

# Report of Preliminary Geotechnical Exploration

Hancock County Flood Risk Reduction Program – Eagle Creek Dry Storage Basin Phase 1

October 17, 2019

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### **Executive Summary**

As part of the Hanacock County Flood Risk Reduction Program, the Maumee Watershed Conservancy District (MWCD) is evaluating several potential dam alignments in order to refine the conceptual design of a dry storage basin on Eagle Creek near Findlay, Ohio. The proposed Eagle Creek Dry Storage Basin is intended to provide storage during flood events to reduce the peak flow rates in Eagle Creek and the Blanchard River, thereby reducing the water surface elevations and risk of flooding downstream of the proposed Project area. The desired outcome of the proposed Project would be the reduction of flood risk and flood damages for the community. Stantec Consulting Services Inc. (Stantec) was contracted by MWCD to perform engineering and design services for the program, including the geotechnical exploration for the proposed dry storage basin.

Eagle Creek runs south to north, flowing into the Blanchard River in the eastern portion of the City of Findlay. The proposed dry storage basin is located approximately 4 miles south of the City of Findlay.

Ten borings were advanced by Stantec to obtain geotechnical data along a proposed embankment alignment west of Eagle Creek. Disturbed and undisturbed soil samples were collected through the soil overburden. Upon encountering bedrock, approximately 10 feet of rock coring was performed. Soil and rock samples obtained from the borings were logged in the field by a geotechnical engineer, then returned to the laboratory for testing and storage. Laboratory testing included natural moisture content determinations, soil classifications including particle size analysis and Atterberg limits, standard Proctor, and unconfined compressive strength testing. In addition, water pressure testing was performed in the bedrock in five of the borings.

Soils encountered along the proposed alignment west of Eagle Creek consisted of alternating layers of fine- and coarse-grained materials. Laboratory testing classified the fine-grained soils as Sandy Lean Clay (CL), Lean Clay (CL), Sandy Silty Clay (CL-ML), Silt with Sand (ML). These soils were described as moist, medium stiff to very stiff, and having varying amounts of sand and gravel. Fine-grained soils were encountered near the ground surface, and again deeper in the profile between two layers of coarse-grained soils. The coarse-grained materials were visually described as poorly graded sand with some gravel or mechanically classified as Silty Sand with Gravel (SM), Silty, Clayey Gravel with Sand (GC-GM), and Clayey Sand (SC). These soils were described as moist and dense to very dense. The layers of coarse-grained materials were found generally near the water table and again above top of bedrock. The depth to bedrock ranged from 12.8 feet (EI. 784.8 feet) in B-1.1 to 21.0 feet (EI. 773.4 feet) in B-2.14a. The bedrock was described as gray dolomite, slightly weathered, fractured to moderately fractured, slightly rough, and thin to medium bedded.

Seepage at and below the base of an embankment can erode the foundation, weaken the materials, and lead to uncontrolled releases of a reservoir. This risk is especially pronounced in a structure that does not retain water on a routine basis, as inspections are not often feasible except during flood events. The design team should consider the potential seepage concerns related to the various dam alignment alternatives currently under evaluation. The conclusions and recommendations herein assume that the preferred dam alignment will either

- 1. Require significant excavation of the natural soils within the reservoir footprint (upstream of the constructed dam), removing the fine-grained, near-surface soils, or
- 2. Not require significant excavation of the natural soil and leave a minimum of three (3) feet of the fine-grained, near-surface soils within the reservoir footprint (upstream of the constructed dam).

The following recommendations should be considered as the project moves to detailed design:

- Additional exploration, including but not limited to, drilling, sampling, instrumentation, in-situ testing, and laboratory testing should be performed to further define the borrow sources and foundation soil and rock near the preferred dam alignment, chosen as a result of the current phase of the project.
  - a. Potential Embankment Borrow Source
  - i. Typical specifications for dam embankment fill suitability require soils classifications of CL, CH, or CL-ML. The plasticity index should be a minimum of 12 percent, and the material should be free of rock, soil clods or gravel larger than three (3) inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. Gravel content should be limited to 15 percent by weight.
  - ii. Considering the typical specifications above, the preliminary findings as discussed in Section 4.0 indicate that approximately 10 to 15 feet of potentially suitable borrow soil would be available below the topsoil layer in the locations of the borings on the northern end of the exploration, with minor amounts of coarse-grained materials that would need to be separated. Generally, there is only about four to eight feet of suitable embankment fill material in the borings south of Township Road 49. The plasticity index of the classified samples was borderline for acceptability with regards to the specifications above.
  - iii. A borrow source study should be performed to determine the available quantity of site-specific fill materials. The study should include laboratory testing to determine design parameters of potential borrow soil, including optimal compaction, potential dispersivity, and as-compacted shear strength, and saturated and unsaturated permeability.
  - b. Exploration of Preferred Dam Alignment
  - i. The current phase of the project includes a multi-disciplinary approach to determining the preferred dam alignment. It is possible that the chosen preferred alignment will differ from the alignment which was evaluated as part of this geotechnical exploration. If the preferred alignment is changed, additional borings should be conducted along the selected alignment to evaluate the subsurface conditions.
  - ii. Conduct additional geotechnical borings, test pits, and/or other exploration methods at more closely, regularly spaced intervals to adequately characterize subsurface conditions. Explorations should include locations along the preferred dam alignment and at select cross sections, and should obtain information to support the design of foundation treatment and/or necessary seepage control measures for the site. Additional borings should also be conducted at regular intervals upstream (detention-side) of the proposed dam alignment to evaluate the continuity of the fine-grained near-surface soils and the ability of same soils to function as a natural upstream blanket. See Section 5.5 for additional discussion.
  - iii. Explorations should include methods to further define characteristics of the dolomite bedrock, including faults, fractures, discontinuities, voids, etc. that could influence the seepage below the proposed dam. See additional recommendations regarding bedrock explorations in Section 5.4.
  - iv. Should significant soil excavations be required, a hydrogeologist should be engaged to advise the design team regarding the overall geology of the site and specific exploration techniques that can further define potential geologic concerns.

- v. Further identify the vertical and lateral extents of coarse-grained materials that may influence foundation treatment and seepage design.
- c. Install temporary piezometers and/or groundwater wells to establish groundwater levels and boundary conditions appropriate for detailed seepage design models.
- d. Perform in-situ hydraulic conductivity testing of foundation soils and bedrock to develop site specific parameters for seepage design models. Testing should include additional water pressure tests of targeted bedrock layers and slug testing of installed piezometers/groundwater wells.
- e. Perform soil water characteristic curve (SWCC) laboratory testing on applicable foundation and potential borrow materials to refine unsaturated permeability parameters for use in design.
- f. Perform dispersive clay laboratory testing to determine the dispersivity of foundation and potential borrow soils.
- 2. An internal drainage system (chimney/blanket drain, finger drains, outlet pipes, etc.) should be considered for final design. Without an internal drainage system, the preliminary stability analyses (Stantec 2018) resulted in low factors of safety for steady-state flood conditions. Additionally, the existing subsurface includes pervious zones of coarse-grained materials and fractured bedrock that will require considerations during design. The use of internal drainage features may reduce the scope of necessary foundation treatment.
- 3. Design of the principal outlet conduits through the dam should include design of a filter diaphragm to intercept and filter preferential seepage paths along the conduits. Design filter diaphragms according to USACE filter criteria (USACE 2003) and other applicable design guidance (FEMA 2005).
- 4. The proposed structure will likely be classified as a high hazard dam. According to the NRCS Technical Release Number 60 (TR-60), the project sites are in Seismic Zone 2, and will therefore require special investigations to determine liquefaction potential and the presence of nearby faults. These seismic analysis requirements should be considered when developing the detailed explorations prior to final design.

The geotechnical exploration results and observations should be considered by the design team during selection of the preferred dam alignment. The dam alignments with the smallest reservoir footprints will likely require extensive excavation of the overburden soils within the reservoir to provide adequate storage capacity to meet project goals. The dam alignments with larger reservoir footprints will require less excavation within the reservoir.

If a selected dam alignment will require excavation of the reservoir footprint the following geotechnical conclusions and recommendations should be considered:

- Excavation of the "Upper Fine Grained" and/or "Lower Fine Grained" materials will expose significant thicknesses of more permeable coarse-grained overburden soils, and potentially expose bedrock with significant flow potential.
- If these materials are exposed, flood waters stored within the reservoir could be hydraulically connected from the reservoir, through the foundation soils and rock, and to the downstream toe of the embankment. This condition could lead to heaving, piping, or other seepage related concerns at the downstream toe of the dam.

• To treat these seepage concerns, the dam typical cross section should consider a key into the bedrock to serve as a seepage cutoff, or the design of an excavation and bedrock grouting program. To sufficiently incorporate a key into bedrock, graded filter layers should also be provided between fine-grained embankment fill soil and the surface of the bedrock.

If a selected dam alignment will not require extensive excavations of the reservoir footprint, the following geotechnical conclusions and recommendations should be considered:

- The "Upper Fine Grained" and/or "Lower Fine Grained" soils would generally remain in place within the reservoir footprint, potentially serving as a natural upstream blanket and reducing the potential for direct hydraulic connection to the permeable overburden soils and bedrock.
- According to the United States Bureau of Reclamation (USBR, 1987), the following recommendations should be considered when relying on a natural upstream blanket:
  - Areas of the embankment foundation covered by natural low-permeability blankets should be stripped of vegetation, defective areas repaired, and rolled to seal root holes or other openings.
  - Excavation of the natural low-permeability blanket should be avoided within 200 to 400 feet of the upstream toe of the dam. It is usually necessary to compact the low-permeability layer with a heavy roller or other appropriate compaction equipment.
  - o The natural blanket soil should meet filter criteria with the underlying coarse-grained soils.
  - An upstream blanket should not be the only method relied upon for reduction of seepage forces in the foundation. Horizontal drainage blankets, trench drains, relief wells, or other seepage control measures should be provided when a cutoff trench will not be extended below the embankment.
  - A minimum of three (3) feet of fine-grained soils should be left in place below and upstream of the embankment fill.
- Additional exploration and sampling should be conducted to evaluate the effectiveness of the "Upper Fine Grained" and "Lower Fine Grained" soils to serve as a natural upstream blanket. This exploration would include enough borings to evaluate the continuity of the layers within approximately 400 feet of the upstream toe of the dam. Laboratory and field permeability testing and dispersivity testing should be conducted on the layers to evaluate the in-situ effectiveness as an upstream blanket. The fine-grained materials should be evaluated for filter compatibility with the underlying coarse-grained materials.

In general, less foundation improvement, including excavation, treatment, and grouting of underlying bedrock will be required for the larger footprints that do not require excavations from within the reservoir. It is likely that internal and downstream drainage features would be required for the typical cross-section of the dam, regardless of the selected alignment. Therefore, a significant cost savings would be expected for a larger reservoir footprint, reducing costs for overburden and bedrock excavation, bedrock surface treatments, and bedrock grouting programs.

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# **1.0 INTRODUCTION**

As part of the Hancock County Flood Risk Reduction (HCFRR) Program, the Maumee Watershed Conservancy District (MWCD) is evaluating several potential dam alignments in order to refine the conceptual design of a dry storage basin on Eagle Creek near Findlay, Ohio. The proposed Eagle Creek Dry Storage Basin is intended to provide storage during flood events to reduce the peak flow rates in Eagle Creek and the Blanchard River, thereby reducing the water surface elevations and risk of flooding downstream of the proposed Project area. The desired outcome of the proposed Project would be the reduction of flood risk and flood damages for the community. Stantec Consulting Services Inc. (Stantec) was contracted by MWCD to perform engineering and design services for the program, including the preliminary geotechnical exploration for the proposed dry storage basin. Stantec's efforts and recommendations to support the Program have included data review, gap analyses, plan and alternatives review, and proof-of-concept development for a dry storage basin on Eagle Creek.

Figure 1 shows the site vicinity and conceptual layouts for the Eagle Creek Dry Storage Basin. Eagle Creek runs south to north, flowing into the Blanchard River in the eastern portion of the City of Findlay. The proposed dry storage basin is located approximately 4 miles south of the City of Findlay. The current phase of design is focused on identifying the preferred alignment of the dam, considering the concerns of the local shareholders group. Several alternative dam alignments being evaluated are shown in Figure 1.

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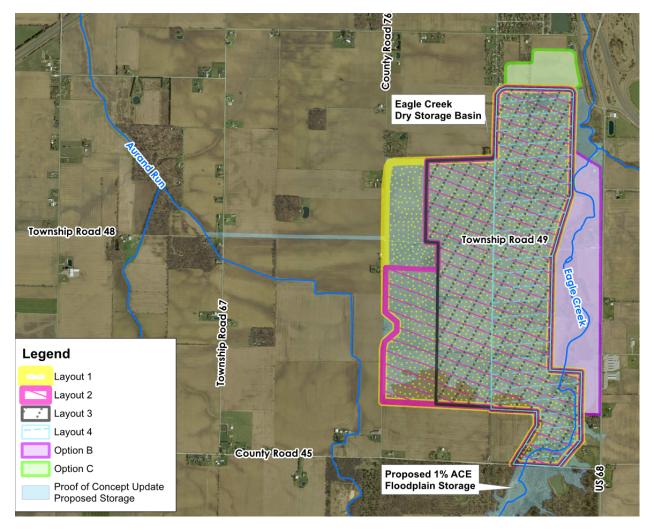


Figure 1. Site Vicinity Map

Site Geology October 17, 2019

# 2.0 SITE GEOLOGY

# 2.1 GENERAL

The *Physiographic Regions of Ohio* map (Ohio Department of Natural Resources (ODNR), 1998) indicates that the proposed dry storage basin site is located in the Central Ohio Clayey Till Plain. The Central Ohio Clayey Till Plain has a surface of clayey till, and contains well-defined moraines with intervening flat-lying ground moraine and intermorainal lake basins. This region contains a few large streams and has moderate relief (100 feet) with elevations of 700 to 1,150 feet. According to the map, the Columbus Escarpment is approximately one to two miles north of the proposed Eagle Creek Dry Storage Basin site.

# 2.2 SOIL GEOLOGY

According to the *Quaternary Geology of Ohio* map (ODNR, 1999), the project site is predominantly underlain by clayey till deposited during the Late Wisconsinan Age. The clayey till originated as flat to gently undulating ground moraine.

The soil survey (*Web Soil Survey of Hancock County, Ohio*, United States Department of Agriculture (USDA), 2017) indicates that the site is underlain predominantly by Blount silt loam. These soils consist of silt loam, silty clay, and clay loam with low to moderately high capacities to transmit water.

The *Drift Thickness Map of Ohio* (ODNR, 2004) suggests a range of soil cover near the project site between 0 and 50 feet.

# 2.3 BEDROCK GEOLOGY

Bedrock mapping (*Reconnaissance Bedrock Geology of the Arlington, Ohio Quadrangle*, ODNR, 1999 and *Reconnaissance Bedrock Geology of the Blanchard, Ohio Quadrangle*, ODNR, 1998) and Descriptions of Geologic Map Units (ODNR, 2000) indicate that overburden soils in the vicinity of the project site are underlain by sedimentary bedrock from the Tymochtee Dolomite Formation of the Silurian System. The Tymochtee Dolomite Formation is composed of olive gray to yellowish brown dolomite with shale laminae. This bedrock is described as thin to massively bedded, with thicknesses ranging from 0 to 140 feet.

According to the Abandoned Underground Mine Locator (ODNR, 2015), mapped underground mines have not been identified in the project vicinity.

The *Ohio Karst Areas* map (ODNR, 2007) does not indicate known karst areas in the vicinity of the sites. Probable karst areas are located east of the project sites in Wyandot and Seneca Counties.

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# 3.0 **EXPLORATION**

# 3.1 HISTORICAL EXPLORATION PROGRAMS

The ODOT Transportation Information Management System (TIMS) indicates that several geotechnical explorations have been performed in the vicinity of the potential dam site. An exploration was performed in 1962 for the existing alignment of US-68/SR-15, which is approximately 0.5 miles north of the proposed Eagle Creek Dam site. The majority of the soils encountered were classified as silt and clay (ODOT Classification A-6a) or silty clay (A-4a). Bedrock encountered was described as hard gray dolomite. The top of bedrock elevation was reported at approximately 780 feet near the intersection of US-68/SR-15 with Eagle Creek.

A search of the ODNR Ohio Oil & Gas Well Locator (2017) indicates that no wells have been drilled within the footprints of the proposed dam sites. Several wells have been drilled in the vicinity of the project sites, but the well reports include limited information to define subsurface conditions.

A search was also performed using the ODNR Ohio Water Wells Map (2017). According to the map, several wells have been drilled in the vicinity of the project sites. The water wells indicate that the overburden materials are typically clay, and bedrock was usually encountered at depths between 15 and 25 feet.

# 3.2 PRELIMINARY EXPLORATIONS

A geotechnical exploration was performed in 2012 by URS/Baird to obtain subsurface information in support of a flood prevention alternatives analysis in Hancock County (URS/Baird, 2013). The possible flood prevention measures included diversion channels, levees in downtown Findlay, and a detention dam on Eagle Creek. A total of forty-eight borings were advanced for this exploration. One boring (F-39-2012) was advanced within the area of the current study. The overburden soil consisted of lean clay (CL) and silty clay (CL-ML). Groundwater was found at a depth of eight feet below the ground surface. Bedrock was encountered at 18 feet below the ground surface (Elevation 783.2 feet). Bedrock was described as brownish-gray dolomite, slightly weathered and very strong. RQD was 87 percent. Additional information on this exploration is found in URS/Baird, 2013.

Stantec performed a geotechnical exploration in 2016 to evaluate subsurface conditions along a proposed diversion channel (Stantec 2016). One boring (B-11) from that exploration was advanced within the footprint of the current study area. The overburden soil consisted of silty clay in the upper 14.5 feet, with a 3.5-foot thick layer of gravel and sand above the top of bedrock. Groundwater was found at a depth of 15 feet below the ground surface. Bedrock was encountered at 18 feet below the ground surface (Elevation 781.7 feet).

In November 2017, two borings (B-101 and B-102) were advanced in the vicinity of the proposed Eagle Creek Dry Storage Basin in order to gather preliminary geotechnical data (Stantec 2018). B-101 was advanced adjacent to CR-77, west of Eagle Creek and B-102 was advanced through US-68, east of Eagle Creek.

Below the surface materials, an 8.5- to 9.8-foot layer of fine-grained material was encountered in the borings above the water table. This soil classified as Lean Clay with Sand (CL) and was described as moist, medium stiff to stiff, and having varying amounts of sand and gravel.

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A thin layer of coarse-grained material was encountered below the upper fine-grained layer. Thin sand seams (1 to 2 inches thick) were encountered in B-101 between approximate elevations 787 feet and 788 feet. A 1.9-foot layer of moist, dense, poorly graded sand with some gravel was visually classified in B-102 between elevations 782.2 feet and 784.1 feet. The elevations correspond to similar locations (relative to the top of bedrock) within the profile of the two borings. The depth of this coarse-grained material generally corresponded to the location of the groundwater table as measured within the boreholes during drilling. The groundwater table was encountered at a depth of 11.5 feet (El. 788.0 feet) in B-101 and 11.4 feet (El. 784.1 feet) in B-102.

A lower layer of fine-grained material was encountered in the borings below the coarse-grained layer. This layer was 4.9 to 5.5 feet thick and classified as Sandy Lean Clay (CL) or Silty Clay with Sand (CL-ML). These soils were encountered between elevations 783.5 and 789.0 feet in B-101 and between elevations 777.3 and 782.2 feet in B-102. The material was described as moist and medium stiff to very stiff.

The final soil layer encountered above top of bedrock was a 3.8- to 3.9-foot layer of coarse-grained material. This material classified as Poorly Graded Gravel with Clay and Sand (GP-GC). The GP-GC soils were encountered between elevations 779.7 and 783.5 feet in B-101 and between elevations 773.4 and 777.3 feet in B-102. This material was described as moist and dense to very dense, with a fairly strong hydro-carbon odor noted in B-102.

Bedrock was encountered at a depth of 19.8 feet (El. 779.7 feet) in B-101 and 22.1 feet (El. 773.4 feet) in B-102. The bedrock was described as gray dolomite, slightly weathered, fractured to moderately fractured, slightly rough, and thin to medium bedded. Recovery of the rock core runs ranged from 90 to 100 percent with RQD ranging from 33 to 87 percent. More details from the 2017 Exploration including boring logs and laboratory test results can be found in the Report of Geotechnical Exploration submitted by Stantec on April 2, 2018 [Stantec (2018)].

# 3.3 EAGLE CREEK DRY STORAGE BASIN DESIGN PHASE I EXPLORATION

Ten borings were advanced by Stantec to obtain geotechnical data along a proposed embankment alignment west of Eagle Creek. In addition, water pressure testing was performed on the bedrock within five of the borings. A summary of the borings advanced for this project is shown in Table 1. A boring layout and boring logs are provided in Appendix A. The multi-disciplinary design team is currently evaluating four potential embankment layouts (1-4), with consideration of two options (B and C). The technical memorandum prepared by the design team for the conceptual design refinement (Phase 1) will contain detailed descriptions of the considered alternatives. The alternatives are shown in Figure 2 in order to provide context to the boring locations.

Prior to award of this phase of work, Stantec developed a proposal for two phases of geotechnical exploration. The first phase included three boring locations (B-1.X), while the second phase included 18 boring locations (B-2.X). The Phase 2 borings were originally intended to be flexible in location in order to explore along the preferred alternative alignment. To account for this flexibility, some Phase 2 boring locations were designated as "alternates" (B-2.Xa). Prior to mobilization for the Phase 1 geotechnical exploration, MWCD requested that Stantec increase the scope of exploration to include several Phase 2 borings, including several alternate locations. The borings conducted as part of this Phase 1 mobilization are shown in Figure 2. The locations of the borings may not align with the preferred alternative, depending on the results of the conceptual design refinement.

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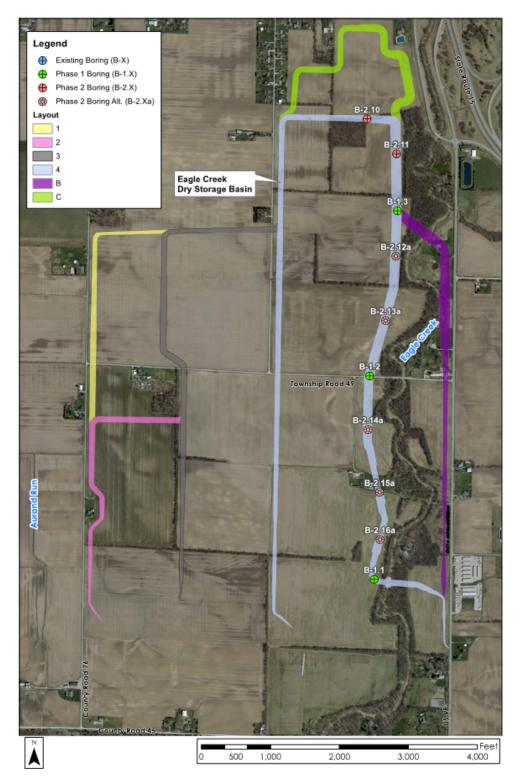


Figure 2. Boring Layout

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Boring No.	Northing	Easting	Ground Surface Elevation (ft)	Thickness of Overburden (ft)	Top of Bedrock Elevation (ft)	Bottom of Boring Elevation (ft)
B-1.1 <sup>1</sup>	477,356.00 <sup>2</sup>	1,649,680.97 <sup>2</sup>	797.6	12.8	784.8	772.8
B-1.2 <sup>1</sup>	480,304.76 <sup>3</sup>	1,649,614.28 <sup>3</sup>	793.1	16.5	776.6	765.9
B-1.3	482,698.92	1,650,019.06	792.0	17.7	774.3	761.8
B-2.10 <sup>1</sup>	484,031.73 <sup>4</sup>	1,649,578.76 <sup>4</sup>	796.3	17.9	778.4	767.5
B-2.11	483,523.70	1,650,003.24	790.7	14.5	776.2	764.6
B-2.12a <sup>1</sup>	482,040.46	1,649,993.92	791.5	15.6	775.9	765.1
B-2.13a	481,106.46	1,649,845.53	794.9	18.5	776.4	765.2
B-2.14a	479,527.22	1,649,589.97	794.4	21.0	773.4	763.0
B-2.15a <sup>1</sup>	478,618.14	1,649,758.81	797.4	16.0	781.4	769.8
B-2.16a	477,934.31 <sup>2</sup>	1,649,764.46 <sup>2</sup>	796.9	13.0	783.9	765.7

### Table 1. Boring Summary

<sup>1</sup>An offset boring was drilled near these locations in order to collect undisturbed Shelby tube samples.

<sup>2</sup> Boring was relocated approximately 3 feet from reported coordinates to avoid potential conflict with drainage tile.

<sup>3</sup> Boring was relocated approximately 3 feet north to avoid potential conflict with storm sewer

<sup>4</sup> Boring was relocated approximately 4 feet south to avoid disturbance to farm field.

Note: Elevations are recorded in NAVD 88, Northing/Easting are Ohio State Plane NAD 83

The borings were completed with a CME 45 track-mounted drill rig using 3¼-inch inside diameter (ID) hollow stem augers to advance through soil. Standard penetration test (SPT) sampling was performed at select intervals until bedrock was encountered in the borings. Undisturbed Shelby tube (ST) samples were collected in offset borings drilled approximately four feet away from the parent borings indicated in Table 1. The energy ratio (ER) of the drill rigs' automatic hammer and drill rod systems was measured on a previous project. The average ER value for the equipment used on this project is 86.2 percent.

The SPT sampling was performed in accordance with ASTM D1586, without the use of liners. The SPT samples were driven with an automatic hammer and consisted of repeatedly dropping a 140-pound hammer from a height of 30 inches to drive a split-spoon sampler a distance of 18-inches. The number of hammer blows needed to advance the sampler was recorded over three 6-inch increments. The blow count from the first 6-inch increment was discarded due to ground disturbance at the bottom of the borehole. The sum of the blow counts from the second and third 6-inch increments is called the field N-value ( $N_{field}$ ). The field N-value is corrected to an equivalent rod energy ratio of 60 percent ( $N_{60}$ ) according to the equation below.

$$N_{60} = N_{field} \left(\frac{ER}{60}\right)$$

The depths/elevations of the SPTs with the corresponding field blow counts are shown on the boring logs in Appendix A.

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Upon encountering bedrock, rock coring was performed in the borings using NQ-size equipment. Recovery length and rock quality designation (RQD) percentage were recorded for the core runs. The recovery is a measurement of the core sample obtained from a core run. The RQD is measured by dividing the sum of intact rock core segments longer than four inches by the total length of the core run. These values are shown on the boring logs in Appendix A.

The materials encountered were logged by a geotechnical engineer, with particular attention given to soil/rock type, consistency, and moisture content. The borings were checked for the presence of groundwater during and after drilling with the depth of water recorded on the boring logs.

Hydraulic pressure testing in rock was performed in five borings. The pressure testing was conducted using a singlepacker system. The Lugeon method of pressure testing was used to correlate the test results to hydraulic conductivity and condition of discontinuities within the rock mass. Details and results of the pressure testing are discussed in Section 4.1.

Borings were backfilled using cement/bentonite grout. A tremie pipe was lowered to the bottom of the borehole and grout was injected as the drilling tools were removed to displace water and remaining soil cuttings, providing a seal within the boring.

The soil samples obtained from the borings were transported to Stantec's Geotechnical Laboratories. Engineering classification testing was performed on selected disturbed SPT and bulk samples reflecting the main soil horizons. The engineering classification tests included sieve and hydrometer analysis (ASTM D 422) and Atterberg limits (ASTM D 4318). Unconfined compressive strength testing (ASTM D 2166) was performed on select Shelby tube samples. The remaining Shelby tube samples are being stored to allow additional testing, if needed, to support the next phase of design. Details and results of laboratory testing are further discussed in Section 4.2. The laboratory test reports are provided in Appendix B.

# 4.0 FINDINGS

## 4.1 ROCK PRESSURE TESTING

Water pressure testing was performed in five borings. The pressure testing was conducted to assist in estimating permeability and flow regimes through the bedrock. These tests were conducted with a single packer configuration following completion of rock coring. Testing was conducted using a five-stage Lugeon method. A maximum pressure of 15 psi was applied within borings on this project. The pressure was incrementally increased to the maximum, and then decreased again in five total stages to complete the test.

Prior to testing at each location, the nitrogen pressure in the inflatable packer was allowed to stabilize for up to 10 minutes after inflation to develop an adequate seal. Following stabilization, the bypass valve was adjusted to apply the target pressure for each stage and the gauge was maintained at a constant pressure for the duration of the stage. The quantity of flow at each stage was measured on one-minute intervals during a five-minute pressure stage. The top and bottom of the testing interval, test pressure, and meter readings were recorded on field data forms. The average flow over each timed period was used to calculate the Lugeon value.

The Lugeon value is empirically defined as the hydraulic conductivity required to achieve a flow rate of 1 liter/minute per meter of test interval under a reference water pressure equal to 1 MPa (Equation 1).

Lugeor	$T Value = \alpha \times \frac{q}{L} \times \frac{P_0}{P}$	Equation 1
Where	$\alpha$ = 12.42 (dimensionless factor for English units) q = flow rate (gal/min) L = Length (ft) $P_0$ = 145 psi (reference pressure) P = water pressure (psi)	
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Under ideal conditions (i.e., homogeneous and isotropic), one Lugeon is equivalent to 1.3 x 10<sup>-5</sup> cm/sec (Quinones-Rozo, 2015). The published relationships provided in Quinones-Rozo (2015) were used to interpret the Lugeon values. Results of this interpretation are summarized in Table 2 below. Pressure testing calculation sheets are provided in Appendix C.

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Boring No.	Test Interval (ft)	Lugeon Value	Flow Potential Classification	Approximate Hydraulic Conductivity (cm/sec)	Condition of Rock Mass Discontinuities based on Lugeon value
B-1.1	17.5 – 24.8	186	Very High	>1 x 10 <sup>-3</sup>	Open closely spaced or voids
B-2.14a	22.0 – 31.4	142	Very High	>1 x 10 <sup>-3</sup>	Open closely spaced or voids
B-2.13a	21.9 – 29.7	58	High	7 x 10 <sup>-4</sup>	Many open
B-1.3	22.5 – 30.2	16	Medium	2 x 10 <sup>-4</sup>	Some open
B-2.10	21.5 – 28.8	1	Low	1 x 10 <sup>-5</sup>	Tight

Table 2. Summary of Pressure Testing Results

Note: Classification, hydraulic conductivity, and condition of rock mass discontinuities are based on Table 2 provided in Camilo Quinones-Rozo, P.E. (2015)

In general, the Lugeon value and approximate hydraulic conductivity of the bedrock was lower moving north along the explored alignment, indicating lower flow potential in the northern reaches of the proposed reservoir.

# 4.2 LABORATORY TESTING

### 4.2.1 Overview

Geotechnical laboratory tests were assigned to select soil samples. Soil samples were tested for soil classification, moisture content, unconfined compressive strength, and standard Proctor compaction parameters. Laboratory testing performed during this phase is summarized in Table 3. Results of laboratory testing are provided in Appendix B.

	ſ	
Laboratory Test	Method	Number of Tests
Natural Moisture Content	ASTM D 2216	82
Sieve and Hydrometer Analysis	ASTM D 422	17
Atterberg Limits	ASTM D 4318	17
Soil Classifications	ASTM D 2487	17
Standard Proctor	ASTM D 1557	2
Unconfined Compressive Strength	ASTM D 2166	6

Table 3. Summary of Laboratory Testing

### 4.2.2 Natural Moisture Content

Selected SPT samples were subjected to natural moisture content testing in accordance with ASTM D 2216. Moisture contents ranged from 6.3 percent to 47.2 percent with an average of 19.8 percent. The test results are provided in Appendix B.

### 4.2.3 Soil Classification

Selected SPT samples were subjected to soil classification testing in accordance with ASTM D 2487 which included sieve and hydrometer analysis in accordance with ASTM D 422 and Atterberg limits in accordance with ASTM D 4318. Classification results are presented in Table 4. Forty-seven percent of the samples tested classified as CL, 21 percent classified as SM, 11 percent classified as SC, and the remaining samples classified as ML, GC-GM, SW-SM, and CL-ML (approximately 5 percent each).

Boring No.	Sample Type	Depth (ft)	LL (%)	PL (%)	РІ (%)	Classification
B-1.1	Bulk	0.0 – 5.5	25	15	10	SC
B-1.1	SPT	10.0 – 11.5	17	14	3	SM
B-2.14a	SPT	7.5 – 9.0	42	28	14	ML
B-2.14a	SPT	12.5 – 14.0	NP	NP	NP	SM
B-2.14a	SPT Composite	17.5 – 21.2	21	13	8	CL
B-2.15a	SPT	12.5 – 14.0	NP	NP	NP	SM
B-2.16a	Bulk	0.0 - 5.0	33	18	15	CL
B-2.16a	SPT	10.0 – 11.5	22	16	6	GC-GM
B-1.2	SPT Composite	1.5 – 4.0	36	20	16	CL
B-1.2	SPT	5.0 - 6.5	24	16	8	SC
B-1.2	SPT	12.5 – 14.0	NP	NP	NP	SW-SM
B-1.3	SPT	12.5 – 14.0	36	22	14	CL
B-2.10	SPT	5.0 - 6.5	28	17	11	CL
B-2.10	SPT	12.5 – 14.0	24	15	9	CL
B-2.11	SPT	10.0 – 11.5	24	15	9	CL
B-2.12a	SPT	10.0 – 11.5	36	23	13	CL
B-2.12a	SPT	12.5 – 14.0	33	18	15	CL
B-2.13a	SPT	7.5 – 9.0	22	15	7	CL-ML
B-2.13a	SPT	15.0 – 16.5	NP	NP	NP	SM

### Table 4. Results of Soil Classification Testing

### 4.2.4 Standard Proctor

Two Standard Proctor tests were performed per ASTM D698 on bulk samples obtained from borings B-1.1 and B-2.16a. Method A was followed, which uses a 4-inch diameter Proctor mold, with three layers of material (screened to pass the No. 4 sieve) compacted by 25 blows (5.50-lbf hammer dropped at a height of 12 inches) per layer. The results of the two tests are summarized in Table 5.

Boring No.	Sample Type	Depth (ft)	Classification	Maximum Dry Unit Weight (pcf)	Optimum Moisture Content (%)
B-1.1	Bulk	0.0 – 5.5	SC	127.9	9.6
B-2.16a	Bulk	0.0 - 5.0	CL	121.0	12.3

Table 5. Results of Standard Proctor Testing

### 4.2.5 Unconfined Compressive Strength

Selected ST samples were subjected to unconfined compressive strength testing in accordance with ASTM D 2166. Unconfined compressive strength results are presented in Table 6. The unconfined compressive strength of the samples tested ranged from 1.0 tons per square foot (tsf) to 4.5 tsf with an average of 2.5 tsf.

Boring No.	Depth (ft)	Unconfined Compressive Strength (tsf)	Undrained Shear Strength (tsf)
B-1.1B	2.7 – 3.2	1.0	0.5
B-1.1B	9.3 – 9.8	4.0	2.0
B-1.2B	0.8 – 1.3	1.9	1.0
B-2.10A	3.0 – 3.5	2.0	1.0
B-2.10A	11.0 – 11.5	1.3	0.6
B-2.10A	13.4 – 13.9	4.5	2.3

### Table 6. Results of Unconfined Compressive Strength Testing

# 4.3 SUBSURFACE CONDITIONS

Ten borings were advanced along one of the proposed dam alignment alternatives, along the west side of Eagle Creek, in order to further define the subsurface conditions at the project site. The following sections discuss the subsurface conditions encountered in these borings. A soil profile diagram illustrating the subsurface materials encountered is provided in Appendix D.

### 4.3.1 Soil

Surface materials encountered consisted of 0.1 to 0.5 feet of topsoil. Below the surface materials, a 4.0- to 11.5-foot layer of generally fine-grained material was encountered in the borings. This fine-grained soil extended down to approximate elevations 792.1 feet (maximum at Boring B-1.1) and 779.0 feet (minimum at Boring B-2.12a). This soil classified as Sandy Lean Clay (CL) in three samples, Sandy Silty Clay (CL-ML) in one sample, and Clayey Sand (SC) in one sample. The Clayey Sand sample had a fines content of 48 percent and a plasticity index of 10. Other samples tested in this layer had fines content ranging from 60 to 70 percent and plasticity indexes ranging from 7 to 16 percent. The Clayey Sand (SC) sample was judged to be similar to the other fine-grained soil below the surface materials. The soils encountered in this layer are described as moist, medium stiff to stiff, and having varying amounts of sand and gravel. In general, this layer is thicker north of Township Road 49. This layer is referred to herein as "Upper Fine-Grained" material.

Coarse-grained material was typically encountered below the "Upper Fine-Grained" material. When observed, this layer ranged in thickness from 0.1 feet (thin sand seam at elevation 785.8 in B-2.10) to 3.5 feet (between elevations 789.1 and 785.6 in boring B-1.2). This soil generally classified as Clayey Sand (SC) with varying amounts of gravel, and was described as moist to wet, medium dense, and medium to coarse grained. The depth of this coarse-grained material generally corresponds with the location of the groundwater table as measured within the boreholes during drilling. The thickness of this layer varies across the site. In general, the layer starts as a thin seam at the north end of the site (B-2.10) and is thickest near Township Road 49 (B-1.2). The layer was not encountered in B-2.16a, B-2.15a, or B-2.12a. This material is referred to herein as "Upper Coarse-Grained" material.

A lower layer of fine-grained material was generally encountered below the "Upper Coarse-Grained" material. This layer was 0.5 to 6.5 feet thick and classified as Lean Clay (CL), Sandy Lean Clay (CL), or Silt with Sand (ML). The material was described as moist and medium stiff to very stiff. This layer was more prevalent in the northern reaches of the exploration, as it was not encountered in Borings B-1.2, B-2.15a, and B-2.16a. This material is referred to herein as "Lower Fine-Grained" material.

Below the "Lower Fine-Grained" material, a 0.6- to 9.8-foot layer of coarse-grained material was generally encountered above the top of bedrock. This material was not observed in Boring B-2.11. This layer mostly classified as Silty Sand (SM) with one sample classifying as Well-Graded Sand with Silt (SW-SM), and one sample classifying as Silty, Clayey Gravel with Sand (GC-GM). This material was described as moist to wet, medium dense to dense, fine to coarse grained, and containing varying amounts of gravel. In general, this layer is thicker near Township Road 49 and to the south. This material is referred to herein as "Lower Coarse-Grained" material.

The "Lower Fine-Grained" layer was encountered below the "Lower Coarse-Grained" material in Borings B-1.3, B-2.12a, B-2.13a, and B-2.14a above the top of bedrock. This layer ranged in thickness from 0.4 feet in borings B-2.12a and B-2.13a to 7.3 feet in B-2.14a. The material classified as Sandy Lean Clay (CL) and was described as being moist, stiff to very stiff, and having varying amounts of sand.

### 4.3.2 Bedrock

The depth to bedrock ranged from 12.8 feet (El. 784.8 feet) in B-1.1 to 21.0 feet (El. 773.4 feet) in B-2.14a. A summary of the encountered bedrock depths and elevations is provided in Table 1. The bedrock was described as

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gray dolomite, slightly weathered, fractured to moderately fractured, slightly rough, and thin to medium bedded. A hydro-carbon odor was noted in borings B-2.10 and B-2.14a. Recovery of the rock core runs ranged from 60 to 100 percent with RQD ranging from 0 to 100 percent. Fractured zones and water loss were noted in the bedrock until the termination depths. In general, the bedrock recovery and RQD increased from south to north. Rock core photos are included in Appendix E.

### 4.3.3 Groundwater

The depth to groundwater at the time of drilling was noted on the boring logs. No observation wells or piezometers were installed as a part of this project, so long term water level monitoring was not performed. Groundwater levels may fluctuate due to seasonal climate changes and rain events. A summary of the groundwater elevations observed during the drilling program is provided in Table 7.

Boring No.	Depth to Groundwater (ft)	Groundwater Elevation (ft)
B-1.1	5.5	792.1
B-1.2	4.0	789.1
B-1.3	7.5	784.5
B-2.10	7.5	788.8
B-2.11	7.5	783.2
B-2.12a	10.0	781.5
B-2.13a	10.0	784.9
B-2.14a	6.0	788.4
B-2.15a	7.9	789.5
B-2.16a	8.0	788.9

### Table 7. Summary of Groundwater Elevations

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# 5.0 CONCLUSIONS AND RECOMMENDATIONS

# 5.1 GENERAL

The recommendations that follow are based on the information discussed in this report and the interpretation of the subsurface conditions encountered at the site during fieldwork. If future design changes are made, Stantec should be notified so that such changes can be reviewed, and the recommendations amended as necessary.

These conclusions and recommendations are based on data and subsurface conditions from the borings advanced during this exploration using the degree of care and skill ordinarily exercised under similar circumstances by competent members of the engineering profession. No warranties can be made regarding the continuity of conditions.

Seepage at and below the base of an embankment can erode the foundation, weaken the materials, and lead to uncontrolled releases of a reservoir. This risk is especially pronounced in a structure that does not retain water on a routine basis, as inspections are not often feasible except during flood events. The design team should consider the potential seepage concerns related to the various dam alignment alternatives currently under evaluation. The conclusions and recommendations herein assume that the preferred dam alignment will either

- 1. Require significant excavation of the natural soils within the reservoir footprint (upstream of the constructed dam), removing the fine-grained, near-surface soils, or
- 2. Not require significant excavation of the natural soil and leave a minimum of three (3) feet of the fine-grained, near-surface soils within the reservoir footprint (upstream of the constructed dam).

# 5.2 PRELIMINARY DAM DESIGN

- Additional exploration, including but not limited to, drilling, sampling, instrumentation, in-situ testing, and laboratory testing should be performed to further define the borrow sources and foundation soil and rock near the preferred dam alignment, chosen as a result of the current phase of the project.
  - a. Potential Embankment Borrow Source
    - i. Typical specifications for dam embankment fill suitability require soils classifications of CL, CH, or CL-ML. The plasticity index should be a minimum of 12 percent, and the material should be free of rock, soil clods or gravel larger than three (3) inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. Gravel content should be limited to 15 percent by weight.
    - ii. Considering the typical specifications above, the preliminary findings as discussed in Section 4.0 indicate that approximately 10 to 15 feet of potentially suitable borrow soil would be available below the topsoil layer in the locations of the borings on the northern end of the exploration, with minor amounts of coarse-grained materials that would need to be separated. Generally, there is only about four to eight feet of suitable embankment fill material in the borings south of Township Road 49. The plasticity index of the classified samples was borderline for acceptability with regards to the specifications above.

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- iii. A borrow source study should be performed to determine the available quantity of site-specific fill materials. The study should include laboratory testing to determine design parameters of potential borrow soil, including optimal compaction, potential dispersivity, and as-compacted shear strength, and saturated and unsaturated permeability.
- b. Exploration of Preferred Dam Alignment
  - i. The current phase of the project includes a multi-disciplinary approach to determining the preferred dam alignment. It is possible that the chosen preferred alignment will differ from the alignment which was evaluated as part of this geotechnical exploration. If the preferred alignment is changed, additional borings should be conducted along the selected alignment to evaluate the subsurface conditions.
  - Conduct additional geotechnical borings, test pits, and/or other exploration methods at more closely, regularly spaced intervals to adequately characterize subsurface conditions. Explorations should include locations along the preferred dam alignment and at select cross sections, and should obtain information to support the design of foundation treatment and/or necessary seepage control measures for the site. Additional borings should also be conducted at regular intervals upstream (detention-side) of the proposed dam alignment to evaluate the continuity of the fine-grained near-surface soils and the ability of same soils to function as a natural upstream blanket. See Section 5.5 for additional discussion.
  - iii. Explorations should include methods to further define characteristics of the dolomite bedrock, including faults, fractures, discontinuities, voids, etc. that could influence the seepage below the proposed dam. See additional recommendations regarding bedrock explorations in Section 5.4.
  - iv. Should significant soil excavations be required (Section 5.1), a hydrogeologist should be engaged to advise the design team regarding the overall geology of the site and specific exploration techniques that can further define potential geologic concerns.
  - v. Further identify the vertical and lateral extents of coarse-grained materials that may influence foundation treatment and seepage design.
- c. Install temporary piezometers and/or groundwater wells to establish groundwater levels and boundary conditions appropriate for detailed seepage design models.
- d. Perform in-situ hydraulic conductivity testing of foundation soils and bedrock to develop site specific parameters for seepage design models. Testing should include additional water pressure tests of targeted bedrock layers and slug testing of installed piezometers/groundwater wells.
- e. Perform soil water characteristic curve (SWCC) laboratory testing on applicable foundation and potential borrow materials to refine unsaturated permeability parameters for use in design.
- f. Perform dispersive clay laboratory testing to determine the dispersivity of foundation and potential borrow soils.
- 2. An internal drainage system (chimney/blanket drain, finger drains, outlet pipes, etc.) should be considered for final design. Without an internal drainage system, the preliminary stability analyses (Stantec 2018) resulted in

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low factors of safety for steady-state flood conditions. Additionally, the existing subsurface includes pervious zones of coarse-grained materials and fractured bedrock that will require considerations during design. The use of internal drainage features may reduce the scope of necessary foundation treatment. See Section 5.5 for additional discussion.

- 3. Design of the principal outlet conduits through the dam should include design of a filter diaphragm to intercept and filter preferential seepage paths along the conduits. Design filter diaphragms according to USACE filter criteria (USACE 2003) and other applicable design guidance (FEMA 2005).
- 4. The proposed structure will likely be classified as a high hazard dam. According to the NRCS Technical Release Number 60 (TR-60), the project sites are in Seismic Zone 2, and will therefore require special investigations to determine liquefaction potential and the presence of nearby faults. These seismic analysis requirements should be considered when developing the detailed explorations prior to final design.

# 5.3 EXCAVATABILITY

The design team assumes that excavations within the footprint of the basin will be limited to elevation 788 feet. Based on the bedrock elevations identified in borings within the study area, the top of rock is below elevation 788. Therefore, excavation of the bedrock should not be a concern unless an unknown knob or pinnacle is encountered during excavation. If excavations result in a condition where reservoir water will be in direct contact with the top of bedrock, care should be taken to seal fractures, bedding planes, discontinuities, etc. that could result in a direct hydraulic connection from the reservoir to the protected side of the embankment. In the event that bedrock is encountered in an area that requires excavation, several historical project documents included guidance, and are summarized below.

The descriptions of the bedrock encountered in the Stantec explorations were similar to those in the Blanchard River Watershed Study (URS/Baird, 2013). According to URS/Baird (2013), local quarry operators are generally able to remove the upper 4 to 5 feet of bedrock with minimal to no blasting. Blasting is considered the most efficient and cost-effective method for bedrock below 5 feet in depth. The bedrock encountered during the Stantec explorations complements this description, as lower RQD values and more fracturing were noted near the top of bedrock.

URS/Baird, 2013 provides the following recommendations for excavation of the bedrock:

"Based on local quarry experience, available rock core data, and existing rock excavatability charts (Tsiambaos and Saroglou, 2010), we conclude that dolomite excavation will require techniques ranging from hard to very hard ripping (e.g., CAT D8-D9) to extremely hard ripping (e.g., CAT D11 or CAT D9+hydraulic breaking) to blasting depending upon the dolomite strength, joint/fracture frequency, and joint/fracture surface roughness and weathering. Dolomite that is moderately strong with closely spaced fractures that are moderately weathered typically will require hard ripping, whereas dolomite that is strong to very strong with widely spaced fractures that are slightly weathered or fresh will require blasting."

# 5.4 BEDROCK SEEPAGE

Should the footprint of the reservoir be excavated extensively to expose (or nearly expose) bedrock, seepage beneath the constructed embankments is a concern. Based on the results of the preliminary bedrock pressure testing, a majority of the currently explored site demonstrates significant flow potential within the bedrock. While the

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testing conducted simulated a maximum water head pressure of approximately 34 feet, flow was noted at each pressure stage.

Should the selected alignment require extensive excavations within the reservoir footprint, two primary options could be considered to mitigate potential seepage flow through the bedrock under the embankment. One option is to conduct mechanical excavation (including ripping and excavation of approximately 5 feet of bedrock), cleaning of the bedrock surface, and concrete capping as needed. This method would treat identified voids and fractures observed at the bedrock surface. The second option is to conduct bedrock grouting operations prior to excavation. The grouting would serve to fill the voids and fractures within the bedrock and be able to treat a wider and deeper area with less labor input. Following the grouting operation, excavation of soil overburden and compaction of a cutoff trench to the top of rock (above the grout curtain) would be necessary. Preliminary estimates indicate that mechanical excavation and compaction of a cutoff trench into the top of rock will be a more economical solution than a grouting program.

To address the concerns related to seepage through the foundation, additional pressure testing should be completed in the subsequent phases of exploration to provide more information concerning flow losses and their approximate depth. Down-hole imaging can also provide a quantitative view of the number and size of fractures present.

The additional exploratory drilling and pressure testing should be planned to adequately characterize the lateral extent of areas with greater flow potential (currently understood to be in the southern reaches of the proposed reservoir). It should also consider pressure testing of shorter intervals moving downward from the top of rock and extending deeper into bedrock at select locations. Based on the rock coring observations and historical information regarding bedrock excavation in the region (Section 5.3), significant amounts of the measured flow may have occurred within the upper approximately five feet of the bedrock. Pressure testing of smaller intervals could identify if this is consistent, which would aid in determining an economical combination of excavation and grouting.

# 5.5 DAM ALIGNMENT SELECTION

The geotechnical exploration results and observations should be considered by the design team during selection of the preferred dam alignment. The dam alignments with the smallest reservoir footprints will likely require extensive excavation of the overburden soils within the reservoir to provide adequate storage capacity to meet project goals. The dam alignments with larger reservoir footprints will require less excavation within the reservoir.

If a selected dam alignment will require excavation of the reservoir footprint the following geotechnical conclusions and recommendations should be considered:

- Excavation of the "Upper Fine Grained" and/or "Lower Fine Grained" materials will expose significant thicknesses of more permeable coarse-grained overburden soils, and potentially expose bedrock with significant flow potential.
- If these materials are exposed, flood waters stored within the reservoir could be hydraulically connected from the reservoir, through the foundation soils and rock, and to the downstream toe of the embankment. This condition could lead to heaving, piping, or other seepage related concerns at the downstream toe of the dam.
- To treat these seepage concerns, the dam typical cross section should consider a key into the bedrock to serve as a seepage cutoff, or the design of an excavation and bedrock grouting program. See Section 5.4 for

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additional discussion. To sufficiently incorporate a key into bedrock, graded filter layers should also be provided between fine-grained embankment fill soil and the surface of the bedrock.

If a selected dam alignment will not require extensive excavations of the reservoir footprint, the following geotechnical conclusions and recommendations should be considered:

- The "Upper Fine Grained" and/or "Lower Fine Grained" soils would generally remain in place within the reservoir footprint, potentially serving as a natural upstream blanket and reducing the potential for direct hydraulic connection to the permeable overburden soils and bedrock.
- According to the United States Bureau of Reclamation (USBR, 1987), the following recommendations should be considered when relying on a natural upstream blanket:
  - Areas of the embankment foundation covered by natural low-permeability blankets should be stripped of vegetation, defective areas repaired, and rolled to seal root holes or other openings.
  - Excavation of the natural low-permeability blanket should be avoided within 200 to 400 feet of the upstream toe of the dam. It is usually necessary to compact the low-permeability layer with a heavy roller or other appropriate compaction equipment.
  - The natural blanket soil should meet filter criteria with the underlying coarse-grained soils.
  - An upstream blanket should not be the only method relied upon for reduction of seepage forces in the foundation. Horizontal drainage blankets, trench drains, relief wells, or other seepage control measures should be provided when a cutoff trench will not be extended below the embankment.
  - A minimum of three (3) feet of fine-grained soils should be left in place below and upstream of the embankment fill.
- Additional exploration and sampling should be conducted to evaluate the effectiveness of the "Upper Fine Grained" and "Lower Fine Grained" soils to serve as a natural upstream blanket. This exploration would include enough borings to evaluate the continuity of the layers within approximately 400 feet of the upstream toe of the dam. Laboratory and field permeability testing and dispersivity testing should be conducted on the layers to evaluate the in-situ effectiveness as an upstream blanket. The fine-grained materials should be evaluated for filter compatibility with the underlying coarse-grained materials.

In general, less foundation improvement, including excavation, treatment, and grouting of underlying bedrock will be required for the larger footprints that do not require excavations from within the reservoir. It is likely that internal and downstream drainage features would be required for the typical cross-section of the dam, regardless of the selected alignment. Therefore, a significant cost savings would be expected for a larger reservoir footprint, reducing costs for overburden and bedrock excavation, bedrock surface treatments, and bedrock grouting programs.

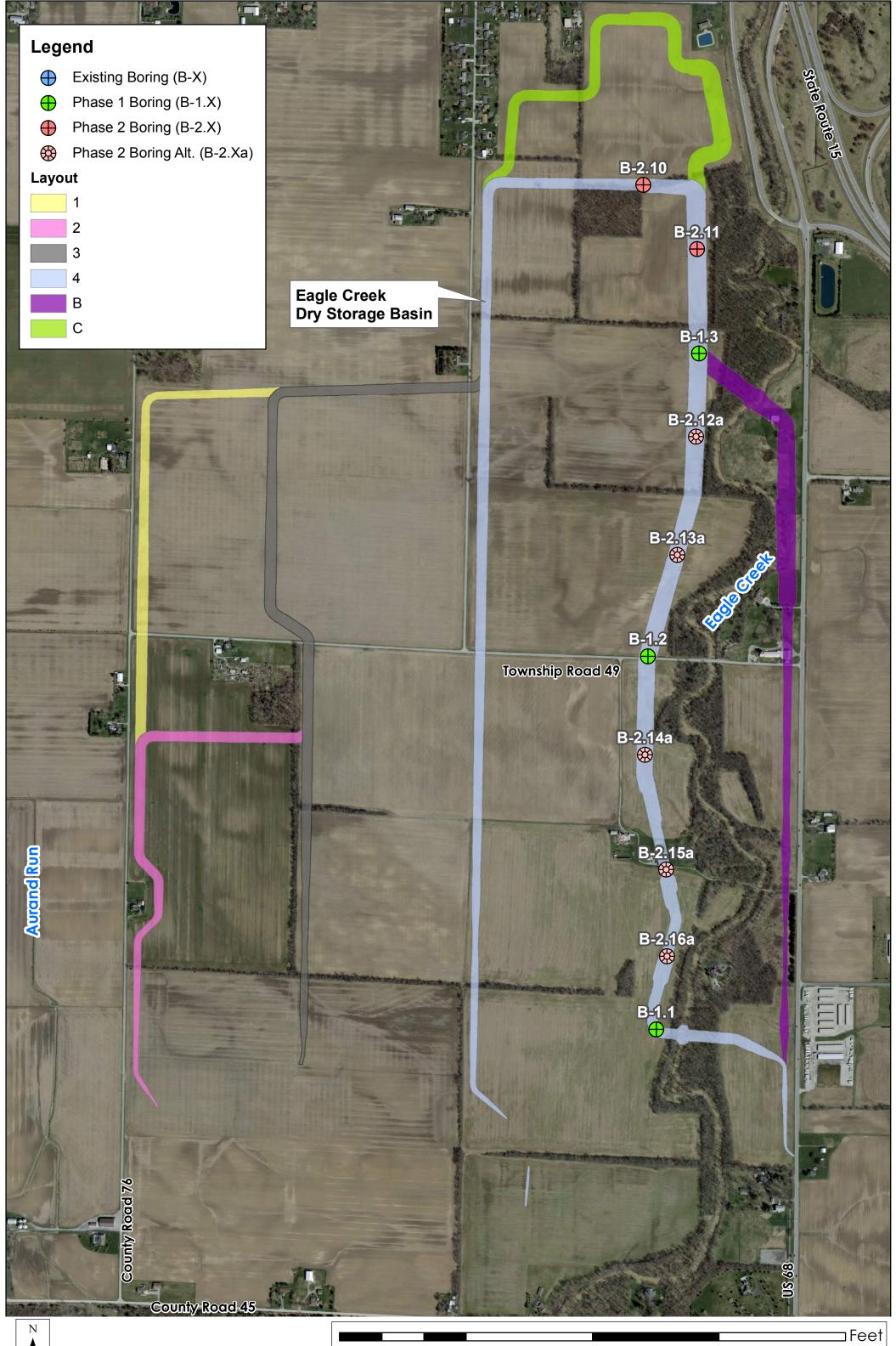
References October 17, 2019

# 6.0 **REFERENCES**

Camilo Quinones-Rozo, P.E. (2015) "Lugeon Test Interpretation, Revisited" URS Corportation, Oakland, California.

- McGregor, Jeffrey A., and Duncan, J. Michael (1998). "Performance and Use of the Standard Penetration Test in Geotechnical Engineering Practice." Center for Geotechnical Practice and Research (CGPR) #12, Virginia Polytechnic Institute and State University, October.
- Naval Facilities Engineering Command (NAVFAC) (1986). "Foundations and Earth Structures." Design Manual 7.02, Alexandria, Virginia, September.
- Stantec, 2016. "Report of Geotechnical Exploration, Hancock County Flood Diversion Project, Phase 1" Prepared for Maumee Watershed Conservancy District, November 10.
- Stantec, 2018. "Report of Geotechnical Exploration, Hancock County Flood Risk Reduction Program Dams Preliminary" Prepared for Maumee Watershed Conservancy District, April 2.
- Terzaghi, K., Peck, R. B., and Mesri, G. (1996). "Soil Mechanics in Engineering Practice." 3rd ed., John Wiley and Sons, Hoboken, New Jersey.
- URS/Baird, 2013. "Blanchard River Watershed Study, Geotechnical Report." March.
- U.S. Army Corps of Engineers (2003). "Engineering and Design Slope Stability." EM 1110-2-1902, October 31.
- U.S. Army Corps of Engineers (2004). "General Design and Construction Considerations for Earth and Rock-Fill Dams." EM 1110-2-2300, July 30.
- U.S. Bureau of Reclamation (1987). "Design of Small Dams." A Water Resources Technical Publication, 3rd ed.
- U.S. Bureau of Reclamation (2011). "Chapter 8: Seepage." Design Standards No. 13; Embankment Dams, October.

# APPENDIX A BORING LAYOUT AND BORING LOGS



					Feet
0	500	1,000	2,000	3,000	4,000

### **Strata Graphics**

Symbol	Soil
$\bigotimes$	Fill
	Topsoil
	Gravel
	ML Soil
$\square$	CL Soil
	MH Soil
	CH Soil
	CLML Soil
•••	SW Soil
•••	SP Soil
<b>₩</b> Ĩ₩	SM Soil
$\mathbb{Z}$	SC Soil
	SCSM Soil
	GW Soil
	GP Soil
+I+	GM Soil
	GC Soil
	GPGM Soil
	Fly Ash
罿	Bottom Ash
	Gypsum
Ţ	Non-Durable Shale
	Durable Shale
	Coal
	Limestone
	Sandstone

### Water Level Graphics

Symbol	Description
<u>▼</u> _	Measured in standpipe, piezometer, or well
$\underline{\nabla}$	Inferred

# Sampler GraphicsSymbolSamplerSymbolSPTSPTSplit Spoon (2" dia.)S3Split Spoon (3" dia.)STShelby TubeUUndisturbed PistonRCRock Core

### Consistency of Fine-Grained Soils

Condition	N-Value (blows/ft)
Very Soft	<2
Soft	2 – 4
Medium Stiff	4 – 8
Stiff	8 – 15
Very Stiff	>15

### **Density of Coarse-Grained Soils**

Condition	N-Value (blows/ft)
Very Loose	<4
Loose	4 – 10
Medium Dense	10 – 30
Dense	30 – 50
Very Dense	>50

### **Common Abbreviations**

WH	Weight of Hammer
WR	Weight of Rod
HSA	Hollow Stem Auger
RQD	Rock Quality Designation
HAF	High Angle Fracture
LAF	Low Angle Fracture
HF	Horizontal Fracture
VF	Vertical Fracture
MF	Mechanical Fracture
HAJ	High Angle Joint
LAJ	Low Angle Joint
HJ	Horizontal Joint



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Cli	ent	MWCD				Bori	ng Locat	ion 4	477,	356.	0 N;	1,6	49,	681	.0 E				_
Pro	oject Nur	nber 174316204				Surf	ace Elev	ation	797.	6 ft	_ E	Elev	atio	n Da	atun	n N	AVE	288	_
Pro	oject Nar	ne HCFRRP - Dry Storage Ba	asin D	Desigr	ו	Date	e Started		8/21	/19	_ (	Com	ple	ted_		8/	22/	19	_
Pro	oject Loo	cation Hancock County, Ohio				Dep	th to Wa	te <u>r</u>	5.5 f	t	_ [	Date	/Tir	ne _		8/	21/	19	_
Ins	pector	Stantec - E. Holcombe				Dep	th to Wa	ter	N/A		_ [	Date	/Tir	ne		N	/A		_
Dri	lling Cor	tractor Stantec - D. Clements				Drill	Rig Type	e and	ID C	ME	45T	(81	5)						_
Ov	erburder	n Drilling and Sampling Tools (Ty	pe ar	nd Siz	e) 3	3.25" I	D HSA, 2	2" SPT	-										_
Ro	ck Drillin	g and Sampling Tools (Type and	l Size	) <u>N</u>	Ç														_
Sa	mpler Ha	ammer Type Automatic We	eight	14	0 lb	D	rop _30 i	n	_	Effic	cien	су	8	6.2					_
Во	rehole A	zimuth N/A (Vertical)			_ E	Boreho	le Inclina	ation (f	from	Verl	ical	)	V	erti	cal				
	(ft)		ы		5	SAMPL	ES	1			UN ,	IDRAIN		HEAR		IGTH -	tsf		
(1J)H.	NOL		A PLO		R	RY	; / si) /	VELL			1		2			3 		4	
DEPTH(ft)	ELEVATION(ff)	SOIL/ROCK DESCRIPTION	STRATA PLOT	ТҮРЕ	NUMBER	RECOVERY	BLOWS / PRESS.(psi) RQD (%)	MONITOR WELL PIEZOMETER	WAT	ER C	ONTE	NT &	ATTE	ERBE	RG LI	MITS	₩ <sub>P</sub> ►	₩ —⊖	W I
_	Ш		ST		z	REC	PRES	ONIT		ket Po NDAR								т	*
0	797.6					ft		Σ			20 20	30	40	50			70	80	90
- 0 -	<b>∖797.4</b> ∕																		Ē
		Clayey Sand (SC), brown, damp to wet, loose, trace fine		SPT	01	0.4	2-3-3												
- 1 -		river gravel																	
		sand increases 0.2'-4.5'																	
- 2 -		soft, moist at 2.0'		SPT	02	0.7	3-3-4				о :		*						Ē
		bulk sample 0.0'-5.5'																	Ē
- 3 -		wet 3.0'-5.5'																	Ē
				SPT	03	1.2	3-3-3				¢ ★								
- 4 -									•										
				×															
- 5 -	792.1			SPT	04A	0.7	2-25-8						*		<u></u>				
		Clayey Sand with Gravel, gray,									<b>ф</b> :::								
- 6 -		wet, dense, very fine to medium grained sand,		SPT	04B										<u></u>				
		rounded medium gravel																	
- 7 -	790.1	wet stone fragment seam 5.5'-5.6'																	
	700.1	Sandy Lean Clay, brown,																	
- 8 -		moist to wet, stiff, low to		SPT	05	0.5	2-6-7		· · · · · · · · · · · · · · · · · · ·		ρ				<u></u>				<u></u>
		medium plasticity		8						•									
- 9 -	788.1			8											<u></u>				
	700.1		$\mathbb{H}$																
-10-										1::::		:1::	::1:	:::					<u>;;;</u> F



Page: 2 of 3

Clie	ent	MWCD				Bori	ng Locat	ion	47	7,3	56.0	N;	1,64	9,6	31.0	Е				
Pro	ject Nur	mber 174316204				Surf	ace Elev	ation	79	7.6	ft	Е	levat	tion	Dat	um	NA	VD	38	
	(ft)		Ъ		5	SAMPLI	ES	1				UNE	RAINE		AR ST		TH - tsf			
DEPIH(II)	ELEVATION(ff)	SOIL/ROCK DESCRIPTION	STRATA PLOT	ТҮРЕ	NUMBER	RECOVERY	BLOWS / PRESS.(psi) / RQD (%)	MONITOR WELL PIEZOMETER	P	ock	et Pe	netro	IT & A <sup>-</sup> meter ETRA1	r/Tor	vane	(tsf)			4 	*
•						ft		ž		10				40	50	, всс 60	70 70			
0	787.1	Lean Clay, gray, moist to we	, /	SPT	06A	1.0	3-12-11						*							
1		soft, trace sand and gravel (till) - (Continued) Silty Sand with Gravel (SM), gray, wet, dense, very fine to medium sand, angular gravel some clay		SPT	06В						Ð									•••••••••••••••••••••••
	784.8	clay seam 12.5'-12.	8'																	
3 1 1 1		Dolomite, gray, slightly weathered, very-fine grained highly to severely fractured, very strong, slightly rough, fla		SPT	07	0.7	4-20- 50+/.4													
5		to vertical fractures severely fractured 14.3'-15. laminated 15.0'-16. HF at 15.1', 15.3', 15.4', 15.	4'	RC	01	1.3	0													
7 8 9 0	781.0	highly fractured 16.4'-16. Dolomite with shale laminations, gray, slightly weathered, very fine grained, moderately to high highly fractured, soft to moderately hard, smooth, laminated, flat bedded, fractures along bedding planes (0°-10°) mos fractures in shale laminations natural fractures 16.9', 17.		RC	02	3.7	43													
1		17.2', 17.3', 17.7', 18. MFs 18.1'-20. highly fractured 20.5'-20. highly fractured 21.3'-21. highly fractured 22.0'-22.	1'	RC	03	4.7	11													······································
3																				



Page: 3 of 3

Client MWCD Boring Location 477,356.0 N; 1,649,681.0 E Project Number 174316204 Surface Elevation 797.6 ft Elevation Datum NAVD88 SoiL/ROCK DESCRIPTION V V V V V V V V V V V V V V V V V V V	
Built     Soll/Rock description     Samples       1     2     3       1     1     1       1     2     3       1     1     1       1     1     1       1     1     1       1     1     1       1     1     1       1     1     1       1     1     1       1     1     1       1     1       1     1 <t< td=""><td>_</td></t<>	_
End     SOIL/ROCK DESCRIPTION     Image: Solid with comparison of the second se	8
-24       severely fractured 23.9'-24.5'       i	
25     Boring terminated and backfilled with cement bentonite grout.       26       27       28       30	0 90
Boring terminated and backfilled with cement bentonite grout.	
-26 -27 -28 -29 	<u> </u>
-27 -28 -29 -30	
-27 -28 -29 -30	
- 28 - 29 - 30 	
- 28 - 29 - 30 	
- 29 - 30 - 30	
- 30	
- 30	=
-31	
	Ē
-32	
-33	
-34	
F - ∃	
-35	
-36	E F
	E
-37	
F 1	-



Page: 1 of 1

									Stan	ntec Boring No	. <b>B-1.1a</b>	<u>i                                     </u>
Clie	ent	MWCD			_	Bori	ng Locat	ion	477,356.0	N; 1,649,681.	0 E	
Pro	oject Nur	nber 174316204			_	Sur	face Elev	ation	797.6 ft	Elevation Da	tum_NA	/D88
Pro	oject Nar	ne HCFRRP - Dry Storage Ba	asin D	Desig	n	Date	e Started		8/22/19	Completed	8/22	2/19
Pro	oject Loo	tation Hancock County, Ohio			_	Dep	th to Wa	ter	N/A	Date/Time	N/A	
Ins	pector	Stantec - E. Holcombe			_	Dep	th to Wa	ter	N/A	Date/Time	N/A	
Dri	lling Cor	tractor Stantec - D. Clements			_	Drill	Rig Type	e and	ID CME 45	5T (815)		
Ov	erburder	n Drilling and Sampling Tools (Ty	pe ar	nd Si	ze) :	3.25" I	D HSA, 3	3" ST				
Ro	ck Drillin	g and Sampling Tools (Type and	Size	) <u>N</u>	/A							
Sa	mpler Ha	ammer Type Automatic We	eight	N	/A	D	rop <u>N/A</u>		Efficie	ency N/A		
Boi	rehole A	zimuth N/A (Vertical)			_ E	Boreho	ole Inclina	ation (	from Vertic	al)Vertic	al	
	(ft)		от		:	SAMPL	ES	1		UNDRAINED SHEAR S		
H(ft)	NOL		A PL(		ĸ	RY	si)/	TER		2	3	4
DEPTH(ft)	ELEVATION(ft)	SOIL/ROCK DESCRIPTION	STRATA PLOT	ТҮРЕ	NUMBER	RECOVERY	BLOWS / PRESS.(psi) RQD (%)	MONITOR WELL PIEZOMETER	WATER CON	ITENT & ATTERBEF		
_	Ш		ST		R	REC	PRES	DIEZ		etrometer/Torvano PENETRATION TES		*
0	797.6					ft		ž	10 20			
0		Overburden. See B-1.1 boring										
		log for detailed soil descriptions.										
- 1 -				ST	01	1.0	300					
- 1												
2				7								
.   												
3-				ST	02	1.2	400					
- 4 -												<u></u>
				and the second								
5				/  ST	03	1.4	400					<u></u>
6		sand in bottom of ST-03		1								<u>::: :::=</u>
- 7 -												<u></u>
				/								
8												<u></u>
		gravel and sand bottom of		/  ST	04	1.1	400-550					
9		ST-04										
	788.1	Boring terminated and backfilled	with .		nt he	ntonit						<u>::: :::</u> E
-10-	· · · · ·		VVILII				e grout.					F



Page: 1 of 3

									Stant	tec Boring	No. <b>B-</b>	1.2	
Clie	ent	MWCD				Bori	ng Locat	ion	480,304.8 N	N; 1,649,6 <sup>-</sup>	14.3 E		
Pro	oject Nur	nber 174316204				Surf	ace Elev	ation	793.1 ft	Elevation	Datum_	NAVD88	8
Pro	oject Nar	ne HCFRRP - Dry Storage Ba	asin D	Desigr	ı	Date	e Started		8/26/19	Complete	d	8/26/19	
Pro	oject Loo	tation Hancock County, Ohio				Dep	th to Wa	ter	4.0 ft	Date/Time	э	8/26/19	
Ins	pector	Stantec - E. Holcombe				Dep	th to Wa	ter	N/A	Date/Time	э	N/A	
Dri	lling Cor	tractor Stantec - D. Clements				Drill	Rig Typ	e and	ID CME 45	T (815)			
Ov	erburder	Drilling and Sampling Tools (Ty	pe ar	nd Siz	e) 3	3.25" I	D HSA, 2	2" SP1	Г				
Ro	ck Drillin	g and Sampling Tools (Type and	Size	e) <u>NC</u>	ג								
Sa	mpler Ha	ammer Type Automatic We	eight	14	0 lb	D	rop <u>30</u> i	in	Efficie	ncy 86	.2		
Bo	rehole A	zimuth N/A (Vertical)		1	. В	Boreho	le Inclina	ation (1	from Vertica	al)Ve	rtical		
	l(ft)		Б		5	SAMPL	ES	-	1	UNDRAINED SHE	AR STRENGT 3	H - tsf ⊿	
DEPTH(ft)	NOIT	SOIL/ROCK DESCRIPTION	A PL		ĸ	ΞRΥ	S / () ()	WELL	i				147 147
DEP	ELEVATION(ft)	SOIL/NOCK DESCRIPTION	STRATA PLOT	ТҮРЕ	NUMBER	RECOVERY	BLOWS / PRESS.(psi) / RQD (%)	MONITOR V PIEZOME	WATER CONT			тѕ ⊢	• • •
	Ξ		S		Ž	RE	BRE		Pocket Pene STANDARD P			WS/FOOT	* •
- 0 -	793.1					ft		2	10 20	30 40	50 60	70 80	90
	<b>∖792.9</b> ∕	Topsoil Sandy Silty Clay, brown, dry to											E E
- 1 -		damp, stiff		SPT	01	0.4	3-5-6						
	791.6												
- 2		Sandy Lean Clay (CL), brown											
2		and gray mottled, damp to moist, medium stiff, low to		SPT	02	0.8	2-2-3				*		Ē
- 3 -		medium plasticity											Ē
- 3 -						4 5							
	789.1			571	03A	1.5	3-3-3						Ē
- 4 -		Clayey Sand with Gravel (SC),		SPT	03B					>:::::::::::::::::::::::::::::::::::::			
		gray and brown, moist to wet, medium dense, fine to											Ē
- 5 -		medium grained											Ē
				SPT	04	0.9	1-4-8		0 <b>-</b> -				Ē
- 6 -									••••				Ē
													Ē
- 7 -	785.6												
		Well-Graded Sand with Silt	0 0 0 0										
- 8 -		(SW-SM), gray, wet, loose to	0 0 0	SPT	05	1.2	4-4-5			D			
		medium dense, very fine to medium grained, little clay	8 8										
- 9 -			000										<u></u>
			0 0 0 0										
-10-													<u></u> +



Page: 2 of 3

											S	Stan	tec	Borir	ıg N	o <b>E</b>	3-1.2	2		_			
Clie	-	MWCD						ng Locat								14.3 E							
Pro	oject Nur	nber 174316204	<u> </u>						vation 793.1 ft Elevation Datum NAVD88														
Ĵ.	N(ft)		PLOT			S	SAMPL	ES	- - -			1	UNDR	AINED 8			3 3	ST	4	-	•		
DEPTH(ft)	АТЮ	SOIL/ROCK DESCRIPTION	TA P	ų	J	BER	ſΕRΥ	/S / (psi) (%)	WELL									WP	, V	W	WI		
	ELEVATION(ft)		STRATA			NUMBER	RECOVERY	BLOWS PRESS.(ps RQD (%)	MONITOR					<sup>-</sup> & ATT neter/T				F					
	ш		0		_	-		PR	MON					TRATIC				;/FO(	от	ſ	•		
-10-			8 8				ft				10 :   : :	20	30	) 40 ::::	) 50	06	0 7	70	80	<del></del>	90 : L		
		Well-Graded Sand with Silt (SW-SM), gray, wet, loose to	***																		÷Ę_		
-11-		medium dense, very fine to		S	PT	06	1.2	10-10-12					5 : : 	<u></u>									
		medium grained, little clay - (Continued)	8 8																		:E		
-12-		trace angular gravel at 11.3'	ອິອ ອິອ ອິອ																		Ē		
			8 8 8 8																		Ē		
-13-			***																				
		little medium grained gravel 13.0'-16.5'	8 8	s	PT	07	1.5	6-5-18			0										Ē		
-14-		rock fragment at 13.8', flat	8 8																		Ē		
		bedded	0 0 0 0																				
-15-			8 8																		Ē		
		sand becomes fine to	8 8 8																		Ē		
		medium grained at 16.0' rock fragment at 16.3'		s	PT	08	1.5	13-11-12			0										Ē		
-16-	776.6	C C	8 8 8 8																		Ē		
		Dolomite, gray, slightly																			Ē		
-17-		weathered, very fine grained,																			Ē		
		slightly to highly fractured, moderately hard to hard, flat																			Ē		
-18-		to 40° fractures, flat bedded																			Ē		
		highly fractured 16.9'-18.0' HAJ (40°) 18.2'-18.3', slightly																			Ē		
-19-		rough, weathered	     	III F	RC	01	4.0	26													E		
		LAF (10°) 18.9'-19.0', slightly rough				-															Ē		
-20-		LAJ (30°) 19.2'-19.3', rough,																			Ē		
		weathered LAJ (20°) rough, weathered at																			E		
-21-		19.5'									: :: : :: : ::		::: :::								: E : F		
		HF 20.3'-20.5', slightly rough VF 20.8'-21.0', smooth	F		_																		
-22-		HJ 21.2'-21.4'												<u></u>							E		
		HAF (80°) 21.7'-22.0', smooth																			Ē		
-23-			F								<u>:   : :</u> :   : :												
			Ē																				
			┣┯┷┨								:1::	::1:	:::	::::1	::::			1::	::[:	<u>::</u>	÷E		



										ę	Sta	inte	сB	Boriı	ng N	lo.	B	1.2	2		_	
Clie	ent	MWCD				Bori	ng Locat	tion	480	,30	4.8	3 N;	1,6	649	,614	1.3	Е					
Pro	ject Nur	nber 174316204				Surf	ace Elev	vation	793.	.1 f	t	_ E	Elev	vati	on D	Dat	um	N		288	}	
	٩(ft)		PLOT		5	SAMPL	ES					UN 1	IDRAI	INED : 2	SHEAR	STF	RENG	TH - 1	tsf	4		<b>k</b>
DEPTH(ft)	ELEVATION(ft)	SOIL/ROCK DESCRIPTION	LA PL	ш	К	ERY	'S / psi) / %)	WELL	-								Ť		WD		v	WT
DEP	rev <i>i</i>		STRATA	ТҮРЕ	NUMBER	RECOVERY	BLOWS / PRESS.(psi) RQD (%)	MONITOR							FERBI			IITS	Ļ			Ť
	Ш		ίο Ο		z	RE	BRB								Forva On te			ows	3/FO(	тс		; )
						ft		_	 	10	2	0	30	40	) 5	0	60		70	80		90
-24-		Dolomite, gray, slightly weathered, very fine grained,		RC	02	3.4	100															
		slightly to highly fractured,				0.1																
-25-		moderately hard to hard, flat to 40° fractures, flat bedded -																				
		(Continued)																				
-26-		HJ at 21.9', weathered fractured 23.0'-23.3', some																				
		shale laminations																				
-27-	765.9	HJ at 24.3', weathered HF at 24.7', smooth																				Ē
		LAF (5°) at 25.3', rough																				Ē
-28-		LAF (5°) at 25.9', rough highly fractured 26.4'-26.7'																				
		Boring terminated and backfilled	with	cemei	nt be	ntonit	e grout.															Ē
-29-		J					0															
-30-																						Ē
-31-																						Ē
-32-																						Ē
																						Ē
-33-																						Ē
																						Ē
-34-																						Ē
-35-																						Ē
																						Ē
-36-																						Ē
-37-																						
																						Ē
																F	Drin	iter	d or	10	1/4	/10



											Stan	tec Bori	ng No	р. <b>В</b>	-1.2	a		
Clie	ent	Μ	1WCD					Bori	ng Locat	ion <u>é</u>	480,304.8	N; 1,649	9,614.	3 E				
Pro	oject Nur	nber 1	74316204					Surf	ace Elev	ation	793.1 ft	Elevat	ion Da	atum	NA	VD8	88	
Pro	oject Nar	ne H	ICFRRP - Dry Storage Ba	sin	De	sign	I	Date	e Started		8/27/19	Compl	eted_		8/2	27/19	)	
Pro	oject Loo	cation	Hancock County, Ohio					Dep	th to Wa	ter	N/A	Date/T	ime _		N//	٩		
Ins	pector		Stantec - E. Holcombe					Dep	th to Wa	ter	N/A	Date/T	ime _		N//	٩		
Dri	lling Cor	ntractor	Stantec - D. Clements					Drill	Rig Type	e and	ID CME 45	5T (815)						
Ov	erburder	n Drilling	and Sampling Tools (Ty	pe a	ind	Size	e) 3	3.25" I	D HSA, 3	3" ST								
Ro	ck Drillin	g and S	ampling Tools (Type and	Siz	e)	N//	4											
	-		Type Automatic We	eight		N//	4	Di	rop <u>N/A</u>		_ Efficie	ncy _	N/A					
Bo	rehole A	zimuth	N/A (Vertical)				E	Boreho	le Inclina	ation (f	from Vertic	al)	Vertio	cal				
-	l(ft)			Ŀ.			5	SAMPLE	ES	<u>ک</u>	1	UNDRAINED	SHEAR S	STRENC		f	4	•
DEPTH(ft)	ELEVATION(ft)	SOII	/ROCK DESCRIPTION	STRATA PLOT			R	ERY	S / psi) / %)	MONITOR WELL PIEZOMETER	i i		-	Ĭ		Wp	W	W <sub>T</sub>
DEP	LEVA	UUIL		TRAT		ТҮРЕ	NUMBER	RECOVERY	BLOWS / PRESS.(psi) RQD (%)	TOR	WATER CON					<b>I</b>	-0-	
	Ш			ò			Z	RE	BRB R	PIE	Pocket Pene STANDARD F					FOOT	- -	ж Э
- 0 -	793.1							ft		6	10 20	30 4	0 50	60	) 7	0 8	0	90
			urden. See B-1.2 boring detailed soil															Ē
- 1 -		descrip				ST	01	1.4	400									Ē
						-												Ē
- 2 -			bulk sample 0.0'-4.0'		/													Ē
																		E
- 3 -						ST	02	1.0	450									Ē
						0.												Ē
- 4 -	789.1																	Ē
		Boring to	erminated and backfilled	with	ce	mer	nt be	entonit	e grout.									Ē
- 5 -																		Ē
																		Ē
- 6 -																		Ē
_																		E
- 7 -																		Ē
																		Ē
- 8 -																		Ē
																		Ē
- 9 -																		Ē
																		E
-10-																		F
10																		



									Stantec Borin	g No. <b>B-</b>	1.3	
Cli	ent	MWCD				Bori	ng Locat	ion 4	82,698.9 N; 1,650,0	)19.1 E		
Pro	ject Nur	nber 174316204				Surf	ace Elev	ation	92.0 ft Elevatio	n Datum_	NAVD88	
Pro	ject Nar	ne HCFRRP - Dry Storage Ba	asin [	Desigr	า	Date	e Started	8	8/29/19 Complet	ed	8/30/19	
Pro	oject Loo	Hancock County, Ohio				Dep	th to Wa	ter	7.5 ft Date/Tir	ne	8/29/19	
Ins	pector	Stantec - E. Holcombe				Dep	th to Wa	te <u>r l</u>	N/A Date/Tir	ne	N/A	
Dri	lling Con	tractor Stantec - D. Clements				Drill	Rig Type	e and I	D CME 45T (815)			
Ov	erburder	n Drilling and Sampling Tools (Ty	pe ai	nd Siz	e) 3	3.25" I	D HSA, 2	2" SPT				
Ro	ck Drillin	g and Sampling Tools (Type and	Size	e) <u>NC</u>	ג							
Sa	mpler Ha	ammer Type Automatic We	eight	14	0 lb	D	rop <u>30 i</u>	n	Efficiency 8	6.2		
Во	rehole A	zimuth N/A (Vertical)			B	lorehc	le Inclina	ation (f	rom Vertical) V	ertical		
_	( <b>L</b>		Б		s	SAMPL	ES	-	UNDRAINED SF 1 2	HEAR STRENGT	"H - tsf 🔒	۱.
DEPTH(ft)	NOIT		A PL		ĸ	RΥ	\$ / (isi) / ()	WELL		+		
DEP'	ELEVATION(ft)	SOIL/ROCK DESCRIPTION	STRATA PLOT	ТҮРЕ	NUMBER	RECOVERY	BLOWS / PRESS.(psi) RQD (%)	OR	WATER CONTENT & ATTE		ITS H O	
	EL		ST		ž	RE(	BI PRE R(	MONITOR /	Pocket Penetrometer/To STANDARD PENETRATIO		WS/FOOT	с •
- 0 -	792.0					ft		Z	10 20 30 40	50 60		90
	\791.9/	Topsoil Silty Cloy, light brown, dry to										E
- 1 -		Silty Clay, light brown, dry to damp, medium stiff		SPT	01	0.8	2-3-5		0		*	
	790.5								•			Ē
- 2 -		Lean Clay, light and dark										
2		brown mottled, damp, medium stiff to stiff, little silt		SPT	02	1.0	3-5-7		Ø	*		Ē
- -		bulk sample 0.0'-5.0'							<b>•</b> •••••••••••••••••••••••••••••••••••			Ē
- 3 -												Ē
				SPT	03	1.0	3-3-6		○ 🔸			Ē
- 4 -		fine sandy clay at bottom of										Ē
_		SPT-03										Ē
- 5 -												Ē
				SPT	04	0.2	3-2-3		о		*	Ē
- 6 -												Ē
				Π								Ē
- 7 -		wood fragment at 7.7'		7								Ē
	784.2			SPT	05A	0.7	1-2-5		*			Ē
- 8 -		Clayey Sand with Gravel, brown, gray and black, wet,		SPT	05P							Ē
		loose, very fine to medium		SP I	ОЭР							
- 9 -	782.5	grained		×								
												Ē
-10-			ا م				1		<u>;;;; ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;</u>	:::l::::l:	<u> .</u>	: [



														Bori	-	-		1.3			
Clie	-	MWCD					ng Locat							,650							
Pro	oject Nur	nber 174316204		1			ace Elev	vation	792	2.0	ft	_		evati						88	
	۱(ft)		PLOT		5	SAMPL	ES					ו 1	JNDF	RAINED		R STRI	engt 3	H - tsf		4	<b></b>
DEPTH(ft)	ELEVATION(ft)	SOIL/ROCK DESCRIPTION	STRATA PL	ТҮРЕ	NUMBER	RECOVERY	BLOWS / PRESS.(psi) / RQD (%)	MONITOR WELL PIEZOMETER	Po	ocke	et P	ene	tron	T & AT neter/	TERB Torva	ane (	LIMI tsf)		 ⊮_P I	w -0-	₩ <sub>1</sub> ★
-10-						ft		Z		10		20	30				60	70		30	90
	781.4	Poorly Graded Sand, gray, wet, medium dense, medium	8 8 9 8 8 8	SP	06A	1.2	3-5-5				c	5									
-11-		grained - (Continued)	$\square$	SP	Г06В													<u></u>	<u></u>		Ē
		Lean Clay (CL), gray, damp to moist, stiff (till)						-													
-12-														<u></u>					<u></u>		::E
				8				-													E
-13-				SPI	07	1.0	3-5-7					•									
						1.0	0-0-1			•											::E
-14-	777.6			8				-													
- 15-	770.0	Clayey Sand, gray, wet, medium dense, medium to		8				-				*		· · · · · · · · · · · · · · · · · · ·							
	776.6	_coarse grained Lean Clay, gray, moist, very		SPI		4 5	0 40 40														
-16-		stiff, some medium grained sand and gravel fragments		57		1.5	6-12-16						•								<u>∶:≮</u> ∶:⊧E
		sand and graver hagments		8				-													
-17-														<u></u>							<u></u> 
	774.3	<b>-</b>	K	SP	09A	1.5	15-19-21	-													
-18-		Dolomite, gray, slightly weathered, moderately		SP	09В																
-19-		fractured, tight fractures, very fine grained, flat to vertical																			
		fractures, flat bedded,																			
-20-		laminated, hard rock fragments at 17.7'			10	0.0	50+/0.1							<u></u>					<u></u>		
		VF 20.0'-20.2'																			
-21-		HF at 20.3', 20.6', 20.7', 20.8,' 21.0'		RC	01	1.3	0							<u></u>					<u></u>		
		21.0						-													
-22-																					<u> </u>
			E																		
-23-																					



											St	ant	ec	Bc	oring	g N	o	B-1	.3			
Clie	-	MWCD					ng Locat	-									.1 E					
Proj	ect Nur	mber 174316204					ace Elev	ation	792	2.0	ft	_							VAV	D88	8	
£	N(ft)		РГОТ		5		ES					ו 1	UNDF	RAINI	ED S⊦ 2	IEAR	STRE	NGTH 3	- tsf	4		•
DEPTH(ft)	ELEVATION(ft)	SOIL/ROCK DESCRIPTION	STRATA PI	ТҮРЕ	NUMBER	RECOVERY	BLOWS / PRESS.(psi) / RQD (%)	MONITOR WELL PIEZOMETER	Po	ocke	et P	ene	tror	nete	er/To	orva	ERG L ne (ts EST, E	sf)	S H	 , от	W 0	₩ <sub>L</sub> 
				11		ft		-		10	. :	20	3	0	40	5	0 0	60	70	80	)	90
-24 -25 -26 -27 -27 -28 -29 -29 -29 -30	761.8	Dolomite, gray, slightly weathered, moderately fractured, tight fractures, very fine grained, flat to vertical fractures, flat bedded, laminated, hard - (Continued)		RC	02	8.8	7															
-31 -32 -33 -33 -34 -35 -36 -37 -37		Boring terminated and backfilled	with a	cemei	nt be	entonit	e grout.															



									Stan	tec Bo	ring N	lo. <b>E</b>	3-2.´	10		
Cli	ent	MWCD				Bori	ing Locat	ion 4	484,031.7	N; 1,64	9,578	3.8 E				
Pro	oject Nur	nber 174316204				Surf	face Elev	ation	796.3 ft	Eleva	tion D	)atun	n_ <b>N</b> /	AVD	88	
Pro	oject Nar	ne HCFRRP - Dry Storage Ba	asin [	Desigr	ı	Date	e Started		9/4/19	Comp	leted		9/	4/19		
Pro	oject Loo	cation Hancock County, Ohio				Dep	oth to Wat	ter	7.5 ft	Date/	Time		9/	4/19		
Ins	pector	Stantec - E. Holcombe				Dep	oth to Wat	te <u>r</u> l	N/A	Date/	Time		N/	'A		
Dri	lling Cor	tractor Stantec - D. Clements				Drill	Rig Type	e and I	ID CME 45	5T (815	)					
Ov	erburder	n Drilling and Sampling Tools (Ty	pe ar	nd Siz	e)_3	3.25" I	D HSA, 2	2" SPT	Г							
Ro	ck Drillin	g and Sampling Tools (Type and	Size	e) <u>NC</u>	Ç											
Sa	mpler Ha	ammer Type Automatic We	eight	14	0 lb	D	rop _30 i	n	Efficie	ncy	86.2					
Во	rehole A	zimuth N/A (Vertical)			. В	Boreho	ole Inclina	ation (f	from Vertic	al)	Vert	ical				
	(ft)		ы		5	SAMPL	ES	1		UNDRAINE				isf		•
(1J)H.	NOI		A PL(		Ř	RY	si)/	VELL			2		3		4	
DEPTH(ft)	ELEVATION(ff)	SOIL/ROCK DESCRIPTION	STRATA PLOT	ТҮРЕ	NUMBER	RECOVERY	BLOWS / PRESS.(psi) RQD (%)	MONITOR WELL PIEZOMETER	WATER CON	TENT & A	TTERBI	ERG LI	MITS	₩ <sub>P</sub> ►	₩ — <del>0</del> —	
	EL		ST		z	REC	PRE	ONIT	Pocket Pene STANDARD F						ר ד ו	*
- 0 -	796.3					ft		Σ	10 20						80	90
- 0 -	795.9	Topsoil														Ē
		Sandy Lean Clay (CL), brown and orange brown mottled, dry		SPT	01	1.1	2-4-4									
- 1 -		to damp, stiff to very stiff, trace														Ē
		organics														Ē
- 2 -		hulk comple 0.01 E.01		SPT	02	1.1	7-5-8									×
		bulk sample 0.0'-5.0'														Ē
- 3 -		trace rounded sand and gravel														Ē
		(till), more brown color 3.0'-4.5'		SPT	03	1.4	12-12-13		:0:							×
- 4 -		pink quartz fragment (1/2") at														Ē
		4.2'														Ē
- 5 -			$\square$													Ē
				SPT	04	1.5	3-6-7		0: <b> -</b>							×
- 6 -																
				×												Ē
- 7 -																÷È
		grayish brown, less gravel														
- 8 -		7.5'-9.0'		SPT	05	1.5	3-7-10		·····							
																Ē
- 9 -				×												
	786 2		$\square$													Ē
-10-	786.3										<u>: ::::</u>	1::::		1::::		÷E



									Sta	ntec	Boring	g No.	B-2	.10		_
Cli	ent	MWCD				Bori	ng Loca	tion	484,031.7	'N; ′	1,649,	578.8	E			_
Pro	oject Nur	nber 174316204			-	Sur	face Elev	ation	796.3 ft	El	evatio	n Datı	um N	NAV	880	-
	(£		5		5	SAMPL	ES	-		UND	RAINED SH	HEAR STR		- tsf		
DEPTH(ft)	NOIL	SOIL/ROCK DESCRIPTION	A PLOT		ER	ERY	S / psi) / %)	WELL			2		3	Wp	4 	WT
DEP	ELEVATION(ft)		STRATA	ТҮРЕ	NUMBER	RECOVERY	BLOWS / PRESS.(psi) RQD (%)	MONITOR WELL PIEZOMETER	WATER CO Pocket Per STANDARD	netror	meter/To	orvane	(tsf)			
10						ft		Σ	10 20		0 40	50	60	70	80	90
-10- - -11-		Sandy Lean Clay (CL), gray, damp, stiff, medium plasticity, trace fine gravel (till) <i>fine sand seam at 10.5</i> '		SPI	06	1.5	4-5-9		•						• •	
-12-								-								
-13-		softer 13.5'-14.0'		SPI	07	1.5	2-5-6		•			*				
-15-				8				-								
-16-		wet, sandy clay 16.0'-16.5'		SP	08	1.5	3-5-8	-	Q			*				
-17-	779.3	Poorly Graded Sand with Clay,	•							<u></u>						
	778.4	gray, wet, loose, fine grained	8 8 8 8 8 8	SP	09		50+/.4	-								
-18-		Dolomite, gray, slightly						-								
-19 20-		weathered, moderately to highly fractured, flat to vertical fractures, moderately hard to hard, smooth to rough fractures <i>VF 18.6'-18.8', slightly rough</i> <i>VF 18.9'-19.3', smooth</i>	   	RC	01	2.3	0									
-21 - -22-		hydrocarbon odor at 19.0' highly fractured 19.0'-19.6' VF 20.0'-20.2', smooth HJ at 20.0, 20.1, open LAF (30°) 20.4'-20.5', smooth competent 21.4'-21.8' flat, fractured, rough														
-23-		21.8'-22.1' VF 22.3'-22.7', smooth		RC	02	5.0	16									



									Star	ntec Boi	ing N	o. <b>E</b>	3-2.1	0	
Clie	ent	MWCD				Bor	ing Locat	ion	484,031.7	N; 1,64	9,578	.8 E			
Pro	ject Nur	nber 174316204		1	-	Sur	face Elev	vation	796.3 ft	Eleva	tion D	atum	<u>1 NA</u>	VD8	8
	l(ft)		PLOT			SAMPL	ES	-	1	UNDRAINE	D SHEAR		GTH - ts 3	f	1
DEPTH(ft)	ELEVATION(ft)	SOIL/ROCK DESCRIPTION	STRATA PL	ТҮРЕ	NUMBER	RECOVERY	BLOWS / PRESS.(psi) / RQD (%)	MONITOR WELL PIEZOMETER	WATER CON Pocket Per STANDARD	netrometer	+ TTERBE 7/Torva	ERG LII	MITS f)		₩ ₩ <sub>L</sub> ↔
						ft		Σ	10 20		40 5				0 90
-24 - -25 -		Dolomite, gray, slightly weathered, moderately to highly fractured, flat to vertical fractures, moderately hard to hard, smooth to rough fractures - (Continued)													
-26-		fractured 22.7'-22.8' HF at 23.1', tight highly fractured 23.4'-23.6', flat, slightly open													
-28		VF 24.4'-24.5', smooth highly fractured 24.7'-25.0' highly fractured 25.3'-25.4' VF 26.1'-26.2'		RC	03	2.4	27								
-29-	767.5	shale lamination at 26.5' LAF (10°) at 27.1', 27.2'													···· · · · · · · · · · · · · · · · · ·
-30 -31 -32 -32 -33		moderately fractured 27.4'-27.8' Boring terminated and backfilled	with o	ceme	nt be	entonit	e grout.								
-34															
-35															
-36 - -37															
															0/4/10



										Stan	tec Bo	oring	g No	. <b>B</b> -	-2.1	0a		
Clie	ent	MWCD					Bori	ng Locat	ion 4	484,031.7	N; 1,6	49,5	578.8	ΒE				
Pro	oject Nur	nber 174316204					Surf	ace Elev	ation	796.3 ft	Eleva	atior	ו Da	tum	NA	٧D	88	
Pro	oject Nar	ne HCFRRP - Dry Storage Ba	asin I	Des	sign		Date	e Started		9/5/19	Com	plet	ed_		9/5	5/19		
Pro	oject Loo	ation Hancock County, Ohio					Dep	th to Wa	te <u>r</u> I	N/A	Date	/Tim	1e _		N//	۹		
Ins	pector	Stantec - E. Holcombe					Dep	th to Wa	te <u>r</u> I	N/A	Date	/Tim	1e _		N//	۹		
Dri	lling Cor	tractor Stantec - D. Clements					Drill	Rig Type	e and I	ID CME 45	T (81	5)						
Ov	erburder	Drilling and Sampling Tools (Ty	vpe a	nd	Size	e) 3	3.25" I	D HSA, 3	3" ST									
Ro	ck Drillin	g and Sampling Tools (Type and	l Size	e) _	N/A	4												
Sa	mpler Ha	mmer Type Automatic We	eight		N/A	4	D	rop <u>N/A</u>	۱	Efficie	ncy	N	/A					
Bo	rehole A	zimuth N/A (Vertical)				В	oreho	le Inclina	ation (f	from Vertica	al)	V	ertic	al				
	(ft)		Ц			S	SAMPL	ES	1		UNDRAIN		EAR ST		TH - ts	f		
H(ft)	NOL		A PLO			R	RY	si) /	VELL			2		3			4	
DEPTH(ft)	ELEVATION(ft)	SOIL/ROCK DESCRIPTION	STRATA PLOT		TYPE	NUMBER	RECOVERY	BLOWS / PRESS.(psi), RQD (%)	MONITOR WELL PIEZOMETER	WATER CON	FENT &	ATTE	RBER	G LIM	IITS	₩ <sub>₽</sub> ┣	W 	W <sub>I</sub>
-	Ц		ST	'		NN	REC	PRES	DIEZ	Pocket Pene STANDARD F							Ŧ	*
•	796.3						ft		ž	10 20	30	40	50	т, вес 60			80	90
- 0 -		Overburden. See B-2.10		Π														Ē
		boring log for detailed soil																
- 1 -		descriptions.																Ē
																		Ë
- 2 -				/														Ë
- 3 -					ST	01	1.6	600										
- 4 -				4														
- 5 -																		
																		Ē
- 6 -		ST-02 pushed 1.5', very stiff		/														
		clay			ST	02	1.5	550										Ē
- 7 -					51	02	1.5	550										
				/														
- 8 -																		
- 9 -																		
-10-																		<u>ii</u> E
-																		



Page: 2 of 2

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												Sta	ant	ec	Bor	ing	No	). <b>_E</b>	<b>3-2</b> .′	10a		_
Clie	ent _	MWCD					Bori	ng Locat	tion	484	,0	31.	7 N	<b>]</b> ; 1	,64	9,57	78.8	<u>8 E</u>				-
Pro	ject Nur	nber 174316204					Sur	face Elev	vation	796	6.3	ft	_						n N		88	
	٩(ft)		Ь.			5	SAMPL	ES	<b>.</b>				ι 1	JNDF	RAINE	2 SHE	AR S		IGTH - 1 <b>3</b>	sf	4	
DEPTH(ft)	ELEVATION(ft)	SOIL/ROCK DESCRIPTION	STRATA PLOT		ш	ER	ΈRΥ	/S / (psi)/ (%)	MONITOR WELL PIEZOMETER	-			+			+				Wp	W	WL
DEF	ILEV,		TRA		ТҮРЕ	NUMBER	RECOVERY	BLOWS / PRESS.(psi), RQD (%)	TOR							TTER /Torv			MITS f)	Ē	-0	—-+ ★
			0			-		а К. В К.	MON										LOWS	/FOC	т	•
-10-				7	1		ft			:::	10	::::	20	3	0 4	40 ⊤:::	50	6	0	70   :::	80	90
		Overburden. See B-2.10 boring log for detailed soil																				
-11-		descriptions (Continued)			ST	03	1.7	1000			:											
-12-				7							:			::								
-13-					ST	04	1.9	1000														
-14-				1	-																	
											:											
-15-					ST	05	2.0	1000														
											:											
-16-	780.3	Boring terminated and backfilled	l with		200	nt he	ntonit	e grout														<u> </u>
		Doning terminated and backlined	with		-1110		morm	e grout.														Ē
-17-																						Ē
-18-																						
-19-																						
																						Ē
-20-																						Ē
-21-																						
																						Ē
-22-																						Ē
																						Ē
-23-																						Ē
																						<u>+</u> _
																		<b>D</b>		<u> </u>		14/40



									Stan	tec Bori	ng No	B-2.11		_
Clie	ent	MWCD				Bori	ng Locat	ion <u>é</u>	483,523.7	N; 1,650	,003.2	E		
Pro	oject Nur	nber 174316204				Surf	ace Elev	ation	790.7 ft	Elevati	on Datu	ım NAV	D88	-
Pro	ject Nar	ne HCFRRP - Dry Storage Ba	asin [	Desigr	I	Date	e Started		9/3/19	Comple	eted	9/3/1	9	-
Pro	oject Loo	•				Dep	th to Wa		7.5 ft	Date/T	me	9/3/1	9	-
Ins	pector	Stantec - E. Holcombe					th to Wa		N/A	Date/T	me	N/A		-
	•	tractor Stantec - D. Clements					• • •		ID CME 45	5T (815)				-
		n Drilling and Sampling Tools (Ty	•			3.25" I	D HSA, 2	2" SPT	Γ					-
		g and Sampling Tools (Type and		·										-
	-		eight	14	0 lb		rop <u>30</u> i		_ Efficie	· _	86.2			-
Bo	rehole A	zimuth N/A (Vertical)		1				ation (f	from Vertic	·	Vertical			<u> </u>
÷	N(ft)		Ь		5	SAMPL	ES	<u> </u>	1	UNDRAINED		ENGTH - tsf 3	4	•
DEPTH(ft)	<b>∆</b> TIOI	SOIL/ROCK DESCRIPTION	TA PI	ш	ER	ΈRΥ	/S / (psi)/ %)	WEL	+					WT
DEF	ELEVATION(ff)		STRATA PLOT	ТҮРЕ	NUMBER	RECOVERY	BLOWS / PRESS.(psi) RQD (%)	MONITOR WELL PIEZOMETER	WATER CON Pocket Pene					—  ★
	ш		S		~		ПЯЧ	MON	STANDARD F				от	•
- 0 -	790.7			×		ft			10 20	30 40	) 50	60 70	80	90 · · · L
		Silty Clay, brown, dry to damp, stiff												
- 1 -				SPT	01	0.4	3-4-5			O:::::::::::::::::::::::::::::::::::::	<u> </u>			
- 2 -														
				SPT	02	0.4	4-6-6		•	d		*		
- 3 -	787.7													
		Lean Clay, brown and gray mottled, damp, very soft to												
- 4 -		stiff, low to med plasticity		SPT	03	1.2	6-7-8			· :•	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · ·		
- 5 -				×						· · · · · · · · · · · · · · · · · · ·	<u> </u>			
- 6 -				SPT	04	0.1	2-1-1		••••••••••••••••••••••••••••••••••••••	2	<u> </u>			÷
- 7 -												· · · · · · · · · · · · · · · · · · ·		::= ::=
	783.2			<u>z</u>										
- 8 -	782.6	Clayey Sand with Gravel, , brown and gray, wet, medium		SPT	05A	1.2	5-5-6							∷Ę ∺F
		dense, coarse grained		SPT	05P									
- 9 -		Sandy Lean Clay (CL), gray, damp, stiff to very stiff, trace	$\square$											
		rounded sand and gravel (till)												
-10-														



	. ,					_		<i>.</i> .					ntec		-	-		2.1	1		_	
	ient oiect Nur	MWCD nber 174316204			_		ring Locat rface Elev			-			N; 1' Fle	,650 evati				NA		088	-	
<u> </u>						SAMP			Ī				•				_					
E)	DN(ft		PLOT					ELL /					1	2	2		3			4		
DEPTH(ft)	ELEVATION(ft)	SOIL/ROCK DESCRIPTION	STRATA	ТҮРЕ	NUMBER	RECOVERY	BLOWS / PRESS.(psi) RQD (%)	MONITOR WE	F	Poc	ket	Pe	NTENT netrom	neter/	Torva	ane (1	sf)		₩ <sub>₽</sub> ►	v —← DT	v → ★	₩ <sub>1</sub>
-10						ft		~		1	10	2	0 30	) 4(	0 5	50	60	7	0	80		90
-11	-	Sandy Lean Clay (CL), gray, damp, stiff to very stiff, trace rounded sand and gravel (till) - (Continued)		SF	от 06	1.2	3-7-8				Q											···· <b>k</b> ·
-12		sand seam 10.0'-10.3'										· · ·										
-								_														
-13				SF	07 T	1.0	3-4-5				0	· · · · · · · · · · · · · · · · · · ·				*						
-14	776.2			8				_				· · ·										
-15		Dolomite, gray, slightly		RE		0.1	50/.1					::										Ē
	-	weathered, moderately to highly fractured, flat to vertical						1														Ē
-16		fractures, very fine grained,		R	C 01	0.9	0															Ē
- -17		thin bedded severely fractured 15.7'-15.9', 16.1'-16.2 HJ at 16.5', smooth fractured shale lamination at										· · · · · · · · · · · · · · · · · · ·										
-18		16.7' HAF (85°) 17.0'-17.5', smooth HF at 17.1' HJ at 17.5', smooth		R	02	5.0	28											<u> </u>				
-19		MF at 17.9' LAF (20°) at 18.0', rough severely fractured 18.0'-18.3'										· · ·										
-20		HJ at 18.5', smooth LAJ (30°) at 18.6', smooth MF at 19.3', 19.7', 20.3', and																				
-21		20.4' HJ at 19.5', slightly rough LAJ (10°) at 21.0', smooth						-				· · ·										
-22		HJ at 21.3', 21.4', 21.5' LAJ (10°) at 21.8' moderately fractured										· · · · · · · · · · · · · · · · · · ·										
-23		22.3'-22.5'		R	C 03	4.8	18					· · · · · · · · · · · · · · · · · · ·										



									Stantec Boring No. B-2.11					
Cli	ent	MWCD				Bori	ing Locat	tion	483,523.7 N; 1,650,003.2 E					
Pro	oject Nur	mber 174316204				Sur	face Elev	vation	790.7 ft Elevation Datum NAVD88					
	(ft)		н		S	SAMPL	ES	<u> </u>	UNDRAINED SHEAR STRENGTH - tsf					
(11)H	ELEVATION(ft)		STRATA PLOT		ĸ	RY	si)/	MONITOR WELL PIEZOMETER						
DEPTH(ft)	EVAT	SOIL/ROCK DESCRIPTION	RAT/	ТҮРЕ	NUMBER	RECOVERY	d) SS () (%	OR V OME	WATER CONTENT & ATTERBERG LIMITS $H \longrightarrow H$					
-	EL		ST		NN	REC	BLOWS / PRESS.(psi) / RQD (%)	PIEZ	Pocket Penetrometer/Torvane (tsf) *					
						ft		ž	STANDARD PENETRATION TEST, BLOWS/FOOT         •           10         20         30         40         50         60         70         80         90					
-24		Dolomite, gray, slightly	F											
		weathered, moderately to highly fractured, flat to vertical												
-25-		fractures, very fine grained,												
		thin bedded - (Continued) shale lamination 23.0'-23.2'												
-26-	764.6	highly fractured 23.3'-23.5'	┍╘╾┵╛											
20 moderately fractured 23.7'-26.1' Boring terminated and backfilled with cement bentonite grout.														
-27-			with	ceme	nt be	ntonit	e grout.							
		-					-							
-28-									E					
									E					
-29-									E					
-30-														
-31-									E					
-32-														
-33-														
-34-														
-35-														
-36-														
-37-														
									- - - - -					
									Printed on 10/4/19					



Client       MWCD       Boring Location       482,040.5 N; 1,649,993.9 E         Project Name       HCFRRP - Dry Storage Basin Design       Surface Elevation       791.5 ft       Elevation Datum       NAVDEd         Project Location       Hancock County, Ohio       Depth to Water       10.0 ft       Date/Time       8/28/19         Inspector       Stantec - E. Holcombe       Depth to Water       10.0 ft       Date/Time       8/28/19         Overburden Drilling Contractor       Stantec - E. Holcombe       Depth to Water       N/A       Date/Time       8/28/19         Overburden Drilling and Sampling Tools (Type and Size)       3.25" ID HSA, 2" SPT       Rock Drilling and Sampling Tools (Type and Size)       NQ         Sampler Hammer Type       Automatic       Weight       140 lb       Drop 30 ln       Efficiency       86.2         Borehole Azimuth       N/A (Verical)       Borehole Inclination (from Vertical)       Vertical       Vertical         0       791.5       SOIL/ROCK DESCRIPTION       N/A (Vertical)       SPT 01       0.6       2-3.6       Vertical         0       791.5       Sond datk       SPT 02       1.0       3-5.4       Vertical       Vertical         0       791.5       Sampler floated dark       SPT 02       1.0       3-5.4 </th <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th>Star</th> <th>ntec Boring N</th> <th>o. <b>B-2.</b></th> <th>.12a</th> <th></th>										Star	ntec Boring N	o. <b>B-2.</b>	.12a	
Project Name         HCFRRP - Dry Storage Basin Design         Date Started         8/28/19         Completed         8/29/19           Project Location         Hancock County, Ohio         Depth to Water         10.0 ft         Date/Time         8/28/19           Inspector         Stantec - E. Holcombe         Depth to Water         N/A         Date/Time         8/28/19           Overburden Drilling and Sampling Tools (Type and Size)         3.25" ID HSA, 2" SPT         Rock Drilling and Sampling Tools (Type and Size)         3.25" ID HSA, 2" SPT           Borehole Azimuth         N/A (Vertical)         Borehole Inclination (from Vertical)         Vertical           Borehole Azimuth         N/A (Vertical)         Borehole Inclination (from Vertical)         Vertical           Borehole Azimuth         N/A (Vertical)         SamPler Hammer Type Automatic         Vertical         Vertical           Borehole Azimuth         N/A (Vertical)         Borehole Inclination (from Vertical)         Vertical         Vertical           Borehole Azimuth         N/A (Vertical)         SamPler Hammer Type Automatic (list)	Clie	ent	MWCD				Bori	ng Locat	ion	482,040.5	N; 1,649,993	.9 E		_
Project Location         Hancock County, Ohio         Depth to Water         10.0 ft         Date/Time         8/28/19           Inspector         Stantec - E. Holcombe         Depth to Water         N/A         Date/Time         N/A           Drilling Contractor         Stantec - D. Clements         Drill Rig Type and ID CME 45T (815)         Overburden Drilling and Sampling Tools (Type and Size)         3.26" ID HSA, 2" SPT           Rock Drilling and Sampling Tools (Type and Size)         NQ         Sampler Hammer Type         Automatic         Weight         140 lb         Drop         30 in         Efficiency         86.2           Borehole Azimuth         N/A (Vertical)         Borehole Inclination (from Vertical)         Vertical         Vertical           SolL/ROCK DESCRIPTION         Yes         <	Pro	oject Nur	nber 174316204				Surf	ace Elev	ation	791.5 ft	Elevation D	atum_N	AVD88	_
Inspector       Stantec - E. Holcombe       Depth to Water       N/A       Date/Time       N/A         Drilling Contractor       Stantec - D. Clements       Drill Rig Type and ID CME 45T (815)         Overburden Drilling and Sampling Tools (Type and Size)       3.25" ID HSA, 2" SPT         Rock Drilling and Sampling Tools (Type and Size)       NQ         Sampler Hammer Type       Automatic       Weight       140 lb       Drop 30 in       Efficiency       86.2         Borehole Azimuth       N/A (Vertical)       Borehole Inclination (from Vertical)       Vertical       Vertical         Image: SoliL/ROCK DESCRIPTION       Image: Solit Stante - En Clay, brown, dry to damp, stiff, some silt       Image: Spring and the stante - En Clay, brown, dry to damp, stiff, some silt       SPT 01       0.6       2-3-5         Image: Solight and dark brown motiled in SPT-02       bulk sample 0.0'-5.0'       SPT 03A       1.5       6-6-7       Image: Spring and the stante and	Pro	oject Nar	ne HCFRRP - Dry Storage Ba	asin E	Desigr	ו	Date	e Started		8/28/19	Completed	8	/29/19	_
Drilling Contractor         Stantec - D. Clements         Drill Rig Type and ID CME 45T (815)           Overburden Drilling and Sampling Tools (Type and Size)         3.25" ID HSA, 2" SPT           Rock Drilling and Sampling Tools (Type and Size)         NQ           Sampler Hammer Type         Automatic         Weight         140 lb         Drop 30 in         Efficiency         86.2           Borehole Azimuth         N/A (Vertical)         Borehole Inclination (from Vertical)         Vertical         Vertical           Borehole Azimuth         N/A (Vertical)         Borehole Inclination (from Vertical)         Vertical           Borehole Azimuth         N/A (Vertical)         Borehole Inclination (from Vertical)         Vertical           Borehole Azimuth         N/A (Vertical)         Borehole Inclination (from Vertical)         Vertical           Borehole Inclination (from Vertical)         Borehole Inclination (from Vertical)         Vertical         Vertical           Borehole Inclination (from Vertical)         SolL/ROCK DESCRIPTION         Sol         Trail 2         Trail 2         Trail 2         Trail 2         Topsoil         Trail 2         Topsoil         Trail 2         Sol 40 50 60 70 80         Sol 40 50 60 70 80         SPT 02         1.0 3-5-6         SPT 02         1.0 3-5-6         SPT 04 0.0 3-1-2         SPT 04 0.0 3-1-2         SPT 04 0.0	Pro	oject Loo	tation Hancock County, Ohio				Dep	th to Wa	ter	10.0 ft	Date/Time	8	/28/19	_
Overburden Drilling and Sampling Tools (Type and Size)         3.25" ID HSA, 2" SPT           Rock Drilling and Sampling Tools (Type and Size)         NQ           Sampler Hammer Type         Automatic         Weight         100           Borehole Azimuth         NA (Vertical)         Borehole Inclination (from Vertical)         Vertical           SoiL/ROCK DESCRIPTION         SoiL/ROCK DESCRIPTION         SoiL/ROCK DESCRIPTION         Sampler Mammer Type Automatic Mediate Steletone           O         Topsoil           Topsoil         Topsoil           SPT 01         0.6         2.35           Sandy Lean Clay, brown, dry to damp, stiff, some silt         SPT 02         10         3.56-67           Sandy Lean Clay (CL), brown to gray, moist, soft to stiff, trace organics         SPT 04         0.0         3.1-1-2           SPT 05         0.3         1-1-2         0         4         6           SPT 02         10         3.56-67         9         9 </td <td>Ins</td> <td>pector</td> <td>Stantec - E. Holcombe</td> <td></td> <td></td> <td></td> <td>Dep</td> <td>th to Wa</td> <td>ter</td> <td>N/A</td> <td>Date/Time</td> <td>N</td> <td>I/A</td> <td>_</td>	Ins	pector	Stantec - E. Holcombe				Dep	th to Wa	ter	N/A	Date/Time	N	I/A	_
Rock Drilling and Sampling Tools (Type and Size)         NQ           Sampler Hammer Type         Automatic         Weight         140 lb         Drop 30 in         Efficiency         86.2           Borehole Azimuth         N/A (Vertical)         Borehole Inclination (from Vertical)         Vertical           UNDRAWED SHART STREATH-INT           NO         SAMPLES           Jundrawed Streat STREATH-INT           Vertical           Vertical           Vertical           Vertical           Soil/ROCK DESCRIPTION           Vertical	Dri	lling Cor	tractor Stantec - D. Clements				Drill	Rig Type	e and	ID CME 45	5T (815)			_
Sampler Hammer Type         Automatic         Weight         140 lb         Drop         30 in         Efficiency         86.2           Borehole Azimuth         N/A (Vertical)         Borehole Inclination (from Vertical)         Vertical           Borehole Azimuth         N/A (Vertical)         Borehole Inclination (from Vertical)         Vertical           Borehole Azimuth         N/A (Vertical)         SAMPLES         Table Astronomy (from Vertical)         Vertical           Borehole Inclination (from Vertical)         SOIL/ROCK DESCRIPTION         SAMPLES         Table Astronomy (from Vertical)         Vertical           0         T91.5         Topsoil         Table Astronomy (from Vertical)         Vertical         Vertical         Vertical           0         T91.5         Topsoil         Topsoil         Table Astronomy (from Vertical)         Vertical	Ov	erburder	n Drilling and Sampling Tools (Ty	pe ar	nd Siz	e) 3	3.25" I	D HSA, 2	2" SP1	Г				_
Borehole Azimuth         N/A (Vertical)         Borehole Inclination (from Vertical)         Vertical	Ro	ck Drillin	g and Sampling Tools (Type and	Size	e) <u>NC</u>	ג								_
EF         SOIL/ROCK DESCRIPTION         Value         SAMPLES         Value         Value </td <td>Sa</td> <td>mpler Ha</td> <td>ammer Type Automatic We</td> <td>eight</td> <td>14</td> <td>0 lb</td> <td> D</td> <td>rop <u>30</u> i</td> <td>in</td> <td>_ Efficie</td> <td>ency 86.2</td> <td></td> <td></td> <td>_</td>	Sa	mpler Ha	ammer Type Automatic We	eight	14	0 lb	D	rop <u>30</u> i	in	_ Efficie	ency 86.2			_
E         SOIL/ROCK DESCRIPTION         Image: bold of the second	Bo	rehole A	zimuth N/A (Vertical)			_ B	lorehc	ole Inclina	ation (	from Vertic	al) Verti	cal		_
Topsoil	-	(ft)		Б		5	SAMPL	ES	-	1			∙tsf	
Topsoil	ΓH(ft)	NOIT		APL		ĸ	ΞRΥ	\$ / 05i) / %)	VELL					
Topsoil	DEP	-EVA	SOIL/ROCK DESCRIPTION	<b>TRAT</b>	TYPE	UMBI	COVE	DD (9	TOR V				; <b>⊢</b> ⊖	,
0       791.5       Topsoil       10       20       30       40       50       60       70       80         1       Lean Clay, brown, dry to damp, stiff, some silt       SPT 01       0.6       2-3-5       0       1		EI		S		ž	RE	PRE					S/FOOT	*
791.2       Topsoil       Lean Clay, brown, dry to damp, stiff, some silt         2       changes to light and dark brown mottled in SPT-02 bulk sample 0.0'-5.0'       SPT 02       1.0       3-5-6         3	- 0 -	791.5					ft		2					90
1       damp, stiff, some silt         2       changes to light and dark brown mottled in SPT-02 bulk sample 0.0'-5.0'         3       SPT 02       1.0       3-5-6         4       787.5       SPT03A       1.5       6-6-7         4       787.5       SPT03B       -         5       SPT04       0.0       3-1-2         6       SPT 05       0.3       1-1-2         9       SPT 05       0.3       1-1-2		791.2												E E
2       changes to light and dark brown mottled in SPT-02 bulk sample 0.0'-5.0'       SPT 02       1.0       3-5-6         3       787.5       Sandy Lean Clay (CL), brown to gray, moist, soft to stiff, trace organics       SPT 03A       1.5       6-6-7         6       SPT 04       0.0       3-1-2         7       SPT 05       0.3       1-1-2	- 1 -				SPT	01	0.6	2-3-5			D	*		
2       brown mottled in SPT-02 bulk sample 0.0'-5.0'       SPT 02       1.0       3-5-6         3														Ë
3       bulk sample 0.0'-5.0'       SPT 02       1.0       3-5-6         4       787.5       Sandy Lean Clay (CL), brown to gray, moist, soft to stiff, trace organics       SPT 03B       SPT 04       0.0       3-1-2         6       SPT 04       0.0       3-1-2       0       -       -         8       SPT 05       0.3       1-1-2       0       -       -	- 2 -													
3	<u> </u>				SPT	02	1.0	3-5-6			0	*		E
4       787.5         4       Sandy Lean Clay (CL), brown to gray, moist, soft to stiff, trace organics         6       SPT03B         6       SPT04         7       SPT 04         8       SPT 05         9       SPT 05         9       SPT 05	- ~ -													
4       787.5         Sandy Lean Clay (CL), brown to gray, moist, soft to stiff, trace organics         6       SPT 04       0.0         8       SPT 04       0.0         9       SPT 05       0.3         1       SPT 05       0.3         1       1       1         1       1       1         1       1       1         1       1       1         1       1       1         1       1       1         1       1       1         1       1       1         1       1       1         2       0       1         1       1       1         2       0       1         2       0       1         2       0       1         3       1       1         2       0       1         2       0       1         3       1       1         4       1       1         5       1       1         4       1       1         5       1       1         4<					ерт	034	15	667						Ē
Sandy Lean Clay (CL), brown to gray, moist, soft to stiff, trace organics SPT 04 0.0 3-1-2 SPT 05 0.3 1-1-2 SPT 05 0.3 1-1-2	4	787.5				034	1.5	0-0-7						Ē
5       trace organics         -6       SPT 04       0.0       3-1-2         -7       -       -         -8       -       -         -9       -       -         -1       -       -         -1       -       -         -2       -       -         -3       -       -         -4       -       -         -5       -       -         -7       -       -         -8       -       -         -9       -       -         -1       -       -         -1       -       -         -1       -       -         -1       -       -         -1       -       -         -1       -       -         -1       -       -         -2       -       -         -3       -       -         -4       -       -         -5       -       -         -5       -       -         -5       -       -         -5       -       -         -5 </td <td>4</td> <td></td> <td></td> <td></td> <td>SPT</td> <td>03B</td> <td></td> <td></td> <td></td> <td><b></b></td> <td>:0:</td> <td></td> <td></td> <td>Ë</td>	4				SPT	03B				<b></b>	:0:			Ë
SPT 04 0.0 3-1-2 - 6	5													Ē
- 6	5													
-7- -8- -9- -9- 	6				SPT	04	0.0	3-1-2						Ē
- 8 - 9 - 9 - 9	- 0 -													
- 8 - 9 - 9 - 9	 - -													Ē
- 9 - 9 	- / -													
- 9 - 9 														Ē
	- 8 -				SPT	05	0.3	1-1-2		*	a			Ē
				$\square$										E
	- 9 -				1									E
					7									
	-10-			12 214	<u>ı  </u>				<u>.</u>	<del>,,,,,,,,,,,,,,,,</del>	· · · · · · · · · · · · · · · · · · ·	<del>!:::</del>	<del></del> .	!



												Sta	ant	ес	Bori	ing	Nc	). <b>_E</b>	3-2	.12	a		
Clie	ent	MWCD				Bori	ng Locat	ion	48	82,	04	10.	5 N	l; 1	,649	9,99	93.	9 E					
Pro	ject Nur	nber 174316204				Sur	face Elev	ation	79	91.	5	ft	_	Ele	evat	ion	Da	atun	n N	JA/	′D8	8	
	( <b>L</b>		5		S	SAMPL	ES	1					L A	INDR	RAINED		AR S			- tsf		. '	
H(ft)	NOL		<b>PLOT</b>		R	RY	/ si)/	Well	-				1			2			3 			₽ ├──	
DEPTH(ft)	ELEVATION(ft)	SOIL/ROCK DESCRIPTION	STRATA	ТҮРЕ	NUMBER	RECOVERY	BLOWS / PRESS.(psi RQD (%)	MONITOR M PIEZOMET	F	oc	ke	t Pe	enet	rom	<sup>-</sup> & AT neter/ TRAT	Tor	van	e (ts	f)		р ООТ	W 	™⊥ → ★
-10-						ft		Ν			10		20	30		0	50			70	8	0	90
- 11-		Sandy Lean Clay (CL), brown to gray, moist, soft to stiff, trace organics - (Continued)		SPT	06	1.4	WOH-1-3						+		<b>-------------</b>	*	2						
-12	779.0																	· · · · · · · · · · · · · · · · · · ·			· · · · · · · · · · · · · · · · · · ·		
-13-		Lean Clay (CL), gray, moist, soft, medium plasticity		SPT	07	0.5	WOH-1-2							· · · · · · · · · · · · · · · · · · ·	4								
-14-																							
-15-	776.5								Ŀ					::	<u></u>			<u></u>			<u></u>		E
	775.9	Clayey Sand with Gravel, gray, wet, medium dense		SPT	08A	1.4	7-20-			0													E
-16-		Lean Clay, gray, wet, very stiff, little sand and gravel (till)		SPT	08B		50+/.4								<u> </u>								
- 17-		Dolomite, gray, slightly to moderately weathered, moderately to highly fractured, very fine grained, few shale laminations, flat to vertical																					
-19		fractures, tight to open fractures, flat, thin bedded, moderately hard to hard highly fractured 16.4'-17.2'		RC	01	4.5	14																
-20		LAF (30°) at 17.5' HJ at 17.6', shale lamination, tight																					
		LAJ (20°) at 17.7', open, rough																					
-21-		highly fractured 18.0'-19.2' VF 18.1'-18.3' HJ at 19.4'																					
		fractured 19.6'-20.1' VF 19.8'-20.0' HJ at 20.5', open, slightly																					
-23-		rough fractured 21.8'-22.0'																					



Client         MWCD         Boring Location         482,040.5 N; 1,649,993.9		
Project Number 174316204 Surface Elevation 791.5 ft Elevation Dat	um_NAVD88	
E SAMPLES UNDRAINED SHEAR STR		
(1)     (1) <td>3 4</td> <td>T-T</td>	3 4	T-T
Image: Solit/Rock description       Image: Solit/Rock description		W <sub>L</sub>
Image: Standard Penetrometer/Torvane       Image: Standard Penetrometer/Torvane		★ ●
ft 10 20 30 40 50	60 70 80	90
-24 HF at 22.3' RC 02 5.0 46 HJ at 22.4', open, rough		
HJ at 22.9', 23.1'		
-25 HAF (50°), 23.2'-23.4', tight highly fractured 23.6'-24.0',		Ē
25.9'-26.4'		
-26 HF at 24.4', tight 765.1 LAF (30°) at 24.5', tight		
HF at 24.7', 24.9', 25.0', tight		Ē
Boring terminated and backfilled with cement bentonite grout.		Ē
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		Ē
-30-		
		E
-31-		Ē
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-34-		
-35-		Ē
-36-		Ē
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-37-		Ē
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	Printed on 10/4	



									Sta	antec	Boriı	ng N	o. <b>_</b>	3-2.1	12b		
Clie	ent	MWCD				Bori	ng Locat	ion	482,040.	5 N; 1	,649	,993	.9 E				
Pro	oject Nur	nber 174316204				Surf	ace Elev	ation	791.5 ft	E	evati	on D	atum	<u>N/</u>	٩VD	88	
Pro	oject Nar	ne HCFRRP - Dry Storage Ba	asin I	Desigr	ו	Date	e Started		8/28/19	_ Co	omple	eted_		8/2	28/1	9	
Pro	oject Loo	cation Hancock County, Ohio				Dep	th to Wa	ter	N/A	_ Da	ate/Ti	ime _		N/	A		
Ins	pector	Stantec - E. Holcombe				Dep	th to Wa	ter	N/A	_ Da	ate/Ti	ime _		N/	A		
Dri	lling Cor	tractor Stantec - D. Clements				Drill	Rig Type	e and	ID CME	45T (	815)						
Ov	erburder	n Drilling and Sampling Tools (Ty	pe a	nd Siz	e) 3	3.25" I	D HSA, 3	3" ST									
Ro	ck Drillin	g and Sampling Tools (Type and	Size	e) <u>N/</u>	A												
Sa	mpler Ha	ammer Type Automatic We	eight	N/	A	D	rop <u>N/A</u>	۱	_ Effic	ciency	/ _	N/A					
Bo	rehole A	zimuth N/A (Vertical)			E	Boreho	ole Inclina	ation (1	from Vert	ical)_		Verti	cal				
(	l(ft)		5			SAMPL	ES			UNDF	RAINED			GTH - t <b>3</b>	sf	4	
DEPTH(ft)	ELEVATION(ff)	SOIL/ROCK DESCRIPTION	STRATA PLOT		۲. ۲	ERY	S / osi) / %)	K WELL		+			— Ì		W_		
DEP	-EVA	SOIL/ROCK DESCRIPTION	<b>TRAT</b>	ТҮРЕ	NUMBER	RECOVERY	BLOWS / PRESS.(psi) RQD (%)	MONITOR /	WATER CO						₩₽ ►	_ <del>0</del> _	<b>i</b>
	E		S		Ž	RE	PRE		Pocket Pe						/FOO	т	* •
- 0 -	791.5					ft		2		20 3						80	90
- 1		Overburden. See B-2.12a															Ē
- 1 -		boring log for detailed soil descriptions.		/   /ST	01	1.3	NR										
						1.0											Ē
- 2 -																	
																	Ë
- 3 -				/ / ST	02	1.3	NR										
					02	1.5											Ē
- 4 -																	Ē
4																	
- 5 -																	Ē
																	Ē
- 6 -																	Ē
																	Ë
- 7 -				ST	03	1.2	500										Ē
																	Ē
- 8 -																	Ē
- 9 -				ST	04	2.0	NR										
																	Ē
-10-		l	<u> </u>		I	I		L	1::::!:::	1::::	::::1	::::	::::	<u></u>	1::::	:1::	::Г



										Stantec Boring No. B-2.12b
Clie	ent	MWCD					Bori	ing Locat	tion	482,040.5 N; 1,649,993.9 E
Pro	ject Nur	nber 174316204					Sur	face Elev	vation	791.5 ft Elevation Datum_NAVD88
	(ft)		от			ę	SAMPL	ES	· ·	UNDRAINED SHEAR STRENGTH - tsf
DEPTH(ft)	ELEVATION(ft)		STRATA PLOT			R.	ïRΥ	\$ / () ()	VELL	
DEP1	EVA	SOIL/ROCK DESCRIPTION	RAT		түре	NUMBER	RECOVERY	SSS.(p	OR	WATER CONTENT & ATTERBERG LIMITS $H \longrightarrow H$
	EL		ST			ž	RE(	BLOWS / PRESS.(psi) / RQD (%)	MONITOR WELL PIEZOMETER	Pocket Penetrometer/Torvane (tsf)*STANDARD PENETRATION TEST, BLOWS/FOOT•
-10-							ft		2	10 20 30 40 50 60 70 80 90
		Overburden. See B-2.12a								
-11-		boring log for detailed soil descriptions (Continued)			ST	05	2.0	NR		
				1000 Million	01	05	2.0			
-12-										
				in the second second						
-13-					ST	06	2.0	NR		
					01		2.0			
-14-	777.5									
		Boring terminated and backfilled	with	n cei	mer	nt be	ntonit	e grout.		
-15-										
-16-										
-17-										
-18-										
-19-										
-20-										
-21-										
-22-										
-23-										
										Ę
										Printed on 10/4/19



									Stan	tec Bori	ng No.	B-2	2.13a	i 👘	_
Clie	ent	MWCD				Bori	ng Locat	ion <u>é</u>	481,106.5	N; 1,649	,845.5	Е			_
Pro	oject Nur	nber 174316204				Surf	ace Elev	ation	794.9 ft	Elevati	on Dat	um	NAVI	D88	_
Pro	oject Nar	he HCFRRP - Dry Storage Ba	asin [	Desigr	۱	Date	e Started		8/27/19	Compl	eted	ł	8/27/	19	_
Pro	oject Loo	ation Hancock County, Ohio				Dep	th to Wa	ter	10.0 ft	Date/T	ime		8/27/	19	_
Ins	pector	Stantec - E. Holcombe				Dep	th to Wa	te <u>r</u>	N/A	Date/T	ime		N/A		_
Dri	lling Con	tractor Stantec - D. Clements				Drill	Rig Type	e and	ID CME 45	T (815)					_
Ov	erburder	Drilling and Sampling Tools (Ty	pe ar	nd Siz	e)_3	3.25" I	D HSA, 2	2" SPT	Г						_
Ro	ck Drillin	g and Sampling Tools (Type and	l Size	e) <u>NC</u>	Q										_
Sa	mpler Ha	mmer Type Automatic We	eight	14	0 lb	Di	op _30 i	n	Efficie	ncy _	86.2				_
Bor	rehole A	zimuth N/A (Vertical)			B	oreho	le Inclina	ation (f	from Vertica	al)	Vertica	al			_
	(ft)		от		5	SAMPLE	ES	1		UNDRAINED			I - tsf		
(11)H.	NOL		A PLO		ĸ	RY	; / si) /	VELL		2	2 	3		4	
DEPTH(ft)	ELEVATION(ft)	SOIL/ROCK DESCRIPTION	STRATA PLOT	ТҮРЕ	NUMBER	RECOVERY	BLOWS / PRESS.(psi) RQD (%)	MONITOR WELL PIEZOMETER	WATER CON	TENT & AT	TERBERG	G LIMIT	™ <sub>P</sub> rs ⊢	W 	W I
	Ш		ST		N	REC	PRE: RG	PIEZ	Pocket Pene STANDARD F			. ,		от	*
•	794.9					ft		Ē	10 20	30 4		, всол 60	70	80	90
- 0 -		Silty Clay, brown, damp to													
		moist, medium stiff, low plasticity, trace sand and		SPT	01	0.9	1-5-3		σ						
- 1 -		gravel	$\square$												Ē
															Ë
- 2 -				SPT	02	0.6	3-4-3								
															Ë
- 3 -															
- 1		mottled (till) 3.3'-5.0'	$\square$	SPT	03	1.1	2-4-3						*		
- 4 -															
- 5 -		soft 5.0'-7.5'													
				SPT	04	0.9	3-2-2			<b>D</b>		*			
- 6 -									•						
		clayey sand in bottom of		8											
- 7 -	787.4	SPT-04													
	707.4	Sandy Silty Clay (CL-ML),													
- 8 -		gray, dry to damp, stiff, trace		SPT	05	1.0	3-4-7		0:1						
		sand (till)				1.0									Ë
- 9 -		quartz rock fragment (1") in		×											
		bottom of SPT-05													
-10			Ш₩	<u>z</u>											<u>ii</u> E



												S	ta	ntec	Boriı	ng N	No.	B-	2.1	l3a			
Clie	ent	MWCD					Bori	ing Locat	ion	48	1,1	106	6.5	N; 1	,649	,84	5.5	E				_	
Pro	oject Nur	nber 174316204					Sur	face Elev	ation	79	4.9	9 ft		Ele	evati	on [	Dati	ım	NA		288	_	
	(ft)		ч			s	AMPL	ES	1					UNDF	RAINED		R STR		TH - t	sf			
H(ft)	NOL		<b>PLOT</b>			ĸ	RY	/ si)/	IER IER	⊢			1		2	-		3			4		
DEPTH(ft)	ELEVATION(ff)	SOIL/ROCK DESCRIPTION	STRATA	TVDE		NUMBER	RECOVERY	BLOWS / PRESS.(psi), RQD (%)	MONITOR WELL PIEZOMETER	P	ocł	ket F	Per	netron	T & ATT neter/T TRATI	Forva	ane (	(tsf)			м — С	™ *	WI
10							ft		Σ		1		20				50	60		70	80	(	90
-10-	784.6		Ϋ́	S	РТО	)6A	1.5	5-10-14							*								Ē
		Poorly Graded Sand, gray, wet, dense, very fine to fine	8 8											0									Ē
-11-		grained	8 8 8 8	S	PTO	юв																	Ē
			8 8	8																			E
-12-			8 8								+++++++++++++++++++++++++++++++++++++++				<u></u>				<u></u>			<u>.</u>	E
			0 0 0 0																				Ē
-13-	781.8		8 8	s	рто	)7A	1.5	6-14-16															Ē
	781.3	Sandy Silt, gray, wet, very stiff,		s	РТО	)7B							o										Ē
		very fine grained sand	╔╋╋	s	РТО	)7C																	
-14-		Silty Sand with Gravel (SM), gray, wet, very dense, coarse	III	Ť																			Ē
		grained sand, medium coarse																					Ē
-15-		gravel	$\left \left \left \left \frac{1}{2}\right \right \right $								<u></u>			::::		:::: ::::			<u></u>			::: :::	E
		vortical brown alow poom																					E
-16-		vertical brown clay seam 15.5'-16.0'		S	PT	08	1.1	8-12-13				0			<u></u>	<u></u>			<u></u>			<u></u>	E
			III																				Ē
-17-																							Ē
			$ \uparrow\uparrow\uparrow $																				È
	776 0			s	РТО	)9A	1.0	3-7-50+/.1															Ē
-18-	776.8 776.4	Lean Clay, gray, moist, very		×	PTO						<u></u>												Ē
		stiff, trace gravel (till)	Ħ	8		эв					Ĩ												E
-19-		Dolomite, gray, slightly to	F	Π							::			::::: :::::	::::: :::::				:::			:::	Ē
		moderately weathered, moderately to highly fractured,	F																				-
-20-		flat bedded, flat to vertical	F		۲C	01	2.4	0							<u></u>	<u></u>			<u></u>			<u></u>	Ē
		fractures, few black	F	∎r			2.4	0															Ē
		laminations, moderately strong to strong, flat fractures are	F																				Ē
-21-		smooth, angled fractures are	F																				E
		slightly rough to rough VF 18.9'-19.4'	E																				Ē
-22-		fractured 20.0'-20.4',	E																			<u></u>	Ē
		20.8'-21.3'	F																				Ē
-23-		LAF (20°) at 21.6'																					ŧ
		moderately fractured 21.3'-25.0', flat, tight																					E
		- , - , - , - , - , - , - , - , - , - ,	ΓT																				F
1																							



											ç	Sta	ante	ec	Boi	ring	, N	o.	В	-2.	13a	1		
Clien	-	MWCD					ng Locat								,64								_	
Proje	ect Nur	nber <u>174316204</u>					face Elev	ation	<u>79</u>	94.9	91	t	-						-		AVI	78	8	
£	N(ft)		PLOT		<u>د</u> ا	SAMPL		_ - Γα					1	NDR	AINE	2 2	EAR	516	3. 3		151	4	4	
DEPTH(ft)	ELEVATION(ft)	SOIL/ROCK DESCRIPTION	STRATA P	ТҮРЕ	NUMBER	RECOVERY	BLOWS / PRESS.(psi) RQD (%)	MONITOR WELL PIEZOMETER	F	oc	ket	Pe	eneti	rom	& A letei TRA	/To	rva	ne (	(tsf)		<sup>₩</sup> ₽ ►	  от	W O	₩ <u>1</u> ★
						ft		≥			0		20	30		40	5		60		70	80	)	90
-24 -25 -26 -27 -27-		Dolomite, gray, slightly to moderately weathered, moderately to highly fractured, flat bedded, flat to vertical fractures, few black laminations, moderately strong to strong, flat fractures are smooth, angled fractures are slightly rough to rough - (Continued) <i>VF 24.6'-24.8'</i> <i>highly fractured 25.0'-25.2'</i> <i>moderately to highly fractured</i>		RC	02	6.8	37																	
- 29-	765.2	27.0'-28.1' rough, open joint (35°) at 27.5' HAF (75°) at 27.7' flat, tight fractures 28.1'-29.7'		RC	03	1.6	0							· · · · · · · · · · · · · · · · · · ·			••••							
-30 -31 -32 -33 -33 -34 -35 -36 -37 -37		Boring terminated and backfilled	with o	ceme	nt be	entonit	e grout.																	



										St	ante	ec Bo	oring	g No	. <b>B</b>	-2.1	l4a		_
Cli	ent	MWCD				Bori	ng Locat	ion 4	479,	527.	2 N	; 1,6	49,5	590.	0 E				_
Pro	oject Nur	nber 174316204				Surf	ace Elev	ation	794.4	4 ft	_	Eleva	atio	n Da	atum	N/	٩VD	)88	_
Pro	oject Nar	ne HCFRRP - Dry Storage Ba	asin [	Desigr	ı	Date	e Started	8	8/22/	/19	_ (	Com	plet	ed_		8/2	23/1	19	_
Pro	oject Loo	Cation Hancock County, Ohio				Dep	th to Wa	te <u>r</u> (	6.0 ft	t	_	Date	/Tin	ne _		8/2	22/1	9	_
Ins	pector	Stantec - E. Holcombe				Dep	th to Wa	te <u>r</u> l	N/A		_	Date	/Tin	ne _		N/	Α		_
Dri	lling Cor	tractor Stantec - D. Clements				Drill	Rig Type	e and I	D C	ME	45T	(81	5)						_
Ov	erburder	n Drilling and Sampling Tools (Ty	pe ar	nd Siz	e) 3	3.25" I	D HSA, 2	2" SPT	-										_
Ro	ck Drillin	g and Sampling Tools (Type and	l Size	e) <u>NC</u>	2														_
Sa	mpler Ha	ammer Type Automatic We	eight	14	0 lb	D	rop _30 i	n	_	Effi	cien	су	8	6.2					_
Во	rehole A	zimuth N/A (Vertical)			E	Boreho	ole Inclina	ation (f	rom	Ver	tical	)	V	ertic	al				_
	(ft)		от		5	SAMPL	ES	1			١U	NDRAIN		HEAR S			.sf		
(IJ)H.	NOL		A PLOT		R	RY	si) /	VELL			1		2		3			4	
DEPTH(ft)	ELEVATION(ff)	SOIL/ROCK DESCRIPTION	STRATA	ТҮРЕ	NUMBER	RECOVERY	BLOWS / PRESS.(psi) RQD (%)	MONITOR WELL PIEZOMETER	WAT	ER C	ONTE	ENT &	ATTE	ERBEF	rg Lin	NITS	₩ <sub>P</sub> ►	W 	W I
-	E		ST		R	REC	PRES	PIEZ				ometo NETR						)T	*
0	794.4					ft		ž			DРE 20	30	40	50	ы, вс 6(		70 70	80	90
- 0 -	\794.3/																		Ī
		Lean Clay, brown, damp to moist, medium stiff to stiff, low		SPT	01	0.2	WOH-2-3				0	*							E
- 1 -		plasticity, trace sand and silt																	E
																			Ē
- 2 -				SPT	02	0.8	4-5-4				0	*							
	791.4																		Ë
- 3 -	101.1	Sandy Lean Clay, brown and	$\square$																
		gray mottled, damp to moist,		SPT	03	1.5	3-3-3				0	*							
- 4 -		medium stiff, medium plasticity							•							<u></u>		<u> </u>	::E
	789.4			8															
- 5 -	709.4	Silty Clay, brown, damp, soft,	$\square$																
	700 4	low plasticity		SPT	04A	0.5	1-2-1												
- 6 -	788.4	Poorly Graded Sand, gray,		SPT	n/P											<u></u>			
	787.9	wet, loose, very fine to fine			040														Ē
- 7 -		grained Silt with Sand (ML), gray, wet,													:::: ::::	<u></u>		<u>: : :</u> : : : :	
		very soft, very fine grained		8															
- 8 -		sand, trace clay														<u></u>			
				SPT	05	1.5	WOH- WOH-1				*			0					
- 9 -				8												<u></u>			::E ::F
-10-	784.4															<u></u>			<u>;;</u> [



											:	Sta	inte	ec	Bori	ng l	No.	В	-2.	14a	3		
Clie	-	MWCD					ing Locat		_						,649							_	
Pro	oject Nur	nber 174316204				Sur	face Elev	ation	79	94.	41	t	-		evati			-			D88	}	
	٩(ft)		PLOT		5	SAMPL	ES						υ 1	INDR.	AINED		R STI	RENG		tsf	4		•
DEPTH(ft)	ELEVATION(ft)	SOIL/ROCK DESCRIPTION	STRATA PL	ТҮРЕ	NUMBER	RECOVERY	BLOWS / PRESS.(psi) / RQD (%)	MONITOR WELL PIEZOMETER							& AT	TERE		G LIN	MITS	₩ <u>∓</u>		 	W <sub>L</sub> 
						ft	ä	рм М							TRATI							•	)
-10-		Clavay Sand brown wat		8					+:	:::	10	2 ::::	0  ::	30 : : :	) 4( ::::	) :::	50	60	) :::	70	80		90 :  -
- 11		Clayey Sand, brown, wet, dense, medium grained sand orange seashell (1/4") at 11.0'		SP1	06	0.4	4-7-6							0									
-12																							
-13	781.9	Silty Sand (SM), gray, wet, medium dense, medium coarse grained		SPI	07A	1.5	8-13-9					ŗ	•	· · · · · · · · · · · · · · · · · · ·									
-14-	100.1	Dolomite stone fragment 13.5'-13.7'		SPI	07B												*						Ē
-15		Sandy Lean Clay (CL), gray, moist, stiff to very stiff, trace rounded medium grained sand																					
- 16		(till) white stone fragment (1/4") at 13.8'		SPI	08	0.2	4-6-9					•											
-17		dolomite stone fragment in SPT-08																	<u></u>	· · · · · · · · · · · · · · · · · · ·			
-18-		brown mottled 17.5'-19.0'		SPI	09	0.7	10-12-12				1	•	1	· · · · · · · · · · · · · · · · · · ·			*						
-19 - -20																							
-21-	773.4			SPI		1.1	5-5-50+/.2			0													***
-22		Dolomite, gray, few shale laminations, slightly weathered, moderately fractured, smooth to slightly rough laminations, flat thin bedded, fractures along		RC	01	0.2	0							· · · · · · · · · · · · · · · · · · ·									
		bedding plane (mostly in shale laminations)																					



											Sta	ant	ec	Bor	ing l	No	<b>B-</b> 2	2.1	4a		_
Cli	ent	MWCD				Bori	ing Locat	tion	479	9,52	27.	2 N	l; 1	,649	9,59	0.0	Ξ				-
Pro	oject Nur	mber 174316204				Sur	face Elev	vation	794	1.4	ft	_	Ele	evat	ion l	Datu	m_	NA	VD	88	-
	l(ft)		PLOT			SAMPL	ES					ι 1	JNDF		) SHEA 2	R STRE	ENGT	H - ts	f	4	
DEPTH(ft)	ELEVATION(ft)	SOIL/ROCK DESCRIPTION	STRATA PL	түре	NUMBER	RECOVERY	BLOWS / PRESS.(psi) / RQD (%)	MONITOR WELL PIEZOMETER	Po	ocke	t Pe	enet	tron	T & AT	 TERE /Torva	BERG ane (t	LIMI Sf)				₩ <sub>L</sub>
						ft		Σ		10		20	30				60	7		80	90
-24 -25 - 26-		Dolomite, gray, few shale laminations, slightly weathered, moderately fractured, smooth to slightly rough laminations, flat thin bedded, fractures along bedding plane (mostly in shale laminations) - (Continued)		RC	02	5.0	30														
-27 -28 -29 -30 -31	763.0	hydrocarbon odor at 21.0' LAF (20°) 21.2'-21.3' HF at 21.4', 21.5', 21.6', 22.0', 22.3', 22.4', 22.8' VF 22.6'-22.7' vug cavity at 23.2' severely fractured 23.6'-23.9' HF at 24.1', 24.3', 24.4', 24.7', 25.3', 26.3' LAF (10°) at 25.2', 25.6', 26.0' highly fractured 26.4'-26.7' LAF (10°) at 26.7' HF at 27.1', 27.2', 27.4', 27.8' LAF (10°) at 27.6', 28.1' HF 28.3', 28.5' (rough), 29.0'		RC	03	5.0	10														
-32 -33 -34 -35 -36 -36 -37		highly fractured with some vertical fractures 29.4'-30.3' highly fractured 30.9'-31.4' Boring terminated and backfilled		ceme	nt be	entonit	e grout.														
																				4.0	///10



										Sta	ntec	: Bori	ing	No	. <b>B</b> -	2.1	ja		
Clie	ent	MWCD				Bori	ng Locat	ion	478,6	518.1	N;	1,649	9,75	58.8	ΒE				
Pro	ject Nur	nber 174316204				Surf	ace Elev	ation	797.4	ft	E	levat	ion	Da	tum	NA	VD8	38	
Pro	ject Nar	ne HCFRRP - Dry Storage Ba	asin [	Design	ı	Date	e Started		8/21/	19	С	ompl	ete	d_		8/2	1/19	}	
Pro	ject Loo	tation Hancock County, Ohio				Dep	th to Wa	ter	7.9 ft		D	ate/T	īme	e _		8/2	1/19	)	
Ins	pector	Stantec - E. Holcombe				Dep	th to Wa	ter	N/A		D	ate/T	īme	e _		N/A			
Dri	lling Con	tractor Stantec - D. Clements				Drill	Rig Typ	e and	ID CI	ME 4	5T (	(815)							
Ov	erburder	n Drilling and Sampling Tools (Ty	pe ai	nd Siz	e) 3	3.25" I	D HSA, 2	2" SPT	Γ										
Ro	ck Drillin	g and Sampling Tools (Type and	Size	e) <u>NC</u>	2														
Sa	mpler Ha	ammer Type Automatic We	eight	14	0 lb	D	rop <u>30</u> i	in	_	Effici	enc	у _	86	.2					
Bo	ehole A	zimuth N/A (Vertical)			. E	Boreho	ole Inclina	ation (f	from `	Verti	cal)		Ve	ertica	al				
-	(#)		ы		5	SAMPL	ES	-				RAINED	SHE	AR ST	rreng <sup>.</sup> 3	"H - tsf		4	•
DEPTH(ft)	NOIT	SOIL/ROCK DESCRIPTION	A PL		Ř	RΥ	\$ / () () (	WELL										+ 	
DEP'	ELEVATION(ft)	SUIL/RUCK DESCRIPTION	STRATA PLOT	ТҮРЕ	NUMBER	RECOVERY	BLOWS / PRESS.(psi) RQD (%)	OR				T & AT				ITS	'P 	- <del>0</del>	
	EI		ST	-	ž	RE	BI PRE R(	MONITOR				meter/ ETRAT			• •	WS/F	оот		*
- 0 -	797.4					ft		Z	1(				0	50	60	70		80	90
	\ <b>797.2</b> /																		Ē
		Silty Clay, brown, damp to moist, stiff, trace sand		SPT	01	0.7	2-4-5			0				*					Ē
- 1 -	795.9																		Ē
		Sandy Silty Clay, light brown,																	Ē
- 2 -		dry, very stiff		SPT	02	0.9	4-6-9												×
	794.4		$\square$																Ē
- 3 -		Lean Clay, brown and orange	$\square$																Ē
		mottled, moist, very stiff, trace sand		SPT	03	0.7	6-8-8			Ø							1	•	Ē
- 4 -		ound								•									Ē
	792.4																		
- 5 -		Lean Clay, brown and gray																	Ē
- 1		mottled, damp to moist, very stiff, trace coarse sand	$\square$	SPT	04	1.2	3-7-8			0									×
- 6 -		(rounded)								•									÷Ē
				×															Ē
- 7 -		quartz fragment (1/2") at 7.7'								<u></u>									÷È
	789.5			, SPT	05A	0.8	2-6-9												Ē
- 8 -		Silty Sand with Gravel (SM),	<b>↓</b> ↓							α									÷È
		gray and brown, wet, dense,		SPT	05B														
- 9 -		medium to coarse sand, medium to coarse gravel		×															
		Ŭ																	Ē
-10			†   †						1::::	::::				:: :	::: :	:::			<u>; F</u>



	4					Deri			47				ntec		-			.15	a		
	ent piect Nur	MWCD nber 174316204					ing Locat face Elev						N; 1 Fle	,649 evatio				JAV	/D8	8	
						SAMPL				<u>··</u>		_		AINED							<u> </u>
(£	DN(ft		PLOT					ВĽ.				1		2			3		4	ŀ	
DEPTH(ft)	ELEVATION(ft)	SOIL/ROCK DESCRIPTION	STRATAI	ТҮРЕ	NUMBER	RECOVERY	BLOWS / PRESS.(psi) RQD (%)	MONITOR WELL PIEZOMETER	P	ocl	ket F	Per	NTENT netrom PENE	neter/1	orva	ne (ts	f)		Р ————————————————————————————————————	W 0	₩ <sub>⊥</sub> 
-10-						ft				1	0	20	30	40	) 5	0 6	60 	70	. 80	)	90
-11-		Silty Sand with Gravel (SM), gray and brown, wet, dense, medium to coarse sand, medium to coarse gravel -		SPT	06	1.0	4-9-11			c		•									
-12-		(Continued) more gravel at 11.0'										· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·						
-13-		brown clay seam 12.8'-13.4' less clay at 13.5'		SPT	07	1.5	8-13-16				0										
-14-																					
- 16-	781.4			SPT	08A	1.5	8-10-15				:0		•								
-17-		Limestone with Shale Interbedded (60/40%), gray, slightly to moderately weathered, very fine grained,		SPT	08B							· · · · · · · · · · · · · · · · · · ·									
-18-		highly to moderately fractured, moderately hard, slightly rough, flat, thin bedding, most fractures along bedding		SPT	09	0.2	50+/.2					· · · · · · · · · · · · · · · · · · ·									
-19 - -20-		planes highly weathered, wet shale seam 17.5'-17.6' VF 17.7'-17.9'		RC	01	2.5	0														
-21-	775 0	highly fractured 17.7'-18.8' LAF (30°) 18.6'-18.8' shale laminations at 18.9', 19.8'	E									· · · · · · · · · · · · · · · · · · ·									
-22	775.9	HAF (45°) at 19.3' highly fractured 19.5'-19.7' HF at 21.2' VF 21.4'-21.6' Dolomite (See next page for																· · · · · · · · · · · · · · · · · · ·			
-23-		full description)		RC	02	4.5	22														



									Star	ntec Bori	ng No.	B-2.1	5a	_
Clie	ent	MWCD				Bori	ing Locat	ion	478,618.1	N; 1,649	,758.8 E			_
Pro	ject Nur	nber 174316204		1	-	Sur	face Elev	ation	797.4 ft	Elevati	on Datu	m NA	VD88	_
	(ft)		Б		5	SAMPL	ES	-	1	UNDRAINED		NGTH - ts 3	f 1	
DEPTH(ft)	ELEVATION(ft)	SOIL/ROCK DESCRIPTION	A PLOT		К	ERY	S / psi) / %)	MONITOR WELL PIEZOMETER						w <sub>T</sub>
DEP	LEVA		STRATA	ТҮРЕ	NUMBER	RECOVERY	BLOWS / PRESS.(psi) RQD (%)	TOR	WATER CON Pocket Pen				<b>⊢</b> ⊖	
	ш		S		Z			MON	STANDARD				FOOT	•
						ft		_	10 20	30 40	) 50	60 7	0 80	90
-24-		Dolomite, gray, slightly weathered, very fine grained,												
		moderately to highly fractured,												
-25-		moderately hard to hard, slightly rough to rough,												Ē
		laminated, thin bedding,												Ē
-26-		slightly micaceous - (Continued)												
		HF at 21.8', 21.9'		RC	03	1.5	27							
-27-	769.8	moderately fractured 22.2'-22.7'												
	703.0	highly fractured 22.7'-24.5'	┢╧╼╡										::::::	Ē
-28-		VF 24.9'-25.1' two VFs 27.1'-27.4'												Ē
		highly fractured 27.4'-27.7'												Ē
-29-		Boring terminated and backfilled	with	ceme	nt be	entonit	e grout.							Ē
														Ē
-30-														Ē
														Ē
-31-														Ē
														Ē
-32-														Ē
														Ē
-33-														Ē
														Ē
-34-														Ē
														Ē
-35-														Ē
														Ē
-36-														Ē
														Ē
-37-														Ē
														Ē
											D	intod	on 10/	14/10



											St	ante	c B	orin	ng N	lo. <b>E</b>	3-2	.15	b		
Clie	ent	M	WCD			-	Bori	ng Locat	ion	478,0	618.	1 N;	1,6	49,	758	5.8 E					
Pro	oject Nur	nber 17	74316204			-	Surf	face Elev	ation	797.4	4 ft	_ E	Elev	atic	on D	atun	n N	IAV	D8	38	
Pro	oject Nar	ne <u>H</u>	CFRRP - Dry Storage Ba	asin D	Desigi	n	Date	e Started		8/21/	/19	_ (	Corr	ple	ted		8	/21	/19	)	
Pro	oject Loo	cation _	Hancock County, Ohio			-	Dep	th to Wa	ter	7.5 fl	t	_ [	Date	e/Ti	me		88	/21	/19	}	
Ins	pector		Stantec - E. Holcombe			-	Dep	th to Wa	ter	N/A		_ [	Date	e/Ti	me		<u> </u>	I/A			
Dri	lling Cor	ntractor	Stantec - D. Clements			-	Drill	Rig Typ	e and	ID C	ME	45T	(81	5)							
Ov	erburder	n Drilling	and Sampling Tools (Ty	pe ar	nd Siz	<u>ze) (</u>	3.25" I	D HSA, S	3" ST												
Ro	ck Drillin	ig and Sa	ampling Tools (Type and	Size	) <u>N</u> /	A															
Sa	mpler Ha	ammer T	ype Automatic We	eight	N/	A	D	rop <u>N/A</u>	۱	_	Effic	cien	су	<u> </u>	N/A						
Bo	rehole A	zimuth	N/A (Vertical)		1	_ E	Boreho	ole Inclina	ation (1	from	Ver	ical	)	١	/erti	cal				_	
~	l(ft)			5			SAMPL	ES				UN 1	IDRAIN	NED S	HEAR	STREN	іGTH⊸ <b>3</b>	- tsf		4	▲
DEPTH(ft)	ELEVATION(ft)	SOIL	ROCK DESCRIPTION	STRATA PLOT		БR	ERY	S / psi) / %)	MONITOR WELL PIEZOMETER			İ		Ē			-	w		 w	
DEP	LEVA	UUIL/		<b>FRAT</b>	ТҮРЕ	NUMBER	RECOVERY	BLOWS / PRESS.(psi) RQD (%)	ZOME							ERG LI		3 1	P	-0	— <b>1</b>
	Ш			ò		z	RE	B R R R	NON!	1						ne (ts <sup>.</sup> EST, BI	,	S/FC	ют		*
- 0 -	797.4						ft		~			20	30	40			0	70		80	90
			ırden. See B-2.15a log for detailed soil																		Ē
- 1 -		descrip			/ / ST	01	2.0	500													Ē
																					Ē
- 2 -					/																Ē
																					Ē
- 3 -					/ / ST	02	1.6	500													Ē
						0-															Ē
- 4 -					//																Ē
- 5 -					/ I st	03	1.3	500													Ē
							1.0	000													
- 6 -					/																Ē
_																					Ē
- 7 -					/   / ST	04	1.5	500													
1						04	1.5	500													Ē
- 8 -	789.4			-																	
0		Boring te	erminated and backfilled	with o	ceme	nt be	entonit	e grout.													
0																					
- 9 -																					
-10-																					
10-																					



									Star	ntec Bo	ring	No. <b>B</b>	8-2.1	6a		_
Clie	ent	MWCD				Bori	ng Locat	ion 4	477,934.3	N; 1,64	49,76	4.5 E				_
Pro	ject Nur	nber 174316204				Surf	ace Elev	ation	796.9 ft	Eleva	ation	Datum	NA	٧D	88	_
Pro	ject Nar	ne HCFRRP - Dry Storage Ba	asin [	Desigr	า	Date	e Started		8/20/19	Com	oleteo	dt	8/2	20/1	9	_
Pro	ject Loo	cation Hancock County, Ohio	rr 174316204 HCFRRP - Dry Storage Basin Design on Hancock County, Ohio Stantec - E. Holcombe Depth to Water 4.0 ft Date/Time 8/20/19 Depth to Water 4.0 ft Date/Time 8/21/19 Depth to Water 4.0 ft Date/Time 8/21/19 Pocket Penetrometer/Towne (st) ** stanuare benetrometer/Towne (st) ** stanuare benetrometer/Towne (st) ** stanuare benetrometer/Towne (st) ** Date 5.0 ft Date/Time 8/2 ft													
Ins	pector	Stantec - E. Holcombe				Dep	th to Wa	te <u>r</u>	4.0 ft	Date	/Time	•	8/2	21/1	9	_
Dril	ling Cor	tractor Stantec - D. Clements				Drill	Rig Type	e and	ID CME 4	5T (81	5)					_
Ove	erburder	n Drilling and Sampling Tools (Ty	pe a	nd Siz	e) 3	3.25" I	D HSA, 2	2" SPT	Г							_
Ro	ck Drillin	g and Sampling Tools (Type and	l Size	e) <u>NC</u>	Q											_
Sar	npler Ha	ammer Type Automatic We	eight	14	0 lb	D	rop <u>30</u> i	in	Efficie	ency	86.	2				_
Bor	ehole A	zimuth N/A (Vertical)			B	oreho	ole Inclina	ation (f	from Vertic	al)	Ver	tical				_
	ft)		F		S	SAMPL	ES	/		UNDRAIN				ſ		
H(ft)	)NOL		A PLO		R	RY	))/	/ELL TER	1		2		3		4	
DEPTH(ft)	ELEVATION(ft)	SOIL/ROCK DESCRIPTION	RAT/	.ΥPE	MBE	OVE	g) CWS (%) CWS (%) CWS	OR V OME	WATER COM	NTENT & A	ATTER	BERG LII	MITS	₩ <sub>P</sub> ►	W 	W <sub>I</sub>
-	Ц		ST		N	REC	PRES	ONIT							Ŧ	*
•	796.9					ft		ž								90
0	796.4	Topsoil														E
		Sandy Lean Clay (CL), brown,		SPT	01	0.7	2-3-4			0		*				
1-		•														Ē
		inoutant plactory														Ē
2				SPT	02	1.2	2-4-5			> · · · · · · · · · · · · · · · · · · ·		*				Ë
.		bulk sample 0.0'-5.0'							· · · • • · · • •							Ē
3-		brown and gray mottled after														
		3.0'		SPT	03	1.4	3-4-4		*							
4				Z					••••••••••••••••••••••••••••••••••••••							<u></u> E
				8												
5		more silty at 5.0'														
				SPT	04	03	1-1-3									
6						0.0			•						: :: : :: : ::	
				8												
7											<u>:</u> : : ::::					
	700.0			Верт	054	0.6	4.5.6									
8	788.9				05A	0.0	4-5-6			×						
			<b>RRR</b>	SPT	05B											
9		brown, wet, medium dense,	R R R	8												
		medium to coarse sand, angular to rounded	8 8 8													
10 <sup>-</sup>			×××													Ē



											Sta	ante	ec B	Bori	ng N	lo. <b>E</b>	3-2.	16a	l	_
Clie	ent	MWCD			_	Bori	ng Locat	ion	47	7,9	34.3	3 N;	; 1,6	649	,764	4.5 E				_
Pro	ject Nur	nber 174316204		1	_	Sur	face Elev	vation	79	6.9	ft	_ E	Elev	/ati	on E	Datur	n N	AVI	288	
	(ft)		PLOT			SAMPL	ES	-				UN 1	IDRAI	ined 2		STREM	ідтн - <b>3</b>	tsf	1	
DEPTH(ft)	NOIL	SOIL/ROCK DESCRIPTION	A PL		R.	ΕRΥ	S / Ssi) / %)	VEL	$\vdash$			i –			-			TAT.	+	- W -
DEP	ELEVATION(ft)	SOIL/ROCK DESCRIPTION	STRATA	ТҮРЕ	NUMBER	RECOVERY	BLOWS / PRESS.(psi) RQD (%)	MONITOR WELL PIEZOMETER								ERG L		F	O	
	E		ی ا		z	RE	PRE R									ine (ts EST, B		S/FO	ЭТ	*
-10-						ft		2		10		20	30	4(				70	80	90
		Silty, Clayey Gravel with Sand	A A																	
-11-		(GC-GM), gray and dark brown, wet, medium dense,	A A	SP.	Т 06	1.0	10-10-10			0	H	<b> </b>								
		medium to coarse sand,	N N																	
		angular to rounded - (Continued)	A A																	
-12-		more gravel 10.0'-11.5'	S S S																	
	783.9	white sandstone fragments 10.2'-10.3'		SP.	T07A	1.2	4-27-43													
-13-		Dolomite, gray, moderately																		
		hard to hard, very fine grained,		SP	тотв															
-14-		highly fractured, flat to vertical fractures, laminated, flat																		
		bedding, slightly weathered,																		
-15-		fractures are slightly rough dolomite rock fragment (1.5")		SP'	T 08	0.1	50+/.1													
		in bottom of SPT-08		RC	01	1.1	0													
-16-																				
-17-		highly fractured 16.9'-20.2'																		
-18-				RC	02	1.8	15													
-19-																				
-20-																				
		VF 20.2'-20.5' moderately fractured																		
-21-		20.5'-23.1'											: : : :		<u></u>					
		fractured 20.6'-20.8'																		
-22-		flat, slightly weathered joint at 21.2'													<u></u>					
		MF at 21.8', 22.0' high fractured 22.3'-22.5'																		
-23-		VF 22.5'-22.8'					05								<u></u>					
				RC	03	4.5	35													
=			Ë																	<u>:::</u> F



Page: 3 of 3

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												St	an	ite	сI	Bo	rin	ıg l	Nc	) <b>I</b>	3-2	2.1	6a		_	
Clie	ent	MWCD				Bori	ing Locat	tion	47	7,	93	84.	3	N;	1,	,64	9,	76	4.	5 E					_	
Pro	ject Nur	mber 174316204		1		Sur	face Elev	vation	79	6.	9 1	ft									_			88		
G	V(ft)		PLOT		:	SAMPL	ES						1	UN	IDR/	AINE	ED S 2	HEA	AR S	TRE	NGTH 3	I - tsf		4		
DEPTH(ft)	ELEVATION(ft)	SOIL/ROCK DESCRIPTION	TA PL	щ	ER	ΈRΥ	/S / (psi) / %)	WELL	┢				+				+				ł		Wp	W	W	L
DEF	ILEVI		STRATA	ТҮРЕ	NUMBER	RECOVERY	BLOWS PRESS.(ps RQD (%)	MONITOR												RG L e (ts	IMIT :f)	S	Ļ	-0	+	F
	ш		S		2		<b>n</b> Kr	MON													LOV	VS/F	-00	т	•	
-24-				m		ft			<u> </u> :	1	10	: : :	20		30 :	:::	40		50 : _ :	6	60   : :	70	) :::	80	90 <u>  : : :</u>	
		Dolomite, gray, moderately hard to hard, very fine grained,																								
-25-		highly fractured, flat to vertical																								
		fractures, laminated, flat bedding, slightly weathered,																								
		fractures are slightly rough -																								
-26-		(Continued) flat fractures 23.5'-24.2'						-			:															
		VF 25.7'-26.2'																								_
-27-		flat shale seams (1/8") 26.8'-29.0'																								_
																										_
-28-																										
				RC	04	4.4	0																			
-29-																										
		highly fractured 29.3'-31.2'																								_
-30-																										_
-31-	765.7						40.000/		÷																	_
		Boring terminated and backfilled bentonite grout to surface.	with	bento	nite	pellets	s to seal l	госк со	ore	e s	:00	CKE	ЭΪ,	tr	ier	מר	ac	CKTI	iie	a v	vitn	CE	eme	ent		
-32-																										_
																										_
-33-																										
-34-																										_
																										_
-35-																										_
																									Ē	_
-36-																										_
-37-																										_
	_																							_		_
																				_		1		10	11/1	_

# APPENDIX B LABORATORY TEST RESULTS



#### **Moisture Content of Soil**

ASTM D 2216

	-			-		-					Tested by	
Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"						
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000				٦	Test Method	ASTM
Material Type: <u>Str</u> atified, <u>Lam</u> inated, <u>Len</u> sed,	Homogeneous, [	<u>Dist</u> urbed	-	-	-	-		-	-			
					Maximum	Mat	erial	Pass Min.		Wet Soil &	Dry Soil &	
			Date	Material	Particle	Excl	uded	Mass?	Can Weight	Can Weight	CanWeight	Moisture
Source		Lab ID	Tested	Туре	Size	Amount	Size	(Y/N)	(g)	(g)	(g)	Content (%)
<mark>B-1.1, 0.0'-1.5'</mark>		70	9/5/19	Dist	No. 4			No	30.54	137.20	120.14	19.0
<mark>B-1.1, 1.5'-3.0'</mark>		71	9/5/19	Hom	No. 10			Yes	32.31	103.17	90.78	21.2
<mark>B-1.1, 3.0'-4.5'</mark>		72	9/5/19	Hom	No. 10			Yes	31.89	134.91	117.95	19.7
<mark>B-1.1, 5.0'-6.5'</mark>		73	9/5/19	Hom	No. 10			Yes	31.56	113.31	99.71	20.0
<mark>B-1.1, 7.5'-9.0'</mark>		74	9/5/19	Hom	No. 10			Yes	30.78	109.50	95.83	21.0
<mark>B-1.1, 10.0'-11.</mark> 5'		75	9/5/19	Dist	No. 4			No	32.09	110.57	100.06	15.5
<mark>B-2.14A, 0.0'-1.</mark> 5'		77	9/5/19	Dist	No. 4			No	32.20	116.03	100.19	23.3
<mark>B-2.14A, 1.5'-3.</mark> 0'		78	9/5/19	Hom	No. 10			Yes	30.73	99.84	86.01	25.0
<mark>B-2.14A, 3.0'-4.</mark> 5'		79	9/5/19	Hom	No. 10			Yes	31.66	118.48	102.68	22.2
<mark>B-2.14A, 5.0'-6.</mark> 5'		80	9/5/19	Dist	No. 4			No	30.62	112.20	95.11	26.5
<mark>B-2.14A, 7.5'-9.</mark> 0'		81	9/5/19	Hom	No. 10			Yes	30.55	128.13	96.84	47.2
<mark>B-2.14A, 10.0'-1</mark> 1.5'		82	9/5/19	Dist	No. 4			No	31.75	102.29	86.06	29.9
<mark>B-2.14A, 12.5'-1</mark> 4.0'		83	9/5/19	Dist	No. 4			No	32.26	133.74	117.32	19.3
<mark>B-2.14A, 15.0'-1</mark> 6.5'		84	9/11/19	Dist	No. 4			No	30.93	70.61	65.02	16.4
<mark>B-2.14A, 17.5'-1</mark> 9.0'		86	9/11/19	Hom	No. 10			Yes	30.61	71.16	64.97	18.0
<mark>B-2.14A, 20.0'-2</mark> 1.2'		87	9/11/19	Hom	No. 10			Yes	32.02	102.39	98.25	6.3
<mark>B-2.15A, 0.0'-1.</mark> 5'		88	9/5/19	Hom	No. 10			Yes	32.26	114.72	102.06	18.1
<mark>B-2.15A, 1.5'-3.</mark> 0'		89	9/5/19	Hom	No. 10			Yes	32.23	117.60	104.65	17.9
<mark>B-2.15A, 3.0'-4.</mark> 5'		90	9/5/19	Hom	No. 10			Yes	31.02	120.46	106.95	17.8
<mark>B-2.15A, 5.0'-6.</mark> 5'		91	9/5/19	Hom	No. 10			Yes	30.88	110.23	97.81	18.6
<mark>B-2.15A, 7.9'-9.</mark> 0'		93	9/5/19	Dist	No. 4			No	30.70	113.09	102.46	14.8
<mark>B-2.15A, 10.0'-1</mark> 1.5'		94	9/5/19	Dist	No. 4			No	30.70	134.58	125.73	9.3
<mark>B-2.15A, 12.5'-1</mark> 4.0'		95	9/5/19	Dist	No. 4			No	32.01	106.38	98.18	12.4
<mark>B-2.15A, 15.0'-</mark> 16.0'		96	9/5/19	Dist	No. 4			No	31.88	130.10	118.22	13.8
<mark>B-2.16A, 0.0'-1.</mark> 5'		97	9/5/19	Hom	No. 10			Yes	31.81	99.37	86.90	22.6
<mark>B-2.16A, 1.5'-3.</mark> 0'		98	9/5/19	Hom	No. 10			Yes	32.05	96.06	84.64	21.7
<mark>B-2.16A, 3.0'-4.</mark> 5'		99	9/5/19	Hom	No. 10			Yes	32.14	105.01	92.37	21.0
B-2.16A, 5.0'-6.5'		100	9/5/19	Dist	No. 4			No	32.16	80.54	73.58	16.8



#### Moisture Content of Soil

ASTM D 2216

				-							· colou Dy	
Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"						
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000				٦	Test Method	ASTM
Material Type: <u>Str</u> atified, <u>Lam</u> inated, <u>Len</u> sed, <u>Hom</u>	ogeneous, <u>[</u>	<u>Dist</u> urbed										
					Maximum	Mate	erial	Pass Min.		Wet Soil &	Dry Soil &	
			Date	Material	Particle	Exclu	uded	Mass?	Can Weight	Can Weight	CanWeight	Moisture
Source		Lab ID	Tested	Туре	Size	Amount	Size	(Y/N)	(g)	(g)	(g)	Content (%)
<mark>B-2.16A, 8.0'-9.</mark> 0'		102	9/5/19	Dist	No. 4			No	32.21	106.08	90.23	27.3
<mark>B-2.16A, 10.0'-1</mark> 1.5'		103	9/5/19	Dist	No. 4			No	31.80	105.15	99.83	7.8
<mark>B-2.16A, 12.5'-1</mark> 3.0'		104	9/5/19	Dist	No. 4			No	32.32	104.49	97.63	10.5



#### **Moisture Content of Soil**

ASTM D 2216

											Tested by	
Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"						
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000				T	Fest Method	ASTM
Material Type: <u>Str</u> atified, <u>Lam</u> inated, <u>Len</u> sed,	<u>Hom</u> ogeneous, <u>[</u>	<u>Dist</u> urbed		-								
					Maximum	Mat	erial	Pass Min.		Wet Soil &	Dry Soil &	
			Date	Material	Particle	Excl	uded	Mass?	Can Weight	Can Weight	CanWeight	Moisture
Source		Lab ID	Tested	Туре	Size	Amount	Size	(Y/N)	(g)	(g)	(g)	Content (%)
<mark>B-1.2, 0.0'-1.5'</mark>		105	9/11/19	Hom	No. 4			No	32.21	117.94	104.90	17.9
<mark>B-1.2, 1.5'-3.0'</mark>		107	9/11/19	Hom	No. 10			Yes	32.19	101.08	89.82	19.5
<mark>B-1.2, 3.0'-4.0'</mark>		108	9/11/19	Hom	No. 10			Yes	30.55	117.98	101.91	22.5
<mark>B-1.2, 4.0'-4.5'</mark>		109	9/11/19	Dist	No. 4			No	30.72	92.73	80.84	23.7
<mark>B-1.2, 5.0'-6.5'</mark>		110	9/11/19	Dist	No. 4			No	32.14	125.41	117.61	9.1
<mark>B-1.2, 7.5'-9.0'</mark>		111	9/11/19	Dist	No. 4			No	32.33	115.04	98.70	24.6
<mark>B-1.2, 10.0'-11.</mark> 5'		112	9/11/19	Dist	No. 4			No	31.74	120.75	103.98	23.2
<mark>B-1.2, 12.5'-14.</mark> 0'		113	9/11/19	Dist	No. 4			No	32.30	102.67	94.79	12.6
<mark>B-1.2, 15.0'-16.</mark> 5'		114	9/11/19	Dist	No. 4			No	32.19	118.82	109.09	12.7
B-1.3, 0.0'-1.5'		115	9/11/19	Hom	No. 10			Yes	32.13	100.94	88.80	21.4
B-1.3, 1.5'-3.0'		116	9/11/19	Hom	No. 10			Yes	32.02	92.68	81.30	23.1
B-1.3, 3.0'-4.5'		117	9/11/19	Hom	No. 10			Yes	32.09	90.08	79.65	21.9
<mark>B-1.3, 5.0'-6.5'</mark>		118	9/11/19	Hom	No. 10			Yes	32.33	89.59	79.48	21.4
<mark>B-1.3, 7.8'-9.0'</mark>		120	9/11/19	Hom	No. 10			Yes	32.01	90.76	77.17	30.1
<mark>B-1.3, 10.0'-10.</mark> 6'		121	9/11/19	Dist	No. 10			Yes	31.22	108.85	97.57	17.0
<mark>B-1.3, 10.6'-11.</mark> 5'		122	9/11/19	Hom	No. 10			Yes	30.93	94.06	83.18	20.8
<mark>B-1.3, 12.5'-14.</mark> 0'		123	9/11/19	Hom	No. 10			Yes	32.07	106.43	93.12	21.8
<mark>B-1.3, 15.0'-16.</mark> 5'		124	9/11/19	Hom	No. 10			Yes	32.05	114.01	101.39	18.2
<mark>B-2.10, 0.0'-1.5</mark> '		127	9/11/19	Hom	No. 10			Yes	32.09	112.05	100.92	16.2
<mark>B-2.10, 1.5'-3.0'</mark>		128	9/11/19	Hom	No. 10			Yes	31.90	98.48	89.13	16.3
B-2.10, 3.0'-4.5'		129	9/11/19	Hom	No. 10			Yes	30.60	97.63	89.32	14.2
B-2.10, 5.0'-6.5'		130	9/11/19	Hom	No. 10			Yes	32.66	114.86	104.46	14.5
<mark>B-2.10, 7.5'-9.0'</mark>		131	9/11/19	Hom	No. 10			Yes	30.94	92.56	82.22	20.2
<mark>B-2.10, 10.0'-11</mark> .5'		132	9/11/19	Hom	No. 10			Yes	31.76	87.87	78.89	19.1
<mark>B-2.10, 12.5'-14</mark> .0'		133	9/11/19	Hom	No. 10			Yes	32.24	84.57	77.52	15.6
<mark>B-2.10, 15.0'-16</mark> .5'		134	9/11/19	Hom	No. 10			Yes	32.08	102.42	94.47	12.7
B-2.11, 0.0'-1.5'		136	9/11/19	Dist	No. 4			No	30.87	95.10	82.46	24.5
B-2.11, 1.5'-3.0'		137	9/11/19	Hom	No. 10			Yes	32.23	87.46	75.02	29.1



#### **Moisture Content of Soil**

ASTM D 2216

1					-		1				residu by	
Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"						
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000		Fest Method	ASTM			
Material Type: <u>Str</u> atified, <u>Lam</u> inated, <u>Len</u> sed,	Homogeneous, E	<u>Dist</u> urbed										
					Maximum	Mate	erial	Pass Min.		Wet Soil &	Dry Soil &	
			Date	Material	Particle	Exclu	uded	Mass?	Can Weight	Can Weight	CanWeight	Moisture
Source		Lab ID	Tested	Туре	Size	Amount	Size	(Y/N)	(g)	(g)	(g)	Content (%)
<mark>B-2.11, 3.0'-4.5'</mark>		138	9/11/19	Hom	No. 10			Yes	30.78	108.11	91.23	27.9
<mark>B-2.11, 5.0'-6.5'</mark>		139	9/11/19	Hom	No. 4			No	31.88	71.50	64.10	23.0
<mark>B-2.11, 8.1'-9.0'</mark>		141	9/11/19	Hom	No. 10			Yes	32.11	112.73	104.03	12.1
<mark>B-2.11, 10.0'-11</mark> .5'		142	9/11/19	Hom	No. 10			Yes	31.68	106.98	98.19	13.2
<mark>B-2.11, 12.5'-14</mark> .0'		143	9/12/19	Hom	No. 10			Yes	31.00	100.95	92.37	14.0
<mark>B-2.12a, 0.0'-1.</mark> 5'		144	9/12/19	Hom	No. 10			Yes	32.35	101.02	88.30	22.7
<mark>B-2.12a, 1.5'-3.</mark> 0'		145	9/12/19	Hom	No. 10			Yes	32.26	89.23	78.53	23.1
<mark>B-2.12a, 3.0'-4.</mark> 0'		146	9/12/19	Hom	No. 10			Yes	31.82	90.50	77.95	27.2
<mark>B-2.12a, 4.0'-4.</mark> 5'		147	9/12/19	Hom	No. 10			Yes	30.71	93.48	80.58	25.9
<mark>B-2.12a, 5.0'-6.</mark> 5'		148	9/12/19	Hom	No. 10			Yes	30.72	65.40	59.93	18.7
<mark>B-2.12a, 7.5'-9.</mark> 0'		149	9/12/19	Hom	No. 10			Yes	32.00	114.56	88.89	45.1
<mark>B-2.12a, 10.0'-1</mark> 1.5'		150	9/11/19	Hom	No. 10			Yes	30.98	105.41	81.91	46.1
<mark>B-2.12a, 12.5'-1</mark> 4.0'		151	9/11/19	Hom	No. 10			Yes	31.89	87.37	76.61	24.1
<mark>B-2.12a, 15.2'-1</mark> 5.6'		152	9/12/19	Dist	No. 4			Yes	31.92	179.25	169.98	6.7
<mark>B-2.13a, 0.0'-1.</mark> 5'		154	9/12/19	Hom	No. 10			Yes	30.62	92.70	83.66	17.0
<mark>B-2.13a, 1.5'-3.</mark> 0'		155	9/12/19	Hom	No. 10			Yes	32.32	86.71	80.23	13.5
<mark>B-2.13a, 3.0'-4.</mark> 5'		156	9/12/19	Hom	No. 10			Yes	31.65	83.44	73.78	22.9
<mark>B-2.13a, 5.0'-6.</mark> 5'		157	9/12/19	Hom	No. 10			Yes	30.79	92.76	80.71	24.1
<mark>B-2.13a, 7.5'-9.</mark> 0'		158	9/11/19	Hom	No. 10			Yes	31.91	116.24	107.11	12.1
<mark>B-2.13a, 10.0'-1</mark> 1.5'		159	9/12/19	Dist	No. 4			No	31.81	153.86	130.87	23.2
<mark>B-2.13a, 13.1'-1</mark> 3.6'		161	9/12/19	Hom	No. 10			Yes	31.57	91.16	81.70	18.9
<mark>B-2.13a, 15.0'-1</mark> 6.5'		163	9/11/19	Dist	No. 4			No	31.25	102.72	94.64	12.7
<mark>B-2.13a, 17.5'-1</mark> 8.6'		164	9/12/19	Hom	No. 10			Yes	32.21	93.85	89.05	8.4

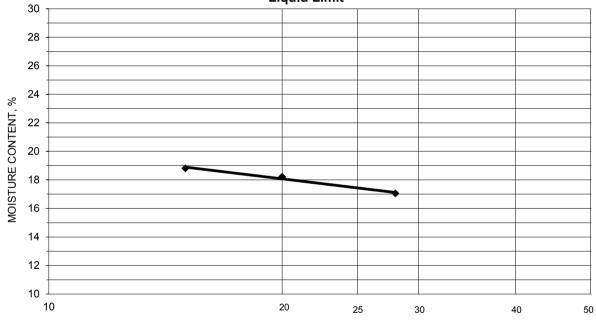


ample Type <u>B-1.1,</u> ample Type <u>SPT</u> <u>Natural Mo</u> Test Method: ASTI Moisture Cor	M D 2216	ontent	Date Received Date Reported Test Results	75
<u>Natural Mo</u> Test Method: ASTI	M D 2216		Test Results	9-5-19 9-18-19
Natural Mo Test Method: ASTI	M D 2216		Test Results	9-18-19
Test Method: AST	M D 2216			
Test Method: AST	M D 2216		1	
Test Method: AST	M D 2216		Atterberg Limits	
Moisture Co	ntent (%):		Test Method: ASTM D 4318 Method	Ą
	. ,	15.5	Prepared: Dry	
			Liquid Limit:	17
			Plastic Limit:	14
Particle	Size Anal	<u>ysis</u>	Plasticity Index:	3
Preparation Metho	d: ASTM [	D 421	Activity Index:	0.4
Gradation Method:	ASTM D	422		
Hydrometer Metho	d: ASTM I	D 422		
-			Moisture-Density Relation	<u>ship</u>
Particle Siz	ze	%	Test Not Performed	
Sieve Size	(mm)	Passing	Maximum Dry Density (lb/ft <sup>3</sup> ):	N/A
	N/A		Maximum Dry Density (kg/m <sup>3</sup> ):	
	N/A		Optimum Moisture Content (%):	
	N/A		Over Size Correction %:	
	N/A N/A			N/A
3/4"	19	100.0		
3/8"	9.5	79.9	California Bearing Rati	•
No. 4	4.75	79.9	Test Not Performed	<u>o</u>
No. 10	2	71.9	Bearing Ratio (%):	NI/A
No. 40	0.425	65.9	Compacted Dry Density (lb/ft <sup>3</sup> ):	
No. 200	0.075	43.4	Compacted Moisture Content (%):	N/A
	0.02	24.5 14.2		
	0.005	7.6	Specific Gravity	
estimated	0.002	3.4	Test Method: ASTM D 854	
estimated	0.001	5.4	Prepared: Dry	
Plus 3 in. material,	not includ	led: 0 (%)	Particle Size:	No. 10
r ius 5 in. materiai,		ieu. 0 (70)	Specific Gravity at 20° Celsius:	
Г	ASTM	AASHTO		2.10
Range	(%)	(%)	L	
Gravel	24.0	28.1	Classification	
Coarse Sand	4.1	6.0	Unified Group Symbol:	SM
Medium Sand	6.0		Group Name:Silty sa	
Fine Sand	22.5	22.5		
Silt	29.2	35.8		
Clay	14.2	7.6	AASHTO Classification:	A-4 ( 0 )

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Project	HCFRRP - Eagle Cr	reek DSB			Project No.	174316204
Source	B-1.1, 10.0'-11.5'				Lab ID	75
					% + No. 40	34
Tested By	MF	Test Method	ASTM D 4318 M	lethod A	Date Received	09-05-2019
Test Date	09-10-2019	Prepared	Dry	_		
		_		-		
	Wet Soil and	Dry Soil and				
	Tare Mass	Tare Mass	Tare Mass	Number of	Water Content	
	(g)	(g)	Blows	(%)	Liquid Limit	
	24.85	22.84	11.05	28	17.0	
	24.35	22.30	11.05	20	18.2	
	23.42	21.45	10.98	15	18.8	17
		<u> </u>		<u> </u>	ļļ.	
			Liquid	Limit		



NUMBER OF BLOWS

#### PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
17.69	16.83	10.69	14.0	14	3
18.00	17.15	11.06	14.0		

Remarks:

Reviewed By



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Project Nam Source		ICFRRP - Ea 3-1.1, 10.0'-1		_	Ρ	roje	ect I		174		204 75							
	_	Sieve a	nalysis	for the	Por	rtion	Coars	er th	nan	the N	o. 10		e					
		ASTM I ASTM I							Sie	ve Siz	e P	% assir	ıg					
Particle Particle Ha	Shape_ rdness:			9														
	sted By_ st Date	MP 09-06-2019									-							
Date Re	eceived	09-05-2019			3/4" 100.0 3/8" 79.9													
Maximum Pa	article siz	e: 3/4" Sieve		l	No. 4 No. 10		76.0 71.9											
Analysis Bas	sed on -3	<b>An</b> 3 inch fractior	-	or the p	oorti	on Fi	ner th	ian t		<b>No. 10</b> Io. 40		<b>′e</b> 65.9						
-		2.7	,						Ν	o. 200 )2 mr		43.4 24.5						
		Apparatus A -	Mecha	nical, fo	r 1 m	ninute	9		0.0 0.0	05 mr 02 mr	n n	14.2 7.6						
				Particle	e Siz	re Dis	stribu	tion	0.0	01 mr	n	3.4						
ASTM Co	oarse Gravel 0.0	Fine Gravel 24.0	C. Sand 4.1	Medium 6.0	Sand		Fine Sar 22.5				Silt 29.2				Clay 14.2			
AASHTO	0.0	<u>Gravel</u> 28.1	4.1	Coarse S	Sand		Fine Sar 22.5	ıd	+		23.2	Silt 35.8			14.2	<u>Clay</u> 7.6		
Sieve Size	in inches	20.1		Sieve Size		ve numbe						33.0				7.0		
3	2 1 3	3/4 3/8 4	1	0 16	30	40	10	0	200				<del></del>				100	
															$\pm$		90	
																	80	
				<b>b</b>		Δ									_		70	g
															_		60	Percent Passing
								$\leq$							_		50	ent P
			+						X	+				+	-+		40	Perc

0.01 1 Diameter (mm) 0.1 Reviewed By

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Comments

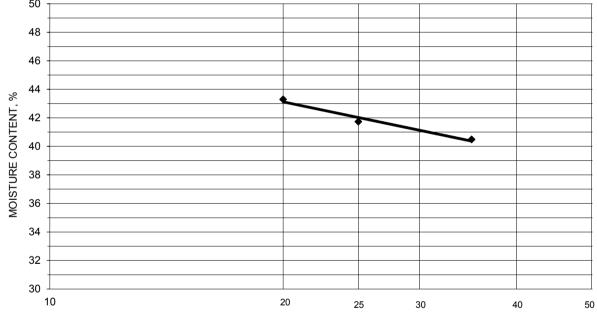
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oject Name	HCFRRP - Eagl	e Creek DSB	Project Number	174316204
	B-2.14A, 7.5'-9.		Lab ID	81
ample Type	SPT		Date Received	9-5-19
	011		Date Received Date Reported	9-18-19
			Test Results	
Natu	ral Moisture Co	ntent	Atterberg Limits	
	: ASTM D 2216	<u>Jinteint</u>	Test Method: ASTM D 4318 Method	Δ
	re Content (%):	47 2	Prepared: Dry	/ \
Wieleta			Liquid Limit:	42
			Plastic Limit:	
Pa	rticle Size Anal	vsis	Plasticity Index:	14
	Method: ASTM I		Activity Index:	1.5
•	ethod: ASTM D			
	Method: ASTM I			
,			Moisture-Density Relation	ship
Parti	icle Size	%	Test Not Performed	
Sieve Size	e (mm)	Passing	Maximum Dry Density (lb/ft <sup>3</sup> ):	N/A
	N/A		Maximum Dry Density (kg/m <sup>3</sup> ):	
	N/A		Optimum Moisture Content (%):	
	N/A		Over Size Correction %:	
	N/A			11/7
	N/A			
3/8"	9.5	100.0	California Bearing Rat	io
No. 4	4.75	97.1	Test Not Performed	-
No. 10	2	96.3	Bearing Ratio (%):	N/A
No. 40	0.425	94.4	Compacted Dry Density (lb/ft <sup>3</sup> ):	N/A
No. 200	0.075	76.0	Compacted Moisture Content (%):	N/A
	0.02	47.7		
	0.005	22.9		
	0.002	9.6	Specific Gravity	
estimated	0.001	0.0	Test Method: ASTM D 854	
			Prepared: Dry	
Plus 3 in. ma	aterial, not incluc	led: 0 (%)	Particle Size:	No. 10
		· · · · · · · · · · · · · · · · · · ·	Specific Gravity at 20° Celsius:	2.70
_	ASTM	AASHTO		
Range	(%)	(%)		
Gravel	2.9	3.7	Classification	• •
Coarse San		1.9	Unified Group Symbol:	
Medium Sar			Group Name:	Silt with sand
Fine Sand		18.4		
i Cilt	53.1	66.4 9.6	AASHTO Classification:	
Silt Clay	22.9			N / G / 11 \



Project	HCFRRP - Eagle Cr	reek DSB			Project No.	174316204
Source	B-2.14A, 7.5'-9.0'				Lab ID	81
					% + No. 40	6
Tested By	MF	Test Method	ASTM D 4318 N	/lethod A	Date Received	09-05-2019
Test Date	09-10-2019	Prepared	Dry			
		_				
	Wet Soil and	Dry Soil and				
	Tare Mass	Tare Mass	Tare Mass	Number of	Water Content	
	(g)	(g)	(g)	Blows	(%)	Liquid Limit
	22.57	19.25	11.05	35	40.5	
	20.59	17.79	11.08	25	41.7	
	21.70	18.47	11.01	20	43.3	42
	50			Limit		



NUMBER OF BLOWS

#### PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass	Dry Soil and Tare Mass	Tare Mass	Water Content (%)	Plastic Limit	Plasticity Index
(g) 20.34	(g) 18.27	(g) 11.01	(%) 28.5	28	14
20.82	18.71	11.15	27.9		

Remarks:

Reviewed By

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Project Na Source	ame	HCFRRP - Eagle Creek DSB B-2.14A, 7.5'-9.0'																	F	Pro	je	ct I			174		204 81						
																							ı.										
			S	Sie	ve	an	aly	sis	s fo	r th	ne	Po	orti	ion	C C	oa	rse	r tł	ha	n tl	ne	No.	1(			ve	_						
То	ot Matha	d	,	\ C <sup>-</sup>	<b>-</b> N <i>A</i>	Б	101	<b>.</b>											6	iou	~ ~				%	~~							
Prena	st Metho ared usin	u	F	10	TM		42	<u>2</u> 1		_										lev	e S	ize	1	Pas	SSI	ng	_						
пере		9 <u> </u>	7	10	1 1 1 1		72	1		_									-														
Partic	cle Shap	е		A	۸ng	ula	ar																										
Particle H	lardness	s:	Hai	rd a	anc	1 D	ura	ble	;																								
_				_																													
	Tested B Test Dat				10	_													_														
	Receive																										_						
Date		u_ <u></u>	0-00	20	10	-													-	3	/8"			10	)0.	0							
Maximum	Particle	size	e: 3/8'	' S	iev	е															0. 4				7.1								
															No	). 1	0		9	6.3	}												
					Α	na	lvs	is f	or	the	e p	or	tio	n F	in	er	tha	n t	the	) N	o. ′	10 5	Sie	ve									
Analysis E	Based or	-3	inch	fra							•									No					4.4	ŀ							
																				No					6.0								
Specif	fic Gravit	у	2.	7		_														.02					7.7								
Diamar		~ ^ .		4			1	ha		- I - I		4							_	.00					2.9		_						
Disper	sed usin	g Ap	opara	lus	5 A	- N	/iec	na	nica	aı, ı	or	1	m	nui	.e					.00					).6 ).0		_						
									_			_	_	_					0	.00					.0								
	Coarse Gra		Fine G	rave			. Sa	nd		I <b>rtic</b> 1ediu				D			utic Sand	on	_				Silt					_	CI	ay		1	
ASTM	0.0		2.	9	,	Ľ	0.8			1	.9					18.	4		4				53.	1						2.9	21		
AASHTO			Gravel 3.7							Coars 1	.9	and			FI	18 18	Sand .4								Silt 6.4						<u>Clay</u> 9.6		
Sieve S	Size in inches	1 2/		0/0		4		4		eve S 16	Size		ieve ) 4		bers		100		200														
·	2	1 3/4	+ 3	3/8	11	Å		1		10					Τ		100		200	,			Т									T <sup>100</sup>	)
																																90	
					+	+										$\rightarrow$						+	-							+			
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					+	-					$\left  \right $		_	+	-	-				$\mathbf{k}$		+	+							+		- 70	_
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				$\square$							Щ												1									- 50	ent
				$\left  \right $	++	+	$\vdash$					+		+	+	+			$\left  \right $		+	+	+	$\rightarrow$	A		+			+		40	Percent Passing

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Comments

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Stantec Consulting Services Inc.

Diameter (mm)

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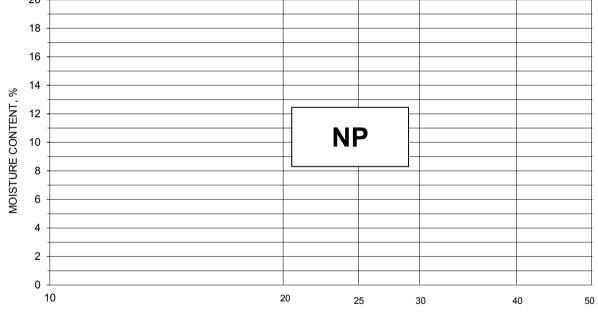
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roject Name	HCFRRP - Eagl	e Creek DSB	Project Number	174316204
	B-2.14A, 12.5'-1		Lab ID	83
ample Type	SPT		Date Received	9-5-19
			Date Reported	9-18-19
				0 10 10
			Test Results	
	ral Moisture Co	ontent	Atterberg Limits	
	: ASTM D 2216		Test Method: ASTM D 4318 Method	A
Moistu	re Content (%):	19.3	Prepared: Dry	
			Liquid Limit:	
Dev			Plastic Limit:	
	ticle Size Anal		Plasticity Index:	
•	Vethod: ASTM I ethod: ASTM D		Activity Index:	N/A
	Method: ASTM D			
i iyaromotor i			Moisture-Density Relation	nship
Parti	cle Size	%	Test Not Performed	
Sieve Size	(mm)	Passing	Maximum Dry Density (lb/ft <sup>3</sup> ):	N/A
	N/A		Maximum Dry Density (kg/m <sup>3</sup> ):	N/A
	N/A		Optimum Moisture Content (%):	N/A
	N/A		Over Size Correction %:	N/A
	N/A			
	N/A			
3/8"	9.5	100.0	California Bearing Rat	io
No. 4	4.75	97.8	Test Not Performed	
No. 10	2	90.5	Bearing Ratio (%):	
No. 40	0.425	31.7	Compacted Dry Density (lb/ft <sup>3</sup> ):	
No. 200	0.075	12.3	Compacted Moisture Content (%):	N/A
	0.02	6.1		
	0.005	3.3		
	0.002	1.9	Specific Gravity	
estimated	0.001	1.2	Test Method: ASTM D 854	
Dius 2 in ma	torial not includ	(0,0)	Prepared: Dry Particle Size:	No. 10
	terial, not incluc	ieu. 0 (%)	Specific Gravity at 20° Celsius:	
	ASTM	AASHTO	Specific Gravity at 20° Celsius.	2.70
Range	(%)	(%)		
Gravel	2.2	9.5	Classification	
Coarse San		58.8	Unified Group Symbol:	SM
Medium Sar			Group Name:	Silty sand
Fine Sand		19.4		,
	9.0	10.4		
Silt		1.9	AASHTO Classification:	



Project	HCFRRP - Eagle C	reek DSB				Project No.	174316204
Source	B-2.14A, 12.5'-14.0	•				Lab ID	83
						% + No. 40	68
Tested By	MF	Test Method	ASTM D 43	18 Method A	\ [	Date Received	09-05-2019
Test Date	09-10-2019	Prepared	Dry			_	
	Wet Soil and	Dry Soil and					
	Tare Mass	Tare Mass	Tare Ma	ss Numl	per of V	Vater Content	
	(g)	(g)	(g)	Blo	WS	(%)	Liquid Limit
	20		Li	quid Limit			
	20						



NUMBER OF BLOWS

#### PLASTIC LIMIT AND PLASTICITY INDEX

	Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
-						

Remarks:

Reviewed By



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Project Name Source	HCFRRP - Eagle Creek DSB B-2.14A, 12.5'-14.0'																	Pro	oje	ct N	lum Lat	iber b ID	174	3162	204 83
							_	_					_												
		Si	eve	an	alysi	s for t	he	Po	rtio	n C	oars	ser t	ha	n t	he l	<u>No. '</u>	10 Sie %		) 						
Test Meth	nod	AS	зти	١D،	422								S	siev	ve S	ize	Pass		1						
Prepared us	ing	AS	STN	۱D،	421														_						
Dartiala Cha			۸										_												
Particle Sha Particle Hardne						<del>.</del>							-						_						
		- Ture		<u>u D</u>		<u> </u>																			
Tested																									
Test D Date Receiv													-						_						
Date Recen	<u>vcu_</u>	0-00-2	.010											3	3/8"		100	0.0							
Maximum Partic	le size	ize: 3/8" Sieve													o. 4	_	97								
		Analysis for the portion Finer t												No	o. 10	0	90	.5							
	-				-	for th	e p	orti	on	Fin	er tl	nan	the												
Analysis Based	on -3	inch fr	actio	on c	only								_		5. 40 . 20		31 12		_						
Specific Gra	vitv	2.7													20 2 m		- 12 6.								
0,000,000	, <u> </u>			_											)5 m	_	3.								
Dispersed us	ing Ap	oparati	ls A	- N	lecha	inical,	for	1 n	ninu	ıte					)2 n	_	1.								
													C	0.00	)1 n	nm	1.	2							
						Parti			ze D																
ASTM Coarse 0		Fine Gra 2.2	ivel	C.	Sand 7.3		58.8				ine Sa 19.4						Silt 1.0					Clay 3.3			
AASHTO		Gravel 9.5					<u>se Sa</u> 58.8	and		F	ine Sa 19.4	nd					<u>Sil</u> 10.						<u>Clay</u> 1.9		
Sieve Size in inch 3 2	ies 1 3/4	4 3/8		4		Sieve 10 16				mbers	1(	00	20	0											
		1 3/4 3/8 4 10 16 30 40 100								T											100				
					$\rightarrow$			++					++			-						_		- 90	
						$\square$																		- 80	
						$\vdash$		+					+									_		- 70	
																								- 70	Вu
							N																	- 60	assii
				+			$\left  \right  \right $	$\mathbb{N}$	++	_	_		$\parallel$			-		+	$\square$			_		- 50	nt P
						-		$\downarrow \downarrow$																- 40	Percent Passing
																									Ā

Diameter (mm)

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Comments

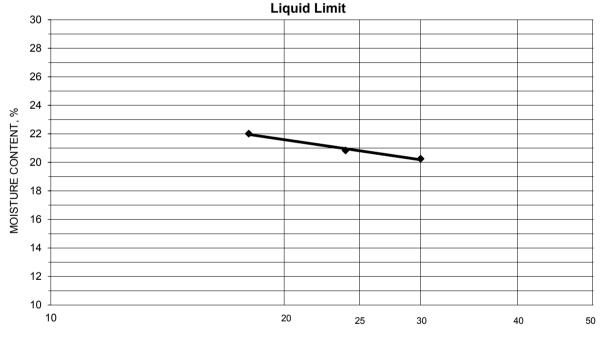
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oject Name	HCFRRP - Eag	le Creek DSB	Project Number	174316204
•	Ţ	19.0', 20.0'-21.2'	, Lab ID	85
mnle Type	SPT Composite		Date Received	0510
inple Type	SFT Composite		Date Received Date Reported	
			Test Results	
Test Not Pe	<u>Iral Moisture Co</u>	ontent	<u>Atterberg Limits</u> Test Method: ASTM D 4318 Method	٨
		10.0		A
MOISIL	re Content (%):	12.2	Prepared: Dry	01
			Liquid Limit: Plastic Limit:	13
Ba	rtiala Siza Anal	voio		
	rticle Size Anal		Plasticity Index:	
	Method: ASTM I ethod: ASTM D		Activity Index:	0.6
	Method: ASTM D			
riyurometer	Method. AS I MI	D 422	Moisture-Density Relation	nship
Part	icle Size	%	Test Not Performed	<u></u>
Sieve Size		Passing	Maximum Dry Density (lb/ft <sup>3</sup> ):	N/A
	N/A	- accurg	Maximum Dry Density (kg/m <sup>3</sup> ):	
	N/A		Optimum Moisture Content (%):	
	N/A		Over Size Correction %:	N/A
	N/A			
- /o''	N/A			-
3/8"	9.5	100.0	California Bearing Rat	10
No. 4	4.75	92.9	Test Not Performed	
No. 10	2	85.1	Bearing Ratio (%):	
No. 40	0.425	71.5	Compacted Dry Density (lb/ft <sup>3</sup> ):	N/A
No. 200	0.075	53.8	Compacted Moisture Content (%):	N/A
	0.02	42.6		
	0.005	23.4		
	0.002	13.5	Specific Gravity	
estimated	0.001	6.5	Test Method: ASTM D 854	
			Prepared: Dry	
Plus 3 in. ma	aterial, not incluc	led: 0 (%)	Particle Size:	
			Specific Gravity at 20° Celsius:	2.70
	ASTM	AASHTO		
Range	(%)	(%)		
Gravel	7.1	14.9	<u>Classification</u>	
Coarse Sar		13.6	Unified Group Symbol:	
Medium Sa			Group Name: S	andy lean clay
Fine Sand		17.7		
Silt	30.4	40.3		
Clay	23.4	13.5	AASHTO Classification:	$\Delta_{-1}(1)$



Project	HCFRRP - Eagle Cr	reek DSB		Project No.	174316204	
Source	B-2.14A, 17.5'-19.0'	, 20.0'-21.2'			Lab ID	85
					% + No. 40	28
Tested By	JP	Test Method	ASTM D 4318 N	lethod A	Date Received	09-05-2019
Test Date	09-12-2019	Prepared	Dry	_		
				-		
	Wet Soil and	Dry Soil and				
	Tare Mass	Tare Mass	Tare Mass	Number of	Water Content	
	(g)	(g)	(g)	Blows	(%)	Liquid Limit
	25.39	22.96	10.96	30	20.3	
	26.02	23.44	11.06	24	20.8	
	25.70	23.05	11.01	18	22.0	21



NUMBER OF BLOWS

#### PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass	Dry Soil and Tare Mass	Tare Mass	Water Content		
(g)	(g)	(g)	(%)	Plastic Limit	Plasticity Index
19.58	18.53	10.47	13.0	13	8
20.54	19.43	11.04	13.2		

Remarks:

Reviewed By



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Reviewed By

**Percent Passing** 



Project Name	HCFRRP - Eagle Creek DSB B-2.14A, 17.5'-19.0', 20.0'-21.2'										Pro	oje	ect				174	3162								
Source	B	-2.14/	A, 17	7.5'-	19.0', :	20.0'-	21.	2'								_					L	.ab	ID _		6	85
																_										
		5	Siev	e ar	alysis	s for t	he	Ро	orti	on (	Coarse	ər t	ha	n the	e No	<b>).</b> 1	0 Sie	eve	;							
																	%	þ								
Test Meth	od	ŀ	<b>AST</b>	ΜD	422								S	ieve	Size	Э	Pass	ing	J							
Prepared usi	ng	ŀ	<b>\ST</b>	ΜD	421																					
Particle Sha			Ar	ngula	ar																					
Particle Hardnes	rticle Hardness: Hard and Durable																									
Tested	-	М																								
Test Da				_																						
Date Receive	ed (	09-05	-201	9																						
														3/8			100									
Maximum Particle	e siz	e: 3/8	" Sie	eve										No.			92.									
														No.	10		85.	1								
				Ana	lvsis	or th	ер	ort	tior	ו Fi	ner th	an	the	No	. 10	Sie	eve									
Analysis Based o	n -3	inch			•								Г	No.		Т	71.	5		1						
5					,									No. 2			53.	8								
Specific Grav	rity	2.	7										_	.02		۱	42.	6								
·	-												0	.005	mm	۱	23.	4								
Dispersed usi	ng A	ppara	itus	A - I	Necha	nical,	for	· 1 r	mir	ute			0	.002	mm	۱	13.	5								
·	Ū	••											0	.001	mm	۱	6.	5								
						Deut				D:-	4															
Coarse Gr	ravel	Fine G	Favel		C. Sand		um S		ize	DIS	Fine Sand		_			Sil	It						lav			
ASTM 0.0	aver	7.	.1		7.8		13.6				17.7					30.	.4						3.4			
AASHTO		Gravel 14.9					<u>rse Sa</u> 13.6	and	_		Fine Sand 17.7	1	+				Silt 40.3							<u>Clay</u> 13.5		
Sieve Size in inche	s					Sieve		in si	eve r	umbe	rs							-								
3 2	1 3	/4 ;	3/8	4	1	0 16	; 	30	40	)	100		200						<b>.</b>						r 100	
	· ·		$\blacksquare$	$\downarrow$			+++		+									++		+		_	_			
	-		┼┼┼	+	$\vdash$			$\left  \right $	+	$\vdash$		-	$\mathbb{H}$	++	+			++	+	+		_	_		- 90	

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Comments

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Stantec Consulting Services Inc.

Diameter (mm)

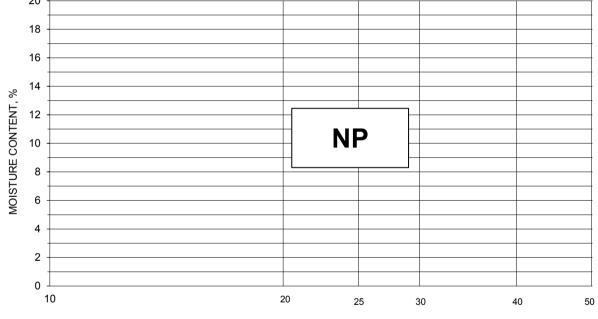


roject Name HC	FRRP - Eag	le Creek DSB	Project Number	174316204
	2.15A, 12.5'-´		Lab ID	
ample Type SP	т		Date Received	9_5_19
	1		Date Reported	9-18-19
			 Test Results	
Natural	Moisture Co	ontent	Atterberg Limits	
Test Method: A			Test Method: ASTM D 4318 Method	Α
	Content (%):	12.4	Prepared: Dry	
	e ee ( / e ).		Liquid Limit:	NP
			Plastic Limit:	
Partic	le Size Anal	vsis	Plasticity Index:	
Preparation Me			Activity Index:	
Gradation Meth				
Hydrometer Me				
<b>,</b>			Moisture-Density Relation	ship
Particle	Size	%	Test Not Performed	
Sieve Size	(mm)	Passing	Maximum Dry Density (lb/ft <sup>3</sup> ):	N/A
	N/A		Maximum Dry Density (kg/m <sup>3</sup> ):	N/A
	N/A		Optimum Moisture Content (%):	N/A
	N/A		Over Size Correction %:	
	N/A			
3/4"	19	100.0		
3/8"	9.5	89.3	California Bearing Rat	0
No. 4	4.75	77.6	Test Not Performed	<u> </u>
No. 10	2	56.1	Bearing Ratio (%):	N/A
No. 40	0.425	22.3	Compacted Dry Density (lb/ft <sup>3</sup> ):	
No. 200	0.075	12.7	Compacted Div Density (ib/it ).	N/A
1101 200	0.02	7.0		
	0.005	3.4		
	0.002	1.6	Specific Gravity	
estimated	0.001	0.0	Test Method: ASTM D 854	
			Prepared: Dry	
Plus 3 in. mater	ial, not includ	led: 0 (%)	Particle Size:	No. 10
			Specific Gravity at 20° Celsius:	2.70
	ASTM	AASHTO		
Range	(%)	(%)		
Gravel	22.4	43.9	Classification	
Coarse Sand	21.5	33.8	Unified Group Symbol:	SM
Medium Sand	33.8		Group Name: Silty sa	
Fine Sand	9.6	9.6		
	9.3	11.1		
Silt	0.0		AASHTO Classification:	

Comments:



Project	HCFRRP - Eagle C	reek DSB			Project No.	174316204
Source	B-2.15A, 12.5'-14.0'				Lab ID	95
					% + No. 40	78
Tested By	MF	Test Method	ASTM D 4318	Method A	Date Received	09-05-2019
Test Date	09-10-2019	Prepared	Dry		-	
	Wet Soil and	Dry Soil and				
	Tare Mass	Tare Mass	Tare Mass	Number of	Water Content	
	(g)	(g)	(g)	Blows	(%)	Liquid Limit
				d Limit		
	20					
	20					



NUMBER OF BLOWS

#### PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index

Remarks:

Reviewed By





Project Name HCFRRP - Eagle Creek DSB Source B-2.15A, 12.5'-14.0'										Ρ	roje	ect l	Numl	ber_	174	3162	
Source		B-2.15A, 12.	5'-14.0'										Lab	ID _			95
		Sieve	analysis	for the	e Port	tion (	Coarser	than the N	<u>lo. 10</u>		e	1					
-		10 <b>-</b>	<b>D</b> 400							%							
les	t Method	ASTM	D 422					Sieve Si	ze P	assin	ıg						
Prepar	rea using	ASTM	D 421														
Partic	le Shane	Ang	nular														
		Hard and		•													
Т	ested By	MP 9/															
Date I	Received	09-05-2019						3/4"		100.0							
								3/8"		89.3							
Maximum	Particle s	size: 3/4" Siev	e					No. 4		77.6							
								No. 10	)	56.1		ļ					
		А	nalysis f	or the	portic	on Fi	her than	the No. 1	0 Siev	/e							
Analysis B	ased on	-3 inch fractio	on only					No. 40	)	22.3							
								No. 20		12.7							
Specifi	c Gravity	2.7	_					0.02 m		7.0							
								0.005 m		3.4							
Dispers	sed using	Apparatus A	- Mecha	nical, fo	or 1 m	inute		0.002 m		1.6							
								0.001 m	m	0.0		ļ					
				Partic	e Siz	e Dis	tributior	า									
ASTM	Coarse Grave 0.0	Fine Gravel	C. Sand 21.5	Medium 33.			Fine Sand 9.6		Silt 9.3					Clay 3.4			
AASHTO	0.0	Gravel	21.5	Coarse	Sand		Fine Sand		9.0	Silt				-	Clay		
	ize in inches	43.9		33. Sieve Si	8 2e in sieve		9.6			11.1					1.6		
3		3/4 3/8	4 1		30		100	200								100	
																100	
											+++			-		90	
· + + + + + + + + + + + + + + + + + + +																80	
																00	
			+N-								+++			-		70	
																60	ing
											П			-		00	Percent Passing
·			+	$\left  \right\rangle +$					+			++	+ +			50	пt
																40	rce
																40	Ре

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Diameter (mm)

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Approved By: RJ

Comments

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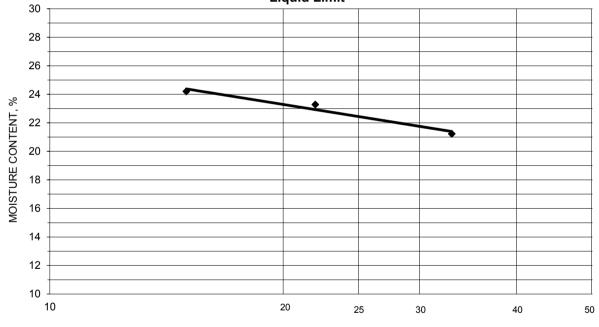


oject Name	HCFRRP - Eag	le Creek DSB	Project Number	174316204
	3-2.16A, 10.0'-´		Lab ID	103
mplo Typo	SPT		Date Received	9-5-19
ample Type	571		Date Received Date Reported	9-0-18
				9-10-18
			Test Results	
	al Moisture Co	ontent	Atterberg Limits	
	ASTM D 2216		Test Method: ASTM D 4318 Method	A
Moistu	re Content (%):	7.8	Prepared: Dry	
			Liquid Limit:	22
			Plastic Limit: Plasticity Index:	16
	ticle Size Anal		Plasticity Index:	6
	/lethod: ASTM		Activity Index:	3.8
	ethod: ASTM D			
Hydrometer N	Method: ASTM	D 422		
			Moisture-Density Relation	<u>iship</u>
Parti	cle Size	%	Test Not Performed	
Sieve Size	(mm)	Passing	Maximum Dry Density (lb/ft <sup>3</sup> ):	N/A
	N/A		Maximum Dry Density (kg/m <sup>3</sup> ):	N/A
	N/A		Optimum Moisture Content (%):	N/A
	N/A		Over Size Correction %:	
	N/A			
3/4"	19	100.0		
3/8"	9.5	67.7	California Bearing Rat	io
No. 4	4.75	52.8	Test Not Performed	
No. 10	2	36.3	Bearing Ratio (%):	N/A
No. 40	0.425	22.9	Compacted Dry Density (lb/ft <sup>3</sup> ):	
No. 200	0.075	14.9	Compacted Moisture Content (%):	
110. 200	0.02	8.1		14/7 (
	0.005	3.7		
	0.002	1.6	Specific Gravity	
estimated	0.001	0.7	Test Method: ASTM D 854	
<u> </u>	0.001	0.1	Prepared: Dry	
Plus 3 in ma	terial, not includ	led: 0 (%)	Particle Size:	No. 10
			Specific Gravity at 20° Celsius:	
	ASTM	AASHTO		2.1 0
Range	(%)	(%)		
Gravel	47.2	63.7	Classification	
Coarse San		13.4	Unified Group Symbol:	GC-GM
Medium San			Group Name: Silty, clayey gr	
Fine Sand	8.0	8.0		
Silt	11.2	13.3		
Clay	3.7	1.6	AASHTO Classification:	A-1-a(0
Joiay	5.7	1.0		A-1-a ( U

Reviewed By



Project	HCFRRP - Eagle Cr	eek DSB			Project No.	174316204
Source	B-2.16A, 10.0'-11.5'				Lab ID	103
					% + No. 40	77
Tested By	JP	Test Method	ASTM D 4318 N	lethod A	Date Received	09-05-2019
Test Date	09-12-2019	Prepared	Dry			
	Wet Soil and	Dry Soil and				
	Tare Mass	Tare Mass	Tare Mass	Number of	Water Content	
	(g)	(g)	(g)	Blows	(%)	Liquid Limit
	28.33	25.31	11.08	33	21.2	
	26.06	23.15	10.65	22	23.3	
	26.62	23.52	10.71	15	24.2	22
		<u> </u>		<u>I</u>	<u> </u>	



NUMBER OF BLOWS

#### PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass	Dry Soil and Tare Mass	Tare Mass	Water Content (%)	Plastic Limit	Plasticity Index
(g) 19.81	(g) 18.57	(g) 11.07	16.5	16	6
20.07	18.80	10.93	16.1		

Remarks:

Reviewed By



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Project Name Source	HCFRRP - Eagle Cre B-2.16A, 10.0'-11.5'		Proje	<u>174316204</u> 103			
	Sieve analysi	s for the Portic	on Coarsor th	an the No			
	Oleve analysi				%		
Test Method	d ASTM D 422			Sieve Size			
Prepared using					ŭ		
	e Angular						
Particle Hardness	Hard and Durable	<u>e</u>					
Tested B	y MP						
	e 09-06-2019						
	d 09-05-2019			3/4"	100.0		
				3/8"	67.7		
Maximum Particle	size: 3/4" Sieve			No. 4	52.8		
				No. 10	36.3		
	Analysis	for the portion	Finer than t	he No. 10 S	Sieve		
Analysis Based on	-3 inch fraction only			No. 40	22.9		
				No. 200	14.9		
Specific Gravit	y <u>2.7</u>			0.02 mm	8.1		
<b>D</b>				0.005 mm	3.7		
Dispersed using	g Apparatus A - Mecha	inical, for 1 min	ute	0.002 mm	1.6		
				0.001 mm	0.7		
		Particle Size					
ASTM Coarse Grav	rel         Fine Gravel         C. Sand           47.2         16.5	Medium Sand 13.4	Fine Sand 8.0		Silt 11.2	Clay 3.7	
AASHTO	Gravel 63.7	Coarse Sand 13.4	Fine Sand 8.0		Silt 13.3		<u>Clay</u> 1.6
Sieve Size in inches		Sieve Size in sieve n	umbers				
3 2		10 16 30 40	100	200			<u> </u>
							90
							80
							70
		+ + + + + + + + + + + + + + + + + + +					Percent Passing
							40 <b>Ja</b>

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Diameter (mm)

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Comments

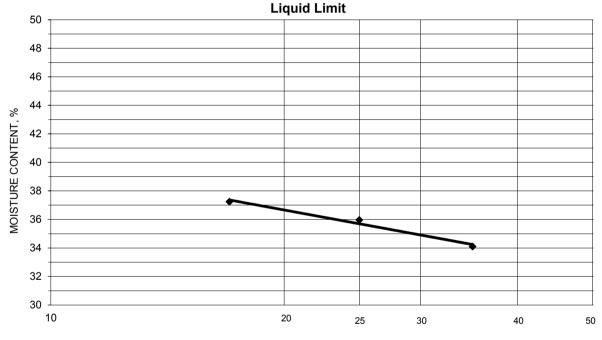


oject Name	HCFRRP - Eagl	e Creek DSB	Project Number	174316204
ource	B-1.2, 1.5'-3.0',		Lab ID	106
Sample Type SPT Composite			Date Received	0 11 10
inple Type		<u> </u>	Date Received Date Reported	<u>9-11-19</u> 9-18-19
				0-10-13
			Test Results	
	ural Moisture Co	ontent	Atterberg Limits	
Test Not Pe			Test Method: ASTM D 4318 Method	A
Moist	ure Content (%):	21.0	Prepared: Dry	
			Liquid Limit:	36
_		_	Plastic Limit:	20
	article Size Anal		Plasticity Index:	
	Method: ASTM [		Activity Index:	0.7
	lethod: ASTM D			
Hydrometer	Method: ASTM I	D 422		1. 1
Dar	ticle Size	%	Moisture-Density Relation Test Not Performed	<u>iship</u>
		-		N1/A
Sieve Siz	· · · ·	Passing	Maximum Dry Density (lb/ft <sup>3</sup> ):	N/A
	N/A		Maximum Dry Density (kg/m <sup>3</sup> ):	N/A
	N/A		Optimum Moisture Content (%):	N/A
	N/A		Over Size Correction %:	N/A
	N/A		-	
	N/A			
	N/A		California Bearing Rat	io
No. 4	4.75	100.0	Test Not Performed	
No. 10	2	94.5	Bearing Ratio (%):	N/A
No. 40	0.425	87.2	Compacted Dry Density (lb/ft <sup>3</sup> ):	
No. 200		62.4	Compacted Moisture Content (%):	N/A
	0.02	51.9		
	0.005	34.1		
	0.002	23.7	Specific Gravity	
estimated		16.3	Test Method: ASTM D 854	
	•	- 4	Prepared: Dry	
Plus 3 in. m	aterial, not includ	led: 0 (%)	Particle Size:	No. 10
		-	Specific Gravity at 20° Celsius:	2.70
	ASTM	AASHTO		
Range	(%)	(%)		
Gravel	0.0	5.5	Classification	
Coarse Sa	and 5.5	7.3	Unified Group Symbol:	CL
Medium Sa	and 7.3		Group Name: S	andy lean clay
	d 24.8	24.8		•
Fine San	00.0	38.7		
Silt	28.3	50.7		

Reviewed By



Project	HCFRRP - Eagle Cr	eek DSB	Project No.	174316204		
Source	B-1.2, 1.5'-3.0', 3.0'-	4.0'			Lab ID	106
					% + No. 40	13
Tested By	MP	Test Method	ASTM D 4318 M	lethod A	Date Received	09-11-2019
Test Date	09-17-2019	Prepared	Dry	_	-	
				_		
	Wet Soil and	Dry Soil and				
	Tare Mass	Tare Mass	Tare Mass	Number of	Water Content	
	(g)	(g)	(g)	Blows	(%)	Liquid Limit
	22.86	19.75	10.63	35	34.1	
	24.64	21.03	10.99	25	36.0	
	22.39	19.31	11.04	17	37.2	36
		1 1		I	1	



NUMBER OF BLOWS

#### PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
20.98	19.32 19.40	11.02 11.08	20.0	20	16

Remarks:

Reviewed By

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Reviewed By

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	HCFRRP - Eagle Cre				Project		174316204 106
Source	B-1.2, 1.5'-3.0', 3.0'-4	1.0				Lab ID	106
	Sieve analysi	s for the Porti	on Coarser th	nan the No.	10 Sieve %		
Test Method	ASTM D 422			Sieve Size	Passing		
Prepared using							
Particle Shape							
Particle Hardness:	Hard and Durable	9					
Tested By	MP						
	09-12-2019						
Date Received	09-11-2019						
	·				400.0		
Maximum Particle s	size: No. 4 Sieve			No. 4 No. 10	100.0 94.5		
		_					
Analysis Deceden	-	for the portion	n Finer than t				
Analysis Based on	-3 inch fraction only			No. 40 No. 200	87.2 62.4		
Specific Gravity	2.7			0.02 mm	51.9		
				0.005 mm	34.1		
Dispersed using	Apparatus A - Mecha	inical, for 1 mir	nute	0.002 mm	23.7		
				0.001 mm	16.3		
		Particle Size	Distribution				
ASTM Coarse Gravel	Fine Gravel C. Sand 0.0 5.5	Medium Sand 7.3	Fine Sand 24.8		Silt 28.3	Clay 34.1	
AASHTO	Gravel 5.5	Coarse Sand 7.3	Fine Sand 24.8		Silt 38.7		<u>Clay</u> 23.7
Sieve Size in inches		Sieve Size in sieve r		•		•	
3 2 1	3/4 3/8 4		0 100	200			<u> </u>
							90
							80
							70
							00 en
							Bass 2
							ert <sup>50</sup>
							60 60 60 60 60 60 60 60 60 60 60 60 60 6

Comments

100

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Diameter (mm)

1

Τ

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oject Name	HCFRRP - Eag	le Creek DSB	Project Number	174316204	
	B-1.2, 5.0'-6.5'		Lab ID	11(	
mple Type	SPT		Date Received	0 11 10	
	SF I		Date Received Date Reported	9-18-19	
			Test Results		
	ral Moisture Co		Atterberg Limits		
	: ASTM D 2216		Test Method: ASTM D 4318 Method	A	
MOISTU	re Content (%):	9.1	Prepared: Dry	04	
			Liquid Limit: Plastic Limit:		
Dev	tiolo Sizo Anol	volo			
	r <b>ticle Size Anal</b> Method: ASTM		Plasticity Index: Activity Index:		
•	ethod: ASTM D		Activity index.	J. I	
	Method: ASTM D		L		
		_ · <b></b>	Moisture-Density Relation	iship	
Parti	cle Size	%	Test Not Performed	-	
Sieve Size	(mm)	Passing	Maximum Dry Density (lb/ft <sup>3</sup> ):	N/A	
	N/A		Maximum Dry Density (kg/m <sup>3</sup> ):	N/A	
	N/A		Optimum Moisture Content (%):		
	N/A		Over Size Correction %:		
	N/A			1077	
3/4"	19	100.0			
3/8"	9.5	83.7	California Bearing Rat	o	
No. 4	4.75	64.4	Test Not Performed		
No. 10	2	50.4	Bearing Ratio (%):	N/A	
No. 40	0.425	31.6	Compacted Dry Density (lb/ft <sup>3</sup> ):		
No. 200	0.075	18.4	Compacted Moisture Content (%):		
	0.02	12.1			
	0.005	5.2			
	0.002	2.6	Specific Gravity		
estimated	0.001	1.0	Test Method: ASTM D 854		
			Prepared: Dry		
Plus 3 in. ma	terial, not inclue	ded: 0 (%)	Particle Size:	No. 10	
			Specific Gravity at 20° Celsius:	2.70	
	ASTM	AASHTO			
Range	(%)	(%)			
Gravel	35.6	49.6	Classification	80	
Coarse San		18.8	Unified Group Symbol:		
Medium Sar Fine Sand		13.2	Group Name: Clayey sa	ind with grave	
Silt	13.2	15.8			
Clay	5.2	2.6	AASHTO Classification:	$\Delta_2 2 4 (0)$	
Ciay	J.Z	2.0		A-2-4 ( U	



# **ATTERBERG LIMITS**

Project HCFRRP - Eagle Creek DSB						Project No.	174316204	
Source	B-1.2	, 5.0'-6.5'					Lab ID	110
							% + No. 40	68
Tested By		JP	Test Method		18 M	lethod A	Date Received	09-11-2019
Test Date	0	9-18-2019	Prepared	Dry		<u>.</u>		
						-	<b>.</b>	
		et Soil and	Dry Soil and					
	Т	are Mass	Tare Mass	Tare Mas	SS	Number of	Water Content	
		(g)	(g)	(g)		Blows	(%)	Liquid Limit
		23.30	20.96	10.92		32	23.3	
		24.98	22.31	11.06		27	23.7	
		24.49	21.75	10.99		16	25.5	24
			· · · · · · · · · · · · · · · · · · ·				ĮĮ_	
	30	-		Lie	quid	Limit		
	00							
	28							
	26							
	20	-	◆					
	24	-						
° H	-							
	22							
SONTENT %	5 20							
Č	5							
	5 18							
MOISTIBE	5 16							
ŬŴ								

NUMBER OF BLOWS

PLASTIC LIMIT AND PLASTICITY INDEX	

Wet Soil and Tare Mass	Dry Soil and Tare Mass	Tare Mass	Water Content		
(g)	(g)	(g)	(%)	Plastic Limit	Plasticity Index
18.65	17.51	10.66	16.6	16	8
18.95	17.87	11.00	15.7		

Remarks:

Reviewed By



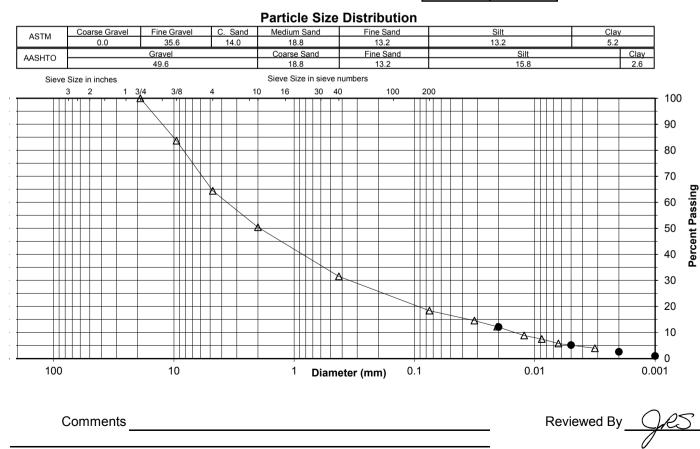


Project Name	HCFRRP - Eagle Creek D		Project Number 17431			
Source	B-1.2, 5.0'-6.5'		Lab ID	110		
	Sieve analysis for	the Portion Coarser th	an the No.	10 Sieve		
				%		
Test Method	ASTM D 422		Sieve Size	Passing		
Prepared using	ASTM D 421					
Particle Shape	Angular					
Particle Hardness:	Hard and Durable					
Tested By	JP					
Test Date	09-12-2019					
Date Received	09-11-2019		3/4"	100.0		
			3/8"	83.7		
Maximum Particle s	size: 3/4" Sieve		No. 4	64.4		
			No. 10	50.4		
	Analysis for th	ne portion Finer than t	he No. 10 S	lieve		
Analysis Based on	-3 inch fraction only		No. 40	31.6		
•	•				1	

Specific Gravity 2.7

Dispersed using Apparatus A - Mechanical, for 1 minute

he No. 10 Sieve						
No. 40	31.6					
No. 200	18.4					
0.02 mm	12.1					
0.005 mm	5.2					
0.002 mm	2.6					
0.001 mm	1.0					





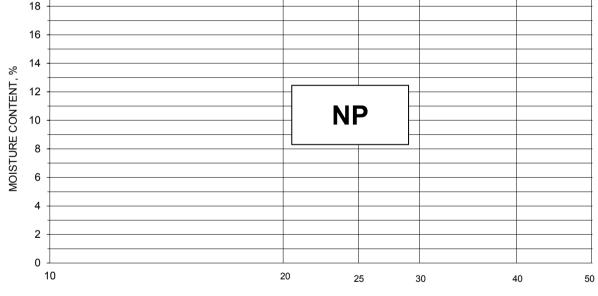
Project Name	HCFRRP - Eagl	e Creek DSB	Project Number	174316204
	B-1.2, 12.5'-14.0		Lab ID	113
Sample Type	SPT		Date Received	9-11-19
			Date Reported	9-18-19
			Test Results	
Natu	ral Moisture Co	ontent	Atterberg Limits	
Test Method	: ASTM D 2216		Test Method: ASTM D 4318 Method /	4
Moistu	re Content (%):	12.6	Prepared: Dry	
			Liquid Limit:	NP
			Plastic Limit:	
<u>Pa</u>	rticle Size Anal	<u>ysis</u>	Plasticity Index:	NP
Preparation	Method: ASTM I	D 421	Activity Index:	N/A
Gradation M	ethod: ASTM D	422		
Hydrometer	Method: ASTM I	D 422		
			Moisture-Density Relation	ship
Part	cle Size	%	Test Not Performed	-
Sieve Size	e (mm)	Passing	Maximum Dry Density (lb/ft <sup>3</sup> ):	N/A
	N/A	Ŭ	Maximum Dry Density (kg/m <sup>3</sup> ):	N/A
	N/A		Optimum Moisture Content (%):	N/A
	N/A		Over Size Correction %:	N/A
	N/A N/A			IN/A
	N/A N/A			
3/8"	9.5	100.0	California Bearing Ratio	
No. 4	4.75	86.3	Test Not Performed	<u>0</u>
No. 10	2	71.2	Bearing Ratio (%):	N/A
No. 40	0.425	40.6	Compacted Dry Density (lb/ft <sup>3</sup> ):	
No. 200	0.075	11.9	Compacted Moisture Content (%):	IN/A
	0.02	7.7		
	0.005	4.0	Creatific Creatity	
a atima ata d	0.002	1.7	Specific Gravity	
estimated	0.001	1.0	Test Method: ASTM D 854	
		$  a d = 0 (0) \rangle$	Prepared: Dry	N= 40
Plus 3 in. ma	iterial, not incluc	ied: 0 (%)	Particle Size:	No. 10
			Specific Gravity at 20° Celsius:	2.70
Damas	ASTM	AASHTO		
Range	(%)	(%)		
Gravel	13.7	28.8	Classification	0.01
Coarse Sar		30.6	Unified Group Symbol:	
Medium Sa			Group Name: Well-graded	sand with silt
Fine Sand		28.7		
	7.9	10.2		
Silt Clay	4.0	1.7	AASHTO Classification:	

Comments:

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Project	HCFRRP - Eagle C	reek DSB			Project No.	174316204
Source	B-1.2, 12.5'-14.0'				Lab ID	113
					% + No. 40	59
Tested By	JP	Test Method	ASTM D 4318 N	1ethod A	Date Received	09-11-2019
Test Date	09-18-2019	Prepared	Dry	_		
	Wet Soil and	Dry Soil and				
	Tare Mass	Tare Mass	Tare Mass	Number of	Water Content	
	(g)	(g)	(g)	Blows	(%)	Liquid Limit
		•			•	
	20		Liquid	Limit		
	20					
	18					
						_



NUMBER OF BLOWS

#### PLASTIC LIMIT AND PLASTICITY INDEX

	Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
-						

Remarks:

Reviewed By



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Project Na Source	me	HCFR B-1.2,			eek D	SB										Pr	oje	ct I	Nur La	nber ıb ID	174 )	13162 1	204  13
			Sieve	analys	is for t	he	Por	tion	Coa	arser	tha Г	an t	ne N	0. 1			)						
Tos	t Method	I	ΔςτΜ	D 422								Siov	e Siz	70	% Pase		r						
Prepar	t Method ed using	· ·	ASTM	D 421							È			20	r as:	SILIC	1						
											F												
	le Shape																						
Particle H	ardness	: Ha	ard and	d Durab	le																		
т	aatad Di	· .									-												
Т	ested By est Date	09-12	1 <u>-</u> 2-2019	_							-			-									
	Received										F												
				-								3	/8"		100	0.0							
Maximum I	Particle s	size: 3/8	8" Siev	е									o. 4		86								
											L	No	0. 10		71	.2							
			Α	nalysis	for th	e p	orti	on F	ine	r than	th	e N	o. 10	) Si	eve								
Analysis Ba	ased on	-3 inch	fractic	on only									. 40	_	40								
0	0		-								F		200		11								
Specific	c Gravity	2	.1										 5 m		<u>7.</u> 4.								
Dispers	ed using		atus A	- Mech	anical	for	1 m	ninute	2				2 m		4. 1.								
Dioporo		, , ippuit		moon	arnoar,	101		initiate					1 m	_	1.								
					Dart	ماء	Siz		etril	butior	- -												
ASTM	Coarse Grave		Gravel	C. Sand	Medi	ium Sa			Fine	Sand	-			S						Clay	,		
AASHTO	0.0	1: Grave	3.7 el	15.1		30.6 rse Sa	and			8.7 Sand				7.	.9 Si	lt				4.0	Clay		
		28.8				<u>30.6</u>				8.7					10.	.2					1.7		
Sieve Siz	ze in inches 2	1 3/4	3/8	4	10 16		30	ve numb 40	ers	100	20	00										r 100	
										-												- 100	
			+++																			- 90	
																						- 80	
				++									-										
																						- 70	ğ
					$\rightarrow$	ĸ					$\square$	+	-									- 60	ssir
																						- 50	Percent Passing
·			++++			+++	$\downarrow$				$\parallel \mid$	++	_			++	+	$\left  \right $				-	cen
																						- 40	Per

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Approved By: RJ

Comments

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Stantec Consulting Services Inc.

Diameter (mm)

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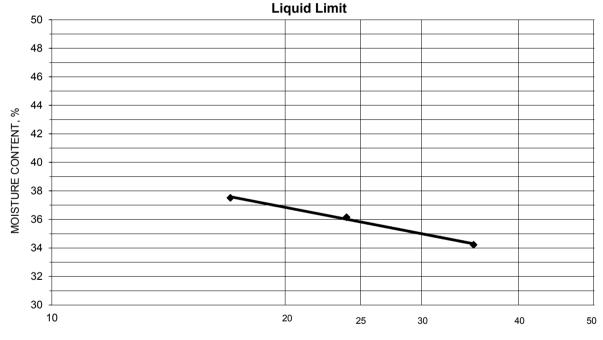
Reviewed By (



oject Name	HCFRRP - Eag	le Creek DSB	Project Number	174316204
	B-1.3, 12.5'-14.		Lab ID	12:
mple Type	SPT		Date Received	9_11_1
			Date Reported	9-18-19
			Test Results	
Natu	ral Moisture Co	ontent	Atterberg Limits	
	ASTM D 2216		Test Method: ASTM D 4318 Method	A
Moistu	re Content (%):	21.8	Prepared: Dry	
			Liquid Limit:	36
			Plastic Limit:	22
<u>Par</u>	ticle Size Anal	<u>ysis</u>	Plasticity Index:	
	Method: ASTM		Activity Index:	0.3
	ethod: ASTM D			
Hydrometer N	Method: ASTM	D 422		
<b></b>			Moisture-Density Relation	<u>nship</u>
	cle Size	%	Test Not Performed	
Sieve Size	(mm)	Passing	Maximum Dry Density (lb/ft <sup>3</sup> ):	N/A
	N/A		Maximum Dry Density (kg/m <sup>3</sup> ):	N/A
	N/A		Optimum Moisture Content (%):	N/A
	N/A		Over Size Correction %:	N/A
	N/A			
	N/A			
	N/A		California Bearing Rat	io
	N/A		Test Not Performed	
No. 10	2	100.0	Bearing Ratio (%):	N/A
No. 40	0.425	98.7	Compacted Dry Density (lb/ft <sup>3</sup> ):	N/A
No. 200	0.075	96.0	Compacted Moisture Content (%):	N/A
	0.02	90.5	_	
	0.005	66.6		
	0.002	44.5	Specific Gravity	
estimated	0.001	27.1	Test Method: ASTM D 854	
			Prepared: Dry	
Plus 3 in. ma	terial, not inclue	led: 0 (%)	Particle Size:	No. 10
			Specific Gravity at 20° Celsius:	2.70
Deres	ASTM	AASHTO		
Range	(%)	(%)	Classification	
Gravel	0.0 d 0.0	0.0	<u>Classification</u> Unified Group Symbol:	CI
Coarse San		1.3		
Medium Sar Fine Sand		2.7	Group Name:	Lean cla
Silt	2.7	51.5		
Clay	66.6	44.5	AASHTO Classification:	Δ-6 ( 14 )
Clay	00.0	44.U		7-0(14)



Project	HCFRRP - Eagle Cr	reek DSB			Project No.	174316204
Source	B-1.3, 12.5'-14.0'				Lab ID	123
					% + No. 40	1
Tested By		Test Method	ASTM D 4318 N	lethod A	Date Received	09-11-2019
Test Date	09-16-2019	Prepared	Dry	-		
	r			1		
	Wet Soil and	Dry Soil and				
	Tare Mass	Tare Mass	Tare Mass	Number of	Water Content	
	(g)	(g)	(g)	Blows	(%)	Liquid Limit
	23.07	20.00	11.03	35	34.2	
	23.58	20.25	11.04	24	36.2	
	22.54	19.40	11.03	17	37.5	36



NUMBER OF BLOWS

#### PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil a Tare Mas (g)	,	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
20.26	18.53 18.15	10.57 11.07	21.7 21.8	22	14

Remarks:

Reviewed By





Project N	lame	Э	F	ICFR	RP	- E;	agle	Cre	ek D	SB										Р	roj	ject	t Nu	ımbe	er f	17431	6204
Source				-1.3,															-					ab II			123
																									_		
					Sie	ve	anal	lvsis	s for	the	Po	ortio	n C	oars	er th	nan	the	No	. 10	Siev	/e						
								,												%	-						
Те	est M	1eth	od		AS	ТΜ	D 42	22								Sie	ve S	Size	Pa	assir	ng						
Prepa										-																	
										-																	
Particle	Hare	dnes	ss:			N/.	A			-																	
	_		_	-																							
				N		10	-															_					
				09-12			-															_					
Date	Re	ceiv	ea_	09-11	1-20	119	-												-			-					
Maximum	n Pa	rticl	a eiz	o. No	<u>, 1</u> (	n Si																					
Maximun	110		0 012	C. NC	<i>י</i> . וכ	5 01										N	lo. 1	10	1	00.0	)						
																					<u> </u>						
A se a la sa i a	<b>D</b>			. :	£				for th	ne p	oor	tion	Fir	er th	an t				1			-					
Analysis	Bas	ea o	n -3	inch	Tra	CTIO	n on	iiy									10.4		-	98.7		_					
Speci	ific (	2rov	itv	2	) 7												o. 2 )2		-	96.0 90.5		-					
Speci		Jiav	···y	2	1		-										)05			66.6		-					
Dispe	rsed	lusi	na A	nnar	atus	sΑ	- Me	cha	nical	fo	r 1 i	minı	ıte				002			44.5							
Diopo				ppu	atut			, on a	mou	,							01		-	27.1							
									Daw	4 - 1	- 0	•	<b>D:</b> -4				-					_					
	Cor	arse Gr	avel	Fine	Grave	el		Sand		dium				ribut		<b>—</b>			Silt				<u> </u>	Cla	av	_	
ASTM		0.0			0.0			.0		1.3				2.7					29.4					66	.6		
AASHTO				<u>Grav</u> 0.0					Co	arse ( 1.3				ine San 2.7	a					Silt 51.5					Cla 44		
Sieve	Size ir											eve nu	mbers														
	3 2	2	13	/4	3/8		4	1		16	30	0 40		100	)	200											00
					+++	++-											+	-			+	++					`
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					+++	++						++	_			+++		_			+	$\square$					cent
	++				+++	++		-		+	++	++	+						-		+	+					Percent Passing
					$\blacksquare$	$\mp$																				30	
	+		$\left  \right $		+++	++				+	+++	++	+	_	-+	+++	+	_	_		++	++	$\left  \right $	_	-	<b>_</b>	
++++	++		-		+++	++			-		+++			_		+	+				++	++	+		+	- 20	)

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Comments

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Reviewed By

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Stantec Consulting Services Inc.



**Summary of Soil Tests** 

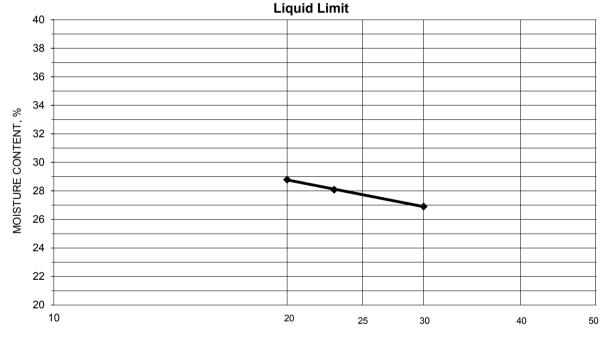
Reviewed By

oject Name HC	FRRP - Eagl	e Creek DSB	Project Number 17431620
	2.10, 5.0'-6.5'		Project Number 17431620
· · · · · · · · · · · · · · · · · · ·	<del>.</del>		
ample Type <u>SP</u>	I		Date Received 9-11-1
			Date Reported 9-18-1
			Test Results
	Moisture Co	ontent	Atterberg Limits
Test Method: AS	STM D 2216		Test Method: ASTM D 4318 Method A
Moisture (	Content (%):	14.5	Prepared: Dry
			Liquid Limit: 28
			Plastic Limit: 17
Partic	le Size Anal	<u>ysis</u>	Plasticity Index: 11
Preparation Met	hod: ASTM	D 421	Activity Index: 0.4
Gradation Metho	od: ASTM D	422	
Hydrometer Met	thod: ASTM I	0 422	
·			Moisture-Density Relationship
Particle	Size	%	Test Not Performed
Sieve Size	(mm)	Passing	Maximum Dry Density (lb/ft <sup>3</sup> ): N/A
	N/A		Maximum Dry Density (kg/m <sup>3</sup> ): N/A
	N/A		Optimum Moisture Content (%): N/A
	N/A		Over Size Correction %: N/A
	N/A		
	N/A		
3/8"	9.5	100.0	California Bearing Ratio
No. 4	4.75	97.0	Test Not Performed
No. 10	2	93.3	Bearing Ratio (%): N/A
No. 40	0.425	85.6	Compacted Dry Density (lb/ft <sup>3</sup> ): N/A
No. 200	0.075	69.5	Compacted Moisture Content (%): N/A
	0.02	59.0	
	0.005	37.6	
	0.002	25.1	Specific Gravity
estimated	0.001	14.9	Test Method: ASTM D 854
		·	Prepared: Dry
Plus 3 in. mater	ial, not includ	ed: 0 (%)	Particle Size: No. 10
	-	. ,	Specific Gravity at 20° Celsius: 2.70
	ASTM	AASHTO	
Range	(%)	(%)	
Gravel	3.0	6.7	Classification
Coarse Sand	3.7	7.7	Unified Group Symbol: CL
Medium Sand	7.7		Group Name: Sandy lean cla
	16.1	16.1	
Fine Sand		44.4	
Fine Sand Silt	31.9	44.4	

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Project	HCFRRP - Eagle C	reek DSB			Project No.	174316204
Source	B-2.10, 5.0'-6.5'				Lab ID	130
					% + No. 40	14
Tested By	JP	Test Method	ASTM D 4318 N	1ethod A	Date Received	09-11-2019
Test Date	09-16-2019	Prepared	Dry	_		
	Wet Soil and	Dry Soil and				
	Tare Mass	Tare Mass	Tare Mass	Number of	Water Content	
	(g)	(g)	(g)	Blows	(%)	Liquid Limit
	26.16	22.95	11.02	30	26.9	
	24.69	21.62	10.69	23	28.1	
	25.07	21.94	11.07	20	28.8	28



NUMBER OF BLOWS

#### PLASTIC LIMIT AND PLASTICITY INDEX

Tare Mass (g)	Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
18.45 17.78	17.37 16.80	11.04 11.05	17.1 17.0	17	11

Remarks:

Reviewed By





Project Name Source	HCFRRP - Eagle Creek DSB B-2.10, 5.0'-6.5'		Proje	ect Number Lab ID	174316204 130
	Sieve analysis for the Portion Coarser t	han the No.	10 Sieve		
			%		
Test Method	ASTM D 422	Sieve Size	Passing		
Prepared using	ASTM D 421				
Particle Shape	Angular				
	Hard and Durable				
Tested Du					
Tested By					
	09-12-2019				
Date Received	09-11-2019	2/0"	100.0		
Maximum Dartiala		3/8"	100.0		
Maximum Particle s	SIZE: 3/8 SIEVE	No. 4	97.0		
		No. 10	93.3	l	
	Analysis for the portion Finer than	the No. 10 S	Sieve		
Analysis Based on	-3 inch fraction only	No. 40	85.6		
		No. 200	69.5		
Specific Gravity	2.7	0.02 mm	59.0		
		0.005 mm	37.6	1	
Dispersed using	Apparatus A - Mechanical, for 1 minute	0.002 mm	25.1	1	
-		0.001 mm	14.9	1	

				Particle	Size	Distributio	on					
ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sa	ind	Fine Sand			Silt	Clay		
ASTIV	0.0	3.0	3.7	7.7		16.1		:	31.9	37.6		
ASHTO		Gravel		Coarse Sa	nd	Fine Sand			Silt		Clay	
Konno		6.7		7.7		16.1			44.4		25.1	
Sieve	Size in inches			Sieve Size i	n sieve nı	umbers						
:	3 2 1	3/4 3/8	4 1	0 16	30 40	100	200	)			— <u> </u>	იი
												50
											90	0
												J
											80	^
												J
							<u> </u>					~
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		+ +++++										D
		+ +++++			++++				+			
											30	0
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		+++++++			++++							0
		+ +++++			++++				+ + + + + + + + + + + + + + + + + + + +		•	
		+ +++++			++++			++++	+ ++++			0
	++++-		+ $+$ $+$ $-$		++++							
											0	

1 Diameter (mm)

0.1

Comments

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Reviewed By

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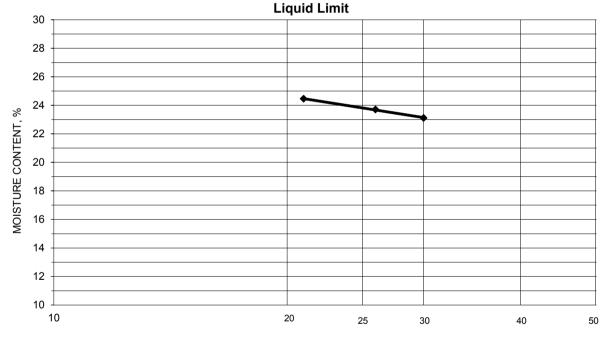
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Eagle Creek DSB 5'-14.0' e Content 216 (%): 15.6 Malysis TM D 421 M D 422 TM D 422 TM D 422 M D 422 M D 422 TM D 422 TM D 422 TM D 422	Project Number       17431620         Lab ID       13         Date Received       9-11-'         Date Reported       9-18-'         Test Results         Test Results         Liquid Limits         Test Method: ASTM D 4318 Method A         Prepared: Dry       Liquid Limit:       24         Plastic Limit:       15         Plastic Limit:       15         Plasticity Index:       9         Activity Index:       0.5         Moisture-Density Relationship         Test Not Performed       Maximum Dry Density (lb/ft <sup>3</sup> ):       N/A         Maximum Dry Density (kg/m <sup>3</sup> ):       N/A         Optimum Moisture Content (%):       N/A         Over Size Correction %:       N/A
216 (%): <u>15.6</u> Analysis TM D 421 M D 422 TM D 422 M D 422 M D 422 M D 422 M D 422 M D 422 M D 422	Test Results         Atterberg Limits         Test Method: ASTM D 4318 Method A         Prepared: Dry         Liquid Limit:       24         Plastic Limit:       15         Plastic Limit:       15         Plasticity Index:       9         Activity Index:       0.5         Moisture-Density Relationship         Test Not Performed       Maximum Dry Density (lb/ft <sup>3</sup> ):         Maximum Dry Density (kg/m <sup>3</sup> ):       N/A         Optimum Moisture Content (%):       N/A
216 (%): <u>15.6</u> Analysis TM D 421 M D 422 TM D 422 M D 422 M D 422 M D 422 M D 422 M D 422 M D 422	Test Results         Atterberg Limits         Test Method: ASTM D 4318 Method A         Prepared: Dry         Liquid Limit:       24         Plastic Limit:       15         Plastic Limit:       15         Plasticity Index:       9         Activity Index:       0.5         Moisture-Density Relationship         Test Not Performed       Maximum Dry Density (lb/ft <sup>3</sup> ):         Maximum Dry Density (kg/m <sup>3</sup> ):       N/A         Optimum Moisture Content (%):       N/A
216 (%): <u>15.6</u> Analysis TM D 421 M D 422 TM D 422 M D 422 M D 422 M D 422 M D 422 M D 422 M D 422	Test Results         Atterberg Limits         Test Method: ASTM D 4318 Method A         Prepared: Dry         Liquid Limit:       24         Plastic Limit:       15         Plastic Limit:       15         Plasticity Index:       9         Activity Index:       0.5         Moisture-Density Relationship         Test Not Performed       Maximum Dry Density (lb/ft <sup>3</sup> ):         Maximum Dry Density (kg/m <sup>3</sup> ):       N/A         Optimum Moisture Content (%):       N/A
216 (%): <u>15.6</u> Analysis TM D 421 M D 422 TM D 422 M D 422 M D 422 M D 422 M D 422 M D 422 M D 422	Atterberg Limits         Test Method: ASTM D 4318 Method A         Prepared: Dry         Liquid Limit:       24         Plastic Limit:       15         Plasticity Index:       9         Activity Index:       0.5         Moisture-Density Relationship         Test Not Performed       Maximum Dry Density (lb/ft <sup>3</sup> ):         Maximum Dry Density (kg/m <sup>3</sup> ):       N/A         Optimum Moisture Content (%):       N/A
216 (%): <u>15.6</u> Analysis TM D 421 M D 422 TM D 422 M D 422 M D 422 M D 422 M D 422 M D 422 M D 422	Test Method: ASTM D 4318 Method A         Prepared: Dry         Liquid Limit:       24         Plastic Limit:       15         Plastic Limit:       9         Activity Index:       9         Activity Index:       0.5         Moisture-Density Relationship         Test Not Performed       Maximum Dry Density (lb/ft <sup>3</sup> ):         Maximum Dry Density (kg/m <sup>3</sup> ):       N/A         Optimum Moisture Content (%):       N/A
15.6         Analysis         TM D 421         M D 422         TM D 422         M D 422         Passing	Prepared: Dry       Liquid Limit: 24         Plastic Limit: 15         Plastic Limit: 15         Plastic Limit: 05         Plasticity Index: 9         Activity Index: 0.5         Moisture-Density Relationship         Test Not Performed         Maximum Dry Density (lb/ft <sup>3</sup> ): N/A         Maximum Dry Density (kg/m <sup>3</sup> ): N/A         Optimum Moisture Content (%): N/A
Analysis TM D 421 M D 422 TM D 422 ) Passing	Liquid Limit: 24 Plastic Limit: 15 Plasticity Index: 9 Activity Index: 0.5 Moisture-Density Relationship Test Not Performed Maximum Dry Density (lb/ft <sup>3</sup> ): N/A Maximum Dry Density (kg/m <sup>3</sup> ): N/A Optimum Moisture Content (%): N/A
TM D 421 M D 422 TM D 422 ) Passing	Plastic Limit:       15         Plasticity Index:       9         Activity Index:       0.5         Moisture-Density Relationship         Test Not Performed         Maximum Dry Density (lb/ft <sup>3</sup> ):       N/A         Maximum Dry Density (kg/m <sup>3</sup> ):       N/A         Optimum Moisture Content (%):       N/A
TM D 421 M D 422 TM D 422 ) Passing	Plasticity Index:       9         Activity Index:       0.5         Moisture-Density Relationship         Test Not Performed         Maximum Dry Density (lb/ft <sup>3</sup> ):       N/A         Maximum Dry Density (kg/m <sup>3</sup> ):       N/A         Optimum Moisture Content (%):       N/A
TM D 421 M D 422 TM D 422 ) Passing	Moisture-Density Relationship         Test Not Performed         Maximum Dry Density (lb/ft <sup>3</sup> ):       N/A         Maximum Dry Density (kg/m <sup>3</sup> ):       N/A         Optimum Moisture Content (%):       N/A
M D 422 TM D 422 ) Passing	Moisture-Density Relationship         Test Not Performed         Maximum Dry Density (lb/ft <sup>3</sup> ):         N/A         Maximum Dry Density (kg/m <sup>3</sup> ):         N/A         Optimum Moisture Content (%):
) Passing	Test Not Performed         Maximum Dry Density (lb/ft <sup>3</sup> ):         Maximum Dry Density (kg/m <sup>3</sup> ):         N/A         Optimum Moisture Content (%):
) Passing	Test Not Performed         Maximum Dry Density (lb/ft <sup>3</sup> ):         Maximum Dry Density (kg/m <sup>3</sup> ):         N/A         Optimum Moisture Content (%):
) Passing	Maximum Dry Density (lb/ft <sup>3</sup> ):       N/A         Maximum Dry Density (kg/m <sup>3</sup> ):       N/A         Optimum Moisture Content (%):       N/A
	Maximum Dry Density (kg/m <sup>3</sup> ): N/A Optimum Moisture Content (%): N/A
	Optimum Moisture Content (%): N/A
	Optimum Moisture Content (%): N/A
100.0	
	California Bearing Ratio
94.7	Test Not Performed
86.5	Bearing Ratio (%): N/A
5 78.5	Compacted Dry Density (lb/ft <sup>3</sup> ): N/A
5 62.0	Compacted Moisture Content (%): N/A
46.8	
5 28.5	
2 18.1	Specific Gravity
1 10.1	Test Method: ASTM D 854
	Prepared: Dry
cluded: 0 (%)	Particle Size: No. 10
	Specific Gravity at 20° Celsius: 2.70
	Classification
	Unified Group Symbol: CL
	Group Name: Sandy lean cla
100	
16.5 43.9	
N) 32 5	3         13.5           2         8.0           0



Project	HCFRRP - Eagle Ci	reek DSB	Project No.	174316204		
Source	B-2.10, 12.5'-14.0'		Lab ID	133		
			% + No. 40	22		
Tested By	JP	Test Method	Date Received	09-11-2019		
Test Date	09-16-2019	Prepared	-			
		-				
	Wet Soil and	Dry Soil and				
	Tare Mass	Tare Mass	Tare Mass	Number of	Water Content	
	(g)	(g)	(g)	Blows	(%)	Liquid Limit
	24.70	22.12	10.96	30	23.1	
	24.97	22.31	11.09	26	23.7	
	25.22	22.41	10.92	21	24.5	24
	L	!		<u>I</u>	<u>I</u>	



NUMBER OF BLOWS

#### PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass	Dry Soil and Tare Mass	Tare Mass	Water Content		
(g)	(g)	(g)	(%)	Plastic Limit	Plasticity Index
17.95	16.97	10.48	15.1	15	9
21.34	20.00	11.01	14.9		

Remarks:

Reviewed By



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Project Na Source		HCFRRP - Eagle Creek DSB B-2.10, 12.5'-14.0'								Project Number1 Lab ID							204
		Siev	e analysis	s for the I	Portio	n Co	arser t	han the	No.		/e	-					
То	at Mathad	Method ASTM D 422								% Passir	20						
Prepa	ared using	AST	MD 422 MD 421					Sieve	Size	F d 5 5 11	ıy						
. tope	arou uonig																
Particle Shape Angular																	
Particle I	Hardness:	Hard ar	nd Durable	)													
-	Tested By	MP															
		09-12-201	9														
		09-11-201															
								3/8	3"	100.	0						
Maximum	n Particle s	ize: 3/8" Sie	ve					No.		94.7							
								No.	10	86.5	,						
			Analysis f	for the po	ortion	Fine	r than t	t <u>he No</u> .	10 S	ieve		_					
Analysis I	Based on	-3 inch fract	ion only					No.		78.5							
Ora e si	fin Oner it.	0.7						No. 2		62.0							
Speci	fic Gravity	2.7						0.02		46.8 28.5							
Disper	sed usina	Apparatus /	A - Mecha	nical for	1 minı	ite		0.003		18.1							
Diopol	oou uonig	/ apparatao /	( moona	moal, ioi				0.001		10.1							
				Particle	Sizo I	Nietril	hution					_					
ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sa		Fine	e Sand			Silt Cla					/		
	0.0	5.3 Gravel	8.2	8.0 16.5 Coarse Sand Fine Sand			33.5 Silt				28.5 Clay						
AASITIO 13.5 8.0 16.5 43.9 18.1																	
Sieve	Size in inches 3 2 1	3/4 3/8	4 1	Sieve Size ir 0 16	30 40	mbers	100	200								400	
																- 100	
											++					- 90	
																- 80	
						$\mathbf{h}$					++						
							$\searrow$									- 70	g
											++					- 60	ssin
																- 50	Percent Passing
				-					$\vdash$	<b>•</b>	++					-	cen
										<u> </u> _ A	4					- 40	Per

0.01 1 Diameter (mm) 0.1 Reviewed By

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Comments

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Stantec Consulting Services Inc.



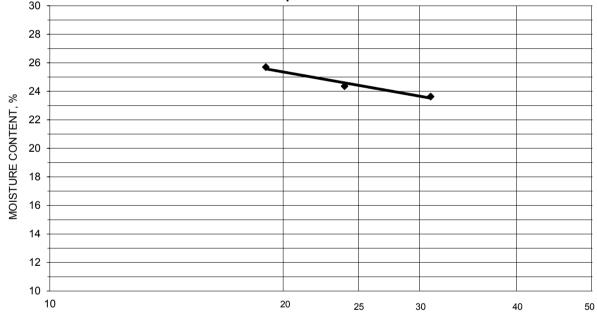
oject Name HCI	FRRP - Eag	le Creek DSB	Project Number	17431620
	.11, 10.0'-11		Lab ID	142
	r			0 11 1
mple Type SP			Date Received Date Reported	9-11-1
				9-10-1
			Test Results	
	Moisture Co		Atterberg Limits	
Test Method: AS	STM D 2216		Test Method: ASTM D 4318 Method	A
Moisture C	Content (%):	13.2	Prepared: Dry	
			Liquid Limit:	24
			Plastic Limit:	
Particl	e Size Anal	<u>ysis</u>	Plasticity Index:	9
Preparation Met	hod: ASTM	D 421	Activity Index:	0.4
Gradation Metho	d: ASTM D	422		
Hydrometer Met	hod: ASTM	D 422		
-			Moisture-Density Relation	nship
Particle	Size	%	Test Not Performed	
Sieve Size	(mm)	Passing	Maximum Dry Density (lb/ft <sup>3</sup> ):	N/A
	N/A		Maximum Dry Density (kg/m <sup>3</sup> ):	N/A
	N/A		Optimum Moisture Content (%):	N/A
	N/A		Over Size Correction %:	N/A
	N/A			
	N/A			
3/8"	9.5	100.0	California Bearing Rat	io
No. 4	4.75	96.9	Test Not Performed	
No. 10	2	90.1	Bearing Ratio (%):	N/A
No. 40	0.425	82.8	Compacted Dry Density (lb/ft <sup>3</sup> ):	
No. 200	0.075	67.3	Compacted Moisture Content (%):	
	0.02	51.5		
	0.005	32.1		
-	0.002	20.9	Specific Gravity	
estimated	0.001	10.7	Test Method: ASTM D 854	
		<u>.                                    </u>	Prepared: Dry	
Plus 3 in. materia	al, not includ	led: 0 (%)	Particle Size:	No. 10
			Specific Gravity at 20° Celsius:	2.70
Γ	ASTM	AASHTO		
Range	(%)	(%)		
Gravel	3.1	9.9	Classification	
Coarse Sand	6.8	7.3	Unified Group Symbol:	CL
Medium Sand	7.3		Group Name: S	
Fine Sand	15.5	15.5		<b>,</b>
	35.2	46.4		
Silt				A-4 ( 3 )

Reviewed By



#### **ATTERBERG LIMITS**

Project	HCFRRP - Eagle Cr	eek DSB			Project No.	174316204
Source	B-2.11, 10.0'-11.5'				Lab ID	142
			% + No. 40	17		
Tested By	MP	Test Method	ASTM D 4318 N	lethod A	Date Received	09-11-2019
Test Date	09-17-2019	Prepared	Dry			
				-		
	Wet Soil and	Dry Soil and				
	Tare Mass	Tare Mass	Tare Mass	Number of	Water Content	
	(g)	(g)	(g)	Blows	(%)	Liquid Limit
	23.72	21.30	11.06	31	23.6	
	24.27	21.68	11.05	24	24.4	
	22.77	20.36	10.98	19	25.7	24
			Liquid	Limit		
	30					



NUMBER OF BLOWS

#### PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass	Dry Soil and Tare Mass	Tare Mass	Water Content		
(g)	(g)	(g)	(%)	Plastic Limit	Plasticity Index
20.03	18.82	10.62	14.8	15	9
22.35	20.85	10.93	15.1		

Remarks:

YRS ! Reviewed By





Sieve analysis for the Portion Coarser than the No. 10 Sieve         Test Method       ASTM D 422       Sieve Size       Passing         Prepared using       ASTM D 421       Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Sieve Size       Passing         Particle Shape       Angular       Image: Colspan="2">Image: Colspan="2" Image: Colspan	42
Test Method ASTM D 422   Prepared using ASTM D 421     Particle Shape Angular   Particle Hardness: Hard and Durable   Tested By MP   Test Date 09-12-2019   Date Received 09-11-2019   Maximum Particle size: 3/8" Sieve No. 4	
Test Method ASTM D 422   Prepared using ASTM D 421     Particle Shape Angular   Particle Hardness: Hard and Durable   Tested By MP   Test Date 09-12-2019   Date Received 09-11-2019   Maximum Particle size: 3/8" Sieve No. 4	
Test Method ASTM D 422   Prepared using ASTM D 421     Particle Shape Angular   Particle Hardness: Hard and Durable   Tested By MP   Test Date 09-12-2019   Date Received 09-11-2019   Maximum Particle size: 3/8" Sieve No. 4	
Prepared using ASTM D 421   Particle Shape Angular   Particle Hardness: Hard and Durable   Tested By MP   Test Date 09-12-2019   Date Received 09-11-2019   Maximum Particle size: 3/8"   100.0	
Particle Shape Angular   Particle Hardness: Hard and Durable   Tested By MP   Test Date 09-12-2019   Date Received 09-11-2019   Maximum Particle size: 3/8"   100.0	
Particle Hardness: Hard and Durable   Tested By MP   Test Date 09-12-2019   Date Received 09-11-2019   Maximum Particle size: 3/8"   100.0   No. 4   96.9	
Particle Hardness: Hard and Durable   Tested By MP   Test Date 09-12-2019   Date Received 09-11-2019   Maximum Particle size: 3/8"   100.0   No. 4   96.9	
Tested By       MP         Test Date       09-12-2019         Date Received       09-11-2019         Maximum Particle size: 3/8" Sieve       3/8"	
Test Date         09-12-2019           Date Received         09-11-2019           Maximum Particle size: 3/8" Sieve         3/8"           No. 4         96.9	
Test Date         09-12-2019           Date Received         09-11-2019           Maximum Particle size: 3/8" Sieve         3/8"           No. 4         96.9	
Date Received         09-11-2019           3/8"         100.0           Maximum Particle size: 3/8" Sieve         No. 4         96.9	
3/8"         100.0           Maximum Particle size: 3/8" Sieve         No. 4         96.9	
Maximum Particle size: 3/8" Sieve No. 4 96.9	
No. 10 90.1	
Analysis for the portion Finer than the No. 10 Sieve	
Analysis Based on -3 inch fraction only No. 40 82.8	
No. 200 67.3	
Specific Gravity         2.7         0.02 mm         51.5           0.005 mm         32.1	
Dispersed using Apparatus A - Mechanical, for 1 minute 0.002 mm 20.9	
0.002 mm 20.9	
Particle Size Distribution	
ASTM         Coarse Gravel         Fine Gravel         C. Sand         Medium Sand         Fine Sand         Silt         Clay           0.0         3.1         6.8         7.3         15.5         35.2         32.1	
Gravel         Coarse Sand         Fine Sand         Silt         Clay           9.9         7.3         15.5         46.4         20.9	
Sieve Size in inches Sieve Size in sieve numbers	
90	
	D
	sing
	Passing
	Percent Passing

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Diameter (mm)

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100

Approved By: RJ

Comments

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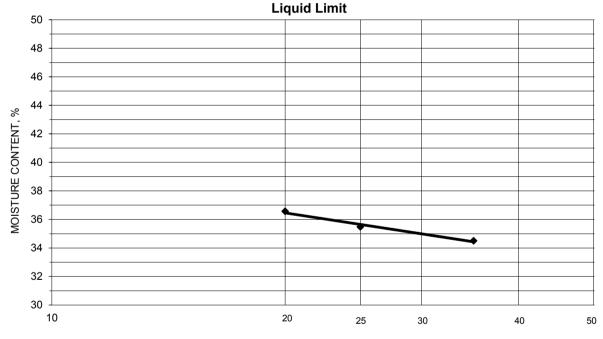
oject Name	HCFRRP - Eag	le Creek DSB	Project Number	17431620
	B-2.12a, 10.0'-1		Lab ID	15
ample Type	SPT		Date Received	Q_11_1
			Date Received Date Reported	9-18-1
Natur	ral Moisture Co	ontent	Atterberg Limits	
	ASTM D 2216		Test Method: ASTM D 4318 Method	А
	re Content (%):		Prepared: Dry	
	(,,)		Liquid Limit:	36
			Plastic Limit:	
Par	ticle Size Anal	vsis	Plasticity Index:	13
	Method: ASTM		Activity Index:	0.7
	ethod: ASTM D			
	Method: ASTM			
5			Moisture-Density Relation	nship
Partie	cle Size	%	Test Not Performed	-
Sieve Size	(mm)	Passing	Maximum Dry Density (lb/ft <sup>3</sup> ):	N/A
	N/A		Maximum Dry Density (kg/m <sup>3</sup> ):	N/A
	N/A		Optimum Moisture Content (%):	N/A
	N/A		Over Size Correction %:	
	N/A			
	N/A			
3/8"	9.5	100.0	California Bearing Rat	io
No. 4	4.75	97.4	Test Not Performed	
No. 10	2	94.4	Bearing Ratio (%):	N/A
No. 40	0.425	90.4	Compacted Dry Density (lb/ft <sup>3</sup> ):	
No. 200	0.075	69.8	Compacted Moisture Content (%):	
<u></u>	0.02	52.8		
	0.005	31.5		
	0.002	19.7	Specific Gravity	
estimated	0.001	10.4	Test Method: ASTM D 854	
			Prepared: Dry	
Plus 3 in. ma	terial, not incluc	led: 0 (%)	Particle Size:	
	·	·	Specific Gravity at 20° Celsius:	2.70
_	ASTM	AASHTO		
Range	(%)	(%)		
Gravel	2.6	5.6	Classification	-
Coarse San		4.0	Unified Group Symbol:	
Medium San			Group Name: S	andy lean cla
Fine Sand		20.6		
Silt	38.3	50.1		
Clay	31.5	19.7	AASHTO Classification:	A-6(8

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### **ATTERBERG LIMITS**

Project	HCFRRP - Eagle Cr	eek DSB			Project No.	174316204
Source	B-2.12a, 10.0'-11.5'		Lab ID	150		
					% + No. 40	10
Tested By	MP	Test Method	ASTM D 4318 M	lethod A	Date Received	09-11-2019
Test Date	09-13-2019	Prepared	Dry	_		
				_		
	Wet Soil and	Dry Soil and				
	Tare Mass	Tare Mass	Tare Mass	Number of	Water Content	
	(g)	(g)	(g)	Blows	(%)	Liquid Limit
	25.14	21.49	10.91	35	34.5	
	23.58	20.27	10.94	25	35.5	
	23.61	20.10	10.50	20	36.6	36
						•



NUMBER OF BLOWS

#### PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
21.72	19.73	11.05	22.9	23	13
19.20	17.68	11.01	22.8		

Remarks:

Reviewed By



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Sieve analysis for the Portion Coarser than the No. 10 Sieve         Test Method       ASTM D 421         Particle Shape       Angular         Particle Shape       Angular         Particle Hardness:       Hard and Durable         Test Method       09-12-2019         Date Received       09-14         Date Received       09-14         Doco       No. 4       97.4         Date Received       2.17       Doco         Dispersed using Apparatus A - Mechanical, for 1 minute       Doco         Marring       See See in ince       See See in See in See See in	Project Name Source	HCFRRP - Eagle B-2.12a, 10.0'-11.	Projec	<u>174316204</u> 150				
Test Method       ASTM D 422       Sieve Size       Passing         Particle Shape       Angular								
Test Method       ASTM D 422       Sieve Size       Passing         Particle Shape       Angular		Sieve anal	ysis for the Porti	on Coarser th	han the No.	10 Sieve		
Prepared using       ASTM D 421         Particle Shape       Angular         Particle Hardness:       Hard and Durable         Tested By       MP         Test Date       09-12-2019         Date Received       09-11-2019         Maximum Particle size: 3/8" Sieve       No. 10         Maximum Particle size: 3/8" Sieve       No. 10         Analysis for the portion Finer than the No. 10 Sieve         Analysis Based on -3 inch fraction only       No. 40         Specific Gravity       2.7         Dispersed using Apparatus A - Mechanical, for 1 minute       0.005 mm 31.5         O.001 mm       10.4						%		
Particle Shape       Angular         Particle Hardness:       Hard and Durable         Tested By       MP         Test Date       09-12-2019         Date Received       09-11-2019         Maximum Particle size: 3/8" Sieve       3/8" 100.0         Maximum Particle size: 3/8" Sieve       No. 4 97.4         Maximum Particle size: 3/8" Sieve       No. 40 90.4         Analysis for the portion Finer than the No. 10 Sieve         Analysis Based on -3 inch fraction only       No. 40 90.4         Specific Gravity       2.7         Dispersed using Apparatus A - Mechanical, for 1 minute       0.002 mm 19.7         Out of the fine Grave       Site Size in silve numbers         Astrico       Size       Size         Size Size in index       Size size in silve numbers       Size size in silve numbers         Out of the size in silve numbers       Size size in silve numbers       Size size in silve numbers         Out of the size in silve numbers       Size size in silve numbers       Size size in silve numbers         Out of the size in silve numbers       Size size in silve numbers       Size size in silve numbers         Out of the size in silve numbers       Size size in silve numbers       Size size in silve numbers         Out of the size in silve numbers       Size size in silve numbe	Test Metho	d ASTM D 42	22		Sieve Size	Passing		
Particle Hardness:       Hard and Durable         Tested By       MP         Test Date       09-12-2019         Date Received       09-11-2019         Maximum Particle size: 3/8" Sieve       No. 4         Maximum Particle size: 3/8" Sieve         Analysis for the portion Finer than the No. 10 Sieve         Analysis Based on -3 inch fraction only         Specific Gravity       2.7         Dispersed using Apparatus A - Mechanical, for 1 minute       0.002 mm 52.8         O.002 mm 19.7       0.001 mm 10.4         Particle Size Distribution         Medium Sand         Sile Cravel         Sile Size in inches	Prepared usin	g ASTM D 42	21					
Particle Hardness:       Hard and Durable         Tested By       MP         Test Date       09-12-2019         Date Received       09-11-2019         Maximum Particle size: 3/8" Sieve       No. 4         Malysis for the portion Finer than the No. 10 Sieve         Analysis Based on -3 inch fraction only       No. 40         Specific Gravity       2.7         Dispersed using Apparatus A - Mechanical, for 1 minute       0.002 mm 52.8         O.002 mm 19.7       0.001 mm 10.4         Particle Size Distribution         Maximo       Clav         Astm       Clave         3.0       4.0         70       1.04         Output file Gravel         Sileve Size in inches         Sileve Size in inches         Output file Gravel         Sileve Size in inches         Output file Gravel         Sileve Size in inches         Output file Gravel	Particle Shap	e Angular						
Test Date       09-12-2019         Date Received       09-11-2019         Maximum Particle size: 3/8" Sieve       3/8" 100.0         No. 4       97.4         No. 10       94.4         No. 40 90.4         No. 10       94.4         No. 40 90.4         No. 10       94.4         No. 40 90.4         No. 200       69.8         0.02 mm       52.8         0.005 mm       0.02 mm         0.001 mm       10.4    Particle Size Distribution			able					
Test Date       09-12-2019         Date Received       09-11-2019         Maximum Particle size: 3/8" Sieve       3/8" 100.0         No. 4       97.4         No. 10       94.4         No. 10       94.4         No. 10       94.4         No. 10       94.4         Specific Gravity       2.7         Dispersed using Apparatus A - Mechanical, for 1 minute       0.02 mm 52.8         0.005 mm 31.5       0.005 mm 31.5         0.001 mm 10.4       0.001 mm 10.4         Particle Size Distribution         100         Sieve Size in sieve numbers         3         Sieve Size in sieve numbers         3         Sieve Size in inches         Sieve Size in sieve numbers         3         3         3         3         3         3         3         3         Sieve Size in sieve numbers         3         3         3         3								
Date Received $09-11-2019$ $3/8"$ $100.0$ Maximum Particle size: $3/8"$ Sieve $3/8"$ $100.0$ No. 4 $97.4$ No. 10 $94.4$ Analysis for the portion Finer than the No. 10 SieveAnalysis Based on -3 inch fraction only $No. 40$ Specific Gravity $2.7$ Dispersed using Apparatus A - Mechanical, for 1 minute $0.02 \text{ mm}$ Dispersed using Apparatus A - Mechanical, for 1 minuteDispersed using Apparatus A - Mechanical, for 1 minuteOut of the Size DistributionSieve Gravel Fine GravelSieve Size in sieve numbers $32 - 1$ $3/4$ $30$ Sieve Size in sieve numbers $32 - 1$ $3/4$ $30$ $30 - 4$ $10$ $200$ $30 - 4$ $10$ $200$ $30 - 4$ $10$ $100$ $90$ $90$ $32 - 1$ $3/4$ $30$ $32 - 1$ $3/4$ $30$ $32 - 1$ $3/4$ $30$ $32 - 1$ $3/4$ $30$ $40 - 20.6$ $50.1$ $32 - 1$ $3/4$ $30$ $32 - 1$ $3/4$ $30$ $40 - 20.6$ $50.1$ $32 - 1$ $3/4$ $30$ $40 - 20.6$ $50.1$ $90 - 30$ $90$ $90 - 30$ $90$ $90 - 30$ $90$ $90 - 30$ $90$ $90 - 30$ $90$ $90 - 30$ $90$ $90 - 30$ $90$ $90 - 30$								
Maximum Particle size: 3/8" Sieve $3/8"$ 100.0         No. 4       97.4         No. 10       94.4         Analysis for the portion Finer than the No. 10 Sieve         Analysis Based on -3 inch fraction only $No. 40$ 90.4         Specific Gravity       2.7 $No. 200$ 69.8         Dispersed using Apparatus A - Mechanical, for 1 minute $0.02 \text{ mm}$ $0.02 \text{ mm}$ Particle Size Distribution         Maximum Earle Cases Gravel         Sieve Size in inches         Sieve								
Maximum Particle size: 3/8" Sieve       No. 4       97.4         Analysis for the portion Finer than the No. 10 Sieve         Analysis Based on -3 inch fraction only       No. 40       90.4         Specific Gravity       2.7       No. 200       69.8         Dispersed using Apparatus A - Mechanical, for 1 minute       0.02 mm 52.8       0.005 mm 31.5         Dispersed using Apparatus A - Mechanical, for 1 minute       0.002 mm 19.7       0.001 mm 10.4         Site Gravel Caree Gravel C. Sand Medium Sand Fine Sand Sitt       Clay         ASHTO       2.6       3.0       4.0       20.6       38.3       31.5         Sileve Size in sinches       Sileve Size in sieve numbers       Sileve Size in sieve numbers       3.2       1.3/4       38.4       10       10       20.0       100       90       80         3.2       1.3/4       38.4       10       16       30.40       100       200       100       90       80         3.2       1.3/4       38.4       10       16       30       40       100       200       70       100       90	Date Receive	<u> </u>			3/8"	100.0		
Analysis for the portion Finer than the No. 10 Sieve         Analysis Based on -3 inch fraction only       No. 40       90.4         Specific Gravity       2.7       No. 200       69.8         Dispersed using Apparatus A - Mechanical, for 1 minute       0.02 mm       52.8         Dispersed using Apparatus A - Mechanical, for 1 minute       0.002 mm       10.7         Particle Size Distribution         Sieve Size in inches         Sieve Size in inches       Sieve Size in sieve numbers         3       2       1       34       4       0       100       200       100       90       80       70	Maximum Particle	size: 3/8" Sieve			No. 4	97.4		
Analysis Based on -3 inch fraction only $No. 40  90.4$ Specific Gravity					No. 10	94.4		
Specific Gravity       2.7         Dispersed using Apparatus A - Mechanical, for 1 minute $0.02 \text{ mm} 52.8$ $0.005 \text{ mm} 31.5$ $0.002 \text{ mm} 19.7$ $0.001 \text{ mm} 10.4$ Dispersed using Apparatus A - Mechanical, for 1 minute         Mathematical for 1 minute         Dispersed using Apparatus A - Mechanical, for 1 minute         Dispersed using Apparatus A - Mechanical, for 1 minute         Dispersed using Apparatus A - Mechanical, for 1 minute         Dispersed using Apparatus A - Mechanical, for 1 minute         Mathematical for 1 minute         Site Site in State for the sand fine Sand fine Sand for the sand fine Sand for the sand for		Analys	sis for the portio	n Finer than t	he No. 10 S	Sieve		
Specific Gravity       2.7         Dispersed using Apparatus A - Mechanical, for 1 minute	Analysis Based or	<ul> <li>-3 inch fraction on</li> </ul>	ly					
Dispersed using Apparatus A - Mechanical, for 1 minute     0.005 mm 31.5 0.002 mm 19.7 0.001 mm 10.4       Particle Size Distribution       Site Coarse Gravel Fine Gravel C. Sand Medium Sand Fine Sand Silt       Coarse Gravel 0.0     C. Sand Medium Sand Fine Sand       ASTM     Coarse Gravel 0.0     C. Sand Medium Sand Fine Sand       Silt     Clay       Silt     Clay       Sieve Size in inches     Sieve Size in sieve numbers       3     2     1       Joint Coarse Cravel 0.0       Output to the size of the sand fine Sand Silt       Clay       Sieve Size in sieve numbers       0       0       Output to the size of t	On a sifin One with	0.7						
Dispersed using Apparatus A - Mechanical, for 1 minute       0.002 mm       19.7         0.001 mm       10.4         Particle Size Distribution	Specific Gravit	.y <u> </u>						
D.001 mm     10.4       D.001 mm     10.4       D.001 mm     10.4       ASTM     Coarse Gravel     Fine Gravel     C. Sand     Medium Sand     Fine Sand     Silt     Clav       ASTM     Coarse Gravel     Fine Gravel     C. Sand     Medium Sand     Fine Sand     Silt     Clav       AASHTO     Gravel     Coarse Sand     Fine Sand     Silt     Clav       Sieve Size in inches     Sieve Size in sieve numbers     Intervention     100     200       3     2     1     3/4     3/8     4     0     16     30     40     100     200       Image: Size in inches     Sieve Size in sieve numbers     Image: Size in sieve numbers     100     90     80       3     2     1     3/4     3/8     4     0     16     30     40     100     200       100     90     80     70     70	Dispersed usin	g Apparatus A - Me	chanical, for 1 mi	nute				
ASTM         Coarse Gravel         Fine Gravel         C. Sand         Medium Sand         Fine Sand         Silt         Clay           0.0         2.6         3.0         4.0         20.6         38.3         31.5           AASHTO         Gravel         Coarse Sand         Fine Sand         Silt         Clay           AASHTO         Gravel         Coarse Sand         Fine Sand         Silt         Clay           Sieve Size in inches         Sieve Size in sieve numbers         Sieve Size in sieve numbers         100         200         100         90           0.0         0.0         0.0         0.0         0.0         0.0         0.0         70		<b>5 PPPPPPPPPPPPP</b>	, -					
ASTM         Coarse Gravel         Fine Gravel         C. Sand         Medium Sand         Fine Sand         Silt         Clay           0.0         2.6         3.0         4.0         20.6         38.3         31.5           AASHTO         Gravel         Coarse Sand         Fine Sand         Silt         Clay           AASHTO         Gravel         Coarse Sand         Fine Sand         Silt         Clay           Sieve Size in inches         Sieve Size in sieve numbers         Sieve Size in sieve numbers         100         200         100         90           0.0         0.0         0.0         0.0         0.0         0.0         0.0         70			Particle Size	Distribution				
AASHTO         Gravel         Coarse Sand         Fine Sand         Silt         Clay           5.6         4.0         20.6         50.1         19.7           Sieve Size in inches           3         2         1 3/4         3/8         4         10         16         30         40         100         200         100         90           Image: Sieve Size in sieve numbers           3         2         1 3/4         3/8         4         10         16         30         40         100         200         100         90         90         80         70         70         70         100         100         100         100         100         100         90         80         10 </td <td></td> <td></td> <td>and Medium Sand</td> <td>Fine Sand</td> <td></td> <td></td> <td></td> <td></td>			and Medium Sand	Fine Sand				
Sieve Size in inches         Sieve Size in sieve numbers           3         2         1         3/4         3/8         4         10         16         30         40         100         200         100         90         90         80           0         0         0         0         0         0         0         70         70		Gravel	Coarse Sand	Fine Sand		Silt	C	
	Sieve Size in inches	5.0	•	•		50.1	I I	9.7
90 80 70	3 2	A	10 16 30 4	0 100	200			<del></del> 100
70			2					90
60 bissed tuber bi								70
					++++++			
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Diameter (mm)

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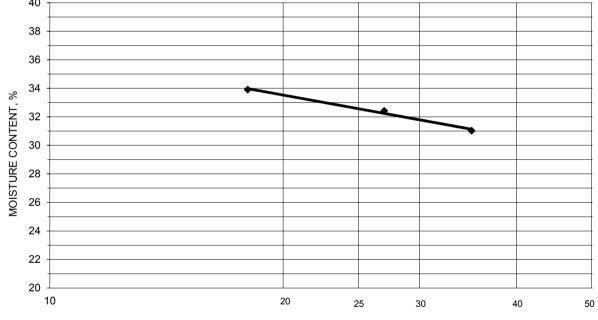


oject Name	HCFRRP - Eag	le Creek DSB	Project Number	17431620
	B-2.12a, 12.5'-1		Lab ID	15
mple Type	SPT		Date Received	0_11_1
			Date Reported	9-18-1
			Test Results	
			-	
	Iral Moisture Co		Atterberg Limits	٨
	I: ASTM D 2216		Test Method: ASTM D 4318 Method	А
WOSLU	ire Content (%):	24.1	Prepared: Dry Liquid Limit:	33
			Plastic Limit:	
Pa	rticle Size Anal	vsis	Plasticity Index:	
	Method: ASTM I		Activity Index:	0.5
	ethod: ASTM D			
	Method: ASTM			
			Moisture-Density Relation	<u>nship</u>
Part	icle Size	%	Test Not Performed	
Sieve Size	e (mm)	Passing	Maximum Dry Density (lb/ft <sup>3</sup> ):	N/A
	N/A		Maximum Dry Density (kg/m <sup>3</sup> ):	N/A
	N/A		Optimum Moisture Content (%):	N/A
	N/A		Over Size Correction %:	N/A
	N/A			
	N/A			
	N/A		California Bearing Rat	io
	N/A		Test Not Performed	
No. 10	2	100.0	Bearing Ratio (%):	
No. 40	0.425	99.7	Compacted Dry Density (lb/ft <sup>3</sup> ):	N/A
No. 200	0.075	98.3	Compacted Moisture Content (%):	N/A
	0.02	81.4		
	0.005	51.9		
	0.002	32.1	Specific Gravity	
estimated	0.001	19.3	Test Method: ASTM D 854	
	starial patinglus		Prepared: Dry	No. 10
	aterial, not incluc	10(%)	Particle Size: Specific Gravity at 20° Celsius:	
	ASTM	AASHTO		2.10
Range	(%)	(%)		
Gravel	0.0	0.0	Classification	
Coarse Sar		0.3	Unified Group Symbol:	CL
Medium Sa			Group Name:	Lean cla
Fine Sand		1.4		
Silt	46.4	66.2		
Clay	51.9	32.1	AASHTO Classification:	A-6 (15)



### ATTERBERG LIMITS

Project	HCFRRP - Eagle C	reek DSB			Project No.	174316204
Source	B-2.12a, 12.5'-14.0'		Lab ID	151		
			% + No. 40	0		
Tested By	JP	Test Method	ASTM D 4318 N	Aethod A	Date Received	09-11-2019
Test Date	09-18-2019	Prepared	Dry			
		_				
	Wet Soil and	Dry Soil and				
	Tare Mass	Tare Mass	Tare Mass	Number of	Water Content	
	(g)	(g)	(g)	Blows	(%)	Liquid Limit
	24.20	20.98	10.60	35	31.0	
	24.29	20.97	10.73	27	32.4	
	23.84	20.50	10.65	18	33.9	33
					• • • •	
	40		Liquic	I Limit		



NUMBER OF BLOWS

#### PLASTIC LIMIT AND PLASTICITY INDEX

,	Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
_	17.84	16.76 16.39	10.75	18.0 17.6	18	15

Remarks:

Reviewed By





	Project Na Source	ime			CFR -2.12						< DS	B											P	roj	ect			oer ID	174		204 151
													_																		
						Sie	eve	an	alys	sis f	or tl	he	Po	rtio	on C	oars	er ti	har	n tl	ne N	lo. 1		iev %	е	7						
	Tes	st Me	etho	d		AS	ТМ	D	422									Si	iev	e Siz	ze	Pas		q							
	Prepa																							Ŭ							
	Partic	ع ما	han	0			N	/A													_										
	Particle H							/A										-													
					ل 9-13		110	_													+				-						
	Date I																	-			╈										
	<b>.</b> .	_																													
Ν	laximum	Parl	ticle	SIZ	e: No	). 1(	0 S	iev	е									_	Nc	. 10		10	0.0	)							
							^	na	lveid	fo	r tha	. n	ort	ion	Ein	er th	on f						0.0		1						
A	nalysis B	ase	d or	ı -3	inch	fra				5 10		≠ h	on	1011	гш	eru				0. 40			9.7		1						
	-								,											200	_	98	3.3								
	Specifi	ic Gi	ravi	ty	2	.7		_												_ m	_		1.4								
	Diapara		unin	a ^	nnor	otu	~ ^	N	loob	oni		for	1 -	nini	ito					<u>5 m</u> 2 m			1.9 2.1		-						
	Dispers	seu	usin	yА	ppar	alu	5 A	- 1	leci	am	Cal,	101	11		lie					2 m 1 m			2.1 9.3								
										D	arti	مام	Si	70 I	Diet	ribut	ion														
[	ASTM		e Gra	vel		Grav	el	С	. Sanc		Mediu	ım Sa				ine San						ilt						Clay			
ł	AASHTO		0.0		Grave				0.0		Coars		and		F	1.4 ine Sar	d				46		ilt					51.9	Clay		
l	Sieve Si	ize in iı	nches		0.0					_	( Sieve S	0.3 Size i	in sie	ve nu	mbers	1.4						66	5.2						32.1		
· •	3	2		1 3/	/4	3/8		4		10	16		30	40		10	0	200												r 100	
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													$\square$	$\square$						$\square$	A									- 90	
																														- 80	
			+									$\left  \right $	++	++		_			_	_			X							- 70	_
													$\square$	$\square$		_				-				A						- 60	Percent Passing
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													#	$\square$						-										- 40	Per
														$\pm$																- 30	
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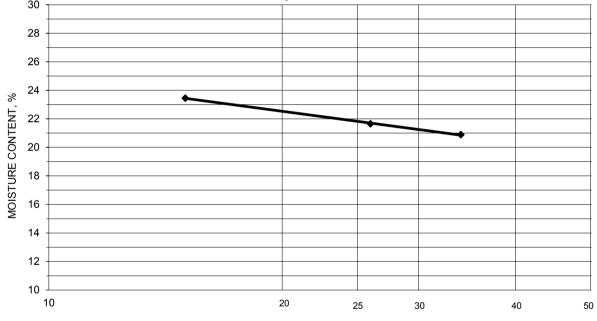
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oject Name	HCFRRP - Eag	le Creek DSB	Project Number	174316204
burce	B-2.13a, 7.5'-9.	0'	Project Number Lab ID	15
ample Type	SPT		Date Received	0_11_1
	JE I		Date Received Date Reported	9-18-1
			Test Results	
Natu	ral Moisture Co	ntont	Atterberg Limits	
	: ASTM D 2216	billent	Test Method: ASTM D 4318 Method	А
	re Content (%):	12.1	Prepared: Dry	
			Liquid Limit:	22
			Plastic Limit:	
Pai	rticle Size Anal	<u>ysis</u>	Plasticity Index:	
	Method: ASTM I		Activity Index:	
Gradation Me	ethod: ASTM D	422		
Hydrometer I	Method: ASTM	D 422		
			Moisture-Density Relation	ship
Parti	cle Size	%	Test Not Performed	
Sieve Size	e (mm)	Passing	Maximum Dry Density (lb/ft <sup>3</sup> ):	N/A
	N/A		Maximum Dry Density (kg/m <sup>3</sup> ):	N/A
	N/A		Optimum Moisture Content (%):	N/A
	N/A		Over Size Correction %:	N/A
	N/A			11/73
	N/A			
	N/A		California Bearing Rati	0
No. 4	4.75	100.0	Test Not Performed	-
No. 10	2	92.7	Bearing Ratio (%):	N/A
No. 40	0.425	83.8	Compacted Dry Density (lb/ft <sup>3</sup> ):	
No. 200	0.075	59.9	Compacted Moisture Content (%):	
	0.02	45.1		
	0.005	26.5		
	0.002	14.6	Specific Gravity	
estimated	0.001	6.0	Test Method: ASTM D 854	
	•	• • • •	Prepared: Dry	
Plus 3 in. ma	iterial, not incluc	led: 0 (%)	Particle Size:	No. 10
			Specific Gravity at 20° Celsius:	2.70
	ASTM	AASHTO		
Range	(%)	(%)		
Gravel	0.0	7.3	<u>Classification</u>	
Coarse San	id 7.3	8.9	Unified Group Symbol:	CL-ML
Medium Sar	nd 8.9		Group Name: S	andy silty cla
Fine Sand	23.9	23.9		
Silt	33.4	45.3		
Olit	26.5	14.6	AASHTO Classification:	A 4 / 4 '



#### **ATTERBERG LIMITS**

Project	HCFRRP - Eagle Cr	reek DSB			Project No.	174316204
Source	B-2.13a, 7.5'-9.0'				Lab ID	158
					% + No. 40	16
Tested By	MP	Test Method	ASTM D 4318 M	lethod A	Date Received	09-11-2019
Test Date	09-16-2019	Prepared	Dry	_		
		_		_		
	Wet Soil and	Dry Soil and				
	Tare Mass	Tare Mass	Tare Mass	Number of	Water Content	
	(g)	(g)	(g)	Blows	(%)	Liquid Limit
	26.99	24.17	10.67	34	20.9	
	25.23	22.64	10.68	26	21.7	
	23.73	21.34	11.15	15	23.5	22
	<u></u>	• • • •				
	30		Liquid	Limit		



NUMBER OF BLOWS

#### PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass	Dry Soil and Tare Mass	Tare Mass	Water Content		
(g)	(g)	(g)	(%)	Plastic Limit	Plasticity Index
21.55	20.18	11.09	15.1	15	7
21.22	19.86	11.02	15.4		

Remarks:

Reviewed By





Project Name	HCFRRP - Eagle Cre	ek DSB			Project		174316204
Source	B-2.13a, 7.5'-9.0'				Lab ID	158	
	Sieve analysis	s for the Porti	on Coarser th	an the No.	10 Sieve %		
Test Method Prepared using				Sieve Size			
Particle Shape Particle Hardness:		;					
Tested By Test Date Date Received	09-13-2019						
Maximum Particle s	size: No. 4 Sieve			No. 4 No. 10	100.0 92.7		
	Analysis	for the portio	n Finer than t	he No. 10 S	Sieve		
Analysis Based on	-3 inch fraction only			No. 40	83.8		
2				No. 200	59.9		
Specific Gravity	2.7			0.02 mm	45.1		
				0.005 mm	26.5		
Dispersed using	Apparatus A - Mecha	nical, for 1 mir	nute	0.002 mm	14.6		
				0.001 mm	6.0		
		Particle Size	Distribution				
ASTM Coarse Grave		Medium Sand	Fine Sand		Silt	Clay	
AASHTO	0.0 7.3 Gravel	8.9 Coarse Sand	23.9 Fine Sand		33.4 Silt	26.5	Clav
	7.3	8.9	23.9		45.3		14.6
Sieve Size in inches 3 2 1	3/4 3/8 4 1	Sieve Size in sieve r 0 16 30 40		200			
							100
							90
							80
							70
							60 is
							50 <b>t</b>
							Percent Passing

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Comments

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Stantec Consulting Services Inc.

Diameter (mm)

1

Τ

0.1



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Reviewed By

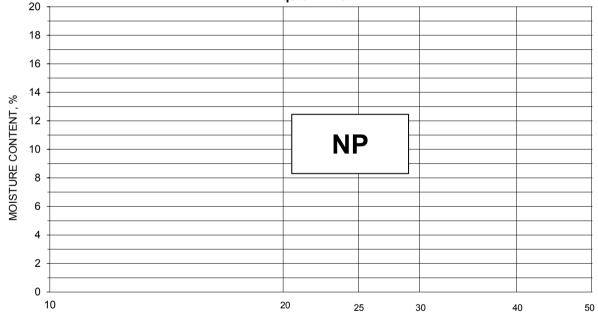
oject Name	HCFRRP - Eag	le Creek DSB	Project Number	17431620
	B-2.13a, 15.0'-1		Lab ID	16
mple Type	SPT		Date Received	Q_11 1
			Date Received Date Reported	9-11-1
			Test Results	
Natu	ral Moisture Co	ontont	Atterberg Limits	
	ASTM D 2216		Test Method: ASTM D 4318 Method	Δ
	re Content (%):		Prepared: Dry	~
Woistu		12.1	Liquid Limit:	NP
			Plastic Limit:	
Par	ticle Size Anal	veie	Plasticity Index:	
	Method: ASTM		Activity Index:	
	ethod: ASTM D			10/1
	Method: ASTM			
			Moisture-Density Relation	<u>nship</u>
Parti	cle Size	%	Test Not Performed	
Sieve Size	(mm)	Passing	Maximum Dry Density (lb/ft <sup>3</sup> ):	N/A
	N/A		Maximum Dry Density (kg/m <sup>3</sup> ):	N/A
	N/A		Optimum Moisture Content (%):	N/A
	N/A		Over Size Correction %:	N/A
	N/A			11/73
3/4"	19	100.0		
3/8"	9.5	93.1	California Bearing Rat	io
No. 4	4.75	78.5	Test Not Performed	<u></u>
No. 10	2	57.9	Bearing Ratio (%):	N/A
No. 40	0.425	23.7	Compacted Dry Density (lb/ft <sup>3</sup> ):	
No. 200	0.075	12.8	Compacted Div Density (IDA ):	
110. 200	0.02	6.9		10/7
	0.005	3.5		
	0.002	1.6	Specific Gravity	
estimated	0.001	1.0	Test Method: ASTM D 854	
			Prepared: Dry	
Plus 3 in. ma	terial, not includ	led: 0 (%)	Particle Size:	No. 10
	,	( )	Specific Gravity at 20° Celsius:	
	ASTM	AASHTO		
Range	(%)	(%)		
Gravel	21.5	42.1	Classification	
Coarse San	d 20.6	34.2	Unified Group Symbol:	SM
Medium Sar			Group Name: Silty sa	
Fine Sand		10.9	· · · · · · · · · · · · · · · · · ·	Ŭ
Silt	9.3	11.2		
	3.5	1.6	AASHTO Classification:	A 1 h / O

ients



#### ATTERBERG LIMITS

Project	HCFRRP - Eagle Cr	eek DSB			Project No.	174316204
Source	B-2.13a, 15.0'-16.5'				Lab ID	163
					% + No. 40	76
Tested By	JP	Test Method	ASTM D 4318 M	lethod A	Date Received	09-11-2019
Test Date	09-17-2019	Prepared	Dry	_		
	Wet Soil and	Dry Soil and				
	Tare Mass	Tare Mass	Tare Mass	Number of	Water Content	
	(g)	(g)	(g)	Blows	(%)	Liquid Limit
		ļļ			ļļ.	
			Liquid	Limit		
	20					



NUMBER OF BLOWS

#### PLASTIC LIMIT AND PLASTICITY INDEX

	Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
-						

Remarks:

Reviewed By





Project Na Source		HCFR B-2.13				ek DS	B								_	ł	Proj	jec				174		204 63
															_									
			Siev	e an	alysis	for t	ne P	orti	on C	oar	ser tl	hai	n th	e No	). 1			-						
Таа	t Mathaal		A O T I		400									0:		% Doool								
Drepar	t Method		AST		422 191							5	leve	Size	3	Passi	ng	-						
пера	eu using		7011		421							-			+									
Partic	le Shape		Ar	igula	ar										T									
Particle H																								
	ested By			_											_									
	est Date Received											_	3/-	<u>/"</u>	-	100.	0	-						
Dater	Veceiven	09-1	1-201	9								-	3/		+	93.								
Maximum	Particle s	ize: 3/4	4" Sie	ve								_	No		1	78.								
													No.			57.9	9							
				Ana	lysis f	or the	e po	rtio	n Fir	ner ti	nan f	the	No	. 10	Sie	eve								
Analysis Ba	ased on	-3 inch			-								No.		T	23.	7	٦						
														200		12.8	8							
Specifi	c Gravity	2	2.7											mm	_	6.9								
<b>D</b> .														5 mm		3.5								
Dispers	ed using	Appar	atus /	4 - N	lechai	nical, i	for 1	mır	nute					2 mm mm	_	<u>1.6</u> 1.0		_						
												0	.00	11111	1	1.0								
	0	<b>Fire</b>	Orrest		Quard	Parti									0:1									
ASTM	Coarse Gravel 0.0	2	Gravel 21.5		. Sand 20.6	3	im San 4.2			ine Sa 10.9					Sil 9.3	3					lay .5			
AASHTO		Grav 42.1					<u>se San</u> 4.2	d		Fine Sa 10.9	nd					Silt 11.2						<u>Clay</u> 1.6		
	ze in inches								numbers															
3	2 1	3/4	3/8	4	10	0 16		30 40		1	00	200						Π					100	
																							90	
			+++					++					++-	++				$\mathbb{H}$	+		-			
				A																			80	
					$\backslash$									+				+			_		70	
																							60	sing
							$\left  \right  \left  \right $	++	+	_		$\left  \right $	++	+			$\left  \right $	$\parallel$			-	-+		Pas
						$\overline{}$																	50	ent
								++		_		$\left  \right $	+	+				$\parallel$		_	_		40	Percent Passing

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Comments

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Summary of Soil Tests

Reviewed By

roject Name	HCFRRP - Eagl	e Creek DSB	Project Number	174316204
	B-1.1, 0.0'-5.5'		Lab ID	176
_				
ample Type	SPT		Date Received	9-5-19
			Date Reported	10-1-19
			Test Results	
Natu	ral Moisture Co	ontent	Atterberg Limits	
Test Method:	ASTM D 2216		Test Method: ASTM D 4318 Method	A
Moistu	re Content (%):	6.2	Prepared: Dry	
			Liquid Limit:	25
			Plastic Limit:	15
<u>Par</u>	ticle Size Anal	<u>ysis</u>	Plasticity Index:	10
Preparation N	Method: ASTM I	D 421	Activity Index:	0.7
Gradation Me	ethod: ASTM D	422		
Hydrometer N	Method: ASTM I	D 422		
-			Moisture-Density Relation	<u>nship</u>
Parti	cle Size	%	Test Not Performed	
Sieve Size	(mm)	Passing	Maximum Dry Density (lb/ft <sup>3</sup> ):	N/A
	N/A		Maximum Dry Density (kg/m <sup>3</sup> ):	N/A
	N/A		Optimum Moisture Content (%):	N/A
	N/A	ł – – – ł	Over Size Correction %:	N/A
	N/A N/A	ł – – – ł		IN/A
3/4"	19	100.0		
3/8"	9.5	98.1	California Bearing Rat	io
No. 4	4.75	95.6	Test Not Performed	
No. 10	2	91.1	Bearing Ratio (%):	N/A
No. 40	0.425	83.0	Compacted Dry Density (lb/ft <sup>3</sup> ):	
No. 200	0.075	47.6	Compacted Dry Density (ib/it ).	N/A
110.200	0.02	30.9		
	0.005	20.2		
	0.002	14.3	Specific Gravity	
estimated	0.001	10.8	Test Method: ASTM D 854	
	0.001	1010	Prepared: Dry	
Plus 3 in. ma	terial, not includ	led: 0 (%)	Particle Size:	No. 10
			Specific Gravity at 20° Celsius:	
	ASTM	AASHTO		
Range	(%)	(%)		
Gravel	4.4	8.9	Classification	
Coarse San	d 4.5	8.1	Unified Group Symbol:	SC
Medium Sar	nd 8.1		Group Name:	
Fine Sand	35.4	35.4		· · ·
Silt	27.4	33.3		
Clay	20.2	14.3	AASHTO Classification:	A-4(2)

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### ATTERBERG LIMITS

HCFF	RRP - Eagle C	reek DSB			Project No.	174316204
B-1.1	, 0.0'-5.5'				Lab ID	176
					% + No. 40	17
	JP	Test Method	ASTM D 431	3 Method A	Date Received	09-05-2019
0	9-25-2019	Prepared	Dry			
T	are Mass	Tare Mass	Tare Mass	Number	of Water Content	
	(g)	(g)	(g)	Blows	s (%)	Liquid Limit
	26.53	23.55	11.02	33	23.8	
	26.83	23.74	11.08	30	24.4	
	26.47	23.39	10.99	23	24.8	25
		1 1			I	
30			Liqu	uid Limit		
50	-					
28						
26				•		
24						
- -					• • • • • • • • • • • • • • • • • • •	
<u> </u>						
20	-					
5 20						
5 18						
_						
5 16			I			
	B-1.1	B-1.1, 0.0'-5.5' JP 09-25-2019 Wet Soil and Tare Mass (g) 26.53 26.83 26.47 30 28 26 24	JP         Test Method           09-25-2019         Prepared           Wet Soil and Tare Mass         Dry Soil and Tare Mass           (g)         (g)           26.53         23.55           26.83         23.74           26.47         23.39           30	B-1.1, 0.0'-5.5'         JP       Test Method ASTM D 4318         09-25-2019       Prepared       Dry         Wet Soil and       Dry Soil and       Tare Mass         (g)       (g)       (g)         26.53       23.55       11.02         26.83       23.74       11.08         26.47       23.39       10.99         Liqu         30	B-1.1, 0.0'-5.5'         JP       Test Method ASTM D 4318 Method A         09-25-2019       Prepared       Dry         Wet Soil and Tare Mass       Dry Soil and Tare Mass       Tare Mass       Number Blows         (g)       (g)       (g)       Blows         26.53       23.55       11.02       33         26.83       23.74       11.08       30         26.47       23.39       10.99       23         Liquid Limit         30	B-1.1, 0.0'-5.5'       Lab ID         JP       Test Method ASTM D 4318 Method A       Date Received         09-25-2019       Prepared       Dry         Wet Soil and Tare Mass       Dry Soil and Tare Mass       Number of (g)       Water Content (%)         26.53       23.55       11.02       33       23.8         26.47       23.39       10.99       23       24.8         Liquid Limit

NUMBER OF BLOWS

PLASTIC LIMIT AND PLASTICITY INDEX	

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
20.31	19.08	10.60	14.5	15	10
20.29	19.03	10.74	15.2		

Remarks:





Project Name	HCFRRP - Eagle Creek	DSB		Proje	ect Number	174316204
Source	B-1.1, 0.0'-5.5'				Lab ID	176
	Sieve analysis fo	r the Portion Coarser th	nan the No.	10 Sieve		
				%		
Test Method	ASTM D 422		Sieve Size	Passing		
Prepared using	ASTM D 421	-				
Particle Shape	Angular					
Particle Hardness:	Hard and Durable	-				
Tested By						
Test Date	09-25-2019					
Date Received	09-05-2019		3/4"	100.0		

Maximum Particle size: 3/4" Sieve

#### Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on -3 inch fraction only

Specific Gravity 2.7

Dispersed using Apparatus A - Mechanical, for 1 minute

he No. 10 Sieve							
No. 40	83.0						
No. 200	47.6						
0.02 mm	30.9						
0.005 mm	20.2						
0.002 mm	14.3						
0.001 mm	10.8						

98.1

95.6

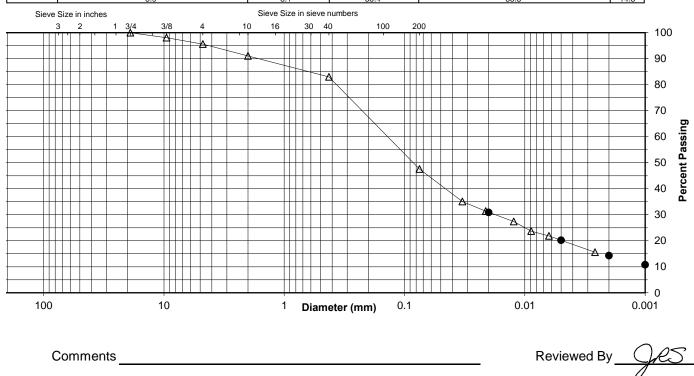
91.1

3/8"

No. 4

No. 10

Particle Size Distribution											
ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay				
ASTM	0.0	4.4	4.5	8.1	35.4	27.4	20.2				
AASHTO		Gravel		Coarse Sand	Fine Sand	Silt		Clay			
AASHIU		89		81	35.4	33.3		14.3			



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Stantec Consulting Services Inc.



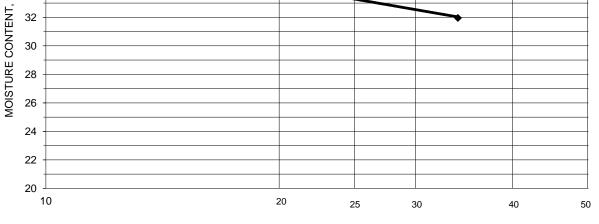
Reviewed By

roject Name H	CFRRP - Eag	le Creek DSB	Project Number	174316204
	2.16A, 0.0'-5.		Lab ID	177
Sample Type SF	от		Date Received	9-5-19
Sample Type <u>Sr</u>			Date Reported	10-1-19
				10 1 10
			Test Results	
	Moisture Co		Atterberg Limits	
Test Method: A	Content (%):		Test Method: ASTM D 4318 Method Prepared: Dry	A
WOISture	Content (78).	1.5	Liquid Limit:	33
			Plastic Limit:	18
Parti	cle Size Anal	ysis	Plasticity Index:	15
Preparation Me			Activity Index:	0.6
Gradation Meth	nod: ASTM D	422		
Hydrometer Me	ethod: ASTM	D 422		
	0.		Moisture-Density Relation	<u>iship</u>
Particle		%	Test Not Performed	
Sieve Size	(mm)	Passing	Maximum Dry Density (lb/ft <sup>3</sup> ):	N/A
	N/A		Maximum Dry Density (kg/m <sup>3</sup> ):	N/A
	N/A		Optimum Moisture Content (%):	N/A
	N/A		Over Size Correction %:	N/A
	N/A			
	N/A			_
	N/A	400.0	California Bearing Rat	<u>io</u>
No. 4 No. 10	4.75 2	100.0	Test Not Performed	N1/A
		98.5	Bearing Ratio (%):	
No. 40 No. 200	0.425	96.7 66.8	Compacted Dry Density (lb/ft <sup>3</sup> ): Compacted Moisture Content (%):	
NO. 200	0.075	53.1		IN/A
	0.02	35.4		
	0.002	25.8	Specific Gravity	
estimated	0.001	17.0	Test Method: ASTM D 854	
		<u> </u>	Prepared: Dry	
Plus 3 in. mate	rial, not incluc	ded: 0 (%)	Particle Size:	No. 10
	·		Specific Gravity at 20° Celsius:	2.70
Denes	ASTM	AASHTO		
Range Gravel	(%)	(%) 1.5	<u>Classification</u>	
Coarse Sand	0.0	1.5	Unified Group Symbol:	CL
Medium Sand	1.8	1.0	Group Name:	
Fine Sand	29.9	29.9		
Silt	31.4	41.0		
Ont				A-6 ( 8 )



#### ATTERBERG LIMITS

Project	HCFR	RRP - Eagle Cr	eek DSB					Project No.	174316204
Source	B-2.16	6A, 0.0'-5.0'						Lab ID	177
								% + No. 40	3
Tested By		MP	Test Method	ASTM D 43	518 M	ethod A		Date Received	09-05-2019
Test Date	09	9-26-2019	Prepared	Dry					
		et Soil and	Dry Soil and						
	T	are Mass	Tare Mass	Tare Ma	SS	Numb		Water Content	
		(g)	(g)	(g)		Blov	WS	(%)	Liquid Limit
		23.69	20.51	10.56		34	4	32.0	
		25.08	21.50	10.92		23	3	33.8	
		23.93	20.63	11.00		19	9	34.3	33
			•					· · · · · ·	
	40 -	1		LI	quid	Limit			
	38 -								
	36 -								
	-								
6	° 34 -			*					



NUMBER OF BLOWS

#### PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass	Dry Soil and Tare Mass	Tare Mass	Water Content		Diosticity Index
(g)	(g)	(g)	(%)	Plastic Limit	Plasticity Index
23.10	21.22	10.58	17.7	18	15
24.22	22.24	11.06	17.7		

Remarks:

Reviewed By





Project Na Source	me	HCFRRP B-2.16A,	P - Eagle Cre 0.0'-5.0'	eek DSB			Projec	t Number Lab ID	174316204 177
		Sie	eve analysi	s for the Porti	on Coarser th	nan the No.	10 Sieve		
							%		
			TM D 422			Sieve Size	Passing		
Prepar	rea using	A5	STM D 421						
Partic	le Shape		Angular						
			and Durable	Э					
Т	ested By	JP	010						
		09-25-20							
Dato	10001100	00 00 20							
Maximum	Particle s	ize: No. 4	Sieve			No. 4	100.0		
						No. 10	98.5		
			Analysis	for the portio	n Finer than t	he No. 10 S	Sieve		
Analysis B	ased on	-3 inch fra	action only			No. 40	96.7		
0	<b>o</b> ''	o <b>-</b>				No. 200	66.8		
Specifi	c Gravity	2.7				0.02 mm 0.005 mm	53.1 35.4		
Dispers	ed usina	Apparatu	is A - Mecha	nical, for 1 mir	nute	0.005 mm	25.8		
Diopore	ou uonig	rippulata			lato	0.001 mm	17.0		
				Particle Size	Distribution				
ASTM	Coarse Grave	Fine Grav	vel C. Sand	Medium Sand	Fine Sand		Silt	Clay	
	0.0	0.0 Gravel	1.5	1.8 Coarse Sand	29.9 Fine Sand		31.4 Silt	35.4	Clay
AASHTO		1.5		1.8	29.9		41.0		25.8
Sieve Si 3	ze in inches 2 1	3/4 3/8	4 1	Sieve Size in sieve r 10 16 30 4		200			<u> </u>
									90
									80
									70
						4			
									00         00           01         00           02         00           03         00
									B

Reviewed By

0.01

30

20

10

6

0.001

Comments

100

1 Diameter (mm)

10

0.1



### Compaction Characteristics of Soil Using Standard Effort

ASTM D 698 - Method A

Source B-1.1, 0.0-5.5' Description Description Clayey sand Date Received 09/05/2019 Date Received 09/05/2019 Date Received 09/05/2019 Date Received 09/05/2019 Date Test Fraction (%) 95.4 Gs of Oversized Fraction (%) 0.8 Mold Weight (g) 4125 Preparation Method Moist Rammer Type Manual Weight (g) 4125 Preparation Method Moist Rammer Type Manual Moisture Content (%) 127.6 Diffusor Moisture Content (%) 11 13 15 17 Maximum Dry Unit Weight (pcf) 127.9 Optimum Moisture Content (%) 9.6 Corrected Maximum Dry Unit Weight (pcf) N/A Reviewed By Yes	F	Project	HCFRRP - E	agle Creek D	SB				Project No.	174316204	
Visual Notes	S	Source	B-1.1, 0.0'-5.	5'					Sample ID	176	
Test Fraction (%)	Desc	ription	clayey sand					Da	ate Received	09/05/2019	
Gs of Test Fraction       2.7       Assumed       Gs of Oversized Fraction       N/A         Oversized Fraction Sieve       No.4       MC of Oversized Fraction (%)       0.8         Mold Weight (g)       4125       Preparation Method       Moist       Rammer Type       Manual         Wet Soil       Wet Soil       Wet Soil       Dry Soil       Dry Soil       Oversized Fraction (%)       Dry         6000       1967       412.93       391.77       54.21       6.3       122.9         6220       2095       395.26       368.69       74.23       0.1       127.6         6235       2110       387.15       366.69       76.14       13.6       119.8         100       107       0.6       126.7       0.6       126.7         110       0.7       2050       315.28       286.68       76.14       13.6       119.8         111       0.6       126.7       110.6       126.7       110.6       126.7       110.6       126.7         120       0       0       0       0       0       0       0       0       17         121       0       0       0       0       0       11       13 <td< td=""><td>Visual</td><td>Notes</td><td></td><td></td><td></td><td></td><td></td><td></td><td>Date Tested</td><td>09/25/2019</td></td<>	Visual	Notes							Date Tested	09/25/2019	
Gs of Test Fraction       2.7       Assumed       Gs of Oversized Fraction       N/A         Oversized Fraction Sieve       No.4       MC of Oversized Fraction (%)       0.8         Mold Weight (g)       4125       Preparation Method       Moist       Rammer Type       Manual         Wet Soil       Wet Soil       Wet Soil       Dry Soil       Dry Soil       Oversized Fraction (%)       Dry         Wet Soil       Wet Soil       Wet Soil       Dry Soil       Dry Soil       Oversized Fraction (%)       Dry         Wet Soil       Wet Soil       Wet Soil       Dry Soil       Dry Soil       Oversized Fraction (%)       Dry         60002       1967       412.93       391.77       54.21       6.3       122.9         6220       2095       395.26       368.69       74.23       0.0       126.7         6175       2050       315.28       286.68       76.14       13.6       119.8         104       Dry       Dry       Dry       Dry       Dry       Dry       Dry         127       Oversized Fraction       NA       Dry       Dry       Dry       Dry       Dry         137       Dry       Dry       Dry       Dry       Dry		Toot	Fraction (9/)	05.4			Overeized	Erection (9/)	-		
Oversized Fraction Sieve       No. 4       MC of Oversized Fraction (%)       0.8         Mold Weight (g)       4125       Preparation Method       Moist       Rammer Type       Manual         Wet Soil       Wet Soil       Wet Soil       Brace (g)       Tare (g)       Content (%)       Unit Weight (g)         Weight (g)       Wet Soil       Wet Soil       Brace (g)       Tare (g)       Content (%)       Unit Weight (pc)         6220       2096       395.26       366.99       74.23       9.0       127.6         6235       2110       387.15       356.94       72.32       10.6       126.7         6175       2050       315.28       286.68       76.14       13.6       119.8         127       G       G       Zero Air Voids       Gs = 2.7       Gs = 2.7         130       Gs = 2.7         131       Gs = 7       9       11       13       15       17         141       Gs = 2.7         131       Gs = 7       9       11       13       15       17       Gs = 2.7					Assumed	C					
Mold Weight (g)       4125       Preparation Method       Moist       Rammer Type       Manual					Assumed						
Wei Soil       Wei Soil       Wei Soil       Dry Soil       Tare (g)       Tare (g)       Content (%)       Unit Weight (pc)         6092       1967       112.93       391.77       54.21       6.3       122.9         6235       2110       387.15       356.94       72.32       10.6       126.7         6175       2050       315.28       286.68       76.14       13.6       119.8         11       19       10       10       10       10       10       10         12       10       11.28       286.68       76.14       13.6       119.8         13       19       10       10       10       10       10       10         13       10       11       13.6       119.8       119.8       119.8         14       13.6       119.8       11       13       15       17         13       15       7       9       11       13       15       17         14       13       5       7       9       11       13       15       17         14       11       13       15       17       13       15       17         15 </td <td>0.013</td> <td>12001</td> <td></td> <td>110. 4</td> <td>-</td> <td></td> <td></td> <td></td> <td>0.0</td> <td></td>	0.013	12001		110. 4	-				0.0		
$\frac{\$ \text{ Mold } Wet Soil } {Wet Soil } \$ Tare (g) & Water \\ Weight (g) & \$ Tare (g) & Tare (g) & Water \\ Content (%) & (pcf) \\ \hline 6092 & 2095 & 395.26 & 368.69 & 74.23 & 9.0 & 127.6 \\ \hline 6223 & 2110 & 387.15 & 356.94 & 72.32 & 10.6 & 126.7 \\ \hline 6175 & 2050 & 315.28 & 286.68 & 76.14 & 13.6 & 119.8 \\ \hline 100 & 1$		Мо	ld Weight (g)	4125	Prepara	ation Method	Moist	R	ammer Type	Manual	
$\frac{\$ \text{ Mold } Wet Soil } {Wet Soil } \$ Tare (g) & Water \\ Weight (g) & \$ Tare (g) & Tare (g) & Water \\ Content (%) & (pcf) \\ \hline 6092 & 2095 & 395.26 & 368.69 & 74.23 & 9.0 & 127.6 \\ \hline 6223 & 2110 & 387.15 & 356.94 & 72.32 & 10.6 & 126.7 \\ \hline 6175 & 2050 & 315.28 & 286.68 & 76.14 & 13.6 & 119.8 \\ \hline 100 & 1$			Wet Soil		Moi	sture Conten	t Determina	tion	Drv		
Weight (g)       Weight (g)       & Tare (g)       & Tare (g)       Content (%)       (pcf)         6092       1967       412.93       391.77       54.21       6.3       122.9         6220       2095       395.26       386.69       74.23       9.0       127.6         6175       2050       315.28       286.68       76.14       13.6       119.8         11       12       13.6       119.8       119.8       119.8       119.8         12       12       10.6       126.76       119.8       119.8       119.8         13       12       13.6       119.8       119.8       119.8       119.8         14       13.6       119.8       119.8       119.8       119.8       119.8         14       13.6       119.8       11       13.6       119.8       119.8         15       7       9       11       13       15       17         Maximum Dry Unit Weight (pcf)       127.9         11       13       15       17         Maximum Dry Unit Weight (pcf)       N/A         Reviewed By       Maximum Dry Unit Weight (pcf)       N/A <td cols<="" td=""><td></td><td></td><td></td><td>Wet Soil</td><td></td><td></td><td></td><td></td><td>-</td><td></td></td>	<td></td> <td></td> <td></td> <td>Wet Soil</td> <td></td> <td></td> <td></td> <td></td> <td>-</td> <td></td>				Wet Soil					-	
$\frac{6092}{6220} \frac{1967}{2095} \frac{412.93}{395.26} \frac{391.77}{368.69} \frac{54.21}{74.23} \frac{6.3}{9.0} \frac{122.9}{127.6}$ $\frac{6235}{2110} \frac{2110}{387.15} \frac{356.94}{2356.94} \frac{72.32}{76.14} \frac{10.6}{13.6} \frac{126.7}{119.8}$ $\frac{131}{129} \frac{129}{125} \frac$			Weight (g)	Weight (g)	& Tare (g)	-	Tare (g)	Content (%)	-		
$\frac{6235 2110 387.15 356.94 72.32 10.6 126.7}{6175 2050 315.28 286.68 76.14 13.6 119.8}$											
$\begin{array}{c c c c c c c c c c c c c c c c c c c $											
131       131       129       120       1											
$\frac{129}{90} + \frac{129}{90} + \frac{11}{90} + 11$			6175	2050	315.28	286.68	76.14	13.6	119.8		
$\frac{129}{90} + \frac{129}{90} + \frac{11}{90} + 11$											
$\frac{129}{90} + \frac{129}{90} + \frac{11}{90} + 11$											
$\frac{129}{90} + \frac{129}{90} + \frac{11}{90} + 11$											
$\frac{129}{90} + \frac{129}{90} + \frac{119}{90} + 1$	131										
$\frac{127}{123}$ $\frac{123}{123}$	400						$\mathbf{N}$			11 1	
$\frac{119}{117} \frac{1}{3} \frac{1}{5} \frac{1}{7} \frac{9}{11} \frac{1}{13} \frac{1}{15} \frac{1}{17}$ $\frac{111}{117} \frac{1}{3} \frac{1}{5} \frac{1}{7} \frac{9}{11} \frac{1}{13} \frac{1}{15} \frac{1}{17}$ $\frac{111}{117} \frac{1}{3} \frac{1}{5} \frac{1}{17}$ $\frac{111}{117} \frac{1}{3} \frac{1}{15} \frac{1}{17}$ $\frac{111}{117} \frac{1}{113} \frac{1}{15} \frac{1}{17}$ $\frac{111}{117} \frac{1}{117} \frac{1}{117} \frac{1}{117}$ $\frac{111}{117} \frac{1}{117} \frac{1}{117} \frac{1}{117} \frac{1}{117}$ $\frac{111}{117} \frac{1}{117} 1$	129					J			- Gs = 2	./	
$\frac{119}{117} \frac{1}{3} \frac{1}{5} \frac{1}{7} \frac{9}{11} \frac{1}{13} \frac{1}{15} \frac{1}{17}$ $\frac{111}{117} \frac{1}{3} \frac{1}{5} \frac{1}{7} \frac{9}{11} \frac{1}{13} \frac{1}{15} \frac{1}{17}$ $\frac{111}{117} \frac{1}{3} \frac{1}{5} \frac{1}{17}$ $\frac{111}{117} \frac{1}{3} \frac{1}{15} \frac{1}{17}$ $\frac{111}{117} \frac{1}{113} \frac{1}{15} \frac{1}{17}$ $\frac{111}{117} \frac{1}{117} \frac{1}{117} \frac{1}{117}$ $\frac{111}{117} \frac{1}{117} \frac{1}{117} \frac{1}{117} \frac{1}{117}$ $\frac{111}{117} \frac{1}{117} 1$	127					×					
$\frac{119}{117} \frac{1}{3} \frac{1}{5} \frac{1}{7} \frac{9}{11} \frac{1}{13} \frac{1}{15} \frac{1}{17}$ $\frac{111}{117} \frac{1}{3} \frac{1}{5} \frac{1}{7} \frac{9}{11} \frac{1}{13} \frac{1}{15} \frac{1}{17}$ $\frac{111}{117} \frac{1}{3} \frac{1}{5} \frac{1}{17}$ $\frac{111}{117} \frac{1}{3} \frac{1}{15} \frac{1}{17}$ $\frac{111}{117} \frac{1}{113} \frac{1}{15} \frac{1}{17}$ $\frac{111}{117} \frac{1}{117} \frac{1}{117} \frac{1}{117}$ $\frac{111}{117} \frac{1}{117} \frac{1}{117} \frac{1}{117} \frac{1}{117}$ $\frac{111}{117} \frac{1}{117} 1$	(j) '2'										
$\frac{119}{117} \frac{1}{3} \frac{1}{5} \frac{1}{7} \frac{9}{11} \frac{1}{13} \frac{1}{13} \frac{1}{15} \frac{1}{17}$ Maximum Dry Unit Weight (pcf) $\frac{127.9}{9.6}$ Optimum Moisture Content (%) $\frac{9.6}{9.6}$ Corrected Maximum Dry Unit Weight (pcf) $\frac{N/A}{N/A}$ Reviewed By $\frac{2}{2}$	년 125										
$\frac{119}{117} \frac{1}{3} \frac{1}{5} \frac{1}{7} \frac{9}{11} \frac{1}{13} \frac{1}{15} \frac{1}{17}$ $\frac{111}{117} \frac{1}{3} \frac{1}{5} \frac{1}{7} \frac{9}{11} \frac{1}{13} \frac{1}{15} \frac{1}{17}$ $\frac{111}{117} \frac{1}{3} \frac{1}{5} \frac{1}{17}$ $\frac{111}{117} \frac{1}{3} \frac{1}{15} \frac{1}{17}$ $\frac{111}{117} \frac{1}{113} \frac{1}{15} \frac{1}{17}$ $\frac{111}{117} \frac{1}{117} \frac{1}{117} \frac{1}{117}$ $\frac{111}{117} \frac{1}{117} \frac{1}{117} \frac{1}{117} \frac{1}{117}$ $\frac{111}{117} \frac{1}{117} 1$	leig										
$\frac{119}{117} \frac{1}{3} \frac{1}{5} \frac{1}{7} \frac{9}{11} \frac{1}{13} \frac{1}{13} \frac{1}{15} \frac{1}{17}$ Maximum Dry Unit Weight (pcf) $\frac{127.9}{9.6}$ Optimum Moisture Content (%) $\frac{9.6}{9.6}$ Corrected Maximum Dry Unit Weight (pcf) $\frac{N/A}{N/A}$ Reviewed By $\frac{2}{2}$	<b>×</b> 123										
$\frac{119}{117} \frac{1}{3} \frac{1}{5} \frac{1}{7} \frac{9}{11} \frac{1}{13} \frac{1}{13} \frac{1}{15} \frac{1}{17}$ Maximum Dry Unit Weight (pcf) $\frac{127.9}{9.6}$ Optimum Moisture Content (%) $\frac{9.6}{9.6}$ Corrected Maximum Dry Unit Weight (pcf) $\frac{N/A}{N/A}$ Reviewed By $\frac{2}{2}$	5			_							
$117 \frac{1}{3} \frac{1}{5} \frac{1}{7} \frac{9}{9} \frac{11}{11} \frac{1}{13} \frac{1}{15} \frac{1}{17}$ $Maximum Dry Unit Weight (pcf) \frac{127.9}{9.6}$ $Optimum Moisture Content (\%) \frac{9.6}{9.6}$ $Corrected Maximum Dry Unit Weight (pcf) N/A Reviewed By \underbrace{\mathcal{HS}}$	<b>6</b> 121							$\rightarrow$	$\rightarrow$		
$117 \frac{1}{3} \frac{1}{5} \frac{1}{7} \frac{9}{11} \frac{11}{13} \frac{1}{15} \frac{1}{17}$ Maximum Dry Unit Weight (pcf) 127.9 Optimum Moisture Content (%) 9.6 Corrected Maximum Dry Unit Weight (pcf) N/A Corrected Optimum Moisture Content (%) N/A Reviewed By $\frac{1}{27.9}$									$\sim$		
3       5       7       9       11       13       15       17         Maximum Dry Unit Weight (pcf)       127.9         Optimum Moisture Content (%)       9.6         Corrected Maximum Dry Unit Weight (pcf)       N/A         Corrected Optimum Moisture Content (%)       N/A       Reviewed By       9.5	119									———————————————————————————————————————	
3       5       7       9       11       13       15       17         Maximum Dry Unit Weight (pcf)       127.9         Optimum Moisture Content (%)       9.6         Corrected Maximum Dry Unit Weight (pcf)       N/A         Corrected Optimum Moisture Content (%)       N/A       Reviewed By       9.5											
Moisture Content (%)         Maximum Dry Unit Weight (pcf)       127.9         Optimum Moisture Content (%)       9.6         Corrected Maximum Dry Unit Weight (pcf)       N/A         Corrected Optimum Moisture Content (%)       N/A	117						11	12	45		
Maximum Dry Unit Weight (pcf)       127.9         Optimum Moisture Content (%)       9.6         Corrected Maximum Dry Unit Weight (pcf)       N/A         Corrected Optimum Moisture Content (%)       N/A		ა	C	1				ıə	GI	17	
Optimum Moisture Content (%) 9.6 Corrected Maximum Dry Unit Weight (pcf) N/A Corrected Optimum Moisture Content (%) N/A Reviewed By 9.5						· · ·					
Optimum Moisture Content (%) 9.6 Corrected Maximum Dry Unit Weight (pcf) N/A Corrected Optimum Moisture Content (%) N/A Reviewed By 9.5			Mavim		Noight (pcf)	127 0					
Corrected Maximum Dry Unit Weight (pcf) N/A Corrected Optimum Moisture Content (%) N/A Reviewed By JeS											
Corrected Optimum Moisture Content (%) N/A Reviewed By C			Optimu			5.0					
Corrected Optimum Moisture Content (%) N/A Reviewed By		Corre	cted Maxim	ım Dry Unit V	Veight (pcf)	N/A					
				-	• • •			ſ	Reviewed Rv	ORS	
Comments		00110						ľ	.concurby_		
	Com	ments								V	



### Compaction Characteristics of Soil Using Standard Effort

ASTM D 698 - Method A

	Project	HCFRRP - E	agle Creek D	SB				Project No.	174316204
;	Source	B-2.16A, 0.0	'-5.0'				_	Sample ID	177
Desc	cription	sandy lean c	lay				Da	ate Received	09/05/2019
Visua	I Notes						•	Date Tested	09/26/2019
	-					<b>a</b>		-	
		Fraction (%)		A			Fraction (%)		
0		Test Fraction		Assumed			zed Fraction	N/A	
Overs	sized F	raction Sieve	No. 4			Oversized	Fraction (%)	2.5	
	Мо	ld Weight (g)	4100	Prepara	ation Method	Moist	. R:	ammer Type	Manual
		Wet Soil		Moi	sture Conten	t Determina	tion	Dry	
		& Mold	Wet Soil	Wet Soil	Dry Soil		Water	Unit Weight	
		Weight (g)	Weight (g)	& Tare (g)	& Tare (g)	Tare (g)	Content (%)	(pcf)	
		5975	1875	531.97	497.11	72.43	8.2	115.1	
		6095	1995	453.83	418.13	74.56		120.0	
		6160		495.71	443.44	55.89	13.5	120.5	
		6127	2027	311.55	279.64	76.10	15.7	116.4	
		6057	1957	351.29	307.49	72.27	18.6	109.6	
123								<b>7</b> a ma <b>A</b> in <b>X</b>	
				_				Zero Air ∖ Gs = 2	
121								GS = 2	
_ 110									
bc						$\mathbf{X}$			
별 117									
Veic									
115 115									
Dry Unit Weight (pcf) 112 112 112 112 113							$\rightarrow$		
<u>ال</u> ک								$\searrow$	
111									
109									
407									
107	5	7	9	11	13	15	17	19	21
				Mois	ture Content (%				
		Maximu	ım Dry Unit V	Veight (pcf)	121.0				
		Optimu	ım Moisture (	Content (%)	12.3				
	-								
			um Dry Unit V						$\bigcirc 15$
	Corre	ected Optimu	ım Moisture (	Content (%)	N/A		F	Reviewed By	YRS
Corr	nments								0



## Unconfined Compressive Strength of Cohesive Soil

ASTM D 2166

Source B-1.1b, 2.0'-4.0'	Eagle Creek I				I	Project I	Number <u>1</u> Lab ID	74316204 16
/isual Description <u>Lean Clay (</u>	CL), brown, m	oist, firm			Recov	arad	1.2	
					Test Int		2.7' - 3	3.2'
Specimen Type: Undisturbe	<u></u>	N/A	PL	N/A				
			PI	N/A			xtruded 0	
Initial Wet Density (pc		Initial MC	Takan Ad		nome Constan		Tested 0	9/23/2019
Initial Moisture Content (% Initial Dry Density (pc			Taken A	ler resi, r	rom Center	or spec	imen	
At Test Moisture Content (%		At Test MC	Taken N	/Α				
At Test Dry Density (pc								
Specific Gravit			<b>c</b> 1	•		(1.5)	0.00	
Degree of Saturation (% Average Height (ir		Un			ive Strength ear Strength		0.99 0.49	
Average Diameter (ir					imum Stress		15.0	
Height to Diameter Rati			Str	ain rate to	failure (% / ı	min.)	1.00	
C C					,	·		
		0.4	Otrain					
		Stress vs	s. Strain					
1.20								
1.00						<b>→</b>		
0.80								
(isi)								
0.80 ( <b>isi</b> ) <b>stress</b>								
Stre								
0.40								
0.20								
0.00							10.0	
0.0 2.0	4.0 6	6.0 8.0			12.0 14	4.0	16.0	18.0
			Strain (%	<b>b</b> )				
Failure Sketch	7			Pocket I	Penetromete	r Read	ling (tsf) N	/Α
					Torvane Re			
	-	omments				•	· · <u> </u>	
	2	2.0'-2.6' - Save	ed in tub	e				
	-							
	-							
						Povia	wed By	$\mathbb{P}^{1}$
						Revie	weu by	$\overline{\mathbf{O}}$
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## **Unconfined Compressive Strength** of Cohesive Soil

ASTM D 2166

Project Name <u>HCFRRP - Ea</u> Source B-1.1b, 7.5'-9.5'	agle Creek [	DSB				Project	t Number Lab ID	17431	6204 168
Visual Description Lean Clay (Cl	), gray, mo	ist, firm, gravel							
·					Reco	vered	2	2.3'	
					Test Ir	nterval	9.3'	- 9.8'	
Specimen Type: Undisturbed	LL	N/A	PL	N/A					
			PI	N/A			Extruded		
Initial Wet Density (pcf)	144.4						te Tested	09/23/	2019
Initial Moisture Content (%)	11.6	Initial MC Ta	aken <u>Aft</u>	er Test, Fi	om Whole	e Specir	nen		
Initial Dry Density (pcf)	129.4	A . T . MAO T							
At Test Moisture Content (%)	N/A	At Test MC Ta	aken N/A	4					
At Test Dry Density (pcf) Specific Gravity	N/A N/A								
Degree of Saturation (%)	N/A	Line	onfined (	omnressi	ve Strengt	h (tef)	4.04		
Average Height (in)	6.098	Unc			ear Strengt		2.02		
Average Diameter (in)	2.837				mum Stres		7.5		
Height to Diameter Ratio	2.007				failure (% /		1.00		
	2.1		010			·····/_	1.00		
		Stress vs.	Strain						
4.50									
		•							
4.00									
3.50	+	++ \	、						
3.00			$\setminus$						
			$\mathbf{X}$						
( <b>ts</b> ) 2.50 <b>set</b> 2.00									
<u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u></u>									
1.50						_			
1.00									
0.50									
0.00 2.0	4.0	6.0 8.0	10	10 1	2.0	14.0	16.0	18	0
0.0 2.0	4.0				2.0	14.0	10.0	10	.0
			Strain (%)						
Failure Sketch				Pocket F	enetromet	ter Rea	ndina (tsf)	N/A	
				1 oonot 1	Torvane F				
	C	omments			TOTVATION	Cauling			
	-	7.5'-9.3' - Save	d in tube						
	<u> -</u>								
	-								
	-								
	-								
	_								
						_		$\square$	<b>'</b> 1
						Rev	iewed By	K	
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Version: 20170217 Approved By: RJ	31	Lexington,	-				Report	Date: 09/3	



## Unconfined Compressive Strength of Cohesive Soil

ASTM D 2166

Project Name <u>HCFRRP - Ea</u> Source B-1.2b, 0.0'-2.0'	agle Creek DSB	Project	Number <u>174316204</u> Lab ID 169
Visual Description Lean Clay (C	L), brown, moist, firm		
		 Test Interval	<u>1.3'</u> 0.8' - 1.3'
Specimen Type: Undisturbed	LL N/A PL N/A	rest mervar	0.0 - 1.3
	PI N/A	Date	Extruded 09/23/2019
Initial Wet Density (pcf)	123.7		e Tested 09/23/2019
Initial Moisture Content (%) Initial Dry Density (pcf)	23.2 Initial MC Taken After Test, F 100.4	rom Whole Specin	nen
At Test Moisture Content (%)	N/A At Test MC Taken N/A		
At Test Dry Density (pcf)	N/A		
Specific Gravity	N/A		4.00
Degree of Saturation (%) Average Height (in)	N/A Unconfined Compress 6.145 Undrained Sh	sive Strength (tst)_ hear Strength (tsf)	<u>1.92</u> 0.96
Average Diameter (in)		ximum Stress (%)	7.2
Height to Diameter Ratio		o failure (% / min.)	0.99
	Stress vs. Strain		
2.50			
2.00			
Et so			
(1.50 ssatt 1.00			
6 1.00			
0.50			
0.00			
0.00			
0.0 2.0	4.0 6.0 8.0 10.0	12.0	14.0 16.0
	Strain (%)		
Failure Sketch	Pocket	Penetrometer Rea	dina (tsf) N/A
		Torvane Reading	
	Comments	Ũ	
	0.0'-0.8' - Saved in tube		
*			
		Revi	iewed By 🛛 🦳
			· <u> </u>
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Stantec Consulting Services Inc. Lexington, Kentucky



## Unconfined Compressive Strength of Cohesive Soil

ASTM D 2166

ource B-2.10a, 2.0'-4.0'	gle Creek DSB				F	-	umber <u>1</u> Lab ID	7431620 17
isual Description Lean Clay (CL	), brown, moist,	firm, gravel				<u> </u>		
					Recove Test Inte		1.5 3.0' -	
Specimen Type: Undisturbed	LL	N/A F	PL N	/A	I ESI IIII	=i vai	3.0 -	5.5
operation type. ondetable				/A		Date Ex	truded 0	9/24/20 <sup>-</sup>
Initial Wet Density (pcf)	131.4						Tested 0	
Initial Moisture Content (%)		itial MC Tak	en <u>After T</u>	est, Fror	n Whole S	Specime	n	
Initial Dry Density (pcf)	110.8		N1/A					
At Test Moisture Content (%) At Test Dry Density (pcf)	N/A At T N/A	est MC Tak	en <u>N/A</u>					
Specific Gravity	N/A							
Degree of Saturation (%)	N/A	Uncon	fined Com	pressive	Strength	(tsf)	1.97	
Average Height (in)	6.008				- Strength		0.98	
Average Diameter (in)	2.877				um Stress		10.3	
Height to Diameter Ratio	2.1		Strain ra	ate to fai	lure (% / r	nin.)	1.00	
	ç	Stress vs. Si	train					
2.50								
2.00								
tist 31.50 1.00								
sse								
<b>5</b> 1.00								
0.50								
0.00								
0.0 2.0	4.0 6.0	8.0	10.0	12.0	) 14	.0	16.0	18.0
		Str	rain (%)					
Failure Sketch			Po	cket Per	netromete	r Readir	na (tsf) N	/Δ
			100		orvane Re			
	Comm	nents				ading (it	g/onn / <u>n</u>	
		.0' - Saved ii	n tube					
$  \langle \rangle     \rangle_{2}   \rangle_{2}$								
						Review	ved By	K)
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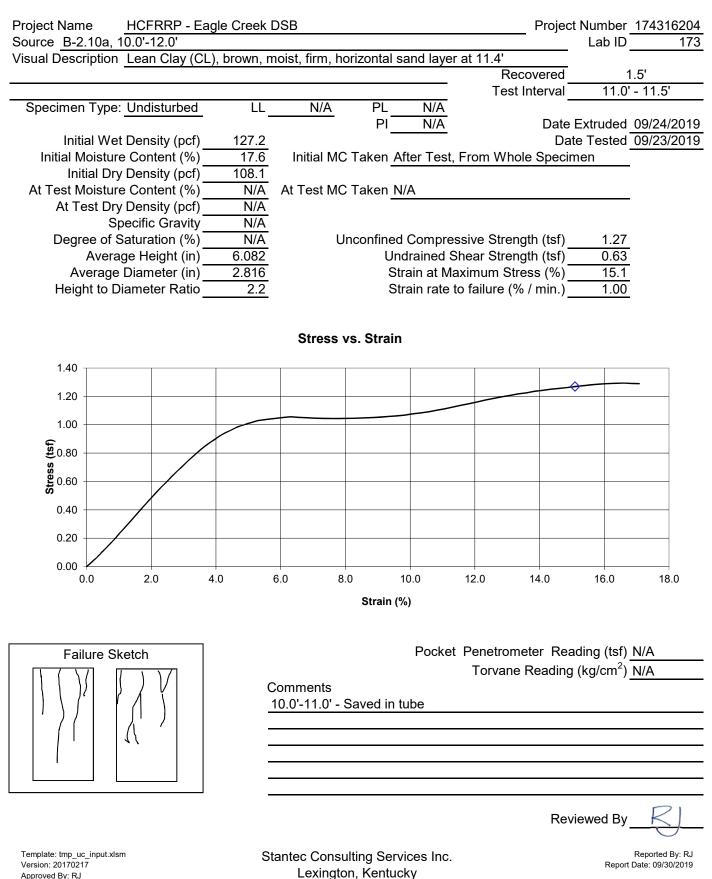
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#### Page 1 of 1

## **Unconfined Compressive Strength** of Cohesive Soil

ASTM D 2166





#### Page 1 of 1

## **Unconfined Compressive Strength** of Cohesive Soil

ASTM D 2166

Project Name <u>HCFRRP - E</u> Source B-2.10a, 12.0'-14.0'	agle Creek l	DSB				Projec	t Number Lab ID	<u>174316204</u> 174
Visual Description Lean Clay (C	L), brown, n	noist, firm, gra	avel					
	,, ,	, , , , ,			Reco	overed	1	.9'
					Test I	nterval _	13.4'	- 13.9'
Specimen Type: Undisturbed	LL	N/A	PL	N/A		-		
	-		PI	N/A		Date	Extruded	09/24/2019
Initial Wet Density (pcf)	139.3							09/24/2019
Initial Moisture Content (%)		Initial MC	Taken Afte	er Test, F	rom Whole	e Speciı	nen	
Initial Dry Density (pcf)								
At Test Moisture Content (%)		At Test MC	laken N/A	4				
At Test Dry Density (pcf)								
Specific Gravity Degree of Saturation (%)		Lin	confined (	Comprose	sive Streng	th (tof)	4.51	
Average Height (in)		UI			ear Streng		2.25	
Average Diameter (in)					imum Stre		14.3	
Height to Diameter Ratio	2.1				failure (%		1.00	
			0114			······/_		
		Stress v	s. Strain					
5.00								
4.50						<b>→</b>	<u> </u>	
4.00								<b>`</b>
3.50								
<b>j</b> 3.00								
<b>9</b> 2 50								
\$2.50 \$2.00								
1.50								
1.00								
0.50						_		
0.00						_		
0.0 2.0	4.0	6.0 8.0	) 10	.0	12.0	14.0	16.0	18.0
			Strain (%)					
Failure Sketch				Pocket I	Penetrome		/	
					Torvane I	Reading	(kg/cm <sup>2</sup> )	N/A
	-	Comments						
	_	12.0'-13.4' - S	aved in tul	be				
	-							
	-							
	-							
	-							
	-							
						Rev	viewed By	<u>R)</u>
	-							Benerited Div D I
Template: tmp_uc_input.xlsm Version: 20170217 Approved By: RJ	SI	antec Consul Lexingtor	ting Servic 1, Kentucky				Report	Reported By: RJ Date: 09/30/2019

# APPENDIX C PRESSURE TESTING RESULTS

oject No. oject Name		316204 Eagle Creek	Gro	Groundw	e Elevation: ater Depth: water Elev:	797.60 4.9 792.70	ft					St St	antec
ring No.	В	-1.1			uge Height: e Diameter:		ft inches						
				Wa	ater Pressu	re							
	Depth (ft)	Elevation (Plant Datum)	Test Length (ft)	Gage (psi)	Test (psi)	Losses due flow	Time Step (min)	Flowmeter (gal)	Flow Rate (gpm)	Take (cuft/ft)	Average Take (cuft/ft)	Net Pressure	Lugeon Value
		( /		<u>u</u> /	<u> </u>			6520.6		· /	· · · ·		
	17.5	780.10	7.3	5	7.1	0.20	1	6521.8	1.2	0.0220			
	24.8	772.80					2	6522.7	0.9	0.0165			
							3	6523.9	1.2	0.0220			
							4	6524.7	0.8	0.0147			
							5	6525.5	0.8	0.0147	1.79E-02	6.90	)
								6550.4					
	17.5	780.10	7.3	10	12.1	5.48	1	6556.1	5.7	0.1044			
	24.8	772.80					2	6561.0	4.9	0.0897			
							3	6566.6	5.6	0.1026			
							4	6571.5	4.9	0.0897			
							5	6576.9	5.4	0.0989	9.71E-02	6.62	2 1
								6579.2					
	17.5	780.10	7.3	15	17.1	7.88	1	6586.0	6.8	0.1245			
	24.8	772.80					2	6592.0	6.0	0.1099			
							3	6598.3	6.3	0.1154			
							4	6605.2	6.9	0.1264			
							5	6611.0	5.8	0.1062	1.16E-01	9.22	2 1
								6614.0					
	17.5	780.10	7.3	10	12.1	3.84	1	6618.8	4.8	0.0879			
	24.8	772.80					2	6624.3	5.5	0.1007			
							3	6629.0	4.7	0.0861			
							4	6634.4	5.4	0.0989	0.405.00	0.00	
							5	6639.0	4.6	0.0842	9.16E-02	8.26	6 1
	47 -	700.40	7.0	-	7 4	0.05	4	6640.2	4.0	0.0707			
	17.5	780.10	7.3	5	7.1	3.05	1	6644.5	4.3	0.0787			
	24.8	772.80					2	6647.8	3.3	0.0604			
							3	6651.5	3.7	0.0678			
							4 5	6655.6	4.1	0.0751		4.05	5 2
							Э	6658.9	3.3	0.0604	6.85E-02	4.05	)
	Noto: Doore	aantativa Lucca		n "Mach a	ut" Dobovica	in Table 2	Summony of	ourropt			Avorago	of Valid Stages:	:
			on value based c ce, "Lugeon Tes								Average	Eugeon Value:	

	Eagle Creek al Investigation sure Testing		Groundw Ground Ga Hole	d Elevation: ater Depth: water Elev: age Height: b Diameter:	4.3 790.10 0 2.98	ft					<b>()</b> s	tantec
Depth	Elevation	Test Length	Wa Gage	ater Pressu Test	Losses	Time Step	Flowmeter	Flow Rate	Take	Average Take	Net Pressure	Lugeon Valu
(ft)	(Plant Datum)	(ft)	(psi)	(psi)	due flow	(min)	(gal)	(gpm)	(cuft/ft)	(cuft/ft)		
							6373.5					
22	772.40	9.4	5	6.9	1.87	1	6376.9	3.4	0.0484			
31.4	763.00					2	6380.6	3.7	0.0526			
						3	6383.4	2.8	0.0398			
						4	6386.5	3.1	0.0441			
						5	6390.2 6396.0	3.7	0.0526	4.75E-02	5.03	5
22	772.40	9.4	10	11.9	4.53	1	6401.2	5.2	0.0740			
31.4	763.00	9.4	10	11.9	4.55	2	6406.6	5.4	0.0740			
51.4	703.00					2	6412.0	5.4	0.0768			
						4	6417.2		0.0708			
						4 5	6422.5	5.3	0.0740		7.37	,
						5	6425.0		0.0734	7.04L-02	1.01	
22	772.40	9.4	15	16.9	8.37	1	6432.0	7	0.0996			
31.4	763.00	0.1	10	10.0	0.01	2	6439.3	7.3	0.1038			
0	100.00					3	6445.6	6.3	0.0896			
						4	6452.5	6.9	0.0981			
						5	6459.8	7.3	0.1038	9.90E-02	8.53	3
							6462.5					
22	772.40	9.4	10	11.9	5.28	1	6468.1	5.6	0.0796			
31.4	763.00					2	6473.2	5.1	0.0725			
1						3	6478.9	5.7	0.0811			
						4	6483.7	4.8	0.0683			
						5	6489.5	5.8	0.0825	7.68E-02	6.62	<u> </u>
							6491.5					
22	772.40	9.4	5	6.9	1.87	1	6494.9	3.4	0.0484			
31.4	763.00					2	6498.9	4	0.0569			
						3	6502.0	3.1	0.0441			
						4	6505.3	3.3	0.0469			
						5	6509.1	3.8	0.0540	5.01E-02	5.03	}
Nata Di				Debeside 1	T-61- 0 0					Augure	of Valid Starse	
	esentative Lugeo	on value based o eon Test Interpr									of Valid Stages: Eugeon Value:	

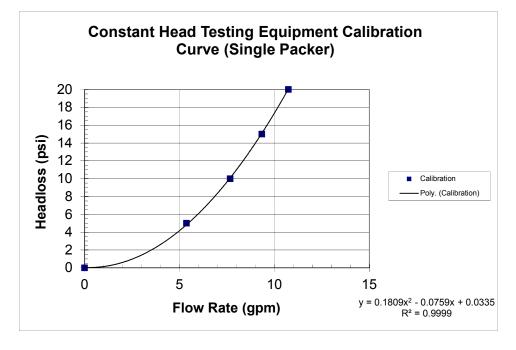
Geotechnic	Eagle Creek al Investigation sure Testing		Groundw Ground Ga Hole	d Elevation: vater Depth: water Elev: age Height: e Diameter:	2.98	ft					St St	tantec
Depth	Elevation	Test Length	Wa Gage	ater Pressu Test	Ire Losses	Time Step	Flowmeter	Flow Rate	Take	Average Take	Net Pressure	Lugeon Valu
(ft)	(Plant Datum)	(ft)	(psi)	(psi)	due flow	(min)	(gal)	(gpm)	(cuft/ft)	(cuft/ft)		-
							6269.0					
21.9		7.8	5	7.9	0.33	1	6270.5	1.5	0.0257			
29.7	746.70					2	6273.4	2.9	0.0497			
						3	6275.4	2.0	0.0343			
						4	6277.7	2.3	0.0394		<b>-</b>	
						5	6280.1 6283.0	2.4	0.0411	3.81E-02	7.57	
21.9	754.50	7.8	10	12.9	1.15	1	6285.7	2.7	0.0463			
21.9		7.0	10	12.9	1.15	2	6288.9	3.2	0.0403			
29.7	740.70					2	6292.4	3.5	0.0548			
						4	6295.2	2.8	0.0000			
						5	6297.8	2.6	0.0446		11.75	
						0	6302.0	2.0	0.0110	0.072.02		
21.9	754.50	7.8	15	17.9	1.87	1	6305.4	3.4	0.0583			
29.7						2	6308.9	3.5	0.0600			
						3	6312.8	3.9	0.0668			
						4	6315.8	3.0	0.0514			
						5	6319.2	3.4	0.0583	5.90E-02	16.03	
							6323.0					
21.9		7.8	10	12.9	0.82	1	6325.3	2.3	0.0394			
29.7	746.70					2	6327.8	2.5	0.0428			
						3	6330.5	2.7	0.0463			
						4	6333.5	3	0.0514			
						5	6335.6	2.1	0.0360	4.32E-02	12.08	
			_				6337.0					
21.9		7.8	5	7.9	0.48	1	6338.8	1.8	0.0309			
29.7	746.70					2	6340.6	1.8	0.0309			
ĺ						3	6342.7	2.1	0.0360			
						4	6344.4	1.7	0.0291		7 10	
						5	6345.7	1.3	0.0223	2.98E-02	7.42	
Noto: Boor	esentative Lugeo	n value bacad	on "Turbulo	ot" Dobovior	in Table 2	Summary of	ourropt			Average	of Valid Stages:	
		ce, "Lugeon Tes								Average	Eugeon Value:	

Geotechnic	Eagle Creek al Investigation sure Testing		Groundw Ground Ga Hole	d Elevation: ater Depth: water Elev: age Height: e Diameter:	2.98	ft					<b>()</b> S	tantec
Depth	Elevation	Test Length	Gage	ater Pressu Test	Losses	Time Step	Flowmeter	Flow Rate	Take	Average Take	Net Pressure	Lugeon Valu
(ft)	(Plant Datum)	(ft)	(psi)	(psi)	due flow	(min)	(gal)	(gpm)	(cuft/ft)	(cuft/ft)		
22.5	769.50	7.7	5	5.5	0.09	1	6349.5 6350.3	0.8	0.0139			
30.2		1.1	5	5.5	0.09	2	6350.3	0.8 0.6	0.0139			
30.2	701.00					2	6350.9	0.6	0.0104			
						4	6352.1	0.6	0.0104			
						4 5	6352.1	0.8	0.0104		5.41	
						5	6352.4	0.5	0.0052	1.012-02	5.41	
22.5	769.50	7.7	10	10.5	0.07	1	6353.4	0.7	0.0122			
30.2			10	10.0	0.07	2	6354.0	0.6	0.0104			
00.2	101.00					3	6354.7	0.7	0.0122			
						4	6355.3	0.6	0.0104			
						5	6356.0	0.7	0.0122		10.43	3
							6356.7					
22.5	769.50	7.7	15	15.5	0.28	1	6358.1	1.4	0.0243			
30.2	761.80					2	6359.0	0.9	0.0156			
						3	6360.0	1.0	0.0174			
						4	6360.8	0.8	0.0139			
						5	6361.7	0.9	0.0156	1.74E-02	15.22	2
							6362.5					
22.5		7.7	10	10.5	0.03	1	6362.9	0.4	0.0069			
30.2	761.80					2	6363.5	0.6	0.0104			
						3	6364.0	0.5	0.0087			
						4	6364.5	0.5	0.0087			
ļ						5	6365.0	0.5	0.0087	8.68E-03	10.47	·
			_				6365.2					
22.5		7.7	5	5.5	0.03	1	6365.6	0.4	0.0069			
30.2	761.80					2	6365.9	0.3	0.0052			
ĺ						3	6366.2	0.3	0.0052			
						4	6366.5	0.3	0.0052			
						5	6366.9	0.4	0.0069	5.90E-03	5.47	
Noto: Door	opportative Lucza		op "\/c¦d ⊏:"	ina" Debe	or in Table (	Cummer -	fourrort			Avoraça	of Valid Stages:	
	esentative Lugeo	on value based ( ce, "Lugeon Tes									e Lugeon Value:	

4 HCFRRP - I Geotechnica Water Press B-2.10	al Investigation		Groundw Ground Ga Hole	d Elevation: rater Depth: water Elev: age Height: e Diameter:	796.30 0 2.98	ft					) St	anteo
Depth	Elevation	Test Length	Gage	ater Pressu Test	re Losses	Time Step	Flowmeter	Flow Rate	Take	Average Take	Net Pressure	Lugeon V
(ft)	(Plant Datum)	(ft)	(psi)	(psi)	due flow	(min)	(gal)	(gpm)	(cuft/ft)	(cuft/ft)		•
							6367.1					
21.5	774.80	7.3	5	5.0	0.03	1	6367.2		0.0018			
28.8	767.50					2	6367.2	0.0	0.0000			
						3	6367.3	0.1	0.0018			
						4	6367.6	0.3	0.0055			
						5	6367.7	0.1	0.0018	2.20E-03	4.97	
							6368.0					
21.5	774.80	7.3	10	10.0	0.00	1	6368.0	0	0.0000			
28.8	767.50					2	6368.0	0.0	0.0000			
						3	6368.0	0.0	0.0000			
						4 5	6368.0 6368.0	0.0	0.0000 0.0000		10.00	
						5	6368.0	0.0	0.0000	0.00E+00	10.00	
21.5	774.80	7.3	15	15.0	0.03	1	6368.7	0.1	0.0018			
21.5	767.50	7.5	15	15.0	0.03	2	6368.8	0.1	0.0018			
20.0	767.50					2	6368.9	0.1	0.0018			
						3 4	6369.0	0.1	0.0018			
						4 5	6369.0	0.0	0.0018		14.97	
						5	6369.0	0.0	0.0000	1.47 2-03	14.57	
21.5	774.80	7.3	10	10.0	0.00	1	6369.0	0	0.0000			
28.8	767.50	7.0	10	10.0	0.00	2	6369.0	0	0.0000			
20.0	101.00					3	6369.0	õ	0.0000			
						4	6369.0	0	0.0000			
						5	6369.0	0 0	0.0000		10.00	
						-	6368.8					
21.5	774.80	7.3	5	5.0	0.00	1	6368.8	0	0.0000			
28.8	767.50					2	6368.8	0	0.0000			
						3	6368.8	0	0.0000			
						4	6368.8	0	0.0000			
						5	6368.8	0	0.0000	0.00E+00	5.00	

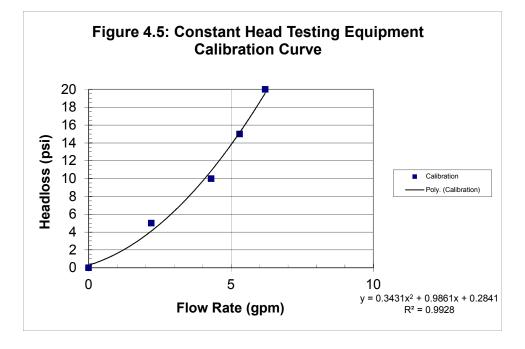
	Geotechni	- Eagle Creek cal Exploration ssure Testing C	Groundwa Groundv Ga Hole	Elevation: ater Depth: water Elev: age Height: Diameter:		ft			
					ressure				
Geologic	•	Elevation	Test Length	Gage	Test		Flowmeter		Average
Unit	(ft)	(Plant Datum)	(ft)	(psi)	(psi)	(min)	(gal) 6095.0	(gpm)	
	0	704.00	0	-	7.0			7.0	
	0		0	5	7.8	1	6102.3	7.3	
	0	794.90				2	6105.8	3.5	
						3	6111.1	5.3	
									5.4
							6115.0		
	0	794.90	0	10	12.8	1	6122.5	7.5	
	0	794.90				2	6130.5	8.0	
						3	6138.0	7.5	
									7.7
							6145.0		
	0	794.90	0	15	17.8	1	6154.4	9.4	
	0	794.90				2	6163.6	9.2	
						3	6173.0	9.4	
									9.3
							6181.0		
	0	794.90	0	20	22.8	1	6191.5	10.5	
	0	794.90				2	6202.3	10.8	
						3	6213.2	10.9	
									10.7
							6220.0		
	0	794.90	0	25	27.8	1	6231.5	11.5	
	0	794.90				2	6243.5	12.0	
						3	6255.8	12.3	
									11.9

Plot N	Plot Numbers								
у	x								
0	0								
5	5.4								
10	7.7								
15	9.3								
20	10.7								
25	11.9								

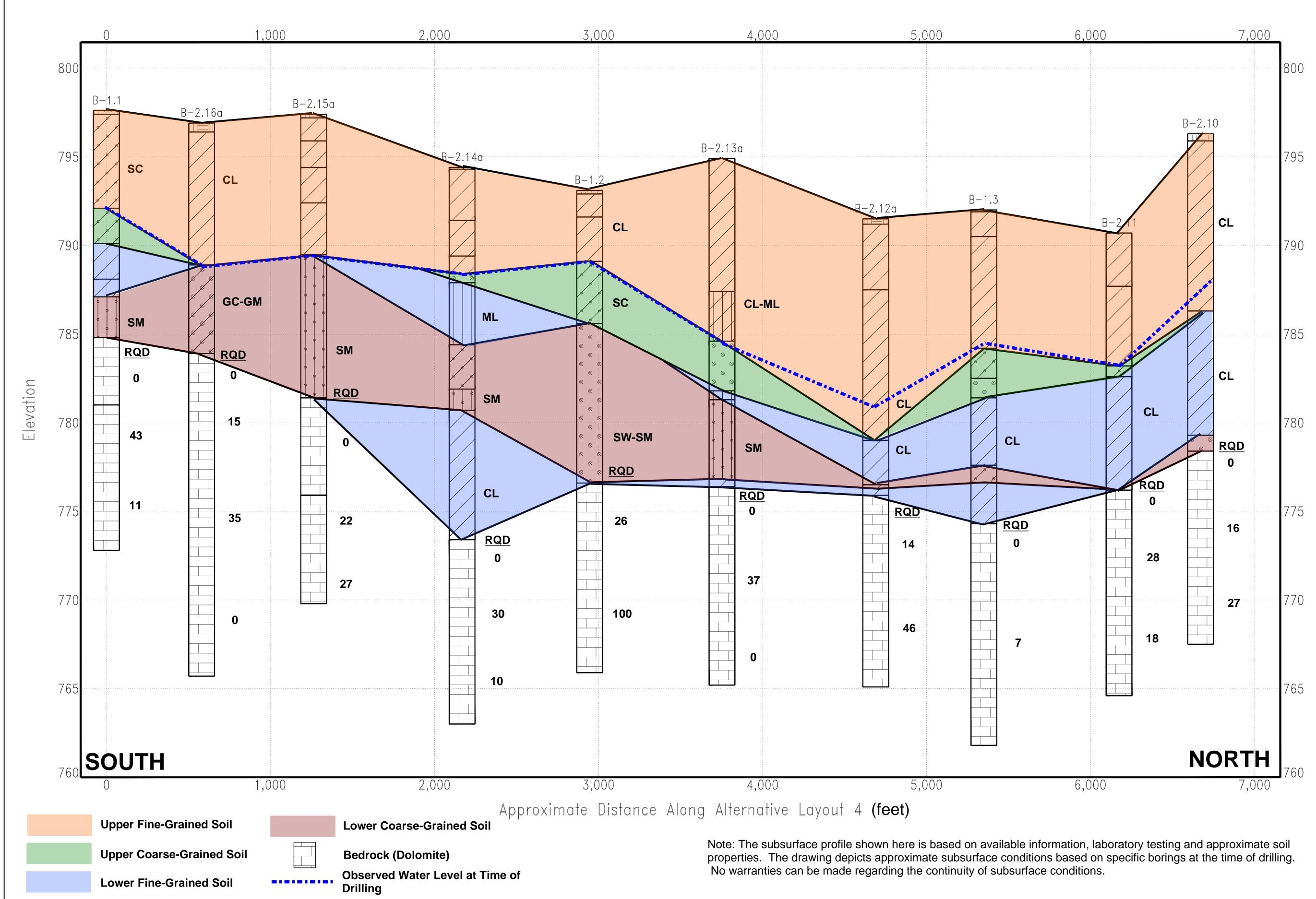


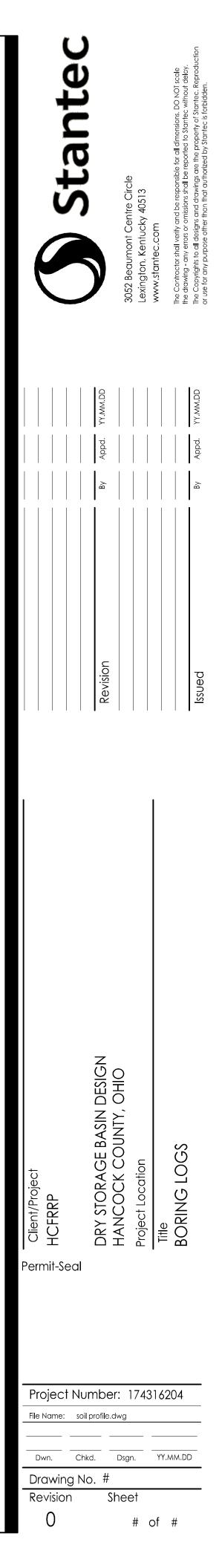
-				Groundwa Groundw Ga Hole	Elevation: ater Depth: vater Elev: ge Height: Diameter:	656.00 0	ft		
				Water P					
Geologic	Depth	Elevation	Test Length	Gage	Test		Flowmeter		Average
Unit	(ft)	(Plant Datum)	(ft)	(psi)	(psi)	(min)	(gal) 2533.0	(gpm)	
				_					
	0		0	5	5.0	1	2535.2	2.2	
	0	656.00				2	2537.4	2.2	
						3	2539.5	2.1	
									2.2
-							2539.5		
	0	656.00	0	10	10.0	1	2543.5	4	
	0	656.00				2	2548.0	4.5	
						3	2552.5	4.5	
									4.3
-							2552.5		
	0	656.00	0	15	15.0	1	2557.7	5.2	
	0	656.00				2	2562.9	5.2	
						3	2568.5	5.6	
									5.3
-							2568.5		
	0	656.00	0	20	20.0	1	2575.0	6.5	
	0					2	2580.9	5.9	
						3	2587.2	6.3	
l									6.2

Plot Numbers							
у	х						
0	0						
5	2.2						
10	4.3						
15	5.3						
20	6.2						



# APPENDIX D SOIL PROFILE DIAGRAM





# APPENDIX E ROCK CORE PHOTOS





B-1.1 - Box 1 of 1. Depth: 14.3 to 24.8 feet



B-1.2 - Box 1 of 1. Depth: 16.9 to 27.2 feet





B-1.3 - Box 1 of 1. Depth: 20.0 to 30.2 feet



B-2.10 - Box 1 of 1. Depth: 18.5 to 28.8 feet





B-2.11 - Box 1 of 1. Depth: 15.1 to 26.1 feet



B-2.12a – Box 1 of 1. Depth: 16.4 to 26.4 feet





B-2.13a – Box 1 of 1. Depth: 18.9 to 29.7 feet



B-2.14a – Box 1 of 1. Depth: 21.0 to 31.4 feet





B-2.15a – Box 1 of 1. Depth: 17.7 to 27.7



B-2.16a – Box 1 of 1. Depth: 15.1 to 31.2 feet