Geotechnical Investigation
Proposed Rail Loadout Facility
Tenas Project Feasibility Study
Telkwa, BC

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Appendices

1 Introduction and Scope

Westrek Geotechnical Services Ltd. (Westrek) conducted a geotechnical investigation for the proposed rail loadout facility for the Tenas Project. The investigation was conducted as part of Telkwa Coal Ltd.'s feasibility study. The purpose of the investigation was to assess the subsurface conditions with respect to stability of the proposed coal stockpiles and subgrade support for the proposed railyard facilities.

The services provided by Westrek are subject to the terms and conditions set out in the *Interpretation and Use of Study and Report and Limitations*, which is attached in Appendix A and incorporated herein by reference.

2 Proposed Development

The proposed rail loadout facility will be an elevated area where a wheeled loader (such as Caterpillar 988 Loader) will load coal into the rail cars using a mobile conveyor system. The area will be gravel-surfaced and there will be no structures associated with this facility. The coal piles could be up to 15 m high and could vary in location.

A rail loop will be located along the perimeter of the loadout facility. The railway, including the track bed formation and ballast thicknesses, is being designed by others. Final grades for the rail loop have not yet been determined.

3 Investigation

3.1 Drilling & Test Pitting

The geotechnical investigation occurred between September 28 and 30, 2018, and included:

- Drilling one borehole, and
- Excavating nine test pits.

Borehole T18-17S was drilled using a rubber-tracked, Minisonic LS250 drill rig supplied by Boart Longyear. The borehole was drilled to 15.2 m depth using 150 mm diameter casing to retrieve 100 mm diameter core samples. Sonic drilling methods were used with and without the use of water, depending on the soil recovery.

Soil densities were assessed using Standard Penetration Tests (SPTs) conducted at selected depths. A continuous Dynamic Cone Penetration Tests (DCPTs) was conducted adjacent to the borehole until encountering practical refusal at the top of the till deposit at 12.8 m depth.

Grab samples were taken from the sonic core for laboratory testing. One Shelby tube sample was obtained from a clay layer for triaxial testing.

Test pits were completed by Vihar Construction Ltd., and were advanced to depths ranging from 2.6 m to 4.0 m, depending on the stability of the pit walls and reach of the machine. The test pits were excavated using a John Deere 135G excavator.

The locations of the boreholes and test pits are shown on Drawing 01 in Appendix B. Detailed logs for the boreholes and test pits are provided in Appendix C; laboratory testing results are

attached in Appendix D. Laboratory test results used to classify the soil units are also presented on the respective borehole and test pit logs.

A summary of the borehole and test pit locations and depths is provided in Table 1.

Table 1
Summary of Boreholes & Test Pits

Borehole/Test Pit	Location	Termination Depth (below surface)
T18-17S	McDonald Farm, formerly R09.	15.2 m
TP18-20	McDonald Farm, formerly R07.	3.2 m
TP18-21	McDonald Farm, formerly R05.	2.6 m
TP18-22	McDonald Farm, formerly R01.	3.3 m
TP18-23	McDonald Farm, formerly R06.	3.2 m
TP18-24	McDonald Farm, formerly R03.	4.0 m
TP18-25	McDonald Farm, formerly R08.	3.7 m
TP18-26	McDonald Farm, formerly R02.	4.0 m
TP18-27	McDonald Farm, formerly R04.	3.7 m
TP18-28	McDonald Farm, south of Lawson Road.	3.0 m

3.2 Laboratory Testing

A laboratory testing program was carried out to assist in characterizing the soil and its engineering behaviour. Selected samples of the soil from the sonic borehole and test pits were submitted for testing to Wood Environment & Infrastructure's laboratory in Kamloops and Golder Associates' laboratory in Burnaby. The analyses carried out included:

- 19 moisture contents,
- 17 wash sieves (grain size analyses),
- 2 Atterberg limits,
- 4 Standard Proctor Density tests,
- 4 $MgSO_4$ Soundness tests,
- 4 LA Abrasion tests,
- 4 California Bearing Ratio (CBR) tests,
- 1 consolidated-undrained triaxial test, and
- 1 lab vane shear tests

The laboratory test program is summarized on Table 2. The laboratory reports are included in Appendix D and the results for the grain size and Atterberg Limits are included on the borehole logs.

Table 2.
Summary of Laboratory Tests Conducted

Test Hole/Pit	Sample	Depth (m)	Moisture Content	Wash Sieve	Atterberg Limits	Standard Proctor	MgSO4 Soundness	LA Abrasion	CBR	Lab Vane	Triaxial
T18-17S	SA-01	1.8 – 2.1	X	X							
T18-17S	SA-02	5.2 – 5.8	X		X						
T18-17S	SS-02	10.7 – 11.3	X								
T18-17S	SA-04	13.1 – 13.4	X								
T18-17S	ST-02	7.6 – 8.2								X	X
TP18-20	SA-01	0.3 – 0.4	X	X							
TP18-20	SA-02	0.7 – 0.8	X	X							
TP18-20	SA-03	1.8 – 2.0	X	X							
TP18-20	SA-04	3.0 – 3.2 m		X							
TP18-21	SA-01	1.0 – 1.2	X	X		X	X		X		
TP18-22	SA-01	0.5 – 0.6	X	X							
TP18-22	SA-02	1.4 – 1.5	X	X				X			
TP18-23	SA-01	1.3 – 1.4	X	X		X	X		X		
TP18-23	SA-02	2.6 – 2.7		X				X			
TP18-23	SA-03	2.9 – 3.1	X		X						
TP18-24	SA-01	1.0 – 1.2	X	X							
TP18-24	SA-02	1.9 – 2.1	X	X		X	X	X	X		
TP18-24	SA-03	3.5 – 3.7	X	X							
TP18-25	SA-01	2.1 – 2.3	X	X		X	X		X		
TP18-25	SA-02	3.2 – 3.4	X	X							
TP18-26	SA-01	1.8 – 2.0	X	X				X			
TP18-27	SA-01	1.8 – 2.0	X	X							

4 Site Conditions

The McDonald Farm is situated on the floodplain of the Bulkley River. Most of the site ranges in elevation from 512.7 m at TP18-21, near the north end of the property, to 515.4 m at Borehole T18-17S, towards the south end. The elevation of the Bulkley River is about 511 m, and the floodplain is generally well-drained. There is evidence from aerial imagery (e.g. Google Earth) of abandoned channel meanders adjacent to and within the property. Figures provided by the client show streams that flow through test pits TP18-22 and TP18-27; however, the sites were dry at the time of our fieldwork.

The floodplain abuts a 6 to 8 m high terraced slope that crosses the south side of the property. The terrain upslope is undulating with a gentle north-facing slope that climbs up towards Lawson Road. Test pit TP18-28 is located south of Lawson Road on gently-sloped, undulating terrain at an elevation of 534.3 m.

Most of the property had been modified and developed for agricultural purposes. Vegetative cover in the open areas near TP18-20, TP18-22, and TP18-27 consists of rose and juvenile aspen. Juvenile and mature aspen are present to the north, adjacent to TP18-21 and TP18-23 and within 500 m of the Bulkley River. Juvenile pine have been planted in cleared areas near TP18-26 and TP18-28. Borehole T18-17S, TP18-24 and TP18-25 are situated in areas of open-floor canopy forested with mature lodgepole pine, juvenile and mature aspen, and minor juvenile spruce. The ground cover in the open-canopy areas includes thimbleberry, rose, and low-bush ash.

5 Subsurface Conditions

5.1 Stratigraphy

The soil on the north side of Lawson Road (Borehole T18-17S and TP18-20 to TP18-27) generally consists of sandy topsoil at the ground surface and up to 1.0 m of compact silt in some areas, overlying interbedded sand and gravel. A soft to firm, silty clay unit was encountered within Borehole T18-17S from 4.1 m to 11.3 m depth (504.1 to 511.3 m elevation). This clay deposit overlies a thin unit of fine-grained silty sand and till composed of silty sand to silt. The clay was also encountered below 2.9 m (510.9 m elevation) in TP18-23 and below 3.8 m (510.7 m elevation) in TP18-26. The clay is assumed to underlie the entire development site on the north side of Lawson Road, but is deeper than the bottom of the other test pits.

TP18-28, excavated south of Lawson Road, encountered interbedded silt and sand overlying very dense, silty sand till at 1.7 m depth (532.6 m elevation), which transitions into silty clay till at 2.8 m depth (531.5 m elevation).

5.2 Sand & Gravel Unit

The ease of excavation of the test pits indicates that the sand and gravel deposit is generally loose in-situ. The DCPT results in Borehole T18-17S indicate that the deposit is compact to dense; however, the cobbles within the deposit significantly increase the blow counts and skew the results. For foundation or subgrade bearing, the deposit should be considered to be loose.

5.3 Clay Unit

The clay unit was encountered at the bottom of TP18-23 and TP18-26, where pocket penetrometer results indicate that the deposit is soft to firm in-situ, with pocket penetrometer values below 50 kPa on relatively intact test pit samples.

This clay unit was about 7 m thick in Borehole T18-17S. Pocket penetrometer results yielded values well under 50 kPa on disturbed sonic core samples. The torvane measured a shear strength of 20 kPa at 7.2 m depth, although this sample would also have been disturbed. The torvane measurement on the undisturbed Shelby tube sample at 7.6 to 8.2 m depth was 39 kPa and is likely a more reliable indication of the undisturbed shear strength of this unit at this depth.

The DCPT results are typically between 15 and 22 blows/foot, which generally indicates the clay is stiff to very stiff, although this correlation is based on SPT results. These DCPT results are probably influenced by friction along the rods, yielding higher blowcounts than an SPT would.

The consolidated-undrained triaxial test, with pore pressure measurements, result in effective stress parameters of c'= 21 kPa and Φ'=8°.

5.4 Groundwater Conditions

Groundwater was encountered in all test pits on the north side of Lawson Road from approximately 2.5 m to 3.9 m depth (510.2 m to 511.3 m elevation). This groundwater table is created by an unconfined aquifer within the sand and gravel units, perched above the clay unit, that generally matches the adjacent river level. A rise in river level would be expected to cause a similar rise in groundwater levels, with both peaking during spring freshet.

Environment Canada's river data for the Bulkley River near Quick (Station 08EE004, located approximately 8 km upstream) recorded the following (all water levels are based on local datum):

- River level on September 28, 2018, at the time of the field investigation = 0.2 m
- Mean historical level in May-June = 1.5 m
- Peak water level in May 2018 = 2.6 m

The river data shows that the peak level in 2018 was 2.4 m higher than at the time of the investigation while the normal annual peak level would be approximately 1.3 m higher than at the time of the investigation. Therefore, the seasonal high groundwater level is expected to rise within 1 to 2 m of the ground surface throughout most of this site.

Note that groundwater levels can rise higher but assessing the flood potential is not part of Westrek's geotechnical scope of work.

The groundwater table was not encountered in TP18-28, on the south side of Lawson Road. The ground surface rises approximately 20 m in this area and slopes to the north, creating well-drained conditions.

6 Aggregate Testing

6.1 Gradation

The gradation of the sand and gravel deposit varies considerably, as noted in the grain size test results. The deposit found in TP18-20 is just 5% gravel, 94% sand, and 1% fines, while the deposit found in TP18-27 is 12% cobbles, 74% gravel, 12% sand and 2% fines. The in-situ cobble content is probably higher than noted from the grain size tests because the sampling tends to avoid cobbles. Overall, the deposit is at least 50% gravel and probably more than 60% gravel.

The fines content ranges from less than 1% up to 4%; therefore, the gravel deposit is considered free-draining. Most of the material would meet gradation specifications for subgrade and subbase fill; however, the grain size test results should be compared directly to any project gradation specifications.

Three of the grain size tests were conducted on the surficial silt deposit overlying the gravel unit. These samples were found to have a fines content ranging from 46% to 89%, with the remainder comprised of fine-grained sand. The deposit is non-plastic; therefore, the fines are predominantly

silt with minimal clay. Such material would be highly susceptible to variations in moisture content and highly erodible.

The general results of the grain size analyses are summarized in Table 3.

Table 3
Summary of Grain Size Analyses

Test Pit/ Borehole	Sample	Gradation				Classification
		% Cobbles	% Gravel	% Sand	% Fines	
T18-17S	1	0	51	45	4	GP
TP18-20	1	0	0	32	68	ML
TP18-20	2	0	0	54	46	SM
TP18-20	3	0	5	94	1	SP
TP18-20	4	2	58	37	3	GP
TP18-21	1	0	63	36	1	GW
TP18-22	1	0	0	11	89	ML
TP18-22	2	3	71	25	1	GP
TP18-22	3	0	74	25	1	GW
TP18-23	1	5	63	31	1	GW
TP18-23	2	5	62	32	1	GW
TP18-24	1	0	57	42	1	GW
TP18-24	2	0	56	43	1	GP
TP18-24	3	0	51	49	0	GP
TP18-25	1	0	63	36	1	GW
TP18-25	2	0	54	45	1	GW
TP18-26	1	8	57	34	1	GW
TP18-27	1	12	74	12	2	GP

6.2 Standard Proctor Density Tests

Standard Proctor density tests were conducted on four samples, all taken from the sandy gravel deposit. The results indicate that these samples are not highly sensitive to variations in moisture content and, therefore, should be readily compactable if used as an engineered fill material.

Table 4
Summary of Standard Proctor Test Results

Test Pit	Sample Depth (m)	Maximum Dry Density (kg/m^3)	Optimum Moisture Content (%)
TP18-21	1.0 - 1.2	2281	6.5
TP18-23	1.3 - 1.4	2355	5.0
TP18-24	1.9 - 2.1	2180	7.3
TP18-25	2.1 - 2.3	2110	8.0

6.3 Soundness Testing

The magnesium sulphate soundness test involves repeatedly submerging an aggregate sample in a saturated solution of magnesium sulfate. This process causes salt crystals to form in the aggregate pores, which simulate ice crystal formation. The results from the four tests are provided on Table 5.

The results range from 0.6% to 1.1% loss, far less than the 20% maximum loss of aggregate coarser than 4.75 mm permitted by the BC Ministry of Transportation & Infrastructure (MOTI).

Table 5
Summary of $MgSO_4$ Soundness Test Results

TEST PIT	SAMPLE DEPTH (m)	WEIGHTED LOSS (%)
TP18-21	1.0 - 1.2	1
TP18-23	1.3 - 1.4	0.6
TP18-24	1.9 - 2.1	1.1
TP18-25	2.1 - 2.3	1.1

The L.A. abrasion test subjects a coarse aggregate sample (retained on the 1.70 mm sieve) to abrasion, impact, and grinding in a rotating steel drum containing a specified number of steel spheres. BC MOTI uses the similar Micro Deval test instead; however, the maximum loss permissible by various transportation agencies throughout the Unites States generally ranges between 25% and 45%, depending on the material's proposed use. The test results, summarized on Table 6, range from 12.6% to 14.8% loss, which meets all relevant highway standards.

Table 6
Summary of LA Abrasion Test Results

TEST PIT	SAMPLE DEPTH (m)	LOSS AFTER 500 REVOLUTIONS (%)
TP18-22	1.4 - 1.5	14.8
TP18-23	2.6 – 2.7	14.8
TP18-24	1.9 - 2.1	14.7
TP18-26	1.8 - 2.0	12.6

6.4 California Bearing Ratio

The California Bearing Ratio (CBR) test is a simple strength test that compares the bearing capacity of a material with that of a well-graded crushed stone. A high quality crushed stone material should have a CBR of 100%. The test results do not indicate a pass or fail but merely provide a relative strength of the tested soils under the conditions tested.

The results depend on the level of compaction and moisture conditions. The four samples tested were each heavily compacted at close to optimal moisture content. Actual levels of compaction ranged from 93.9% to 100.4% of Standard Proctor density and moisture contents were slightly dry of optimum.

The results summarized on Table 7 are relatively high for a non-crushed gravel, indicating that the sandy gravel unit should provide a relatively solid subgrade if compacted prior to placing any fill. The unit should also provide a good aggregate for use as subbase.

Table 7
Summary of California Bearing Ratio Test Results

TEST PIT	SAMPLE DEPTH (m)	CBR VALUE RANGE (%)
TP18-21	1.0 - 1.2	77 - 99
TP18-23	1.3 - 1.4	98 - 113
TP18-24	1.9 - 2.1	68 - 90
TP18-25	2.1 - 2.3	72 - 95

7 Slope Stability Analyses

7.1 Methodology

Two-dimensional limit equilibrium slope stability software (RocScience SLIDE 7.0) was used to estimate the stability of the natural subsurface conditions under the anticipated weight of the 15 m high coal piles. The focus of the analysis was the potential for a bearing failure within the clay deposit beneath the coal piles. The soil conditions were modeled using the stratigraphy in Borehole T18-17S, which includes surficial sand and gravel overlying clay at approximately 4 m depth. The model also considered the conditions in TP18-23, where the clay is approximately 3 m below the existing ground surface.

Note that significant changes to the existing site grade would affect stability. Raising the grade should improve stability while lowering the grade would reduce the depth to the top of the clay unit and, therefore, reduce stability.

The analysis was initially conducted using total stress parameters (undrained shear strengths) in the clay to simulate undrained conditions. The following scenarios were analyzed:

- Scenario A – Using the undrained shear strengths measured using both a pocket penetrometer and torvane.
- Scenario B – Allowing for weaker zones in the clay unit, conservative shear strengths were estimated assuming that the clay is normally consolidated. The undrained shear strength was estimated based on the existing overburden pressure (using the formula $c_u=(0.22)\sigma_o$).
- Scenario C – In the long-term, consolidation of the clay under the weight of the coal piles should increase the shear strength. Therefore, the long-term, undrained shear strengths of the clay were estimated using the formula $c_u=(0.22)\sigma_{ob}$, where σ_{ob} is the total confining pressure on the clay, including the weight of 15 m high coal piles.

The overlying sand and gravel deposit is free-draining; therefore, the groundwater level was assumed to be at its seasonal high, estimated to be 1.0 m below the ground surface, as discussed in Section 5.4.

The analysis was then conducted using effective stress conditions and drained strength parameters in the clay, as determined from the laboratory triaxial test. With effective stress analyses, the piezometric pressure in the clay varies depending on the loading conditions. The weight of the coal piles will initially cause the pore pressures in the clay to rise rapidly to a level that depends on the over-consolidation in the clay and the pore pressure parameters of the clay, none of which are known. The excess pore pressure then dissipates with time.

The effective stress analysis considered a wide range of pore pressure conditions, as follows:

- Scenario D - The piezometric level was set 1 m below the surface to simulate seasonal high groundwater levels but without any excess pore pressure in the clay. This would be considered the long-term stability condition, after all excess pore pressures have dissipated.
- Scenario E – The piezometric pressure in the clay was raised in 2 m increments to account for excess pore pressure generated by the initial loading from the coal stockpiles. These represent the various stages of drainage from initial undrained conditions to fully drained conditions.

The soil properties used in the analysis are summarized on Table 8.

Table 8:
Summary of Soil Properties Used in Analyses

Soil Unit	Bulk Density (kN/m^3)	Scenario A		Scenario B		Scenario C		Scenario D		Scenario E	
		c (kPa)	Φ (°)	c (kPa)	Φ (°)	c (kPa)	Φ (°)	c (kPa)	Φ (°)	c (kPa)	Φ (°)
Coal Pile	11	0	34	0	34	0	34	0	34	0	34
Sand – Upper	21	0	36	0	36	0	36	0	36	0	36
Gravel and Sand	22	0	38	0	38	0	38	0	38	0	38
Clay 1	17	30	0	20	0	50	0	21	8	21	8
Clay 1	17	35	0	25	0	55	0				
Clay 1	17	40	0	30	0	60	0				
Sand – Lower	21	0	34	0	34	0	34	0	34	0	34
Till	22	0	38	0	38	0	38	0	38	0	38

7.2 Results of Analysis

The analysis ignored slope stability of the coal piles themselves, which will depend largely on the slope angles. These piles are assumed to be piled as steep as they can and will be prone to surficial failures. Surficial failures on a 15 m high stockpile can pose a risk to workers at the base. Operation of the loadout facility should consider such failures in their worker safety plan.

The focus of the analyses was on deeper bearing failures within the underlying clay. The bearing capacity of the clay under the weight of the coal piles will change with time. The initial loading of the clay will cause the pore pressures within the clay to rise dramatically because much of the added load is initially carried by the undrained groundwater within the clay. With time, the excess pore pressure in the clay reduces and the load from the coal piles is transferred onto the clay soil structure, causing the clay to consolidate. As the clay consolidates, its undrained shear

strength increases. Therefore, the first time an area is loaded with coal piles will create a lower factor of safety than the long-term conditions. Once an area has been loaded for at least 6 to 12 months (cumulatively), subsequent reloading of the same area should not cause the same degree of excess pore pressures and the long-term stability conditions should apply.

The results of the stability analyses for the various scenarios is summarized on Table 9 and discussed in the following subsections.

Table 9
Summary of Slope Stability Results

	Scenario	Height of Coal Pile (m)	Conditions	Factor of Safety	
				Top of Clay 4 m deep	Top of Clay 3 m deep
Total Stress Analysis	Scenario A	15	Initial soil conditions (no consolidation) Measured undrained shear strengths	1.44	1.32
	Scenario B	15	Conservative shear strengths (no over-consolidation)	1.20	1.08
	Scenario B	10	Conservative shear strengths (no over-consolidation)	1.58	1.41
	Scenario C	15	Increased shear strength due to consolidation	1.84	1.75
Effective Stress Analysis	Scenario D	15	Long term conditions. No excess pore pressure. Piezometric level 1 m below original ground	1.61	1.51
	Scenario E	15	2 m excess pore pressure in clay	1.55	1.45
	Scenario E	15	4 m excess pore pressure in clay	1.51	1.40
	Scenario E	15	6 m excess pore pressure in clay	1.48	1.37
	Scenario E	15	8 m excess pore pressure in clay	1.45	1.34
	Scenario E	15	10 m excess pore pressure in clay	1.43	1.31
	Scenario E	15	12 m excess pore pressure in clay	1.39	1.28
	Scenario E	15	14 m excess pore pressure in clay	1.36	1.24
	Scenario E	15	16 m excess pore pressure in clay	1.33	1.21

7.2.1 Initial Loading

The short-term or initial loading conditions can be represented by the total stress analysis or the effective stress analysis with assumed excess pore pressures.

Using total stress parameters, and the measured shear strengths in Borehole T18-17S (Scenario A), the weight of a 15 m high coal pile creates a factor of safety of 1.44. More conservative strengths based on normally consolidated clay lowers the factor of safety to 1.20 (Scenario B).

The effective stress analysis with excess pore pressure yields similar but slightly lower factors of safety. Assuming that the clay is slightly over-consolidated, as apparent from the measured shear strengths in Borehole T18-17S, the initial elevated pore pressure for the near-normally consolidated clay loaded with a 15 m high coal pile is expected to rise to approximately 16 m above the ground surface (assuming a pore pressure coefficient of 0.4 for the over-consolidated loading and 1.0 for normally consolidated loading), resulting in a FoS of 1.33.

If the initial loading of the area limits the coal piles to 10 m in height, the total stress analysis results in a factor of safety of 1.58 even when assuming conservative clay strengths (Scenario B). In the effective stress analysis, the increase in pore pressures is estimated to be approximately 10 m, resulting in a factor of safety of 1.43.

The effective stress analysis assumes that the full load of the coal pile appears at once, causing the full increase in the pore pressure. In reality, the coal piles will take time to accumulate, allowing the excess pore pressure to drain slightly. Assuming an 8 m rise in pore pressure in the clay by the time the clay pile reaches 10 m height results in a factor of safety of 1.45, still lower than the factor of safety from the total stress analysis.

If the surface granular layer is assumed to be just 3 m thick, as noted in TP18-23, all factors of safety are 0.10 to 0.12 lower. For example, the factor of safety under a 10 m high coal pile would be 1.41 in the total stress analysis and 1.34 in the effective stress analysis (with 8 m of excess pore pressure).

7.2.2 Subsequent Loading

The total stress analysis does not take into account excess pore pressures and, therefore, does not differentiate between subsequent loadings. Assuming the top of the clay unit is 4 m deep, the factor of safety remains at 1.44 under the weight of a 15 m high coal pile. In the long-term, the undrained shear strength of the clay should increase due to consolidation (Scenario C) and the factor of safety should eventually reach 1.84; however, the increased shear strength could take several years to develop. Considering the transient loading conditions of the coal piles, Scenario C and the increased shear strengths should be ignored; however, the analysis shows that the critical factor of safety is expected to occur shortly after the load from the coal piles is first applied.

In the effective stress analyses, the excess pore pressure will gradually decrease with time as the clay consolidates. Subsequent loading will increase the excess pore pressure again, but to a lower degree. The excess pore pressure in over-consolidated clay also tends to dissipate at a faster rate than normally consolidated clay. Subsequent loading of a 15 m high coal pile onto clay that has already consolidated under previous coal piles would likely create approximately 6 m of excess

pore pressure resulting in a factor of safety of 1.48, which would gradually increase towards 1.55 in the long-term condition. Again, the analysis demonstrates that the stability should increase with time after the initial loading from the coal piles.

7.2.3 Internal Friction of the Coal Piles

The internal friction angle for the coal piles is unknown and depends on several factors, such as the gradation and angularity. The sensitivity of the analysis to the friction angle of the coal piles was tested by using Φ′ of both 34° and 27°.

In the slope stability analyses, the slope of the coal pile was assumed to be at or very near its angle of repose. If the coal pile was assumed to have a Φ′ of 34°, the slope of the coal pile was also assumed to be 34°. Likewise, if the friction angle for the coal pile was assumed to be 27°, the slope of the coal pile was also assumed to be 27°. The benefit of the flatter slope balances the negative impact of the lower Φ′; therefore, the lower internal friction angle has only a minor effect on the overall factor of safety.

8 Consolidation of the Clay

The clay unit is just slightly over-consolidated and will be prone to consolidation under the weight of the stockpiles, causing considerable settlement at the ground surface. Consolidation analysis was not conducted on the Shelby tube sample from Borehole T18-17S; however, using assumed consolidation parameters, a 15 m high coal pile would likely cause between 0.3 and 0.4 m of settlement. Such settlement would likely take 6 to 12 months to occur. Long-term secondary consolidation can also occur within the clay but is typically much less than the primary consolidation.

Settlement would be greatest directly beneath the middle of each coal pile and minor roughly 10 m beyond the toe of the coal pile. Moving the coal piles throughout the yard will also affect the differential settlement, as some areas will have already consolidated while others are loaded for the first time. Since the coal piles are likely to grow, shrink, and move frequently as part of the loadout facility operation, such settlement would likely occur irregularly and differentially across the site, depending on how and where the coal piles are located.

The yard is expected to be gravel-surfaced; therefore, differential settlement is not expected to cause much damage other than requiring periodic regrading. Settlement beneath the coal piles could have a greater impact on the railway, depending on the proximity of the coal piles to the railway. The railway could require frequent re-levelling during the first few years of operation, until loading conditions have normalized.

9 Conclusions & Recommendations

The thick blanket of gravel and sand should provide good foundation support and a good subgrade for the railway, but should be heavily compacted in place to improve its density. This granular material is free-draining and not very sensitive to variations in moisture content. The gravel deposit meets the general criteria for aggregate soundness and should be suitable for re-use as engineered fill material.

The surficial silt layer found in most test pits will provide less subgrade support, will be susceptible to frost heave, and is sensitive to moisture conditions. The designers of the railway may decide to sub-excavate the silt layer or place a thick granular subgrade over the silt layer, depending on the final design grades.

The coal piles are expected to be quite high and cover wide areas; therefore, the load of these piles will transfer to depth into the underlying clay, causing consolidation and the potential for deep-seated failure beneath the coal piles.

For embankment stability beneath the coal piles, the factor of safety should be no less than 1.3 and preferably 1.5. Allowing for some areas where the top of the clay unit is only 3 m deep, the coal piles are recommended to be limited to no more than 10 m high during the initial loading stages of the site. After at least 6 months of loading, the height of the coal piles can be gradually increased to 15 m high. Note that this 6 month period refers to the total cumulative time that the stockpiles are in place. If the piles are constantly being loaded and unloaded, and moved around the yard, this period could take at least 1 to 2 years.

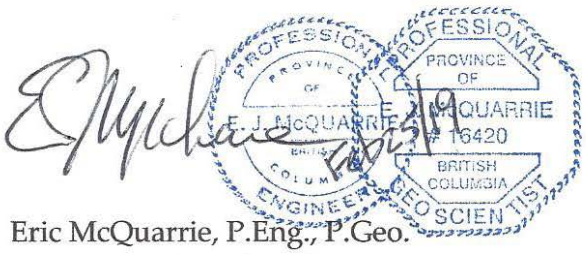
Alternatively, vibrating wire piezometers could be installed to measure pore pressures within the clay during the initial loading period, to determine the maximum allowable height of the coal piles. These piezometers would have to remain accessible for monitoring, which could affect operations.

Settlement beneath a 15 m high coal pile could exceed 0.3 m and take at least 6 to 12 months to occur. Settlement will be highly differential, depending on how and where the coal piles are located. Moving the coal piles throughout the yard will also affect the differential settlement, as some areas will have already consolidated while others are loaded for the first time.

The impacts of settlement on the coal storage area are expected to be relatively minor and merely require re-grading of the gravel surface. The railway line could also be prone to settlement, depending on its proximity to the coal piles, and require periodic regrading.

10 Closure

This report has been prepared for Telkwa Coal Ltd. by the following:



Eric McQuarrie, P.Eng., P.Geo.
Senior Geotechnical Engineer

Reviewed by:

Timothy Smith, P.Geo., Eng.L.
Principal and Senior Engineering Geologist

Appendix A

Interpretation and Use of Study and Report
and Limitations of Liability

Appendix A

Interpretation and Use of Study and Report and Limitations

1. STANDARD OF CARE.

This study and Report have been prepared in accordance with generally accepted engineering and geoscience practices. No other warranty, expressed or implied, is made. Geological and geotechnical studies and reports do not include environmental consulting unless specifically stated in the report.

2. COMPLETE REPORT.

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report which is of a summary nature and is not intended to stand alone without reference to the instructions given to us by the Client, communications between us and the Client, and to any other reports, writings, proposals or documents prepared by us for the Client relative to the specific site described herein, all of which constitute the Report.

IN ORDER TO UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. WE CANNOT BE RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF THE REPORT.

The Report has been prepared for the specific site, development, design objectives and purpose that were described to us by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document are only valid to the extent that there has been no material alteration to or variation from any of the said descriptions provided to us unless we are specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT.

The information and opinions expressed in the Report, or any document forming the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT OUR WRITTEN CONSENT. WE WILL CONSENT TO ANY REASONABLE REQUEST BY THE CLIENT TO APPROVE THE USE OF THIS REPORT BY OTHER PARTIES AS "APPROVED USERS". The contents of the Report remain our copyright property and we authorise only the Client and Approved Users to make copies of the Report only in such quantities as are reasonably necessary for the use of the Report by those parties. The Client and Approved Users may not give, lend, sell or otherwise make the Report or any portion thereof, available to any party without our written permission. Any uses, which a third party makes of the Report, or any portion of the Report, are the sole responsibility of such third parties. Westrek accepts no responsibility for damages suffered by any third party resulting from unauthorised use of the Report.

5. INTERPRETATION OF THE REPORT.

(i) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, and engineering estimates have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature and even comprehensive sampling and testing programs, implemented with the appropriate equipment by experienced personnel, may fail to locate some conditions. All investigations utilising the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarising such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and all persons making use of such documents or records should be aware of, and accept, this risk. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

(ii) Reliance on Provided information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to us. We have relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, we cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in the report as a result of misstatements, omissions, misrepresentations or fraudulent acts of persons provided information.

(iii) To avoid misunderstandings, Westrek should be retained to work with the other design professionals to explain relevant geotechnical findings and to review the adequacy of their plans and specifications relative to engineering issues. Further, Westrek should be retained to provide field reviews during the construction, consistent with generally accepted practices.

6. LIMITATIONS OF LIABILITY.

(i) In recognition of the relative risks and benefits of the study and report to be provided to the Client by Westrek, the risks have been allocated such that the Client agrees, to the fullest extent permitted by law, to limit the liability of Westrek, its officers, directors, partners, employees, shareholders, owners, sub-consultants and principals for any and all claims, losses, costs, damages of any nature whatsoever or claims expenses from any cause or causes, whether arising in contract or tort, including legal fees and costs and disbursements, so that the total aggregate liability of Westrek, its officers, directors, partners, employees, shareholders, owners, sub-consultants and principals shall not exceed the limits of Westrek's insurance for services rendered for this matter. It is intended that this limitation will apply to any and all liability or cause of action however alleged or arising, unless otherwise prohibited by law. Notwithstanding the foregoing, it is expressly agreed that there shall be no claim whatsoever against Westrek, its officers, directors, partners, employees, shareholders, owners, sub-consultants and principals for loss of income, profit or other consequential damages howsoever arising.

(ii) Westrek is not responsible for any errors, omissions, mistakes or inaccuracies contained in information provided by the Client, including but not limited to the location of underground or buried services, and with respect to such information, Westrek may rely on it without having to verify or test that information. Further, Westrek is not responsible for any errors or omissions committed by persons, consultants or specialists retained directly by the Client and with respect to any information, documents or opinions provided by such persons, consultants or specialists, Westrek may rely on such information, documents or opinions without having to verify or test the same.

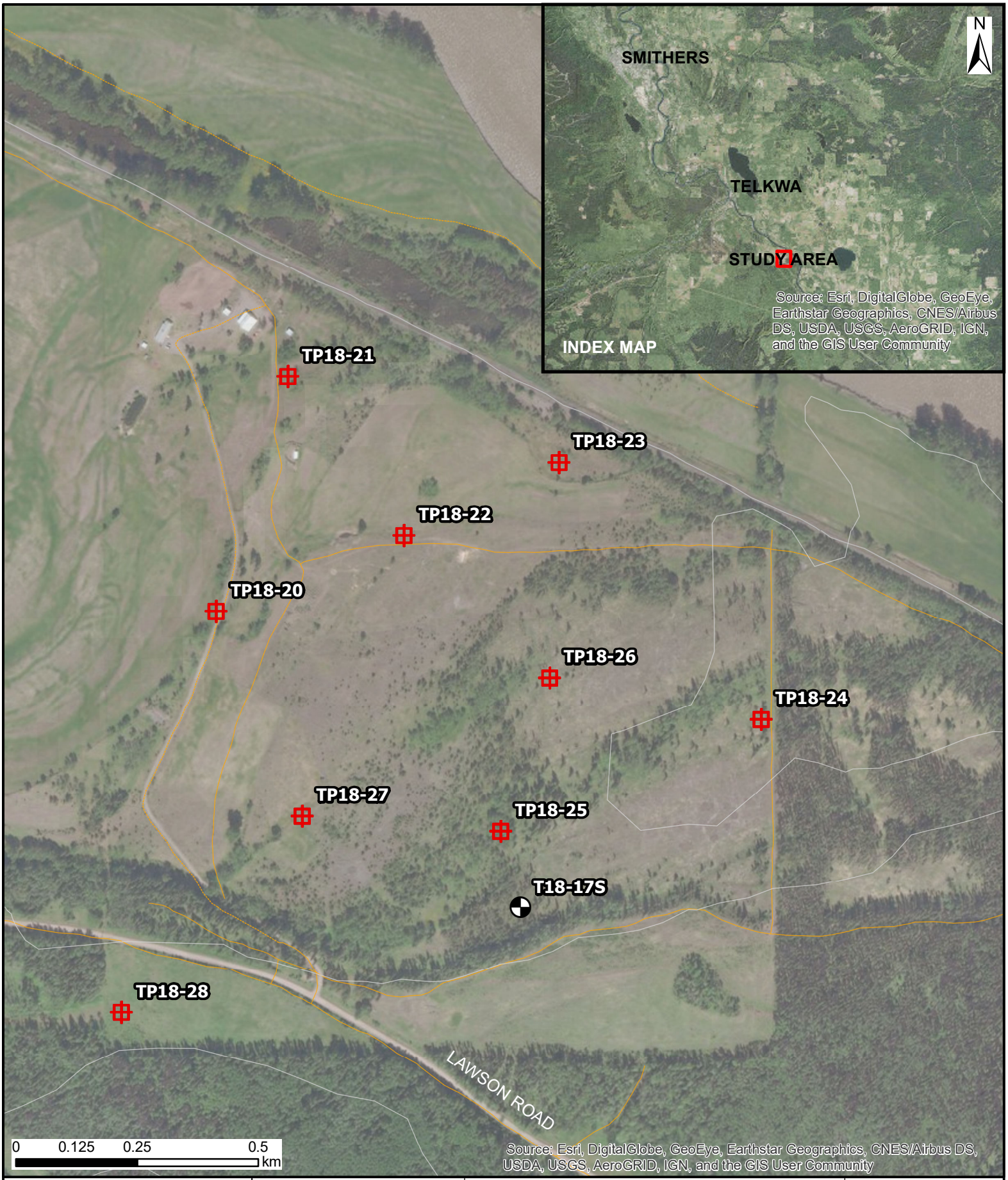
(iii) Notwithstanding the provisions of the *Limitations Act*, R.S.B.C. 1996 c. 266, Westrek's liability for any and all claims of the Client shall absolutely cease to exist after a period of two (2) years following the date of:

(a) Substantial performance of the services,
(b) suspension or abandonment of the agreement to provide the services to be provided under this agreement, or
(c) termination of Westrek's services under the agreement,

whichever shall occur first, and following such period, the Client shall have no claim whatsoever against Westrek.

Appendix B

Drawings



westrek geotechnical services ltd.	Scale: 1 : 20,000	**BOREHOLE AND TEST PIT LOCATION PLAN RAIL LOADOUT FACILITY TELKWA COAL LTD.**	**DRAWING 01**
	January 15, 2018		
	Project: 017-318		

Appendix C

Borehole Log & Test Pit Logs

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T18-17S
Telkwa Coal
R09, McDonald Farm.

Date Drilled: Sep 29-2018
Drill Type: Sonic
Driller: Boart Longyear
Project No.: 017-318
Co-ordinate: 9U 629708E 6058103N
Elevation: 515.4 m

SAMPLE TYPE: SPT SAMPLE; GRAB SAMPLE; SHELBY TUBE; CORE SAMPLE; NO RECOVERY
INSTALLATION: GROUT; BENTONITE; SAND; DRILL CUTTINGS; SCREEN

Depth (m)	DRILLING METHOD	SOIL DESCRIPTION	SOIL SYMBOL	DEPTH (m) (ELEV.)	SAMPLE TYPE	SAMPLE NO	PLASTIC / M.C. / LIQUID; BLOW COUNT [SPT] ◆ [DCPT] ▼; VANE SHEAR (kPa) [Rig] ✖ [Pocket] ⊗	OTHER DATA	Elevation (m)
0	Sonic	TOPSOIL		0.2 / 515.3					515
		(SM) gravelly SILTY SAND fine- to coarse-grained, fine to coarse gravel, rounded to subrounded, trace organics; dark brown; moist, compact.							
1									
				1.5 / 513.9					514
2		(GP/SP) GRAVEL and SAND fine to coarse gravel, rounded to subangular, fine- to coarse-grained sand, trace fines, some cobbles; inferred medium brown; dry, dense.				1		W_n = 0.7% Sieve Analysis (2.0 m): Gravel = 51% Sand = 45% Fines = 5% - DCPT results skewed by cobbles	513
3						1		N = 28 REC = 42%	
4				4.1 / 511.3		1		- Shelby sample captured granular soil at top, did not retain sample REC = 29%	512
		(CI) SILTY CLAY medium grey; w>PL, soft.							
5									511
6						2		W_n = 26.0% PL = 17.3% LL = 30.8%	510
7								- run from 4.6 m to 7.6 m drilled and came out in 1.5 m run, pushed in by weight of drill string and not drilled; sonic core may be consolidated	509
8						2		Torvane @ 7.3 m = 20 kPa REC = 100%	508
		- becomes firm.		8.5 / 506.9				Torvane @ 8.2 m = 39 kPa - Triaxial test conducted on sample	507
9								- tried SPT at 9.1 m, but no recovery. Re-drilled with 2 different bits with no recovery (sloughed out of barrel). Drilled to 10.7 m to try SPT again	506
10									

N - Blow Count
Standard Penetration Test [SPT]: ASTM D1586
Dynamic Cone Penetration Test [DCPT]: Number of blows using SPT energy to produce 300 mm of penetration of a 50 mm diameter cone.

LOGGED: hkw
DRAWN: hkw

westrek
geotechnical services ltd.

T18-17S
Telkwa Coal
R09, McDonald Farm.

Date Drilled: Sep 29-2018
Drill Type: Sonic
Driller: Boart Longyear
Project No.: 017-318
Co-ordinate: 9U 629708E 6058103N
Elevation: 515.4 m

SAMPLE TYPE: SPT SAMPLE | GRAB SAMPLE | SHELBY TUBE | CORE SAMPLE | NO RECOVERY
INSTALLATION: GROUT | BENTONITE | SAND | DRILL CUTTINGS | SCREEN

Depth (m)	DRILLING METHOD	SOIL DESCRIPTION	SOIL SYMBOL	DEPTH (m) (ELEV.)	SAMPLE TYPE	SAMPLE NO	PLASTIC / M.C. / LIQUID; BLOW COUNT [SPT] ◆ [DCPT] ▼; VANE SHEAR (kPa) [Rig] ✖ [Pocket] ⊗	OTHER DATA	Elevation (m)
10									505
11						2		- SS-02 had weight of hammer for first 2 blow count intervals (10.7 m - 11 m) N = 7 W_n = 32.3% REC = 100% Torvane @ 11.3 m = 27 kPa Cpen @ 11.3 m = 135 to 150 kPa	
				11.3 504.1		3			504
12	Sonic	(SM) SILTY SAND fine-grained; medium grey; moist, dense.							
				12.8 502.6					503
13		(ML) SILT trace to some sand, fine-grained, trace gravel; dark grey; dry, very dense (TILL).				4		W_n = 9.6%	
14						3		N = 150 REC = 0%	502
15				15.2 500.2					501
		End of hole at 15.2 m (500.2 m)							500
16									
									499
17									
									498
18									
									497
19									
									496
20									

N - Blow Count
Standard Penetration Test [SPT]: ASTM D1586
Dynamic Cone Penetration Test [DCPT]: Number of blows using SPT energy to produce 300 mm of penetration of a 50 mm diameter cone.

LOGGED: hkw
DRAWN: hkw

RECORD OF TEST PIT TP18-20
Telkwa Coal

Date Excavated: 2018-Sep-28
Equipment: John Deere 135G
Project No.: 017-318
Coordinates: 9U 629332E 6058445N
Elevation: 512.80 m [Surveyed]

Site Conditions: Partial wall collapse.

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Depth (m)	DEPTH (m) (ELEV.)	SOIL DESCRIPTION	SOIL SYMBOL	SAMPLE	SAMPLE NO	PLASTIC M.C. LIQUID 20 40 60 80 / DCPT RESISTANCE [PORTABLE] 20 40 60 80 / POCKET PEN. UCS (kPa) TORVANE UCS (kPa) 50 100 150 200	OTHER DATA	Elevation (m)
0	0.1 512.7	TOPSOIL (SP)SAND fine-grained, trace to some silt, with organics; medium brown; dry to moist, compact.			1		W_n = 5.0% Sieve Analysis : Gravel = 0% Sand = 32% Fines = 68%	
	0.5 512.3	(ML) sandy SILT fine-grained sand, with trace organics; light brown; dry to moist, compact.						
		(SM) SAND and SILT fine-grained sand; light to medium brown, with discrete beds of medium grey with brown mottling fines; moist; compact.			2		W_n = 14.6% Sieve Analysis : Gravel = 0% Sand = 54% Fines = 46%	512
1	1.1 511.7	(SP) SAND medium- to coarse-grained, trace gravel, fine; dark grey, bedded; moist to wet, loose.						
					3		W_n = 8.9% Sieve Analysis : Gravel = 5% Sand = 94% Fines = 1%	511
2	2.0 510.8	- buried log encountered.						
	2.3 510.5	- becomes wet.						▼
								510
3	3.0 509.8							
	3.2 (509.6)	(GP) sandy GRAVEL fine to coarse gravel, subrounded, medium- to coarse-grained sand, trace fines, some cobbles; dark grey to dark brown; wet, loose.			4		Sieve Analysis : Gravel = 60% Sand = 37% Fines = 3%	
		End of hole at 3.2 m (509.6 m) Notes: Excavation 3.3 m (east-west) x 3.5 m (north-south). North wall described.						509
4								
								508
5								

DCP Resistance
Number of blows of a 15 lb (6.8 kg) hammer dropped 10 inches (254 mm) to produce 1-3/4 inches (44 mm) of penetration of a 1.5 inch (38.1 mm) diameter, 45 degree cone.

LOGGED: hkw
DRAWN: hkw

RECORD OF TEST PIT TP18-21
Telkwa Coal

westrek geotechnical services ltd.

Date Excavated: 2018-Sep-28
Equipment: John Deere 135G
Project No.: 017-318
Site Conditions: Wall sloughed.
Coordinates: 9U 629397E 6058729N
Elevation: 512.70 m [Surveyed]

Depth (m)	DEPTH (m) (ELEV.)	SOIL DESCRIPTION	SOIL SYMBOL	SAMPLE	SAMPLE NO	PLASTIC M.C. LIQUID 20 40 60 80 / DCPT RESISTANCE [PORTABLE] 20 40 60 80 / POCKET PEN. UCS (kPa) TORVANE UCS (kPa) 50 100 150 200	OTHER DATA	Elevation (m)
0	0.1 512.6	TOPSOIL						
	0.2 512.5	(SP)SAND fine-grained, trace to some silt, with organics; medium brown; dry, compact.						
		(ML) SILT trace to some gravel, subrounded; tan, dry to moist, compact.						
		(GW) sandy GRAVEL fine to coarse, subrounded to rounded, medium-grained sand, trace fines, some cobbles; medium to dark brown, bedded; moist, loose.						512
1	1.0 511.7	- organics from ground surface to 1.0 m.			1		W_n = 2.4% Sieve Analysis : Gravel = 63% Sand = 36% Fines = 1% SA-01 additional lab testing: Standard Proctor, MgSO4 Soundness, and CBR. Refer to report for results.	511
2	2.3 510.4	- becomes wet.						▼
	2.6 (510.1)	End of hole at 2.6 m (510.1 m) Notes: Excavation 2 m (east-west) x 3.5 m (north-south). East wall described.						510
3								509
4								508
5								

DCP Resistance
Number of blows of a 15 lb (6.8 kg) hammer dropped 10 inches (254 mm) to produce 1-3/4 inches (44 mm) of penetration of a 1.5 inch (38.1 mm) diameter, 45 degree cone.

LOGGED: hkw
DRAWN: hkw

RECORD OF TEST PIT TP18-22
Telkwa Coal

westrek geotechnical services ltd.

Date Excavated: 2018-Sep-28
Equipment: John Deere 135G
Project No.: 017-318
Site Conditions: Wall upright.
Coordinates: 9U 629555E 6058541N
Elevation: 514.00 m [Surveyed]

Depth (m)	DEPTH (m) (ELEV.)	SOIL DESCRIPTION	SOIL SYMBOL	SAMPLE	SAMPLE NO	PLASTIC / M.C. / LIQUID (20 40 60 80); DCPT RESISTANCE [PORTABLE] (20 40 60 80); POCKET PEN. UCS (kPa) / TORVANE UCS (kPa) (50 100 150 200)	OTHER DATA	Elevation (m)
0	0.2 (513.9)	TOPSOIL (SP) SAND fine-grained, trace to some silt, with organics; medium brown; dry to moist, compact.						
		(ML) SILT some sand, fine-grained, trace gravel, subrounded, with trace organics; tan, bedded with darker organics, undulating contact with overlying sand; dry, compact.			1	●	W_n = 7.7% Sieve Analysis : Gravel = 0% Sand = 11% Fines = 89%	
1	1.0 (513.0)	(GP/GW) sandy GRAVEL fine to coarse, subrounded to rounded, medium-grained sand, some cobbles; dark grey to dark brown, bedded; moist, loose. - cobble content increases below 1.3 m depth.						513
	1.3 (512.7)				2	●	W_n = 2.3% Sieve Analysis : Gravel = 74% Sand = 25% Fines = 1% SA-02 additional lab testing: LA Abrasion. Refer to report for results.	
2								512
3	3.0 (511.0)	- becomes wet.						▼ 511
					3		Sieve Analysis : Gravel = 74% Sand = 25% Fines = 1%	
	3.3 (510.7)	End of hole at 3.3 m (510.7 m) Notes: Excavation 2 m (east-west) x 3.5 m (north-south). East wall described.						
4								510
5								

DCP Resistance
Number of blows of a 15 lb (6.8 kg) hammer dropped 10 inches (254 mm) to produce 1-3/4 inches (44 mm) of penetration of a 1.5 inch (38.1 mm) diameter, 45 degree cone.

LOGGED: hkw
DRAWN: hkw

RECORD OF TEST PIT TP18-23
Telkwa Coal

Date Excavated: 2018-Sep-28
Equipment: John Deere 135G
Project No.: 017-318
Site Conditions: Wall sloughed.
Coordinates: 9U 629738E 6058637N
Elevation: 513.80 m [Surveyed]

Depth (m)	DEPTH (m) (ELEV.)	SOIL DESCRIPTION	SOIL SYMBOL	SAMPLE	SAMPLE NO	PLASTIC M.C. LIQUID 20 40 60 80 / DCPT RESISTANCE [PORTABLE] 20 40 60 80 / POCKET PEN. UCS (kPa) TORVANE UCS (kPa) 50 100 150 200	OTHER DATA	Elevation (m)
0	0.1 513.8	TOPSOIL (SP) SAND fine-grained, trace to some silt, with organics; medium brown; dry to moist, compact.						
	0.6 513.2	(GW) sandy GRAVEL fine to coarse, subrounded to rounded, medium-grained sand, trace fines, some cobbles; dark grey to dark brown, bedded; dry, loose. - organics from ground surface to 0.6 m depth.						513
1								
	1.3 512.5	- becomes moist.			1	●	W_n = 2.6% Sieve Analysis : Gravel = 68% Sand = 31% Fines = 2% SA-01 additional lab testing: Standard Proctor, MgSO4 Soundness, and CBR. Refer to report for results.	512
2					2		Sieve Analysis : Gravel = 67% Sand = 32% Fines = 1% SA-02 additional lab testing: LA Abrasion. Refer to report for results. W_n = 27.5% PL = 17.3% LL = 32.2%	▼ 511
	2.8 511.0							
	2.9 510.9	(SP) SAND fine-grained; medium brown; wet, loose to compact.						
3		(CI) SILTY CLAY medium grey; w>PL, soft to firm.			3	⊢●		
	3.2 (510.6)	End of hole at 3.2 m (510.6 m) Notes: Excavation 2.5 m (east-west) x 3.5 m (north-south). East wall described.						510
4								
								509
5								

DCP Resistance
Number of blows of a 15 lb (6.8 kg) hammer dropped 10 inches (254 mm) to produce 1-3/4 inches (44 mm) of penetration of a 1.5 inch (38.1 mm) diameter, 45 degree cone.

LOGGED: hkw
DRAWN: hkw

RECORD OF TEST PIT TP18-24
Telkwa Coal

Date Excavated: 2018-Sep-28
Equipment: John Deere 135G
Project No.: 017-318
Coordinates: 9U 629991E 6058336N
Elevation: 515.00 m [Surveyed]

Site Conditions: Collapse below 0.8m, forming overhanging section.

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Depth (m)	DEPTH (m) (ELEV.)	SOIL DESCRIPTION	SOIL SYMBOL	SAMPLE	SAMPLE NO	PLASTIC / M.C. / LIQUID (20 40 60 80); DCPT RESISTANCE [PORTABLE] (20 40 60 80); POCKET PEN. UCS (kPa) / TORVANE UCS (kPa) (50 100 150 200)	OTHER DATA	Elevation (m)
0	0.1 514.9	TOPSOIL (SP) SAND fine-grained, trace to some silt, with organics; medium brown; dry to moist, compact.						
	0.6 514.4	(ML) sandy SILT fine-grained sand, with some organics (rootlets); light brown, thinly bedded; dry, compact. - interbedded with underlying gravel and sand unit.						
	0.8 514.2	(GP to GW) GRAVEL and SAND dominantly fine gravel, rounded to subangular, medium- to coarse-grained sand; medium brown, thinly to medium bedded with well-sorted beds; dry.					Sloughed below 0.8 m, with up to 1.0 m of overhanging silt-sand unit	
1					1		W_n = 1.0% Sieve Analysis : Gravel = 57% Sand = 42% Fines = 1%	514
	1.3 513.7	- becomes fine to coarse gravel, medium-grained sand, with occasional cobbles; dark grey.						
2					2		W_n = 2.5% Sieve Analysis : Gravel = 57% Sand = 43% Fines = 0% SA-02 additional lab testing: Standard Proctor, MgSO4 Soundness, LA Abrasion, and CBR. Refer to report for results.	513
3	3.1 511.9	- becomes moist to wet.						512
					3		W_n = 8.5% Sieve Analysis : Gravel = 51% Sand = 49% Fines = 1%	
	3.9 511.1	- becomes wet.						▼
4	4 (511)	End of hole at 4.0 m (511 m) Notes: Excavation 1.5 m (east-west) x 3.5 m (north-south). West wall described.						511
5								

DCP Resistance
Number of blows of a 15 lb (6.8 kg) hammer dropped 10 inches (254 mm) to produce 1-3/4 inches (44 mm) of penetration of a 1.5 inch (38.1 mm) diameter, 45 degree cone.

LOGGED: hkw
DRAWN: hkw

RECORD OF TEST PIT TP18-25
Telkwa Coal

Date Excavated: 2018-Sep-30
Equipment: John Deere 135G
Project No.: 017-318
Site Conditions: Partial wall collapse.
Coordinates: 9U 629676E 6058192N
Elevation: 514.90 m [Surveyed]

westrek geotechnical services ltd.

Depth (m)	DEPTH (m) (ELEV.)	SOIL DESCRIPTION	SOIL SYMBOL	SAMPLE	SAMPLE NO	PLASTIC / M.C. / LIQUID (20 40 60 80); DCPT RESISTANCE [PORTABLE] (20 40 60 80); POCKET PEN. UCS (kPa) / TORVANE UCS (kPa) (50 100 150 200)	OTHER DATA	Elevation (m)
0	0.2 514.7	TOPSOIL (SP)SAND fine-grained, trace to some silt, with organics; medium brown; dry to moist, compact.						
	0.8 514.1	(ML) SILT with organics (roots); light brown; dry, compact.						
1	1.2 513.7	- becomes with trace organics; grey and light brown, with thinly-interbedded loose fine-grained sand.						514
2		(GW) sandy GRAVEL to SAND and GRAVEL fine to coarse, subrounded to rounded, fine- to coarse-grained sand, with trace cobbles; dark grey to dark brown, bedded; moist, compact.			1		W_n = 2.7% Sieve Analysis : Gravel = 63% Sand = 36% Fines = 2% SA-01 additional lab testing: Standard Proctor, MgSO4 Soundness, and CBR. Refer to report for results.	513
3	3.2 511.7	- becomes GRAVEL and SAND.			2		W_n = 3.9% Sieve Analysis : Gravel = 54% Sand = 45% Fines = 1%	512
4	3.7 (511.2)	End of hole at 3.7 m (511.2 m) Notes: Excavation 3 m (east-west) x 1.5 m (north-south). South wall described.						511
5								510

DCP Resistance
Number of blows of a 15 lb (6.8 kg) hammer dropped 10 inches (254 mm) to produce 1-3/4 inches (44 mm) of penetration of a 1.5 inch (38.1 mm) diameter, 45 degree cone.

LOGGED: hkw
DRAWN: hkw

RECORD OF TEST PIT TP18-26
Telkwa Coal

Date Excavated: 2018-Sep-30
Equipment: John Deere 135G
Project No.: 017-318
Site Conditions: Wall upright.
Coordinates: 9U 629731E 6058366N
Elevation: 514.50 m [Surveyed]

westrek geotechnical services ltd.

Depth (m)	DEPTH (m) (ELEV.)	SOIL DESCRIPTION	SOIL SYMBOL	SAMPLE	SAMPLE NO	PLASTIC M.C. LIQUID 20 40 60 80 / DCPT RESISTANCE [PORTABLE] 20 40 60 80 / POCKET PEN. UCS (kPa) TORVANE UCS (kPa) 50 100 150 200	OTHER DATA	Elevation (m)
0	0.2 514.4	TOPSOIL (SP)SAND fine-grained, trace to some silt, with organics; medium brown; dry to moist, compact.						
	0.3 514.2	(ML) SILT trace gravel, fine, with organics (roots); light brown to buff, undulating contact with underlying gravel; dry, compact.						514
	0.6 513.9	(GP) GRAVEL dominantly fine, subangular to rounded, with trace organics (rootlets); grey-brown, thinly bedded; dry, loose.						
1		(GP/GW) sandy GRAVEL fine to coarse, subangular to subrounded, medium- to coarse-grained sand, some cobbles; dark grey; moist, loose.						513
	1.7 512.8	- becomes more cobbles.			1		W_n = 2.6% Sieve Analysis : Gravel = 65% Sand = 34% Fines = 1% SA-01 Lab Testing: LA Abrasion. Refer to report for results.	
2								512
3								
	3.5 511.0	- becomes wet, cobbles are average 0.15 m, max 0.4 m.						511
	3.6 510.9	- interbedded sand and gravel with underlying clay.						
	3.8 510.7	(CI) SILTY CLAY medium grey, uniform; w~PL, soft.			2	◆ ⊗	Torvane @ 3.9 m = 181 kPa	
4	4 (510.5)	End of hole at 4.0 m (510.5 m) Notes: Excavation 1.5 m (east-west) x 3.5 m (north-south). West wall described.						510
5								

DCP Resistance
Number of blows of a 15 lb (6.8 kg) hammer dropped 10 inches (254 mm) to produce 1-3/4 inches (44 mm) of penetration of a 1.5 inch (38.1 mm) diameter, 45 degree cone.

LOGGED: hkw
DRAWN: hkw

RECORD OF TEST PIT TP18-27
Telkwa Coal

westrek geotechnical services ltd.

Date Excavated: 2018-Sep-30
Equipment: John Deere 135G
Project No.: 017-318
Site Conditions: Wall upright.
Coordinates: 9U 629448E 6058205N
Elevation: 513.70 m [Surveyed]

Depth (m)	DEPTH (m) (ELEV.)	SOIL DESCRIPTION	SOIL SYMBOL	SAMPLE	SAMPLE NO	PLASTIC / M.C. / LIQUID; DCPT RESISTANCE [PORTABLE]; POCKET PEN. UCS (kPa); TORVANE UCS (kPa)	OTHER DATA	Elevation (m)
0	0.1 (513.6)	TOPSOIL (SP) SAND fine-grained, trace to some silt, with organics; medium brown; dry to moist, compact.						
	0.3 (513.4)	(ML) SILT with organics (roots); tan; dry, compact.						
	0.7 (513.0)	(GM) SILTY GRAVEL fine to coarse, rounded to subrounded, trace sand, trace organics (rootlets), some cobbles; light brown; dry.						513
1		(GP) GRAVEL fine to coarse, rounded to subangular, some sand, cobbly, trace fines; dark grey; dry, dense.						
	1.3 (512.4)	- becomes moist, dark brown						512
2					1		W_n = 3.0% Sieve Analysis : Gravel = 85% Sand = 13% Fines = 2%	
								511
3								
	3.5 (510.2)	- becomes wet						▼
	3.7 (510)	End of hole at 3.7 m (510 m) Notes: Excavation 3.5 m (east-west) x 2.5 m (north-south). North wall described.						510
4								
								509
5								

DCP Resistance
Number of blows of a 15 lb (6.8 kg) hammer dropped 10 inches (254 mm) to produce 1-3/4 inches (44 mm) of penetration of a 1.5 inch (38.1 mm) diameter, 45 degree cone.

LOGGED: hkw
DRAWN: hkw

RECORD OF TEST PIT TP18-28
Telkwa Coal

Date Excavated: 2018-Sep-30
Equipment: John Deere 135G
Project No.: 017-318
Site Conditions: Wall upright.
Coordinates: 9U 629233E 6057967N
Elevation: 534.30 m [Surveyed]

Depth (m)	DEPTH (m) (ELEV.)	SOIL DESCRIPTION	SOIL SYMBOL	SAMPLE	SAMPLE NO	PLASTIC M.C. LIQUID 20 40 60 80 / DCPT RESISTANCE [PORTABLE] 20 40 60 80 / POCKET PEN. UCS (kPa) TORVANE UCS (kPa) 50 100 150 200	OTHER DATA	Elevation (m)
0	0.2 534.1	TOPSOIL (SP)SAND fine-grained, trace to some silt, with organics; medium brown; dry to moist, compact.						534
		(ML) SILT some clay, trace organics (roots and rootlets); thinly to medium bedded, undulating contact with overlying topsoil; dry, dense.			1			
	0.9 533.5	(SM) SILTY SAND fine-grained, trace cobbles; medium brown; moist, compact.			2			
1	1.1 533.2	(ML) SILT some clay, trace cobbles; medium brown-grey; moist, dense.			3			533
	1.7 532.6	(SM) SILTY SAND fine-grained, some clay, trace gravel, trace cobbles; grey-brown; moist, very dense (TILL).			4		Very hard digging below 1.7 m	
2								532
	2.8 531.5	(CL) SILTY CLAY trace gravel, trace cobbles; dark grey; w<PL to w~PL, hard (TILL).			5			
3	3 (531.3)	End of hole at 3.0 m (531.3 m) Notes: Excavation 1.0 m (east-west) x 2.5 m (north-south). West wall described.						531
4								530
5								

DCP Resistance
Number of blows of a 15 lb (6.8 kg) hammer dropped 10 inches (254 mm) to produce 1-3/4 inches (44 mm) of penetration of a 1.5 inch (38.1 mm) diameter, 45 degree cone.

LOGGED: hkw
DRAWN: hkw
Page 1 of 1

Appendix D

Laboratory Test Results

Golder Associates Ltd -Burnaby Laboratory
Unit 300 3811 North Fraser Way
Burnaby,B.C. Canada V5J 5J2

Consolidated Undrained Triaxial Compression Test for Soils

Reference ASTM D4767

Client:	Westrek	**Borehole:**	T18-175
Project:	Lab Testing	**Sample:**	TP-02
Location:	Burnaby	**Depth (m):**	7.62
Project No.:	1894161-1023	**Lab ID No:**	304

Test	CIU1	CIU2	CIU3		
Sample	Multi-Stage Test				
Initial Dimensions					
H_o (cm)	18.46				
D_o (cm)	7.45				
Specific Gravity (assumed)	2.75				
w (%)	38.7				
$\gamma_{o\ dry}$ (kN/m^3)	13.08				
Sat. (%)	100				
e_o	1.06				
B_{Value}	0.96				
Consolidation Results					
σ_{CELL} (kPa)	789	887	988		
OCR	n/a	n/a	n/a		
$\sigma_{3c'}$ (kPa)	95	195	297		
ΔV_c (cc)	-19.9	-24.0	-32.8		
t_{50} (min)	N/A	N/A	N/A		
After Consolidation Dimensions					
H_c (cm)	18.36	17.81	17.25		
D_c (cm)	7.38	7.38	7.33		
A_c (cm^2)	42.73	42.73	42.20		
V_c (cm^3)	784.8	760.8	728.0		
$\gamma_{c\ dry}$ (kN/m^3)	13.41	13.83	14.45		
e_c	1.01	0.95	0.87		
w (%)	36.8	34.6	31.5		
Sat (%)	100	100	100		
Failure At Maximum Deviator Stress σ_1'-σ_3' :					
σ_1'-σ_3' (kPa)	62	84	103		
ε_f (%)	2.18	0.76	0.42		
u (kPa)	55	90	114		
σ_3' (kPa)	41	104	182		
σ_1' (kPa)	103	188	285		

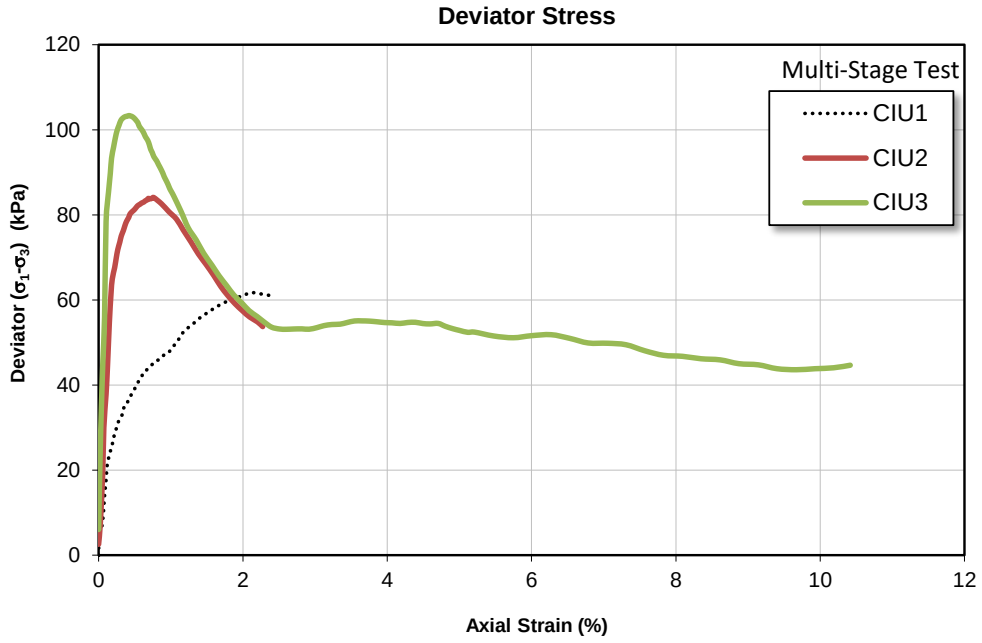
TM	November 16, 2018	JK	December 19, 2018
TESTED BY	DATE	CHECKED BY	DATE

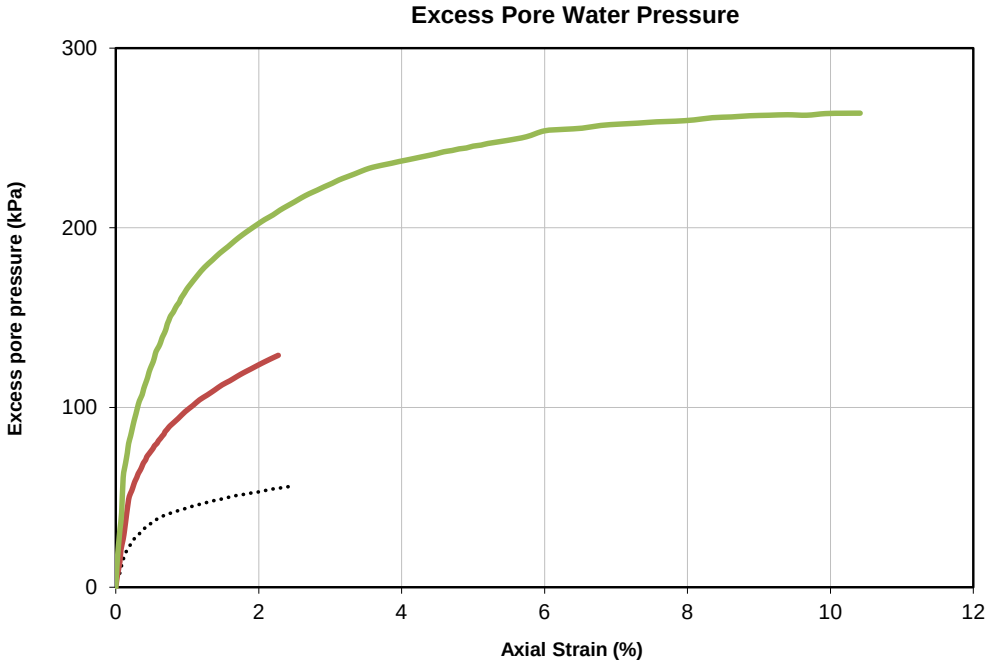
Golder Associates Ltd -Burnaby Laboratory
Unit 300 3811 North Fraser Way
Burnaby,B.C. Canada V5J 5J2

Consolidated Undrained Triaxial Compression Test for Soils

Reference
ASTM D4767

Client:	Westrek	**Borehole:**	T18-175
Project:	Lab Testing	**Sample:**	TP-02
Location:	Burnaby	**Depth (m):**	7.62
Project No.:	1894161-1023	**Lab ID No:**	304





TM	November 16, 2018	JK	December 19, 2018
TESTED BY	DATE	CHECKED BY	DATE

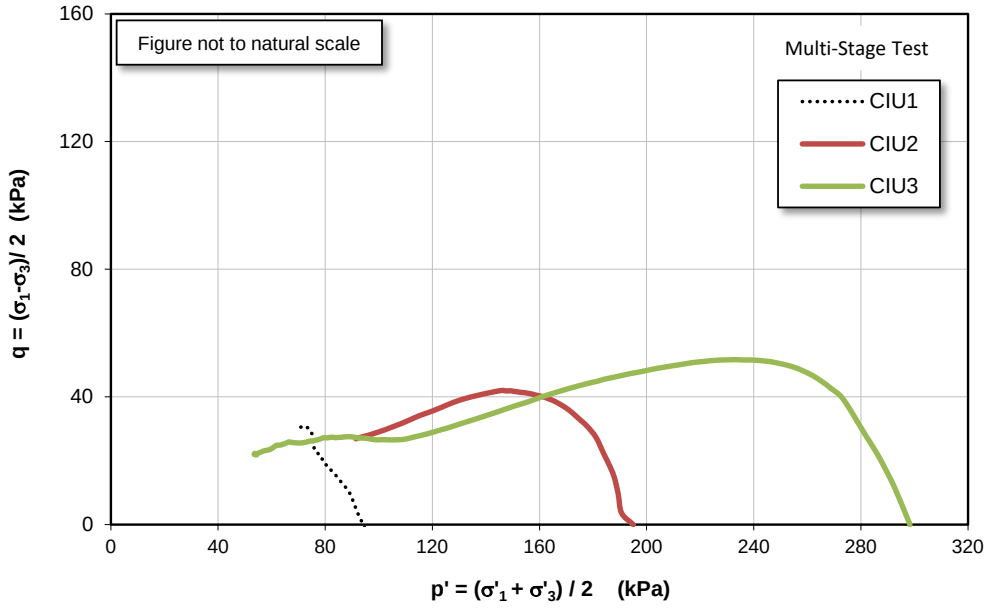
Golder Associates Ltd -Burnaby Laboratory
Unit 300 3811 North Fraser Way
Burnaby,B.C. Canada V5J 5J2

Consolidated Undrained Triaxial Compression Test for Soils

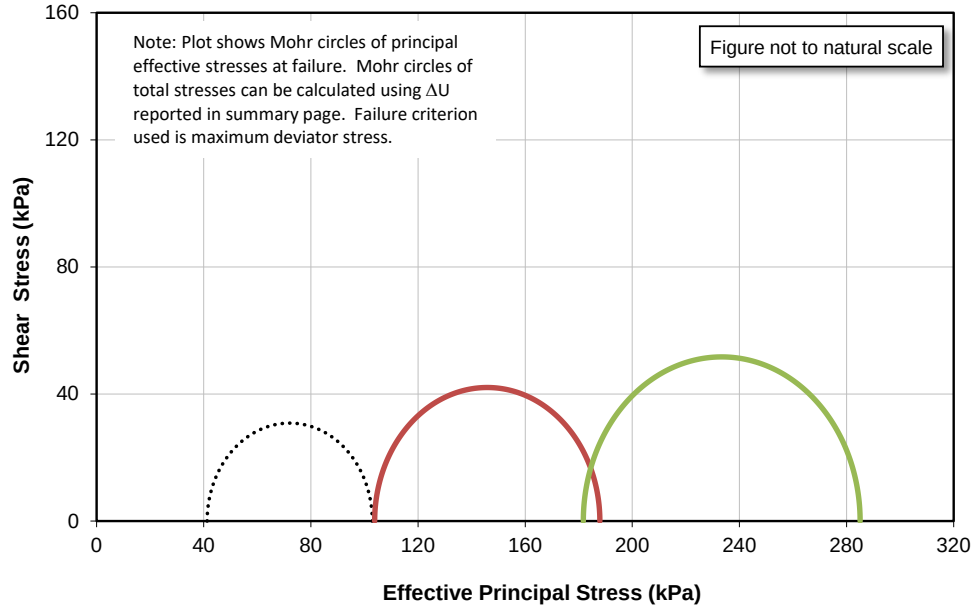
Reference
ASTM D4767

Client:	Westrek	**Borehole:**	T18-175
Project:	Lab Testing	**Sample:**	TP-02
Location:	Burnaby	**Depth (m):**	7.62
Project No.:	1894161-1023	**Lab ID No:**	304

Stress Paths



Mohr Circles Deviator Stress



TM	November 16, 2018	JK	December 19, 2018
TESTED BY	DATE	CHECKED BY	DATE

Golder Associates Ltd -Burnaby Laboratory
Unit 300 3811 North Fraser Way
Burnaby,B.C. Canada V5J 5J2

Consolidated Undrained Triaxial Compression Test for Soils

Reference: ASTM D4767

Client:	Westrek	**Borehole:**	T18-175
Project:	Lab Testing	**Sample:**	TP-02
Location:	Burnaby	**Depth (m):**	7.62
Project No.:	1894161-1023	**Lab ID No:**	304
Type :	Intact	**Soil Classification:**	N/A
Saturation Method:	Back Pressure Saturation	**Material Type**	Soil
Visual Description	CLAYEY SILT, brown, w > PL, stiff.		
Other Remarks:	Sand lenses through the sample.		

Sample Data

	Before Consolidation	After Consolidation
Height (cm):	18.46	18.36
Diameter (cm):	7.45	7.38
Area (cm^2):	43.59	42.73
Volume (cm^3):	805	785
γ_{dry} (kN/m^3):	13.08	13.41
γ_{sat} (kN/m^3):	18.13	18.34
Water content, w (%):	38.7	36.8
Saturation (%):	100	100
Void ratio, e:	1.06	1.01
Specific Gravity (assumed):	2.75	2.75

Consolidation Results

$\sigma'_{eff} = \sigma_{cell} - \sigma_{pwp}$ (kPa):	95
σ_{pwp} (kPa):	693
B value:	0.96
Volume Change (cc):	-19.9
t_{50} (min):	N/A

Strength Results

$\sigma_1' - \sigma_3'_{MAX}$:	62
Strain, ε_f:	2.18
u (kPa):	55
σ_1' (kPa):	103
σ_3' (kPa):	41

Equipment

Machine:	Truepath Load Frame - Stn. 4
Chamber:	KW
Load Cell:	400469
Axial DCDT:	LP-174
Cell Pressure:	PS-3322
Back Pressure:	PS3-146
Pore Pressure:	PS3-190
Feed Rate (%/hr):	1.00

PHOTO AT END OF TEST

NA

TM	November 16, 2018	JK	December 19, 2018
TESTED BY	DATE	CHECKED BY	DATE

Golder Associates Ltd -Burnaby Laboratory
Unit 300 3811 North Fraser Way
Burnaby,B.C. Canada V5J 5J2

Consolidated Undrained Triaxial Compression Test for Soils

Reference: ASTM D4767

Client:	Westrek	**Borehole:**	T18-175
Project:	Lab Testing	**Sample:**	TP-02
Location:	Burnaby	**Depth (m):**	7.62
Project No.:	1894161-1023	**Lab ID No:**	304
Type :	Intact	**Soil Classification:**	N/A
Saturation Method:	Back Pressure Saturation	**Material Type**	Soil
Visual Description	CLAYEY SILT, brown, w > PL, stiff.		
Other Remarks:	Sand lenses through the sample.		

Sample Data

	Before Consolidation	After Consolidation
Height (cm):	17.92	17.81
Diameter (cm):	7.47	7.38
Area (cm^2):	43.80	42.73
Volume (cm^3):	785	761
γ_{dry} (kN/m^3):	13.41	13.83
γ_{sat} (kN/m^3):	18.34	18.61
Water content, w (%):	36.8	34.6
Saturation (%):	100	100
Void ratio, e:	1.01	0.95
Specific Gravity (assumed):	2.75	2.75

Consolidation Results

$\sigma'_{eff} = \sigma_{cell} - \sigma_{pwp}$ (kPa):	195
σ_{pwp} (kPa):	693
B value:	0.96
Volume Change (cc):	-24.0
t_{50} (min):	N/A

Strength Results

$\sigma_1' - \sigma_3'_{MAX}$:	84
Strain, ε_f:	0.76
u (kPa):	90
σ_1' (kPa):	188
σ_3' (kPa):	104

Equipment

Machine:	Truepath Load Frame - Stn. 4
Chamber:	KW
Load Cell:	400469
Axial DCDT:	LP-174
Cell Pressure:	PS-3322
Back Pressure:	PS3-146
Pore Pressure:	PS3-190
Feed Rate (%/hr):	1.00

PHOTO AT END OF TEST

NA

TM	November 16, 2018	JK	December 19, 2018
TESTED BY	DATE	CHECKED BY	DATE

Golder Associates Ltd -Burnaby Laboratory
Unit 300 3811 North Fraser Way
Burnaby,B.C. Canada V5J 5J2

Consolidated Undrained Triaxial Compression Test for Soils

Reference
ASTM D4767

Client:	Westrek	**Borehole:**	T18-175
Project:	Lab Testing	**Sample:**	TP-02
Location:	Burnaby	**Depth (m):**	7.62
Project No.:	1894161-1023	**Lab ID No:**	304

Type :	Intact	**Soil Classification:**	N/A
Saturation Method:	Back Pressure Saturation	**Material Type**	Soil
Visual Description	CLAYEY SILT, brown, w > PL, stiff.		
Other Remarks:	Sand lenses through the sample.		

Sample Data

	Before Consolidation	After Consolidation
Height (cm):	17.40	17.25
Diameter (cm):	7.46	7.33
Area (cm^2):	43.72	42.20
Volume (cm^3):	761	728
γ_{dry} (kN/m^3):	13.83	14.45
γ_{sat} (kN/m^3):	18.61	19.01
Water content, w (%):	34.6	31.5
Saturation (%):	100	100
Void ratio, e:	0.95	0.87
Specific Gravity (assumed):	2.75	2.75

Consolidation Results

$\sigma'_{eff} = \sigma_{cell} - \sigma_{pwp}$ (kPa):	297
σ_{pwp} (kPa):	693
B value:	0.96
Volume Change (cc):	-32.8
t_{50} (min):	N/A

Strength Results

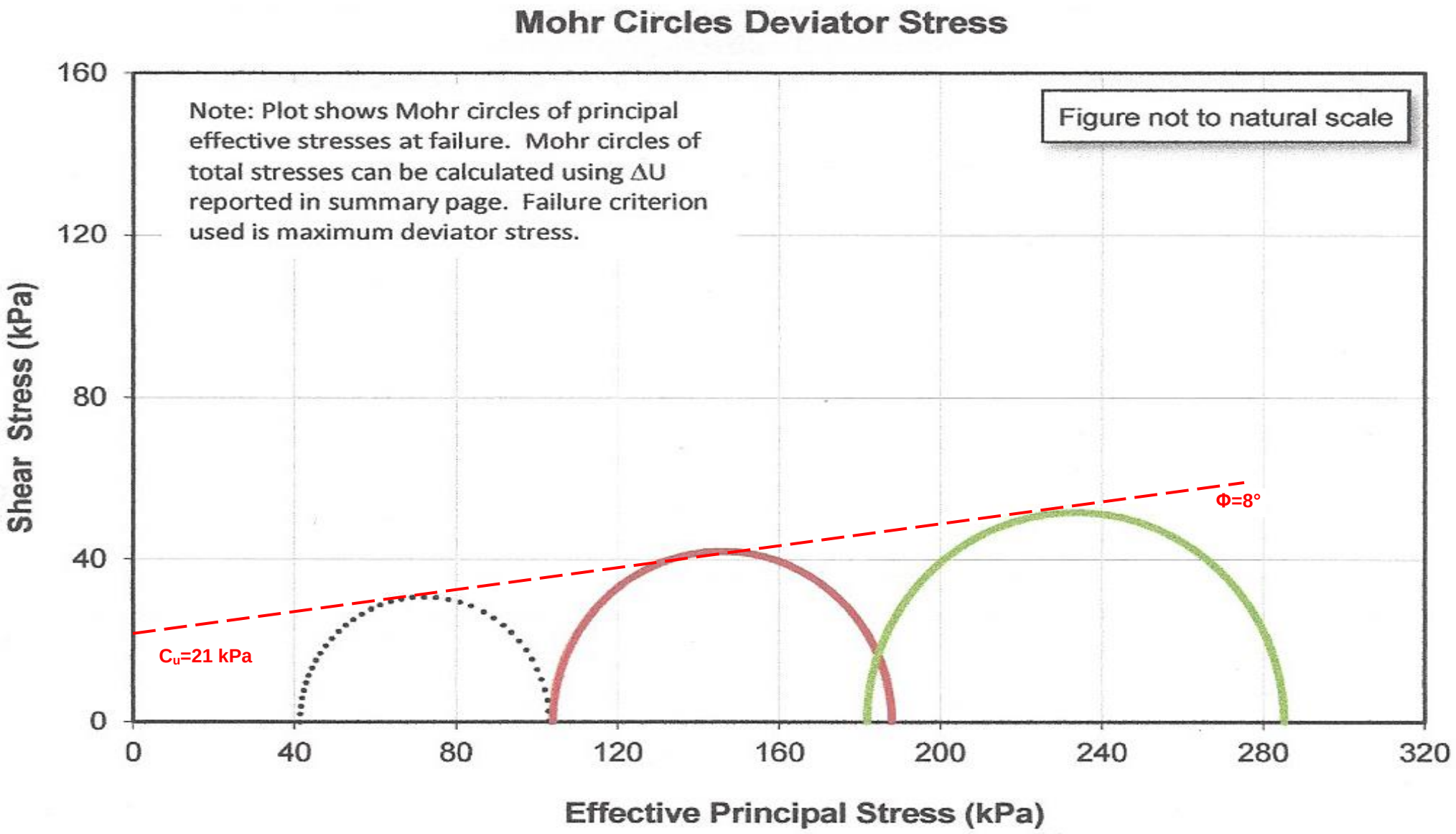
$\sigma_1' - \sigma_3'_{MAX}$:	103
Strain, ε_f:	0.42
u (kPa):	114
σ_1' (kPa):	285
σ_3' (kPa):	182

Equipment

Machine:	Truepath Load Frame - Stn. 4
Chamber:	KW
Load Cell:	400469
Axial DCDT:	LP-174
Cell Pressure:	PS-3322
Back Pressure:	PS3-146
Pore Pressure:	PS3-190
Feed Rate (%/hr):	1.00

PHOTO AT END OF TEST

TM	November 16, 2018	JK	December 19, 2018
TESTED BY	DATE	CHECKED BY	DATE


Mohr Circles Deviator Stress
Note: Plot shows Mohr circles of principal effective stresses at failure. Mohr circles of total stresses can be calculated using ΔU reported in summary page. Failure criterion used is maximum deviator stress.
Figure not to natural scale
Shear Stress (kPa)
160
120
80
40
0
0
40
80
120
160
200
240
280
320
Effective Principal Stress (kPa)
Φ=8°
Cu=21 kPa

Miniature Vane Shear Test for Saturated Fine-Grained Clayey Soils

ASTM D4648-D4648M

Project No.:	1894161-1029	**Vane Apparatus:**	Pilcon Geotechnics Hand Held Shear Vane
Project:	Lab Testing	**Instrument ID:**	GEO839
Location:	Burnaby	**Lab ID No:**	356
Client:	Westrek		

BOREHOLE	SAMPLE	DEPTH (m)	TEST DEPTH	VANE TYPE	PEAK		REMOULDED		VISUAL DESCRIPTION
					Torque reading [-]	Vane shear strength [kPa]	Torque reading [-]	Vane shear strength [kPa]	
T18-17S	TP-02	7.62	Top	Small	17.0	29.4	6.0	12.9	SAND some silt
			Bottom	Small	36.5	58.7	12.0	21.9	CLAYEY SILT

** The test data given herein pertain to the sample provided only. This report constitutes a testing service only. Interpretation of the data can be provided upon request.*

TM	December 20, 2018	DL	December 20, 2018
TESTED BY	DATE	CHECKED BY	DATE

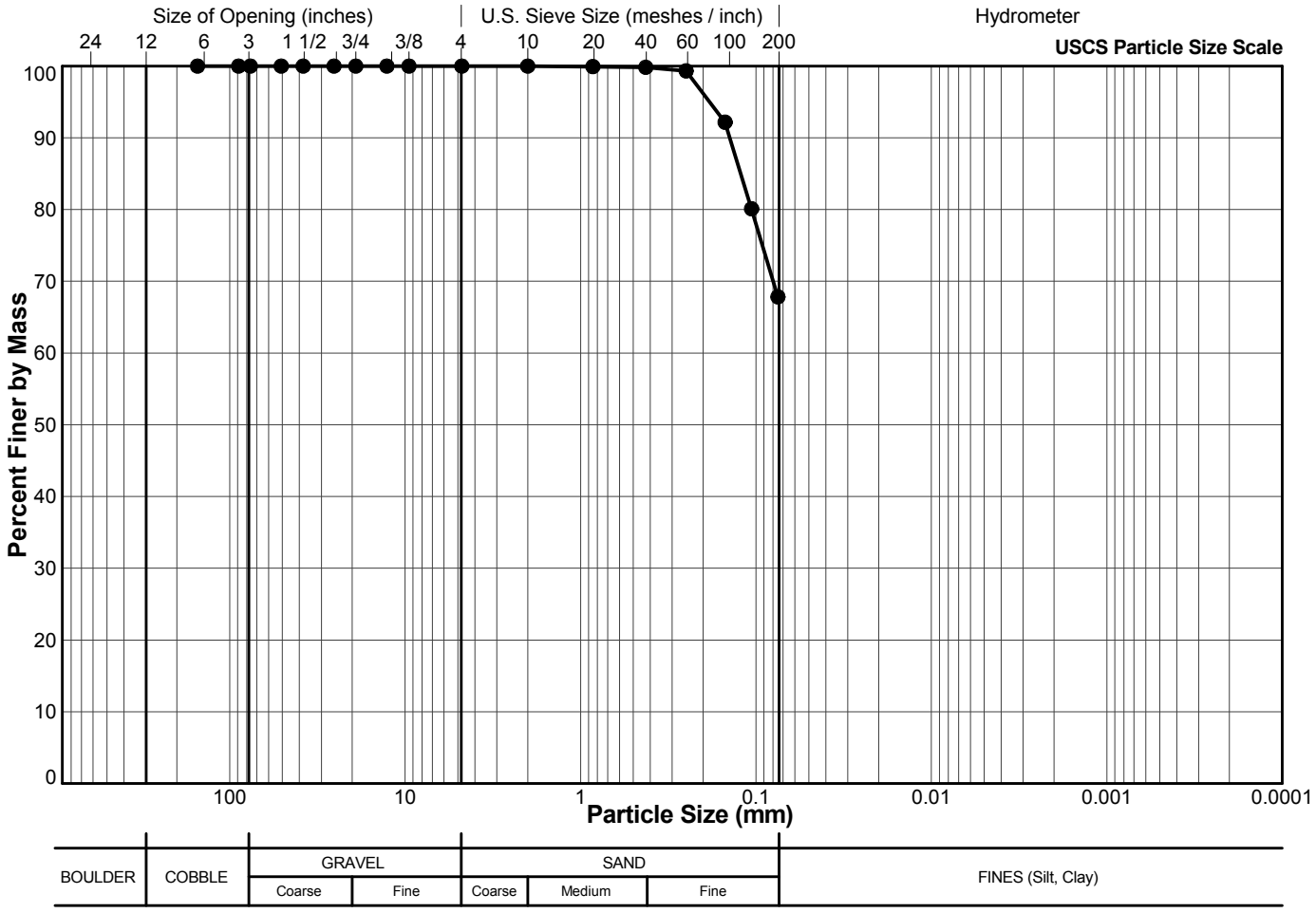
Golder Associates Ltd.
300, 3811 North Fraser Way, Burnaby, British Columbia, Canada V5J 5J2
Tel: 604-412-6899 Fax: 604-412-6816 www.golder.com

SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D6913

Client: Telkwa Coal Ltd.
Project: Ref #017-318
Location:
Project No.: 18109666 **Phase:** 1000

Sample Location: TP18-20
Sample No.: SA-01
Depth Interval (m): 0.30 to 0.40
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		100.0
3/8"	9.5		100.0
#4 US MESH	4.75		100.0
#10 US MESH	2		100.0
#20 US MESH	0.85		99.9
#40 US MESH	0.425		99.8
#60 US MESH	0.25		99.3
#100 US MESH	0.15		92.2
#140 US MESH	0.106		80.1
#200 US MESH	0.075		67.8

VN	10/26/2018	LH	10/30/2018
Tech	Date	Checked	Date

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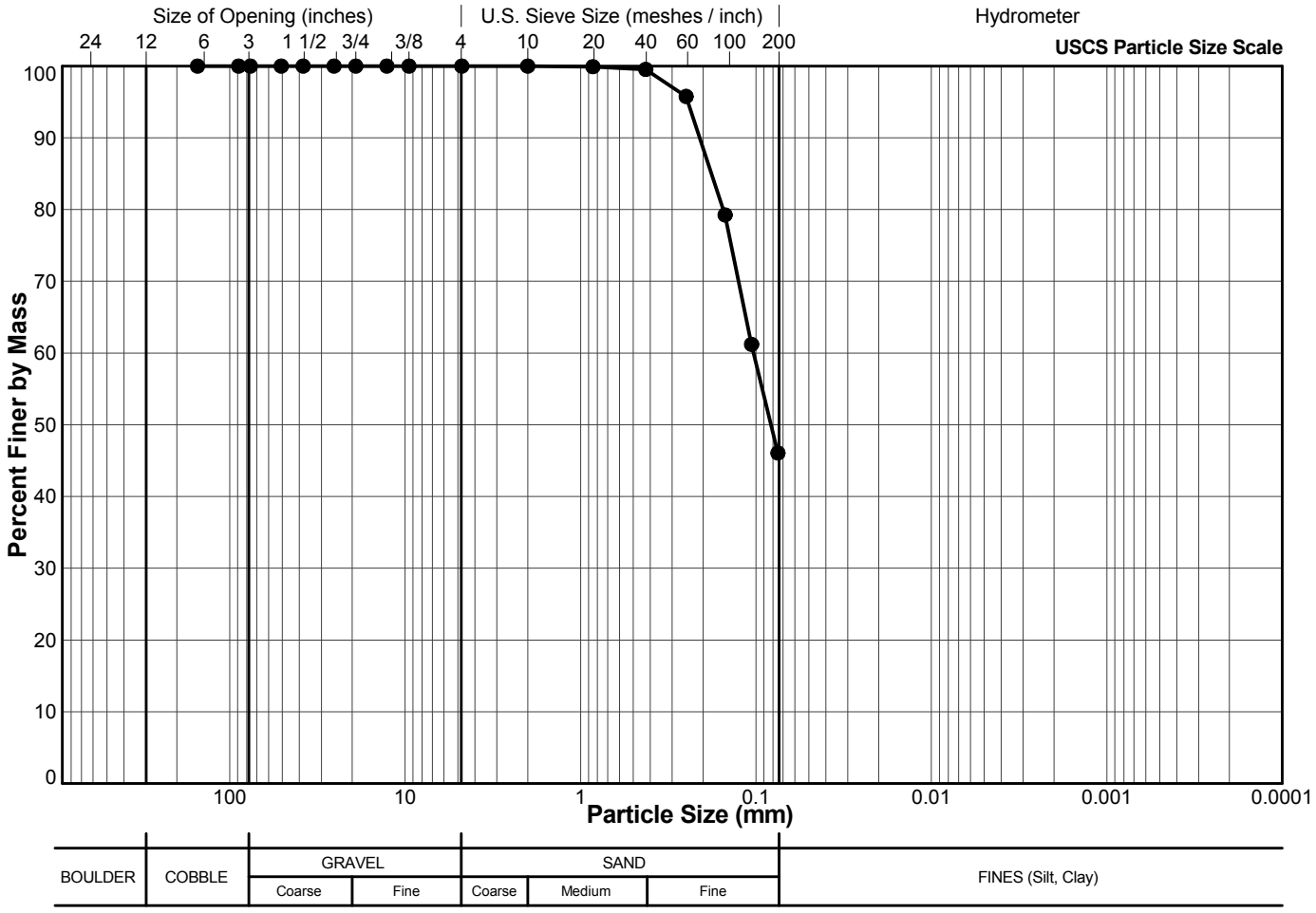
#300 - 3811 North Fraser Way Burnaby, British Columbia, Canada V5J 5J2
Tel: +1 (604) 412 6899 Fax: +1 (604) 412 6816 www.golder.com

SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D6913

Client: Telkwa Coal Ltd.
Project: Ref #017-318
Location:
Project No.: 18109666 **Phase:** 1000

Sample Location: TP18-20
Sample No.: SA-02
Depth Interval (m): 0.70 to 0.80
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		100.0
3/8"	9.5		100.0
#4 US MESH	4.75		100.0
#10 US MESH	2		100.0
#20 US MESH	0.85		99.9
#40 US MESH	0.425		99.5
#60 US MESH	0.25		95.8
#100 US MESH	0.15		79.3
#140 US MESH	0.106		61.2
#200 US MESH	0.075		46.1

VN/BH	10/26/2018	LH	10/30/2018
Tech	Date	Checked	Date

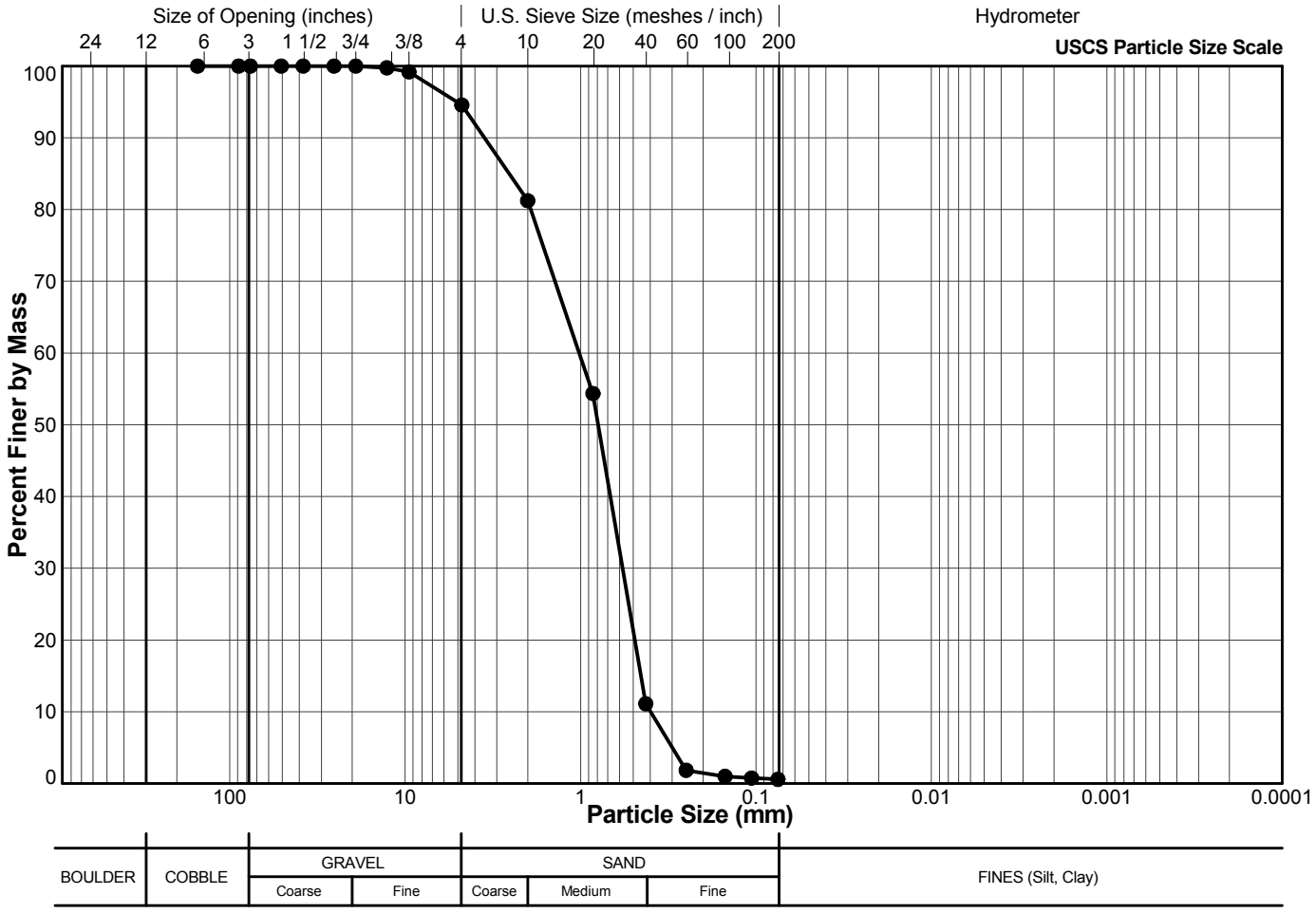
Golder Associates Ltd.
#300 - 3811 North Fraser Way Burnaby, British Columbia, Canada V5J 5J2
Tel: +1 (604) 412 6899 Fax: +1 (604) 412 6816 www.golder.com

SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D6913

Client: Telkwa Coal Ltd.
Project: Ref #017-318
Location:
Project No.: 18109666 **Phase:** 1000

Sample Location: TP18-20
Sample No.: SA-03
Depth Interval (m): 1.80 to 2.00
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		99.8
3/8"	9.5		99.2
#4 US MESH	4.75		94.6
#10 US MESH	2		81.2
#20 US MESH	0.85		54.4
#40 US MESH	0.425		11.1
#60 US MESH	0.25		1.8
#100 US MESH	0.15		1.0
#140 US MESH	0.106		0.8
#200 US MESH	0.075		0.6

VN/RZ	10/25/2018	LH	10/30/2018
Tech	Date	Checked	Date

Golder Associates Ltd.
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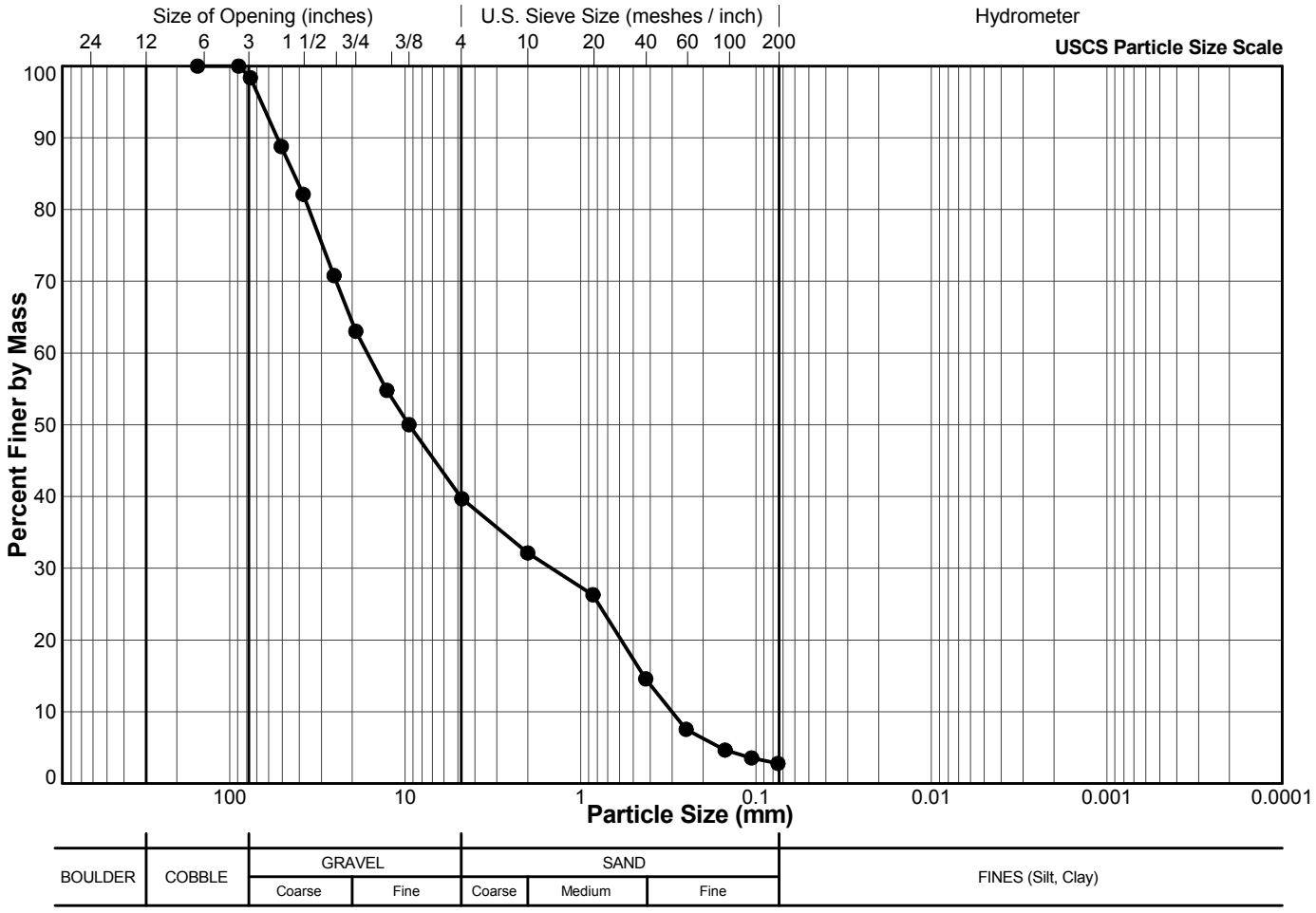
SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D6913

Client: Telkwa Coal Ltd.
Project: Ref #017-318
Location:
Project No.: 18109666 **Phase:** 1000

Sample Location: TP18-20
Sample No.: SA-04
Depth Interval (m): 3.00 to 3.20
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		98.4
2"	50.8		88.8
1 1/2"	38.1		82.1
1"	25.4		70.8
3/4"	19.1		63.0
1/2"	12.7		54.8
3/8"	9.5		50.0
#4 US MESH	4.75		39.7
#10 US MESH	2		32.1
#20 US MESH	0.85		26.3
#40 US MESH	0.425		14.6
#60 US MESH	0.25		7.5
#100 US MESH	0.15		4.7
#140 US MESH	0.106		3.6
#200 US MESH	0.075		2.8

VN/RZ	10/25/2018	LH	10/30/2018
Tech	Date	Checked	Date

Golder Associates Ltd.
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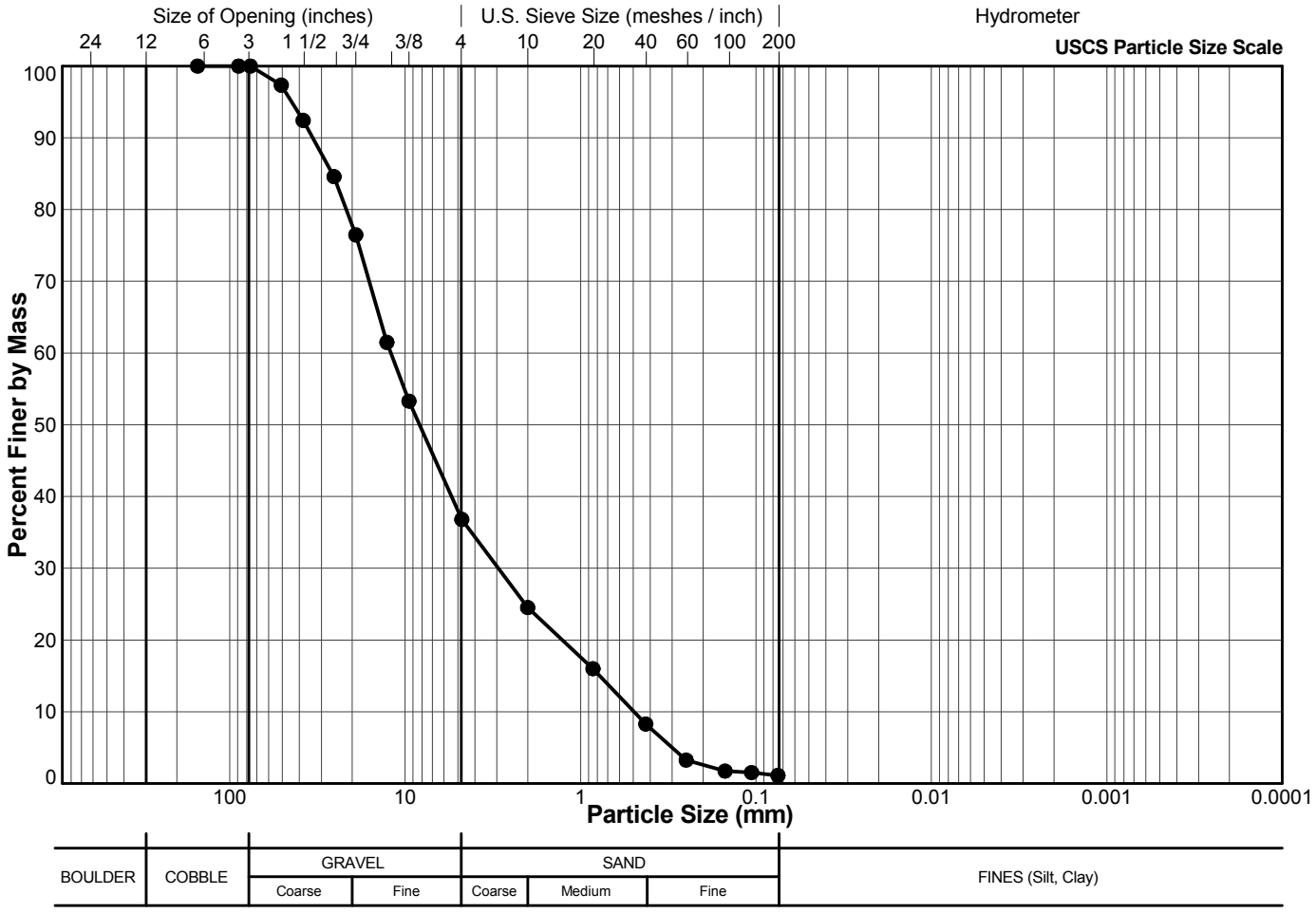
SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D6913

Client: Telkwa Coal Ltd.
Project: Ref #017-318
Location:
Project No.: 18109666 **Phase:** 1000

Sample Location: TP18-21
Sample No.: SA-01
Depth Interval (m): 1.00 to 1.20
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		97.4
1 1/2"	38.1		92.4
1"	25.4		84.6
3/4"	19.1		76.5
1/2"	12.7		61.5
3/8"	9.5		53.3
#4 US MESH	4.75		36.8
#10 US MESH	2		24.5
#20 US MESH	0.85		16.0
#40 US MESH	0.425		8.3
#60 US MESH	0.25		3.3
#100 US MESH	0.15		1.7
#140 US MESH	0.106		1.5
#200 US MESH	0.075		1.1

VN/RZ	10/25/2018	LH	10/30/2018
Tech	Date	Checked	Date

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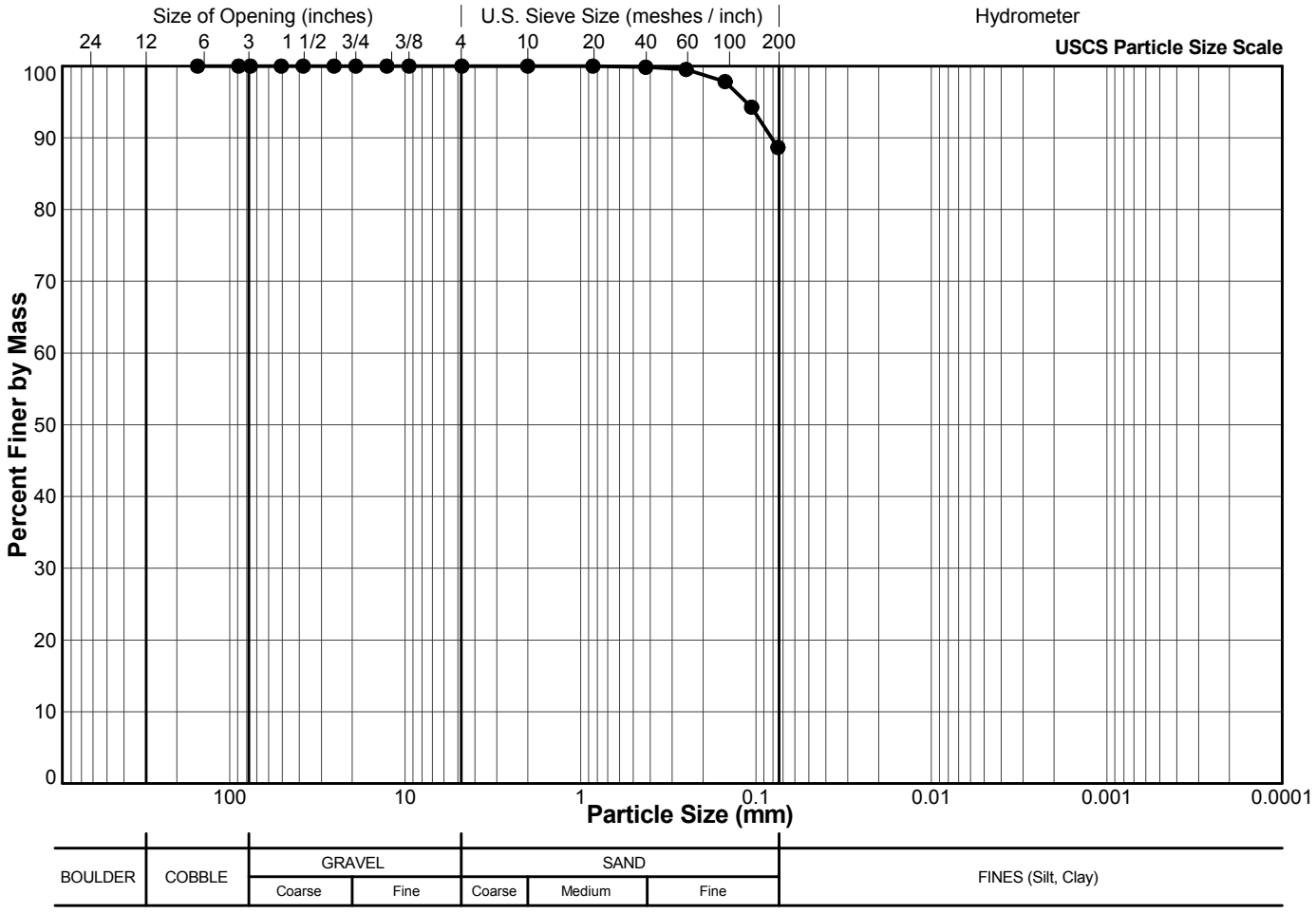
SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D6913

Client: Telkwa Coal Ltd.
Project: Ref #017-318
Location:
Project No.: 18109666 **Phase:** 1000

Sample Location: TP18-22
Sample No.: SA-01
Depth Interval (m): 0.50 to 0.60
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		100.0
3/8"	9.5		100.0
#4 US MESH	4.75		100.0
#10 US MESH	2		100.0
#20 US MESH	0.85		100.0
#40 US MESH	0.425		99.8
#60 US MESH	0.25		99.5
#100 US MESH	0.15		97.8
#140 US MESH	0.106		94.3
#200 US MESH	0.075		88.7

VN	10/26/2018	LH	10/30/2018
Tech	Date	Checked	Date

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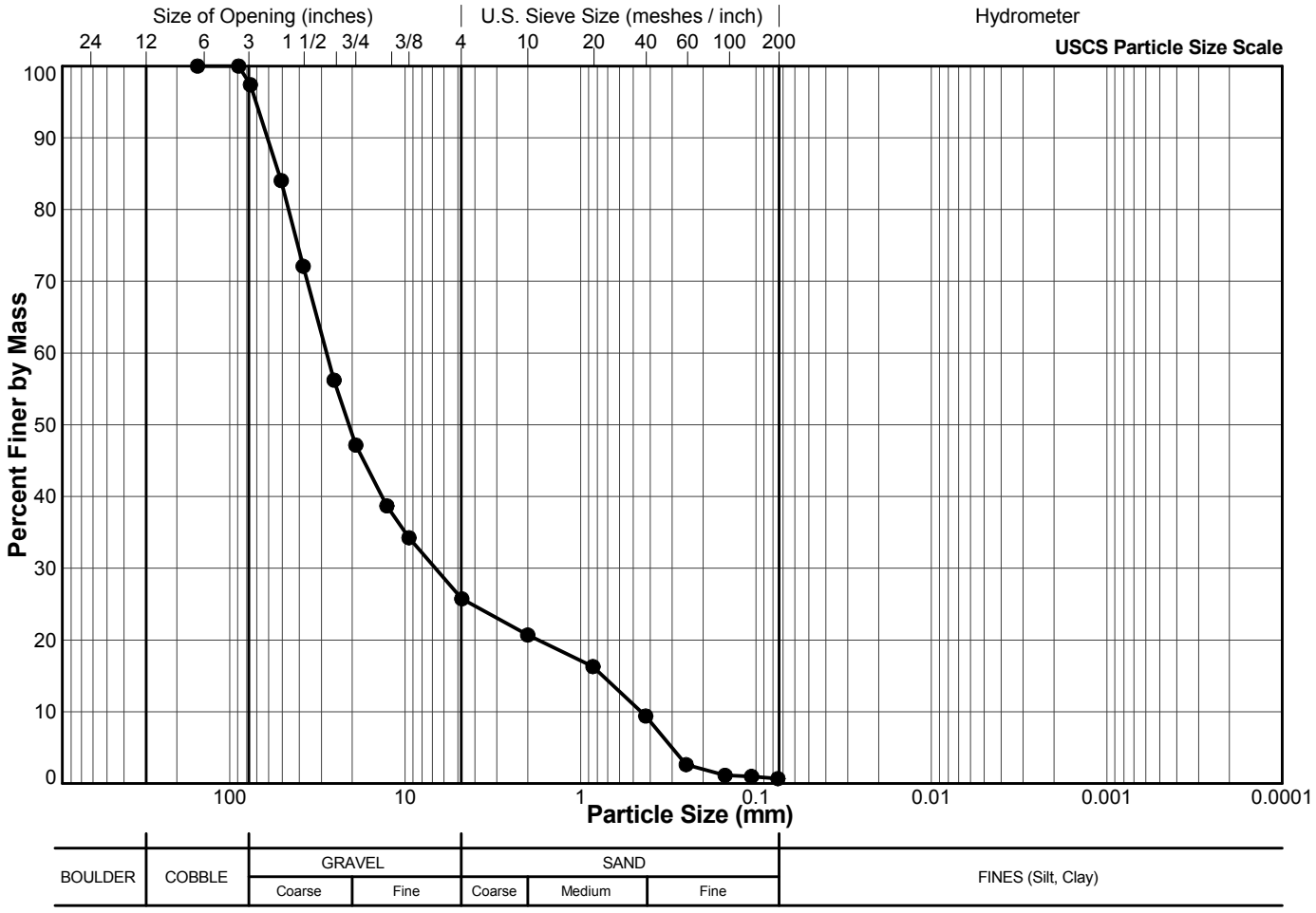
SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D6913

Client: Telkwa Coal Ltd.
Project: Ref #017-318
Location:
Project No.: 18109666 **Phase:** 1000

Sample Location: TP18-22
Sample No.: SA-02
Depth Interval (m): 1.40 to 1.50
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		97.4
2"	50.8		84.0
1 1/2"	38.1		72.1
1"	25.4		56.2
3/4"	19.1		47.2
1/2"	12.7		38.7
3/8"	9.5		34.2
#4 US MESH	4.75		25.7
#10 US MESH	2		20.7
#20 US MESH	0.85		16.3
#40 US MESH	0.425		9.4
#60 US MESH	0.25		2.6
#100 US MESH	0.15		1.1
#140 US MESH	0.106		1.0
#200 US MESH	0.075		0.7

VN/RZ	10/25/2018	LH	10/30/2018
Tech	Date	Checked	Date

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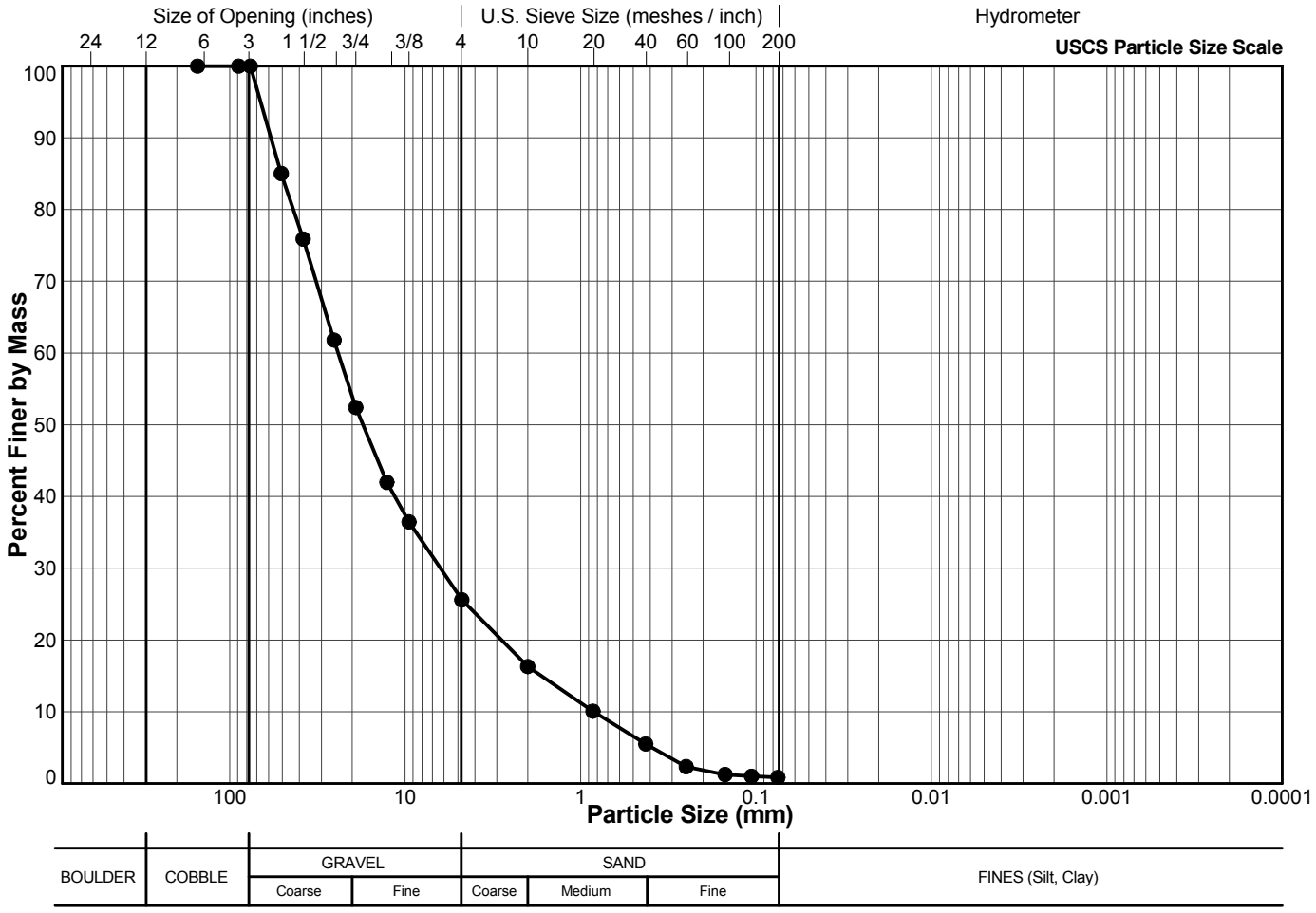
SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D6913

Client: Telkwa Coal Ltd.
Project: Ref #017-318
Location:
Project No.: 18109666 **Phase:** 1000

Sample Location: TP18-22
Sample No.: SA-03
Depth Interval (m): 3.10 to 3.30
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		85.0
1 1/2"	38.1		75.9
1"	25.4		61.8
3/4"	19.1		52.4
1/2"	12.7		42.0
3/8"	9.5		36.5
#4 US MESH	4.75		25.6
#10 US MESH	2		16.3
#20 US MESH	0.85		10.1
#40 US MESH	0.425		5.5
#60 US MESH	0.25		2.3
#100 US MESH	0.15		1.2
#140 US MESH	0.106		1.0
#200 US MESH	0.075		0.9

VN/RZ	10/26/2018	LH	10/30/2018
Tech	Date	Checked	Date

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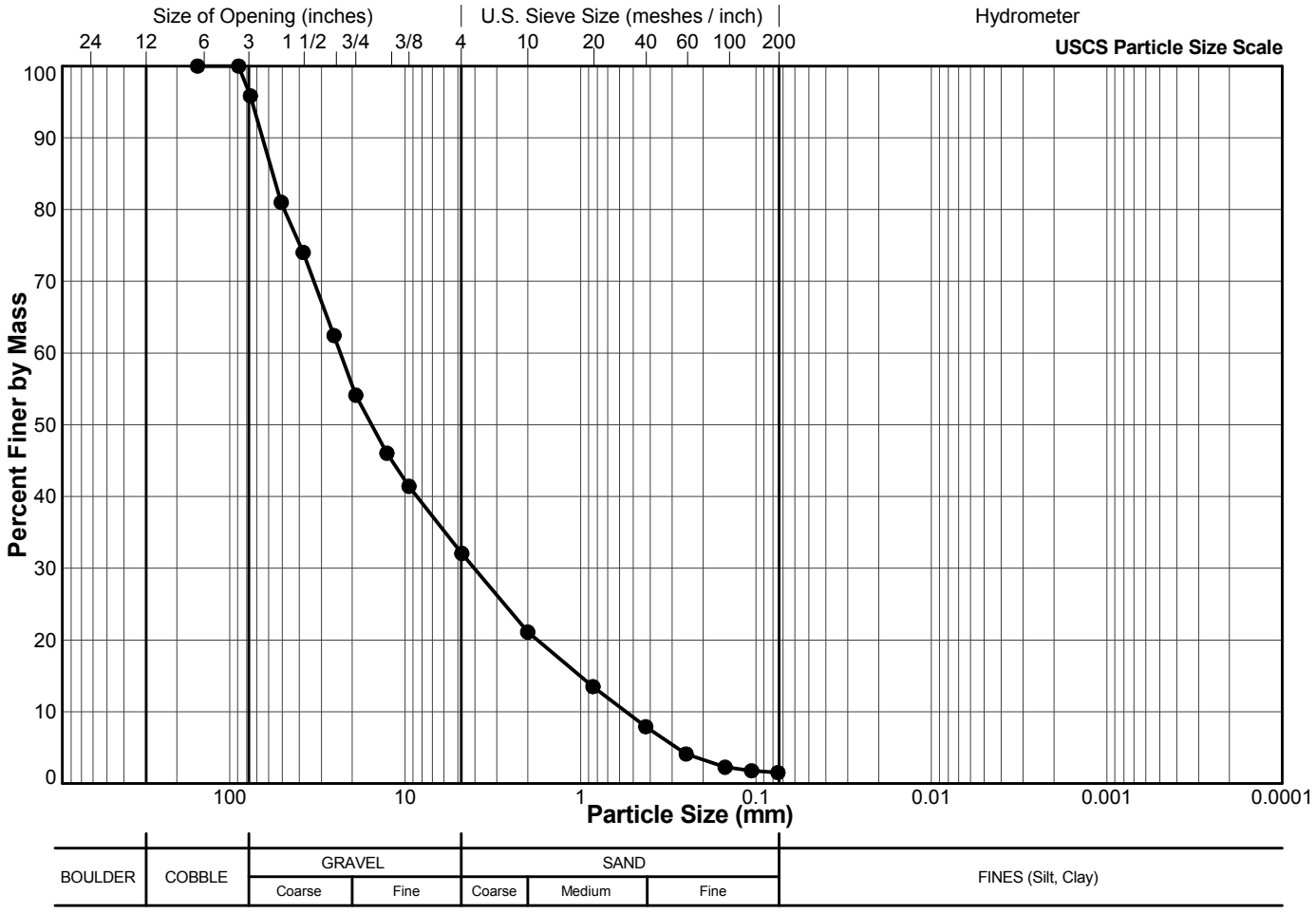
SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D6913

Client: Telkwa Coal Ltd.
Project: Ref #017-318
Location:
Project No.: 18109666 **Phase:** 1000

Sample Location: TP18-23
Sample No.: SA-01
Depth Interval (m): 1.30 to 1.40
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		95.8
2"	50.8		81.0
1 1/2"	38.1		74.0
1"	25.4		62.4
3/4"	19.1		54.1
1/2"	12.7		46.0
3/8"	9.5		41.4
#4 US MESH	4.75		32.1
#10 US MESH	2		21.1
#20 US MESH	0.85		13.5
#40 US MESH	0.425		7.9
#60 US MESH	0.25		4.1
#100 US MESH	0.15		2.3
#140 US MESH	0.106		1.8
#200 US MESH	0.075		1.5

VN/RZ	10/25/2018	LH	10/30/2018
Tech	Date	Checked	Date

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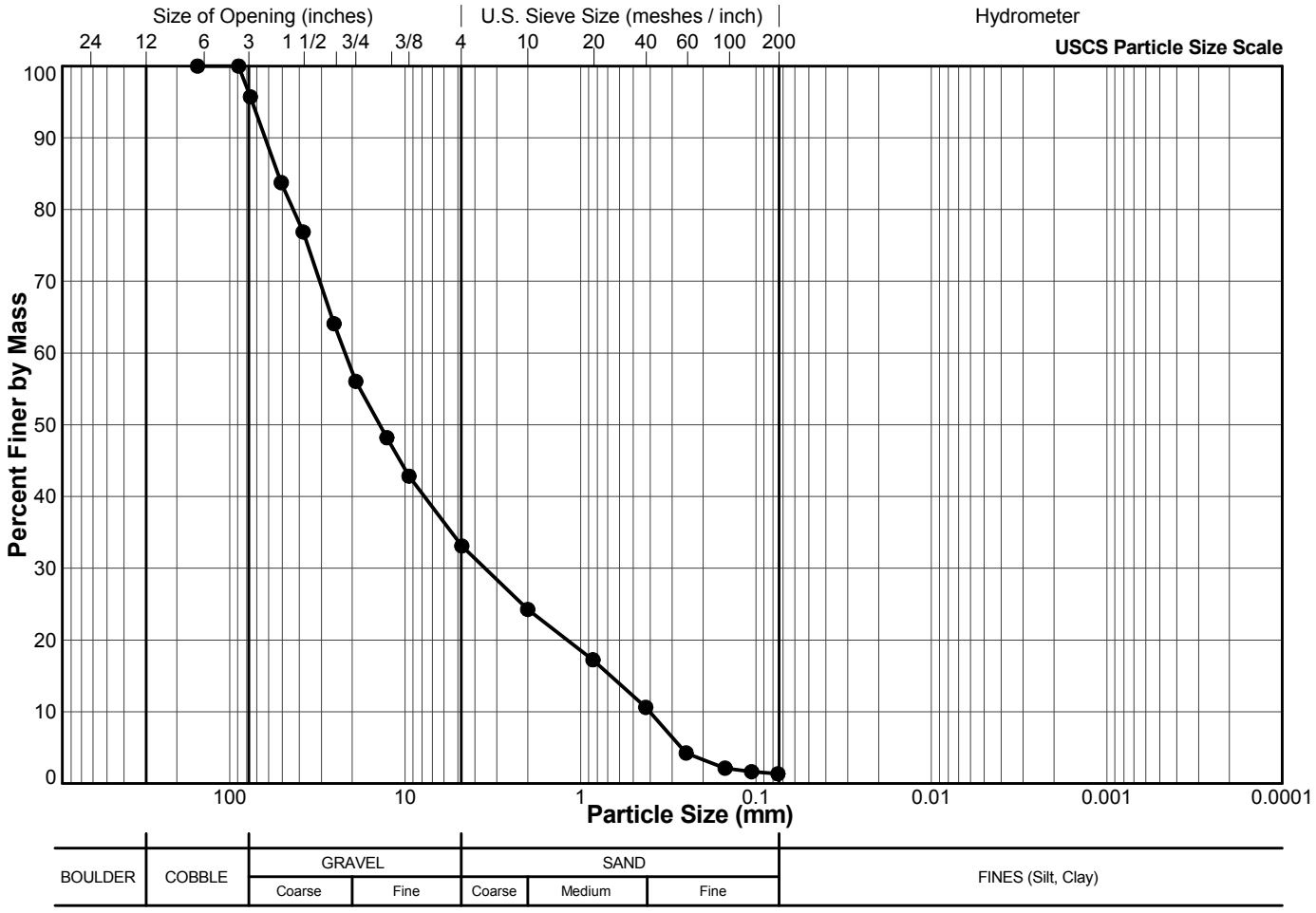
SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D6913

Client: Telkwa Coal Ltd.
Project: Ref #017-318
Location:
Project No.: 18109666 **Phase:** 1000

Sample Location: TP18-23
Sample No.: SA-02
Depth Interval (m): 2.60 to 2.70
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		95.7
2"	50.8		83.8
1 1/2"	38.1		76.9
1"	25.4		64.1
3/4"	19.1		56.0
1/2"	12.7		48.2
3/8"	9.5		42.8
#4 US MESH	4.75		33.1
#10 US MESH	2		24.3
#20 US MESH	0.85		17.2
#40 US MESH	0.425		10.6
#60 US MESH	0.25		4.2
#100 US MESH	0.15		2.1
#140 US MESH	0.106		1.6
#200 US MESH	0.075		1.4

VN/RZ	10/25/2018	LH	10/30/2018
Tech	Date	Checked	Date

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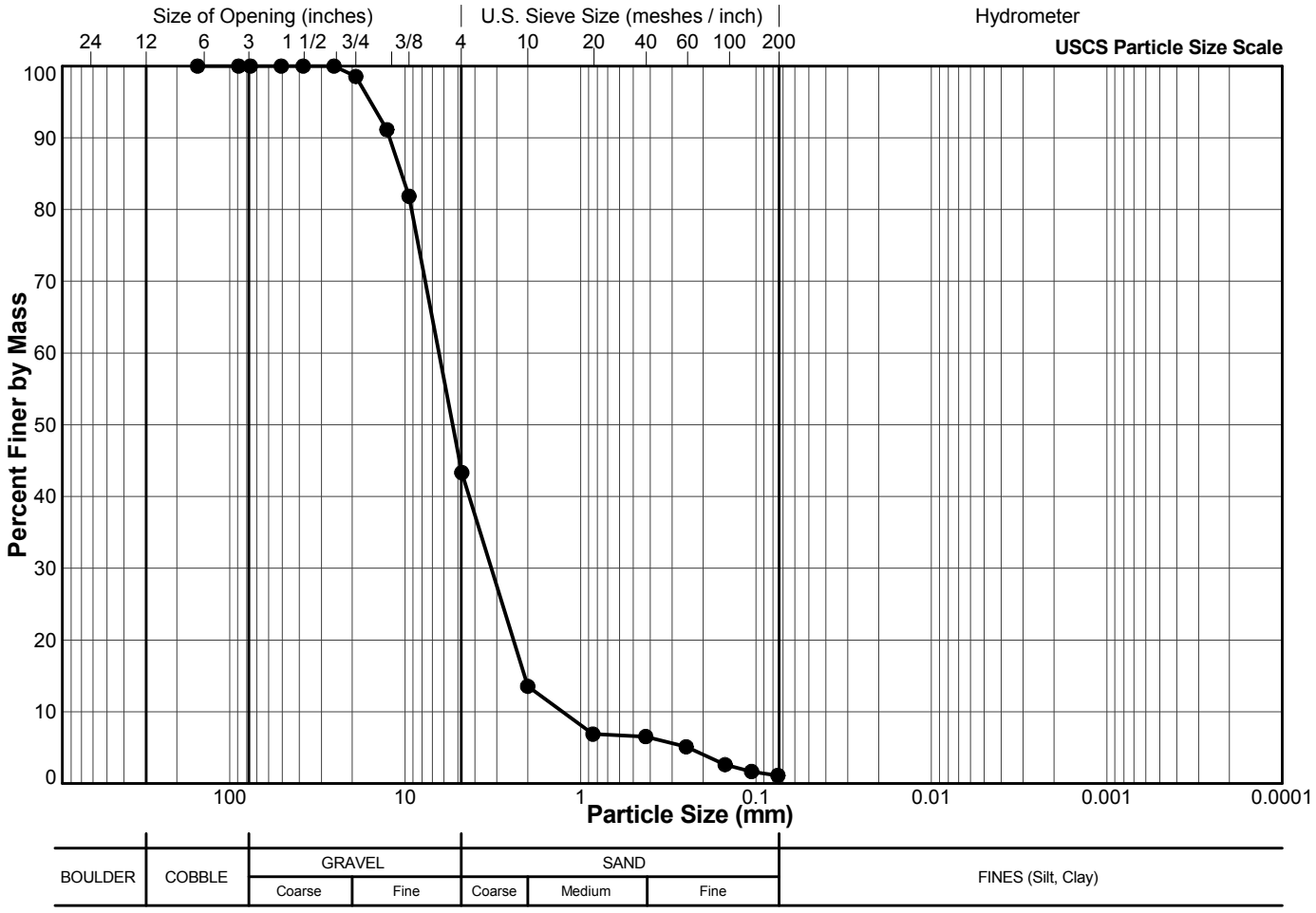
SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D6913

Client: Telkwa Coal Ltd.
Project: Ref #017-318
Location:
Project No.: 18109666 **Phase:** 1000

Sample Location: TP18-24
Sample No.: SA-01
Depth Interval (m): 1.00 to 1.20
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		98.5
1/2"	12.7		91.1
3/8"	9.5		81.9
#4 US MESH	4.75		43.3
#10 US MESH	2		13.5
#20 US MESH	0.85		6.9
#40 US MESH	0.425		6.5
#60 US MESH	0.25		5.1
#100 US MESH	0.15		2.6
#140 US MESH	0.106		1.7
#200 US MESH	0.075		1.1

VN	10/26/2018	LH	10/30/2018
Tech	Date	Checked	Date

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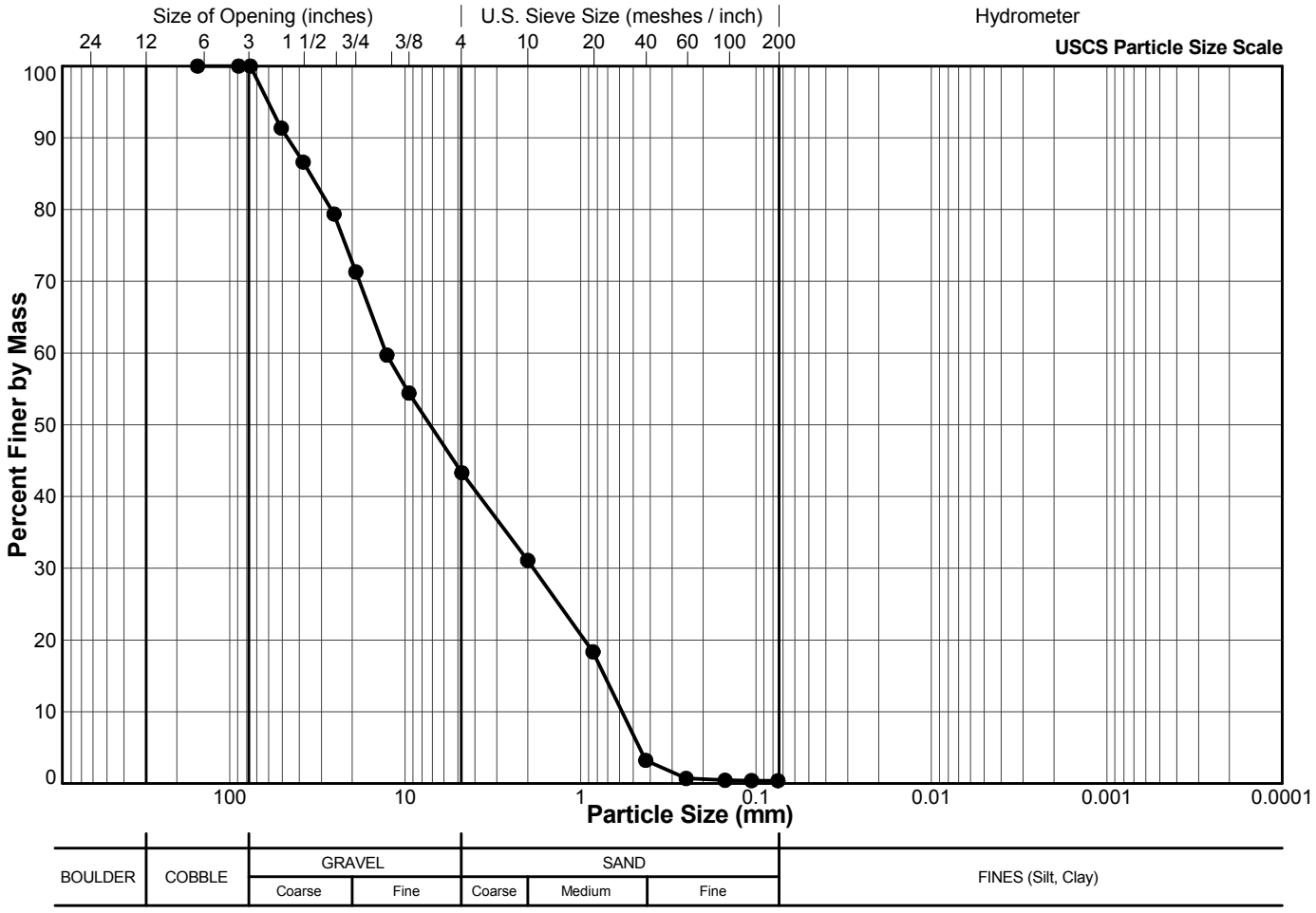
SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D6913

Client: Telkwa Coal Ltd.
Project: Ref #017-318
Location:
Project No.: 18109666 **Phase:** 1000

Sample Location: TP18-24
Sample No.: SA-02
Depth Interval (m): 1.90 to 2.10
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		91.4
1 1/2"	38.1		86.6
1"	25.4		79.4
3/4"	19.1		71.3
1/2"	12.7		59.7
3/8"	9.5		54.4
#4 US MESH	4.75		43.3
#10 US MESH	2		31.1
#20 US MESH	0.85		18.4
#40 US MESH	0.425		3.2
#60 US MESH	0.25		0.7
#100 US MESH	0.15		0.5
#140 US MESH	0.106		0.4
#200 US MESH	0.075		0.4

VN/RZ	10/25/2018	LH	10/30/2018
Tech	Date	Checked	Date

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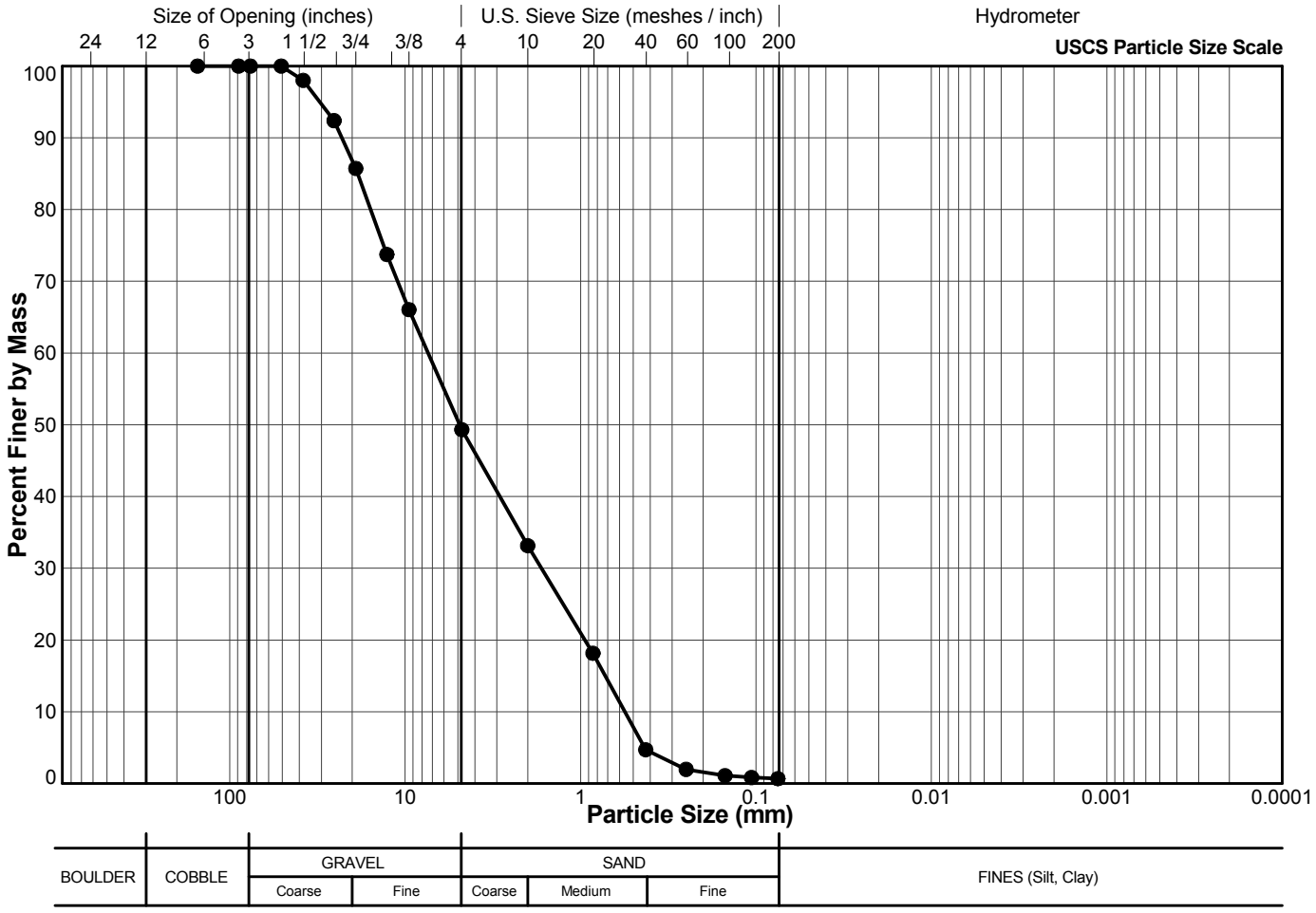
SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D6913

Client: Telkwa Coal Ltd.
Project: Ref #017-318
Location:
Project No.: 18109666 **Phase:** 1000

Sample Location: TP18-24
Sample No.: SA-03
Depth Interval (m): 3.50 to 3.70
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		98.0
1"	25.4		92.4
3/4"	19.1		85.7
1/2"	12.7		73.7
3/8"	9.5		66.0
#4 US MESH	4.75		49.3
#10 US MESH	2		33.1
#20 US MESH	0.85		18.2
#40 US MESH	0.425		4.7
#60 US MESH	0.25		2.0
#100 US MESH	0.15		1.1
#140 US MESH	0.106		0.8
#200 US MESH	0.075		0.7

VN	10/26/2018	LH	10/30/2018
Tech	Date	Checked	Date

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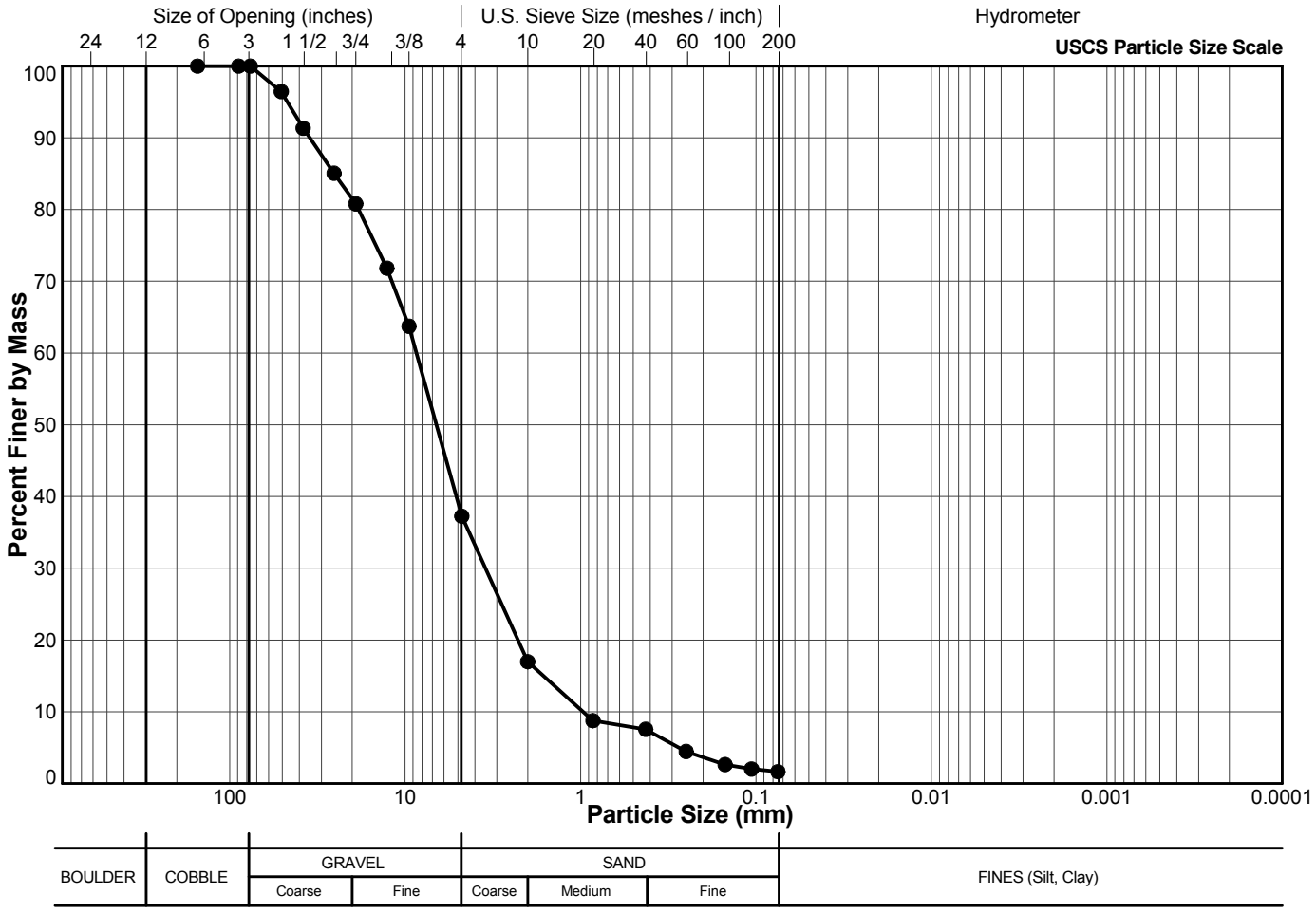
SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D6913

Client: Telkwa Coal Ltd.
Project: Ref #017-318
Location:
Project No.: 18109666 **Phase:** 1000

Sample Location: TP18-25
Sample No.: SA-01
Depth Interval (m): 2.10 to 2.30
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		96.5
1 1/2"	38.1		91.3
1"	25.4		85.1
3/4"	19.1		80.8
1/2"	12.7		71.8
3/8"	9.5		63.7
#4 US MESH	4.75		37.2
#10 US MESH	2		17.0
#20 US MESH	0.85		8.8
#40 US MESH	0.425		7.6
#60 US MESH	0.25		4.5
#100 US MESH	0.15		2.6
#140 US MESH	0.106		2.0
#200 US MESH	0.075		1.6

VN/RZ	10/26/2018	LH	10/30/2018
Tech	Date	Checked	Date

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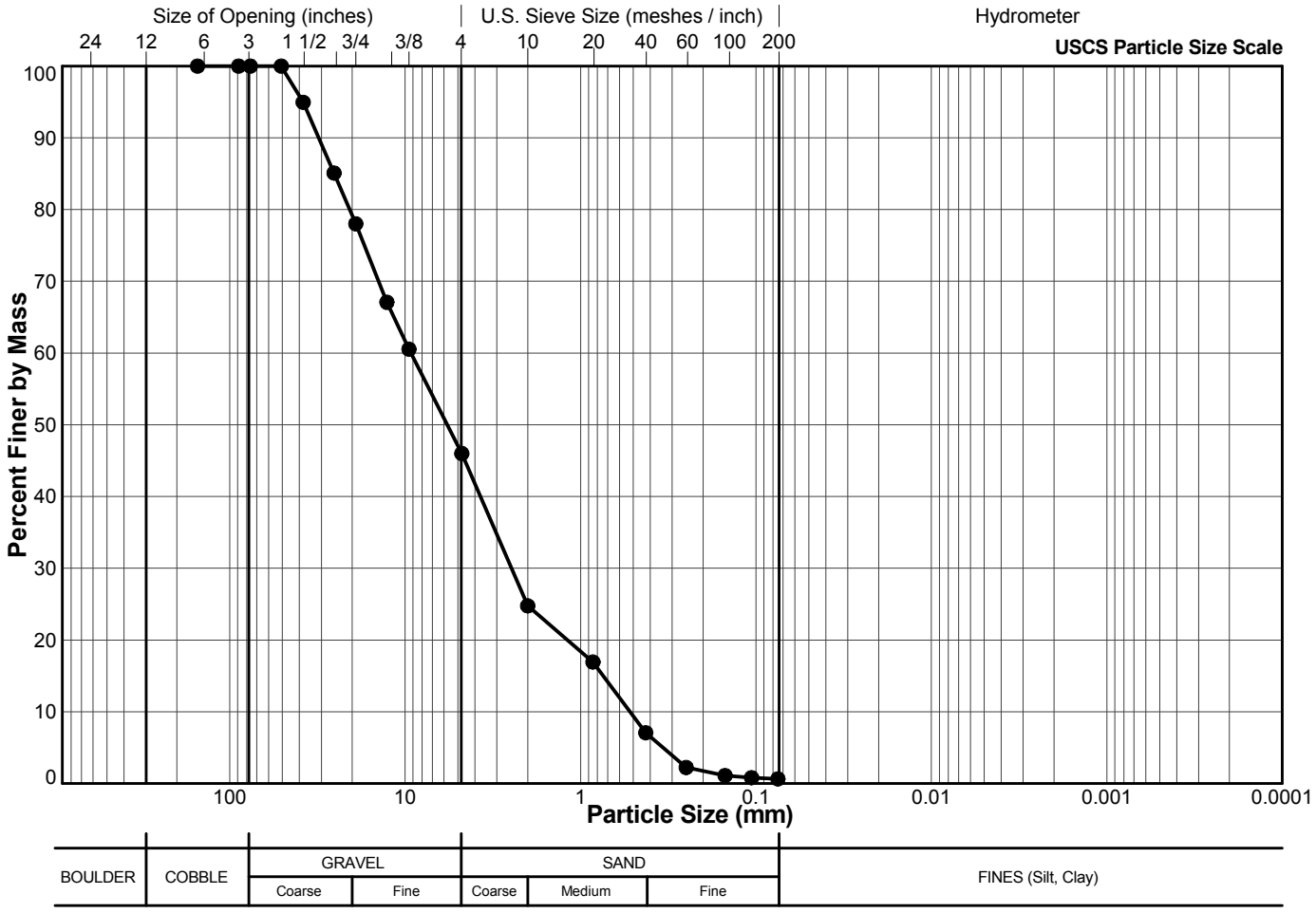
SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D6913

Client: Telkwa Coal Ltd.
Project: Ref #017-318
Location:
Project No.: 18109666 **Phase:** 1000

Sample Location: TP18-25
Sample No.: SA-02
Depth Interval (m): 3.20 to 3.40
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		94.9
1"	25.4		85.1
3/4"	19.1		78.0
1/2"	12.7		67.1
3/8"	9.5		60.5
#4 US MESH	4.75		46.0
#10 US MESH	2		24.8
#20 US MESH	0.85		16.9
#40 US MESH	0.425		7.1
#60 US MESH	0.25		2.2
#100 US MESH	0.15		1.1
#140 US MESH	0.106		0.8
#200 US MESH	0.075		0.6

VN	10/26/2018	LH	10/30/2018
Tech	Date	Checked	Date

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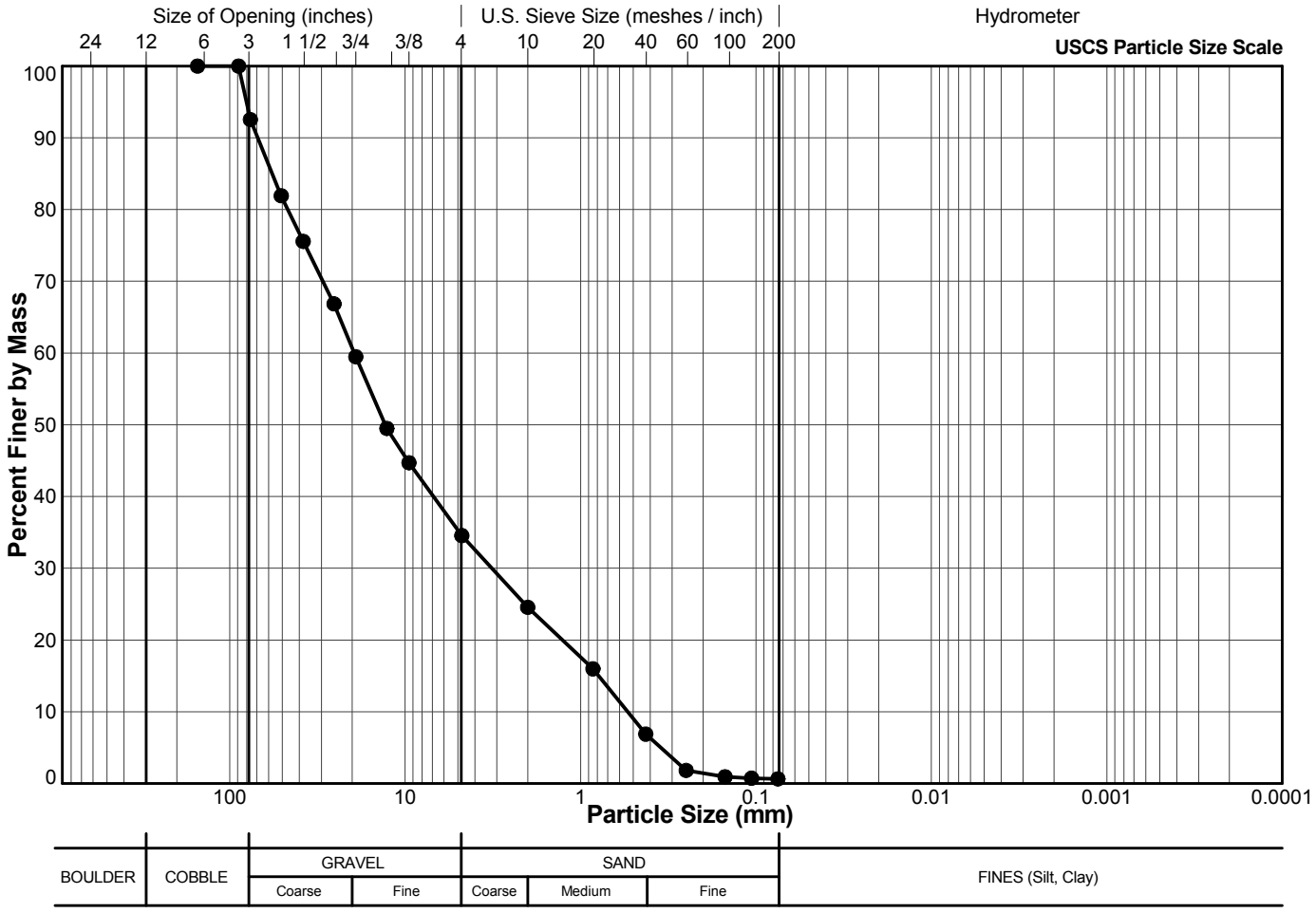
SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D6913

Client: Telkwa Coal Ltd.
Project: Ref #017-318
Location:
Project No.: 18109666 **Phase:** 1000

Sample Location: TP18-26
Sample No.: SA-01
Depth Interval (m): 1.80 to 2.00
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		92.5
2"	50.8		81.9
1 1/2"	38.1		75.6
1"	25.4		66.9
3/4"	19.1		59.5
1/2"	12.7		49.5
3/8"	9.5		44.7
#4 US MESH	4.75		34.6
#10 US MESH	2		24.6
#20 US MESH	0.85		16.0
#40 US MESH	0.425		6.9
#60 US MESH	0.25		1.8
#100 US MESH	0.15		0.9
#140 US MESH	0.106		0.7
#200 US MESH	0.075		0.6

VN/RZ	10/25/2018	LH	10/30/2018
Tech	Date	Checked	Date

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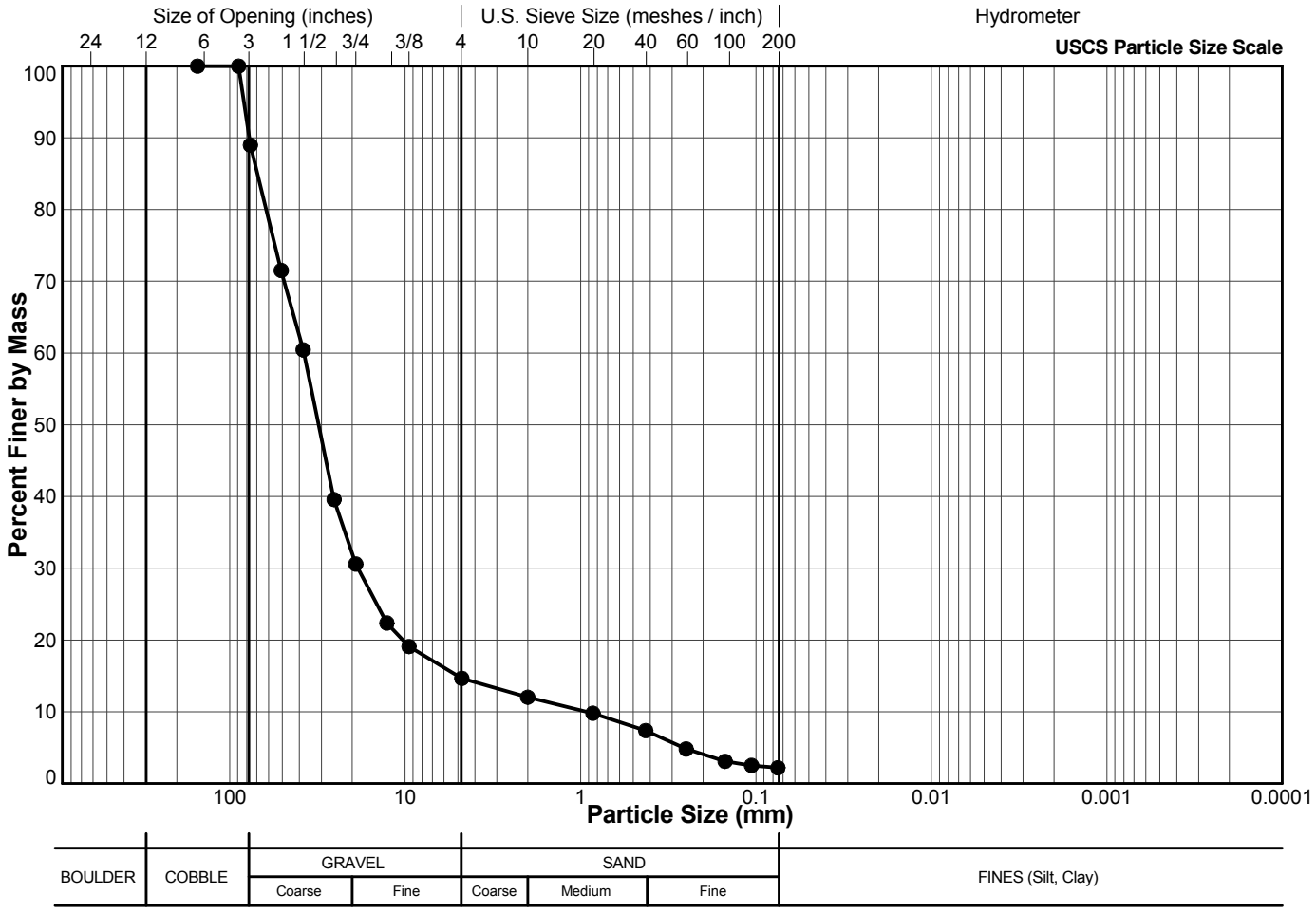
SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D6913

Client: Telkwa Coal Ltd.
Project: Ref #017-318
Location:
Project No.: 18109666 **Phase:** 1000

Sample Location: TP18-27
Sample No.: SA-01
Depth Interval (m): 1.80 to 2.00
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		89.0
2"	50.8		71.5
1 1/2"	38.1		60.4
1"	25.4		39.6
3/4"	19.1		30.6
1/2"	12.7		22.4
3/8"	9.5		19.1
#4 US MESH	4.75		14.7
#10 US MESH	2		12.0
#20 US MESH	0.85		9.8
#40 US MESH	0.425		7.4
#60 US MESH	0.25		4.8
#100 US MESH	0.15		3.1
#140 US MESH	0.106		2.5
#200 US MESH	0.075		2.2

VN/RZ	10/26/2018	LH	10/30/2018
Tech	Date	Checked	Date

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GRAIN SIZE DISTRIBUTION

wood.

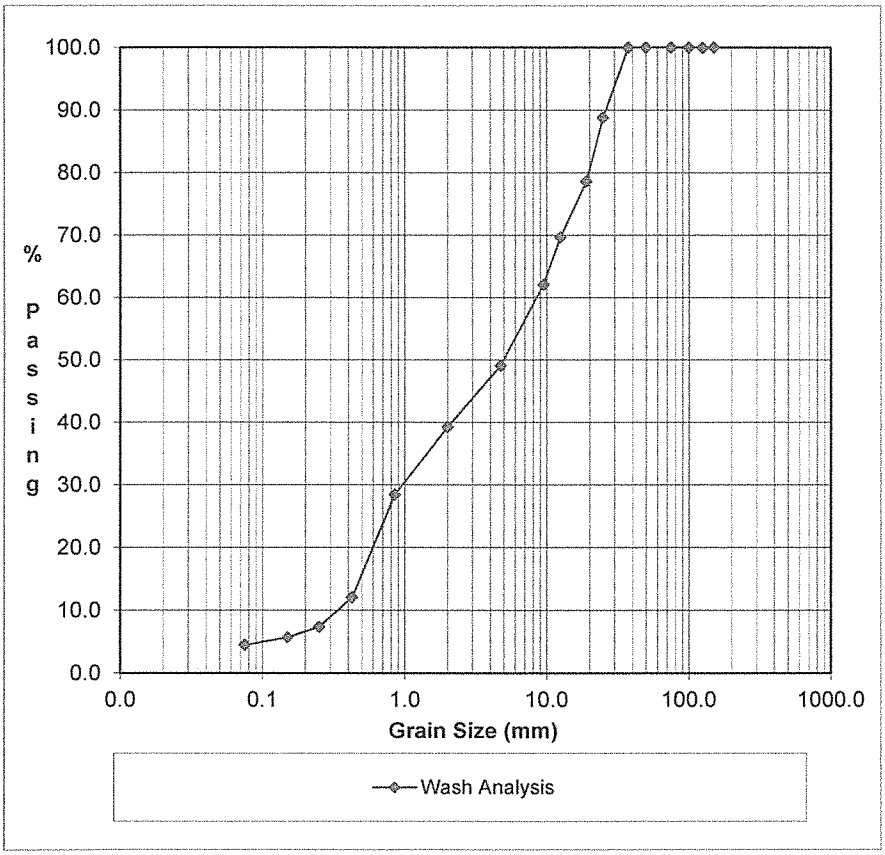
Westrek Geotechnical Services Ltd
101- 1383 McGill Road
Kamloops, BC
V2C 6K7

Attn: Hazel Wong / Kevin Turner

Project Name: Telkwa Coal - Telkwa, BC.

Project No:KX13690
Date: October 25, 2018

Test No.: 18 - 145-2
Source: TH 18 - 17S @ 1.8 - 2.1m Sample #01
Sample Type: Grab sample
Date Sampled: Sept 28, 2018
By: Client
Date Tested: October 22, 2018



Wash Sieve Analysis

Wash Sieve Analysis

Sieve Size(mm)	Percent Retained	Percent Passing	Limits	
			Upper	Lower
150.0	0.0	100.0		
125.0	0.0	100.0		
100.0	0.0	100.0		
75.0	0.0	100.0		
50.0	0.0	100.0		
37.5	0.0	100.0		
25.0	11.2	88.8		
19.0	10.2	78.6		
12.5	8.9	69.7		
9.5	7.6	62.1		
4.75	13.0	49.1		
2.000	9.9	39.2		
0.850	10.8	28.5		
0.425	16.4	12.1		
0.250	4.7	7.3		
0.150	1.7	5.7		
0.075	1.2	4.5		
PAN	4.5			

Sieve Mass (g): 2049.3

Gravel	50.9 %
Sand	44.6 %
Fines	4.5 %

COMMENTS

Wood Environment & Infrastructure Solutions

Per: B. Shearer

ATTERBERG LIMITS

wood.

PROJECT : Westrek Geotechnical Services Ltd.
Project Number: KX13690
Lab : 18-145-4
Date: October 25, 2018

Sample ID: Telkwa Coal - TP 18-23 @ 2.9 - 3.1m - Sa# 03
Technician: B. Shearer

Liquid Limit

Trial No.	1	2	3	
No. of Blows	33	25	20	
Tare ID:	1	2	3	
Mass Wet + Tare	83.06	82.31	85.49	
Mass Dry + Tare	76.14	75.35	77.71	
Mass Tare:	53.82	53.74	54.13	
Mass of Water:	6.92	6.96	7.78	
Dry Soil Mass:	22.32	21.61	23.58	
Moisture Content:	31.0%	32.2%	33.0%	
Liquid Limit:	32.2%	32.2%	32.1%	

Average Liquid Limit: 32.2%

Plastic Limit

Trial No.	4	5	6	
Tare ID:	1	2	3	
Mass Wet + Tare	62.18	60.11	61.33	
Mass Dry + Tare	61.00	58.99	60.14	
Mass Tare:	54.20	52.49	53.22	
Mass of Water:	1.18	1.12	1.19	
Dry Soil Mass:	6.80	6.50	6.92	
Moisture Content:	17.4%	17.2%	17.2%	

Average Plastic Limit: 17.3%

Plasticity Index: 14.9

ATTERBERG LIMITS

wood.

PROJECT : Westrek Geotechnical Services Ltd.
Project Number: KX13690
Lab : 18-145-3
Date: October 25, 2018

Sample ID: Telkwa Coal - TH 18-17S @ 5.2- 5.8m - Sa# 02
Technician: B. Shearer

Liquid Limit

Trial No.	1	2	3	
No. of Blows	30	27	22	
Tare ID:	1	2	3	
Mass Wet + Tare	90.51	90.32	94.12	
Mass Dry + Tare	82.10	81.78	84.65	
Mass Tare:	54.39	53.88	54.08	
Mass of Water:	8.41	8.54	9.47	
Dry Soil Mass:	27.71	27.90	30.57	
Moisture Content:	30.4%	30.6%	31.0%	
Liquid Limit:	31.1%	30.9%	30.5%	

Average Liquid Limit: 30.8%

Plastic Limit

Trial No.	4	5	6	
Tare ID:	1	2	3	
Mass Wet + Tare	62.24	61.79	61.83	
Mass Dry + Tare	61.00	60.60	60.69	
Mass Tare:	53.82	53.74	54.12	
Mass of Water:	1.24	1.19	1.14	
Dry Soil Mass:	7.18	6.86	6.57	
Moisture Content:	17.3%	17.3%	17.4%	

Average Plastic Limit: 17.3%

Plasticity Index: 13.5

MOISTURE CONTENT WORKSHEET

Project:	KX13690
Lab	18-145
Technician:	B. Shearer
Date:	October 22, 2018
Telkwa Coal - Telkwa, BC.	

Hole No.	TH18-14S Sa3	TH18-14S Sa6	TH18-14S SS2	TH18-14S Sa8	TH18-14S Sa10
Depth(M)	4.9-5.2	7.0-7.3	10.7-11.3	12.8-13.1	17.1-17.4
Tare No.	1	2	3	4	5
Wt. Sple. Wet + Tare	953.4	1029.1	334.2	682.1	267.8
Wt. Sple. Dry + Tare	830.9	931.1	306.4	616.7	235.6
Wt. Water	122.5	98.0	27.8	65.4	32.2
Tare Container	14.7	14.6	14.4	14.5	14.7
Wt. Dry Sample	816.2	916.5	292.0	602.2	220.9
Moist. Cont. %	15.0%	10.7%	9.5%	10.9%	14.6%

Hole No.	TH18-14S Sa12	TH18-14S Sa15			
Depth(M)	21.9-22.3	28.3-28.7			
Tare No.	6	7			
Wt. Sple. Wet + Tare	705.8	718.8			
Wt. Sple. Dry + Tare	637.7	636.9			
Wt. Water	68.1	81.9			
Tare Container	15.0	14.4			
Wt. Dry Sample	622.7	622.5			
Moist. Cont. %	10.9%	13.2%			

Hole No.	TH18-15S Sa3	TH18-15S Sa5	TH18-15S Sa6	TH18-15S Sa8	TH18-15S Sa11
Depth(M)	5.2-5.5	11.0-11.3	13.7-14.0	20.7-21.0	26.5-27.1
Tare No.	8	9	10	11	12
Wt. Sple. Wet + Tare	2173.7	810.1	849.7	486.9	601.2
Wt. Sple. Dry + Tare	2113.2	785.8	786.8	400.3	506.2
Wt. Water	60.5	24.3	62.9	86.6	95.0
Tare Container	475.0	14.7	14.8	14.7	14.6
Wt. Dry Sample	1638.2	771.1	772.0	385.6	491.6
Moist. Cont. %	3.7%	3.2%	8.1%	22.5%	19.3%

Hole No.	TH18-17S Sa1	TH18-17S Sa2	TH18-17S SS2	TH18-17S Sa4	
Depth(M)	1.8-2.1	5.2-5.8	10.7-11.3	13.1-13.4	
Tare No.	13	14	15	16	
Wt. Sple. Wet + Tare	2565.2	640.5	454.3	925.6	
Wt. Sple. Dry + Tare	2551.6	511.4	346.8	845.5	
Wt. Water	13.6	129.1	107.5	80.1	
Tare Container	501.8	14.4	14.3	14.6	
Wt. Dry Sample	2049.8	497.0	332.5	830.9	
Moist. Cont. %	0.7%	26.0%	32.3%	9.6%	

Hole No.	TH18-23 Sa3				
Depth(M)	2.9-3.1				
Tare No.	17				
Wt. Sple. Wet + Tare	461.8				
Wt. Sple. Dry + Tare	365.4				
Wt. Water	96.4				
Tare Container	15.1				
Wt. Dry Sample	350.3				
Moist. Cont. %	27.5%				

GOLDER

WATER CONTENT DETERMINATION

ASTM D 2216

Client: Telkwa Coal Ltd.
Project: Ref #017-318
Location:
Project No.: 18109666 **Phase:** 1000

Lab Schedule No.:

Sample Location	Sample No.	Specimen No.	Depth Interval		Water Content (%)
			Depth (m)	Bottom (m)	
TP18-20	**SA-01**		0.30	0.40	**5.0**
TP18-20	**SA-02**		0.70	0.80	**14.6**
TP18-20	**SA-03**		1.80	2.00	**8.9**
TP18-21	**SA-01**		1.00	1.20	**2.4**
TP18-22	**SA-01**		0.50	0.60	**7.7**
TP18-22	**SA-02**		1.40	1.50	**2.3**
TP18-23	**SA-01**		1.30	1.40	**2.6**
TP18-24	**SA-01**		1.00	1.20	**1.0**
TP18-24	**SA-02**		1.90	2.10	**2.5**
TP18-24	**SA-03**		3.50	3.70	**8.5**
TP18-25	**SA-01**		2.10	2.30	**2.7**
TP18-25	**SA-02**		3.20	3.40	**3.9**
TP18-26	**SA-01**		1.80	2.00	**2.6**
TP18-27	**SA-01**		1.80	2.00	**3.0**

LH — Checked
10/30/2018 — Date

Golder Associates Ltd.
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Standard Test Method for California Bearing Ratio (CBR) of Laboratory-Compacted Soils

ASTM D1883

Project No.:	18109666-1000	**Borehole:**	TP18-21
Project:	Ref #017-318	**Sample:**	1
Location:	N/A	**Depth (m):**	1.0 - 1.2
Client:	Telkwa Coal Ltd.	**Lab ID No:**	328

Sample Description:	Sand and Gravel		
Remarks:	Water oozing out during preparation		
Classification:	N/A	**Oversize Material (%):**	23.5

Initial Sample Properties

Sample Diameter (cm):	15.24
Sample Height (cm):	11.86
Area (cm^2):	182.4
Volume (cm^3):	2163.4
Wet Weight (g):	4812.1
Dry Weight (g):	4585.0
Water Content (%):	5.0
Dry Density (kg/m^3):	2119

Final Water Contents

Top 1.0 inch (%):	3.6
Bottom of Sample (%):	5.2
Average Sample (%):	4.8

Equipment

Machine:	3
Load Cell:	729252
Axial DCDT:	LP-1209

Test Properties

Target Dry Density (%):	100 % of Standard Proctor
Target Dry Density (kg/m^3):	2163
Soaking:	No
Immersion Period (hours):	-
Swelling:	N/A
Penetration Rate (mm/min):	1.27
Surcharge Weight (kg):	9.1
Piston Diameter (cm):	4.98

Test Comments:	Sample was compacted to 100% of standard Proctor.
	Free water drained during the test

Test Results

Penetration (mm), corrected:	3.00	5.54
Standard Stress (kPa):	6900	10300
Penetration Stress (kPa), corrected:	5279	10164
CBR Value (%), corrected:	**77**	**99**

TM	November 14, 2018	LH	November 23, 2018
TESTED BY	DATE	CHECKED BY	DATE

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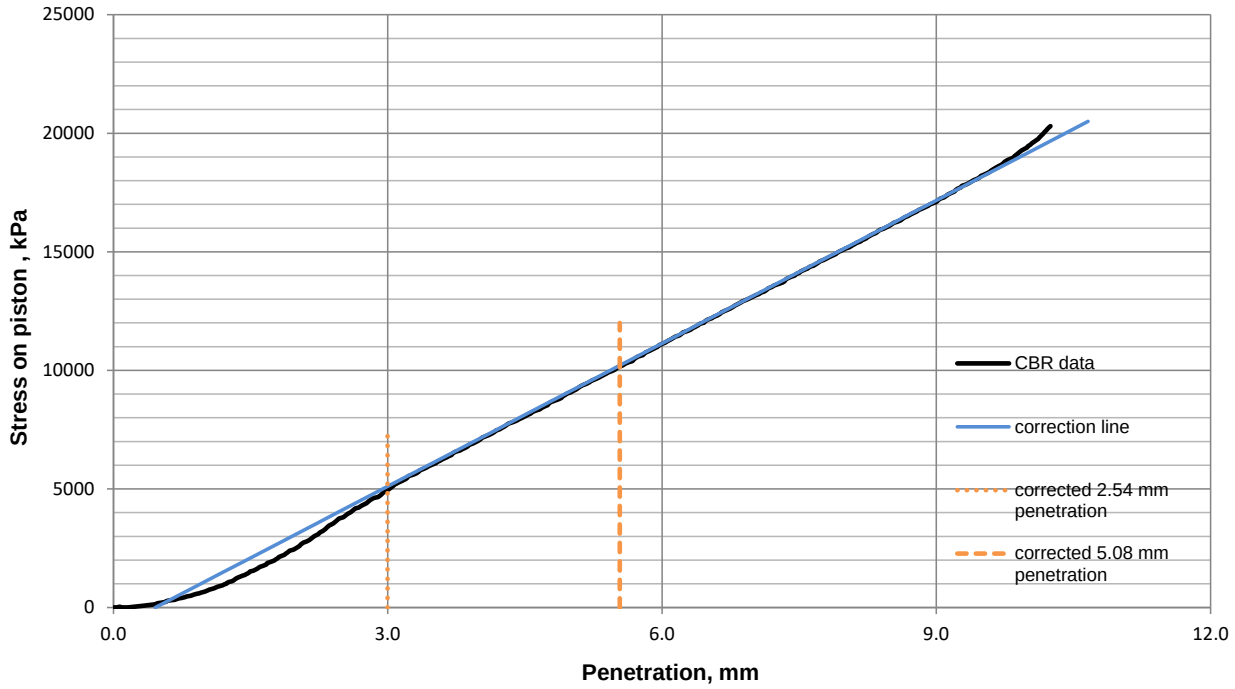
Standard Test Method for California Bearing Ratio (CBR) of Laboratory-Compacted Soils

ASTM D1883

Project No.:	18109666-1000	**Borehole:**	TP18-21
Project:	Ref #017-318	**Sample:**	1
Location:	N/A	**Depth (m):**	1.0 - 1.2
Client:	Telkwa Coal Ltd.	**Lab ID No:**	328

CBR Data



Test Results (corrected)

Penetration	Penetration Stress	CBR Value
3.00 mm	5279 kPa	**77** %
5.54 mm	10164 kPa	**99** %

TM	November 14, 2018	LH	November 23, 2018
TESTED BY	DATE	CHECKED BY	DATE

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Standard Test Method for California Bearing Ratio (CBR) of Laboratory-Compacted Soils

ASTM D1883

Project No.:	18109666-1000	**Borehole:**	TP18-23
Project:	Ref #017-318	**Sample:**	1
Location:	N/A	**Depth (m):**	1.3 - 1.4
Client:	Telkwa Coal Ltd.	**Lab ID No:**	328

Sample Description:	Sand and Gravel		
Remarks:	Water oozing out during preparation		
Classification:	N/A	**Oversize Material (%):**	45.9

Initial Sample Properties

Sample Diameter (cm):	15.24
Sample Height (cm):	11.97
Area (cm^2):	182.4
Volume (cm^3):	2183.5
Wet Weight (g):	4802.8
Dry Weight (g):	4578.0
Water Content (%):	4.9
Dry Density (kg/m^3):	2097

Final Water Contents

Top 1.0 inch (%):	3.9
Bottom of Sample (%):	5.2
Average Sample (%):	4.9

Equipment

Machine:	3
Load Cell:	729252
Axial DCDT:	LP-1209

Test Properties

Target Dry Density (%):	100 % of Standard Proctor
Target Dry Density (kg/m^3):	2135
Soaking:	No
Immersion Period (hours):	-
Swelling:	N/A
Penetration Rate (mm/min):	1.27
Surcharge Weight (kg):	9.1
Piston Diameter (cm):	4.98

Test Comments:	Sample was compacted to 100% of standard Proctor.
	Free water drained during the test

Test Results

Penetration (mm), corrected:	3.02	5.56
Standard Stress (kPa):	6900	10300
Penetration Stress (kPa), corrected:	6766	11620
CBR Value (%), corrected:	**98**	**113**

TM	November 15, 2018	LH	November 23, 2018
TESTED BY	DATE	CHECKED BY	DATE

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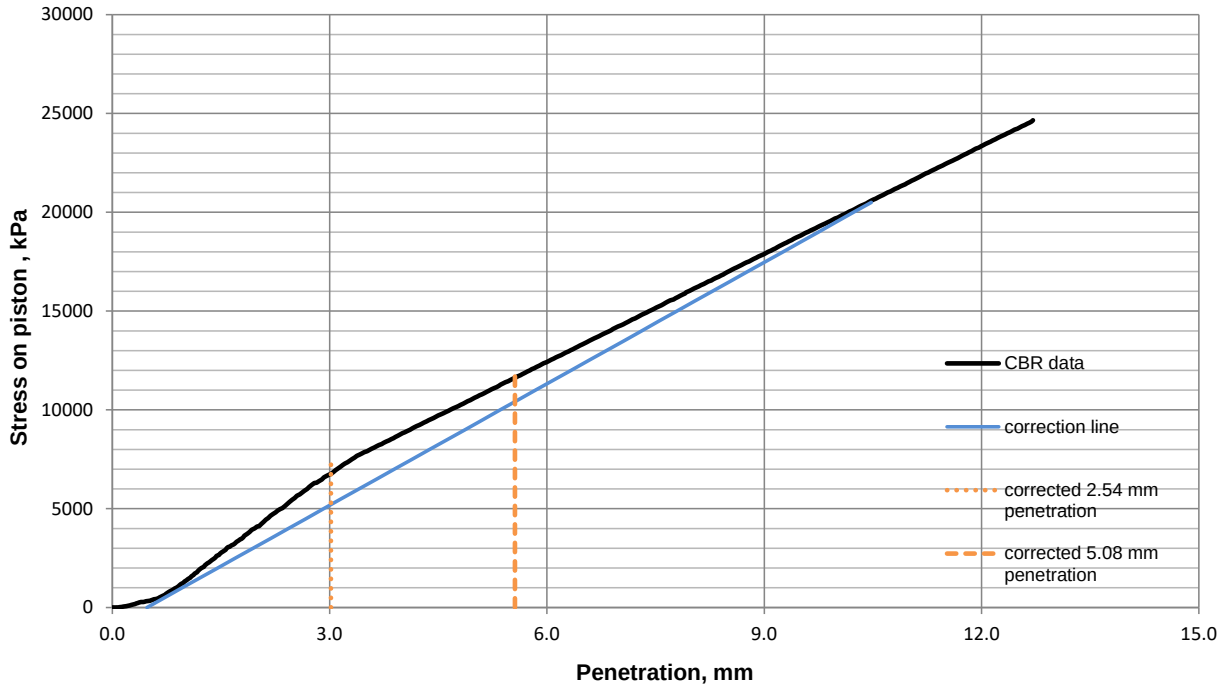
Standard Test Method for California Bearing Ratio (CBR) of Laboratory-Compacted Soils

ASTM D1883

Project No.:	18109666-1000	**Borehole:**	TP18-23
Project:	Ref #017-318	**Sample:**	1
Location:	N/A	**Depth (m):**	1.3 - 1.4
Client:	Telkwa Coal Ltd.	**Lab ID No:**	328

CBR Data



Test Results (corrected)

Penetration	Penetration Stress	CBR Value
3.02 mm	6766 kPa	**98** %
5.56 mm	11620 kPa	**113** %

TM	November 15, 2018	LH	November 23, 2018
TESTED BY	DATE	CHECKED BY	DATE

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Standard Test Method for California Bearing Ratio (CBR) of Laboratory-Compacted Soils

ASTM D1883

Project No.:	18109666-1000	**Borehole:**	TP18-24
Project:	Ref #017-318	**Sample:**	2
Location:	N/A	**Depth (m):**	1.9 - 2.1
Client:	Telkwa Coal Ltd.	**Lab ID No:**	328

Sample Description:	Sand and Gravel		
Remarks:	Water oozing out during preparation		
Classification:	N/A	**Oversize Material (%):**	28.7

Initial Sample Properties

Sample Diameter (cm):	15.24
Sample Height (cm):	11.61
Area (cm^2):	182.4
Volume (cm^3):	2117.8
Wet Weight (g):	4609.6
Dry Weight (g):	4326.5
Water Content (%):	6.5
Dry Density (kg/m^3):	2043

Final Water Contents

Top 1.0 inch (%):	3.1
Bottom of Sample (%):	7.5
Average Sample (%):	6.4

Equipment

Machine:	3
Load Cell:	729252
Axial DCDT:	LP-1209

Test Properties

Target Dry Density (%):	100 % of Standard Proctor
Target Dry Density (kg/m^3):	2035
Soaking:	No
Immersion Period (hours):	-
Swelling:	N/A
Penetration Rate (mm/min):	1.27
Surcharge Weight (kg):	9.1
Piston Diameter (cm):	4.98

Test Comments:	Sample was compacted to 100% of standard Proctor.
	Free water drained during the test

Test Results

Penetration (mm), corrected:	4.79	7.33
Standard Stress (kPa):	6900	10300
Penetration Stress (kPa), corrected:	4670	9318
CBR Value (%), corrected:	**68**	**90**

TM	November 14, 2018	LH	November 23, 2018
TESTED BY	DATE	CHECKED BY	DATE

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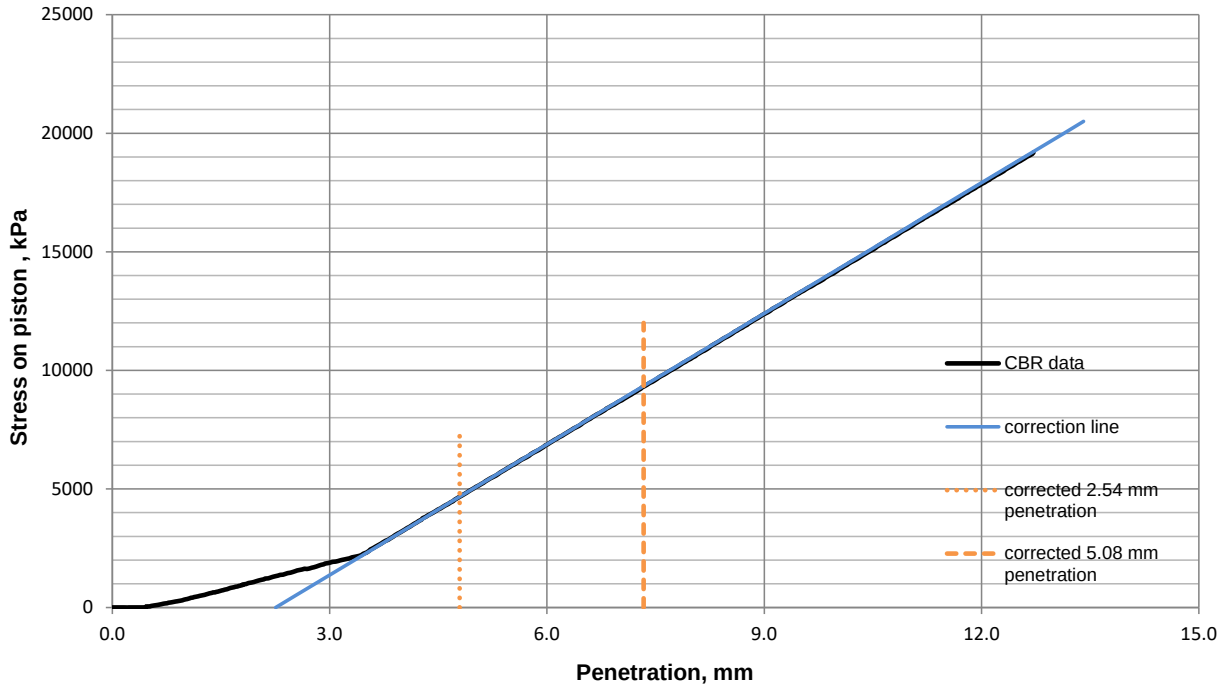
Standard Test Method for California Bearing Ratio (CBR) of Laboratory-Compacted Soils

ASTM D1883

Project No.:	18109666-1000	**Borehole:**	TP18-24
Project:	Ref #017-318	**Sample:**	2
Location:	N/A	**Depth (m):**	1.9 - 2.1
Client:	Telkwa Coal Ltd.	**Lab ID No:**	328

CBR Data



Test Results (corrected)

Penetration	Penetration Stress	CBR Value
4.79 mm	4670 kPa	**68** %
7.33 mm	9318 kPa	**90** %

TM	November 14, 2018	LH	November 23, 2018
TESTED BY	DATE	CHECKED BY	DATE

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Standard Test Method for California Bearing Ratio (CBR) of Laboratory-Compacted Soils

ASTM D1883

Project No.:	18109666-1000	**Borehole:**	TP18-25
Project:	Ref #017-318	**Sample:**	1
Location:	N/A	**Depth (m):**	2.1 - 2.3
Client:	Telkwa Coal Ltd.	**Lab ID No:**	328

Sample Description:	Sand and Gravel		
Remarks:	Water oozing out during preparation		
Classification:	N/A	**Oversize Material (%):**	19.2

Initial Sample Properties

Sample Diameter (cm):	15.24
Sample Height (cm):	11.41
Area (cm^2):	182.4
Volume (cm^3):	2081.4
Wet Weight (g):	3992.4
Dry Weight (g):	3934.7
Water Content (%):	1.5
Dry Density (kg/m^3):	1890

Final Water Contents

Top 1.0 inch (%):	3.3
Bottom of Sample (%):	3.3
Average Sample (%):	3.3

Equipment

Machine:	3
Load Cell:	729252
Axial DCDT:	LP-1209

Test Properties

Target Dry Density (%):	100 % of Standard Proctor
Target Dry Density (kg/m^3):	2012
Soaking:	No
Immersion Period (hours):	-
Swelling:	N/A
Penetration Rate (mm/min):	1.27
Surcharge Weight (kg):	9.1
Piston Diameter (cm):	4.98

Test Comments:	Sample was compacted to 100% of standard Proctor.
	Free water drained during the test

Test Results

Penetration (mm), corrected:	3.37	5.91
Standard Stress (kPa):	6900	10300
Penetration Stress (kPa), corrected:	4996	9819
CBR Value (%), corrected:	**72**	**95**

TM	November 14, 2018	LH	November 23, 2018
TESTED BY	DATE	CHECKED BY	DATE

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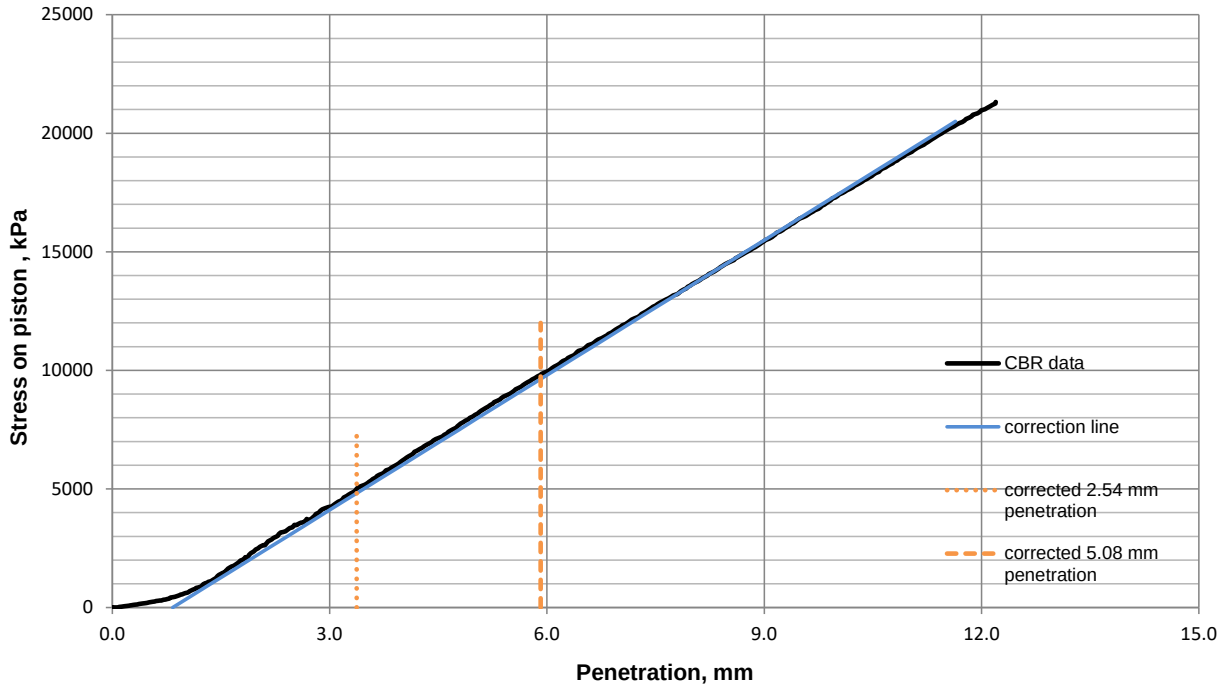
Standard Test Method for California Bearing Ratio (CBR) of Laboratory-Compacted Soils

ASTM D1883

Project No.:	18109666-1000	**Borehole:**	TP18-25
Project:	Ref #017-318	**Sample:**	1
Location:	N/A	**Depth (m):**	2.1 - 2.3
Client:	Telkwa Coal Ltd.	**Lab ID No:**	328

CBR Data



Test Results (corrected)

Penetration	Penetration Stress	CBR Value
3.37 mm	4996 kPa	**72** %
5.91 mm	9819 kPa	**95** %

TM	November 14, 2018	LH	November 23, 2018
TESTED BY	DATE	CHECKED BY	DATE

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GOLDER

Compaction Characteristics of Soil Using Standard Effort (12,000 ft-lbf/ft³ (600 kN-m/m³))

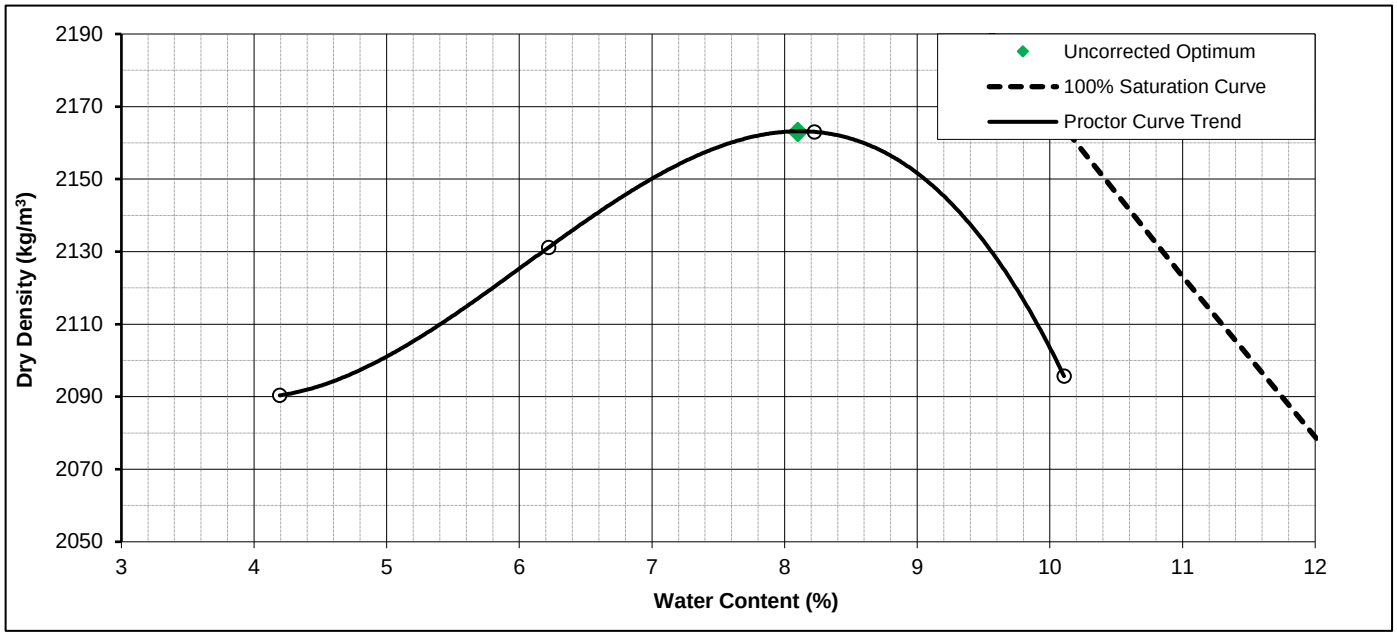
ASTM D698

Project No.:	18109666-1000	**Sample No.:**	1
Project:	Ref #017-318	**Sample Depth (m):**	1.0 - 1.2
Location:	Not Given	**Sample Source:**	TP18-21
Client:	Telkwa Coal Ltd.	**Sampled By:**	HW
Lab ID No:	328	**Date sampled:**	9/28/2018

Effort Type:	Standard	**Preparation Method:**	Dry
Test Method:	C	**As Received w (%):**	2.4
Mold Volume (cm³):	2124	**Visual Description:**	
Type of Rammer:	Manual	**Remarks:**	

ASTM D 4718 - Correction for Oversize Particles			
Oversized Fraction		*Test Fraction*	
Oversized Fraction (%):	23.5	**Max Nominal Size of Test Fraction (mm):**	19
G_{SC} (assumed):	2.77	**G_{SF} (assumed):**	2.77
Water Content, w (%):	1.5	**Water Content, w (%):**	8.1

Compaction Results					
Trial No.:	1	2	3	4	
Dry Density (kg/m³)	2163	2131	2096	2090	
Water Content (%):	8.2	6.2	10.1	4.2	



Final Results			
Uncorrected Optimum w (%):	8.1	**Corrected Optimum w (%):**	**6.5**
Uncorrected Max Dry Density (kg/m³)	2163	**Corrected Max Dry Density (kg/m³)**	**2281**
Uncorrected Max Unit Weight (kN/m³)	21.21	**Corrected Max Unit Weight (kN/m³)**	**22.35**

The test data given herein pertain to the sample provided only. This report constitutes a testing service only.

VN	November 7, 2018	LH	November 9, 2018
TESTED BY	DATE	CHECKED BY	DATE

Golder Associates Ltd.
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Tel: 604-412-6899 Fax: 604-412-6816 www.golder.com

GOLDER

Compaction Characteristics of Soil Using Standard Effort (12,000 ft-lbf/ft³ (600 kN-m/m³))

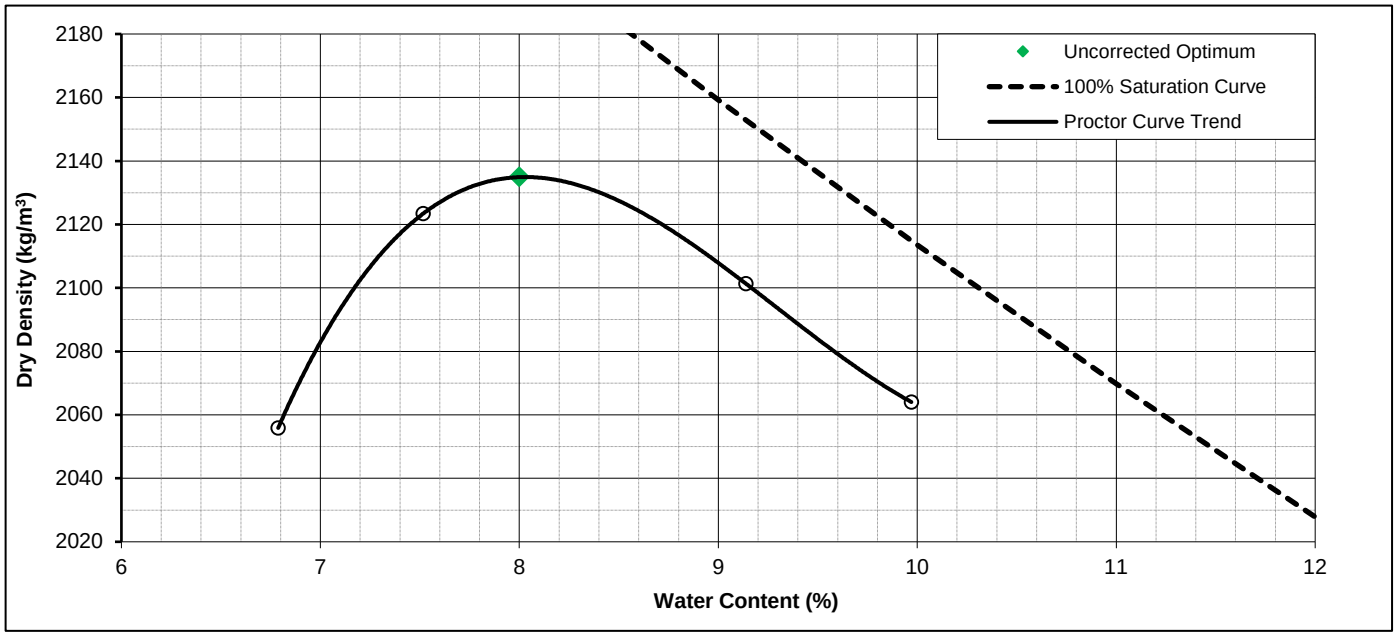
ASTM D698

Project No.:	18109666-1000	**Sample No.:**	1
Project:	Ref #017-318	**Sample Depth (m):**	1.3 - 1.4
Location:	Not Given	**Sample Source:**	TP18-23
Client:	Telkwa Coal Ltd.	**Sampled By:**	HW
Lab ID No:	328	**Date sampled:**	9/28/2018

Effort Type:	Standard	**Preparation Method:**	Dry
Test Method:	C	**As Received w (%):**	2.6
Mold Volume (cm^3):	2124	**Visual Description:**	
Type of Rammer:	Manual	**Remarks:**	

ASTM D 4718 - Correction for Oversize Particles			
Oversized Fraction		*Test Fraction*	
Oversized Fraction (%):	45.9	**Max Nominal Size of Test Fraction (mm):**	19
G_{SC} (assumed):	2.68	**G_{SF} (assumed):**	2.68
Water Content, w (%):	1.5	**Water Content, w (%):**	8.0

Compaction Results					
Trial No.:	1	2	3	4	
Dry Density (kg/m^3)	2064	2123	2056	2101	
Water Content (%):	10.0	7.5	6.8	9.1	



Final Results			
Uncorrected Optimum w (%):	8.0	**Corrected Optimum w (%):**	**5.0**
Uncorrected Max Dry Density (kg/m^3)	2135	**Corrected Max Dry Density (kg/m^3)**	**2355**
Uncorrected Max Unit Weight (kN/m^3)	20.94	**Corrected Max Unit Weight (kN/m^3)**	**23.08**

The test data given herein pertain to the sample provided only. This report constitutes a testing service only.

VN	November 7, 2018	LH	November 9, 2018
TESTED BY	DATE	CHECKED BY	DATE

Golder Associates Ltd.
300, 3811 North Fraser Way, Burnaby, British Columbia, Canada V5J 5J2
Tel: 604-412-6899 Fax: 604-412-6816 www.golder.com

GOLDER

Compaction Characteristics of Soil Using Standard Effort (12,000 ft-lbf/ft³ (600 kN-m/m³))

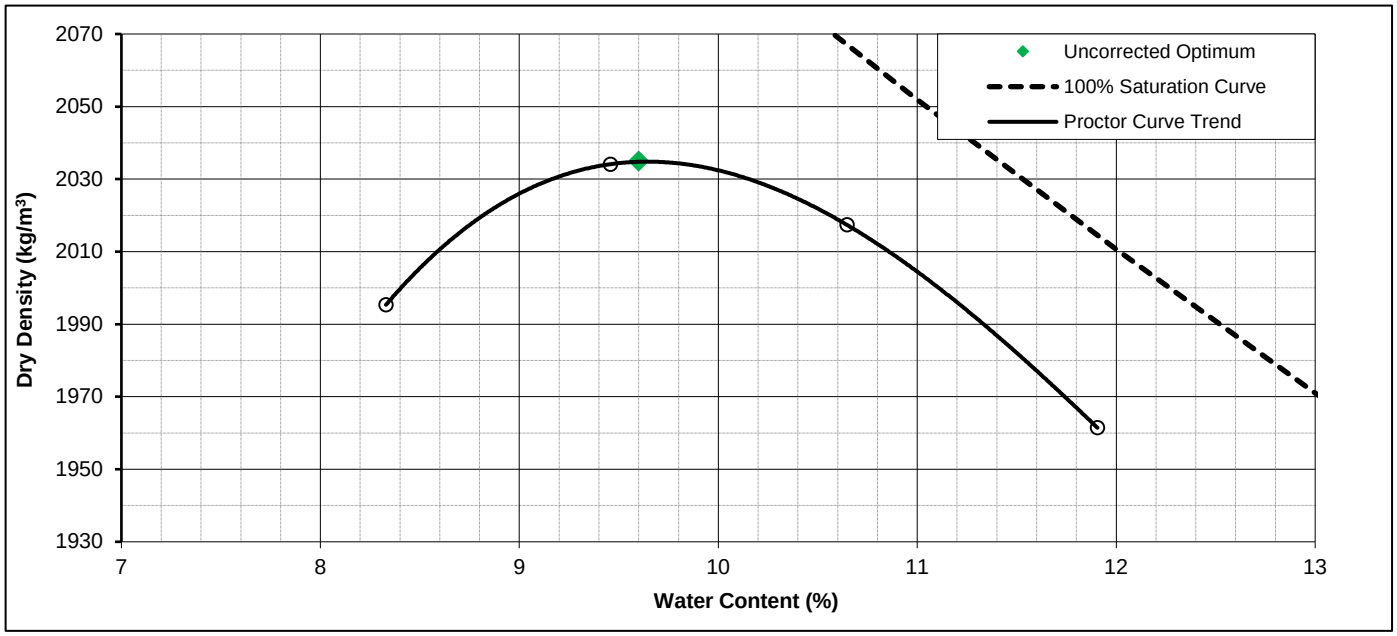
ASTM D698

Project No.:	18109666-1000	**Sample No.:**	2
Project:	Ref #017-318	**Sample Depth (m):**	1.9 - 2.1
Location:	Not Given	**Sample Source:**	TP18-24
Client:	Telkwa Coal Ltd.	**Sampled By:**	HW
Lab ID No:	328	**Date sampled:**	9/28/2018

Effort Type:	Standard	**Preparation Method:**	Dry
Test Method:	C	**As Received w (%):**	2.5
Mold Volume (cm³):	2124	**Visual Description:**	
Type of Rammer:	Manual	**Remarks:**	

ASTM D 4718 - Correction for Oversize Particles			
Oversized Fraction		*Test Fraction*	
Oversized Fraction (%):	28.7	**Max Nominal Size of Test Fraction (mm):**	19
G_{SC} (assumed):	2.65	**G_{SF} (assumed):**	2.65
Water Content, w (%):	1.5	**Water Content, w (%):**	9.6

Compaction Results					
Trial No.:	1	2	3	4	
Dry Density (kg/m³)	1995	2034	1961	2017	
Water Content (%):	8.3	9.5	11.9	10.6	



Final Results			
Uncorrected Optimum w (%):	9.6	**Corrected Optimum w (%):**	**7.3**
Uncorrected Max Dry Density (kg/m³)	2035	**Corrected Max Dry Density (kg/m³)**	**2180**
Uncorrected Max Unit Weight (kN/m³)	19.96	**Corrected Max Unit Weight (kN/m³)**	**21.37**

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VN	November 7, 2018	LH	November 9, 2018
TESTED BY	DATE	CHECKED BY	DATE

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GOLDER

Compaction Characteristics of Soil Using Standard Effort (12,000 ft-lbf/ft³ (600 kN-m/m³))

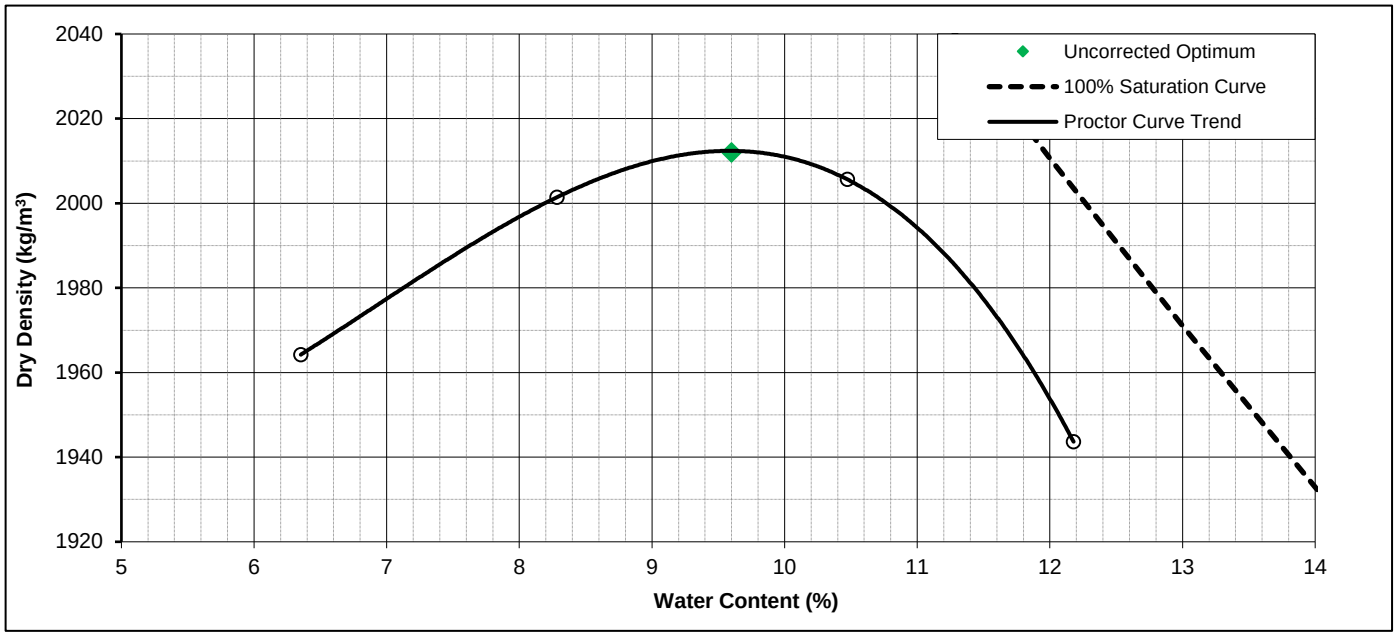
ASTM D698

Project No.:	18109666-1000	**Sample No.:**	1
Project:	Ref #017-318	**Sample Depth (m):**	2.1 - 2.3
Location:	Not Given	**Sample Source:**	TP18-25
Client:	Telkwa Coal Ltd.	**Sampled By:**	HW
Lab ID No:	328	**Date sampled:**	9/30/2018

Effort Type:	Standard	**Preparation Method:**	Dry
Test Method:	C	**As Received w (%):**	2.7
Mold Volume (cm³):	2124	**Visual Description:**	
Type of Rammer:	Manual	**Remarks:**	

ASTM D 4718 - Correction for Oversize Particles			
Oversized Fraction		*Test Fraction*	
Oversized Fraction (%):	19.2	**Max Nominal Size of Test Fraction (mm):**	19
G_{SC} (assumed):	2.65	**G_{SF} (assumed):**	2.65
Water Content, w (%):	1.5	**Water Content, w (%):**	9.6

Compaction Results					
Trial No.:	1	2	3	4	
Dry Density (kg/m³)	2001	2006	1944	1964	
Water Content (%):	8.3	10.5	12.2	6.4	



Final Results			
Uncorrected Optimum w (%):	9.6	**Corrected Optimum w (%):**	**8.0**
Uncorrected Max Dry Density (kg/m³)	2012	**Corrected Max Dry Density (kg/m³)**	**2110**
Uncorrected Max Unit Weight (kN/m³)	19.73	**Corrected Max Unit Weight (kN/m³)**	**20.68**

The test data given herein pertain to the sample provided only. This report constitutes a testing service only.

VN	November 7, 2018	LH	November 8, 2018
TESTED BY	DATE	CHECKED BY	DATE

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GOLDER

RESISTANCE TO DEGRADATION OF SMALL-SIZE COARSE AGGREGATE BY ABRASION & IMPACT IN THE LOS ANGELES MACHINE

ASTM C 131

Client:	Telkwa Coal Ltd.	Project No.:	18109666
Short Title:	Ref #017-318	Phase No.:	1000
Source:	TP18-22	Date sampled:	September 28, 2018
Sample No.:	2	Sampled by:	HW
Depth (m):	1.4 - 1.5	Date Tested:	November 14, 2018
Description:	Gravel & Sand	Tested by:	VN

Grading	**A**
Number of Revolutions	500
Loss After 500 Revolutions (%)	**14.8**

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

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GOLDER ASSOCIATES LTD., 300, 3811 North Fraser Way, Burnaby, BC Canada V5J 5J2 Tel: 604-412-6899 Fax: 604-412-6816

RESISTANCE TO DEGRADATION OF SMALL-SIZE COARSE AGGREGATE BY ABRASION & IMPACT IN THE LOS ANGELES MACHINE

ASTM C 131

Client:	Telkwa Coal Ltd.	Project No.:	18109666
Short Title:	Ref #017-318	Phase No.:	1000
Source:	TP18-23	Date sampled:	September 28, 2018
Sample No.:	2	Sampled by:	HW
Depth (m):	2.6 - 2.7	Date Tested:	November 14, 2018
Description:	Gravel & Sand	Tested by:	VN

Grading	**A**
Number of Revolutions	500
Loss After 500 Revolutions (%)	**14.8**

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

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RESISTANCE TO DEGRADATION OF SMALL-SIZE COARSE AGGREGATE BY ABRASION & IMPACT IN THE LOS ANGELES MACHINE

ASTM C 131

Client:	Telkwa Coal Ltd.	Project No.:	18109666
Short Title:	Ref #017-318	Phase No.:	1000
Source:	TP18-24	Date sampled:	September 28, 2018
Sample No.:	2	Sampled by:	HW
Depth (m):	1.9 - 2.1	Date Tested:	November 14, 2018
Description:	Gravelly sand	Tested by:	VN

Grading	**A**
Number of Revolutions	500
Loss After 500 Revolutions (%)	**14.7**

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

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RESISTANCE TO DEGRADATION OF SMALL-SIZE COARSE AGGREGATE BY ABRASION & IMPACT IN THE LOS ANGELES MACHINE

ASTM C 131

Client:	Telkwa Coal Ltd.	Project No.:	18109666
Short Title:	Ref #017-318	Phase No.:	1000
Source:	TP18-26	Date sampled:	September 30, 2018
Sample No.:	1	Sampled by:	HW
Depth (m):	1.8 - 2.0	Date Tested:	November 14, 2018
Description:	Sand & Gravel	Tested by:	VN

Grading	**A**
Number of Revolutions	500
Loss After 500 Revolutions (%)	**12.6**

Reported by: S. John, AScT

Reviewed by: _____
L. Hu, M. Sc. E., P.Eng.

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GOLDER

SOUNDNESS OF AGGREGATE BY USE OF MAGNESIUM SULFATE

ASTM C 88

Client:	Telkwa Coal Ltd.	Project No.:	18109666
Short Title:	Ref #017-318	Phase No.:	1000
Source:	TP18-21	Date sampled:	September 28, 2018
Sample No.:	1	Sampled by:	HW
Depth (m):	1.0 - 1.2	Date Tested:	November 9 - 16, 2018
Description:	Gravel & Sand	Tested by:	VN

Sieve Fraction (mm)	Original Grading (%)	Mass/Fraction Before Test (g)	No. of particles (+19 mm only)		Loss (%)	Weighted Loss (%)
			Before Test	After Test		
63 × 50 50 × 37.5	12.0	1800.2	9	9	0.0	0.0
37.5 × 25 25 × 19	25.2	1505.0	37	37	0.0	0.0
19 × 12.5 12.5 × 9.5	36.7	1001.4			1.2	0.4
9.5 × 4.75	26.1	300.5			2.2	0.6
	100.0				**TOTAL**	**1.0**

Reported by: S. John, AScT

Reviewed by: _____

L. Hu, M. Sc. E., P.Eng.

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GOLDER

SOUNDNESS OF AGGREGATE BY USE OF MAGNESIUM SULFATE

ASTM C 88

Client:	Telkwa Coal Ltd.	Project No.:	18109666
Short Title:	Ref #017-318	Phase No.:	1000
Source:	TP18-23	Date sampled:	September 30, 2018
Sample No.:	1	Sampled by:	HW
Depth (m):	1.3 - 1.4	Date Tested:	November 9 - 16, 2018
Description:	Gravel & Sand	Tested by:	VN

Sieve Fraction (mm)	Original Grading (%)	Mass/Fraction Before Test (g)	No. of particles (+19 mm only)		Loss (%)	Weighted Loss (%)
			Before Test	After Test		
63 × 50 50 × 37.5	38.3	5038.8	22	22	0.5	0.2
37.5 × 25 25 × 19	29.2	1505.0	36	36	0.1	0.0
19 × 12.5 12.5 × 9.5	18.7	1003.0			0.7	0.1
9.5 × 4.75	13.8	300.7			2.2	0.3
	100.0				**TOTAL**	**0.6**

Reported by: S. John, AScT

Reviewed by: _____

L. Hu, M. Sc. E., P.Eng.

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GOLDER

SOUNDNESS OF AGGREGATE BY USE OF MAGNESIUM SULFATE

ASTM C 88

Client:	Telkwa Coal Ltd.	Project No.:	18109666
Short Title:	Ref #017-318	Phase No.:	1000
Source:	TP18-24	Date sampled:	September 28, 2018
Sample No.:	2	Sampled by:	HW
Depth (m):	1.9 - 2.1	Date Tested:	November 9 - 16, 2018
Description:	Gravelly sand	Tested by:	VN

Sieve Fraction (mm)	Original Grading (%)	Mass/Fraction Before Test (g)	No. of particles (+19 mm only)		Loss (%)	Weighted Loss (%)
			Before Test	After Test		
63 × 50 50 × 37.5	23.6	3793.1	17	17	0.7	0.2
37.5 × 25 25 × 19	27.0	1510.1	41	41	0.1	0.0
19 × 12.5 12.5 × 9.5	29.8	1002.7			1.3	0.4
9.5 × 4.75	19.6	300.2			2.4	0.5
	100.0				**TOTAL**	**1.1**

Reported by: S. John, AScT

Reviewed by: _____
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GOLDER

SOUNDNESS OF AGGREGATE BY USE OF MAGNESIUM SULFATE

ASTM C 88

Client:	Telkwa Coal Ltd.	Project No.:	18109666
Short Title:	Ref #017-318	Phase No.:	1000
Source:	TP18-25	Date sampled:	September 30, 2018
Sample No.:	1	Sampled by:	HW
Depth (m):	2.1 - 2.3	Date Tested:	November 9 - 16, 2018
Description:	Gravel & Sand	Tested by:	VN

Sieve Fraction (mm)	Original Grading (%)	Mass/Fraction Before Test (g)	No. of particles (+19 mm only)		Loss (%)	Weighted Loss (%)
			Before Test	After Test		
63 × 50 50 × 37.5	13.8	1931.2	10	10	0.0	0.0
37.5 × 25 25 × 19	16.8	1509.1	45	44	0.9	0.2
19 × 12.5 12.5 × 9.5	27.2	1001.4			1.3	0.4
9.5 × 4.75	42.2	300.1			1.2	0.5
	100.0				**TOTAL**	**1.1**

Reported by: S. John, AScT

Reviewed by: _____

L. Hu, M. Sc. E., P.Eng.

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