TERRAPEX

CANADA LANDS COMPANY CLC LIMITED

SLOPE STABILITY ASSESSMENT REPORT

Wateridge Village
Park Block 1- Phase 4
Ottawa, Ontario

March 22, 2024

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DISTRIBUTION: **Canada Lands Company (CLC) Limited** **PROJECT # CO682.04**

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1.0 INTRODUCTION

Terrapex Environmental Ltd. (Terrapex), was retained by Canada Lands Company (CLC) Limited (CLC) to carry out a Stability Assessment for the slope present on the southern boundary of Block 1 located within the Phase 4 development Lands at Wateridge Village in Ottawa, Ontario (the Site).

The term of reference for this Geotechnical Investigation was documented in the Terrapex proposal dated September 2, 2020. An agreement and fully executed Change Order dated September 18, 2020 was received from Ms. Erin Forzley on behalf of CLC to proceed with this investigation.

The subject slope is located at the southern section of the proposed Park 1: North Community Park. Park 1 is located on Block 1 of the Phase 4 development at Wateridge Village. The location of the slope is shown on Figure 1; Borehole Location Plan provided at the end of this report.

Based on the information provided to us by CLC, we understand that a toboggan hill will be constructed approximately 50 m north of the toe of the slope and low to mid-rise mixed use buildings will be situated to the south of the crest of the slope; on Block 3. The location of the Parks features are also shown on the Figure 1 and attached in Appendix III.

To assist in our evaluation of the stability of the slope, IBI provided a topographic survey of the slope; attached in Appendix III of this report. This drawing shows the location of the Block boundaries for the Phase 4 development Lands as well as the subject slope, and contour lines along the face of the slope. According to the existing topographic survey, the steepest section of the slope is approximately 8 m; standing at approximate inclination of 1V:2.2 H.

The scope of the investigation undertaken by Terrapex was to characterize the subsurface soil and groundwater conditions underlying the subject slope, to determine the relevant geotechnical properties of encountered soils, and to determine the safety factor of the subject slope with respect to sliding failure and the LTSTOS line.

This report presents the results of the investigation performed in accordance with the general terms of reference outlined above.

2.0 FIELDWORK

The fieldwork for this investigation was carried out on October 23 and 26, 2020 and consisted of advancing four boreholes extended to bedrock at depths ranging from 1.0 m to 3.4 m below grade.

The locations of the boreholes are shown on Figure 1: Borehole Location Plan attached to this report.

The geotechnical field drilling was performed by a geotechnical drilling subcontractor, Marathon Drilling. The boreholes were advanced by using track and truck mounted CME 45 rigs outfitted with hollow stem augers. Standard penetration tests (SPT) were carried out in the course of advancing the boreholes to take representative soil samples and to measure penetration index values (N-values) to characterize the condition of the various soil materials. The number of blows of the striking hammer required to drive the split spoon sampler to 300 mm depth was recorded and these are presented on the logs as penetration index values.

The unconfined shear strength of the silty clay soil was measured by performing in-situ field vane tests. Results of SPT and undrained shear strengths are shown on the borehole log sheets in Appendix I of this report.

Groundwater level observations were made in the boreholes during and upon completion of each of their advancement.

The ground surface elevations at the locations of the boreholes were recorded by Terrapex field staff using a Topcon Hiper V GNSS Receiver with centimetre-scale accuracy.

3.0 LABORATORY TESTS

The soil samples recovered from the split spoon sampler were properly sealed, labelled and brought to our laboratory. They were visually classified and water content tests were conducted on all soil samples retained from Boreholes BH402 and BH404. The results of the classification, water contents, and Standard Penetration Tests are presented on the borehole logs sheets attached in Appendix I of this report.

Grain-size analysis by hydrometer and Atterberg Limit test was carried out on one (1) native soil sample. The results of these tests are presented as Figures 3 and 4 in Appendix II.

4.0 SITE AND SUBSURFACE CONDITONS

Full details of the subsurface and groundwater conditions at the site are given on the Borehole Log sheets attached in Appendix I of this report.

The following subsections present a description of the site and slopes under study and provide a commentary on the engineering properties of the various soil materials contacted in the boreholes advanced adjacent to the slope.

4.1. SITE DESCRIPTION

The subject slope is located on the southern boundary of Block 1 in Phase 4, with the crest of the slope being situated approximately 3 m north of Cottage Private (road) and is oriented in an approximate west-east direction.

A visual inspection of the subject slope was carried out by Terrapex on October 26, 2020.

The slope in general lies at a moderate inclination. Based on the topographic plan provided to us by IBI, the slope has a vertical height of 7 to 8 m; measured between the top of the slope and the base of the slope, with overall gradients ranging from 1V to 2.2H to 1V to 3.4H.

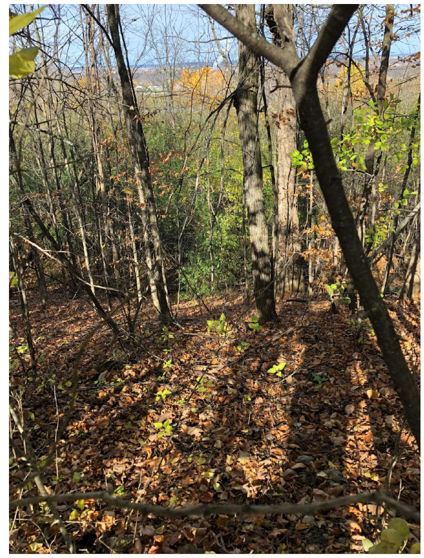
The photographs below depict the general conditions of the subject slope.

Looking up from the bottom of the slope (North to South).

The study slope is a natural slope covered with medium to dense vegetation, and treed with predominately young trees. Most of the trees appear to be straight and vertical.

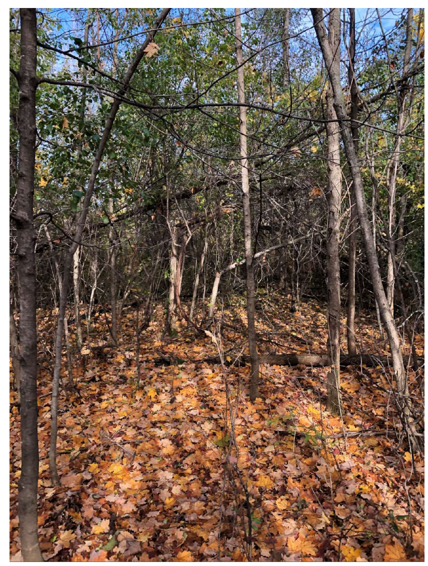
There are no indications of long term movement of the near surface soils on the slope.

Looking down from the top to the bottom of the slope (South to North).
The top of the slope is relatively flat; which slopes down towards the east. There is currently an asphaltic roadway located approximately 3 m north of the top of the slope, beyond the road to the north is a flat vegetated area.



A drainage ditch is present approximately 10 m north of the toe of the slope; oriented in a west to east position. The width of the ditch ranges from 0.5 to 1 m.

At the time of our inspection, there was no water present in the ditch.



There were visible outcrops of Limestone bedrock along the face of the slope, indicating that bedrock is close to the surface. A test pit hand dug half way up the slope revealed that there was approximately 0.4 m of organic material overlying bedrock.

Our inspection of the slope conditions did not reveal any signs of overall instability such as tension cracks at the slope crest, soil creep, subsidence, or erosion. There is no bulging or heave close to the toe of the slope. During our inspection on October 26, 2020, the slope face was dry with no visible groundwater seepage.

Using the Slope Stability rating Chart of the Ontario Ministry of Natural Resources (OMNR) document "Geotechnical Principles for Stable Slopes", the study slope is rated as having a total instability rating of 20, corresponding to a "low potential" and a requirement of "Site inspection, report letter".

4.2. SOIL AND GROUNDWATER CONDITIONS

The boreholes located at the top of the slope; Boreholes (BH401 and BH402) reveal that, a thin layer of fill extending to a depth of 300 mm is present at BH402. In BH401 and below the fill layer in BH402 is a native silty sand soil with trace limestone fragments, which extends to bedrock located at 1.0 m below ground surface (m bgs).

The soil is brown in colour and damp in appearance. The water content of the soil determined on the samples retained from Borehole BH402 ranged from about 7 to 17%.

Standard penetration resistance in the silty sand layer provided N-values of 47 to 50 for 75 mm of penetration, indicating a very dense compactness condition.

The boreholes located at the toe of the slope Borehole (BH403 and BH404) reveal that below a thin topsoil layer is a natural soil deposit of silty clay which extends to bedrock encountered at depths of 3.3 and 3.4 m bgs.

The soil is greyish brown in colour and damp to moist in appearance. The water content of the soil determined on the samples retained from Borehole BH404 ranged from about 21 to 39%.

Standard penetration resistance in the silty clay layer provided N-values of 7 to 9, in-situ field vanes were attempted however we were unable to shear the silty clay soil, indicating a very stiff to hard consistency.

A grain size analysis by hydrometer and Atterberg Limits test were carried out on one (1) representative soil samples of the silty clay. The laboratory test results are provided in Appendix II as Figures 3 and 4, and summarized below.

Borehole No.	Sample Depth (mbgs) and No.	Sample Description	Gravel %	Sand %	Silt %	Clay %	Liquid Limit	Plastic Limit
BH404	3.0 (Sample 4)	Silty Clay	0	0	38	62	65	37

The soil classification, based on the plasticity chart on Figure 4, is Inorganic Clay of High Plasticity.

Upon completion of drilling, cave-in of the unlined sidewalls was measured at 2.8 m below grade in Borehole BH403 and BH404. Groundwater or cave-in was not encountered in Boreholes BH401 and BH402.

5.0 EROSION HAZARD LIMIT

The Ontario Ministry of Natural Resources (MNR) Natural Hazards Policies provided general guidelines for the determination of the setback for new developments adjacent to the crest of steep natural slopes (shoreline bluffs, river valleys, ravines) in the document titled *Technical Guide – River and Stream Systems: Erosion Hazard Limit* published by MNR dated 2002. The 100-year Erosion Limit (also known as the Erosion Hazard Limit) is defined as a horizontal line located near the crest of steep slopes which limits the proximity of any new developments to natural hazard areas. The erosion hazard limit (or setback) is the sum of the following three (3) setback allowances, measured from the toe of the slope towards the slope crest:

1. Toe Erosion Allowance
2. Stable Slope Allowance
3. Erosion Access Allowance

The toe erosion allowance is applicable to slopes situated within 15 m distance from a water course.

The stable slope allowance is determined by analytical methods to derive the stable top of slope and stable slope inclination in order to establish the setback distance that is required from the top of slope. For land development and planning, a minimum Factor of Safety of 1.5 is required for engineering design of slopes for stability.

The sum of the toe erosion allowance and stable slope allowance is the Long-Term Stable Top of Slope (LTSTOS).

An erosion access allowance is also required to ensure that there is enough safety zone along the top of a slope for machinery to enter or exit the area during an emergency. The erosion access allowance is typically determined by the local conservation authority.

6.0 SLOPE STABILITY ASSESSMENT

Stability analyses were carried out using the GEO5 2020 Slope Stability software package. The program was configured to calculate the minimum factor of safety for moment equilibrium assuming circular failure surfaces. The Bishop method employing effective stress was used to calculate the minimum factor of safety against circular failure.

SLOPE PROFILE

Three cross sections (1, 2 and 3), representing the slope were analyzed by Terrapex.

The locations of the slope sections are shown on Figure 2. The following table summarizes the vertical height and inclination angle at each slope section.

VERTICAL HEIGHT AND INCLINATION ANGLES OF SLOPE SECTIONS

Slope Section No.	Approximate Vertical Height of Slope	Overall Slope Inclination / Degrees to Horizontal
1 (A-A')	7.0 m	1V : 3.44H / 16.2º
2 (B-B')	8.0 m	1V : 2.16H / 24.8º
3 (C-C')	8.0 m	1V : 2.7 H/ 20.3 º

The safety factor against circular failure were determined at each slope section.

SOIL PROPERTIES AND WATER LEVELS USED IN STABILITY ANALYSIS

Soil strength parameters used in the slope stability analyses were based on the results of the in situ Standard Penetration Tests, together with an assessment on the soil type using the results of the Particle Size Distribution tests and Atterberg Limits.

Based on the field tests and laboratory test results, the following soil properties were utilized in the slope stability analyses:

SOIL PROPERTIES USED IN THE STABILITY ANALYSES

Soil Type	Unit Weight (kN/m^3)	Angle of Internal Fiction (degrees)	Effective Cohesion (KPa)
Silty Sand	20.0	32	0
Topsoil/organic Material	15.0	26	0
Very Stiff Silty Clay	20.0	28	0
Bedrock	25.0	40	0

For analysis of long-term stability, the drained shear strength of the soil is expressed in terms of angle of internal friction, not utilizing the cohesion.

Although groundwater was not encountered in the boreholes, a groundwater level of 0.5 m below the base of the slope was used in the stability analysis for the slope sections.

STABILITY ANALYSIS AND FACTORS OF SAFETY AGAINST FAILURE

Results of the slope stability analyses on Slope Sections 1, 2 and 3 are contained in Appendices

IV, V and VI. The results of the analyses are summarized below:

STABILITY ANALYSES OF SLOPE SECTIONS

Slope Section	Computed Minimum Factor of Safety Against Circular Failure
1 (A-A')	2.94
2 (B-B')	1.93
3(C-C')	2.19

The analyses indicate the safety factors of the slope sections with respect to circular failure range between 1.93 and 2.94; greater than 1.5. Accordingly, the slope is considered to be stable.

TOE EROSION ALLOWANCE

As there is no water body near the bottom of the slope the toe erosion allowance does not apply for the slope.

LONG TERM STABLE TOP OF SLOPE

Based on the findings of the stability analysis, the LTSTOS including both stability and toe erosion components is situated at the top of the existing slope.

The erosion access allowance is typically determined by the local authority.

7.0 LIMITATIONS OF REPORT

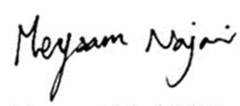
The conclusion and recommendations in this report are based on information determined at the inspection locations. Soil and groundwater conditions between and beyond the test holes may differ from those encountered at the test hole locations, and conditions may become apparent during construction which could not be detected or anticipated at the time of the soil investigation.

The design recommendations given in this report are applicable only to the project described in the text. Since all details of the design may not be known to us, in our analysis certain assumptions had to be made as set out in this report. The actual conditions may, however, vary from those assumed, in which case changes and modifications may be required to our recommendations.

This report was prepared for Canada Lands Company CLC Limited by Terrapex Environmental Ltd. The material in it reflects Terrapex Environmental Ltd. judgement in light of the information available to it at the time of preparation. Any use which a Third Party makes of this report, or any reliance on decisions which the Third Party may make based on it, are the sole responsibility of such Third Parties.

The comments given in this report on potential construction problems and possible methods are intended for the guidance of the design engineer, only. The number of inspection locations may not be sufficient to determine all the factors that may affect construction methods and costs. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work.

Respectfully submitted,
TERRAPEX ENVIRONMENTAL LTD.



Yacouba Doro, MBA, PMP®, P.Eng.
Senior Project Manager, Geotechnical

Meysam Najari, PhD.
Vice President, Geotechnical Services

FIGURES

Figure 1: Borehole Location Plan

Figure 2: Slope Stability Analysis

TERRAPEX

BOREHOLE LOCATION PLAN

WATERIDGE VILLIAGE
OTTAWA, ONTARIO

CLIENT

Canada Lands Company
Société immobilière du Canada

SOURCE: SITE PLAN PROVIDED BY CLIENT.

LEGEND

BOREHOLE LOCATION

PROJECT #	CO682.04
SCALE	AS SHOWN
DATE	NOVEMBER 2020
DRAWN	AB / ECV
CHECKED	RH
DRAWING #	FIGURE 1

TERRAPEX

SLOPE STABILITY ANALYSIS

WATERIDGE VILLIAGE - PARK BLOCK 1
OTTAWA, ONTARIO

CLIENT

Canada Lands Company
Société immobilière du Canada

0 25m 50m
(APPROXIMATE)

SOURCE: IMAGE FROM FIRST BASE SOLUTION, GOOGLE IMAGE, 2020.
CONTOURS IMAGE PROVIDED BY CLIENT

LEGEND

BOREHOLE LOCATION

PROJECT #	CO682.04
SCALE	AS SHOWN
DATE	DECEMBER 2020
DRAWN ECV	CHECKED RH
DRAWING #	FIGURE 2

APPENDIX I

BOREHOLE LOGS

RECORD OF: BH401

CLIENT: CLC	PROJECT NO.: CO682.04	
ADDRESS: Wateridge Village Park Block 1- Phase 4	STATION:	
CITY/PROVINCE: Ottawa, Ontario	NORTHING (m): 5033658	EASTING (m): 450332 — ELEV. (m) 91.0
CONTRACTOR: Marathon Underground	METHOD: Hollow Stem Augers/Split Spoon Sampler	
BOREHOLE DIAMETER (cm):	WELL DIAMETER (cm):	SCREEN SLOT #: — SAND TYPE: — SEALANT TYPE:

SAMPLE TYPE: AUGER, DRIVEN, CORING, DYNAMIC CONE, SHELBY, SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) 40 80 120 160 / N-VALUE (Blows/300mm) 20 40 60 80	WATER CONTENT (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		very dense dry brown SILTY SAND trace gravel trace limestone fragments	0 0.5 1	91 90.5 90	47 50/75mm		1 2						On completion borehole remained open and dry Auger refusal on inferred bedrock at 1 mbgs.
		END OF BOREHOLE											

	LOGGED BY: RH	DRILLING DATE: 26-OCT-20
	INPUT BY: RH	MONITORING DATE:
	REVIEWED BY: VN	PAGE 1 OF 1

CLIENT: CLC	PROJECT NO.: CO682.04	RECORD OF: BH402
ADDRESS: Wateridge Village Park Block 1-Phase 4	STATION:	
CITY/PROVINCE: Ottawa, Ontario	NORTHING (m): 5033661 / EASTING (m): 450348	ELEV. (m) 91.1
CONTRACTOR: Marathon Underground	METHOD: Hollow Stem Augers/Split Spoon Sampler	
BOREHOLE DIAMETER (cm): / WELL DIAMETER (cm):	SCREEN SLOT #: / SAND TYPE:	SEALANT TYPE:

SAMPLE TYPE: AUGER, DRIVEN, CORING, DYNAMIC CONE, SHELBY, SPLIT SPOON

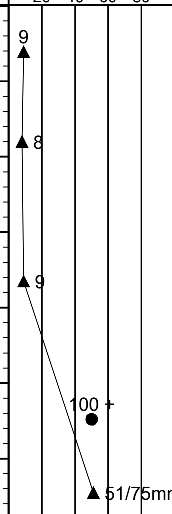
GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) ● 40 80 120 160 / N-VALUE (Blows/300mm) ▲ 20 40 60 80	WATER CONTENT (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		dense, moist, brown sand some gravel, trace silt, trace organics (FILL)	0	91	33	15, 17	1A, 1B						On completion borehole remained open and dry
		very dense, damp, brown SILTY SAND trace limestone fragments	0.5 – 1	90.5	50/75mm	7	2						Auger refusal on inferred bedrock at 1.0 mbgs.
		END OF BOREHOLE											

LOGGED BY: RH	DRILLING DATE: 23-OCT-20
INPUT BY: RH	MONITORING DATE:
REVIEWED BY: VN	PAGE 1 OF 1

CLIENT: CLC	PROJECT NO.: CO682.04	RECORD OF:
ADDRESS: Wateridge Village Park Block 1-Phase 4	STATION:	BH403
CITY/PROVINCE: Ottawa, Ontario	NORTHING (m): 5033692 / EASTING (m): 450292	ELEV. (m) 82.5
CONTRACTOR: Marathon Underground	METHOD: Hollow Stem Augers/Split Spoon Sampler	
BOREHOLE DIAMETER (cm): / WELL DIAMETER (cm):	SCREEN SLOT #: / SAND TYPE:	SEALANT TYPE:

SAMPLE TYPE: AUGER, DRIVEN, CORING, DYNAMIC CONE, SHELBY, SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) ● / N-VALUE (Blows/300mm) ▲	WATER CONTENT (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		150 mm of TOPSOIL	0	82.5									
		stiff to very stiff damp to moist greyish brown SILTY CLAY, trace organics -----			9		1A						On completion borehole sidewalls caved in at 2.8 mbgs
			0.5	82			1B						
			1	81.5	8		2						
			1.5	81									
			2	80.5	9		3						
			2.5	80	100 +								Vane = refusal with torque wrench
			3	79.5	51/75mm		4						Auger refusal on inferred bedrock at 3.4 m bgs.
		END OF BOREHOLE											



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RECORD OF: BH404

CLIENT: CLC	PROJECT NO.: CO682.04	
ADDRESS: Wateridge Village Park Block 1 -Phase 4	STATION:	
CITY/PROVINCE: Ottawa, Ontario	NORTHING (m): 5033709	EASTING (m): 450315 — ELEV. (m) 82.6
CONTRACTOR: Marathon Underground	METHOD: Hollow Stem Augers/Split Spoon Sampler	
BOREHOLE DIAMETER (cm):	WELL DIAMETER (cm):	SCREEN SLOT #: — SAND TYPE: — SEALANT TYPE:

SAMPLE TYPE: AUGER, DRIVEN, CORING, DYNAMIC CONE, SHELBY, SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) ● 40 80 120 160 / N-VALUE (Blows/300mm) ▲ 20 40 60 80	WATER CONTENT (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		150 mm TOPSOIL	0	82.5		22	1A						On completion borehole sidewalls caved in at 2.8 mbgs.
		stiff to very stiff damp to moist greyish brown SILTY CLAY trace organics -----	0.5	82	7	21	1B						
			1	81.5	8	28	2						
			1.5	81									
			2	80.5	100 +								Vane = refusal with torque wrench
			2.5	80		29	3A						
					8	30	3B						Auger refusal on apparent bedrock at 3.3 m bgs.
			3	79.5	50/0mm	39	4						

END OF BOREHOLE

LOGGED BY: RH	DRILLING DATE: 23-OCT-20
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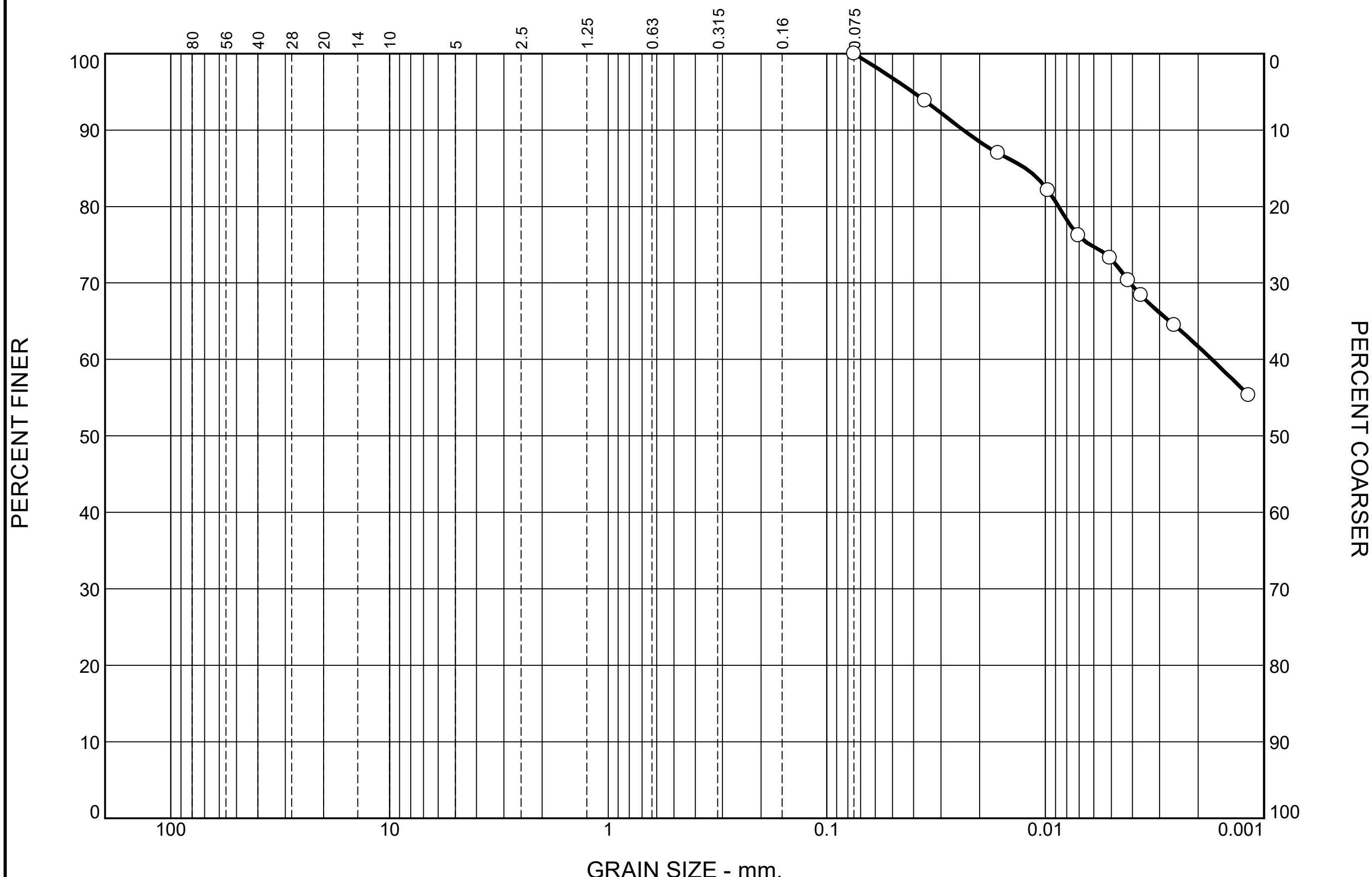
APPENDIX II

LABORATORY RESULTS

Grain Size Distribution Report



	% +3"	% Gravel	% Sand Coarse	% Sand Fine	% Fines Silt	% Fines Clay
○	0	0	0	0	38	62

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				0.0123	0.0017						

Material Description	USCS	AASHTO
○ SILTY CLAY		

Project No. CO682.04 **Client:** Canada Lands Company (CLC)

Project: Wateridge Village Park Block 1 Slope Stability Analysis

○ **Sample Number:** MW404-4

Date: ○ November 4, 2020

Terrapex

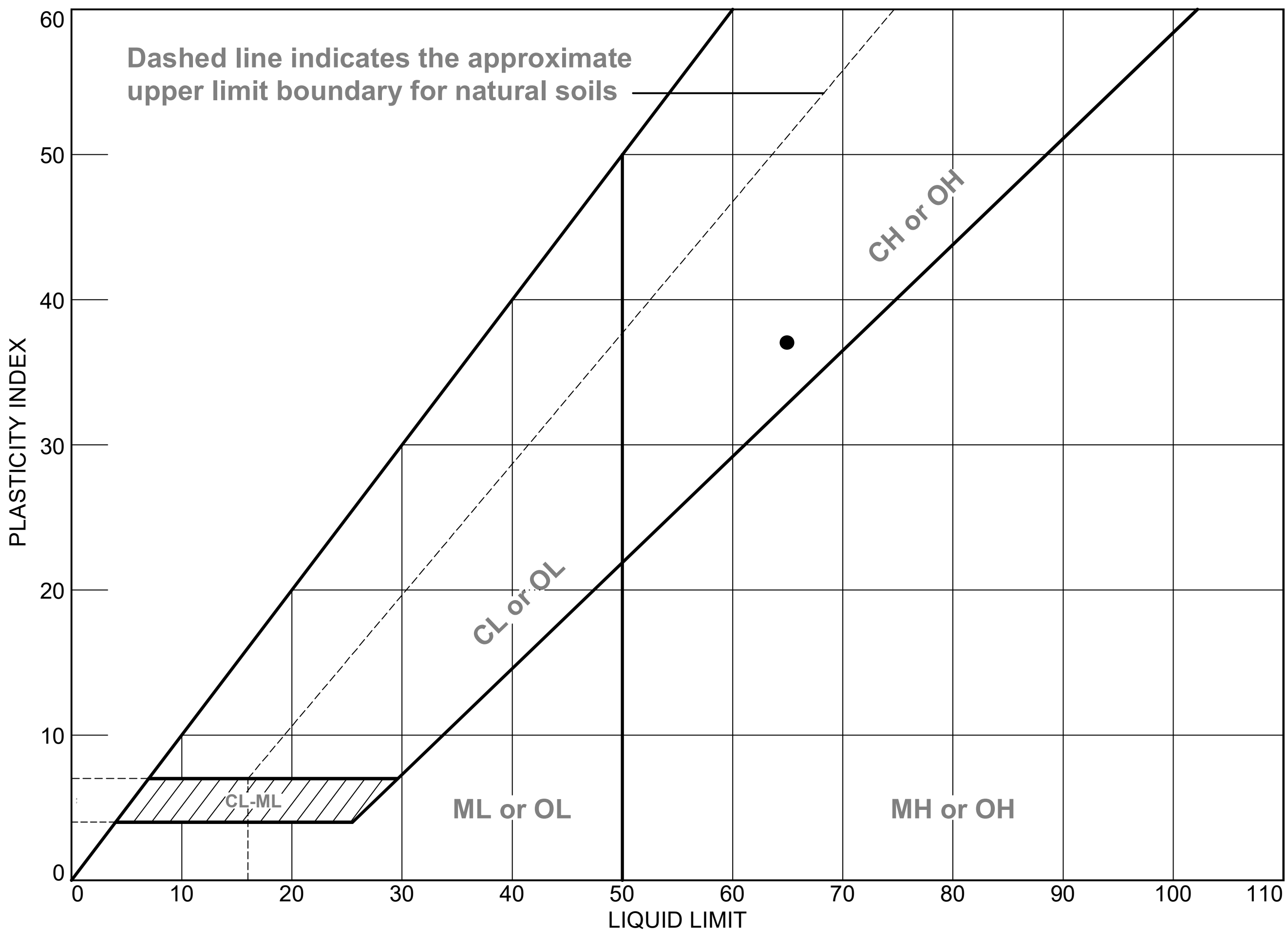
Ottawa, ON

Remarks:

Figure 3

Tested By: RH **Checked By:** VN

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●		MW404-4		28.5	28	65	37	CH

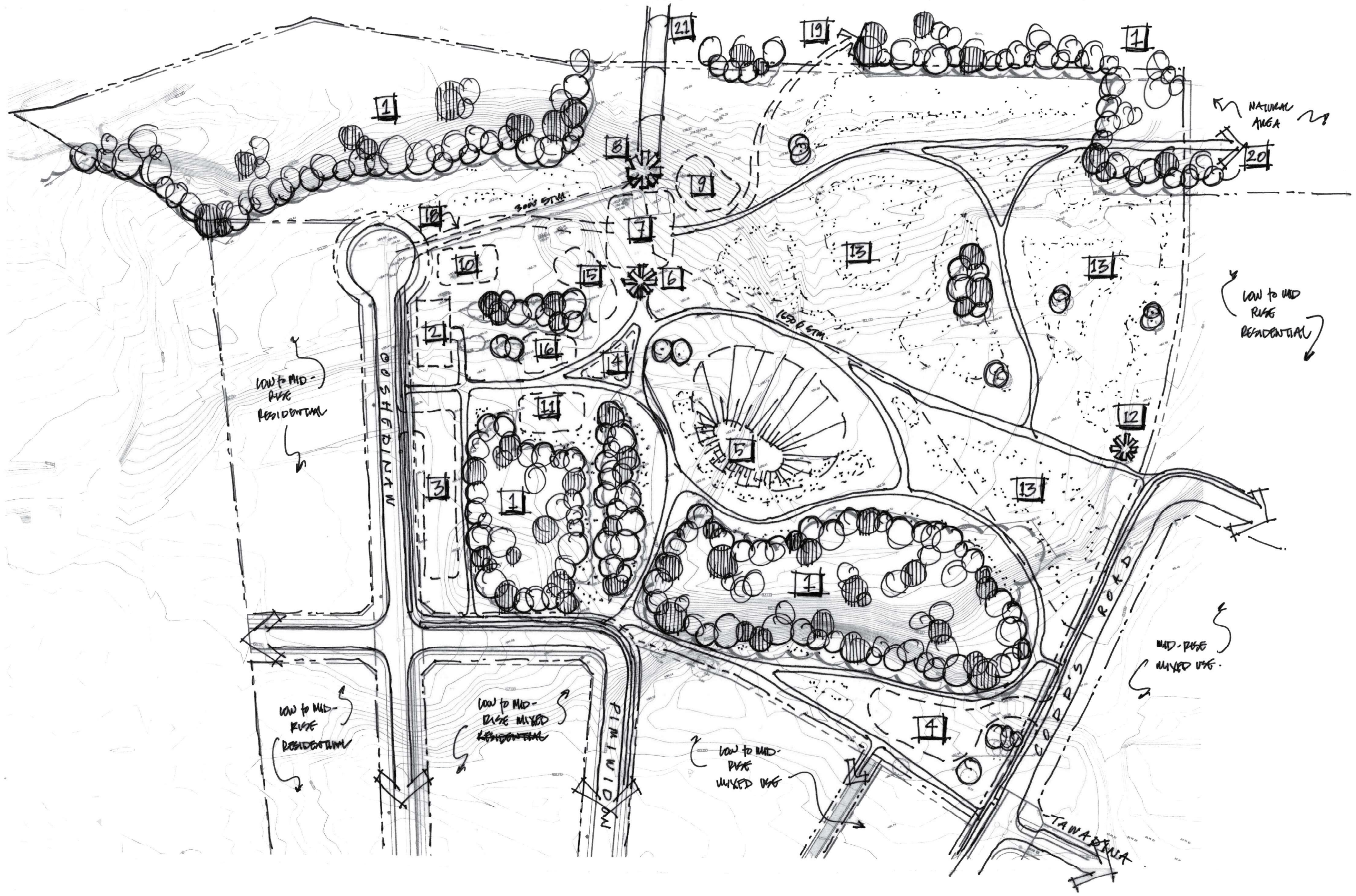
Terrapex **Ottawa, ON**	**Client:** Canada Lands Company (CLC) **Project:** Wateridge Village- Park Block 1 Slope Stability Analysis **Project No.:** CO682.04 **Figure** 4

Tested By: RH **Checked By:** VN

APPENDIX III

Client Provided Drawings

FACILITY FIT PLAN



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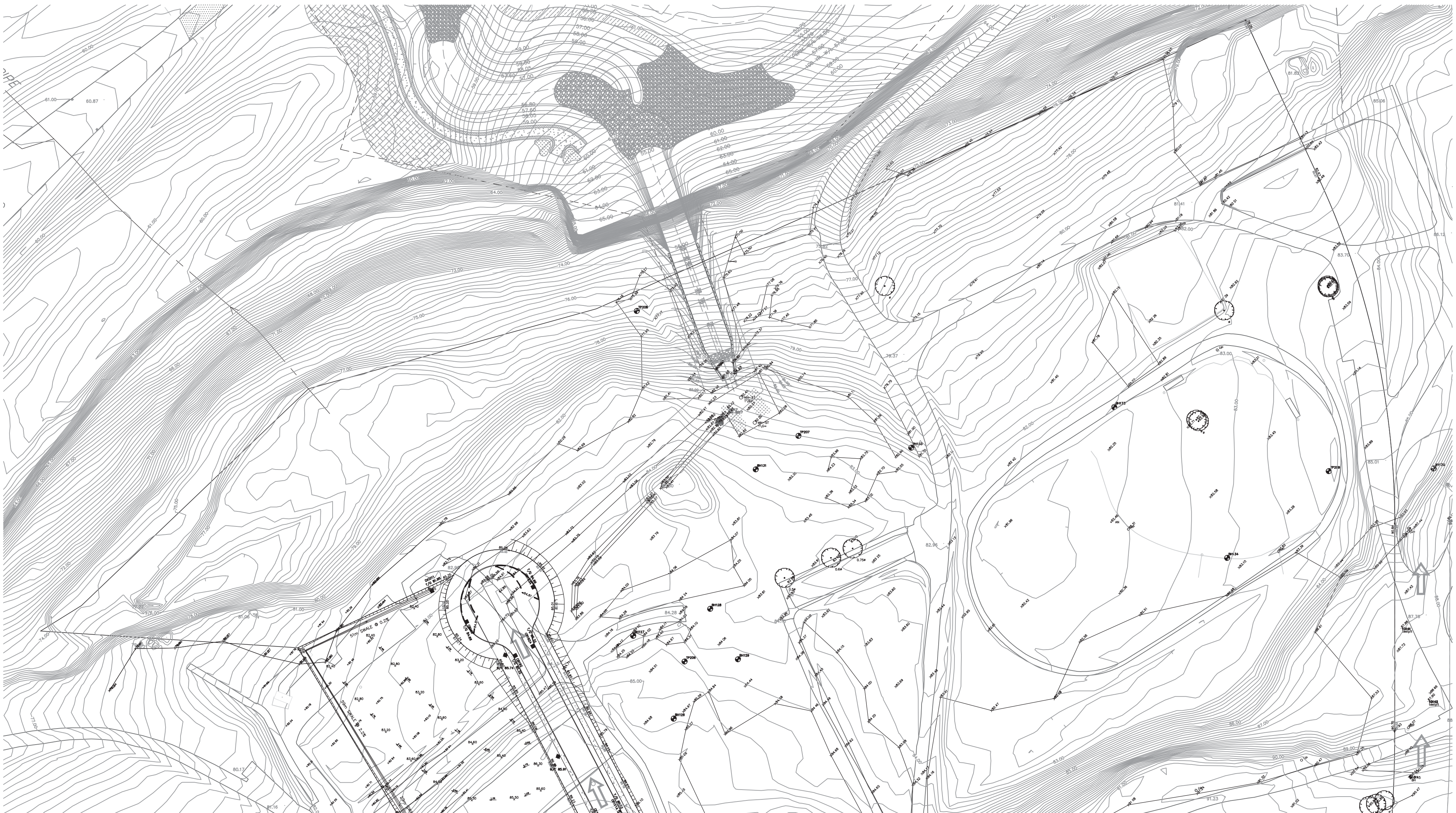
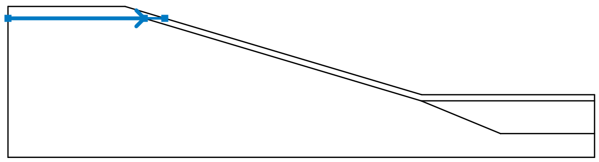
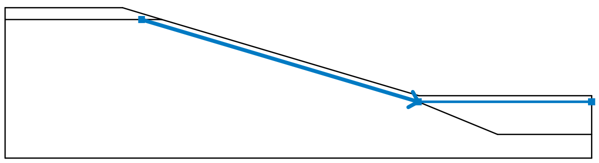
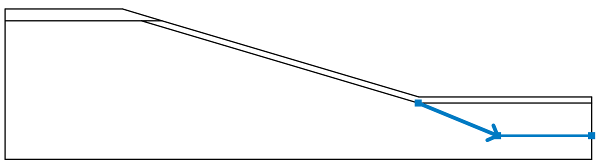
ISSUED FOR INTERNAL REVIEW DISCUSSION

KEY	DESCRIPTION
1	EXISTING FORESTED AREAS TO BE RETAINED
2	LOCATION FOR POSSIBLE FUTURE COMMUNITY BUILDING
3	WEST PARKING CELL with space for up to approx. 30 vehicles. Additional street parking available, including accessible stalls near building location.
4	EAST PARKING CELL with space for up to approx. 20 vehicles.
5	SLIDING HILL. Potentially 10m in height, offers a commanding view of the Ottawa River (approx. 45m above) and the rest of the park.
6	CUSTOM SHADE SHELTER. The design, guided by Algonquins, will have sculptural qualities that echo the downward pointed wings of an eagle. Its prominent location will ensure its visibility, even from the Sir George-Étienne Cartier Parkway below.
7	GATHERING AREA. The primary hub of the park, with ample seating, picnic tables and a (possible) ceremonial fire pit that functions as a sculpture when not in use.
8	BELVEDERE. A generously sized look-out plaza to celebrate the connection to the water. A cantilevered design will to downplay the visual prominence of the stormwater outlet pipe below. The Algonquin presence in the Ottawa Valley can be further reinforced through the railing design of the belvedere.
9	AMPHITHEATRE / TEACHING CIRCLE in this location takes advantage of the natural topography. This feature will provide a space for performance and education and be designed using natural materials
10	COMMUNITY FOOD GARDENS (subject to community interest / commitment)
11	"PUDDLE" RINK. A flat turfgrass area nestled within existing forested areas provide the feeling of skating in the woods. A catenary lighting system should be explored as an alternative to City-standard light poles.
12	GATEWAY GATEWAY / ENTRANCE FEATURE to highlight the Algonquin tradition of entering from the east. This pedestrian-scale feature will include an introduction to the interpretive / commemorative elements planned to be located throughout the park.
13	NATURALIZED AREAS. These areas are proposed to be maintained as "managed meadow" spaces. They may include regularly mown grass pathways throughout to encourage exploration as well as indigenous plant species that have significance to Algonquin people. These features will be highlighted through the interpretive program.
14	SPLASH PAD to be themed to include representations of indigenous animals and the traditional Algonquin canoe.
15	JUNIOR-AGED PLAYGROUND to be themed to include representations of indigenous animals.
16	SENIOR-AGED PLAYGROUND to be themed to include representations of indigenous animals.
17	Not used
18	SERVICE ACCESS with vehicle control gates to accommodate regular park maintenance vehicles and access for special event set-up.
19	CYCLING CONNECTION to NCC trail network. Existing service road alignment may be modified (downsized) and re-surfaced.
20	PATHWAY CONNECTION to Tanakiwin Park.
21	EXISTING "WATERFALL" (storm sewer outlet to SWM pond below)


Chemin Codd's Road
Codd's Road
BLOCK 107

APPENDIX IV

STABILITY ANALYSIS OF SLOPE ALONG SECTION ‘1’

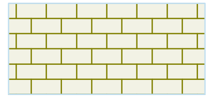
No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
2		-10.00	89.50	1.63	89.50	3.37	89.50
3		1.63	89.50	25.22	82.50	40.00	82.50
4		25.22	82.50	31.99	79.70	40.00	79.70

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]
1	Silty Sand		32.00	0.00	20.00
2	Topsoil/Organic Material		26.00	0.00	15.00
3	Silty Clay		28.00	0.00	19.00
4	Bedrock		40.00	0.00	25.00

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [kN/m^3]	γ_s [kN/m^3]	n [–]
1	Silty Sand		20.00		
2	Topsoil/Organic Material		15.00		
3	Silty Clay		19.00		

No.	Name	Pattern	γ_{sat} [kN/m3]	γ_s [kN/m3]	n [–]
4	Bedrock		25.00		

Soil parameters

Silty Sand

Unit weight : γ = 20.00 kN/m3
Stress-state : effective
Angle of internal friction : φ_{ef} = 32.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 20.00 kN/m3

Topsoil/Organic Material

Unit weight : γ = 15.00 kN/m3
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 15.00 kN/m3

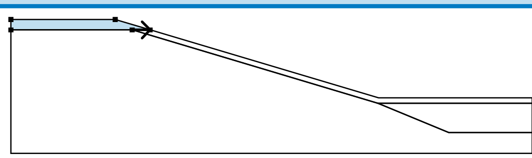
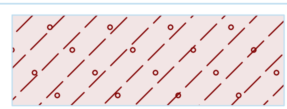
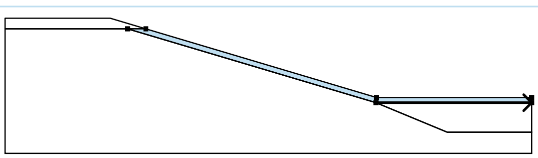
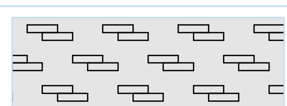
Silty Clay

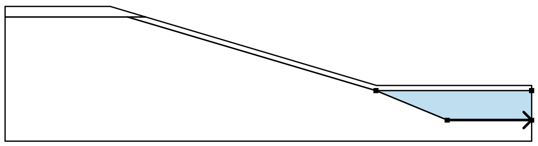
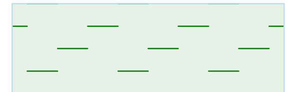
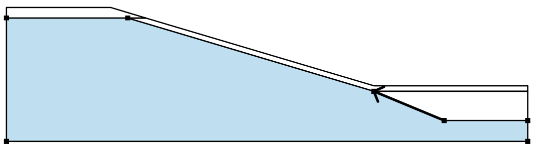
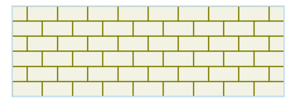
Unit weight : γ = 19.00 kN/m3
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 19.00 kN/m3

Bedrock

Unit weight : γ = 25.00 kN/m3
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 25.00 kN/m3

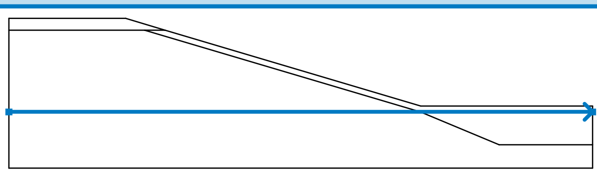
Assigning and surfaces

No.	Surface position	Coordinates of surface points [m] x	z	x	z	Assigned soil
1		1.63	89.50	3.37	89.50	Silty Sand
		0.00	90.50	-10.00	90.50	
		-10.00	89.50			
2		25.22	82.50	40.00	82.50	Topsoil/Organic Material
		40.00	83.00	25.28	83.00	
		3.37	89.50	1.63	89.50	

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
3		31.99	79.70	40.00	79.70	Silty Clay 
		40.00	82.50	25.22	82.50	
4		31.99	79.70	25.22	82.50	Bedrock 
		1.63	89.50	-10.00	89.50	
		-10.00	77.70	40.00	77.70	
		40.00	79.70			

Water

Water type : GWT

No.	GWT location	Coordinates of GWT points [m]					
		x	z	x	z	x	z
1		-10.00	82.50	40.00	82.50		

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	25.81	[m]	Angles :	α_1 =	-32.98	[°]
	z =	131.16	[m]		α_2 =	6.48	[°]
Radius :	R =	48.47	[m]				
Analysis of the slip surface without optimization.							

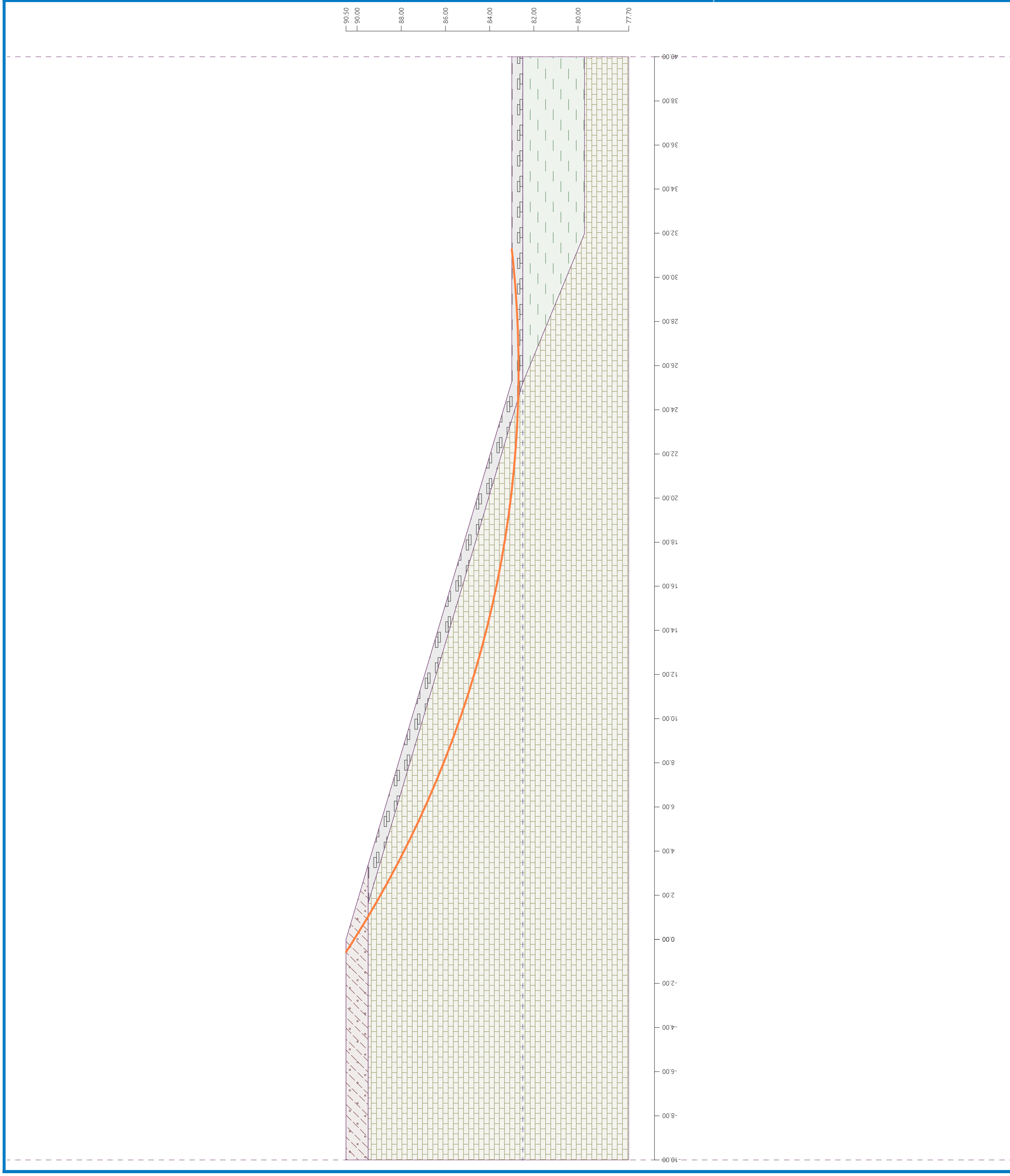
Slope stability verification (Bishop)

Sum of active forces : F_a = 248.49 kN/m
Sum of passive forces : F_p = 730.19 kN/m

Sliding moment : M_a = 12044.33 kNm/m
Resisting moment : M_p = 35392.08 kNm/m
Factor of safety = 2.94 > 1.50

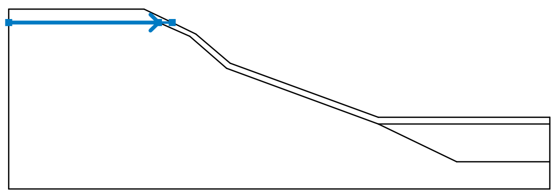
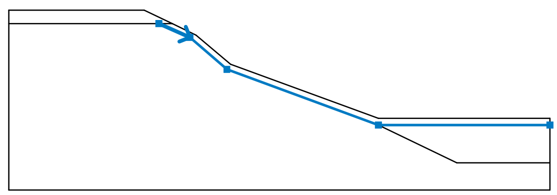
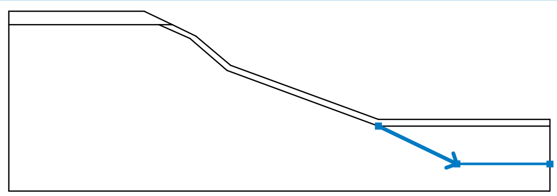
Slope stability ACCEPTABLE

Name : Analysis | **Stage - analysis : 1 - 1**



APPENDIX V

STABILITY ANALYSIS OF SLOPE ALONG SECTION '2'

No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
2		-10.00	90.00	1.08	90.00	2.09	90.00
3		1.08	90.00	3.39	88.98	6.12	86.63
		17.32	82.50	30.00	82.50		
4		17.32	82.50	23.13	79.71	30.00	79.70

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]
1	Silty Sand		32.00	0.00	20.00
2	Topsoil/Organic Material		26.00	0.00	15.00
3	Silty Clay		28.00	0.00	19.00
4	Bedrock		40.00	0.00	25.00

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [kN/m^3]	γ_s [kN/m^3]	n [–]
1	Silty Sand		20.00		
2	Topsoil/Organic Material		15.00		

No.	Name	Pattern	γ_{sat} [kN/m³]	γ_s [kN/m³]	n [–]
3	Silty Clay		19.00		
4	Bedrock		25.00		

Soil parameters

Silty Sand

Unit weight : γ = 20.00 kN/m³
Stress-state : effective
Angle of internal friction : φ_{ef} = 32.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 20.00 kN/m³

Topsoil/Organic Material

Unit weight : γ = 15.00 kN/m³
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 15.00 kN/m³

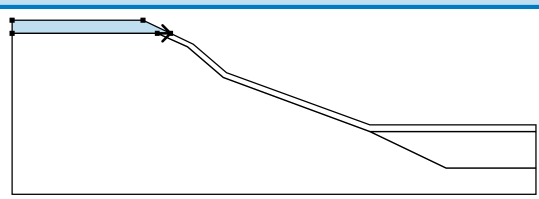
Silty Clay

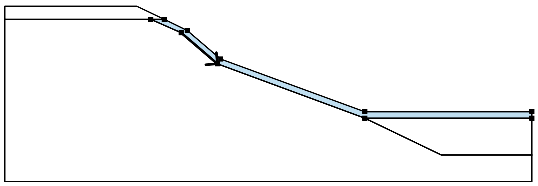
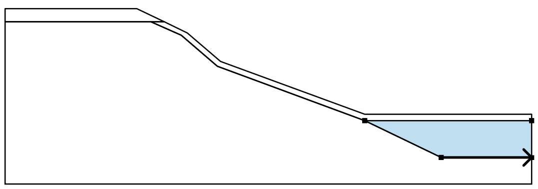
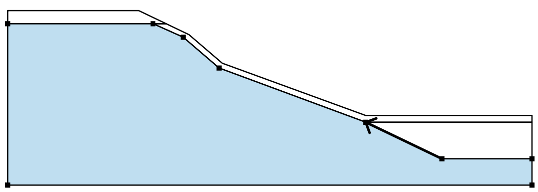
Unit weight : γ = 19.00 kN/m³
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 19.00 kN/m³

Bedrock

Unit weight : γ = 25.00 kN/m³
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 25.00 kN/m³

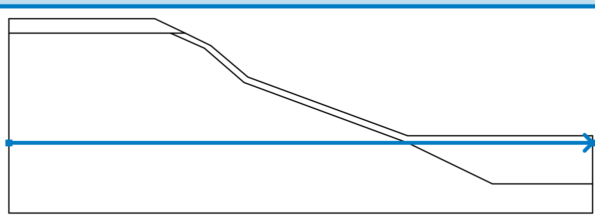
Assigning and surfaces

No.	Surface position	Coordinates of surface points [m] x	z	x	z	Assigned soil
1		1.08	90.00	2.09	90.00	Silty Sand
		0.00	91.00	-10.00	91.00	
		-10.00	90.00			

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
2		3.39	88.98	6.12	86.63	Topsoil/Organic Material
		17.32	82.50	30.00	82.50	
		30.00	83.00	17.32	83.00	
		6.38	87.00	3.84	89.16	
		2.09	90.00	1.08	90.00	
3		23.13	79.71	30.00	79.70	Silty Clay
		30.00	82.50	17.32	82.50	
4		23.13	79.71	17.32	82.50	Bedrock
		6.12	86.63	3.39	88.98	
		1.08	90.00	-10.00	90.00	
		-10.00	77.70	30.00	77.70	
		30.00	79.70			

Water

Water type : GWT

No.	GWT location	Coordinates of GWT points [m]					
		x	z	x	z	x	z
1		-10.00	82.50	30.00	82.50		

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	17.86	[m]	Angles :	α_1 =	-47.76	[°]
	z =	108.08	[m]		α_2 =	9.24	[°]
Radius :	R =	25.41	[m]				
Analysis of the slip surface without optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 244.49 kN/m

Sum of passive forces : F_p = 473.05 kN/m

Sliding moment : M_a = 6212.55 kNm/m

Resisting moment : M_p = 12020.33 kNm/m

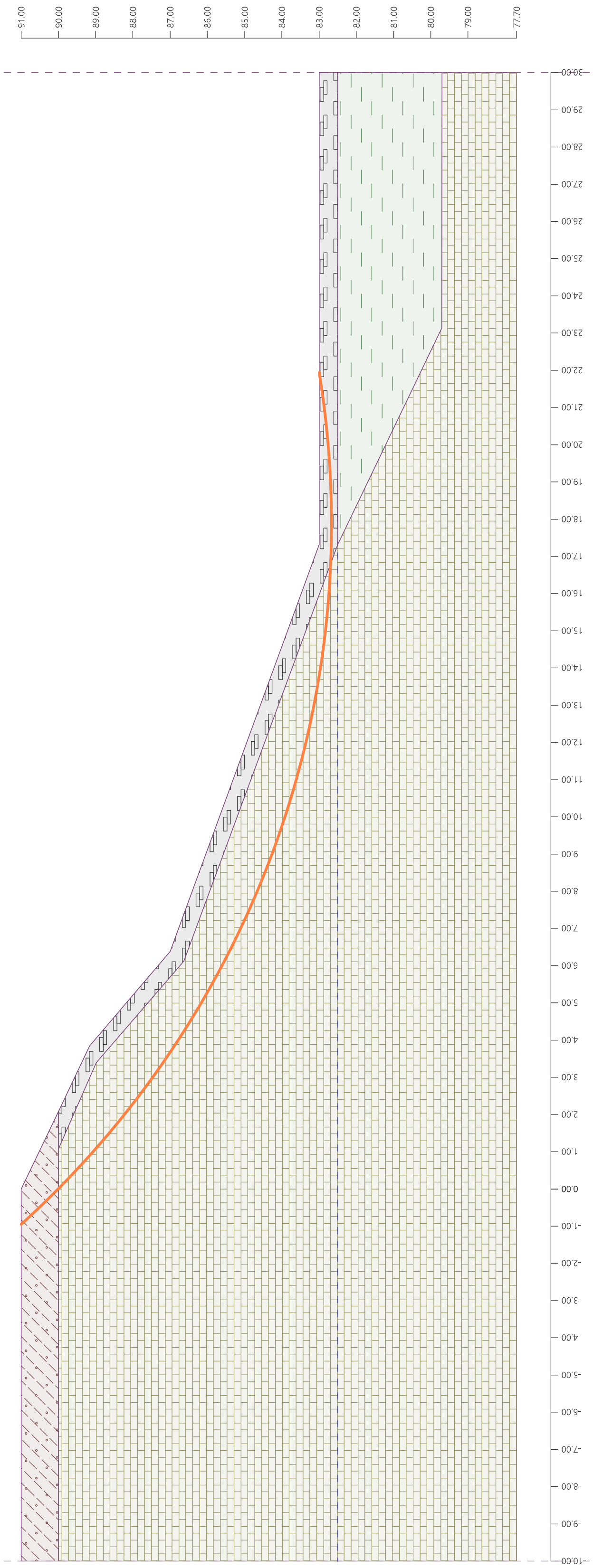
Factor of safety = 1.93 > 1.50

Slope stability ACCEPTABLE

Slope Stability Analysis Cross Section B-B

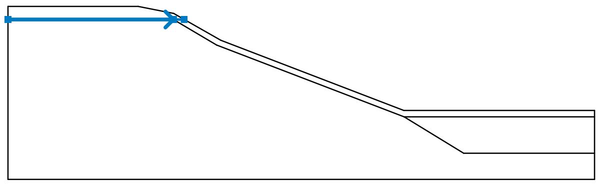
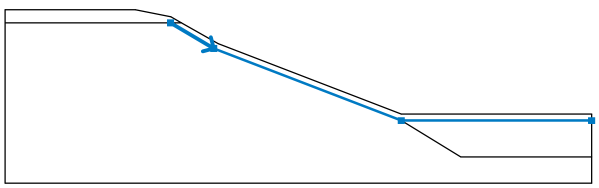
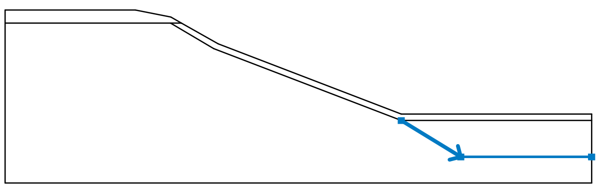
RH/KC

Name : Analysis	Stage - analysis : 1 - 1



APPENDIX VI

STABILITY ANALYSIS OF SLOPE ALONG SECTION '3'

No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
2		-10.00	90.00	2.69	90.00	3.52	90.00
3		2.69	90.00	6.01	88.04	20.39	82.50
		35.00	82.50				
4		20.39	82.50	24.95	79.70	35.00	79.70

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]
1	Silty Sand		32.00	0.00	20.00
2	Topsoil/Organic Material		26.00	0.00	15.00
3	Silty Clay		28.00	0.00	19.00
4	Bedrock		40.00	0.00	25.00

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [kN/m^3]	γ_s [kN/m^3]	n [–]
1	Silty Sand		20.00		
2	Topsoil/Organic Material		15.00		

No.	Name	Pattern	γ_{sat} [kN/m³]	γ_s [kN/m³]	n [–]
3	Silty Clay		19.00		
4	Bedrock		25.00		

Soil parameters

Silty Sand

Unit weight :	γ = 20.00 kN/m³
Stress-state :	effective
Angle of internal friction :	φ_{ef} = 32.00 °
Cohesion of soil :	c_{ef} = 0.00 kPa
Saturated unit weight :	γ_{sat} = 20.00 kN/m³

Topsoil/Organic Material

Unit weight :	γ = 15.00 kN/m³
Stress-state :	effective
Angle of internal friction :	φ_{ef} = 26.00 °
Cohesion of soil :	c_{ef} = 0.00 kPa
Saturated unit weight :	γ_{sat} = 15.00 kN/m³

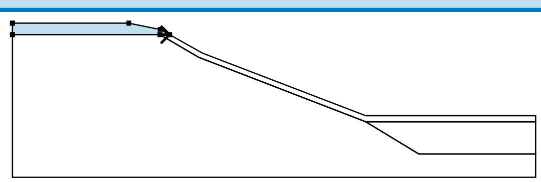
Silty Clay

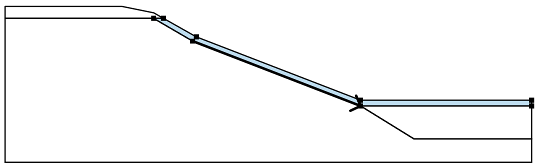
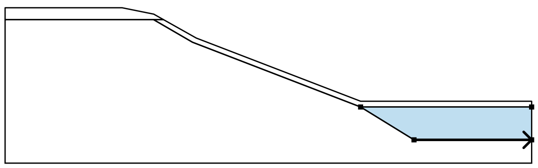
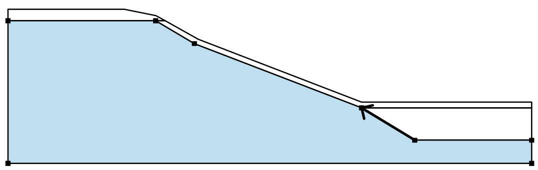
Unit weight :	γ = 19.00 kN/m³
Stress-state :	effective
Angle of internal friction :	φ_{ef} = 28.00 °
Cohesion of soil :	c_{ef} = 0.00 kPa
Saturated unit weight :	γ_{sat} = 19.00 kN/m³

Bedrock

Unit weight :	γ = 25.00 kN/m³
Stress-state :	effective
Angle of internal friction :	φ_{ef} = 40.00 °
Cohesion of soil :	c_{ef} = 0.00 kPa
Saturated unit weight :	γ_{sat} = 25.00 kN/m³

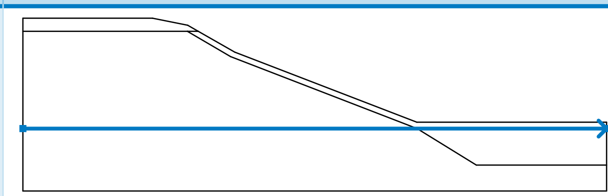
Assigning and surfaces

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
1		2.69	90.00	3.52	90.00	Silty Sand
		2.71	90.46	0.00	91.00	
		-10.00	91.00	-10.00	90.00	

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
2		6.01	88.04	20.39	82.50	Topsoil/Organic Material
		35.00	82.50	35.00	83.00	
		20.38	83.00	6.34	88.40	
		3.52	90.00	2.69	90.00	
3		24.95	79.70	35.00	79.70	Silty Clay
		35.00	82.50	20.39	82.50	
4		24.95	79.70	20.39	82.50	Bedrock
		6.01	88.04	2.69	90.00	
		-10.00	90.00	-10.00	77.70	
		35.00	77.70	35.00	79.70	

Water

Water type : GWT

No.	GWT location	Coordinates of GWT points [m]					
		x	z	x	z	x	z
1		-10.00	82.50	35.00	82.50		

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	21.26	[m]	Angles :	α_1 =	-41.61	[°]
	z =	115.41	[m]		α_2 =	6.95	[°]
Radius :	R =	32.65	[m]				
Analysis of the slip surface without optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 277.69 kN/m
Sum of passive forces : F_p = 607.00 kN/m
Sliding moment : M_a = 9066.64 kNm/m
Resisting moment : M_p = 19818.39 kNm/m
Factor of safety = 2.19 > 1.50

Slope stability ACCEPTABLE

Name : Analysis | **Stage - analysis : 1 - 1**