number  Blow Count	Recovery (in.)  Q <sub>L</sub> (tsf)  Lithology / Symbol  Description	Graphic
	SM Silty sand (SM) (topsoil), transpieces, light brown withour e	e gravel + shale ray, slightly moist
5'A 4 5'B 11		VOCS = 35 ppm , HaS=0, CO=0 , LEL=0
10'A 15		Auger cuttings comtouin numerous rounded, alluvial rocks (~1" diameter)
15'Bag 13		chunter  Bulk sample from A+B  liners (accidentally emptical liners thinking it was analytical sample)
## SANDS ## 610've ## 610'	red gravels, gravel-sand mistures, latte or no finds  GP  Size body gravels, gravel-sand mistures, latte or no finds  GP  Size body gravels, gravel-sand mistures, latte or no finds  GP  Size body gravels, gravel-sand mistures  GP  Size body gravels, gravel-sand mistures  GP  Size body gravels, gravel-sand mistures  GP  Size body gravels  Ferm (SPT)  Very soft 0-2-  Very soft 0-2-  Very soft 0-2-  Size body gravels  Size body gr	Nows/it   Term   (SPT)   Blows/it   Term   Size (Inches)   Size (Inches)   Term   Size (Inches)   Size (Inches)

Star	ntec	Client: GE - United Nuclear Corporation Project Number: 233001076		SOIL BORING BOREHOLE No.: P4 - LOG FORM Sheet 3 of 3
ng Company: Cascade Ders (day / night): S. Lom, . Representative (day / ni	A. Rodriguez, J. V	Drilling Rig: CME 85 Truck Rig	Bit Type: 4,25" I.D., 8" O.D. Logged by: C. Fritz	Auger Start Date: See Si Finish Date: Total Depth:
Depth Sample Number	Blow Count Recovery (in.) qu (tsf)	Descriptio		Graphic Remarks
20'Brg	6 6 5	M Same as above, loose to me	ynw genze	Analytical sample from A.B.C liners
95'A	14 21 14	IL Sandy silt (ML) w/sandstone shale pieces, brown & gray o orange oxidation	duntes of trace white solls and some	B liner = sandstone
30' Bog		IL Some as above, dense		Analytical sample from A,B lines
35'A 35'B	15 50/ <sub>5"</sub>	IL Soudy silt (ML) with clay a black w/white salts, very de from hitting rock)	growel, brown and use (could just be	Samples got souted in water powed down hole after stopping due to gas
				Drillers noted puff of gas smell Has=18.3 ppm, LEL=470
450% coarse adlon passes (RAVELS SANDS SON COARSE) FOR COARSE AND SANDS SAN	ony-graded gravels, gravels y gravels, poorly-graded gr yer gravels, poorly-graded ligited sands, gravely y sanes, poorly-graded san rysy sands, poorly-graded san rysy sands, poorly-graded yeans satuvery-fine sands,	200   200	Blowsi   T	CO > SOO ppm , VDC = 43.1 pp   Porce   Sol   Porce   Porce

ers (day	pany: Cascade // night): S. Lom sentitive (day / n	A. Ro	drigu		uena Drilling Method: Hollow Stern Auger Logged by: Core Diameter: 😕 / 🔉	25" I.D., 8" O.D. Auger C. Fritz	Start Date: Firsh Date: Total Depth: \
Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf) Lithology / Symbol	Description	Graphic	Remarks
				5F	Silty Saved, medicum clense, s Moist, light brown	Signally	
	5' A 5' B	10/8/1		54	iscime as above		
	10'A 10'b	5119		SH	AFILL IN OITHVE SOURDISTITY (SM), IMPROVED STRUCTURE & rupture resistance strate carbonates stignity darker brown (), organics)	ncreased	-10re "soiry"
	ら'A	7117		21	July Sand, carbonates, intac visible within samples EDB@165'	ت ( ب أر ا المو ا تقر	
GRAVEL 50% coar action part 54 there SANOS 50% coar action pas 54 there	GRAVELS SANGS W	orly-grad ty gravels tyey grav ell-grades only-scale	ed grav posity els posit sands ed san	vels, gravel sar- r-graded grave only-graded gra- c, gravely sand dt, gravelly sand	Very sct   0.2   0.2   Very loose   0.2   0.2   Very loose   0.2   0.2   Very loose   0	0-4 0-5 0-7 0-7 0-7 0-7 0-7 0-7 0-7 0-7 0-7 0-7	irm Size (frim) Site (finites)  subders >300 >12  bbles 75 to 300 3 to 12  amere gravel 19 to 75  argeres and 2 to 47  2 to 176 to 346  argeres and 2 to 176 to 346

Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Description	Graphic	Remarks
			1991	34	LOOSE TO intection dense sand (SM), light brown moist	niti gatly	
	5 A 5 も	599	→ 本	5	M Science as about		Loose sand in particuly full livers
	10' A	900	\ \ \ \	5	→Trace carbonates, Cementation (still)	increased in	
	15' A 15' B	588	9.0 	\$	pieces	andstone &	
GRAVE	drse GRAVELS	borly grad aty graver	ed grav	elt, grave graded g	od marknes, 1890 er pe fraje  and marknes, 1890 er pe fraje  Der versichen of marknes  Der versichen of der versichen  Der versichen of der versichen  Der versichen of der versichen oder versichen oder der versichen oder de	y, darker	Term

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Drilling Company: Ca	tante		Client: GE - United Nuclear Corporation  Project Number: 233001076  Drilling Rig:	SOIL BORING LOG FORM  Bit Type: 4,25" I.D., 8" O.D. Auger	Sheet 2 of 2
Onliers (day / night): -ield Representitive	S. Lorn, A. Ro	driguez, J. V	gueria Drilling Method: Hollow Stem Auger Core Diameter: 7 25"	Logged by: C. Fritz	Finish Date: Total Depth
Depth	Blow Count	Recovery (in.) qu (tsf)	Description	Graphic	Remarks
20		A .	y Same as above	7.5 - 0.1 - 0.1 - 0.1 - 0.1	
		54	> Few serverstone e	MUNYS (3)	
250 25		\$ 5a	Notive stilly sand, a carristances, greater of angularity	raie ementation (s	
30'	A 1578	2)	Same as above trace troops	1	
			20B@ 31.5		
				Alteria	
GRAVELS GRAV SOUR PRINTS GRAV SANDS SAND SON CARES GRAV Filebon pais SAN Filebon pais SAN Filebon pais SAN	LS Sity gravels, ton Clayey graves	d gravels, gravel- poprly-graded gra is, poprly-graded sands, prayedy sa	nd inschures, little or ne fines OPP   Term (SPT) Blows/fit (mord under state of the fit (mord under st	very loose 0-4 0-5 0-7 loose 0-4 10 5-12 7-18 medium denie 10-30 12-37 16-51 dense 30-50 37-60 51-86 27 2	Size (mm)   Size (inches)   Personal   12   75 in 300   3 in 12   19 in 75 in 19   37 in in 50   47   47 in in 19   47 in in 1
SILTS AND CLAY: Ilquid limit <50 SILTS AND CLAY:	Main clays Organic sits	and clays of low p	Asialigid -00 -10 -00	*s 140 good Nammer dipgord 30 inches Silt / clay (fines)	0 075 to 0 425 0 003 to 1/64 🙎 Some

rillers (day	npany: Cascade y night): S. Lon sentative (day /	A Ro	odrigu		Drilling Rig: CME 85 Truck Rig eria Drilling Method: Hollow Stem Auger Core Diameter: N/A	Bit Type: 4.25" I.D., 8" Logged by: C. Fritz	O.D. Auger	Start Date: 3   30 Finish Date: 3   30 Total Depth: 7 \ . 5
Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf) Lithology / Symbol	Description		Graphic	Remarks
				ML	Sandy sitt wllitle shale (weo slightly moist, medium dense darter gray shale	thered + Flatry),( , light brown,	ML),	
	5'A 5'B	17 16 16		ML	Same as above			
		14		ML				
	10'A 10'B	30			Same as above			
	15'A 16'B	10		wr	Same as above		14,11,14,11,14,1	
							11777411	
GRAVEL <50% coa fraction pais #4 sleve SANDS <50% coa fraction pais #4 sleve	GRAVELS with >15% hons SANDS SANDS SANDS SANDS SANDS SANDS SANDS	layey grade layey grade vell-grade bony-grade ty sands	ed graves, poorly seed sands bod sands poorly de, poorl	gravel-san graded gravel ny graded gra- gravely bande is, gravely san graded sand-gr	et sand-day retaines GC SW Let on fines SW Let of send un still de la company send un	Term 1 25 10 2 0	0-7 7-18 Cobbles Coarse gravel 18-51 Fine gravel	Size (mm)   Size (mhes)   >300   >12   7

Drillers (da	Stal mpany: Cascade y/night): S. Lorr	Drilling		Project Number: 233001076  Drilling Rig: CME 85 Truck Rig  Viguena Drilling Method: Hollow Stem Auger	Bit Type: 4.25" J.D., 8" Logged by: C. Fritz	O.D. Auger	Sheet 2 of 4 Start Date: See 5 Finish Date:	heet
Depth Depth	Sample Number		Recovery (In.) q <sub>u</sub> (tsf)	Core Diameter: N A  Descri		Graphic	Total Depth:	
	90' A	11 15 15		ML Silt, some moderately to shale (lean clay), darte by very stiff silt, very har	slightly weathered brown Igray, slightly mo a shalle	st, 11/1/1		trittiii.
	as'A	10		Lean clay (moderately & shale)	to highly weatheren	1		
								mpromon
	30'A	Q 14 15		il Same as above		111111111111111111111111111111111111111		
						1311111		
	32, B	7 8 10		ML Sandy silt, light brown, weathered sandstone,	trace moderately slightly moist, stiff	THAT THE		
						मामनिय		
GRAVE  GRAVE  SOCIO  SON COS  Fraction pe  #4 elev  SILT	GRAVELS who 15% fines SANDS	ceny graded wy graven, po layey graven, wo graded to certy-graded wy graded wy graded wy grades wy gra	graveis, graves ourly-graded ( poorly-graded ands, gravely sands, gravely orly-graded sa poorly-graded very-fine sands	and mortures, lattle or no fines  -sand mortures  -sand mortures  -sand mortures  -sand lattle or no fines  -sands, la	2-4 2-4 2-4 loose 4-10 5-12 7 4-8 4-8 4-8 4-8 8-15 9-17 9-18 dense 30-50 37-60 5	0-7 Cobbles Coarse gravel Fine gravel Fine gravel Head Wedlum sand Fine sand		5 1: e 3:

0	antec	Project Number: 233001076		G FORM Sheet 3 of 4
rilling Company: Cascad rillers (day / night): S. Lo eld Representative (day	m, A. Rodriguez, J.	Orilling Rig: CME 85 Truck Rig Viguena Drilling Method: Hollow Stern Auger Core Diameter:	Bit Type: 4.25" I.D., 8" O.D. Auger Logged by: C. Fritz	Start Date: See 5N Finish Date: Total Depth:
Depth Sample Number	Blow Count Recovery (in.) q <sub>u</sub> (tsf)	Description Description	Graphic	Remarks
40' A 40' B	13	dork brown, trace iron ex	wisand + some silt, ==	
45'8	8 10	ML Sandy silt to silty sand, wedown dense, hight brown few carbonates, trace w	weakly comented, wn, slightly moist wathered sandstone	
50' A	13 21 22	ch Highly to completely wed silt of sand, slightly mois brown I gray, very stiff to	athered shale, little == t to moist, dartz o hard	
S5' A	13	AFILL Sandy silt (ML), very stiff moist (native)	, light brown, slightly	Native may be at 60', unsure due to a bit of clayer material in upper- lener @ 60'
GRAVELS  GRA	Sitty gravets, boony-graded Clayer gravets, poonly-graded West-graded sands, gravety Poonly-graded sands, gravety Poonly-graded sands, gravety Sitty sands, poonly-graded is Clayery sands, poonly-graded Imagency situates Imagency situates for sands	-saint montupo, liste or no forme GPP  -rem (###71 -re	0-2 0-2 very losse 0-4 0-5 0-7 leave 1-4 1-0 5-12 7-18 for 1-5 0-7 leave 1-4 1-0 5-12 7-18 for 1-5 0-17 1-15 1-5 0-17 1-	Coarse gravel 19 to 75 3/4 to 3 Fine gravel 4 75 to 19 3/16 to 3/4 Coarse sand 2 0 to 4 75 1/16 to 3/16 Trace Few

Orilling Con	npany: Cascade	ntec Drilling		nber: 233001076 Drilling Rig: CME 85 Truck Rig	Bit Type: 4.25" I.D., 8"	LOG FORM O.D. Auger	Start Date: See She
rillers (day	/ night): S. Lon sentative (day /	n, A. Rodriguez, J	Vigueria	Drilling Method: Hollow Stem Auger Core Diameter:	Logged by: C. Fritz		Finish Date: Total Depth:
Depth	Sample Number	Blow Count Recovery (in.) q <sub>u</sub> (tsf)	Lithology / Symbol	Descriptio		Graphic	Remarks
	60, V	14 15 17	ML Sand	y silt, few clay, slight stiff, light brown, w	tly moist to moist, eak comentation		
	65'A	710	ML Sam	e as above			
		19					
	70'A	12 15 84	ML Sam	ne as above		1/1/1/1/1	
				EOB @ T	1\.5'		
: [] - -						1	
						Transferring	
GRAVEL <50% coal fraction pas #4 sleve	Ses GRAVELS with >15% fines	Well-praided gravels, gravi Veolin-praided gravels, grav Tilly gravels, poolin-grade Tilly or gravels, poolin-grade Well-graded sparks, gravyl	vel-sand mixtures. Alle o gravel-sand-sit mixture od gravel-sand-clay mix y sands. Hitle or no fines.	t no fines   GP   Term (SP1)	0-Z 0-Z very loose 0-4 0-5	0-7 S M Cobbles Coarse gravel	Size (mm)   Size (inches)   Size (inches)
<50% confraction pas #4 sleve	SAND CLAYS	Poorly-graded sands, grav	elly sands. little or no fine sand-gravel-sil matters d-sand-gravel-clay mixtu ds. silty or clayoy fine sa- dium plasticity, gravolly o	5P 5M 5M 5M 6M	4-8 4-8 9-17 9-18 17-39 18-42 39-78 42-85 >78 >85 18 18 18 18 18 18 18 18 18 18 18 18 18	18-51 AV STATE STA	4 75 to 19 3/16 to 3/4 2 0 to 4 75 1/16 to 3/16 0 425 to 2 0 1/64 to 1/16 0 075 to 0 425 0 003 to 1/64 Some

rillers (day	pany: Cascade 7 night): S. Lom sentative (day / r	, A. R	g odrigu		Vigueria Drilling Core I	ng Rig: CME LAR 75 High Torque Track R ng Method: Hollow Stern Auger e Diameter NJA	Bit Type: 4.25" I.D., 8" ( Logged by: C. Fritz	O.D. Auger	Start Date: 3   28   Finish Date: 3   28   Total Depth: 3   6.5
Depth	Sample Number	Blow Count	Recovery (in.)	qu (tsf)	Lithology / Symbol	Description		Graphic	Remarks
	S'A	20 16 15			ML Sandy of brown	Silt (NL) whoseathered solder in dayey spots	shale, light to dar s), slightly mod st	THE PERMIT	Auto-hammer was double bouncing"
	Α' <i>σι</i>	18			MLSame a	as above			
	ıs'A	10			ML Same a	as above		THE STATE OF THE PARTY OF THE STATE OF THE S	
GRAVEL  GRAVE  G	GRAVELS SANDS SANDS SANDS SANDS SANDS SAND CLAYS uld limit <50	Peony grave Clayey grave Med-grad Phody grad Tray sand Clayey sa morganic morganic den clays	ded grades poorly and save save save save save save save save	vels, gra- graded orly-grades, gravel- ids, grav- graded fy-graded dine sam ow to me	Leand mistures, little or no fines yet-sain mistures, little or no fine yet-sain mistures, little or no fine graveleand-city mistures or graveleand-city mistures yet aurits, little or no fines of a saint-digital city mistures is a little or clayery fine saids, saint-did own plassicity gravely citys, saint political programmes and programmes of the p	Company   Comp	No.   Control   Control	0-7 7-18 and Gravels) 18-51 61-86 >86	Tarm   Size (mm)   Size (inches)

Onllers (da	mpany: Cascade ny / night): S. Lon esentative (day /	n, A. Ro	drigue		Drilling Rig: CME LAR 75 High Torque Track Rig Bit Type: 4.25" L.D Brilling Method: Hollow Stem Auger Core Diameter: N A		Start Date: See Sh Finish Date: Total Depth:
Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf) Lithology / Symbol	Description	Graphic	Remarks
	20'A 20'B	8 16 80		ML	Sandy silt (ML) (native), light brown, medi dense, slightly moist	N. THEFT	
	25'A	11		SS	Moderately to highly weathered sandstone bedreed don't brown gray	ck,	
		90	1		EOB @ 26.5'		
						3	
						1	
GRAVE 450% cos fraction pa #4 sign SAND <50% cos	GRAVELS with >15% fines S	oorly-grade Aty gravels Jayey grave Net-graded oorly-grade	poorly-gr bands, gr sands, gr sands.	gravel-tized uded gravel- graded grave avoily sands gravely sand	Term   1/2   Ter	42 740 P W COBISE	6 75 to 300 3 to 12 gravel 19 to 75 3/4 to 3 evel 4 75 to 19 3/16 to 3/4
fraction pa #4 slev	S AND CLAYS	Jayey sands norganic sitt	bearty-s	sands, arry o	Section   Sect	80 51-86 Sy Ve S Coarse Medium Fine sa	sand 2 0 to 4 75 1/16 to 3/16 Trace Few I sand 0 425 to 2 0 1/64 to 1/16

Stantec	Project Number: 233001076	IL BORING BOREHOLE No.: T/0 - 3
rilling Company: Cascade Drilling rillers ((ay) night): S. Lom, A. Rodriguez, J. Vig eld Representative (day / night):	Drilling Rig: CME LAR 75, CME 85 (below 35')  Bit Type: 4.25" I.D., 8" O.D. Aug  Logged by: C. Fritz  Core Diameter: 4.35 inch	er Start Date: 3   3   1   1   1   1   1   1   1   1
Depth Sample Number Blow Count Recovery (in.) qu (tsf) Lithology / Symbol	Description	Remarks
148 WI	Sandy silt (ML), few to little growel, little to some shale. Light brown (shale dark gray). Slightly moist, medium dense very stiff, moderate comentation whereas of strong rock-like comentation. Trace carbonates.	Flakes of broken shale
5'A 9 X	> mostly shale, some silt & sand, weathered and weakly comented	
52	> mostly sand  > shale wistly + sand  > mostly sand	
10, V 16	> sandy silt 4 shale	
15' B 10		
36		
GRAVELS  GRA	Semilar   Semi	Term   Size (nrm)   Size (inchen)

rilling Company: Cascade rillers (day / night): S. Lom	A. Rodriguez, J. Vigueria Drilling Method: Hollow		Bit Type: 4,25" I.D., 8" O.D. Au Logged by: C. Fritz	iger	Start Date: See Sheer Finish Date: Total Depth:
eld Representative (day / I	Blow Count Recovery (in.)  Qu (tsf) Lithology / Symbol	Description		Graphic	Remarks
20' B=3	5 ML Loose sandy sill cores show media	t wheathered st ium dense-dense mentation	rale (liners); sand	1,1,1,1	
25'A	42  ML Sandy silt (ML), r	nedown dowse			The state of the s
	SM Silty sand (SM)	and slightly to a	ompletely		
30, 8	5M Silty sand (SM) weathered shale shift shale, light 10 (Shale), shightly	medium dense moist	sonor, very bork-gray l black		
	13 17	adorate comentat	ton, pockets of	Used downh hammer @ 3 using CME & beyond 35'	de (manual) 15'. Began 35 rig to drill bgs.
	48 -> mostly shale, w	rs I way a supe a	carbonates		
SANDS SANDS SANDS SANDS SANDS SANDS SANDS	L-graded gravels, gravel-sand revolutes, little or no fines  Graded gravels, gravel-sand metades, little or no fines  gravels, gravel-sand metades, little or no fines  Gravels, proxy-graded gravel-sand arteratures  Gravels, proxy-graded gravels, and day metades  regraded sands, gravely ands, little or no fines  frygraded sands, gravely ands, little or no fines  yands, goody-graded sands-gravels-air maximums  yet sands, goody-graded sands-gravels-air maximums  graded sands, gravely ands, gravels-air maximums  graded sands, goody-graded sand-gravels-air maximums  graded sands, goody-graded sand-gravels-air maximums  graded sands, goody-graded sand-gravels-air maximums  graded sands, graded graded sands	1.4*ID 20*ID 25*ID very soft 0-2 0-2 0-2 soft 2-4 2-4 medium stiff 4-8 4-8 4-8 sliff 6-15 9-17 9-18	very loose 0-4 0-5 0-7 loose 4-10 5-12 7-18 medium dense 10-30 12-37 18-51 dense 30-50 37-60 51-86 ii	Term   Size (mm   Disc)   Size	>12 3 to 12 3/4 to 3 3/16 to 3/4 5 1/16 to 3/16

-	20	nte	3	Project Nu	ımber: 233001076				LO	BORING G FORM	Sheet 3 of	
Orillers (da	ompany: Cascade ay / night): S. Lor	n, A. Rodri	juez, J.	Vigueria	Drilling Rig: CME LAR Drilling Method: Hollov	Stem Auger	v 35')	Bit Type: 4.25" I.D., 8 Logged by: C. Fritz	3" O.D. Auger		Start Date: 5	ee Shee
ield Repr	resentative (day /	night):	1		Core Diameter 4,	15 inch					Total Depth:	
Depth	Sample Number	Blow Count	q <sub>u</sub> (tsf)	Lithology / Symbol		Description			Graphic		Remarks	
	40' A 40' B	10/		dens	t shale welvey shiff,	sloslotly w	wast, si	ity	100 mm			A for District
		ų	4	cen → me	stly shale, so nentation, fo	m gabenu anga'meg	erate to	strong	***********			dimental
	45'A	11 9 9	<del>(</del>	shal				hered shale chunks of	A Company of the Comp			and tarrefair
		5	0	~ c-	ostly sand, peo 4" very hord che to sand	slightly	weath			Auger wo harder, le greaning vibration	rteing much and granding noises, pho	anh
	50'B	13	4	SM Silly	sand					Addition	al moisture in	bke.
	53' Bog			book	ly shale, shigh	why to his	שאיילי ביי	eathered		poured (	lown hole	Jungaria
	55' B	9 10	4	Ster an Liner Few	sight coment correctes samples: sil- stiff days	ed hard i s ty sand (S (dorte + u	n), mes	ace sypsom about douse shale)	<b>5</b>			n colla region
		5	5						4.5.5.5.4.5			bridge
GRAVE  450% co in traction pi 450% co friedman pi 15 son	GRAVELS OF SANOS STATE SANOS	reorly-graded g any gravets, poo- hayey gravets, poo- vell-graded san vell-graded san tray sands, po- lidyey sands, po- norganic sitts ve	aveis grave by graded g corty graded ds gravelly s inds gravelly graded sa only graded y time sands	Lang missives. Hitico F-band mestures. Hitico Gravial-band-citay m bands, actic or no for y bands. Hiti or no fi nd-gravial-si resture and-gravial-si resture band-gravial-si resture unity or clayer fine a lum plastic rest	er no fines	very soft 0-2 soft 2-4 medium sliff 4-8 sliff 8-15	0-2 0-2 2-4 2-4 4-8 4-8 5 9-17 9-18 0 17-39 18-42	1 4"ID 20"ID very loose 0-4 0-5 loose 4-10 5-12 medium dense 10-30 12-37 dense 30-50 37-60	0-7 7-18 18-51	Boulders Cobbles 7 Coarse gravel 1 Fine gravel 4 Coarse sand 2 Medium sand 0	Size (mm) Size (mehes) 3300 -12 510 300 3 10 12 910 75 3/4 0 3 175 10 19 3/16 10 3/4 176 10 176 17/16 0 3/16 1775 10 425 2 1 1/16 10 3/16	Persentages of a said, and fines stated, and fines stated as terms indicating a said percentages at a Trace Few Little Some
SILT	guid fimit <50	nan clays Organic sits and norganic sits, m norganic stays o	clays of low categors or a high plastic	plasticity distorranceus fine sa	QL.	very hard >60		Absence of moislure, dry to tou	ch VVeak	Field Test Crumples or breaks with the		Mostly  Depth to first water (time and care)  Depth to vision afti

(	20	ntec	- 4	lient: GE - United Nuclear Corporation roject Number: 233001076	SOIL BO	ORM Sheet L1 of S
rillers (da	mpany: Cascade sy / night): S. Lorr esentative (day /	, A. Rodrigue	z, J. Vigue	Drilling Rig: CME LAR 75, CME 85 (below 35')  Bit Type: 4.25" I.D.,  Drilling Method: Hollow Stem Auger  Logged by: C. Fritz	8" O.D. Auger	Start Date: See She Finish Date: Total Depth:
Depth	Sample Number	ount ary (in.)	q <sub>u</sub> (tsf) Lithology / Symbol	Description	Graphic	Remarks
	60' A	9 11 13 54	ML	Sandy silt (ML), few clay, reddish brown, he moderate cementation	xb, 111111111111111111111111111111111111	
	66' B	24 X 20 23	ML	Silf (ML), little day (weathered shale), few san	11111111111	
	69' Bag	1	A11		1,1,1,1,1,1,1	
	70' B	33 7	MU	Same as above, trace gravel	11111111	
	75' A 75' B	6 X	ML	AFILI Sandy silt (MI) (native), light brown, slo moist, stiff	hwy -	
		40		⇒Few clay	11(1)111	
	ISSA SANDS STANDS STAND	roody-graded grave hity gravels, poorly of layer gravels, poorly hel-graded sands of cody-graded sands inty sands poorly gravely layer sands poorly gravely herganic sets very fire	is gravel sand of raded gravels, y graced grave pravely sands, gravely sands aded sand-gravel graded sand-gravels seeds sand-gravels	Seand carry institute	5 0-7 2 7-18 87 18-51 60 51-86 0 > 86 0 18-51 60 \$ 1-86 0	m Size (mm) Size (inches)  Idders > 300 > 12  Ibbles 75 to 300 3 to 12
5 11	rs AND CLAYS	Property sits and clay	oous or diatoma hiplashoty, fat o s of modum to	desus the sand or set MM Note State	Term Field Te Work Crumble Moderate Crumble Strong Weiner	st Union of breaks with handing or signifyinger pressure be or breaks with considerable finger pressure to considerable finger pressure to the break to the considerable of the state of th

Orilling Cor	Sta mpany: Cascade	e Drillin	q		Pro	ient: GE - United Nuclear Corporation  oject Number: 233001076  Drilling Rig: CME LAR 75, CME 85 (below 35')	Bit Type: 4.25" I.D., 8" O	LO	BORING FORM	Sheet S of 5	٠,٠
Orillers (da ield Repre	y / night): S. Lomesentative (day /	n, A. Ro night):	odrigu			Core Diameter: 4.26 inch	Logged by: C. Fritz			Finish Date: Total Depth:	
Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description		Graphic		Remarks	
Ť	80' A	6				Same as above		=			
	80'B	77						E			
	30 0	t			+	EOB @ 81.5'		-			
						500 (1.0)		1			1
											150
								-			2
								1			- 5
ā		ľ									1
								1			É
								1			1
								1			1
2								4			d
								3			100
								1			0.00
								7			-
								1			
								1			
											-
								1			
								1			13
	1										
								1			100
								1			-
					Ш			-			-
								1			1
								1			8
								1			1
											3
GRAVE <50% coa fraction par #4 slevi	GRAVELS	Poorly-grad Sitty gravol Clayey gra	ed grav s. poorly- ress. poo	grased- grased- rly-grade	of-sand m gravel-sar gravel-	unes, lettle or no fines	very loose 0-4 0-5 0-1		Boulders Cobbles	75 to 300 3 to 12	rcentages of the find in term incating a re-
SAND: <50% cos fraction par #4 sieve	S SANDS I	Nell-grade Poorly-grad	ed sandt	gravely a grave	sands, litt ly sands.	te or no fines SW 0 of 2-4 2-4 2 into or no fines SP 0 medium stiff 4-8 4-8	1-8 loose 4-10 5-12 7-1 medium dense 10-30 12-37 18-5 dense 30-50 37-60 51-6	RAIN RAIN	Fine gravel Coarse sand	4 75 to 19 3/16 to 3/4 Te 2 0 to 4 75 1/16 to 3/16 Tr 0/435 to 3/0 1/64 to 1/16	ece ew
SILT:	S AND CLAYS					very hard >60 >78 >	85 = 140 pound hammer drapped 30 mg	thes S	Fine sand Sitt / clay (fines)	0 075 to 0 425  0 003 to 1/64	tile pose osby
SILT:	S AND CLAYS guld limit >50	norganic s norganic c Onganic sit Peat, numu	s. and cu	gh plasto	diatomaci city, fat cla	coue fine sand or wit MH Note:  Set Well-graded = poorly soided by Paolity graded = well soided Well-graded = well-soided = well-soi	On Absence of moisture, dry to touch  Moist Damp, does not well palm	VVeak (	Trumbles or breaks with h Crumbles or breaks with b	andling or alight linger pressure considerable finger pressure with finger pressure	and date)

Besorption  Description  Remarks  Remarks  Description  Remarks  Remarks  Description  Remarks  Remarks  NL Sandy silt topseil (ML)  Sold Silv multive (ML), gray, slightly process) in sandy slightly maist, very slightly maist, very  Silv multive (ML)  Solve as above  ML Same as above  ML Same as above	Orilling Company: Cas Onllers (day/ night): S. Field Representative (o	Lom, A. Ro	drīguez, J. Vi	Drilling Rig: CME LAR 75 High Torque Track Rig pueria Drilling Method: Hollow Stem Auger Core Diameter: N A	Bit Type: 4.25" I.D., 8" O.D. Auger Logged by: C. Fritz	Start Date: 3   39   18 Finish Date: 3   39   17 Total Depth: 36.5
ML Weathwed shake (broken + flaky pieces) in sandy  Six matrix (ML), gray, slightly maist, very  Stiff, trace carbonates  10' A 8  10' B 19  ML Same as above	e Number		Recovery (in.)  Ju (tsf)  ithology / Symbol	Description	Graphic	Remarks
10' A 8 ML Same as above 10' B 19  ML Same as above, slightly less shale					1111111111	Trong to a train
15' A 12 ML Same as above, slightly less shale		13	^	- Weathered shale (broken + flaky p silt mutrix (ML), gray, slightly n stiff, trace carbonates	teres) in sandy	
1,5,0  19		16	M	Some as above		Principle of the state of the s
		19	M	- Same as above, slightly less shal		Standing Internal

Orillers (da	mpany: Cascade ay / night): S. Lon	n, A. Ro				8" O.D. Auger	Finish Date:
Depth Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf) Lithology / Symbol	Core Diameter: N / A  Description	Graphic	Total Depth:
	ao B	14		ML	Soudy silt (ML), little shale (moderately weathered pieces), mostly light brown with dorter shale, weak comentation, trace carbonates (less than above)		
	92, B	90		ML	Same as above, increased shale presence		Mostly sand in C (topmos liner, mixtures in A+B
						111111	
	30,8	10		SM	Silty sand (SM) (native), medium dense, transto few carbonates, slightly moist, light brown	Le way And	Improved soil structure, more uniform material whes shale + rock intermixed
	35'8	16 24		SS	Weathered soundstone bedruck, very stiff, doors grave EOB @ 36.5'	y	Rock in A liner @ 36'
and francisch approximate						***	
GRAVI  SONS constraints of the state of the	GRAVELS	Pacify-grad Sity graves Clayey grav Well-grades	os gravel poorly gr ols poorly sands g	s. gravel-sandad gravel- graded gravel- graded gra- ravelly sands	Term   CP   Term	0-7 7-18 7 18-51 0 51-86	Term   Size (mm)   Size (inches)   Forcest

Drilling Cor	mpany: Cascade	nte			Project Number: 233001076  Drilling Rig: CME LAR 75 High Torque Track Rig	Bit Type: 4.25" I.D., 8" O.D	LOC	BORING ST	neet of	2711
Drillers (da ield Repre	y/ night): S. Lon esentative (day /	n, A. Roo night):	drigue	-	Core Diameter: 4.95 Inch	Logged by: C. Fritz			Finish Date: 3 1 Total Depth: 3	9 Ff
Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf) Lithology / Symbol	Description		Graphic	F	Remarks	
	5' A 5' B		×	W	Silt (ML) and shale mixtures, few interlayered light + dark brown, cementation, slightly moist > mostly shale	to little sand, stiff, moderate				Transamba ana basa an
	10, B	14 17 16	**************************************	MI	->mostly shale  Sandy silt (ML), moderate commental  -> Few shale, still mostly silt	Non, little shale				بيبيئينا بيونيساليسينينانين
					-> clayey					condininh
	15' A 15' B	7 9 10	*	ML	Same as above, trace gravel, less	day	11111			milan
			48				111111			andreni bren
GRAVE  GRAVE  GRAVE  GO coa  action  SO% coa  fraction pai  #4 clev.	GRAYELS  SANDS  SANDS  SANDS  SANDS  SANDS  AND CLAYS  quid limit <50	Poorty-grade bity gravels. Clayey grave Well-graded Poorty-grader Litty winds. c	d grave poorly-g is poor sands, d sands corry-gri poorly- sivery-fir ys of low	is, graver-san raded grave r-graded gra- gravelly sand- gravelly san aded sand-g- graded sand- graded sand- to med-um p	Term   (SPT)   BlowsiT   (mod/CA   SPT)   BlowsiT   (mod/CA   SPT)   BlowsiT   (mod/CA   SPT)   BlowsiT   (mod/CA   SPT)   SPT)   SPT   SPT	very loose 0-4 0-5 0-7 1006e 4-10 5-12 7-18 medium dense 10-30 12-37 18-51 dense 30-50 37-60 51-86 very dense >50 >60 >86	Signary Due spues) Alishad GRAIN SIZE	Fine grayel 4 75 to 19 Course sand 2 0 to 4 75 Medium sand 0 425 to 2 Fine actid 0 075 to 0 Sit clay (times) <0 075	3 to 12 3/4 to 3 3/16 to 3/4 1/16 to 3/16 0 1/64 to 1/16 425 0003 to 164 < 0.003	trountages of and faret safed in lerms deading a run recentages as ferm frace ew ittle come fastly the fast value and date)

Stantec	Client: GE - United Nuclear Corporation Project Number: 233001076	SOIL BORING BOREHOLE NO. TIO -5 LOG FORM Sheet 2 of 2
rilling Company: Cascade Drilling rillers (day / night): S. Lom, A. Rodriguez, J. \ ield Representative (day / night):	Drilling Rig: CME LAR 75 High Torque Track Rig  Bit Type: 4.25"   D., 8" C  Ingueria Drilling Method: Hollow Stem Auger  Core Diameter: 4.85 \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	D.D. Auger Start Date: See Shee Finish Date: Total Depth:
Depth Sample Number Blow Count Recovery (in.)	Description  Description  L Silt (ML), few sand + clay, light brown/tan,  slightly moist, very stiff	Remarks
50		
25' A 6 8	11-Same as above	
50/pource		
	EDB @ 29'	Auger Prefusal
GRAVELS GRAVELS Wipil-graded gravels gravels  450% coarse with 101 is as been Psorty-graded gravels, gravels	Term	

Drilling Company: Cascade Drilling Drilling Rig: CME LAR 75 High Torque Track Rig Bit Type: 4.25" I.D., 8" O.D. Auger Start Date: 3 1391	Stanto	ec	Client: GE - United Nuclear Corporation Project Number: 233001076	SOIL BORING BOREHOLE No.: TID - 6
Description  Description  Description  Description  Description  Remarks	rillers (day) night): S. Lom, A. Ro	odriguez, J. Vig	Drilling Rig: CME LAR 75 High Torque Track Rig Bit Type: 4.25" l.D., ueria Drilling Method: Hollow Stern Auger Logged by: C. Fritz	8" O.D. Auger Start Date: 3 29 1 Finish Date: 3 29
ML Sith with sand (ML), little clay (weathered shale), slightly moist, gray I brown, very stiff  ML Same as above  5'A 16 19  ML Same as above  Fill Sondy sitt, little clay (ML), notive, light brown, slightly moist, stiff  55 Sandstone bedrock, light brown, very dense	e Number	(in.)	Provintion	Remarks
Jo'A 8 10 Sandy silt, little clay (ML), notive, light brown, slightly mass, stiff  55 Sandstone bedrock, light brown, very dense			SiH with sand (ML), little clay (weathered shall slightly moist, gray I brown, very stiff	
10' A 8 Sandy silt, little clay (ML), notive, light brown, slightly mothy, stiff  55 Sandstone bedrock, light brown, very dense	5'A 16		-Same as above	
55 Soundstone bedrock, light brown, very dense		- M	JFILL Sandy silt, little clay (ML), notive, light bro	
	50/	4"	EOB @ 15.33'	
GRAVELS ORANELS Well-graded gravely, gravel-sand matures, little or no fines OW (mode/AL) Term (SPT) Blows/ft (mode/AL) Term (SPT) Blows/ft (mode/AL) Term (SPT) Blows/ft (mode/AL) Term (SPT) Term (SPT) Blows/ft (mode/AL) Term (SPT) Blows/ft (mode	ARREST ANNUAL WITH SIDE OF NO SANS   POORTY-GER	dod gravels gravel-sa	nd matures little of no times GP Term (SPT) (modCAL) Term (SPT)	(modCAL) is

Orilling Company: Cascade Orillers ((ay) night): S. Lon ield Representative (day /	n, A. Rodriguez, J. V	Drilling Rig: CME 85 Truck Rig gueria Drilling Method: Hollow Stem Auger Core Diameter. N A	Bit Type: 4.25" I.D., 8" O Logged by: C. Fritz	.D. Auger	Start Date: 4 / 3 / Finish Date: 4 / 3 / Total Depth: 35 f
Depth Sample Number	Blow Count Recovery (in ) qu (tsf)	Description		Graphic	Remarks
	S	4 Silty sand topsoil (SM), few pieces, brown, slightly mo	weathered shale		
5' A 5' B	23 25 25	MSilty sand (SM) and weathered gray, downse of wealthy ceme trace carbonates	d shale, brown t nted, slightly most,	- 000 8-870 8-18-18-18-18-18-18-18-18-18-18-18-18-18	
10' A 10' B	10 01	IL Sandy silt (ML), few shale stiff, slightly moist	pieces, brown, very		
15' A	15 16 17	brown + gray, slightly mo	ale + sandstone, let, very stiff		
SANDS	Verl-graded gravels, gravel-sa Foothy-graded gravels, gravel- try gravels, poly-graded gravels, gravel- try gravels, poly-graded gravels, gravely gravels, gravely graded sand, gravely gravels, gravely graded sand, gravely gray graded sand, gravely graded sand, gravely	Application   Application	OWS/R* (modCAL) 20*10 25*10  0-2 0-2 4-24 4-8 4-8 9-17 9-18 19-17 39-18 20*10 25*2  14-10 20*10 25*2  14-10 20*10 25*2  14-10 5-12 7-11  medium danse 1-0-30 12-37 5-18  dense 30-50 37-60 5-18  very dense 50 > 50-80  very dense 50 > 50-80  very dense 50 > 60-80  very dense 60-80  very	Cobbles Coarse gravel Fine gravel Coarse sand	Size (invm)   Size (inches)   Size (inches)

() Stantec	Client: GE - United Nuclear Corporation  Project Number: 233001076	SOIL BORING BOREHOLE No.: TS-   LOG FORM Sheet 2 of 2
Drilling Company: Cascade Drilling Drillers (day) night): S. Lom, A. Rodriguez, J. Vi Field Representative (day / night):	Drilling Rig: CME 85 Truck Rig  Bit Type: 4.25" I.D., 8" O.  guerna Drilling Method: Hollow Stem Auger  Core Diarneter: N A  Bit Type: 4.25" I.D., 8" O.  Logged by: C. Fritz	D. Auger Start Date: See Shee Finish Date: Total Depth:
Depth Sample Number Blow Count Recovery (in.) qu. (tsf)	Description	Graphic Remarks
90' A 30' A'		
25' A 8 15 25' B 14	Silty sand (SM) (native), medium dense, slightly moist, trace carbonates, light brown	
30, C 34 /8	Same as above  Weathered sandstone bedrock	
	EOB @ 35'	
		1   1

V	Sta	TLE	3C		Project Number: 233001076	LOG FOR	
rillers (day)	any: Cascade night): S. Lom	A. Ro		z, J. Vig			Start Date: 4 2 18 Finish Date: 4 2 18
eld Represe	entative (day / r	night):		Symbol	Core Diameter: 4.35 Inch		Total Depth: 36.5 f
Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf) Lithology / Sy	Description	Graphic	Remarks
			1		Sandy silt topsoil, few clay, brown wispects of gray, slightly moist, loose		1411111
			38				1
				SM	Highly weathered sandstone + silty sand (SM mostly broken rock, gray + brown - trace moderately weathered rock	9' S.	
	5'B	13	*				
		9	39				
						1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
	10' A	15	*	SN	Weathered sandstone + shale, brown wisome gr iron staining, sitty	<b>w</b> , = 0.	
			49		-> mostly sound a silt (less rock)		
	\5' A	11	*	SM	Silty sand (SM), few to little weathered shall to sandstone, increased comentation of sand few earbonates	e	, India
			53 1				dronta
GRAVELS  450% cearbe fraction passes #4 serve  SANDS  <50% cearse fraction passes	GRAVELS SI GRAVELS SI attact to Arms Ca SANDS W	ony-grad ny graveh ayey grav en-grades	ed grave i, poorly-g elli, poorl i sandi,	in gravol-sar radod-grava y-gradod gra y-avelly sand	Term   SPT   Blows   Term   Term   SPT   Blows   Term   Term   SPT   Blows   Term   Term   SPT   Blows   Term   Term	Boulders 5 0-7 S B Cobbles Cobbles Coarse of	4.75 to 19 3/16 to 3/4 7 Term 9

( Sta	antec	Client: GE - United Nuclear Corporation			OREHOLE No.: 75 -
illing Company: Casca illers (day / night): S. Lo	de Drilling	Project Number: 233001076  Drilling Rig: CME 85 Truck Rig  Vigueria Dnilling Method: Hollow Stern Auger	Bit Type: 4.25" I.D., 8" O.D. A Logged by: C. Fritz		Start Date: See Si
Depth Sample Number		Core Diameter: 4.35 Inch    Description   Core Diameter: 4.35 Inch   Descripti	tion	Graphic	Total Depth:
90, C	V A	Same as above SS Highly weathered sandstone, (darker patches, possibly we cemented, considerable from easily along horizontal plan	gray, some fines eathered shale), weakly staining, breaks nes	Topseil In	C (top) liner, N-B + A
as' A	18 X 29 19	SS Same as above			
30, B	8 * 7 6 14	SS Same as above			
	30 23 81	SS Same as above		Initially had @ 33'. Drev were able to 35'. No saw	auger refusal e sampler then continue to ples collected en rock.
	13 15 10	SS Same as above	61	due to broke	en rock.
			g. J		
GRAVELS  GRAVELS  GRAVELS  GRAVELS  SANDS  S	Poorly-graded gravols gra- Say gravels, poorly-graded Clayer gravels, poorly-graded Wed-graded sands, graves Poorly-graded sands, gravel Say sands, poorly-graded Clayery sands, poorly-graded Incidence of the yory-free san	the gravinsand-day matures (GC) 22 2 Very son U.  sands, titilitie or no fines (SW) 32 5 on 1 2 signatures (SW) 35 on 1 2	70 2010 2510 16111 1410 2010 2510 6 77 0-2 0-2 very loose 0-4 0-5 0-7 1624 2-4 2-4 100se 4-10 5-12 7-18	Teim   Size (mm   Si	>12 3 lo 12 3/4 lo 3 9 3/16 lo 3/4 5 1/16 lo 3/16 2 0 1/84 lo 1/16

	C	Sta	nte	<b>ec</b>			lient: GE - United Nuclear Corporation roject Number: 233001076			BORING G FORM	BOREHOLE N	10 TS - 3 of 2	,
1	Drillers (day	pany: Cascade night): S. Lom sentative (day /	, A. Ro	drígu	ez, J.	∕igue	Drilling Rig: CME 85 Truck Rig  Drilling Method: Hollow Stem Auger  Core Diameter: N A	Bit Type: 4.25" I.D., 8" O Logged by: C. Fritz	D. Auger		Start Dat Finish Da Total Dep	e: 4   1   18 ate: 4   2   1 oth: 31.5	8
	Depth	Sample Number	Blow Count	Recovery (in.)	q <sub>u</sub> (tsf)	Lithology / Symbol	Description		Graphic		Remarks		Well Details
3						۸۲	Sandy silt/silty sand topsoil						
4		5' A 5' B	30 34 36		1	ΛL	Mostly silt, little weathered sandston growel. (ML). Brown, slightly moi:	e + shale, trace st. Few sand.					
10		10, B	16 30 33			ML	Same as above						
14 16 -		15' A 15' B	15 21 39		j	41-	Weathered shale, sand, + silt mixture	es.Mostly silt (Mì					
18-							↑Fill above ~20'						
۵U -	SILTS SILTS	GRAVELS SANDS SANDS SAND CLAYS III IIII III III III III III III III	looily-grad lity-gravels lity-grades Vell-grades layey-sands, layey-sand norganic sit oan clays organic sit norganic sit norganic sit norganic sit norganic sit norganic sit norganic sit	ed grave poorly els good sands ed sands ed sands ed sands flavery ays of its sand cla ays of to a and cla	practice of the practice of th	design of the control	The same of the sa	1.4" D 2010 25	DENSITY DENSITY OF THE PROPERTY OF THE PROPERT	Boulders × Cobbles 7 Coarse gravel 1 Fine gravel 4 Coarse sand 2 Medium sand 0 Fine stod 0 Sit (slay (fines) <		James and head of the ment of	% <5 5-10 15-25 30-45 50-100

Stantec	Client: GE - United Nuclear Corporation Project Number: 233001076	SOIL BORING BOREHOLE No.: TS -3 LOG FORM Sheet 2 of 2
Onlling Company: Cascade Drilling Onlliers (day) night): S. Lorn, A. Rodriguez, J. Vi rield Representative (day / night):		25" I,D., 8" O,D. Auger C. Fritz Start Date: See Shee Finish Date: Total Depth:
Depth Sample Number Blow Count Recovery (in )	Description	Remarks
30, 8 14 30, 8 14	Weathered sandstone, light grow wheel + or oxidation	range Native @ ~20'
35' A 34 33	5 Same as above, but darter gray/black. Still grathed but possible shale influence (?)	coarse -
30' A 14 20	Sandstone, highly weathered, gray EOB @ 31.5'	
		-
GRAVELS Solve coarse Factor pasco Ad socie SANDS SOLve coarse SANDS SOlve coarse SOlve coarse SANDS SOlve coarse Solve coa	and mindures, title or no fines	Term   Size (mm)   Size (inches)   Percentage   Size (inches)

This Company Contact Drilling  The C	Stantec	Client: GE - United Nuclear Corporation Project Number: 233001076		SOIL BORIN		•
Description  Remarks  Description  Description  Remarks  To A 33  51 A 33  51 B 35  Dense as above  Superhard Sandstone, Few Fives (weathered shale through the shale through through through through through the	ers (day) night): S. Lorn, A. Rodriguez, J. Vi	ueria Drilling Method: Hollow Stem Auger		D. Auger	Finish Date: 4	11/18
Strange as above  5' A 37  5' B 35  Source as above  10' A 13  10' B 33  Source as above  5' B 33  Source as above  5' B 33  Source as above  15' A 15	Sample Number Blow Count Recovery (in.) qu (tsf)	Description	weathered shale			3,45
5'B 35  10' A 13 10' B 23  SC Dense sand wickey + gravel (SC), brown, slightly moist  moist  SS Weathered sandstone, few fines (weathered shale to still) mixed in brown + gray, iron statuting  SS Weathered sandstone + gray, iron statuting  Same as above	5/	trace growel & sandstone precessingly moist	es, light brown,			
SS Weathered Sandstone, Few fines (weathered shale to silt) mixed in , brown + gray, iron statuting  15' A 15 15' B 19  Same as above	5 A 27	Same as above				
15' A 15 16'B 19  Same as above	IND	Dense sand willow & gravel (	(SC), brown, slightly	2	. I took wine	ative
15 7 19	S		res (weathered shale y, iron statutng	Estima	Heo william	-
	15'B 19	Same as above				_

(	Sta	nte	ec		Client: GE - United Nuclear Corporation Project Number: 233001076				BORING G FORM	BOREHOLE No	-
Orillers (da	ompany: Cascade ay / night): S. Lor	n, A. Ro	drigu		Drilling Rig: CME 85 Truck Rig ueria Drilling Method: Hollow Stem Auger		Bit Type: 4.25" I.D., 8" C Logged by: C. Fritz	.D. Auger		Finish Date	
Depth	esentative (day )	Blow Count (146iu	Recovery (in )	q <sub>u</sub> (tsf) Lithology / Symbol	Core Diameter: N/A	ption		Graphic		Total Depti	n:
	90, Y	98		55	Same as above		Name and Add	=		D	. =
	30'B	50/6		2H	Moderately weathered sha	Te			shak ste	Ating in B	liver =
		cal						teriores.			milimi
		50/	3"		EOB @ 95	. 25'		- 1111			
								1			-
								and trans			41411
								فيتملقينا			en et en en
								4111111111			111111
								لمتنظيفينا			111111111
- - - - -								مستطيعتا			4114
-								ينديه التجيدات			41144
g. GRAV		Woll-grade	d gravel	a graval sand	s mahures, little of no fince: GW	Blown (mod Cal	Term (SPI) (max	544	Term 3	ize (mm) Size (inch	es) y Porcertages of
SAN SOME OF BRACKET SAN SOME STAN STAN SOME SAN	ORAVELS ON SANDS  ESTIMATE  ASSUMBLE OF THE SANDS  ASSUMBLE OR	Priory-grade Sitty graves Clayey gra- Wolf-grade Poory-grad Sity sands Clayey san Inorganic si	ted grav a poorly vels poo d sanos bod sano poorly-g ds poor	ere gravel-sa graded grav rig-graded or gravelly sand is gravelly sa graded sand- y-graded sand- y-graded sand- se sands an	mel marques, lote or no fines gleand-dut metatures grave-sid metatures gleand-dut metatures g	(SPT) (madCAL 14"ID 2 0"ID 2 5"ID 0-7 0-7 0-2 0-2 2-4 2-4 2-4 4-8 4-8 4-8 6-15 9-17 9-18 15-30 17-39 18-42 3-60 3-78 42-55 5-60 >78 >85	very loose 0-4 0-5 0 100se 4-10 5-12 7- medium dense 10-30 12-37 18 dense 30-50 37-80 51- very dense >50 >60 >6	DENSITY DENSITY 866 66	Cobbles 7 Coarse gravel 1 Fine gravel 4 Coarse sand 2 Medium sand 0 Fine sand 0	300 +12 5 to 300 3 to 12 9 to 75 3/4 to 3 75 to 19 3/16 to 3/4 0 to 4 75 1/16 to 3/1 425 to 2 0 1/64 to 1/1 0 75 to 0 425 0 003 to 1/1 0 0075 0 003 to 1/1	Term Trace Few
SIL	TS AND CLAYS	Organic sill Inorganic si Inorganic sill Organic sill	its, mica lays of hi is and cli	gh plashofy, t sys-of modeum	ornaceous fine sand or sitt MH Note	Nonplastic # Tei	The Absence of moisture, dry to touch ist Damp, does not well palm it Visible Free Water	Term VVesk Moderate	Field Test	ndling or slight linger pressure nsiderable linger pressure	Depth to first water  Depth to water after  Depth to water after  Eme and date)

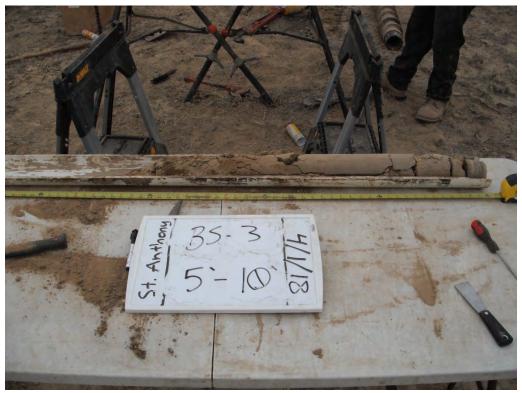


#### **Attachment C. Photos**





Photograph 1. BS-3: 0' (left) to 5' (right) bgs



Photograph 2. BS-3: 5' (left) to 10' (right) bgs





Photograph 3. BS-3: 10' (left) to 15' (right) bgs

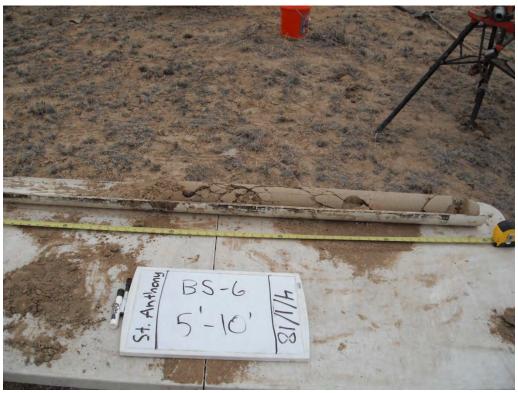


Photograph 4. BS-5: 0' (left) to 5' (right) bgs





Photograph 5. BS-6: 0' (left) to 5' (right) bgs



Photograph 6. BS-6: 5' (left) to 10' (right) bgs





Photograph 7. BS-6: 10' (left) to 15' (right) bgs



Photograph 8. BW-1: 0' (top left) to 10' (bottom right) bgs





Photograph 9. BW-1: 10' (top left) to 20' (bottom right) bgs



Photograph 10. BW-1: 20' (top left) to 30' (bottom right) bgs





Photograph 11. L1-1 (all cores): 0' (bottom left) to 20' (top right) bgs



Photograph 12. L1-5 (all cores): 0' (bottom left) to 20' (top right) bgs





Photograph 13. L2-4 (all cores): 0' (bottom left) to 20' (top right) bgs







Photograph 15. P1-1 (all cores): 0' (bottom left) to 20' (top right) bgs



Photograph 16. P1-1A (all cores): 20'-30' (bottom two boxes) & 30'-35' (top box) bgs





Photograph 17. P3-2: 0' (left) to 5' (right) bgs



Photograph 18. P3-2: 5' (left) to 10' (right) bgs





Photograph 19. P3-2: 10' (left) to 15' (right) bgs



Photograph 20. P3-2: 15' (left) to 20' (right) bgs





Photograph 21. P3-2: 17.5' (bottom left) to 45' (top right) bgs



Photograph 22. P4-7: 0' (left) to 5' (right) bgs





Photograph 23. P4-7: 5' (left) to 10' (right) bgs



Photograph 24. P4-7: 10' (left) to 15' (right) bgs





Photograph 25. P4-7: 15' (left) to 20' (right) bgs



Photograph 26. P4-7: 20' (left) to 25' (right) bgs





Photograph 27. P4-7: 25' (left) to 30' (right) bgs



Photograph 28. TN-2 (all cores): 0' (bottom left) to 30' (top right) bgs





Photograph 29. T/O-3: 0' (top right box) to 35' (bottom left box) bgs



Photograph 30. T/O-3: 35' (top left) to 80' (bottom right) bgs





Photograph 31. T/O-5 (all cores): 0' (bottom left) to 29' (top right) bgs



Photograph 32. TS-2 (all cores): 0' (bottom left) to 30' (top right) bgs



# **Attachment D. Daily Field Reports**



Date Mon, 3/26/2018

PROJECT: St. Anthony Mine													
JOB NO: 233001076		Weather	. 🗀	Bright Sun	t	□ Sun	ny	⊠ O\			Rain		Snow
CLIENT: United Nuclear Corpora		Гетр. °F		<32		32-50	$\boxtimes$	50-70	□ <b>7</b>	0-85	□ 85- 100		□ >100
CONTRACTOR: Cascade Drillin	ng	Wind		Still		⊠ Mod	er.	☐ Hig	ıh	Rep	ort No	•	
PROJECT MANAGER: Melanie	Davis	Humidity	'	Dry		⊠ Mod	er.	☐ Hui	mid			1	
Onsite Personnel													
Name	Company				Dog	sition				_	Remar	·kc	
Cameron Fritz	Company Stantec					ingine	ar			<u>'</u>	\CIIIai	NO	
Rob Murphy	Cedar Creek	,				cientis							
Arnold	Cascade	,				Supervi		.					
Sopotyn Lorn	Cascade					iller	1301						
Anthony Martinez	Cascade					lper							
Joey Vigueria	Cascade					lper							
Joey Vigueria	Oascade				1 10	прст							
Equipment													
Item				Com					0	p Hr	S		
CME LAR 75 track rig w/ho	llow stem auger			Caso	cad	le							
Safety:													
No incidents reported													
Activities Summany													
Activities Summary:													
First day of St. Anthony work. I then met Breanna Van (Stanted Patel (AVM) for rad and site sain the Lobo Tract borrow area, deep.	c) and followed her fety training. After fi	to the Sit nishing tı	te. V raini	Ve arr ing at	ive 10	d at 8a :30, we	am e m	and moved	net w to th	ith N e firs	lat and st drilli	d V ng	ictor location
After completing L1-1, we move and completed drilling to 20' at leave and were off-site by 5:15	4:30. After frisking t												
Total depth drilled: 60 ft Total depth cored: 40 ft Total CA brass liner samples co	ollected: 17												
	By: C. Fr	itz					Title	e: Fie	ld Fr	naine	er		



Date Tue, 3/27/2018

PROJECT: St. Anthony Mine				1	1		1	
JOB NO: 233001076		Weather	Sun		-	ast	⊠ Rain	⊠ Snow
CLIENT: United Nuclear Corpora	ation	Temp. °F	□ <32	⊠ 32-50 □			0-85 🗆 85- 100	
CONTRACTOR: Cascade Drillin	ng	Wind	☐ Still	⊠ Moder.	,		Report No	•
PROJECT MANAGER: Melanie	Davis	Humidity	□ Dry	☐ Moder.	⊠ Hu	mid		1
Onsite Personnel								
Name	Company			osition			Remar	rko
	Company						Remai	IKS
Cameron Fritz	Stantec	1.		d Engineer				
Rob Murphy	Cedar Cree	K		Scientist				
Arnold	Cascade			Superviso	r			
Sopotyn Lorn	Cascade			Driller				
Anthony Martinez	Cascade		ŀ	Helper				
Joey Vigueria	Cascade		ŀ	Helper				
Equipment								
Item			Comp	any		О	p Hrs	
CME LAR 75 track rig w/hol	llow stem auger		Casc					
Safety:								
No incidents reported								
Activities Summary:								
Arrived to site at 7:10am and his support trucks back onto the rothen moved to L1-4 location, ar The drillers then went to retriev hole. Drilling was completed at across the arroyo to the L2 hole blocked access to the borehole topsoil/overburden pile. Rob an	ad before additionand drilling began at the flatbed truck 11:00 after drilling es. However, upon a locations on the e	al rain can 8:30. Afte to prepare to 20' and arrival at ast side o	ne and ma er drilling to e for loading the rig wo the L2-1 lo f the arroy	ade it too m o 20' at 9:1 ng up the riq as loaded u ocation, we vo. As a res	uddy a 5, the g to m ip onto disco ult we	and d rig w ove a o the vered mov	lifficult. The ras moved areas after flatbed to d a cattle fe ed on to th	e rig was to L1-3. the next move ence that ne nearby
Drilling began at 1:10 at T/O-3 we had to stop work due to ligh refusal (and a 50-for-bounce m	tning. After a 1-hr	delay, wor						
At 4:30, the rig was moved to T frisking all persons and trucks f					rt first	thing	tomorrow	v. After
Total depth drilled: 69 ft Total depth cored: 29 ft Total CA brass liner samples co	ollected: 21							
	By: C. F	ritz		Title	e: Fie	ld Er	ngineer	



Date Wed, 3/28/2018

PROJECT: St. Anthony Mine								
JOB NO: 233001076	Weather	☐ Bright Sun	⊠ Sunny	□ Ove	· I—	Rain	☐ Snow	
CLIENT: United Nuclear Corpor	ation	Temp. °F	□ <32	□ 32-50 🗵	50-70	□ 70-85	□ 85- 100	□ >100
CONTRACTOR: Cascade Drilli	ng	Wind	☐ Still	⊠ Moder.	☐ High	n Rep	oort No.	
PROJECT MANAGER: Melanie	Humidity	⊠ Dry	☐ Moder.	□ Hum	nid	1		
Onsite Personnel								
Name	Company	r	Р	osition			Remark	(S
Cameron Fritz	Stantec		Field Engineer					
Rob Murphy	Cedar Cree	ek	Soil Scientist					
Arnold	Cascade		Drilling Supervisor					
Sopotyn Lorn	Cascade		Driller					
Anthony Martinez	Cascade		Helper					
Joey Vigueria	Cascade		H	Helper				
Equipment								
1								
Item			Comp	any		Op Hr	S	

#### Safety:

No incidents reported

#### **Activities Summary:**

Arrived to the rig at 7:15am and had safety tailgate. After our meeting and warming up the rig, drilling began at T/O-3 and 8:20. Drilling continued until 10:15 before encountering mechanical issues with the rig. The transmission partially broke down, resulting in 2<sup>nd</sup> and 4<sup>th</sup> gears being the only functional gears. While Arnold went to make a phone call to determine a course of action to fix the rig, the rest of us drove to the top of pile 4 to evaluate the possibility of using a full-size truck rig to access and drill the upcoming locations. Soap said his truck rig would be much faster for drilling the holes throughout the site, and should be able to access all of the locations, other than the 3 northernmost holes on pile 4, which appeared to be blocked by erosion channels that were too deep to drive (or even track) over. We'll need to discuss with Ricky Spitz how to access these locations.

After returning to the rig at 11:45, Arnold was there already and said he would be taking Jose back to Arizona to retrieve the full-size truck rig. They left the site, with the intention to return with the truck tomorrow morning. Soap noted he would have brought the truck rig from the start had he known the true nature of the terrain on site, however he was told a track rig would be required. We discussed and agreed that a pre-job site visit would have solved many of the problems we encountered today, as the track rig was clearly not the best option for this job.

At noon, I drove back up to pile 4 to find cell phone service and call Jason Cumbers (Stantec) to discuss the day's events. We decided we would go ahead with bringing in the new rig and would discuss additional costs at a later date with Cascade.

Drilling resumed at T/O-3 at 12:30, though speed and power were limited due to the lack of a fully functional transmission. After sampling at 35', Soap stopped drilling because the rig lacked enough power to drill deeper without the risk of the auger getting stuck. We then walked around the remaining T/O holes to determine how to proceed with the track rig. It was decided to leave T/O-3 at 35' and finish it when the truck rig arrives, and in the



meantime to move to T/O-2. This hole is estimated to involve only 25' of drilling and thus will be doable with the
track rig. Also, this location would not be accessible with the truck rig. Drilling started at 2:15 and was completed
at 3:30 after drilling into shale bedrock at 25'. All parties left the site at 4:30pm.

Total depth	drilled: 60 ft
Total depth	cored: 35 ft

Total CA brass liner samples collected: 12

Dv. C Eritz	Title: Field Engineer
By: C. Fritz	Title: Field Engineer



Date Thu, 3/29/2018

PROJECT: St. Anthony Mine						
JOB NO: 233001076	Weathe	er 🗆 Bright Sun	⊠ Sunny	□ Over- cast	□ Rain	☐ Snow
CLIENT: United Nuclear Corporation	Temp. °	F □ <32 [	□ 32-50 🗵	50-70 🗆 7	′0-85 □ 85 10	
CONTRACTOR: Cascade Drilling	Win	d Still	⊠ Moder.	☐ High	Report No	D.
PROJECT MANAGER: Melanie Davis	Humidit	y 🛭 Dry	☐ Moder.	☐ Humid		1
Onsite Personnel						
Name C	ompany	Po	osition		Rema	ırks
Cameron Fritz	Stantec	Field	Engineer			
Rob Murphy Ce	dar Creek	Soil				
	Cascade					
	Cascade	Н				
	Cascade	Н	elper			
Equipment						
Item		Compa	anv		p Hrs	
CME LAR 75 track rig w/hollow stem	auger	Cascade			7 7 1 11 0	
OWE EAR 75 tracking willollow stell	augui	Casca	iuc			

#### Safety:

No incidents reported

#### **Activities Summary:**

Arrived to the front gate at 7am, had safety tailgate at 7:45 after bathroom breaks. At 8:15, the rig was moved from T/O-2 to T/O-4 location and drilling was started. This hole was finished at 11:15 after drilling to 35'. Some extra time was involved due to stopping at 30' and 35' to examine surrounding terrain and our soil samples to determine if we had reached native soil at the bottom of the pile.

The rig was then moved to T/O-6 and drilling started at 11:45. This hole was completed after encountering native soil at only 10' depth, and sandstone bedrock at 15'. At this location, the pile is likely located atop a sandstone shelf similar to those in the surrounding area.

Soap and Anthony then left the site to go back to the casino for lunch and to contact Joey, who at the time was driving the truck rig from Phoenix to the site, for an ETA on his arrival with the rig. In the meantime, Rob and I drove up to scout pile 4 locations again to re-evaluate access for the truck rig. We were able to find a route that should allow the rig to reach all borehole locations atop the pile. We then went to evaluate access to the Topsoil North pile, and widened an opening in the road berm that should allow the rig to pass through and access the pile.

Soap and Anthony returned at 2:15 and we all proceeded to go evaluate most of the remaining borehole locations at piles 1, 2, and 3, as well as the Topsoil South pile. We returned to the rig at 3:15 and Joey still had not arrived, so Soap and Anthony loaded the track rig onto the flatbed and prepared it for transport back to Albuquerque, where the transmission will be worked on.

At 4:30, Joey finally arrived with the truck rig. All three drillers then began work setting it up and making mechanical adjustments to prepare it for drilling tomorrow. The finished up and left the site at 5:50 after being frisked for radiological contamination. I left the site soon after at 6pm.



Bv: C. Fritz	7 Title: Field Engineer	
Total depth drilled: 50 ft Total depth cored: 0 ft Total CA brass liner samples collected: 12		



Date Fri, 3/30/2018

PROJECT: St. Anthony Mine										
JOB NO: 233001076		Weather	☐ Bright Sun	☐ Sunny	□ O	ver- ast	□ F	Rain	☐ Snow	
CLIENT: United Nuclear Corpora		Temp. °F	□ <32	□ 32-50 □	50-70	□ <b>7</b> 0	)-85	□ 85- 100	□ >100	
CONTRACTOR: Cascade Drillin	ng	Wind	□ Still	⊠ Moder.	☐ Hig	gh	Repo	ort No.		
PROJECT MANAGER: Melanie	Davis	Humidity	⊠ Dry	☐ Moder.	□ Hu	ımid 1				
Onsite Personnel										
Name	Company		P	osition			R	Remark	(S	
Cameron Fritz	Stantec			l Engineer				Cilian		
Rob Murphy	Cedar Cree	L I		Scientist						
Sopotyn Lorn	Cascade	^		Driller						
Anthony Martinez	Cascade			Helper						
Joey Vigueria	Cascade			Helper						
Joey Vigueria	Cascade		Į.	leipei						
Equipment										
Item	Item			any		O	o Hrs	5		
CME 85 drill rig w/hollow	stem auger		Casc	ade						
Safety:										
No incidents reported										
Activities Summary:										
Arrived to gate at 7am, and to rup LAR track rig to make sure idrilling resumed at T/O-3 at 35 in the hole). Shortly thereafter, after drilling to 80 ft. The actual some time and came to different have to be revisited to make a	t was secure, then ft after the rig was Joey left to drive the depth of contact was conclusions. He	began pro aligned when track right with native	epping the rith the exing back to A remains f	e CME 85 tre sting hole a Albuquerque ully unknow	uck rion nd co e. T/O n, Ro	g for onections of the second	drillin ted to as fin d I dis	g. At 8 the a ished a scusse	Bam, ugers (still at 2pm ed for	
Around 2:45, Bryan Nydoske (0 discuss the work thus far. At 3: completed after drilling to 70 ft  Total depth drilled: 115 ft	15, drilling began a	it the near	by T/O-1	location and						
Total depth cored: 45 ft Total CA brass liner samples co	ollected:									
	By: C. F	ritz		Title	e: Fie	eld Er	ngine	er		



Title: Field Engineer

Date Sat, 3/31/2018

		Date	<b>Cat</b> , 0/0	172010					
PROJECT: St. Anthony Mine					1		ı		
JOB NO: 233001076	Weather	□ Bright Sun	⊠ Sunny	□ Ov		□ F	Rain	☐ Snow	
CLIENT: United Nuclear Corpora	ation	Temp. °F	□ <32	□ 32-50 🗵	50-70	⊠ 70	)-85	□ 85- 100	□ >100
CONTRACTOR: Cascade Drillir	ng .	Wind	⊠ Still	☐ Moder.	☐ Hig	h	Rep	ort No.	
		Humidity	⊠ Dry	☐ Moder.	☐ Hur	nid		•	1
PROJECT MANAGER: Melanie	Davis								
Onsite Personnel									
Name	Company	/	Р	osition			F	Remar	ks
Cameron Fritz	Stantec		Field	Engineer					
Rob Murphy	Cedar Cree	ek		Scientist					
Sopotyn Lorn	Cascade		I	Driller					
Anthony Martinez	Cascade		H	Helper					
Joey Vigueria	Cascade		ŀ	- Helper					
Equipment									
Item			Comp	anv		Or	Hrs	3	
CME 85 drill rig w/hollow	stem auger		Casca						
3	3.								
Safety:									
No incidents reported									
Activities Summary:									
Arrived on-site at 7am, had saf									
equipment to move areas, and									
(east of the arroyo) and began									
before moving on to L2-2. In th									
same conditions were encounted									
drilling began at L2-5, and was									
mechanical issue with the auto								-7 ther	n was
completed after 20' of drilling. T	he drillers then to	ok a 30 m	inute break	k due to wa	rm wea	ather			
At 2:30, the first hole with corin	a was begun at L3	2-6 and fin	siched afte	r 20' of cori	na ana	l cam	nnlin	a The	ria was
then moved to the other coreho									
sampling. We then moved over									
drillers. It was determined that									
both sides of the narrow pile. A									opes on
	, , ,		. ,						
The drillers left the site at 5:30p				reafter once	we ha	ad fin	ishe	d unlo	ading
core samples near the site entr	ance and covering	g with a tar	p.						
Total depth drilled: 130 ft									
Total depth cored: 40 ft									
Total CA brass liner samples of	ollected: 38								

By: C. Fritz



Date Sun, 4/1/2018

PROJECT: St. Anthony Mine										
		Weather		⊠ Sunny	□ Ov			Rain		Snow
JOB NO: 233001076		Temp. °F	Sun □ <32	<u> </u>	50-70		0-85	□ 85-	1	□ >100
CLIENT: United Nuclear Corpora	ation	remp. r		_ 32-30 A	30-70	□ <i>(</i>	0-03	100		_ >100
		Wind	⊠ Still	☐ Moder.	☐ Hig	h	Rep	ort No.		
CONTRACTOR: Cascade Drillir	ng				J					
PROJECT MANAGER: Melanie	Davis	Humidity	⊠ Dry	☐ Moder.	☐ Hur	mid			1	
				1	I					
Onsite Personnel										
Name	Company	′		osition			F	Remar	ks	
Cameron Fritz	Stantec	_		Engineer						
Rob Murphy	Cedar Cree			Scientist						
Sopotyn Lorn	Cascade			Driller						
Anthony Martinez	Cascade			lelper						
Joey Vigueria	Cascade		F	lelper						
Equipment										
Item			Compa			0	p Hr	S		
CME 85 drill rig w/hollow	ı stem auger		Casca	ade						
Safety:										
No incidents reported										
No incidents reported										
Activities Summary:										
-		7.45					TL	مد مالاداد	41	_
Arrived on-site at 7am, began										
refueled the rig and drilling and drilling 30' and encountering na										
completed at 10:15am.	ative soil. The fig w	vas illeli li	ioved to 11	<b>N-</b> 1 III III IE S	anie p	iie, a	anu i	15 UI C	11 111111	iy was
completed at 10.10am.										
At 10:30, we moved across the	site to the Borrow	South are	ea. Drilling	began at B	S-1 at	11.	and	contin	ued	until
bedrock was encountered at 15										
in the CA sampler just past 20'.										
completing BS-3, we decided n	ot to drill at location	on BS-4 du	ie to expos	ed bedrock	c at the	sur	face	in the	ger	neral
vicinity, which was of no interes	st to us in terms of	potential I	oorrow mat	terial. Ther	efore, v	we n	nove	d on to	b BS	S-5.
However, this location also had	I shallow bedrock,	resulting i	n only 5' of	f soil coring	j. BS-6	exh	iibite	d impr	ove	d
borrow materials, with 20' of co	ring completed an	id no bedro	ock encour	ntered.						
After a second of the final beautiful and		45						. 9		
After completing the final borro										
location TS-4. Drilling began at										
TS-3 and drilling was complete After 30 mins of work on the ha										
autohammer, which was still or									JK 11	y s
				<b>.</b>						
Total depth drilled: 160 ft										
Total depth cored: 70 ft	allogtod: FO									
Total CA brass liner samples co	Directed: 52									
	By: C. F	-ritz		Title	e: Fiel	ld Er	ngine	er		



Date Mon, 4/2/2018

		Date	101011, 172	./2010						
PROJECT: St. Anthony Mine			ī	T			1			
JOB NO: 233001076		Weather	☐ Bright Sun	⊠ Sunny	□ O	ver- ist	□ F	Rain		Snow
CLIENT: United Nuclear Corpor	ation	Temp. °F	□ <32	□ 32-50 🗵	50-70	⊠ 70	0-85	□ 85- 100		□ >100
CONTRACTOR: Cascade Drillin		Wind	□ Still	☐ Moder.	⊠ Hig	jh	Rep	ort No.		
PROJECT MANAGER: Melanie		Humidity	⊠ Dry	☐ Moder.	□ Hu	mid			1	
T TOOLOT WINTER TOOLING	Bavio									
Onsite Personnel										
Name	Company	/	P	osition			F	Remar	ks	
Cameron Fritz	Stantec		Field	Engineer						
Rob Murphy	Cedar Cree	ek		Scientist						
Sopotyn Lorn	Cascade		[	Driller						
Anthony Martinez	Cascade		F	Helper						
Joey Vigueria	Cascade			lelper						
, ,		I .			ı					
Equipment										
Item			Comp			O	p Hrs	3		
CME 85 drill rig w/hollov	v stem auger		Casca	ade						
Safety:										
No incidents reported										
The melderne reported										
Activities Summary:										
Arrived on-site at 7am, the drill	are than want to e	alvana tha	hammer n	art from the	۱ΔΡ	ria'e	ham	mar v	whil	ام
unloaded cores and buckets of										
The drillers then worked on atta										
10am, drilling was completed a										
Significant amounts of rock we										
determine whether the rock wa										
for such rocky material. The absteam. We took a break from 1								e noie	ar	ıa
Steam. We took a break from 1	1.45-12.15 to allow	w tile toolii	ig to cool i	Jeiore III IISI	iiig u	16 110	ic.			
Drilling then began at TS-1 at 1	1:20 after moving t	he original	location to	the top of	the ni	le ne	ar th	e road	d th	at
comes up from pile 1. The original										
35', again hitting rocky materia										
rock shelf, with topsoil material below.	pilea on the north	SIUE OI THE	s snen, abo	Jul OU IT ao	WII (O	uie f	ialive	grou	ııu	suriace
Delow.										
At 3:15, the rig was moved to le	ocation P1-3 and to	owered un	. However	. drilling wa	is not	starte	ed at	this l	oca	tion
due to an increase in wind spe										
(hard hats were being blown of										
radiation.	,, and an marriage	4.5 545564	ability loft	and only at t	J. 10 a		. J., 19		<i>,</i> u 1	<b>.</b>
Total depth drilled: 125 ft										
Total depth cored: 35 ft										
Total CA brass liner samples c	ollected: 30									
	By: C. F	Fritz		Title	e: Fie	ld Er	naine	er		
	<i>−,</i> . <b>∪</b> . i						ىى			



Date Tue, 4/3/2018

PROJECT: St. Anthony Mine												
JOB NO: 233001076		Weather	□ Brig Sun		⊠ Sunr	ny	□ O	ver- ist		Rain		Snow
CLIENT: United Nuclear Corpora		Temp. °F	□ <32		32-50		50-70	□ 7	0-85	□ 85- 100		□ >100
OLILIVI. Officed Nuclear Corpora	ation	Wind	□ Still		⊠ Mode	er.	☐ Hig	ıh	Rep		<u>l</u>	
CONTRACTOR: Cascade Drillin	ng								·			
PROJECT MANAGER: Melanie	Davis	Humidity	⊠ Dry		☐ Mode	er.	□ Hu	Remarks  Op Hrs				
Onsite Personnel												
Name	Company			Po	sition				F	Remar	ks	
Cameron Fritz	Stantec		Fie		Enginee	er						
Rob Murphy	Cedar Cree	k			Scientis							
Sopotyn Lorn	Cascade			D	riller							
Anthony Martinez	Cascade			Н	elper							
Joey Vigueria	Cascade				elper							
Equipment												
Item			Cor	npa	ny			0	p Hr	S		
CME 85 drill rig w/hollow	stem auger		Ca	sca	de							
Safety:							<u> </u>					
No incidents reported												
Activities Summary:												
Arrived to site at 7:10am, began Encountered numerous boulde Around 10am, Victor Patel (AVI drillers' working area. At this tin upcoming maintenance on the hole. Resumed drilling at 40' at continued grinding on rock. Sop so they could return to the shop would risk breaking augers bey replacement costs at Stantec's stop after today.	rs with voids in betom) arrived with the ne, the drillers went augers due to dam and 11:15, but after properties explained Cascado and perform main and repair and posexpense. I then cascado expense. I then cascado and sexpense.	ween, res air sampl t to make age resul ogressing de's desirentenance assibly losiralled my si	sulted in ler to att a phone ting from 1 ft furte to stop on the a ng equipuperviso	lots ach e ca n ab her o wo uge omer or to	of grine to Sop all to ma prasive we dec ork for the ars. He s nt down discuss	ding to mag ide his said s th	g and meas gers to terial d to s 10-da l if we ble, which is opt	wea ure a o dis in the top o y rot wer hich	ar on air quality of the control of	the au uality ir the ne pile an g the h n one c continu d resu we agre	ger theed nd chole day ue the lt ir eed	e I for current e due to early we n high d to
At 12:15, moved the rig to local the sampling rod but encounter the bottom. Apparently, the aug from the hole and noted cracks significant dame to additional a I left the site at 2:45 after organ.  Total depth drilled: 60 ft	red a bend in the loger had shifted off to and warped blade ugers. At 1:45pm,	wermost to the side s. It was of the driller	auger the after hidecided soleling the soleling and solel	at posterior	orevente g a large could n e to retu	ed to be of post of the post o	he sa oulde oroce to Ca	mpli r. So ed w scac	ng ro p pu ithou de's f	od from lled all it caus Peoria	re 4 a ing wo	eaching augers orkshop
Total depth cored: 20 ft												
Total CA brass liner samples co	ollected: 12											
	By: C. F	ritz			Т	Γitle	: Fie	ld Er	ngine	eer		



Date Mon, 4/9/2018

PROJECT: St. Anthony Mine												
JOB NO: 233001076		Weather		right Jun	⊠ Sunı	ny	□ Ov ca:			Rain	☐ Snow	
CLIENT: United Nuclear Corpora	ation	Temp. °F	_	32	□ 32-50	⊠ 50	)-70	□ <b>7</b> 0	)-85	□ 85- 100	□ >100	
CONTRACTOR: Cascade Drillin	ng	Wind	□ S	itill	⊠ Mode	er. 🗆	] Hig	h	Rep	ort No.		
PROJECT MANAGER: Melanie	Davis	Humidity	√ ⊠ D	ry	☐ Mode	er. 🗆	] Hur	mid		1		
Onsite Personnel												
Name	Compar	ny	Position					Remarks				
Cameron Fritz	Stanted	;	Field Engineer									
Rob Murphy	Cedar Cre	eek		Soil S	Scientis	t						
Sopotyn Lorn	Cascad	е		Driller								
Anthony Martinez	Cascad	е		He	elper							
Joey Vigueria	Cascad	е		He	elper							
					-							

Equipment		
Item	Company	Op Hrs
CME 85 drill rig w/hollow stem auger	Cascade	

#### Safety:

At 12pm, at a depth of 60' while drilling boring P1-2 in shale pile 1, a very loud bang came from the hole. I was standing next to the rig at the time and would describe it as a deafening (I didn't have earplugs in at that moment), percussive boom from underground. Rob was standing about 50 feet away behind his truck and could feel the impact of it. We immediately stopped work and gathered away from the rig. After waiting about 30-40 minutes to let things settle (and air out in case there was any gas of some sort), the driller slowly drilled down a couple more feet and continued to hear a couple of small pops from inside the hole. We then shut down the rig without continuing further and I went to call Stantec and Cascade supervisors.

Cascade operations manager requested that we immediately stop work (which we already had) and leave the area as a precaution until we could get more information and figure out what we were dealing with. With the augers still in the hole, we then left the site. Later in the day, I had a conference call with Cascade management, health and safety, and the drilling crew to discuss the events. It was decided that their ops manager would meet me and the drillers in the morning with a gas meter to see if there were any detectable gases in the borehole.

#### **Activities Summary:**

Arrived to site at 7am, collected materials from staging area near entrance, then began warming up rig where it had been left on 4/3 on shale pile 1 and had tailgate meeting at 7:30. At 8am, the rig was moved about 5' over from location P1-1 and drilling commenced at P1-1A, with the intention to avoid the rock that bent the auger in P1-1. Stopped from 8:15-8:45 while helpers refueled rig and Sop went to retrieve materials from support truck. Drilling then resumed, with coring from the surface down to 20' without collected SPT samples. P1-1A was completed after drilling to 35' and encountering native bedrock. We then moved to location P1-2, towered up at 10:30, and began drilling at 10:45. At 12pm, while drilling from 55-60', the safety incident described above occurred. All parties left site at 2pm after I made the initial phone calls to inform Cascade and Stantec supervisors of the incident.

Total depth drilled: 100 ft Total depth cored: 35 ft

Total CA brass liner samples collected: 14





Date Tue, 4/10/2018

PROJECT: St. Anthony Mine										
JOB NO: 233001076		Weather	· □ Bright Sun	⊠ Sunny	☐ Over- cast	- □ Rain	☐ Snow			
CLIENT: United Nuclear Corpor		Temp. °F	□ <32	□ 32-50 🗵	50-70	-70 × 70-85 × 85-				
CONTRACTOR: Cascade Drillin	ng	Wind	⊠ Still	☐ Moder.	☐ High	Report No	0.			
PROJECT MANAGER: Melanie	Davis	Humidity	√ ⊠ Dry	☐ Moder.	☐ Humio	t	1			
Onsite Personnel										
Name	Company			osition		Rema	arks			
Cameron Fritz	Stantec			Engineer						
Rob Murphy	Cedar Creel	k		Scientist						
Bryan Nydoske	Cascade		•	ons Manage	er					
Sopotyn Lorn	Cascade			Driller						
Anthony Martinez Joey Vigueria	Cascade Cascade			lelper lelper						
	Cascade		ı	ieipei						
Equipment		1	0			0.11				
Item	v otom ougor		Comp			Op Hrs				
CME 85 drill rig w/hollov	v stem auger		Casca	ade						
Safety:										
No incidents reported										
Activities Summary:										
At 7:15am, I met the drilling creyesterday's HSSE incident. At approaching the borehole. We including measuring gas levels a radiation dosimetry badge on stated the requirements for onon the site today, without a bad with fresh air readings, Bryan a of the gas meter just inside the ppm carbon monoxide gas. We the findings with Cascade heal discuss. It was decided that the that will be used to proceed with At 11am, Rob and Bryan left we	8am, after arriving to discussed the method and removing tooling his person and recestite personnel having, to address the approached the hole top of the auger operall then left the site of the arrival and safety. I also de drillers would return the tooling removal from the discussion of the drillers and the drillers and the discussion of the drillers and the discussion of the method in the drillers and the discussion of the discussion of the drillers and the discussion of th	to location and that any from the said because the current said because the current said and gat and gat and gat and gat and and the com P1-2.	n P1-2, Bry would be ended he hole. At variance fadges. I prafety situate rest of used measure hered at any supervisuruerque would to the rig	ran led a sa employed to this time, E rom the he- ovided verb ion. At 9am s stayed band 4.6 ppm location with or and Star vith Bryan to	afety mee o safely a Bryan no alth and oal affirm n, after ca ck about hydroger th cell ph o prepare n exclusi	eting prior to address the ted that he safety plan ation that h alibrating th 150'. He plan sulfide ga none service th and safe e engineering	situation, did not have, which he could be he gas mete laced the tip s and 346 he to discuss by to high controls ound the			
borehole. We then let the site a methods for tooling removal. It the chance of igniting gases. We gas is not pulled up into the wood.  Total depth drilled: 0 ft	was decided that d Ve will also record g	rilling mu as readir	d would be	mixed and	l placed	down-hole t	to reduce			
Total depth cored: 0 ft Total CA brass liner samples c	ollected: 0									
	By: C. F	ritz		Title	e: Field	Engineer				



Date Wed, 4/11/2018

PROJECT: St. Anthony Mine									
JOB NO: 233001076		Weather	Sun	☐ Sunny	□ Over- cast	□ Rain	□ Snow		
CLIENT: United Nuclear Corpor	ation	Temp. °F		□ 32-50 □		10	0		
CONTRACTOR: Cascade Drillin	ng	Wind		⊠ Moder.	☐ High	Report No			
PROJECT MANAGER: Melanie Davis		Humidity	√ ⊠ Dry	☐ Moder.	☐ Humid		1		
Onsite Personnel									
Name	Compan	v	Po	osition		Rema	rks		
Cameron Fritz	Stantec			Engineer		rtoma	110		
Rob Murphy	Cedar Cre			Scientist					
Sopotyn Lorn	Cascade			Oriller Oriller					
Anthony Martinez	Cascade			lelper					
Joey Vigueria	Cascade			lelper					
Joey vigueria	Cascaut	<del>,</del>	I I	ieipei					
Equipment									
Item			Compa	any	С	p Hrs			
CME 85 drill rig w/hollov		Casca			•				
g	OWE of this hig withollow sterm dager								
		I			l l				
Safety:									
No incidents reported									
Activities Summary:									
Began day on standby while waiting for Stantec health and safety to approve the updated health and safety plan, which will address procedures related to the gases encountered at P1-2. At 10am, I received the updated version of the HASP and we drove to the site. At 11am, we had a safety meeting to discuss procedures for tooling removal from the borehole. Work began at 12:45, with drilling mud being mixed and placed down the hole. Immediately after pumping the mud into the hole, a spike in H2S and CO was detected at top of the hole (3ppm H2S and 200 ppm CO). We then waited 10 mins to air out the hole before proceeding. Sop then pulled the AWJ sampling rods in 30' increments, with gas readings between increments. He then began pulling up augers in 5' increments, again with gas readings between each increment. At 2pm, with 25' of auger still in the hole, H2S spiked to 5ppm. We took a 20 min break until the gas meter stopping beeping (indicative of elevated readings). At 2:30, backfilling of the hole with cuttings was completed and the drillers began packing up to move to the next location. The drillers then took the mud mixer and other equipment back to the staging area.  At 3:30, the rig was moved to location P3-2 and coring began at 4pm. Auger refusal was encountered at 45',									
consistent with expected depth rig and work area to move to no	to native bedrock	k based on	assessmer	nt of surrou					
Total depth drilled: 45 ft									
Total depth cored: 45 ft									
Total CA brass liner samples c	ollected: 12								
	By: C	Erit-		T:41	o: Field F	nginoor			



Date Thu, 4/12/2018

		Date		,, _ 0	•						
PROJECT: St. Anthony Mine						1		1		-	
JOB NO: 233001076		Weather	· □ Brigl Sun	ht 🗵 Sı	unny	□ O	ver- ist		Rain		Snow
CLIENT: United Nuclear Corpora		Temp. °F	□ <32	□ 32-5	50 🗆	50-70	⊠ 70	0-85	□ 85- 100		□ >100
CONTRACTOR: Cascade Drillir		Wind	□ Still	☐ Still ☐ Moder. ☒ H		⊠ Hig	ligh Report No.				
		Humidity	√ ⊠ Dry	□Мо	oder.	☐ Hu	mid			1	
PROJECT MANAGER: Melanie	Davis										
Onsite Personnel											
Name	Company			Position	l			F	Remar	ks	
Cameron Fritz	Stantec		Fie	eld Engin	eer						
Rob Murphy	Cedar Creel	k		oil Scien							
Sopotyn Lorn	Cascade			Driller							
Anthony Martinez	Cascade			Helper							
Joey Vigueria	Cascade			Helper							
Equipment											
Item			Con	npany			O	p Hr	S		
CME 85 drill rig w/hollow	stem auger		Cas	scade							
Safety:											
No incidents reported											
Activities Summary:											
•											
Arrived to site at 7:10am, bega											
location P3-2 to P3-4, and drilli											
was seen at P1-2 just prior to the										ea	red to
have significant organics. Rob											_
caution. After connecting a sma											
CO were measured at 22 ppm											
explosive limit for methane. We											
site to make phone calls to sup											
pull out of the hole as previous											
the same pile using drilling muc											
manager noted that mud could											
better option for this site. I told											, and
that he would have to speak wi	th Stantec manage	ment abo	out that p	ossibility	and	its as	socia	ated	costs.		
We then returned to the rig, wh	ere the gas meter v	was still r	eading fi	rom 4' do	own t	he hol	e Th	ne m	eter at	t th	at time
read 32 ppm H2S, 499 ppm C0											
hole. By this time, winds were											
drilling. Because of the wind ar											
tomorrow to pull tooling from th										- • •	
Total depth drilled: 40 ft											
Total depth cored: 0 ft											
Total CA brass liner samples of	ollected: 13										
	_										
	By: C. F	ritz			Titl	e: Fie	ld Er	ngine	er		



Title: Field Engineer

Date Fri, 4/13/2018

PROJECT: St. Anthony Mine					1		1	
JOB NO: 233001076		Weather	□ Bright Sun	⊠ Sunny	□ O	ver- ast	☐ Rain	⊠ Snow
CLIENT: United Nuclear Corpor		Temp. °F	□ <32	⊠ 32-50 □	50-70	□ <b>7</b> 0	0-85 🗆 85 10	_
CONTRACTOR: Cascade Drillin	ng	Wind	☐ Still	☐ Moder.	⊠ Hig	igh Report No.		).
PROJECT MANAGER: Melanie	Davis	Humidity	□ Dry	⊠ Moder.	□ Hu	mid		1
Onsite Personnel								
Name	Company		Р	osition			Rema	rks
Cameron Fritz	Stantec			Engineer				-
Rob Murphy	Cedar Cree	k		Scientist				
Jesse Dillon	Cedar Cree			cologist				
Sopotyn Lorn	Cascade			Driller				
Anthony Martinez	Cascade		ŀ	Helper				
Joey Vigueria	Cascade			Helper				
Equipment		_						
Item			Comp	oany		0	p Hrs	
CME 85 drill rig w/hollov	v stem auger		Casc	ade				
Safety:								
No incidents reported								
Activities Summary:								
Arrived on-site at 7:10am, had stopping work again if more da the gas meter. Did not detect hextending the measurement tu remained below 8%. Ectraction backfilling of the hole with cutti however, the wind was too strough.	ngerous gas levels 12S anywhere outs be as deep as 20' o n of tooling began a ngs was completed	are enco ide boreho down the it 8am with d at 9:15.	untered. A ole, thougl hole. CO r h gas read The rig wa	at 7:45, drille h levels up reached as dings record is moved to	ers be to 2 pr high a led aft the no	gan tom was 400 er ea	taking read vere meas 0 ppm, but ach 5' incre ocation (P3	dings with ured after t LEL ement, and 3-3) at 9:40
Total depth drilled: 0 ft Total depth cored: 0 ft Total CA brass liner samples of	ollected: 0							
L								

By: C. Fritz



Date Sat, 4/14/2018

PROJECT: St. Anthony Mine								
JOB NO: 233001076		Weather	Sun	⊠ Sunny	☐ Over- cast		☐ Snow	
CLIENT: United Nuclear Corpo		Гетр. °F	□ <32	□ 32-50 🗵	50-70		5- 00 □ >100	
CONTRACTOR: Cascade Drilli	ng	Wind	☐ Still	⊠ Moder.		High Report No.		
PROJECT MANAGER: Melanie	e Davis	Humidity	⊠ Dry	☐ Moder.	☐ Humid		1	
Onsite Personnel								
Name	Company		Р	osition		Rema	arks	
Cameron Fritz	Stantec			Engineer			-	
Rob Murphy	Cedar Creek			Scientist				
Jesse Dillon	Cedar Creek			cologist				
Sopotyn Lorn	Cascade			Driller				
Anthony Martinez	Cascade		H	Helper				
Joey Vigueria	Cascade		ŀ	- Helper				
Equipment								
Item			Comp	anv	(	Op Hrs		
CME 85 drill rig w/hollo	w stem auger		Casca			<b>5</b> P 1 11 C		
<b>3</b>	3							
Safety: No incidents reported								
Activities Summary:								
Arrived to site at 7am, had saf 8am, and was completed upor 40'. The rig was then moved to much blacker. Gas readings o Work was then stopped for 30 11:30-12pm. At 12:30, the rig the rig was moved over several elevated gas readings was end	n measuring 2 ppm Ho location P3-6 and of 4 ppm H2S, >500 pmins to allow the howas moved to P3-5 all feet and drilling be	H2S, 499 drilling be opm CO, ole to air o and drillir gan agai	ppm CO, gan at 9:4 and 15% I out. Extrac ig began. n at 1pm a	and 12% LI 5. At 55' de LEL were re ction of tooli The auger h after fixing tl	EL in the appth, the appth, the appth, the appth	hole after of auger cutting the top of the t	drilling to ngs became f the hole. eted from surface, so	
The rig was then moved back the problematic black, organic we took a break to air out the l backfilled, and all parties left th	material at greater on ole before extraction	depths. E	levated ga	as levels we	re measu	ired after c	drilling 30',	
Total depth drilled: 140 ft Total depth cored: 0 ft								
Total CA brass liner samples of	collected: 48							
	By: C. Fr	ritz		Title	e: Field E	naineer		



Date Sun, 4/15/2018

PROJECT: St. Anthony Mine					_		
JOB NO: 233001076		Weather	☐ Bright Sun	⊠ Sunny	☐ Over- cast	- ☐ Rain	☐ Snow
CLIENT: United Nuclear Corpora		emp. °F	□ <32	□ 32-50 □	50-70	70-85 🗆 85	
CONTRACTOR: Cascade Drillin	ng	Wind	⊠ Still	☐ Moder.	☐ High	Report No	0.
PROJECT MANAGER: Melanie	Davis	Humidity	⊠ Dry	☐ Moder.	☐ Humid	I	1
Onsite Personnel							
Name	Company		Р	osition		Rema	arks
Cameron Fritz	Stantec			Engineer			
Jesse Dillon	Cedar Creek			cologist			
Sopotyn Lorn	Cascade			Driller			
Anthony Martinez	Cascade			Helper			
Joey Vigueria	Cascade			Helper			
Equipment							
Item			Comp	any	(	Op Hrs	
CME 85 drill rig w/hollow	stem auger	Cascade					
	·						
Safety:							
No incidents reported							
Activities Summary:							
Arrived on-site at 7am, had safuntil encountering elevated gas extracted and the hole backfille several of the pile 4 holes, Jess began at location P4-7 at 10:45 depth. Work was then stopped was moved to location P4-9 at gas from the hole and work wawaiting for the hole to air out, to 3:40pm. Shortly thereafter, elevallow the hole to air out overnig	s levels at 20' depth. ed, and we began the se and I had to scou sam. An hour later, e for about 30 mins to 12:45. After drilling t s stopped. Elevated poling was pulled an vated gas levels wer ght before extracting	Drilling of the move to the route delevated of the route gas level of the right record.	did not controlled that the rithat the ritha	ntinue past 9:30. Beca g could nav LEL were m t. Tooling w 9, the driller leasured at to locatio	this depthuse of the rigate. Drieasured ras then easured the top on P4-8.	n, tooling we difficult activities and continuous after coring extracted and activities and fithe boreh Drilling begans and continuous and co	ras ccess to cring then g to 30' and the rig dden puff of ole. After an at
Total CA brass liner samples of	oliected: 23						
	By: C. Fr	itz		Title	e: Field E	Engineer	



Date Mon, 4/16/2018

PROJECT: St. Anthony Mine							,			
JOB NO: 233001076		Weather	Sun	☐ Sunny	ca	ast		Rain	L	Snow
CLIENT: United Nuclear Corpor		Temp. °F	□ <32	□ 32-50 □	50-70	⊠ 7	0-85	□ 85- 100		□ >100
CONTRACTOR: Cascade Drillin	ng	Wind	☐ Still	⊠ Moder.	☐ Hig	High Report No.				
PROJECT MANAGER: Melanie	Davis	Humidity	√ ⊠ Dry	☐ Moder.	☐ Hu	mid			1	
Onsite Personnel										
Name	Company		D	osition				Remar	rke	
Cameron Fritz	Stantec	+		Engineer	+		Г	Temai	ΝS	
Jesse Dillon	Cedar Creek	,		cologist						
Sopotyn Lorn	Cascade	`		Driller						
Anthony Martinez	Cascade			Helper						
Joey Vigueria	Cascade			Helper						
Joey Vigueria	Cascade		<u>'</u>	leipei						
Equipment										
Item			Comp			0	p Hrs	3		
CME 85 drill rig w/hollov	v stem auger		Casca	ade						
Safety:		<b>'</b>								
No incidents reported										
Activities Summeru										
Activities Summary:										
Arrived on-site at 7:15am and t	unloaded samples a	at staging	area near	entrance.	Had sa	afety	mee	eting a	t 7:	45
while rig was warming up. At 8										
encountered elevated gas leve										
hole was backfilled. Cuttings ha										
in the water poured over the to										
at 9:45. Gas was encountered										
was moved to P4-3 and drilling										
12:45, augers were pulled and										
feeling well and was acting slig										
measuring gas levels with his f										
noted they were much more tire	•		•		•			_		i i u
temperatures and amount of w										eft the
site at 1:30. All drillers later sai							top v	voik a		on the
Total depth drilled: 45 ft										
Total depth cored: 0 ft										
Total CA brass liner samples c	ollected: 11									
	By: C. Fr	ritz		Titl	e: Fie	ld Er	ngine	er		



Date Tue, 4/17/2018

PROJECT: St. Anthony Mine									
JOB NO: 233001076		Weather	□ Bright Sun	⊠ Sunny	□ O	ver- ast	□ Ra	ain	☐ Snow
CLIENT: United Nuclear Corpora		Temp. °F	□ <32	□ 32-50 □	50-70	70 🛭 70-85 🗀 8		35- 100	□ >100
OLILIVI. Office Nuclear Corpore		Wind	□ Still	☐ Moder.	⊠ Hig	gh	Repor		
CONTRACTOR: Cascade Drillin	ng						•		
PROJECT MANAGER: Melanie	Davis	Humidity	☑ Dry ☐ Moder. ☐ I			Humid 1			
Onsite Personnel									
Name	Company		P	osition			Re	mark	S
Cameron Fritz	Stantec			Engineer					
Jesse Dillon	Cedar Cree	k		cologist					
Sopotyn Lorn	Cascade			Driller					
Anthony Martinez	Cascade		H	Helper					
Joey Vigueria	Cascade			- Helper					
Equipment								$\neg$	
Item			Comp	any		0	p Hrs		
CME 85 drill rig w/hollow	stem auger		Casc	ade					
Safety:									
No incidents reported									
Activities Summary:									
	20 20 11							0	i
At 7am, met drillers at location									
and Stantec supervisors and de unfinished hole. We then arrive									
on-site to discuss drilling an ad-									
from pile 4, no accessible drilling									
samples. By this time (9am) the									
material with elevated radiation									19
recommended stopping work, a									test pits)
were planning on leaving due to									
drilling could not proceed. As a									
Because radiological sampling									
(backhoe operator) use his equ									
remaining borehole was located									
borrow area near the large pit to									
then left at 10am, and I returned									
return from conducting separate									
being frisked for radiological co area in preparation for deliverin				•	JIY OI S	samp	nes m	me S	aging
Total depth drilled: 0 ft									
Total depth cored: 0 ft									
Total CA brass liner samples co	ollected: 0								
	By: C. F	ritz		Titl	e: Fie	ld Er	nginee	r	



Date Wed, 4/18/2018

PROJECT: St. Anthony Mine							
JOB NO: <u>233001076</u>		Weather	· □ Bright Sun	⊠ Sunny	□ Over- cast	□ Rain	☐ Snow
CLIENT: United Nuclear Corpor	ation	Temp. °F	<32	□ 32-50 🗵	50-70 🗆 7	70-85 🗆 85 10	_
CONTRACTOR: Cascade Drillin	ng	Wind	⊠ Still	☐ Moder.	☐ High	Report No	).
PROJECT MANAGER: Melanie	Davis	Humidity	⊠ Dry	☐ Moder.	☐ Humid		1
Onsite Personnel							
Name	Company	,	Position			Rema	ırks
Cameron Fritz	Stantec		Field	Engineer			
Sopotyn Lorn	Cascade		Driller				
Anthony Martinez	Cascade		Н	lelper			
Joey Vigueria	Cascade		Н	lelper			
Equipment							
Item			Compa	any	С	p Hrs	
CME 85 drill rig w/hollow stem auger			Casca				

#### Safety:

No incidents reported

#### **Activities Summary:**

Arrived on-site at 7am. We then went to survey the new access to pile 3, as well as access to newly proposed locations in the west borrow area near the large pit. At 7:45, we had a safety meeting while the rig warmed up at location P3-1. Drilling then began, with the additional use of a blower fan the drillers retrieved from Albuquerque yesterday. This fan will be more effective at removing gases from the borehole, and depositing them away from the working area such that the effects felt by the drillers yesterday will not be an issue again. At 8:30, after drilling to 15' depth, CO and LEL began to slowly increase at the top of the borehole. Work was then stopped so we could monitor the gas levels, which continued to increase inside the hole. Although H2S was not detected, CO and LEL increased to as high as 140 ppm and 5%, respectively. We decided not to continue drilling the hole, as we expected levels to further increase if we kept drilling deeper. Upon removing the sampler from the hole, black shale was evident in the tip of the sampler from ~16' depth.

The rig was then moved to location BW-1 in the west borrow area and coring began at 9:15. At 10:30, elevated H2S, CO, and LEL were detected in the borehole after drilling to 35' depth. Because this location was in a clean, undisturbed borrow area, it was believed that we had drilled through the potential borrow material (alluvium) and into the native shale at a depth consistent with where the shale layer is visible in the walls of the open pit just to the north, at which point gas levels began to increase. Tooling was then extracted and the rig moved to location BW-4. Drilling was completed at 20' depth without any gas issues, as we did not drill deep enough to encounter materials other than the alluvium. We then completed drilling at locations BW-3 (hit bedrock at 15') and BW-2 (drilled to 20') without incident.

After completing the final borehole of the drilling program, the drillers went to prepare the rig and support vehicles for demobilization back to the Cascade shop. While they did that, I did sample inventory and collected buckets to bring to the geotechnical testing lab in Albuquerque. After the drillers had already left the site, I left at 5pm along with the remaining on-site Stantec and AVM personnel.



	Bv: C. Fritz	Title: Field Engineer
Total CA brass liner samples collec	neu. 20	
Total depth cored: 35 ft Total CA brass liner samples collect	ted: 26	
Total depth drilled: 105 ft		



# **Attachment E. Laboratory Results**

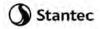


Table E-1. Laboratory Results – Initial Properties

Sample ID	Gravimetric Moisture Content (%, g/g)	Volumetric Moisture Content (%, ft³/ft³)	Dry Bulk Density (pcf)	Wet Bulk Density (pcf)	Calculated Porosity (%)
L1-1 (10'A)	6.3	8.7	86.6	92.1	47.6
L1-2 (20'B)	10.2	17.8	109.4	120.5	33.9
L1-3 (5'A)	4.2	6.3	93.7	97.6	43.4
L1-4 (5'B)	7.5	10.6	88.2	94.8	46.7
L2-1 (5'B)	4.1	7.0	105.4	109.7	36.3
L2-1 (15'A)	5.0	8.7	108.6	114.0	34.4
L2-3 (5'A)	3.8	6.1	100.5	104.3	39.3
L2-5 (5'B)	11.8	19.8	104.8	117.2	36.6
L2-6 (10'B)	14.4	21.9	97.3	111.4	41.3
T/O-1 (20'A)	11.4	19.5	106.6	118.8	35.6
T/O-1 (45'B)	7.2	10.9	94.5	101.3	42.9
T/O-2 (15'A)	11.3	18.5	101.6	113.1	38.6
T/O-3 (15'B)	9.9	18.4	116.6	128.1	29.5
T/O-3 (40'B)	6.8	10.9	100.5	107.3	39.3
T/O-4 (5'A)	8.9	16.4	115.8	126.1	30.0
T/O-5 (20'A)	6.3	9.4	94.2	100.1	43.1
T/O-6 (5'A)	6.9	12.0	108.9	116.5	34.1
TN-2 (20'A)	6.0	7.8	81.5	86.3	50.8
BS-1 (10'A)	8.4	12.3	91.2	98.9	44.9
BS-6 (20'A)	7.0	9.5	84.7	90.6	48.8
TS-1 (5'A)	7.8	14.4	114.4	123.4	30.8
TS-2 (15'A)	8.9	14.3	99.9	108.8	39.6



TS-3 (10'A)	6.0	9.6	100.4	106.4	39.3
TS-4 (10'A)	7.0	13.8	123.4	132.0	25.4
P1-1 (15'B)	10.0	13.4	84.2	92.6	49.1
P1-1A (30'A)	3.9	4.8	76.6	79.7	53.7
P1-2 (50'A)	4.3	6.9	99.7	104.0	39.7
P2-1 (5'A)	13.2	24.6	115.8	131.2	30.0
P2-1 (25'B)	15.4	25.6	104.1	120.1	37.1
P3-1 (5'A)	7.3	13.6	116.4	124.8	29.7
P3-1 (15'A)	9.4	8.8	58.3	63.8	64.8
P3-2 (10'A)	6.6	11.1	105.5	112.4	36.2
P3-2 (20'A)	11.3	18.8	104.1	115.8	37.1
P3-3 (20'A)	8.1	13.7	105.5	114.1	36.2
P3-3 (40'A)	14.7	26.3	112.0	128.4	32.3
P3-4 (10'A)	9.3	14.4	96.2	105.2	41.8
P3-4 (30'A)	6.0	9.1	95.2	100.9	42.4
P3-4 (40'A)	7.1	13.3	117.0	125.3	29.3
P3-5 (10'A)	8.3	15.5	115.8	125.4	30.0
P3-6 (5'A)	4.8	7.8	101.8	106.7	38.4
P3-6 (20'A)	9.3	16.1	107.9	117.9	34.8
P3-6 (50'A)	6.0	10.7	110.8	117.4	33.1
P4-5 (20'A)	7.3	12.6	108.6	116.4	34.4
P4-6 (10'A)	10.0	15.9	99.0	108.9	40.2
P4-7 (5'A)	9.8	14.6	93.1	102.2	43.7
P4-7 (25'B)	6.2	11.0	110.1	117.0	33.5
P4-8 (15'B)	13.0	21.0	101.1	114.2	38.9



P4-9 (5'A)	4.4	8.3	116.7	121.9	29.4
P4-9 (35'B)	13.5	22.4	103.7	117.7	37.3
BW-1 (30'A)	9.3	13.0	87.2	95.3	47.3
BW-2 (10'A)	5.9	8.9	94.7	100.3	42.8
BW-3 (5'A)	3.8	6.1	101.0	104.8	38.9



Table E-2. Laboratory results – Particle Size Analyses

Sample ID	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	Cu	Cc	
L1-1 (10'A)	0.0	33.2	43.1	23.7	2.2E-05	0.046	0.061	2773	33	(Est)
L1-2 (20'B)	0.1	2.3	68.1	29.5	2.8E-05	0.0092	0.015	536	12	(Est)
L1-3 (5'A)	0.0	46.5	40.8	12.7	6.4E-45	0.066	0.088	1.4E+43	2.1E+42	(Est)
L1-5 (20'B)	0.0	49.7	37.7	12.6	0.0011	0.074	0.093	85	17	(Est)
L2-1 (5'A)	0.0	32.5	49.0	18.5	0.00040	0.045	0.060	150	9.4	(Est)
L2-2 (5'A)	0.0	46.3	37.5	16.2	0.00019	0.067	0.085	447	60	(Est)
L2-3 (5'A)	0.0	51.2	36.8	12.1	0.00094	0.076	0.089	95	26	(Est)
L2-4 (10'B)	0.0	28.8	50.0	21.2	3.9E-05	0.045	0.057	1462	65	(Est)
L2-5 (5'A)	0.0	2.8	48.6	48.6	4.4E-05	0.0022	0.0047	107	0.50	(Est)
L2-6 (5'A)	0.0	14.8	55.2	29.9	0.00031	0.013	0.030	97	0.43	(Est)
L2-7 (10'A)	0.0	40.1	48.2	11.7	1.9E-09	0.057	0.075	3.9E+07	4.4E+06	(Est)
T/O-1 (20'A)	0.2	3.2	66.0	30.6	0.00030	0.0088	0.016	53	0.75	(Est)
T/O-1 (45'B)	0.0	47.9	31.0	21.1	5.1E-05	0.070	0.099	1941	51	(Est)
T/O-2 (5'A)	0.0	23.0	71.5	5.5	0.0025	0.010	0.022	8.8	0.15	



T/O-3 (40'A)	0.0	51.5	34.4	14.1	0.00083	0.078	0.10	120	20	(Est)
T/O-3 (70'B)	0.5	8.7	73.8	17.1	0.00032	0.034	0.045	141	8.4	(Est)
T/O-4 (20'B)	0.0	24.8	57.7	17.5	0.00059	0.034	0.050	85	4.1	(Est)
T/O-5 (10'B)	0.0	10.1	75.3	14.6	0.0011	0.028	0.039	35	2.3	(Est)
T/O-6 (5'A)	0.0	24.3	59.7	16.0	0.00066	0.043	0.054	82	9.1	(Est)
TN-1 (5'A)	0.4	50.9	33.3	15.4	0.00074	0.077	0.097	131	17	(Est)
TN-2 (20'A)	0.0	51.9	34.4	13.8	0.00077	0.079	0.10	130	18	(Est)
BS-1 (10'A)	0.0	40.8	36.1	23.0	0.00029	0.052	0.076	262	4.4	(Est)
BS-2 (15'A)	0.0	43.0	51.6	5.3	0.0039	0.061	0.082	21	0.61	
BS-6 (20'A)	0.0	26.3	55.8	17.9	0.00018	0.054	0.062	344	43	(Est)
TS-1 (20'A)	0.0	18.2	65.1	16.7	0.0010	0.035	0.048	48	2.0	(Est)
TS-2 (10'A)	0.0	53.9	35.3	10.8	0.0019	0.087	0.12	63	3.0	
TS-3 (10'A)	0.0	16.1	68.6	15.2	0.00086	0.043	0.051	59	3.9	(Est)
TS-4 (5'A)	0.7	63.1	22.7	13.5	0.0011	0.11	0.13	118	20	(Est)
P1-1 (5'A)	18.8	49.8	20.8	10.6	0.0012	0.13	0.17	142	23	(Est)
P1-2 (30'B)	20.3	43.0	24.9	11.8	0.0010	0.11	0.16	160	21	(Est)



P2-1 (25'A)	0.3	54.0	30.7	15.1	0.00071	0.087	0.12	169	11	(Est)
P2-2 (5'B)	5.1	53.2	27.1	14.6	0.00078	0.089	0.11	141	28	(Est)
P3-1 (5'A)	19.7	64.9	15	.3	NA	0.23	0.33	NA	NA	(Est)
P3-2 (15'B)	0.0	78.8	21	.2	NA	0.20	0.25	NA	NA	(Est)
P3-2 (35'B)	1.1	68.2	30	.7	NA	0.15	0.19	NA	NA	(Est)
P3-3 (5'A)	0.3	67.7	31	.9	NA	0.15	0.19	NA	NA	(Est)
P3-3 (40'B)	1.4	56.3	42	.3	NA	0.085	0.099	NA	NA	(Est)
P3-4 (20'A)	0.0	92.7	7.	3	0.11	0.25	0.29	2.6	0.91	
P3-4 (30'A)	0.0	92.3	7.	7	0.10	0.19	0.22	2.2	0.89	
P3-4 (40'A)	0.0	48.1	44.2	7.7	0.0029	0.072	0.087	30	7.7	_
P3-5 (10'A)	0.0	68.6	27.8	3.6	0.020	0.099	0.12	6.0	2.2	
P3-6 (20'A)	0.0	85.2	14	.8	NA	0.20	0.24	NA	NA	(Est)
P3-6 (50'A)	7.2	76.4	16	.4	NA	0.23	0.30	NA	NA	(Est)
P4-5 (20'A)	24.9	61.0	14	.1	NA	0.30	0.39	NA	NA	(Est)
P4-6 (10'A)	0.0	48.0	41.0	11.0	0.0012	0.072	0.084	70	23	(Est)
P4-7 (5'A)	7.2	43.9	49	.0	NA	0.077	0.095	NA	NA	(Est)



P4-7 (25'B)	0.0	77.0	17.5	5.5	0.0052	0.28	0.34	65	9.6	
P4-8 (15'B)	0.5	51.9	35.5	12.1	0.0011	0.085	0.13	118	5.1	(Est)
P4-9 (35'B)	15.7	26.6	46.4	11.4	6.7E-06	0.061	0.087	1.3E+04	1160	(Est)
BW-1 (20'A)	0.0	45.4	34.9	19.7	0.0012	0.047	0.083	69	1.2	(Est)
BW-2 (10'A)	0.0	44.1	38.1	17.8	0.00035	0.062	0.084	240	18	(Est)
BW-3 (5'A)	0.0	53.1	35.9	11.0	0.0011	0.080	0.099	90	23	(Est)

d<sub>50</sub> = Median particle diameter

 $<sup>(</sup>Est) \ = \ Reported\ values\ for\ d_{10},\ C_u,\ and\ C_c\ are\ estimates,\ since\ extrapolation\ was\ required\ to\ obtain\ the\ d_{10}\ diameter$ 



**Table E-3. Laboratory Results – Atterberg Limits** 

Sample ID	Liquid Limit	Plastic Limit	Plasticity Index	Classification
L1-2 (20'A)	41	19	22	CL
L2-2 (5'B)				ML
L2-6 (5'A)	34	17	17	CL
T/O-1 (25'A)	30	16	14	CL
T/O-2 (10'A)	48	23	25	CL
T/O-3 (60'A)				ML
P1-1 (10'A)				ML
P1-2 (15'A)				ML
P2-2 (5'A)	39	15	24	CL
P3-1 (15'A)				ML
P3-3 (40'A)				ML
P3-4 (40'B)				ML
P3-5 (10'B)				ML
P3-6 (50'A)				ML
P4-8 (15'A)				ML

<sup>--- =</sup> Soil requires visual-manual classification due to non-plasticity



**Table E-4. Laboratory Results – Proctor Compaction** 

	Meas	sured	Oversize	Corrected
Sample ID	Optimum Moisture Content, (% g/g)	Maximum Dry Bulk Density (pcf)	Optimum Moisture Content (% g/g)	Maximum Dry Bulk Density (pcf)
L1 Auger Cuttings (1 & 2)	14.6	260.10		
L2 Auger Cuttings (1 & 2)	14.1	261.06		
T/O Auger Cuttings (1 & 2) (T/O-1 & T/O-3,4)	14.5	263.33		
Topsoil North Cuttings (1 & 2)	12.6	272.45		
Borrow South Cuttings (1 & 2)	13.0	265.66		
Topsoil South Cuttings (1 & 2) (TS-2 & TS-3,4)	15.2	260.17	12.3	277.03
Borrow West Auger Cuttings (1 & 2)	12.7	269.62		
P1-2 Auger Cuttings	12.8	262.59		
P3 Auger Cuttings (1 & 2)	9.9	282.46	9.2	287.45
P4 Auger Cuttings (1 & 2)	11.1	279.37	9.0	294.60

<sup>--- =</sup> Oversize correction is unnecessary because coarse fraction is <5% of composite mass



Table E-5. Laboratory Results – Triaxial Shear

Sample ID	Effective Consolidation Stress (psf)	Effective Minor Stress at Failure (psf)	Effective Major Stress at Failure (psf)	Pore- Water Pressure at Failure (psf)	Total Minor Stress at Failure (psf)	Total Major Stress at Failure (psf)	% Strain at Failure* (%)	Cohesion, c' (psf)	Friction Angle, φ' (°)
L2-1 (15'A) CU Stage 1 (6.0 psi)	861.0	367.1	1,212.6	10,803.2	11,170.3	12,015.8	2.12		
L2-1 (15'A) CU Stage 2 (12.0 psi)	1,734.8	724.2	2,597.1	11,313.4	12,037.6	13,910.5	2.96	0	35
L2-1 (15'A) CU Stage 3 (24.0 psi)	3,460.9	1,376.8	5,152.1	12,396.6	13,773.4	17,548.8	7.73	_	
L2-5 (5'B) CU Stage 1 (2.0 psi)	283.9	105.9	753.1	11,796.0	11,901.9	12,549.1	1.88		
L2-5 (5'B) CU Stage 2 (4.0 psi)	577.7	290.7	1,347.1	11,885.8	12,176.5	13,232.9	0.97	129.6	35.8
L2-5 (5'B) CU Stage 3 (8.0 psi)	1,151.2	471.6	2,222.1	12,303.9	12,775.5	14,526.0	1.13	<del>-</del>	
L2-6 (10'B) CU Stage 1 (3.5 psi)	501.3	305.2	501.2	11,945.9	12,251.1	12,447.1	0.69		
L2-6 (10'B) CU Stage 2 (7.1 psi)	1,016.3	456.6	1,483.0	12,308.7	12,765.4	13,791.8	3.02	0	32.3
L2-6 (10'B) CU Stage 3 (14.0 psi)	2,016.8	871.0	3,224.1	12,914.0	13,784.9	16,138.1	11.74	-	

<sup>\*</sup>Noted percent strain used as failure criterion.



Table E-6. Laboratory Results – Analytical Testing

Borehole ID	Sample Depth (ft)	Ra-226 (pCi/g)	Uranium (µg/kg)	Thorium-230 (pCi/g)	Gross Alpha (pCi/g)
P1-2	20	11.5 +/- 1.5	36,000	16.6 +/- 2.6	48.2 +/- 9.6
P1-2	20 (duplicate)	16.1 +/- 2.0	36,300	-	-
P1-2	40	1.25 +/- 0.30	3,700	1.11 +/- 0.23	5.3 +/- 2.1
P1-2	60	1.31 +/- 0.28	530	0.99 +/- 0.22	3.7 +/- 1.7
P2-1	10	3.85 +/- 0.58	1,000	4.11 +/- 0.69	10.5 +/- 3.2
P2-1	20	1.25 +/- 0.31	2,000	1.15 +/- 0.23	2.1 +/- 1.5
P2-1	20 (duplicate)	-	-	1.05 +/- 0.21	4.9 +/- 2.1
P2-2	10	0.91 +/- 0.21	1,000	0.89 +/- 0.19	2.7 +/- 1.5
P4-3	5	2.15 +/- 0.41	1,600	1.60 +/- 0.29	6.8 +/- 1.6
P4-5	5	29.5 +/- 3.6	29,000	19.5 +/- 3.1	65 +/- 11
P4-5	15	18.6 +/- 2.3	24,000	15.4 +/- 2.4	67 +/- 11
P4-9	20	3.14 +/- 0.48	5,300	2.51 +/- 0.42	7.0 +/- 1.5
P4-9	30	1.26 +/- 0.27	580	0.93 +/- 0.20	4.8 +/- 2.1
BW-1	10	0.76 +/- 0.22	480	0.90 +/- 0.20	6.0 +/- 2.5
BW-4	5	1.15 +/- 0.27	550	1.20 +/- 0.24	5.0 +/- 2.3
BW-4	15	0.81 +/- 0.25	610	0.90 +/- 0.20	6.6 +/- 2.5
BW-3	10	0.83 +/- 0.20	510	0.85 +/- 0.19	3.3 +/- 1.9
BW-2	5	0.73 +/- 0.22	520	0.78 +/- 0.18	5.4 +/- 2.2
BW-2	20	0.82 +/- 0.23	460	0.64 +/- 0.17	2.2 +/- 1.6



# Attachment F. Geotechnical Laboratory Testing Report

# Laboratory Report for Stantec

St. Anthony Geotech Investigation PO# 233001076-DBS

June 20, 2018 Revised July 2, 2018



Daniel B. Stephens & Associates, Inc.

4400 Alameda Blvd. NE, Suite C • Albuquerque, New Mexico 87113



June 20, 2018, Revised July 2, 2018

Cameron Fritz Stantec Consulting Services Inc. 3325 South Timberline Road Suite 150 Fort Collins, CO 80525-2903 (970) 482-5922

Re: DBS&A Laboratory Report for the Stantec St. Anthony Geotech Investigation, PO# 233001076-DBS Project

Dear Mr. Fritz:

Enclosed is the report for the Stantec St. Anthony Geotech Investigation, PO# 233001076-DBS project samples. Please review this report and provide any comments as samples will be held for a maximum of 30 days. After 30 days samples will be returned or disposed of in an appropriate manner.

All testing results were evaluated subjectively for consistency and reasonableness, and the results appear to be reasonably representative of the material tested. However, DBS&A does not assume any responsibility for interpretations or analyses based on the data enclosed, nor can we guarantee that these data are fully representative of the undisturbed materials at the field site. We recommend that careful evaluation of these laboratory results be made for your particular application.

The testing utilized to generate the enclosed report employs methods that are standard for the industry. The results do not constitute a professional opinion by DBS&A, nor can the results affect any professional or expert opinions rendered with respect thereto by DBS&A. You have acknowledged that all the testing undertaken by us, and the report provided, constitutes mere test results using standardized methods, and cannot be used to disqualify DBS&A from rendering any professional or expert opinion, having waived any claim of conflict of interest by DBS&A.

We are pleased to provide this service to Stantec and look forward to future laboratory testing on other projects. If you have any questions about the enclosed data, please do not hesitate to call.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC. SOIL TESTING & RESEARCH LABORATORY

Joleen Hines

Laboratory Manager

Enclosure

**Summaries** 



#### **Summary of Tests Performed**

	0		aturate					. ,								
Laboratory	itial S operti		lydraul nductiv				Moi Charac	isture :teristi			Particle Size <sup>4</sup>		ecific vity <sup>5</sup>		Atterberg	Proctor
Sample Number		VD		FW	НС	PP			WHC	$K_{unsat}$		F	C	CU <sup>6</sup>	Limits	Compaction
SA-GM 1B											Х					
SA-GM 1T											Х					
SA-GM 2B											Х					
SA-GM 2T											Х					
SA-GM 3B											Х					
SA-GM 3T											Х					
SA-GM 4B											Х					
SA-GM 5B											Х					
SA-GM 5T											Х					
SA-GM 6B											Х					
SA-GM 6T											Х					
SA-GM 7B											Х					
SA-GM 8B											Х					
SA-GM 8T											Х					
L1 Auger Cuttings (1 & 2)																Х

<sup>&</sup>lt;sup>1</sup> G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method

<sup>&</sup>lt;sup>2</sup> CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

<sup>&</sup>lt;sup>3</sup> HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box,

EP = Effective Porosity, WHC = Water Holding Capacity, Kunsat = Calculated Unsaturated Hydraulic Conductivity

<sup>&</sup>lt;sup>4</sup> DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

<sup>&</sup>lt;sup>5</sup> F = Fine (<4.75mm), C = Coarse (>4.75mm)

<sup>&</sup>lt;sup>6</sup> CU = Consolidated Undrained Triaxial



				S	aturate	ed																
		itial S			lydrau						sture					Particl			cific			
Laboratory		operti			nducti					Charac			:			Size <sup>4</sup>			vity <sup>5</sup>	0.16	Atterberg	Proctor
Sample Number	G	VM	VD	СН	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K <sub>unsat</sub>	DS	WS	Н	F	С	CU <sup>6</sup>	Limits	Compaction
L2 Auger Cuttings (1 & 2)																						Х
T/O Auger Cuttings (1 & 2) (T/O- 1 & T/O-3,4)																						Х
Topsoil North Cuttings (1 & 2)																						Х
Borrow South Cuttings (1 & 2)																						Х
Topsoil South Cuttings (1 & 2) (TS-2 & TS-3,4)																						Х
Borrow West Auger Cuttings (1 & 2)																						Х
P1-2 Auger Cuttings																						Х
P3 Auger Cuttings (1 & 2)																						Х
P4 Auger Cuttings (1 & 2)																						Х
L1-1 (10'A)	Х	Х														Х	Х					
L1-2 (20'A)																					Х	
L1-2 (20'B)	Х	Х														Х	Х					
L1-3 (5'A)	Χ	Х														Х	Χ					
L1-3 (5'B)																						
L1-4 (5'B)	Χ	Χ																				

<sup>&</sup>lt;sup>1</sup> G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method

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<sup>&</sup>lt;sup>4</sup> DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

<sup>&</sup>lt;sup>5</sup> F = Fine (<4.75mm), C = Coarse (>4.75mm)

<sup>&</sup>lt;sup>6</sup> CU = Consolidated Undrained Triaxial

Laboratory	Pro	itial S operti	es <sup>1</sup>	H Co	aturate lydrau nductiv	lic vity <sup>2</sup>		-		Charac		ics <sup>3</sup>	-			Particl Size <sup>4</sup>		Gra	ecific vity <sup>5</sup>	a 6	Atterberg	Proctor
Sample Number	G	VM	VD	СН	FH	FW	НС	PP	FP	DPP	RH	EP	WHC	K <sub>unsat</sub>	DS	WS	Н	F	С	CU <sup>6</sup>	Limits	Compaction
L1-5 (8' Bag)																						
L1-5 (20'B)																Х	Х					
L2-1 (5'A)																Х	Х					
L2-1 (5'B)	Х	Х																				
L2-1 (15'A)	Х	Х														Х	Х			Х		
L2-2 (5'A)																Х	Х					
L2-2 (5'B)																					Х	
L2-3 (5'A)	Х	Х														Х	Х					
L2-3 (5'B)																						
L2-4 (10'B)																Х	Х					
L2-5 (5'A)																Х	Х					
L2-5 (5'B)	Х	Х																		Х		
L2-6 (5'A)																Х	Χ				X	
L2-6 (10'B)	Х	Х																		X		
L2-7 (10'A)																Х	Χ					

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<sup>&</sup>lt;sup>2</sup> CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

<sup>&</sup>lt;sup>3</sup> HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box,

EP = Effective Porosity, WHC = Water Holding Capacity, Kunsat = Calculated Unsaturated Hydraulic Conductivity

<sup>&</sup>lt;sup>4</sup> DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

<sup>&</sup>lt;sup>5</sup> F = Fine (<4.75mm), C = Coarse (>4.75mm)

<sup>&</sup>lt;sup>6</sup> CU = Consolidated Undrained Triaxial

		10		aturate										_	.c			
Laboratory		itial S operti		lydrau nducti				ivioi Charac	isture cteristi			Particle Size <sup>4</sup>			cific vity <sup>5</sup>		Atterberg	Proctor
Sample Number			VD		FW	НС	PP			WHC	K <sub>unsat</sub>	WS		F	С	CU <sup>6</sup>	Limits	Compaction
T/O-1 (20'A)	Х	Х										Х	Χ					
T/O-1 (25'A)																	Х	
T/O-1 (45'B)	Х	Х										Х	Χ					
T/O-2 (5'A)												Х	Χ					
T/O-2 (10'A)																	х	
T/O-2 (15'A)	Х	Х																
T/O-3 (15'B)	Х	Х																
T/O-3 (40'A)												Х	Χ					
T/O-3 (40'B)	Х	Х																
T/O-3 (60'A)																	Х	
T/O-3 (70'B)												Х	Χ					
T/O-4 (5'A)	Х	Х																
T/O-4 (20'B)												Х	Χ					
T/O-5 (10'B)												Х	Χ					
T/O-5 (20'A)	Х	Χ															_	

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<sup>&</sup>lt;sup>2</sup> CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

<sup>&</sup>lt;sup>3</sup> HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box,

EP = Effective Porosity, WHC = Water Holding Capacity, Kunsat = Calculated Unsaturated Hydraulic Conductivity

<sup>&</sup>lt;sup>4</sup> DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

<sup>&</sup>lt;sup>5</sup> F = Fine (<4.75mm), C = Coarse (>4.75mm)

<sup>&</sup>lt;sup>6</sup> CU = Consolidated Undrained Triaxial

Laboratory	Initial Soil Properties <sup>1</sup>		Saturated Hydraulic Conductivity <sup>2</sup>						Charac		cs <sup>3</sup>			Particle Size <sup>4</sup>			Specific Gravity <sup>5</sup>			Atterberg	Proctor	
Sample Number	G	VM	VD	СН	FH	FW	НС	PP	FP	DPP	RH	EP	WHC	$K_{\text{unsat}}$	DS	WS	Н	F	С	CU <sup>6</sup>	Limits	Compaction
T/O-6 (5'A)	Х	Х														Х	Х					
TN-1 (5'A)																Х	Χ					
TN-2 (20'A)	Х	Х														Х	Χ					
TN-2 (20'B)																						
BS-1 (10'A)	Х	Х														Х	Х					
BS-1 (10'B)																						
BS-2 (15'A)																Х	Х					
BS-6 (20'A)	Х	Х														Х	Χ					
BS-6 (20'B)																						
TS-1 (5'A)	Х	Х																				
TS-1 (20'A)																Х	Χ					
TS-2 (10'A)																Х	Х					
TS-2 (15'A)	Х	Х																				
TS-3 (10'A)	Х	Х														Х	Χ					
TS-3 (10'B)																						

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<sup>&</sup>lt;sup>2</sup> CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

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EP = Effective Porosity, WHC = Water Holding Capacity, Kunsat = Calculated Unsaturated Hydraulic Conductivity

<sup>&</sup>lt;sup>4</sup> DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

<sup>&</sup>lt;sup>5</sup> F = Fine (<4.75mm), C = Coarse (>4.75mm)

<sup>&</sup>lt;sup>6</sup> CU = Consolidated Undrained Triaxial

	a:I	aturate					Mai	sture				Particle			Cma	aifi a					
Laboratory		itial S operti		lydrau nducti					ivio Charac						Size <sup>4</sup>			ecific vity <sup>5</sup>		Atterberg	Proctor
Sample Number			VD		FW	НС	PP	FP	DPP	RH	EP	WHC	$\mathbf{K}_{\text{unsat}}$	DS	WS	Н	F	С	CU <sup>6</sup>	Limits	Compaction
TS-4 (5'A)															Х	Х					
TS-4 (10'A)	Х	Х																			
P1-1 (5'A)															Х	Х					
P1-1 (10'A)																				Х	
P1-1 (15'B)	Х	Х																			
P1-1A (30'A)	Х	Х																			
P1-2 (15'A)																				х	
P1-2 (30'B)															Х	Х					
P1-2 (50'A)	Х	Х																			
P2-1 (5'A)	Х	Х																			
P2-1 (25'A)															Х	Х					
P2-1 (25'B)	Х	Х																			
P2-2 (5'A)																				Х	
P2-2 (5'B)															Х	Х					
P3-1 (5'A)	Х	Χ													Χ						

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<sup>&</sup>lt;sup>5</sup> F = Fine (<4.75mm), C = Coarse (>4.75mm)

<sup>&</sup>lt;sup>6</sup> CU = Consolidated Undrained Triaxial

	ln	itial S	oil		aturate Iydraul					Moi	isture				F	Particle	e	Specific				
Laboratory		operti			nductiv					Charac						Size <sup>4</sup>			vity <sup>5</sup>		Atterberg	Proctor
Sample Number			VD	СН	FH	FW	НС	PP	FP	DPP	RH	EP	WHC	$K_{\text{unsat}}$	DS	WS	Н	F	С	CU <sup>6</sup>	Limits	Compaction
P3-1 (5'B)																						
P3-1 (15'A)	Х	Х																			Х	
P3-2 (10'A)	Х	Х																				
P3-2 (15'B)																Х						
P3-2 (20'A)	Х	Х																				
P3-2 (35'B)																Х						
P3-3 (5'A)																Х						
P3-3 (20'A)	Х	Χ																				
P3-3 (40'A)	Х	Х																			Х	
P3-3 (40'B)																Х						
P3-4 (10'A)	Х	Х																				
P3-4 (20'A)																Х						
P3-4 (30'A)	Χ	Х														Х						
P3-4 (40'A)	Χ	Х														Х	Χ					
P3-4 (40'B)																					Х	

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<sup>&</sup>lt;sup>4</sup> DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

<sup>&</sup>lt;sup>5</sup> F = Fine (<4.75mm), C = Coarse (>4.75mm)

<sup>&</sup>lt;sup>6</sup> CU = Consolidated Undrained Triaxial

Laboratory	Initial Soil Properties <sup>1</sup>			Saturated Hydraulic Conductivity <sup>2</sup>						Charac		ics <sup>3</sup>			Particle Size <sup>4</sup>			Specific Gravity <sup>5</sup>			Atterberg	Proctor
Sample Number	G	VM	VD	СН	FH	FW	НС	PP	FP	DPP	RH	EP	WHC	$K_{unsat}$	DS	WS	Н	F	С	CU <sup>6</sup>	Limits	Compaction
P3-5 (10'A)	Х	Х														Х	Х					
P3-5 (10'B)																					х	
P3-6 (5'A)	Х	Х																				
P3-6 (20'A)	Х	Х														Х						
P3-6 (50'A)	Х	Х														Х						
P4-3 (10'B)																					Х	
P4-5 (20'A)	Х	Х														Х						
P4-6 (10'A)	Х	Х														Х	Χ					
P4-6 (10'B)																						
P4-7 (5'A)	Х	Х														Х						
P4-7 (5'B)																						
P4-7 (25'B)	Х	Х														Х	Χ					
P4-8 (15'A)																					Х	
P4-8 (15'B)	Х	Х														Х	Χ					
P4-9 (5'A)	Х	Χ																				

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<sup>&</sup>lt;sup>3</sup> HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box,

EP = Effective Porosity, WHC = Water Holding Capacity, Kunsat = Calculated Unsaturated Hydraulic Conductivity

<sup>&</sup>lt;sup>4</sup> DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

<sup>&</sup>lt;sup>5</sup> F = Fine (<4.75mm), C = Coarse (>4.75mm)

<sup>&</sup>lt;sup>6</sup> CU = Consolidated Undrained Triaxial



		itial S		Saturated Hydraulic							isture				Particle			Specific Gravity <sup>5</sup>				
Laboratory		Properties <sup>1</sup> Conductivity <sup>2</sup> G VM VD CH FH FW HC				110	Characteristics <sup>3</sup> HC PP FP DPP RH EP WHC K <sub>unsat</sub>									Size <sup>4</sup> DS WS H			CU <sup>6</sup>	Atterberg	Proctor	
Sample Number	G	VIVI	٧D	Сп	гп	FVV	пС	PP	۲P	שרע	ΚП	EP	WHC	Nunsat	סט	W 5	П	F	С	00	Limits	Compaction
P4-9 (35'B)	Х	Х														Х	Х					
BW-1 (20'A)																Х	Х					
BW-1 (30'A)	Х	Χ																				
BW-2 (10'A)	Х	Χ														Χ	Х					
BW-2 (10'B)																						
BW-3 (5'A)	X	Χ														Х	Х					
BW-4 (20'A)																						
BW-4 (20'B)																						

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<sup>&</sup>lt;sup>3</sup> HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box,

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<sup>&</sup>lt;sup>4</sup> DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

<sup>&</sup>lt;sup>5</sup> F = Fine (<4.75mm), C = Coarse (>4.75mm)

<sup>&</sup>lt;sup>6</sup> CU = Consolidated Undrained Triaxial



#### **Notes**

#### Report Revision July 2, 2018:

This revised report includes all results previously submitted in the report dated June 20, 2018, as well as initial properties test data for sample L2-1 (5'A) and particle size analysis test data for sample L2-1 (15'A). Other than the addition of these test results, no changes were made to the previously submitted data.

#### Sample Receipt:

Three hundred ninety five samples were hand delivered between April 4, 2018 and May 4, 2018. Ten samples were received, each as loose material in two full 5-gallon buckets sealed with a lid. Fourteen samples were received each as loose material, double-bagged in 1/4 full 1-gallon Ziploc bag. The remaining three hundred seventy one samples were received each in a 2" x 6" brass sleeve sealed with end caps.

#### **Sample Preparation and Testing Notes:**

One hundred fifteen samples were tested. Forty nine samples were subjected to initial properties testing. Sixty seven samples were subjected to particle size analysis, forty two of which included hydrometer analysis. Fifteen samples were subjected to Atterberg limits testing. Ten of the samples were subjected to standard proctor compaction testing. And, three samples were selected for 3-stage consolidated undrained triaxial shear testing.

Porosity calculations, and the particle diameter calculations in the hydrometer portion of the particle size analysis testing, are based on the use of an assumed specific gravity value of 2.65.

#### **Consolidated Undrained Triaxial Shear Testing:**

Each of the staged consolidated undrained (CU) triaxial shear tests were performed using a single sample. The test samples were extruded from the sampling sleeves and the ends were trimmed using a blade. Each three-stage CU triaxial shear test was performed using test parameters and effective confining stresses specified by the client.

The first stage was performed by consolidating the sample at the lowest specified effective stress and then shearing to 3% strain, unless there was a clear peak or leveling off of the deviator stress prior to the 3% strain, in which case the Stage 1 test was halted. Upon completion, the specimen was unloaded and returned to the starting pre-compression load. The effective stress was increased to the next highest confining stress for the second stage, and was once again consolidated and sheared to 3% strain unless there was a clear peak or leveling off of the deviator stress prior to the 3% strain, in which case the Stage 2 test was halted. Upon completion, the specimen was unloaded and returned to the starting pre-compression load. The effective stress was then increased to the highest requested confining stress for the third and final stage, and the sample was consolidated and sheared to 15% strain. In all cases 'failure' was interpreted as the peak deviator stress achieved for each stage.

The cohesion and friction angle provided represent one possible interpretation of a Mohr-Coulomb failure envelope. Qualified persons familiar with the material and the site should evaluate the test results independently prior to use in the intended application.



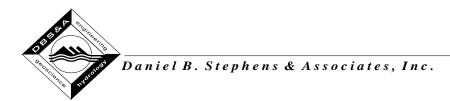
## Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

**Moisture Content** 

		Moistare	Contont				
	As Re	ceived	Rem	olded	Dry Bulk	Wet Bulk	Calculated
Sample Number	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )	Density (g/cm <sup>3</sup> )	Density (g/cm³)	Porosity (%)
L1-1 (10'A)	6.3	8.7			1.39	1.47	47.6
L1-2 (20'B)	10.2	17.8			1.75	1.93	33.9
L1-3 (5'A)	4.2	6.3			1.50	1.56	43.4
L1-4 (5'B)	7.5	10.6			1.41	1.52	46.7
L2-1 (5'B)	4.1	7.0			1.69	1.76	36.3
L2-3 (5'A)	3.8	6.1			1.61	1.67	39.3
T/O-1 (20'A)	11.4	19.5			1.71	1.90	35.6
T/O-1 (45'B)	7.2	10.9			1.51	1.62	42.9
T/O-2 (15'A)	11.3	18.5			1.63	1.81	38.6
T/O-3 (15'B)	9.9	18.4			1.87	2.05	29.5
T/O-3 (40'B)	6.8	10.9			1.61	1.72	39.3
T/O-4 (5'A)	8.9	16.4			1.86	2.02	30.0

NA = Not analyzed

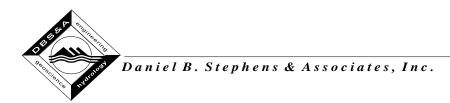
<sup>--- =</sup> This sample was not remolded



**Moisture Content** 

	Wolstare Content						
	As Re	eceived	Rem	olded	Dry Bulk	Wet Bulk	Calculated
Sample Number	Gravimetric (%, g/g)	Volumetric (%, cm³/cm³)	Gravimetric (%, g/g)	Volumetric (%, cm³/cm³)	Density (g/cm <sup>3</sup> )	Density (g/cm³)	Porosity (%)
T/O-5 (20'A)	6.3	9.4			1.51	1.60	43.1
T/O-6 (5'A)	6.9	12.0			1.75	1.87	34.1
TN-2 (20'A)	6.0	7.8			1.30	1.38	50.8
BS-1 (10'A)	8.4	12.3			1.46	1.58	44.9
BS-6 (20'A)	7.0	9.5			1.36	1.45	48.8
TS-1 (5'A)	7.8	14.4			1.83	1.98	30.8
TS-2 (15'A)	8.9	14.3			1.60	1.74	39.6
TS-3 (10'A)	6.0	9.6			1.61	1.70	39.3
TS-4 (10'A)	7.0	13.8			1.98	2.11	25.4
P1-1 (15'B)	10.0	13.4			1.35	1.48	49.1
P1-1A (30'A)	3.9	4.8			1.23	1.28	53.7
P1-2 (50'A)	4.3	6.9			1.60	1.67	39.7

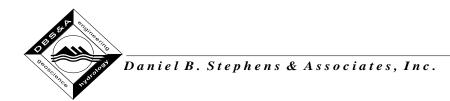
<sup>--- =</sup> This sample was not remolded



**Moisture Content** 

	Moisture Content							
	As Re	ceived	Rem	olded	Dry Bulk	Wet Bulk	Calculated	
 Sample Number	Gravimetric (%, g/g)	Volumetric (%, cm³/cm³)	Gravimetric (%, g/g)	Volumetric (%, cm³/cm³)	Density (g/cm <sup>3</sup> )	Density (g/cm³)	Porosity (%)	
P2-1 (5'A)	13.2	24.6			1.86	2.10	30.0	
P2-1 (25'B)	15.4	25.6			1.67	1.92	37.1	
P3-1 (5'A)	7.3	13.6			1.86	2.00	29.7	
P3-1 (15'A)	9.4	8.8			0.93	1.02	64.8	
P3-2 (10'A)	6.6	11.1			1.69	1.80	36.2	
P3-2 (20'A)	11.3	18.8			1.67	1.86	37.1	
P3-3 (20'A)	8.1	13.7			1.69	1.83	36.2	
P3-3 (40'A)	14.7	26.3			1.79	2.06	32.3	
P3-4 (10'A)	9.3	14.4			1.54	1.69	41.8	
P3-4 (30'A)	6.0	9.1			1.53	1.62	42.4	
P3-4 (40'A)	7.1	13.3			1.87	2.01	29.3	
P3-5 (10'A)	8.3	15.5			1.85	2.01	30.0	

<sup>--- =</sup> This sample was not remolded



**Moisture Content** 

	Wolstare Content						
	As Re	eceived	Rem	olded	Dry Bulk	Wet Bulk	Calculated
 Sample Number	Gravimetric (%, g/g)	Volumetric (%, cm³/cm³)	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )	Density (g/cm <sup>3</sup> )	Density (g/cm³)	Porosity (%)
P3-6 (5'A)	4.8	7.8			1.63	1.71	38.4
P3-6 (20'A)	9.3	16.1			1.73	1.89	34.8
P3-6 (50'A)	6.0	10.7			1.77	1.88	33.1
P4-5 (20'A)	7.3	12.6			1.74	1.87	34.4
P4-6 (10'A)	10.0	15.9			1.59	1.74	40.2
P4-7 (5'A)	9.8	14.6			1.49	1.64	43.7
P4-7 (25'B)	6.2	11.0			1.76	1.87	33.5
P4-8 (15'B)	13.0	21.0			1.62	1.83	38.9
P4-9 (5'A)	4.4	8.3			1.87	1.95	29.4
P4-9 (35'B)	13.5	22.4			1.66	1.89	37.3
BW-1 (30'A)	9.3	13.0			1.40	1.53	47.3
BW-2 (10'A)	5.9	8.9			1.52	1.61	42.8

<sup>--- =</sup> This sample was not remolded



Moisture Content

		เทอเรเนเษ	Content				
	As Re	eceived	Rem	olded	Dry Bulk	Wet Bulk	Calculated
	Gravimetric	Volumetric	Gravimetric	Volumetric	Density	Density	Porosity
Sample Number	(%, g/g)	(%, cm <sup>3</sup> /cm <sup>3</sup> )	(%, g/g)	(%, cm <sup>3</sup> /cm <sup>3</sup> )	(g/cm <sup>3</sup> )	(g/cm <sup>3</sup> )	(%)
BW-3 (5'A)	3.8	6.1			1.62	1.68	38.9

<sup>--- =</sup> This sample was not remolded



### **Summary of Particle Size Characteristics**

 Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	$C_{u}$	$C_c$	Method	ASTM Classification	USDA Classification	_
SA-GM 1B	NA	NA	NA	NA	NA	WS	NA	NA	(Est)
SA-GM 1T	NA	NA	NA	NA	NA	WS	NA	NA	(Est)
SA-GM 2B	NA	NA	0.071	NA	NA	WS	NA	NA	(Est)
SA-GM 2T	NA	NA	NA	NA	NA	WS	NA	NA	(Est)
SA-GM 3B	NA	0.18	0.25	NA	NA	WS	NA	NA	(Est)
SA-GM 3T	NA	0.18	0.37	NA	NA	WS	NA	NA <sup>†</sup>	(Est)
SA-GM 4B	NA	0.11	0.13	NA	NA	WS	NA	NA	(Est)
SA-GM 5B	NA	0.21	0.28	NA	NA	WS	NA	NA <sup>†</sup>	(Est)
SA-GM 5T	0.16	0.38	0.43	2.7	1.3	WS	NA	Sand	
SA-GM 6B	NA	NA	NA	NA	NA	WS	NA	NA	(Est)
SA-GM 6T	NA	NA	NA	NA	NA	WS	NA	NA	(Est)

d<sub>50</sub> = Median particle diameter

 $C_u = \frac{d}{dx}$ 

DS = Dry sieve

<sup>†</sup> Greater than 10% of sample is coarse material

Est = Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

u<sub>10</sub>

 $= \frac{(d_{30})^2}{(d_{10})(d_{60})}$ 

WS = Wet sieve

= Hydrometer



#### **Summary of Particle Size Characteristics (Continued)**

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	$C_{u}$	$C_c$	Method	ASTM Classification	USDA Classification	
SA-GM 7B	NA	0.11	0.13	NA	NA	WS	NA	NA	(Est)
SA-GM 8B	NA	0.12	0.16	NA	NA	WS	NA	NA	(Est)
SA-GM 8T	NA	0.37	0.52	NA	NA	WS	NA	NA <sup>†</sup>	(Est)
L1-1 (10'A)	2.2E-05	0.046	0.061	2773	33	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam	(Est)
L1-2 (20'B)	2.8E-05	0.0092	0.015	536	12	WS/H	Classification by ASTM 2487 requires Atterberg test	Silty Clay Loam	(Est)
L1-3 (5'A)	6.4E-45	0.066	0.088	1.4E+43	2.1E+42	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
L1-5 (20'B)	0.0011	0.074	0.093	85	17	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
L2-1 (5'A)	0.00040	0.045	0.060	150	9.4	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam	(Est)
L2-1 (15'A)	0.00024	0.056	0.065	271	11	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
L2-2 (5'A)	0.00019	0.067	0.085	447	60	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
L2-3 (5'A)	0.00094	0.076	0.089	95	26	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)

d<sub>50</sub> = Median particle diameter

Est = Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

 $C_{u} = \frac{d_{60}}{d_{10}}$ 

DS = Dry sieve

= Hydrometer

WS = Wet sieve

<sup>†</sup> Greater than 10% of sample is coarse material



#### **Summary of Particle Size Characteristics (Continued)**

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	$C_{u}$	$C_c$	Method	ASTM Classification	USDA Classification	
L2-4 (10'B)	3.9E-05	0.045	0.057	1462	65	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam	(Est)
L2-5 (5'A)	4.4E-05	0.0022	0.0047	107	0.50	WS/H	Classification by ASTM 2487 requires Atterberg test	Silty Clay	(Est)
L2-6 (5'A)	0.00031	0.013	0.030	97	0.43	WS/H	Lean clay (CL)	Clay Loam	(Est)
L2-7 (10'A)	1.9E-09	0.057	0.075	3.9E+07	4.4E+06	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
T/O-1 (20'A)	0.00030	0.0088	0.016	53	0.75	WS/H	Classification by ASTM 2487 requires Atterberg test	Silty Clay Loam	(Est)
T/O-1 (45'B)	5.1E-05	0.070	0.099	1941	51	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Clay Loam	(Est)
T/O-2 (5'A)	0.0025	0.010	0.022	8.8	0.15	WS/H	Classification by ASTM 2487 requires Atterberg test	Silt Loam	
T/O-3 (40'A)	0.00083	0.078	0.10	120	20	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
T/O-3 (70'B)	0.00032	0.034	0.045	141	8.4	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam	(Est)
T/O-4 (20'B)	0.00059	0.034	0.050	85	4.1	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam	(Est)
T/O-5 (10'B)	0.0011	0.028	0.039	35	2.3	WS/H	Classification by ASTM 2487 requires Atterberg test	Silt Loam	(Est)
									-

d<sub>50</sub> = Median particle diameter

DS = Dry sieve = Hydrometer

WS = Wet sieve

<sup>†</sup> Greater than 10% of sample is coarse material



## **Summary of Particle Size Characteristics (Continued)**

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	$C_{u}$	$C_c$	Method	ASTM Classification	USDA Classification	_
T/O-6 (5'A)	0.00066	0.043	0.054	82	9.1	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam	(Est)
TN-1 (5'A)	0.00074	0.077	0.097	131	17	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
TN-2 (20'A)	0.00077	0.079	0.10	130	18	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
BS-1 (10'A)	0.00029	0.052	0.076	262	4.4	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Clay Loam	(Est)
BS-2 (15'A)	0.0039	0.061	0.082	21	0.61	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	
BS-6 (20'A)	0.00018	0.054	0.062	344	43	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
TS-1 (20'A)	0.0010	0.035	0.048	48	2.0	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam	(Est)
TS-2 (10'A)	0.0019	0.087	0.12	63	3.0	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	
TS-3 (10'A)	0.00086	0.043	0.051	59	3.9	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam	(Est)
TS-4 (5'A)	0.0011	0.11	0.13	118	20	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
P1-1 (5'A)	0.0012	0.13	0.17	142	23	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam <sup>†</sup>	(Est)
d <sub>50</sub> = Median particle diameter	C <sub>u</sub> =	$\frac{d_{60}}{d_{40}}$		DS = Dry sieve		<sup>†</sup> Greater tha	n 10% of sample is coarse material		

Est = Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

= Hydrometer

WS = Wet sieve



#### **Summary of Particle Size Characteristics (Continued)**

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	$C_{u}$	$C_c$	Method	ASTM Classification	USDA Classification	_
P1-2 (30'B)	0.0010	0.11	0.16	160	21	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam <sup>†</sup>	(Est)
P2-1 (25'A)	0.00071	0.087	0.12	169	11	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
P2-2 (5'B)	0.00078	0.089	0.11	141	28	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
P3-1 (5'A)	NA	0.23	0.33	NA	NA	WS	NA	NA <sup>†</sup>	(Est)
P3-2 (15'B)	NA	0.20	0.25	NA	NA	WS	NA	NA	(Est)
P3-2 (35'B)	NA	0.15	0.19	NA	NA	WS	NA	NA	(Est)
P3-3 (5'A)	NA	0.15	0.19	NA	NA	WS	NA	NA	(Est)
P3-3 (40'B)	NA	0.085	0.099	NA	NA	WS	NA	NA	(Est)
P3-4 (20'A)	0.11	0.25	0.29	2.6	0.91	WS	NA	Sand	
P3-4 (30'A)	0.10	0.19	0.22	2.2	0.89	WS	NA	Sand	
P3-4 (40'A)	0.0029	0.072	0.087	30	7.7	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	

d<sub>50</sub> = Median particle diameter

 $C_u = \frac{d_{60}}{d_{10}}$ 

DS = Dry sieve

H = Hydrometer

 $(d_{30})^2$  WS = Wet sieve

 $^{\dagger}$  Greater than 10% of sample is coarse material



## **Summary of Particle Size Characteristics (Continued)**

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	$C_{u}$	$C_c$	Method	ASTM Classification	USDA Classification	
P3-5 (10'A)	0.020	0.099	0.12	6.0	2.2	WS/H	Classification by ASTM 2487 requires Atterberg test	Loamy Sand	_
P3-6 (20'A)	NA	0.20	0.24	NA	NA	WS	NA	NA	(Est)
P3-6 (50'A)	NA	0.23	0.30	NA	NA	WS	NA	NA	(Est)
P4-5 (20'A)	NA	0.30	0.39	NA	NA	WS	NA	NA <sup>†</sup>	(Est)
P4-6 (10'A)	0.0012	0.072	0.084	70	23	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
P4-7 (5'A)	NA	0.077	0.095	NA	NA	WS	NA NA	NA	(Est)
P4-7 (25'B)	0.0052	0.28	0.34	65	9.6	WS/H	Classification by ASTM 2487 requires Atterberg test	Loamy Sand	
P4-8 (15'B)	0.0011	0.085	0.13	118	5.1	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
P4-9 (35'B)	6.7E-06	0.061	0.087	1.3E+04	1160	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam <sup>†</sup>	(Est)
BW-1 (20'A)	0.0012	0.047	0.083	69	1.2	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam	(Est)
BW-2 (10'A)	0.00035	0.062	0.084	240	18	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
BW-3 (5'A)	0.0011	0.080	0.099	90	23	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)

d<sub>50</sub> = Median particle diameter

Est = Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>o</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

<sup>†</sup> Greater than 10% of sample is coarse material

WS = Wet sieve



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#### Percent Gravel, Sand, Silt and Clay\*

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
SA-GM 1B	0.0	15.0	85.0	**
SA-GM 1T	0.1	34.3	65.6	**
SA-GM 2B	0.0	39.4	60.6	**
SA-GM 2T	0.0	24.4	75.6	**
SA-GM 3B	0.0	69.0	31.0	**
SA-GM 3T	15.1	48.0	36.9	**
SA-GM 4B	0.0	64.2	35.8	**
SA-GM 5B	14.6	61.8	23.6	**
SA-GM 5T	0.1	94.9	5.1	**
SA-GM 6B	0.0	20.4	79.6	**
SA-GM 6T	0.0	17.6	82.4	**
SA-GM 7B	0.0	62.6	37.4	**
SA-GM 8B	0.0	61.1	38.9	**
SA-GM 8T	13.4	70.7	15.8	**
L1-1 (10'A)	0.0	33.2	43.1	23.7
L1-2 (20'B)	0.1	2.3	68.1	29.5

<sup>\*</sup>USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

<sup>\*\*</sup>Fractions of silt and clay were not determined by hydrometer analysis; percentages of silt and clay represent fraction finer than 0.075mm.

#### Percent Gravel, Sand, Silt and Clay\* (Continued)

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
L1-3 (5'A)	0.0	46.5	40.8	12.7
L1-5 (20'B)	0.0	49.7	37.7	12.6
L2-1 (5'A)	0.0	32.5	49.0	18.5
L2-1 (15'A)	0.0	31.5	50.5	18.0
L2-2 (5'A)	0.0	46.3	37.5	16.2
L2-3 (5'A)	0.0	51.2	36.8	12.1
L2-4 (10'B)	0.0	28.8	50.0	21.2
L2-5 (5'A)	0.0	2.8	48.6	48.6
L2-6 (5'A)	0.0	14.8	55.2	29.9
L2-7 (10'A)	0.0	40.1	48.2	11.7
T/O-1 (20'A)	0.2	3.2	66.0	30.6
T/O-1 (45'B)	0.0	47.9	31.0	21.1
T/O-2 (5'A)	0.0	23.0	71.5	5.5
T/O-3 (40'A)	0.0	51.5	34.4	14.1
T/O-3 (70'B)	0.5	8.7	73.8	17.1
T/O-4 (20'B)	0.0	24.8	57.7	17.5

<sup>\*</sup>USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

<sup>\*\*</sup>Fractions of silt and clay were not determined by hydrometer analysis; percentages of silt and clay represent fraction finer than 0.075mm.



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#### Percent Gravel, Sand, Silt and Clay\* (Continued)

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
T/O-5 (10'B)	0.0	10.1	75.3	14.6
T/O-6 (5'A)	0.0	24.3	59.7	16.0
TN-1 (5'A)	0.4	50.9	33.3	15.4
TN-2 (20'A)	0.0	51.9	34.4	13.8
BS-1 (10'A)	0.0	40.8	36.1	23.0
BS-2 (15'A)	0.0	43.0	51.6	5.3
BS-6 (20'A)	0.0	26.3	55.8	17.9
TS-1 (20'A)	0.0	18.2	65.1	16.7
TS-2 (10'A)	0.0	53.9	35.3	10.8
TS-3 (10'A)	0.0	16.1	68.6	15.2
TS-4 (5'A)	0.7	63.1	22.7	13.5
P1-1 (5'A)	18.8	49.8	20.8	10.6
P1-2 (30'B)	20.3	43.0	24.9	11.8
P2-1 (25'A)	0.3	54.0	30.7	15.1
P2-2 (5'B)	5.1	53.2	27.1	14.6
P3-1 (5'A)	19.7	64.9	15.3	**
P3-2 (15'B)	0.0	78.8	21.2	**

<sup>\*</sup>USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

<sup>\*\*</sup>Fractions of silt and clay were not determined by hydrometer analysis; percentages of silt and clay represent fraction finer than 0.075mm. 27



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#### Percent Gravel, Sand, Silt and Clay\* (Continued)

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)	
P3-2 (35'B)	1.1	68.2	30.7		**
P3-3 (5'A)	0.3	67.7	31.9		**
P3-3 (40'B)	1.4	56.3	42.3		**
P3-4 (20'A)	0.0	92.7	7.3		**
P3-4 (30'A)	0.0	92.3	7.7		**
P3-4 (40'A)	0.0	48.1	44.2	7.7	
P3-5 (10'A)	0.0	68.6	27.8	3.6	
P3-6 (20'A)	0.0	85.2	14.8		**
P3-6 (50'A)	7.2	76.4	16.4		**
P4-5 (20'A)	24.9	61.0	14.1		**
P4-6 (10'A)	0.0	48.0	41.0	11.0	
P4-7 (5'A)	7.2	43.9	49.0		**
P4-7 (25'B)	0.0	77.0	17.5	5.5	
P4-8 (15'B)	0.5	51.9	35.5	12.1	
P4-9 (35'B)	15.7	26.6	46.4	11.4	
BW-1 (20'A)	0.0	45.4	34.9	19.7	
BW-2 (10'A)	0.0	44.1	38.1	17.8	
BW-3 (5'A)	0.0	53.1	35.9	11.0	

<sup>\*</sup>USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

<sup>\*\*</sup>Fractions of silt and clay were not determined by hydrometer analysis; percentages of silt and clay represent fraction finer than 0.075mm.



## **Summary of Atterberg Tests**

Sample Number	Liquid Limit	Plastic Limit	Plasticity Index	Classification
L1-2 (20'A)	41	19	22	CL
L2-2 (5'B)				ML
L2-6 (5'A)	34	17	17	CL
T/O-1 (25'A)	30	16	14	CL
T/O-2 (10'A)	48	23	25	CL
T/O-3 (60'A)				ML
P1-1 (10'A)				ML
P1-2 (15'A)				ML
P2-2 (5'A)	39	15	24	CL
P3-1 (15'A)				ML
P3-3 (40'A)				ML
P3-4 (40'B)				ML
P3-5 (10'B)				ML
P3-6 (50'A)				ML
P4-8 (15'A)				ML

<sup>--- =</sup> Soil requires visual-manual classification due to non-plasticity



## **Summary of Proctor Compaction Tests**

	Meas	sured	Oversize Corrected		
Sample Number	Optimum Moisture Content (% g/g)	Maximum Dry Bulk Density (g/cm³)	Optimum Moisture Content (% g/g)	Maximum Dry Bulk Density (g/cm <sup>3</sup> )	
L1 Auger Cuttings (1 & 2)	14.6	1.81			
L2 Auger Cuttings (1 & 2)	14.1	1.81			
T/O Auger Cuttings (1 & 2) (T/O-1 & T/O-3,4)	14.5	1.83			
Topsoil North Cuttings (1 & 2)	12.6	1.89			
Borrow South Cuttings (1 & 2)	13.0	1.84			
Topsoil South Cuttings (1 & 2) (TS-2 & TS-3,4)	15.2	1.81	12.3	1.92	
Borrow West Auger Cuttings (1 & 2)	12.7	1.87			
P1-2 Auger Cuttings	12.8	1.82			
P3 Auger Cuttings (1 & 2)	9.9	1.96	9.2	2.00	
P4 Auger Cuttings (1 & 2)	11.1	1.94	9.0	2.05	

<sup>--- =</sup> Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable

## **Summary of Consolidated Undrained (CU) Triaxial Shear Testing**

Sample Number	Effective Consolidation Stress (psi)	Effective Minor Stress at Failure (psi)	Effective Major Stress at Failure (psi)	Pore-Water Pressure at Failure (psi)	Total Minor Stress at Failure (psi)	Total Major Stress at Failure (psi)	% Strain at Failure* (%)
L2-1 (15'A) CU Stage 1 (6.0 psi)	6.0	2.5	8.4	75.0	77.6	83.4	2.12
L2-1 (15'A) CU Stage 2 (12.0 psi)	12.0	5.0	18.0	78.6	83.6	96.6	2.96
L2-1 (15'A) CU Stage 3 (24.0 psi)	24.0	9.6	35.8	86.1	95.6	121.9	7.73
L2-5 (5'B) CU Stage 1 (2.0 psi)	2.0	0.7	5.2	81.9	82.7	87.1	1.88
L2-5 (5'B) CU Stage 2 (4.0 psi)	4.0	2.0	9.4	82.5	84.6	91.9	0.97
L2-5 (5'B) CU Stage 3 (8.0 psi)	8.0	3.3	15.4	85.4	88.7	100.9	1.13
L2-6 (10'B) CU Stage 1 (3.5 psi)	3.5	2.1	3.5	83.0	85.1	86.4	0.69
L2-6 (10'B) CU Stage 2 (7.1 psi)	7.1	3.2	10.3	85.5	88.6	95.8	3.02
L2-6 (10'B) CU Stage 3 (14.0 psi)	14.0	6.0	22.4	89.7	95.7	112.1	11.74

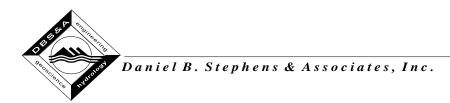
<sup>\*</sup>Noted percent strain used as failure criterion.

## Summary of Consolidated Undrained Estimated Effective Friction Angle and Cohesion

	c' Cohesion	φ' Friction Angle
Sample Number	(psi)	(°)
L2-1 (15'A) CU	0	35
L2-5 (5'B) CU	0.9	35.8
L2-6 (10'B) CU	0	32.3

<sup>&</sup>lt;sup>1</sup>The cohesion and friction angle provided represent one possible interpretation of a Mohr-Coulomb failure envelope. Qualified persons familiar with the material and the site should evaluate the test results independently prior to use in the intended application.

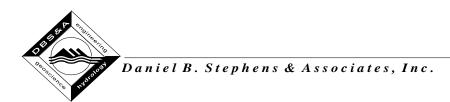
**Initial Properties** 



**Moisture Content** 

		Wolstare Content					
	As Re	eceived	Rem	olded	Dry Bulk	Wet Bulk	Calculated
 Sample Number	Gravimetric (%, g/g)	Volumetric (%, cm³/cm³)	Gravimetric (%, g/g)	Volumetric (%, cm³/cm³)	Density (g/cm <sup>3</sup> )	Density (g/cm³)	Porosity (%)
L1-1 (10'A)	6.3	8.7			1.39	1.47	47.6
L1-2 (20'B)	10.2	17.8			1.75	1.93	33.9
L1-3 (5'A)	4.2	6.3			1.50	1.56	43.4
L1-4 (5'B)	7.5	10.6			1.41	1.52	46.7
L2-1 (5'B)	4.1	7.0			1.69	1.76	36.3
L2-3 (5'A)	3.8	6.1			1.61	1.67	39.3
T/O-1 (20'A)	11.4	19.5			1.71	1.90	35.6
T/O-1 (45'B)	7.2	10.9			1.51	1.62	42.9
T/O-2 (15'A)	11.3	18.5			1.63	1.81	38.6
T/O-3 (15'B)	9.9	18.4			1.87	2.05	29.5
T/O-3 (40'B)	6.8	10.9			1.61	1.72	39.3
T/O-4 (5'A)	8.9	16.4			1.86	2.02	30.0

<sup>--- =</sup> This sample was not remolded



**Moisture Content** 

	Moistare Content						
	As Re	eceived	Rem	olded	Dry Bulk	Wet Bulk	Calculated
Sample Number	Gravimetric (%, g/g)	Volumetric (%, cm³/cm³)	Gravimetric (%, g/g)	Volumetric (%, cm³/cm³)	Density (g/cm <sup>3</sup> )	Density (g/cm³)	Porosity (%)
T/O-5 (20'A)	6.3	9.4			1.51	1.60	43.1
T/O-6 (5'A)	6.9	12.0			1.75	1.87	34.1
TN-2 (20'A)	6.0	7.8			1.30	1.38	50.8
BS-1 (10'A)	8.4	12.3			1.46	1.58	44.9
BS-6 (20'A)	7.0	9.5			1.36	1.45	48.8
TS-1 (5'A)	7.8	14.4			1.83	1.98	30.8
TS-2 (15'A)	8.9	14.3			1.60	1.74	39.6
TS-3 (10'A)	6.0	9.6			1.61	1.70	39.3
TS-4 (10'A)	7.0	13.8			1.98	2.11	25.4
P1-1 (15'B)	10.0	13.4			1.35	1.48	49.1
P1-1A (30'A)	3.9	4.8			1.23	1.28	53.7
P1-2 (50'A)	4.3	6.9			1.60	1.67	39.7

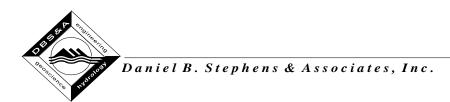
<sup>--- =</sup> This sample was not remolded



**Moisture Content** 

	IVIOISTUTE COTTLETT						
	As Re	ceived	Rem	olded	Dry Bulk	Wet Bulk	Calculated
 Sample Number	Gravimetric (%, g/g)	Volumetric (%, cm³/cm³)	Gravimetric (%, g/g)	Volumetric (%, cm³/cm³)	Density (g/cm <sup>3</sup> )	Density (g/cm³)	Porosity (%)
P2-1 (5'A)	13.2	24.6			1.86	2.10	30.0
P2-1 (25'B)	15.4	25.6			1.67	1.92	37.1
P3-1 (5'A)	7.3	13.6			1.86	2.00	29.7
P3-1 (15'A)	9.4	8.8			0.93	1.02	64.8
P3-2 (10'A)	6.6	11.1			1.69	1.80	36.2
P3-2 (20'A)	11.3	18.8			1.67	1.86	37.1
P3-3 (20'A)	8.1	13.7			1.69	1.83	36.2
P3-3 (40'A)	14.7	26.3			1.79	2.06	32.3
P3-4 (10'A)	9.3	14.4			1.54	1.69	41.8
P3-4 (30'A)	6.0	9.1			1.53	1.62	42.4
P3-4 (40'A)	7.1	13.3			1.87	2.01	29.3
P3-5 (10'A)	8.3	15.5			1.85	2.01	30.0

<sup>--- =</sup> This sample was not remolded



**Moisture Content** 

		Wolsture Content					
	As Re	eceived	Rem	olded	Dry Bulk	Wet Bulk	Calculated
 Sample Number	Gravimetric (%, g/g)	Volumetric (%, cm³/cm³)	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )	Density (g/cm <sup>3</sup> )	Density (g/cm³)	Porosity (%)
P3-6 (5'A)	4.8	7.8			1.63	1.71	38.4
P3-6 (20'A)	9.3	16.1			1.73	1.89	34.8
P3-6 (50'A)	6.0	10.7			1.77	1.88	33.1
P4-5 (20'A)	7.3	12.6			1.74	1.87	34.4
P4-6 (10'A)	10.0	15.9			1.59	1.74	40.2
P4-7 (5'A)	9.8	14.6			1.49	1.64	43.7
P4-7 (25'B)	6.2	11.0			1.76	1.87	33.5
P4-8 (15'B)	13.0	21.0			1.62	1.83	38.9
P4-9 (5'A)	4.4	8.3			1.87	1.95	29.4
P4-9 (35'B)	13.5	22.4			1.66	1.89	37.3
BW-1 (30'A)	9.3	13.0			1.40	1.53	47.3
BW-2 (10'A)	5.9	8.9			1.52	1.61	42.8

<sup>--- =</sup> This sample was not remolded



**Moisture Content** 

		Moisture	Content				
	As Re	eceived	Remolded		Dry Bulk	Wet Bulk	ılk Calculated
	Gravimetric	Volumetric	Gravimetric	Volumetric	Density	Density	Porosity
 Sample Number	(%, g/g)	(%, cm <sup>3</sup> /cm <sup>3</sup> )	(%, g/g)	(%, cm <sup>3</sup> /cm <sup>3</sup> )	(g/cm <sup>3</sup> )	(g/cm <sup>3</sup> )	(%)
BW-3 (5'A)	3.8	6.1			1.62	1.68	38.9

<sup>--- =</sup> This sample was not remolded



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: L1-1 (10'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

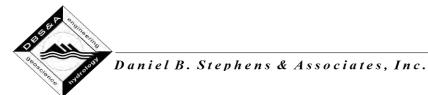
	As Received	Remolded
Test Date:	10-May-18	
Field weight* of sample (g): Tare weight, ring (g):	584.09 0.00	
Tare weight, an/plate (g): Tare weight, other (g):	294.41 0.00	
Dry weight of sample (g):  Sample volume (cm <sup>3</sup> ):  Assumed particle density (g/cm <sup>3</sup> ):	272.52 196.40 2.65	
Assumed particle density (grown).	2.03	
Gravimetric Moisture Content (% g/g):	6.3	
Volumetric Moisture Content (% vol):	8.7	
Dry bulk density (g/cm <sup>3</sup> ):	1.39	
Wet bulk density (g/cm <sup>3</sup> ):	1.47	
Calculated Porosity (% vol):	47.6	
Percent Saturation:	18.3	

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: L1-2 (20'B)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

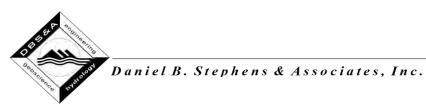
	As Received	Remolded
Test Date:	10-May-18	
Field weight* of sample (g):	813.19 0.00 271.60 0.00 491.56 280.53 2.65	
Gravimetric Moisture Content (% g/g):	10.2	
Volumetric Moisture Content (% vol):	17.8	
Dry bulk density (g/cm <sup>3</sup> ):	1.75	
Wet bulk density (g/cm <sup>3</sup> ):	1.93	
Calculated Porosity (% vol):	33.9	
Percent Saturation:	52.6	

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: L1-3 (5'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

	As Received	Remolded
Test Date:	10-May-18	
Field weight* of sample (g): Tare weight, ring (g): Tare weight, pan/plate (g): Tare weight, other (g):  Dry weight of sample (g):	736.63 0.00 283.35 0.00	
Sample volume (cm³):	289.93	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	
Gravimetric Moisture Content (% g/g):	4.2	
Volumetric Moisture Content (% vol):	6.3	
Dry bulk density (g/cm <sup>3</sup> ):	1.50	
Wet bulk density (g/cm <sup>3</sup> ):	1.56	
Calculated Porosity (% vol):	43.4	
Percent Saturation:	14.6	
·		

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: L1-4 (5'B)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

	As Received	Remolded
Test Date:	23-May-18	
Field weight* of sample (g): Tare weight, ring (g): Tare weight, pan/plate (g): Tare weight, other (g):	720.27 0.00 295.01 0.00	
Dry weight of sample (g): Sample volume (cm³): Assumed particle density (g/cm³):	395.59 279.95 2.65	
Gravimetric Moisture Content (% g/g):	7.5	
Volumetric Moisture Content (% vol):	10.6	
Dry bulk density (g/cm <sup>3</sup> ):	1.41	
Wet bulk density (g/cm <sup>3</sup> ):	1.52	
Calculated Porosity (% vol):	46.7	
Percent Saturation:	22.7	

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: L2-1 (5'B)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

	As Received	Remolded
Test Date:	25-Jun-18	
Field weight* of sample (g): Tare weight, ring (g): Tare weight, pan/plate (g): Tare weight, other (g):	43.78 0.00 6.50 0.00	
Dry weight of sample (g):	35.80	
Sample volume (cm³):	21.20	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	
Gravimetric Moisture Content (% g/g):	4.1	
Volumetric Moisture Content (% vol):	7.0	
Dry bulk density (g/cm <sup>3</sup> ):	1.69	
Wet bulk density (g/cm <sup>3</sup> ):	1.76	
Calculated Porosity (% vol):	36.3	
Percent Saturation:	19.2	

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: L2-3 (5'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

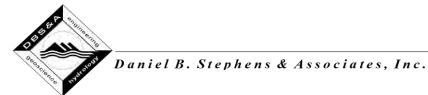
	As Received	Remolded
Test Date:	10-May-18	
Field weight* of sample (g): Tare weight, ring (g): Tare weight, pan/plate (g): Tare weight, other (g):	785.37 0.00 298.50 0.00	
Dry weight of sample (g):	469.13	
Sample volume (cm³):	291.47	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	
Gravimetric Moisture Content (% g/g):	3.8	
Volumetric Moisture Content (% vol):	6.1	
Dry bulk density (g/cm <sup>3</sup> ):	1.61	
Wet bulk density (g/cm <sup>3</sup> ):	1.67	
Calculated Porosity (% vol):	39.3	
Percent Saturation:	15.5	

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: T/O-1 (20'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

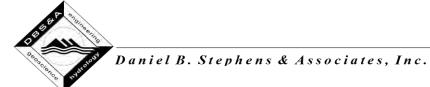
	As Received	Remolded
Test Date:	10-May-18	
Field weight* of sample (g): Tare weight, ring (g): Tare weight, pan/plate (g): Tare weight, other (g):  Dry weight of sample (g):	771.59 0.00 268.53 0.00 451.54	
Sample volume (cm³):	264.39	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	
Gravimetric Moisture Content (% g/g):	11.4	
Volumetric Moisture Content (% vol):	19.5	
Dry bulk density (g/cm <sup>3</sup> ):	1.71	
Wet bulk density (g/cm <sup>3</sup> ):	1.90	
Calculated Porosity (% vol):	35.6	
Percent Saturation:	54.8	

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: T/O-1 (45'B)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

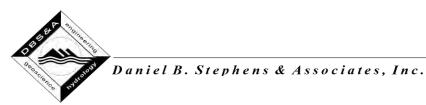
	As Received	Remolded
Test Date:	10-May-18	
Field weight* of sample (g):	757.08	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	284.52	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	440.68	
Sample volume (cm³):	291.25	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	
Accounted particle deficity (grown).	2.00	
Gravimetric Moisture Content (% g/g):	7.2	
Volumetric Moisture Content (% vol):	10.9	
` ,		
Dry bulk density (g/cm <sup>3</sup> ):	1.51	
Wet bulk density (g/cm <sup>3</sup> ):	1.62	
Calculated Porosity (% vol):	42.9	
Percent Saturation:	25.5	

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: T/O-2 (15'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Field weight* of sample (g): 720.49 Tare weight, ring (g): 0.00 Tare weight, pan/plate (g): 210.97 Tare weight, other (g): 0.00  Dry weight of sample (g): 457.59 Sample volume (cm³): 281.26 Assumed particle density (g/cm³): 2.65  Gravimetric Moisture Content (% g/g): 11.3  Volumetric Moisture Content (% vol): 18.5 Dry bulk density (g/cm³): 1.63 Wet bulk density (g/cm³): 1.81 Calculated Porosity (% vol): 38.6 Percent Saturation: 47.8		As Received	Remolded
Tare weight, ring (g): 0.00 Tare weight, pan/plate (g): 210.97 Tare weight, other (g): 0.00  Dry weight of sample (g): 457.59 Sample volume (cm³): 281.26 Assumed particle density (g/cm³): 2.65  Gravimetric Moisture Content (% g/g): 11.3  Volumetric Moisture Content (% vol): 18.5 Dry bulk density (g/cm³): 1.63 Wet bulk density (g/cm³): 1.81 Calculated Porosity (% vol): 38.6	Test Date:	23-May-18	
Volumetric Moisture Content (% vol): 18.5  Dry bulk density (g/cm³): 1.63  Wet bulk density (g/cm³): 1.81  Calculated Porosity (% vol): 38.6	Tare weight, ring (g): Tare weight, pan/plate (g): Tare weight, other (g):  Dry weight of sample (g): Sample volume (cm <sup>3</sup> ):	0.00 210.97 0.00 457.59 281.26	
Percent Saturation: 47.8	Volumetric Moisture Content (% vol):  Dry bulk density (g/cm <sup>3</sup> ):  Wet bulk density (g/cm <sup>3</sup> ):	18.5 1.63 1.81	
	,	47.8	

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: T/O-3 (15'B)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

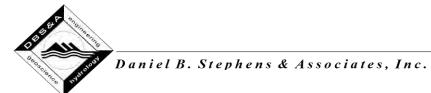
	As Received	Remolded
Test Date:	23-May-18	
Field weight* of sample (g):	772.95 0.00 268.52 0.00 459.12 245.75 2.65	
Gravimetric Moisture Content (% g/g):	9.9	
Volumetric Moisture Content (% vol):	18.4	
Dry bulk density (g/cm <sup>3</sup> ):	1.87	
Wet bulk density (g/cm <sup>3</sup> ):	2.05	
Calculated Porosity (% vol):	29.5	
Percent Saturation:	62.5	

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: T/O-3 (40'B)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

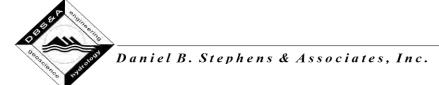
	As Received	Remolded
Test Date:	23-May-18	
Field weight* of sample (g):     Tare weight, ring (g):     Tare weight, pan/plate (g):     Tare weight, other (g):     Dry weight of sample (g):     Sample volume (cm³): Assumed particle density (g/cm³):	781.23 0.00 288.04 0.00 461.86 286.89 2.65	
Gravimetric Moisture Content (% g/g):	6.8	
Volumetric Moisture Content (% yol):	10.9	
, ,		
Dry bulk density (g/cm³):	1.61	
Wet bulk density (g/cm <sup>3</sup> ):	1.72	
Calculated Porosity (% vol):	39.3	
Percent Saturation:	27.8	

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: T/O-4 (5'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

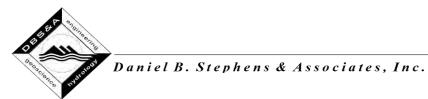
	As Received	Remolded
Test Date:	23-May-18	
Field weight* of sample (g): Tare weight, ring (g): Tare weight, pan/plate (g): Tare weight, other (g):  Dry weight of sample (g):	873.18 0.00 291.00 0.00 534.78	
Sample volume (cm <sup>3</sup> ): Assumed particle density (g/cm <sup>3</sup> ):	288.20 2.65	
Gravimetric Moisture Content (% g/g):	8.9	
Volumetric Moisture Content (% vol):	16.4	
Dry bulk density (g/cm <sup>3</sup> ):	1.86	
Wet bulk density (g/cm <sup>3</sup> ):	2.02	
Calculated Porosity (% vol):	30.0	
Percent Saturation:	54.9	
	•	

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: T/O-5 (20'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

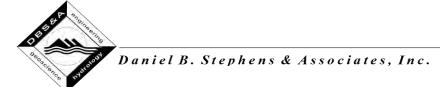
	As Received	Remolded
Test Date:	23-May-18	
Field weight* of sample (g): Tare weight, ring (g): Tare weight, pan/plate (g): Tare weight, other (g):  Dry weight of sample (g):	733.13 0.00 288.33 0.00 418.58	
Sample volume (cm <sup>3</sup> ): Assumed particle density (g/cm <sup>3</sup> ):	277.52 2.65	
	2.00	
Gravimetric Moisture Content (% g/g):	6.3	
Volumetric Moisture Content (% vol):	9.4	
Dry bulk density (g/cm <sup>3</sup> ):	1.51	
Wet bulk density (g/cm <sup>3</sup> ):	1.60	
Calculated Porosity (% vol):	43.1	
Percent Saturation:	21.9	

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: T/O-6 (5'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

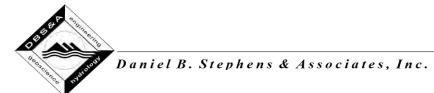
	As Received	Remolded
Test Date:	10-May-18	
Field weight* of sample (g): Tare weight, ring (g): Tare weight, pan/plate (g):	826.85 0.00 284.35	
Tare weight, other (g):	0.00	
Dry weight of sample (g): Sample volume (cm³): Assumed particle density (g/cm³):	507.52 290.82 2.65	
Gravimetric Moisture Content (% g/g):	6.9	
Volumetric Moisture Content (% vol):	12.0	
Dry bulk density (g/cm <sup>3</sup> ):	1.75	
Wet bulk density (g/cm <sup>3</sup> ):	1.87	
Calculated Porosity (% vol):	34.1	
Percent Saturation:	35.2	

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: TN-2 (20'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

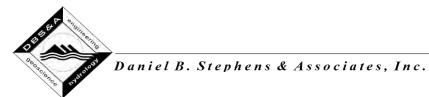
	As Received	Remolded
Test Date:	10-May-18	
Field weight* of sample (g):  Tare weight, ring (g):  Tare weight, pan/plate (g):  Tare weight, other (g):	577.54 0.00 284.28 0.00	
Dry weight of sample (g):	276.75	
Sample volume (cm <sup>3</sup> ): Assumed particle density (g/cm <sup>3</sup> ):	212.09 2.65	
		_
Gravimetric Moisture Content (% g/g):	6.0	
Volumetric Moisture Content (% vol):	7.8	
Dry bulk density (g/cm <sup>3</sup> ):	1.30	
Wet bulk density (g/cm <sup>3</sup> ):	1.38	
Calculated Porosity (% vol):	50.8	
Percent Saturation:	15.3	_

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: BS-1 (10'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

	As Received	Remolded
Test Date:	10-May-18	
Field weight* of sample (g):  Tare weight, ring (g):  Tare weight, pan/plate (g):	730.69 0.00 268.40 0.00	
Tare weight, other (g):  Dry weight of sample (g):  Sample volume (cm³):  Assumed particle density (g/cm³):	426.30 291.88 2.65	
Gravimetric Moisture Content (% g/g):	8.4	
Volumetric Moisture Content (% vol):	12.3	
Dry bulk density (g/cm <sup>3</sup> ):	1.46	
Wet bulk density (g/cm <sup>3</sup> ):	1.58	
Calculated Porosity (% vol):	44.9	
Percent Saturation:	27.5	

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: BS-6 (20'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

	As Received	Remolded
Test Date:	10-May-18	
Field weight* of sample (g):     Tare weight, ring (g):     Tare weight, pan/plate (g):     Tare weight, other (g):     Dry weight of sample (g):     Sample volume (cm³): Assumed particle density (g/cm³):	660.78 0.00 263.67 0.00 371.11 273.57 2.65	
Gravimetric Moisture Content (% g/g):	7.0	
Volumetric Moisture Content (% vol):	9.5	
Dry bulk density (g/cm <sup>3</sup> ):	1.36	
Wet bulk density (g/cm <sup>3</sup> ):	1.45	
Calculated Porosity (% vol):	48.8	
Percent Saturation:	19.5	

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: TS-1 (5'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

	As Received	Remolded
Test Date:	23-May-18	
Field weight* of sample (g):	837.27	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	269.17	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	526.79	
Sample volume (cm³):	287.39	
Assumed particle density (g/cm³):	2.65	
Assumed particle density (grown).	2.00	
Gravimetric Moisture Content (% g/g):	7.8	
( 00)		
Volumetric Moisture Content (% vol):	14.4	
Dry bulk density (g/cm <sup>3</sup> ):	1.83	
Wet bulk density (g/cm <sup>3</sup> ):	1.98	
Calculated Porosity (% vol):	30.8	
Percent Saturation:	46.6	

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: TS-2 (15'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

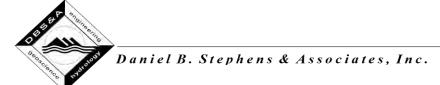
	As Received	Remolded
Test Date:	23-May-18	
Field weight* of sample (g):	765.98 0.00 268.91 0.00 456.41 285.11	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	
Gravimetric Moisture Content (% g/g):	8.9	
Volumetric Moisture Content (% vol):	14.3	
Dry bulk density (g/cm <sup>3</sup> ):	1.60	
Wet bulk density (g/cm <sup>3</sup> ):	1.74	
Calculated Porosity (% vol):	39.6	
Percent Saturation:	36.0	

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: TS-3 (10'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

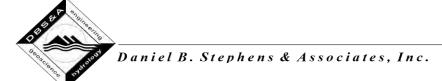
	As Received	Remolded
Test Date:	10-May-18	
Field weight* of sample (g): Tare weight, ring (g): Tare weight, pan/plate (g): Tare weight, other (g):	790.32 0.00 292.26 0.00	
Dry weight of sample (g):	470.01	
Sample volume (cm³):	292.17	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	
Gravimetric Moisture Content (% g/g):	6.0	
Volumetric Moisture Content (% vol):	9.6	
Dry bulk density (g/cm <sup>3</sup> ):	1.61	
Wet bulk density (g/cm <sup>3</sup> ):	1.70	
Calculated Porosity (% vol):	39.3	
Percent Saturation:	24.4	

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: TS-4 (10'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

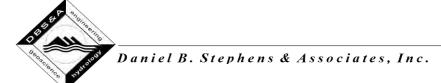
	As Received	Remolded
Test Date:	23-May-18	
Field weight* of sample (g): Tare weight, ring (g): Tare weight, pan/plate (g): Tare weight, other (g):	794.64 0.00 284.24 0.00	
Dry weight of sample (g): Sample volume (cm <sup>3</sup> ): Assumed particle density (g/cm <sup>3</sup> ):	477.08 241.45 2.65	
Gravimetric Moisture Content (% g/g):	7.0	
Volumetric Moisture Content (% vol):	13.8	
Dry bulk density (g/cm <sup>3</sup> ):	1.98	
Wet bulk density (g/cm <sup>3</sup> ):	2.11	
Calculated Porosity (% vol):	25.4	
Percent Saturation:	54.2	

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P1-1 (15'B)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

	As Received	Remolded
Test Date:	23-May-18	
Field weight* of sample (g): Tare weight, ring (g): Tare weight, pan/plate (g): Tare weight, other (g):	686.24 0.00 297.38 0.00	
Dry weight of sample (g): Sample volume (cm³): Assumed particle density (g/cm³):	353.60 262.30 2.65	
Gravimetric Moisture Content (% g/g):	10.0	
Volumetric Moisture Content (% vol):	13.4	
Dry bulk density (g/cm <sup>3</sup> ):	1.35	
Wet bulk density (g/cm <sup>3</sup> ):	1.48	
Calculated Porosity (% vol):	49.1	
Percent Saturation:	27.4	

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P1-1A (30'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

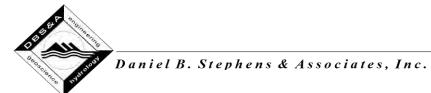
	As Received	Remolded
Test Date:	23-May-18	
Field weight* of sample (g): Tare weight, ring (g): Tare weight, pan/plate (g): Tare weight, other (g):	553.07 0.00 269.55 0.00	
Dry weight of sample (g):	272.79	
Sample volume (cm³):	222.18	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	
Gravimetric Moisture Content (% g/g):	3.9	
Volumetric Moisture Content (% vol):	4.8	
Dry bulk density (g/cm <sup>3</sup> ):	1.23	
Wet bulk density (g/cm <sup>3</sup> ):	1.28	
Calculated Porosity (% vol):	53.7	
Percent Saturation:	9.0	

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P1-2 (50'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

	As Received	Remolded
Test Date:	23-May-18	
Field weight* of sample (g):	738.56	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	282.24	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	437.31	
Sample volume (cm <sup>3</sup> ):	273.85	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	
Gravimetric Moisture Content (% g/g):	4.3	
Volumetric Moisture Content (% vol):	6.9	
Dry bulk density (g/cm <sup>3</sup> ):	1.60	
Wet bulk density (g/cm <sup>3</sup> ):	1.67	
Calculated Porosity (% vol):	39.7	
Percent Saturation:	17.5	

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P2-1 (5'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Field weight* of sample (g): 862.56 Tare weight, ring (g): 0.00 Tare weight, pan/plate (g): 269.31 Tare weight, other (g): 0.00  Dry weight of sample (g): 523.86 Sample volume (cm³): 282.39 Assumed particle density (g/cm³): 2.65  Gravimetric Moisture Content (% g/g): 13.2  Volumetric Moisture Content (% vol): 24.6 Dry bulk density (g/cm³): 1.86 Wet bulk density (g/cm³): 2.10 Calculated Porosity (% vol): 30.0	Test Date:	•	
Tare weight, ring (g): 0.00 Tare weight, pan/plate (g): 269.31 Tare weight, other (g): 0.00  Dry weight of sample (g): 523.86 Sample volume (cm³): 282.39 Assumed particle density (g/cm³): 2.65  Gravimetric Moisture Content (% g/g): 13.2  Volumetric Moisture Content (% vol): 24.6 Dry bulk density (g/cm³): 1.86 Wet bulk density (g/cm³): 2.10 Calculated Porosity (% vol): 30.0		000 50	
Volumetric Moisture Content (% vol): 24.6  Dry bulk density (g/cm³): 1.86  Wet bulk density (g/cm³): 2.10  Calculated Porosity (% vol): 30.0	Tare weight, ring (g): Tare weight, pan/plate (g): Tare weight, other (g):  Dry weight of sample (g): Sample volume (cm <sup>3</sup> ):	0.00 269.31 0.00 523.86 282.39	
Percent Saturation: 81.9	Volumetric Moisture Content (% vol):  Dry bulk density (g/cm³):  Wet bulk density (g/cm³):  Calculated Porosity (% vol):	24.6 1.86 2.10 30.0	

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P2-1 (25'B)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

	As Received	Remolded
Test Date:	22-May-18	
Field weight* of sample (g):     Tare weight, ring (g):     Tare weight, pan/plate (g):     Tare weight, other (g):     Dry weight of sample (g):     Sample volume (cm³): Assumed particle density (g/cm³):	739.39 0.00 209.29 0.00 459.48 275.50 2.65	
Gravimetric Moisture Content (% g/g):	15.4	
Volumetric Moisture Content (% vol):	25.6	
Dry bulk density (g/cm <sup>3</sup> ):	1.67	
Wet bulk density (g/cm <sup>3</sup> ):	1.92	
Calculated Porosity (% vol):	37.1	
Percent Saturation:	69.2	

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P3-1 (5'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

	As Received	Remolded
Test Date:	16-May-18	
Field weight* of sample (g):     Tare weight, ring (g):     Tare weight, pan/plate (g):     Tare weight, other (g):     Dry weight of sample (g):     Sample volume (cm <sup>3</sup> ):	789.58 0.00 208.68 0.00 541.45 290.47	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	
Gravimetric Moisture Content (% g/g):	7.3	
Volumetric Moisture Content (% vol):	13.6	
Dry bulk density (g/cm <sup>3</sup> ):	1.86	
Wet bulk density (g/cm <sup>3</sup> ):	2.00	
Calculated Porosity (% vol):	29.7	
Percent Saturation:	45.8	
•		

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P3-1 (15'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

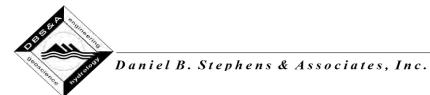
	As Received	Remolded
Test Date:	15-May-18	
Field weight* of sample (g):  Tare weight, ring (g):  Tare weight, pan/plate (g):  Tare weight, other (g):	555.60 0.00 258.76 0.00	
Dry weight of sample (g): Sample volume (cm³):	271.23	
Sample volume (cm ): Assumed particle density (g/cm <sup>3</sup> ):	290.68 2.65	
Gravimetric Moisture Content (% g/g):	9.4	
Volumetric Moisture Content (% vol):	8.8	
Dry bulk density (g/cm <sup>3</sup> ):	0.93	
Wet bulk density (g/cm <sup>3</sup> ):	1.02	
Calculated Porosity (% vol):	64.8	
Percent Saturation:	13.6	

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P3-2 (10'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

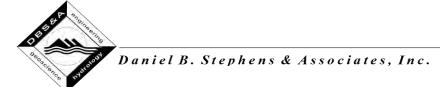
	As Received	Remolded
Test Date:	23-May-18	
Field weight* of sample (g):	792.24 0.00 298.95 0.00 462.96 273.96 2.65	
Gravimetric Moisture Content (% g/g):	6.6	
Volumetric Moisture Content (% vol):	11.1	
Dry bulk density (g/cm <sup>3</sup> ):	1.69	
Wet bulk density (g/cm <sup>3</sup> ):	1.80	
Calculated Porosity (% vol):	36.2	
Percent Saturation:	30.6	

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P3-2 (20'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

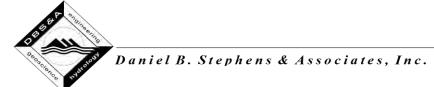
	As Received	Remolded
Test Date:	15-May-18	
Field weight* of sample (g):	717.70 0.00 208.58 0.00 457.43 274.45 2.65	
Gravimetric Moisture Content (% g/g):	11.3	
Volumetric Moisture Content (% vol):	18.8	
Dry bulk density (g/cm <sup>3</sup> ):	1.67	
Wet bulk density (g/cm <sup>3</sup> ):	1.86	
Calculated Porosity (% vol):	37.1	
Percent Saturation:	50.8	
		_

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P3-3 (20'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

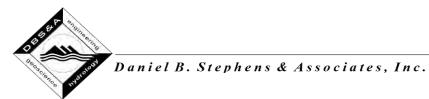
	As Received	Remolded
Test Date:	15-May-18	
Field weight* of sample (g):	703.70 0.00 208.56 0.00 457.99 270.93 2.65	
Gravimetric Moisture Content (% g/g):	8.1	
Volumetric Moisture Content (% vol):	13.7	
Dry bulk density (g/cm <sup>3</sup> ):	1.69	
Wet bulk density (g/cm <sup>3</sup> ):	1.83	
Calculated Porosity (% vol):	36.2	
Percent Saturation:	37.9	
		_

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P3-3 (40'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

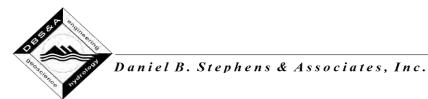
	As Received	Remolded
Test Date:	16-May-18	
Field weight* of sample (g): Tare weight, ring (g): Tare weight, pan/plate (g): Tare weight, other (g):  Dry weight of sample (g):	813.73 0.00 213.53 0.00	
Sample volume (cm³):	291.74	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	
Gravimetric Moisture Content (% g/g):	14.7	
Volumetric Moisture Content (% vol):	26.3	
Dry bulk density (g/cm <sup>3</sup> ):	1.79	
Wet bulk density (g/cm <sup>3</sup> ):	2.06	
Calculated Porosity (% vol):	32.3	
Percent Saturation:	81.4	
·		

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P3-4 (10'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

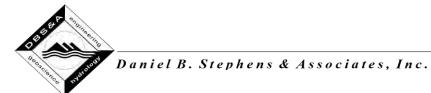
	As Received	Remolded
Test Date:	15-May-18	
Field weight* of sample (g):  Tare weight, ring (g):  Tare weight, pan/plate (g):  Tare weight, other (g):  Dry weight of sample (g):  Sample volume (cm³):  Assumed particle density (g/cm³):	706.80 0.00 213.41 0.00 451.37 292.80 2.65	
Accounted particle deficity (grown).	2.00	
Gravimetric Moisture Content (% g/g):	9.3	
Volumetric Moisture Content (% vol):	14.4	
Dry bulk density (g/cm <sup>3</sup> ):	1.54	
Wet bulk density (g/cm <sup>3</sup> ):	1.69	
Calculated Porosity (% vol):	41.8	
Percent Saturation:	34.3	
-		

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P3-4 (30'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

	As Received	Remolded
Test Date:	15-May-18	
Field weight* of sample (g):  Tare weight, ring (g):  Tare weight, pan/plate (g):  Tare weight, other (g):  Dry weight of sample (g):  Sample volume (cm³):	757.20 0.00 293.36 0.00 437.63 286.94	
Assumed particle density (g/cm³):	2.65	
Gravimetric Moisture Content (% g/g):	6.0	
Volumetric Moisture Content (% vol):	9.1	
Dry bulk density (g/cm <sup>3</sup> ):	1.53	
Wet bulk density (g/cm <sup>3</sup> ):	1.62	
Calculated Porosity (% vol):	42.4	
Percent Saturation:	21.5	
-		

Laboratory analysis by: E. Bastien
Data entered by: C. Krous
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P3-4 (40'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

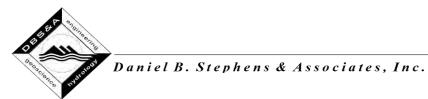
	As Received	Remolded
Test Date:	15-May-18	
Field weight* of sample (g): Tare weight, ring (g): Tare weight, pan/plate (g): Tare weight, other (g):  Dry weight of sample (g):	798.70 0.00 213.76 0.00 546.30	
Sample volume (cm³):	291.43	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	
Gravimetric Moisture Content (% g/g):	7.1	
Volumetric Moisture Content (% vol):	13.3	
Dry bulk density (g/cm <sup>3</sup> ):	1.87	
Wet bulk density (g/cm <sup>3</sup> ):	2.01	
Calculated Porosity (% vol):	29.3	
Percent Saturation:	45.3	
·	<del></del>	

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P3-5 (10'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

	As Received	Remolded
Test Date:	10-May-18	
Field weight* of sample (g): Tare weight, ring (g): Tare weight, pan/plate (g): Tare weight, other (g):	867.36 0.00 292.86 0.00	
Dry weight of sample (g): Sample volume (cm³): Assumed particle density (g/cm³):	530.27 285.93 2.65	
Gravimetric Moisture Content (% g/g):	8.3	
Volumetric Moisture Content (% vol):	15.5	
Dry bulk density (g/cm <sup>3</sup> ):	1.85	
Wet bulk density (g/cm <sup>3</sup> ):	2.01	
Calculated Porosity (% vol):	30.0	
Percent Saturation:	51.5	

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P3-6 (5'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

	As Received	Remolded
Test Date:	22-May-18	
Field weight* of sample (g):     Tare weight, ring (g):     Tare weight, pan/plate (g):     Tare weight, other (g):     Dry weight of sample (g):     Sample volume (cm³): Assumed particle density (g/cm³):	660.32 0.00 263.20 0.00 378.94 232.31 2.65	
Gravimetric Moisture Content (% g/g):	4.8	
Volumetric Moisture Content (% vol):	7.8	
Dry bulk density (g/cm <sup>3</sup> ):	1.63	
Wet bulk density (g/cm <sup>3</sup> ):	1.71	
Calculated Porosity (% vol):	38.4	
Percent Saturation:	20.4	

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P3-6 (20'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

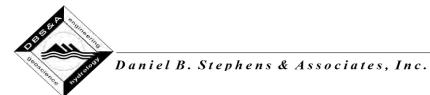
	As Received	Remolded
Test Date:	15-May-18	
Field weight* of sample (g):  Tare weight, ring (g):  Tare weight, pan/plate (g):  Tare weight, other (g):	764.00 0.00 212.68 0.00	
Dry weight of sample (g): Sample volume (cm³):	504.36	
Assumed particle density (g/cm <sup>3</sup> ):	291.86 2.65	
Gravimetric Moisture Content (% g/g):	9.3	
( 33,		
Volumetric Moisture Content (% vol):	16.1	
Dry bulk density (g/cm <sup>3</sup> ):	1.73	
Wet bulk density (g/cm <sup>3</sup> ):	1.89	
Calculated Porosity (% vol):	34.8	
Percent Saturation:	46.2	

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P3-6 (50'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

	As Received	Remolded
Test Date:	10-May-18	
Field weight* of sample (g): Tare weight, ring (g): Tare weight, pan/plate (g): Tare weight, other (g):  Dry weight of sample (g):	758.56 0.00 210.96 0.00 516.43	
Sample volume (cm <sup>3</sup> ): Assumed particle density (g/cm <sup>3</sup> ):	291.09 2.65	
Gravimetric Moisture Content (% g/g):	6.0	
Volumetric Moisture Content (% vol):	10.7	
Dry bulk density (g/cm <sup>3</sup> ):	1.77	
Wet bulk density (g/cm <sup>3</sup> ):	1.88	
Calculated Porosity (% vol):	33.1	
Percent Saturation:	32.4	

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P4-5 (20'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

	As Received	Remolded
Test Date:	16-May-18	
Field weight* of sample (g):	710.57 0.00 210.11 0.00 466.53 268.31 2.65	
Assumed particle density (grown).	2.00	
Gravimetric Moisture Content (% g/g):	7.3	
Volumetric Moisture Content (% vol):	12.6	
Dry bulk density (g/cm <sup>3</sup> ):	1.74	
Wet bulk density (g/cm <sup>3</sup> ):	1.87	
Calculated Porosity (% vol):	34.4	
Percent Saturation:	36.8	
-		

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P4-6 (10'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

	As Received	Remolded
Test Date:	10-May-18	
Field weight* of sample (g):	795.13 0.00 286.81 0.00 462.06 291.36 2.65	
Gravimetric Moisture Content (% g/g):  Volumetric Moisture Content (% vol):  Dry bulk density (g/cm³):  Wet bulk density (g/cm³):	10.0 15.9 1.59 1.74	
Calculated Porosity (% vol):	40.2	
Percent Saturation:	39.5	

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P4-7 (5'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

	As Received	Remolded
Test Date:	16-May-18	
Field weight* of sample (g):     Tare weight, ring (g):     Tare weight, pan/plate (g):     Tare weight, other (g):  Dry weight of sample (g):	638.50 0.00 207.42 0.00	
Sample volume (cm <sup>3</sup> ): Assumed particle density (g/cm <sup>3</sup> ):	263.40 2.65	
Gravimetric Moisture Content (% g/g):	9.8	
Volumetric Moisture Content (% vol):	14.6	
Dry bulk density (g/cm <sup>3</sup> ):	1.49	
Wet bulk density (g/cm <sup>3</sup> ):	1.64	
Calculated Porosity (% vol):	43.7	
Percent Saturation:	33.3	

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P4-7 (25'B)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

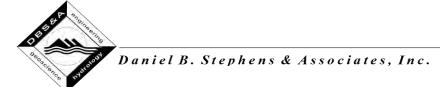
	As Received	Remolded
Test Date:	10-May-18	
Field weight* of sample (g): Tare weight, ring (g): Tare weight, pan/plate (g): Tare weight, other (g):	832.52 0.00 288.58 0.00	
Dry weight of sample (g):	512.00	
Sample volume (cm³):	290.35	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	
Gravimetric Moisture Content (% g/g):	6.2	
Volumetric Moisture Content (% vol):	11.0	
Dry bulk density (g/cm <sup>3</sup> ):	1.76	
Wet bulk density (g/cm <sup>3</sup> ):	1.87	
Calculated Porosity (% vol):	33.5	
Percent Saturation:	32.9	
·		

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P4-8 (15'B)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

	As Received	Remolded
Test Date:	10-May-18	
Field weight* of sample (g): Tare weight, ring (g): Tare weight, pan/plate (g):	803.98 0.00 297.95	
Tare weight, other (g):	0.00	
Dry weight of sample (g): Sample volume (cm <sup>3</sup> ): Assumed particle density (g/cm <sup>3</sup> ):	447.92 276.60 2.65	
Gravimetric Moisture Content (% g/g):	13.0	
Volumetric Moisture Content (% vol):	21.0	
Dry bulk density (g/cm <sup>3</sup> ):	1.62	
Wet bulk density (g/cm <sup>3</sup> ):	1.83	
Calculated Porosity (% vol):	38.9	
Percent Saturation:	54.0	

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P4-9 (5'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

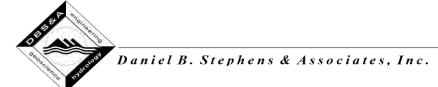
	As Received	Remolded
Test Date:	23-May-18	
Field weight* of sample (g): Tare weight, ring (g): Tare weight, pan/plate (g): Tare weight, other (g):	792.93 0.00 267.28 0.00	
Dry weight of sample (g):	503.41	
Sample volume (cm³):	269.21	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	
Gravimetric Moisture Content (% g/g):	4.4	
Volumetric Moisture Content (% vol):	8.3	
Dry bulk density (g/cm <sup>3</sup> ):	1.87	
Wet bulk density (g/cm <sup>3</sup> ):	1.95	
Calculated Porosity (% vol):	29.4	
Percent Saturation:	28.1	

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P4-9 (35'B)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

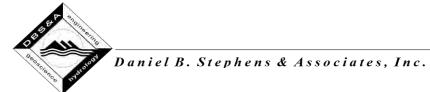
	As Received	Remolded
Test Date:	10-May-18	
Field weight* of sample (g):     Tare weight, ring (g):     Tare weight, pan/plate (g):     Tare weight, other (g):     Dry weight of sample (g):     Sample volume (cm³):  Assumed particle density (g/cm³):	820.17 0.00 284.68 0.00 471.98 284.05 2.65	
Gravimetric Moisture Content (% g/g):  Volumetric Moisture Content (% vol):  Dry bulk density (g/cm³):  Wet bulk density (g/cm³):  Calculated Porosity (% vol):	13.5 22.4 1.66 1.89 37.3	
Percent Saturation:	59.9	

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: BW-1 (30'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

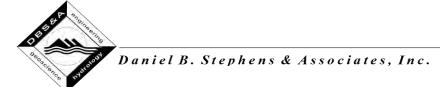
	As Received	Remolded
Test Date:	23-May-18	
Field weight* of sample (g):     Tare weight, ring (g):     Tare weight, pan/plate (g):     Tare weight, other (g):     Dry weight of sample (g):     Sample volume (cm³): Assumed particle density (g/cm³):	714.17 0.00 284.25 0.00 393.38 281.54 2.65	
Gravimetric Moisture Content (% g/g):	9.3	
Volumetric Moisture Content (% vol):	13.0	
Dry bulk density (g/cm <sup>3</sup> ):	1.40	
Wet bulk density (g/cm <sup>3</sup> ):	1.53	
Calculated Porosity (% vol):	47.3	
Percent Saturation:	27.5	

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: BW-2 (10'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

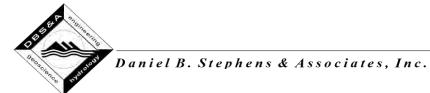
	As Received	<u>Remolded</u>
Test Date:	10-May-18	
Field weight* of sample (g):	751.25 0.00 283.91 0.00 441.31 290.92 2.65	
Gravimetric Moisture Content (% g/g):	5.9	
Volumetric Moisture Content (% vol):	8.9	
Dry bulk density (g/cm <sup>3</sup> ):	1.52	
Wet bulk density (g/cm <sup>3</sup> ):	1.61	
Calculated Porosity (% vol):	42.8	
Percent Saturation:	20.9	

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



# Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: BW-3 (5'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

As Received	Remolded
10-May-18	
756.43 0.00 268.23 0.00	
470.38	
290.70	
2.65	
3.8	
6.1	
1.62	
1.68	
38.9	
15.7	
	10-May-18 756.43 0.00 268.23 0.00 470.38 290.70 2.65  3.8 6.1 1.62 1.68 38.9

Laboratory analysis by: D. O'Dowd
Data entered by: M. Garcia
Checked by: J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed

--- = This sample was not remolded

**Particle Size Analysis** 



# **Summary of Particle Size Characteristics**

 Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	$C_{u}$	$C_c$	Method	ASTM Classification	USDA Classification	_
SA-GM 1B	NA	NA	NA	NA	NA	WS	NA	NA	(Est)
SA-GM 1T	NA	NA	NA	NA	NA	WS	NA	NA	(Est)
SA-GM 2B	NA	NA	0.071	NA	NA	ws	NA	NA	(Est)
SA-GM 2T	NA	NA	NA	NA	NA	ws	NA	NA	(Est)
SA-GM 3B	NA	0.18	0.25	NA	NA	ws	NA	NA	(Est)
SA-GM 3T	NA	0.18	0.37	NA	NA	WS	NA	NA <sup>†</sup>	(Est)
SA-GM 4B	NA	0.11	0.13	NA	NA	WS	NA	NA	(Est)
SA-GM 5B	NA	0.21	0.28	NA	NA	WS	NA	NA <sup>†</sup>	(Est)
SA-GM 5T	0.16	0.38	0.43	2.7	1.3	WS	NA	Sand	
SA-GM 6B	NA	NA	NA	NA	NA	WS	NA	NA	(Est)
SA-GM 6T	NA	NA	NA	NA	NA	WS	NA	NA	(Est)

d<sub>50</sub> = Median particle diameter

Est = Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

DS = Dry sieve

 $^{\dagger}$  Greater than 10% of sample is coarse material

$$C_c = \frac{(d_{30})^2}{(d_{30})(d_{30})}$$

WS = Wet sieve

= Hydrometer



### **Summary of Particle Size Characteristics (Continued)**

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	$C_{u}$	$C_c$	Method	ASTM Classification	USDA Classification	_
SA-GM 7B	NA	0.11	0.13	NA	NA	WS	NA	NA	(Est)
SA-GM 8B	NA	0.12	0.16	NA	NA	WS	NA	NA	(Est)
SA-GM 8T	NA	0.37	0.52	NA	NA	WS	NA	NA <sup>†</sup>	(Est)
L1-1 (10'A)	2.2E-05	0.046	0.061	2773	33	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam	(Est)
L1-2 (20'B)	2.8E-05	0.0092	0.015	536	12	WS/H	Classification by ASTM 2487 requires Atterberg test	Silty Clay Loam	(Est)
L1-3 (5'A)	6.4E-45	0.066	0.088	1.4E+43	2.1E+42	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
L1-5 (20'B)	0.0011	0.074	0.093	85	17	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
L2-1 (5'A)	0.00040	0.045	0.060	150	9.4	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam	(Est)
L2-1 (15'A)	0.00024	0.056	0.065	271	11	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
L2-2 (5'A)	0.00019	0.067	0.085	447	60	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
L2-3 (5'A)	0.00094	0.076	0.089	95	26	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)

d<sub>50</sub> = Median particle diameter

Est = Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

 $C_u = \frac{d_{60}}{d_{10}}$ 

DS = Dry sieve

= Hydrometer

<sup>†</sup> Greater than 10% of sample is coarse material

 $C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$ 

WS = Wet sieve



## **Summary of Particle Size Characteristics (Continued)**

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	$C_{u}$	C <sub>c</sub>	Method	ASTM Classification	USDA Classification	_
L2-4 (10'B)	3.9E-05	0.045	0.057	1462	65	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam	(Est)
L2-5 (5'A)	4.4E-05	0.0022	0.0047	107	0.50	WS/H	Classification by ASTM 2487 requires Atterberg test	Silty Clay	(Est)
L2-6 (5'A)	0.00031	0.013	0.030	97	0.43	WS/H	Lean clay (CL)	Clay Loam	(Est)
L2-7 (10'A)	1.9E-09	0.057	0.075	3.9E+07	4.4E+06	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
T/O-1 (20'A)	0.00030	0.0088	0.016	53	0.75	WS/H	Classification by ASTM 2487 requires Atterberg test	Silty Clay Loam	(Est)
T/O-1 (45'B)	5.1E-05	0.070	0.099	1941	51	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Clay Loam	(Est)
T/O-2 (5'A)	0.0025	0.010	0.022	8.8	0.15	WS/H	Classification by ASTM 2487 requires Atterberg test	Silt Loam	
T/O-3 (40'A)	0.00083	0.078	0.10	120	20	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
T/O-3 (70'B)	0.00032	0.034	0.045	141	8.4	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam	(Est)
T/O-4 (20'B)	0.00059	0.034	0.050	85	4.1	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam	(Est)
T/O-5 (10'B)	0.0011	0.028	0.039	35	2.3	WS/H	Classification by ASTM 2487 requires Atterberg test	Silt Loam	(Est)

d<sub>50</sub> = Median particle diameter

 $C_u = \frac{d_{60}}{d_{10}}$ 

DS = Dry sieve

Oroator

H = Hydrometer

WS = Wet sieve

 $=\frac{(d_{30})^2}{(d_{30})^2}$ 

 $^{\dagger}$  Greater than 10% of sample is coarse material



# **Summary of Particle Size Characteristics (Continued)**

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	$C_{u}$	C <sub>c</sub>	Method	ASTM Classification	USDA Classification	_
T/O-6 (5'A)	0.00066	0.043	0.054	82	9.1	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam	(Est)
TN-1 (5'A)	0.00074	0.077	0.097	131	17	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
TN-2 (20'A)	0.00077	0.079	0.10	130	18	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
BS-1 (10'A)	0.00029	0.052	0.076	262	4.4	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Clay Loam	(Est)
BS-2 (15'A)	0.0039	0.061	0.082	21	0.61	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	
BS-6 (20'A)	0.00018	0.054	0.062	344	43	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
TS-1 (20'A)	0.0010	0.035	0.048	48	2.0	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam	(Est)
TS-2 (10'A)	0.0019	0.087	0.12	63	3.0	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	
TS-3 (10'A)	0.00086	0.043	0.051	59	3.9	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam	(Est)
TS-4 (5'A)	0.0011	0.11	0.13	118	20	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
P1-1 (5'A)	0.0012	0.13	0.17	142	23	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam <sup>†</sup>	(Est)
d <sub>50</sub> = Median particle diameter	C <sub>u</sub> =	$\frac{d_{60}}{d_{10}}$		DS = Dry sie		<sup>†</sup> Greater tha	an 10% of sample is coarse material		-

Est = Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

= Hydrometer

WS = Wet sieve



### **Summary of Particle Size Characteristics (Continued)**

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	$C_{u}$	$C_c$	Method	ASTM Classification	USDA Classification	_
P1-2 (30'B)	0.0010	0.11	0.16	160	21	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam <sup>†</sup>	(Est)
P2-1 (25'A)	0.00071	0.087	0.12	169	11	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
P2-2 (5'B)	0.00078	0.089	0.11	141	28	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
P3-1 (5'A)	NA	0.23	0.33	NA	NA	WS	NA	NA <sup>†</sup>	(Est)
P3-2 (15'B)	NA	0.20	0.25	NA	NA	WS	NA	NA	(Est)
P3-2 (35'B)	NA	0.15	0.19	NA	NA	WS	NA	NA	(Est)
P3-3 (5'A)	NA	0.15	0.19	NA	NA	WS	NA	NA	(Est)
P3-3 (40'B)	NA	0.085	0.099	NA	NA	WS	NA	NA	(Est)
P3-4 (20'A)	0.11	0.25	0.29	2.6	0.91	WS	NA	Sand	
P3-4 (30'A)	0.10	0.19	0.22	2.2	0.89	WS	NA	Sand	
P3-4 (40'A)	0.0029	0.072	0.087	30	7.7	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	

d<sub>50</sub> = Median particle diameter

 $C_{u} = \frac{d_{60}}{d_{10}}$ 

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

<sup>†</sup> Greater than 10% of sample is coarse material



# **Summary of Particle Size Characteristics (Continued)**

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	$C_{u}$	$C_c$	Method	ASTM Classification	USDA Classification	
P3-5 (10'A)	0.020	0.099	0.12	6.0	2.2	WS/H	Classification by ASTM 2487 requires Atterberg test	Loamy Sand	_
P3-6 (20'A)	NA	0.20	0.24	NA	NA	WS	NA	NA	(Est)
P3-6 (50'A)	NA	0.23	0.30	NA	NA	WS	NA	NA	(Est)
P4-5 (20'A)	NA	0.30	0.39	NA	NA	WS	NA	NA <sup>†</sup>	(Est)
P4-6 (10'A)	0.0012	0.072	0.084	70	23	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
P4-7 (5'A)	NA	0.077	0.095	NA	NA	WS	NA NA	NA	(Est)
P4-7 (25'B)	0.0052	0.28	0.34	65	9.6	WS/H	Classification by ASTM 2487 requires Atterberg test	Loamy Sand	
P4-8 (15'B)	0.0011	0.085	0.13	118	5.1	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
P4-9 (35'B)	6.7E-06	0.061	0.087	1.3E+04	1160	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam <sup>†</sup>	(Est)
BW-1 (20'A)	0.0012	0.047	0.083	69	1.2	WS/H	Classification by ASTM 2487 requires Atterberg test	Loam	(Est)
BW-2 (10'A)	0.00035	0.062	0.084	240	18	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
BW-3 (5'A)	0.0011	0.080	0.099	90	23	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)

d<sub>50</sub> = Median particle diameter

Est = Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

<sup>†</sup> Greater than 10% of sample is coarse material

H = Hydrometer

WS = Wet sieve



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### Percent Gravel, Sand, Silt and Clay\*

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
SA-GM 1B	0.0	15.0	85.0	**
SA-GM 1T	0.1	34.3	65.6	**
SA-GM 2B	0.0	39.4	60.6	**
SA-GM 2T	0.0	24.4	75.6	**
SA-GM 3B	0.0	69.0	31.0	**
SA-GM 3T	15.1	48.0	36.9	**
SA-GM 4B	0.0	64.2	35.8	**
SA-GM 5B	14.6	61.8	23.6	**
SA-GM 5T	0.1	94.9	5.1	**
SA-GM 6B	0.0	20.4	79.6	**
SA-GM 6T	0.0	17.6	82.4	**
SA-GM 7B	0.0	62.6	37.4	**
SA-GM 8B	0.0	61.1	38.9	**
SA-GM 8T	13.4	70.7	15.8	**
L1-1 (10'A)	0.0	33.2	43.1	23.7
L1-2 (20'B)	0.1	2.3	68.1	29.5

<sup>\*</sup>USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

<sup>\*\*</sup>Fractions of silt and clay were not determined by hydrometer analysis; percentages of silt and clay represent fraction finer than 0.075mm.



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### Percent Gravel, Sand, Silt and Clay\* (Continued)

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
L1-3 (5'A)	0.0	46.5	40.8	12.7
L1-5 (20'B)	0.0	49.7	37.7	12.6
L2-1 (5'A)	0.0	32.5	49.0	18.5
L2-1 (15'A)	0.0	31.5	50.5	18.0
L2-2 (5'A)	0.0	46.3	37.5	16.2
L2-3 (5'A)	0.0	51.2	36.8	12.1
L2-4 (10'B)	0.0	28.8	50.0	21.2
L2-5 (5'A)	0.0	2.8	48.6	48.6
L2-6 (5'A)	0.0	14.8	55.2	29.9
L2-7 (10'A)	0.0	40.1	48.2	11.7
T/O-1 (20'A)	0.2	3.2	66.0	30.6
T/O-1 (45'B)	0.0	47.9	31.0	21.1
T/O-2 (5'A)	0.0	23.0	71.5	5.5
T/O-3 (40'A)	0.0	51.5	34.4	14.1
T/O-3 (70'B)	0.5	8.7	73.8	17.1
T/O-4 (20'B)	0.0	24.8	57.7	17.5

<sup>\*</sup>USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

<sup>\*\*</sup>Fractions of silt and clay were not determined by hydrometer analysis; percentages of silt and clay represent fraction finer than 0.075mm.



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### Percent Gravel, Sand, Silt and Clay\* (Continued)

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
T/O-5 (10'B)	0.0	10.1	75.3	14.6
T/O-6 (5'A)	0.0	24.3	59.7	16.0
TN-1 (5'A)	0.4	50.9	33.3	15.4
TN-2 (20'A)	0.0	51.9	34.4	13.8
BS-1 (10'A)	0.0	40.8	36.1	23.0
BS-2 (15'A)	0.0	43.0	51.6	5.3
BS-6 (20'A)	0.0	26.3	55.8	17.9
TS-1 (20'A)	0.0	18.2	65.1	16.7
TS-2 (10'A)	0.0	53.9	35.3	10.8
TS-3 (10'A)	0.0	16.1	68.6	15.2
TS-4 (5'A)	0.7	63.1	22.7	13.5
P1-1 (5'A)	18.8	49.8	20.8	10.6
P1-2 (30'B)	20.3	43.0	24.9	11.8
P2-1 (25'A)	0.3	54.0	30.7	15.1
P2-2 (5'B)	5.1	53.2	27.1	14.6
P3-1 (5'A)	19.7	64.9	15.3	**
P3-2 (15'B)	0.0	78.8	21.2	**

<sup>\*</sup>USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

<sup>\*\*</sup>Fractions of silt and clay were not determined by hydrometer analysis; percentages of silt and clay represent fraction finer than 0.075mm. 97



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### Percent Gravel, Sand, Silt and Clay\* (Continued)

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)	
P3-2 (35'B)	1.1	68.2	30.7		**
P3-3 (5'A)	0.3	67.7	31.9		**
P3-3 (40'B)	1.4	56.3	42.3		**
P3-4 (20'A)	0.0	92.7	7.3		**
P3-4 (30'A)	0.0	92.3	7.7		**
P3-4 (40'A)	0.0	48.1	44.2	7.7	
P3-5 (10'A)	0.0	68.6	27.8	3.6	
P3-6 (20'A)	0.0	85.2	14.8		**
P3-6 (50'A)	7.2	76.4	16.4		**
P4-5 (20'A)	24.9	61.0	14.1		**
P4-6 (10'A)	0.0	48.0	41.0	11.0	
P4-7 (5'A)	7.2	43.9	49.0		**
P4-7 (25'B)	0.0	77.0	17.5	5.5	
P4-8 (15'B)	0.5	51.9	35.5	12.1	
P4-9 (35'B)	15.7	26.6	46.4	11.4	
BW-1 (20'A)	0.0	45.4	34.9	19.7	
BW-2 (10'A)	0.0	44.1	38.1	17.8	
BW-3 (5'A)	0.0	53.1	35.9	11.0	

<sup>\*</sup>USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

<sup>\*\*</sup>Fractions of silt and clay were not determined by hydrometer analysis; percentages of silt and clay represent fraction finer than 0.075mm.



#### Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name:Stantec Consulting Services IncInitial Dry Weight of Sample (g): 402.69Job Number:DB18.1151.00Weight Passing #10 (g): 402.69

Sample Number: SA-GM 1B Weight Retained #10 (g): 0.00
Project Name: St. Anthony Geotech Investigation Wt. of -10 Sieve Sample (g): 83.95

PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 83.95

Test Date: 23-May-18 Shape: Rounded Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing_
+10						
	3"	75	0.00	0.00	402.69	100.00
	2"	50	0.00	0.00	402.69	100.00
	1.5"	38.1	0.00	0.00	402.69	100.00
	1"	25	0.00	0.00	402.69	100.00
	3/4"	19.0	0.00	0.00	402.69	100.00
	3/8"	9.5	0.00	0.00	402.69	100.00
	4	4.75	0.00	0.00	402.69	100.00
	10	2.00	0.00	0.00	402.69	100.00
-10			(Based on calc	ulated sieve wt.	)	
	20	0.85	0.08	0.08	83.87	99.90
	40	0.425	0.32	0.40	83.55	99.52
	60	0.250	0.27	0.67	83.28	99.20
	140	0.106	4.87	5.54	78.41	93.40
	200	0.075	7.02	12.56	71.39	85.04
	dry pan		1.72	14.28	69.67	
	wet pan			69.67	0.00	

 $d_{10}$  (mm): NA  $d_{50}$  (mm): NA  $d_{16}$  (mm): NA  $d_{60}$  (mm): NA  $d_{30}$  (mm): NA  $d_{84}$  (mm): NA

Median Particle Diameter -- d<sub>50</sub> (mm): NA

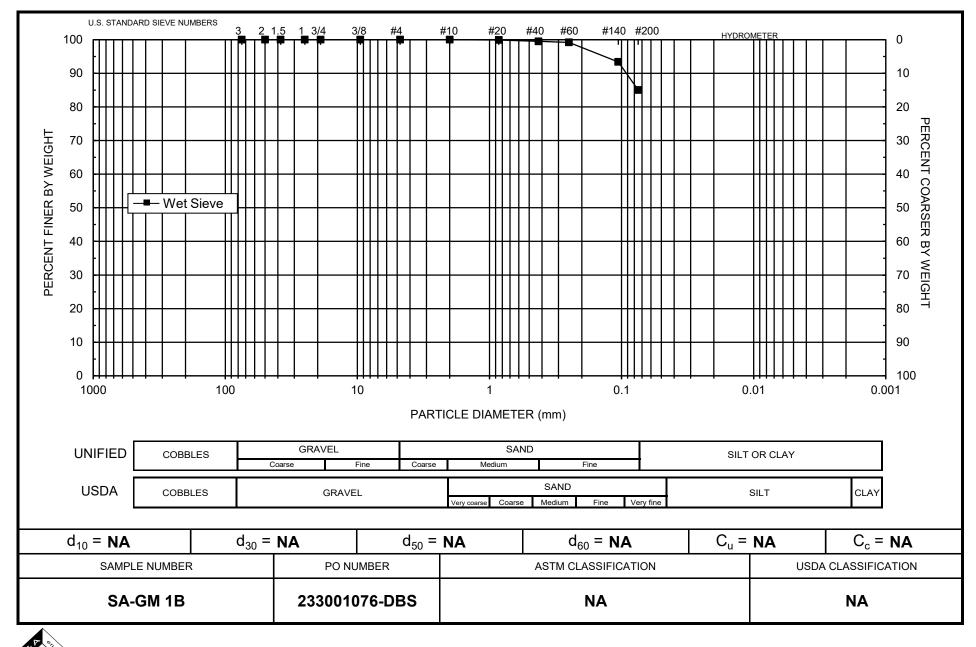
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): NA

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}^*d_{60})$ ] (mm): NA

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): NA

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

ASTM Soil Classification: NA USDA Soil Classification: NA





### Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name:Stantec Consulting Services IncInitial Dry Weight of Sample (g): 394.50Job Number:DB18.1151.00Weight Passing #10 (g): 393.94

Sample Number: SA-GM 1T Weight Retained #10 (g): 0.56
Project Name: St. Anthony Geotech Investigation
PO Number: 233001076-DBS
Weight Retained #10 (g): 0.56
Wt. of -10 Sieve Sample (g): 55.40
Calculated Weight of Sieve Sample (g): 55.48

Test Date: 23-May-18 Shape: Rounded Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	394.50	100.00
	2"	50	0.00	0.00	394.50	100.00
	1.5"	38.1	0.00	0.00	394.50	100.00
	1"	25	0.00	0.00	394.50	100.00
	3/4"	19.0	0.00	0.00	394.50	100.00
	3/8"	9.5	0.00	0.00	394.50	100.00
	4	4.75	0.23	0.23	394.27	99.94
	10	2.00	0.33	0.56	393.94	99.86
-10			(Based on calc	ulated sieve wt.	)	
	20	0.85	1.93	2.01	53.47	96.38
	40	0.425	1.51	3.52	51.96	93.66
	60	0.250	1.32	4.84	50.64	91.28
	140	0.106	7.96	12.80	42.68	76.93
	200	0.075	6.29	19.09	36.39	65.59
	dry pan		1.81	20.90	34.58	
	wet pan			34.58	0.00	

 $\begin{array}{lll} d_{10} \ (mm): \ NA & d_{50} \ (mm): \ NA \\ d_{16} \ (mm): \ NA & d_{60} \ (mm): \ NA \\ d_{30} \ (mm): \ NA & d_{84} \ (mm): \ 0.16 \end{array}$ 

Median Particle Diameter -- d<sub>50</sub> (mm): NA

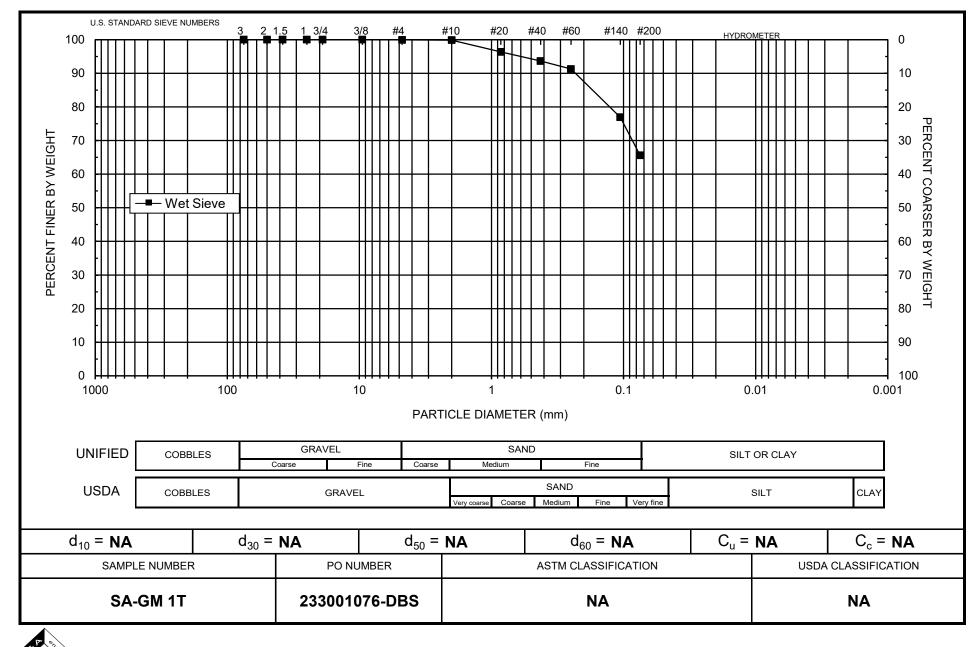
Uniformity Coefficient, Cu--[ $d_{60}/d_{10}$ ] (mm): NA

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}^*d_{60})$ ] (mm): NA

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): NA

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

ASTM Soil Classification: NA USDA Soil Classification: NA





### **Particle Size Analysis** Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 632.00 Job Number: DB18.1151.00 Weight Passing #10 (g): 632.00

Sample Number: SA-GM 2B Weight Retained #10 (g): 0.00 Project Name: St. Anthony Geotech Investigation Wt. of -10 Sieve Sample (g): 53.48

PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 53.48

Test Date: 25-May-18 Shape: Angular Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	632.00	100.00
	2"	50	0.00	0.00	632.00	100.00
	1.5"	38.1	0.00	0.00	632.00	100.00
	1"	25	0.00	0.00	632.00	100.00
	3/4"	19.0	0.00	0.00	632.00	100.00
	3/8"	9.5	0.00	0.00	632.00	100.00
	4	4.75	0.00	0.00	632.00	100.00
	10	2.00	0.00	0.00	632.00	100.00
-10			(Based on calc	ulated sieve wt.	)	
	20	0.85	0.14	0.14	53.34	99.74
	40	0.425	1.32	1.46	52.02	97.27
	60	0.250	5.06	6.52	46.96	87.81
	140	0.106	12.46	18.98	34.50	64.51
	200	0.075	2.11	21.09	32.39	60.56
	dry pan		0.21	21.30	32.18	
	wet pan			32.18	0.00	

d<sub>10</sub> (mm): NA d<sub>50</sub> (mm): NA d<sub>16</sub> (mm): NA d<sub>60</sub> (mm): 0.071 d<sub>30</sub> (mm): NA d<sub>84</sub> (mm): 0.22

Median Particle Diameter -- d<sub>50</sub> (mm): NA

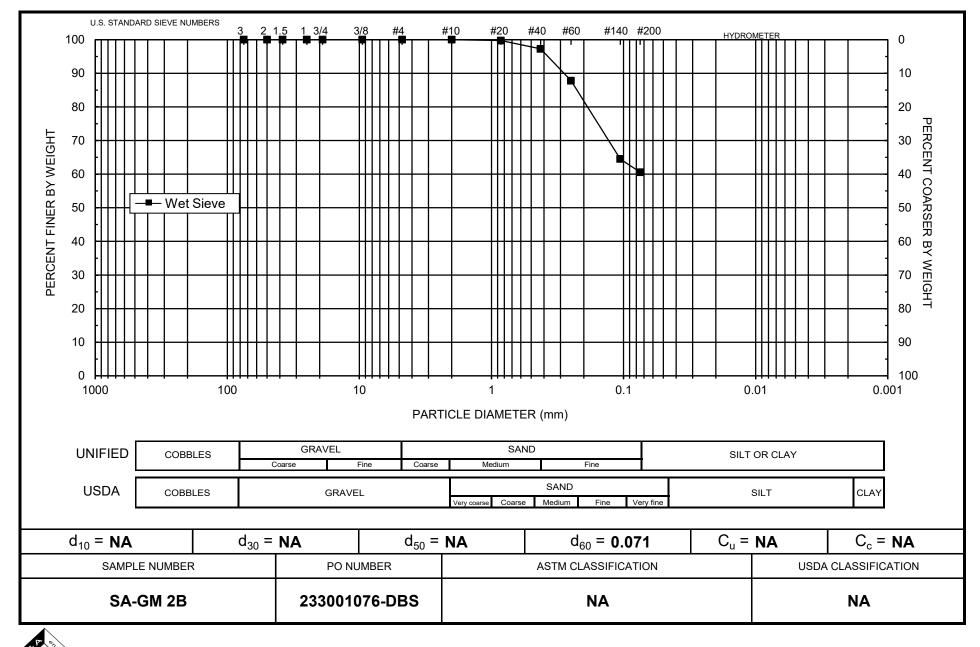
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): NA

Coefficient of Curvature,  $Cc - [(d_{30})^2/(d_{10}*d_{60})]$  (mm): NA

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): NA

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: NA USDA Soil Classification: NA





### Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Initial Dry Weight of Sample (g): 544.47

Weight Passing #10 (g): 544.47

Sample Number: SA-GM 2T Weight Retained #10 (g): 0.00

Project Name: St. Anthony Geotech Investigation Wt. of -10 Sieve Sample (g): 60.16

PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 60.16

Test Date: 24-May-18 Shape: Rounded Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	544.47	100.00
	2"	50	0.00	0.00	544.47	100.00
	1.5"	38.1	0.00	0.00	544.47	100.00
	1"	25	0.00	0.00	544.47	100.00
	3/4"	19.0	0.00	0.00	544.47	100.00
	3/8"	9.5	0.00	0.00	544.47	100.00
	4	4.75	0.00	0.00	544.47	100.00
	10	2.00	0.00	0.00	544.47	100.00
-10			(Based on calc	ulated sieve wt.	)	
	20	0.85	0.13	0.13	60.03	99.78
	40	0.425	0.36	0.49	59.67	99.19
	60	0.250	1.16	1.65	58.51	97.26
	140	0.106	8.90	10.55	49.61	82.46
	200	0.075	4.11	14.66	45.50	75.63
	dry pan		0.38	15.04	45.12	
	wet pan			45.12	0.00	

 $d_{10}$  (mm): NA  $d_{50}$  (mm): NA  $d_{16}$  (mm): NA  $d_{60}$  (mm): NA  $d_{84}$  (mm): 0.12

Median Particle Diameter--d<sub>50</sub> (mm): NA

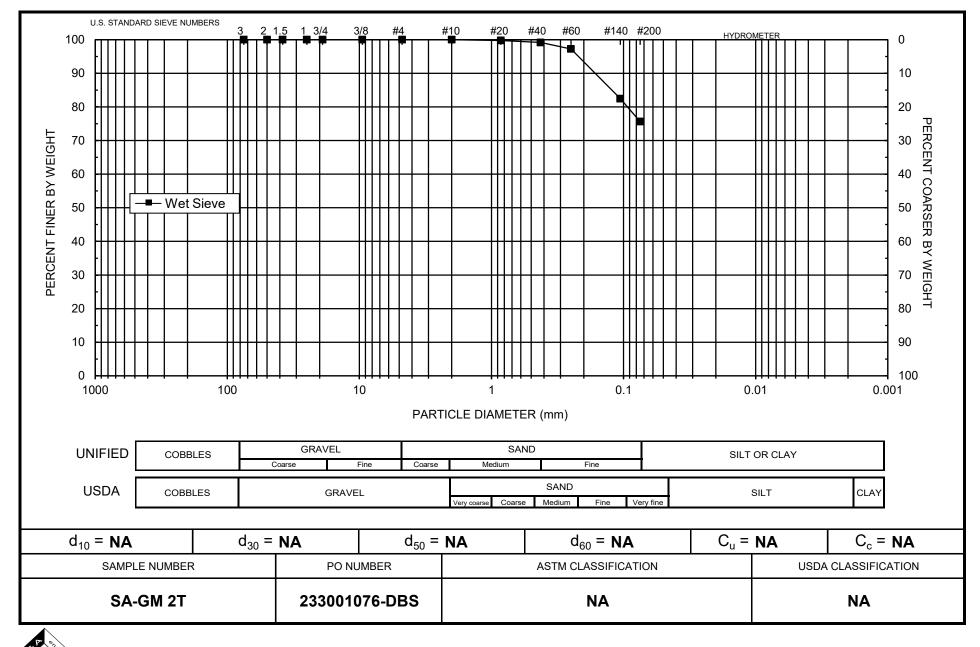
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): NA

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}^*d_{60})$ ] (mm): NA

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): NA

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

ASTM Soil Classification: NA USDA Soil Classification: NA





### Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name:Stantec Consulting Services IncInitial Dry Weight of Sample (g): 509.48Job Number:DB18.1151.00Weight Passing #10 (g): 509.48

Sample Number: SA-GM 3B Weight Retained #10 (g): 0.00
Project Name: St. Anthony Geotech Investigation Wt. of -10 Sieve Sample (g): 90.13

PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 90.13

Test Date: 23-May-18 Shape: Rounded

Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	509.48	100.00
	2"	50	0.00	0.00	509.48	100.00
	1.5"	38.1	0.00	0.00	509.48	100.00
	1"	25	0.00	0.00	509.48	100.00
	3/4"	19.0	0.00	0.00	509.48	100.00
	3/8"	9.5	0.00	0.00	509.48	100.00
	4	4.75	0.00	0.00	509.48	100.00
	10	2.00	0.00	0.00	509.48	100.00
-10			(Based on calc	ulated sieve wt.	)	
	20	0.85	0.24	0.24	89.89	99.73
	40	0.425	8.88	9.12	81.01	89.88
	60	0.250	26.63	35.75	54.38	60.34
	140	0.106	22.88	58.63	31.50	34.95
	200	0.075	3.56	62.19	27.94	31.00
	dry pan		0.70	62.89	27.24	
	wet pan			27.24	0.00	

Median Particle Diameter -- d<sub>50</sub> (mm): 0.18

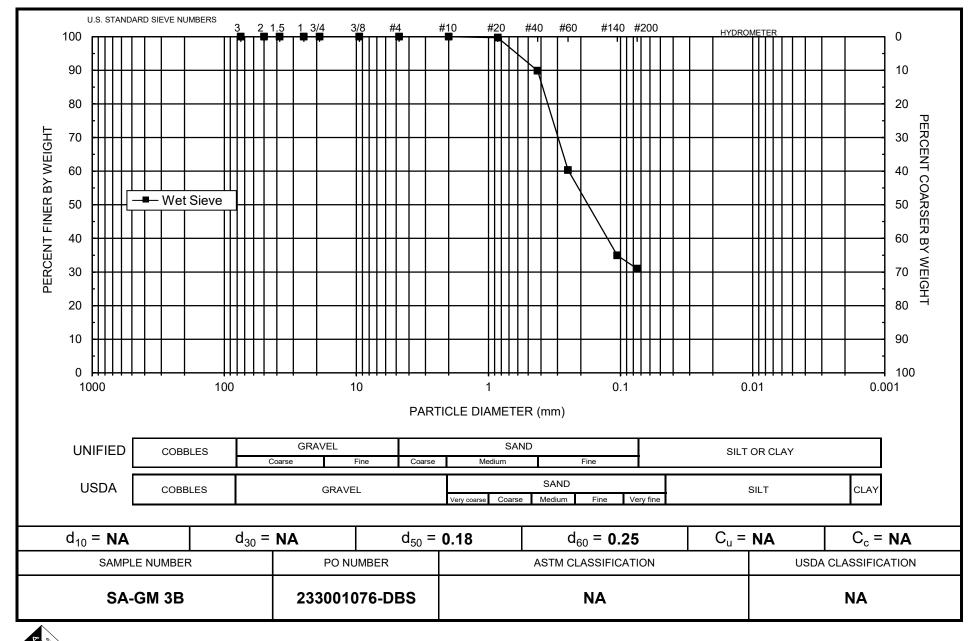
Uniformity Coefficient, Cu--[ $d_{60}/d_{10}$ ] (mm): NA

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}^*d_{60})$ ] (mm): NA

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): NA

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

ASTM Soil Classification: NA USDA Soil Classification: NA





### Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name:Stantec Consulting Services IncInitial Dry Weight of Sample (g): 787.33Job Number:DB18.1151.00Weight Passing #10 (g): 628.52

Sample Number: SA-GM 3T Weight Retained #10 (g): 158.81

Project Name: St. Anthony Geotech Investigation Wt. of -10 Sieve Sample (g): 61.15

PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 76.60

Test Date: 23-May-18 Shape: Angular

Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	787.33	100.00
	2"	50	0.00	0.00	787.33	100.00
	1.5"	38.1	78.11	78.11	709.22	90.08
	1"	25	28.97	107.08	680.25	86.40
	3/4"	19.0	0.00	107.08	680.25	86.40
	3/8"	9.5	0.00	107.08	680.25	86.40
	4	4.75	11.81	118.89	668.44	84.90
	10	2.00	39.92	158.81	628.52	79.83
-10			(Based on calc	culated sieve wt.	)	
	20	0.85	7.14	22.59	54.01	70.51
	40	0.425	6.48	29.07	47.53	62.05
	60	0.250	5.62	34.69	41.91	54.71
	140	0.106	10.17	44.86	31.74	41.44
	200	0.075	3.47	48.33	28.27	36.91
	dry pan		0.58	48.91	27.69	
	wet pan			27.69	0.00	

Median Particle Diameter -- d<sub>50</sub> (mm): 0.18

Uniformity Coefficient, Cu--[ $d_{60}/d_{10}$ ] (mm): NA

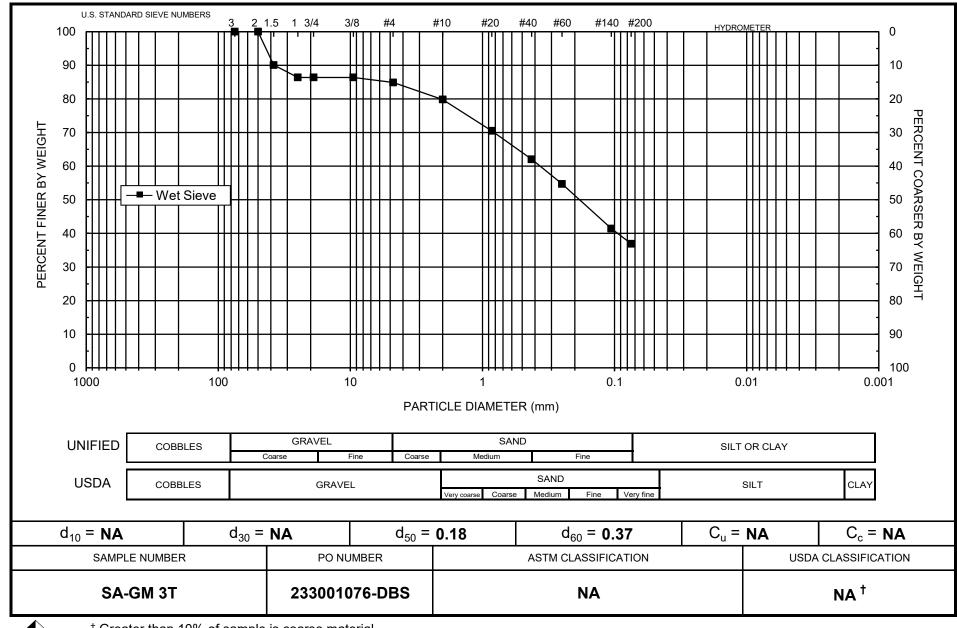
Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}^*d_{60})$ ] (mm): NA

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): NA

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

ASTM Soil Classification: NA USDA Soil Classification: NA <sup>†</sup>

<sup>†</sup> Greater than 10% of sample is coarse material



 $^{\dagger}$  Greater than 10% of sample is coarse material

Daniel B. Stephens & Associates, Inc.



### Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name:Stantec Consulting Services IncInitial Dry Weight of Sample (g): 587.80Job Number:DB18.1151.00Weight Passing #10 (g): 587.80

Sample Number: SA-GM 4B Weight Retained #10 (g): 0.00
Project Name: St. Anthony Geotech Investigation Wt. of -10 Sieve Sample (g): 66.17

PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 66.17

Test Date: 23-May-18 Shape: Rounded Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
Traction	Nullibei	(11111)	Netaineu	Netaineu	rassing	70 F assiriy
+10						
	3"	75	0.00	0.00	587.80	100.00
	2"	50	0.00	0.00	587.80	100.00
	1.5"	38.1	0.00	0.00	587.80	100.00
	1"	25	0.00	0.00	587.80	100.00
	3/4"	19.0	0.00	0.00	587.80	100.00
	3/8"	9.5	0.00	0.00	587.80	100.00
	4	4.75	0.00	0.00	587.80	100.00
	10	2.00	0.00	0.00	587.80	100.00
-10			(Based on calc	culated sieve wt.	)	
	20	0.85	0.04	0.04	66.13	99.94
	40	0.425	0.31	0.35	65.82	99.47
	60	0.250	4.84	5.19	60.98	92.16
	140	0.106	29.07	34.26	31.91	48.22
	200	0.075	8.20	42.46	23.71	35.83
	dry pan		1.24	43.70	22.47	
	wet pan			22.47	0.00	

 $d_{10}$  (mm): NA  $d_{50}$  (mm): 0.11  $d_{16}$  (mm): NA  $d_{60}$  (mm): 0.13  $d_{30}$  (mm): NA  $d_{84}$  (mm): 0.21

Median Particle Diameter -- d<sub>50</sub> (mm): 0.11

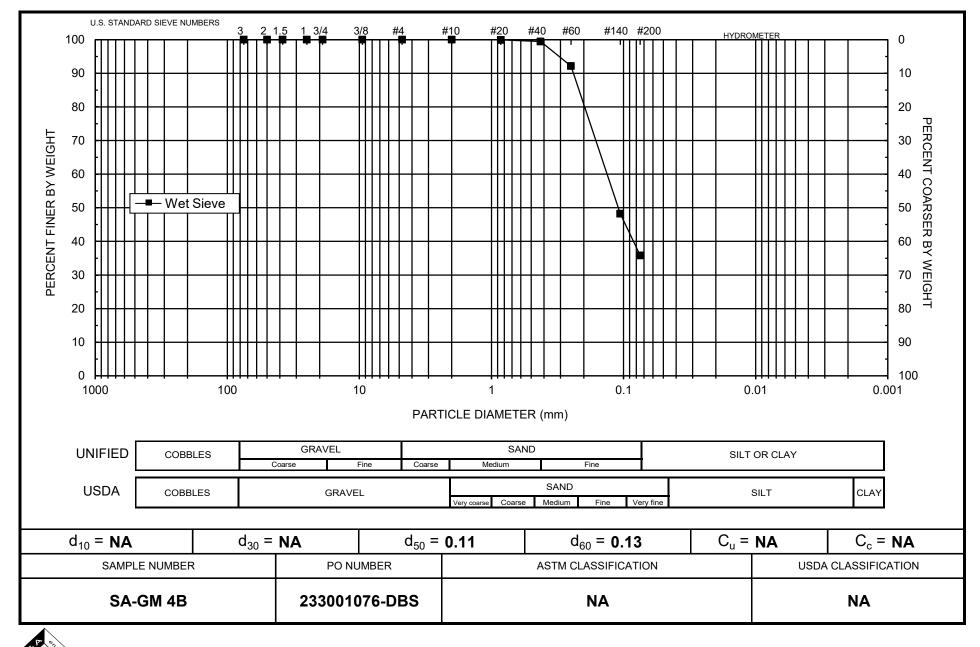
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): NA

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): NA

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): NA

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

ASTM Soil Classification: NA USDA Soil Classification: NA





#### Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name:Stantec Consulting Services IncInitial Dry Weight of Sample (g): 556.89Job Number:DB18.1151.00Weight Passing #10 (g): 456.92Sample Number:SA-GM 5BWeight Retained #10 (g): 99.97

Project Name: St. Anthony Geotech Investigation
PO Number: 233001076-DBS

Wt. of -10 Sieve Sample (g): 65.29
Calculated Weight of Sieve Sample (g): 79.57

Test Date: 23-May-18 Shape: Angular

Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	556.89	100.00
	2"	50	0.00	0.00	556.89	100.00
	1.5"	38.1	0.00	0.00	556.89	100.00
	1"	25	47.83	47.83	509.06	91.41
	3/4"	19.0	0.00	47.83	509.06	91.41
	3/8"	9.5	14.63	62.46	494.43	88.78
	4	4.75	18.74	81.20	475.69	85.42
	10	2.00	18.77	99.97	456.92	82.05
-10			(Based on calc	culated sieve wt.	)	
	20	0.85	1.73	16.01	63.56	79.87
	40	0.425	4.81	20.82	58.75	73.83
	60	0.250	14.48	35.30	44.27	55.63
	140	0.106	20.87	56.17	23.40	29.41
	200	0.075	4.63	60.80	18.77	23.59
	dry pan		0.71	61.51	18.06	
	wet pan			18.06	0.00	

 $d_{10}$  (mm): NA  $d_{50}$  (mm): 0.21  $d_{16}$  (mm): NA  $d_{60}$  (mm): 0.28  $d_{30}$  (mm): 0.11  $d_{84}$  (mm): 3.3

Median Particle Diameter -- d<sub>50</sub> (mm): 0.21

Uniformity Coefficient, Cu--[ $d_{60}/d_{10}$ ] (mm): NA

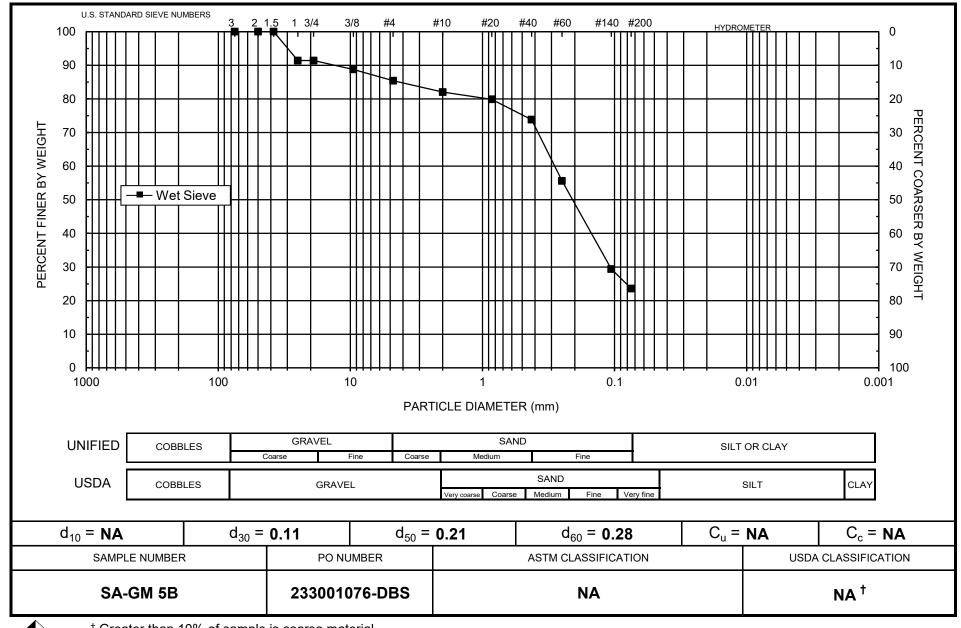
Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}^*d_{60})$ ] (mm): NA

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): NA

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

ASTM Soil Classification: NA USDA Soil Classification: NA <sup>†</sup>

<sup>†</sup> Greater than 10% of sample is coarse material



 $^{\dagger}$  Greater than 10% of sample is coarse material

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and ASTM classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Daniel B. Stephens & Associates, Inc.



#### Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc

Initial Dry Weight of Sample (g): 1308.27

Job Number:DB18.1151.00Weight Passing #10 (g):1305.54Sample Number:SA-GM 5TWeight Retained #10 (g):2.73Project Name:St. Anthony Geotech InvestigationWt. of -10 Sieve Sample (g):62.18

PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 62.31

Test Date: 4-Jun-18 Shape: Rounded

Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1308.27	100.00
	2"	50	0.00	0.00	1308.27	100.00
	1.5"	38.1	0.00	0.00	1308.27	100.00
	1"	25	0.00	0.00	1308.27	100.00
	3/4"	19.0	0.00	0.00	1308.27	100.00
	3/8"	9.5	0.00	0.00	1308.27	100.00
	4	4.75	0.68	0.68	1307.59	99.95
	10	2.00	2.05	2.73	1305.54	99.79
-10			(Based on calc	ulated sieve wt.	)	
	20	0.85	2.91	3.04	59.27	95.12
	40	0.425	22.18	25.22	37.09	59.52
	60	0.250	27.66	52.88	9.43	15.13
	140	0.106	6.06	58.94	3.37	5.41
	200	0.075	0.20	59.14	3.17	5.09
	dry pan		0.02	59.16	3.15	
	wet pan			3.15	0.00	

 $d_{10}$  (mm): 0.16  $d_{50}$  (mm): 0.38  $d_{16}$  (mm): 0.25  $d_{60}$  (mm): 0.43  $d_{30}$  (mm): 0.30  $d_{84}$  (mm): 0.68

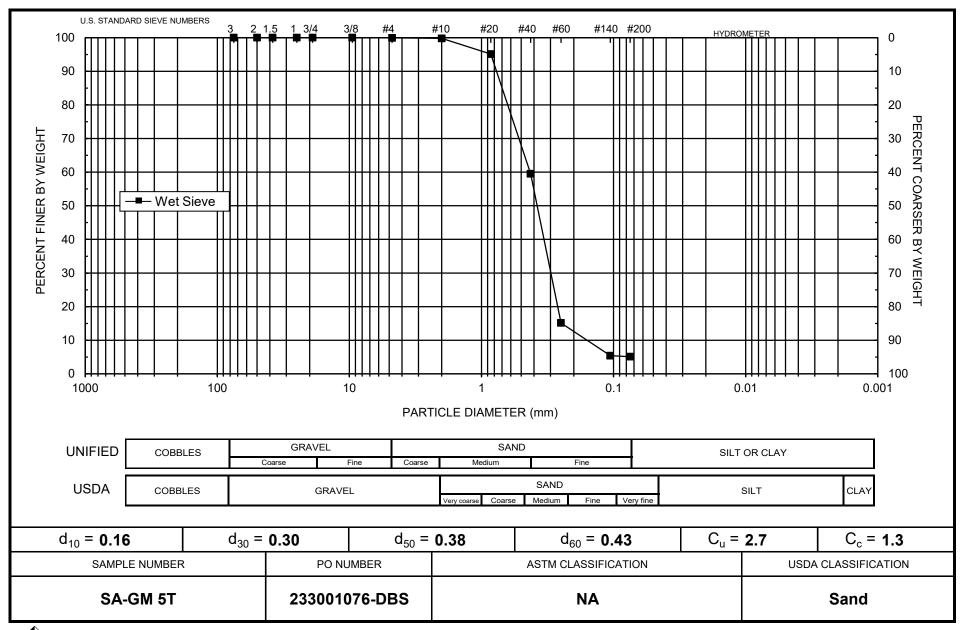
Median Particle Diameter--d<sub>50</sub> (mm): 0.38

Uniformity Coefficient, Cu -- [d<sub>60</sub>/d<sub>10</sub>] (mm): 2.7

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}^*d_{60})$ ] (mm): 1.3

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.44

ASTM Soil Classification: NA USDA Soil Classification: Sand







#### Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Initial Dry Weight of Sample (g): 641.27

Weight Passing #10 (g): 641.27

Sample Number: SA-GM 6B Weight Retained #10 (g): 0.00

Project Name: St. Anthony Geotech Investigation Wt. of -10 Sieve Sample (g): 53.75

PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 53.75

Test Date: 25-May-18 Shape: Rounded

Snape: Rounder Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	641.27	100.00
	2"	50	0.00	0.00	641.27	100.00
	1.5"	38.1	0.00	0.00	641.27	100.00
	1"	25	0.00	0.00	641.27	100.00
	3/4"	19.0	0.00	0.00	641.27	100.00
	3/8"	9.5	0.00	0.00	641.27	100.00
	4	4.75	0.00	0.00	641.27	100.00
	10	2.00	0.00	0.00	641.27	100.00
-10			(Based on calc	culated sieve wt.	)	
	20	0.85	0.02	0.02	53.73	99.96
	40	0.425	0.05	0.07	53.68	99.87
	60	0.250	0.34	0.41	53.34	99.24
	140	0.106	6.26	6.67	47.08	87.59
	200	0.075	4.31	10.98	42.77	79.57
	dry pan		0.92	11.90	41.85	
	wet pan			41.85	0.00	

 $d_{10}$  (mm): NA  $d_{50}$  (mm): NA  $d_{16}$  (mm): NA  $d_{60}$  (mm): NA  $d_{30}$  (mm): NA  $d_{84}$  (mm): 0.091

Median Particle Diameter--d<sub>50</sub> (mm): NA

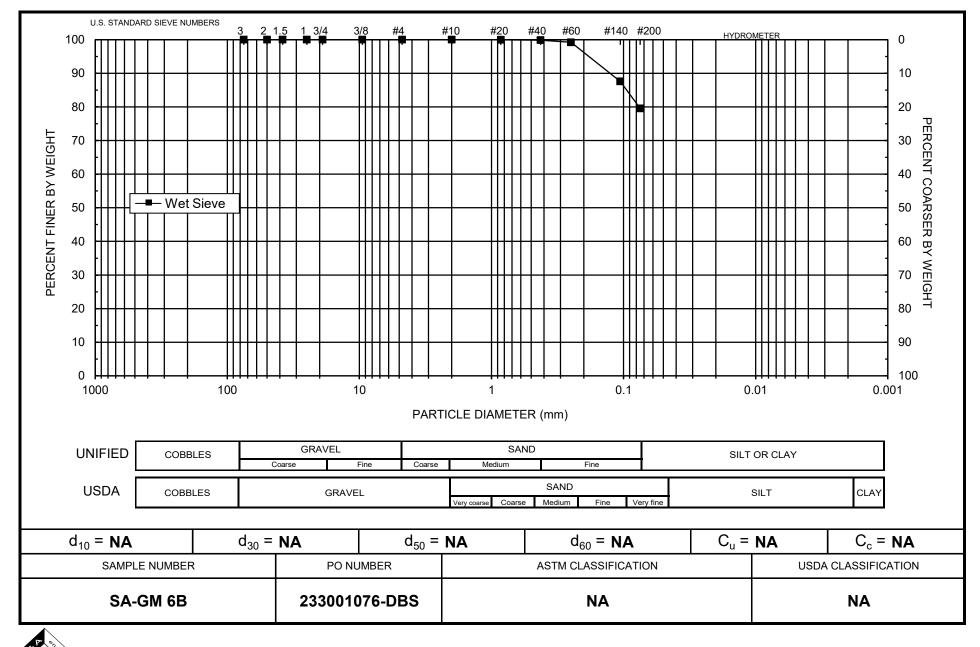
Uniformity Coefficient, Cu--[ $d_{60}/d_{10}$ ] (mm): NA

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}^*d_{60})$ ] (mm): NA

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): NA

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

ASTM Soil Classification: NA USDA Soil Classification: NA





### Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name:Stantec Consulting Services IncInitial Dry Weight of Sample (g): 508.84Job Number:DB18.1151.00Weight Passing #10 (g): 508.84

Sample Number: SA-GM 6T Weight Retained #10 (g): 0.00
Project Name: St. Anthony Geotech Investigation Wt. of -10 Sieve Sample (g): 60.17

PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 60.17

Test Date: 23-May-18 Shape: Rounded Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	508.84	100.00
	2"	50	0.00	0.00	508.84	100.00
	1.5"	38.1	0.00	0.00	508.84	100.00
	1"	25	0.00	0.00	508.84	100.00
	3/4"	19.0	0.00	0.00	508.84	100.00
	3/8"	9.5	0.00	0.00	508.84	100.00
	4	4.75	0.00	0.00	508.84	100.00
	10	2.00	0.00	0.00	508.84	100.00
-10			(Based on calc	ulated sieve wt.	)	
	20	0.85	0.55	0.55	59.62	99.09
	40	0.425	0.62	1.17	59.00	98.06
	60	0.250	0.79	1.96	58.21	96.74
	140	0.106	4.78	6.74	53.43	88.80
	200	0.075	3.85	10.59	49.58	82.40
	dry pan		1.07	11.66	48.51	
	wet pan			48.51	0.00	

 $d_{10}$  (mm): NA  $d_{50}$  (mm): NA  $d_{16}$  (mm): NA  $d_{60}$  (mm): NA  $d_{30}$  (mm): NA  $d_{84}$  (mm): 0.082

Median Particle Diameter -- d<sub>50</sub> (mm): NA

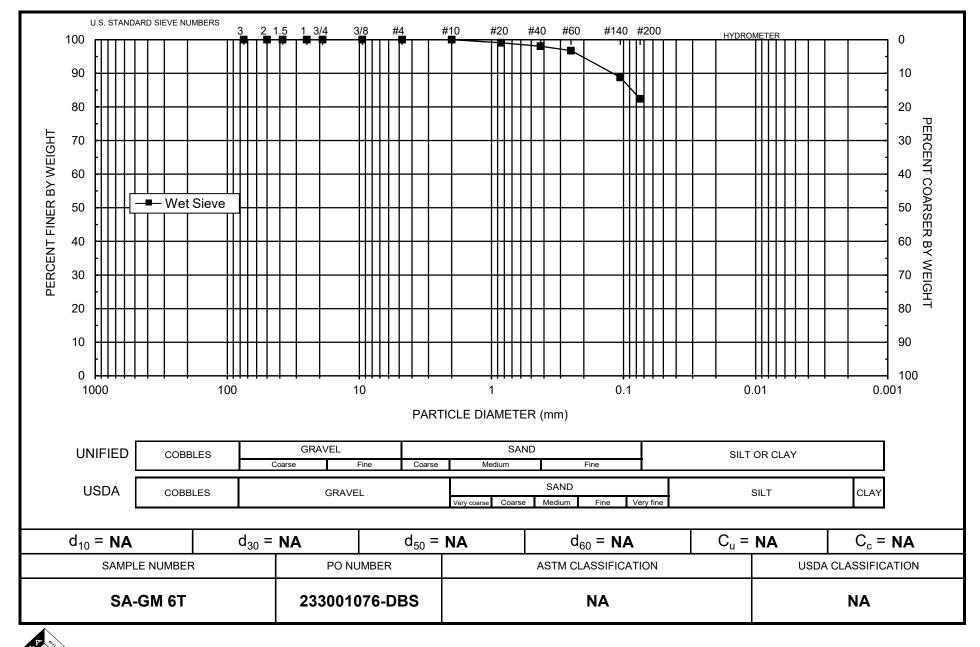
Uniformity Coefficient, Cu--[ $d_{60}/d_{10}$ ] (mm): NA

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}^*d_{60})$ ] (mm): NA

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): NA

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

ASTM Soil Classification: NA USDA Soil Classification: NA





### Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name:Stantec Consulting Services IncInitial Dry Weight of Sample (g): 916.23Job Number:DB18.1151.00Weight Passing #10 (g): 916.23

Sample Number: SA-GM 7B Weight Retained #10 (g): 0.00
Project Name: St. Anthony Geotech Investigation Wt. of -10 Sieve Sample (g): 54.29

PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 54.29

Test Date: 25-May-18 Shape: Rounded Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10					-	
	3"	75	0.00	0.00	916.23	100.00
	2"	50	0.00	0.00	916.23	100.00
	1.5"	38.1	0.00	0.00	916.23	100.00
	1"	25	0.00	0.00	916.23	100.00
	3/4"	19.0	0.00	0.00	916.23	100.00
	3/8"	9.5	0.00	0.00	916.23	100.00
	4	4.75	0.00	0.00	916.23	100.00
	10	2.00	0.00	0.00	916.23	100.00
-10			(Based on calc	ulated sieve wt.	)	
	20	0.85	0.00	0.00	54.29	100.00
	40	0.425	0.33	0.33	53.96	99.39
	60	0.250	4.51	4.84	49.45	91.08
	140	0.106	22.71	27.55	26.74	49.25
	200	0.075	6.44	33.99	20.30	37.39
	dry pan		1.21	35.20	19.09	
	wet pan			19.09	0.00	

Median Particle Diameter -- d<sub>50</sub> (mm): 0.11

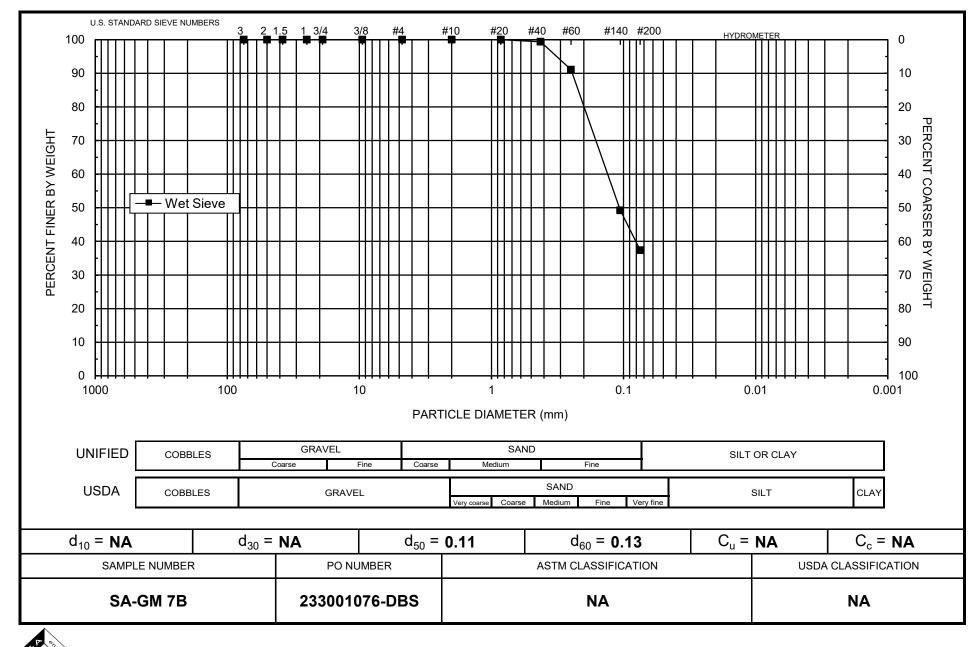
Uniformity Coefficient, Cu--[ $d_{60}/d_{10}$ ] (mm): NA

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}^*d_{60})$ ] (mm): NA

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): NA

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

ASTM Soil Classification: NA USDA Soil Classification: NA





### Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc

Initial Dry Weight of Sample (g): 1050.54

Job Number: DB18.1151.00

Weight Passing #10 (g): 1050.54

Sample Number: SA-GM 8B Weight Retained #10 (g): 0.00
Project Name: St. Anthony Geotech Investigation Wt. of -10 Sieve Sample (g): 60.03

Test Date: 25-May-18 Shape: Rounded Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	1050.54	100.00
	2"	50	0.00	0.00	1050.54	100.00
	1.5"	38.1	0.00	0.00	1050.54	100.00
	1"	25	0.00	0.00	1050.54	100.00
	3/4"	19.0	0.00	0.00	1050.54	100.00
	3/8"	9.5	0.00	0.00	1050.54	100.00
	4	4.75	0.00	0.00	1050.54	100.00
	10	2.00	0.00	0.00	1050.54	100.00
-10			(Based on calc	ulated sieve wt.	)	
	20	0.85	0.10	0.10	59.93	99.83
	40	0.425	2.29	2.39	57.64	96.02
	60	0.250	11.11	13.50	46.53	77.51
	140	0.106	19.19	32.69	27.34	45.54
	200	0.075	3.97	36.66	23.37	38.93
	dry pan		1.27	37.93	22.10	
	wet pan			22.10	0.00	

 $\begin{array}{lll} d_{10} \ (mm): \ NA & d_{50} \ (mm): \ 0.12 \\ d_{16} \ (mm): \ NA & d_{60} \ (mm): \ 0.16 \\ d_{30} \ (mm): \ NA & d_{84} \ (mm): \ 0.30 \end{array}$ 

Median Particle Diameter -- d<sub>50</sub> (mm): 0.12

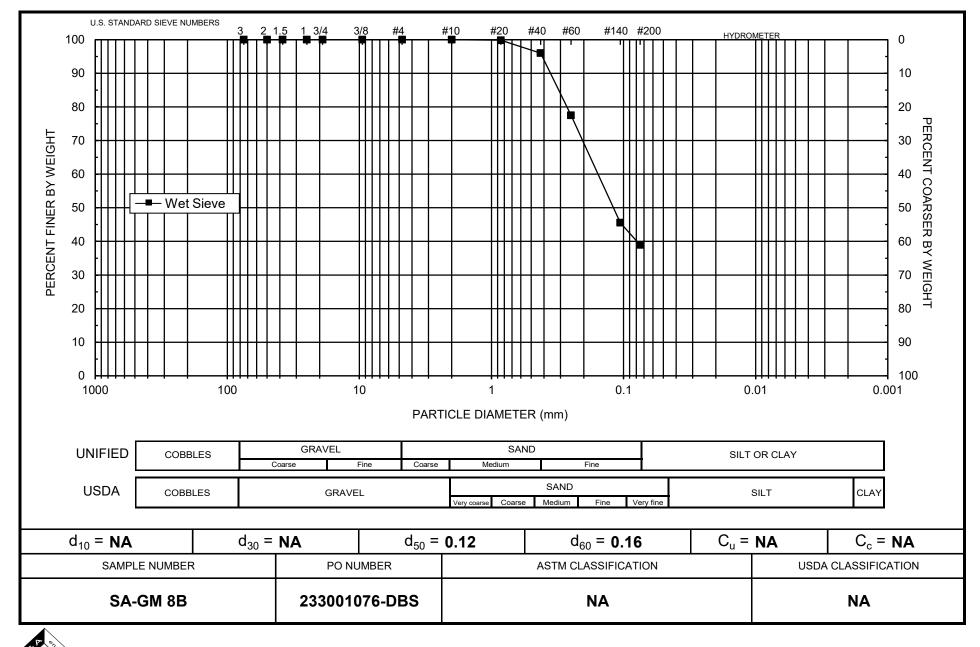
Uniformity Coefficient, Cu--[ $d_{60}/d_{10}$ ] (mm): NA

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): NA

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): NA

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

ASTM Soil Classification: NA USDA Soil Classification: NA





## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Initial Dry Weight of Sample (g): 1380.92

Weight Passing #10 (g): 1136.29

Sample Number: SA-GM 8T Weight Retained #10 (g): 1136.29

Project Name: St. Anthony Geotech Investigation Wt. of -10 Sieve Sample (g): 57.64

PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 70.05

Test Date: 24-May-18 Shape: Rounded

Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
	Number	(111111)	rtetained	Retained	i assiriy	70 T assiring
+10						
	3"	75	0.00	0.00	1380.92	100.00
	2"	50	0.00	0.00	1380.92	100.00
	1.5"	38.1	0.00	0.00	1380.92	100.00
	1"	25	44.66	44.66	1336.26	96.77
	3/4"	19.0	46.71	91.37	1289.55	93.38
	3/8"	9.5	49.31	140.68	1240.24	89.81
	4	4.75	44.99	185.67	1195.25	86.55
	10	2.00	58.96	244.63	1136.29	82.28
-10			(Based on cald	culated sieve wt.	)	
	20	0.85	7.38	19.79	50.26	71.75
	40	0.425	11.45	31.24	38.81	55.40
	60	0.250	13.38	44.62	25.43	36.30
	140	0.106	12.32	56.94	13.11	18.72
	200	0.075	2.01	58.95	11.10	15.85
	dry pan		0.13	59.08	10.97	2.00
	wet pan		3.10	10.97	0.00	

 $d_{10}$  (mm): NA  $d_{50}$  (mm): 0.37  $d_{16}$  (mm): 0.076  $d_{60}$  (mm): 0.52  $d_{30}$  (mm): 0.18  $d_{84}$  (mm): 2.8

Median Particle Diameter -- d<sub>50</sub> (mm): 0.37

Uniformity Coefficient, Cu--[ $d_{60}/d_{10}$ ] (mm): NA

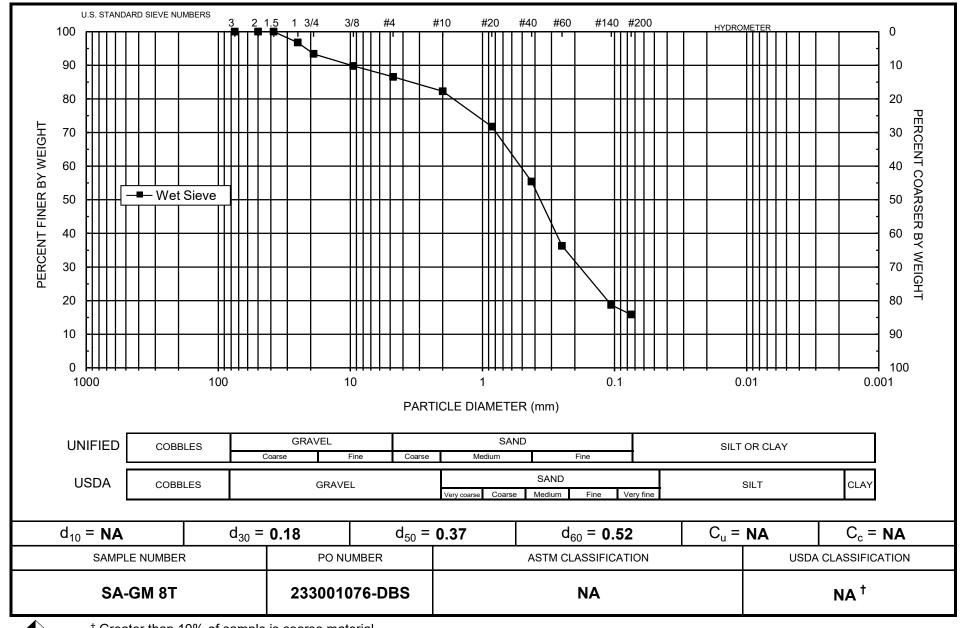
Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}^*d_{60})$ ] (mm): NA

Mean Particle Diameter -- [ $(d_{16}+d_{50}+d_{84})/3$ ] (mm): 1.1

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

ASTM Soil Classification: NA USDA Soil Classification: NA <sup>†</sup>

<sup>†</sup> Greater than 10% of sample is coarse material



 $^{\dagger}$  Greater than 10% of sample is coarse material

Daniel B. Stephens & Associates, Inc.



## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 272.52

 Job Number:
 DB18.1151.00
 Weight Passing #10 (g): 272.52

 Sample Number:
 L1-1 (10'A)
 Weight Retained #10 (g): 0.00

Project Name: St. Anthony Geotech Investigation Weight of Hydrometer Sample (g): 56.68
PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 56.68

Test Date: 17-May-18 Shape: Rounded Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	272.52	100.00
	2"	50	0.00	0.00	272.52	100.00
	1.5"	38.1	0.00	0.00	272.52	100.00
	1"	25	0.00	0.00	272.52	100.00
	3/4"	19.0	0.00	0.00	272.52	100.00
	3/8"	9.5	0.00	0.00	272.52	100.00
	4	4.75	0.00	0.00	272.52	100.00
	10	2.00	0.00	0.00	272.52	100.00
-10			(Based on calcı	ulated sieve wt.)	)	
	20	0.85	0.08	0.08	56.60	99.86
	40	0.425	0.16	0.24	56.44	99.58
	60	0.250	0.49	0.73	55.95	98.71
	140	0.106	10.80	11.53	45.15	79.66
	200	0.075	7.28	18.81	37.87	66.81
	dry pan		0.83	19.64	37.04	
	wet pan			37.04	0.00	

 $\begin{array}{lll} d_{10} \ (mm): \ 2.2 E-05 & d_{50} \ (mm): \ 0.046 \\ d_{16} \ (mm): \ 0.00016 & d_{60} \ (mm): \ 0.061 \\ d_{30} \ (mm): \ 0.0067 & d_{84} \ (mm): \ 0.13 \end{array}$ 

Median Particle Diameter--d<sub>50</sub> (mm): 0.046

Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 2773

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 33

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.059

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Loam



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: L1-1 (10'A)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 15-May-18

Total Sample Wt. (g): 56.68

Total Sample Wt. (g): 272.52

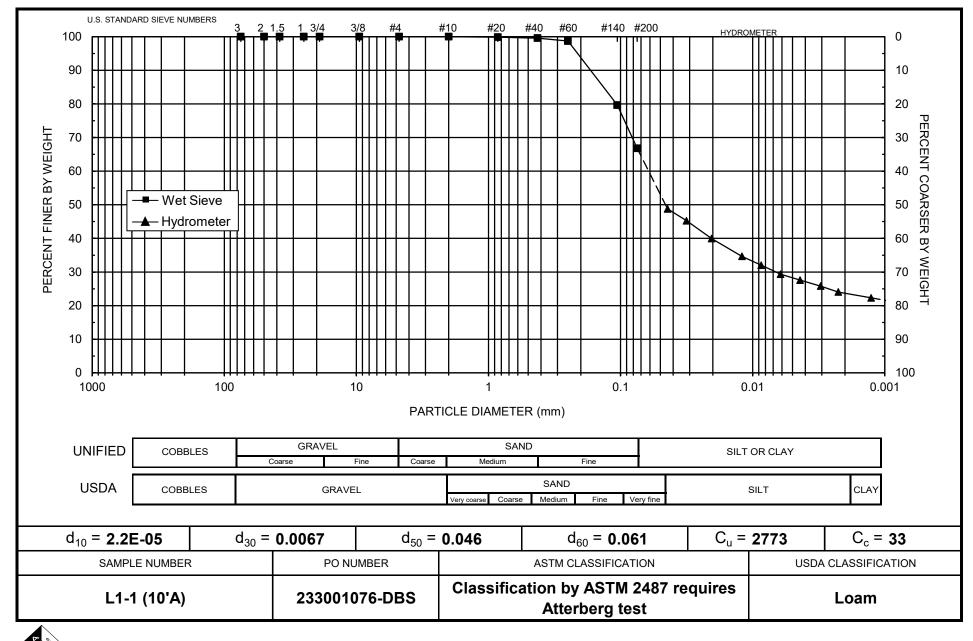
Start Time: 9:00

Wt. Passing #10 (g): 272.52

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
15-May-18	1	21.6	33.0	5.4	27.6	10.9	0.04409	48.8	48.8
	2	21.6	31.0	5.4	25.6	11.2	0.03164	45.2	45.2
	5	21.6	28.0	5.4	22.6	11.7	0.02045	39.9	39.9
	15	21.6	25.0	5.4	19.6	12.2	0.01205	34.7	34.7
	30	21.6	23.5	5.4	18.1	12.4	0.00861	32.0	32.0
	60	21.5	22.0	5.4	16.6	12.7	0.00615	29.3	29.3
	120	21.5	21.0	5.4	15.6	12.9	0.00438	27.6	27.6
	250	21.5	20.0	5.4	14.6	13.0	0.00305	25.8	25.8
	468	21.5	19.0	5.4	13.6	13.2	0.00225	24.0	24.0
16-May-18	1484	21.6	18.0	5.4	12.6	13.3	0.00127	22.3	22.3

#### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device





## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 491.56

Job Number: DB18.1151.00 Weight Passing #10 (g): 489.94 Sample Number: L1-2 (20'B) Weight Retained #10 (g): 1.62

Project Name: St. Anthony Geotech Investigation Weight of Hydrometer Sample (g): 57.04

PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 57.23

Test Date: 17-May-18 Shape: Rounded

Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	491.56	100.00
	2"	50	0.00	0.00	491.56	100.00
	1.5"	38.1	0.00	0.00	491.56	100.00
	1"	25	0.00	0.00	491.56	100.00
	3/4"	19.0	0.00	0.00	491.56	100.00
	3/8"	9.5	0.00	0.00	491.56	100.00
	4	4.75	0.63	0.63	490.93	99.87
	10	2.00	0.99	1.62	489.94	99.67
-10			(Based on calcu	ulated sieve wt.)		
	20	0.85	0.12	0.31	56.92	99.46
	40	0.425	0.12	0.43	56.80	99.25
	60	0.250	0.09	0.52	56.71	99.09
	140	0.106	0.42	0.94	56.29	98.36
	200	0.075	0.46	1.40	55.83	97.56
	dry pan		0.12	1.52	55.71	
	wet pan			55.71	0.00	

 $\begin{array}{lll} d_{10} \ (mm): \ 2.8 E-05 & d_{50} \ (mm): \ 0.0092 \\ d_{16} \ (mm): \ 0.00010 & d_{60} \ (mm): \ 0.015 \\ d_{30} \ (mm): \ 0.0022 & d_{84} \ (mm): \ 0.044 \end{array}$ 

Median Particle Diameter--d<sub>50</sub> (mm): 0.0092

Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 536

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 12

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.018

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Silty Clay Loam



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: L1-2 (20'B)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 15-May-18

Total Sample Wt. (g): 57.04

Total Sample Wt. (g): 491.56

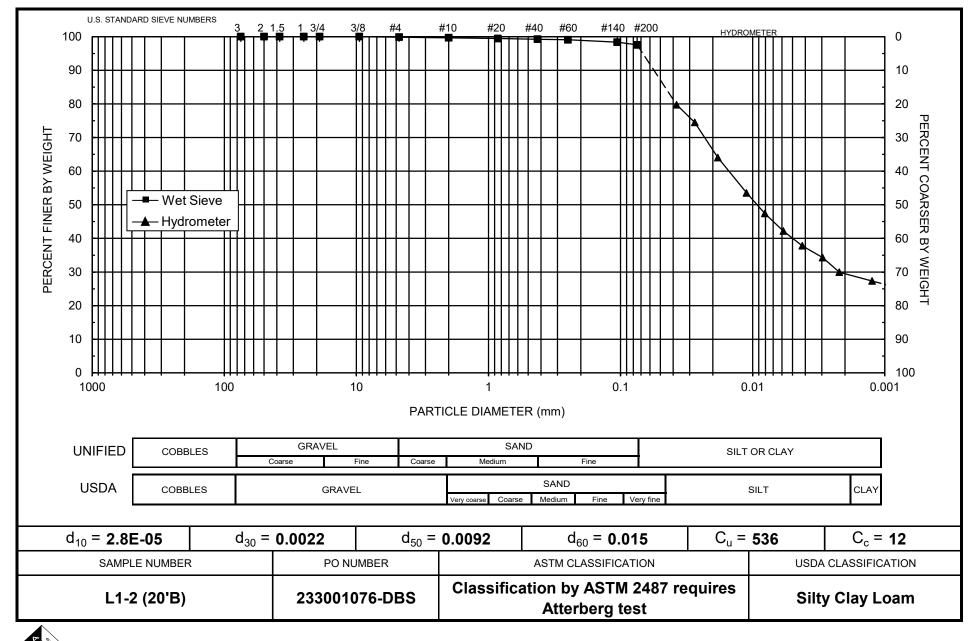
Start Time: 9:06

Wt. Passing #10 (g): 489.94

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
	_								
15-May-18	1	21.6	51.0	5.4	45.6	7.9	0.03765	80.0	79.8
	2	21.6	48.0	5.4	42.6	8.4	0.02743	74.8	74.5
	5	21.6	42.0	5.4	36.6	9.4	0.01833	64.2	64.0
	15	21.6	36.0	5.4	30.6	10.4	0.01112	53.7	53.5
	30	21.6	32.5	5.4	27.1	11.0	0.00808	47.6	47.4
	60	21.5	29.5	5.4	24.1	11.5	0.00585	42.3	42.2
	120	21.5	27.0	5.4	21.6	11.9	0.00421	37.9	37.8
	250	21.5	25.0	5.4	19.6	12.2	0.00296	34.4	34.3
	463	21.5	22.5	5.4	17.1	12.6	0.00221	30.0	29.9
16-May-18	1480	21.6	21.0	5.4	15.6	12.9	0.00125	27.4	27.3

#### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device





## **Particle Size Analysis** Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc

Initial Dry Weight of Sample (g): 434.95

Job Number: DB18.1151.00

Test Date: 17-May-18

Weight Passing #10 (g): 434.90

Sample Number: L1-3 (5'A)

Weight Retained #10 (g): 0.05 Weight of Hydrometer Sample (g): 59.96

Project Name: St. Anthony Geotech Investigation

Calculated Weight of Sieve Sample (g): 59.97

PO Number: 233001076-DBS

Shape: Angular

Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10		,				<u> </u>
	3"	75	0.00	0.00	434.95	100.00
	2"	50	0.00	0.00	434.95	100.00
	1.5"	38.1	0.00	0.00	434.95	100.00
	1"	25	0.00	0.00	434.95	100.00
	3/4"	19.0	0.00	0.00	434.95	100.00
	3/8"	9.5	0.00	0.00	434.95	100.00
	4	4.75	0.00	0.00	434.95	100.00
	10	2.00	0.05	0.05	434.90	99.99
-10			(Based on calc	ulated sieve wt.)	)	
	20	0.85	0.32	0.33	59.64	99.45
	40	0.425	0.65	0.98	58.99	98.37
	60	0.250	1.65	2.63	57.34	95.62
	140	0.106	16.58	19.21	40.76	67.97
	200	0.075	8.65	27.86	32.11	53.55
	dry pan		1.00	28.86	31.11	
	wet pan			31.11	0.00	

d<sub>10</sub> (mm): 6.4E-45

d<sub>50</sub> (mm): 0.066

d<sub>16</sub> (mm): 0.0031 d<sub>30</sub> (mm): 0.034

d<sub>60</sub> (mm): 0.088 d<sub>84</sub> (mm): 0.17

Median Particle Diameter -- d<sub>50</sub> (mm): 0.066

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 1.4E+43 and soil classification are estimates,

Coefficient of Curvature,  $Cc - [(d_{30})^2/(d_{10}*d_{60})]$  (mm): 2.1E+42

since extrapolation was required to obtain the d<sub>10</sub> diameter

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.080

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Sandy Loam



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: L1-3 (5'A)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 15-May-18

Start Time: 9:12

Initial Wt. (g): 59.96

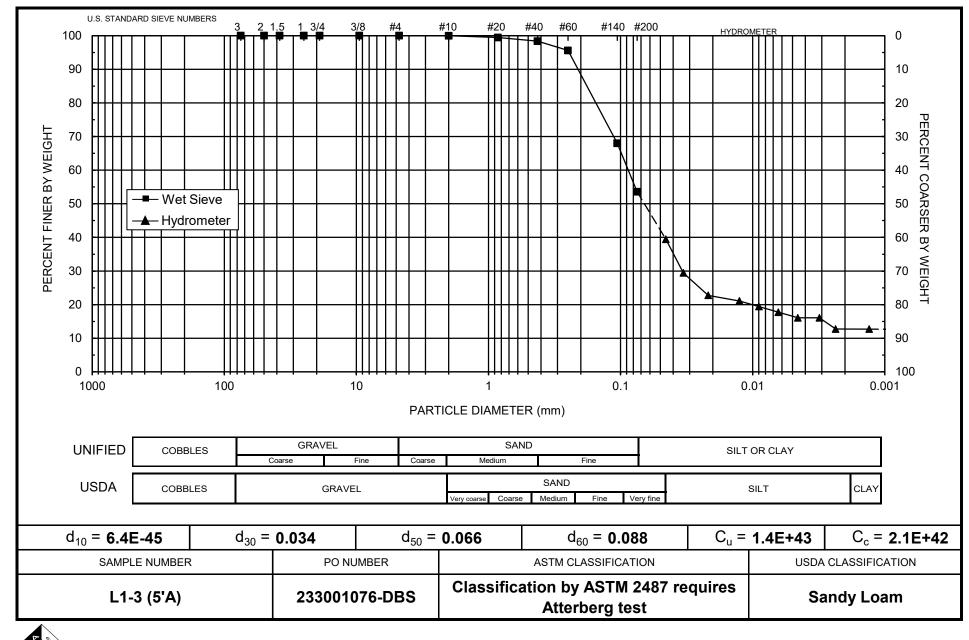
Total Sample Wt. (g): 434.95

Wt. Passing #10 (g): 434.90

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
45.14	4	04.0	00.0	<b>5</b> 4	00.0	44.5	0.04540	00.4	00.4
15-May-18	1	21.6	29.0	5.4	23.6	11.5	0.04540	39.4	39.4
	2	21.6	23.0	5.4	17.6	12.5	0.03344	29.4	29.4
	5	21.6	19.0	5.4	13.6	13.2	0.02170	22.7	22.7
	15	21.6	18.0	5.4	12.6	13.3	0.01260	21.1	21.1
	30	21.7	17.0	5.4	11.6	13.5	0.00896	19.4	19.4
	60	21.5	16.0	5.4	10.6	13.7	0.00639	17.7	17.7
	120	21.5	15.0	5.4	9.6	13.8	0.00454	16.1	16.1
	254	21.5	15.0	5.4	9.6	13.8	0.00312	16.1	16.1
	458	21.5	13.0	5.4	7.6	14.2	0.00235	12.7	12.7
16-May-18	1475	21.6	13.0	5.4	7.6	14.2	0.00131	12.7	12.7

#### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device





## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 419.21

Job Number: DB18.1151.00 Weight Passing #10 (g): 419.21 Sample Number: L1-5 (20'B) Weight Retained #10 (g): 0.00 Project Name: St. Anthony Geotech Investigation Weight of Hydrometer Sample (g): 55.07

Test Date: 24-May-18 Shape: Angular

Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	419.21	100.00
	2"	50	0.00	0.00	419.21	100.00
	1.5"	38.1	0.00	0.00	419.21	100.00
	1"	25	0.00	0.00	419.21	100.00
	3/4"	19.0	0.00	0.00	419.21	100.00
	3/8"	9.5	0.00	0.00	419.21	100.00
	4	4.75	0.00	0.00	419.21	100.00
	10	2.00	0.00	0.00	419.21	100.00
-10			(Based on calcı	ulated sieve wt.)	)	
	20	0.85	0.02	0.02	55.05	99.96
	40	0.425	0.05	0.07	55.00	99.87
	60	0.250	0.41	0.48	54.59	99.13
	140	0.106	18.28	18.76	36.31	65.93
	200	0.075	8.60	27.36	27.71	50.32
	dry pan		0.80	28.16	26.91	
	wet pan			26.91	0.00	

 $\begin{array}{lll} d_{10} \ (mm): \ 0.0011 & d_{50} \ (mm): \ 0.074 \\ d_{16} \ (mm): \ 0.0045 & d_{60} \ (mm): \ 0.093 \\ d_{30} \ (mm): \ 0.042 & d_{84} \ (mm): \ 0.17 \end{array}$ 

Median Particle Diameter--d<sub>50</sub> (mm): 0.074

Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 85

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 17

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.083

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Sandy Loam



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: L1-5 (20'B)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 18-May-18 Initial Wt. (g): 55.07

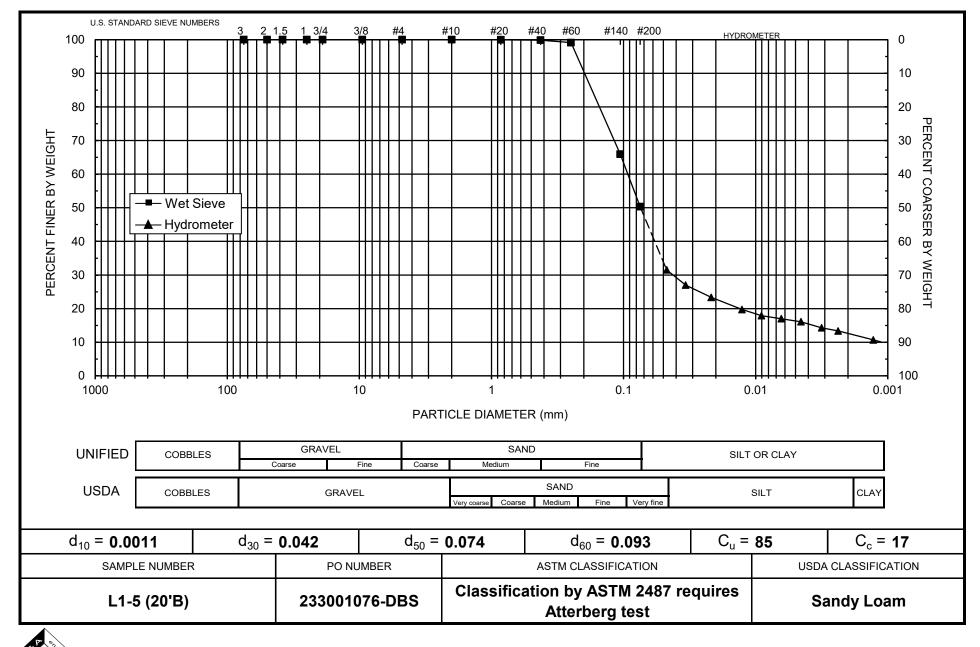
Test Date: 18-May-18 Total Sample Wt. (g): 419.21

Start Time: 9:30 Wt. Passing #10 (g): 419.21

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
18-May-18	1	21.6	23.5	6.1	17.4	12.4	0.04714	31.5	31.5
	2	21.6	21.0	6.1	14.9	12.9	0.03388	27.0	27.0
	5	21.6	19.0	6.1	12.9	13.2	0.02170	23.4	23.4
	15	21.6	17.0	6.1	10.9	13.5	0.01268	19.7	19.7
	30	21.6	16.0	6.1	9.9	13.7	0.00902	17.9	17.9
	60	21.6	15.5	6.1	9.4	13.8	0.00640	17.0	17.0
	120	21.6	15.0	6.1	8.9	13.8	0.00454	16.1	16.1
	250	21.6	14.0	6.1	7.9	14.0	0.00316	14.3	14.3
	446	21.6	13.5	6.1	7.4	14.1	0.00237	13.4	13.4
19-May-18	1544	21.7	12.0	6.1	5.9	14.3	0.00129	10.7	10.7

#### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device





## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 507.75

Job Number: DB18.1151.00

Weight Passing #10 (g): 507.75

Sample Number: L2-1 (5'A)

Weight Retained #10 (g): 0.00

Project Name: St. Anthony Geotech Investigation

Weight of Hydrometer Sample (g): 65.87

PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 65.87

Test Date: 17-May-18 Shape: Angular Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	507.75	100.00
	2"	50	0.00	0.00	507.75	100.00
	1.5"	38.1	0.00	0.00	507.75	100.00
	1"	25	0.00	0.00	507.75	100.00
	3/4"	19.0	0.00	0.00	507.75	100.00
	3/8"	9.5	0.00	0.00	507.75	100.00
	4	4.75	0.00	0.00	507.75	100.00
	10	2.00	0.00	0.00	507.75	100.00
-10			(Based on calcu	ılated sieve wt.)	)	
	20	0.85	0.52	0.52	65.35	99.21
	40	0.425	0.54	1.06	64.81	98.39
	60	0.250	0.84	1.90	63.97	97.12
	140	0.106	10.50	12.40	53.47	81.18
	200	0.075	9.01	21.41	44.46	67.50
	dry pan		1.73	23.14	42.73	
	wet pan			42.73	0.00	

 $\begin{array}{lll} d_{10} \, (mm): \ 0.00040 & d_{50} \, (mm): \ 0.045 \\ d_{16} \, (mm): \ 0.0013 & d_{60} \, (mm): \ 0.060 \\ d_{30} \, (mm): \ 0.015 & d_{84} \, (mm): \ 0.12 \end{array}$ 

Median Particle Diameter--d<sub>50</sub> (mm): 0.045

Uniformity Coefficient, Cu -- [d<sub>60</sub>/d<sub>10</sub>] (mm): 150

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}^*d_{60})$ ] (mm): 9.4

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.055

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Loam



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: L2-1 (5'A)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation

Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 15-May-18 Initial Wt. (g): 65.87

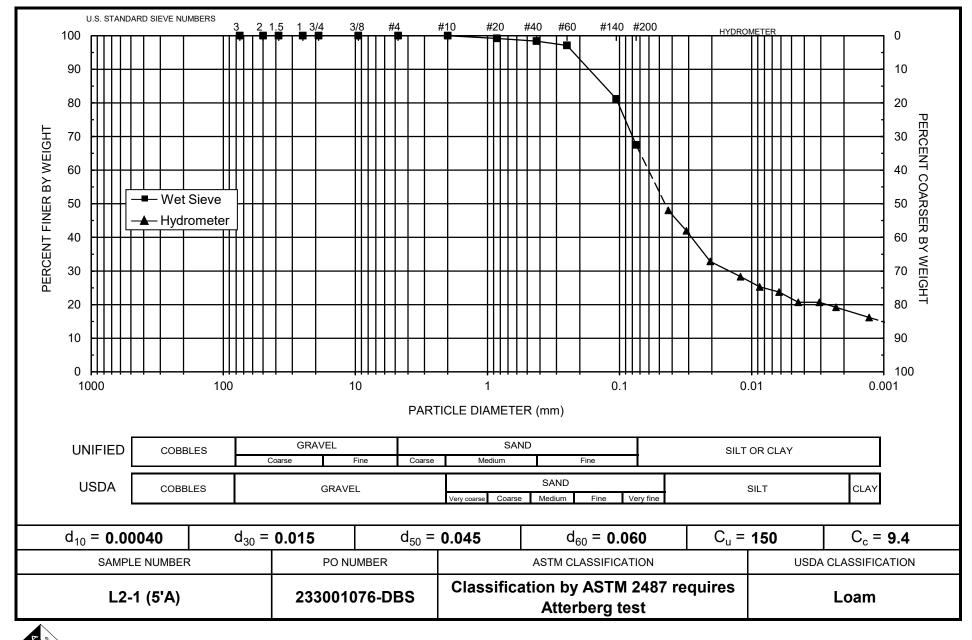
Total Sample Wt. (g): 507.75

Start Time: 9:18 Wt. Passing #10 (g): 507.75

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
15-May-18	1	21.6	37.0	5.4	31.6	10.2	0.04274	48.0	48.0
	2	21.6	33.0	5.4	27.6	10.9	0.03118	42.0	42.0
	5	21.6	27.0	5.4	21.6	11.9	0.02059	32.9	32.9
	15	21.6	24.0	5.4	18.6	12.4	0.01213	28.3	28.3
	30	21.7	22.0	5.4	16.6	12.7	0.00868	25.3	25.3
	60	21.5	21.0	5.4	15.6	12.9	0.00619	23.7	23.7
	120	21.4	19.0	5.4	13.6	13.2	0.00444	20.7	20.7
	250	21.5	19.0	5.4	13.6	13.2	0.00307	20.7	20.7
	453	21.5	18.0	5.4	12.6	13.3	0.00230	19.2	19.2
16-May-18	1472	21.6	16.0	5.4	10.6	13.7	0.00129	16.2	16.2

#### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device





# Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 371.36

Project Name: St. Anthony Geotech Investigation Weight of Hydrometer Sample (g): 52.42
PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 52.42

Test Date: 29-Jun-18 Shape: Rounded Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						_
	3"	75	0.00	0.00	371.36	100.00
	2"	50	0.00	0.00	371.36	100.00
	1.5"	38.1	0.00	0.00	371.36	100.00
	1"	25	0.00	0.00	371.36	100.00
	3/4"	19.0	0.00	0.00	371.36	100.00
	3/8"	9.5	0.00	0.00	371.36	100.00
	4	4.75	0.00	0.00	371.36	100.00
	10	2.00	0.00	0.00	371.36	100.00
-10			(Based on calcı	ulated sieve wt.	)	
	20	0.85	0.11	0.11	52.31	99.79
	40	0.425	0.19	0.30	52.12	99.43
	60	0.250	0.42	0.72	51.70	98.63
	140	0.106	8.56	9.28	43.14	82.30
	200	0.075	7.21	16.49	35.93	68.54
	dry pan		0.42	16.91	35.51	
	wet pan			35.51	0.00	

 $\begin{array}{lll} d_{10} \ (mm): \ 0.00024 & d_{50} \ (mm): \ 0.056 \\ d_{16} \ (mm): \ 0.0012 & d_{60} \ (mm): \ 0.065 \\ d_{30} \ (mm): \ 0.013 & d_{84} \ (mm): \ 0.12 \end{array}$ 

Median Particle Diameter--d<sub>50</sub> (mm): 0.056

Uniformity Coefficient, Cu -- [d<sub>60</sub>/d<sub>10</sub>] (mm): 271

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 11

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.059

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Sandy Loam



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: L2-1 (15'A)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 27-Jun-18

Total Sample Wt. (g): 52.42

Test Date: 9:00

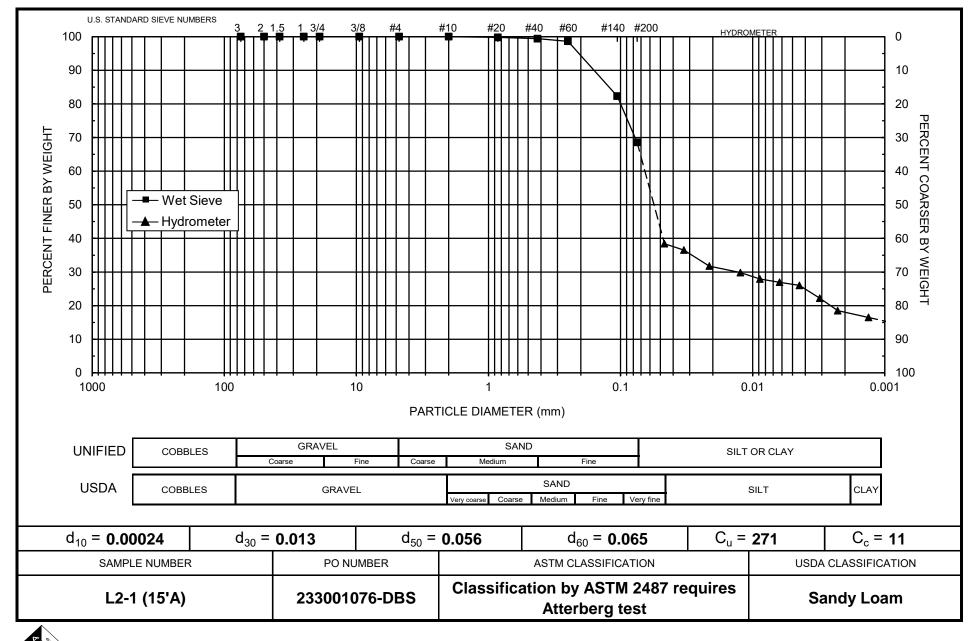
Total Sample Wt. (g): 371.36

Wt. Passing #10 (g): 371.36

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
27-Jun-18	1	21.6	25.5	5.4	20.1	12.1	0.04651	38.4	38.4
	2	21.6	24.5	5.4	19.1	12.3	0.03311	36.5	36.5
	5	21.6	22.0	5.4	16.6	12.7	0.02129	31.7	31.7
	15	21.5	21.0	5.4	15.6	12.9	0.01238	29.8	29.8
	30	21.5	20.0	5.4	14.6	13.0	0.00881	27.9	27.9
	60	21.4	19.5	5.4	14.1	13.1	0.00626	27.0	27.0
	120	21.6	19.0	5.4	13.6	13.2	0.00443	26.0	26.0
	250	21.6	17.0	5.4	11.6	13.5	0.00311	22.2	22.2
	470	22.5	15.0	5.3	9.7	13.8	0.00227	18.5	18.5
28-Jun-18	1429	21.4	14.0	5.4	8.6	14.0	0.00133	16.5	16.5

#### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device





## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 483.31

Job Number: DB18.1151.00 Weight Passing #10 (g): 483.31 Sample Number: L2-2 (5'A) Weight Retained #10 (g): 0.00 Project Name: St. Anthony Geotech Investigation Weight of Hydrometer Sample (g): 63.94

PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 63.94

Test Date: 17-May-18 Shape: Angular

Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10					-	
	3"	75	0.00	0.00	483.31	100.00
	2"	50	0.00	0.00	483.31	100.00
	1.5"	38.1	0.00	0.00	483.31	100.00
	1"	25	0.00	0.00	483.31	100.00
	3/4"	19.0	0.00	0.00	483.31	100.00
	3/8"	9.5	0.00	0.00	483.31	100.00
	4	4.75	0.00	0.00	483.31	100.00
	10	2.00	0.00	0.00	483.31	100.00
-10			(Based on calcı	ulated sieve wt.)	)	
	20	0.85	0.09	0.09	63.85	99.86
	40	0.425	0.12	0.21	63.73	99.67
	60	0.250	0.73	0.94	63.00	98.53
	140	0.106	17.65	18.59	45.35	70.93
	200	0.075	11.02	29.61	34.33	53.69
	dry pan		1.32	30.93	33.01	
	wet pan			33.01	0.00	

 $\begin{array}{lll} d_{10} \ (mm): \ 0.00019 & d_{50} \ (mm): \ 0.067 \\ d_{16} \ (mm): \ 0.0018 & d_{60} \ (mm): \ 0.085 \\ d_{30} \ (mm): \ 0.031 & d_{84} \ (mm): \ 0.16 \end{array}$ 

Median Particle Diameter--d<sub>50</sub> (mm): 0.067

Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 447

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 60

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.076

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Sandy Loam



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: L2-2 (5'A)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 15-May-18

Start Time: 9:24

Initial Wt. (g): 63.94

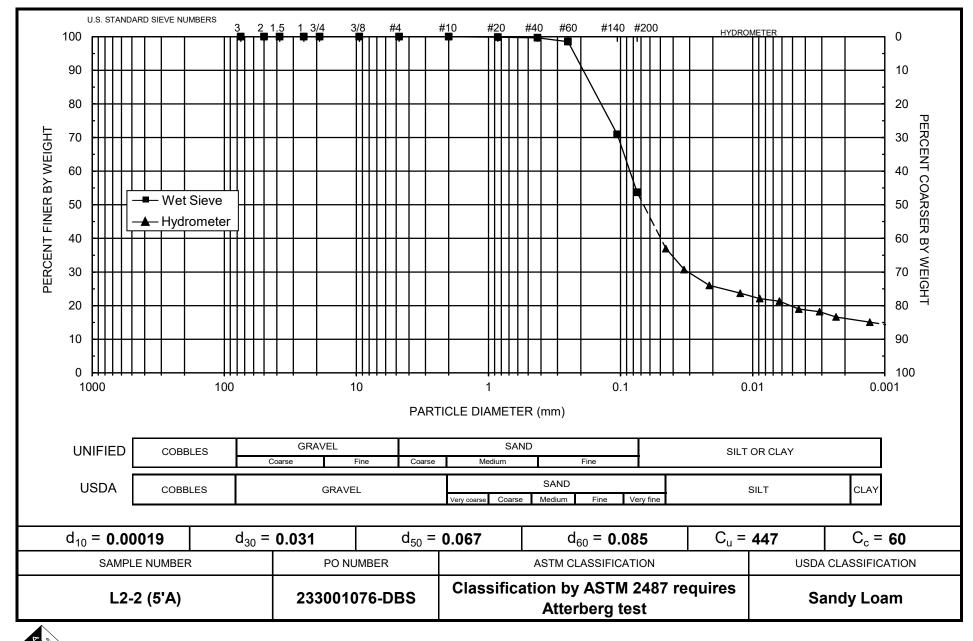
Total Sample Wt. (g): 483.31

Wt. Passing #10 (g): 483.31

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
15-May-18	1	21.6	29.0	5.4	23.6	11.5	0.04540	37.0	37.0
	2	21.6	25.0	5.4	19.6	12.2	0.03300	30.7	30.7
	5	21.6	22.0	5.4	16.6	12.7	0.02129	26.0	26.0
	15	21.6	20.5	5.4	15.1	12.9	0.01241	23.7	23.7
	30	21.5	19.5	5.4	14.1	13.1	0.00884	22.1	22.1
	60	21.5	19.0	5.4	13.6	13.2	0.00627	21.3	21.3
	120	21.5	17.5	5.4	12.1	13.4	0.00448	19.0	19.0
	250	21.5	17.0	5.4	11.6	13.5	0.00311	18.2	18.2
	448	21.5	16.0	5.4	10.6	13.7	0.00234	16.6	16.6
16-May-18	1468	21.6	15.0	5.4	9.6	13.8	0.00130	15.1	15.1

#### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device





## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 469.13

Job Number: DB18.1151.00 Weight Passing #10 (g): 469.13
Sample Number: L2-3 (5'A) Weight Retained #10 (g): 0.00
Project Name: St. Anthony Geotech Investigation Weight of Hydrometer Sample (g): 60.77

Test Date: 17-May-18 Shape: Angular Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						_
	3"	75	0.00	0.00	469.13	100.00
	2"	50	0.00	0.00	469.13	100.00
	1.5"	38.1	0.00	0.00	469.13	100.00
	1"	25	0.00	0.00	469.13	100.00
	3/4"	19.0	0.00	0.00	469.13	100.00
	3/8"	9.5	0.00	0.00	469.13	100.00
	4	4.75	0.00	0.00	469.13	100.00
	10	2.00	0.00	0.00	469.13	100.00
-10			(Based on calcı	ulated sieve wt.)	)	
	20	0.85	0.55	0.55	60.22	99.09
	40	0.425	0.62	1.17	59.60	98.07
	60	0.250	1.90	3.07	57.70	94.95
	140	0.106	13.92	16.99	43.78	72.04
	200	0.075	14.10	31.09	29.68	48.84
	dry pan		1.31	32.40	28.37	
	wet pan			28.37	0.00	

 $\begin{array}{lll} d_{10} \, (mm) \!\!: \!\! 0.00094 & d_{50} \, (mm) \!\!: \!\! 0.076 \\ d_{16} \, (mm) \!\!: \!\! 0.0097 & d_{60} \, (mm) \!\!: \!\! 0.089 \\ d_{30} \, (mm) \!\!: \!\! 0.047 & d_{84} \, (mm) \!\!: \!\! 0.17 \end{array}$ 

Median Particle Diameter--d<sub>50</sub> (mm): 0.076

Uniformity Coefficient, Cu -- [d<sub>60</sub>/d<sub>10</sub>] (mm): 95

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 26

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.085

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Sandy Loam



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: L2-3 (5'A) Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 15-May-18

Start Time: 9:30

Initial Wt. (g): 60.77

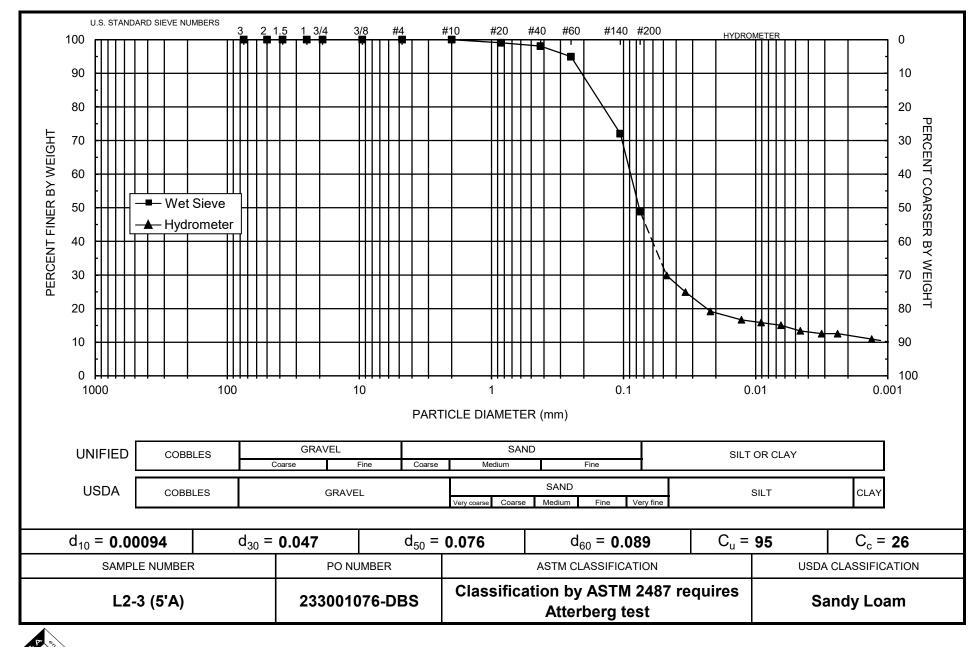
Total Sample Wt. (g): 469.13

Wt. Passing #10 (g): 469.13

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
15-May-18	1	21.6	23.5	5.4	18.1	12.4	0.04714	29.9	29.9
	2	21.6	20.5	5.4	15.1	12.9	0.03398	24.9	24.9
	5	21.6	17.0	5.4	11.6	13.5	0.02196	19.2	19.2
	15	21.5	15.5	5.4	10.1	13.8	0.01281	16.7	16.7
	30	21.5	15.0	5.4	9.6	13.8	0.00909	15.8	15.8
	60	21.6	14.5	5.4	9.1	13.9	0.00644	15.0	15.0
	120	21.4	13.5	5.4	8.1	14.1	0.00459	13.4	13.4
	253	21.5	13.0	5.4	7.6	14.2	0.00317	12.6	12.6
	443	21.5	13.0	5.4	7.6	14.2	0.00239	12.6	12.6
16-May-18	1463	21.6	12.0	5.4	6.6	14.3	0.00132	10.9	10.9

#### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device





## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 333.87

 Job Number:
 DB18.1151.00
 Weight Passing #10 (g): 333.87

 Sample Number:
 L2-4 (10'B)
 Weight Retained #10 (g): 0.00

Project Name: St. Anthony Geotech Investigation Weight of Hydrometer Sample (g): 58.28
PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 58.28

Test Date: 17-May-18 Shape: Angular

Snape: Angular

Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing_
+10						
	3"	75	0.00	0.00	333.87	100.00
	2"	50	0.00	0.00	333.87	100.00
	1.5"	38.1	0.00	0.00	333.87	100.00
	1"	25	0.00	0.00	333.87	100.00
	3/4"	19.0	0.00	0.00	333.87	100.00
	3/8"	9.5	0.00	0.00	333.87	100.00
	4	4.75	0.00	0.00	333.87	100.00
	10	2.00	0.00	0.00	333.87	100.00
-10			(Based on calcu	ulated sieve wt.)	)	
	20	0.85	0.38	0.38	57.90	99.35
	40	0.425	0.54	0.92	57.36	98.42
	60	0.250	0.84	1.76	56.52	96.98
	140	0.106	7.17	8.93	49.35	84.68
	200	0.075	7.86	16.79	41.49	71.19
	dry pan		1.12	17.91	40.37	
	wet pan			40.37	0.00	

 $\begin{array}{lll} d_{10} \ (mm): \ 3.9E-05 & d_{50} \ (mm): \ 0.045 \\ d_{16} \ (mm): \ 0.00032 & d_{60} \ (mm): \ 0.057 \\ d_{30} \ (mm): \ 0.012 & d_{84} \ (mm): \ 0.10 \end{array}$ 

Median Particle Diameter -- d<sub>50</sub> (mm): 0.045

Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 1462

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 65

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.048

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Loam



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: L2-4 (10'B)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 15-May-18

Total Sample Wt. (g): 58.28

Total Sample Wt. (g): 333.87

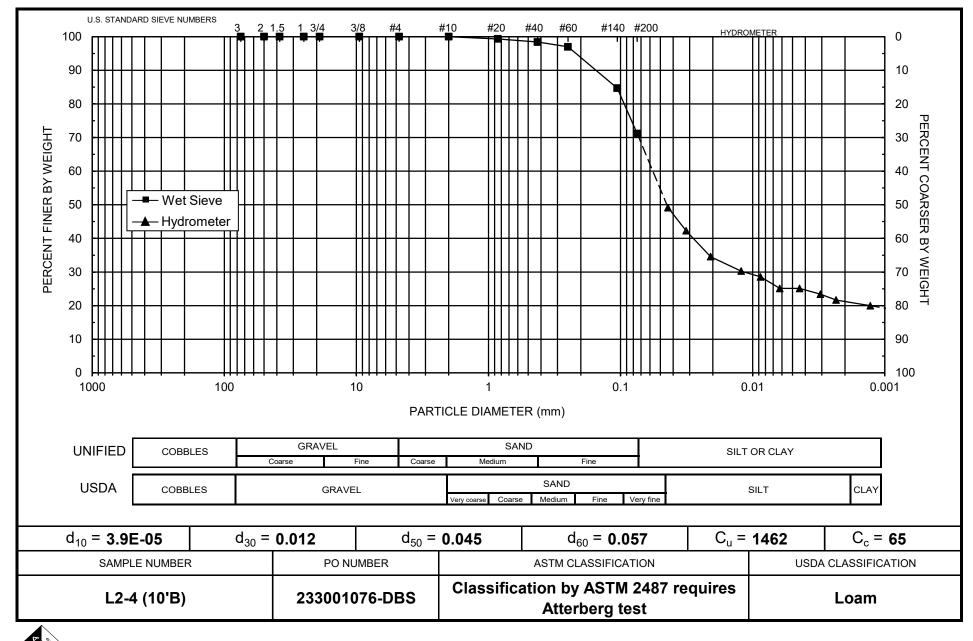
Start Time: 9:36

Wt. Passing #10 (g): 333.87

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
15-May-18	1	21.6	34.0	5.4	28.6	10.7	0.04376	49.1	49.1
	2	21.6	30.0	5.4	24.6	11.4	0.03187	42.3	42.3
	5	21.6	25.5	5.4	20.1	12.1	0.02080	34.6	34.6
	15	21.6	23.0	5.4	17.6	12.5	0.01221	30.3	30.3
	30	21.5	22.0	5.4	16.6	12.7	0.00870	28.5	28.5
	60	21.5	20.0	5.4	14.6	13.0	0.00623	25.1	25.1
	120	21.4	20.0	5.4	14.6	13.0	0.00441	25.1	25.1
	250	21.5	19.0	5.4	13.6	13.2	0.00307	23.4	23.4
	438	21.5	18.0	5.4	12.6	13.3	0.00234	21.7	21.7
16-May-18	1458	21.6	17.0	5.4	11.6	13.5	0.00129	20.0	20.0

#### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device





# Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 485.58

PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 59.33

Test Date: 17-May-18 Shape: Angular

Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	485.58	100.00
	2"	50	0.00	0.00	485.58	100.00
	1.5"	38.1	0.00	0.00	485.58	100.00
	1"	25	0.00	0.00	485.58	100.00
	3/4"	19.0	0.00	0.00	485.58	100.00
	3/8"	9.5	0.00	0.00	485.58	100.00
	4	4.75	0.00	0.00	485.58	100.00
	10	2.00	0.00	0.00	485.58	100.00
-10			(Based on calcı	ulated sieve wt.)	)	
	20	0.85	0.00	0.00	59.33	100.00
	40	0.425	0.00	0.00	59.33	100.00
	60	0.250	0.04	0.04	59.29	99.93
	140	0.106	0.89	0.93	58.40	98.43
	200	0.075	0.75	1.68	57.65	97.17
	dry pan		0.16	1.84	57.49	
	wet pan			57.49	0.00	

 $\begin{array}{lll} d_{10} \ (mm): \ 4.4 E-05 & d_{50} \ (mm): \ 0.0022 \\ d_{16} \ (mm): \ 8.0 E-05 & d_{60} \ (mm): \ 0.0047 \\ d_{30} \ (mm): \ 0.00032 & d_{84} \ (mm): \ 0.023 \end{array}$ 

Median Particle Diameter--d<sub>50</sub> (mm): 0.0022

Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 107

Coefficient of Curvature, Cc--[( $d_{30}$ ) $^2$ /( $d_{10}$ \* $d_{60}$ )] (mm): 0.50

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.0084

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Silty Clay



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: L2-5 (5'A)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 15-May-18

Start Time: 9:42

Initial Wt. (g): 59.33

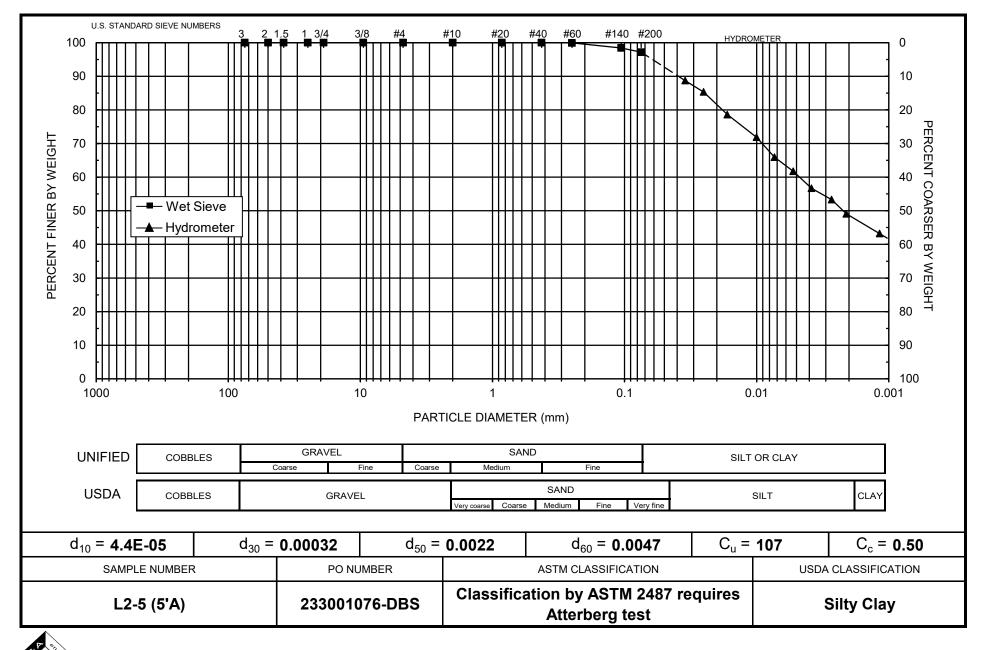
Total Sample Wt. (g): 485.58

Wt. Passing #10 (g): 485.58

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
	_								
15-May-18	1	21.7	58.0	5.4	52.6	6.8	0.03478	88.7	88.7
	2	21.6	56.0	5.4	50.6	7.1	0.02521	85.4	85.4
	5	21.6	52.0	5.4	46.6	7.8	0.01666	78.6	78.6
	15	21.6	48.0	5.4	42.6	8.4	0.01002	71.9	71.9
	30	21.5	44.5	5.4	39.1	9.0	0.00733	66.0	66.0
	60	21.6	42.0	5.4	36.6	9.4	0.00529	61.8	61.8
	120	21.5	39.0	5.4	33.6	9.9	0.00384	56.7	56.7
	250	21.5	37.0	5.4	31.6	10.2	0.00271	53.3	53.3
	433	21.5	34.5	5.4	29.1	10.6	0.00210	49.1	49.1
16-May-18	1454	21.6	31.0	5.4	25.6	11.2	0.00117	43.2	43.2

#### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device





# Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc

Initial Dry Weight of Sample (g): 230.60

Job Number: DB18.1151.00

Weight Passing #10 (g): 230.60

Sample Number: L2-6 (5'A)

Weight Retained #10 (g): 0.00

Project Name: St. Anthony Geotech Investigation

Weight of Hydrometer Sample (g): 54.02

PO Number: 233001076-DBS

Calculated Weight of Sieve Sample (g): 54.02

Test Date: 24-May-18 Shape: Rounded Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	230.60	100.00
	2"	50	0.00	0.00	230.60	100.00
	1.5"	38.1	0.00	0.00	230.60	100.00
	1"	25	0.00	0.00	230.60	100.00
	3/4"	19.0	0.00	0.00	230.60	100.00
	3/8"	9.5	0.00	0.00	230.60	100.00
	4	4.75	0.00	0.00	230.60	100.00
	10	2.00	0.00	0.00	230.60	100.00
-10			(Based on calcu	ulated sieve wt.)	)	
	20	0.85	0.00	0.00	54.02	100.00
	40	0.425	0.03	0.03	53.99	99.94
	60	0.250	0.17	0.20	53.82	99.63
	140	0.106	3.57	3.77	50.25	93.02
	200	0.075	4.24	8.01	46.01	85.17
	dry pan		0.65	8.66	45.36	
	wet pan			45.36	0.00	

 $\begin{array}{lll} d_{10} \, (mm) \!\!: \!\! 0.00031 & d_{50} \, (mm) \!\!: \!\! 0.013 \\ d_{16} \, (mm) \!\!: \!\! 0.00054 & d_{60} \, (mm) \!\!: \!\! 0.030 \\ d_{30} \, (mm) \!\!: \!\! 0.0020 & d_{84} \, (mm) \!\!: \!\! 0.072 \end{array}$ 

Median Particle Diameter -- d<sub>50</sub> (mm): 0.013

Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 97

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 0.43

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.029

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

Classification of fines: CL

ASTM Soil Classification: Lean clay (CL) USDA Soil Classification: Clay Loam



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: L2-6 (5'A)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 18-May-18

Start Time: 9:36

Initial Wt. (g): 54.02

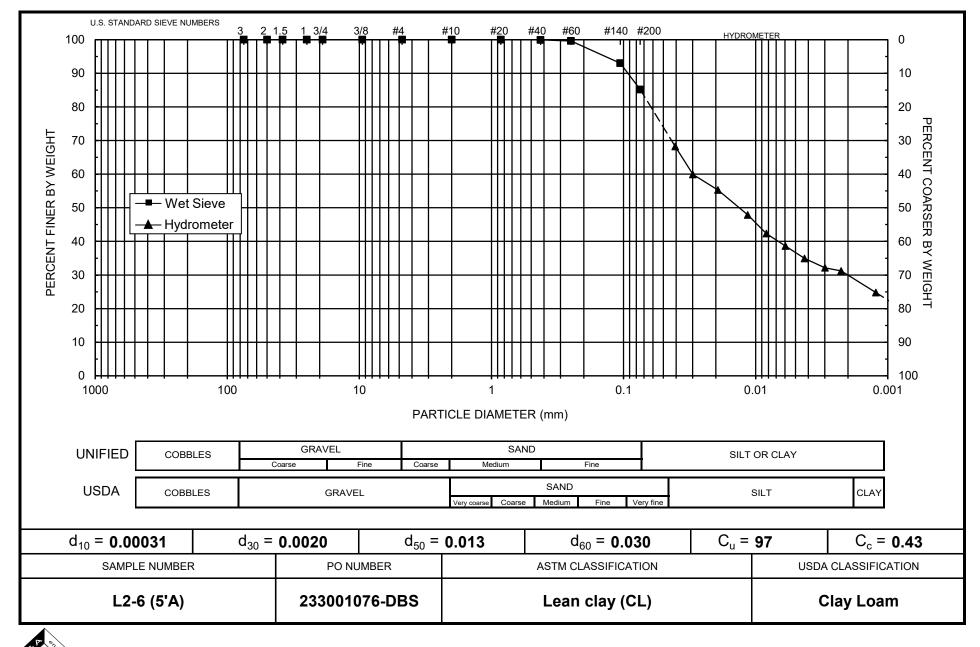
Total Sample Wt. (g): 230.60

Wt. Passing #10 (g): 230.60

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
	_								
18-May-18	1	21.6	43.0	6.1	36.9	9.3	0.04064	68.2	68.2
	2	21.6	38.5	6.1	32.4	10.0	0.02986	59.9	59.9
	5	21.6	36.0	6.1	29.9	10.4	0.01927	55.3	55.3
	15	21.6	32.0	6.1	25.9	11.1	0.01147	47.9	47.9
	30	21.6	29.0	6.1	22.9	11.5	0.00829	42.3	42.3
	60	21.6	27.0	6.1	20.9	11.9	0.00594	38.6	38.6
	120	21.6	25.0	6.1	18.9	12.2	0.00426	34.9	34.9
	250	21.6	23.5	6.1	17.4	12.4	0.00298	32.1	32.1
	441	21.6	23.0	6.1	16.9	12.5	0.00225	31.2	31.2
19-May-18	1539	21.7	19.5	6.1	13.4	13.1	0.00123	24.8	24.8

#### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device





## **Particle Size Analysis** Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 458.29

Job Number: DB18.1151.00 Weight Passing #10 (g): 458.15 Sample Number: L2-7 (10'A) Weight Retained #10 (g): 0.14

Project Name: St. Anthony Geotech Investigation Weight of Hydrometer Sample (g): 59.02 PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 59.04

Test Date: 30-May-18 Shape: Angular Hardness: Soft

Test	Sieve	Diameter	Wt.	Cum Wt.	Wt.	
Fraction	Number	(mm)	Retained	Retained	Passing	% Passing
+10						
	3"	75	0.00	0.00	458.29	100.00
	2"	50	0.00	0.00	458.29	100.00
	1.5"	38.1	0.00	0.00	458.29	100.00
	1"	25	0.00	0.00	458.29	100.00
	3/4"	19.0	0.00	0.00	458.29	100.00
	3/8"	9.5	0.00	0.00	458.29	100.00
	4	4.75	0.00	0.00	458.29	100.00
	10	2.00	0.14	0.14	458.15	99.97
-10			(Based on calcı	ulated sieve wt.)	)	
	20	0.85	0.10	0.12	58.92	99.80
	40	0.425	0.14	0.26	58.78	99.56
	60	0.250	0.47	0.73	58.31	98.77
	140	0.106	12.39	13.12	45.92	77.78
	200	0.075	10.54	23.66	35.38	59.93
	dry pan		0.75	24.41	34.63	
	wet pan			34.63	0.00	

d<sub>10</sub> (mm): 1.9E-09 d<sub>50</sub> (mm): 0.057 d<sub>16</sub> (mm): 0.0067 d<sub>60</sub> (mm): 0.075 d<sub>30</sub> (mm): 0.025 d<sub>84</sub> (mm): 0.14

Median Particle Diameter -- d<sub>50</sub> (mm): 0.057

Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 3.9E+07

Coefficient of Curvature,  $Cc - [(d_{30})^2/(d_{10}*d_{60})]$  (mm): 4.4E+06

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.068

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Sandy Loam



## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: L2-7 (10'A)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 23-May-18

Total Sample Wt. (g): 59.02

Test Date: 9:00

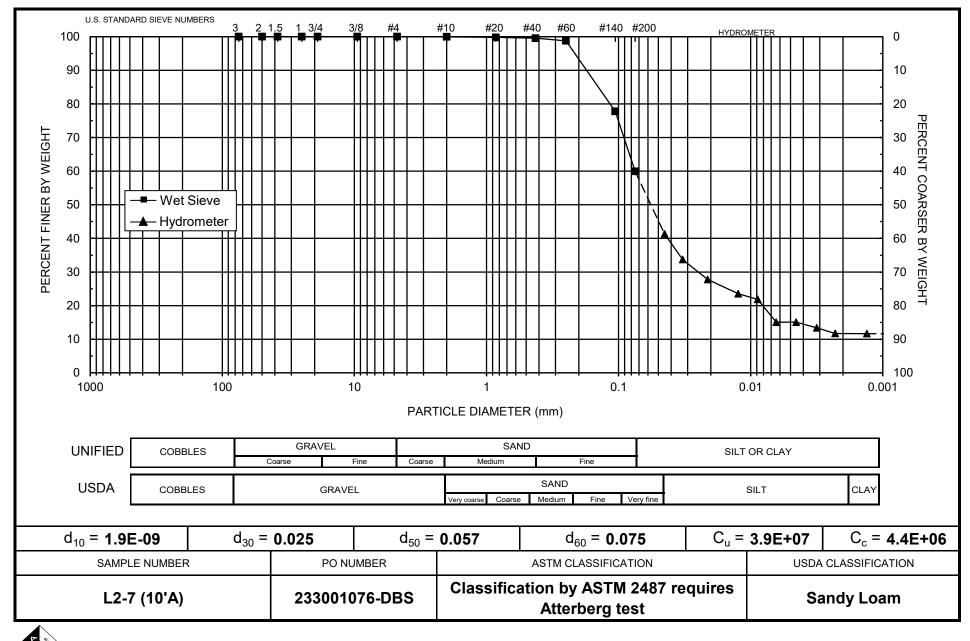
Total Sample Wt. (g): 458.29

Wt. Passing #10 (g): 458.15

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
23-May-18	1	21.8	30.5	6.1	24.4	11.3	0.04481	41.3	41.3
	2	21.8	26.0	6.1	19.9	12.0	0.03270	33.7	33.7
	5	21.8	22.5	6.1	16.4	12.6	0.02117	27.8	27.8
	15	21.8	20.0	6.1	13.9	13.0	0.01242	23.6	23.5
	30	21.8	19.0	6.1	12.9	13.2	0.00884	21.9	21.9
	60	21.8	15.0	6.1	8.9	13.8	0.00640	15.1	15.1
	120	21.8	15.0	6.1	8.9	13.8	0.00453	15.1	15.1
	250	21.8	14.0	6.1	7.9	14.0	0.00315	13.4	13.4
	480	21.9	13.0	6.1	6.9	14.2	0.00229	11.7	11.7
24-May-18	1455	21.7	13.0	6.1	6.9	14.2	0.00132	11.7	11.7

### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device





# Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 451.54

 Job Number:
 DB18.1151.00
 Weight Passing #10 (g): 449.76

 Sample Number:
 T/O-1 (20'A)
 Weight Retained #10 (g): 1.78

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Weight of Hydrometer Sample (g): 54.86

Calculated Weight of Sieve Sample (g): 55.08

Test Date: 17-May-18 Shape: Angular Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	451.54	100.00
	2"	50	0.00	0.00	451.54	100.00
	1.5"	38.1	0.00	0.00	451.54	100.00
	1"	25	0.00	0.00	451.54	100.00
	3/4"	19.0	0.00	0.00	451.54	100.00
	3/8"	9.5	0.00	0.00	451.54	100.00
	4	4.75	1.11	1.11	450.43	99.75
	10	2.00	0.67	1.78	449.76	99.61
-10			(Based on calcu	ulated sieve wt.)		
	20	0.85	0.24	0.46	54.62	99.17
	40	0.425	0.21	0.67	54.41	98.79
	60	0.250	0.15	0.82	54.26	98.52
	140	0.106	0.37	1.19	53.89	97.84
	200	0.075	0.72	1.91	53.17	96.54
	dry pan		0.25	2.16	52.92	
	wet pan			52.92	0.00	

 $\begin{array}{lll} d_{10} \ (mm): \ 0.00030 & d_{50} \ (mm): \ 0.0088 \\ d_{16} \ (mm): \ 0.00052 & d_{60} \ (mm): \ 0.016 \\ d_{30} \ (mm): \ 0.0019 & d_{84} \ (mm): \ 0.043 \end{array}$ 

Median Particle Diameter -- d<sub>50</sub> (mm): 0.0088

Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 53

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 0.75

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.017

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Silty Clay Loam

Laboratory analysis by: Z. Calhoun

Data entered by: J. Hines

Checked by: J. Hines



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: T/O-1 (20'A)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 15-May-18

Start Time: 9:48

Initial Wt. (g): 54.86

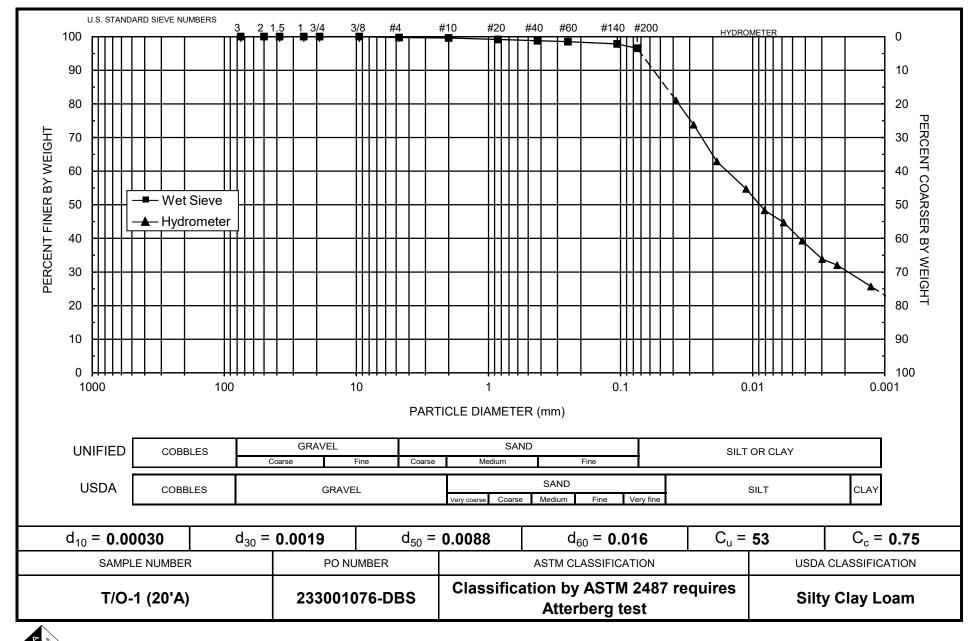
Total Sample Wt. (g): 451.54

Wt. Passing #10 (g): 449.76

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
15-May-18	1	21.7	50.0	5.4	44.6	8.1	0.03799	81.4	81.0
	2	21.7	46.0	5.4	40.6	8.8	0.02793	74.1	73.8
	5	21.5	40.0	5.4	34.6	9.7	0.01867	63.1	62.9
	15	21.5	35.5	5.4	30.1	10.5	0.01118	54.9	54.7
	30	21.5	32.0	5.4	26.6	11.1	0.00812	48.5	48.4
	60	21.6	30.0	5.4	24.6	11.4	0.00582	44.9	44.7
	120	21.5	27.0	5.4	21.6	11.9	0.00421	39.4	39.3
	250	21.5	24.0	5.4	18.6	12.4	0.00298	34.0	33.8
	428	21.5	23.0	5.4	17.6	12.5	0.00229	32.1	32.0
16-May-18	1449	21.6	19.5	5.4	14.1	13.1	0.00127	25.8	25.7

### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device





## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 440.68

 Job Number:
 DB18.1151.00
 Weight Passing #10 (g): 440.68

 Sample Number:
 T/O-1 (45'B)
 Weight Retained #10 (g): 0.00

Project Name: St. Anthony Geotech Investigation Weight of Hydrometer Sample (g): 53.68

PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 53.68

Test Date: 17-May-18 Shape: Angular Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10		, ,				
	3"	75	0.00	0.00	440.68	100.00
	2"	50	0.00	0.00	440.68	100.00
	1.5"	38.1	0.00	0.00	440.68	100.00
	1"	25	0.00	0.00	440.68	100.00
	3/4"	19.0	0.00	0.00	440.68	100.00
	3/8"	9.5	0.00	0.00	440.68	100.00
	4	4.75	0.00	0.00	440.68	100.00
	10	2.00	0.00	0.00	440.68	100.00
-10			(Based on calcu	ulated sieve wt.	)	
	20	0.85	0.27	0.27	53.41	99.50
	40	0.425	0.29	0.56	53.12	98.96
	60	0.250	0.79	1.35	52.33	97.49
	140	0.106	19.08	20.43	33.25	61.94
	200	0.075	5.28	25.71	27.97	52.11
	dry pan		0.45	26.16	27.52	
	wet pan			27.52	0.00	

 $d_{10}$  (mm): 5.1E-05  $d_{50}$  (mm): 0.070  $d_{16}$  (mm): 0.00037  $d_{60}$  (mm): 0.099  $d_{30}$  (mm): 0.016  $d_{84}$  (mm): 0.18

Median Particle Diameter--d<sub>50</sub> (mm): 0.070

Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 1941

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 51

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.083

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Sandy Clay Loam



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: T/O-1 (45'B)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 15-May-18

Start Time: 9:54

Initial Wt. (g): 53.68

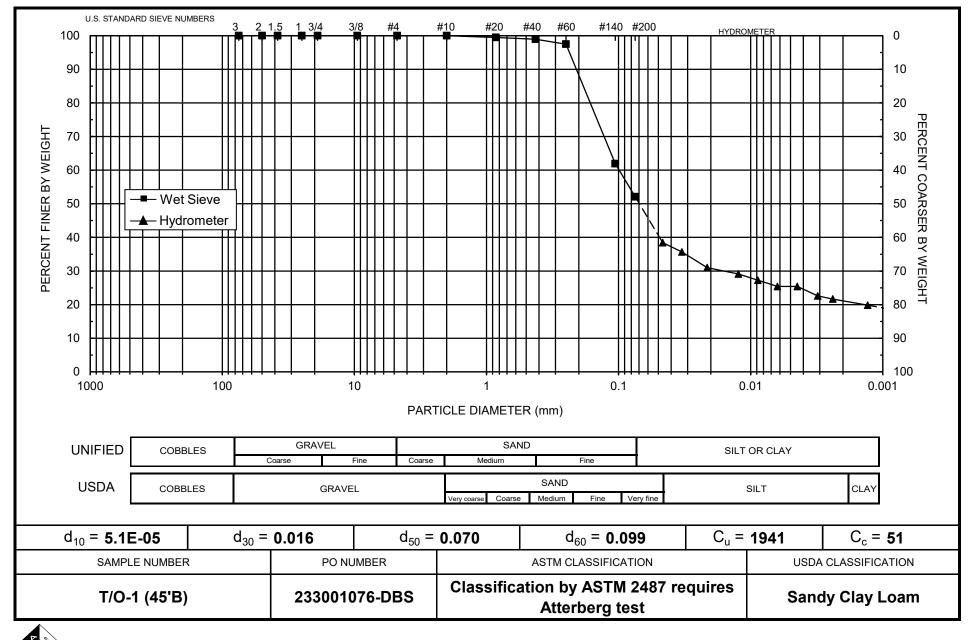
Total Sample Wt. (g): 440.68

Wt. Passing #10 (g): 440.68

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
	_								
15-May-18	1	21.6	26.0	5.4	20.6	12.0	0.04636	38.5	38.5
	2	21.6	24.5	5.4	19.1	12.3	0.03311	35.7	35.7
	5	21.5	22.0	5.4	16.6	12.7	0.02131	31.0	31.0
	15	21.5	21.0	5.4	15.6	12.9	0.01238	29.1	29.1
	30	21.5	20.0	5.4	14.6	13.0	0.00881	27.3	27.3
	60	21.5	19.0	5.4	13.6	13.2	0.00627	25.4	25.4
	120	21.5	19.0	5.4	13.6	13.2	0.00444	25.4	25.4
	250	21.4	17.5	5.4	12.1	13.4	0.00310	22.6	22.6
	423	21.5	17.0	5.4	11.6	13.5	0.00239	21.7	21.7
16-May-18	1444	21.6	16.0	5.4	10.6	13.7	0.00130	19.8	19.8

### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device





## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 502.66

Job Number: DB18.1151.00

Weight Passing #10 (g): 501.78

Sample Number: T/O-2 (5'A)

Weight Retained #10 (g): 0.88

Project Name: St. Anthony Geotech Investigation

Weight of Hydrometer Sample (g): 52.20

Project Name: St. Anthony Geotech Investigation Weight of Hydrometer Sample (g): 52.20
PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 52.29

Test Date: 23-May-18 Shape: Angular

Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10					_	
	3"	75	0.00	0.00	502.66	100.00
	2"	50	0.00	0.00	502.66	100.00
	1.5"	38.1	0.00	0.00	502.66	100.00
	1"	25	0.00	0.00	502.66	100.00
	3/4"	19.0	0.00	0.00	502.66	100.00
	3/8"	9.5	0.00	0.00	502.66	100.00
	4	4.75	0.00	0.00	502.66	100.00
	10	2.00	0.88	0.88	501.78	99.82
-10			(Based on calcu	ulated sieve wt.)	)	
	20	0.85	2.09	2.18	50.11	95.83
	40	0.425	4.57	6.75	45.54	87.09
	60	0.250	2.38	9.13	43.16	82.54
	140	0.106	2.23	11.36	40.93	78.27
	200	0.075	0.66	12.02	40.27	77.01
	dry pan		0.31	12.33	39.96	
	wet pan			39.96	0.00	

 $d_{10}$  (mm): 0.0025  $d_{50}$  (mm): 0.010  $d_{16}$  (mm): 0.0026  $d_{60}$  (mm): 0.022  $d_{30}$  (mm): 0.0029  $d_{84}$  (mm): 0.30

Median Particle Diameter --  $d_{50}$  (mm): 0.010 Uniformity Coefficient, Cu--[ $d_{60}/d_{10}$ ] (mm): 8.8 Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 0.15 Mean Particle Diameter --[ $(d_{16}+d_{50}+d_{84})/3$ ] (mm): 0.10

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Silt Loam

Laboratory analysis by: Z. Calhoun/M. Garcia
Data entered by: M. Garcia
Checked by: J. Hines

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# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: T/O-2 (5'A)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

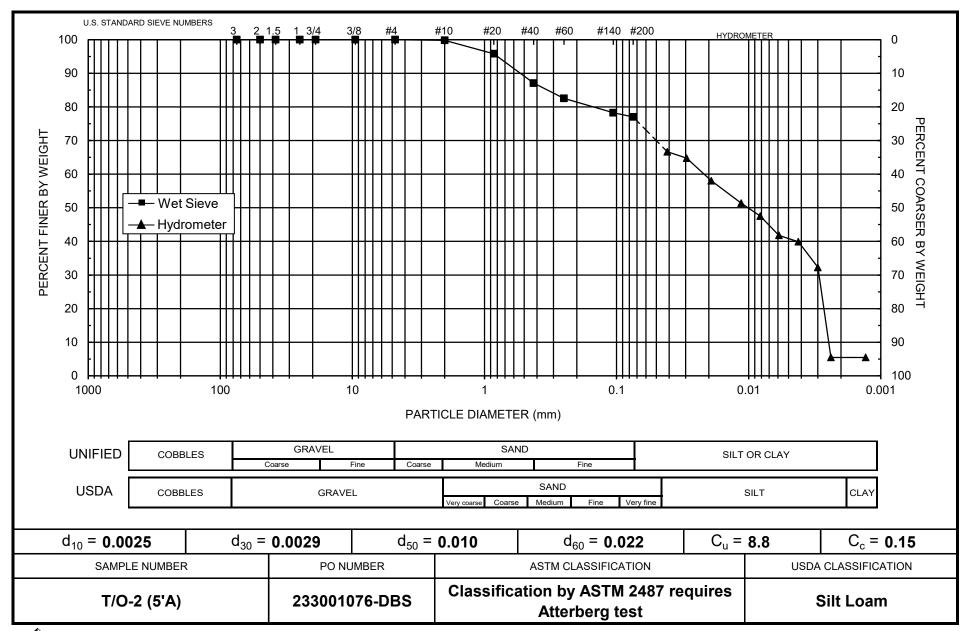
Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
40.14		0.4.0	44.6		0.4.0		0.0440=	22.2	00 =
18-May-18	1	21.6	41.0	6.1	34.9	9.6	0.04135	66.8	66.7
	2	21.6	40.0	6.1	33.9	9.7	0.02949	64.9	64.8
	5	21.6	36.5	6.1	30.4	10.3	0.01919	58.2	58.1
	15	21.6	33.0	6.1	26.9	10.9	0.01138	51.5	51.4
	30	21.6	31.0	6.1	24.9	11.2	0.00817	47.6	47.5
	60	21.6	28.0	6.1	21.9	11.7	0.00590	41.9	41.8
	120	21.6	27.0	6.1	20.9	11.9	0.00420	40.0	39.9
	250	21.6	23.0	6.1	16.9	12.5	0.00299	32.3	32.2
	466	21.6	9.0	6.1	2.9	14.8	0.00238	5.5	5.5
19-May-18	1565	21.7	9.0	6.1	2.9	14.8	0.00130	5.5	5.5

### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device







## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 403.81

 Job Number:
 DB18.1151.00
 Weight Passing #10 (g): 403.64

 Sample Number:
 T/O-3 (40'A)
 Weight Retained #10 (g): 0.17

Project Name: St. Anthony Geotech Investigation Weight of Hydrometer Sample (g): 53.27
PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 53.29

Test Date: 24-May-18 Shape: Angular

Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	403.81	100.00
	2"	50	0.00	0.00	403.81	100.00
	1.5"	38.1	0.00	0.00	403.81	100.00
	1"	25	0.00	0.00	403.81	100.00
	3/4"	19.0	0.00	0.00	403.81	100.00
	3/8"	9.5	0.00	0.00	403.81	100.00
	4	4.75	0.15	0.15	403.66	99.96
	10	2.00	0.02	0.17	403.64	99.96
-10			(Based on calcı	ulated sieve wt.)	)	
	20	0.85	0.14	0.16	53.13	99.70
	40	0.425	0.22	0.38	52.91	99.28
	60	0.250	0.83	1.21	52.08	97.72
	140	0.106	19.16	20.37	32.92	61.77
	200	0.075	7.09	27.46	25.83	48.47
	dry pan		0.50	27.96	25.33	
	wet pan			25.33	0.00	

 $\begin{array}{lll} d_{10} \ (mm): \ 0.00083 & d_{50} \ (mm): \ 0.078 \\ d_{16} \ (mm): \ 0.0036 & d_{60} \ (mm): \ 0.10 \\ d_{30} \ (mm): \ 0.041 & d_{84} \ (mm): \ 0.18 \\ \end{array}$ 

Median Particle Diameter--d<sub>50</sub> (mm): 0.078

Uniformity Coefficient, Cu -- [d<sub>60</sub>/d<sub>10</sub>] (mm): 120

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 20

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.087

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Sandy Loam

Laboratory analysis by: Z. Calhoun/M. Garcia

Data entered by: M. Garcia Checked by: J. Hines



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: T/O-3 (40'A)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

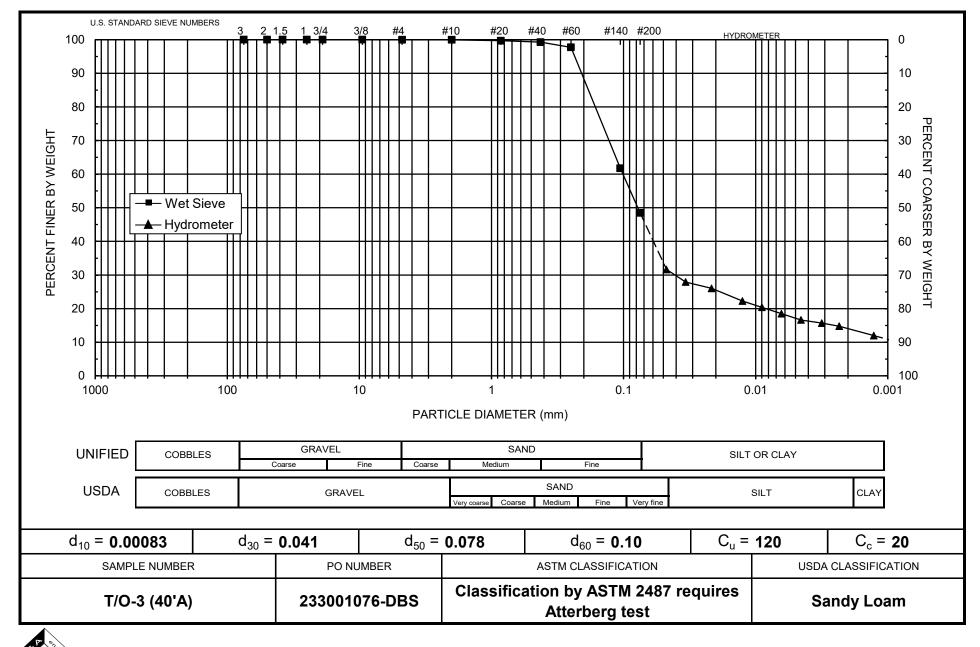
Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

Test Date: 18-May-18 Total Sample Wt. (g): 403.81 Start Time: 9:12 Wt. Passing #10 (g): 403.64

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
40.14		0.4.0	00.0	0.4	40.0	40.5	0.04700	0.4 =	0.4.0
18-May-18	1	21.6	23.0	6.1	16.9	12.5	0.04729	31.7	31.6
	2	21.6	21.0	6.1	14.9	12.9	0.03388	27.9	27.9
	5	21.6	20.0	6.1	13.9	13.0	0.02156	26.0	26.0
	15	21.6	18.0	6.1	11.9	13.3	0.01260	22.3	22.3
	30	21.6	17.0	6.1	10.9	13.5	0.00897	20.4	20.4
	60	21.6	16.0	6.1	9.9	13.7	0.00638	18.5	18.5
	120	21.6	15.0	6.1	8.9	13.8	0.00454	16.6	16.6
	250	21.6	14.5	6.1	8.4	13.9	0.00315	15.7	15.7
	462	21.6	14.0	6.1	7.9	14.0	0.00233	14.8	14.7
19-May-18	1560	21.7	12.5	6.1	6.4	14.3	0.00128	12.0	12.0

### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device





## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 563.72

 Job Number: DB18.1151.00
 Weight Passing #10 (g): 558.38

 Sample Number: T/O-3 (70'B)
 Weight Retained #10 (g): 5.34

Project Name: St. Anthony Geotech Investigation Weight of Hydrometer Sample (g): 49.58
PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 50.05

Test Date: 22-May-18 Shape: Angular

Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	563.72	100.00
	2"	50	0.00	0.00	563.72	100.00
	1.5"	38.1	0.00	0.00	563.72	100.00
	1"	25	0.00	0.00	563.72	100.00
	3/4"	19.0	0.00	0.00	563.72	100.00
	3/8"	9.5	0.00	0.00	563.72	100.00
	4	4.75	2.62	2.62	561.10	99.54
	10	2.00	2.72	5.34	558.38	99.05
-10			(Based on calcı	ulated sieve wt.)	)	
	20	0.85	0.13	0.60	49.45	98.79
	40	0.425	0.16	0.76	49.29	98.47
	60	0.250	0.12	0.88	49.17	98.23
	140	0.106	1.05	1.93	48.12	96.14
	200	0.075	2.63	4.56	45.49	90.88
	dry pan		0.53	5.09	44.96	
	wet pan			44.96	0.00	

 $\begin{array}{lll} d_{10} \ (mm): \ 0.00032 & d_{50} \ (mm): \ 0.034 \\ d_{16} \ (mm): \ 0.0015 & d_{60} \ (mm): \ 0.045 \\ d_{30} \ (mm): \ 0.011 & d_{84} \ (mm): \ 0.067 \end{array}$ 

Median Particle Diameter--d<sub>50</sub> (mm): 0.034

Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 141

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}^*d_{60})$ ] (mm): 8.4

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.034

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Loam



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: T/O-3 (70'B)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

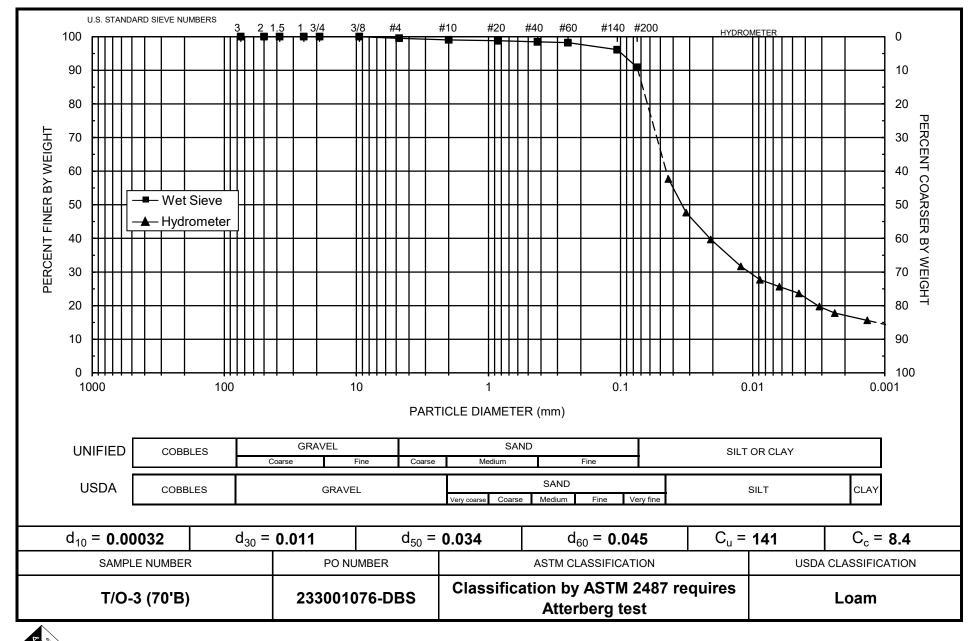
 Test Date:
 17-May-18
 Total Sample Wt. (g):
 563.72

 Start Time:
 9:48
 Wt. Passing #10 (g):
 558.38

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
									_
17-May-18	1	21.6	35.0	6.1	28.9	10.6	0.04342	58.2	57.7
	2	21.6	30.0	6.1	23.9	11.4	0.03187	48.1	47.7
	5	21.6	26.0	6.1	19.9	12.0	0.02073	40.1	39.7
	15	21.6	22.0	6.1	15.9	12.7	0.01229	32.0	31.7
	30	21.6	20.0	6.1	13.9	13.0	0.00880	28.0	27.7
	60	21.5	19.0	6.2	12.8	13.2	0.00627	25.9	25.6
	120	21.5	18.0	6.2	11.8	13.3	0.00446	23.9	23.6
	250	21.6	16.0	6.1	9.9	13.7	0.00313	19.9	19.7
	431	21.8	15.0	6.1	8.9	13.8	0.00239	18.0	17.8
18-May-18	1364	21.4	14.0	6.2	7.8	14.0	0.00136	15.8	15.6

## Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device





## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 454.63

Job Number: DB18.1151.00

Sample Number: T/O-4 (20'B)

Project Name: St. Anthony Geotech Investigation

Weight Passing #10 (g): 454.63

Weight Retained #10 (g): 0.00

Weight of Hydrometer Sample (g): 53.65

Project Name: St. Anthony Geotech Investigation Weight of Hydrometer Sample (g): 53.65
PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 53.65

Test Date: 24-May-18 Shape: Angular Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	454.63	100.00
	2"	50	0.00	0.00	454.63	100.00
	1.5"	38.1	0.00	0.00	454.63	100.00
	1"	25	0.00	0.00	454.63	100.00
	3/4"	19.0	0.00	0.00	454.63	100.00
	3/8"	9.5	0.00	0.00	454.63	100.00
	4	4.75	0.00	0.00	454.63	100.00
	10	2.00	0.00	0.00	454.63	100.00
-10			(Based on calcu	ılated sieve wt.)	)	
	20	0.85	0.12	0.12	53.53	99.78
	40	0.425	0.13	0.25	53.40	99.53
	60	0.250	0.36	0.61	53.04	98.86
	140	0.106	8.30	8.91	44.74	83.39
	200	0.075	4.41	13.32	40.33	75.17
	dry pan		0.53	13.85	39.80	
	wet pan			39.80	0.00	

 $\begin{array}{lll} d_{10} \, (mm) \!\!: \!\! 0.00059 & d_{50} \, (mm) \!\!: \!\! 0.034 \\ d_{16} \, (mm) \!\!: \!\! 0.0016 & d_{60} \, (mm) \!\!: \!\! 0.050 \\ d_{30} \, (mm) \!\!: \!\! 0.011 & d_{84} \, (mm) \!\!: \!\! 0.11 \end{array}$ 

Median Particle Diameter -- d<sub>50</sub> (mm): 0.034

Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 85

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}^*d_{60})$ ] (mm): 4.1

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.049

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Loam

Laboratory analysis by: Z. Calhoun/M. Garcia

Data entered by: M. Garcia Checked by: J. Hines



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: T/O-4 (20'B)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 18-May-18

Start Time: 9:18

Initial Wt. (g): 53.65

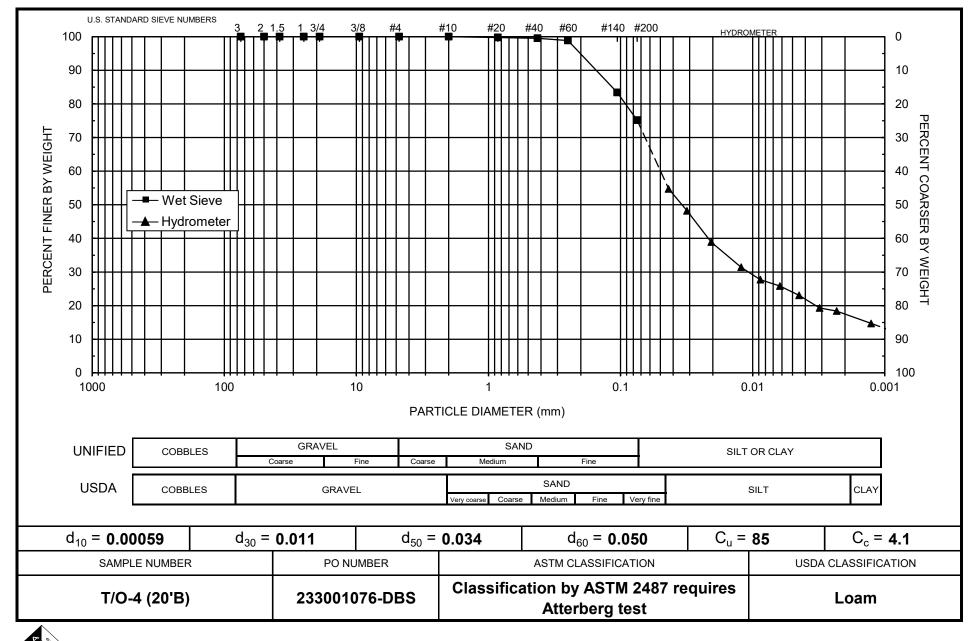
Total Sample Wt. (g): 454.63

Wt. Passing #10 (g): 454.63

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
18-May-18	1	21.6	35.5	6.1	29.4	10.5	0.04325	54.7	54.7
	2	21.6	32.0	6.1	25.9	11.1	0.03141	48.2	48.2
	5	21.6	27.0	6.1	20.9	11.9	0.02059	38.9	38.9
	15	21.6	23.0	6.1	16.9	12.5	0.01221	31.4	31.4
	30	21.6	21.0	6.1	14.9	12.9	0.00875	27.7	27.7
	60	21.6	20.0	6.1	13.9	13.0	0.00622	25.8	25.8
	120	21.6	18.5	6.1	12.4	13.3	0.00444	23.0	23.0
	250	21.6	16.5	6.1	10.4	13.6	0.00312	19.3	19.3
	457	21.6	16.0	6.1	9.9	13.7	0.00231	18.4	18.4
19-May-18	1555	21.7	14.0	6.1	7.9	14.0	0.00127	14.7	14.7

### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device





## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 402.66

Job Number: DB18.1151.00 Weight Passing #10 (g): 402.55

Sample Number: T/O-5 (10'B) Weight Retained #10 (g): 0.11

Project Name: St. Anthony Geotech Investigation Weight of Hydrometer Sample (g): 52.88
PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 52.89

Test Date: 24-May-18 Shape: Angular Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10		,			<u> </u>	
	3"	75	0.00	0.00	402.66	100.00
	2"	50	0.00	0.00	402.66	100.00
	1.5"	38.1	0.00	0.00	402.66	100.00
	1"	25	0.00	0.00	402.66	100.00
	3/4"	19.0	0.00	0.00	402.66	100.00
	3/8"	9.5	0.00	0.00	402.66	100.00
	4	4.75	0.00	0.00	402.66	100.00
	10	2.00	0.11	0.11	402.55	99.97
-10			(Based on calcı	ulated sieve wt.	)	
	20	0.85	0.37	0.38	52.51	99.27
	40	0.425	0.27	0.65	52.24	98.76
	60	0.250	0.24	0.89	52.00	98.31
	140	0.106	1.60	2.49	50.40	95.28
	200	0.075	2.85	5.34	47.55	89.90
	dry pan		0.66	6.00	46.89	
	wet pan			46.89	0.00	

 $\begin{array}{lll} d_{10} \ (mm): \ 0.0011 & d_{50} \ (mm): \ 0.028 \\ d_{16} \ (mm): \ 0.0025 & d_{60} \ (mm): \ 0.039 \\ d_{30} \ (mm): \ 0.0100 & d_{84} \ (mm): \ 0.066 \end{array}$ 

Median Particle Diameter -- d<sub>50</sub> (mm): 0.028

Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 35

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}^*d_{60})$ ] (mm): 2.3

Mean Particle Diameter -- [ $(d_{16}+d_{50}+d_{84})/3$ ] (mm): 0.032

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Silt Loam

Laboratory analysis by: Z. Calhoun/M. Garcia

Data entered by: M. Garcia Checked by: J. Hines



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: T/O-5 (10'B)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

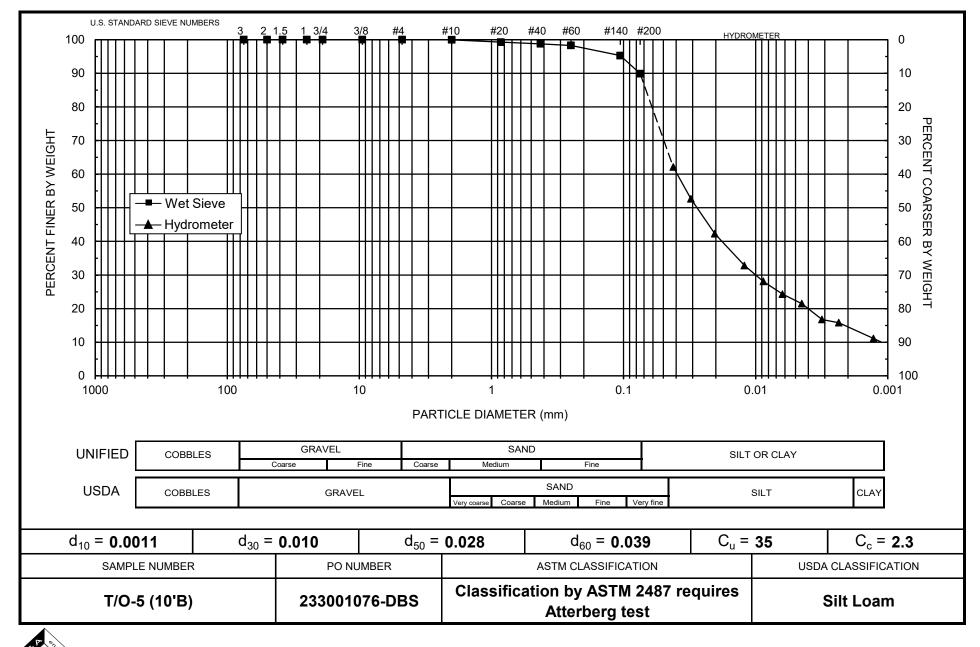
 Test Date:
 18-May-18
 Total Sample Wt. (g):
 402.66

 Start Time:
 9:24
 Wt. Passing #10 (g):
 402.55

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
									_
18-May-18	1	21.6	39.0	6.1	32.9	9.9	0.04205	62.1	62.1
	2	21.6	34.0	6.1	27.9	10.7	0.03094	52.7	52.7
	5	21.6	28.5	6.1	22.4	11.6	0.02038	42.3	42.3
	15	21.6	23.5	6.1	17.4	12.4	0.01217	32.8	32.8
	30	21.6	21.0	6.1	14.9	12.9	0.00875	28.1	28.1
	60	21.6	19.0	6.1	12.9	13.2	0.00626	24.3	24.3
	120	21.6	17.5	6.1	11.4	13.4	0.00447	21.5	21.5
	250	21.6	15.0	6.1	8.9	13.8	0.00314	16.8	16.8
	451	21.6	14.5	6.1	8.4	13.9	0.00235	15.8	15.8
19-May-18	1549	21.7	12.0	6.1	5.9	14.3	0.00128	11.1	11.1

### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device





# Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 507.52

 Job Number: DB18.1151.00
 Weight Passing #10 (g): 507.52

 Sample Number: T/O-6 (5'A)
 Weight Retained #10 (g): 0.00

Project Name: St. Anthony Geotech Investigation Weight of Hydrometer Sample (g): 49.32
PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 49.32

Test Date: 18-May-18 Shape: Angular Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10		,			9	
	3"	75	0.00	0.00	507.52	100.00
	2"	50	0.00	0.00	507.52	100.00
	1.5"	38.1	0.00	0.00	507.52	100.00
	1"	25	0.00	0.00	507.52	100.00
	3/4"	19.0	0.00	0.00	507.52	100.00
	3/8"	9.5	0.00	0.00	507.52	100.00
	4	4.75	0.00	0.00	507.52	100.00
	10	2.00	0.00	0.00	507.52	100.00
-10			(Based on calcu	ulated sieve wt.	)	
	20	0.85	0.95	0.95	48.37	98.07
	40	0.425	0.44	1.39	47.93	97.18
	60	0.250	0.38	1.77	47.55	96.41
	140	0.106	5.12	6.89	42.43	86.03
	200	0.075	5.08	11.97	37.35	75.73
	dry pan		0.69	12.66	36.66	
	wet pan			36.66	0.00	

 $\begin{array}{lll} d_{10} \ (mm): \ 0.00066 & d_{50} \ (mm): \ 0.043 \\ d_{16} \ (mm): \ 0.0020 & d_{60} \ (mm): \ 0.054 \\ d_{30} \ (mm): \ 0.018 & d_{84} \ (mm): \ 0.099 \end{array}$ 

Median Particle Diameter--d<sub>50</sub> (mm): 0.043

Uniformity Coefficient, Cu -- [d<sub>60</sub>/d<sub>10</sub>] (mm): 82

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}^*d_{60})$ ] (mm): 9.1

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.048

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Loam



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: T/O-6 (5'A)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 16-May-18

Start Time: 9:42

Initial Wt. (g): 49.32

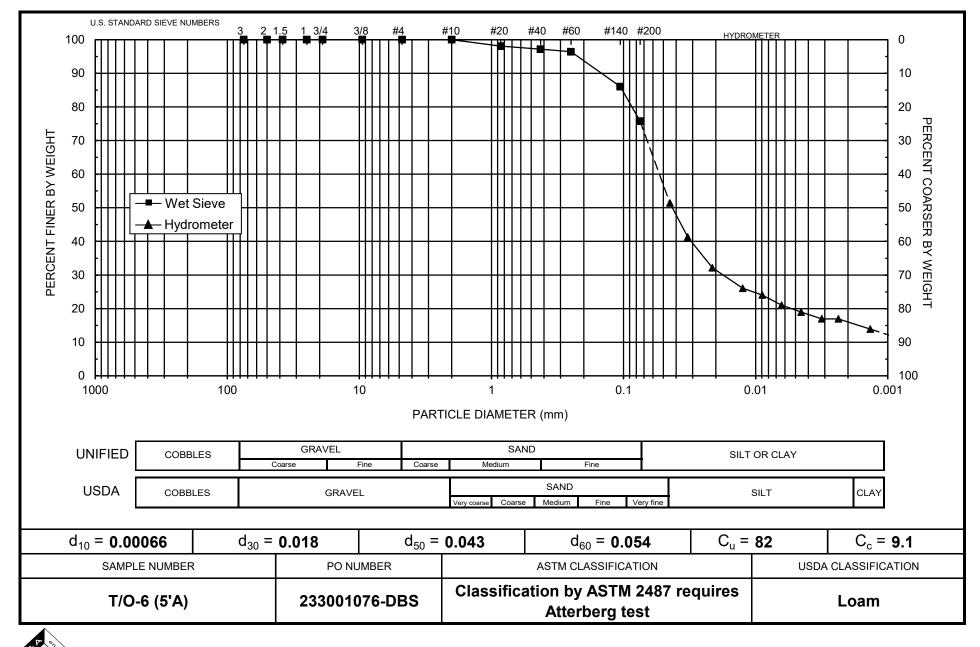
Total Sample Wt. (g): 507.52

Wt. Passing #10 (g): 507.52

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
16-May-18	1	21.6	31.5	6.1	25.4	11.1	0.04459	51.4	51.4
	2	21.6	26.5	6.1	20.4	12.0	0.03267	41.3	41.3
	5	21.6	22.0	6.1	15.9	12.7	0.02129	32.2	32.2
	15	21.6	19.0	6.1	12.9	13.2	0.01253	26.1	26.1
	30	21.6	18.0	6.1	11.9	13.3	0.00891	24.0	24.0
	60	21.6	16.5	6.1	10.4	13.6	0.00636	21.0	21.0
	120	21.6	15.5	6.1	9.4	13.8	0.00452	19.0	19.0
	250	21.6	14.5	6.1	8.4	13.9	0.00315	17.0	17.0
	445	21.6	14.5	6.1	8.4	13.9	0.00236	17.0	17.0
17-May-18	1377	21.6	13.0	6.1	6.9	14.2	0.00136	13.9	13.9

### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device





## **Particle Size Analysis** Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc

Initial Dry Weight of Sample (g): 489.48

Job Number: DB18.1151.00

Weight Passing #10 (g): 485.66

Sample Number: TN-1 (5'A)

Weight Retained #10 (g): 3.82

Project Name: St. Anthony Geotech Investigation

Weight of Hydrometer Sample (g): 60.67

PO Number: 233001076-DBS

Test Date: 23-May-18

Calculated Weight of Sieve Sample (g): 61.15

Shape: Angular Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10					-	
	3"	75	0.00	0.00	489.48	100.00
	2"	50	0.00	0.00	489.48	100.00
	1.5"	38.1	0.00	0.00	489.48	100.00
	1"	25	0.00	0.00	489.48	100.00
	3/4"	19.0	0.00	0.00	489.48	100.00
	3/8"	9.5	0.00	0.00	489.48	100.00
	4	4.75	1.81	1.81	487.67	99.63
	10	2.00	2.01	3.82	485.66	99.22
-10			(Based on calcu	ulated sieve wt.)	)	
	20	0.85	0.49	0.97	60.18	98.42
	40	0.425	0.42	1.39	59.76	97.73
	60	0.250	1.04	2.43	58.72	96.03
	140	0.106	19.80	22.23	38.92	63.65
	200	0.075	9.15	31.38	29.77	48.69
	dry pan		1.39	32.77	28.38	
	wet pan			28.38	0.00	

d<sub>10</sub> (mm): 0.00074 d<sub>50</sub> (mm): 0.077 d<sub>16</sub> (mm): 0.0022 d<sub>60</sub> (mm): 0.097 d<sub>30</sub> (mm): 0.035 d<sub>84</sub> (mm): 0.18

Median Particle Diameter -- d<sub>50</sub> (mm): 0.077

Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 131

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 17

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.086

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Sandy Loam

Laboratory analysis by: Z. Calhoun/M. Garcia

Data entered by: M. Garcia Checked by: J. Hines



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: TN-1 (5'A)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 18-May-18

Start Time: 9:00

Initial Wt. (g): 60.67

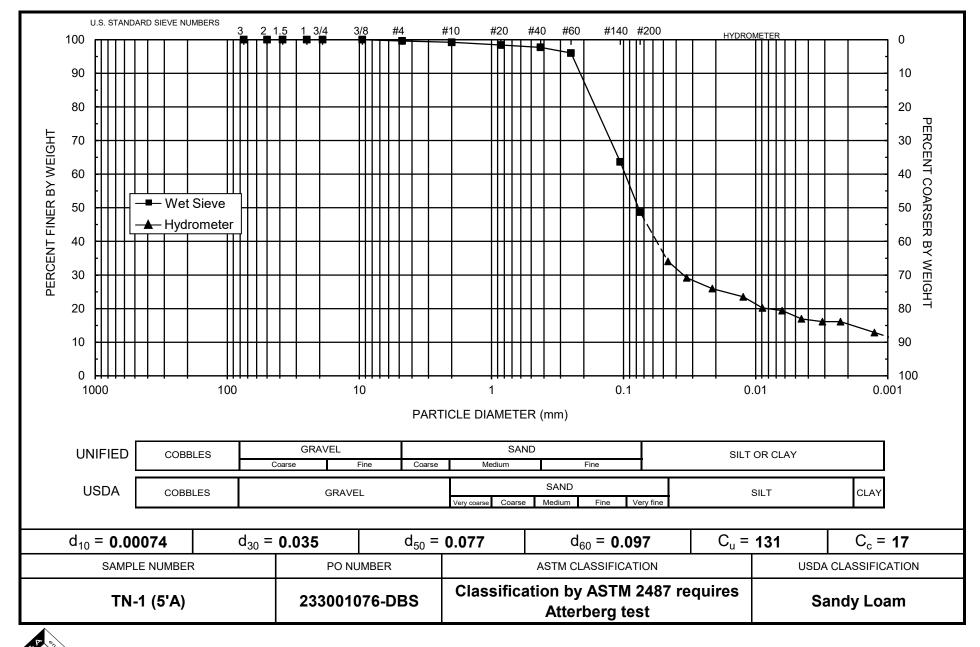
Total Sample Wt. (g): 489.48

Wt. Passing #10 (g): 485.66

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
18-May-18	1	21.5	27.0	6.2	20.8	11.9	0.04609	34.3	34.1
	2	21.5	24.0	6.2	17.8	12.4	0.03326	29.4	29.2
	5	21.6	22.0	6.1	15.9	12.7	0.02129	26.1	25.9
	15	21.6	20.5	6.1	14.4	12.9	0.01241	23.7	23.5
	30	21.6	18.5	6.1	12.4	13.3	0.00889	20.4	20.2
	60	21.6	18.0	6.1	11.9	13.3	0.00630	19.5	19.4
	120	21.6	16.5	6.1	10.4	13.6	0.00450	17.1	16.9
	250	21.6	16.0	6.1	9.9	13.7	0.00313	16.3	16.1
	471	21.6	16.0	6.1	9.9	13.7	0.00228	16.3	16.1
19-May-18	1570	21.7	14.0	6.1	7.9	14.0	0.00126	13.0	12.9

### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device





## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc

Initial Dry Weight of Sample (g): 276.75

Job Number: DB18.1151.00 Sample Number: TN-2 (20'A)

Test Date: 18-May-18

Weight Passing #10 (g): 276.75 Weight Retained #10 (g): 0.00

Project Name: St. Anthony Geotech Investigation

Weight of Hydrometer Sample (g): 68.55

PO Number: 233001076-DBS

Calculated Weight of Sieve Sample (g): 68.55

PO Number: 233001076-DBS

Shape: Angular

Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	276.75	100.00
	2"	50	0.00	0.00	276.75	100.00
	1.5"	38.1	0.00	0.00	276.75	100.00
	1"	25	0.00	0.00	276.75	100.00
	3/4"	19.0	0.00	0.00	276.75	100.00
	3/8"	9.5	0.00	0.00	276.75	100.00
	4	4.75	0.00	0.00	276.75	100.00
	10	2.00	0.00	0.00	276.75	100.00
-10			(Based on calcı	ulated sieve wt.)		
	20	0.85	0.22	0.22	68.33	99.68
	40	0.425	0.29	0.51	68.04	99.26
	60	0.250	1.08	1.59	66.96	97.68
	140	0.106	24.88	26.47	42.08	61.39
	200	0.075	9.08	35.55	33.00	48.14
	dry pan		0.99	36.54	32.01	
	wet pan			32.01	0.00	

 $\begin{array}{lll} d_{10} \ (mm): \ 0.00077 & d_{50} \ (mm): \ 0.079 \\ d_{16} \ (mm): \ 0.0036 & d_{60} \ (mm): \ 0.10 \\ d_{30} \ (mm): \ 0.037 & d_{84} \ (mm): \ 0.18 \\ \end{array}$ 

Median Particle Diameter--d<sub>50</sub> (mm): 0.079

Uniformity Coefficient, Cu -- [d<sub>60</sub>/d<sub>10</sub>] (mm): 130

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 18

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.088

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Sandy Loam



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: TN-2 (20'A)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 16-May-18

Total Sample Wt. (g): 68.55

Test Date: 9:36

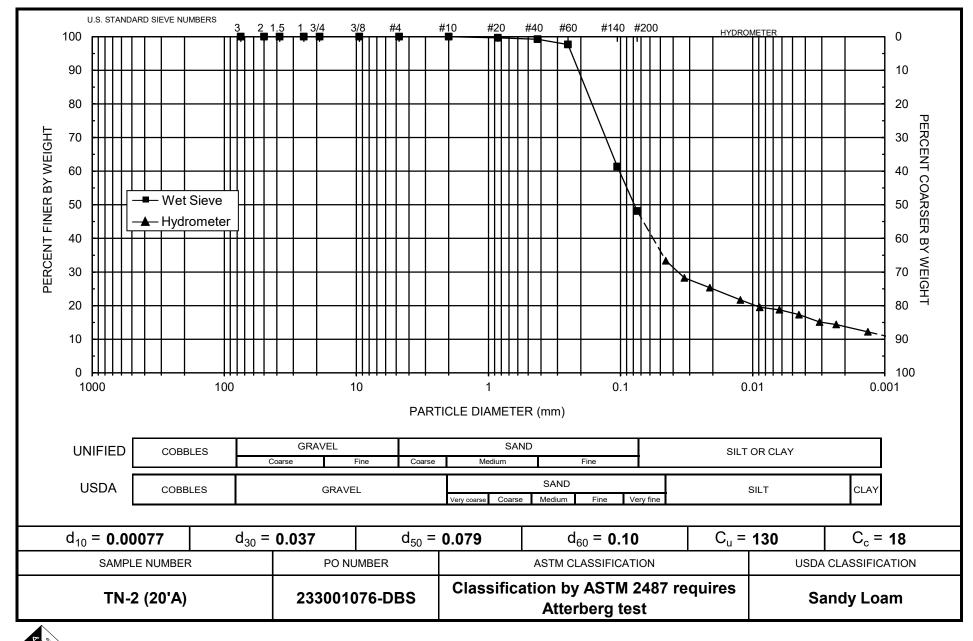
Total Sample Wt. (g): 276.75

Wt. Passing #10 (g): 276.75

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
16-May-18	1	21.6	29.0	6.1	22.9	11.5	0.04540	33.3	33.3
	2	21.6	25.5	6.1	19.4	12.1	0.03289	28.2	28.2
	5	21.6	23.5	6.1	17.4	12.4	0.02108	25.3	25.3
	15	21.6	21.0	6.1	14.9	12.9	0.01237	21.7	21.7
	30	21.6	19.5	6.1	13.4	13.1	0.00883	19.5	19.5
	60	21.6	19.0	6.1	12.9	13.2	0.00626	18.8	18.8
	120	21.6	18.0	6.1	11.9	13.3	0.00446	17.3	17.3
	250	21.6	16.5	6.1	10.4	13.6	0.00312	15.1	15.1
	450	21.6	16.0	6.1	9.9	13.7	0.00233	14.4	14.4
17-May-18	1383	21.6	14.5	6.1	8.4	13.9	0.00134	12.2	12.2

### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device





## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 426.30

 Job Number: DB18.1151.00
 Weight Passing #10 (g): 426.30

 Sample Number: BS-1 (10'A)
 Weight Retained #10 (g): 0.00

Project Name: St. Anthony Geotech Investigation Weight of Hydrometer Sample (g): 56.34
PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 56.34

Test Date: 18-May-18 Shape: Angular Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	426.30	100.00
	2"	50	0.00	0.00	426.30	100.00
	1.5"	38.1	0.00	0.00	426.30	100.00
	1"	25	0.00	0.00	426.30	100.00
	3/4"	19.0	0.00	0.00	426.30	100.00
	3/8"	9.5	0.00	0.00	426.30	100.00
	4	4.75	0.00	0.00	426.30	100.00
	10	2.00	0.00	0.00	426.30	100.00
-10			(Based on calc	ulated sieve wt.	)	
	20	0.85	0.29	0.29	56.05	99.49
	40	0.425	0.26	0.55	55.79	99.02
	60	0.250	0.71	1.26	55.08	97.76
	140	0.106	13.36	14.62	41.72	74.05
	200	0.075	8.38	23.00	33.34	59.18
	dry pan		0.98	23.98	32.36	
	wet pan			32.36	0.00	

 $\begin{array}{lll} d_{10} \ (mm): \ 0.00029 & d_{50} \ (mm): \ 0.052 \\ d_{16} \ (mm): \ 0.00070 & d_{60} \ (mm): \ 0.076 \\ d_{30} \ (mm): \ 0.0098 & d_{84} \ (mm): \ 0.15 \end{array}$ 

Median Particle Diameter -- d<sub>50</sub> (mm): 0.052

Uniformity Coefficient, Cu -- [d<sub>60</sub>/d<sub>10</sub>] (mm): 262

Coefficient of Curvature, Cc --[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 4.4

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.068

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Sandy Clay Loam



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: BS-1 (10'A) Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 16-May-18

Start Time: 9:00

Initial Wt. (g): 56.34

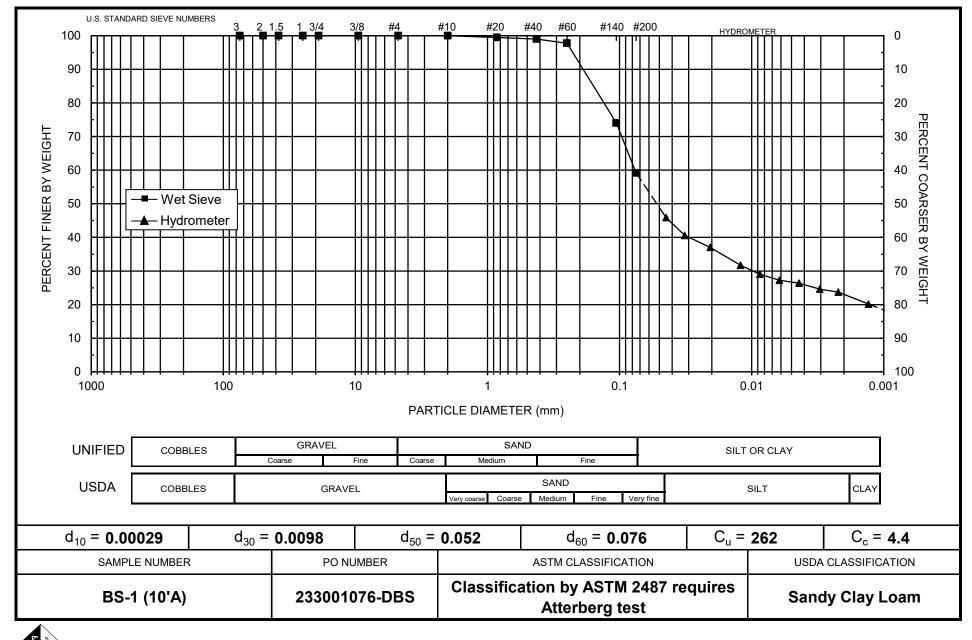
Total Sample Wt. (g): 426.30

Wt. Passing #10 (g): 426.30

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
16-May-18	1	21.6	32.0	6.1	25.9	11.1	0.04442	45.9	45.9
	2	21.6	29.0	6.1	22.9	11.5	0.03210	40.6	40.6
	5	21.6	27.0	6.1	20.9	11.9	0.02059	37.0	37.0
	15	21.6	24.0	6.1	17.9	12.4	0.01213	31.7	31.7
	30	21.6	22.5	6.1	16.4	12.6	0.00866	29.0	29.0
	60	21.6	21.5	6.1	15.4	12.8	0.00617	27.3	27.3
	120	21.6	21.0	6.1	14.9	12.9	0.00437	26.4	26.4
	250	21.6	20.0	6.1	13.9	13.0	0.00305	24.6	24.6
	480	21.6	19.5	6.1	13.4	13.1	0.00221	23.7	23.7
17-May-18	1414	21.6	17.5	6.1	11.4	13.4	0.00130	20.2	20.2

### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device





## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 413.95

 Job Number:
 DB18.1151.00
 Weight Passing #10 (g): 413.95

 Sample Number:
 BS-2 (15'A)
 Weight Retained #10 (g): 0.00

Project Name: St. Anthony Geotech Investigation Weight of Hydrometer Sample (g): 53.66
PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 53.66

Test Date: 18-May-18 Shape: Rounded Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10					-	
	3"	75	0.00	0.00	413.95	100.00
	2"	50	0.00	0.00	413.95	100.00
	1.5"	38.1	0.00	0.00	413.95	100.00
	1"	25	0.00	0.00	413.95	100.00
	3/4"	19.0	0.00	0.00	413.95	100.00
	3/8"	9.5	0.00	0.00	413.95	100.00
	4	4.75	0.00	0.00	413.95	100.00
	10	2.00	0.00	0.00	413.95	100.00
-10			(Based on calcu	ulated sieve wt.)	)	
	20	0.85	1.44	1.44	52.22	97.32
	40	0.425	1.17	2.61	51.05	95.14
	60	0.250	1.42	4.03	49.63	92.49
	140	0.106	12.29	16.32	37.34	69.59
	200	0.075	6.78	23.10	30.56	56.95
	dry pan		0.58	23.68	29.98	
	wet pan			29.98	0.00	

 $d_{10}$  (mm): 0.0039  $d_{50}$  (mm): 0.061  $d_{16}$  (mm): 0.0048  $d_{60}$  (mm): 0.082  $d_{30}$  (mm): 0.014  $d_{84}$  (mm): 0.18

 $\label{eq:median Particle Diameter--d} \begin{tabular}{ll} \textit{Median Particle Diameter--}$-d_{50} (mm): 0.061 \\ \textit{Uniformity Coefficient, Cu--}[d_{60}/d_{10}] (mm): 21 \\ \textit{Coefficient of Curvature, Cc--}[(d_{30})^2/(d_{10}*d_{60})] (mm): 0.61 \\ \textit{Mean Particle Diameter--}[(d_{16}+d_{50}+d_{84})/3] (mm): 0.082 \\ \end{tabular}$ 

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Sandy Loam

Laboratory analysis by: E. Bastien
Data entered by: M. Garcia
Checked by: J. Hines



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: BS-2 (15'A)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 16-May-18

Total Sample Wt. (g): 53.66

Total Sample Wt. (g): 413.95

Start Time: 9:06

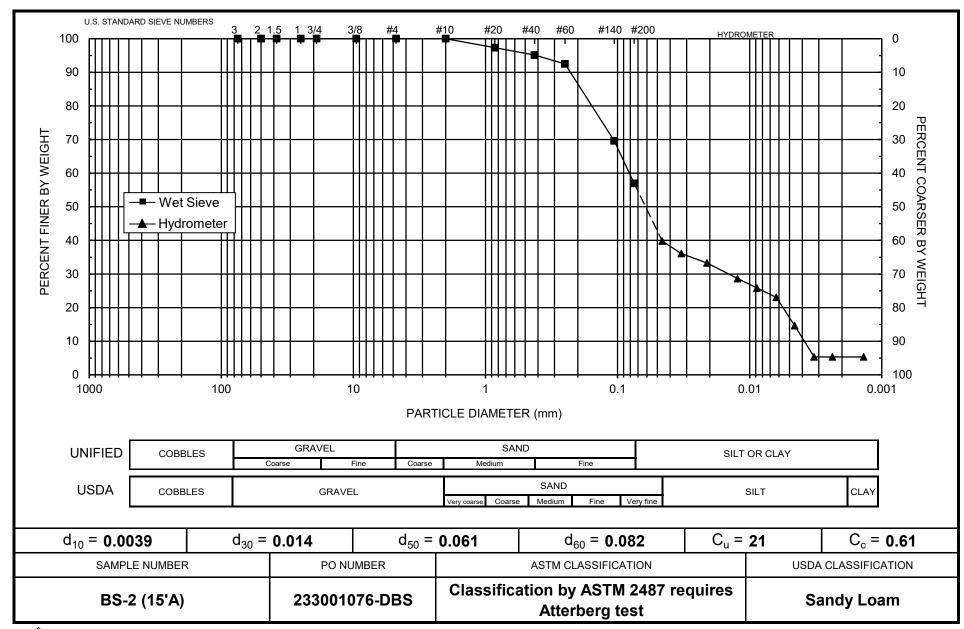
Wt. Passing #10 (g): 413.95

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
•									_
16-May-18	1	21.6	27.5	6.1	21.4	11.8	0.04588	39.8	39.8
	2	21.6	25.5	6.1	19.4	12.1	0.03289	36.1	36.1
	5	21.6	24.0	6.1	17.9	12.4	0.02101	33.3	33.3
	15	21.6	21.5	6.1	15.4	12.8	0.01233	28.6	28.6
	30	21.6	20.0	6.1	13.9	13.0	0.00880	25.8	25.8
	60	21.6	18.5	6.1	12.4	13.3	0.00628	23.0	23.0
	120	21.6	14.0	6.1	7.9	14.0	0.00456	14.6	14.6
	250	21.6	9.0	6.1	2.9	14.8	0.00325	5.3	5.3
	475	21.6	9.0	6.1	2.9	14.8	0.00236	5.3	5.3
17-May-18	1409	21.6	9.0	6.1	2.9	14.8	0.00137	5.3	5.3

#### Comments:

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

<sup>\*</sup> Dispersion device: mechanically operated stirring device







Test Date: 18-May-18

Daniel B. Stephens & Associates, Inc.

## **Particle Size Analysis** Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 371.11

Weight Passing #10 (g): 371.11

Job Number: DB18.1151.00 Sample Number: BS-6 (20'A) Weight Retained #10 (g): 0.00

Weight of Hydrometer Sample (g): 56.55 Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 56.55

> Shape: Angular Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	371.11	100.00
	2"	50	0.00	0.00	371.11	100.00
	1.5"	38.1	0.00	0.00	371.11	100.00
	1"	25	0.00	0.00	371.11	100.00
	3/4"	19.0	0.00	0.00	371.11	100.00
	3/8"	9.5	0.00	0.00	371.11	100.00
	4	4.75	0.00	0.00	371.11	100.00
	10	2.00	0.00	0.00	371.11	100.00
-10			(Based on calcı	ulated sieve wt.)	)	
	20	0.85	0.01	0.01	56.54	99.98
	40	0.425	0.02	0.03	56.52	99.95
	60	0.250	0.06	0.09	56.46	99.84
	140	0.106	6.93	7.02	49.53	87.59
	200	0.075	7.85	14.87	41.68	73.70
	dry pan		0.92	15.79	40.76	
	wet pan			40.76	0.00	

d<sub>10</sub> (mm): 0.00018 d<sub>50</sub> (mm): 0.054 d<sub>16</sub> (mm): 0.0011 d<sub>60</sub> (mm): 0.062 d<sub>30</sub> (mm): 0.022 d<sub>84</sub> (mm): 0.097

Median Particle Diameter -- d<sub>50</sub> (mm): 0.054

Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 344

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 43

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.051

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Sandy Loam

Laboratory analysis by: E. Bastien Data entered by: M. Garcia Checked by: J. Hines



## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: BS-6 (20'A)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 16-May-18

Total Sample Wt. (g): 56.55

Test Date: 9:12

Initial Wt. (g): 56.55

Total Sample Wt. (g): 371.11

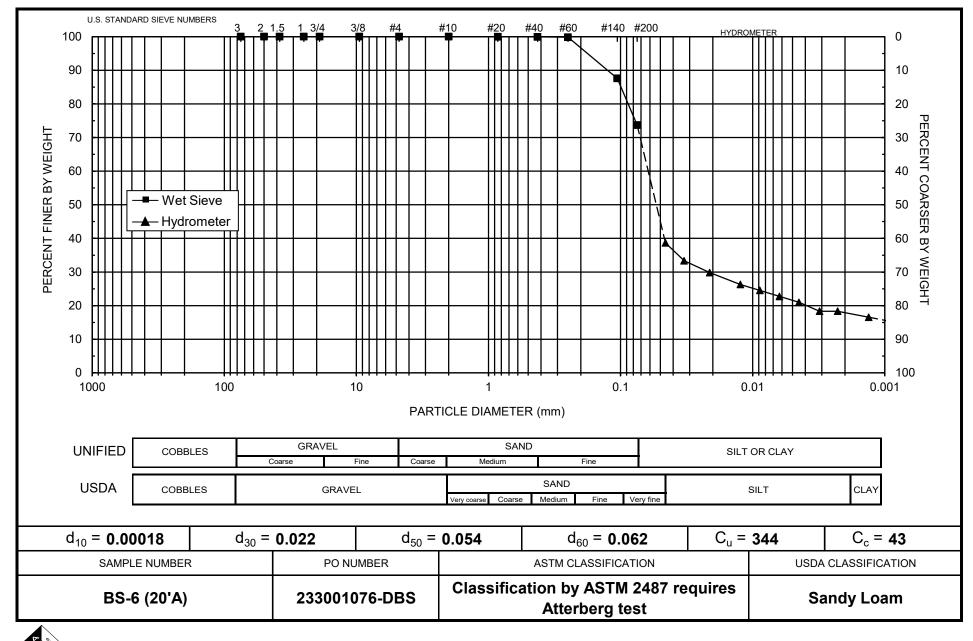
Wt. Passing #10 (g): 371.11

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
16-May-18	1	21.6	28.0	6.1	21.9	11.7	0.04572	38.7	38.7
	2	21.6	25.0	6.1	18.9	12.2	0.03300	33.4	33.4
	5	21.6	23.0	6.1	16.9	12.5	0.02115	29.8	29.8
	15	21.6	21.0	6.1	14.9	12.9	0.01237	26.3	26.3
	30	21.6	20.0	6.1	13.9	13.0	0.00880	24.5	24.5
	60	21.6	19.0	6.1	12.9	13.2	0.00626	22.7	22.7
	120	21.6	18.0	6.1	11.9	13.3	0.00446	21.0	21.0
	250	21.6	16.5	6.1	10.4	13.6	0.00312	18.3	18.3
	470	21.6	16.5	6.1	10.4	13.6	0.00227	18.3	18.3
17-May-18	1404	21.6	15.5	6.1	9.4	13.8	0.00132	16.6	16.6

#### Comments:

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

<sup>\*</sup> Dispersion device: mechanically operated stirring device





## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry W

Initial Dry Weight of Sample (g): 512.99

Job Number: DB18.1151.00 Sample Number: TS-1 (20'A) Weight Passing #10 (g): 510.37 Weight Retained #10 (g): 2.62

Project Name: St. Anthony Geotech Investigation

Weight of Hydrometer Sample (g): 56.02

PO Number: 233001076-DBS

Calculated Weight of Sieve Sample (g): 56.31

Test Date: 24-May-18

Shape: Angular

Hardness: Hard and durable

Test	Sieve	Diameter	Wt.	Cum Wt.	Wt.	0/ 🗖
Fraction	Number	(mm)	Retained	Retained	Passing	% Passing
+10						
	3"	75	0.00	0.00	512.99	100.00
	2"	50	0.00	0.00	512.99	100.00
	1.5"	38.1	0.00	0.00	512.99	100.00
	1"	25	0.00	0.00	512.99	100.00
	3/4"	19.0	0.00	0.00	512.99	100.00
	3/8"	9.5	0.00	0.00	512.99	100.00
	4	4.75	0.00	0.00	512.99	100.00
	10	2.00	2.62	2.62	510.37	99.49
-10			(Based on calcu	ulated sieve wt.	)	
	20	0.85	0.88	1.17	55.14	97.93
	40	0.425	0.47	1.64	54.67	97.09
	60	0.250	0.33	1.97	54.34	96.51
	140	0.106	1.86	3.83	52.48	93.20
	200	0.075	6.41	10.24	46.07	81.82
	dry pan		1.03	11.27	45.04	
	wet pan			45.04	0.00	

 $\begin{array}{lll} d_{10} \ (mm): \ 0.0010 & d_{50} \ (mm): \ 0.035 \\ d_{16} \ (mm): \ 0.0019 & d_{60} \ (mm): \ 0.048 \\ d_{30} \ (mm): \ 0.0098 & d_{84} \ (mm): \ 0.080 \end{array}$ 

Median Particle Diameter -- d<sub>50</sub> (mm): 0.035

Uniformity Coefficient, Cu--[ $d_{60}/d_{10}$ ] (mm): 48

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}^*d_{60})$ ] (mm): 2.0

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.039

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Loam

Laboratory analysis by: Z. Calhoun/M. Garcia

Data entered by: M. Garcia Checked by: J. Hines



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: TS-1 (20'A)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 18-May-18

Start Time: 9:48

Initial Wt. (g): 56.02

Total Sample Wt. (g): 512.99

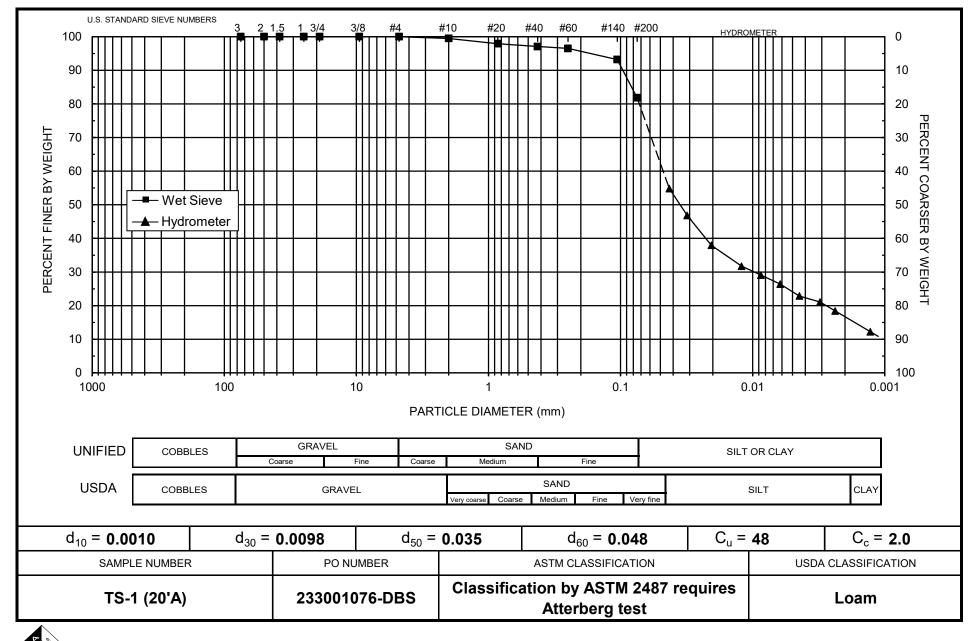
Wt. Passing #10 (g): 510.37

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
18-May-18	1	21.6	37.0	6.1	30.9	10.2	0.04274	55.1	54.8
	2	21.6	32.5	6.1	26.4	11.0	0.03129	47.1	46.8
	5	21.6	27.5	6.1	21.4	11.8	0.02052	38.1	37.9
	15	21.6	24.0	6.1	17.9	12.4	0.01213	31.9	31.7
	30	21.6	22.5	6.1	16.4	12.6	0.00866	29.2	29.1
	60	21.6	21.0	6.1	14.9	12.9	0.00618	26.5	26.4
	120	21.6	19.0	6.1	12.9	13.2	0.00443	23.0	22.8
	250	21.6	18.0	6.1	11.9	13.3	0.00309	21.2	21.1
	431	21.6	16.5	6.1	10.4	13.6	0.00237	18.5	18.4
19-May-18	1529	21.7	13.0	6.1	6.9	14.2	0.00128	12.3	12.2

#### Comments:

Laboratory analysis by: M. Zbrozek
Data entered by: M. Garcia
Checked by: J. Hines

<sup>\*</sup> Dispersion device: mechanically operated stirring device





## **Particle Size Analysis** Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 343.53

Job Number: DB18.1151.00 Weight Passing #10 (g): 343.53 Sample Number: TS-2 (10'A) Weight Retained #10 (g): 0.00

Weight of Hydrometer Sample (g): 57.64 Project Name: St. Anthony Geotech Investigation PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 57.64

Test Date: 18-May-18

Shape: Rounded

Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing_
+10						_
	3"	75	0.00	0.00	343.53	100.00
	2"	50	0.00	0.00	343.53	100.00
	1.5"	38.1	0.00	0.00	343.53	100.00
	1"	25	0.00	0.00	343.53	100.00
	3/4"	19.0	0.00	0.00	343.53	100.00
	3/8"	9.5	0.00	0.00	343.53	100.00
	4	4.75	0.00	0.00	343.53	100.00
	10	2.00	0.00	0.00	343.53	100.00
-10			(Based on calcı	ulated sieve wt.)	)	
	20	0.85	0.88	0.88	56.76	98.47
	40	0.425	0.65	1.53	56.11	97.35
	60	0.250	1.09	2.62	55.02	95.45
	140	0.106	23.08	25.70	31.94	55.41
	200	0.075	5.36	31.06	26.58	46.11
	dry pan		0.22	31.28	26.36	
	wet pan			26.36	0.00	

d<sub>10</sub> (mm): 0.0019 d<sub>50</sub> (mm): 0.087 d<sub>16</sub> (mm): 0.0027 d<sub>60</sub> (mm): 0.12 d<sub>30</sub> (mm): 0.026 d<sub>84</sub> (mm): 0.20

Median Particle Diameter -- d<sub>50</sub> (mm): 0.087 Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 63 Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 3.0 Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.097

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Sandy Loam

Laboratory analysis by: E. Bastien Data entered by: M. Garcia Checked by: J. Hines



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: TS-2 (10'A)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 16-May-18

Start Time: 9:48

Initial Wt. (g): 57.64

Total Sample Wt. (g): 343.53

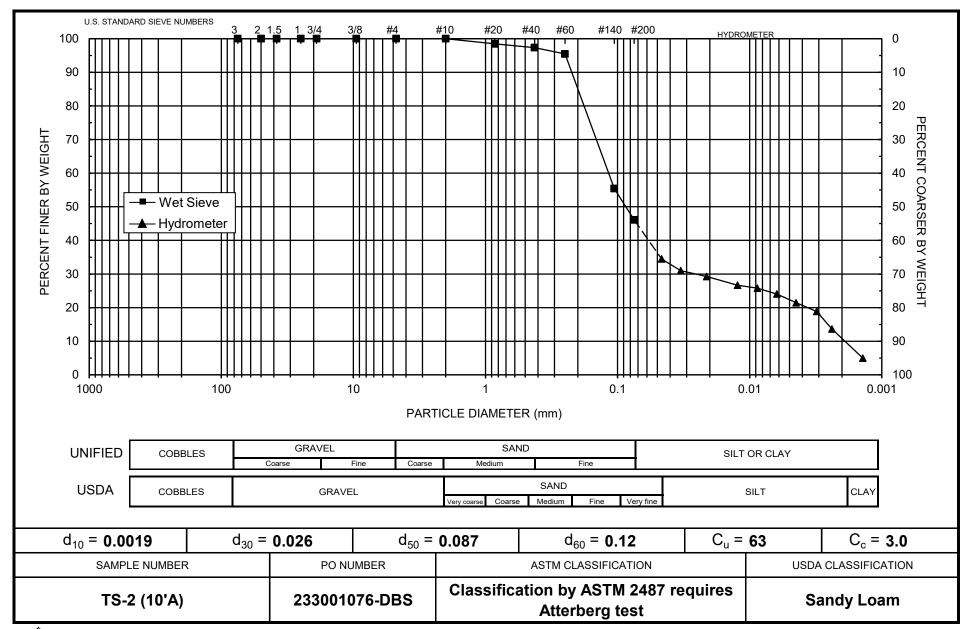
Wt. Passing #10 (g): 343.53

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
16-May-18	1	21.6	26.0	6.1	19.9	12.0	0.04636	34.5	34.5
	2	21.6	24.0	6.1	17.9	12.4	0.03322	31.0	31.0
	5	21.6	23.0	6.1	16.9	12.5	0.02115	29.3	29.3
	15	21.6	21.5	6.1	15.4	12.8	0.01233	26.6	26.6
	30	21.6	21.0	6.1	14.9	12.9	0.00875	25.8	25.8
	60	21.6	20.0	6.1	13.9	13.0	0.00622	24.0	24.0
	120	21.6	18.5	6.1	12.4	13.3	0.00444	21.4	21.4
	250	21.6	17.0	6.1	10.9	13.5	0.00311	18.8	18.8
	440	21.6	14.0	6.1	7.9	14.0	0.00238	13.6	13.6
17-May-18	1372	21.6	9.0	6.1	2.9	14.8	0.00139	5.0	5.0

#### Comments:

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

<sup>\*</sup> Dispersion device: mechanically operated stirring device







## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 470.01

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Weight of Hydrometer Sample (g): 57.40

Calculated Weight of Sieve Sample (g): 57.42

Test Date: 18-May-18 Shape: Angular Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	470.01	100.00
	2"	50	0.00	0.00	470.01	100.00
	1.5"	38.1	0.00	0.00	470.01	100.00
	1"	25	0.00	0.00	470.01	100.00
	3/4"	19.0	0.00	0.00	470.01	100.00
	3/8"	9.5	0.00	0.00	470.01	100.00
	4	4.75	0.00	0.00	470.01	100.00
	10	2.00	0.18	0.18	469.83	99.96
-10			(Based on calcu	ulated sieve wt.)	)	
	20	0.85	0.40	0.42	57.00	99.27
	40	0.425	0.43	0.85	56.57	98.52
	60	0.250	0.30	1.15	56.27	97.99
	140	0.106	1.19	2.34	55.08	95.92
	200	0.075	6.92	9.26	48.16	83.87
	dry pan		1.73	10.99	46.43	
	wet pan			46.43	0.00	

 $\begin{array}{lll} d_{10} \ (mm): \ 0.00086 & d_{50} \ (mm): \ 0.043 \\ d_{16} \ (mm): \ 0.0023 & d_{60} \ (mm): \ 0.051 \\ d_{30} \ (mm): \ 0.013 & d_{84} \ (mm): \ 0.075 \end{array}$ 

Median Particle Diameter--d<sub>50</sub> (mm): 0.043

Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 59

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 3.9

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.040

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Loam

Laboratory analysis by: E. Bastien/Z. Calhoun

Data entered by: M. Garcia Checked by: J. Hines



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: TS-3 (10'A)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 16-May-18

Total Sample Wt. (g): 57.40

Total Sample Wt. (g): 470.01

Start Time: 9:54

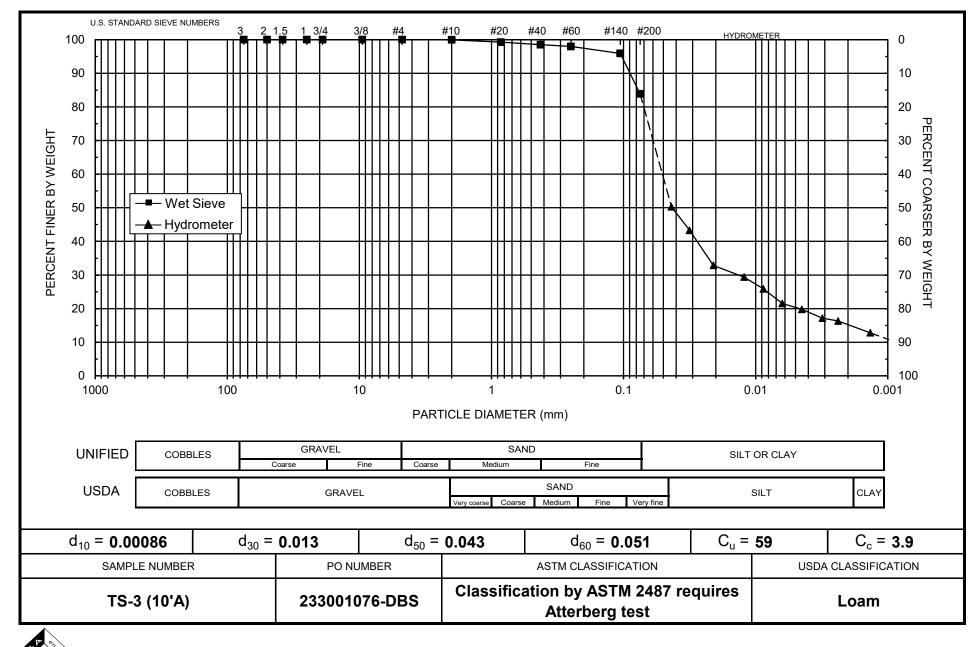
Wt. Passing #10 (g): 469.83

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
									_
16-May-18	1	21.6	35.0	6.1	28.9	10.6	0.04342	50.3	50.3
	2	21.6	31.0	6.1	24.9	11.2	0.03164	43.3	43.3
	5	21.6	25.0	6.1	18.9	12.2	0.02087	32.9	32.8
	15	21.6	23.0	6.1	16.9	12.5	0.01221	29.4	29.4
	30	21.6	21.0	6.1	14.9	12.9	0.00875	25.9	25.9
	60	21.6	18.5	6.1	12.4	13.3	0.00628	21.5	21.5
	120	21.6	17.5	6.1	11.4	13.4	0.00447	19.8	19.8
	250	21.6	16.0	6.1	9.9	13.7	0.00313	17.2	17.2
	435	21.6	15.5	6.1	9.4	13.8	0.00238	16.3	16.3
17-May-18	1367	21.6	13.5	6.1	7.4	14.1	0.00136	12.8	12.8

#### Comments:

Laboratory analysis by: A. Bland
Data entered by: M. Garcia
Checked by: J. Hines

<sup>\*</sup> Dispersion device: mechanically operated stirring device





#### **Particle Size Analysis** Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 536.95

Job Number: DB18.1151.00 Weight Passing #10 (g): 522.77 Sample Number: TS-4 (5'A) Weight Retained #10 (g): 14.18 Weight of Hydrometer Sample (g): 52.41 Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 53.83

Test Date: 24-May-18 Shape: Angular

Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						_
	3"	75	0.00	0.00	536.95	100.00
	2"	50	0.00	0.00	536.95	100.00
	1.5"	38.1	0.00	0.00	536.95	100.00
	1"	25	0.00	0.00	536.95	100.00
	3/4"	19.0	0.00	0.00	536.95	100.00
	3/8"	9.5	0.00	0.00	536.95	100.00
	4	4.75	3.53	3.53	533.42	99.34
	10	2.00	10.65	14.18	522.77	97.36
-10			(Based on calcu	ulated sieve wt.)	)	
	20	0.85	0.64	2.06	51.77	96.17
	40	0.425	0.53	2.59	51.24	95.19
	60	0.250	0.87	3.46	50.37	93.57
	140	0.106	24.08	27.54	26.29	48.84
	200	0.075	6.80	34.34	19.49	36.21
	dry pan		0.49	34.83	19.00	
	wet pan			19.00	0.00	

d<sub>10</sub> (mm): 0.0011 d<sub>50</sub> (mm): 0.11 d<sub>16</sub> (mm): 0.0038 d<sub>60</sub> (mm): 0.13 d<sub>30</sub> (mm): 0.054 d<sub>84</sub> (mm): 0.21

Median Particle Diameter -- d<sub>50</sub> (mm): 0.11

Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 118

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 20

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.11

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Sandy Loam

Laboratory analysis by: Z. Calhoun/M. Garcia

Data entered by: M. Garcia Checked by: J. Hines



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: TS-4 (5'A)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 18-May-18

Start Time: 9:54

Initial Wt. (g): 52.41

Total Sample Wt. (g): 536.95

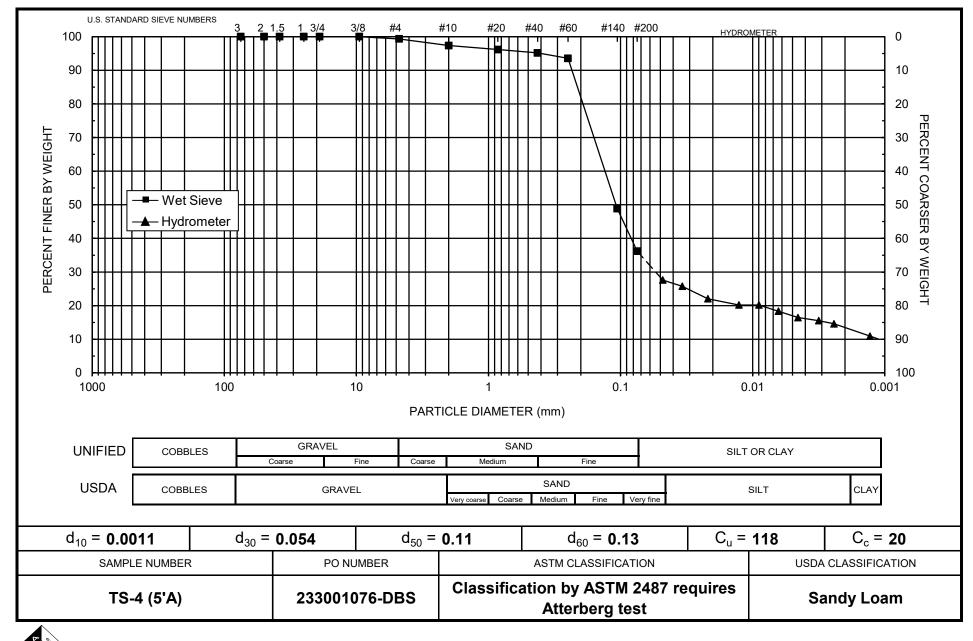
Wt. Passing #10 (g): 522.77

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
18-May-18	1	21.6	21.0	6.1	14.9	12.9	0.04791	28.4	27.6
	2	21.6	20.0	6.1	13.9	13.0	0.03409	26.4	25.7
	5	21.6	18.0	6.1	11.9	13.3	0.02183	22.6	22.0
	15	21.6	17.0	6.1	10.9	13.5	0.01268	20.7	20.2
	30	21.6	17.0	6.1	10.9	13.5	0.00897	20.7	20.2
	60	21.6	16.0	6.1	9.9	13.7	0.00638	18.8	18.3
	120	21.6	15.0	6.1	8.9	13.8	0.00454	16.9	16.5
	250	21.6	14.5	6.1	8.4	13.9	0.00315	16.0	15.5
	426	21.6	14.0	6.1	7.9	14.0	0.00242	15.0	14.6
19-May-18	1524	21.7	12.0	6.1	5.9	14.3	0.00129	11.2	10.9

#### Comments:

Laboratory analysis by: M. Zbrozek
Data entered by: M. Garcia
Checked by: J. Hines

<sup>\*</sup> Dispersion device: mechanically operated stirring device





## **Particle Size Analysis** Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc

Initial Dry Weight of Sample (g): 323.18

Job Number: DB18.1151.00

Test Date: 21-May-18

Weight Passing #10 (g): 254.78

Sample Number: P1-1 (5'A)

Weight Retained #10 (g): 68.40 Weight of Hydrometer Sample (g): 68.64

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Calculated Weight of Sieve Sample (g): 87.07

Shape: Angular Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10		, ,				
	3"	75	0.00	0.00	323.18	100.00
	2"	50	0.00	0.00	323.18	100.00
	1.5"	38.1	0.00	0.00	323.18	100.00
	1"	25	0.00	0.00	323.18	100.00
	3/4"	19.0	15.05	15.05	308.13	95.34
	3/8"	9.5	35.95	51.00	272.18	84.22
	4	4.75	9.84	60.84	262.34	81.17
	10	2.00	7.56	68.40	254.78	78.84
-10			(Based on calcı	ulated sieve wt.)	)	
	20	0.85	1.63	20.06	67.01	76.96
	40	0.425	0.95	21.01	66.06	75.87
	60	0.250	1.17	22.18	64.89	74.53
	140	0.106	27.03	49.21	37.86	43.48
	200	0.075	10.55	59.76	27.31	31.37
	dry pan		0.88	60.64	26.43	
	wet pan			26.43	0.00	

d<sub>10</sub> (mm): 0.0012 d<sub>50</sub> (mm): 0.13 d<sub>16</sub> (mm): 0.013 d<sub>60</sub> (mm): 0.17 d<sub>30</sub> (mm): 0.069 d<sub>84</sub> (mm): 9.0

Median Particle Diameter -- d<sub>50</sub> (mm): 0.13

Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 142

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 23

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 3.0

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Sandy Loam †

† Greater than 10% of sample is coarse material

Laboratory analysis by: M. Garcia Data entered by: M. Garcia Checked by: J. Hines



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: P1-1 (5'A)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

 Test Date:
 17-May-18
 Total Sample Wt. (g):
 323.18

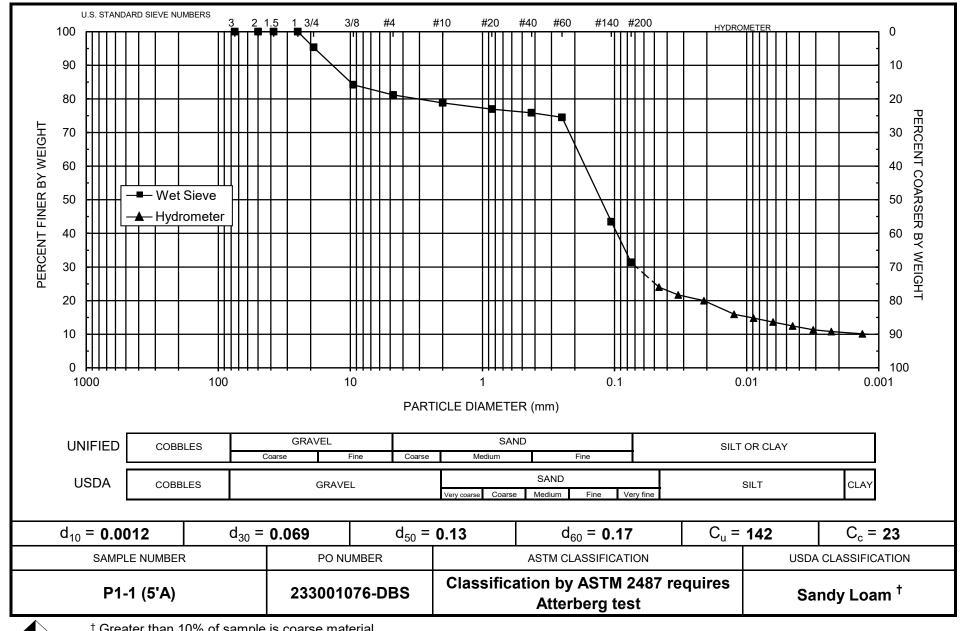
 Start Time:
 9:00
 Wt. Passing #10 (g):
 254.78

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
17-May-18	1	21.7	27.0	6.1	20.9	11.9	0.04598	30.4	24.0
	2	21.7	25.0	6.1	18.9	12.2	0.03296	27.5	21.7
	5	21.7	23.5	6.1	17.4	12.4	0.02106	25.3	20.0
	15	21.6	20.0	6.1	13.9	13.0	0.01245	20.2	15.9
	30	21.6	19.0	6.1	12.9	13.2	0.00886	18.7	14.8
	60	21.6	18.0	6.1	11.9	13.3	0.00630	17.3	13.6
	120	21.5	17.0	6.2	10.8	13.5	0.00449	15.8	12.4
	250	21.6	16.0	6.2	9.8	13.7	0.00313	14.3	11.3
	471	21.7	15.5	6.1	9.4	13.8	0.00228	13.7	10.8
18-May-18	1404	21.4	15.0	6.2	8.8	13.8	0.00133	12.8	10.1

#### Comments:

Laboratory analysis by: M. Zbrozek
Data entered by: M. Garcia
Checked by: J. Hines

<sup>\*</sup> Dispersion device: mechanically operated stirring device



<sup>†</sup> Greater than 10% of sample is coarse material

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and ASTM classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Daniel B. Stephens & Associates, Inc.



# Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 268.32

Job Number: DB18.1151.00 Weight Passing #10 (g): 210.98
Sample Number: P1-2 (30'B) Weight Retained #10 (g): 57.34
Project Name: St. Anthony Geotech Investigation Weight of Hydrometer Sample (g): 57.55

Project Name: St. Anthony Geotech Investigation Weight of Hydrometer Sample (g): 57.55
PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 73.19

Test Date: 21-May-18 Shape: Rounded

Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	268.32	100.00
	2"	50	0.00	0.00	268.32	100.00
	1.5"	38.1	0.00	0.00	268.32	100.00
	1"	25	0.00	0.00	268.32	100.00
	3/4"	19.0	31.23	31.23	237.09	88.36
	3/8"	9.5	17.38	48.61	219.71	81.88
	4	4.75	5.97	54.58	213.74	79.66
	10	2.00	2.76	57.34	210.98	78.63
-10			(Based on calcu	ulated sieve wt.)	)	
	20	0.85	1.55	17.19	56.00	76.51
	40	0.425	1.00	18.19	55.00	75.15
	60	0.250	1.18	19.37	53.82	73.53
	140	0.106	18.74	38.11	35.08	47.93
	200	0.075	8.23	46.34	26.85	36.68
	dry pan		0.54	46.88	26.31	
	wet pan			26.31	0.00	

 $d_{10}$  (mm): 0.0010  $d_{50}$  (mm): 0.11  $d_{16}$  (mm): 0.0071  $d_{60}$  (mm): 0.16  $d_{30}$  (mm): 0.058  $d_{84}$  (mm): 12

Median Particle Diameter--d<sub>50</sub> (mm): 0.11

Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 160

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 21

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 4.0

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Sandy Loam †

† Greater than 10% of sample is coarse material

Laboratory analysis by: M. Garcia
Data entered by: M. Garcia
Checked by: J. Hines



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: P1-2 (30'B)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 17-May-18

Start Time: 9:06

Initial Wt. (g): 57.55

Total Sample Wt. (g): 268.32

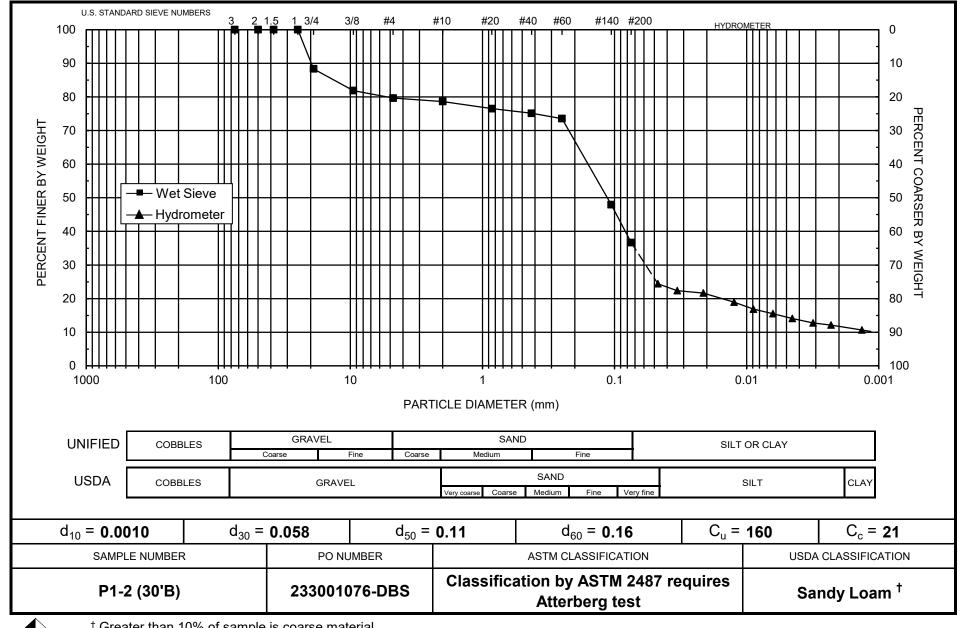
Wt. Passing #10 (g): 210.98

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
	_								
17-May-18	1	21.7	24.0	6.1	17.9	12.4	0.04696	31.1	24.4
	2	21.7	22.5	6.1	16.4	12.6	0.03353	28.4	22.4
	5	21.6	22.0	6.1	15.9	12.7	0.02129	27.6	21.7
	15	21.6	20.0	6.1	13.9	13.0	0.01245	24.1	18.9
	30	21.6	18.5	6.1	12.4	13.3	0.00889	21.5	16.9
	60	21.6	17.5	6.1	11.4	13.4	0.00632	19.7	15.5
	120	21.5	16.5	6.2	10.3	13.6	0.00451	17.9	14.1
	250	21.6	15.5	6.2	9.3	13.8	0.00314	16.2	12.8
	466	21.7	15.0	6.1	8.9	13.8	0.00230	15.4	12.1
18-May-18	1399	21.4	14.0	6.2	7.8	14.0	0.00134	13.6	10.7

#### Comments:

Laboratory analysis by: M. Zbrozek
Data entered by: M. Garcia
Checked by: J. Hines

<sup>\*</sup> Dispersion device: mechanically operated stirring device



<sup>†</sup> Greater than 10% of sample is coarse material

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and ASTM classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Daniel B. Stephens & Associates, Inc.



## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 487.96

 Job Number:
 DB18.1151.00
 Weight Passing #10 (g): 485.94

 Sample Number:
 P2-1 (25'A)
 Weight Retained #10 (g): 2.02

Project Name: St. Anthony Geotech Investigation

Weight Notaling Investigation

Weight of Hydrometer Sample (g): 59.29

PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 59.54

Test Date: 21-May-18 Shape: Rounded

Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	T CALLED CO.	(11111)	rtotairiou	rtotamou	r deening	70 1 doomig
+10	3"	75	0.00	0.00	487.96	100.00
	2"	50	0.00	0.00	487.96	100.00
	1.5"	38.1	0.00	0.00	487.96	100.00
	1"	25	0.00	0.00	487.96	100.00
	3/4"	19.0	0.00	0.00	487.96	100.00
	3/8"	9.5	0.00	0.00	487.96	100.00
	4	4.75	1.27	1.27	486.69	99.74
	10	2.00	0.75	2.02	485.94	99.59
-10			(Based on calcu	ulated sieve wt.	)	
	20	0.85	` 1.48	1.73	57.81	97.10
	40	0.425	1.24	2.97	56.57	95.02
	60	0.250	1.60	4.57	54.97	92.33
	140	0.106	22.04	26.61	32.93	55.31
	200	0.075	5.68	32.29	27.25	45.77
	dry pan		0.42	32.71	26.83	
	wet pan			26.83	0.00	

 $\begin{array}{lll} d_{10} \ (mm): \ 0.00071 & d_{50} \ (mm): \ 0.087 \\ d_{16} \ (mm): \ 0.0025 & d_{60} \ (mm): \ 0.12 \\ d_{30} \ (mm): \ 0.030 & d_{84} \ (mm): \ 0.21 \end{array}$ 

Median Particle Diameter--d<sub>50</sub> (mm): 0.087

Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 169

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 11

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.100

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Sandy Loam

Laboratory analysis by: M. Garcia Data entered by: M. Garcia Checked by: J. Hines



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: P2-1 (25'A)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 17-May-18

Start Time: 9:12

Initial Wt. (g): 59.29

Total Sample Wt. (g): 487.96

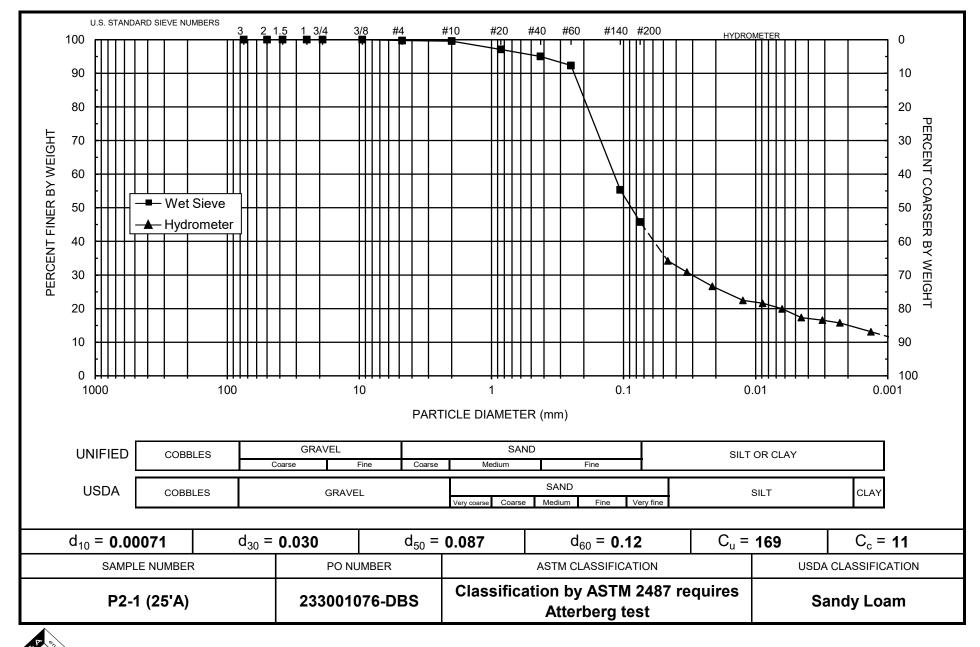
Wt. Passing #10 (g): 485.94

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
17-May-18	1	21.6	26.5	6.1	20.4	12.0	0.04620	34.3	34.2
	2	21.6	24.5	6.1	18.4	12.3	0.03311	31.0	30.8
	5	21.6	22.0	6.1	15.9	12.7	0.02129	26.7	26.6
	15	21.6	19.5	6.1	13.4	13.1	0.01249	22.5	22.4
	30	21.6	19.0	6.1	12.9	13.2	0.00886	21.7	21.6
	60	21.6	18.0	6.1	11.9	13.3	0.00630	20.0	19.9
	120	21.5	16.5	6.2	10.3	13.6	0.00451	17.4	17.3
	250	21.6	16.0	6.1	9.9	13.7	0.00313	16.6	16.6
	461	21.7	15.5	6.1	9.4	13.8	0.00231	15.8	15.8
18-May-18	1394	21.4	14.0	6.2	7.8	14.0	0.00134	13.2	13.1

#### Comments:

Laboratory analysis by: M. Zbrozek
Data entered by: M. Garcia
Checked by: J. Hines

<sup>\*</sup> Dispersion device: mechanically operated stirring device





# Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 509.13

 Job Number:
 DB18.1151.00
 Weight Passing #10 (g): 474.49

 Sample Number:
 P2-2 (5'B)
 Weight Retained #10 (g): 34.64

Project Name: St. Anthony Geotech Investigation Weight of Hydrometer Sample (g): 72.59
PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 77.89

Test Date: 21-May-18 Shape: Angular

Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						_
	3"	75	0.00	0.00	509.13	100.00
	2"	50	0.00	0.00	509.13	100.00
	1.5"	38.1	0.00	0.00	509.13	100.00
	1"	25	0.00	0.00	509.13	100.00
	3/4"	19.0	0.00	0.00	509.13	100.00
	3/8"	9.5	18.36	18.36	490.77	96.39
	4	4.75	7.79	26.15	482.98	94.86
	10	2.00	8.49	34.64	474.49	93.20
-10			(Based on calcı	ulated sieve wt.)	)	
	20	0.85	1.21	6.51	71.38	91.64
	40	0.425	0.60	7.11	70.78	90.87
	60	0.250	0.63	7.74	70.15	90.06
	140	0.106	24.65	32.39	45.50	58.42
	200	0.075	13.04	45.43	32.46	41.67
	dry pan		0.72	46.15	31.74	
	wet pan			31.74	0.00	

 $\begin{array}{lll} d_{10} \ (mm): \ 0.00078 & d_{50} \ (mm): \ 0.089 \\ d_{16} \ (mm): \ 0.0027 & d_{60} \ (mm): \ 0.11 \\ d_{30} \ (mm): \ 0.049 & d_{84} \ (mm): \ 0.21 \end{array}$ 

Median Particle Diameter -- d<sub>50</sub> (mm): 0.089 Uniformity Coefficient, Cu -- [d<sub>60</sub>/d<sub>10</sub>] (mm): 141

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 28

Mean Particle Diameter -- [ $(d_{16}+d_{50}+d_{84})/3$ ] (mm): 0.10

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Sandy Loam

Laboratory analysis by: M. Garcia Data entered by: M. Garcia Checked by: J. Hines



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: P2-2 (5'B)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

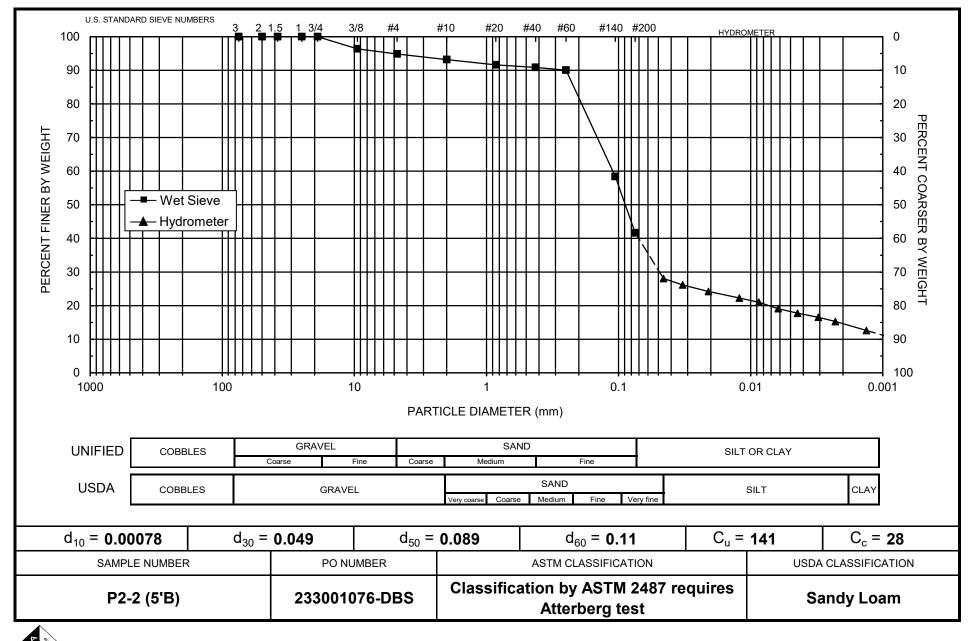
Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
17-May-18	1	21.6	28.0	6.1	21.9	11.7	0.04572	30.1	28.1
	2	21.6	26.5	6.1	20.4	12.0	0.03267	28.0	26.1
	5	21.6	25.0	6.1	18.9	12.2	0.02087	26.0	24.2
	15	21.6	23.5	6.2	17.3	12.4	0.01218	23.9	22.3
	30	21.6	22.5	6.1	16.4	12.6	0.00866	22.5	21.0
	60	21.6	21.0	6.1	14.9	12.9	0.00618	20.5	19.1
	120	21.5	20.0	6.2	13.8	13.0	0.00441	19.0	17.7
	250	21.6	19.0	6.1	12.9	13.2	0.00307	17.7	16.5
	456	21.7	18.0	6.1	11.9	13.3	0.00228	16.4	15.3
18-May-18	1389	21.4	16.0	6.2	9.8	13.7	0.00133	13.5	12.6

#### Comments:

Laboratory analysis by: M. Zbrozek
Data entered by: M. Garcia
Checked by: J. Hines

<sup>\*</sup> Dispersion device: mechanically operated stirring device





## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc

Initial Dry Weight of Sample (g): 541.45

Job Number: DB18.1151.00 Weight Passing #10 (g): 418.25 Sample Number: P3-1 (5'A) Weight Retained #10 (g): 123.20 Project Name: St. Anthony Geotech Investigation Wt. of -10 Sieve Sample (g): 57.93

PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 74.99

Test Date: 23-May-18 Shape: Angular Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
Traction	Number	(11111)	Netaineu	rtetaineu	rassing	70 F assiriy
+10						
	3"	75	0.00	0.00	541.45	100.00
	2"	50	0.00	0.00	541.45	100.00
	1.5"	38.1	0.00	0.00	541.45	100.00
	1"	25	0.00	0.00	541.45	100.00
	3/4"	19.0	39.21	39.21	502.24	92.76
	3/8"	9.5	34.72	73.93	467.52	86.35
	4	4.75	32.76	106.69	434.76	80.30
	10	2.00	16.51	123.20	418.25	77.25
-10			(Based on calc	culated sieve wt.	)	
	20	0.85	3.93	20.99	54.00	72.01
	40	0.425	4.22	25.21	49.78	66.38
	60	0.250	9.70	34.91	40.08	53.44
	140	0.106	24.22	59.13	15.86	21.15
	200	0.075	4.35	63.48	11.51	15.35
	dry pan		0.84	64.32	10.67	
	wet pan			10.67	0.00	

 $\begin{array}{lll} d_{10} \ (mm): \ NA & d_{50} \ (mm): \ 0.23 \\ d_{16} \ (mm): \ 0.078 & d_{60} \ (mm): \ 0.33 \\ d_{30} \ (mm): \ 0.13 & d_{84} \ (mm): \ 7.3 \end{array}$ 

Median Particle Diameter -- d<sub>50</sub> (mm): 0.23

Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): NA

Coefficient of Curvature, Cc--[(d $_{30}$ ) $^2$ /(d $_{10}$ \*d $_{60}$ )] (mm): NA

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 2.5

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

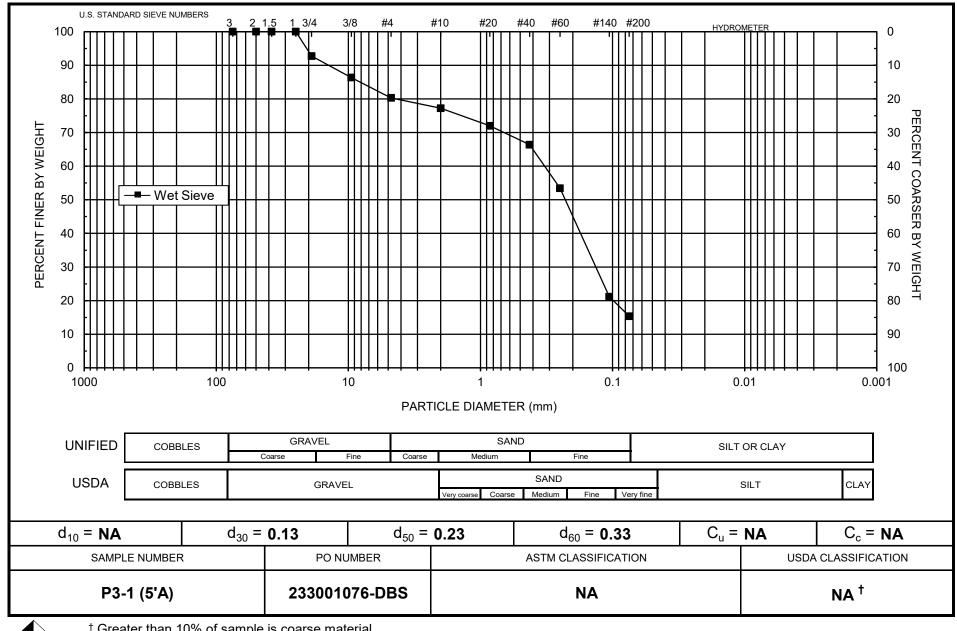
ASTM Soil Classification: NA USDA Soil Classification: NA <sup>†</sup>

<sup>†</sup> Greater than 10% of sample is coarse material

Laboratory analysis by: Z. Calhoun

Data entered by: M. Garcia

Checked by: J. Hines



<sup>†</sup> Greater than 10% of sample is coarse material

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and ASTM classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Daniel B. Stephens & Associates, Inc.



## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name:Stantec Consulting Services IncInitial Dry Weight of Sample (g): 410.00Job Number:DB18.1151.00Weight Passing #10 (g): 410.00

Sample Number: P3-2 (15'B) Weight Retained #10 (g): 0.00
Project Name: St. Anthony Geotech Investigation Wt. of -10 Sieve Sample (g): 58.51

PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 58.51

Test Date: 23-May-18 Shape: Angular Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10		,			<u> </u>	<u> </u>
	3"	75	0.00	0.00	410.00	100.00
	2"	50	0.00	0.00	410.00	100.00
	1.5"	38.1	0.00	0.00	410.00	100.00
	1"	25	0.00	0.00	410.00	100.00
	3/4"	19.0	0.00	0.00	410.00	100.00
	3/8"	9.5	0.00	0.00	410.00	100.00
	4	4.75	0.00	0.00	410.00	100.00
	10	2.00	0.00	0.00	410.00	100.00
-10			(Based on calc	ulated sieve wt.	)	
	20	0.85	0.89	0.89	57.62	98.48
	40	0.425	4.90	5.79	52.72	90.10
	60	0.250	17.46	23.25	35.26	60.26
	140	0.106	21.30	44.55	13.96	23.86
	200	0.075	1.58	46.13	12.38	21.16
	dry pan		0.24	46.37	12.14	
	wet pan			12.14	0.00	

 $d_{10}$  (mm): NA  $d_{50}$  (mm): 0.20  $d_{16}$  (mm): NA  $d_{60}$  (mm): 0.25  $d_{30}$  (mm): 0.12  $d_{84}$  (mm): 0.38

Median Particle Diameter -- d<sub>50</sub> (mm): 0.20

Uniformity Coefficient, Cu--[ $d_{60}/d_{10}$ ] (mm): NA

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}^*d_{60})$ ] (mm): NA

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): NA

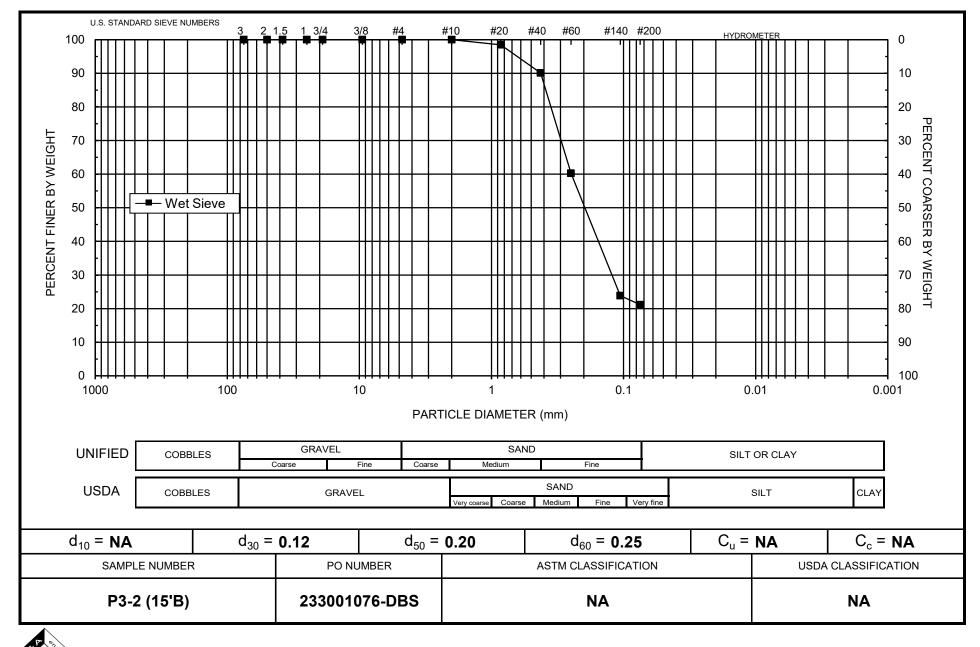
Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

ASTM Soil Classification: NA USDA Soil Classification: NA

Laboratory analysis by: Z. Calhoun

Data entered by: M. Garcia

Checked by: J. Hines





## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name:Stantec Consulting Services IncInitial Dry Weight of Sample (g): 426.94Job Number:DB18.1151.00Weight Passing #10 (g): 422.32

Sample Number: P3-2 (35'B) Weight Retained #10 (g): 4.62
Project Name: St. Anthony Geotech Investigation Wt. of -10 Sieve Sample (g): 58.70

PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 59.34

Test Date: 23-May-18 Shape: Rounded Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	426.94	100.00
	2"	50	0.00	0.00	426.94	100.00
	1.5"	38.1	0.00	0.00	426.94	100.00
	1"	25	0.00	0.00	426.94	100.00
	3/4"	19.0	0.00	0.00	426.94	100.00
	3/8"	9.5	4.62	4.62	422.32	98.92
	4	4.75	0.00	4.62	422.32	98.92
	10	2.00	0.00	4.62	422.32	98.92
-10			(Based on calc	ulated sieve wt.)	)	
	20	0.85	1.10	1.74	57.60	97.06
	40	0.425	2.97	4.71	54.63	92.06
	60	0.250	11.98	16.69	42.65	71.87
	140	0.106	22.65	39.34	20.00	33.70
	200	0.075	1.76	41.10	18.24	30.74
	dry pan		0.27	41.37	17.97	
	wet pan			17.97	0.00	

 $\begin{array}{lll} d_{10} \ (mm): \ NA & d_{50} \ (mm): \ 0.15 \\ d_{16} \ (mm): \ NA & d_{60} \ (mm): \ 0.19 \\ d_{30} \ (mm): \ NA & d_{84} \ (mm): \ 0.34 \end{array}$ 

Median Particle Diameter -- d<sub>50</sub> (mm): 0.15

Uniformity Coefficient, Cu--[ $d_{60}/d_{10}$ ] (mm): NA

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}^*d_{60})$ ] (mm): NA

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): NA

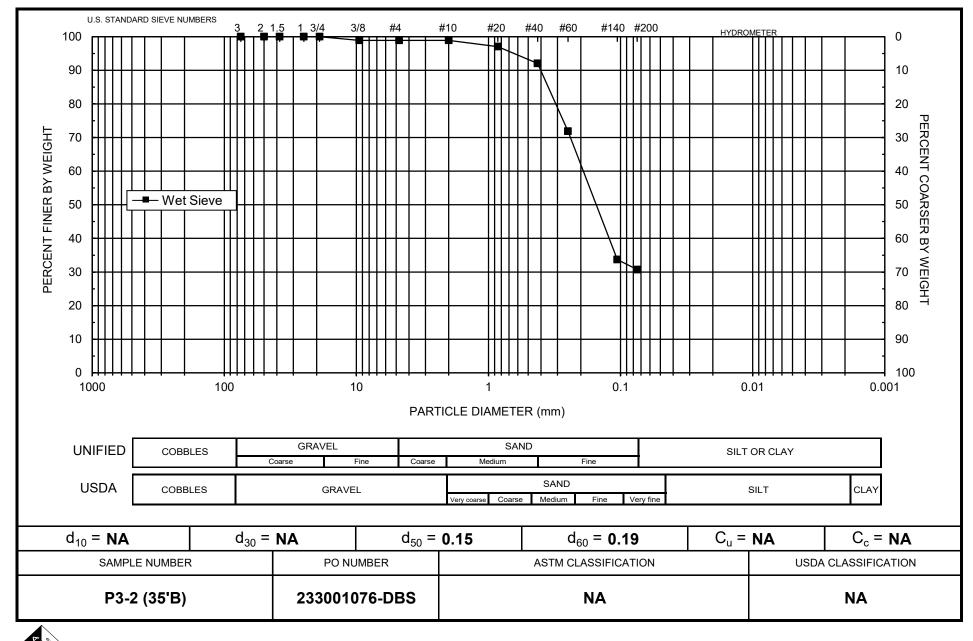
Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

ASTM Soil Classification: NA USDA Soil Classification: NA

Laboratory analysis by: Z. Calhoun

Data entered by: M. Garcia

Checked by: J. Hines





## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 492.77

Job Number:DB18.1151.00Weight Passing #10 (g): 489.86Sample Number:P3-3 (5'A)Weight Retained #10 (g): 2.91Project Name:St. Anthony Geotech InvestigationWt. of -10 Sieve Sample (g): 65.64

PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 66.03

Test Date: 23-May-18 Shape: Rounded Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	492.77	100.00
	2"	50	0.00	0.00	492.77	100.00
	1.5"	38.1	0.00	0.00	492.77	100.00
	1"	25	0.00	0.00	492.77	100.00
	3/4"	19.0	0.00	0.00	492.77	100.00
	3/8"	9.5	0.00	0.00	492.77	100.00
	4	4.75	1.58	1.58	491.19	99.68
	10	2.00	1.33	2.91	489.86	99.41
-10			(Based on calc	ulated sieve wt.	)	
	20	0.85	0.69	1.08	64.95	98.36
	40	0.425	3.51	4.59	61.44	93.05
	60	0.250	13.49	18.08	47.95	72.62
	140	0.106	24.20	42.28	23.75	35.97
	200	0.075	2.66	44.94	21.09	31.94
	dry pan		0.39	45.33	20.70	
	wet pan			20.70	0.00	

 $\begin{array}{lll} d_{10} \ (mm): \ NA & d_{50} \ (mm): \ 0.15 \\ d_{16} \ (mm): \ NA & d_{60} \ (mm): \ 0.19 \\ d_{30} \ (mm): \ NA & d_{84} \ (mm): \ 0.34 \end{array}$ 

Median Particle Diameter -- d<sub>50</sub> (mm): 0.15

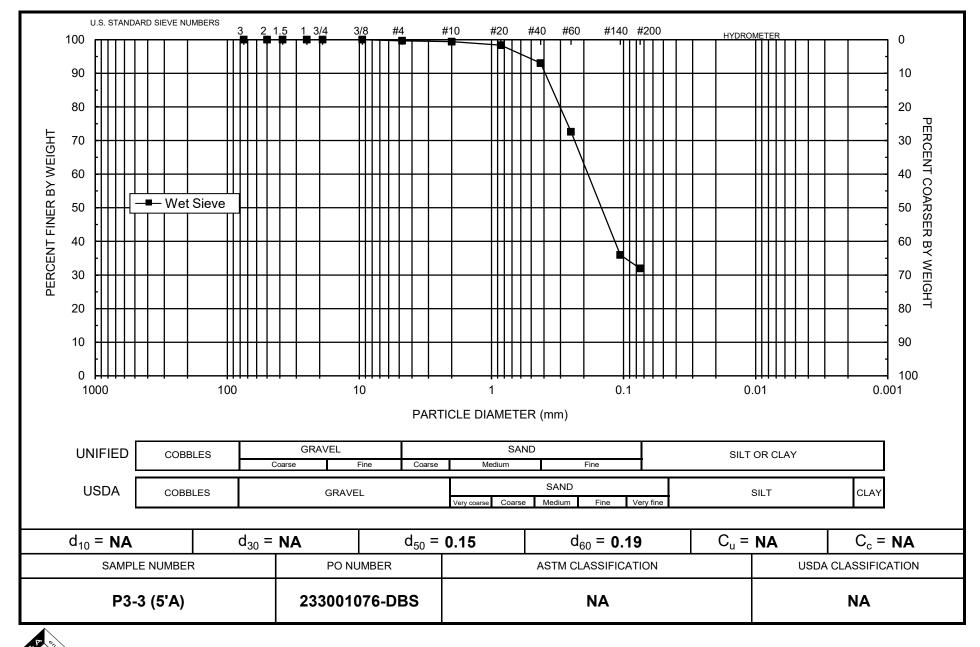
Uniformity Coefficient, Cu--[ $d_{60}/d_{10}$ ] (mm): NA

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): NA

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): NA

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

ASTM Soil Classification: NA USDA Soil Classification: NA





## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Weight Passing #10 (g): 478.89

Sample Number: P3-3 (40'B)

Project Name: St. Anthony Geotech Investigation
PO Number: 233001076-DBS

Weight Retained #10 (g): 22.97
Wt. of -10 Sieve Sample (g): 53.69
Calculated Weight of Sieve Sample (g): 56.27

Test Date: 23-May-18 Shape: Angular

Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10		•				
	3"	75	0.00	0.00	501.86	100.00
	2"	50	0.00	0.00	501.86	100.00
	1.5"	38.1	0.00	0.00	501.86	100.00
	1"	25	0.00	0.00	501.86	100.00
	3/4"	19.0	0.00	0.00	501.86	100.00
	3/8"	9.5	0.00	0.00	501.86	100.00
	4	4.75	7.07	7.07	494.79	98.59
	10	2.00	15.90	22.97	478.89	95.42
-10			(Based on calc	culated sieve wt.	)	
	20	0.85	1.13	3.71	52.56	93.41
	40	0.425	0.97	4.68	51.59	91.69
	60	0.250	1.37	6.05	50.22	89.26
	140	0.106	14.16	20.21	36.06	64.09
	200	0.075	12.28	32.49	23.78	42.26
	dry pan		1.47	33.96	22.31	
	wet pan			22.31	0.00	

 $d_{10}$  (mm): NA  $d_{50}$  (mm): 0.085  $d_{16}$  (mm): NA  $d_{60}$  (mm): 0.099  $d_{30}$  (mm): NA  $d_{84}$  (mm): 0.21

Median Particle Diameter -- d<sub>50</sub> (mm): 0.085

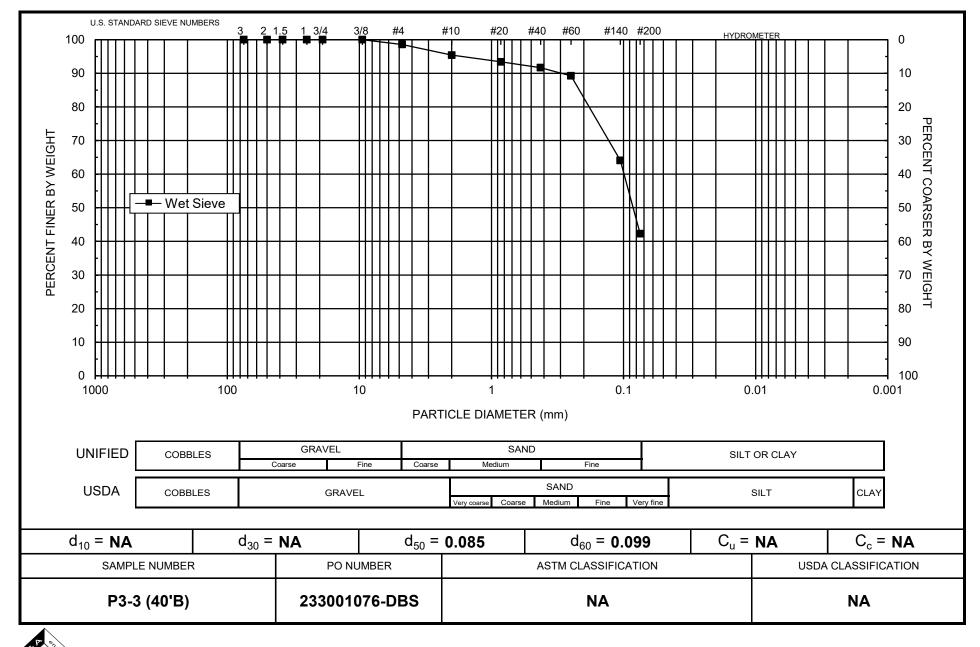
Uniformity Coefficient, Cu--[ $d_{60}/d_{10}$ ] (mm): NA

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}^*d_{60})$ ] (mm): NA

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): NA

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

ASTM Soil Classification: NA USDA Soil Classification: NA





## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name:Stantec Consulting Services IncInitial Dry Weight of Sample (g): 489.96Job Number:DB18.1151.00Weight Passing #10 (g): 489.74

Sample Number: P3-4 (20'A) Weight Retained #10 (g): 0.22
Project Name: St. Anthony Geotech Investigation Wt. of -10 Sieve Sample (g): 64.28

PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 64.28

Test Date: 23-May-18 Shape: Rounded Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	489.96	100.00
	2"	50	0.00	0.00	489.96	100.00
	1.5"	38.1	0.00	0.00	489.96	100.00
	1"	25	0.00	0.00	489.96	100.00
	3/4"	19.0	0.00	0.00	489.96	100.00
	3/8"	9.5	0.00	0.00	489.96	100.00
	4	4.75	0.19	0.19	489.77	99.96
	10	2.00	0.03	0.22	489.74	99.96
-10			(Based on calc	culated sieve wt.	)	
	20	0.85	0.69	0.72	63.59	98.88
	40	0.425	3.81	4.53	59.78	92.96
	60	0.250	28.17	32.70	31.61	49.15
	140	0.106	26.15	58.85	5.46	8.49
	200	0.075	0.78	59.63	4.68	7.28
	dry pan		0.18	59.81	4.50	
	wet pan			4.50	0.00	

 $d_{10}$  (mm): 0.11  $d_{50}$  (mm): 0.25  $d_{16}$  (mm): 0.12  $d_{60}$  (mm): 0.29  $d_{30}$  (mm): 0.17  $d_{84}$  (mm): 0.38

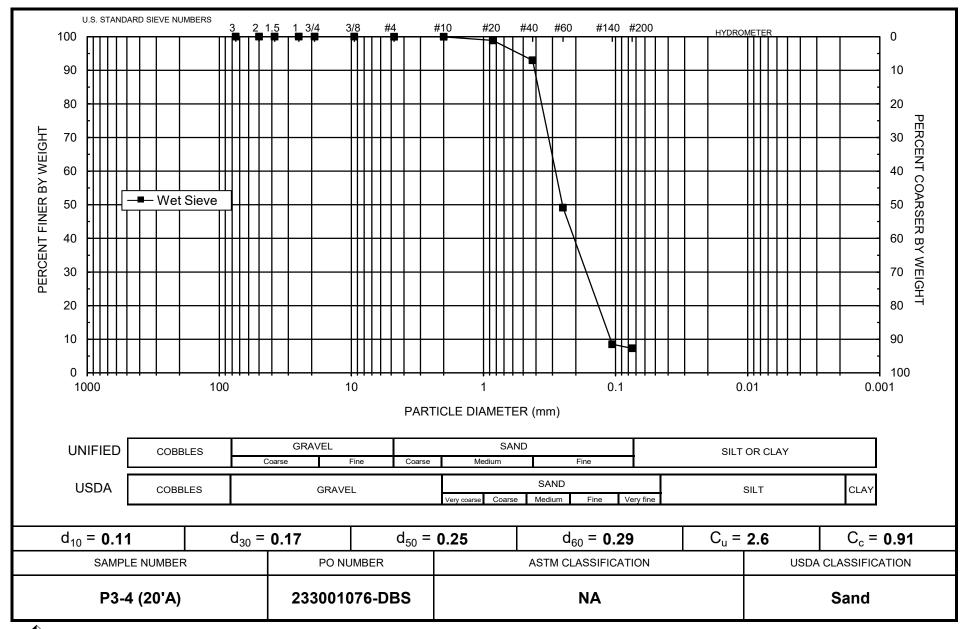
Median Particle Diameter--d<sub>50</sub> (mm): 0.25

Uniformity Coefficient, Cu--[ $d_{60}/d_{10}$ ] (mm): 2.6

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 0.91

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.25

ASTM Soil Classification: NA USDA Soil Classification: Sand







## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name:Stantec Consulting Services IncInitial Dry Weight of Sample (g): 437.63Job Number:DB18.1151.00Weight Passing #10 (g): 437.63

Sample Number: P3-4 (30'A)

Project Name: St. Anthony Geotech Investigation
PO Number: 233001076-DBS

Weight Retained #10 (g): 0.00
Wt. of -10 Sieve Sample (g): 76.13
Calculated Weight of Sieve Sample (g): 76.13

Test Date: 23-May-18 Shape: Angular Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing_
+10						
	3"	75	0.00	0.00	437.63	100.00
	2"	50	0.00	0.00	437.63	100.00
	1.5"	38.1	0.00	0.00	437.63	100.00
	1"	25	0.00	0.00	437.63	100.00
	3/4"	19.0	0.00	0.00	437.63	100.00
	3/8"	9.5	0.00	0.00	437.63	100.00
	4	4.75	0.00	0.00	437.63	100.00
	10	2.00	0.00	0.00	437.63	100.00
-10			(Based on calc	ulated sieve wt.	)	
	20	0.85	0.90	0.90	75.23	98.82
	40	0.425	3.21	4.11	72.02	94.60
	60	0.250	19.75	23.86	52.27	68.66
	140	0.106	44.38	68.24	7.89	10.36
	200	0.075	2.00	70.24	5.89	7.74
	dry pan		0.12	70.36	5.77	
	wet pan			5.77	0.00	

 $d_{10}$  (mm): 0.10  $d_{50}$  (mm): 0.19  $d_{16}$  (mm): 0.12  $d_{60}$  (mm): 0.22  $d_{30}$  (mm): 0.14  $d_{84}$  (mm): 0.34

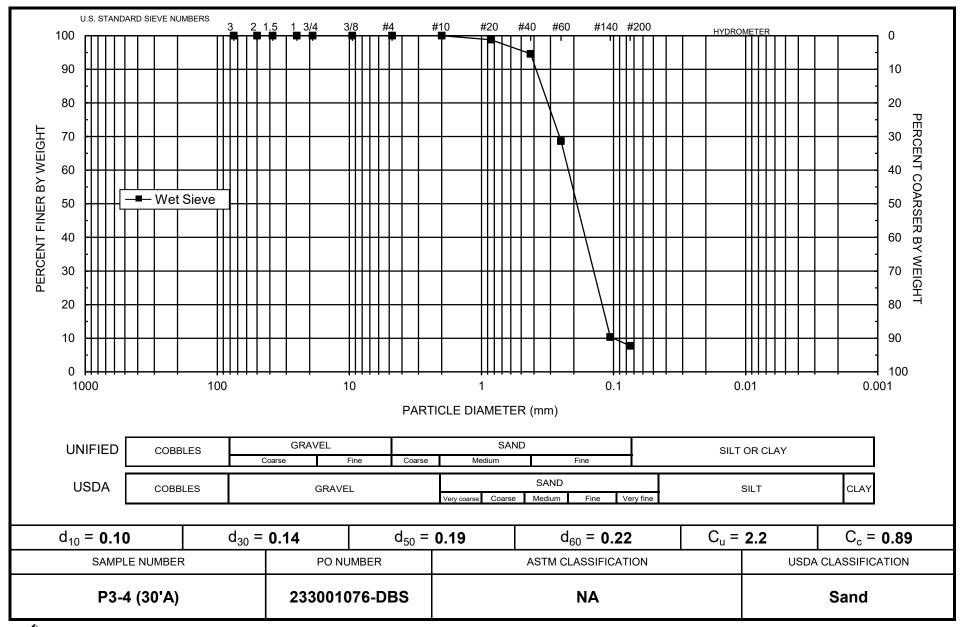
Median Particle Diameter -- d<sub>50</sub> (mm): 0.19

Uniformity Coefficient, Cu--[ $d_{60}/d_{10}$ ] (mm): 2.2

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 0.89

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.22

ASTM Soil Classification: NA USDA Soil Classification: Sand







## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 546.30

 Job Number:
 DB18.1151.00
 Weight Passing #10 (g): 546.30

 Sample Number:
 P3-4 (40'A)
 Weight Retained #10 (g): 0.00

Project Name: St. Anthony Geotech Investigation Weight of Hydrometer Sample (g): 54.62
PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 54.62

Test Date: 24-May-18 Shape: Angular Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	546.30	100.00
	2"	50	0.00	0.00	546.30	100.00
	1.5"	38.1	0.00	0.00	546.30	100.00
	1"	25	0.00	0.00	546.30	100.00
	3/4"	19.0	0.00	0.00	546.30	100.00
	3/8"	9.5	0.00	0.00	546.30	100.00
	4	4.75	0.00	0.00	546.30	100.00
	10	2.00	0.00	0.00	546.30	100.00
-10			(Based on calc	ulated sieve wt.)	)	
	20	0.85	0.03	0.03	54.59	99.95
	40	0.425	0.07	0.10	54.52	99.82
	60	0.250	0.14	0.24	54.38	99.56
	140	0.106	16.01	16.25	38.37	70.25
	200	0.075	10.01	26.26	28.36	51.92
	dry pan		1.23	27.49	27.13	
	wet pan			27.13	0.00	

 $d_{10}$  (mm): 0.0029  $d_{50}$  (mm): 0.072  $d_{16}$  (mm): 0.0099  $d_{60}$  (mm): 0.087  $d_{30}$  (mm): 0.044  $d_{84}$  (mm): 0.16

Median Particle Diameter-- $d_{50}$  (mm): 0.072 Uniformity Coefficient, Cu-- $[d_{60}/d_{10}]$  (mm): 30 Coefficient of Curvature, Cc-- $[(d_{30})^2/(d_{10}*d_{60})]$  (mm): 7.7 Mean Particle Diameter-- $[(d_{16}+d_{50}+d_{84})/3]$  (mm): 0.081

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Sandy Loam



## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: P3-4 (40'A)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 18-May-18 Initial Wt. (g): 54.62

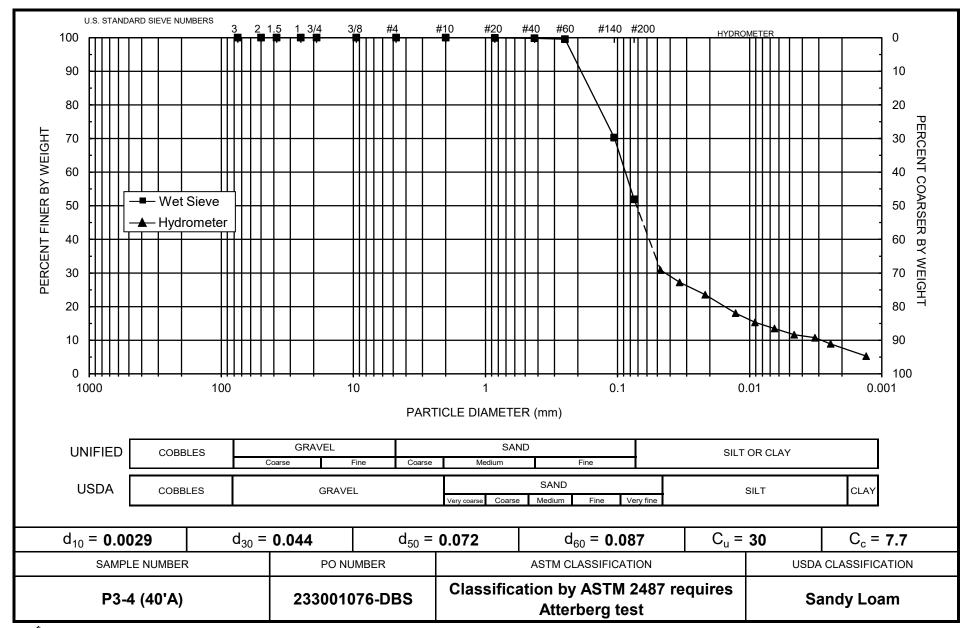
Test Date: 18-May-18 Total Sample Wt. (g): 546.30

Start Time: 9:42 Wt. Passing #10 (g): 546.30

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
18-May-18	1	21.6	23.0	6.1	16.9	12.5	0.04729	30.9	30.9
	2	21.6	21.0	6.1	14.9	12.9	0.03388	27.2	27.2
	5	21.6	19.0	6.1	12.9	13.2	0.02170	23.5	23.5
	15	21.6	16.0	6.1	9.9	13.7	0.01276	18.1	18.1
	30	21.6	14.5	6.1	8.4	13.9	0.00910	15.3	15.3
	60	21.6	13.5	6.1	7.4	14.1	0.00647	13.5	13.5
	120	21.6	12.5	6.1	6.4	14.3	0.00460	11.6	11.6
	250	21.6	12.0	6.1	5.9	14.3	0.00320	10.7	10.7
	436	21.6	11.0	6.1	4.9	14.5	0.00244	8.9	8.9
19-May-18	1534	21.7	9.0	6.1	2.9	14.8	0.00131	5.3	5.3

### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device







## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 530.27

Job Number: DB18.1151.00 Sample Number: P3-5 (10'A)

Ample Number: P3-5 (10'A)

Project Name: St. Anthony Geotech Investigation

Weight Retained #10 (g): 0.00

Weight of Hydrometer Sample (g): 51.69

Weight Passing #10 (g): 530.27

PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 51.69

Test Date: 21-May-18 Shape: Angular Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	530.27	100.00
	2"	50	0.00	0.00	530.27	100.00
	1.5"	38.1	0.00	0.00	530.27	100.00
	1"	25	0.00	0.00	530.27	100.00
	3/4"	19.0	0.00	0.00	530.27	100.00
	3/8"	9.5	0.00	0.00	530.27	100.00
	4	4.75	0.00	0.00	530.27	100.00
	10	2.00	0.00	0.00	530.27	100.00
-10			(Based on calcı	ulated sieve wt.)	)	
	20	0.85	0.24	0.24	51.45	99.54
	40	0.425	0.48	0.72	50.97	98.61
	60	0.250	0.74	1.46	50.23	97.18
	140	0.106	21.82	23.28	28.41	54.96
	200	0.075	12.18	35.46	16.23	31.40
	dry pan		1.16	36.62	15.07	
	wet pan			15.07	0.00	

 $d_{10}$  (mm): 0.020  $d_{50}$  (mm): 0.099  $d_{16}$  (mm): 0.040  $d_{60}$  (mm): 0.12  $d_{30}$  (mm): 0.072  $d_{84}$  (mm): 0.19

Median Particle Diameter--d<sub>50</sub> (mm): 0.099

Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 6.0

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}^*d_{60})$ ] (mm): 2.2 Mean Particle Diameter--[ $(d_{16}^+d_{50}^+d_{84}^+)/3$ ] (mm): 0.11

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Loamy Sand



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: P3-5 (10'A)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 17-May-18

Total Sample Wt. (g): 51.69

Total Sample Wt. (g): 530.27

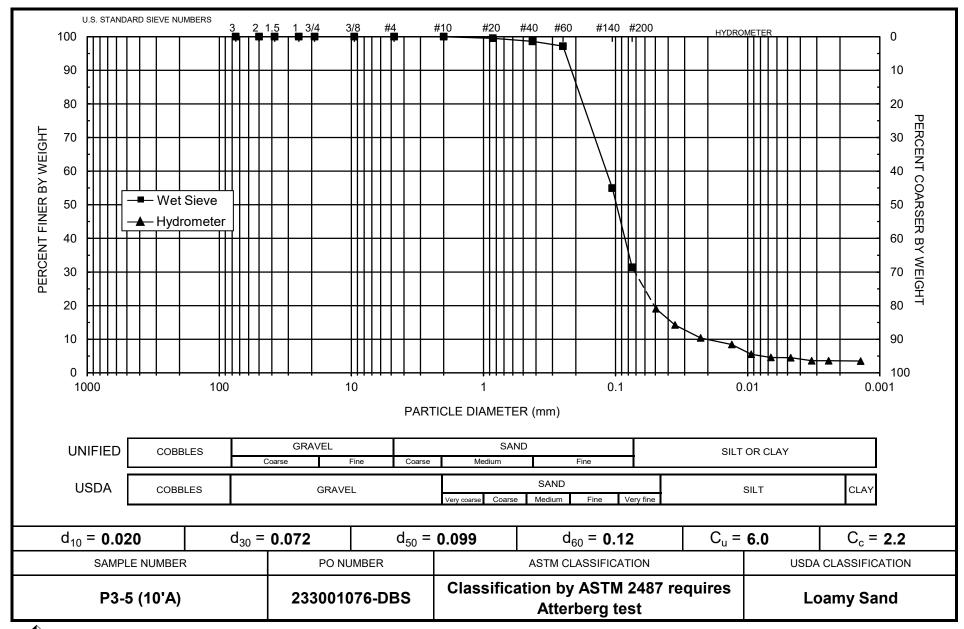
Start Time: 9:24

Wt. Passing #10 (g): 530.27

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
47.14		0.4.0	40.0			40.7	0.04044	40.4	40.4
17-May-18	1	21.6	16.0	6.1	9.9	13.7	0.04941	19.1	19.1
	2	21.6	13.5	6.1	7.4	14.1	0.03546	14.2	14.2
	5	21.6	11.5	6.1	5.4	14.4	0.02269	10.4	10.4
	15	21.6	10.5	6.1	4.4	14.6	0.01317	8.4	8.4
	30	21.6	9.0	6.1	2.9	14.8	0.00939	5.5	5.5
	60	21.6	8.5	6.1	2.4	14.9	0.00666	4.6	4.6
	120	21.5	8.5	6.2	2.3	14.9	0.00472	4.5	4.5
	250	21.6	8.0	6.1	1.9	15.0	0.00327	3.6	3.6
	451	21.7	8.0	6.1	1.9	15.0	0.00243	3.6	3.6
18-May-18	1384	21.4	8.0	6.2	1.8	15.0	0.00139	3.5	3.5

### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device







## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Initial Dry Weight of Sample (g): 504.36

Weight Passing #10 (g): 504.12

Sample Number: P3-6 (20'A)

Project Name: St. Anthony Geotech Investigation

Weight Retained #10 (g): 0.24

Weight Retained #10 (g): 67.91

PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 67.94

Test Date: 23-May-18 Shape: Angular Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	504.36	100.00
	2"	50	0.00	0.00	504.36	100.00
	1.5"	38.1	0.00	0.00	504.36	100.00
	1"	25	0.00	0.00	504.36	100.00
	3/4"	19.0	0.00	0.00	504.36	100.00
	3/8"	9.5	0.00	0.00	504.36	100.00
	4	4.75	0.00	0.00	504.36	100.00
	10	2.00	0.24	0.24	504.12	99.95
-10			(Based on calc	ulated sieve wt.	)	
	20	0.85	0.74	0.77	67.17	98.86
	40	0.425	4.63	5.40	62.54	92.05
	60	0.250	20.41	25.81	42.13	62.01
	140	0.106	30.53	56.34	11.60	17.07
	200	0.075	1.53	57.87	10.07	14.82
	dry pan		0.27	58.14	9.80	
	wet pan			9.80	0.00	

 $d_{10}$  (mm): NA  $d_{50}$  (mm): 0.20  $d_{16}$  (mm): 0.090  $d_{60}$  (mm): 0.24  $d_{30}$  (mm): 0.14  $d_{84}$  (mm): 0.37

Median Particle Diameter -- d<sub>50</sub> (mm): 0.20

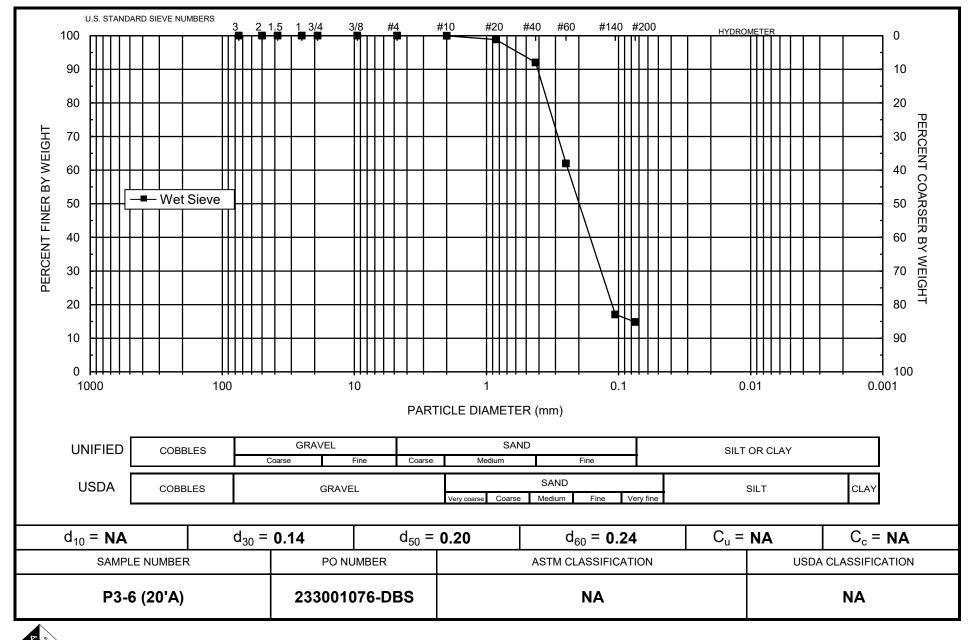
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): NA

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): NA

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.22

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

ASTM Soil Classification: NA USDA Soil Classification: NA





# Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name:Stantec Consulting Services IncInitial Dry Weight of Sample (g): 516.43Job Number:DB18.1151.00Weight Passing #10 (g): 478.59

Sample Number: P3-6 (50'A) Weight Retained #10 (g): 37.84

Project Name: St. Anthony Geotech Investigation Wt. of -10 Sieve Sample (g): 53.46

PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 57.69

Test Date: 23-May-18 Shape: Angular

Hardness: Hard and durable

Test	Sieve	Diameter	Wt.	Cum Wt.	Wt.	
Fraction	Number	(mm)	Retained	Retained	Passing	% Passing
+10						
	3"	75	0.00	0.00	516.43	100.00
	2"	50	0.00	0.00	516.43	100.00
	1.5"	38.1	0.00	0.00	516.43	100.00
	1"	25	24.39	24.39	492.04	95.28
	3/4"	19.0	0.00	24.39	492.04	95.28
	3/8"	9.5	11.43	35.82	480.61	93.06
	4	4.75	1.21	37.03	479.40	92.83
	10	2.00	0.81	37.84	478.59	92.67
-10			(Based on calc	ulated sieve wt.	)	
	20	0.85	3.87	8.10	49.59	85.96
	40	0.425	6.71	14.81	42.88	74.33
	60	0.250	12.35	27.16	30.53	52.92
	140	0.106	18.46	45.62	12.07	20.92
	200	0.075	2.61	48.23	9.46	16.40
	dry pan		0.22	48.45	9.24	
	wet pan			9.24	0.00	

 $\begin{array}{lll} d_{10} \ (mm): \ NA & d_{50} \ (mm): \ 0.23 \\ d_{16} \ (mm): \ 0.073 & d_{60} \ (mm): \ 0.30 \\ d_{30} \ (mm): \ 0.14 & d_{84} \ (mm): \ 0.76 \end{array}$ 

Median Particle Diameter -- d<sub>50</sub> (mm): 0.23

Uniformity Coefficient, Cu--[ $d_{60}/d_{10}$ ] (mm): NA

Coefficient of Curvature, Cc--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): NA

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.35

Classification of fines (visual method): ML

ASTM Soil Classification: Silty sand (SM)

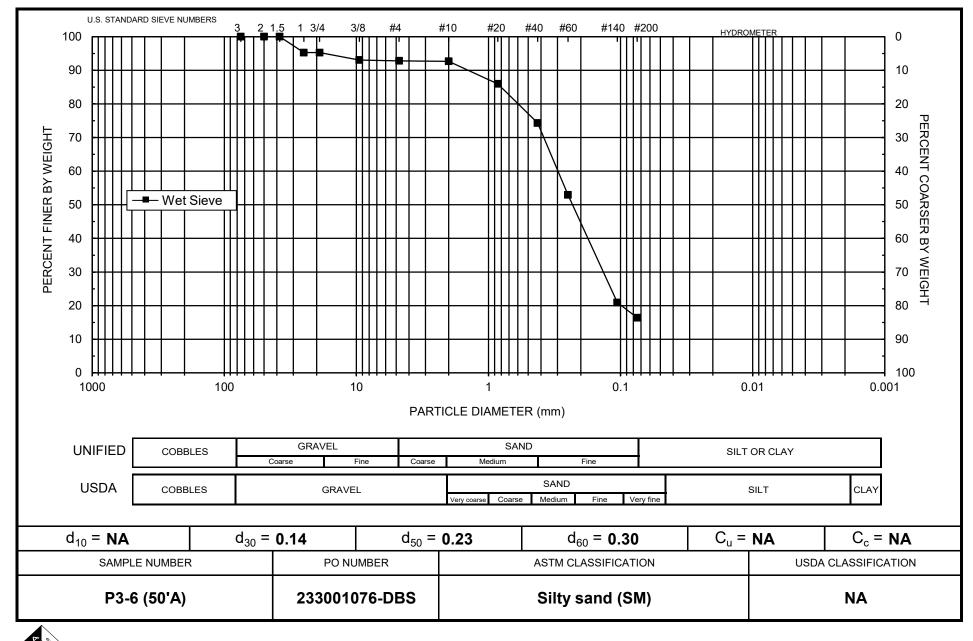
USDA Soil Classification: NA

Laboratory analysis by: Z. Calhoun

Data entered by: M. Garcia

Checked by: J. Hines

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter





## **Particle Size Analysis** Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 466.53 Job Number: DB18.1151.00 Weight Passing #10 (g): 348.80

Sample Number: P4-5 (20'A) Weight Retained #10 (g): 117.73 Project Name: St. Anthony Geotech Investigation Wt. of -10 Sieve Sample (g): 79.83 PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 106.77

Test Date: 23-May-18

	Shape:	Angular
Ha	ardness:	Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
Traction	Number	(111111)	Netaineu	Netaineu	rassing	70 Fassing
+10						
	3"	75	0.00	0.00	466.53	100.00
	2"	50	0.00	0.00	466.53	100.00
	1.5"	38.1	0.00	0.00	466.53	100.00
	1"	25	30.38	30.38	436.15	93.49
	3/4"	19.0	73.43	103.81	362.72	77.75
	3/8"	9.5	11.00	114.81	351.72	75.39
	4	4.75	1.17	115.98	350.55	75.14
	10	2.00	1.75	117.73	348.80	74.76
-10			(Based on calc	culated sieve wt.	)	
	20	0.85	4.15	31.09	75.68	70.88
	40	0.425	8.37	39.46	67.31	63.04
	60	0.250	21.50	60.96	45.81	42.90
	140	0.106	27.64	88.60	18.17	17.02
	200	0.075	3.11	91.71	15.06	14.10
	dry pan		0.44	92.15	14.62	
	wet pan			14.62	0.00	

d<sub>10</sub> (mm): NA d<sub>50</sub> (mm): 0.30 d<sub>16</sub> (mm): 0.094 d<sub>60</sub> (mm): 0.39 d<sub>30</sub> (mm): 0.16 d<sub>84</sub> (mm): 21

Median Particle Diameter -- d<sub>50</sub> (mm): 0.30

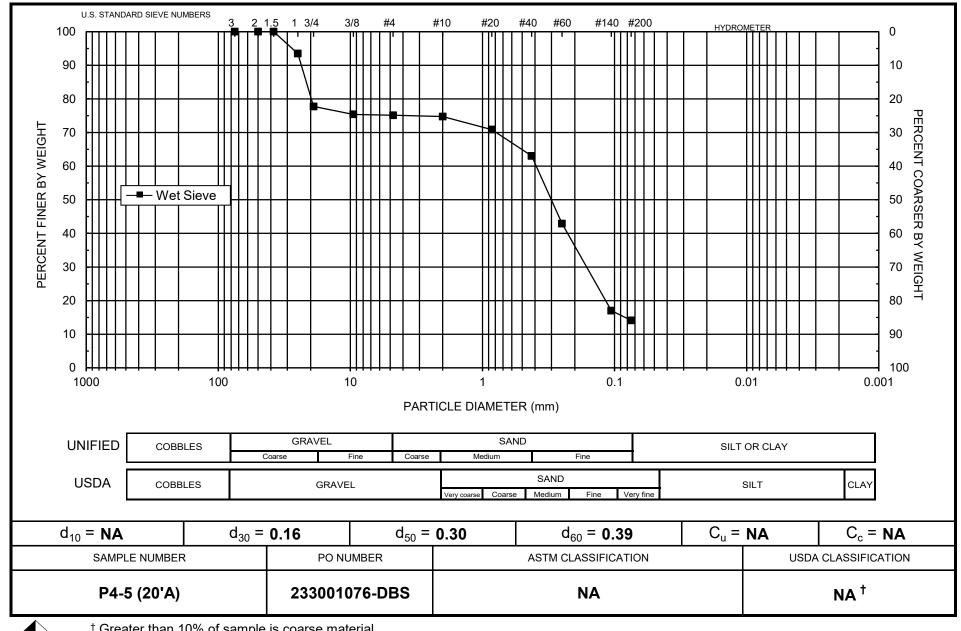
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): NA Coefficient of Curvature, Cc--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): NA

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 7.1

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: NA USDA Soil Classification: NA †

<sup>†</sup> Greater than 10% of sample is coarse material



<sup>†</sup> Greater than 10% of sample is coarse material

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and ASTM classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Daniel B. Stephens & Associates, Inc.



## **Particle Size Analysis** Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 462.06

Weight Passing #10 (g): 462.06

Job Number: DB18.1151.00 Sample Number: P4-6 (10'A)

Weight Retained #10 (g): 0.00

Project Name: St. Anthony Geotech Investigation

Weight of Hydrometer Sample (g): 51.81

PO Number: 233001076-DBS

Test Date: 21-May-18

Calculated Weight of Sieve Sample (g): 51.81

Shape: Angular

Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	462.06	100.00
	2"	50	0.00	0.00	462.06	100.00
	1.5"	38.1	0.00	0.00	462.06	100.00
	1"	25	0.00	0.00	462.06	100.00
	3/4"	19.0	0.00	0.00	462.06	100.00
	3/8"	9.5	0.00	0.00	462.06	100.00
	4	4.75	0.00	0.00	462.06	100.00
	10	2.00	0.00	0.00	462.06	100.00
-10			(Based on calcı	ulated sieve wt.)	)	
	20	0.85	2.10	2.10	49.71	95.95
	40	0.425	1.18	3.28	48.53	93.67
	60	0.250	0.88	4.16	47.65	91.97
	140	0.106	7.66	11.82	39.99	77.19
	200	0.075	13.05	24.87	26.94	52.00
	dry pan		0.98	25.85	25.96	
	wet pan			25.96	0.00	

d<sub>10</sub> (mm): 0.0012 d<sub>50</sub> (mm): 0.072 d<sub>16</sub> (mm): 0.0087 d<sub>60</sub> (mm): 0.084 d<sub>30</sub> (mm): 0.048 d<sub>84</sub> (mm): 0.16

Median Particle Diameter -- d<sub>50</sub> (mm): 0.072

Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 70

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 23

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.080

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Sandy Loam



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: P4-6 (10'A)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 17-May-18

Total Sample Wt. (g): 51.81

Total Sample Wt. (g): 462.06

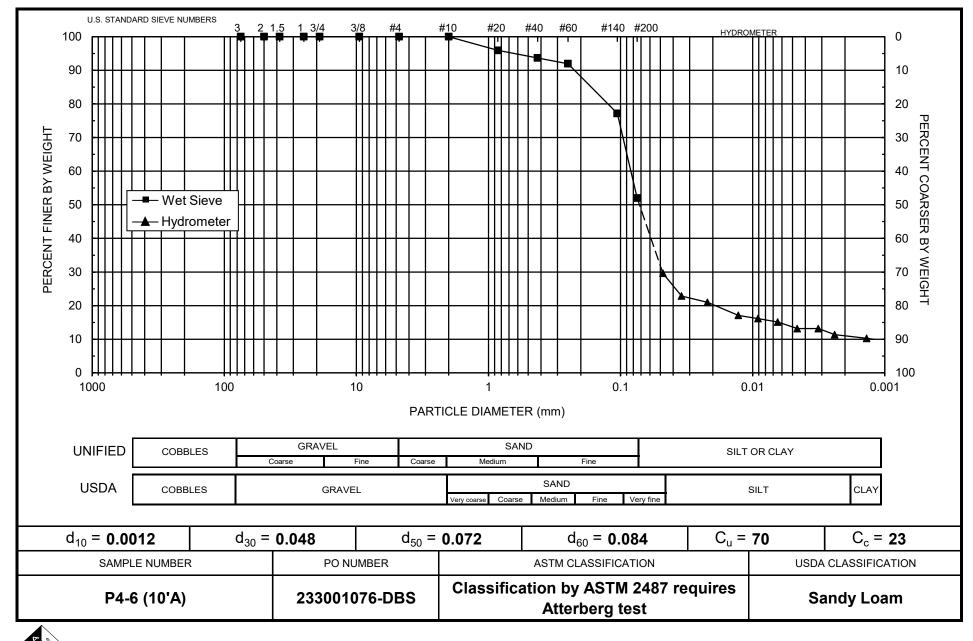
Start Time: 9:30

Wt. Passing #10 (g): 462.06

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
17-May-18	1	21.6	21.5	6.2	15.3	12.8	0.04778	29.6	29.6
	2	21.6	18.0	6.2	11.8	13.3	0.03454	22.9	22.9
	5	21.6	17.0	6.1	10.9	13.5	0.02196	21.0	21.0
	15	21.6	15.0	6.1	8.9	13.8	0.01283	17.1	17.1
	30	21.6	14.5	6.1	8.4	13.9	0.00910	16.1	16.1
	60	21.5	14.0	6.2	7.8	14.0	0.00646	15.1	15.1
	120	21.5	13.0	6.2	6.8	14.2	0.00460	13.2	13.2
	250	21.6	13.0	6.2	6.8	14.2	0.00318	13.2	13.2
	446	21.7	12.0	6.1	5.9	14.3	0.00239	11.3	11.3
18-May-18	1379	21.4	11.5	6.2	5.3	14.4	0.00137	10.2	10.2

### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device





## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name:Stantec Consulting Services IncInitial Dry Weight of Sample (g): 392.69Job Number:DB18.1151.00Weight Passing #10 (g): 363.52

Sample Number: P4-7 (5'A) Weight Retained #10 (g): 29.17
Project Name: St. Anthony Geotech Investigation Wt. of -10 Sieve Sample (g): 70.76

PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 76.44

Test Date: 23-May-18 Shape: Angular Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	392.69	100.00
	2"	50	0.00	0.00	392.69	100.00
	1.5"	38.1	0.00	0.00	392.69	100.00
	1"	25	0.00	0.00	392.69	100.00
	3/4"	19.0	0.00	0.00	392.69	100.00
	3/8"	9.5	19.91	19.91	372.78	94.93
	4	4.75	8.24	28.15	364.54	92.83
	10	2.00	1.02	29.17	363.52	92.57
-10			(Based on calc	culated sieve wt.	)	
	20	0.85	2.09	7.77	68.67	89.84
	40	0.425	1.75	9.52	66.92	87.55
	60	0.250	4.75	14.27	62.17	81.33
	140	0.106	12.43	26.70	49.74	65.07
	200	0.075	12.32	39.02	37.42	48.95
	dry pan		1.84	40.86	35.58	
	wet pan			35.58	0.00	

 $d_{10}$  (mm): NA  $d_{50}$  (mm): 0.077  $d_{16}$  (mm): NA  $d_{60}$  (mm): 0.095  $d_{30}$  (mm): NA  $d_{84}$  (mm): 0.31

Median Particle Diameter -- d<sub>50</sub> (mm): 0.077

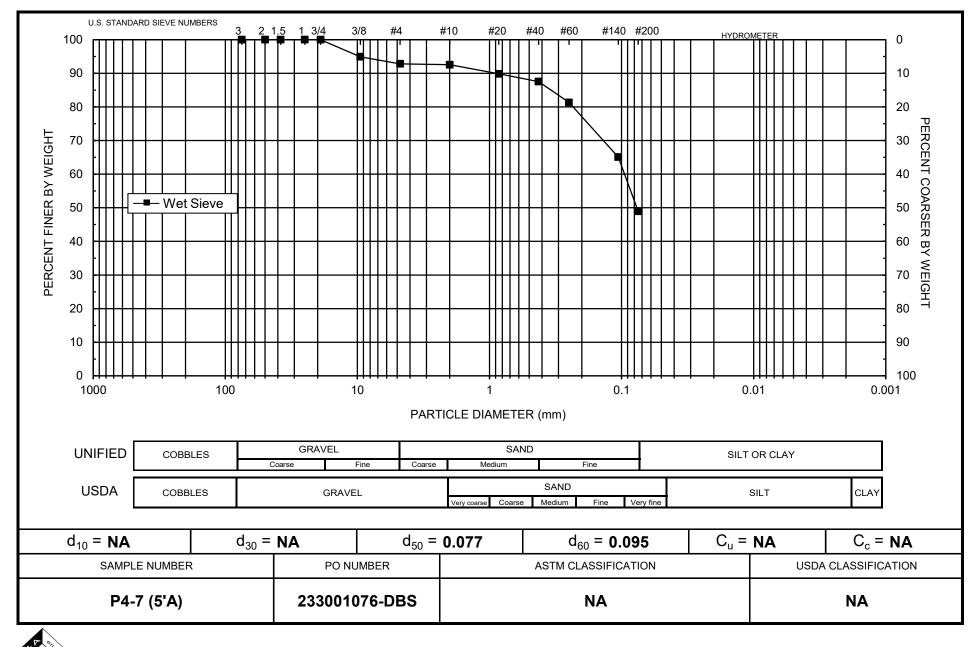
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): NA

Coefficient of Curvature, Cc--[(d $_{30}$ ) $^2$ /(d $_{10}$ \*d $_{60}$ )] (mm): NA

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): NA

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

ASTM Soil Classification: NA USDA Soil Classification: NA





## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 512.00

Weight Passing #10 (g): 512.00

Job Number: DB18.1151.00 Sample Number: P4-7 (25'B)

Weight Retained #10 (g): 512.0

Project Name: St. Anthony Geotech Investigation

Weight of Hydrometer Sample (g): 63.98

PO Number: 233001076-DBS

Calculated Weight of Sieve Sample (g): 63.98

Test Date: 21-May-18 Shape: Angular Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						_
	3"	75	0.00	0.00	512.00	100.00
	2"	50	0.00	0.00	512.00	100.00
	1.5"	38.1	0.00	0.00	512.00	100.00
	1"	25	0.00	0.00	512.00	100.00
	3/4"	19.0	0.00	0.00	512.00	100.00
	3/8"	9.5	0.00	0.00	512.00	100.00
	4	4.75	0.00	0.00	512.00	100.00
	10	2.00	0.00	0.00	512.00	100.00
-10			(Based on calcu	ulated sieve wt.	)	
	20	0.85	1.36	1.36	62.62	97.87
	40	0.425	15.92	17.28	46.70	72.99
	60	0.250	18.56	35.84	28.14	43.98
	140	0.106	12.11	47.95	16.03	25.05
	200	0.075	1.34	49.29	14.69	22.96
	dry pan		0.11	49.40	14.58	
	wet pan			14.58	0.00	

 $d_{10}$  (mm): 0.0052  $d_{50}$  (mm): 0.28  $d_{16}$  (mm): 0.026  $d_{60}$  (mm): 0.34  $d_{30}$  (mm): 0.13  $d_{84}$  (mm): 0.58

 $\label{eq:median Particle Diameter--d} \begin{tabular}{ll} \textit{Median Particle Diameter--}$d_{50} (mm): 0.28 \\ \textit{Uniformity Coefficient, Cu--}[d_{60}/d_{10}] (mm): 65 \\ \textit{Coefficient of Curvature, Cc--}[(d_{30})^2/(d_{10}*d_{60})] (mm): 9.6 \\ \textit{Mean Particle Diameter--}[(d_{16}+d_{50}+d_{84})/3] (mm): 0.30 \\ \end{tabular}$ 

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Loamy Sand

Laboratory analysis by: J. Hines/M. Garcia
Data entered by: M. Garcia
Checked by: J. Hines



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: P4-7 (25'B)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 17-May-18

Total Sample Wt. (g): 63.98

Total Sample Wt. (g): 512.00

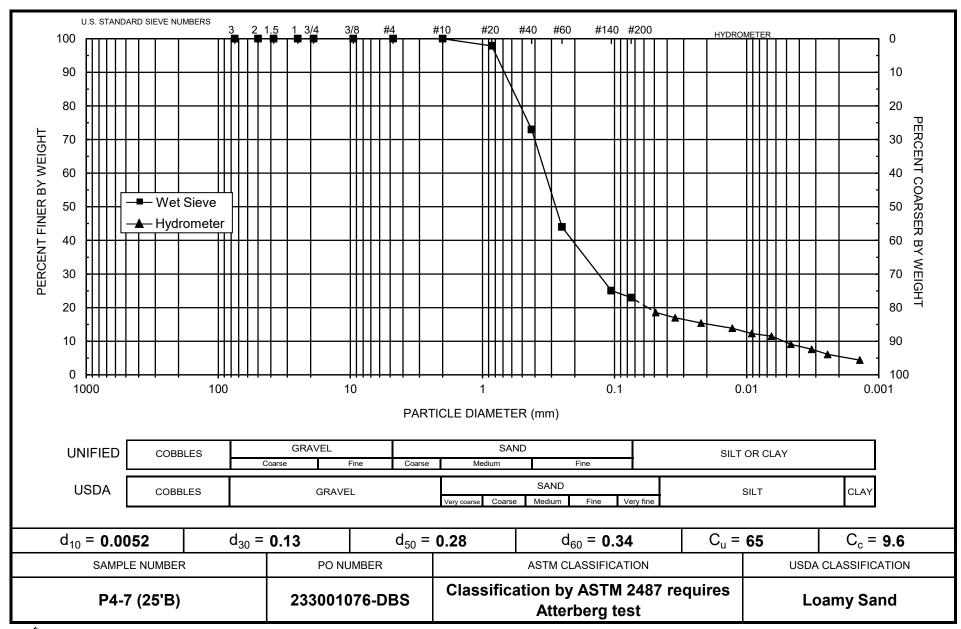
Start Time: 9:36

Wt. Passing #10 (g): 512.00

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
17-May-18	1	21.6	18.0	6.1	11.9	13.3	0.04882	18.5	18.5
	2	21.6	17.0	6.1	10.9	13.5	0.03473	17.0	17.0
	5	21.6	16.0	6.1	9.9	13.7	0.02210	15.4	15.4
	15	21.6	15.0	6.1	8.9	13.8	0.01283	13.8	13.8
	30	21.6	14.0	6.1	7.9	14.0	0.00913	12.3	12.3
	60	21.6	13.5	6.1	7.4	14.1	0.00647	11.5	11.5
	120	21.5	12.0	6.2	5.8	14.3	0.00463	9.1	9.1
	250	21.6	11.0	6.1	4.9	14.5	0.00322	7.6	7.6
	441	21.7	10.0	6.1	3.9	14.7	0.00243	6.1	6.1
18-May-18	1374	21.4	9.0	6.2	2.8	14.8	0.00139	4.4	4.4

### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device







## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 447.92

 Job Number:
 DB18.1151.00
 Weight Passing #10 (g): 441.77

 Sample Number:
 P4-8 (15'B)
 Weight Retained #10 (g): 6.15

Project Name: St. Anthony Geotech Investigation Weight of Hydrometer Sample (g): 53.46
PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 54.20

Test Date: 22-May-18 Shape: Angular Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	447.92	100.00
	2"	50	0.00	0.00	447.92	100.00
	1.5"	38.1	0.00	0.00	447.92	100.00
	1"	25	0.00	0.00	447.92	100.00
	3/4"	19.0	0.00	0.00	447.92	100.00
	3/8"	9.5	0.00	0.00	447.92	100.00
	4	4.75	2.23	2.23	445.69	99.50
	10	2.00	3.92	6.15	441.77	98.63
-10			(Based on calcu	ulated sieve wt.)		
	20	0.85	3.56	4.30	49.90	92.06
	40	0.425	3.26	7.56	46.64	86.04
	60	0.250	2.80	10.36	43.84	80.88
	140	0.106	14.27	24.63	29.57	54.55
	200	0.075	3.78	28.41	25.79	47.58
	dry pan		0.41	28.82	25.38	
	wet pan			25.38	0.00	

 $\begin{array}{lll} d_{10} \, (mm) \!\!: \!\! 0.0011 & d_{50} \, (mm) \!\!: \!\! 0.085 \\ d_{16} \, (mm) \!\!: \!\! 0.0061 & d_{60} \, (mm) \!\!: \!\! 0.13 \\ d_{30} \, (mm) \!\!: \!\! 0.027 & d_{84} \, (mm) \!\!: \!\! 0.34 \end{array}$ 

Median Particle Diameter--d<sub>50</sub> (mm): 0.085

Uniformity Coefficient, Cu -- [d<sub>60</sub>/d<sub>10</sub>] (mm): 118

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}^*d_{60})$ ] (mm): 5.1

Mean Particle Diameter --  $[(d_{16}+d_{50}+d_{84})/3]$  (mm): 0.14

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Sandy Loam

Laboratory analysis by: M. Garcia/Z. Calhoun

Data entered by: M. Garcia Checked by: J. Hines



## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: P4-8 (15'B)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 17-May-18

Start Time: 9:42

Initial Wt. (g): 53.46

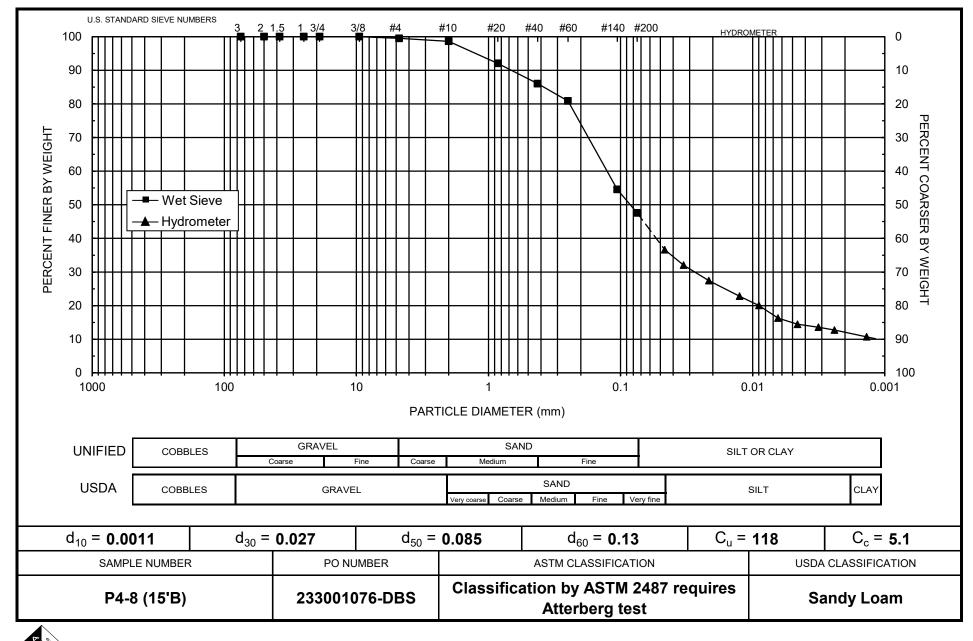
Total Sample Wt. (g): 447.92

Wt. Passing #10 (g): 441.77

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
17-May-18	1	21.6	26.0	6.1	19.9	12.0	0.04636	37.1	36.6
	2	21.6	23.5	6.1	17.4	12.4	0.03333	32.5	32.0
	5	21.6	21.0	6.1	14.9	12.9	0.02143	27.8	27.4
	15	21.6	18.5	6.1	12.4	13.3	0.01257	23.1	22.8
	30	21.6	17.0	6.1	10.9	13.5	0.00897	20.3	20.0
	60	21.5	15.0	6.2	8.8	13.8	0.00642	16.5	16.3
	120	21.5	14.0	6.2	7.8	14.0	0.00457	14.6	14.4
	250	21.6	13.5	6.1	7.4	14.1	0.00317	13.8	13.6
	436	21.8	13.0	6.1	6.9	14.2	0.00240	12.9	12.7
18-May-18	1369	21.4	12.0	6.2	5.8	14.3	0.00137	10.9	10.7

### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device





## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc

Initial Dry Weight of Sample (g): 471.98

Job Number: DB18.1151.00

Weight Passing #10 (g): 382.23

Sample Number: P4-9 (35'B)

Weight Retained #10 (g): 89.75 Weight of Hydrometer Sample (g): 52.47

Project Name: St. Anthony Geotech Investigation

Calculated Weight of Sieve Sample (g): 64.79

PO Number: 233001076-DBS

Observe Sample (g).

Test Date: 21-May-18

Shape: Angular Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10		, ,				
	3"	75	0.00	0.00	471.98	100.00
	2"	50	0.00	0.00	471.98	100.00
	1.5"	38.1	0.00	0.00	471.98	100.00
	1"	25	0.00	0.00	471.98	100.00
	3/4"	19.0	19.43	19.43	452.55	95.88
	3/8"	9.5	37.71	57.14	414.84	87.89
	4	4.75	16.82	73.96	398.02	84.33
	10	2.00	15.79	89.75	382.23	80.98
-10			(Based on calcu	ulated sieve wt.	)	
	20	0.85	2.15	14.47	50.32	77.67
	40	0.425	1.87	16.34	48.45	74.78
	60	0.250	2.63	18.97	45.82	70.72
	140	0.106	5.03	24.00	40.79	62.96
	200	0.075	3.36	27.36	37.43	57.77
	dry pan		0.79	28.15	36.64	
	wet pan			36.64	0.00	

d<sub>10</sub> (mm): 6.7E-06

d<sub>50</sub> (mm): 0.061

d<sub>16</sub> (mm): 0.0035 d<sub>30</sub> (mm): 0.026 d<sub>60</sub> (mm): 0.087 d<sub>84</sub> (mm): 4.4

Median Particle Diameter -- d<sub>50</sub> (mm): 0.061

Uniformity Coefficient, Cu -- [d<sub>60</sub>/d<sub>10</sub>] (mm): 1.3E+04

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 1160

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 1.5

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Loam †

<sup>†</sup> Greater than 10% of sample is coarse material

Laboratory analysis by: M. Garcia/Z. Calhoun Data entered by: M. Garcia

Checked by: J. Hines



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: P4-9 (35'B)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

Test Date: 17-May-18

Start Time: 9:54

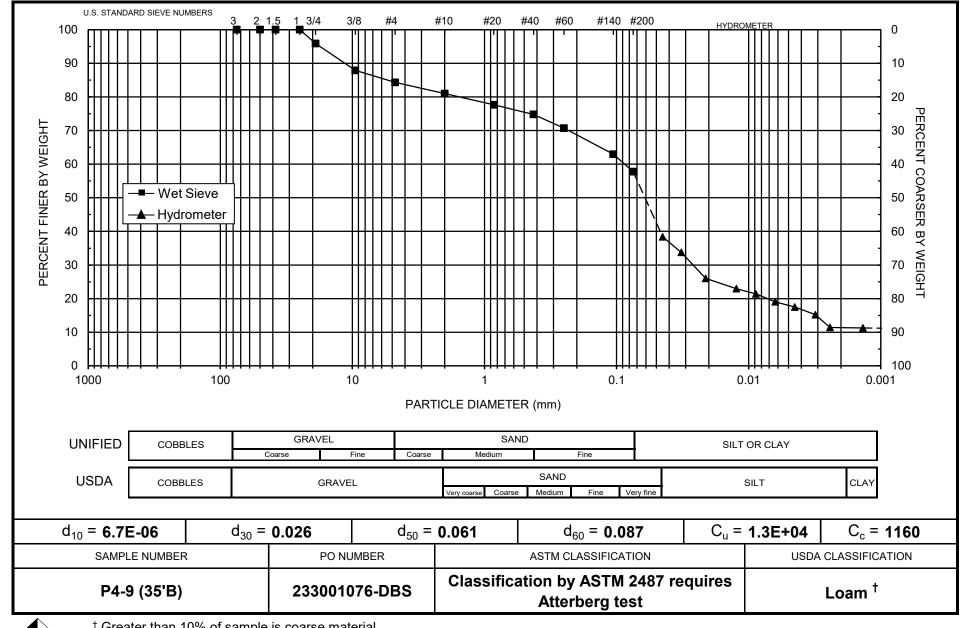
Total Sample Wt. (g): 471.98

Wt. Passing #10 (g): 382.23

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
17-May-18	1	21.6	31.0	6.1	24.9	11.2	0.04475	47.4	38.4
	2	21.6	28.0	6.1	21.9	11.7	0.03233	41.7	33.7
	5	21.6	23.0	6.1	16.9	12.5	0.02115	32.1	26.0
	15	21.6	21.0	6.1	14.9	12.9	0.01237	28.3	22.9
	30	21.6	20.0	6.1	13.9	13.0	0.00880	26.4	21.4
	60	21.5	18.5	6.2	12.3	13.3	0.00629	23.5	19.0
	120	21.5	17.5	6.2	11.3	13.4	0.00448	21.6	17.5
	250	21.6	16.0	6.1	9.9	13.7	0.00313	18.8	15.2
	426	21.8	13.5	6.1	7.4	14.1	0.00242	14.1	11.4
18-May-18	1359	21.4	13.5	6.2	7.3	14.1	0.00136	13.9	11.3

### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device



<sup>†</sup> Greater than 10% of sample is coarse material

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and ASTM classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Daniel B. Stephens & Associates, Inc.



# Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 400.84

Job Number: DB18.1151.00 Weight Passing #10 (g): 400.84 Sample Number: BW-1 (20'A) Weight Retained #10 (g): 0.00

Project Name: St. Anthony Geotech Investigation Weight of Hydrometer Sample (g): 53.41

PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 53.41

Test Date: 18-May-18 Shape: Rounded Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	400.84	100.00
	2"	50	0.00	0.00	400.84	100.00
	1.5"	38.1	0.00	0.00	400.84	100.00
	1"	25	0.00	0.00	400.84	100.00
	3/4"	19.0	0.00	0.00	400.84	100.00
	3/8"	9.5	0.00	0.00	400.84	100.00
	4	4.75	0.00	0.00	400.84	100.00
	10	2.00	0.00	0.00	400.84	100.00
-10			(Based on calcu	ulated sieve wt.)	)	
	20	0.85	0.12	0.12	53.29	99.78
	40	0.425	0.36	0.48	52.93	99.10
	60	0.250	1.22	1.70	51.71	96.82
	140	0.106	12.74	14.44	38.97	72.96
	200	0.075	9.80	24.24	29.17	54.62
	dry pan		2.09	26.33	27.08	
	wet pan			27.08	0.00	

 $\begin{array}{lll} d_{10} \ (mm): \ 0.0012 & d_{50} \ (mm): \ 0.047 \\ d_{16} \ (mm): \ 0.0017 & d_{60} \ (mm): \ 0.083 \\ d_{30} \ (mm): \ 0.011 & d_{84} \ (mm): \ 0.16 \end{array}$ 

Median Particle Diameter--d<sub>50</sub> (mm): 0.047

Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 69

Coefficient of Curvature, Cc --[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 1.2

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.070

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Loam



## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: BW-1 (20'A)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 16-May-18

Start Time: 9:18

Initial Wt. (g): 53.41

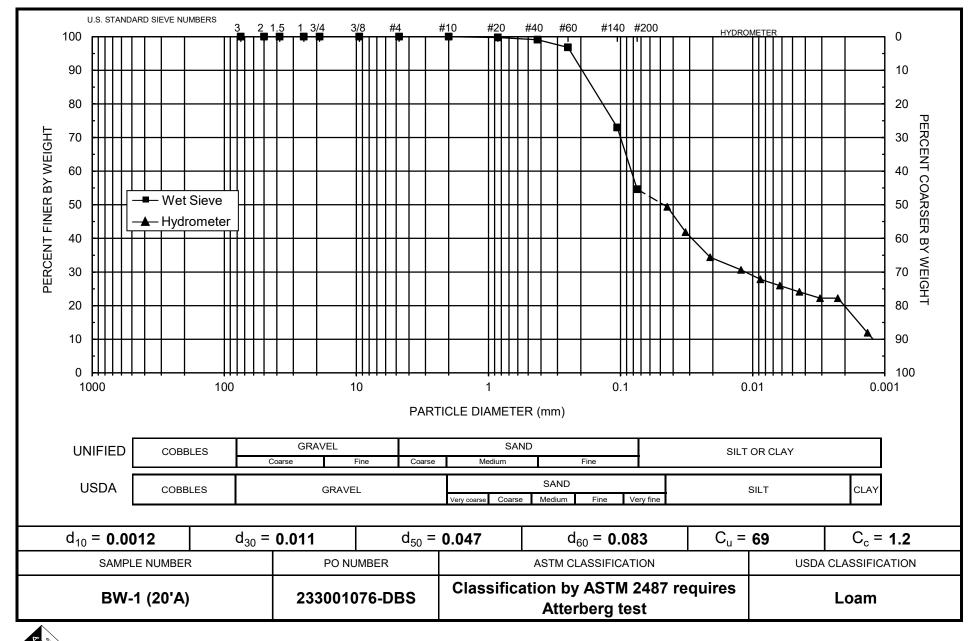
Total Sample Wt. (g): 400.84

Wt. Passing #10 (g): 400.84

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
40.14		0.4.0			00.4	44.0	0.04400	40.4	40.4
16-May-18	1	21.6	32.5	6.1	26.4	11.0	0.04426	49.4	49.4
	2	21.6	28.5	6.1	22.4	11.6	0.03222	41.9	41.9
	5	21.6	24.5	6.1	18.4	12.3	0.02094	34.4	34.4
	15	21.6	22.5	6.1	16.4	12.6	0.01225	30.6	30.6
	30	21.6	21.0	6.1	14.9	12.9	0.00875	27.8	27.8
	60	21.6	20.0	6.1	13.9	13.0	0.00622	26.0	26.0
	120	21.6	19.0	6.1	12.9	13.2	0.00443	24.1	24.1
	250	21.6	18.0	6.1	11.9	13.3	0.00309	22.2	22.2
	465	21.6	18.0	6.1	11.9	13.3	0.00226	22.2	22.2
17-May-18	1398	21.6	12.5	6.1	6.4	14.3	0.00135	11.9	11.9

#### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

Daniel B. Stephens & Associates, Inc.



## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 441.31

Job Number: DB18.1151.00 Weight Passing #10 (g): 441.31 Sample Number: BW-2 (10'A) Weight Retained #10 (g): 0.00 Project Name: St. Anthony Geotech Investigation Weight of Hydrometer Sample (g): 61.69

Test Date: 18-May-18 Shape: Angular Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						_
	3"	75	0.00	0.00	441.31	100.00
	2"	50	0.00	0.00	441.31	100.00
	1.5"	38.1	0.00	0.00	441.31	100.00
	1"	25	0.00	0.00	441.31	100.00
	3/4"	19.0	0.00	0.00	441.31	100.00
	3/8"	9.5	0.00	0.00	441.31	100.00
	4	4.75	0.00	0.00	441.31	100.00
	10	2.00	0.00	0.00	441.31	100.00
-10			(Based on calc	ulated sieve wt.	)	
	20	0.85	0.39	0.39	61.30	99.37
	40	0.425	0.38	0.77	60.92	98.75
	60	0.250	0.69	1.46	60.23	97.63
	140	0.106	17.78	19.24	42.45	68.81
	200	0.075	7.96	27.20	34.49	55.91
	dry pan		1.02	28.22	33.47	
	wet pan			33.47	0.00	

 $\begin{array}{lll} d_{10} \ (mm): \ 0.00035 & d_{50} \ (mm): \ 0.062 \\ d_{16} \ (mm): \ 0.0013 & d_{60} \ (mm): \ 0.084 \\ d_{30} \ (mm): \ 0.023 & d_{84} \ (mm): \ 0.17 \end{array}$ 

Median Particle Diameter--d<sub>50</sub> (mm): 0.062

Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 240

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 18

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.078

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Sandy Loam



## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: BW-2 (10'A)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 16-May-18

Total Sample Wt. (g): 61.69

Total Sample Wt. (g): 441.31

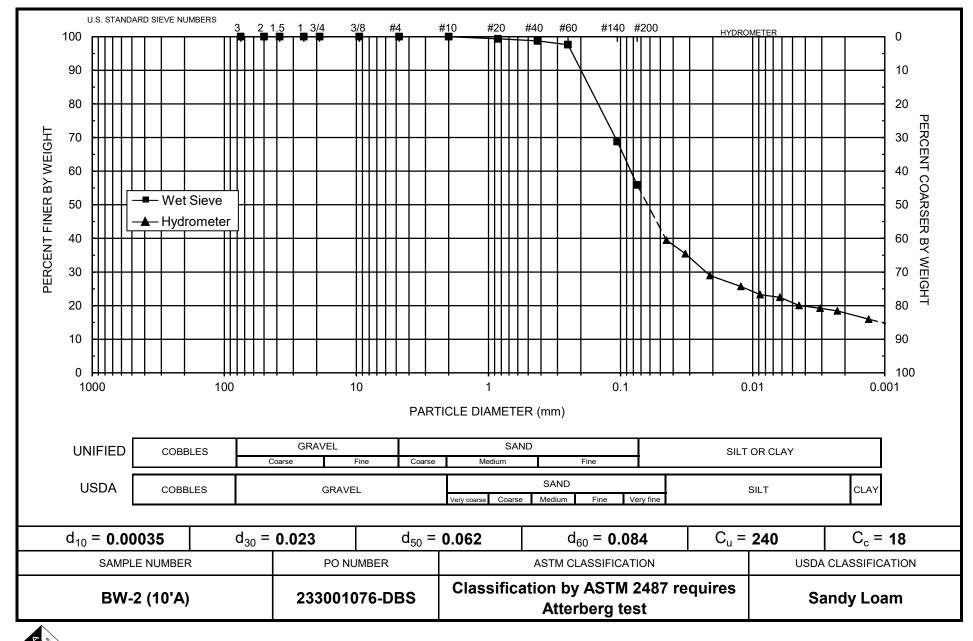
Start Time: 9:24

Wt. Passing #10 (g): 441.31

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
16-May-18	1	21.6	30.5	6.1	24.4	11.3	0.04491	39.5	39.5
	2	21.6	28.0	6.1	21.9	11.7	0.03233	35.4	35.4
	5	21.6	24.0	6.1	17.9	12.4	0.02101	29.0	29.0
	15	21.6	22.0	6.1	15.9	12.7	0.01229	25.7	25.7
	30	21.6	20.5	6.1	14.4	12.9	0.00877	23.3	23.3
	60	21.6	20.0	6.1	13.9	13.0	0.00622	22.5	22.5
	120	21.6	18.5	6.1	12.4	13.3	0.00444	20.0	20.0
	250	21.6	18.0	6.1	11.9	13.3	0.00309	19.2	19.2
	460	21.6	17.5	6.1	11.4	13.4	0.00228	18.4	18.4
17-May-18	1393	21.6	16.0	6.1	9.9	13.7	0.00132	16.0	16.0

#### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

Daniel B. Stephens & Associates, Inc.



# Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc Initial Dry Weight of Sample (g): 470.38

 Job Number:
 DB18.1151.00
 Weight Passing #10 (g): 470.38

 Sample Number:
 BW-3 (5'A)
 Weight Retained #10 (g): 0.00

Project Name: St. Anthony Geotech Investigation Weight of Hydrometer Sample (g): 56.32
PO Number: 233001076-DBS Calculated Weight of Sieve Sample (g): 56.32

Test Date: 18-May-18 Shape: Angular

Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10		(*****)				
1.0	3"	75	0.00	0.00	470.38	100.00
	2"	50	0.00	0.00	470.38	100.00
	1.5"	38.1	0.00	0.00	470.38	100.00
	1"	25	0.00	0.00	470.38	100.00
	3/4"	19.0	0.00	0.00	470.38	100.00
	3/8"	9.5	0.00	0.00	470.38	100.00
	4	4.75	0.00	0.00	470.38	100.00
	10	2.00	0.00	0.00	470.38	100.00
-10			(Based on calcu	ulated sieve wt.)	)	
	20	0.85	0.41	0.41	55.91	99.27
	40	0.425	0.58	0.99	55.33	98.24
	60	0.250	1.26	2.25	54.07	96.00
	140	0.106	18.31	20.56	35.76	63.49
	200	0.075	9.35	29.91	26.41	46.89
	dry pan		1.59	31.50	24.82	
	wet pan			24.82	0.00	

 $\begin{array}{lll} d_{10} \ (mm): \ 0.0011 & d_{50} \ (mm): \ 0.080 \\ d_{16} \ (mm): \ 0.014 & d_{60} \ (mm): \ 0.099 \\ d_{30} \ (mm): \ 0.050 & d_{84} \ (mm): \ 0.18 \end{array}$ 

Median Particle Diameter-- $d_{50}$  (mm): 0.080

Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 90

Coefficient of Curvature, Cc--[ $(d_{30})^2/(d_{10}*d_{60})$ ] (mm): 23

Mean Particle Diameter -- [(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.091

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to

obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test

USDA Soil Classification: Sandy Loam



# Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc Type of Water Used: DISTILLED

Job Number: DB18.1151.00 Reaction with H<sub>2</sub>O<sub>2</sub>: NA

Sample Number: BW-3 (5'A)

Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>

Project Name: St. Anthony Geotech Investigation Assumed particle density: 2.65

PO Number: 233001076-DBS

Test Date: 16-May-18

Start Time: 9:30

Initial Wt. (g): 56.32

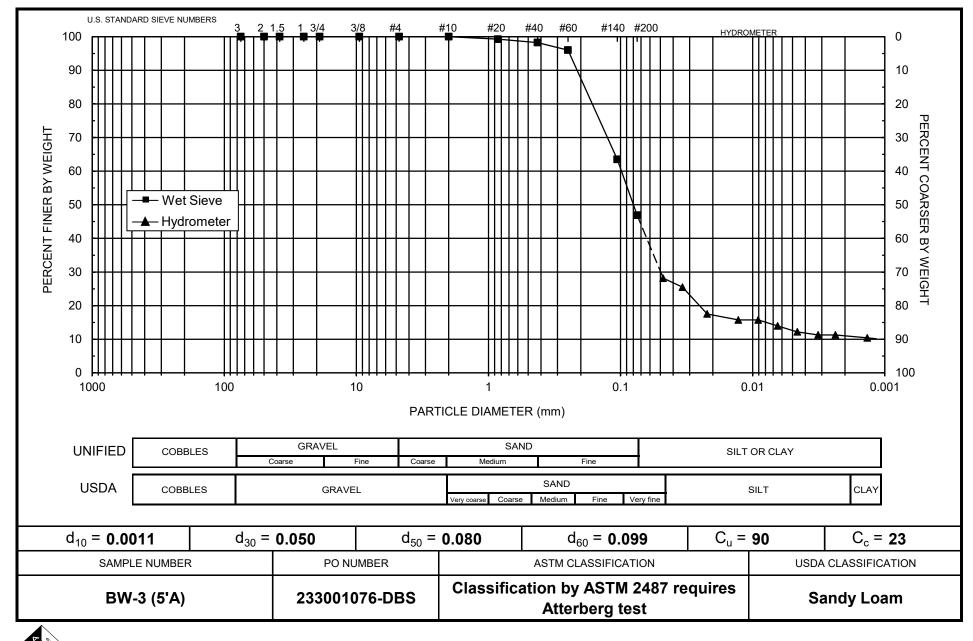
Total Sample Wt. (g): 470.38

Wt. Passing #10 (g): 470.38

	Time	Temp	R	$R_L$	$R_{corr}$	L	D	Р	
Date	(min)	(°C)	(g/L)	(g/L)	(g/L)	(cm)	(mm)	(%)	% Finer
16-May-18	1	21.6	22.0	6.1	15.9	12.7	0.04760	28.2	28.2
	2	21.6	20.5	6.1	14.4	12.9	0.03398	25.5	25.5
	5	21.6	16.0	6.1	9.9	13.7	0.02210	17.5	17.5
	15	21.6	15.0	6.1	8.9	13.8	0.01283	15.7	15.7
	30	21.6	15.0	6.1	8.9	13.8	0.00908	15.7	15.7
	60	21.6	14.0	6.1	7.9	14.0	0.00646	14.0	14.0
	120	21.6	13.0	6.1	6.9	14.2	0.00459	12.2	12.2
	250	21.6	12.5	6.1	6.4	14.3	0.00319	11.3	11.3
	455	21.6	12.5	6.1	6.4	14.3	0.00236	11.3	11.3
17-May-18	1388	21.6	12.0	6.1	5.9	14.3	0.00136	10.4	10.4

#### Comments:

<sup>\*</sup> Dispersion device: mechanically operated stirring device



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

Daniel B. Stephens & Associates, Inc.

Atterberg Limits/ Identification of Fines



# **Summary of Atterberg Tests**

Sample Number	Liquid Limit	Plastic Limit	Plasticity Index	Classification
L1-2 (20'A)	41	19	22	CL
L2-2 (5'B)				ML
L2-6 (5'A)	34	17	17	CL
T/O-1 (25'A)	30	16	14	CL
T/O-2 (10'A)	48	23	25	CL
T/O-3 (60'A)				ML
P1-1 (10'A)				ML
P1-2 (15'A)				ML
P2-2 (5'A)	39	15	24	CL
P3-1 (15'A)				ML
P3-3 (40'A)				ML
P3-4 (40'B)				ML
P3-5 (10'B)				ML
P3-6 (50'A)				ML
P4-8 (15'A)				ML

<sup>--- =</sup> Soil requires visual-manual classification due to non-plasticity



### **Atterberg Limits**

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: L1-2 (20'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Test Date: 24-May-18

#### **Liquid Limit**

	Trial 1	Trial 2	Trial 3
Number of drops:	35	27	19
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	129.37	123.19	125.05
Weight of pan plus dry soil (g)	126.57	120.14	121.57
Weight of pan (g):	119.34	112.55	113.30
Gravimetric moisture content (% g/g):	38.73	40.18	42.08

Liquid Limit: 41

#### **Plastic Limit**

	Trial 1	Trial 2
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	123.79	122.02
Weight of pan plus dry soil (g)	122.47	120.79
Weight of pan (g):	115.57	114.20
Gravimetric moisture content (% g/g):	19.13	18.66

Plastic Limit: 19

#### **Results**

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: 41
Plastic Limit: 19
Plasticity Index: 22
Classification: CL

#### Comments:

--- = Soil requires visual-manual classification due to non-plasticity

\* = 1-point method requested by client



### **Atterberg Limits**

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: L2-2 (5'B)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Test Date: 24-May-18

### **Liquid Limit**

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):			
Liquid Limit:			

#### **Plastic Limit**

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):		

Plastic Limit: ---

#### Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: --Plastic Limit: --Plasticity Index: ---

Classification (Visual Method): ML

#### Comments:

--- = Soil requires visual-manual classification due to non-plasticity

\* = 1-point method requested by client



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: L2-2 (5'B)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Test Date: 24-May-18

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

#### **Descriptive Information:**

Color of Moist Sample: Dark Grayish Brown (2.5Y 4/2)

Odor: None

Moisture Condition: Moist

HCI Reaction: None

#### **Preliminary Identification:**

Dry Strength: Low

Dilatency: Rapid

Toughness: Low

Plasticity: Non-plastic

#### **Identification of Inorganic Fine Grained Soils:**

Silt (ML)

Laboratory analysis by: D. O'Dowd

Data entered by: M. Garcia Checked by: J. Hines



### **Atterberg Limits**

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: L2-6 (5'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Test Date: 25-May-18

### **Liquid Limit**

	Trial 1	Trial 2	Trial 3
Number of drops:	33	26	21
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	126.79	125.83	128.90
Weight of pan plus dry soil (g)	123.84	122.43	125.45
Weight of pan (g):	114.42	112.27	115.70
Gravimetric moisture content (% g/g):	31.32	33.46	35.38

Liquid Limit: 34

#### **Plastic Limit**

	Trial 1	Trial 2
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	125.68	122.40
Weight of pan plus dry soil (g)	124.31	120.96
Weight of pan (g):	116.56	112.62
Gravimetric moisture content (% g/g):	17.68	17.27

Plastic Limit: 17

#### **Results**

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: 34
Plastic Limit: 17
Plasticity Index: 17
Classification: CL

#### Comments:

--- = Soil requires visual-manual classification due to non-plasticity

\* = 1-point method requested by client



### **Atterberg Limits**

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: T/O-1 (25'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Test Date: 24-May-18

### **Liquid Limit**

	Trial 1	Trial 2	Trial 3
Number of drops:	35	26	20
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	131.02	130.17	133.23
Weight of pan plus dry soil (g)	127.58	126.82	129.76
Weight of pan (g):	115.76	115.62	118.66
Gravimetric moisture content (% g/g):	29.10	29.91	31.26

Liquid Limit: 30

#### **Plastic Limit**

	Trial 1	Trial 2
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	125.77	125.95
Weight of pan plus dry soil (g)	124.55	124.61
Weight of pan (g):	116.80	116.23
Gravimetric moisture content (% g/g):	15.74	15.99

Plastic Limit: 16

#### **Results**

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: 30
Plastic Limit: 16
Plasticity Index: 14
Classification: CL

#### Comments:

--- = Soil requires visual-manual classification due to non-plasticity

\* = 1-point method requested by client



### **Atterberg Limits**

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: T/O-2 (10'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Test Date: 24-May-18

#### **Liquid Limit**

	Trial 1	Trial 2	Trial 3
Number of drops:	34	27	20
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	126.06	125.51	129.53
Weight of pan plus dry soil (g)	123.09	121.88	125.52
Weight of pan (g):	116.49	114.26	117.44
Gravimetric moisture content (% g/g):	45.00	47.64	49.63

Liquid Limit: 48

#### **Plastic Limit**

Trial 1	Trial 2
PL1	PL2
124.49	122.16
122.97	120.57
116.26	113.70
22.65	23.14
	PL1 124.49 122.97 116.26

Plastic Limit: 23

#### **Results**

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: 48
Plastic Limit: 23
Plasticity Index: 25
Classification: CL

#### Comments:

--- = Soil requires visual-manual classification due to non-plasticity

\* = 1-point method requested by client



## **Atterberg Limits**

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: T/O-3 (60'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Test Date: 24-May-18

### **Liquid Limit**

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):			
Liamid Lingite			
Liquid Limit:			

#### **Plastic Limit**

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):		

Plastic Limit: --

#### Results

Percent of Sample Retained on #40 Sieve: See Sieve

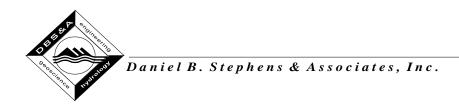
Liquid Limit: --Plastic Limit: --Plasticity Index: ---

Classification (Visual Method): ML

#### Comments:

--- = Soil requires visual-manual classification due to non-plasticity

\* = 1-point method requested by client



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: T/ 0-3 (60'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Test Date: 24-May-18

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

#### **Descriptive Information:**

Color of Moist Sample: Dark Grayish Brown (2.5Y 4/2)

Odor: None

Moisture Condition: Moist

HCI Reaction: None

#### **Preliminary Identification:**

Dry Strength: Low

Dilatency: Rapid

Toughness: Low

Plasticity: Non-plastic

#### **Identification of Inorganic Fine Grained Soils:**

Silt (ML)

Laboratory analysis by: D. O'Dowd

Data entered by: M. Garcia Checked by: J. Hines



### **Atterberg Limits**

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P1-1 (10'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Test Date: 25-May-18

### **Liquid Limit**

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):			
Liamid Lingite			
Liquid Limit:			

# Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):		

Plastic Limit: -

#### Results

Percent of Sample Retained on #40 Sieve: See Sieve

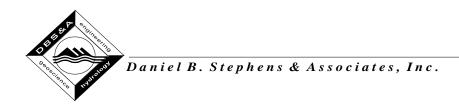
Liquid Limit: --Plastic Limit: --Plasticity Index: ---

Classification (Visual Method): ML

#### Comments:

--- = Soil requires visual-manual classification due to non-plasticity

\* = 1-point method requested by client



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P1-1 (10'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Test Date: 25-May-18

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

#### **Descriptive Information:**

Color of Moist Sample: Very Dark Grayish Brown (2.5Y 3/2)

Odor: None

Moisture Condition: Moist
HCl Reaction: None

#### **Preliminary Identification:**

Dry Strength: None

Dilatency: Rapid

Toughness: Low

Plasticity: Non-plastic

#### **Identification of Inorganic Fine Grained Soils:**

Silt (ML)

Laboratory analysis by: D. O'Dowd

Data entered by: M. Garcia

Checked by: J. Hines



### **Atterberg Limits**

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P1-2 (15'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Test Date: 25-May-18

### **Liquid Limit**

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):			
Liamid Lingite			
Liquid Limit:			

# **Plastic Limit**

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):		

Plastic Limit:

#### Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: --Plastic Limit: --Plasticity Index: ---

Classification (Visual Method): ML

#### Comments:

--- = Soil requires visual-manual classification due to non-plasticity

\* = 1-point method requested by client



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P1-2 (15'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Test Date: 25-May-18

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

#### **Descriptive Information:**

Color of Moist Sample: Dark Olive Brown (2.5Y 3/3)

Odor: None

Moisture Condition: Moist

HCI Reaction: None

#### **Preliminary Identification:**

Dry Strength: None

Dilatency: Rapid

Toughness: Low

Plasticity: Non-plastic

#### **Identification of Inorganic Fine Grained Soils:**

Silt (ML)

Laboratory analysis by: D. O'Dowd

Data entered by: M. Garcia Checked by: J. Hines



### **Atterberg Limits**

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P2-2 (5'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Test Date: 24-May-18

#### **Liquid Limit**

	Trial 1	Trial 2	Trial 3
Number of drops:	30	23	17
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	125.25	125.09	124.77
Weight of pan plus dry soil (g)	121.92	121.40	121.35
Weight of pan (g):	113.14	112.25	113.24
Gravimetric moisture content (% g/g):	37.93	40.33	42.17

Liquid Limit: 39

#### **Plastic Limit**

	Trial 1	Trial 2
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	127.23	122.78
Weight of pan plus dry soil (g)	125.93	121.53
Weight of pan (g):	117.26	113.02
Gravimetric moisture content (% g/g):	14.99	14.69

Plastic Limit: 15

#### **Results**

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: 39
Plastic Limit: 15
Plasticity Index: 24
Classification: CL

#### Comments:

--- = Soil requires visual-manual classification due to non-plasticity

\* = 1-point method requested by client



### **Atterberg Limits**

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P3-1 (15'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Test Date: 25-May-18

### **Liquid Limit**

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):			
Liquid Limit:			

#### **Plastic Limit**

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):		

Plastic Limit:

#### Results

Percent of Sample Retained on #40 Sieve: See Sieve

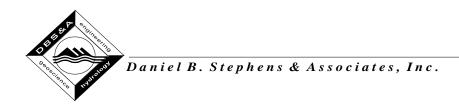
Liquid Limit: --Plastic Limit: --Plasticity Index: ---

Classification (Visual Method): ML

#### Comments:

--- = Soil requires visual-manual classification due to non-plasticity

\* = 1-point method requested by client



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P3-1 (15'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Test Date: 25-May-18

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

#### **Descriptive Information:**

Color of Moist Sample: Dark Olive Brown (2.5Y 3/3)

Odor: None

Moisture Condition: Moist

HCI Reaction: None

#### **Preliminary Identification:**

Dry Strength: Low

Dilatency: Rapid

Toughness: Low

Plasticity: Non-plastic

#### **Identification of Inorganic Fine Grained Soils:**

Silt (ML)

Laboratory analysis by: D. O'Dowd

Data entered by: M. Garcia

Checked by: J. Hines



## **Atterberg Limits**

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P3-3 (40'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Test Date: 25-May-18

### **Liquid Limit**

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):			
Liquid Limit:			

#### **Plastic Limit**

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):		

Plastic Limit: ---

#### Results

Percent of Sample Retained on #40 Sieve: See Sieve

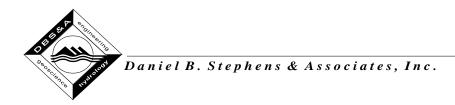
Liquid Limit: --Plastic Limit: --Plasticity Index: ---

Classification (Visual Method): ML

#### Comments:

--- = Soil requires visual-manual classification due to non-plasticity

\* = 1-point method requested by client



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P3-3 (40'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Test Date: 25-May-18

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

#### **Descriptive Information:**

Color of Moist Sample: Light Olive Brown (2.5Y 5/3)

Odor: None

Moisture Condition: Moist

HCl Reaction: Strong

#### **Preliminary Identification:**

Dry Strength: Low

Dilatency: Rapid

Toughness: Low

Plasticity: Non-plastic

#### **Identification of Inorganic Fine Grained Soils:**

Silt (ML)

Laboratory analysis by: D. O'Dowd

Data entered by: M. Garcia Checked by: J. Hines



### **Atterberg Limits**

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P3-4 (40'B)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Test Date: 25-May-18

### **Liquid Limit**

	Trial 1	Trial 2	Trial 3
Number of drops: Pan number: Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)  Weight of pan plus dry soil (g)  Weight of pan (g):  Gravimetric moisture content (% g/g):			
Gravimetric moisture content (78 g/g).			
Liquid Limit:			

#### **Plastic Limit**

	Trial 1	Trial 2
Pan number: Weight of pan plus moist soil (g): Weight of pan plus dry soil (g) Weight of pan (g): Gravimetric moisture content (% g/g):		

#### Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: --Plastic Limit: --Plasticity Index: ---

Classification (Visual Method): ML

#### Comments:

--- = Soil requires visual-manual classification due to non-plasticity

\* = 1-point method requested by client



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P3-4 (40'B)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Test Date: 25-May-18

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

#### **Descriptive Information:**

Color of Moist Sample: Very Dark Gray (2.5Y 3/1)

Odor: None

Moisture Condition: Moist

HCI Reaction: None

#### **Preliminary Identification:**

Dry Strength: Low

Dilatency: Rapid

Toughness: Low

Plasticity: Non-plastic

#### **Identification of Inorganic Fine Grained Soils:**

Silt (ML)

Laboratory analysis by: D. O'Dowd

Data entered by: M. Garcia Checked by: J. Hines



#### **Atterberg Limits**

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P3-5 (10'B)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Test Date: 24-May-18

### **Liquid Limit**

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):			

Liquid Limit:

#### **Plastic Limit**

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):		

Plastic Limit: ---

#### Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: --Plastic Limit: --Plasticity Index: ---

Classification (Visual Method): ML

#### Comments:

--- = Soil requires visual-manual classification due to non-plasticity

\* = 1-point method requested by client



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P3-5 (10'B)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Test Date: 24-May-18

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

#### **Descriptive Information:**

Color of Moist Sample: Very Dark Grayish Brown (2.5Y 3/2)

Odor: None

Moisture Condition: Moist
HCl Reaction: None

#### **Preliminary Identification:**

Dry Strength: None

Dilatency: Rapid

Toughness: Low

Plasticity: Non-plastic

#### **Identification of Inorganic Fine Grained Soils:**

Silt (ML)

Laboratory analysis by: D. O'Dowd

Data entered by: M. Garcia

Checked by: J. Hines



#### **Atterberg Limits**

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P4-3 (10'B)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Test Date: 24-May-18

### **Liquid Limit**

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):			
Liamid Lingite			
Liquid Limit:			

# Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):		

Plastic Limit:

#### Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: --Plastic Limit: --Plasticity Index: ---

Classification (Visual Method): ML

#### Comments:

--- = Soil requires visual-manual classification due to non-plasticity

\* = 1-point method requested by client



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P4-3 (10'B)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Test Date: 24-May-18

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

#### **Descriptive Information:**

Color of Moist Sample: Grayish Brown (2.5 Y 5/2)

Odor: None

Moisture Condition: Moist

HCI Reaction: None

#### **Preliminary Identification:**

Dry Strength: Low

Dilatency: Rapid

Toughness: Low

Plasticity: Non-plastic

#### **Identification of Inorganic Fine Grained Soils:**

Silt (ML)

Laboratory analysis by: D. O'Dowd

Data entered by: M. Garcia Checked by: J. Hines



### **Atterberg Limits**

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P4-8 (15'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Test Date: 24-May-18

### **Liquid Limit**

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):			

Liquid Limit:

#### **Plastic Limit**

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):		

Plastic Limit: --

#### Results

Percent of Sample Retained on #40 Sieve: See Sieve

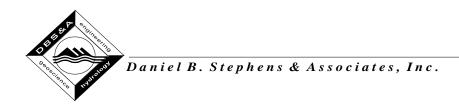
Liquid Limit: --Plastic Limit: --Plasticity Index: ---

Classification (Visual Method): ML

#### Comments:

--- = Soil requires visual-manual classification due to non-plasticity

\* = 1-point method requested by client



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: P4-8 (15'A)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Test Date: 24-May-18

Visual-manual classification of material passing the #40 sieve in lieu of Atterberg analysis due to non-plasticity:

#### **Descriptive Information:**

Color of Moist Sample: Very Dark Grayish Brown (2.5Y 3/2)

Odor: None

Moisture Condition: Moist
HCl Reaction: None

#### **Preliminary Identification:**

Dry Strength: Low

Dilatency: Rapid

Toughness: Low

Plasticity: Non-plastic

#### **Identification of Inorganic Fine Grained Soils:**

Silt (ML)

Laboratory analysis by: D. O'Dowd

Data entered by: M. Garcia

Checked by: J. Hines

**Proctor Compaction** 



## **Summary of Proctor Compaction Tests**

	Measured		Oversize Corrected	
Sample Number	Optimum Moisture Content (% g/g)	Maximum Dry Bulk Density (g/cm <sup>3</sup> )	Optimum Moisture Content (% g/g)	Maximum Dry Bulk Density (g/cm³)
•		· ·	(10 919)	(9/ /
L1 Auger Cuttings (1 & 2)	14.6	1.81		
L2 Auger Cuttings (1 & 2)	14.1	1.81		
T/O Auger Cuttings (1 & 2) (T/O-1 & T/O-3,4)	14.5	1.83		
Topsoil North Cuttings (1 & 2)	12.6	1.89		
Borrow South Cuttings (1 & 2)	13.0	1.84		
Topsoil South Cuttings (1 & 2) (TS-2 & TS-3,4)	15.2	1.81	12.3	1.92
Borrow West Auger Cuttings (1 & 2)	12.7	1.87		
P1-2 Auger Cuttings	12.8	1.82		
P3 Auger Cuttings (1 & 2)	9.9	1.96	9.2	2.00
P4 Auger Cuttings (1 & 2)	11.1	1.94	9.0	2.05

<sup>--- =</sup> Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable



### **Proctor Compaction Data**

Job Name: Stantec Consulting Services Inc

Split (3/4", 3/8", #4): #4

Job Number: DB18.1151.00

Mass of coarse material (g): 1706.10

Sample Number: L1 Auger Cuttings (1 & 2)

Mass of fines material (g): 42928.00

Project Name: St. Anthony Geotech Investigation

Mold weight (g): 4226

PO Number: 233001076-DBS

Mold volume (cm<sup>3</sup>): 942.46

Test Date: 17-May-18

Compaction Method: Standard A

Preparation Method: Dry

As Received Moisture Content (% g/g): NA

Type of Rammer: Mechanical

	Weight of Mold and	Weight of Container and	Weight of Container and	Weight of	Dry Bulk	Moisture
	Compacted Soil	Wet Soil	Dry Soil	Container	Density	Content
Trial	(g)	(g)	(g)	(g)	(g/cm <sup>3</sup> )	(% g/g)
1	6030	1077.29	1000.09	289.63	1.73	10.87
2	6119	922.44	850.65	284.61	1.78	12.68
3	6185	1005.58	908.36	282.13	1.80	15.52
4	6138	1012.94	907.34	297.40	1.73	17.31
5	6088	942.07	835.56	269.59	1.66	18.82

Soil Fractions

**Properties of Coarse Material** 

Coarse Fraction (% g/g): 3.8 Fines Fraction (% g/g): 96.2 Assumed particle density (g/cm<sup>3</sup>): 2.65

Assumed Initial Moisture Content (% g/g): 0.0

### Oversize Corrected Values for Dry Bulk Density and Moisture Content

	Dry Bulk	Moisture
	Density of	Content of
	Composite	Composite
Trial	(g/cm <sup>3</sup> )	(% g/g)
1		
2		
3		
4		
5		

<sup>--- =</sup> Oversize correction is unnecessary since coarse fraction < 5% of composite mass

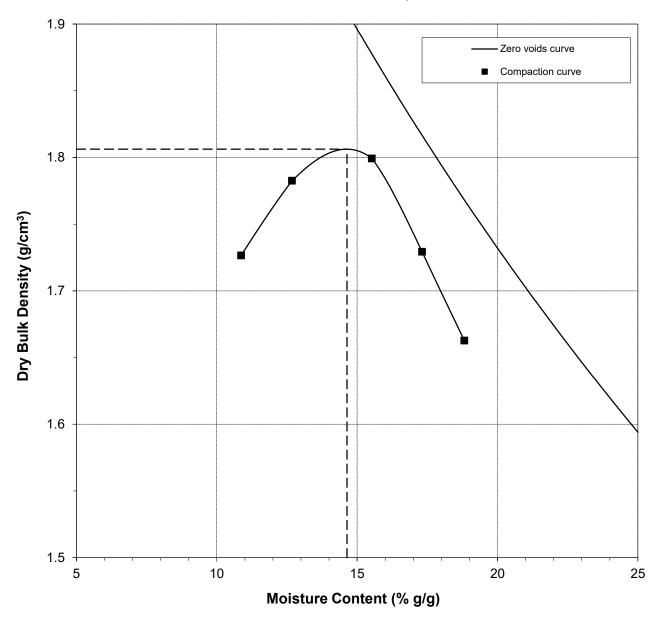


## **Proctor Compaction Data Points with Fitted Curve**

Sample Number: L1 Auger Cuttings (1 & 2)

	Measured	Corrected
Optimum Moisture Content (% g/g):	14.6	
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.81	

Test Date: 17-May-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass



### **Proctor Compaction Data**

Job Name: Stantec Consulting Services Inc

Split (3/4", 3/8", #4): #4

Job Number: DB18.1151.00

Mass of coarse material (g): 892.80

Sample Number: L2 Auger Cuttings (1 & 2)

Mass of fines material (g): 47420.00

Project Name: St. Anthony Geotech Investigation

Mold weight (g): 4226

PO Number: 233001076-DBS

Mold volume (cm<sup>3</sup>): 942.46

Test Date: 16-May-18

Compaction Method: Standard A

As Received Moisture Content (% g/g): NA

Preparation Method: Dry

Type of Rammer: Mechanical

	Weight of Mold and Compacted Soil	Weight of Container and Wet Soil	Weight of Container and Dry Soil	Weight of Container	Dry Bulk Density	Moisture Content
Trial	(g)	(g)	(g)	(g)	(g/cm <sup>3</sup> )	(% g/g)
1	6011	962.16	898.93	268.39	1.72	10.03
2	6116	1085.28	1000.85	290.42	1.79	11.88
3	6176	1062.87	968.24	298.44	1.81	14.13
4	6179	1009.32	906.58	284.54	1.78	16.52
5	6127	923.31	825.37	284.32	1.71	18.10

Soil Fractions

**Properties of Coarse Material** 

Coarse Fraction (% g/g): 1.8

Assumed particle density (g/cm<sup>3</sup>): 2.65

Fines Fraction (% g/g): 98.2

Assumed Initial Moisture Content (% g/g): 0.0

### Oversize Corrected Values for Dry Bulk Density and Moisture Content

	Dry Bulk	Moisture
	Density of	Content of
	Composite	Composite
Trial	(g/cm <sup>3</sup> )	(% g/g)
1		
2		
3		
4		
5		

<sup>--- =</sup> Oversize correction is unnecessary since coarse fraction < 5% of composite mass

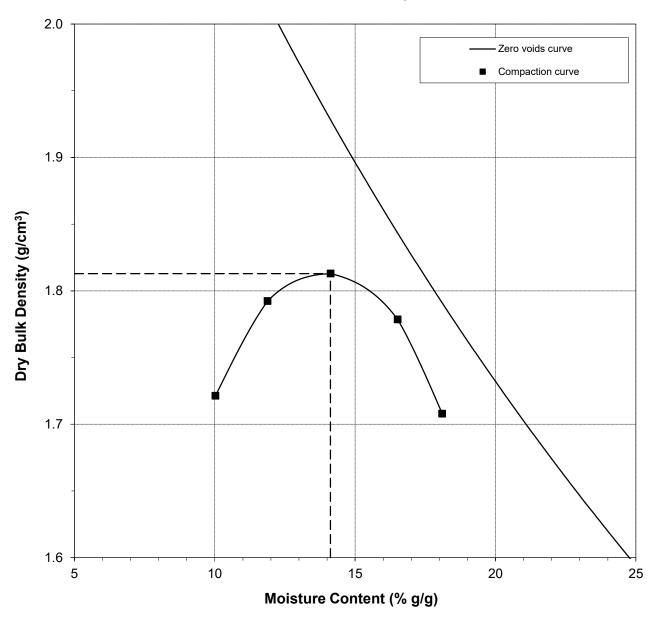


## **Proctor Compaction Data Points with Fitted Curve**

Sample Number: L2 Auger Cuttings (1 & 2)

	Measured	Corrected
Optimum Moisture Content (% g/g):	14.1	
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.81	

Test Date: 16-May-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass



### **Proctor Compaction Data**

Job Name: Stantec Consulting Services Inc Split (3/4", 3/8", #4): #4 Job Number: DB18.1151.00 Mass of coarse material (g): 2357.50

Sample Number: T/O Auger Cuttings (1 & 2) (T/O-1 & T/O-Mass of fines material (g): 45348.00 Project Name: St. Anthony Geotech Investigation Mold weight (g): 4226

Mold volume (cm<sup>3</sup>): 942.46 PO Number: 233001076-DBS

Compaction Method: Standard A Test Date: 16-May-18

Preparation Method: Dry

As Received Moisture Content (% g/g): NA

Type of Rammer: Mechanical

	Weight of	Weight of	Weight of				
	Mold and	Container and	Container and	Weight of	Dry Bulk	Moisture	
	Compacted Soil	Wet Soil	Dry Soil	Container	Density	Content	
Trial	(g)	(g)	(g)	(g)	(g/cm <sup>3</sup> )	(% g/g)	
1	6014	997.05	925.87	269.45	1.71	10.84	
2	6144	1095.35	1004.84	292.22	1.81	12.70	
3	6204	1132.12	1022.57	282.88	1.83	14.81	
4	6199	899.82	813.68	289.57	1.80	16.44	
5	6139	938.80	831.19	269.92	1.70	19.17	

Soil Fractions

**Properties of Coarse Material** 

Coarse Fraction (% g/g): 4.9 Fines Fraction (% g/g): 95.1

Assumed particle density (g/cm<sup>3</sup>): 2.65

Assumed Initial Moisture Content (% g/g): 0.0

### Oversize Corrected Values for Dry Bulk Density and Moisture Content

	Dry Bulk	Moisture
	Density of	Content of
	Composite	Composite
Trial	(g/cm <sup>3</sup> )	(% g/g)
1		
2		
3		
4		
5		

<sup>--- =</sup> Oversize correction is unnecessary since coarse fraction < 5% of composite mass

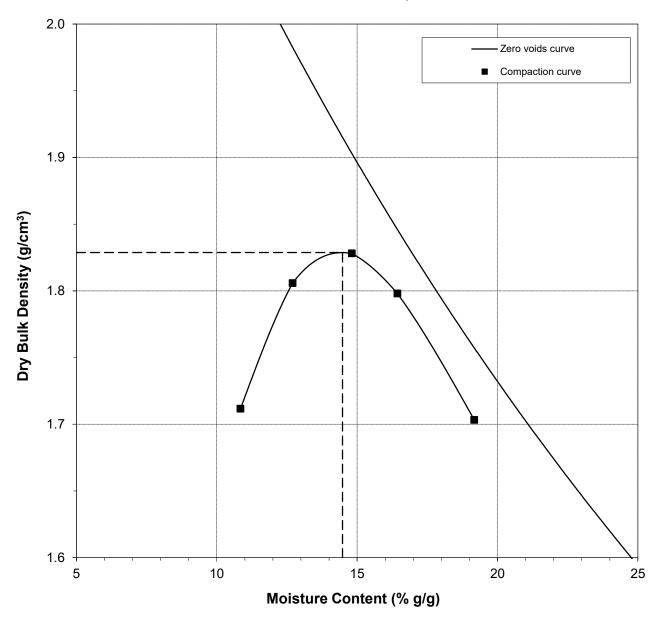


## **Proctor Compaction Data Points with Fitted Curve**

Sample Number: T/O Auger Cuttings (1 & 2) (T/O-1 & T/O-3,4)

	Measured	Corrected
Optimum Moisture Content (% g/g):	14.5	
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.83	

Test Date: 16-May-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass



### **Proctor Compaction Data**

Job Name: Stantec Consulting Services Inc

Split (3/4", 3/8", #4): #4

Job Number: DB18.1151.00

Mass of coarse material (g): 591.00

Sample Number: Topsoil North Cuttings (1 & 2)

Mass of fines material (g): 34020.00

Project Name: St. Anthony Geotech Investigation

Mold weight (g): 4226

PO Number: 233001076-DBS

*Mold volume* (cm<sup>3</sup>): 942.46

Test Date: 17-May-18

, , ,

Compaction Method: Standard A Preparation Method: Dry

As Received Moisture Content (% g/g): NA

Type of Rammer: Mechanical

	Weight of Mold and Compacted Soil	Weight of Container and Wet Soil	Weight of Container and Dry Soil	Weight of Container	Dry Bulk Density	Moisture Content
Trial	(g)	(g)	(g)	(g)	(g/cm <sup>3</sup> )	(% g/g)
1	6064	996.39	937.78	268.08	1.79	8.75
2	6162	1063.65	988.83	291.63	1.86	10.73
3	6237	1016.08	933.26	289.17	1.89	12.86
4	6179	1055.57	954.88	269.83	1.81	14.70
5	6121	1195.75	1063.30	292.88	1.72	17.19

Soil Fractions

**Properties of Coarse Material** 

Coarse Fraction (% g/g): 1.7

Assumed particle density (g/cm<sup>3</sup>): 2.65

Fines Fraction (% g/g): 98.3

Assumed Initial Moisture Content (% g/g): 0.0

### Oversize Corrected Values for Dry Bulk Density and Moisture Content

	Dry Bulk Density of Composite	Moisture Content of Composite
Trial	(g/cm <sup>3</sup> )	(% g/g)
1		
2		
3		
4		
5		

<sup>--- =</sup> Oversize correction is unnecessary since coarse fraction < 5% of composite mass

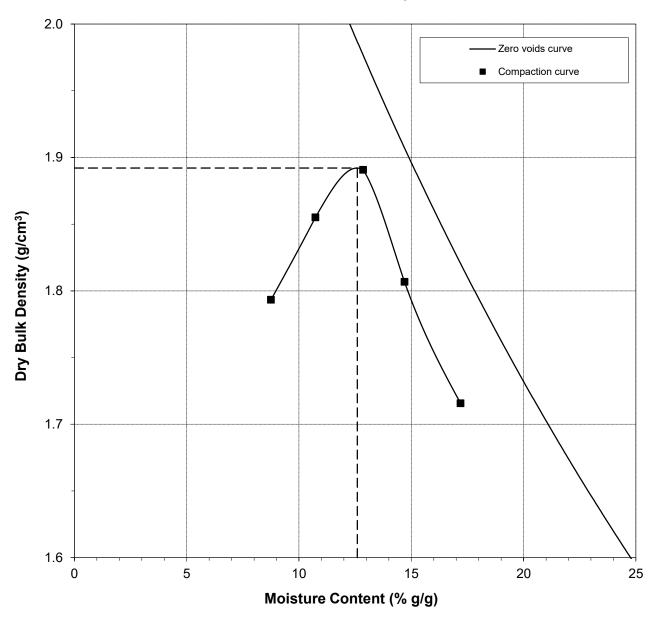


## **Proctor Compaction Data Points with Fitted Curve**

Sample Number: Topsoil North Cuttings (1 & 2)

	Measured	Corrected
Optimum Moisture Content (% g/g):	12.6	
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.89	

Test Date: 17-May-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass



### **Proctor Compaction Data**

Job Name: Stantec Consulting Services Inc

Split (3/4", 3/8", #4): #4

Job Number: DB18.1151.00

Mass of coarse material (g): 337.52

Sample Number: Borrow South Cuttings (1 & 2)

Mass of fines material (g): 46770.00

Project Name: St. Anthony Geotech Investigation

Mold weight (g): 4226

PO Number: 233001076-DBS

Mold volume (cm<sup>3</sup>): 942.46

Test Date: 23-May-18

Compaction Method: Standard A

Preparation Method: Dry

As Received Moisture Content (% g/g): NA

Type of Rammer: Mechanical

	Weight of Mold and Compacted Soil	Weight of Container and Wet Soil	Weight of Container and Dry Soil	Weight of Container	Dry Bulk Density	Moisture Content
Trial	(g)	(g)	(g)	(g)	(g/cm <sup>3</sup> )	(% g/g)
1	5947	979.08	925.82	286.94	1.69	8.34
2	6077	1068.89	996.06	293.36	1.78	10.36
3	6186	1143.03	1047.75	300.24	1.84	12.75
4	6197	1059.23	959.03	283.30	1.82	14.83
5	6143	1147.62	1022.92	289.53	1.74	17.00

Soil Fractions

**Properties of Coarse Material** 

Coarse Fraction (% g/g): 0.7

Assumed particle density (g/cm<sup>3</sup>): 2.65

Fines Fraction (% g/g): 99.3

Assumed Initial Moisture Content (% g/g): 0.0

Oversize Corrected Values for Dry Bulk Density and Moisture Content

	Dry Bulk	Moisture
	Density of	Content of
	Composite	Composite
Trial	(g/cm <sup>3</sup> )	(% g/g)
1		
2		
3		
4		
5		

<sup>--- =</sup> Oversize correction is unnecessary since coarse fraction < 5% of composite mass

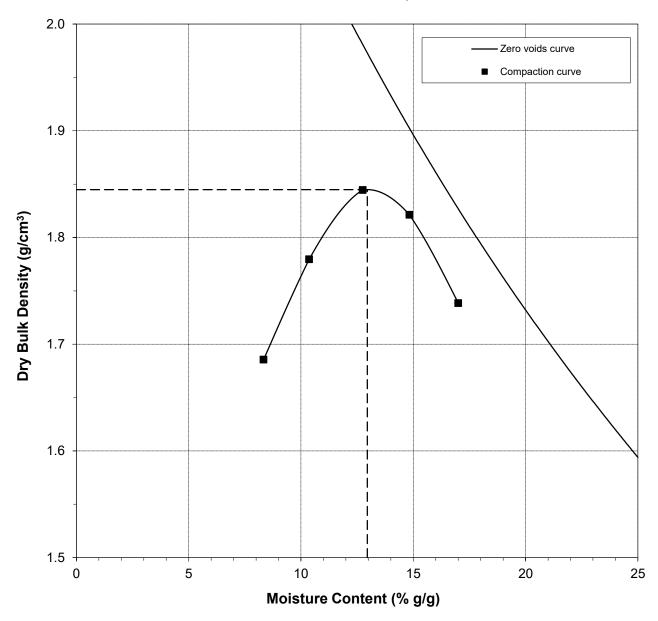


## **Proctor Compaction Data Points with Fitted Curve**

Sample Number: Borrow South Cuttings (1 & 2)

	Measured	Corrected
Optimum Moisture Content (% g/g):	13.0	
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.84	

Test Date: 23-May-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass



### **Proctor Compaction Data**

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Mass of coarse material (g): 5710.40

Sample Number: Topsoil South Cuttings (1 & 2) (TS-2 & TSM8,st) of fines material (g): 24015.18

Project Name: St. Anthony Geotech Investigation

Mold weight (g): 4226

PO Number: 233001076-DBS

Mold volume (cm³): 942.46

Test Date: 16-May-18 Compaction Method: Standard A

Preparation Method: Dry

As Received Moisture Content (% g/g): NA

Type of Rammer: Mechanical

	Weight of	Weight of	Weight of			
	Mold and	Container and	Container and	Weight of	Dry Bulk	Moisture
	Compacted Soil	Wet Soil	Dry Soil	Container	Density	Content
Trial	(g)	(g)	(g)	(g)	(g/cm <sup>3</sup> )	(% g/g)
1	6038	1126.72	1054.15	296.93	1.75	9.58
2	6097	1085.79	1004.40	284.58	1.78	11.31
3	6160	1015.23	924.00	267.30	1.80	13.89
4	6181	994.82	892.02	289.75	1.77	17.07
5	6124	1073.18	954.74	296.46	1.71	17.99

Soil Fractions

Properties of Coarse Material

Coarse Fraction (% g/g): 19.2 Fines Fraction (% g/g): 80.8 Assumed particle density (g/cm<sup>3</sup>): 2.65 Assumed Initial Moisture Content (% g/g): 0.0

### Oversize Corrected Values for Dry Bulk Density and Moisture Content

	Dry Bulk	Moisture
	Density of	Content of
	Composite	Composite
Trial	(g/cm <sup>3</sup> )	(% g/g)
1	1.88	7.74
2	1.90	9.13
3	1.92	11.22
4	1.89	13.79
5	1.83	14.54

<sup>--- =</sup> Oversize correction is unnecessary since coarse fraction < 5% of composite mass

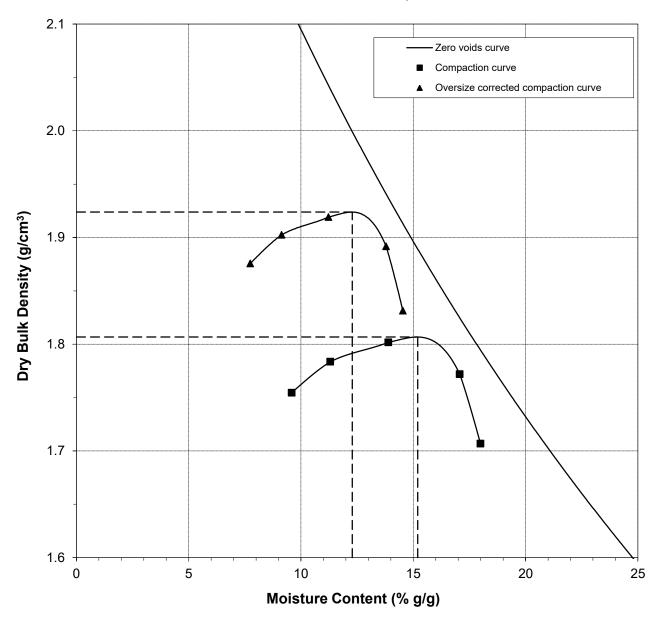


## **Proctor Compaction Data Points with Fitted Curve**

Sample Number: Topsoil South Cuttings (1 & 2) (TS-2 & TS-3,4)

	Measured	Corrected
Optimum Moisture Content (% g/g):	15.2	12.3
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.81	1.92

Test Date: 16-May-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass



### **Proctor Compaction Data**

Job Name: Stantec Consulting Services Inc Split (3/4", 3/8", #4): #4

Mass of coarse material (g): 699.80

Job Number: DB18.1151.00 Mass of fines material (g): 44700.00 Sample Number: Borrow West Auger Cuttings (1 & 2)

Project Name: St. Anthony Geotech Investigation Mold weight (g): 4226

PO Number: 233001076-DBS Mold volume (cm<sup>3</sup>): 942.46

Compaction Method: Standard A Test Date: 23-May-18

Preparation Method: Dry

As Received Moisture Content (% g/g): NA

Type of Rammer: Mechanical

	Weight of Mold and Compacted Soil	Weight of Container and Wet Soil	Weight of Container and Dry Soil	Weight of Container	Dry Bulk Density	Moisture Content	
Trial	(g)	(g)	(g)	(g)	(g/cm <sup>3</sup> )	(% g/g)	
1	5996	993.18	936.74	268.32	1.73	8.44	
2	6120	1052.40	976.47	267.86	1.82	10.72	
3	6211	977.97	899.31	270.20	1.87	12.50	
4	6203	1078.97	975.04	269.32	1.83	14.73	
5	6129	1070.18	955.15	268.21	1.73	16.75	

Soil Fractions

**Properties of Coarse Material** 

Coarse Fraction (% g/g): 1.5 Fines Fraction (% g/g): 98.5 Assumed particle density (g/cm<sup>3</sup>): 2.65

Assumed Initial Moisture Content (% g/g): 0.0

### Oversize Corrected Values for Dry Bulk Density and Moisture Content

	Dry Bulk	Moisture
	Density of	Content of
	Composite	Composite
Trial	(g/cm <sup>3</sup> )	(% g/g)
1		
2		
3		
4		
5		

<sup>--- =</sup> Oversize correction is unnecessary since coarse fraction < 5% of composite mass

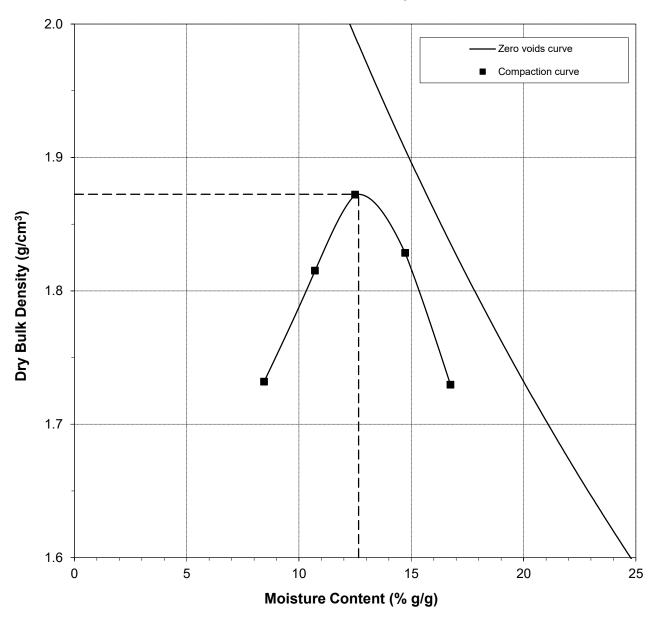


## **Proctor Compaction Data Points with Fitted Curve**

Sample Number: Borrow West Auger Cuttings (1 & 2)

	Measured	Corrected
Optimum Moisture Content (% g/g):	12.7	
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.87	

Test Date: 23-May-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass



## **Proctor Compaction Data**

Job Name: Stantec Consulting Services Inc Split (3/4", 3/8", #4): #4

Job Number: DB18.1151.00 Mass of coarse material (g): 793.10
Sample Number: P1-2 Auger Cuttings Mass of fines material (g): 20670.00

Project Name: St. Anthony Geotech Investigation Mold weight (g): 4226

Test Date: 23-May-18 Compaction Method: Standard A

Preparation Method: Dry

As Received Moisture Content (% g/g): NA

Type of Rammer: Mechanical

	Weight of Mold and Compacted Soil	Weight of Container and Wet Soil	Weight of Container and Dry Soil	Weight of Container	Dry Bulk Density	Moisture Content
Trial	(g)	(g)	(g)	(g)	(g/cm <sup>3</sup> )	(% g/g)
1	5992	939.86	883.72	284.26	1.71	9.37
2	6096	1025.24	953.81	288.60	1.79	10.74
3	6166	959.37	880.64	269.61	1.82	12.88
4	6158	1079.80	974.79	284.78	1.78	15.22
5	6107	976.63	872.96	284.13	1.70	17.61

Soil Fractions

Properties of Coarse Material

Coarse Fraction (% g/g): 3.7 Fines Fraction (% g/g): 96.3 Assumed particle density (g/cm<sup>3</sup>): 2.65

Assumed Initial Moisture Content (% g/g): 0.0

### Oversize Corrected Values for Dry Bulk Density and Moisture Content

	Dry Bulk	Moisture
	Density of	Content of
	Composite	Composite
Trial	(g/cm <sup>3</sup> )	(% g/g)
1		
2		
3		
4		
5		

<sup>--- =</sup> Oversize correction is unnecessary since coarse fraction < 5% of composite mass

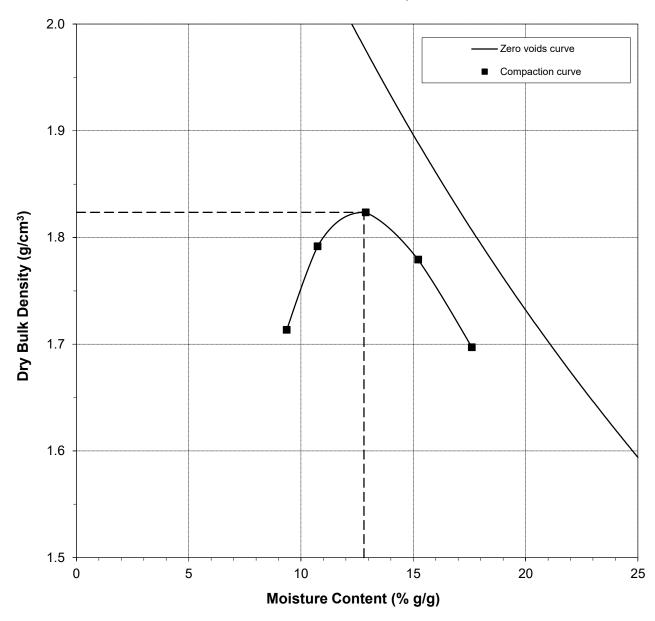


## **Proctor Compaction Data Points with Fitted Curve**

Sample Number: P1-2 Auger Cuttings

	Measured	Corrected
Optimum Moisture Content (% g/g):	12.8	
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.82	

Test Date: 23-May-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass



### **Proctor Compaction Data**

Job Name: Stantec Consulting Services Inc

Split (3/4", 3/8", #4): #4

Job Number: DB18.1151.00

Mass of coarse material (g): 2644.40

Sample Number: P3 Auger Cuttings (1 & 2)

Mass of fines material (g): 36609.20

Project Name: St. Anthony Geotech Investigation

Mold weight (g): 4226

PO Number: 233001076-DBS

Mold volume (cm<sup>3</sup>): 942.46

Test Date: 17-May-18

Compaction Method: Standard A

Preparation Method: Dry

Type of Rammer: Mechanical

As Received Moisture Content (% g/g): NA

	Weight of Mold and Compacted Soil	Weight of Container and Wet Soil	Weight of Container and Dry Soil	Weight of Container	Dry Bulk Density	Moisture Content
Trial	(g)	(g)	(g)	(g)	(g/cm <sup>3</sup> )	(% g/g)
1	6095	968.15	927.41	298.44	1.86	6.48
2	6185	1116.67	1054.91	292.84	1.92	8.10
3	6258	1191.07	1109.22	283.88	1.96	9.92
4	6246	1167.22	1073.30	294.43	1.91	12.06
5	6182	1228.99	1112.04	286.79	1.82	14.17

Soil Fractions

**Properties of Coarse Material** 

Coarse Fraction (% g/g): 6.7 Fines Fraction (% g/g): 93.3 Assumed particle density (g/cm<sup>3</sup>): 2.65

Assumed Initial Moisture Content (% g/g): 0.0

### Oversize Corrected Values for Dry Bulk Density and Moisture Content

	Dry Bulk	Moisture
	Density of	Content of
	Composite	Composite
Trial	(g/cm <sup>3</sup> )	(% g/g)
1	1.90	6.04
2	1.96	7.56
3	2.00	9.25
4	1.95	11.25
5	1.86	13.22

<sup>--- =</sup> Oversize correction is unnecessary since coarse fraction < 5% of composite mass

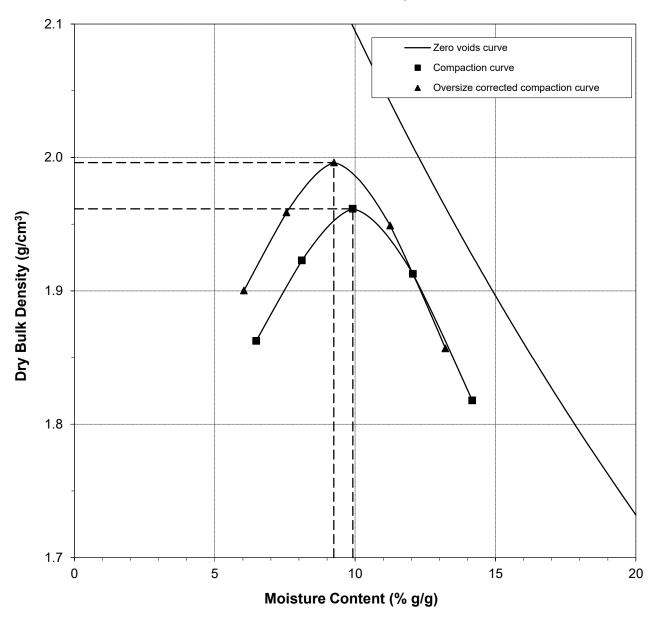


## **Proctor Compaction Data Points with Fitted Curve**

Sample Number: P3 Auger Cuttings (1 & 2)

	Measured	Corrected
Optimum Moisture Content (% g/g):	9.9	9.2
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.96	2.00

Test Date: 17-May-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass



### **Proctor Compaction Data**

Job Name: Stantec Consulting Services Inc Split (3/4", 3/8", #4): #4

Job Number: DB18.1151.00 Mass of coarse material (g): 7810.70

Sample Number: P4 Auger Cuttings (1 & 2)

Mass of fines material (g): 32410.00

Project Name: St. Anthony Geotech Investigation Mold weight (g): 4226
PO Number: 233001076-DBS Mold volume (cm³): 942.46

Test Date: 23-May-18 Compaction Method: Standard A

Preparation Method: Dry

As Received Moisture Content (% g/g): NA Type

Type of Rammer: Mechanical

	Weight of Mold and Compacted Soil	Weight of Container and Wet Soil	Weight of Container and Dry Soil	Weight of Container	Dry Bulk Density	Moisture Content
Trial	(g)	(g)	(g)	(g)	(g/cm <sup>3</sup> )	(% g/g)
1	6021	1062.03	1016.33	283.72	1.79	6.24
2	6138	1145.66	1078.20	269.57	1.87	8.34
3	6236	1004.05	935.64	269.39	1.93	10.27
4	6265	1028.30	946.86	282.76	1.93	12.26
5	6192	1002.37	912.55	284.64	1.82	14.30

Soil Fractions

Coarse Fraction (% g/g): 19.4

Fines Fraction (% g/g): 80.6

**Properties of Coarse Material** 

Assumed particle density (g/cm<sup>3</sup>): 2.65

Assumed Initial Moisture Content (% g/g): 0.0

### Oversize Corrected Values for Dry Bulk Density and Moisture Content

	Dry Bulk	Moisture
	Density of	Content of
	Composite	Composite
Trial	(g/cm <sup>3</sup> )	(% g/g)
1	1.91	5.03
2	1.98	6.72
3	2.04	8.27
4	2.03	9.88
5	1.94	11.53

<sup>--- =</sup> Oversize correction is unnecessary since coarse fraction < 5% of composite mass

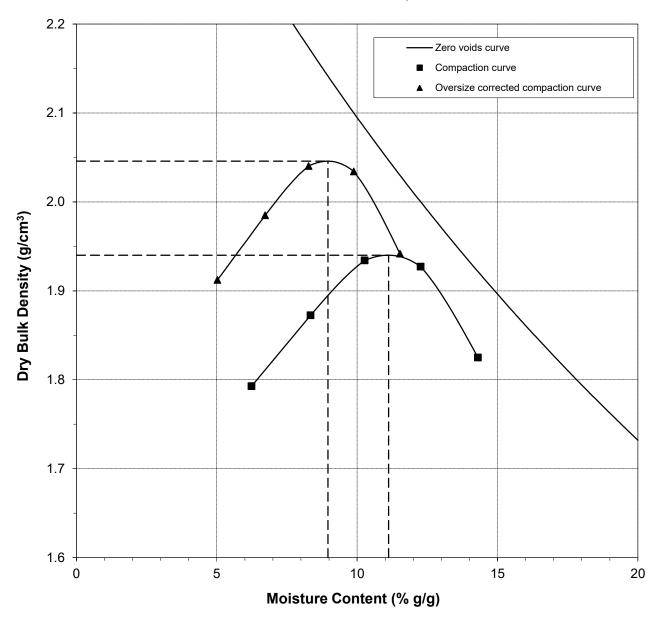


## **Proctor Compaction Data Points with Fitted Curve**

Sample Number: P4 Auger Cuttings (1 & 2)

	Measured	Corrected
Optimum Moisture Content (% g/g):	11.1	9.0
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.94	2.05

Test Date: 23-May-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

**Consolidated Undrained Testing** 

## **Summary of Consolidated Undrained (CU) Triaxial Shear Testing**

Sample Number	Effective Consolidation Stress (psi)	Effective Minor Stress at Failure (psi)	Effective Major Stress at Failure (psi)	Pore-Water Pressure at Failure (psi)	Total Minor Stress at Failure (psi)	Total Major Stress at Failure (psi)	% Strain at Failure* (%)
L2-1 (15'A) CU Stage 1 (6.0 psi)	6.0	2.5	8.4	75.0	77.6	83.4	2.12
L2-1 (15'A) CU Stage 2 (12.0 psi)	12.0	5.0	18.0	78.6	83.6	96.6	2.96
L2-1 (15'A) CU Stage 3 (24.0 psi)	24.0	9.6	35.8	86.1	95.6	121.9	7.73
L2-5 (5'B) CU Stage 1 (2.0 psi)	2.0	0.7	5.2	81.9	82.7	87.1	1.88
L2-5 (5'B) CU Stage 2 (4.0 psi)	4.0	2.0	9.4	82.5	84.6	91.9	0.97
L2-5 (5'B) CU Stage 3 (8.0 psi)	8.0	3.3	15.4	85.4	88.7	100.9	1.13
L2-6 (10'B) CU Stage 1 (3.5 psi)	3.5	2.1	3.5	83.0	85.1	86.4	0.69
L2-6 (10'B) CU Stage 2 (7.1 psi)	7.1	3.2	10.3	85.5	88.6	95.8	3.02
L2-6 (10'B) CU Stage 3 (14.0 psi)	14.0	6.0	22.4	89.7	95.7	112.1	11.74

<sup>\*</sup>Noted percent strain used as failure criterion.

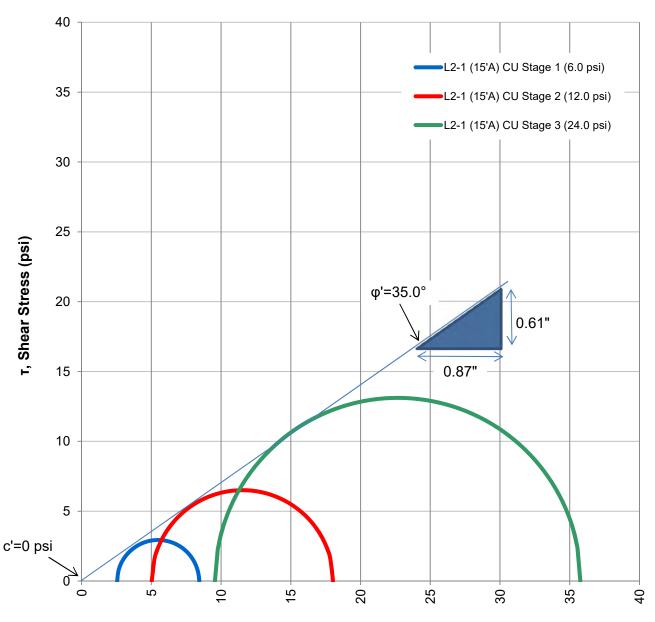
# Summary of Consolidated Undrained Estimated Effective Friction Angle and Cohesion

	c' Cohesion	φ' Friction Angle
Sample Number	(psi)	(°)
L2-1 (15'A) CU	0	35
L2-5 (5'B) CU	0.9	35.8
L2-6 (10'B) CU	0	32.3

<sup>&</sup>lt;sup>1</sup>The cohesion and friction angle provided represent one possible interpretation of a Mohr-Coulomb failure envelope. Qualified persons familiar with the material and the site should evaluate the test results independently prior to use in the intended application.

## Mohr's Circles: Effective

# L2-1 (15'A) CU



σ', Effective Normal Stress (psi)

# Estimated Effective Mohr-Coulomb Failure Parameters<sup>1</sup>:

cohesion (c')(psi) = 0 friction angle  $(\phi')(^\circ)$  = 35.0

<sup>&</sup>lt;sup>1</sup>The cohesion and friction angle provided represent one possible interpretation of a Mohr-Coulomb failure envelope. Qualified persons familiar with the material and the site should evaluate the test results independently prior to use in the intended application.

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: L2-1 (15'A) CU

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

### **Remolded or Initial Sample Properties**

Initial Mass (g): 389.62

Length (cm): 11.35

Diameter (cm): 4.89

Area (cm<sup>2</sup>): 18.80

Volume (cm<sup>3</sup>): 213.46

Dry Mass (g): 371.07

Dry Density (g/cm<sup>3</sup>): 1.74

Dry Unit Weight (lbf/ft<sup>3</sup>): 108.53

Equivalent Height of Solids (cm): 7.45

Water Content (%, g/g): 5.0

Water Content (%, vol): 8.7

Water Content Based On: ☐ Cuttings ☑ Whole Specimen

Porosity (%, vol): 34.4

Void Ratio (e): 0.524

Saturation (%): 25.3

### **Test and Sample Conditions**

Height to Diameter Ratio: 2.3

Largest Particle Dimension (approx.) (cm): 0.475

Diameter to Largest Particle Ratio (approx.): 10.30

Visual Description of Sample: Silt-Consolidated

USCS Classification: NA

Plastic Limit: NA

Liquid Limit: NA

Sample Preparation:  $\ oxdot$  In situ sample, extruded  $\ oxdot$  Remolded Sample

Trimming Procedure: NA

Split: NA

Percent Coarse Material (%): <5%

Particle Density (g/cm<sup>3</sup>): 2.65 ☑ Assumed ☐ Measured

B-Value Post Saturation: 0.99

Method for Specimen Saturation: ☐ Dry ☑ Wet

Laboratory analysis by: D. O'Dowd

Data entered by: C. Krous

Checked by: J. Hines



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: L2-1 (15'A) CU

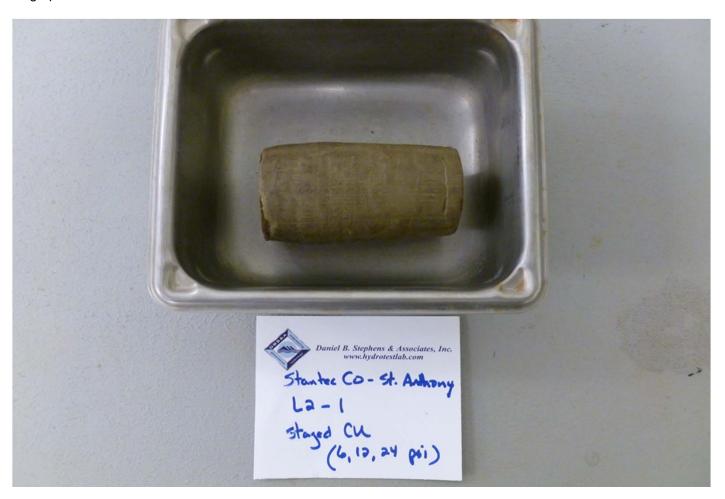
Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Remarks on Failure: Buldge failure.

General Notes: The entire sample was extruded and subjected to CU triaxial shear testing.

### Photograph of Failure



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-1 (15'A) CU Stage 1 (6.0 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

### Stage 1

Date/Time Shear Initiated: 6/14/18 1240 Date/Time Shear Completed: 6/14/18 1255

#### **Consolidation Data**

Length (cm): 11.08

Diameter (cm): 4.89

Measured outflow (cm<sup>3</sup>): 5.04

Area (cm2): 18.80

Area Determined by Method: ☑ A ☐ B

Volume (cm<sup>3</sup>): 208.42

Dry Density (g/cm<sup>3</sup>): 1.78

Dry Unit Weight (lbf/ft<sup>3</sup>): 111.15

Equivalent Height of Solids (cm): 7.45

Porosity (%, vol): 32.8

Void Ratio (e): 0.488

Time to 50% Primary Consol. (t50) (min): 0.7

### **Shear Data**

Effective Consolidation Stress (psi): 5.98

Total Back Pressure (psi): 71.58

Failure Criterion: Peak

Deviator Stress at Failure (psi): 5.9

Effective Minor Stress at Failure (psi): 2.5

Effective Major Stress at Failure (psi): 8.4

Membrane Correction Required/Applied: ☐ Yes ☑ No

Axial Strain (ε) at Failure (%): 2.12

Strain Rate (%/hr): 8.5

### Test Notes:

Test was halted prior to reaching a maximum target of 3% strain, after a reduction in deviator stress was recorded. Failure was interpreted as the peak deviator stress achieved.

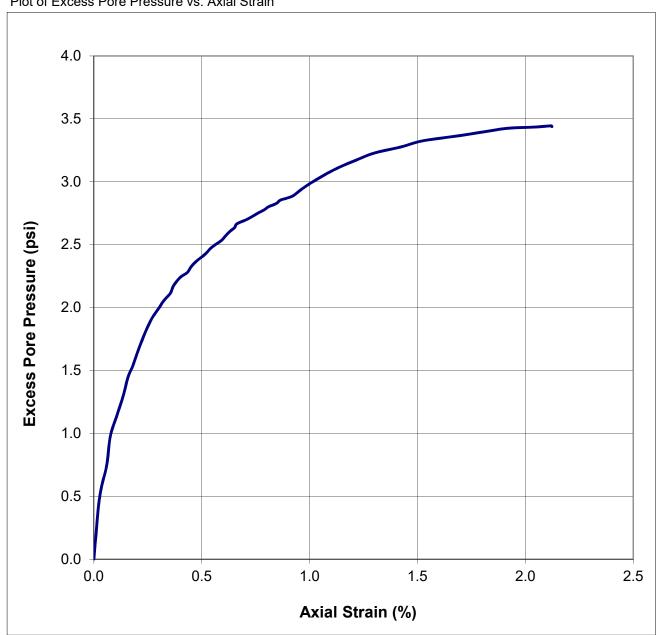
Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-1 (15'A) CU Stage 1 (6.0 psi) Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

### Plot of Excess Pore Pressure vs. Axial Strain



Job Name: Stantec Consulting Services Inc

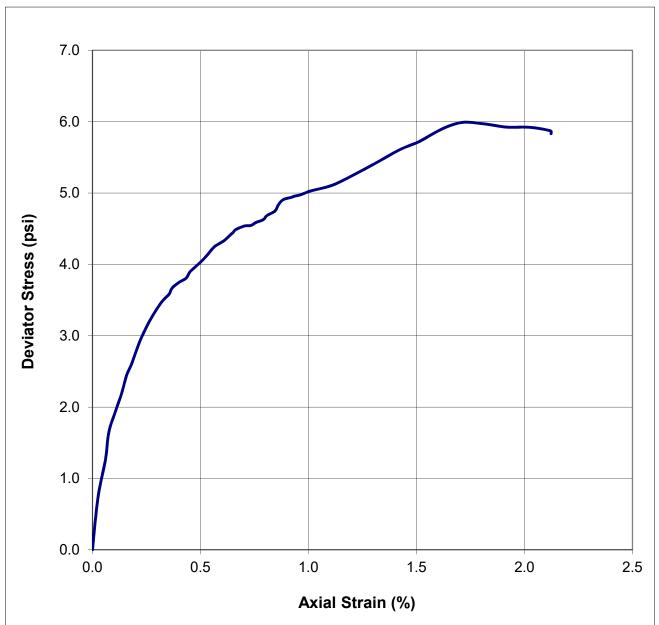
Job Number: DB18.1151.00

Sample Number: L2-1 (15'A) CU Stage 1 (6.0 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

### Plot of Deviator Stress vs. Axial Strain



Job Name: Stantec Consulting Services Inc

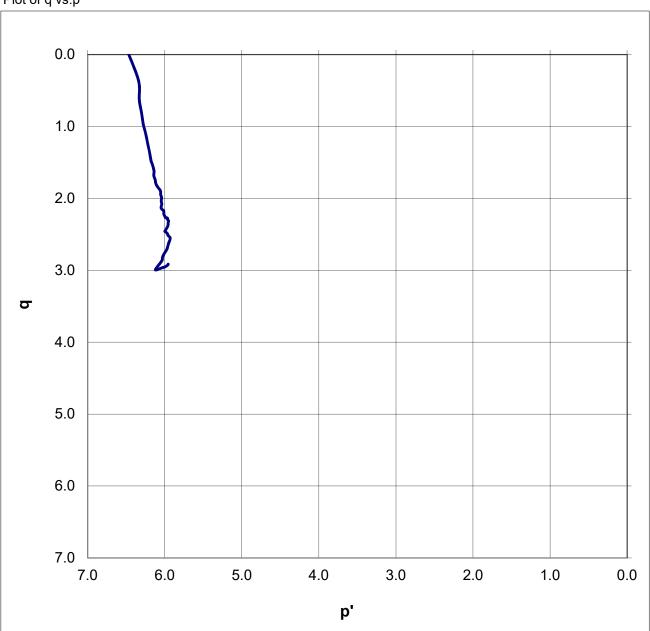
Job Number: DB18.1151.00

Sample Number: L2-1 (15'A) CU Stage 1 (6.0 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS







Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-1 (15'A) CU Stage 1 (6.0 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

### **Raw Data**

Axial	Effective Major	Effective Minor		Axial	Effective Maion	F
				Axiai	Effective Major	Effective Minor
Strain	Stress	Stress	Pore Pressure	Strain	Stress	Stress
(%)	(psi)	(psi)	(psi)	(%)	(psi)	(psi)
0.00	5.98	5.98				
0.03	6.22	5.49				
0.06	6.48	5.21				
80.0	6.64	4.99				
0.11	6.77	4.82				
0.14	6.86	4.66				
0.16	6.96	4.52				
0.18	7.03	4.42				
0.20	7.10	4.31				
0.22	7.17	4.21				
0.24	7.21	4.13				
0.27	7.27	4.04				
0.30	7.34	3.97				
0.33	7.38	3.89				
0.35	7.42	3.84				
0.37	7.45	3.78				
0.40	7.46	3.71				
0.43	7.47	3.67				
0.45	7.52	3.62				
0.48	7.55	3.57				
0.51	7.60	3.52				
0.54	7.63	3.47				
0.56	7.68	3.44				
0.59	7.70	3.40				
0.61	7.70	3.36				
0.63	7.73	3.33				
0.65	7.75	3.30				
0.66	7.76	3.27				
0.70	7.77	3.24				
0.73	7.75	3.21				
0.76	7.77	3.18				
0.79	7.78	3.15				
0.81	7.81	3.13				
0.85	7.85	3.10				
0.86	7.92	3.07				
0.89	7.97	3.06				
0.92	7.97	3.04				
0.93	7.97	3.02				
0.96	7.97	3.00				
0.99	7.98	2.97				
1.01	7.99	2.96				
1.11	8.00	2.89				
1.22	8.10	2.83				
1.31	8.19	2.78				
1.42	8.34	2.74				
1.52	8.41	2.69				
1.61	8.55	2.66				
1.71	8.63	2.64				
1.81	8.58	2.61				
1.92	8.50	2.58				
2.02	8.49	2.57				
2.12	8.42	2.55				
2.12	8.39	2.55				
	0.00 0.03 0.06 0.08 0.11 0.14 0.16 0.18 0.20 0.22 0.24 0.27 0.30 0.33 0.35 0.37 0.40 0.43 0.45 0.56 0.59 0.61 0.63 0.65 0.66 0.70 0.73 0.76 0.79 0.81 0.85 0.86 0.89 0.92 0.93 0.96 0.99 1.01 1.11 1.22 1.31 1.42 1.52 1.61 1.71 1.81 1.92 2.02 2.12	0.00	0.00         5.98         5.98           0.03         6.22         5.49           0.06         6.48         5.21           0.08         6.64         4.99           0.11         6.77         4.82           0.14         6.86         4.66           0.16         6.96         4.52           0.18         7.03         4.42           0.20         7.10         4.31           0.22         7.17         4.21           0.24         7.21         4.13           0.27         7.27         4.04           0.30         7.34         3.97           0.33         7.38         3.89           0.35         7.42         3.84           0.37         7.45         3.78           0.40         7.46         3.71           0.43         7.47         3.67           0.45         7.55         3.57           0.51         7.60         3.52           0.54         7.63         3.47           0.59         7.70         3.40           0.61         7.76         3.27           0.73         7.75         3.21	0.00         5.98         5.98           0.03         6.22         5.49           0.06         6.48         5.21           0.08         6.64         4.99           0.11         6.77         4.82           0.14         6.86         4.66           0.16         6.96         4.52           0.18         7.03         4.42           0.20         7.10         4.31           0.22         7.17         4.21           0.24         7.21         4.13           0.27         7.27         4.04           0.30         7.34         3.97           0.33         7.38         3.89           0.35         7.42         3.84           0.37         7.45         3.78           0.40         7.46         3.71           0.43         7.47         3.67           0.45         7.52         3.62           0.48         7.55         3.57           0.51         7.60         3.52           0.54         7.63         3.47           0.56         7.68         3.44           0.59         7.70         3.40	0.00	0.00 5.98 5.98 5.98 0.03 6.22 5.49 0.06 6.48 5.21 0.08 6.64 4.99 0.11 6.77 4.82 0.14 6.86 4.66 0.16 6.96 4.52 0.18 7.03 4.42 0.20 7.10 4.31 0.22 7.17 4.21 0.24 7.21 4.13 0.27 7.27 4.04 0.30 7.34 3.97 0.33 7.34 3.89 0.35 7.42 3.84 0.37 7.45 3.78 0.40 7.46 3.71 0.43 7.47 0.43 7.47 0.43 7.47 0.43 7.47 0.43 7.47 0.50 3.50 7.52 3.62 0.48 7.55 3.57 0.51 7.60 3.52 0.54 7.63 3.44 0.59 7.70 3.40 0.61 7.70 3.36 0.63 7.73 3.33 0.65 7.75 3.21 0.76 7.77 3.24 0.73 7.75 3.21 0.76 7.77 3.18 0.81 7.81 3.15 0.81 7.81 3.13 0.85 7.85 3.10 0.86 7.92 3.07 0.89 7.97 3.06 0.99 7.97 3.06 0.99 7.97 3.06 0.99 7.97 3.00 0.99 7.98 2.97 1.01 7.99 7.98 2.97 1.01 7.99 7.98 2.97 1.01 7.99 7.98 2.97 1.01 7.99 7.98 2.97 1.01 7.99 7.98 2.97 1.01 7.99 7.98 2.97 1.01 7.99 7.98 2.97 1.01 7.99 7.98 2.97 1.01 7.99 7.98 2.97 1.01 7.99 7.98 2.97 1.01 7.99 7.98 2.97 1.01 7.99 7.98 2.97 1.01 7.99 7.98 2.97 1.01 7.99 7.98 2.97 1.01 7.99 7.98 2.97 1.01 7.99 2.96 1.11 8.00 2.89 1.22 8.10 2.83 1.31 8.19 2.78 1.42 8.34 2.74 1.52 8.41 2.69 1.61 8.55 2.66 1.71 8.63 2.64 1.81 8.58 2.61 1.92 8.50 2.58 2.02 8.49 2.57 2.12 8.42 2.55

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-1 (15'A) CU Stage 2 (12.0 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

### Stage 2

Date/Time Shear Initiated: 6/14/18 1529 Date/Time Shear Completed: 6/14/18 1539

#### **Consolidation Data**

Length (cm): 11.17

Diameter (cm): 4.89

Measured outflow (cm<sup>3</sup>): 3.39

Area (cm<sup>2</sup>): 18.80

Area Determined by Method: ☑ A ☐ B

Volume (cm<sup>3</sup>): 210.07

Dry Density (g/cm<sup>3</sup>): 1.77

Dry Unit Weight (lbf/ft<sup>3</sup>): 110.28

Equivalent Height of Solids (cm): 7.45

Porosity (%, vol): 33.3

Void Ratio (e): 0.500

Time to 50% Primary Consol. (t50) (min): 0.97

### **Shear Data**

Effective Consolidation Stress (psi): 12.05

Total Back Pressure (psi): 71.48

Failure Criterion: Peak

Deviator Stress at Failure (psi): 13.0

Effective Minor Stress at Failure (psi): 5.0

Effective Major Stress at Failure (psi): 18.0

Membrane Correction Required/Applied: ☐ Yes ☑ No

Axial Strain (ε) at Failure (%): 2.96

Strain Rate (%/hr): 18.59

### Test Notes:

Test was halted after reaching a maximum target of 3% strain. Failure was interpreted as the peak deviator stress achieved.

Job Name: Stantec Consulting Services Inc

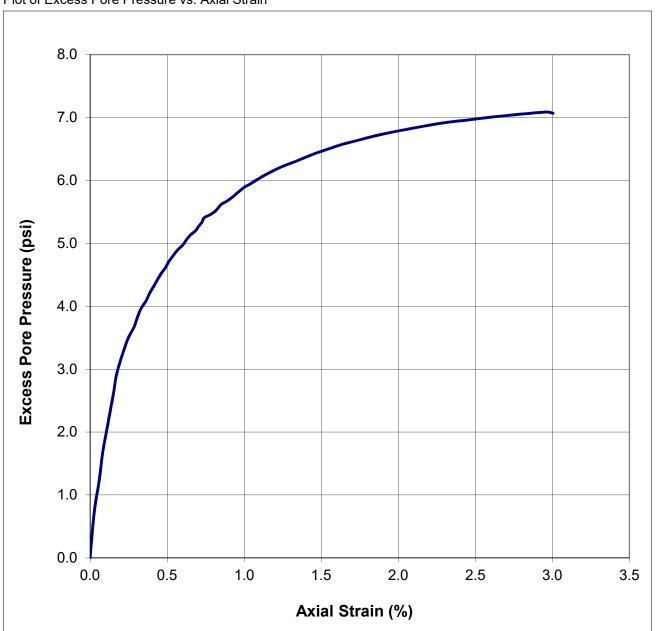
Job Number: DB18.1151.00

Sample Number: L2-1 (15'A) CU Stage 2 (12.0 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

### Plot of Excess Pore Pressure vs. Axial Strain



Job Name: Stantec Consulting Services Inc

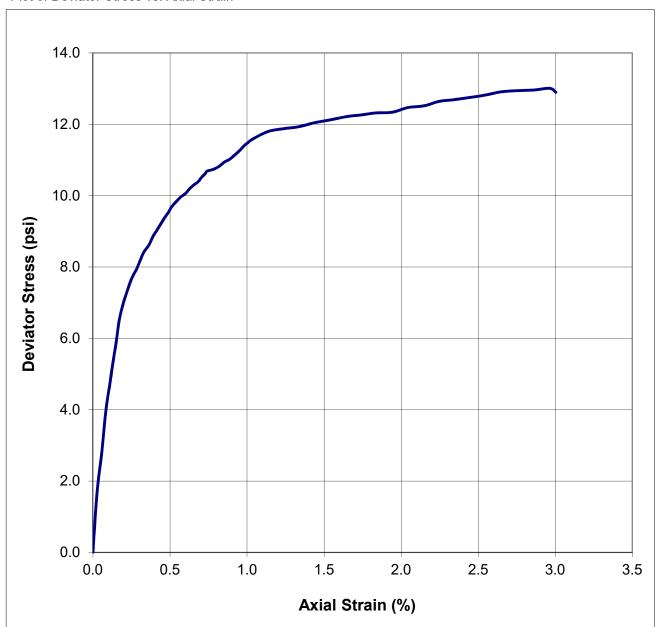
Job Number: DB18.1151.00

Sample Number: L2-1 (15'A) CU Stage 2 (12.0 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

### Plot of Deviator Stress vs. Axial Strain



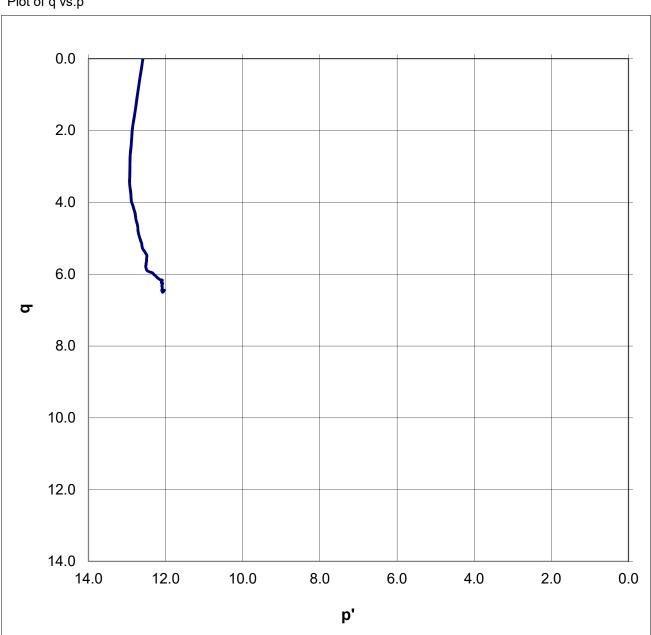
Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-1 (15'A) CU Stage 2 (12.0 psi) Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

### Plot of q vs.p'



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-1 (15'A) CU Stage 2 (12.0 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### **Raw Data**

Raw Data								
Pore Pressure	Axial Strain	Effective Major Stress	Effective Minor Stress	Pore Pressure	Axial Strain	Effective Major Stress	Effective Mino Stress	
(psi)	(%)	(psi)	(psi)	(psi)	(%)	(psi)	(psi)	
71.48	0.00	12.05	12.05	(1)	(7-7)	(1)	(1)	
72.21	0.03	13.02	11.32					
72.71	0.06	13.67	10.81					
73.15	0.08	14.27	10.37					
73.53	0.11	14.71	9.98					
73.84	0.11	15.08	9.67					
74.13	0.15	15.38	9.39					
74.13	0.13	15.63	9.15					
74.60	0.17	15.87	8.92					
74.80	0.22	16.03	8.72					
74.98	0.25	16.18	8.53					
75.15	0.29	16.32	8.36					
75.31	0.31	16.41	8.20					
75.44	0.33	16.49	8.07					
75.57	0.36	16.56	7.94					
75.69	0.39	16.65	7.82					
75.80	0.41	16.73	7.71					
75.91	0.44	16.79	7.60					
76.01	0.46	16.87	7.49					
76.09	0.49	16.94	7.41					
76.20	0.51	17.01	7.32					
76.29	0.54	17.06	7.23					
76.37	0.57	17.11	7.16					
76.45	0.60	17.15	7.08					
76.53	0.62	17.19	7.01					
76.61	0.65	17.22	6.94					
76.68	0.68	17.27	6.88					
76.75	0.71	17.32	6.80					
76.82	0.73	17.35	6.75					
76.88	0.74	17.36	6.68					
76.94	0.78	17.37	6.63					
76.99	0.81	17.39	6.58					
77.05	0.83	17.40	6.53					
77.10	0.85	17.42	6.48					
77.15	0.89	17.45	6.44					
77.19	0.91	17.50	6.40					
77.23	0.93	17.55	6.36					
77.28	0.96	17.59	6.31					
77.33	0.98	17.66	6.27					
77.38	1.00	17.71	6.23					
77.41	1.03	17.76	6.19					
77.56	1.13	17.84	6.05					
77.69	1.24	17.81	5.93					
77.78	1.34	17.77	5.83					
77.89	1.44	17.77	5.73					
77.97	1.54	17.77	5.65					
78.05	1.64	17.77	5.56					
78.12	1.74	17.76	5.50					
78.18	1.84	17.75	5.43					
78.24	1.94	17.71	5.38					
78.28	2.04	17.80	5.34					
78.33	2.15	17.80	5.28					
78.38	2.25	17.88	5.24					
78.41	2.34	17.89	5.20					
78.44	2.45	17.92	5.17					
78.47	2.54	17.95	5.14					
78.49	2.64	18.01	5.11					
78.52	2.75	18.02	5.08					
78.55	2.75	18.01	5.05					
78.57	2.96	18.04	5.03					
78.55	3.00	17.94	5.04					

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-1 (15'A) CU Stage 3 (24.0 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### Stage 3

Date/Time Shear Initiated: 6/15/18 1339 Date/Time Shear Completed: 6/15/18 1447

#### **Consolidation Data**

Length (cm): 11.20

Diameter (cm): 4.89

Measured outflow (cm<sup>3</sup>): 2.78

Area (cm2): 18.80

Area Determined by Method: ☑ A ☐ B

Volume (cm<sup>3</sup>): 210.68

Dry Density (g/cm<sup>3</sup>): 1.76

Dry Unit Weight (lbf/ft<sup>3</sup>): 109.96

Equivalent Height of Solids (cm): 7.45

Porosity (%, vol): 33.5

Void Ratio (e): 0.505

Time to 50% Primary Consol. (t50) (min): 1.82

#### **Shear Data**

Effective Consolidation Stress (psi): 24.03

Total Back Pressure (psi): 71.59

Failure Criterion: Peak

Deviator Stress at Failure (psi): 26.2

Effective Minor Stress at Failure (psi): 9.6

Effective Major Stress at Failure (psi): 35.8

Membrane Correction Required/Applied: ☐ Yes ☑ No

Axial Strain (ε) at Failure (%): 7.73

Strain Rate (%/hr): 13.21

#### Test Notes:

Test was halted after reaching the target of 15% strain. Failure was interpreted as the peak deviator stress achieved.

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

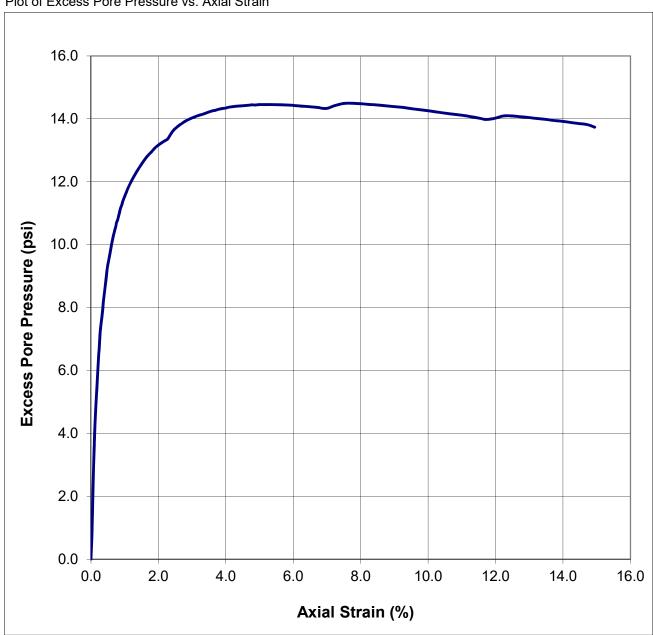
Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-1 (15'A) CU Stage 3 (24.0 psi) Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### Plot of Excess Pore Pressure vs. Axial Strain



Job Name: Stantec Consulting Services Inc

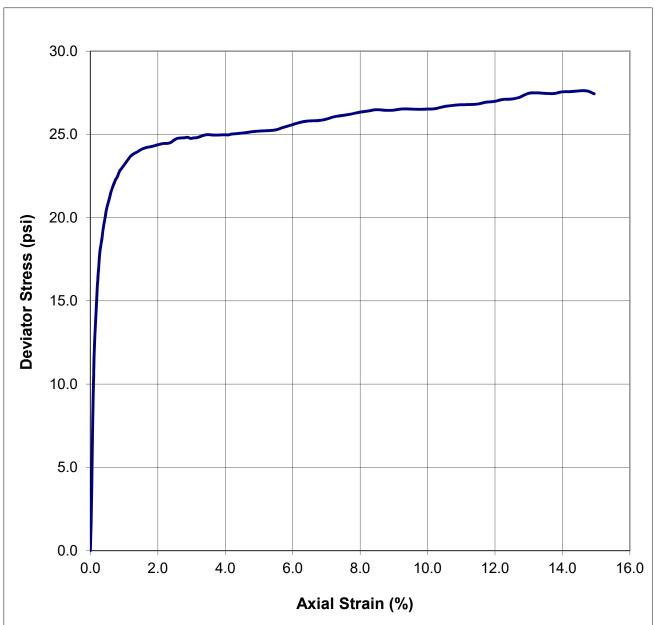
Job Number: DB18.1151.00

Sample Number: L2-1 (15'A) CU Stage 3 (24.0 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### Plot of Deviator Stress vs. Axial Strain



Job Name: Stantec Consulting Services Inc

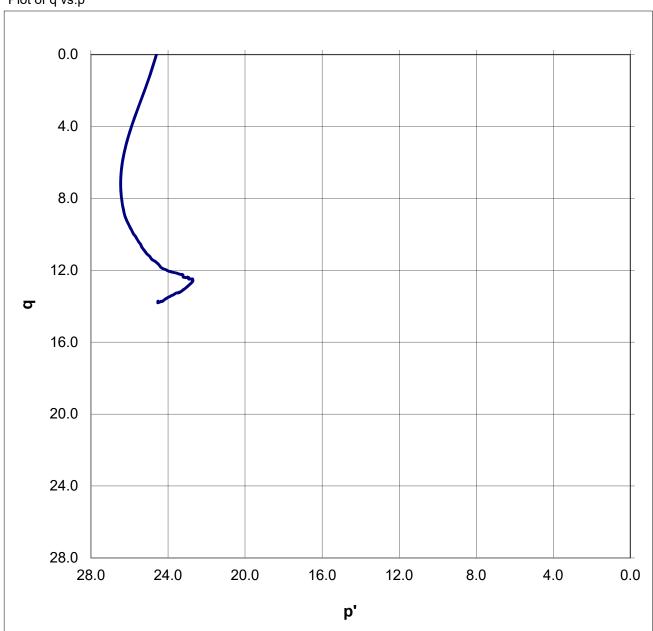
Job Number: DB18.1151.00

Sample Number: L2-1 (15'A) CU Stage 3 (24.0 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS





Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-1 (15'A) CU Stage 3 (24.0 psi)

Project Name: St. Anthony Geotech Investigation

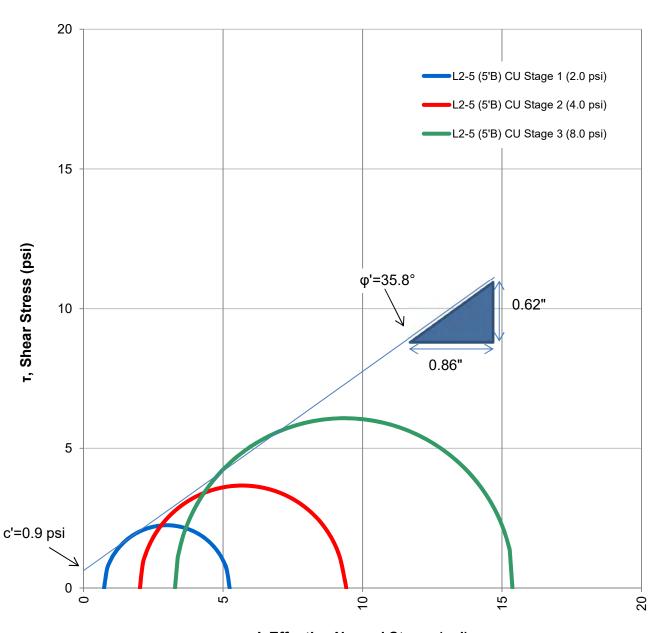
PO Number: 233001076-DBS

#### **Raw Data**

			Raw				
	Axial	Effective Major	Effective Minor		Axial	Effective Major	Effective Minor
Pore Pressure	Strain	Stress	Stress	Pore Pressure	Strain	Stress	Stress
(psi)	(%)	(psi)	(psi)	(psi)	(%)	(psi)	(psi)
71.59	0.00	24.03	24.03	85.65	3.07	34.80	10.01
72.57	0.03	25.83	23.06	85.69	3.17	34.77	9.96
73.41	0.05	27.55	22.22	85.73	3.28	34.81	9.93
74.26	0.07	29.27	21.36	85.76	3.38	34.84	9.89
75.06	0.09	30.66	20.57	85.80	3.47	34.84	9.85
75.74 76.25	0.11	31.70	19.88	85.84	3.57	34.78	9.81 9.79
76.35 76.87	0.14 0.17	32.46 33.03	19.27 18.75	85.86 85.89	3.68 3.78	34.74 34.72	9.79 9.76
77.34	0.17	33.49	18.28	85.92	3.76	34.69	9.73
77.76	0.19	33.84	17.85	85.93	3.98	34.69	9.71
78.15	0.21	34.13	17.47	85.96	4.09	34.64	9.68
78.52	0.26	34.39	17.09	85.98	4.18	34.67	9.66
78.84	0.28	34.60	16.77	85.99	4.28	34.68	9.64
79.15	0.31	34.76	16.46	86.00	4.38	34.67	9.63
79.43	0.34	34.87	16.18	86.01	4.48	34.68	9.61
79.69	0.36	34.97	15.92	86.02	4.57	34.69	9.60
79.93	0.38	35.06	15.68	86.02	4.68	34.71	9.59
80.15	0.41	35.13	15.45	86.04	4.78	34.72	9.57
80.38	0.43	35.21	15.23	86.03	4.87	34.74	9.57
80.58	0.46	35.24	15.02	86.04	4.97	34.75	9.56
80.77	0.47	35.29	14.83	86.04	5.23	34.76	9.54
80.94	0.50	35.34	14.66	86.04	5.47	34.78	9.53
81.11	0.53	35.38	14.49	86.04	5.71	34.93	9.52
81.28	0.56	35.41	14.31	86.02	5.97	35.08	9.52
81.42	0.58	35.47	14.17	86.00	6.23	35.25	9.52
81.56	0.60	35.52	14.03	85.98	6.47	35.33	9.52
81.70	0.63	35.54	13.90	85.95	6.74	35.34	9.52
81.83	0.65	35.56	13.76	85.92	6.98	35.43	9.53
81.94	0.68	35.59	13.65	86.01	7.23	35.59	9.53
82.07	0.71	35.61	13.52	86.08	7.49	35.69	9.55
82.18	0.74	35.62	13.41	86.09	7.73	35.78	9.56
82.29	0.76	35.61	13.29	86.07	7.98	35.90	9.57
82.38	0.79	35.61	13.20	86.05	8.24	35.99	9.59
82.49	0.81	35.62	13.09	86.04	8.49	36.09	9.60
82.58	0.84	35.65	12.99	86.00	8.73	36.07	9.63
82.67	0.86	35.66	12.90	85.98	8.99	36.09	9.64
82.76	0.88	35.66	12.81	85.96	9.24	36.18	9.65
82.84	0.91	35.64	12.73	85.92	9.49	36.20	9.68
82.92	0.93	35.62	12.66	85.88	9.75	36.21	9.71
83.00	0.95	35.61	12.57	85.85	10.00	36.24	9.72
83.08	0.98	35.60	12.49	85.81	10.24	36.30	9.75
83.34 83.58	1.08	35.60 35.64	12.22 11.98	85.78 85.74	10.49 10.74	36.44	9.77 9.79
83.79	1.18 1.29	35.59	11.76	85.71	10.74	36.53 36.58	9.79
83.96	1.29	35.52	11.58	85.67	11.24	36.62	9.83
84.13	1.49	35.47	11.40	85.62	11.49	36.68	9.85
84.28	1.49	35.40	11.24	85.57	11.73	36.80	9.87
84.42	1.68	35.31	11.09	85.61	11.98	36.89	9.92
84.53 84.65	1.78 1.88	35.23 35.15	10.97 10.84	85.69 85.69	12.24 12.48	37.03 37.07	9.93 9.95
84.74	1.00	35.11	10.74	85.66	12.46	37.20	9.98
84.82	2.09	35.06	10.74	85.64	12.73	37.46	10.00
84.89	2.09	35.03	10.57	85.60	13.23	37.52	10.03
84.96	2.18	34.95	10.37	85.58	13.48	37.52 37.51	10.05
85.13	2.28	34.92	10.49	85.54	13.74	37.52	10.08
85.25	2.30	34.98	10.33	85.51	13.74	37.64	10.09
85.35	2.47	35.02	10.33	85.48	14.23	37.68	10.12
85.43	2.68	34.99	10.21	85.44	14.48	37.75	10.12
85.51	2.78	34.95	10.16	85.41	14.73	37.77	10.14
85.56	2.88	34.92	10.10	85.33	14.94	37.67	10.10
85.61	2.98	34.80	10.05				

## **Mohr's Circles: Effective**

## L2-5 (5'B) CU



 $\sigma$ ', Effective Normal Stress (psi)

# Estimated Effective Mohr-Coulomb Failure Parameters<sup>1</sup>:

cohesion (c')(psi) = 0.9 friction angle  $(\phi')(^{\circ})$  = 35.8

<sup>&</sup>lt;sup>1</sup>The cohesion and friction angle provided represent one possible interpretation of a Mohr-Coulomb failure envelope. Qualified persons familiar with the material and the site should evaluate the test results independently prior to use in the intended application.

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: L2-5 (5'B) CU

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### **Remolded or Initial Sample Properties**

Initial Mass (g): 410.32

Length (cm): 11.51

Diameter (cm): 4.91

Area (cm<sup>2</sup>): 18.97

Volume (cm<sup>3</sup>): 218.37

Dry Mass (g): 366.98

Dry Density (g/cm<sup>3</sup>): 1.68

Dry Unit Weight (lbf/ft<sup>3</sup>): 104.92

Equivalent Height of Solids (cm): 7.30

Water Content (%, g/g): 11.8

Water Content (%, vol): 19.8

 $Water\ Content\ Based\ On:\ \square$  Cuttings  $\ oxdot$  Whole Specimen

Porosity (%, vol): 36.6

Void Ratio (e): 0.577

Saturation (%): 54.3

#### **Test and Sample Conditions**

Height to Diameter Ratio: 2.3

Largest Particle Dimension (approx.) (cm): 0.475

Diameter to Largest Particle Ratio (approx.): 10.35

Visual Description of Sample: Silt-Consolidated

USCS Classification: NA

Plastic Limit: NA

Liquid Limit: NA

Sample Preparation:  $\ oxdot$  In situ sample, extruded  $\ oxdot$  Remolded Sample

Trimming Procedure: NA

Split: NA

Percent Coarse Material (%): <5%

Particle Density (g/cm<sup>3</sup>): 2.65 ☑ Assumed ☐ Measured

B-Value Post Saturation: 0.97

Method for Specimen Saturation: ☐ Dry ☑ Wet

Laboratory analysis by: D. O'Dowd

Data entered by: C. Krous

Checked by: J. Hines



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: L2-5 (5'B) CU

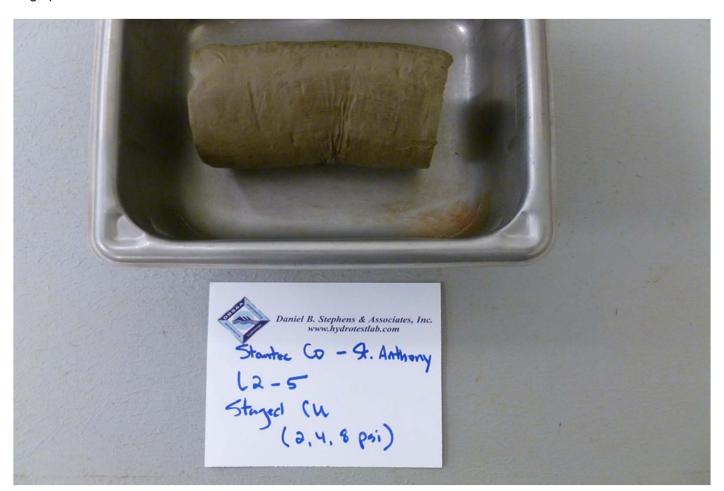
Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Remarks on Failure: Buldge failure.

General Notes: The entire sample was extruded and subjected to CU triaxial shear testing.

#### Photograph of Failure



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-5 (5'B) CU Stage 1 (2.0 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### Stage 1

Date/Time Shear Initiated: 6/14/18 1205 Date/Time Shear Completed: 6/14/18 1210

#### **Consolidation Data**

Length (cm): 11.49

Diameter (cm): 4.91

Measured outflow (cm<sup>3</sup>): 0.513

Area (cm2): 18.97

Area Determined by Method: ☑ A ☐ B

Volume (cm<sup>3</sup>): 217.85

Dry Density (g/cm<sup>3</sup>): 1.68

Dry Unit Weight (lbf/ft<sup>3</sup>): 105.16

Equivalent Height of Solids (cm): 7.30

Porosity (%, vol): 36.4

Void Ratio (e): 0.573

Time to 50% Primary Consol. (t50) (min): 0.16

#### **Shear Data**

Effective Consolidation Stress (psi): 1.97

Total Back Pressure (psi): 80.68

Failure Criterion: Peak

Deviator Stress at Failure (psi): 4.5

Effective Minor Stress at Failure (psi): 0.7

Effective Major Stress at Failure (psi): 5.2

Membrane Correction Required/Applied: ☐ Yes ☑ No

Axial Strain (ε) at Failure (%): 1.88

Strain Rate (%/hr): 37.08

#### Test Notes:

Test was halted after reaching a maximum target of 3% strain. Failure was interpreted as the peak deviator stress achieved.

Laboratory analysis by: D. O'Dowd

Data entered by: C. Krous

Checked by: J. Hines

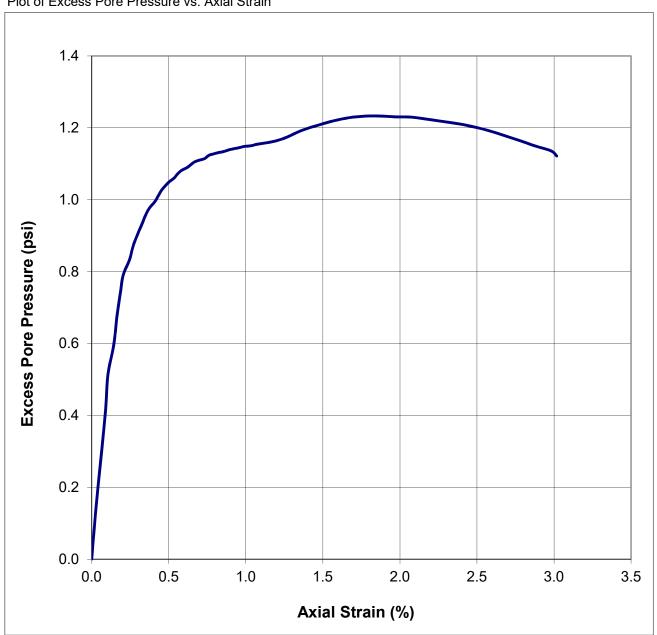
Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-5 (5'B) CU Stage 1 (2.0 psi) Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### Plot of Excess Pore Pressure vs. Axial Strain



Job Name: Stantec Consulting Services Inc

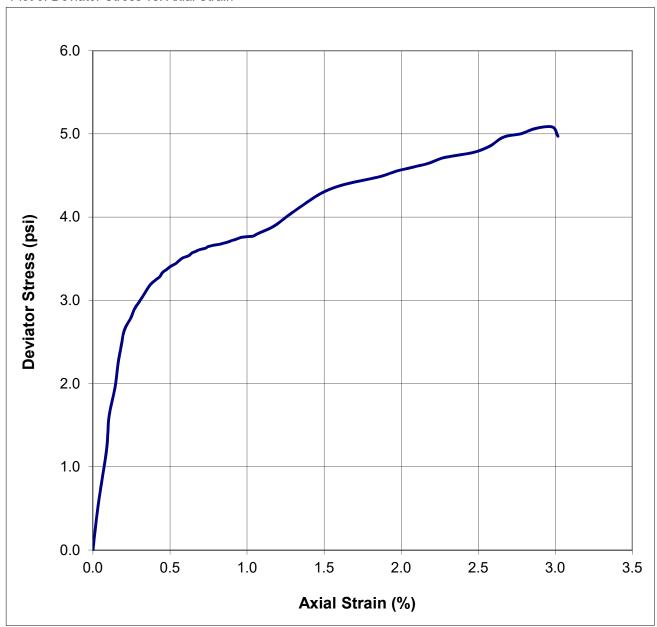
Job Number: DB18.1151.00

Sample Number: L2-5 (5'B) CU Stage 1 (2.0 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### Plot of Deviator Stress vs. Axial Strain



Job Name: Stantec Consulting Services Inc

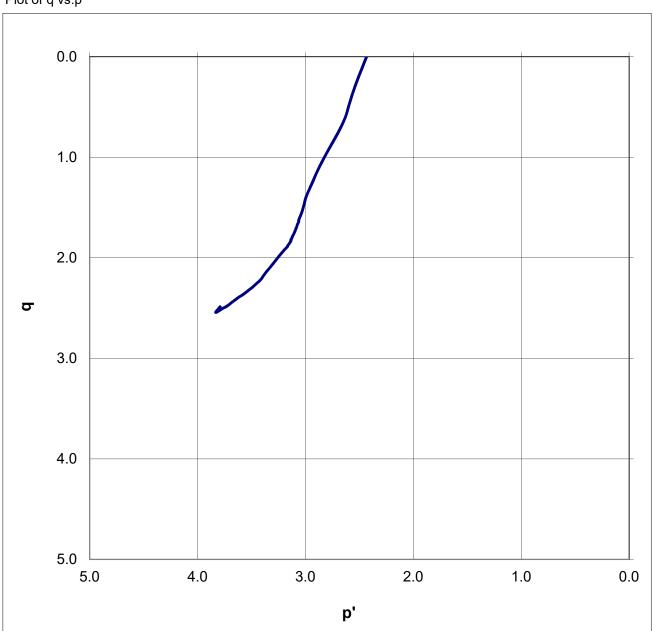
Job Number: DB18.1151.00

Sample Number: L2-5 (5'B) CU Stage 1 (2.0 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### Plot of q vs.p'



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-5 (5'B) CU Stage 1 (2.0 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### **Raw Data**

Raw Data								
Pore Pressure	Axial Strain	Effective Major Stress	Effective Minor Stress	Pore Pressure	Axial Strain	Effective Major Stress	Effective Minor Stress	
(psi)	(%)	(psi)	(psi)	(psi)	(%)	(psi)	(psi)	
80.68	0.00	1.97	1.97	,	• • • • • • • • • • • • • • • • • • • •	,		
80.84	0.03	2.31	1.81					
80.98	0.06	2.57	1.68					
81.10	0.09	2.79	1.56					
81.20	0.11	3.07	1.46					
81.28	0.14	3.33	1.37					
81.36	0.16	3.54	1.30					
81.42	0.18	3.69	1.24					
81.47	0.20	3.82	1.18					
81.52	0.25	3.93	1.14					
81.56	0.27	3.99	1.10					
81.59	0.30	4.04	1.07					
81.62	0.33	4.09	1.04					
81.64	0.35	4.14	1.01					
81.66	0.37	4.19	0.99					
81.68	0.41	4.23	0.98					
81.70	0.43	4.24	0.96					
81.71	0.45	4.28	0.95					
81.72	0.48	4.30	0.93					
81.73	0.50	4.33	0.92					
81.74	0.54	4.35	0.91					
81.75	0.55	4.37 4.40	0.90					
81.76 81.77	0.58 0.62	4.42	0.89 0.88					
81.78	0.64	4.44	0.87					
81.79	0.66	4.45	0.87					
81.79	0.69	4.47	0.86					
81.80	0.73	4.48	0.86					
81.80	0.74	4.50	0.85					
81.81	0.76	4.50	0.84					
81.81	0.79	4.51	0.84					
81.81	0.82	4.51	0.84					
81.82	0.85	4.52	0.84					
81.82	0.87	4.53	0.83					
81.82	0.90	4.55	0.83					
81.83	0.93	4.56	0.83					
81.83	0.96	4.58	0.82					
81.83	0.99	4.58	0.82					
81.83	1.01	4.59	0.82					
81.83	1.04	4.59	0.82					
81.84	1.06	4.61	0.81					
81.85	1.17	4.70	0.81					
81.86	1.26	4.80	0.80					
81.88	1.36	4.92	0.78					
81.89	1.47	5.04	0.76					
81.90	1.57	5.11	0.75					
81.91	1.67	5.15	0.74					
81.92	1.77	5.18	0.73					
81.92	1.88	5.23	0.74					
81.91	1.97	5.29	0.74					
81.91	2.07	5.33	0.74					
81.91	2.18	5.39	0.74					
81.90	2.27	5.46	0.75					
81.90	2.38	5.50	0.75					
81.89	2.48	5.54	0.76					
81.88	2.58	5.63 5.75	0.77					
81.86	2.67	5.75	0.78					
81.85 81.83	2.78	5.80	0.80					
81.82	2.87 2.98	5.88 5.91	0.81 0.83					
01.02	3.02	5.81	0.84					

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-5 (5'B) CU Stage 2 (4.0 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### Stage 2

Date/Time Shear Initiated: 6/14/18 1446 Date/Time Shear Completed: 6/14/18 1501

#### **Consolidation Data**

Length (cm): 11.43

Diameter (cm): 4.91

Measured outflow (cm<sup>3</sup>): 1.608

Area (cm2): 18.97

Area Determined by Method: ☑ A ☐ B

Volume (cm<sup>3</sup>): 216.76

Dry Density (g/cm<sup>3</sup>): 1.69

Dry Unit Weight (lbf/ft<sup>3</sup>): 105.70

Equivalent Height of Solids (cm): 7.30

Porosity (%, vol): 36.1

Void Ratio (e): 0.565

Time to 50% Primary Consol. (t50) (min): 1.49

#### **Shear Data**

Effective Consolidation Stress (psi): 4.01

Total Back Pressure (psi): 80.54

Failure Criterion: Peak

Deviator Stress at Failure (psi): 7.3

Effective Minor Stress at Failure (psi): 2.0

Effective Major Stress at Failure (psi): 9.4

Membrane Correction Required/Applied: ☐ Yes ☑ No

Axial Strain (ε) at Failure (%): 0.97

Strain Rate (%/hr): 12.11

#### Test Notes:

Test was halted after reaching a maximum target of 3% strain. Failure was interpreted as the peak deviator stress achieved.

Laboratory analysis by: D. O'Dowd

Data entered by: C. Krous

Checked by: J. Hines

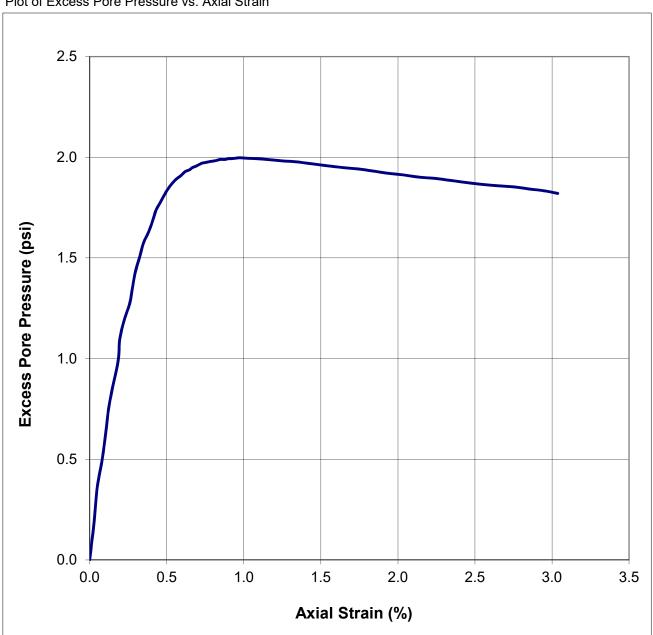
Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-5 (5'B) CU Stage 2 (4.0 psi) Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### Plot of Excess Pore Pressure vs. Axial Strain



Job Name: Stantec Consulting Services Inc

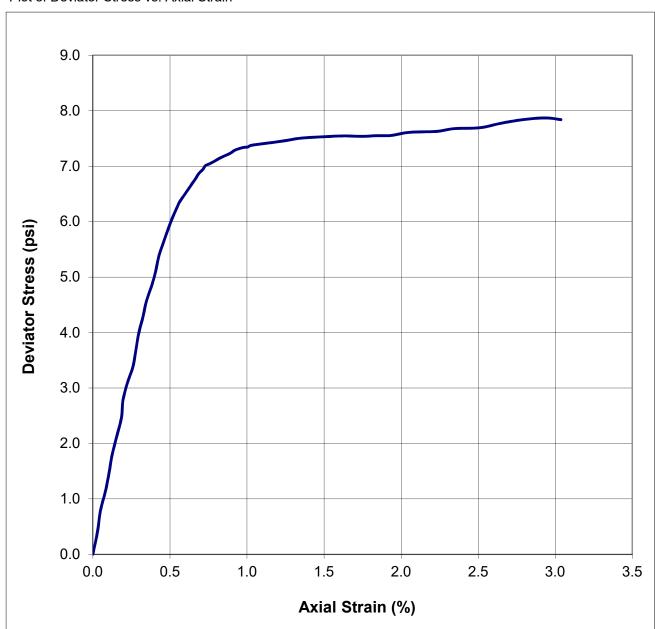
Job Number: DB18.1151.00

Sample Number: L2-5 (5'B) CU Stage 2 (4.0 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### Plot of Deviator Stress vs. Axial Strain



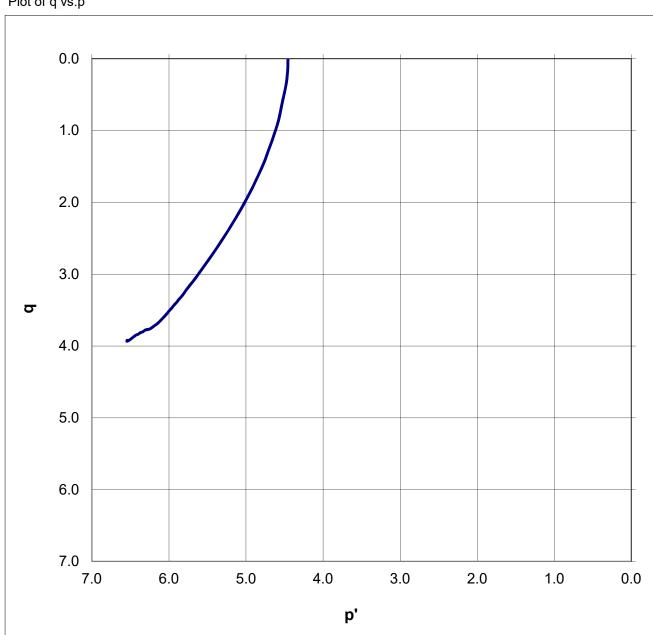
Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-5 (5'B) CU Stage 2 (4.0 psi) Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### Plot of q vs.p'



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-5 (5'B) CU Stage 2 (4.0 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### **Raw Data**

	Raw Data									
Pore Pressure	Axial Strain	Effective Major Stress	Effective Minor Stress	Pore Pressure	Axial Strain	Effective Major Stress	Effective Minor Stress			
(psi)	(%)	(psi)	(psi)	(psi)	(%)	(psi)	(psi)			
80.54	0.00	4.01	4.01							
80.74	0.03	4.23	3.81							
80.90	0.05	4.43	3.65							
81.04	0.08	4.65	3.51							
81.18	0.10	4.84	3.38							
81.30	0.12	5.04	3.25							
81.42	0.15	5.26	3.13							
81.54	0.19	5.49	3.02							
81.64	0.20	5.70	2.91							
81.73	0.22	5.91	2.82							
81.82	0.26	6.12	2.73							
81.90	0.28	6.34	2.65							
81.98	0.30	6.57	2.58							
82.05 82.12	0.33 0.35	6.79 7.02	2.51 2.44							
82.17	0.35	7.02 7.24	2.44							
82.23	0.36	7.46	2.33							
82.28	0.41	7.67	2.28							
82.32	0.46	7.86	2.24							
82.36	0.49	8.05	2.20							
82.39	0.51	8.19	2.17							
82.41	0.54	8.34	2.15							
82.43	0.56	8.48	2.13							
82.45	0.59	8.58	2.11							
82.47	0.62	8.68	2.09							
82.48	0.65	8.78	2.08							
82.49	0.67	8.84	2.07							
82.50	0.69	8.93	2.06							
82.51	0.71	8.99	2.05							
82.51	0.73	9.05	2.05							
82.52	0.76	9.09	2.04							
82.52	0.79	9.12	2.04							
82.53	0.82	9.17	2.03							
82.53	0.84	9.20	2.03							
82.53	0.88	9.24	2.03							
82.54	0.90	9.27	2.02							
82.54	0.92	9.31	2.02							
82.54	0.95	9.33	2.02							
82.54	0.97	9.35	2.02							
82.54	1.01	9.37	2.02							
82.54	1.03	9.39	2.02							
82.53	1.14	9.44	2.02							
82.53	1.24	9.49	2.03							
82.52	1.33	9.54	2.04							
82.51	1.43	9.56	2.04							
82.50 82.40	1.54	9.59	2.05							
82.49 82.48	1.64 1.74	9.61 9.61	2.06 2.07							
82.47	1.84	9.63	2.08							
82.46	1.93	9.64	2.09							
82.46 82.44	2.04 2.14	9.70 9.73	2.09 2.11							
82.44 82.44	2.14	9.73 9.74								
82.44 82.43	2.24	9.74 9.80	2.11 2.12							
82.43 82.42	2.34 2.44	9.80 9.81	2.12							
82.41	2.44	9.84	2.14							
82.40	2.63	9.64 9.91	2.14							
82.40 82.40	2.03	9.97	2.15							
02.40		10.02								
82 30										
82.39 82.38	2.85 2.95	10.02	2.16 2.17							

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-5 (5'B) CU Stage 3 (8.0 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### Stage 3

Date/Time Shear Initiated: 6/15/18 1315 Date/Time Shear Completed: 6/15/18 1345

#### **Consolidation Data**

Length (cm): 11.44

Diameter (cm): 4.91

Measured outflow (cm<sup>3</sup>): 1.356

Area (cm2): 18.97

Area Determined by Method: ☑ A ☐ B

Volume (cm<sup>3</sup>): 217.01

Dry Density (g/cm<sup>3</sup>): 1.69

Dry Unit Weight (lbf/ft<sup>3</sup>): 105.57 Equivalent Height of Solids (cm): 7.30

Porosity (%, vol): 36.2

Void Ratio (e): 0.567

Time to 50% Primary Consol. (t50) (min): 0.80

#### **Shear Data**

Effective Consolidation Stress (psi): 7.99

Total Back Pressure (psi): 80.73

Failure Criterion: Peak

Deviator Stress at Failure (psi): 12.2

Effective Minor Stress at Failure (psi): 3.3

Effective Major Stress at Failure (psi): 15.4

Membrane Correction Required/Applied: ✓ Yes ☐ No

Axial Strain (ε) at Failure (%): 1.13

Strain Rate (%/hr): 29.86

#### Test Notes:

Test was halted after reaching the target of 15% strain. Failure was interpreted as the peak deviator stress achieved.

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

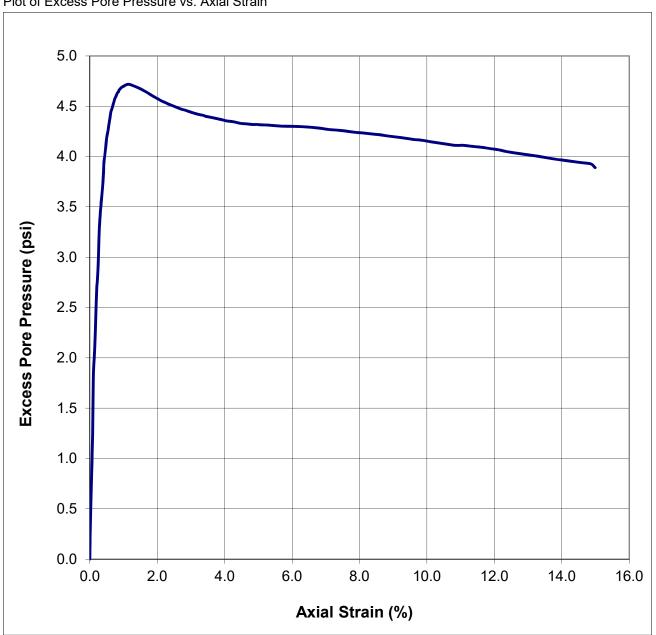
Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-5 (5'B) CU Stage 3 (8.0 psi) Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### Plot of Excess Pore Pressure vs. Axial Strain



Job Name: Stantec Consulting Services Inc

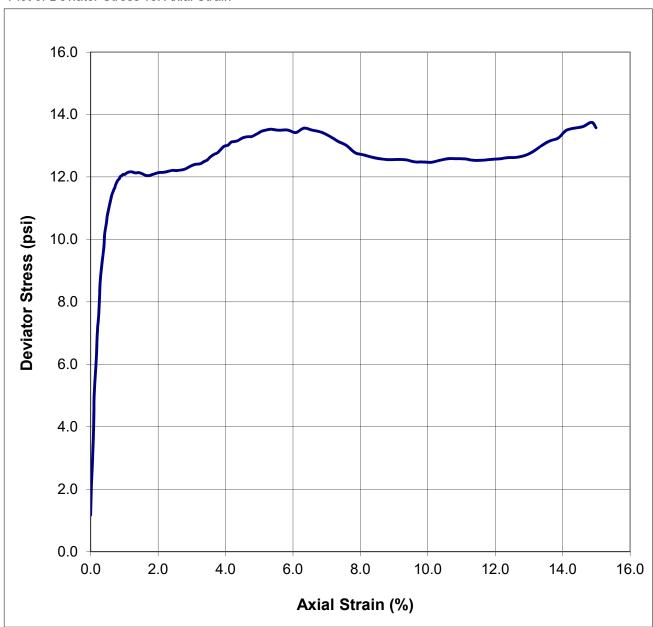
Job Number: DB18.1151.00

Sample Number: L2-5 (5'B) CU Stage 3 (8.0 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### Plot of Deviator Stress vs. Axial Strain



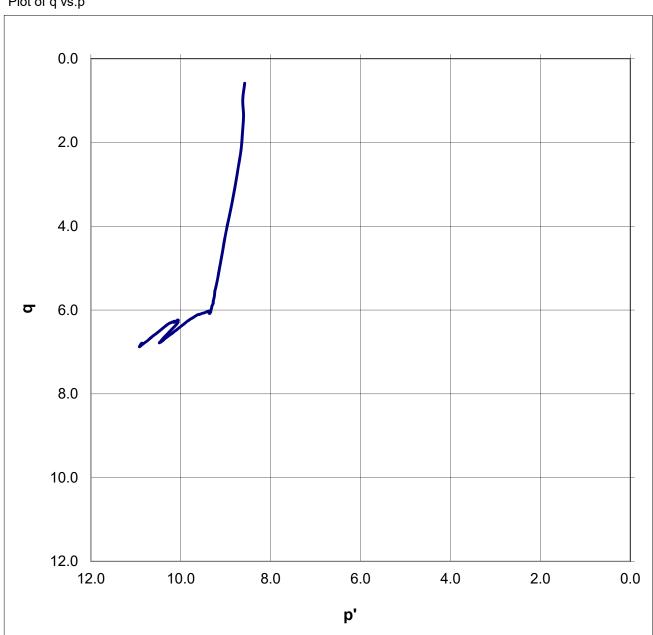
Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-5 (5'B) CU Stage 3 (8.0 psi) Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### Plot of q vs.p'



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-5 (5'B) CU Stage 3 (8.0 psi)

Project Name: St. Anthony Geotech Investigation

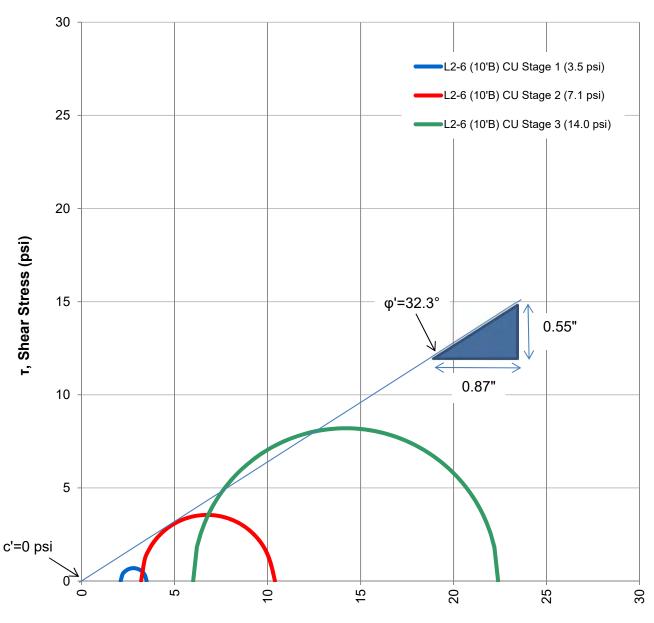
PO Number: 233001076-DBS

#### **Raw Data**

	Avial	Effective Major	Effective Minor		Avial	Effoctive Maia	Effective Miner
Doro Brocouro	Axial	•	Stress	Pore Pressure	Axial	Effective Major	Effective Mino
Pore Pressure	Strain	Stress			Strain	Stress	Stress
(psi)	(%)	(psi)	(psi)	(psi)	(%)	(psi)	(psi)
80.73	0.00	9.16	7.99	85.15	3.15 3.26	15.98	3.57 3.57
81.08 81.49	0.02 0.05	9.59 9.97	7.65 7.24	85.14 85.14	3.26	16.00 16.07	3.58
81.88	0.05		6.84	85.12	3.45	16.13	3.59
		10.42					
82.25	0.09	10.85	6.47	85.12	3.55	16.24	3.60
82.57	0.11	11.29	6.15	85.11	3.66	16.33	3.60
82.87	0.15	11.70	5.85	85.10	3.76	16.39	3.61
83.14	0.18	12.07	5.58	85.10	3.86	16.50	3.62
83.38	0.20	12.41	5.34	85.09	3.96	16.61	3.63
83.58	0.24	12.72	5.14	85.08	4.07	16.65	3.63
83.77	0.26	13.00	4.95	85.08	4.17	16.76	3.64
83.94	0.28	13.24	4.78	85.07	4.25	16.77	3.64
84.10	0.30	13.47	4.62	85.06	4.37	16.81	3.65
84.24	0.33	13.65	4.48	85.06	4.47	16.89	3.66
84.36	0.36	13.84	4.36	85.05	4.57	16.93	3.66
84.48	0.39	13.99	4.24	85.05	4.67	16.95	3.66
84.58	0.41	14.14	4.14	85.05	4.77	16.96	3.67
84.68	0.42	14.27	4.04	85.04	4.87	17.02	3.67
84.76	0.46	14.39	3.96	85.04	4.97	17.07	3.67
84.84	0.48	14.51	3.88	85.04	5.07	17.14	3.67
84.91	0.50	14.61	3.81	85.04	5.33	17.21	3.68
84.97	0.53	14.71	3.75	85.03	5.58	17.18	3.69
85.03	0.56	14.80	3.69	85.03	5.84	17.20	3.69
85.08	0.58	14.85	3.64	85.03	6.08	17.12	3.69
85.13	0.61	14.91	3.59	85.02	6.33	17.26	3.70
85.17	0.63	14.98	3.55	85.02	6.58	17.20	3.70
85.21	0.66	15.04	3.51	85.01	6.82	17.15	3.71
85.24	0.69	15.08	3.48	85.00	7.09	17.03	3.72
85.27	0.72	15.11	3.45	84.99	7.34	16.87	3.73
85.30	0.74	15.16	3.42	84.98	7.59	16.75	3.74
85.32	0.76	15.21	3.40	84.97	7.84	16.53	3.75
85.33	0.79	15.24	3.39	84.96	8.09	16.46	3.75
85.36	0.81	15.27	3.36	84.95	8.35	16.39	3.76
85.37	0.85	15.29	3.35	84.94	8.60	16.35	3.77
85.38	0.86	15.32	3.33	84.93	8.85	16.34	3.78
85.39	0.89	15.35	3.32	84.92	9.10	16.35	3.79
85.41	0.92	15.35	3.31	84.91	9.35	16.35	3.80
85.42	0.95	15.38	3.30	84.90	9.60	16.30	3.81
85.42	0.98	15.38	3.30	84.89	9.85	16.30	3.82
85.42	1.01	15.37	3.29	84.87	10.10	16.31	3.84
85.43	1.01	15.38	3.29	84.86	10.10	16.38	3.85
	1.13			84.85			3.86
85.44	1.13	15.43	3.28		10.61	16.44	
85.44		15.44	3.28	84.84	10.85	16.45	3.87
85.42	1.32	15.43	3.29	84.84	11.10	16.45	3.87
85.41	1.43	15.45	3.31	84.83	11.35	16.41	3.88
85.39	1.54	15.43	3.33	84.82	11.62	16.42	3.89
85.38	1.63	15.40	3.34	84.81	11.85	16.46	3.90
85.36	1.74	15.41	3.36	84.79	12.12	16.49	3.91
85.33	1.83	15.47	3.38	84.78	12.36	16.55	3.93
85.32	1.93	15.51	3.40	84.76	12.61	16.57	3.94
85.30	2.03	15.56	3.42	84.75	12.87	16.64	3.95
85.28	2.14	15.59	3.44	84.74	13.10	16.76	3.96
85.26	2.25	15.62	3.46	84.73	13.37	16.98	3.98
85.25	2.34	15.66	3.47	84.71	13.61	17.14	3.99
85.23	2.44	15.70	3.48	84.70	13.87	17.25	4.00
85.22	2.54	15.70	3.50	84.69	14.11	17.50	4.01
85.21	2.64	15.73	3.51	84.68	14.37	17.59	4.03
85.19	2.74	15.76	3.52	84.66	14.60	17.65	4.03
85.19	2.84	15.80	3.53	84.65	14.86	17.80	4.05
85.17	2.94	15.88	3.54	84.62	14.99	17.66	4.08
85.16	3.05	15.95	3.56	·			

## **Mohr's Circles: Effective**

## L2-6 (10'B) CU



σ', Effective Normal Stress (psi)

# Estimated Effective Mohr-Coulomb Failure Parameters<sup>1</sup>:

cohesion (c')(psi) = 0 friction angle  $(\phi')(\circ)$  = 32.3

<sup>&</sup>lt;sup>1</sup>The cohesion and friction angle provided represent one possible interpretation of a Mohr-Coulomb failure envelope. Qualified persons familiar with the material and the site should evaluate the test results independently prior to use in the intended application.

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: L2-6 (10'B) CU

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### **Remolded or Initial Sample Properties**

Initial Mass (g): 365.40

Length (cm): 11.35

Diameter (cm): 4.81

Area (cm<sup>2</sup>): 18.15

Volume (cm<sup>3</sup>): 205.89

Dry Mass (g): 320.37

Dry Density (g/cm<sup>3</sup>): 1.56

Dry Unit Weight (lbf/ft3): 97.14

Equivalent Height of Solids (cm): 6.66

Water Content (%, g/g): 14.1

Water Content (%, vol): 21.9

Water Content Based On: ☐ Cuttings ☐ Whole Specimen

Porosity (%, vol): 41.3

Void Ratio (e): 0.703

Saturation (%): 53.0

#### **Test and Sample Conditions**

Height to Diameter Ratio: 2.4

Largest Particle Dimension (approx.) (cm): 0.475

Diameter to Largest Particle Ratio (approx.): 10.12

Visual Description of Sample: Clayey Silt-Brittle

USCS Classification: NA

Plastic Limit: NA

Liquid Limit: NA

Sample Preparation:  $\ oxdot$  In situ sample, extruded  $\ oxdot$  Remolded Sample

Trimming Procedure: NA

Split: NA

Percent Coarse Material (%): <5%

Particle Density (g/cm<sup>3</sup>): 2.65 ☑ Assumed ☐ Measured

B-Value Post Saturation: 0.96

Method for Specimen Saturation: ☐ Dry ☑ Wet

Laboratory analysis by: D. O'Dowd

Data entered by: C. Krous

Checked by: J. Hines



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00 Sample Number: L2-6 (10'B) CU

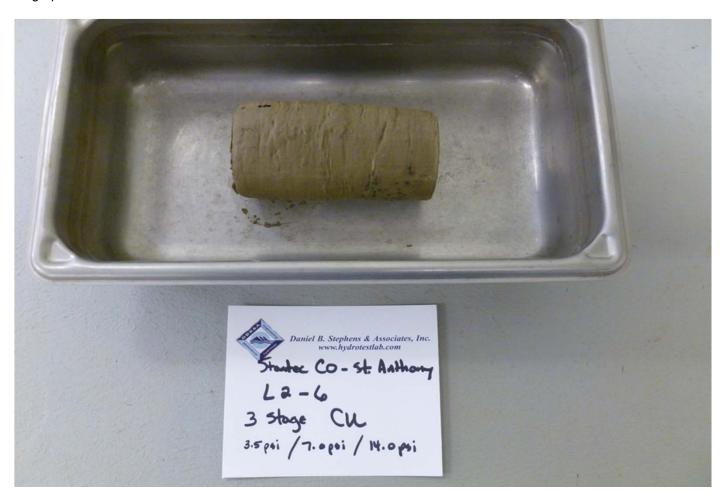
Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

Remarks on Failure: Buldge failure.

General Notes: The entire sample was extruded and subjected to CU triaxial shear testing.

#### Photograph of Failure



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-6 (10'B) CU Stage 1 (3.5 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### Stage 1

Date/Time Shear Initiated: 6/6/18 1513 Date/Time Shear Completed: 6/6/18 1514

#### **Consolidation Data**

Length (cm): 11.21

Diameter (cm): 4.81

Measured outflow (cm<sup>3</sup>): 2.46

Area (cm2): 18.15

Area Determined by Method: ☑ A ☐ B

Volume (cm<sup>3</sup>): 203.43

Dry Density (g/cm<sup>3</sup>): 1.57

Dry Unit Weight (lbf/ft<sup>3</sup>): 98.32

Equivalent Height of Solids (cm): 6.66

Porosity (%, vol): 40.6

Void Ratio (e): 0.683

Time to 50% Primary Consol. (t50) (min): 0.32

#### **Shear Data**

Effective Consolidation Stress (psi): 3.48

Total Back Pressure (psi): 81.60

Failure Criterion: Peak

Deviator Stress at Failure (psi): 1.4

Effective Minor Stress at Failure (psi): 2.1

Effective Major Stress at Failure (psi): 3.5

Membrane Correction Required/Applied: ☐ Yes ☑ No

Axial Strain (ε) at Failure (%): 0.69

Strain Rate (%/hr): 57.0

#### Test Notes:

Test was halted prior to reaching a maximum target of 3% strain, after a reduction in deviator stress was recorded. Failure was interpreted as the peak deviator stress achieved.

Laboratory analysis by: D. O'Dowd

Data entered by: C. Krous

Checked by: J. Hines

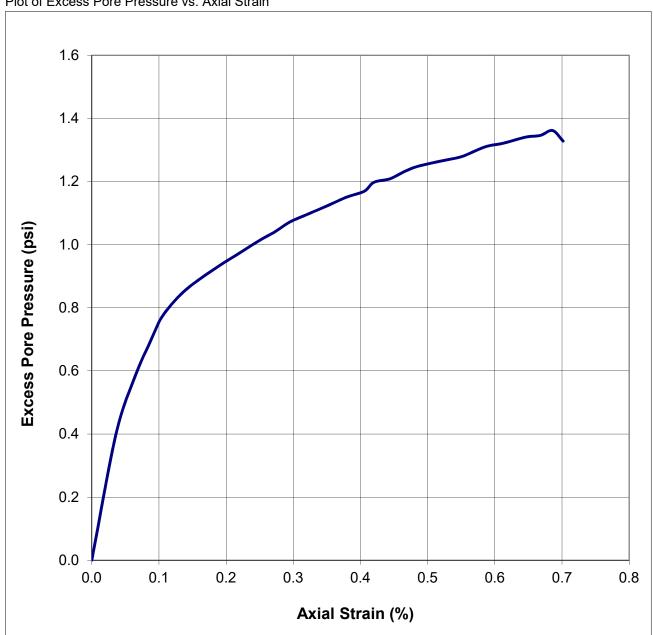
Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-6 (10'B) CU Stage 1 (3.5 psi) Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### Plot of Excess Pore Pressure vs. Axial Strain



Job Name: Stantec Consulting Services Inc

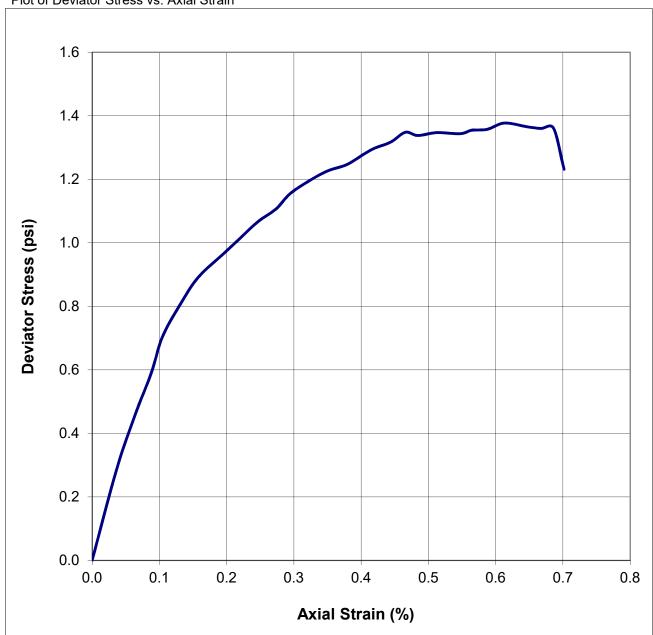
Job Number: DB18.1151.00

Sample Number: L2-6 (10'B) CU Stage 1 (3.5 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

## Plot of Deviator Stress vs. Axial Strain



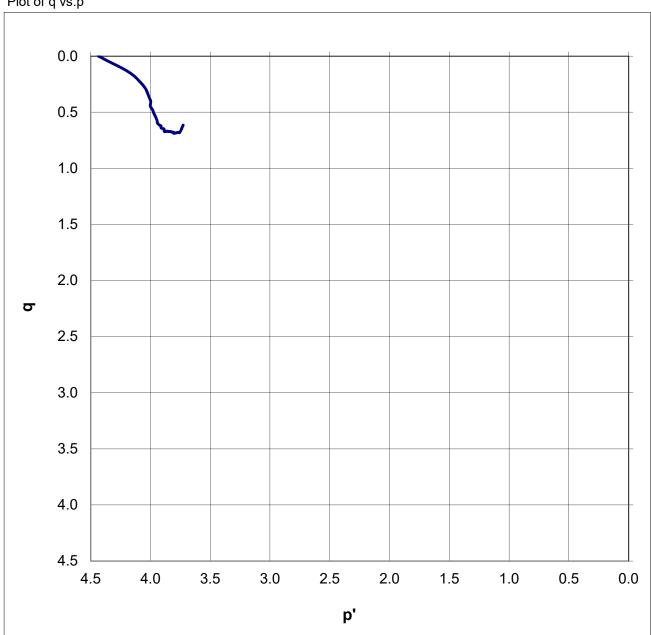
Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-6 (10'B) CU Stage 1 (3.5 psi) Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS







Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-6 (10'B) CU Stage 1 (3.5 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### **Raw Data**

	Axial	Effective Major	Effective Minor		Axial	Effective Major	Effective Minor
Pore Pressure	Strain	Stress	Stress	Pore Pressure	Strain	Stress	Stress
(psi)	(%)	(psi)	(psi)	(psi)	(%)	(psi)	(psi)
81.60	0.00	3.48	3.48				
82.00	0.04	3.37	3.08				
82.18	0.06	3.36	2.90				
82.29	0.09	3.38	2.79				
82.37	0.10	3.41	2.71				
82.44	0.13	3.45	2.64				
82.48	0.16	3.49	2.60				
82.54	0.19	3.51	2.54				
82.57	0.22	3.52	2.51				
82.60	0.25	3.54	2.47				
82.64	0.27	3.55	2.44				
82.67	0.29	3.57	2.41				
82.69	0.32	3.58	2.39				
82.72	0.35	3.59	2.36				
82.75	0.38	3.58	2.33				
82.77	0.41	3.60	2.31				
82.79	0.42	3.58	2.28				
82.81	0.44	3.59	2.27				
82.83	0.47	3.60	2.25				
82.84	0.48	3.57	2.24				
82.86	0.51	3.57	2.22				
82.87	0.55	3.55	2.21				
82.89	0.56	3.55	2.19				
82.91	0.59	3.53	2.17				
82.92	0.61	3.54	2.16				
82.94	0.65	3.51	2.14				
82.94	0.67	3.50	2.14				
82.96	0.69	3.48	2.12				
82.92	0.70	3.39	2.16				

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-6 (10'B) CU Stage 2 (7.1 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### Stage 2

Date/Time Shear Initiated: 6/7/18 825 Date/Time Shear Completed: 6/7/18 841

#### **Consolidation Data**

Length (cm): 11.20

Diameter (cm): 4.81

Measured outflow (cm<sup>3</sup>): 2.60

Area (cm<sup>2</sup>): 18.15

Area Determined by Method: ☑ A ☐ B

Volume (cm<sup>3</sup>): 203.30

Dry Density (g/cm<sup>3</sup>): 1.58

Dry Unit Weight (lbf/ft<sup>3</sup>): 98.38

Equivalent Height of Solids (cm): 6.66

Porosity (%, vol): 40.5

Void Ratio (e): 0.682

Time to 50% Primary Consol. (t50) (min): 0.5

#### **Shear Data**

Effective Consolidation Stress (psi): 7.06

Total Back Pressure (psi): 81.58

Failure Criterion: Peak

Deviator Stress at Failure (psi): 7.1

Effective Minor Stress at Failure (psi): 3.2

Effective Major Stress at Failure (psi): 10.3

Membrane Correction Required/Applied: ☐ Yes ☑ No

Axial Strain (ε) at Failure (%): 3.02

Strain Rate (%/hr): 11.1

#### Test Notes:

Test was halted after reaching a maximum target of 3% strain. Failure was interpreted as the peak deviator stress achieved.

Laboratory analysis by: D. O'Dowd

Data entered by: C. Krous

Checked by: J. Hines

Job Name: Stantec Consulting Services Inc

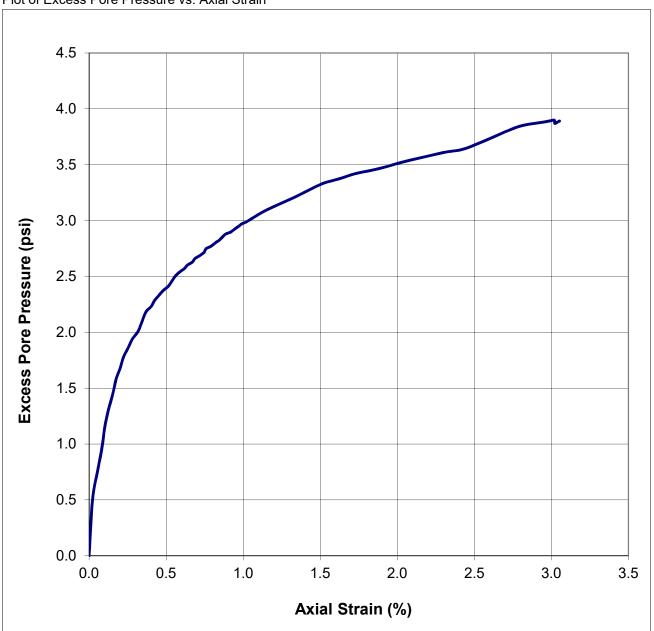
Job Number: DB18.1151.00

Sample Number: L2-6 (10'B) CU Stage 2 (7.1 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### Plot of Excess Pore Pressure vs. Axial Strain



Job Name: Stantec Consulting Services Inc

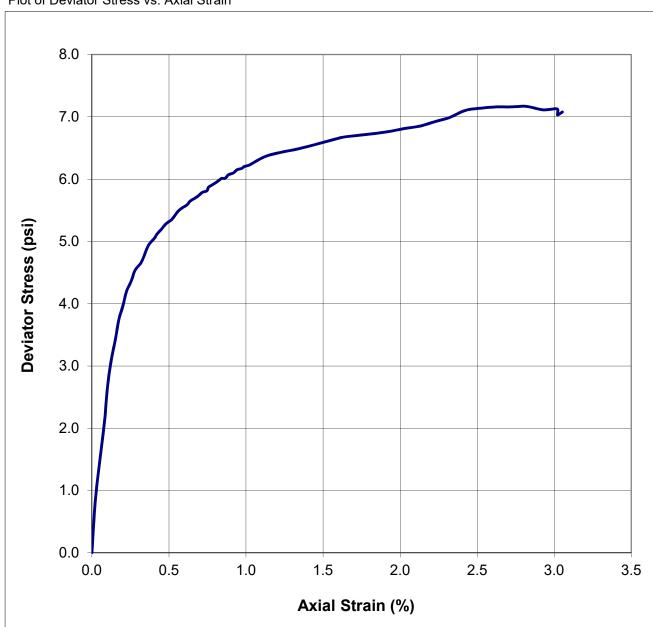
Job Number: DB18.1151.00

Sample Number: L2-6 (10'B) CU Stage 2 (7.1 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### Plot of Deviator Stress vs. Axial Strain



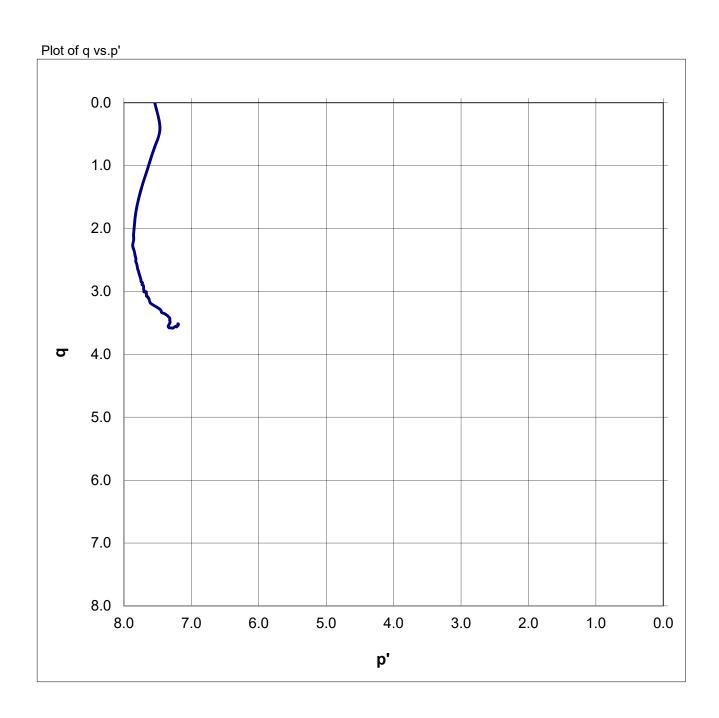
Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-6 (10'B) CU Stage 2 (7.1 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS



85.48

3.02

10.30

# Data for Consolidated Undrained (CU) Triaxial Shear Testing

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-6 (10'B) CU Stage 2 (7.1 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### **Raw Data**

			Raw	Data			
Pore Pressure	Axial Strain	Effective Major Stress	Effective Minor Stress	Pore Pressure	Axial Strain	Effective Major Stress	Effective Minor Stress
(psi)	(%)	(psi)	(psi)	(psi)	(%)	(psi)	(psi)
81.58	0.00	7.06	7.06	85.47	3.02	10.24	3.18
82.08	0.02	7.40	6.57	85.45	3.02	10.23	3.20
82.33	0.05	7.86	6.31	85.47	3.05	10.26	3.18
82.54	0.08	8.24	6.10	00.11	0.00	10.20	0.10
82.72	0.10	8.57	5.92				
82.88	0.12	8.84	5.76				
83.02	0.15	9.06	5.62				
83.16	0.18	9.23	5.48				
83.26	0.20	9.35	5.37				
83.36	0.22	9.47	5.28				
83.44	0.25	9.55	5.19				
83.52	0.28	9.65	5.12				
83.58	0.32	9.70	5.05				
83.65	0.34	9.73	4.98				
83.71	0.35	9.78	4.92				
83.77	0.37	9.82	4.86				
83.81	0.40	9.86	4.82				
83.86	0.42	9.89	4.77				
83.91	0.45	9.92	4.72				
83.95	0.48	9.95	4.67				
83.99	0.52	9.97	4.63				
84.04	0.54	10.00	4.59				
84.08	0.56	10.02	4.54				
84.12	0.59	10.04	4.51				
84.15	0.62	10.06	4.48				
84.18	0.64	10.09	4.44				
84.21	0.67	10.11	4.41				
84.24	0.69	10.10	4.38				
84.26	0.72	10.14	4.35				
84.29	0.75	10.13	4.32				
84.32	0.76	10.16	4.29				
84.35	0.79	10.19	4.26				
84.38	0.83	10.21	4.23				
84.40	0.84	10.22	4.21				
84.43	0.87	10.19	4.18				
84.46	0.89	10.22	4.15				
84.47	0.92	10.23	4.13				
84.50	0.94	10.26	4.11				
84.53	0.97	10.25	4.08				
84.55	0.99	10.26	4.06				
84.57	1.02	10.26	4.03				
84.65	1.12	10.31	3.95				
84.72	1.23	10.30	3.87				
84.78	1.33	10.28	3.80				
84.85	1.42	10.27	3.73				
84.91	1.52	10.27	3.67				
84.95	1.62	10.29	3.62				
85.00	1.72	10.27	3.57				
85.03	1.82	10.26	3.54				
85.06	1.93	10.26	3.49				
85.10	2.03	10.26	3.45				
85.13	2.13	10.26	3.41				
85.16	2.22	10.30	3.38				
85.19	2.32	10.33	3.34				
85.22	2.42	10.41	3.31				
85.27	2.53	10.42	3.28				
85.33	2.63	10.42	3.27				
85.38	2.72	10.40	3.24				
85.43 85.45	2.82 2.93	10.37 10.30	3.21 3.19				
65.45 85.48	2.93 3.02	10.30	3.19				

Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-6 (10'B) CU Stage 3 (14.0 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### Stage 3

Date/Time Shear Initiated: 6/7/18 1254 Date/Time Shear Completed: 6/7/18 1437

#### **Consolidation Data**

Length (cm): 11.08

Diameter (cm): 4.81

Measured outflow (cm<sup>3</sup>): 4.85

Area (cm2): 18.15

Area Determined by Method: ☑ A ☐ B

Volume (cm<sup>3</sup>): 201.04

Dry Density (g/cm<sup>3</sup>): 1.59

Dry Unit Weight (lbf/ft<sup>3</sup>): 99.48

Equivalent Height of Solids (cm): 6.66

Porosity (%, vol): 39.9

Void Ratio (e): 0.663

Time to 50% Primary Consol. (t50) (min): 2.06

#### **Shear Data**

Effective Consolidation Stress (psi): 14.01

Total Back Pressure (psi): 81.60

Failure Criterion: Peak

Deviator Stress at Failure (psi): 16.3

Effective Minor Stress at Failure (psi): 6.0

Effective Major Stress at Failure (psi): 22.4

Membrane Correction Required/Applied: ✓ Yes ☐ No

Axial Strain (ε) at Failure (%): 11.74

Strain Rate (%/hr): 8.7

#### Test Notes:

Test was halted after reaching the target of 15% strain. Failure was interpreted as the peak deviator stress achieved.

Laboratory analysis by: D. O'Dowd

Data entered by: C. Krous

Checked by: J. Hines

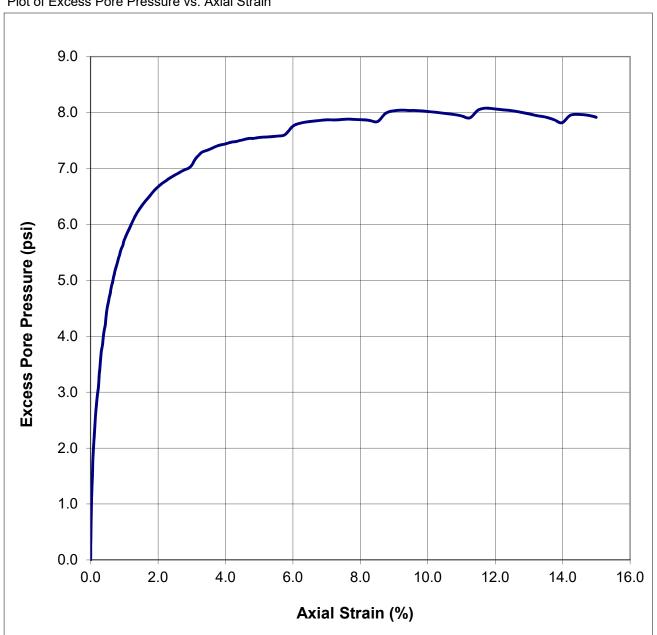
Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-6 (10'B) CU Stage 3 (14.0 psi) Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### Plot of Excess Pore Pressure vs. Axial Strain



Job Name: Stantec Consulting Services Inc

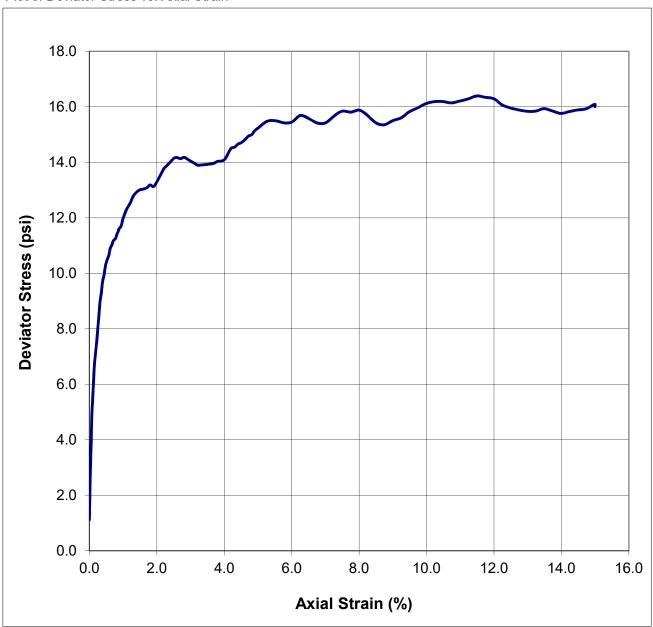
Job Number: DB18.1151.00

Sample Number: L2-6 (10'B) CU Stage 3 (14.0 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### Plot of Deviator Stress vs. Axial Strain



Job Name: Stantec Consulting Services Inc

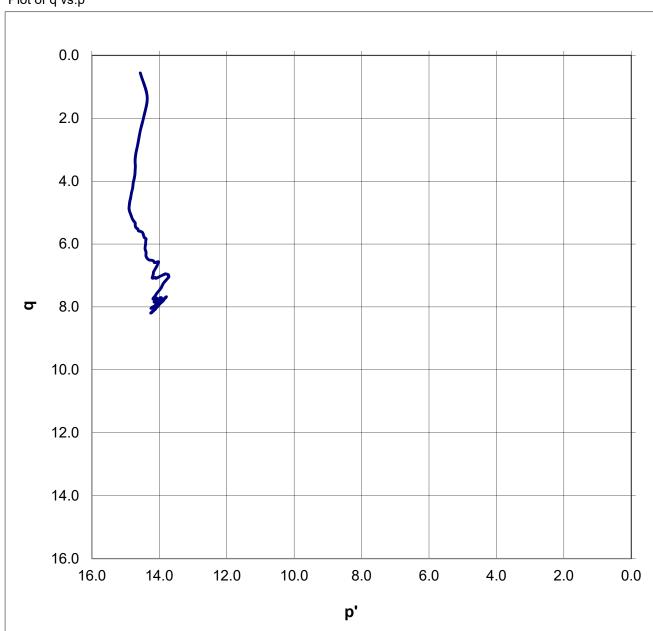
Job Number: DB18.1151.00

Sample Number: L2-6 (10'B) CU Stage 3 (14.0 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### Plot of q vs.p'



Job Name: Stantec Consulting Services Inc

Job Number: DB18.1151.00

Sample Number: L2-6 (10'B) CU Stage 3 (14.0 psi)

Project Name: St. Anthony Geotech Investigation

PO Number: 233001076-DBS

#### **Raw Data**

Pore Pressure	Axial	Effective Major	Effective Minor		Axial	Effective Major	Effective Minor
	Strain	Stress	Stress	Pore Pressure	Strain	Stress	Stress
(psi)	(%)	(psi)	(psi)	(psi)	(%)	(psi)	(psi)
81.60	0.00	15.13	14.01	88.77	3.11	20.88	6.91
82.55	0.02	15.67	13.05	88.84	3.21	20.77	6.88
83.06	0.05	16.36	12.54	88.90	3.31	20.75	6.84
83.43	0.07	16.96	12.17	88.92	3.40	20.74	6.83
83.74	0.10	17.41	11.85	88.94	3.51	20.73	6.80
83.99	0.13	17.78	11.60	88.96	3.60	20.71	6.77
84.20	0.14	18.05	11.38	88.99	3.70	20.71	6.74
84.39	0.18	18.23	11.19	89.02	3.81	20.75	6.71
84.56	0.20	18.42	11.02	89.03	3.91	20.74	6.70
84.72	0.24	18.62	10.86	89.05	4.02	20.78	6.67
84.90	0.25	18.84	10.71	89.06	4.11	20.95	6.65
85.06	0.28	19.00	10.58	89.08	4.21	21.14	6.63
85.20	0.30	19.19	10.46	89.08	4.31	21.16	6.62
85.33	0.32	19.35	10.34	89.10	4.41	21.25	6.59
85.46	0.36	19.52	10.23	89.11	4.50	21.28	6.57
85.57	0.37	19.65	10.12	89.13	4.61	21.35	6.55
85.69	0.40	19.77	10.02	89.14	4.71	21.47	6.53
85.80	0.43	19.84	9.92	89.14	4.81	21.52	6.52
85.91	0.45	19.89	9.82	89.15	4.91	21.65	6.50
86.01	0.47	19.94	9.73	89.16	5.02	21.73	6.48
86.10	0.49	19.99	9.64	89.17	5.27	21.93	6.45
86.20	0.52	20.02	9.54	89.18	5.52	21.90	6.41
86.29	0.55	20.02	9.46	89.21	5.76	21.80	6.37
86.37	0.58	20.05	9.38	89.36	6.01	21.80	6.35
86.44		20.11	9.31	89.42	6.25	22.00	6.31
86.51	0.60 0.62	20.11	9.24	89.44	6.50	21.87	6.28
86.57	0.65	20.17	9.18	89.46	6.76	21.68	6.26
86.64	0.67	20.16	9.11	89.47	7.01	21.65	6.23
86.71	0.70	20.20	9.04	89.47	7.26	21.89	6.21
86.77	0.72	20.17	8.98	89.48	7.50	22.03	6.19
86.82	0.74	20.14	8.93	89.48	7.76	21.97	6.16
86.87	0.77	20.13	8.87	89.48	8.01	22.02	6.14
86.93	0.80	20.15	8.82	89.46	8.26	21.81	6.13
86.99	0.82	20.18	8.76	89.44	8.51	21.53	6.12
87.04	0.85	20.21	8.70	89.59	8.75	21.47	6.11
87.09	0.87	20.24	8.66	89.63	8.99	21.59	6.10
87.14	0.89	20.23	8.61	89.64	9.25	21.69	6.08
87.19	0.93	20.23	8.56	89.64	9.49	21.90	6.08
87.23	0.96	20.28	8.52	89.64	9.73	22.02	6.07
87.27	0.97	20.34	8.47	89.62	9.99	22.18	6.06
87.32	1.00	20.39	8.42	89.61	10.24	22.24	6.06
87.47	1.10	20.57	8.27	89.59	10.49	22.24	6.06
87.60	1.21	20.65	8.14	89.57	10.73	22.19	6.05
87.72	1.29	20.78	8.01	89.54	10.99	22.26	6.05
87.83	1.40	20.82	7.89	89.51	11.25	22.34	6.05
87.92	1.51	20.80	7.79	89.64	11.49	22.45	6.06
88.00	1.60	20.74	7.70	89.68	11.74	22.39	6.05
88.08	1.71	20.71	7.62	89.67	12.00	22.35	6.06
88.14	1.80	20.73	7.55	89.65	12.24	22.14	6.07
88.22	1.90	20.59	7.46	89.64	12.48	22.03	6.07
88.28	2.01	20.71	7.40	89.61	12.74	21.96	6.08
88.33	2.10	20.86	7.34	89.58	12.74	21.92	6.09
88.37	2.10	21.04	7.29	89.55	13.24	21.94	6.10
88.42	2.20	21.13	7.23	89.52	13.48	22.03	6.10
88.45	2.31	21.13	7.23	89.47	13.46	21.96	6.12
88.49	2.41	21.29	7.16 7.14	89.42	13.75	21.90	6.14
88.52	2.60	21.27	7.10	89.55	14.23	21.98	6.15
88.55	2.70	21.18	7.05	89.57	14.49	22.05	6.16
88.58	2.80 2.90	21.19 21.09	7.01 6.97	89.56 89.52	14.73 14.98	22.09 22.29	6.17 6.20
88.61			n 97	09.07	14 90	// /9	ט א מ

Laboratory Tests and Methods



#### Daniel B. Stephens & Associates, Inc.

#### **Tests and Methods**

Dry Bulk Density: ASTM D7263

Moisture Content: ASTM D7263, ASTM D2216

Calculated Porosity: ASTM D7263

Particle Size Analysis: ASTM D7928, ASTM D6913

USCS (ASTM) Classification: ASTM D7928, ASTM D6913, ASTM D2487

USDA Classification: ASTM D7928, ASTM D6913, USDA Soil Textural Triangle

Atterberg Limits: ASTM D4318

Visual-Manual Description: ASTM D2488

Standard Proctor Compaction: ASTM D698

Coarse Fraction (Gravel)

Correction (calc):

ASTM D4718; Bouwer, H. and Rice, R.C. 1984. Hydraulic Properties of Stony Vadose

Zones. Groundwater Vol. 22, No. 6

Consolidated Undrained

Triaxial:

**ASTM D4767** 

Cohesion & Friction Angle: Das, Braja M. 2002. Principles of Geotechnical Engineering. Chp. 11: Shear Strength of

Soil. Brooks/Cole, Pacific Grove, CA

Mohr's Circles: ASTM D4767; Das, Braja M. 2002. Principles of Geotechnical Engineering. Chp. 11:

Shear Strength of Soil. Brooks/Cole, Pacific Grove, CA



# Attachment G. Analytical Laboratory Testing Reports



# Gross Alpha Case Narrative

# **Stantec Consulting Services**

St. Anthony Geotechnical Investigation – 233001076

Work Order Number: 1804492

- 1. This report consists of the analytical results for 17 soil samples received by ALS on 04/23/2018.
- 2. These samples were prepared according to the current revisions of SOP 702 and SOP 736.
- 3. The samples were analyzed for gross alpha activity by gas flow proportional counting according to the current revision of SOP 724. The analyses were completed on 05/17/2018. Gross alpha results are referenced to <sup>241</sup>Am.
- 4. The analysis results for these samples are reported on a 'Dry Weight' basis in units of pCi/gram.
- 5. No anomalous situations were encountered during the preparation or analysis of these samples. All quality control criteria were met.

The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

Pik Yee Yuen Date

Radiochemistry Primary Data Reviewer

5/23/18
Date

5/29/18

Radiochemistry Final Data Reviewer

Date

# **ALS -- Fort Collins**

# Sample Number(s) Cross-Reference Table

**OrderNum:** 1804492

**Client Name:** Stantec Consulting Services

Client Project Name: St. Anthony Geotechnical Investigation

Client Project Number: 233001076

Client PO Number: 233001076-ALS2

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
P1-2 20'	1804492-1		SOIL	09-Apr-18	11:00
P1-2 40'	1804492-2		SOIL	09-Apr-18	11:30
P1-2 60'	1804492-3		SOIL	11-Apr-18	14:30
P2-1 10'	1804492-4		SOIL	14-Apr-18	16:15
P2-1 20'	1804492-5		SOIL	14-Apr-18	16:25
P2-2 10'	1804492-6		SOIL	15-Apr-18	8:30
P4-3 5'	1804492-7		SOIL	16-Apr-18	12:10
P4-5 5'	1804492-8		SOIL	16-Apr-18	10:00
P4-5 15'	1804492-9		SOIL	16-Apr-18	10:10
P4-9 20'	1804492-10		SOIL	15-Apr-18	13:30
P4-9 30'	1804492-11		SOIL	15-Apr-18	13:50
BW-1 10'	1804492-12		SOIL	18-Apr-18	9:35
BW-4 5'	1804492-13		SOIL	18-Apr-18	12:00
BW-4 15'	1804492-14		SOIL	18-Apr-18	12:15
BW-3 10'	1804492-15		SOIL	18-Apr-18	12:50
BW-2 5'	1804492-16		SOIL	18-Apr-18	13:45
BW-2 20'	1804492-17		SOIL	18-Apr-18	14:05

Date Printed: Wednesday, May 23, 2018

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# Chain-of-Custody

ALS WORKORDER#

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Turnaround time for samples received after 2 p.m. will be calculated beginning from the next business day.

Turnaround time for samples received Saturday will be calculated beginning from the next business day.

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PROJECT No.	.   <i>a33</i> 001076	EDD FORMAT		Microsoft E	Excel 5	Sproudsheet	+		Α/	RAMETI	PARAMETER/METHOD REQUEST FOR ANALYSIS	OD REQ	UEST F	OR ANA	YSIS	
		PURCHASE ORDER						٧	Ba-6	) 9ee-	(EPA 901.1)	961.1				
COMPANY NAME	Stanter Consulting Services	BILL TO COMPANY		Stantec Cons	S galllag S	Sevices		В	Uranium	) W	EPA 901.1	901.				
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1-HCI 2-HNO3 3-H2SO4 4-NeOH 5-NeOH/ZnAcelate 6-NeHSO4 7-4°C 8-Other

PRESERVATION KEY

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# Chain-of-Custody

ALS WORKORDER #

2044081

PAGE

Turnaround time for samples received after 2 p.m. will be calculated beginning from the next business day.

Turnaround time for samples received Saturday will be calculated beginning from the next business day.

SAMPLER

TURNAROUND TIME

SEE NOTES SECTION RETURN PARAMETER/METHOD REQUEST FOR ANALYSIS (BY LAB) I \* | Audrum - 236 (EPA 901.1) Story alpha (EPA 901.1 Therium - 330 (EPA 901) DISPOSAL (EPA 901.1) ø ш ш ٥ B Uranium Ç > 7 8 Ç ٥ ш ø I ⋖ **L** မွ Excel Spreadsheet ADDRESS 3335 S Timbedone Rd #150 Jason. cumber @stantec. com **PRESERVATIVE** Fort Collins, CO 80536 4 Stantec Consulting Sovies Y Z <u>≺</u> 2 Z # OF BOTTLES SSLC- 616 (016) and -2755 SITE ID St. Anthony Mine Jason Combes Matrix: O = oil S = soil NS = non-soil solid W = water L = liquid E = extract F = filter 13:00pm 19:15pm SAMPLE TIME M8/18 11:45pm 4/18/18 113:50 pm 4(18(18 |3:05pm EDD FORMAT Microsoft 1181 H SAMPLE DATE 4 118 118 CITY / STATE / ZIP INVOICE ATTN TO E-MAIL BILL TO COMPANY PURCHASE ORDER REPORT LEVEL / QC REQUIRED MATRIX من S S 5 PROJECT NAME St. Anthony George dantal Investigation Cameron. Fritz & stantec. com 4150 COMPANY NAME Stanter CONSULTING Services CITY/STATE/ZIP | FOLY CO 80525 ADDRESS 3335 S Timberline Pla FIELD ID PHONE (970) 313 - 2754 ameron Filt Ź Time Zone (Circle): EST CST (MST) PST PROJECT No. | 3330 01676 Ś BW-3 10 NOTES 8W-2 8W-3 BW-4 BW-4 E-MAIL SEND REPORT TO ¥ **ZB B** 23 ٩ 14

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Summary
(Standard QC)
LEVEL II
(Standard QC)
LEVEL III (Std
QC + forms)
LEVEL IV (Std
QC + forms + raw

PRESERVATION KEY 1-HCI 2-HN03 3-H2SO4 4-NBOH 5-NBOH/ZhAcelale 6-NBHSO4 7-4°C 8-Other

4 of 29



# ALS Environmental - Fort Collins CONDITION OF SAMPLE UPON RECEIPT FORM

Client: Stantec	Workorder No: 1804	1497	-	
Project Manager: L15	Initials: Gw	Date:	4.23.15	<b>.</b>
Does this project require any special handling in addition to stand	ard ALS procedures?		YES	(NO)
2. Are custody seals on shipping containers intact?		NÓNE	YES	NO
3. Are Custody seals on sample containers intact?		NONE	YES	NO
4. Is there a COC (Chain-of-Custody) present or other represe	ntative documents?		(FES)	NO
5. Are the COC and bottle labels complete and legible?			YES	NO
6. Is the COC in agreement with samples received? (IDs, dates containers, matrix, requested analyses, etc.)	s, times, no. of samples, no. of		YES	NO
Were airbills / shipping documents present and/or removab	le?	DROP OFF	YES	NO
8. Are all aqueous samples requiring preservation preserved correctl	y? (excluding volatiles)	A77A9	YES	NO
9. Are all aqueous non-preserved samples pH 4-9?		(N)A	YES	NO
10. Is there sufficient sample for the requested analyses?			XES	NO
11. Were all samples placed in the proper containers for the rec	quested analyses?			NO
12. Are all samples within holding times for the requested anal	yses?		(TE)s	NO
13. Were all sample containers received intact? (not broken or	leaking, etc.)		YES	NO
14. Are all samples requiring no headspace (VOC, GRO, RSK/headspace free? Size of bubble: < green pea	MEE, Rx CN/S, radon)> green pea	N/A	YES	NO
15. Do any water samples contain sediment?  Amount of sediment: dusting moderate	Amount heavy	N/A	YES	NO
16. Were the samples shipped on ice?			YES	(NO)
Were cooler temperatures measured at 0.1-6.0°C?	IR gun used*: #2 #4	(RAD ONLY)	YES	NO
Cooler #: 1 2				
Temperature (°C): Amb Amb				
No. of custody seals on cooler: $Q$				
DOT Survey/ Acceptance External μR/hr reading:	· —— ——			
Background μR/hr reading:				
Were external µR/hr readings ≤ two times background and within DOT acceptance	ce criteria? YES / NO / NA (If no, see	Form 008.)		
Additional Information: PROVIDE DETAILS BELOW FOR A NO RESPONDED			ND #16.	
		_		
	· · · · · · · · · · · · · · · · · · ·			
If applicable, was the client contacted? YES / NO / NA Contact:	_///	_ Date/Tii	me:	
Project Manager Signature / Date:	AM 4/4/18	_		

\*IR Gun #2: Oakton, SN 29922500201-0066 \*IR Gun #4: Oakton, SN 2372220101-0002 FROM: CAMERON FRITZ

(907) 947-2225

SHIP DATE: 19APR18 ACTHGT: 36.00 LB CAD: 006993643/SSFE1904 DIMMED: 15 X 12 X 12 IN

. 718 MARIGOLD LN

FORT COLLINS CO 80526 US

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ALS ENVIRONMENTAL 225 COMMERCE DR

FORT COLLINS CO 80524

(US)



1 of 2 TRK# 7805 9618 7711 ## MASTER ##

80524

9622 0019 0 (000 000 0000) 0 00 7805 9618 7711



FROM: CAMERON FRITZ

(907) 947-2225

718 MARIGOLD LN

FORT COLLINS CO 90526

TO

## **ALS ENVIRONMENTAL** 225 COMMERCE DR

# FORT COLLINS CO 80524

(US)





2 of 2 MPS# 7805 9618 7722 Mstr# 7805 9618 7711

80524

9622 0019 0 (000 000 0000) 0 00 7805 9618 7722



# **PAI 724 Rev 12 Method Blank Results**

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Lab ID: AB180514-1MB

Sample Matrix: SOIL

Prep Batch: AB180514-1 QCBatchID: AB180514-1-1 Final Aliquot: 1.50 g Result Units: pCi/g File Name: ABC0517E

Date Collected: 14-May-18 Date Prepared: 14-May-18 Date Analyzed: 17-May-18

Prep SOP: PAI 702 Rev 21

Run ID: AB180514-1A

Count Time: 45 minutes

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	0.02 +/- 0.18	0.51	3	NA	U

#### Comments:

Qualifiers/Flags:

 $\ensuremath{\mathsf{U}}\xspace$  - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

DL - Decision Level

Data Package ID: AB1804492-1

Date Printed: Wednesday, May 23, 2018

**ALS -- Fort Collins** Page 1 of 1

### **PAI 724 Rev 12**

# **Laboratory Control Sample(s)**

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Lab ID: AB180514-1LCS

Sample Matrix: SOIL

Date Collected: 14-May-18

Date Prepared: 14-May-18

Date Analyzed: 17-May-18

Prep SOP: PAI 702 Rev 21

Prep Batch: AB180514-1 QCBatchID: AB180514-1-1

Run ID: AB180514-1A Count Time: 45 minutes

Final Aliquot: 2.50 g Result Units: pCi/g

File Name: ABC0517E

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec		Lab Qualifier
12587-46-1	GROSS ALPHA	16.9 +/- 3.0	0.4	15.06	112	70 - 130	Р

#### Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC.

LT - Result is less than Requested MDC, greater than sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS Recovery within control limits.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

Data Package ID: AB1804492-1

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

Date Printed: Wednesday, May 23, 2018 ALS -- Fort Collins Page 1 of 1

# PAI 724 Rev 12 Matrix Spike Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P4-9 20'

Lab ID: 1804492-10MS

Sample Matrix: SOIL

Prep SOP: PAI 702 Rev 21

**Date Collected:** 15-Apr-18 **Date Prepared:** 14-May-18

Date Analyzed: 17-May-18

Prep Batch: AB180514-1

QCBatchID: AB180514-1-1

Run ID: AB180514-1A Count Time: 30 minutes Report Basis: Dry Weight Final Aliquot: 3.07 g

Prep Basis: Dry Weight
Moisture(%): NA
Popult Units: pGi/g

Result Units: pCi/g File Name: ABC0517D

CASNO	Target Nuclide	Matrix Spike	Sample Results	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
12587-46-1	GROSS ALPHA	22.6	7.0	0.5	14.7	106	70 - 130	Р

#### **Comments:**

#### Qualifiers/Flags:

 $\ensuremath{\mathsf{U}}\xspace$  - Result is less than the sample specific MDC.

 $\ensuremath{\mathsf{LT}}$  - Result is less than Requested MDC, greater than sample specific MDC.

Y1 - Chemical Yield in control at 100-110%. Quantitative yield is assumed.

Y2 - Chemical Yield outside default limits.

N - Matrix Spike Recovery outside control limits

P - Matrix Spike Recovery within control limits

M - The requested MDC was not met.

M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

Data Package ID: AB1804492-1

Abbreviations:

MDC - Sample specific Minimum Detectable Concentration

Date Printed: Wednesday, May 23, 2018ALS -- Fort CollinsPage 1 of 1

#### **PAI 724 Rev 12**

#### **Duplicate Sample Results (DER)**

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P2-1 20'

**Lab ID:** 1804492-5DUP

Sample Matrix: SOIL

Prep SOP: PAI 702 Rev 21

Date Collected: 14-Apr-18

Date Prepared: 14-May-18

Date Analyzed: 17-May-18

**Prep Batch:** AB180514-1 **QCBatchID:** AB180514-1-1

Run ID: AB180514-1A

Count Time: 30 minutes Report Basis: Dry Weight Final Aliquot: 0.503 g

Prep Basis: Dry Weight Moisture(%): NA

Result Units: pCi/g File Name: ABC0517C

CASNO	Analyte	Sample			Duplicate			DER	DER
	Allalyte	Result +/- 2 s TPU	MDC	Flags	Result +/- 2 s TPU	MDC	Flags		Lim
12587-46-1	GROSS ALPHA	2.1 +/- 1.5	2.1	U	4.9 +/- 2.1	2.0		1.11	2.13

#### Comments:

#### Duplicate Qualifiers/Flags:

- U Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 Chemical Yield outside default limits.
- $\ensuremath{\mathsf{W}}$  DER is greater than Warning Limit of 1.42
- D DER is greater than Control Limit of 2.13
- LT Result is less than Request MDC, greater than sample specific MDC
- M Requested MDC not met.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L LCS Recovery below lower control limit.
- H LCS Recovery above upper control limit.
- P LCS, Matrix Spike Recovery within control limits.
- N Matrix Spike Recovery outside control limits

Data Package ID: AB1804492-1

Abbreviations:

TPU - Total Propagated Uncertainty

DER - Duplicate Error Ratio

BDL - Below Detection Limit

NR - Not Reported

# PAI 724 Rev 12 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P1-2 20'
Lab ID: 1804492-1

Sample Matrix: SOIL

Prep Batch: AB180514-1

Final Aliquot: 0.501 g

Prep SOP: PAI 702 Rev 21

Date Collected: 09-Apr-18

QCBatchID: AB180514-1-1 Run ID: AB180514-1A Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/q

Date Prepared: 14-May-18

Count Time: 30 minutes

File Name: ABC0517B

Date Analyzed: 17-May-18

Report Basis: Dry Weight

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	48.2 +/- 9.6	2.2	3	NA	

#### Comments:

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1804492-1

# PAI 724 Rev 12 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P1-2 40'
Lab ID: 1804492-2

Sample Matrix: SOIL

**Prep SOP:** PAI 702 Rev 21 **Date Collected:** 09-Apr-18

**Date Prepared:** 14-May-18 **Date Analyzed:** 17-May-18

Prep Batch: AB180514-1

QCBatchID: AB180514-1-1 Run ID: AB180514-1A Count Time: 30 minutes Report Basis: Dry Weight Final Aliquot: 0.516 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g File Name: ABC0517B

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	5.3 +/- 2.1	1.8	3	NA	

#### Comments:

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1804492-1

# **PAI 724 Rev 12** Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P1-2 60' Lab ID: 1804492-3 Sample Matrix: SOIL

Prep SOP: PAI 702 Rev 21 Date Collected: 11-Apr-18

Date Prepared: 14-May-18

Date Analyzed: 17-May-18

Prep Batch: AB180514-1

QCBatchID: AB180514-1-1 Run ID: AB180514-1A

Count Time: 30 minutes Report Basis: Dry Weight Final Aliquot: 0.510 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/q

File Name: ABC0517B

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	3.7 +/- 1.7	1.7	3	NA	

#### **Comments:**

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1804492-1

Date Printed: Wednesday, May 23, 2018

# **PAI 724 Rev 12** Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P2-1 10' Lab ID: 1804492-4 Sample Matrix: SOIL

Prep SOP: PAI 702 Rev 21 Date Collected: 14-Apr-18

Date Prepared: 14-May-18 Date Analyzed: 17-May-18

Prep Batch: AB180514-1

QCBatchID: AB180514-1-1 Run ID: AB180514-1A

Count Time: 30 minutes Report Basis: Dry Weight Final Aliquot: 0.514 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/q File Name: ABC0517B

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	10.5 +/- 3.2	2.1	3	NA	

#### **Comments:**

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1804492-1

# **PAI 724 Rev 12** Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P2-1 20' Lab ID: 1804492-5 Sample Matrix: SOIL

Prep SOP: PAI 702 Rev 21 Date Collected: 14-Apr-18

Date Prepared: 14-May-18 Date Analyzed: 17-May-18

Prep Batch: AB180514-1

QCBatchID: AB180514-1-1 Run ID: AB180514-1A Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 0.512 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/q File Name: ABC0517C

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	2.1 +/- 1.5	2.1	3	NA	U

#### **Comments:**

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1804492-1

Date Printed: Wednesday, May 23, 2018

#### **PAI 724 Rev 12**

#### **Sample Duplicate Results**

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P2-1 20'

**Lab ID:** 1804492-5DUP

Sample Matrix: SOIL

Prep SOP: PAI 702 Rev 21

**Date Collected:** 14-Apr-18 **Date Prepared:** 14-May-18

Date Analyzed: 17-May-18

Prep Batch: AB180514-1
QCBatchID: AB180514-1-1

Run ID: AB180514-1A Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 0.503 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g

File Name: ABC0517C

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	4.9 +/- 2.1	2.0	3	NA	

#### **Comments:**

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.

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- $\ensuremath{\mathsf{M}}$  The requested MDC was not met.
- M3 The requested MDC was not met, but thereported activity is greater than the reported MDC.
- $\ensuremath{W}$  DER is greater than  $\ensuremath{W}$  arning Limit of 1.42
- $\ensuremath{\text{D}}$   $\ensuremath{\text{DER}}$  is greater than Control Limit of 2.13

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

**BDL** - Below Detection Limit

DL - Decision Level

Data Package ID: AB1804492-1

Date Printed:

**ALS -- Fort Collins** 

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# PAI 724 Rev 12 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P2-2 10'
Lab ID: 1804492-6

Sample Matrix: SOIL

Prep SOP: PAI 702 Rev 21

Date Collected: 15-Apr-18

**Date Prepared:** 14-May-18 **Date Analyzed:** 17-May-18

Prep Batch: AB180514-1

QCBatchID: AB180514-1-1 Run ID: AB180514-1A Count Time: 30 minutes

Count Time: 30 minutes Report Basis: Dry Weight Final Aliquot: 0.512 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g File Name: ABC0517C

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	2.7 +/- 1.5	1.7	3	NA	LT

#### Comments:

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1804492-1

Date Printed: Wednesday, May 23, 2018

# **PAI 724 Rev 12** Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P4-3 5' Lab ID: 1804492-7 Sample Matrix: SOIL

Prep SOP: PAI 702 Rev 21

Date Prepared: 14-May-18 Date Analyzed: 17-May-18

Date Collected: 16-Apr-18

Report Basis: Dry Weight

Count Time: 30 minutes

Prep Batch: AB180514-1

QCBatchID: AB180514-1-1

Run ID: AB180514-1A

Final Aliquot: 2.07 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/q

File Name: ABC0517C

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	6.8 +/- 1.6	0.7	3	NA	

#### **Comments:**

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1804492-1

# PAI 724 Rev 12 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P4-5 5'
Lab ID: 1804492-8

Sample Matrix: SOIL

Prep SOP: PAI 702 Rev 21

Date Collected: 16-Apr-18

**Date Prepared:** 14-May-18 **Date Analyzed:** 17-May-18

Prep Batch: AB180514-1

QCBatchID: AB180514-1-1 Run ID: AB180514-1A

**Count Time:** 30 minutes **Report Basis:** Dry Weight

Final Aliquot: 3.03 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g File Name: ABC0517C

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	65 +/- 11	1	3	NA	

#### Comments:

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1804492-1

Date Printed: Wednesday, May 23, 2018

# PAI 724 Rev 12 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P4-5 15'
Lab ID: 1804492-9

Sample Matrix: SOIL

Prep SOP: PAI 702 Rev 21

Date Collected: 16-Apr-18

**Date Prepared:** 14-May-18 **Date Analyzed:** 17-May-18

Prep Batch: AB180514-1

QCBatchID: AB180514-1-1 Run ID: AB180514-1A

Count Time: 30 minutes Report Basis: Dry Weight Final Aliquot: 3.07 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g File Name: ABC0517C

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	67 +/- 11	1	3	NA	

#### Comments:

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1804492-1

# PAI 724 Rev 12 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P4-9 20'
Lab ID: 1804492-10

Sample Matrix: SOIL

Prep SOP: PAI 702 Rev 21

Date Collected: 15-Apr-18

**Date Prepared:** 14-May-18 **Date Analyzed:** 17-May-18

Prep Batch: AB180514-1

QCBatchID: AB180514-1-1 Run ID: AB180514-1A Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 3.03 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g File Name: ABC0517C

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	7.0 +/- 1.5	0.4	3	NA	

#### Comments:

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1804492-1

Date Printed: Wednesday, May 23, 2018

# **PAI 724 Rev 12** Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P4-9 30' Lab ID: 1804492-11 Sample Matrix: SOIL

Prep Batch: AB180514-1 QCBatchID: AB180514-1-1 Final Aliquot: 0.501 g Prep Basis: Dry Weight Moisture(%): NA

Date Collected: 15-Apr-18 Date Prepared: 14-May-18 Date Analyzed: 17-May-18

Prep SOP: PAI 702 Rev 21

Run ID: AB180514-1A Count Time: 30 minutes Report Basis: Dry Weight

Result Units: pCi/q File Name: ABC0517D

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	4.8 +/- 2.1	2.1	3	NA	

#### Comments:

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1804492-1

# PAI 724 Rev 12 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: BW-1 10'
Lab ID: 1804492-12

Sample Matrix: SOIL

Prep SOP: PAI 702 Rev 21

Date Collected: 18-Apr-18

**Date Prepared:** 14-May-18 **Date Analyzed:** 17-May-18

Prep Batch: AB180514-1

QCBatchID: AB180514-1-1 Run ID: AB180514-1A Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 0.501 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g File Name: ABC0517D

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	6.0 +/- 2.5	2.1	3	NA	

#### Comments:

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1804492-1

Date Printed: Wednesday, May 23, 2018

# **PAI 724 Rev 12** Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: BW-4 5'

Lab ID: 1804492-13

Sample Matrix: SOIL

Prep SOP: PAI 702 Rev 21 Date Collected: 18-Apr-18

Date Prepared: 14-May-18

Date Analyzed: 17-May-18

Prep Batch: AB180514-1

QCBatchID: AB180514-1-1 Run ID: AB180514-1A

Count Time: 30 minutes Report Basis: Dry Weight Final Aliquot: 0.513 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/q

File Name: ABC0517D

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	5.0 +/- 2.3	2.6	3	NA	

#### **Comments:**

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1804492-1

Date Printed: Wednesday, May 23, 2018

# **PAI 724 Rev 12** Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: BW-4 15' Lab ID: 1804492-14 Sample Matrix: SOIL

Prep SOP: PAI 702 Rev 21 Date Collected: 18-Apr-18

Date Prepared: 14-May-18 Date Analyzed: 17-May-18

Prep Batch: AB180514-1

QCBatchID: AB180514-1-1 Run ID: AB180514-1A Count Time: 45 minutes

Report Basis: Dry Weight

Final Aliquot: 0.508 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/q File Name: ABC0517E

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	6.6 +/- 2.5	2.2	3	NA	

#### **Comments:**

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1804492-1

Date Printed: Wednesday, May 23, 2018

# PAI 724 Rev 12 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: BW-3 10'
Lab ID: 1804492-15

Sample Matrix: SOIL

Prep SOP: PAI 702 Rev 21

Date Collected: 18-Apr-18

Date Prepared: 14-May-18 Date Analyzed: 17-May-18 Prep Batch: AB180514-1

QCBatchID: AB180514-1-1 Run ID: AB180514-1A Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 0.507 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g File Name: ABC0517D

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	3.3 +/- 1.9	2.2	3	NA	

#### Comments:

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1804492-1

Date Printed: Wednesday, May 23, 2018

# **Gross Alpha by GFPC**

## PAI 724 Rev 12 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: BW-2 5'

Sample Matrix: SOIL

Prep Batch: AB180514-1

Final Aliquot: 0.505 g

**Lab ID:** 1804492-16

Prep SOP: PAI 702 Rev 21

Date Collected: 18-Apr-18

QCBatchID: AB180514-1-1 Run ID: AB180514-1A Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/q

**Date Prepared:** 14-May-18 **Date Analyzed:** 17-May-18

Count Time: 30 minutes Report Basis: Dry Weight

File Name: ABC0517D

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	5.4 +/- 2.2	1.9	3	NA	

#### Comments:

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1804492-1

Date Printed: Wednesday, May 23, 2018

# **Gross Alpha by GFPC**

## PAI 724 Rev 12 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: BW-2 20'

Sample Matrix: SOIL

Prep Batch: AB180514-1

Final Aliquot: 0.503 g

Lab ID: 1804492-17 Prep SOP: PAI 702 Rev 21
Date Collected: 18-Apr-18

QCBatchID: AB180514-1-1 Run ID: AB180514-1A Prep Basis: Dry Weight Moisture(%): NA

Date Prepared: 14-May-18

Count Time: 30 minutes

Result Units: pCi/g

Date Analyzed: 17-May-18

Report Basis: Dry Weight

File Name: ABC0517D

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	2.2 +/- 1.6	2.3	3	NA	U

#### Comments:

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1804492-1

Date Printed: Wednesday, May 23, 2018



# Isotopic Thorium Case Narrative

# **Stantec Consulting Services**

St. Anthony Geotechnical Investigation – 233001076

Work Order Number: 1804492

- 1. This report consists of the analytical results for 17 soil samples received by ALS on 04/23/2018.
- These samples were prepared according to the current revisions of SOP 773, SOP 777, and SOP 736.
- 3. The samples were analyzed for the presence of isotopic thorium according to the current revision of SOP 714. The analyses were completed on 05/10/2018.
- 4. The isotopic analysis results for these samples are reported on a 'Dry Weight' basis in units of pCi/gram.
- 5. No anomalous situations were encountered during the preparation or analysis of these samples. All quality control criteria were met.

The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

Pik Yee Yuen Data Reviewer

Radiochemistry Primary Data Reviewer

5/23/18

Date

5/29/18

Date

# **ALS -- Fort Collins**

# Sample Number(s) Cross-Reference Table

**OrderNum:** 1804492

Client Name: Stantec Consulting Services

Client Project Name: St. Anthony Geotechnical Investigation

Client Project Number: 233001076

Client PO Number: 233001076-ALS2

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
P1-2 20'	1804492-1		SOIL	09-Apr-18	11:00
P1-2 40'	1804492-2		SOIL	09-Apr-18	11:30
P1-2 60'	1804492-3		SOIL	11-Apr-18	14:30
P2-1 10'	1804492-4		SOIL	14-Apr-18	16:15
P2-1 20'	1804492-5		SOIL	14-Apr-18	16:25
P2-2 10'	1804492-6		SOIL	15-Apr-18	8:30
P4-3 5'	1804492-7		SOIL	16-Apr-18	12:10
P4-5 5'	1804492-8		SOIL	16-Apr-18	10:00
P4-5 15'	1804492-9		SOIL	16-Apr-18	10:10
P4-9 20'	1804492-10		SOIL	15-Apr-18	13:30
P4-9 30'	1804492-11		SOIL	15-Apr-18	13:50
BW-1 10'	1804492-12		SOIL	18-Apr-18	9:35
BW-4 5'	1804492-13		SOIL	18-Apr-18	12:00
BW-4 15'	1804492-14		SOIL	18-Apr-18	12:15
BW-3 10'	1804492-15		SOIL	18-Apr-18	12:50
BW-2 5'	1804492-16		SOIL	18-Apr-18	13:45
BW-2 20'	1804492-17		SOIL	18-Apr-18	14:05

Date Printed: Wednesday, May 23, 2018

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225 Commerce Drive, Fort Collins, Colorado 80524 TF: (800) 443-1511 PH: (970) 490-1511 FX: (970) 490-1522

# Chain-of-Custody

ALS WORKORDER#

25440S1

Turnaround time for samples received after 2 p.m. will be calculated beginning from the next business day.

Turnaround time for samples received Saturday will be calculated beginning from the next business day.

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PRESERVATION KEY	1-HCI 2-HNO3 3-H2SO4 4-NeOH 5-NeOH/ZnAcetate 6-NeHSO4	M 7-4°C 8-Other	RECEIVED BY												

RECEIVED BY

1-HCI 2-HNO3 3-H2SO4 4-NeOH 5-NeOH/ZnAcelate 6-NeHSO4 7-4°C 8-Other

PRESERVATION KEY

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TF: (800) 443-1511 PH: (970) 490-1511 FX: (970) 490-1522 225 Commerce Drive, Fort Collins, Colorado 80524

Chain-of-Custody

ALS WORKORDER #

8644081

Turnaround time for samples received after 2 p.m. will be calculated beginning from the next business day.

Turnaround time for samples received Saturday will be calculated beginning from the next business day.

SEE NOTES SECTION 7:00 pm RETURN 990 TIME PARAMETER/METHOD REQUEST FOR ANALYSIS (BY LAB) 4.23.18 81/81/4 DATE I \* | Audrim - 236 (EPA 90).1) Thorwn - 330 (EPA 901. Story LEPA 901.1 DISPOSAL (EPA 901.1) ø PAGE ш ameron tritz Emily Lyons ш PRINTED NAME ٥ B Uranium Ç > 7 8 Ç ٥ ш ø I ⋖ **L** မွ Excel Spreadsheet ADDRESS 3335 S Timbedone Rd #150 Jason. cumber @stantec. com SIGNATURE **PRESERVATIVE** Fort Collins, CO 80536 4 Stantec Consulting Sovies <u>≺</u> 2 Z SAMPLER # OF BOTTLES PHONE (970) 213 - 2755 SITE ID St. Anthony Mine Jason Combes Matrix: O = oil S = soil NS = non-soil solid W = water L = liquid E = extract F = filter 13:00pm 19:15pm SAMPLE TIME M8/18 11:45pm 4/18/18 113:50pm 4(18(18 |3:05pm RELINQUISHED BY RELINQUISHED BY EDD FORMAT Microsoft RECEIVED BY Form 202r9 1181 H SAMPLE DATE 4 118 118 CITY / STATE / ZIP INVOICE ATTN TO E-MAIL TURNAROUND TIME BILL TO COMPANY PURCHASE ORDER Summary
(Standard QC)
LEVEL II
(Standard QC)
LEVEL III (Standard QC)
LEVEL III (Standard QC + forms)
LEVEL IV (Std REPORT LEVEL / QC REQUIRED MATRIX من S S PROJECT NAME St. Anthony George dantal Investigation Cameron. Fritz & stantec. com 4150 COMPANY NAME Stanter CONSULTING Services CITY STATE / ZP / FOLY CONDING CO 80525 ADDRESS 3335 S Timberline Rd PHONE (970) 313 - 2754 ameron Fritz 8W-2 20, Time Zone (Circle): EST CST (MST) PST PROJECT No. | 3330 01076 BW-3 10 8W-2 5' NOTES BW-4 BW-4 SEND REPORT TO E-MAIL **ZB B** <u>و</u>  $\Xi$ 4 of 28

RELINQUISHED BY

RECEIVED BY

PRESERVATION KEY 1-HCI 2-HN03 3-H2SO4 4-NeOH 5-NeOH/ZnAcelais 6-NeHSO4 7-4°C 8-Other

RECEIVED BY



# ALS Environmental - Fort Collins CONDITION OF SAMPLE UPON RECEIPT FORM

Client: Stantec	Workorder No: 1804	1497	-	
Project Manager: L15	Initials: Gw	Date:	4.23.15	<b>.</b>
Does this project require any special handling in addition to stand	ard ALS procedures?		YES	(NO)
2. Are custody seals on shipping containers intact?		NÓNE	YES	NO
3. Are Custody seals on sample containers intact?		NONE	YES	NO
4. Is there a COC (Chain-of-Custody) present or other represe	ntative documents?		(FES)	NO
5. Are the COC and bottle labels complete and legible?			YES	NO
6. Is the COC in agreement with samples received? (IDs, dates containers, matrix, requested analyses, etc.)	s, times, no. of samples, no. of		YES	NO
Were airbills / shipping documents present and/or removab	le?	DROP OFF	YES	NO
8. Are all aqueous samples requiring preservation preserved correctl	y? (excluding volatiles)	A77A9	YES	NO
9. Are all aqueous non-preserved samples pH 4-9?		(N)A	YES	NO
10. Is there sufficient sample for the requested analyses?			XES	NO
11. Were all samples placed in the proper containers for the rec	quested analyses?			NO
12. Are all samples within holding times for the requested anal	yses?		(TE)s	NO
13. Were all sample containers received intact? (not broken or	leaking, etc.)		YES	NO
14. Are all samples requiring no headspace (VOC, GRO, RSK/headspace free? Size of bubble: < green pea	MEE, Rx CN/S, radon)> green pea		YES	NO
15. Do any water samples contain sediment?  Amount of sediment: dusting moderate	Amount heavy	N/A	YES	NO
16. Were the samples shipped on ice?			YES	(NO)
Were cooler temperatures measured at 0.1-6.0°C?	IR gun used*: #2 #4	(RAD ONLY)	YES	NO
Cooler #: 1 2				
Temperature (°C): Amb Amb				
No. of custody seals on cooler: $Q$				
DOT Survey/ Acceptance External μR/hr reading:	· —— ——			
Background μR/hr reading:				
Were external µR/hr readings ≤ two times background and within DOT acceptance	ce criteria? YES / NO / NA (If no, see	Form 008.)		
Additional Information: PROVIDE DETAILS BELOW FOR A NO RESPONDED			ND #16.	
		_		
	· · · · · · · · · · · · · · · · · · ·			
If applicable, was the client contacted? YES / NO / NA Contact:	_///	_ Date/Tii	me:	
Project Manager Signature / Date:	AM 4/4/18	_		

\*IR Gun #2: Oakton, SN 29922500201-0066 \*IR Gun #4: Oakton, SN 2372220101-0002 FROM: CAMERON FRITZ (907) 947-2225

SHIP DATE: 19APR18 ACTHGT: 36.00 LB CAD: 006993643/SSFE1904 DIMMED: 15 X 12 X 12 IN

. 718 MARIGOLD LN

FORT COLLINS CO 80526 US

10

# ALS ENVIRONMENTAL 225 COMMERCE DR

# FORT COLLINS CO 80524

(US)

(800) 443-1511

REF:





1 of 2 TRK# 7805 9618 7711 ## MASTER ##

80524

9622 0019 0 (000 000 0000) 0 00 7805 9618 7711



FROM: CAMERON FRITZ

(907) 947-2225

718 MARIGOLD LN

FORT COLLINS CO 80526

TO

## **ALS ENVIRONMENTAL** 225 COMMERCE DR

# FORT COLLINS CO 80524

(US)





2 of 2 MPS# 7805 9618 7722 Mstr# 7805 9618 7711

80524

9622 0019 0 (000 000 0000) 0 00 7805 9618 7722



# PAI 714 Rev 13 Method Blank Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Lab ID: AS180430-2MB

Sample Matrix: SOIL

Prep SOP: PAI 777 Rev 12 Date Collected: 01-May-18

Date Prepared: 01-May-18
Date Analyzed: 10-May-18

**Prep Batch:** AS180430-2 **QCBatchID:** AS180430-2-1

Run ID: AS180430-2TH Count Time: 1000 minutes

Final Aliquot: 2.00 g Result Units: pCi/g

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	-0.002 +/- 0.022	0.039	0.2	NA	U

## **Chemical Yield Summary**

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	2.301	1.50	pCi/g	65.2	30 - 110 %	

#### Comments:

#### Qualifiers/Flags:

 $\ensuremath{\mathsf{U}}\xspace$  - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

DL - Decision Level

Data Package ID: TH1804492-1

Date Printed: Wednesday, May 23, 2018

ALS -- Fort Collins Page 1 of 1

#### **PAI 714 Rev 13**

#### **Laboratory Control Sample(s)**

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Lab ID: AS180430-2LCS

Sample Matrix: SOIL

Date Collected: 01-May-18

Date Prepared: 01-May-18

Date Analyzed: 10-May-18

Prep SOP: PAI 777 Rev 12

Prep Batch: AS180430-2 QCBatchID: AS180430-2-1

Run ID: AS180430-2TH

Count Time: 1000 minutes

**Final Aliquot:** 2.00 g **Result Units:** pCi/g

File Name: Spectrum #1

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec		Lab Qualifier
14269-63-7	Th-230	2 63 +/- 0 42	0.04	2 464	107	85 - 121	Р

## **Chemical Yield Summary**

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	2.301	1.48	pCi/g	64.3	30 - 110 %	

#### **Comments:**

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

LT - Result is less than Requested MDC, greater than sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS Recovery within control limits.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

Data Package ID: TH1804492-1

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

Date Printed: Wednesday, May 23, 2018 ALS -- Fort Collins Page 1 of 1

#### **PAI 714 Rev 13**

#### **Duplicate Sample Results (DER)**

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P2-1 20'

Lab ID: 1804492-5DUP

Sample Matrix: SOIL

Prep SOP: PAI 777 Rev 12 Date Collected: 14-Apr-18

Date Prepared: 01-May-18

Date Analyzed: 09-May-18

Prep Batch: AS180430-2 QCBatchID: AS180430-2-1

Run ID: AS180430-2TH Count Time: 1000 minutes

Report Basis: Dry Weight

Final Aliquot: 0.539 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g

File Name: Spectrum #1

CASNO	Analyte	Sample	9		Duplica	ate		DER	DER
	Allalyte	Result +/- 2 s TPU	MDC	Flags	Result +/- 2 s TPU	MDC	Flags		Lim
14269-63-7	Th-230	1.15 +/- 0.23	0.13		1.05 +/- 0.21	0.13		0.325	2.13

#### **Comments:**

#### **Duplicate Qualifiers/Flags:**

- U Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 Chemical Yield outside default limits.
- W DER is greater than Warning Limit of 1.42
- D DER is greater than Control Limit of 2.13
- LT Result is less than Request MDC, greater than sample specific MDC
- M Requested MDC not met.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC
- L LCS Recovery below lower control limit.
- H LCS Recovery above upper control limit.
- P LCS, Matrix Spike Recovery within control limits.
- N Matrix Spike Recovery outside control limits

Data Package ID: TH1804492-1

Abbreviations:

TPU - Total Propagated Uncertainty

DER - Duplicate Error Ratio

BDL - Below Detection Limit

NR - Not Reported

# PAI 714 Rev 13 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P1-2 20'
Lab ID: 1804492-1

Sample Matrix: SOIL

Prep SOP: PAI 777 Rev 12

Date Collected: 09-Apr-18

Date Prepared: 01-May-18

Date Analyzed: 09-May-18

Prep Batch: AS180430-2 QCBatchID: AS180430-2-1

Run ID: AS180430-2TH Count Time: 1000 minutes Report Basis: Dry Weight Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/q

Final Aliquot: 0.542 g

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	16.6 +/- 2.6	0.1	0.2	NA	

# **Chemical Yield Summary**

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	8.498	6.47	pCi/g	76.2	30 - 110 %	

#### **Comments:**

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

Date Printed: Wednesday, May 23, 2018

# PAI 714 Rev 13 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P1-2 40'
Lab ID: 1804492-2

Sample Matrix: SOIL

Prep SOP: PAI 777 Rev 12 Date Collected: 09-Apr-18

**Date Prepared:** 01-May-18 **Date Analyzed:** 09-May-18

Prep Batch: AS180430-2 QCBatchID: AS180430-2-1

Run ID: AS180430-2TH
Count Time: 1000 minutes

Report Basis: Dry Weight

Final Aliquot: 0.554 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	1.11 +/- 0.23	0.14	0.2	NA	

# **Chemical Yield Summary**

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	8.302	5.60	pCi/g	67.5	30 - 110 %	

#### **Comments:**

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

Date Printed: Wednesday, May 23, 2018

# PAI 714 Rev 13 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P1-2 60'
Lab ID: 1804492-3

Th-230

Sample Matrix: SOIL

**Prep SOP:** PAI 777 Rev 12 **Date Collected:** 11-Apr-18

**Date Prepared:** 01-May-18 **Date Analyzed:** 09-May-18

Prep Batch: AS180430-2 QCBatchID: AS180430-2-1

Run ID: AS180430-2TH

0.15

Count Time: 1000 minutes Report Basis: Dry Weight Moisture(%): NA
Result Units: pCi/g
File Name: Spectrum #1

0.2

Final Aliquot: 0.512 g

Prep Basis: Dry Weight

NΑ

CASNO Target Nuclide Result +/- 2 s TPU MDC Requested DL Lab MDC Qualifier

## **Chemical Yield Summary**

0.99 +/- 0.22

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	8.990	5.53	pCi/g	61.5	30 - 110 %	

#### Comments:

14269-63-7

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

Date Printed: Wednesday, May 23, 2018

# PAI 714 Rev 13 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P2-1 10'
Lab ID: 1804492-4

Sample Matrix: SOIL

Prep SOP: PAI 777 Rev 12

Date Collected: 14-Apr-18

Date Prepared: 01-May-18

Date Analyzed: 09-May-18

Prep Batch: AS180430-2 QCBatchID: AS180430-2-1

Run ID: AS180430-2TH
Count Time: 1000 minutes

Report Basis: Dry Weight

Final Aliquot: 0.538 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	4.11 +/- 0.69	0.14	0.2	NA	

# **Chemical Yield Summary**

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	8.557	5.68	pCi/g	66.3	30 - 110 %	

#### **Comments:**

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

Date Printed: Wednesday, May 23, 2018

# PAI 714 Rev 13 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P2-1 20'
Lab ID: 1804492-5

Sample Matrix: SOIL

Prep SOP: PAI 777 Rev 12 Date Collected: 14-Apr-18

**Date Prepared:** 01-May-18 **Date Analyzed:** 09-May-18

Prep Batch: AS180430-2 QCBatchID: AS180430-2-1

Run ID: AS180430-2TH Count Time: 1000 minutes

Report Basis: Dry Weight

Final Aliquot: 0.538 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/q

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	1.15 +/- 0.23	0.13	0.2	NA	

# **Chemical Yield Summary**

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	8.562	6.10	pCi/g	71.3	30 - 110 %	

#### **Comments:**

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

Date Printed: Wednesday, May 23, 2018

#### **PAI 714 Rev 13**

#### Sample Duplicate Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P2-1 20'
Lab ID: 1804492-5DUP

Sample Matrix: SOIL

Prep SOP: PAI 777 Rev 12

Date Collected: 14-Apr-18

Date Prepared: 01-May-18

Date Analyzed: 09-May-18

Prep Batch: AS180430-2 QCBatchID: AS180430-2-1

Run ID: AS180430-2TH Count Time: 1000 minutes Report Basis: Dry Weight Final Aliquot: 0.539 g Prep Basis: Dry Weight

Moisture(%): NA Result Units: pCi/g File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	1.05 +/- 0.21	0.13	0.2	NA	

## **Chemical Yield Summary**

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	8.533	6.20	pCi/g	72.7	30 - 110 %	

#### **Comments:**

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.

Y2 - Chemical Yield outside default limits.

 $\ensuremath{\mathsf{LT}}$  - Result is less than Requested MDC, greater than sample specific MDC.

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M - The requested MDC was not met.

M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

 $\ensuremath{W}$  - DER is greater than  $\ensuremath{W}$  arning Limit of 1.42

 $\ensuremath{\text{D}}$  -  $\ensuremath{\text{DER}}$  is greater than Control Limit of 2.13

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

**BDL** - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

Date Printed:

**ALS -- Fort Collins** 

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# PAI 714 Rev 13 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P2-2 10'
Lab ID: 1804492-6

Sample Matrix: SOIL

Prep SOP: PAI 777 Rev 12

Date Collected: 15-Apr-18

Date Prepared: 01-May-18

Date Analyzed: 09-May-18

Prep Batch: AS180430-2 QCBatchID: AS180430-2-1

Run ID: AS180430-2TH Count Time: 1000 minutes Report Basis: Dry Weight Final Aliquot: 0.586 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	0.89 +/- 0.19	0.13	0.2	NA	

# **Chemical Yield Summary**

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	7.850	5.54	pCi/g	70.5	30 - 110 %	

#### **Comments:**

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

Date Printed: Wednesday, May 23, 2018

# PAI 714 Rev 13 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P4-3 5'
Lab ID: 1804492-7

Sample Matrix: SOIL

Prep SOP: PAI 777 Rev 12

Date Collected: 16-Apr-18

**Date Prepared:** 01-May-18 **Date Analyzed:** 09-May-18

Prep Batch: AS180430-2

QCBatchID: AS180430-2-1 Run ID: AS180430-2TH

Count Time: 1000 minutes Report Basis: Dry Weight

Final Aliquot: 0.590 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	1.60 +/- 0.29	0.13	0.2	NA	

# **Chemical Yield Summary**

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	7.800	5.45	pCi/g	69.8	30 - 110 %	

#### **Comments:**

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

Date Printed: Wednesday, May 23, 2018

# PAI 714 Rev 13 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P4-5 5'
Lab ID: 1804492-8

Sample Matrix: SOIL

Prep SOP: PAI 777 Rev 12

Date Collected: 16-Apr-18

**Date Prepared:** 01-May-18 **Date Analyzed:** 09-May-18

Prep Batch: AS180430-2 QCBatchID: AS180430-2-1

Run ID: AS180430-2TH Count Time: 1000 minutes

Report Basis: Dry Weight

Final Aliquot: 0.541 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	19.5 +/- 3.1	0.1	0.2	NA	

# **Chemical Yield Summary**

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	8.514	5.82	pCi/g	68.4	30 - 110 %	

#### **Comments:**

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

Date Printed: Wednesday, May 23, 2018

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## **PAI 714 Rev 13** Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P4-5 15' Lab ID: 1804492-9 Sample Matrix: SOIL

Prep SOP: PAI 777 Rev 12

Date Prepared: 01-May-18

Date Collected: 16-Apr-18

Date Analyzed: 09-May-18

Prep Batch: AS180430-2 QCBatchID: AS180430-2-1

Run ID: AS180430-2TH Count Time: 1000 minutes

Report Basis: Dry Weight

Final Aliquot: 0.517 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/q

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	15.4 +/- 2.4	0.1	0.2	NA	

# **Chemical Yield Summary**

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	8.906	6.44	pCi/g	72.3	30 - 110 %	

#### **Comments:**

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

**BDL** - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

Date Printed: Wednesday, May 23, 2018

# PAI 714 Rev 13 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P4-9 20'
Lab ID: 1804492-10

Sample Matrix: SOIL

Prep SOP: PAI 777 Rev 12

Date Collected: 15-Apr-18

**Date Prepared:** 01-May-18 **Date Analyzed:** 09-May-18

Prep Batch: AS180430-2

QCBatchID: AS180430-2-1 Run ID: AS180430-2TH

Count Time: 1000 minutes Report Basis: Dry Weight

Final Aliquot: 0.582 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g

File Name: Spectrum #1

	CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
142	269-63-7	Th-230	2.51 +/- 0.42	0.12	0.2	NA	

# **Chemical Yield Summary**

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	7.913	6.43	pCi/g	81.2	30 - 110 %	

#### **Comments:**

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

Date Printed: Wednesday, May 23, 2018

# PAI 714 Rev 13 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P4-9 30'
Lab ID: 1804492-11

Sample Matrix: SOIL

Prep SOP: PAI 777 Rev 12

Date Collected: 15-Apr-18

Date Prepared: 01-May-18

Date Analyzed: 09-May-18

Prep Batch: AS180430-2 QCBatchID: AS180430-2-1

Run ID: AS180430-2TH
Count Time: 1000 minutes

Report Basis: Dry Weight

Final Aliquot: 0.510 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	0.93 +/- 0.20	0.14	0.2	NA	

# **Chemical Yield Summary**

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	9.028	6.5	pCi/g	72.1	30 - 110 %	

#### **Comments:**

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

Date Printed: Wednesday, May 23, 2018

# PAI 714 Rev 13 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: BW-1 10'
Lab ID: 1804492-12

Sample Matrix: SOIL

Prep SOP: PAI 777 Rev 12

Date Collected: 18-Apr-18

**Date Prepared:** 01-May-18 **Date Analyzed:** 09-May-18

Prep Batch: AS180430-2 QCBatchID: AS180430-2-1

Run ID: AS180430-2TH
Count Time: 1000 minutes

Report Basis: Dry Weight

Final Aliquot: 0.567 g

Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/q

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	0.90 +/- 0.20	0.14	0.2	NA	

# **Chemical Yield Summary**

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	8.116	5.11	pCi/g	62.9	30 - 110 %	

#### **Comments:**

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

Date Printed: Wednesday, May 23, 2018

## **PAI 714 Rev 13** Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: BW-4 5' Lab ID: 1804492-13 Sample Matrix: SOIL

Prep SOP: PAI 777 Rev 12 Date Collected: 18-Apr-18

Date Prepared: 01-May-18

Date Analyzed: 09-May-18

Prep Batch: AS180430-2 QCBatchID: AS180430-2-1

Run ID: AS180430-2TH

Count Time: 1000 minutes Report Basis: Dry Weight

Final Aliquot: 0.532 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/q

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	1.20 +/- 0.24	0.14	0.2	NA	

# **Chemical Yield Summary**

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	8.658	5.92	pCi/g	68.4	30 - 110 %	

#### Comments:

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC
- M The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

**BDL** - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

Date Printed: Wednesday, May 23, 2018

# PAI 714 Rev 13 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: BW-4 15'
Lab ID: 1804492-14

Sample Matrix: SOIL

Prep SOP: PAI 777 Rev 12

Date Collected: 18-Apr-18

**Date Prepared:** 01-May-18 **Date Analyzed:** 09-May-18

Prep Batch: AS180430-2 QCBatchID: AS180430-2-1

Run ID: AS180430-2TH
Count Time: 1000 minutes

Report Basis: Dry Weight

Final Aliquot: 0.533 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	0.90 +/- 0.20	0.14	0.2	NA	

# **Chemical Yield Summary**

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	8.631	5.99	pCi/g	69.4	30 - 110 %	

#### **Comments:**

#### Qualifiers/Flags:

- $\ensuremath{\mathsf{U}}\xspace$  Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- $\ensuremath{\mathsf{LT}}$  Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

Date Printed: Wednesday, May 23, 2018

## **PAI 714 Rev 13** Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: BW-3 10' Lab ID: 1804492-15 Sample Matrix: SOIL

Prep SOP: PAI 777 Rev 12 Date Collected: 18-Apr-18

Date Prepared: 01-May-18 Date Analyzed: 09-May-18

Prep Batch: AS180430-2 QCBatchID: AS180430-2-1

Run ID: AS180430-2TH Count Time: 1000 minutes

Report Basis: Dry Weight

Final Aliquot: 0.507 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/q

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	0.85 +/- 0.19	0.14	0.2	NA	

## **Chemical Yield Summary**

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	9.078	6.46	pCi/g	71.2	30 - 110 %	

#### **Comments:**

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC
- M The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

**BDL** - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

Date Printed: Wednesday, May 23, 2018

# PAI 714 Rev 13 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: BW-2 5'
Lab ID: 1804492-16

Sample Matrix: SOIL

Prep SOP: PAI 777 Rev 12

Date Collected: 18-Apr-18

Date Prepared: 01-May-18

Date Analyzed: 09-May-18

Prep Batch: AS180430-2 QCBatchID: AS180430-2-1

Run ID: AS180430-2TH Count Time: 1000 minutes

Report Basis: Dry Weight

Final Aliquot: 0.514 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	0.78 +/- 0.18	0.14	0.2	NA	

# **Chemical Yield Summary**

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	8.963	6.6	pCi/g	73.7	30 - 110 %	

#### **Comments:**

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

Date Printed: Wednesday, May 23, 2018

# PAI 714 Rev 13 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: BW-2 20'
Lab ID: 1804492-17

Sample Matrix: SOIL

Prep SOP: PAI 777 Rev 12

Date Collected: 18-Apr-18

**Date Prepared:** 01-May-18 **Date Analyzed:** 10-May-18

Prep Batch: AS180430-2 QCBatchID: AS180430-2-1

Run ID: AS180430-2TH
Count Time: 1000 minutes

Report Basis: Dry Weight

Final Aliquot: 0.515 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g

File Name: Spectrum #1

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
14269-63-7	Th-230	0.64 +/- 0.17	0.16	0.2	NA	

# **Chemical Yield Summary**

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
Th-229	8.943	5.14	pCi/g	57.4	30 - 110 %	

#### **Comments:**

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC.
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: TH1804492-1

Date Printed: Wednesday, May 23, 2018



# Metals Case Narrative

# **Stantec Consulting Services**

# St. Anthony Geotechnical Investigation -- 233001076

Work Order Number: 1804492

- 1. This report consists of 17 soil samples.
- 2. The samples were received intact at ambient temperature by ALS on 04/23/18
- 3. The samples were prepared and analyzed based on SW-846, 3<sup>rd</sup> Edition procedures.

For analysis by ICP-MS, the samples were digested following method 3050B and the current revision of SOP 806.

- 4. Analysis by ICP-MS followed method 6020A and the current revision of SOP 827.
- All standards and solutions are NIST traceable and were used within their recommended shelf life.
- 6. The samples were prepared and analyzed within the established hold times.

All in house quality control procedures were followed, as described below.

- 7. General quality control procedures.
  - A preparation (method) blank and laboratory control sample were digested and analyzed with the samples in this digestion batch.
  - The preparation (method) blank associated with this digestion batch was below the reporting limit for the requested analyte.
  - All laboratory control sample criteria were met.
  - All initial and continuing calibration blanks were below the reporting limit for the requested analyte.



- All initial and continuing calibration verifications were within the acceptance criteria for the requested analyte.
- The interference check samples associated with Method 6020A were analyzed.
- 8. Matrix specific quality control procedures.

Sample 1804492-1 was designated as the quality control sample for this analysis.

Similarity of matrix and therefore relevance of the QC results should not be automatically inferred for any sample other than the native sample selected for QC.

- A matrix spike and matrix spike duplicate were digested and analyzed with this batch. All acceptance criteria for accuracy were met.
- Matrix spike recoveries could not be evaluated for the following analyte:

<u>Analyte</u>	Sample ID
Uranium	-1

The concentration of this analyte in the native sample was greater than four times the concentration of matrix spike added during the digestion. When sample concentration is that much greater than the spike added, spike recoveries may not be accurate. The laboratory control sample indicates that the digestion and analysis were in control.

 A sample duplicate and matrix spike duplicate were digested and analyzed with this batch. All acceptance criteria for precision were met with the following exception:

<u>Analyte</u>	Sample ID
Uranium	-1MS/MSD

The associated sample results are flagged for duplicate failure. Where spike duplicate precision was outside control limits only the duplicate page shows the flag.

- A serial dilution was analyzed with this ICP batch. All acceptance criteria were met.
- 9. It is a standard practice that samples for ICP-MS are analyzed at a dilution.



The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

Emily Lyons Date
Inorganics Primary Data Reviewer

5/21/18
Date

5/29/18
Date



#### **Inorganic Data Reporting Qualifiers**

The following qualifiers are used by the laboratory when reporting results of inorganic analyses:

- Result qualifier -- If the analyte was analyzed for but not detected a "U" is entered.
- QC qualifier -- Specified entries and their meanings are as follows:
  - E The reported value is estimated because of the presence of interference. An explanatory note may be included in the narrative.
  - M Duplicate injection precision was not met.
  - N Spiked sample recovery not within control limits. A post spike is analyzed for all ICP analyses when the matrix spike and or spike duplicate fail and the native sample concentration is less than four times the spike added concentration.
  - Z Spiked recovery not within control limits. An explanatory note may be included in the narrative.
  - \* Duplicate analysis (relative percent difference) not within control limits.
  - S SAR value is estimated as one or more analytes used in the calculation were not detected above the detection limit.

# **ALS -- Fort Collins**

# Sample Number(s) Cross-Reference Table

**OrderNum:** 1804492

Client Name: Stantec Consulting Services

Client Project Name: St. Anthony Geotechnical Investigation

Client Project Number: 233001076

Client PO Number: 233001076-ALS2

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
P1-2 20'	1804492-1		SOIL	09-Apr-18	11:00
P1-2 40'	1804492-2		SOIL	09-Apr-18	11:30
P1-2 60'	1804492-3		SOIL	11-Apr-18	14:30
P2-1 10'	1804492-4		SOIL	14-Apr-18	16:15
P2-1 20'	1804492-5		SOIL	14-Apr-18	16:25
P2-2 10'	1804492-6		SOIL	15-Apr-18	8:30
P4-3 5'	1804492-7		SOIL	16-Apr-18	12:10
P4-5 5'	1804492-8		SOIL	16-Apr-18	10:00
P4-5 15'	1804492-9		SOIL	16-Apr-18	10:10
P4-9 20'	1804492-10		SOIL	15-Apr-18	13:30
P4-9 30'	1804492-11		SOIL	15-Apr-18	13:50
BW-1 10'	1804492-12		SOIL	18-Apr-18	9:35
BW-4 5'	1804492-13		SOIL	18-Apr-18	12:00
BW-4 15'	1804492-14		SOIL	18-Apr-18	12:15
BW-3 10'	1804492-15		SOIL	18-Apr-18	12:50
BW-2 5'	1804492-16		SOIL	18-Apr-18	13:45
BW-2 20'	1804492-17		SOIL	18-Apr-18	14:05

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225 Commerce Drive, Fort Collins, Colorado 80524 TF: (800) 443-1511 PH: (970) 490-1511 FX: (970) 490-1522

Chain-of-Custody

ALS WORKORDER#

56440S1

Turnaround time for samples received after 2 p.m. will be calculated beginning from the next business day,

Turnaround time for samples received Saturday will be calculated beginning from the next business day.

SEE NOTES SECTION RETURN TIME PARAMETER/METHOD REQUEST FOR ANALYSIS (BY IAB) I (EPA 901.1 DISPOSAL EPA 901 Ø PAGE (EPA 901.1) Ra-236 (EPA 901.1) ш PRINTED NAME Thorium - 230 Gross alpha ٥ > Uranium ပ > > 8 ۵ w ø I 7 ⋖ > ဗ Excel Spreadsheet #/50 SIGNATURE PRESERVATIVE Jason.cumbers (a) stanfec.com **∀**/2 <u>₹</u> MM Y Z Stantec Consulting Sewhees <u>≺</u> Z 20536 SAMPLER # OF BOTTLES 3335 S TImberline Fort Collins, CO PHONE (970) 213 - 2755 St. Anthony Mine Jason Compars Matrix: O = oil S = soil NS = non-soil solid W = water L = liquid E = extract F = filter 4/14/18 H:15 pm SAMPLE TIME 11:30am 3:30 18:10 pm -1 16/18 110:10 an 4:85 pm 8:30 am 4/16/18 10:00 am 1:30 pm 1.50pm 11:00an 9.35 am Microsoft Form 202r9 4 115/18 81 11 H 81/91/1 4/15/18 81/81/17 81 417 4 19/18 81/6/18 4/15/18 SAMPLE DATE SITEID ADDRESS **EDD FORMAT** BILL TO COMPANY CITY / STATE / ZIP E-MAIL TURNAROUND TIME INVOICE ATTN TO ξ PURCHASE ORDER MATRIX 1108 ڰؘؙؚڔ -8 50:1 S.1. <u>ه</u>ز. ۔ کی ر R Søil PROJECT NAME St. Anthrony Geofconital Involting they Converon. fritz @ stanger.com # 150 80535 Stanter Consulting Services ADDRESS 3335 S Timberline Pd P2154 616 (OLP) 2159 FEDE CITY/STATE/ZIP | FORT COllins, CO Lameron Fists **1**9e 9 9 36 9 <u>ਡ</u> 5 S S EST CST (MST) PST PROJECT No. | 233001016 NOTES 6-19 6-td t-10 P1-2 P4.3 P-49 8- Hd RW-1 1-69 P4-9 1-40 5-Hd COMPANY NAME SEND REPORT TO E-MAIL ξ Time Zone (Circle): 2 ٥  $\mathcal{R}$ و 80 9 a

4:00 pm 0900 4.23.18 8//81 7 hritz 2002 ameron Emily RELINQUISHED BY RELINQUISHED BY RELINQUISHED BY RECEIVED BY RECEIVED BY RECEIVED BY

Summary
(Standard QC)
LEVEL II
(Standard QC)
LEVEL III (Std
QC + forms)
LEVEL IV (Std
QC + forms + raw

1-HCI 2-HNO3 3-H2SO4 4-NeOH 5-NeOH/ZnAcelate 6-NeHSO4 7-4°C 8-Other

PRESERVATION KEY

REPORT LEVEL / QC REQUIRED

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225 Commerce Drive, Fort Collins, Colorado 80524 TF: (800) 443-1511 PH: (970) 490-1511 FX: (970) 490-1522

Chain-of-Custody

ALS WORKORDER #

8644081

Turnaround time for samples received after 2 p.m. will be calculated beginning from the next business day.

Turnaround time for samples received Saturday will be calculated beginning from the next business day.

SEE NOTES SECTION 7:00 pm RETURN TIME PARAMETER/METHOD REQUEST FOR ANALYSIS BY IAB 81/81/4 DATE I \* | Audrim - 236 (EPA 90).1) Thorwn-330 (EPA 901) Stoss alpha (EPA 901.1 DISPOSAL (EPA 901.1) ø PAGE ш ameron tritz ш PRINTED NAME ٥ B Uranium Ç > 7 8 Ç ٥ ш ø I ⋖ **L** မွ Excel Spreadsheet ADDRESS 3335 S Timbedone Rd #150 Jason. cumber @stantec. com SIGNATURE **PRESERVATIVE** Fort Collins, CO 80536 4 Stantec Consulting Sovies Z SAMPLER # OF BOTTLES PHONE (970) 213 - 2755 SITE ID St. Anthony Mine Jason Combes Matrix: O = oil S = soil NS = non-soil solid W = water L = liquid E = extract F = filter 13:00pm 19:15pm SAMPLE TIME M8/18 11:45pm 4/18/18 113:50pm 4(18(18 |3:05pm RELINQUISHED BY EDD FORMAT Microsoft Form 202r9 1181 H SAMPLE DATE 4 118 118 CITY / STATE / ZIP INVOICE ATTN TO E-MAIL TURNAROUND TIME BILL TO COMPANY PURCHASE ORDER REPORT LEVEL / QC REQUIRED MATRIX من S S PROJECT NAME St. Anthony George dantal Investigation Cameron. Fritz & stantec. com 4150 COMPANY NAME Stanter CONSULTING Services CITY STATE / ZP / FOLY CONDING CO 80525 ADDRESS 3335 S Timberline Rd PHONE (970) 313- 2754 ameron Fritz 8W-2 20, Time Zone (Circle): EST CST (MST) PST PROJECT No. | 3330 0\676 رك BW-3 10 8W-3 BW-4 P-M8 SEND REPORT TO E-MAIL **ZB B** <u>و</u>  $\Xi$ 

0960

4.23.18

Emily Lyons

RELINQUISHED BY

RECEIVED BY

of 18

RECEIVED BY

Summary
(Standard QC)
LEVEL II
(Standard QC)
LEVEL III (Standard QC)
LEVEL III (Standard QC + forms)
LEVEL IV (Std

RELINQUISHED BY

RECEIVED BY

PRESERVATION KEY 1-HCI 2-HN03 3-H2SO4 4-NeOH 5-NeOHIZnAcelate 6-NeHSO4 7-4°C 8-Other



## ALS Environmental - Fort Collins CONDITION OF SAMPLE UPON RECEIPT FORM

Client: Stantec Workorder No: 1804	<u>497</u>	•	-
Project Manager: Lf5 Initials: Gut	Date:	4.23.18	3
Does this project require any special handling in addition to standard ALS procedures?		YES	(NO)
2. Are custody seals on shipping containers intact?	NÓN	YES	NO
3. Are Custody seals on sample containers intact?	MONE	YES	NO
4. Is there a COC (Chain-of-Custody) present or other representative documents?		(E)	NO
5. Are the COC and bottle labels complete and legible?		YES	NO
6. Is the COC in agreement with samples received? (IDs, dates, times, no. of samples, no. of containers, matrix, requested analyses, etc.)		YES	NO
7 Were airbills / shipping documents present and/or removable?	OROP OFF	YES	NO
8. Are all aqueous samples requiring preservation preserved correctly? (excluding volatiles)	AVA	YES	NO
9. Are all aqueous non-preserved samples pH 4-9?	(NA)	YES	NO
10. Is there sufficient sample for the requested analyses?		XES	NO
Were all samples placed in the proper containers for the requested analyses?		(E)	NO
12. Are all samples within holding times for the requested analyses?		(YE)s	NO
13. Were all sample containers received intact? (not broken or leaking, etc.)		YES	NO
14. Are all samples requiring no headspace (VOC, GRO, RSK/MEE, Rx CN/S, radon) headspace free? Size of bubble: < green pea > green pea		YES	NO
15. Do any water samples contain sediment?  Amount of sediment: dusting moderateheavy	N/A	YES	NO
16. Were the samples shipped on ice?		YES	(NO)
17. Were cooler temperatures measured at 0.1-6.0°C? IR gun used*: #2 #4	(RAD)	YES	NO
Cooler #: 3			
Temperature (°C): Amb Amb			
No. of custody seals on cooler:			
DOT Survey/ Acceptance External µR/hr reading:			
Background μR/hr reading:			
Were external µR/hr readings ≤ two times background and within DOT acceptance criteria? YES / NO / NA (If no, see F	'orm (108.)		
Additional Information: PROVIDE DETAILS BELOW FOR A NO RESPONSE TO ANY QUESTION ABOVE, EXC		JD #16	
Additional Information. TROVIDE DETAILS BELOW FOR A NO RESTONSE TO ANY QUESTION ABOVE, EACH	ELI#IAI	ND #10.	
	_		
,			
If applicable, was the client contacted? YES / NO / NA Contact:  Project Manager Signature / Date:	Date/Tin	ne:	<u>.</u>

\*IR Gun #2: Oakton, SN 29922500201-0066 \*IR Gun #4: Oakton, SN 2372220101-0002 FROM: CAMERON FRITZ

(907) 947-2225

SHIP DATE: 19APR18 ACTHGT: 36.00 LB CAD: 006993643/SSFE1904 DIMMED: 15 X 12 X 12 IN

. 718 MARIGOLD LN

FORT COLLINS CO 80526 US

10

### ALS ENVIRONMENTAL 225 COMMERCE DR

FORT COLLINS CO 80524

(US)





1 of 2 TRK# 7805 9618 7711 ## MASTER ##

80524

9622 0019 0 (000 000 0000) 0 00 7805 9618 7711



FROM: CAMERON FRITZ

(907) 947-2225

718 MARIGOLD LN

FORT COLLINS CO 80526

TO

### **ALS ENVIRONMENTAL** 225 COMMERCE DR

# FORT COLLINS CO 80524

(US)



2 of 2 MPS# 7805 9618 7722 Mstr# 7805 9618 7711

80524

9622 0019 0 (000 000 0000) 0 00 7805 9618 7722



### **Total URANIUM**

#### Method SW6020 Revision A

### **Sample Results**

Lab Name: ALS -- Fort Collins
Client Name: Stantec Consulting Services

Client Project ID: St. Anthony Geotechnical Investigation 233001076

Work Order Number: 1804492 Final Volume: 100 ml
Reporting Basis: Dry Weight Matrix: SOIL
Prep Method: SW3050B Result Units: UG/KG

Analyst: Amanda J. Lynn

Client Sample ID	Lab ID	Date Collected	Date Prepared	Date Analyzed	Percent Moisture	Dilution Factor	Result	RptLimit/ LOQ/LOD	Flag	Sample Aliquot
P1-2 20'	1804492-1	04/09/2018	04/26/2018	04/27/2018	9.0	10	36000	11		1.025 g
P1-2 40'	1804492-2	04/09/2018	04/26/2018	04/27/2018	6.0	10	3700	9.9		1.073 g
P1-2 60'	1804492-3	04/11/2018	04/26/2018	04/27/2018	11.4	10	530	11		1.021 g
P2-1 10'	1804492-4	04/14/2018	04/26/2018	04/27/2018	10.3	10	1000	10		1.074 g
P2-1 20'	1804492-5	04/14/2018	04/26/2018	04/27/2018	8.9	10	2000	11		1.002 g
P2-2 10'	1804492-6	04/15/2018	04/26/2018	04/27/2018	9.5	10	1000	11		1.045 g
P4-3 5'	1804492-7	04/16/2018	04/26/2018	04/27/2018	6.8	10	1600	10		1.038 g
P4-5 5'	1804492-8	04/16/2018	04/26/2018	04/27/2018	3.9	10	29000	9.6		1.08 g
P4-5 15'	1804492-9	04/16/2018	04/26/2018	04/27/2018	6.7	10	24000	10		1.058 g
P4-9 20'	1804492-10	04/15/2018	04/26/2018	04/27/2018	2.1	10	5300	9.7		1.057 g
P4-9 30'	1804492-11	04/15/2018	04/26/2018	04/27/2018	8.3	10	580	11		1.001 g
BW-1 10'	1804492-12	04/18/2018	04/26/2018	04/27/2018	4.4	10	480	9.6		1.084 g
BW-4 5'	1804492-13	04/18/2018	04/26/2018	04/27/2018	3.2	10	550	10		1.025 g
BW-4 15'	1804492-14	04/18/2018	04/26/2018	04/27/2018	5.4	10	610	9.9		1.063 g
BW-3 10'	1804492-15	04/18/2018	04/26/2018	04/27/2018	4.7	10	510	10		1.047 g
BW-2 5'	1804492-16	04/18/2018	04/26/2018	04/27/2018	2.2	10	520	9.8		1.041 g
BW-2 20'	1804492-17	04/18/2018	04/26/2018	04/27/2018	4.2	10	460	10		1.018 g

#### **Comments:**

1. ND or U = Not Detected at or above the client requested detection limit.

Data Package ID: IM1804492-1

Date Printed: Monday, May 21, 2018 ALS -- Fort Collins

LIMS Version: 6.862

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### Method SW6020A Method Blank

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

**Lab ID:** IP180426-3MB

Sample Matrix: SOILPrep Batch: IP180426-3Sample Aliquot:1 g% Moisture: N/AQCBatchID: IP180426-3-1Final Volume:100 mlDate Collected: N/ARun ID: IM180426-10A8Result Units: UG/KGDate Extracted: 26-Apr-18Cleanup: NONEClean DF:1

Date Analyzed: 27-Apr-18Basis: N/APrep Method: SW3050 Rev BFile Name: 096SMPL\_

CASNO	Target Analyte	DF	Result	Result Qualifier	Reporting Limit	DL
7440-61-1	URANIUM	10	10	U	10	

Data Package ID: IM1804492-1

Date Printed: Monday, May 21, 2018

### Method SW6020A **Laboratory Control Sample**

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Lab ID: IM180426-3LCS

Sample Matrix: SOIL Prep Batch: IP180426-3 % Moisture: N/A QCBatchID: IP180426-3-1 Date Collected: N/A Run ID: IM180426-10A8 **Date Extracted: 04/26/2018** Cleanup: NONE **Date Analyzed:** 04/27/2018 Basis: N/A Prep Method: SW3050B

File Name: 097SMPL

CASNO	Target Analyte	Spike Added	LCS Result	Reporting Limit	Result Qualifier	LCS % Rec.	Control Limits
7440-61-1	URANIUM	1000	941	10		94	80 - 120%

Data Package ID: IM1804492-1

Date Printed: Monday, May 21, 2018

Sample Aliquot:

**Final Volume:** 

Result Units: UG/KG

Clean DF:

1 g

100 ml

# Method SW6020A Matrix Spike And Matrix Spike Duplicate

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P1-2 20'
LabID: 1804492-1MS

Sample Matrix: SOIL
% Moisture: 9.0
Date Collected: 09-Apr-18
Date Extracted: 26-Apr-18

**Date Analyzed:** 27-Apr-18 **Prep Method:** SW 3050 Rev B

Prep Batch: IP180426-3 QCBatchID: IP180426-3-1 Run ID: IM180426-10A8

Cleanup: NONE
Basis: Dry Weight

Sample Aliquot: 1.025 g
Final Volume: 100 ml
Result Units: UG/KG
File Name: 101SMPL

CASNO	Target Analyte	Sample Result	Samp Qual	MS Result	MS Qual	Reporting Limit	Spike Added	MS % Rec.	Control Limits
7440-61-1	URANIUM	36000		35100		10.7	1070	-88	75 - 125%

Field ID: P1-2 20'

LabID: 1804492-1MSD

Sample Matrix: SOIL % Moisture: 9.0 Date Collected: 09-Apr-18 Date Extracted: 26-Apr-18

**Date Analyzed:** 27-Apr-18 **Prep Method:** SW 3050 Rev B

Prep Batch: IP180426-3 QCBatchID: IP180426-3-1 Run ID: IM180426-10A8 Cleanup: NONE Basis: Dry Weight Sample Aliquot: 1.025 g Final Volume: 100 ml Result Units: UG/KG File Name: 102SMPL\_

CASNO	Target Analyte	MSD Result	MSD Qual	Spike Added	MSD % Rec.	Reporting Limit	RPD Limit	RPD
7440-61-1	URANIUM	49300	*	1070	1229	10.7	20	

Data Package ID: IM1804492-1

### Method SW6020 Duplicate Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P1-2 20'
Lab ID: 1804492-1D

Sample Matrix: SOIL % Moisture: 9.0

**Date Collected:** 04/09/2018 **Date Extracted:** 04/26/2018 **Date Analyzed:** 04/27/2018

Prep Batch: IP180426-3 QCBatchID: IP180426-3-1 Run ID: IM180426-10A8

Cleanup: NONE
Basis: Dry Weight
File Name: 100SMPL

Sample Aliquot: 1.024 g
Final Volume: 100 ml
Result Units: UG/KG

Clean DF: 1

CASNO	Target Analyte	Sample Result	Samp Qual	Duplicate Result	Dup Qual	Reporting Limit	Dilution Factor	RPD	RPD Limit
7440-61-1	URANIUM	36000		36300		10.7	10	1	20

Data Package ID: IM1804492-1

### Method SW6020 Serial Dilution

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P1-2 20'
Lab ID: 1804492-1L

Run ID: IM180426-10A8

Date Analyzed: 27-Apr-18

Result Units: mg/l

CASNO	Target Analyte	Sample Result	Samp Qual	SD Result	SD Qual	EPA Qualifier	%D
7440-61-1	URANIUM	0.0337		0.0338			0

Data Package ID: IM1804492-1

### **URANIUM**

### **Method SW6020**

#### **Calibration Verifications**

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Run ID: IM180426-10A8

Result Units: MG/L

Lab ID	Verification Type	Date Analyzed	Time Analyzed	Spike Added	Result	Reporting Limit	Result Qualifier	% Rec.	Control Limits
ICV	Initial Calibration	4/26/2018	17:57	0.002	0.00194	0.00001	N/A	97	90 - 110
CCV1	Continuing Calibration	4/26/2018	18:24	0.001	0.000921	0.00001	N/A	92	90 - 110
CCV2	Continuing Calibration	4/26/2018	19:29	0.001	0.000926	0.00001	N/A	93	90 - 110
CCV3	Continuing Calibration	4/26/2018	20:20	0.001	0.000935	0.00001	N/A	93	90 - 110
CCV4	Continuing Calibration	4/26/2018	21:10	0.001	0.000929	0.00001	N/A	93	90 - 110
CCV5	Continuing Calibration	4/26/2018	21:57	0.001	0.000938	0.00001	N/A	94	90 - 110
CCV6	Continuing Calibration	4/26/2018	22:21	0.001	0.000937	0.00001	N/A	94	90 - 110
CCV7	Continuing Calibration	4/26/2018	23:02	0.001	0.000932	0.00001	N/A	93	90 - 110
CCV8	Continuing Calibration	4/26/2018	23:47	0.001	0.000930	0.00001	N/A	93	90 - 110
CCV9	Continuing Calibration	4/27/2018	0:31	0.001	0.000933	0.00001	N/A	93	90 - 110
CCV10	Continuing Calibration	4/27/2018	1:22	0.001	0.000941	0.00001	N/A	94	90 - 110
CCV11	Continuing Calibration	4/27/2018	2:03	0.001	0.000931	0.00001	N/A	93	90 - 110
CCV12	Continuing Calibration	4/27/2018	2:42	0.001	0.000930	0.00001	N/A	93	90 - 110

Data Package ID: IM1804492-1

Date Printed: Monday, May 21, 2018ALS -- Fort CollinsPage 1 of 1

### **URANIUM**

### **Method SW6020**

#### **Calibration Blanks**

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Run ID: IM180426-10A8

Result Units: MG/L

Lab ID	Verification Type	Date Analyzed	Time Analyzed	Result	Reporting Limit	Flag
ICB	Initial Calibration	4/26/2018	18:03	0.00001	0.00001	U
CCB1	Continuing Calibration	4/26/2018	18:30	0.00001	0.00001	U
CCB2	Continuing Calibration	4/26/2018	19:35	0.00001	0.00001	U
CCB3	Continuing Calibration	4/26/2018	20:25	0.00001	0.00001	U
CCB4	Continuing Calibration	4/26/2018	21:16	0.00001	0.00001	U
CCB5	Continuing Calibration	4/26/2018	22:03	0.00001	0.00001	U
CCB6	Continuing Calibration	4/26/2018	22:27	0.00001	0.00001	U
CCB7	Continuing Calibration	4/26/2018	23:08	0.00001	0.00001	U
CCB8	Continuing Calibration	4/26/2018	23:53	0.00001	0.00001	U
CCB9	Continuing Calibration	4/27/2018	0:37	0.00001	0.00001	U
CCB10	Continuing Calibration	4/27/2018	1:27	0.00001	0.00001	U
CCB11	Continuing Calibration	4/27/2018	2:09	0.00001	0.00001	U
CCB12	Continuing Calibration	4/27/2018	2:48	0.00001	0.00001	U

Data Package ID: IM1804492-1

Date Printed: Monday, May 21, 2018

**ALS -- Fort Collins** 

Page 1 of 1



# Gamma Spectroscopy Case Narrative

### **Stantec Consulting Services**

St. Anthony Geotechnical Investigation – 233001076

Work Order Number: 1804492

- 1. The following report consists of analytical results for 17 soil samples received by ALS on 04/23/2018.
- 2. These samples were prepared according to the current revision of SOP 739. The samples were sealed in steel cans and stored for at least 21 days to allow <sup>222</sup>Rn to approach secular equilibrium with its parent, <sup>226</sup>Ra. The degree of ingrowth achieved prior to analysis is at least 97.8%. Conservatively assuming a radon emanation efficiency of approximately 50%, the effective radon progeny ingrowth for these samples would be greater than 98.9%.
- 3. The samples were analyzed for the presence of gamma emitting radionuclides according to the current revision of SOP 713. The analyses were completed on 05/18/2018.
- 4. The results for these samples are reported on a "Dry Weight" basis in units of pCi/gram.
- 5. ALS has observed a reproducible low bias in <sup>226</sup>Ra results (about -30% for the geometry in question) when using a mixed gamma source for the calibration of HPGe detectors for solid samples. This bias is eliminated by calibration using a NIST traceable <sup>226</sup>Ra source in the same geometry and configuration as the samples.
- 6. The library used for calibration and analysis employs multiple peaks for the <sup>226</sup>Ra progeny, <sup>214</sup>Pb (352 and 295 keV) and <sup>214</sup>Bi (609 and 1120 keV). Using these peaks avoids the use of the problematic <sup>226</sup>Ra photopeak at 186 keV, which suffers from poorly resolvable interference from <sup>235</sup>U at the same energy. Final activity results for <sup>226</sup>Ra are calculated, using the uncertainty-weighted mean of the activities for the four photopeaks, by the Seeker gamma spectroscopy software assuming secular equilibrium.



- 7. There are cases where the sample density is less than the associated calibration standard density. Cases that exceed the limit of +/- 15% of the density of the calibration standard are flagged with a 'G', denoting a significant density difference between the sample and calibration standard. Consequently, the results may be biased high for the flagged results in this work order. If requested, ALS can perform a transmission spike in order to estimate a magnitude of this bias. The results are reported without further qualification.
- 8. The requested detection limit was not met for samples 1804492-1, -1DUP, -5, -8, and -9. The reported activity exceeds the achieved MDC. The results are submitted without further qualification. The results are flagged with an "M3" qualifier on the final reports.
- 9. No further problems were encountered with either the client samples or the associated quality control samples. All remaining quality control criteria were met.

The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

Pik Yee Yuen
Radiochemistry Primary Data Reviewer

5/23/18
Date

5/29/18

Radiochemistry Pinal Data Reviewer

Date

### **ALS -- Fort Collins**

### Sample Number(s) Cross-Reference Table

**OrderNum:** 1804492

Client Name: Stantec Consulting Services

Client Project Name: St. Anthony Geotechnical Investigation

Client Project Number: 233001076

**Client PO Number: 233001076-ALS2** 

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
P1-2 20'	1804492-1		SOIL	09-Apr-18	11:00
P1-2 40'	1804492-2		SOIL	09-Apr-18	11:30
P1-2 60'	1804492-3		SOIL	11-Apr-18	14:30
P2-1 10'	1804492-4		SOIL	14-Apr-18	16:15
P2-1 20'	1804492-5		SOIL	14-Apr-18	16:25
P2-2 10'	1804492-6		SOIL	15-Apr-18	8:30
P4-3 5'	1804492-7		SOIL	16-Apr-18	12:10
P4-5 5'	1804492-8		SOIL	16-Apr-18	10:00
P4-5 15'	1804492-9		SOIL	16-Apr-18	10:10
P4-9 20'	1804492-10		SOIL	15-Apr-18	13:30
P4-9 30'	1804492-11		SOIL	15-Apr-18	13:50
BW-1 10'	1804492-12		SOIL	18-Apr-18	9:35
BW-4 5'	1804492-13		SOIL	18-Apr-18	12:00
BW-4 15'	1804492-14		SOIL	18-Apr-18	12:15
BW-3 10'	1804492-15		SOIL	18-Apr-18	12:50
BW-2 5'	1804492-16		SOIL	18-Apr-18	13:45
BW-2 20'	1804492-17		SOIL	18-Apr-18	14:05

Date Printed: Wednesday, May 23, 2018

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225 Commerce Drive, Fort Collins, Colorado 80524 TF: (800) 443-1511 PH: (970) 490-1511 FX: (970) 490-1522

Turnaround time for samples received after 2 p.m. will be calculated beginning from the next business day.

Chain-of-Custody

ALS WORKORDER #

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Turnaround time for samples received Saturday will be calculated beginning from the next business day.

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Chain-of-Custody

ALS WORKORDER #

8644081

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Turnaround time for samples received after 2 p.m. will be calculated beginning from the next business day.

Turnaround time for samples received Saturday will be calculated beginning from the next business day.

SAMPLER

TURNAROUND TIME

SEE NOTES SECTION RETURN TIME PARAMETER/METHOD REQUEST FOR ANALYSIS (BY LAB) DATE I \* | Audrim - 236 (EPA 90).1) Thorwn - 330 (EPA 901. Stoss alpha (EPA 901.1 DISPOSAL (EPA 901.1) ø ш ш PRINTED NAME ٥ B Uranium Ç > 7 8 Ç ٥ ш ø I ⋖ **L** မွ Excel Sproadsheet ADDRESS 3335 S Timbedone Rd #150 Jason. cumber @stantec. com SIGNATURE **PRESERVATIVE** Fort Collins, CO 80536 4 Stantec Consulting Sovies Z # OF BOTTLES PHONE (970) 213 - 2755 SITE ID St. Anthony Mine Jason Combes Matrix: O = oil S = soil NS = non-soil solid W = water L = liquid E = extract F = filter 13:00pm 19:15pm SAMPLE TIME M8/18 11:45pm 4/18/18 113:50pm 4(18(18 |3:05pm EDD FORMAT Microsoft Form 202r9 1181 H SAMPLE DATE 4 118 118 CITY / STATE / ZIP INVOICE ATTN TO E-MAIL BILL TO COMPANY PURCHASE ORDER MATRIX من S S PROJECT NAME St. Anthony George dantal Investigation Cameron. Fritz & stantec. com 4150 COMPANY NAME Stanter CONSULTING Services CITY STATE / ZP / FOLY CONDING CO 80525 ADDRESS 3335 S Timberline Rd PHONE (970) 313- 2754 ameron Firtz 8W-2 20, Time Zone (Circle): EST CST (MST) PST PROJECT No. | 3330 01076 رك BW-3 10 NOTES 8W-3 BW-4 BW-4 SEND REPORT TO E-MAIL **ZB B** <u>و</u>  $\Xi$ 

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PRESERVATION KEY 1-HCI 2-HN03 3-H2SO4 4-NaOH 5-NaOH/ZnAcelais 6-NeHSO4 7-4°C 8-Other

5 of 29



## ALS Environmental - Fort Collins CONDITION OF SAMPLE UPON RECEIPT FORM

Client: Stantec	Workorder No: 1804	1497	-	
Project Manager: L15	Initials: Gw	Date:	4.23.15	<b>.</b>
Does this project require any special handling in addition to stand	ard ALS procedures?		YES	(NO)
2. Are custody seals on shipping containers intact?		NÓNE	YES	NO
3. Are Custody seals on sample containers intact?		NONE	YES	NO
4. Is there a COC (Chain-of-Custody) present or other represe	ntative documents?		(FES)	NO
5. Are the COC and bottle labels complete and legible?			YES	NO
6. Is the COC in agreement with samples received? (IDs, dates containers, matrix, requested analyses, etc.)	s, times, no. of samples, no. of		YES	NO
Were airbills / shipping documents present and/or removab	le?	DROP OFF	YES	NO
8. Are all aqueous samples requiring preservation preserved correctl	y? (excluding volatiles)	A77A9	YES	NO
9. Are all aqueous non-preserved samples pH 4-9?		(N)A	YES	NO
10. Is there sufficient sample for the requested analyses?			XES	NO
11. Were all samples placed in the proper containers for the rec	quested analyses?			NO
12. Are all samples within holding times for the requested anal	yses?		(TE)s	NO
13. Were all sample containers received intact? (not broken or	leaking, etc.)		YES	NO
14. Are all samples requiring no headspace (VOC, GRO, RSK/headspace free? Size of bubble: < green pea	MEE, Rx CN/S, radon)> green pea		YES	NO
15. Do any water samples contain sediment?  Amount of sediment: dusting moderate	Amount heavy	N/A	YES	NO
16. Were the samples shipped on ice?			YES	(NO)
Were cooler temperatures measured at 0.1-6.0°C?	IR gun used*: #2 #4	(RAD ONLY)	YES	NO
Cooler #: 1 2				
Temperature (°C): Amb Amb				
No. of custody seals on cooler: $Q$				
DOT Survey/ Acceptance External μR/hr reading:	· —— ——			
Background μR/hr reading:				
Were external µR/hr readings ≤ two times background and within DOT acceptance	ce criteria? YES / NO / NA (If no, see	Form 008.)		
Additional Information: PROVIDE DETAILS BELOW FOR A NO RESPONDED			ND #16.	
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If applicable, was the client contacted? YES / NO / NA Contact:	_///	_ Date/Tii	me:	
Project Manager Signature / Date:	AM 4/4/18	_		

\*IR Gun #2: Oakton, SN 29922500201-0066 \*IR Gun #4: Oakton, SN 2372220101-0002 FROM: CAMERON FRITZ

(907) 947-2225

SHIP DATE: 19APR18 ACTHGT: 36.00 LB CAD: 006993643/SSFE1904 DIMMED: 15 X 12 X 12 IN

. 718 MARIGOLD LN

FORT COLLINS CO 80526 US

10

### ALS ENVIRONMENTAL 225 COMMERCE DR

FORT COLLINS CO 80524

(US)





1 of 2 TRK# 7805 9618 7711 ## MASTER ##

80524

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FROM: CAMERON FRITZ

(907) 947-2225

718 MARIGOLD LN

FORT COLLINS CO 90526

TO

### **ALS ENVIRONMENTAL** 225 COMMERCE DR

# FORT COLLINS CO 80524

(US)





2 of 2 MPS# 7805 9618 7722 Mstr# 7805 9618 7711

80524

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### PAI 713 Rev 14 Method Blank Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

**Lab ID:** GS180502-2MB

Sample Matrix: SOIL

**Prep Batch:** GS180502-2 **QCBatchID:** GS180502-2-1

Final Aliquot: 215 g Result Units: pCi/g

Library: RA226.LIB

Prep SOP: PAI 739 Rev 12 Date Collected: 02-May-18

Run ID: GS180502-2A Count Time: 30 minutes

File Name: 180883d03

Date Prepared: 02-May-18

Date Analyzed: 17-May-18

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	0.10 +/- 0.17	0.30	0.5	NA	U

#### Comments:

#### Qualifiers/Flags:

 $\ensuremath{\mathsf{U}}\xspace$  - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

DL - Decision Level

Data Package ID: GSS1804492-1

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

Date Printed: Wednesday, May 23, 2018 ALS -- Fort Collins Page 1 of 1

#### **PAI 713 Rev 14**

#### Laboratory Control Sample(s)

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Lab ID: GS180502-2LCS

Sample Matrix: SOIL

Prep Batch: GS180502-2

Final Aliquot: 215 g Result Units: pCi/g

File Name: 180592d09

Date Collected: 02-May-18 Library: RA226.LIB

Prep SOP: PAI 739 Rev 12 QCBatchID: GS180502-2-1 Run ID: GS180502-2A Date Prepared: 02-May-18

Count Time: 30 minutes

Date Analyzed: 18-May-18

	CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added		Contro I Limits	Lab Qualifier
Ī	13982-63-3	Ra-226	454 +/- 53	3	468.3	97.0	85 - 115	P,M3

#### Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

Abbreviations:

LT - Result is less than Requested MDC, greater than sample specific MDC. Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

SQ - Spectral quality prevents accurate quantitation.

L - LCS Recovery below lower control limit.

SI - Nuclide identification and/or quantitation is tentative.

H - LCS Recovery above upper control limit. P - LCS Recovery within control limits.

TI - Nuclide identification is tentative.

M - The requested MDC was not met.

R - Nuclide has exceeded 8 halflives.

M3 - The requested MDC was not met, but thereported

activity is greater than the reported MDC.

Data Package ID: GSS1804492-1

Date Printed: Wednesday, May 23, 2018

Page 1 of 1 **ALS -- Fort Collins** 

#### **PAI 713 Rev 14**

#### **Duplicate Sample Results (DER)**

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P1-2 20'

**Lab ID:** 1804492-1DUP

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12 Date Collected: 09-Apr-18

Date Prepared: 02-May-18

Date Analyzed: 17-May-18

Prep Batch: GS180502-2

QCBatchID: GS180502-2-1 Run ID: GS180502-2A

Count Time: 30 minutes Report Basis: Dry Weight Final Aliquot: 182 g

Prep Basis: Dry Weight Moisture(%): NA

Result Units: pCi/g File Name: 180673d02

CASNO	Analyte	Sample	<del>)</del>		Duplica	ate		DER	DER
	Allalyte	Result +/- 2 s TPU	MDC	Flags	Result +/- 2 s TPU	MDC	Flags		Lim
13982-63-3	Ra-226	11.5 +/- 1.5	0.6	M3,G	16.1 +/- 2.0	0.7	M3,G	1.84	2.13

#### Comments:

#### Duplicate Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.

Y2 - Chemical Yield outside default limits.

 $\ensuremath{\mathsf{W}}$  - DER is greater than Warning Limit of 1.42

D - DER is greater than Control Limit of 2.13

LT - Result is less than Request MDC, greater than sample specific MDC

M - Requested MDC not met.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.
P - LCS, Matrix Spike Recovery within control limits.

N - Matrix Spike Recovery outside control limits

\_\_\_\_\_

TPU - Total Propagated Uncertainty DER - Duplicate Error Ratio BDL - Below Detection Limit

NR - Not Reported

Abbreviations:

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

 $\mbox{G}$  - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1804492-1

Date Printed: Wednesday, May 23, 2018

# PAI 713 Rev 14 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P1-2 20'
Lab ID: 1804492-1

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 09-Apr-18

**Date Prepared:** 02-May-18 **Date Analyzed:** 17-May-18

Prep Batch: GS180502-2

QCBatchID: GS180502-2-1 Run ID: GS180502-2A Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 167 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g File Name: 180692d01

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	11.5 +/- 1.5	0.6	0.5	NA	M3,G

#### Comments:

#### Qualifiers/Flags:

- $\ensuremath{\mathsf{U}}\xspace$  Result is less than the sample specific MDC or less than the associated TP
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

- TPU Total Propagated Uncertainty
- MDC Sample specific Minimum Detectable Concentration
- BDL Below Detection Limit
- DL Decision Level
- Data Package ID: GSS1804492-1

- SQ Spectral quality prevents accurate quantitation.
- SI Nuclide identification and/or quantitation is tentative.
- TI Nuclide identification is tentative
- R Nuclide has exceeded 8 halflives.
- $\mbox{G}$  Sample density differs by more than 15% of LCS density.

Date Printed: Wednesday, May 23, 2018 ALS -- Fort Collins Page 1 of 17

#### **PAI 713 Rev 14**

#### Sample Duplicate Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P1-2 20'

Lab ID: 1804492-1DUP

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12 Date Collected: 09-Apr-18

Date Prepared: 02-May-18 Date Analyzed: 17-May-18

Prep Batch: GS180502-2

QCBatchID: GS180502-2-1 Run ID: GS180502-2A Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 182 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g

File Name: 180673d02

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	16.1 +/- 2.0	0.7	0.5	NA	M3,G

#### Comments:

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC or less than the associated TPU.
- Y1 Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M The requested MDC was not met.
- M3 The requested MDC was not met, but thereported activity is greater than the reported MDC.
- W DER is greater than Warning Limit of 1.42
- D DER is greater than Control Limit of 2.13
- Abbreviations:
- TPU Total Propagated Uncertainty
- MDC Sample specific Minimum Detectable Concentration
- BDL Below Detection Limit
- DL Decision Level
- Data Package ID: GSS1804492-1

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

**Date Printed:** Wednesday, May 23, 2018

**ALS -- Fort Collins** LIMS Version: 6.862

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# PAI 713 Rev 14 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Library: RA226.LIB

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P1-2 40'
Lab ID: 1804492-2

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12 Date Collected: 09-Apr-18

Date Prepared: 02-May-18

Date Analyzed: 17-May-18

Prep Batch: GS180502-2

QCBatchID: GS180502-2-1 Run ID: GS180502-2A

Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 199 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g File Name: 180881d03

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.25 +/- 0.30	0.48	0.5	NA	

#### Comments:

#### Qualifiers/Flags:

- $\ensuremath{\mathsf{U}}\xspace$  Result is less than the sample specific MDC or less than the associated TP
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

- TPU Total Propagated Uncertainty
- MDC Sample specific Minimum Detectable Concentration
- BDL Below Detection Limit
- DL Decision Level

Data Package ID: GSS1804492-1

- SQ Spectral quality prevents accurate quantitation.
- SI Nuclide identification and/or quantitation is tentative.
- TI Nuclide identification is tentative
- R Nuclide has exceeded 8 halflives.
- $\mbox{G}$  Sample density differs by more than 15% of LCS density.

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# PAI 713 Rev 14 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P1-2 60'
Lab ID: 1804492-3

Library: RA226.LIB

Sample Matrix: SOIL

Date Prepared: 02-May-18

Date Analyzed: 17-May-18

Prep SOP: PAI 739 Rev 12
Date Collected: 11-Apr-18

Prep Batch: GS180502-2 QCBatchID: GS180502-2-1

QCBatchID: GS180502-2-1 Prep II
Run ID: GS180502-2A Moistur
Count Time: 30 minutes Result II
Report Basis: Dry Weight File II

Final Aliquot: 180 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g File Name: 180539d05

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.31 +/- 0.28	0.38	0.5	NA	G

#### **Comments:**

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC or less than the associated TP
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

- TPU Total Propagated Uncertainty
- MDC Sample specific Minimum Detectable Concentration
- BDL Below Detection Limit
- DL Decision Level
- Data Package ID: GSS1804492-1

- SQ Spectral quality prevents accurate quantitation.
- SI Nuclide identification and/or quantitation is tentative.
- TI Nuclide identification is tentative
- R Nuclide has exceeded 8 halflives.
- $\mbox{G}$  Sample density differs by more than 15% of LCS density.

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### PAI 713 Rev 14 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P2-1 10'
Lab ID: 1804492-4

Sample Matrix: SOIL Prep SOP: PAI 739 Rev 12 Prep Batch: GS180502-2 QCBatchID: GS180502-2-1 Run ID: GS180502-2A Final Aliquot: 188 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/q

Library: RA226.LIB

Date Collected: 14-Apr-18 Date Prepared: 02-May-18 Date Analyzed: 17-May-18

Count Time: 30 minutes
Report Basis: Dry Weight

port Basis: Dry Weight File Name: 180599d08

	CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
ſ	13982-63-3	Ra-226	3.85 +/- 0.58	0.47	0.5	NA	

#### Comments:

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC or less than the associated TP
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

- TPU Total Propagated Uncertainty
- MDC Sample specific Minimum Detectable Concentration
- BDL Below Detection Limit
- DL Decision Level
- Data Package ID: GSS1804492-1

- SQ Spectral quality prevents accurate quantitation.
- SI Nuclide identification and/or quantitation is tentative.
- TI Nuclide identification is tentative
- R Nuclide has exceeded 8 halflives.
- $\mbox{G}$  Sample density differs by more than 15% of LCS density.

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### **PAI 713 Rev 14** Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P2-1 20' Lab ID: 1804492-5

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12 Date Collected: 14-Apr-18

Prep Batch: GS180502-2 QCBatchID: GS180502-2-1 Run ID: GS180502-2A

Report Basis: Dry Weight

Date Prepared: 02-May-18 Date Analyzed: 17-May-18

Final Aliquot: 184 g Prep Basis: Dry Weight Moisture(%): NA Count Time: 30 minutes Result Units: pCi/q

File Name: 180584d09

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.25 +/- 0.31	0.54	0.5	NA	М3

#### Comments:

#### Qualifiers/Flags:

- U Result is less than the sample specific MDC or less than the associated TP
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC
- M The requested MDC was not met.

#### Abbreviations:

- TPU Total Propagated Uncertainty
- MDC Sample specific Minimum Detectable Concentration
- **BDL** Below Detection Limit
- DL Decision Level

Data Package ID: GSS1804492-1

- SQ Spectral quality prevents accurate quantitation.
- SI Nuclide identification and/or quantitation is tentative.
- TI Nuclide identification is tentative
- R Nuclide has exceeded 8 halflives.
- G Sample density differs by more than 15% of LCS density.

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### PAI 713 Rev 14 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P2-2 10'
Lab ID: 1804492-6

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 15-Apr-18

Date Prepared: 02 May 18

**Date Prepared:** 02-May-18 **Date Analyzed:** 17-May-18

Prep Batch: GS180502-2 QCBatchID: GS180502-2-1

Run ID: GS180502-2A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 195 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g File Name: 180594d10

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	0.91 +/- 0.21	0.36	0.5	NA	

#### Comments:

#### Qualifiers/Flags:

- $\ensuremath{\mathsf{U}}\xspace$  Result is less than the sample specific MDC or less than the associated TP
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

- TPU Total Propagated Uncertainty
- MDC Sample specific Minimum Detectable Concentration
- BDL Below Detection Limit
- DL Decision Level

Data Package ID: GSS1804492-1

- SQ Spectral quality prevents accurate quantitation.
- SI Nuclide identification and/or quantitation is tentative.
- TI Nuclide identification is tentative
- R Nuclide has exceeded 8 halflives.
- $\mbox{G}$  Sample density differs by more than 15% of LCS density.

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### PAI 713 Rev 14 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P4-3 5'
Lab ID: 1804492-7

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 16-Apr-18

**Date Prepared:** 02-May-18 **Date Analyzed:** 18-May-18

Prep Batch: GS180502-2

QCBatchID: GS180502-2-1 Run ID: GS180502-2A Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 201 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g File Name: 181104d04

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	2.15 +/- 0.41	0.49	0.5	NA	

#### **Comments:**

#### Qualifiers/Flags:

- $\ensuremath{\mathsf{U}}\xspace$  Result is less than the sample specific MDC or less than the associated TP
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

- TPU Total Propagated Uncertainty
- MDC Sample specific Minimum Detectable Concentration
- BDL Below Detection Limit
- DL Decision Level

Data Package ID: GSS1804492-1

- SQ Spectral quality prevents accurate quantitation.
- SI Nuclide identification and/or quantitation is tentative.
- TI Nuclide identification is tentative
- R Nuclide has exceeded 8 halflives.
- $\mbox{G}$  Sample density differs by more than 15% of LCS density.

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# PAI 713 Rev 14 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P4-5 5'
Lab ID: 1804492-8

Sample Matrix: SOIL Prep SOP: PAI 739 Rev 12 Prep Batch: GS180502-2 QCBatchID: GS180502-2-1 Run ID: GS180502-2A Final Aliquot: 231 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/q

File Name: 180693d01

Library: RA226.LIB

Date Collected: 16-Apr-18 Date Prepared: 02-May-18 Date Analyzed: 17-May-18

**Count Time:** 30 minutes **Report Basis:** Dry Weight

**CASNO** Result +/- 2 s TPU Requested **Target Nuclide MDC** DL Lab **MDC** Qualifier 13982-63-3 Ra-226 29.5 +/- 3.6 0.8 0.5 NΑ М3

#### **Comments:**

#### Qualifiers/Flags:

- $\ensuremath{\mathsf{U}}\xspace$  Result is less than the sample specific MDC or less than the associated TP
- 11 Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1804492-1

- SQ Spectral quality prevents accurate quantitation.
- SI Nuclide identification and/or quantitation is tentative.
- TI Nuclide identification is tentative
- R Nuclide has exceeded 8 halflives.
- G Sample density differs by more than 15% of LCS density.

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### **PAI 713 Rev 14** Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P4-5 15' Lab ID: 1804492-9 Sample Matrix: SOIL

Prep Batch: GS180502-2 Prep SOP: PAI 739 Rev 12 QCBatchID: GS180502-2-1 Date Collected: 16-Apr-18 Run ID: GS180502-2A

Final Aliquot: 213 g Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/q

File Name: 180674d02

Library: RA226.LIB

Date Prepared: 02-May-18 Date Analyzed: 17-May-18

Count Time: 30 minutes Report Basis: Dry Weight

**CASNO** Result +/- 2 s TPU Requested **Target Nuclide MDC** DL Lab **MDC** Qualifier 13982-63-3 Ra-226 18.6 +/- 2.3 0.7 0.5 NΑ М3

#### Comments:

#### Qualifiers/Flags:

- $\ensuremath{\mathsf{U}}\xspace$  Result is less than the sample specific MDC or less than the associated TP
- 11 Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC
- M The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

**BDL** - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1804492-1

- SQ Spectral quality prevents accurate quantitation.
- SI Nuclide identification and/or quantitation is tentative.
- TI Nuclide identification is tentative
- R Nuclide has exceeded 8 halflives.
- G Sample density differs by more than 15% of LCS density.

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# PAI 713 Rev 14 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P4-9 20'
Lab ID: 1804492-10

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 15-Apr-18

**Date Prepared:** 02-May-18 **Date Analyzed:** 17-May-18

Prep Batch: GS180502-2

QCBatchID: GS180502-2-1 Run ID: GS180502-2A

Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 246 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g File Name: 180882d03

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	3.14 +/- 0.48	0.39	0.5	NA	

#### **Comments:**

#### Qualifiers/Flags:

- $\ensuremath{\mathsf{U}}\xspace$  Result is less than the sample specific MDC or less than the associated TP
- 11 Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

- TPU Total Propagated Uncertainty
- MDC Sample specific Minimum Detectable Concentration
- BDL Below Detection Limit
- DL Decision Level

Data Package ID: GSS1804492-1

- SQ Spectral quality prevents accurate quantitation.
- SI Nuclide identification and/or quantitation is tentative.
- TI Nuclide identification is tentative
- R Nuclide has exceeded 8 halflives.
- $\mbox{G}$  Sample density differs by more than 15% of LCS density.

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### PAI 713 Rev 14 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: P4-9 30'
Lab ID: 1804492-11

Sample Matrix: SOIL Prep SOP: PAI 739 Rev 12 Prep Batch: GS180502-2 QCBatchID: GS180502-2-1 Run ID: GS180502-2A Final Aliquot: 196 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/q

Library: RA226.LIB

Date Collected: 15-Apr-18
Date Prepared: 02-May-18
Date Analyzed: 17-May-18

Count Time: 30 minutes
Report Basis: Dry Weight

File Name: 180540d05

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.26 +/- 0.27	0.38	0.5	NA	

#### Comments:

#### Qualifiers/Flags:

- $\ensuremath{\mathsf{U}}\xspace$  Result is less than the sample specific MDC or less than the associated TP
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

- TPU Total Propagated Uncertainty
- MDC Sample specific Minimum Detectable Concentration
- BDL Below Detection Limit
- DL Decision Level

Data Package ID: GSS1804492-1

- SQ Spectral quality prevents accurate quantitation.
- SI Nuclide identification and/or quantitation is tentative.
- TI Nuclide identification is tentative
- R Nuclide has exceeded 8 halflives.
- $\mbox{G}$  Sample density differs by more than 15% of LCS density.

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# PAI 713 Rev 14 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: BW-1 10'
Lab ID: 1804492-12

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12 Date Collected: 18-Apr-18

**Date Prepared:** 02-May-18 **Date Analyzed:** 18-May-18

Prep Batch: GS180502-2

QCBatchID: GS180502-2-1 Run ID: GS180502-2A Count Time: 30 minutes Report Basis: Dry Weight Final Aliquot: 204 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g File Name: 180607d08

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	0.76 +/- 0.22	0.35	0.5	NA	

#### **Comments:**

#### Qualifiers/Flags:

- $\ensuremath{\mathsf{U}}\xspace$  Result is less than the sample specific MDC or less than the associated TP
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

- TPU Total Propagated Uncertainty
- MDC Sample specific Minimum Detectable Concentration
- BDL Below Detection Limit
- DL Decision Level

Data Package ID: GSS1804492-1

- SQ Spectral quality prevents accurate quantitation.
- SI Nuclide identification and/or quantitation is tentative.
- TI Nuclide identification is tentative
- R Nuclide has exceeded 8 halflives.
- $\mbox{G}$  Sample density differs by more than 15% of LCS density.

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### **PAI 713 Rev 14** Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: BW-4 5'

Lab ID: 1804492-13

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12 Date Collected: 18-Apr-18

Date Prepared: 02-May-18 Date Analyzed: 17-May-18

Prep Batch: GS180502-2

QCBatchID: GS180502-2-1 Run ID: GS180502-2A

Count Time: 30 minutes Report Basis: Dry Weight Final Aliquot: 202 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/q File Name: 180600d08

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.15 +/- 0.27	0.37	0.5	NA	

#### Comments:

#### Qualifiers/Flags:

- $\ensuremath{\mathsf{U}}\xspace$  Result is less than the sample specific MDC or less than the associated TP
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC
- M The requested MDC was not met.

#### Abbreviations:

- TPU Total Propagated Uncertainty
- MDC Sample specific Minimum Detectable Concentration
- BDL Below Detection Limit
- DL Decision Level

Data Package ID: GSS1804492-1

- SQ Spectral quality prevents accurate quantitation.
- SI Nuclide identification and/or quantitation is tentative.
- TI Nuclide identification is tentative
- R Nuclide has exceeded 8 halflives.
- G Sample density differs by more than 15% of LCS density.

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### PAI 713 Rev 14 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: BW-4 15'
Lab ID: 1804492-14

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 18-Apr-18

Date Prepared: 02 May 18

Date Prepared: 02-May-18 Date Analyzed: 17-May-18 Prep Batch: GS180502-2

QCBatchID: GS180502-2-1 Run ID: GS180502-2A Count Time: 30 minutes Report Basis: Dry Weight Final Aliquot: 207 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g File Name: 180585d09

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	0.81 +/- 0.25	0.46	0.5	NA	

#### **Comments:**

#### Qualifiers/Flags:

- $\ensuremath{\mathsf{U}}\xspace$  Result is less than the sample specific MDC or less than the associated TP
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

- TPU Total Propagated Uncertainty
- MDC Sample specific Minimum Detectable Concentration
- BDL Below Detection Limit
- DL Decision Level
- Data Package ID: GSS1804492-1

- SQ Spectral quality prevents accurate quantitation.
- SI Nuclide identification and/or quantitation is tentative.
- TI Nuclide identification is tentative
- R Nuclide has exceeded 8 halflives.
- $\mbox{G}$  Sample density differs by more than 15% of LCS density.

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# PAI 713 Rev 14 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: BW-3 10'
Lab ID: 1804492-15

Sample Matrix: SOIL Prep SOP: PAI 739 Rev 12 Prep Batch: GS180502-2 QCBatchID: GS180502-2-1 Run ID: GS180502-2A Final Aliquot: 209 g
Prep Basis: Dry Weight
Moisture(%): NA
Result Units: pCi/q

File Name: 180595d10

Library: RA226.LIB

Date Collected: 18-Apr-18 Date Prepared: 02-May-18 Date Analyzed: 17-May-18

Count Time: 30 minutes Report Basis: Dry Weight

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	0.83 +/- 0.20	0.37	0.5	NA	

#### Comments:

#### Qualifiers/Flags:

- $\ensuremath{\mathsf{U}}\xspace$  Result is less than the sample specific MDC or less than the associated TP
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

- TPU Total Propagated Uncertainty
- MDC Sample specific Minimum Detectable Concentration
- BDL Below Detection Limit
- DL Decision Level
- Data Package ID: GSS1804492-1

- SQ Spectral quality prevents accurate quantitation.
- SI Nuclide identification and/or quantitation is tentative.
- TI Nuclide identification is tentative
- R Nuclide has exceeded 8 halflives.
- $\mbox{G}$  Sample density differs by more than 15% of LCS density.

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### **PAI 713 Rev 14** Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: BW-2 5'

Lab ID: 1804492-16

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12 Date Collected: 18-Apr-18

Date Prepared: 02-May-18 Date Analyzed: 17-May-18

Prep Batch: GS180502-2

QCBatchID: GS180502-2-1 Run ID: GS180502-2A

Count Time: 30 minutes Report Basis: Dry Weight Final Aliquot: 222 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/q File Name: 180694d01

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	0.73 +/- 0.22	0.37	0.5	NA	

#### Comments:

#### Qualifiers/Flags:

- $\ensuremath{\mathsf{U}}\xspace$  Result is less than the sample specific MDC or less than the associated TP
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC
- M The requested MDC was not met.

#### Abbreviations:

- TPU Total Propagated Uncertainty
- MDC Sample specific Minimum Detectable Concentration
- BDL Below Detection Limit
- DL Decision Level

Data Package ID: GSS1804492-1

- SQ Spectral quality prevents accurate quantitation.
- SI Nuclide identification and/or quantitation is tentative.
- TI Nuclide identification is tentative
- R Nuclide has exceeded 8 halflives.
- G Sample density differs by more than 15% of LCS density.

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### PAI 713 Rev 14 Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1804492

Client Name: Stantec Consulting Services

ClientProject ID: St. Anthony Geotechnical Investigation 233001076

Field ID: BW-2 20'
Lab ID: 1804492-17

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 18-Apr-18

Date Prepared: 02-May-18

Date Analyzed: 17-May-18

Prep Batch: GS180502-2 QCBatchID: GS180502-2-1

Run ID: GS180502-2A
Count Time: 30 minutes
Report Basis: Dry Weight

Final Aliquot: 215 g

Prep Basis: Dry Weight Moisture(%): NA Result Units: pCi/g File Name: 180675d02

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	0.82 +/- 0.23	0.42	0.5	NA	

#### Comments:

#### Qualifiers/Flags:

- $\ensuremath{\mathsf{U}}\xspace$  Result is less than the sample specific MDC or less than the associated TP
- Y1 Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 Chemical Yield outside default limits.
- LT Result is less than Requested MDC, greater than sample specific MDC.
- M3 The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M The requested MDC was not met.

#### Abbreviations:

- TPU Total Propagated Uncertainty
- MDC Sample specific Minimum Detectable Concentration
- BDL Below Detection Limit
- DL Decision Level

Data Package ID: GSS1804492-1

- SQ Spectral quality prevents accurate quantitation.
- SI Nuclide identification and/or quantitation is tentative.
- TI Nuclide identification is tentative
- R Nuclide has exceeded 8 halflives.
- $\mbox{G}$  Sample density differs by more than 15% of LCS density.

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