THURBER ENGINEERING LTD.

July 12, 2023 File No.: 37457

McElhanney Ltd.
Suite 500 – 3960 Quadra Street
Victoria, BC V8X 4A3

Attention: Jack McKee, MESc., ENV SP., P.Eng

FRASER VALLEY HIGHWAY 1 CORRIDOR IMPROVEMENTS
ENVIRONMENTAL HABITAT ENHANCEMENTS – BRADNER NORTH & NATHAN CREEK

Dear Jack,

At the request of McElhanney Ltd. (McElhanney), Thurber Engineering Ltd. (Thurber) has completed a geotechnical assessment as part of the above-mentioned project in Abbotsford, BC. This letter outlines our understanding of the project, summarizes the results of our analysis, and provides geotechnical recommendations for detailed design.

It is a condition of this letter that the performance of Thurber's professional services is subject to the attached Statement of Limitations and Conditions.

1. PROJECT UNDERSTANDING

We understand that the British Columbia Ministry of Transportation and Infrastructure (BC MoTI) is planning to complete environmental habitat enhancements as part of the Fraser Valley Highway 1 Corridor Improvement Program. This includes two sites in the Township of Langley identified as Salmon Wetland #1 and #2, and two sites in Abbotsford identified as Bradner North and Nathan Creek. This report includes our assessment of Bradner North and Nathan Creek for McElhanney`s 100% detailed design submission to BC MoTI. The geotechnical assessment of the Salmon Wetland #1 and #2 sites is provided in a separate report.

The Bradner North enhancement area is located north of the existing and planned expansion of the Brader Rest Area. The enhancements include a new channel with side channels connecting the Bradner rest area to an existing channel to the northeast. One access road is proposed from the north side of the planned Bradner rest area expansion to where the new channel connects with the existing channel. A stop log weir structure is also proposed to be installed in the existing channel, approximately 5 m downstream from the connection with the new channel.

The Nathan Creek enhancement area is located northwest of the Highway 1 Bradner Road overpass and has existing access from Bradner Road. The proposed enhancements include a wetland which drains via a new channel following the natural downward grade to the west connecting with Nathan Creek. The combined new channel and Nathan Creek will continue

through the existing access road via a new culvert. A grade raise of the existing road is planned near the installation location of the new culvert. A stop log weir structure is also proposed downstream of the connection of the new channel and Nathan Creek.

Based on drawings for the 50% detailed design submission provided by McElhanney, the existing ground surface elevation at the Bradner North site varies between El. 93 m and El. 101 m, and the Nathan Creek site varies between El. 98 m, and 108 m. The proposed access road embankment slopes are drawn with slope ratios of 3 horizontal units to 1 vertical unit (3H:1V) and the proposed cut slopes for the side channels and the rock lined channel are 3H:1V and 2.5H:1V, respectively. The proposed culvert comprises typical 2800 mm x 1500 mm concrete box sections for a channel length of approximately 18 m including endwalls.

The stop-log weir structures consist of heavy duty composite reinforced lagging supported between a total of four 8x36 H-Piles embedded into the native surficial soil. The piles are shown with a stick-up of roughly 2 m above the bottom of the new channel with the lagging extending 0.9 m above the bottom of the channel. The downstream side of the weir includes 100 kg rip rap riffle with a 4H:1V slope parallel to the direction of the channel.

2. GEOTECHNICAL CONDITIONS

A site-specific geotechnical site investigation was not completed by Thurber for the environmental habitat enhancement areas. However, available geotechnical information as part of the Fraser Valley Highway 1 Corridor Improvement Program was considered sufficient for assessment of the geotechnical components of the detailed design. The degree of understanding for the enhancement areas discussed in Section 3.1 reflects the uncertainty of not completing a geotechnical investigation near the proposed infrastructure.

2.1 Surficial Geology

The Geological Survey of Canada (GSC) surficial geology map for Mission (Map 1485A) indicates both sites are underlain by the Fort Langley Formation (FLc). The specific formation at the sites includes glaciomarine stoney silt to loamy clay 8 m to 100 m thick.

2.2 Existing Geotechnical Information

Thurber completed geotechnical investigations for the functional and detailed design of the Fraser Valley Highway 1 Corridor Improvement Program. Geotechnical information was used from the following reports to infer the soil conditions at the habitat enhancement areas:

- *"Fraser Valley Highway 1 Corridor Improvement Program - 264th Street to Watcom Road Segment 1, Geotechnical Investigation Factual Report"* (2023) by Thurber

- *"Highway 1 – 264 Street to Whatcom Road, WAR#4 – Bradner Road Rest Area Improvements, Geotechnical Report Issued for Tender"* (2023) by Thurber.

The site investigation locations were generally within the Highway 1 right-of-way and the planned extents of the Bradner rest area expansion. The site investigations included test pits, cone penetration tests (CPTS), and solid stem auger, mud rotary and sonic test holes. The maximum depth of the investigation near the Bradner North site was 12 m below ground surface (Approximately El. 89 m) and near the Nathan Creek site the maximum depth was 30 m (Approximately El. 96 m).

The results of the geotechnical investigations considered relevant for the interpretation of the Bradner North and Nathan Creek enhancement areas are presented on the attached logs and CPT profiles. The logs provide detailed descriptions of the soil and groundwater conditions encountered near the Bradner rest area and Highway 1 Bradner Road overpass and should be used in preference to the generalized descriptions provided below. The following section provides a description of the inferred soil conditions at the sites for discussion related to the proposed enhancement area infrastructure.

2.3 Soil and Groundwater Conditions

2.3.1 Bradner North Enhancement Area

The soil conditions at the Bradner North site are inferred to comprise organic silt overlying silty clay to depths greater than 12 m. The depth to more dense, competent soil is unknown based on the available geotechnical information and is not expected to influence the design of the enhancement area.

The test holes and test pits completed for the Bradner rest area expansion indicate that the organic silt layer is soft and approximately 0.5 m to 0.9 m thick. Considering the proximity of these holes to the planned enhancement area, similar thicknesses of this layer can be assumed for the enhancement area. The water content of the organic silt ranges from 58% to 78%.

The underlying silty clay is considered stiff to very stiff with interpreted undrained shear strengths between 75 kPa to 100 kPa. The water content of this layer ranges from 21% to 27%. Atterberg limit testing indicates liquid limits between 31% to 33%, and plastic limits between 18% to 21%.

Groundwater level observations for the Bradner rest area expansion measure the water level between surface and a depth of 1.8 m. These measurements have been inferred to represent a perched groundwater table at the site that is expected to fluctuate seasonally. In general, the provided winter and summer average, and 2-year water surface elevations were used to guide

the geotechnical analysis for drained conditions and assumed groundwater table depth of 1 m was used for undrained conditions.

2.3.2 Nathan Creek Enhancement Area

The test holes for interpretation of the Nathan Creek site were generally located within the Highway 1 right-of-way where stripping is presumed to have been completed before placement of fill. Therefore, organic soils were not observed either at ground surface or underlying the fill materials at these locations. However, at the Nathan Creek site, it has been inferred that the soil conditions comprise organic soils overlying silty clay and thick, alternating layers of silt and sand.

The silty clay is assumed to be stiff near ground surface with consistency increasing with depth to very stiff. Similar to the Bradner North site, the undrained shear strengths have been assumed between 75 kPa to 100 kPa, even though interpretation from the CPTs and attempted vane shear tests (VST) closer to the Bradner Road Overpass indicate the undrained shear strengths likely exceed 100 kPa. Water contents ranged between 17% and 32% and Atterberg testing results indicate liquid limits between 27% and 36% and plastic limits between 17% and 26% for this layer.

Alternating layers of sand and silt were encountered at a depth of 16 m (Approximately El. 96 m) at TH21-04 in the westbound right-of-way of Highway 1. The alternating layers were up to 3 m thick and continued to the maximum depth of the test hole. Varying amounts of gravel were observed in the sand layers. The beginning of a sand layer was also observed at the same elevation near the termination depth of TH22-SEG1-47. The sand is considered dense based on standard penetration test (SPT) results. Depending on the extent of these sand layers, it is possible that dense gravelly sand could be encountered a few meters below ground surface near the end of the new channel where the stop-log weir structure and box culvert are planned.

3. GEOTECHNICAL ANALYSIS

3.1 Design Criteria

Consistent with the BC MoTI Geotechnical Design Criteria (Technical Circular T-04-17), the geotechnical analysis was completed with consideration of the following design guides and codes:

- Canadian Highway Design Bridge Code (CSA-S6-19)
- BC MoTI Supplement to CSA-S6-19
- BC MoTI Pavement Structure Design Guidelines (Technical Circular T-01/15)
- Canadian Foundation Engineering Manual (4th Ed., 2006)

Given the distance to available geotechnical site investigation information, a “Low” degree of understanding was used for analysis and design. A “Typical” consequence factor was applied for

the design of the access roads. The use of a “Low” consequence factor was considered for the cut slopes where nearby infrastructure or roads are unlikely to be affected. We consider this appropriate for the project intent of re-establishing more natural terrain where minor sloughing of slopes are not likely to affect the function of the habitat enhancement area and can be repaired if needed. McElhanney should confirm with BC MoTI if the use of a “Low” consequence is considered acceptable for this circumstance.

As directed by McElhanney, seismic loading on the proposed access roads, cut slopes and culvert were not included in our geotechnical analysis.

3.2 Slope Stability

The slope stability of the proposed access road and channel cut slopes was assessed using the limit equilibrium analysis software Slide2 (Build 9.023) by Rocscience Inc. The estimated geotechnical soil parameters used in the analysis for drained and undrained conditions are summarized in Table 1. Where applicable, a surcharge load of 16 kPa was included to represent construction and maintenance equipment traffic.

Table 1: Estimated soil parameters for slope stability analysis

Material Name	Unit Weight (kN/m^3)	Friction Angle (degrees)	Undrained Shear Strength (kPa)
Granular Fill	20	38	-
Silty Clay	19	30	75
Rip Rap	22	45	-

The target factors of safety (FOS) for global stability given the degree of understanding and consequence factors are summarized in Table 2 (BC MoTI Supplement to CSA-S6-19 Table 6.2B). The permanent FOS was considered applicable for drained conditions and the temporary FOS was considered applicable for undrained conditions.

Table 2: Factors of Safety for Global Stability (BC MoTI Supplement to CSA-S6-19)

Factor of Safety for Global Stability	Degree of Understanding	
	Low	
	Consequence Factor	
	Typical	Low
Permanent (Drained)	1.67	1.45
Temporary (Undrained)	1.43	1.24

3.3 Settlement Analysis

Settlement analysis of the proposed access road and culvert was completed using the software Settle3 (Build 5.020) by Rocscience Inc. The estimated primary and secondary consolidation parameters used in the analysis are summarized in Table 3. These parameters were based on 1D consolidation test results from the Fraser Valley Highway 1 Corridor Improvement Program - 264th Street to Watcom Road Segment 1. The analysis was completed assuming steady state conditions (i.e. time-dependent parameters were not included) for estimating long-term settlement magnitudes.

Table 3: Estimated geotechnical parameters for settlement analysis

Material Name	Unit Weight (kN/m^3)	Comp. Index (Cc)	Recomp. Index (Cr)	Initial Void Ratio (e_o)	OCM[1] (kPa)	Secondary Consolidation Ratio (Cα/Cc)
Silty Clay	19	0.23	0.03	0.8	200	0.035

Note: 1) Overconsolication Magnitude

The access roads and concrete box culvert were applied as surcharge loads at ground surface and the channel bottom elevation, respectively. The access road surcharge was estimated assuming a soil unit weight of 20 kN/m^3 and the maximum height of the fill provided on the 50% detailed design drawings. The concrete box culvert self-weight was estimated based on values for typical sections provided by local manufacturers.

3.4 Lateral Resistance of Piles

The lateral resistance of the proposed piles for the stop-log weir structures was completed using the software RSPile (Build 3.018) by RocScience Inc. The non-linear load (p) versus deflection (y) curves applied to the soil were based on an undrained shear strength of 75 kPa and associated default strain factors recommended in the RSPile manual by RocScience.

The estimated force per pile for the analysis was estimated based on the hydrostatic force applied over the height stop-log lagging and evenly distributed to the appropriate number of piles. Given a “Low” degree of understanding for the site, geotechnical resistance factors of 0.45 and 0.7 were used for analysis of the lateral resistance and lateral deflection, respectively.

4. GEOTECHNICAL DISCUSSION AND RECOMMENDATIONS

4.1 Cut Material Reuse as Fill

The in situ water content of the native silty clay is expected to be between 20% and 30%. These water contents are likely much higher than the optimum water content required for adequate compaction. Given the moisture sensitivity of this material and the challenges associated with drying and maintaining the material for reuse, we do not recommend the reuse of the excavated silty clay for access road embankment construction. However, if the contractor can dry the material within 2% of the optimum water content, it could potentially be used for berms less than 1.5 m high planned along the parts of the new channel.

4.2 Access Roads

4.2.1 Bradner North Enhancement Area

The subgrade of the access roads should be stripped of vegetation, topsoil and organic material to expose the stiff silty clay. The exposed subgrade is expected to be susceptible to disturbance from rain and construction traffic. Therefore, we recommend limiting construction traffic on the subgrade and considering placement of fill shortly after stripping activities.

All embankments should be constructed in accordance with BC MoTI standard specifications. The access road fill below the proposed pavement structure should comprise well-graded granular material such as 75 mm minus pit run sand and gravel. The fill should be placed in 200 mm maximum thick loose lifts and compacted to 95% standard Proctor maximum dry density (SPMDD).

We understand the typical section for a Type C or Type D Pavement Structure is considered appropriate for the expected maintenance traffic and site conditions. Given the expected silty clay (CL) subgrade at Bradner North, the select granular subbase (SGSB) layer should be a minimum of 300 mm thick. Where access road fill is not required to reach final grades with the proposed pavement structure, a non-woven geotextile should be placed as a separator between the SGSB layer and the silty clay subgrade. Based on the results of the slope stability analysis, access road embankment slope angles of 3H:1V or flatter are considered appropriate.

Immediate settlement of the access road is expected during construction but will likely not have significant effects on the final grade. Consolidation settlement of the compressible silty clay should be considered in the design and function of the access road. Consolidation settlement due to the self-weight of the road is estimated to be in the range of 25 mm to 50 mm, where fill heights are between 0.75 m and 1.5 m. Due to the variability in existing ground elevations along the access

road and the uncertainty regarding the site conditions, there is a potential for differential settlement along the access road alignment. A graded aggregate seal (GAS) or high fines gravel surface (HFSA) are considered suitable for accommodating the estimated settlement. Surface regrading may be required as future maintenance.

4.2.2 Nathan Creek Enhancement Area

The access road grade raise near the proposed culvert is expected to require surface preparation depending on the type of road surfacing and quality of the existing road embankment fill. In general, the road surface should be stripped of organic, loose and deleterious material before placement of access road fill or pavement structure materials. Further subexcavation may be required if unsuitable soils are encountered.

The access road fill and typical pavement structure recommendations for the Bradner North site are also considered applicable for the Nathan Creek site. If the access road comprises suitable coarse-grained material for subgrade, the SGSB pavement layer can be reduced to 150 mm thick. The consolidation settlement estimates for the Bradner North site are also considered applicable for the Nathan Creek site.

4.3 Cut Slopes

The cut slopes in the Bradner North and Nathan Creek habitat enhancement areas have been divided into two typical sections. The first typical section is the rock-lined channel which includes 2.5H:1V cut slopes up to 3 m high and lined with 450 mm of 25 kg rip rap. The minimum factor of safety for this typical section was 1.46.

The second typical section is the side channel with optional spawning gravel which includes 3H:1V cut slopes up to 5 m high and partially lined with 200 mm of round rock. The optional spawning gravel is proposed to be 500 mm thick and extend across the base of the channel only. The minimum factor of safety for this typical section was 1.47.

The slope stability analysis results meet the required factors of safety for permanent conditions with a “Low” degree of understanding and a “Low” consequence factor. Generally, further flattening the slopes improves the factor of safety. It should be noted that a minimum 2.5H:1V slope along the channel profile should also be maintained where the typical rock-lined channel section is being constructed.

4.4 Concrete Box Culvert and Endwalls

The subgrade for the concrete box culvert and endwall is expected to comprise the stiff silty clay. We recommend the placement of a granular working pad over the subgrade for construction of

the culvert and endwall. The recommended working pad specifications will depend on the amount of seepage entering the excavation.

If the excavation is relatively dry, the subgrade should be subexcavated and replaced with a minimum of 300 mm of well-graded sand and gravel. If the excavation is wet and the subgrade is easily disturbed, we recommend subexcavating and placing a minimum of 300 mm clear crush gravel fully wrapped with a non-woven geotextile. In both cases, the working pad should be compacted with light compaction equipment such as a 200 lb plate tamper only until the material "locks up". Over compaction could result in reduced density of the working pad and underlying subgrade. Deeper subexcavation typically develops more challenges in wet excavation conditions, and therefore subexcavation should not exceed 600 mm.

Provided that the subgrade and working pad are prepared as described above and the base of the culvert and endwalls are embedded a minimum of 0.5 m below the channel bottom, a factored bearing resistance 150 kPa is considered suitable for the ultimate limit state (ULS). A geotechnical resistance factor of 0.45 was used for "Low" degree of understanding. Assuming a target elastic settlement of approximately 15 mm, a bearing resistance of 100 kPa is considered suitable for the serviceability limit state (SLS).

Total consolidation settlement estimated at the base of the box culvert and endwalls is expected to be in the range of 25 mm to 50 mm. This settlement is expected to be relatively uniform along the culvert alignment due to the locations of the heavier loading from the endwalls and the load contribution from the access road in the middle of the alignment. If the magnitude of settlement exceeds the tolerances of the structural or functional aspects of the box culvert, preloading could potentially be used to mitigate the amount of settlement. However, preloading was not included in our assessment.

Backfill around the culvert and endwalls should comprise well-graded granular material (e.g. 75 mm minus pit run sand and gravel) placed in 200 mm thick lifts and compacted to 95% SPMDD.

4.5 Stop-Log Weir Structure

The HP 8x36 piles for the stop-log weir structure are considered suitable for resistance of hydrostatic loads. The piles should be installed with a minimum toe embedment of 4 m below the channel bottom to develop the required geotechnical resistance. Given this embedment, the lateral deflection of the pile head with a 2 m stick-up above the channel bottom is estimated to be less than 25 mm.

The piles can be installed using vibratory or impact driving methods. The proposed installation method and equipment should be reviewed with the contractor prior to mobilization. There is a possibility that the dense sand layer observed near the highway (TH22-SEG1-47) could also be present near the lower surface elevations of the Nathan Creek site where the stop-log weir is planned. Encountering this layer could result in early refusal of the piles during installation. The contractor should provide alternative options for installation to the minimum toe embedment if this occurs.

4.6 Construction Review

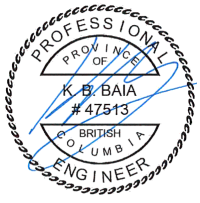
During construction, Thurber should be given the opportunity to review the exposed subgrade for the access roads, concrete box culvert and endwalls to confirm our design assumptions before placement of fill or geotextile. If required, Thurber can also provide review of imported material proctor, gradation and density test results completed by others.

5. CLOSURE

We trust this information meets your current needs. If you have any questions, please contact the undersigned at your convenience.

Yours truly,
Thurber Engineering Ltd.
Paul Evans, M.Eng., P.Eng.
Review Principal

Thurber Engineering Ltd.
Permit to Practice #1001319



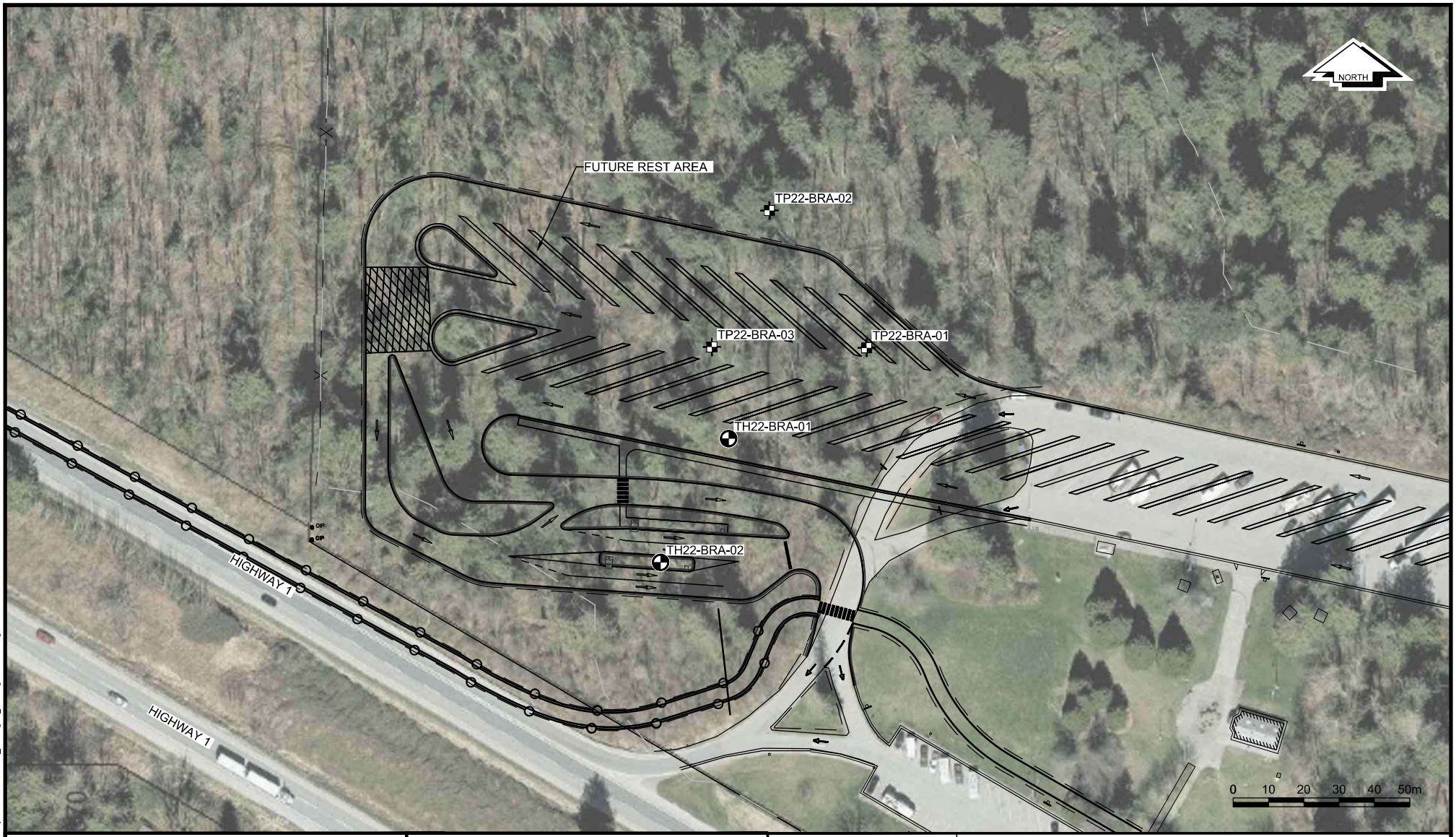
2023-07-12

Kurt Baia, M.Eng., P.Eng.
Geotechnical Engineer

Attachment

- Statement of Limitations and Conditions
- Highway 1 – 264th Street to Watcom Road Site Investigation Results
- Slope Stability Analysis Outputs

Plotted: June 20, 2022



LEGEND:

- AUGER HOLE
- TEST PIT

NOTES:

1. AERIAL IMAGE TAKEN FROM ABBOTSFORD MAP VIEWER.
2. INVESTIGATION LOCATIONS ARE APPROXIMATE.
3. FUTURE REST AREA TAKEN FROM "GEOMLANE-BRADNER_RA_ALTERNATIVE.DWG".
4. EXISTING REST AREA AND SAMPLING LOCATIONS BASEPLAN TAKEN FROM CAD FILE "SURVBASE_COG-2D.DWG." BY ISL ENGINEERING.

THURBER ENGINEERING LTD.

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE

INVESTIGATION LOCATION PLAN

BRADNER ROAD REST AREA — ABBOTSFORD, BC

DESIGNED	DRAWN	APPROVED	DATE	SCALE	PROJECT No.	DWG. NO.	REV.
REM	MOM		JUNE 20, 2022	1:1000	32079-20 - 1		0

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SUMMARY LOG

Drill Hole #: **TH22-BRA-01**

Ministry of Transportation and Infrastructure

Project: **Bradner Road Rest Area**

Location: Abbotsford, BC

Prepared by: 32079 Thurber Engineering Ltd.

Logged by: RM Reviewed by:

Datum: UTM-Nad-83 Alignment:

Northing/Easting: 5436563.76 , 541182.35 Station/Offset:

Elevation: *Coordinates Surveyed*

Date(s) Drilled: March 3, 2022

Company: On-Track Drilling Inc.

Driller: Andrew

Drill Make/Model: Track

Drilling Method: Solid Stem Auger

DEPTH (m)	DRILLING DETAILS	Pocket Penetrometer / Shear Strength (kPa) 100 200 300 400; SPT "N" (BLOWS/300 mm); Wp% 20 W% 40 60 WL% 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate {G % S % F %}	DEPTH (m)
0		68.9		1			OH - ORGANIC SILT, some sand, trace rootlets, dark brown, soft.	OH		0
							0.46m			
1		20.5		2			CL - SILTY CLAY, some sand, grey-brown-orange, very stiff to hard.	CL	**Atterberg** (Sa#2): PL:20% LL:31%	1
									Water level estimated at 0.0 m depth from VWP127422 read on March 31, 2022	
							1.52m			
2		24.6		3			CL - SILTY CLAY, trace sand, trace gravel, grey-orange-brown, hard.	CL		2
		23.7		4			- very stiff below 2.5 m depth	CL		
3										3
4		22.9		5			- stiff, occasional pockets of sand at 3.7 m depth	CL	**Atterberg** (Sa#5): PL:20% LL:33%	4
5							- blue-grey below 4.9 m depth			5
		25.3		6				CL	**Atterberg** (Sa#6): PL:18% LL:33%	
6										6
7		23.9		7			- very stiff below 6.7 m depth	CL		7
8		23.8		8				CL		8
9							9.14m			9
							End of hole at required depth. Hole open to 5.8 m depth. Water observed at 2.7 m depth upon completion of test hole. Vibrating Wire Piezometer VW127422 installed at 6.8 m depth.			
10										10
10.5										

Legend Sample Type: A-Auger; B-Becker; C-Core; G-Grab; V-Vane; L#-Lab Sample; S-Split Spoon; O-Odex (air rotary); W-Wash (mud return); T-Shelby Tube

Legend Installation: Sand; Grout; Cement; Bentonite; Drill Cuttings; Slotted; Slough; Piezometer

Final Depth of Hole: 9.1 m

Depth to Top of Rock:

MOTI-SOIL-REV3 32079_BRADNER.GPJ MOTI_DATATEMPLATE_REV3.GDT 22-10-21

BRITISH COLUMBIA — Ministry of Transportation and Infrastructure

SUMMARY LOG

Drill Hole #: **TH22-BRA-02**

Project: **Bradner Road Rest Area**

Location: Abbotsford, BC

Prepared by: 32079 Thurber Engineering Ltd.

Logged by: MJCM Reviewed by:

Datum: UTM-Nad-83 Alignment:

Northing/Easting: 5436529 , 5411163 Station/Offset:

Elevation: *Coordinates taken with GPS*

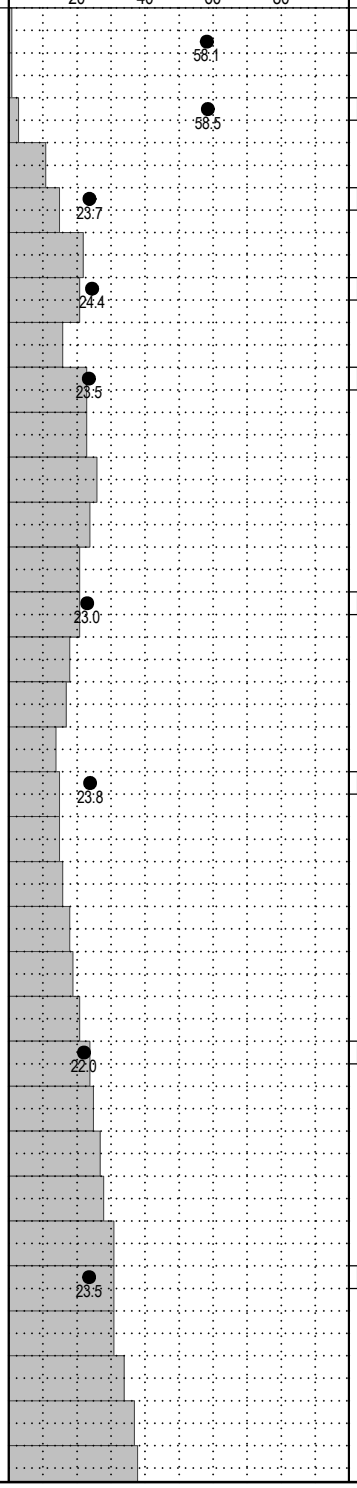
Date(s) Drilled: May 24, 2022

Company: On-Track Drilling Inc.

Driller: Andrew

Drill Make/Model: Track

Drilling Method: Solid Stem Auger / DCPT



DEPTH (m)	DRILLING DETAILS	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate *{G % S % F %}*	DEPTH (m)
0			1			OH - ORGANIC SILT, trace clay, trace sand, brown with pockets of orange mottling, soft to very soft.	OH		0
			2				OH		
1						0.91m CL - SILTY CLAY, trace sand, trace organics, grey-brown with brown-orange staining, very stiff to stiff.			1
			3				CL		
2	1.8m		4				CL	Water level estimated at 1.8 m depth from VWP138746 read on June 3, 2022	2
			5				CL		
3									3
4			6				CL		4
						4.57m CL - SILTY CLAY, trace gravel, grey, very stiff to stiff.			
5			7				CL		5
6						- very stiff below 6.1 m depth			6
7			8				CL		7
8						- hard below 8.3 m depth			8
9			9				CL		9
10									

Legend Sample Type: A-Auger; B-Becker; C-Core; G-Grab; V-Vane; L#-Lab Sample; S-Split Spoon; O-Odex (air rotary); W-Wash (mud return); T-Shelby Tube

Legend Installation: Sand; Grout; Cement; Bentonite; Drill Cuttings; Slotted; Slough; Piezometer

Final Depth of Hole: 12.2 m

Depth to Top of Rock:

MOTI-SOIL-REV3 32079_BRADNER.GPJ MOTI_DATATEMPLATE_REV3.GDT 22-10-21

Ministry of Transportation and Infrastructure

SUMMARY LOG

Drill Hole #: **TH22-BRA-02**

Project: **Bradner Road Rest Area**

Location: Abbotsford, BC

Prepared by: 32079 Thurber Engineering Ltd.

Logged by: MJCM Reviewed by:

Datum: UTM-Nad-83 Alignment:

Northing/Easting: 5436529 , 5411163 Station/Offset:

Elevation: *Coordinates taken with GPS*

Date(s) Drilled: May 24, 2022

Company: On-Track Drilling Inc.

Driller: Andrew

Drill Make/Model: Track

Drilling Method: Solid Stem Auger / DCPT

DEPTH (m)	DRILLING DETAILS	Pocket Penetrometer / Shear Strength (kPa) 100 200 300 400; SPT "N" (BLOWS/300 mm); Wp% 20 W% 40 60 WL% 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate {G % S % F %}	DEPTH (m)
10		23.1		10			CL - SILTY CLAY, trace gravel, grey, very stiff to stiff. *(continued)*	CL		10
11										11
		23.3		11				CL		
12							12.19m			12
							End of hole at required depth. Hole open to 11.1 m depth. Vibrating Wire Piezometer VW138746 installed at 6.1 m depth.			
13										13
14										14
15										15
16										16
17										17
18										18
19										19
20										

Legend Sample Type: A-Auger; B-Becker; C-Core; G-Grab; V-Vane; L#-Lab Sample; S-Split Spoon; O-Odex (air rotary); W-Wash (mud return); T-Shelby Tube

Legend Installation: Sand; Grout; Cement; Bentonite; Drill Cuttings; Slotted; Slough; Piezometer

Final Depth of Hole: 12.2 m

Depth to Top of Rock:

MOTI-SOIL-REV3 32079_BRADNER.GPJ MOTI_DATATEMPLATE_REV3.GDT 22-10-21

TEST PIT LOG

Test Pit #: **TP22-BRA-01**

Ministry of Transportation and Infrastructure

Project: **Bradner Road Rest Area**

Location: Abbotsford, BC

Date(s) Drilled: March 2, 2022

Company: On-Track Drilling Inc.

Operator: Troy

Excavator: Excavator

Prepared by: 32079
Thurber Engineering Ltd.

Logged by: RM Reviewed by:

Datum: UTM-Nad-83 Alignment:

Northing/Easting: 5436589.46 , 541221.45 Station/Offset:

Elevation: *Coordinates Surveyed*

DEPTH (m)	DRILLING DETAILS	Pocket Penetrometer / Shear Strength (kPa) 100 200 300 400; SPT "N" (BLOWS/300 mm); Wp% 20 W% 40 60 WL% 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate *{G % S % F %}*	DEPTH (m)
0		62.0		1			OH - ORGANIC SILT, some sand, trace rootlets, dark brown, soft.	OH		0
0.91m										
1							CL - SILTY CLAY, trace sand, trace brown staining, grey-brown, stiff to hard.		Difficult digging with excavator below 1.5 m depth	1
2		21.0 ×		2				CL		2
2.5m							End of test pit at required depth. Test pit open to 2.5 m depth. Seepage observed at 0.9 m depth during excavation.			
3										3
4										4
5										5
6										6
7										7
8										8
9										9
10										

Legend Sample Type: A-Auger; B-Becker; C-Core; G-Grab; V-Vane; L#-Lab Sample; S-Split Spoon; O-Odex (air rotary); W-Wash (mud return); T-Shelby Tube

Legend Installation: Sand; Grout; Cement; Bentonite; Drill Cuttings; Slotted; Slough; Piezometer

Final Depth of Hole: 2.1 m

Depth to Top of Rock:

MOTI-SOIL-REV3 32079_BRADNER.GPJ MOTI_DATATEMPLATE_REV3.GDT 22-10-21

TEST PIT LOG

Test Pit #: **TP22-BRA-02**

Ministry of Transportation and Infrastructure

Project: **Bradner Road Rest Area**

Location: Abbotsford, BC

Date(s) Drilled: March 2, 2022

Company: On-Track Drilling Inc.

Operator: Troy

Excavator: Excavator

Prepared by: 32079 Thurber Engineering Ltd.

Logged by: RM Reviewed by:

Datum: UTM-Nad-83 Alignment:

Northing/Easting: 5436628.36 , 541193.91 Station/Offset:

Elevation: *Coordinates Surveyed*

DEPTH (m)	DRILLING DETAILS	Pocket Penetrometer / Shear Strength (kPa) 100 200 300 400; SPT "N" (BLOWS/300 mm); Wp% 20 W% 40 60 WL% 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate *{G % S % F %}*	DEPTH (m)
0		78.2		1			OH - ORGANIC SILT, some sand, trace rootlets, dark brown, soft.	OH		0
							0.61m			
1							CL - SILTY CLAY, some sand, grey, stiff to hard.		Difficult digging with excavator	1
2		22.4 ×		2				CL		2
							2.29m			
3							End of test pit at required depth. Test pit open to 2.3 m depth. Seepage observed at 0.6 m depth during excavation.			3
4										4
5										5
6										6
7										7
8										8
9										9
10										

Legend Sample Type: **A**-Auger, **B**-Becker, **C**-Core, **G**-Grab, **V**-Vane, **L#**-Lab Sample, **S**-Split Spoon, **O**-Odex (air rotary), **W**-Wash (mud return), **T**-Shelby Tube

Legend Installation: Sand, Grout, Cement, Bentonite, Drill Cuttings, Slotted, Slough, Piezometer

Final Depth of Hole: 2.1 m

Depth to Top of Rock:

MOTI-SOIL-REV3 32079_BRADNER.GPJ MOTI_DATATEMPLATE_REV3.GDT 22-10-21

TEST PIT LOG

Ministry of Transportation and Infrastructure

Test Pit #: **TP22-BRA-03**

Project: **Bradner Road Rest Area**

Location: Abbotsford, BC

Date(s) Drilled: March 2, 2022

Company: On-Track Drilling Inc.

Operator: Troy

Excavator: Excavator

Prepared by: 32079 Thurber Engineering Ltd.

Logged by: RM Reviewed by:

Datum: UTM-Nad-83 Alignment:

Northing/Easting: 5436589.73 , 541177.6 Station/Offset:

Elevation: *Coordinates Surveyed*

DEPTH (m)	DRILLING DETAILS	Pocket Penetrometer / Shear Strength (kPa) 100 200 300 400; SPT "N" (BLOWS/300 mm); Wp% 20 W% 40 60 WL% 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate *{G % S % F %}*	DEPTH (m)
0		73.4		1			OH - ORGANIC SILT, some sand, trace rootlets, dark brown, soft.	OH		0
							0.76m			
1							CL - SILTY CLAY, some sand, grey, stiff to hard.		Difficult digging with excavator	1
		27.1		2				CL	**Atterberg** (Sa#2): PL:21% LL:31%	
2							2.29m			2
							End of test pit at required depth. Test pit open to 0.8 m depth. Seepage observed at 0.8 m depth during excavation.			
3										3
4										4
5										5
6										6
7										7
8										8
9										9
10										

Legend Sample Type: A-Auger; B-Becker; C-Core; G-Grab; V-Vane; L#-Lab Sample; S-Split Spoon; O-Odex (air rotary); W-Wash (mud return); T-Shelby Tube

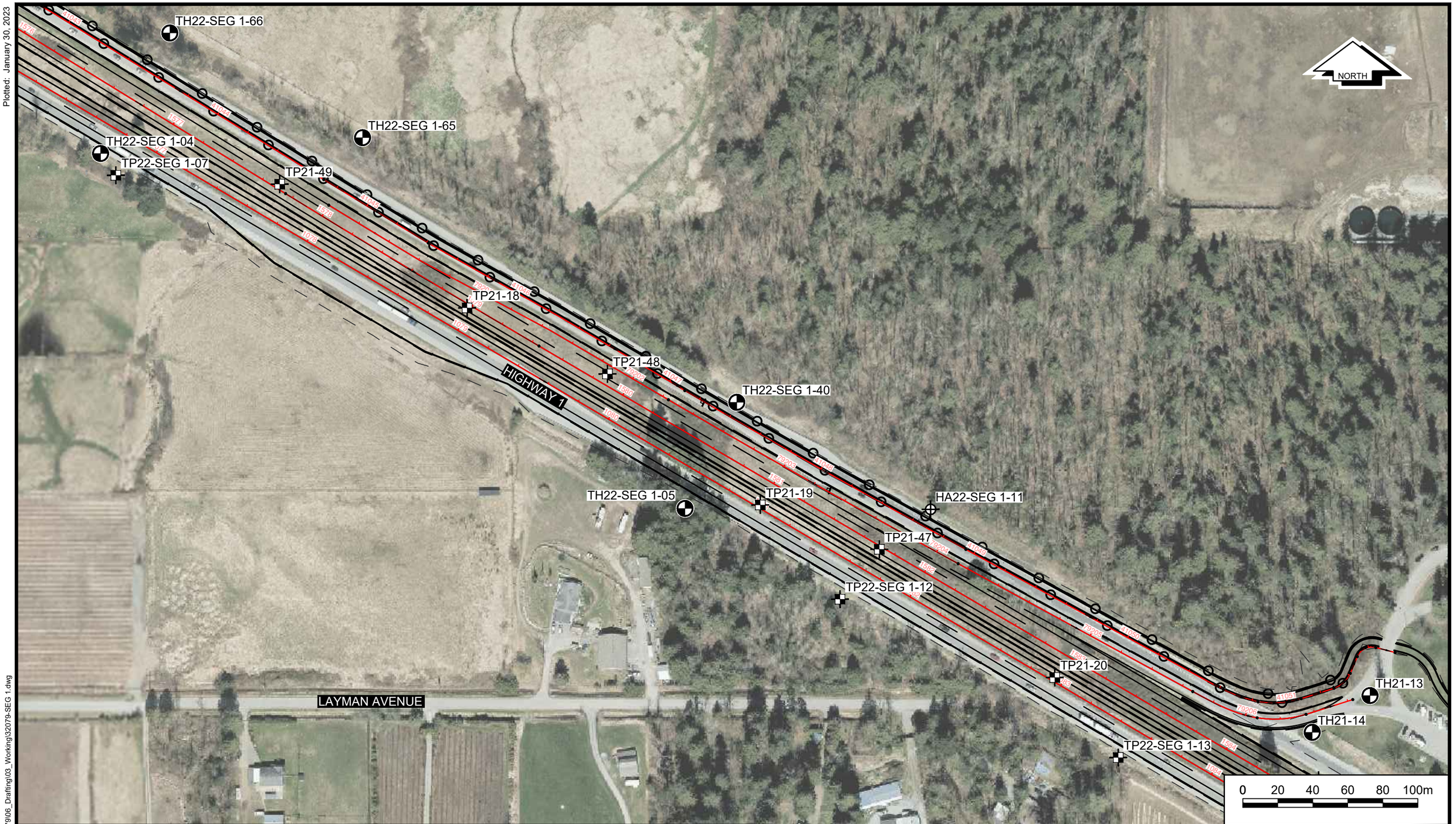
Legend Installation: Sand; Grout; Cement; Bentonite; Drill Cuttings; Slotted; Slough; Piezometer

Final Depth of Hole: 2.1 m

Depth to Top of Rock:

MOTI-SOIL-REV3 32079_BRADNER.GPJ MOTI_DATATEMPLATE_REV3.GDT 22-10-21

Plotted: January 30, 2023



LEGEND:

- TEST HOLE (SOLID STEM AUGER)
- TEST HOLE (MUD ROTARY)
- TEST HOLE (SONIC)
- TEST HOLE (HAND AUGER)
- TEST PIT
- CPT / SCPT

NOTES:

1. AERIAL MAGE TAKEN FROM THE CITY OF ABBOTSFORD MAPPING SITE.
2. INVESTIGATION LOCATIONS ARE APPROXIMATE .
3. BASE PLAN TAKEN FROM "GEOMLANE_264BRADNR.DWG" PROVIDED BY ASSOCIATED ENGINEERING.

THURBER ENGINEERING LTD.

MINISTRY OF TRANSPORTATION AND INFRASTUCTURE

INVESTIGATION LOCATION PLAN

FRASER VALLEY HIGHWAY 1
CORRIDOR IMPROVEMENT

LANGLEY AND ABBOTSFORD, BC

DESIGNED	DRAWN	APPROVED	DATE	SCALE	PROJECT No.	DWG. NO.	REV.
ANR	MOM		JAN. 30, 2023	1:2000	32079 - **SEG 1-10**	0	

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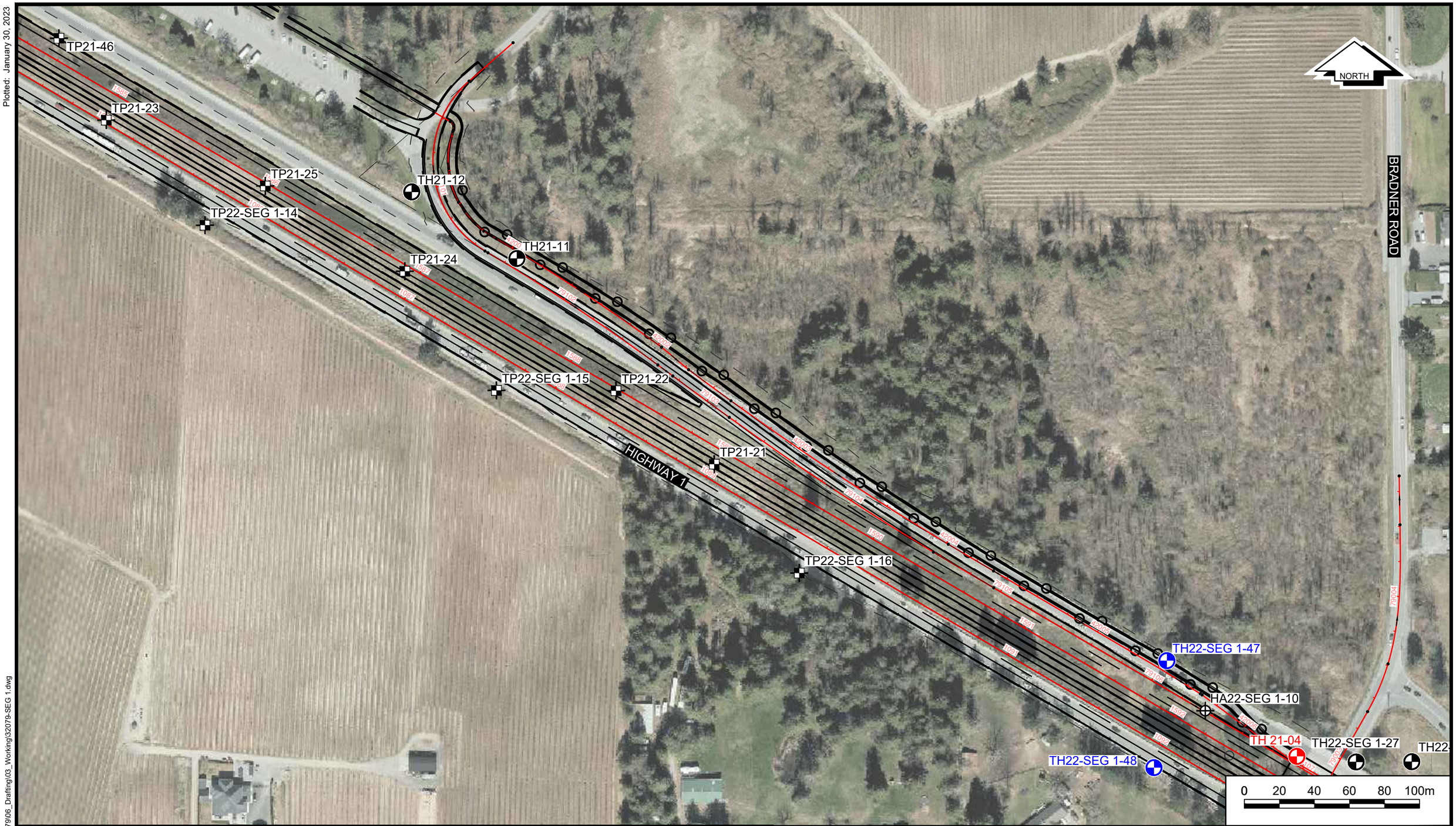
Plotted: January 30, 2023



LEGEND:

- TEST HOLE (SOLID STEM AUGER)
- TEST HOLE (MUD ROTARY)
- TEST HOLE (SONIC)
- TEST HOLE (HAND AUGER)
- TEST PIT
- CPT / SCPT

NOTES:
1. AERIAL MAGE TAKEN FROM THE CITY OF ABBOTSFORD MAPPING SITE.
2. INVESTIGATION LOCATIONS ARE APPROXIMATE .
3. BASE PLAN TAKEN FROM "GEOMLANE_264BRADNR.DWG" PROVIDED BY ASSOCIATED ENGINEERING.

THURBER ENGINEERING LTD.

MINISTRY OF TRANSPORTATION AND INFRASTUCTURE

INVESTIGATION LOCATION PLAN

FRASER VALLEY HIGHWAY 1
CORRIDOR IMPROVEMENT

LANGLEY AND ABBOTSFORD, BC

DESIGNED	DRAWN	APPROVED	DATE	SCALE	PROJECT No.	DWG. NO.	REV.
ANR	MOM		JAN. 30, 2023	1:2000	32079 - **SEG 1-11**	0	

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Plotted: March 9, 2023

3
16

TH 21-04
TH22-SEG 1-27
TH22-SEG 1-26
TH21-16
TH 21-02
TH23-SEG 1-99
TH21-17
TH 21-01
TH 21-03A
TH 21-03B
TP21-45
TH22-SEG 1-45
TH22-SEG 1-28
TH22-SEG 1-29
TP21-44
HA22-SEG 1-09
TH22-SEG 1-30
TP21-43
TH22-SEG 1-44
HA22-SEG 1-08
TP21-26
TP22-SEG 1-17
TP21-42
HA22-SEG 1-07
TH22-SEG 1-43
HA22-SEG 1-06
TP21-27
HA22-SEG 1-05
TH22-SEG 1-42
TP21-41

DOWNESS ROAD
HIGHWAY 1
BRADNER ROAD

NORTH

0 20 40 60 80 100m

LEGEND:

- TEST HOLE (SOLID STEM AUGER)
- TEST HOLE (MUD ROTARY)
- TEST HOLE (SONIC)
- TEST HOLE (HAND AUGER)
- TEST PIT
- CPT / SCPT

NOTES:
1. AERIAL MAGE TAKEN FROM THE CITY OF ABBOTSFORD MAPPING SITE.
2. INVESTIGATION LOCATIONS ARE APPROXIMATE .
3. BASE PLAN TAKEN FROM "GEOMLANE_264BRADNR.DWG" PROVIDED BY ASSOCIATED ENGINEERING.

THURBER ENGINEERING LTD.

MINISTRY OF TRANSPORTATION AND INFRASTUCTURE

INVESTIGATION LOCATION PLAN

FRASER VALLEY HIGHWAY 1
CORRIDOR IMPROVEMENT

LANGLEY AND ABBOTSFORD, BC

DESIGNED	DRAWN	APPROVED	DATE	SCALE	PROJECT No.	DWG. NO.	REV.
ANR	MOM		MAR. 09, 2023	1:2000	32079 - **SEG 1-12**		0

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SUMMARY LOG

Ministry of Transportation and Infrastructure — BRITISH COLUMBIA

Drill Hole #: TH21-04

Project: **TC - FV Segment 1**
Location: Abbotsford, B.C.

Date(s) Drilled: May 30, 2021
Company: On Track Drilling Inc.
Driller: Tim GIlbert
Drill Make/Model: MS-75 Track Mounted
Drilling Method: Sonic

Prepared by: 30989 Thurber Engineering Ltd.
Logged by: MM Reviewed by: CJC

Datum: UTM-Nad83 Alignment:
Northing/Easting: 5436028 , 541880 Station/Offset:
Elevation: 112.3 m *Coordinates Surveyed*

DEPTH (m)	DRILLING DETAILS (S P T)	Pocket Penetrometer / Shear Strength (kPa) 100 200 300 400; Dynamic Cone (Blows/300mm); SPT "N" (BLOWS/300 mm); Wp% W% WL% 20 40 60 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING — Drillers Estimate {G % S % F %}	BACKFILL INFORMATION	ELEVATION (m)
0							ASPHALT (254 mm thick).				112
		9.8		1			0.3m Grey-brown SAND and GRAVEL with trace to some silt, a trace of cobbles and mixed silt zones (FILL).	SW/GW	Drill cuttings		
		15.5		2				GM/SM	Atterberg (Sa#3): PL:19% LL:36%		
1		24.2		3			0.7m Firm to stiff (inferred), brown SILT and CLAY with traces of gravel and sand (FILL).	CL			
		21.0		4				CL	Sieve (Sa#4) G:% S:% F:73%		111
		3.7		5			1.5m Grey-brown GRAVEL and SAND to gravelly SAND with a trace to some silt (FILL)	GM/SM			
2		16.6		6			- a trace to some clay between 2.1 m and 2.2 m depth	GM/SM			
		8.0		7				SM/GM	Sieve (Sa#7) G:% S:% F:9%		110
		4.6		8				SP/GP			
3		3.2		9				SP-GP			109
4		8.8		10				SM			108
		4.9		11			4.9m Grey-brown, sandy GRAVEL to GRAVEL and SAND with a trace to some silt (FILL).	GP-GM			
5		7.7		12				GM			107
		4.9		13				GP/SP			
6		2.7		14				GM			106
				15				SM/GM			
		7.1		16				SP/GP			
7		24.0		17			7.0m Grey-brown, sandy SILT to SAND and SILT with a trace to some clay and a trace of organics.	SC/CL			
		31.9		A				SM/ML	Sieve (Sa#A) G:% S:% F:59% Atterberg (Sa#B): PL:24% LL:29% Sieve (Sa#B) G:% S:% F:91%		105
8		30.1		B			7.6m Grey-brown SILT with traces of sand, clay and organics.	ML			
		27.8		18				ML	Atterberg (Sa#18): PL:26% LL:31%		104
9		32.1		19			9.1m Firm (inferred), grey SILT with traces of clay and sand and zones of organic silt.	OL/ML			103
		24.0		20			9.6m	CL	Atterberg (Sa#20): PL:17% LL:27%		
10											

MOTI-SOIL-REV3 (EST COORDS) DEPTH 0.0 30989 MOTI.GPJ MOTI_DATATEMPLATE_REV3.GDT 28/9/21

Legend Sample Type: A-Auger; B-Becker; C-Core; G-Grab; V-Vane; L#-Lab Sample; S-Split Spoon; O-Odex (air rotary); W-Wash (mud return); T-Shelby Tube

Legend Installation: Sand; Grout; Cement; Bentonite; Drill Cuttings; Slotted; Slough; Piezometer

Final Depth of Hole: 30.5 m
Depth to Top of Rock:

SUMMARY LOG

Ministry of Transportation and Infrastructure — BRITISH COLUMBIA

Drill Hole #: TH21-04

Project: **TC - FV Segment 1**
Location: Abbotsford, B.C.
Datum: UTM-Nad83 Alignment:
Northing/Easting: 5436028 , 541880 Station/Offset:
Elevation: 112.3 m *Coordinates Surveyed*

Date(s) Drilled: May 30, 2021
Company: On Track Drilling Inc.
Driller: Tim GIlbert
Drill Make/Model: MS-75 Track Mounted
Drilling Method: Sonic

Prepared by: 30989 Thurber Engineering Ltd.
Logged by: MM Reviewed by: CJC

DEPTH (m)	DRILLING DETAILS (S P T)	Pocket Penetrometer / Shear Strength (kPa) 100 200 300 400; Dynamic Cone (Blows/300mm); SPT "N" (BLOWS/300 mm); Wp% 20 W% 40 60 WL% 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING — Drillers Estimate {G % S % F %}	BACKFILL INFORMATION	ELEVATION (m)
10		23.6		21			Soft (inferred), grey, clayey SILT to SILT and CLAY with some sand and a trace of organics. *(continued)*	ML/CL			102
							10.7m				
11		23.7		22			Firm to stiff (inferred), grey SILT and CLAY with a trace to some sand and a trace of gravel.	CL	Atterberg (Sa#22): PL:18% LL:36%		101
12											100
		22.2		23				CL			
13											99
		21.2		24				CL			
14											98
		17.3		25			- very stiff (inferred) below 14.5 m depth	CL			
15											97
		14.6		26				CL			
							15.8m				
16		7.7		27			Grey GRAVEL and SAND, silty to some silt.	GM/SM			96
							16.5m				
		4.1		28			Grey SAND with a trace to some silt and gravel.	SP-SM			
17											95
		1.7		29				SP			
18											94
		10.5		30				SP			
		10.6		31				SP-SM			
19							- some silt to silty below 18.9 m depth				93
		11.3		32				SM			
							19.8m				
20							Grey SAND and SILT to silty SAND.				

Legend Sample Type: A-Auger; B-Becker; C-Core; G-Grab; V-Vane; L#-Lab Sample; S-Split Spoon; O-Odex (air rotary); W-Wash (mud return); T-Shelby Tube

Legend Installation: Sand; Grout; Cement; Bentonite; Drill Cuttings; Slotted; Slough; Piezometer

Final Depth of Hole: 30.5 m
Depth to Top of Rock:

MOTI-SOIL-REV3 (EST COORDS) DEPTH 0.0 30989 MOTI.GPJ MOTI_DATATEMPLATE_REV3.GDT 28/9/21

SUMMARY LOG

Drill Hole #: **TH21-04**

Ministry of Transportation and Infrastructure

Project: **TC - FV Segment 1**
Location: Abbotsford, B.C.

Date(s) Drilled: May 30, 2021
Company: On Track Drilling Inc.
Driller: Tim GIlbert
Drill Make/Model: MS-75 Track Mounted
Drilling Method: Sonic

Prepared by: 30989 Thurber Engineering Ltd.
Logged by: MM Reviewed by: CJC

Datum: UTM-Nad83 Alignment:
Northing/Easting: 5436028 , 541880 Station/Offset:
Elevation: 112.3 m *Coordinates Surveyed*

DEPTH (m)	DRILLING DETAILS (S P T)	Pocket Penetrometer / Shear Strength (kPa) 100 200 300 400; Dynamic Cone (Blows/300mm); SPT "N" (BLOWS/300 mm); W_P% 20 W% 40 60 W_L% 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate {G % S % F %}	BACKFILL INFORMATION	ELEVATION (m)
20		6.0		33			Grey SAND and SILT to silty SAND. *(continued)*	ML/SM			92
							20.6m				
21		5.0		34			Grey SAND with some silt and silty sand pockets.	SM			91
22		15.2		35				SM			90
23		2.4		36				SP-SM			
		13.3		37			23.2m Grey SAND and SILT with traces of clay and gravel. - occasional clayey silt zones between 23.5 m and 24.4 m depth	SM/ML	Sieve (Sa#37) G:% S:% F:54%		89
24		21.5		38				ML			88
							24.4m Soft to firm (inferred), grey SILT with traces of sand and clay.				
		22.8		39				ML			
25							25.0m Grey-brown SAND with a trace to some silt.				87
		2.4		40				SP-SM			
26		1.6		41			- trace gravel below 25.9 m depth - silty below 26.2 m depth	SP			86
		1.9		42				SM			
27											
		8.2		43			- 150 mm thick layer of gravelly silt and sand at 27.3 m depth	ML/SM			85
							27.4m Grey-brown SAND with traces of gravel and silt.				
28		13.7		44			28.0m	SP-SM			
		6.4		45			Grey-brown SAND and GRAVEL with some silt.	GM/SM			84
		5.7		46				SM/GM			
29							29.0m No sample recovery between 29.0 and 30.5 m depth.				83
30											

Legend Sample Type: A-Auger, B-Becker, C-Core, G-Grab, V-Vane, L#-Lab Sample, S-Split Spoon, O-Odex (air rotary), W-Wash (mud return), T-Shelby Tube

Legend Installation: Sand, Grout, Cement, Bentonite, Drill Cuttings, Slotted, Slough, Piezometer

Final Depth of Hole: 30.5 m
Depth to Top of Rock:

MOTI-SOIL-REV3 (EST COORDS) DEPTH 0.0 30989 MOTI.GPJ MOTI_DATATEMPLATE_REV3.GDT 28/9/21

Ministry of Transportation and Infrastructure

SUMMARY LOG

Drill Hole #: **TH21-04**

Project: **TC - FV Segment 1**
Location: Abbotsford, B.C.

Date(s) Drilled: May 30, 2021
Company: On Track Drilling Inc.
Driller: Tim GIlbert
Drill Make/Model: MS-75 Track Mounted
Drilling Method: Sonic

Prepared by: 30989 Thurber Engineering Ltd.
Logged by: MM Reviewed by: CJC

Datum: UTM-Nad83 Alignment:
Northing/Easting: 5436028 , 541880 Station/Offset:
Elevation: 112.3 m *Coordinates Surveyed*

DEPTH (m)	DRILLING DETAILS (S P T)	Pocket Penetrometer / Shear Strength (kPa) 100 200 300 400; Dynamic Cone (Blows/300mm); SPT "N" (BLOWS/300 mm); W_P% 20 W% 40 60 W_L% 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate *{G % S % F %}*	BACKFILL INFORMATION	ELEVATION (m)
30							No sample recovery between 29.0 and 30.5 m depth. *(continued)*				82
							30.5m End of hole at required depth.		Bentonite chips		
31											81
32											80
33											79
34											78
35											77
36											76
37											75
38											74
39											73
40											

Legend Sample Type: A-Auger; B-Becker; C-Core; G-Grab; V-Vane; L#-Lab Sample; S-Split Spoon; O-Odex (air rotary); W-Wash (mud return); T-Shelby Tube

Legend Installation: Sand; Grout; Cement; Bentonite; Drill Cuttings; Slotted; Slough; Piezometer

Final Depth of Hole: 30.5 m
Depth to Top of Rock:

MOTI-SOIL-REV3 (EST COORDS) DEPTH 0.0 30989 MOTI.GPJ MOTI_DATATEMPLATE_REV3.GDT 28/9/21

SUMMARY LOG

Drill Hole #: **TH21-11**

BRITISH COLUMBIA — Ministry of Transportation and Infrastructure

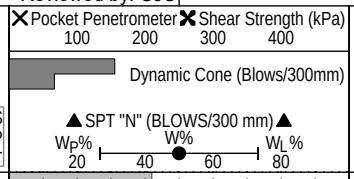
Project: **TC - FV Segment 1**
Location: Abbotsford, B.C.

Prepared by: 30989
Thurber Engineering Ltd.

Logged by: JP Reviewed by: CJC

Datum: UTM-Nad83 Alignment:
Northing/Easting: 5436312 , 541435 Station/Offset:
Elevation: 108.8 m *Coordinates taken with GPS*

Date(s) Drilled: May 19, 2021
Company: On Track Drilling Inc.
Driller: Craig Sanders
Drill Make/Model: Track D-120 Rig
Drilling Method: Solid Stem Auger / DCPT



DEPTH (m)	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate {G % S % F %}	BACKFILL INFORMATION	ELEVATION (m)
0		1			Dense, brown SAND with some gravel and a trace of silt (FILL).	SP-SM			108
0.6					Very stiff, brown SILT and CLAY with grey silt lenses, a trace to some sand and orange oxidation staining.	CL			
1		2							
2		3				CL			107
3		4				CL			106
3.4					Stiff to very stiff, grey, silty CLAY with a trace of sand.	CL			
4		5							105
5		6				CL			104
5.2					- a trace to some sand below 5.2 m depth				
6		7				CL			103
6.1					End of hole at required depth. Hole open to 5.8 m depth. No water observed upon completion of drilling.		Bentonite chips		
7									102
8									101
9									100
10									99

Legend Sample Type: A-Auger, B-Becker, C-Core, G-Grab, V-Vane, L#-Lab Sample, S-Split Spoon, O-Odex (air rotary), W-Wash (mud return), T-Shelby Tube

Legend Installation: Sand, Grout, Cement, Bentonite, Drill Cuttings, Slotted, Slough, Piezometer

Final Depth of Hole: 6.1 m
Depth to Top of Rock:

MOTI-SOIL-REV3 (EST COORDS) DEPTH 0.0 30989 MOTI.GPJ MOTI_DATATEMPLATE_REV3.GDT 28/9/21

SUMMARY LOG

Drill Hole #: **TH21-12**

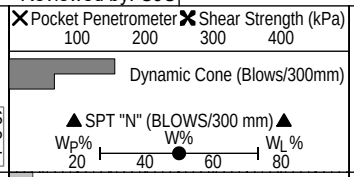
Ministry of Transportation and Infrastructure

Project: **TC - FV Segment 1**
Location: Abbotsford, B.C.

Date(s) Drilled: May 19, 2021
Company: On Track Drilling Inc.
Driller: Craig Sanders
Drill Make/Model: Track D-120 Rig
Drilling Method: Solid Stem Auger / DCPT

Prepared by: 30989 Thurber Engineering Ltd.
Logged by: JP Reviewed by: CJC

Datum: UTM-Nad83 Alignment:
Northing/Easting: 5436350 , 541375 Station/Offset:
Elevation: 108.8 m *Coordinates taken with GPS*



DEPTH (m)	SOIL DESCRIPTION	SAMPLE NO	CLASSIFICATION	ELEVATION (m)
0	Loose to compact, brown SILT and SAND with some gravel and a trace of rootlets.	1	ML/SM	108
1.2m	Stiff to very stiff, grey, SILT and CLAY with some oxidation and a trace to some sand.	2	CL	107
		3	CL	106
3.4m	Very stiff, grey, clayey SILT to SILT and CLAY with traces of sand and gravel.	4	ML/CL	105
		5	CL	
4.3m	Very Stiff, grey SILT and CLAY with traces of sand and gravel.	6	CL	104
		7	CL	103
6.1m	End of hole at required depth. Hole open to 5.8 m depth. Water observed at 6.1 m depth upon completion of drilling.			102
				101
				100
				99

COMMENTS TESTING
Drillers Estimate {G % S % F %}

BACKFILL INFORMATION: Bentonite chips

Legend Sample Type: A-Auger, B-Becker, C-Core, G-Grab, V-Vane, L#-Lab Sample, S-Split Spoon, O-Odex (air rotary), W-Wash (mud return), T-Shelby Tube

Legend Installation: Sand, Grout, Cement, Bentonite, Drill Cuttings, Slotted, Slough, Piezometer

Final Depth of Hole: 6.1 m
Depth to Top of Rock:

MOTI-SOIL-REV3 (EST COORDS) DEPTH 0.0 30989 MOTI.GPJ MOTI_DATATEMPLATE_REV3.GDT 28/9/21

SUMMARY LOG

Drill Hole #: **TH21-13**

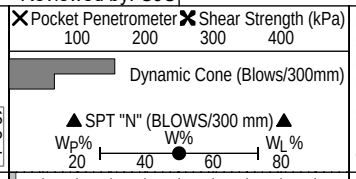
Ministry of Transportation and Infrastructure

Project: **TC - FV Segment 1**
Location: Abbotsford, B.C.

Date(s) Drilled: May 19, 2021
Company: On Track Drilling Inc.
Driller: Craig Sanders
Drill Make/Model: Track D-120 Rig
Drilling Method: Solid Stem Auger / DCPT

Prepared by: 30989 Thurber Engineering Ltd.
Logged by: JP Reviewed by: CJC

Datum: UTM-Nad83 Alignment:
Northing/Easting: 5436486 , 541203 Station/Offset:
Elevation: 107.7 m *Coordinates taken with GPS*



DEPTH (m)	SAMPLE NO	RECOVERY (%)	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate {G % S % F %}	BACKFILL INFORMATION	ELEVATION (m)
0	1	54.8	Dark brown ORGANIC SILT with some gravel and a trace to some clay and sand.	OH			107
1.2	2	26.5	Very stiff to hard, Grey-brown, clayey SILT to SILT and CLAY with a trace of sand and mixed zones of sandy silt	CL & ML			106
2.1	3	24.4	Very stiff to hard, grey-brown SILT and CLAY with traces of sand, organics and oxidation staining.	CL			105
	4	22.2	- a trace of gravel below 2.8 m depth	CL			
3.7	5	21.1	Very stiff to hard, grey-brown, SILT and CLAY with trace to some sand and mixed zones of silty sand.	ML/CL			104
	6	21.4		CL			103
5.2	7	24.2	Very stiff, grey SILT and CLAY with traces of sand and gravel	CL			102
6.1			End of hole at required depth. Hole open to 5.8 m depth. Water observed at 4.0 m depth upon completion of drilling.		Bentonite chips		101
							100
							99
							98

Legend Sample Type: A-Auger, B-Becker, C-Core, G-Grab, V-Vane, L#-Lab Sample, S-Split Spoon, O-Odex (air rotary), W-Wash (mud return), T-Shelby Tube

Legend Installation: Sand, Grout, Cement, Bentonite, Drill Cuttings, Slotted, Slough, Piezometer

Final Depth of Hole: 6.1 m
Depth to Top of Rock:

MOTI-SOIL-REV3 (EST COORDS) DEPTH 0.0 30989 MOTI.GPJ MOTI_DATATEMPLATE_REV3.GDT 28/9/21

SUMMARY LOG

Drill Hole #: **TH21-14**

Ministry of Transportation and Infrastructure

Project: **TC - FV Segment 1**
Location: Abbotsford, B.C.

Date(s) Drilled: May 19, 2021
Company: On Track Drilling Inc.
Driller: Craig Sanders
Drill Make/Model: Track D-120 Rig
Drilling Method: Solid Stem Auger / DCPT

Prepared by: 30989 Thurber Engineering Ltd.
Logged by: JP Reviewed by: CJC

Datum: UTM-Nad83 Alignment:
Northing/Easting: 5436465 , 541170 Station/Offset:
Elevation: 107.5 m *Coordinates taken with GPS*

DEPTH (m)	DRILLING DETAILS (S P T)	Pocket Penetrometer / Shear Strength (kPa) / Dynamic Cone (Blows/300mm) / SPT "N" (BLOWS/300 mm) / W_P% W% W_L%	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate {G % S % F %}	BACKFILL INFORMATION	ELEVATION (m)
0							Compact to dense, brown, gravelly SAND to sandy GRAVEL with some silt (FILL).	GM/SM			107
	7.2			1			0.8m				
1							Very stiff to hard, brown CLAY and SILT with a trace to some sand and a trace of gravel and organics	CL			106
	21.9			2							
2	23.2			3				CL			
							2.1m				
							Very stiff, grey-brown, clayey SILT to CLAY and SILT with traces of sand and gravel.				105
3	25.4			4				CL			
											104
4	24.4			5				CL			
							- silt lenses below 4.1 m depth				
	25.8			6				CL			103
5											
	22.8			7				CL			
											102
6	24.4			8				CL			
							6.1m				
							End of hole at required depth. Hole open to 3.1 m depth. No water observed upon completion of drilling.		Bentonite chips		101
7											
											100
8											
											99
9											
											98
10											

Legend Sample Type: A-Auger, B-Becker, C-Core, G-Grab, V-Vane, L#-Lab Sample, S-Split Spoon, O-Odex (air rotary), W-Wash (mud return), T-Shelby Tube

Legend Installation: Sand, Grout, Cement, Bentonite, Drill Cuttings, Slotted, Slough, Piezometer

Final Depth of Hole: 6.1 m
Depth to Top of Rock:

MOTI-SOIL-REV3 (EST COORDS) DEPTH 0.0 30989 MOTI.GPJ MOTI_DATATEMPLATE_REV3.GDT 28/9/21

SUMMARY LOG

Drill Hole #: **TH22-SEG 1-26**

Ministry of Transportation and Infrastructure

Project: **Fraser Valley Highway 1 Corridor Improvement**

Location: Abbotsford, BC

Prepared by: 32079
Thurber Engineering Ltd.

Logged by: RJT Reviewed by: ANR

Datum: UTM-Nad83 Alignment:

Northing/Easting: 5436025 , 541946 Station/Offset:

Elevation: 109.7 m *Coordinates taken with GPS*

Date(s) Drilled: 2022-05-18

Company: OnTrack

Driller: Craig

Drill Make/Model: Diedrick D-120

Drilling Method: CPT/Solid Stem Auger

DEPTH (m)	DRILLING DETAILS (SPT)	Pocket Penetrometer / Shear Strength (kPa) 100 200 300 400 / SPT "N" (BLOWS/300 mm) / W_P% 20 — W% 40 60 — W_L% 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING (Drillers Estimate {G % S % F %})	ELEVATION (m)
0							CL - SILTY CLAY, trace sand, trace gravel, trace partially decomposed organics; low to medium plasticity; grey-brown; cohesive, moist, firm to stiff.			109
		30.1		1				CL		
1										
		25.9		2				CL		
							1.52m			
2							CL - SILTY CLAY, trace to some sand, trace gravel; medium plasticity; fine to coarse grained sand; grey-brown; cohesive, moist, stiff to very stiff.			108
		23.7		3				CL		
3										107
		24.9		4				CL		
4										106
										105
5							5.18m			
		20.7		5			CL - SILTY CLAY, trace sand; medium to high plasticity; fine grained sand, grey; cohesive, moist, very stiff.	CL	Atterberg (Sa#5): PL:19% LL:36%	104
6										103
		21.2		6				CL		
7										102
8										101
		22.8		7				CL		
9							9.14m			
							CL - SILTY CLAY, trace sand; medium plasticity; fine grained sand, grey; cohesive, moist, soft to firm.			100
10										

Legend Sample Type: A-Auger, B-Becker, C-Core, G-Grab, V-Vane, L#-Lab Sample, S-Split Spoon, O-Odex (air rotary), W-Wash (mud return), T-Shelby Tube

Legend Installation: Sand, Grout, Cement, Bentonite, Drill Cuttings, Slotted, Slough, Piezometer

Final Depth of Hole: 13.7 m

Depth to Top of Rock:

MOTI-SOIL-REV3_EL. 1 DECIMAL PLACE 32079_FRASER VALLEY HWY 1 CORRIDOR.GPJ MOTI_DATATEMPLATE_REV3.GDT 23-5-19

SUMMARY LOG

Drill Hole #: **TH22-SEG 1-26**

Ministry of Transportation and Infrastructure

Project: **Fraser Valley Highway 1 Corridor Improvement**

Location: Abbotsford, BC

Date(s) Drilled: 2022-05-18

Company: OnTrack

Prepared by: 32079 Thurber Engineering Ltd.

Datum: UTM-Nad83 Alignment:

Northing/Easting: 5436025 , 541946 Station/Offset:

Elevation: 109.7 m *Coordinates taken with GPS*

Driller: Craig

Drill Make/Model: Diedrick D-120

Logged by: RJT Reviewed by: ANR

Drilling Method: CPT/Solid Stem Auger

DEPTH (m)	DRILLING DETAILS (S P T)	Pocket Penetrometer / Shear Strength (kPa) 100 200 300 400; SPT "N" (BLOWS/300 mm); W_P% 20 — W% — 40 60 — W_L% 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate *{G % S % F %}*	ELEVATION (m)
10		22.8		8			CL - SILTY CLAY, trace sand; medium plasticity; fine grained sand, grey; cohesive, moist, soft to firm. *(continued)*	CL	Atterberg (Sa#8): PL:17% LL:29%	99
11							11.13m			
		22.5		9			CL - SILTY CLAY, trace sand, trace gravel; medium to high plasticity; grey; cohesive, moist, firm.	CL		98
12							- density of clay becomes very stiff to hard at 12.2 m depth			97
13		19.2		10				CL		
							13.72m			96
14							End of hole at 13.7 m depth. Hole open to 13.6 m depth. Ground water observed at 4.9 m depth upon completion of drilling.			
15										95
16										94
17										93
18										92
19										91
20										90

Legend Sample Type: A-Auger; B-Becker; C-Core; G-Grab; V-Vane; L#-Lab Sample; S-Split Spoon; O-Odex (air rotary); W-Wash (mud return); T-Shelby Tube

Legend Installation: Sand; Grout; Cement; Bentonite; Drill Cuttings; Slotted; Slough; Piezometer

Final Depth of Hole: 13.7 m

Depth to Top of Rock:

MOTI-SOIL-REV3_EL. 1 DECIMAL PLACE 32079_FRASER VALLEY HWY 1 CORRIDOR.GPJ MOTI_DATATEMPLATE_REV3.GDT 23-5-19

SUMMARY LOG

Drill Hole #: **TH22-SEG 1-27**

BRITISH COLUMBIA — Ministry of Transportation and Infrastructure

Project: **Fraser Valley Highway 1 Corridor Improvement**
Location: Abbotsford, BC

Prepared by: 32079
Thurber Engineering Ltd.
Logged by: RJT Reviewed by: ANR

Datum: UTM-Nad83 Alignment:
Northing/Easting: 5436025 , 541914 Station/Offset:
Elevation: 106.7 m *Coordinates taken with GPS*

Date(s) Drilled: 2022-05-18
Company: OnTrack
Driller: Craig
Drill Make/Model: Diedrick D-120
Drilling Method: CPT/Solid Stem Auger

DEPTH (m)	DRILLING DETAILS (SPT)	Pocket Penetrometer / Shear Strength (kPa) 100 200 300 400; SPT "N" (BLOWS/300 mm); W_P% 20 — W% 40 60 — W_L% 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING (Drillers Estimate {G % S % F %})	ELEVATION (m)
0							SM - SAND, silty, some gravel, trace partially decomposed organics; fine to coarse grained; low to medium plasticity silt; fine to coarse grained, 38 mm max. size gravel, brown (FILL); non-cohesive, moist, compact to dense.			106
1		12.4		1			- wet at 0.9 m depth.	SM/SC		
							1.68m			105
2		43.5		2			ML - SILT, some sand, trace partially decomposed organics; low to medium plasticity; fine to coarse grained sand, dark brown-grey; cohesive, moist to wet, soft.	ML/OL		
							1.98m			
3		26.7		3			ML - SILT, trace sand, trace oxidation; low to medium plasticity; fine grained sand, grey; cohesive, moist, very stiff.	CL/ML		104
							- rust staining at 2.4 m depth			
							3.05m			
4		20.8		4			CL - SILTY CLAY, trace sand, trace gravel, trace partially decomposed organics; medium to high plasticity; grey-brown with trace oxidation; cohesive, moist, firm to very stiff.	CL	Atterberg (Sa#4): PL:19% LL:36%	103
4		22.8		5				CL	Atterberg (Sa#5): PL:18% LL:32%	
							4.57m			
5		27.9		6			ML - SILT, some sand; low plasticity; fine grained sand, brown-grey; cohesive, moist to wet, very soft.	ML/CL	Atterberg (Sa#6): PL:20% LL:27%	102
							5.64m			
6		22.9		7			CL - SILTY CLAY, trace sand, trace gravel; medium plasticity; brown-grey; cohesive, moist, firm.	CL		101
7		22.1		8				CL		100
8										99
9		16.1		9				CL		98
							9.14m			
							End of hole at 9.1 m depth. Hole open to 1.5 m depth. Groundwater observed at 0.9 m depth upon completion of drilling.			
10										97

Legend Sample Type: A-Auger; B-Becker; C-Core; G-Grab; V-Vane; L#-Lab Sample; S-Split Spoon; O-Odex (air rotary); W-Wash (mud return); T-Shelby Tube

Legend Installation: Sand; Grout; Cement; Bentonite; Drill Cuttings; Slotted; Slough; Piezometer

Final Depth of Hole: 9.1 m
Depth to Top of Rock:

MOTI-SOIL-REV3_EL. 1 DECIMAL PLACE 32079_FRASER VALLEY HWY 1 CORRIDOR.GPJ MOTI_DATATEMPLATE_REV3.GDT 23-5-19

SUMMARY LOG

Drill Hole #: **TH22-SEG 1-47**

Ministry of Transportation and Infrastructure

Project: **Fraser Valley Highway 1 Corridor Improvement**

Location: Abbotsford, BC

Prepared by: 32079
Thurber Engineering Ltd.

Logged by: SY Reviewed by: ANR

Datum: UTM-Nad83 Alignment:

Northing/Easting: 5436083 , 541806 Station/Offset:

Elevation: 110.9 m *Coordinates taken with GPS*

Date(s) Drilled: 2022-05-26

Company: Mud Bay

Driller: Brandon

Drill Make/Model: Fraste XL -03

Drilling Method: SPT/Mud Rotary

DEPTH (m)	DRILLING DETAILS (SPT)	Pocket Penetrometer / Shear Strength (kPa) 100 200 300 400 / SPT "N" (BLOWS/300 mm) / W_P% 20 — W% 40 60 — W_L% 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate {G % S % F %}	ELEVATION (m)
0	16 14 7 6	21 ▲ 12.5 ●		1	33		ASPHALT. 0.08m SP - SAND and GRAVEL, trace silt; fine to coarse grained sand; fine to coarse grained, sub-angular to sub-rounded, 51 mm max. size gravel; none to low plasticity silt; well graded, brown (FILL); non-cohesive, moist, compact to dense. 0.79m	GP-GM		110
1		20.6 ●		2				CL		
2	3 3 6 5	9 ▲ 23.4 ●		3	54		CL - SILTY CLAY, trace sand, trace gravel; low to medium plasticity; brown; cohesive, dry to moist, stiff. 1.22m CL - SILTY CLAY, trace to some sand, trace partially decomposed organics; medium plasticity; fine grained sand, grey-brown, partially oxidized; cohesive, dry to moist, stiff.	CL		109
3	3 3 3 3	6 ▲ 23.7 ●		4	88			CL		108
4	4 7 8 9	15 ▲ 22.8 ●		5	83			CL		107
5										106
6	3 4 5 7	9 ▲ 30.5 ●		6	100			CL		105
7	8 13 19 22	32 ▲ 26.9 ●		7	100		7.01m CL - SILTY CLAY, trace sand, trace gravel; medium plasticity; brown; cohesive, dry to moist, stiff to very stiff.	CL		104
8										103
9	4 7 9 10	16 ▲ 23.2 ●		8	100			CL		102
10										101

Legend Sample Type: A-Auger, B-Becker, C-Core, G-Grab, V-Vane, L#-Lab Sample, S-Split Spoon, O-Odex (air rotary), W-Wash (mud return), T-Shelby Tube

Legend Installation: Sand, Grout, Cement, Bentonite, Drill Cuttings, Slotted, Slough, Piezometer

Final Depth of Hole: 15.2 m

Depth to Top of Rock:

MOTI-SOIL-REV3_EL. 1 DECIMAL PLACE 32079_FRASER VALLEY HWY 1 CORRIDOR.GPJ MOTI_DATATEMPLATE_REV3.GDT 23-5-19

Ministry of Transportation and Infrastructure

SUMMARY LOG

Drill Hole #: **TH22-SEG 1-47**

Project: **Fraser Valley Highway 1 Corridor Improvement**

Location: Abbotsford, BC

Prepared by: 32079
Thurber Engineering Ltd.

Logged by: SY Reviewed by: ANR

Datum: UTM-Nad83 Alignment:

Northing/Easting: 5436083 , 541806 Station/Offset:

Elevation: 110.9 m *Coordinates taken with GPS*

Date(s) Drilled: 2022-05-26

Company: Mud Bay

Driller: Brandon

Drill Make/Model: Fraste XL -03

Drilling Method: SPT/Mud Rotary

DEPTH (m)	DRILLING DETAILS (SPT)	Pocket Penetrometer / Shear Strength (kPa) 100 200 300 400 / SPT "N" (BLOWS/300 mm) / W_P% 20 W% 40 60 W_L% 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate {G % S % F %}	ELEVATION (m)
10	7 8 12 12	20 21.9		9	100		CL - SILTY CLAY, trace sand, trace gravel; medium plasticity; brown; cohesive, dry to moist, stiff to very stiff. *(continued)*	CL		100
11	100	17.9		10	42			CL		99
12										
13	10 15 17 21	20.0 32		11	100			CL		98
14										97
15	15 20 25 23	25.2 45		12	83			CL		96
		19.2		13			14.88m SP - SAND; fine to coarse grained, poorly graded; non-cohesive, more coarse with increasing depth, moist, very dense. 15.24m	SM		
16							End of hole at 15.2 m depth.			95
17										94
18										93
19										92
20										91

Legend Sample Type: A-Auger, B-Becker, C-Core, G-Grab, V-Vane, L#-Lab Sample, S-Split Spoon, O-Odex (air rotary), W-Wash (mud return), T-Shelby Tube

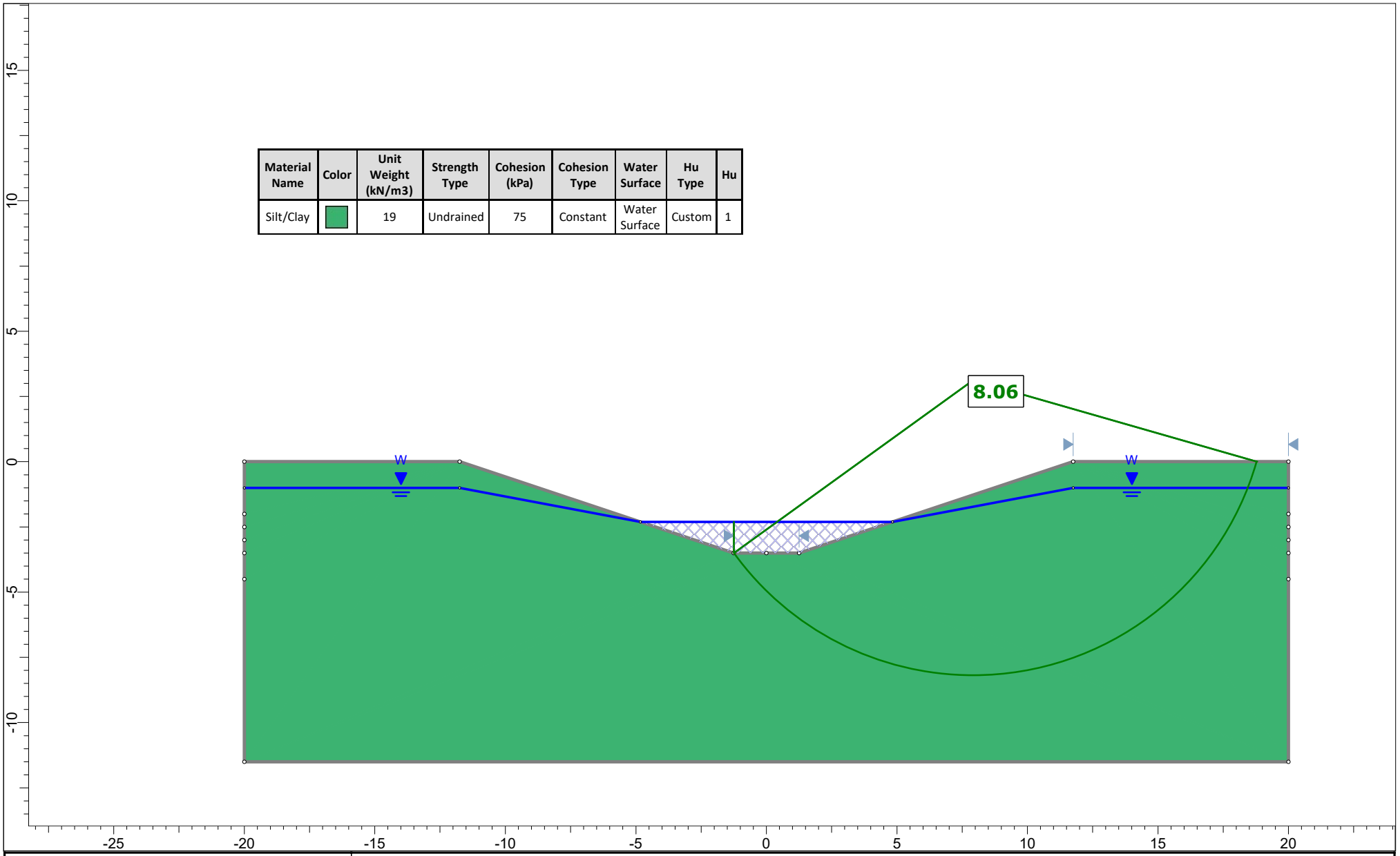
Legend Installation: Sand, Grout, Cement, Bentonite, Drill Cuttings, Slotted, Slough, Piezometer

Final Depth of Hole: 15.2 m

Depth to Top of Rock:

MOTI-SOIL-REV3_EL. 1 DECIMAL PLACE 32079_FRASER VALLEY HWY 1 CORRIDOR.GPJ MOTI_DATATEMPLATE_REV3.GDT 23-5-19

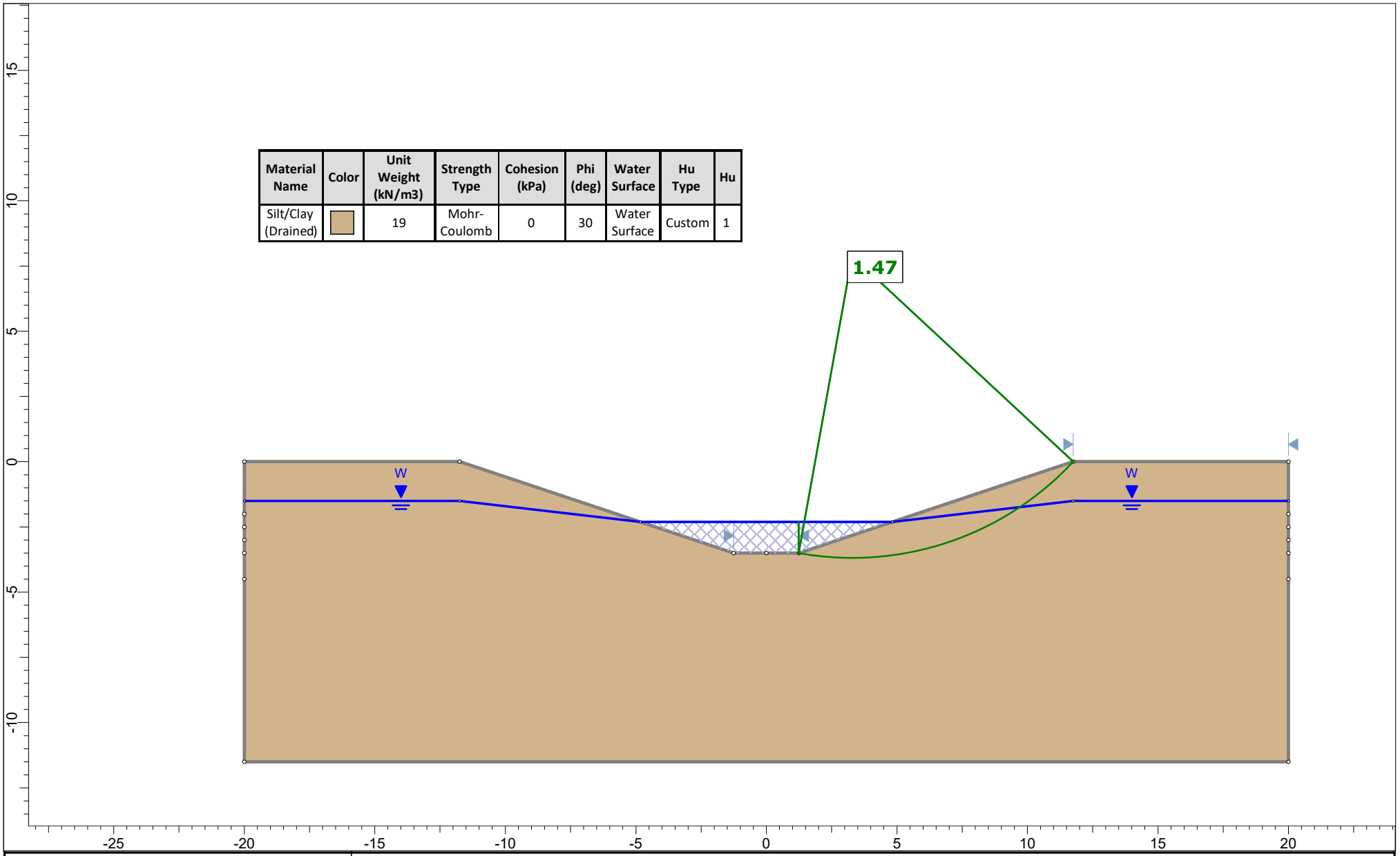
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Cohesion Type	Water Surface	Hu Type	Hu
Silt/Clay		19	Undrained	75	Constant	Water Surface	Custom	1



THURBER ENGINEERING LTD.

Project	Environemental Offset Areas - Bradner North - Cut Slopes
Client	McElhanney
Project Number	37457
Date	7/10/2023
Title	Static (3H:1V) Undrained
File Name	kbb_Bradner North_Cut Slopes_37457.slmd

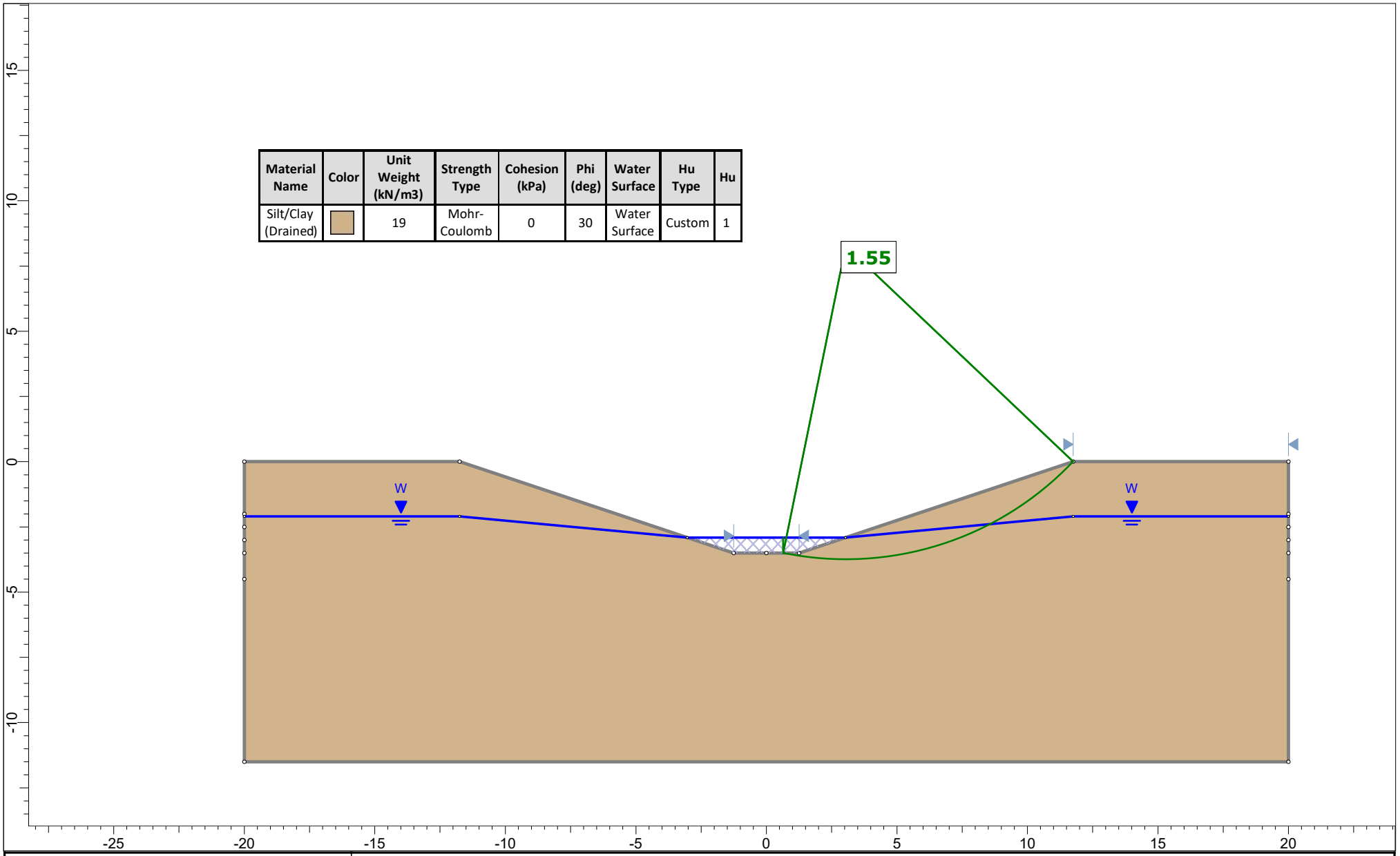
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Silt/Clay (Drained)		19	Mohr-Coulomb	0	30	Water Surface	Custom	1



THURBER ENGINEERING LTD.

Project	Environemental Offset Areas - Bradner North - Cut Slopes
Client	McElhanney
Project Number	37457
Date	7/10/2023
Title	Static (3H:1V) Drained (Higher Channel Water)
File Name	kbb_Bradner North_Cut Slopes_37457.slmd

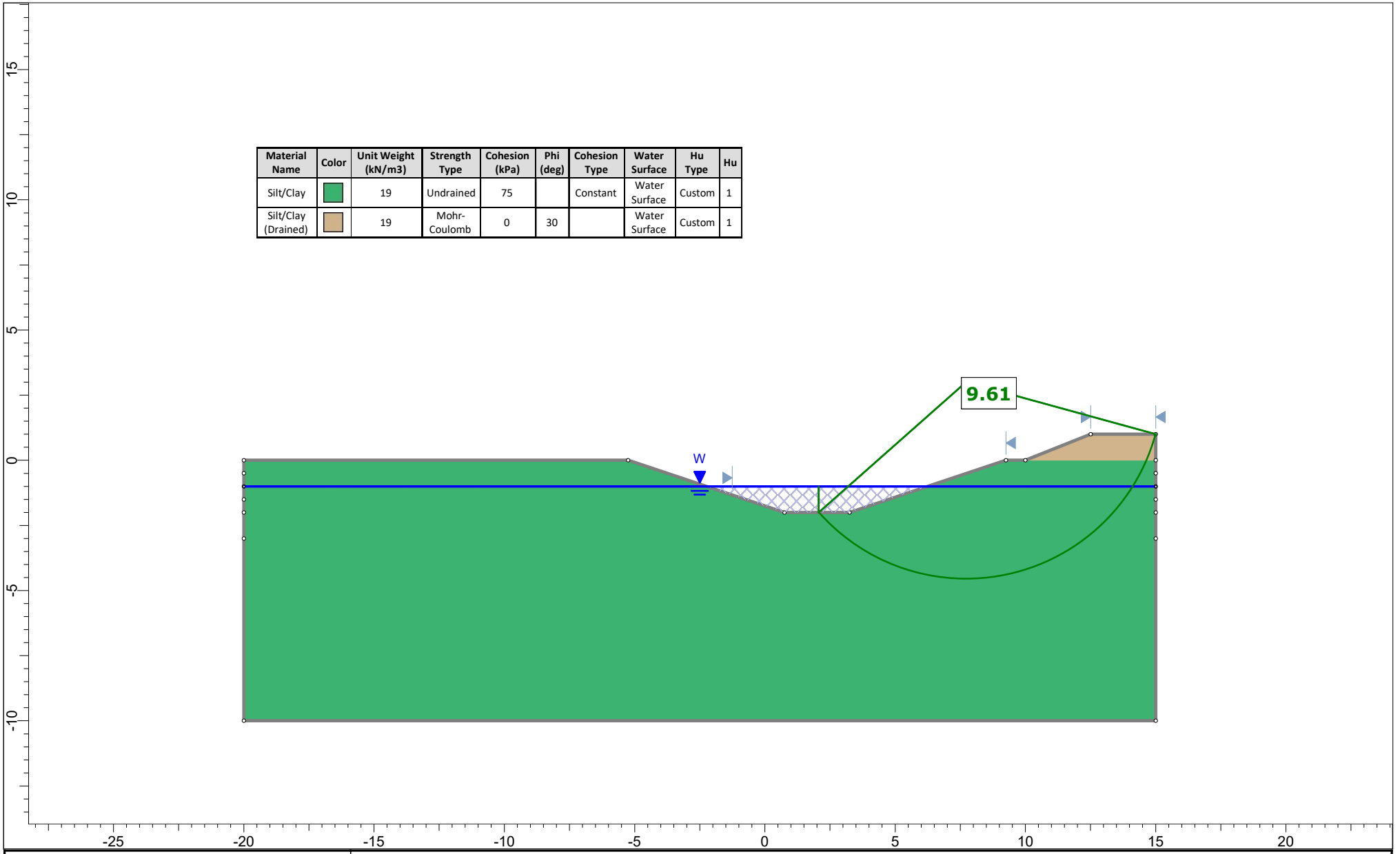
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Silt/Clay (Drained)		19	Mohr-Coulomb	0	30	Water Surface	Custom	1



THURBER ENGINEERING LTD.

Project	**Environemental Offset Areas - Bradner North - Cut Slopes**
Client	McElhanney
Project Number	37457
Date	7/10/2023
Title	Static (3H:1V) Drained (Lower Channel Water)
File Name	kbb_Bradner North_Cut Slopes_37457.slmd

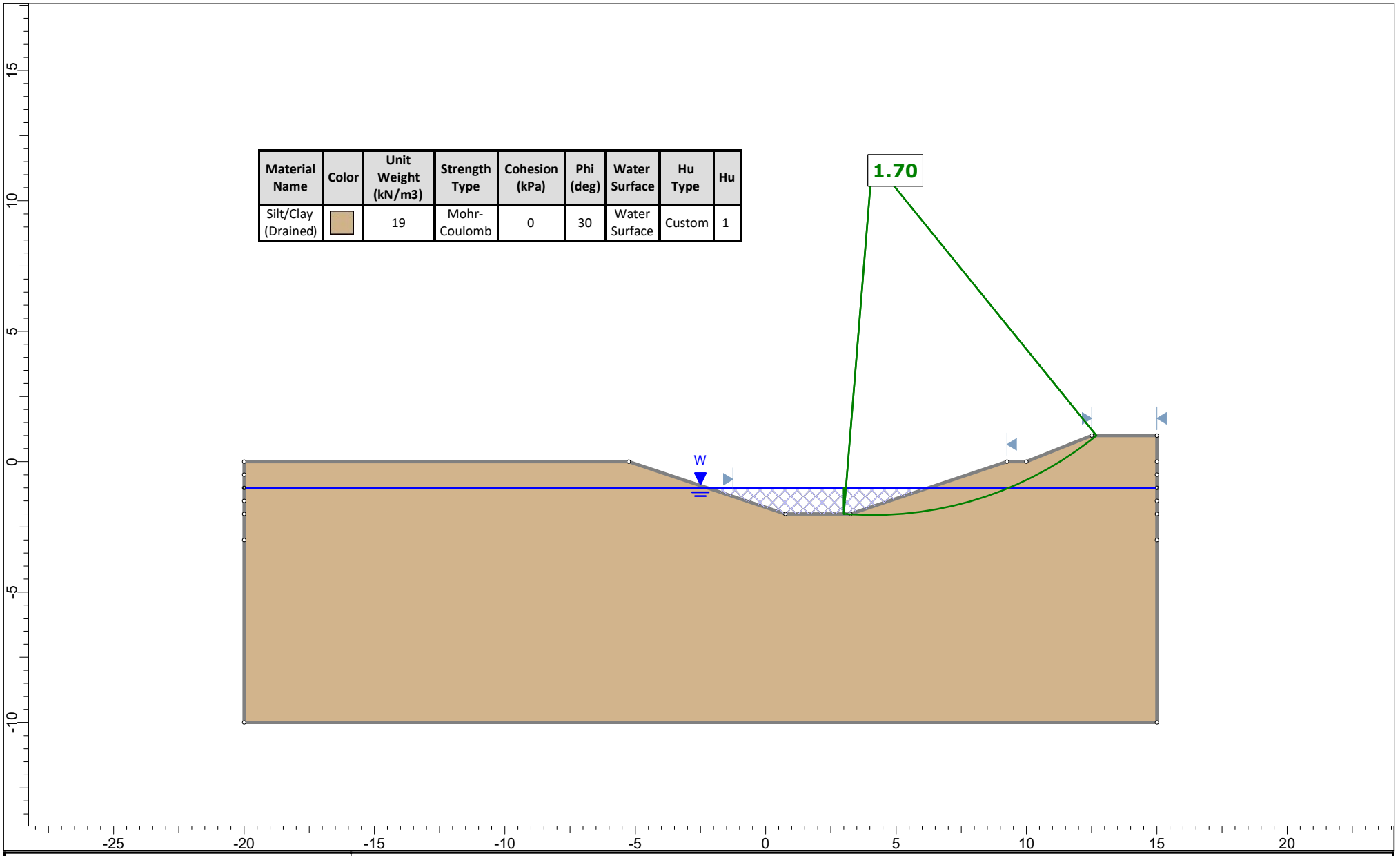
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Cohesion Type	Water Surface	Hu Type	Hu
Silt/Clay		19	Undrained	75		Constant	Water Surface	Custom	1
Silt/Clay (Drained)		19	Mohr-Coulomb	0	30		Water Surface	Custom	1



THURBER ENGINEERING LTD.

Project	Environemental Offset Areas - Bradner North - Cut Slopes
Client	McElhanney
Project Number	37457
Date	7/10/2023
Title	Static (3H:1V) - Near Berm Undrained (MC)
File Name	kbb_Bradner North_Cut Slopes_37457.slmd

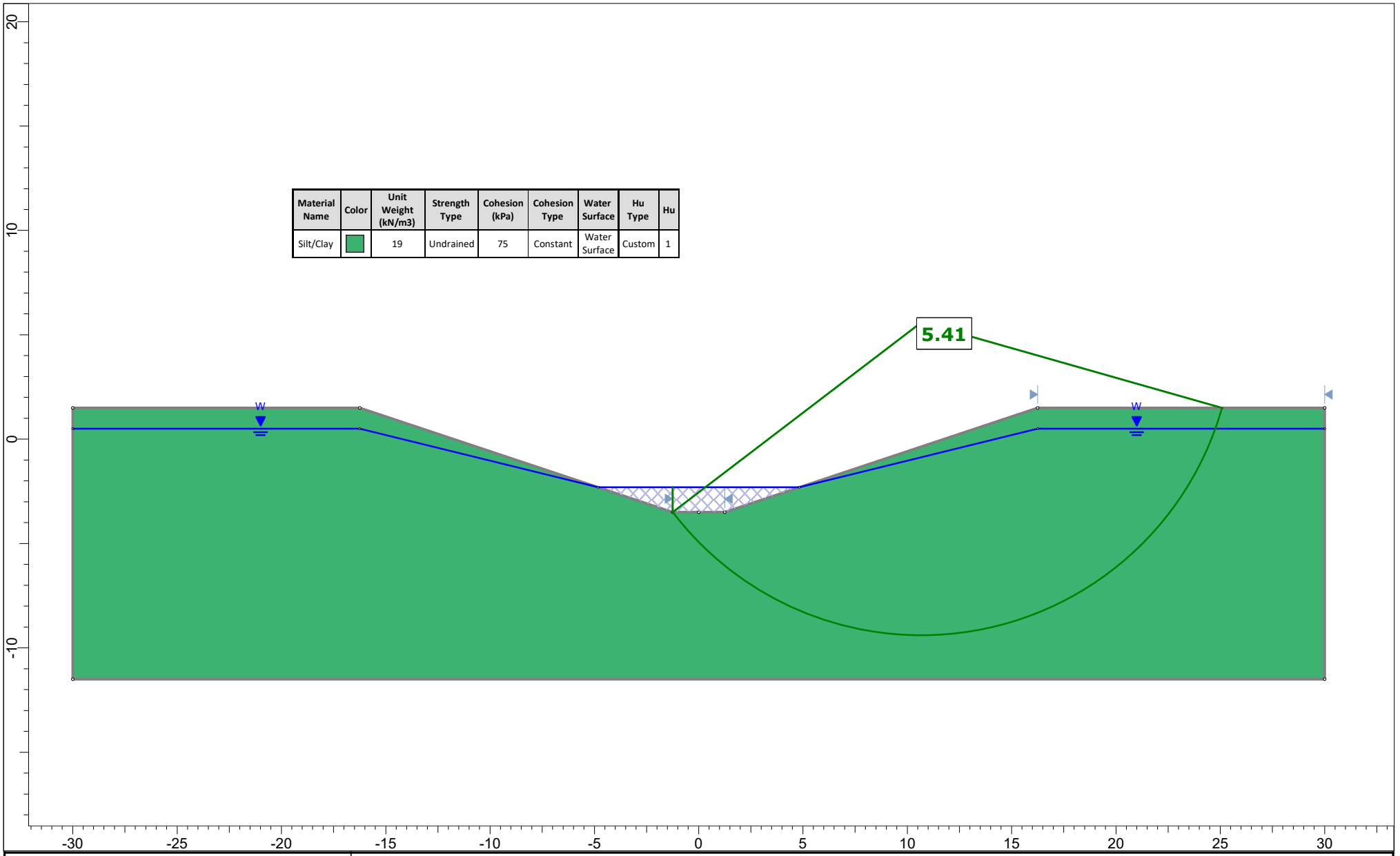
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Silt/Clay (Drained)		19	Mohr-Coulomb	0	30	Water Surface	Custom	1



THURBER ENGINEERING LTD.

Project	Environemental Offset Areas - Bradner North - Cut Slopes
Client	McElhanney
Project Number	37457
Date	7/10/2023
Title	Static (3H:1V) - Near Berm Drained
File Name	kbb_Bradner North_Cut Slopes_37457.slmd

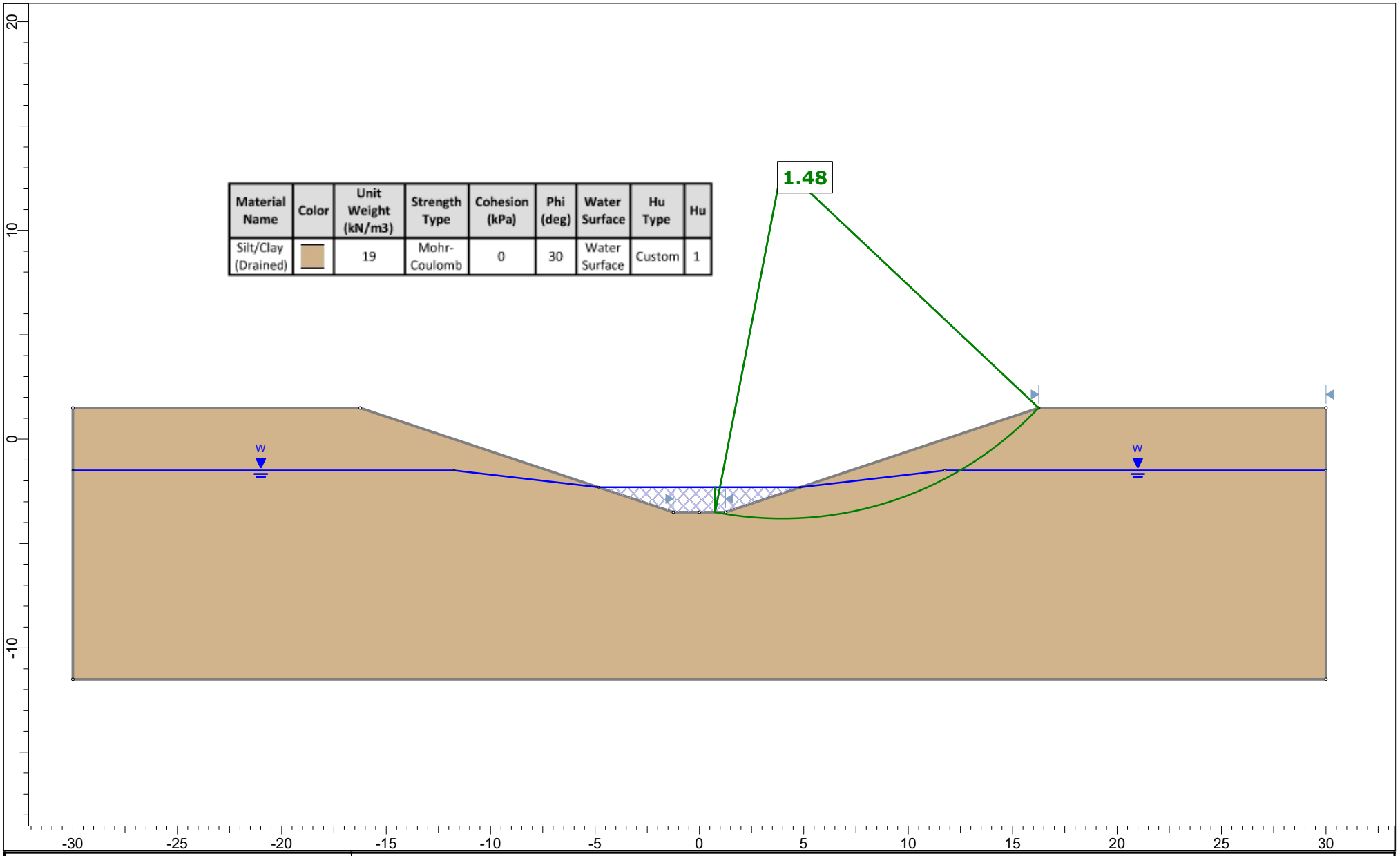
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Cohesion Type	Water Surface	Hu Type	Hu
Silt/Clay		19	Undrained	75	Constant	Water Surface	Custom	1



THURBER ENGINEERING LTD.

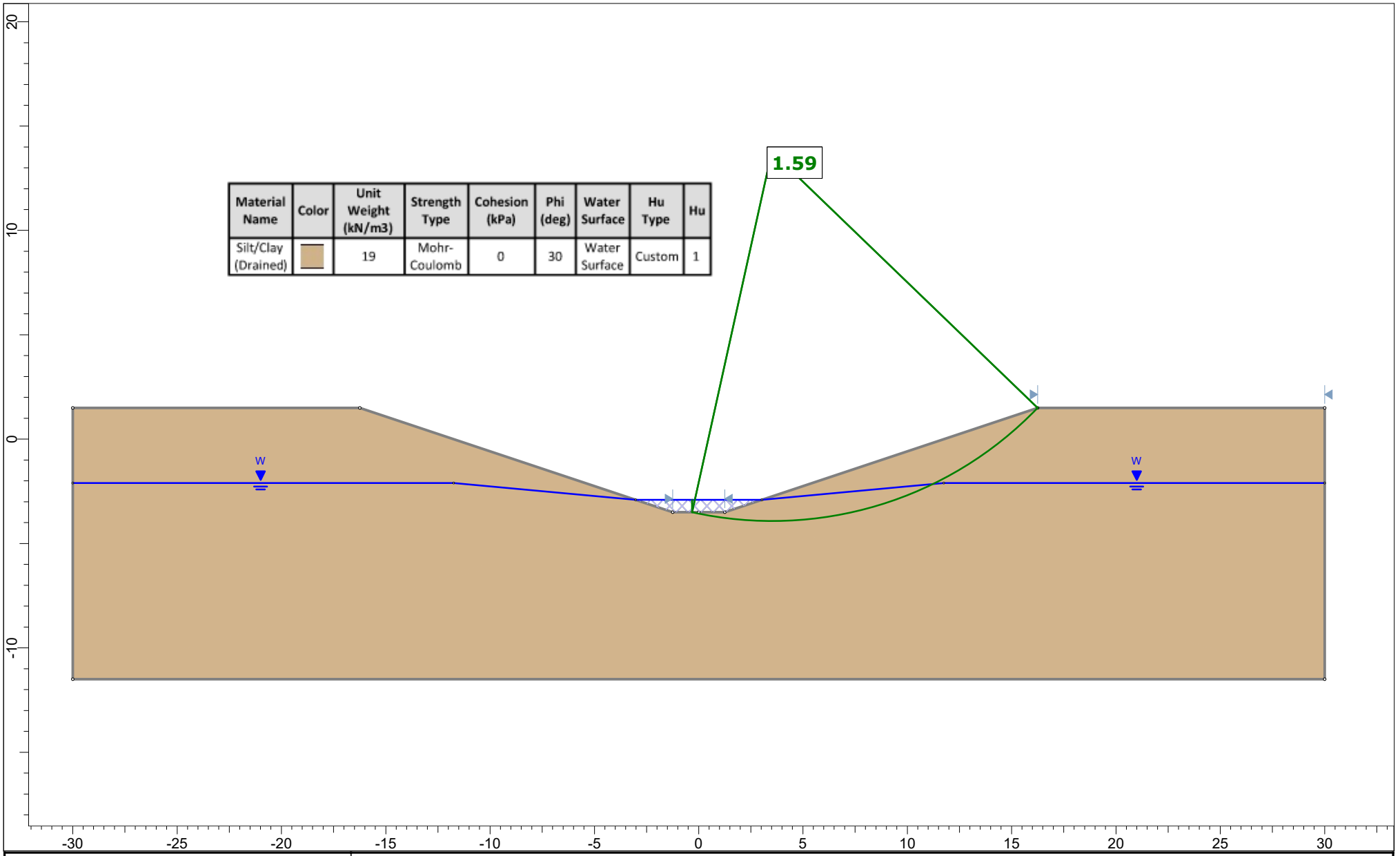
Project	**Environemental Offset Areas - Nathan Creek - Cut Slopes**
Client	McElhanney
Project Number	37457
Date	7/10/2023
Title	Static (3H:1V) Undrained
File Name	kbb_Nathan Creek_Cut Slopes 3H1V_37457.slmd

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Silt/Clay (Drained)		19	Mohr-Coulomb	0	30	Water Surface	Custom	1



THURBER ENGINEERING LTD.

Project	**Environemental Offset Areas - Nathan Creek - Cut Slopes**
Client	McElhanney
Project Number	37457
Date	7/10/2023
Title	Static (3H:1V) Drained (Higher Channel Water)
File Name	kbb_Nathan Creek_Cut Slopes 3H1V_37457.slmd

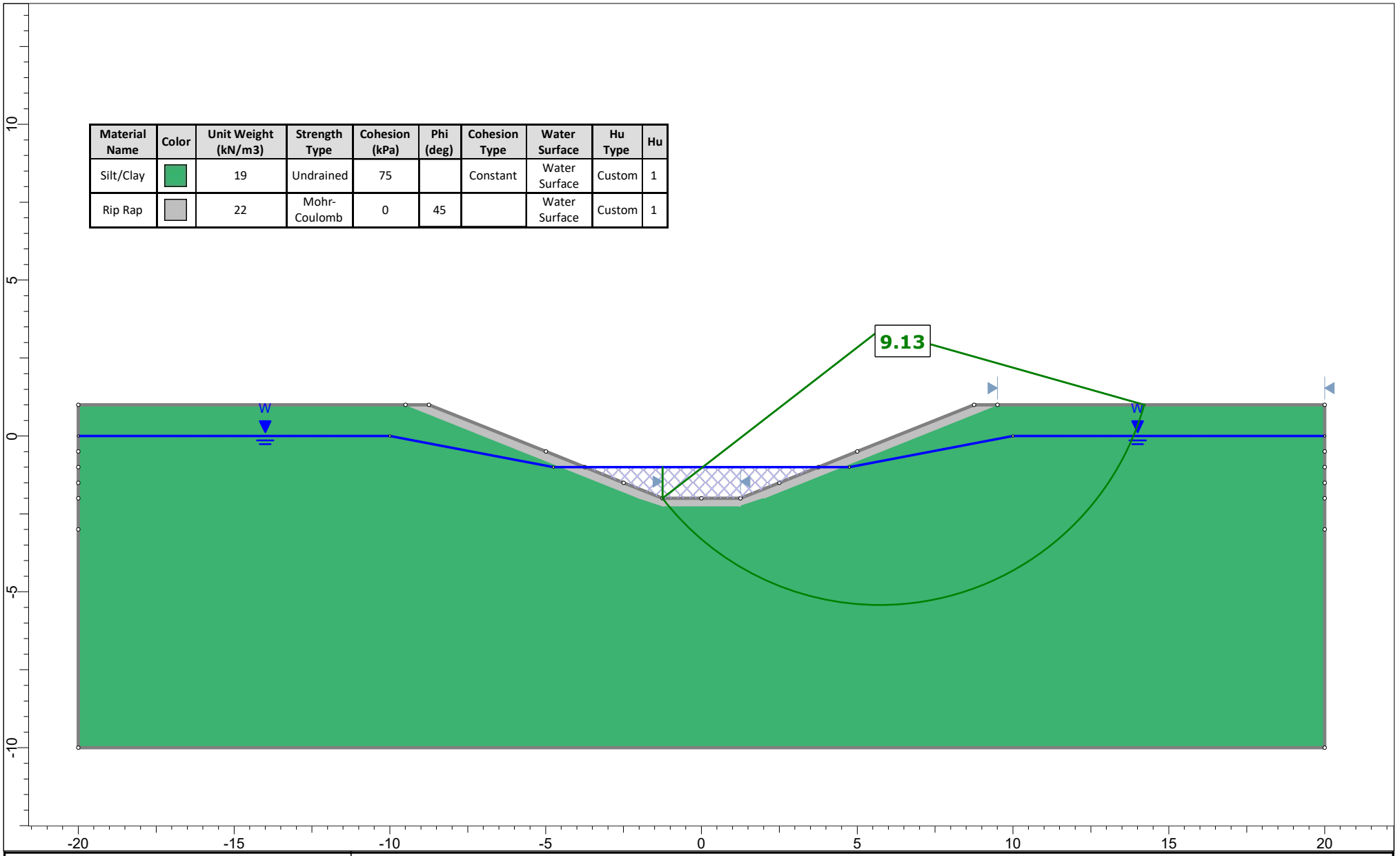


Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Silt/Clay (Drained)		19	Mohr-Coulomb	0	30	Water Surface	Custom	1

THURBER ENGINEERING LTD.

Project	**Environemental Offset Areas - Nathan Creek - Cut Slopes**
Client	McElhanney
Project Number	37457
Date	7/10/2023
Title	Static (3H:1V) Drained (Lower Channel Water)
File Name	kbb_Nathan Creek_Cut Slopes 3H1V_37457.slmd

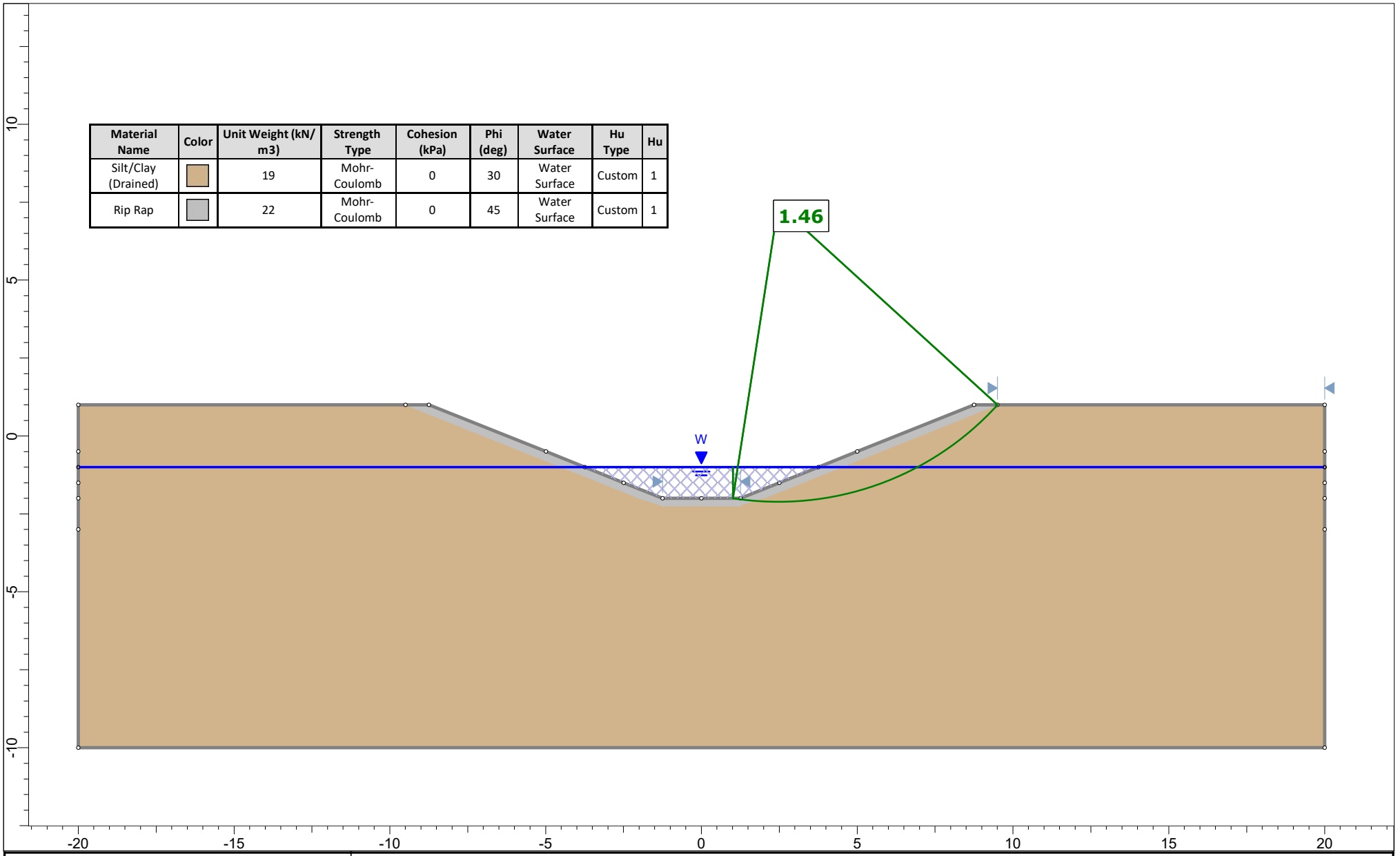
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Cohesion Type	Water Surface	Hu Type	Hu
Silt/Clay		19	Undrained	75		Constant	Water Surface	Custom	1
Rip Rap		22	Mohr-Coulomb	0	45		Water Surface	Custom	1



THURBER ENGINEERING LTD.

Project	Environemental Offset Areas - Nathan Creek - Cut Slopes
Client	McElhanney
Project Number	37457
Date	7/10/2023
Title	Static (2.5H:1V) Undrained (MC)
File Name	kbb_Nathan Creek_Cut Slopes_37457_r2kbb.slmd

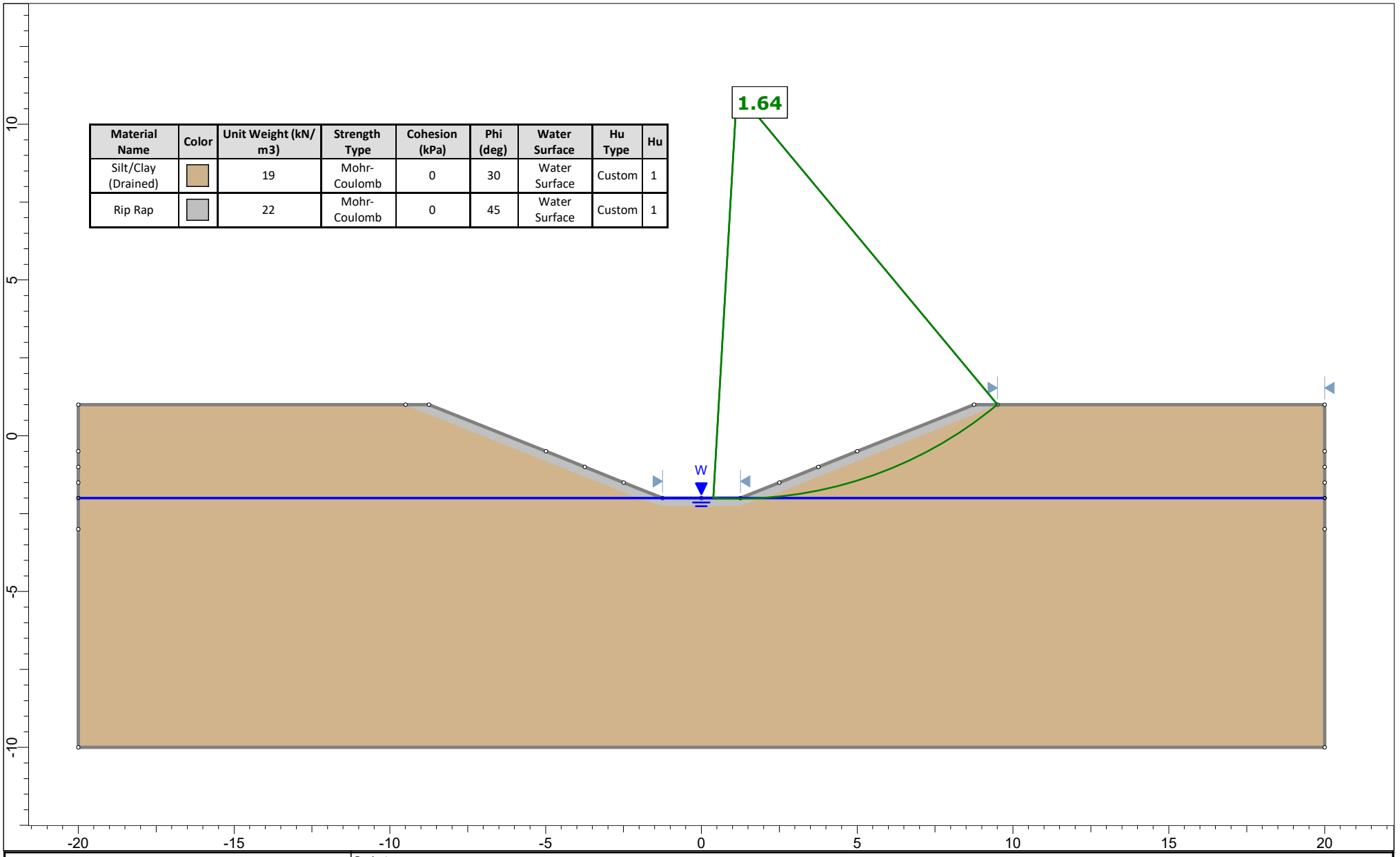
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Silt/Clay (Drained)		19	Mohr-Coulomb	0	30	Water Surface	Custom	1
Rip Rap		22	Mohr-Coulomb	0	45	Water Surface	Custom	1



THURBER ENGINEERING LTD.

Project	Environemental Offset Areas - Nathan Creek - Cut Slopes
Client	McElhanney
Project Number	37457
Date	7/10/2023
Title	Static (2.5H:1V) Drained
File Name	kbb_Nathan Creek_Cut Slopes_37457_r2kbb.slmd

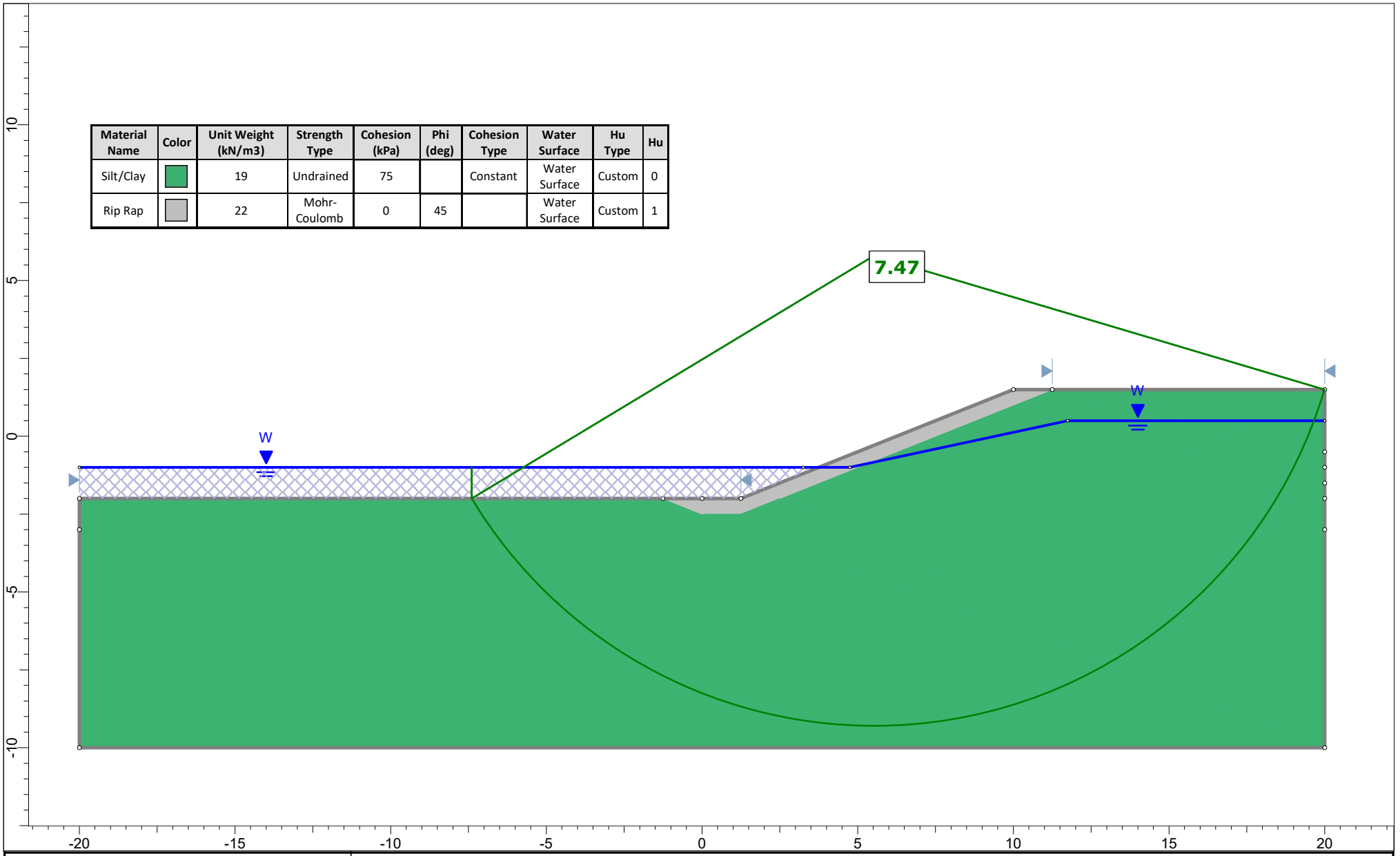
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Silt/Clay (Drained)		19	Mohr-Coulomb	0	30	Water Surface	Custom	1
Rip Rap		22	Mohr-Coulomb	0	45	Water Surface	Custom	1



THURBER ENGINEERING LTD.

Project	**Environemental Offset Areas - Nathan Creek - Cut Slopes**
Client	McElhanney
Project Number	37457
Date	7/10/2023
Title	Static (2.5H:1V) Drained (Lower Water)
File Name	kbb_Nathan Creek_Cut Slopes_37457_r2kbb.slmd

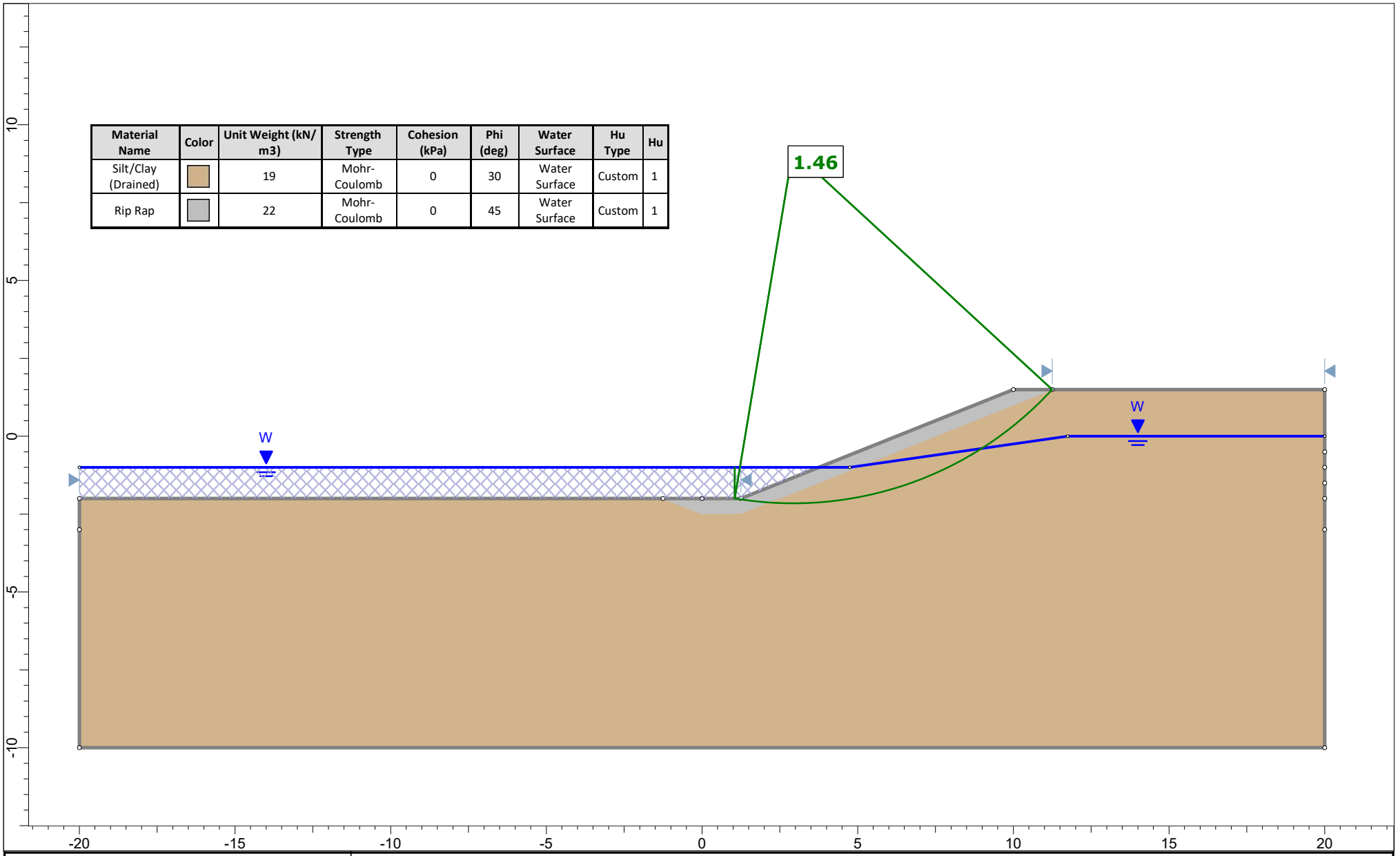
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Cohesion Type	Water Surface	Hu Type	Hu
Silt/Clay		19	Undrained	75		Constant	Water Surface	Custom	0
Rip Rap		22	Mohr-Coulomb	0	45		Water Surface	Custom	1



THURBER ENGINEERING LTD.

Project	Environemental Offset Areas - Nathan Creek - Cut Slopes
Client	McElhanney
Project Number	37457
Date	7/10/2023
Title	Static (2.5H:1V) - Channel Profile Undrained (MC)
File Name	kbb_Nathan Creek_Cut Slopes_37457_r2kbb.slmd

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Silt/Clay (Drained)		19	Mohr-Coulomb	0	30	Water Surface	Custom	1
Rip Rap		22	Mohr-Coulomb	0	45	Water Surface	Custom	1



THURBER ENGINEERING LTD.

Project	**Environemental Offset Areas - Nathan Creek - Cut Slopes**
Client	McElhanney
Project Number	37457
Date	7/10/2023
Title	Static (2.5H:1V) - Channel Profile Drained
File Name	kbb_Nathan Creek_Cut Slopes_37457_r2kbb.slmd