PATERSON GROUP

memorandum

re: **Redi-Rock Retaining Wall – Global Stability Analysis**
Proposed Residential Development
1650 Shea Road – Ottawa, Ontario

to: Arcadis IBI Group - **Mr. Anton Chetrar** - Anton.Chetrar@ibigroup.com
cc: Taggart Investments & Tartan Homes - **Ms. Melissa Côté** - melissa.cote@taggart.ca

date: June 05, 2025

file: PG6633-MEMO.01. Revision.01

Further to your request and authorization, Paterson Group (Paterson) prepared the following memorandum to provide a geotechnical review of the global stability analysis of the proposed retaining wall structure.

1.0 Background Information

As requested, Paterson Group Inc. (Paterson) completed a Redi-Rock retaining wall design to be located along the east and south property lines of the subject site. The Redi-Rock retaining wall system has been designed for the subject site to consider site constraints and grading requirements. The walls have also been designed in accordance with the Canadian Highway and Bridge Design Code (CHBDC) 2019. Details of the retaining walls are presented below and are depicted in Drawing PG6633-1 Revision 3, PG6633-2 Revision 4, and PG6633-3 Revision 4 attached.

The following grading plan prepared by Arcadis was reviewed as part of our retaining wall designs:

- ❑ Project no. 139185 Revision.03, grading plan, dated March 21, 2025.

Based on our review, the exposed portions of the subject Redi Rock retaining wall vary in height between 1.1 to 3.4 m.

This memorandum should be read in conjunction with Gemtec Report File: 63900.02 – Geotechnical Investigation – Proposed Residential Subdivision – Phase 2 – 5993 Flewellyn Road dated July 28, 2020.

Retaining Wall Fencing

The proposed fence posts are recommended to be extended through the top two Redi-Rock and designed by others. It is understood that the fencing is to consist of open railing and chain-link, with non-wind bearing properties. It should be noted that the fencing should be installed using galvanized steel to protect the railing/fencing system from long-term corrosion. Refer to City of Ottawa fencing standard - Figure 7.9.

2.0 Global and Internal Stability Analysis

The global stability analysis was modeled using Fine by Geo 5, a computer program which permits a two-dimensional slope stability analysis calculating several methods including the Bishop's method, which is a widely accepted slope analysis method. The software further allows for the internal review of the design as per various codes including the CHBDC 2019. The program calculates a factor of safety, which represents the ratio of the forces resisting failure to forces favoring failure. Theoretically, a factor of safety of 1.0 represents a condition where the slope is stable. However, due to intrinsic limitations of the calculation methods and the variability of the subsurface soil and groundwater conditions, a factor of safety greater than 1.0 is generally required for the failure risk to be considered acceptable.

A minimum factor of safety of 1.5 is generally recommended for conditions where the slope failure would comprise permanent structures. An analysis considering seismic loading was also completed. A horizontal acceleration of 0.15 g was considered for the sections for the seismic loading condition. A factor of safety of 1.1 is considered to be satisfactory for stability analyses including seismic loading.

The retaining wall section was reviewed using the design loading according to CHBDC 2019.

The highest retaining wall cross-section was studied as the worst-case scenario. The following parameters were used for the slope stability analysis under static and seismic conditions:

Table 1 - Effective Soil Parameters for Stability Analysis

Soil Layer	Unit Weight (kN/m^3)	Friction Angle (degrees)	Cohesion (kPa)
Granular B Type II	22	38	0
Pavement Structure (Engineering Fill)	22	38	0
Silty Sand	19	33	2
Glacial Till	22	36	1
Bedrock	44	-	-

The total strength parameters for seismic analysis were chosen based on our general knowledge of the geology in the area.

The strength parameters used for seismic analysis at the slope cross-section are presented in Table 2 below.

Table 2 - Total Strength Soil Parameters for Seismic Analysis			
Soil Layer	**Unit Weight (kN/m^3)**	**Friction Angle (degrees)**	**Cohesion (kPa)**
Granular B Type II	22	38	0
Pavement Structure (Engineering Fill)	22	38	0
Silty Sand	19	33	2
Glacial Till	22	36	1
Bedrock	44	-	-

Analysis Results

The factor of safety for the retaining wall section was greater than 1.5 for static conditions. Similarly, the results under seismic loading yielded a factor of safety for this section greater than 1.1.

The internal and structural design reviewed the bearing capacity, overturning resistance, and sliding resistance of the retaining wall units as per various loading conditions described in the CHBDC 2019. All analysis were found to be acceptable; the worst-case scenario is presented in attached calculation sheets.

Based on these results, the retaining wall design is considered suitable from a geotechnical perspective.

Table 3 below provides preliminary structural review of the proposed retaining walls based on Canadian Bridge and Highway design code (CHBDC) using the Redi Rock retaining wall product specifications.

Table 3 - Preliminary Structural Check of All Failure Modes (CDR/FS)				
Section	**Overturning** (Service/Ultimate/ Seismic)	**Sliding** (Service/Ultimate/ Seismic)	**Bearing** (Service/Ultimate/ Seismic)	**Global Stability** (Static/Seismic)
Section 1	3.81/4.58/2.20	2.21/2.80/1.51	1.90/2.22/1.36	1.67/1.35

3.0 Geotechnical Recommendations

Backfill Material

The retaining wall should be backfilled with free-draining granular backfill materials and incorporate longitudinal drains and weeper holes to provide positive drainage for the backfill. For the purpose of this report, it is recommended that the wall is backfilled with either OPSS Granular B Type II or Granular A materials.

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The backfill should be placed within a wedge-shaped zone defined by a line drawn up and back from the back edge of the base block of the wall at an inclination of 1H:1V or a minimum of 1 m behind the back of the blocks. All material should be compacted to a minimum of 98% of the material's SPMDD.

Drainage

A 100 mm diameter perforated drainage pipe wrapped in geotextile such as Terrafix 270R or equivalent approved other, surrounded on all sides by 150 mm of clear crushed stone, and should be installed at the heel of the bottom block. The drainage system should have a positive outlet to a nearby catch basin or an existing ditch. It is recommended that the outlets be spaced evenly along the retaining wall with a minimum spacing of 30 m center to center passing through the wall or connected to a nearby catch basin.

Testing and Inspections Criteria

It is recommended that the following be completed once the retaining wall design and construction program are determined:

- Observation of all bearing surfaces prior to backfill.
- Observation of all subgrades prior to placing backfilling materials.
- Observation of the drainage system prior to backfilling.
- Field density tests to ensure the specified level of compaction was achieved.
- Periodic observation of the retaining wall installation, especially at the first course.

A report confirming that these works have been conducted in general accordance with Paterson's recommendations could be issued upon request, following the completion of a satisfactory material testing and observation program by the geotechnical consultant.

We trust that the current submission meets your immediate requirements.

Best Regards,

Paterson Group Inc.

LICENSED PROFESSIONAL ENGINEER
June 05, 2025
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Analysis of Redi Rock wall

Input data (Stage of construction 1)

Project : Retaining Wall Global Stability Analysis
Description : 1650 Shea Road - Retaining Wall
Date : 6/5/2025
Project number : PG6633

Settings

(input for current task)

Wall analysis

Verification methodology : according to LRFD
Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Mazindrani (Rankine)
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Internal stability : Standard - straight slip surface
Reduction coeff. of contact first block - base : 1.00

Load factors					
Design situation - Service I					
		Minimum		Maximum	
Dead load of structural components :	DC =	1.00	[–]	1.00	[–]
Dead load of wearing surfaces :	DW =	1.00	[–]	1.00	[–]
Earth pressure - active :	EH_A =	1.00	[–]	1.00	[–]
Earth pressure - at rest :	EH_R =	1.00	[–]	1.00	[–]
Earth surcharge load (permanent) :	ES =	1.00	[–]	1.00	[–]
Vertical pressure of earth fill :	EV =	1.00	[–]	1.00	[–]
Live load surcharge :	LL =	0.00	[–]	1.00	[–]
Water load :	WA =	1.00	[–]	1.00	[–]

Resistance factors			
Design situation - Service I			
Resistance factor on overturning :	ϕ_o =	1.00	[–]
Resistance factor on sliding :	ϕ_t =	1.00	[–]
Resistance factor on bearing capacity :	ϕ_b =	1.00	[–]
Resistance factor on passive pressure :	ϕ_{VE} =	1.00	[–]

Load factors					
Design situation - Extreme I					
		Minimum		Maximum	
Dead load of structural components :	DC =	0.90	[–]	1.10	[–]
Dead load of wearing surfaces :	DW =	0.65	[–]	1.50	[–]
Earth pressure - active :	EH_A =	0.80	[–]	1.25	[–]

Load factors					
Design situation - Extreme I					
Earth pressure - at rest :	EH_R =	0.80	[–]	1.25	[–]
Earth surcharge load (permanent) :	ES =	0.50	[–]	1.25	[–]
Vertical pressure of earth fill :	EV =	0.80	[–]	1.50	[–]
Live load surcharge :	LL =	0.00	[–]	0.00	[–]
Water load :	WA =	0.90	[–]	1.10	[–]

Resistance factors			
Design situation - Extreme I			
Resistance factor on overturning :	ϕ_o =	1.00	[–]
Resistance factor on sliding :	ϕ_t =	1.00	[–]
Resistance factor on bearing capacity :	ϕ_b =	1.00	[–]
Resistance factor on passive pressure :	ϕ_{VE} =	1.00	[–]

Blocks

No.	Description	Block height h [mm]	Block width w [mm]	Unit weight γ [kN/m³]
1	Block 41	457.2	1028.7	18.85
2	Block 60	457.2	1524.0	20.42
3	Top block 28	457.2	711.2	18.85

No.	Description	Shear bearing capacity of joint F_{min} [kN/m]	Max. shear strength F_{max} [kN/m]	Block friction f [°]
1	Block 41	88.45	164.56	44.00
2	Block 60	88.45	164.56	44.00
3	Top block 28	88.45	164.56	44.00

Setbacks

No.	Setback s [mm]
1	0.000
2	0.010
3	0.041
4	0.238
5	0.422

Geometry

No. group	Description	Count	Setback s [mm]
1	Block 60	1	0.0
2	Block 60	1	0.0
3	Block 60	1	0.0
4	Block 41	1	0.0
5	Block 41	1	0.0

No. group	Description	Count	Setback s [mm]
6	Block 41	1	0.0
7	Top block 28	1	-

Base

Geometry

Upper setback a_1 = 0.30 m
Lower setback a_2 = 0.30 m
Height h = 0.30 m
Width b = 2.12 m

Material

Soil creating foundation - GB2

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
1	GB2		38.00	0.00	22.00	12.00	27.00
2	Sandy Silt		33.00	2.00	19.00	9.00	22.00
3	Bedrock		44.00	400.00	23.00	13.00	31.00
4	Till		36.00	1.00	22.00	12.00	33.00
5	pavement structure (engineered fill)		38.00	0.00	22.00	12.00	26.00

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

GB2

Unit weight : γ = 22.00 kN/m^3
Stress-state : effective
Angle of internal friction : φ_{ef} = 38.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Angle of friction struc.-soil : δ = 27.00 °
Saturated unit weight : γ_{sat} = 22.00 kN/m^3

Sandy Silt

Unit weight : γ = 19.00 kN/m^3
Stress-state : effective
Angle of internal friction : φ_{ef} = 33.00 °
Cohesion of soil : c_{ef} = 2.00 kPa
Angle of friction struc.-soil : δ = 22.00 °
Saturated unit weight : γ_{sat} = 19.00 kN/m^3

Bedrock

Unit weight : γ = 23.00 kN/m^3
Stress-state : effective
Angle of internal friction : ϕ_{ef} = 44.00 °
Cohesion of soil : c_{ef} = 400.00 kPa
Angle of friction struc.-soil : δ = 31.00 °
Saturated unit weight : γ_{sat} = 23.00 kN/m^3

Till

Unit weight : γ = 22.00 kN/m^3
Stress-state : effective
Angle of internal friction : ϕ_{ef} = 36.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Angle of friction struc.-soil : δ = 33.00 °
Saturated unit weight : γ_{sat} = 22.00 kN/m^3

pavement structure (engineered fill)

Unit weight : γ = 22.00 kN/m^3
Stress-state : effective
Angle of internal friction : ϕ_{ef} = 38.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Angle of friction struc.-soil : δ = 26.00 °
Saturated unit weight : γ_{sat} = 22.00 kN/m^3

Backfill

Assigned soil : GB2
Slope = 45.00 °

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	2.30	0.00 .. 2.30	pavement structure (engineered fill)	
2	2.00	2.30 .. 4.30	Sandy Silt	
3	-	4.30 .. ∞	Till	

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1 [kN/m²]	Mag.2 [kN/m²]	Ord.x x [m]	Length l [m]	Depth z [m]
	new	change						
1	Yes		permanent	17.50		1.80	8.00	on terrain

No.	Name
1	Traffic Loading

Resistance on front face of the structure

Resistance on front face of the structure: at rest

Soil on front face of the structure - Sandy Silt

Soil thickness in front of structure h = 0.60 m

Terrain in front of structure is flat.

Settings of the stage of construction

Design situation : Service I

Reduction of soil/soil friction angle : do not reduce

Verification No. 1 (Stage of construction 1)

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.00	-1.39	88.07	1.05	1.000	1.000	1.000
FF resistance	-1.55	-0.20	0.01	-0.15	1.000	1.000	1.000
Weight - earth wedge	0.00	-0.48	1.76	1.93	1.000	1.000	1.000
Weight - earth wedge	0.00	-1.95	4.15	1.62	1.000	1.000	1.000
Weight - earth wedge	0.00	-3.33	3.29	1.16	1.000	1.000	1.000
Active pressure	28.70	-1.15	36.54	1.87	1.000	1.000	1.000
Traffic Loading	6.92	-1.19	6.78	1.84	1.000	1.000	1.000

Verification of complete wall

Check for overturning stability

Resisting moment M_{res} = 187.07 kNm/m

Overturning moment M_{ovr} = 40.85 kNm/m

Capacity demand ratio CDR = 4.58

Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 95.46 kN/m

Active horizontal force H_{act} = 34.06 kN/m

Capacity demand ratio CDR = 2.80

Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1 (Stage of construction 1)

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.00	-1.33	74.07	0.75	1.000	1.000	1.000
FF resistance	-0.39	-0.10	0.00	0.00	1.000	1.000	1.000
Weight - earth wedge	0.00	-1.65	4.15	1.32	1.000	1.000	1.000
Weight - earth wedge	0.00	-3.03	3.29	0.86	1.000	1.000	1.000
Active pressure	21.73	-1.13	20.27	1.44	1.000	1.000	1.000
Traffic Loading	6.61	-1.00	5.20	1.46	1.000	1.000	1.000

Verification of most stressed block No. 1

Check for overturning stability

Resisting moment M_{res} = 100.36 kNm/m
Overturning moment M_{ovr} = 31.09 kNm/m

Capacity demand ratio CDR = 3.23

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 83.59 kN/m
Active horizontal force H_{act} = 27.96 kN/m

Capacity demand ratio CDR = 2.99

Joint for verification is SATISFACTORY

Bearing capacity of foundation soil (Stage of construction 1)

Design load acting at the center of footing bottom

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]	Eccentricity [–]	Stress [kPa]
1	2.80	140.58	34.06	0.009	67.58

Service load acting at the center of footing bottom

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]
1	2.80	140.58	34.06

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.009
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 67.58 kPa
Allowable bearing capacity of foundation soil R_d = 150.00 kPa

Capacity demand ratio CDR = 2.22

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data (Construction stage 1)

Project

Settings

(input for current task)

Stability analysis

Verification methodology : according to LRFD
Earthquake analysis : Standard

Load factors					
Design situation - Service I					
		Minimum		Maximum	
Earth surcharge load (permanent) :	ES =	1.00	[–]	1.00	[–]
Live load surcharge :	LL =	0.00	[–]	1.00	[–]

Resistance factors			
Design situation - Service I			
Resistance factor on stability :	ϕ_{SS} =	0.65	[–]

Load factors					
Design situation - Extreme I					
		Minimum		Maximum	
Earth surcharge load (permanent) :	ES =	1.00	[–]	1.00	[–]
Live load surcharge :	LL =	0.00	[–]	1.00	[–]

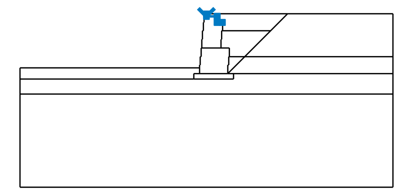
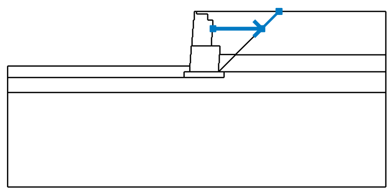
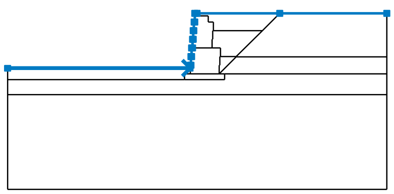
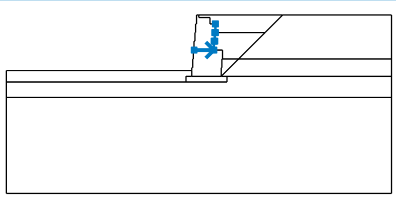
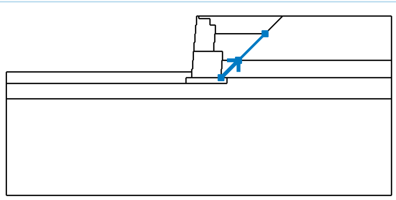
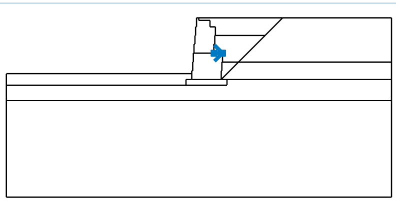
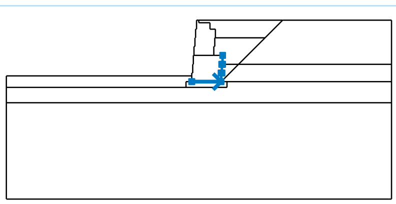
Resistance factors			
Design situation - Extreme I			
Resistance factor on stability :	ϕ_{SS} =	0.90	[–]

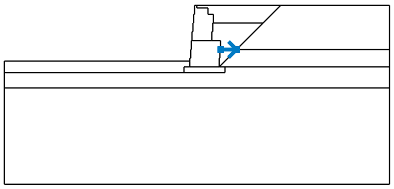
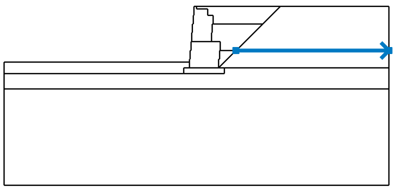
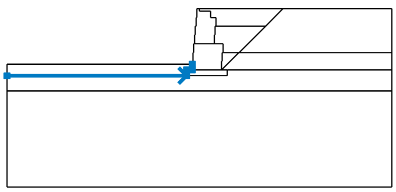
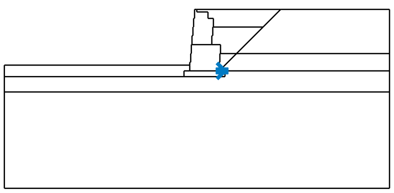
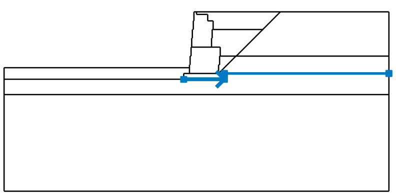
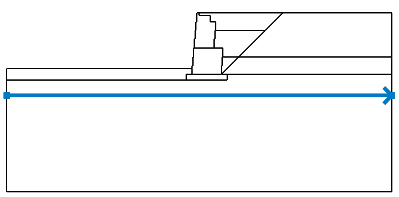
Anchors

Verification methodology : Safety factors (ASD)

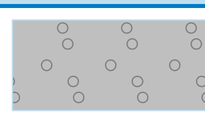
Safety factors			
Safety factor for steel strength :	SF_t =	1.50	[–]
Safety factor for pull out resistance (soil) :	SF_e =	1.50	[–]
Safety factor for pull out resistance (grouting) :	SF_c =	1.50	[–]

Interface

No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
1		0.00 0.58	0.00 -0.46	0.00 0.86	-0.13 -0.46	0.58	-0.13
2		0.86	-0.91	3.44	-0.91	4.35	0.00
3		-10.00 -0.33 -0.29 -0.21 -0.17 0.00	-2.90 -2.74 -1.83 -1.37 -0.46 0.00	-0.37 -0.33 -0.25 -0.21 -0.13 4.35	-2.90 -2.29 -1.83 -0.91 -0.46 0.00	-0.37 -0.29 -0.25 -0.17 -0.13 10.00	-2.74 -2.29 -1.37 -0.91 0.00 0.00
4		-0.25 0.82 0.86	-1.83 -1.37 -0.46	0.78 0.82	-1.83 -0.91	0.78 0.86	-1.37 -0.91
5		1.15 3.44	-3.20 -0.91	2.05	-2.30	2.06	-2.29
6		0.78	-1.83	1.23	-1.83		
7		-0.37 1.19 1.23	-3.20 -2.74 -1.83	1.15 1.19	-3.20 -2.29	1.15 1.23	-2.74 -2.29

No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
8		1.23	-2.29	2.06	-2.29		
9		2.05	-2.30	10.00	-2.30		
10		-10.00	-3.50	-0.67	-3.50	-0.67	-3.20
		-0.37	-3.20	-0.37	-2.90		
11		1.15	-3.20	1.45	-3.20		
12		-0.67	-3.50	1.45	-3.50	1.45	-3.20
		10.00	-3.20				
13		-10.00	-4.30	10.00	-4.30		

Soil parameters - effective stress state

No.	Name	Pattern	ϕ_{ef} [°]	c_{ef} [kPa]	γ [kN/m³]
1	GB2		38.00	0.00	22.00

No.	Name	Pattern	ϕ_{ef} [°]	c_{ef} [kPa]	γ [kN/m3]
2	Sandy Silt		33.00	2.00	19.00
3	Bedrock		44.00	400.00	23.00
4	Till		36.00	1.00	22.00
5	pavement structure (engineered fill)		38.00	0.00	22.00

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [kN/m3]	γ_s [kN/m3]	n [–]
1	GB2		22.00		
2	Sandy Silt		19.00		
3	Bedrock		23.00		
4	Till		22.00		
5	pavement structure (engineered fill)		22.00		

Soil parameters

GB2

Unit weight : γ = 22.00 kN/m3
Stress-state : effective
Shear strength : Mohr-Coulomb
Angle of internal friction : ϕ_{ef} = 38.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 22.00 kN/m3

Sandy Silt
Unit weight : γ = 19.00 kN/m^3
Stress-state : effective
Shear strength : Mohr-Coulomb
Angle of internal friction : ϕ_{ef} = 33.00 °
Cohesion of soil : c_{ef} = 2.00 kPa
Saturated unit weight : γ_{sat} = 19.00 kN/m^3

Bedrock
Unit weight : γ = 23.00 kN/m^3
Stress-state : effective
Shear strength : Mohr-Coulomb
Angle of internal friction : ϕ_{ef} = 44.00 °
Cohesion of soil : c_{ef} = 400.00 kPa
Saturated unit weight : γ_{sat} = 23.00 kN/m^3

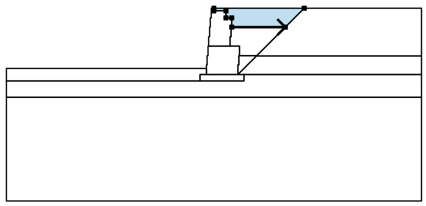
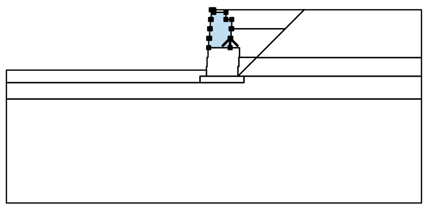
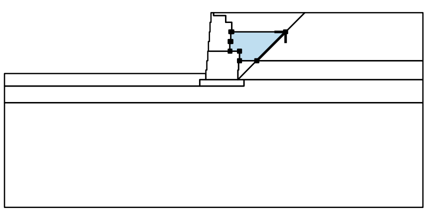
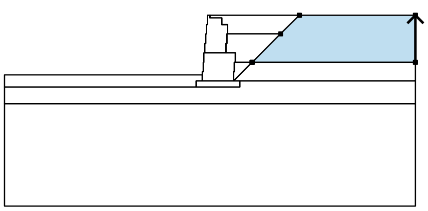
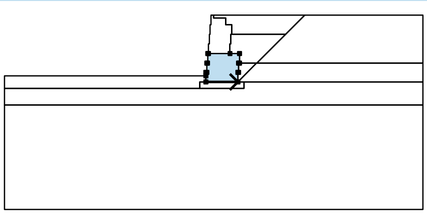
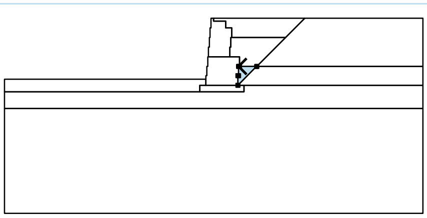
Till
Unit weight : γ = 22.00 kN/m^3
Stress-state : effective
Shear strength : Mohr-Coulomb
Angle of internal friction : ϕ_{ef} = 36.00 °
Cohesion of soil : c_{ef} = 1.00 kPa
Saturated unit weight : γ_{sat} = 22.00 kN/m^3

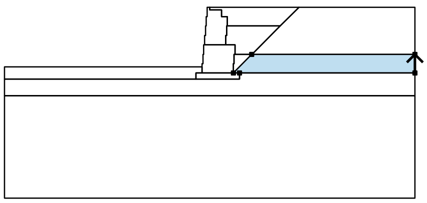
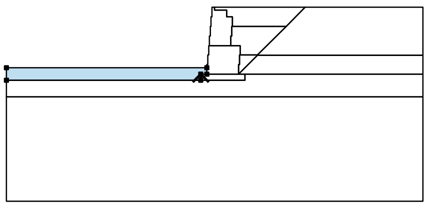
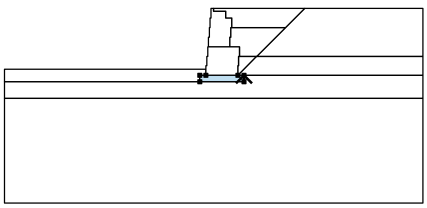
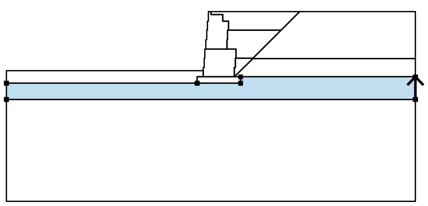
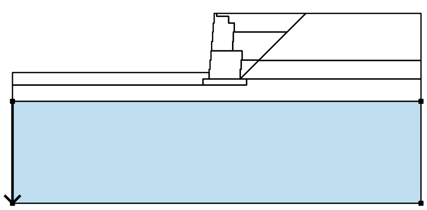
pavement structure (engineered fill)
Unit weight : γ = 22.00 kN/m^3
Stress-state : effective
Shear strength : Mohr-Coulomb
Angle of internal friction : ϕ_{ef} = 38.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 22.00 kN/m^3

Rigid Bodies

No.	Name	Sample	γ [kN/m^3]
1	Material of structure		18.85

Assigning and surfaces

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
1		0.86	-0.91	3.44	-0.91	GB2
		4.35	0.00	0.00	0.00	
		0.00	-0.13	0.58	-0.13	
		0.58	-0.46	0.86	-0.46	
2		0.78	-1.83	0.78	-1.37	Material of structure
		0.82	-1.37	0.82	-0.91	
		0.86	-0.91	0.86	-0.46	
		0.58	-0.46	0.58	-0.13	
		0.00	-0.13	0.00	0.00	
		-0.13	0.00	-0.13	-0.46	
		-0.17	-0.46	-0.17	-0.91	
		-0.21	-0.91	-0.21	-1.37	
		-0.25	-1.37	-0.25	-1.83	
3		2.06	-2.29	3.44	-0.91	GB2
		0.86	-0.91	0.82	-0.91	
		0.82	-1.37	0.78	-1.37	
		0.78	-1.83	1.23	-1.83	
		1.23	-2.29			
4		10.00	-2.30	10.00	0.00	pavement structure (engineered fill)
		4.35	0.00	3.44	-0.91	
		2.06	-2.29	2.05	-2.30	
5		-0.37	-3.20	1.15	-3.20	Material of structure
		1.15	-2.74	1.19	-2.74	
		1.19	-2.29	1.23	-2.29	
		1.23	-1.83	0.78	-1.83	
		-0.25	-1.83	-0.29	-1.83	
		-0.29	-2.29	-0.33	-2.29	
		-0.33	-2.74	-0.37	-2.74	
		-0.37	-2.90			
6		1.23	-2.29	1.19	-2.29	GB2
		1.19	-2.74	1.15	-2.74	
		1.15	-3.20	2.05	-2.30	
		2.06	-2.29			

No.	Surface position	Coordinates of surface points [m] x	z	x	z	Assigned soil
7		10.00	-3.20	10.00	-2.30	Sandy Silt
		2.05	-2.30	1.15	-3.20	
		1.45	-3.20			
8		-0.67	-3.50	-0.67	-3.20	Sandy Silt
		-0.37	-3.20	-0.37	-2.90	
		-10.00	-2.90	-10.00	-3.50	
9		1.45	-3.50	1.45	-3.20	GB2
		1.15	-3.20	-0.37	-3.20	
		-0.67	-3.20	-0.67	-3.50	
10		10.00	-4.30	10.00	-3.20	Sandy Silt
		1.45	-3.20	1.45	-3.50	
		-0.67	-3.50	-10.00	-3.50	
		-10.00	-4.30			
11		-10.00	-4.30	-10.00	-9.30	Till
		10.00	-9.30	10.00	-4.30	

Surcharge

No.	Type	Type of action	Location z [m]	Origin x [m]	Length l [m]	Width b [m]	Slope α [°]	Magnitude q, q_1, f, F, x	q_2, z	unit
1	strip	permanent	on terrain	x = 1.80	l = 8.00		0.00	17.50		kN/m^2

Surcharges

No.	Name
1	Traffic Loading

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : Service I

Results (Construction stage 1)

Analysis 1 (stage 1)

Circular slip surface

Slip surface parameters							
Center :	x =	-0.74	[m]	Angles :	α_1 =	-34.12	[°]
	z =	0.66	[m]		α_2 =	81.17	[°]
Radius :	R =	4.30	[m]				
The slip surface after optimization.							

Total weight of soil above the slip surface: 233.61 kN/m

Slope stability verification (Bishop)

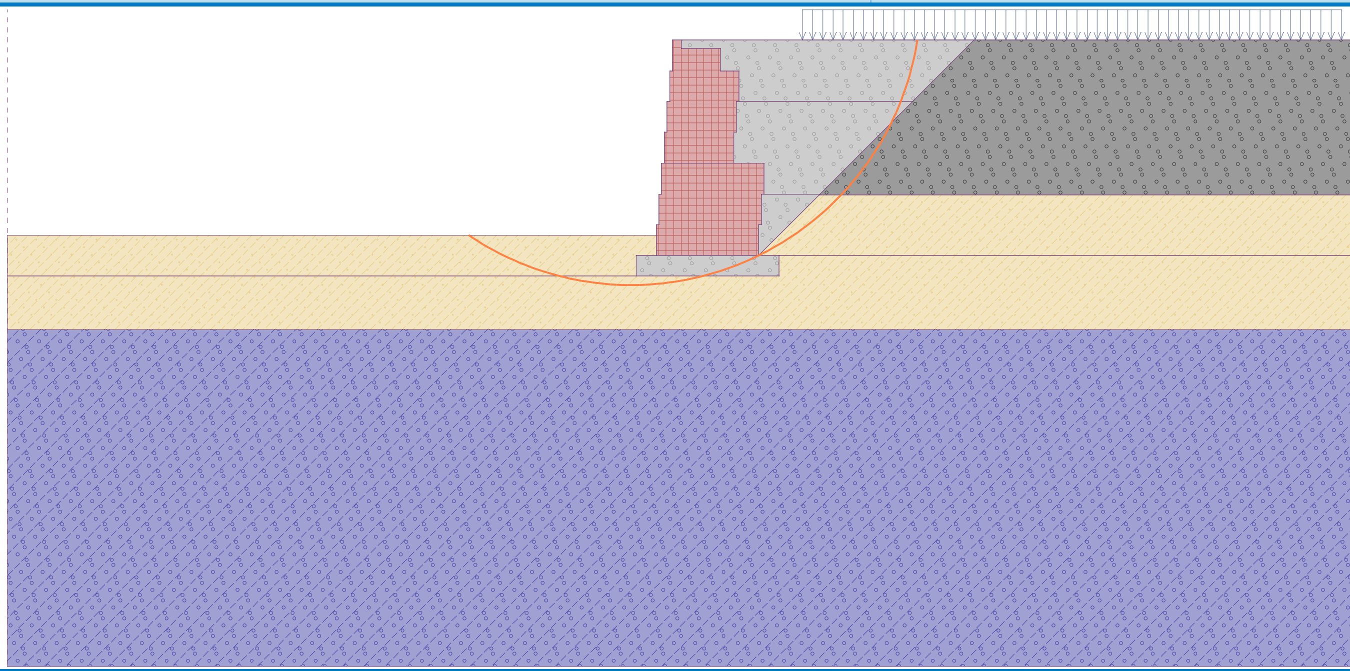
Sum of active forces : F_a = 116.98 kN/m
Sum of passive forces : F_p = 195.96 kN/m

Sliding moment : M_a = 503.03 kNm/m
Resisting moment : M_p = 547.72 kNm/m
Utilization : 91.8 %

Capacity demand ratio CDR: 1.089

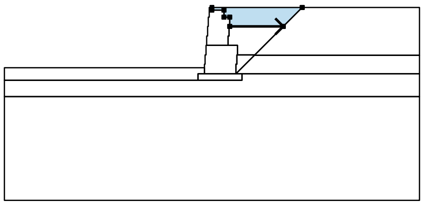
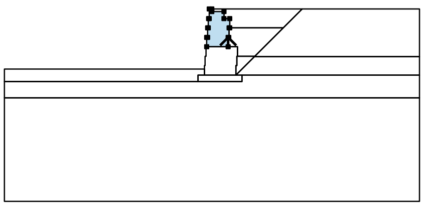
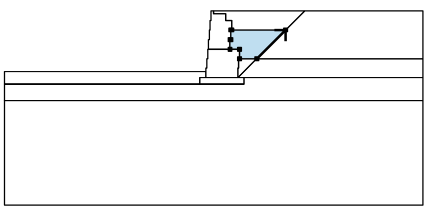
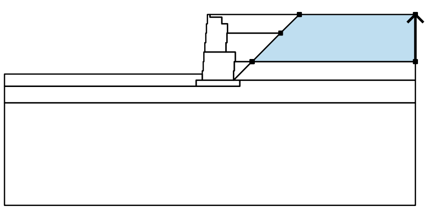
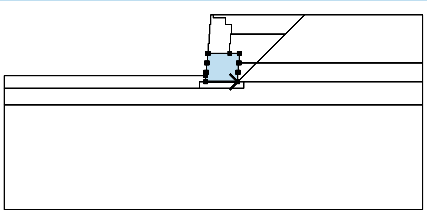
Factor of Safety : 1.675
Slope stability ACCEPTABLE

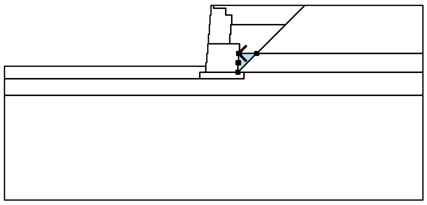
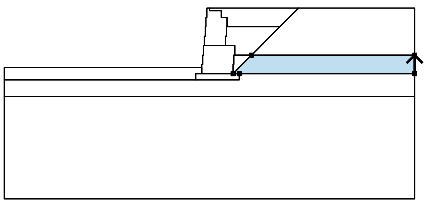
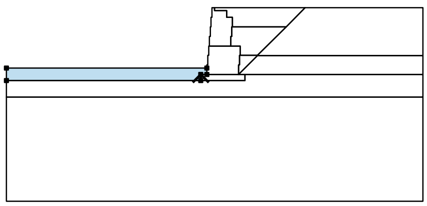
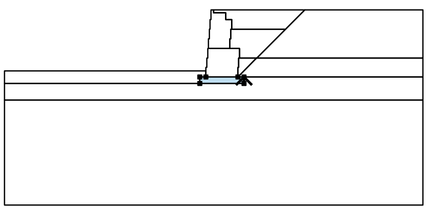
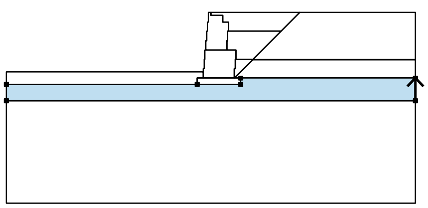
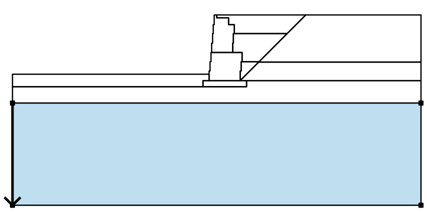
Name : Global Analysis - Static Conditions | **Stage - analysis : 1 - 1**



Input data (Construction stage 2)

Assigning and surfaces

No.	Surface position	Coordinates of surface points [m] x	z	x	z	Assigned soil
1		0.86	-0.91	3.44	-0.91	GB2
		4.35	0.00	0.00	0.00	
		0.00	-0.13	0.58	-0.13	
		0.58	-0.46	0.86	-0.46	
2		0.78	-1.83	0.78	-1.37	Material of structure
		0.82	-1.37	0.82	-0.91	
		0.86	-0.91	0.86	-0.46	
		0.58	-0.46	0.58	-0.13	
		0.00	-0.13	0.00	0.00	
		-0.13	0.00	-0.13	-0.46	
		-0.17	-0.46	-0.17	-0.91	
		-0.21	-0.91	-0.21	-1.37	
		-0.25	-1.37	-0.25	-1.83	
3		2.06	-2.29	3.44	-0.91	GB2
		0.86	-0.91	0.82	-0.91	
		0.82	-1.37	0.78	-1.37	
		0.78	-1.83	1.23	-1.83	
		1.23	-2.29			
4		10.00	-2.30	10.00	0.00	pavement structure (engineered fill)
		4.35	0.00	3.44	-0.91	
		2.06	-2.29	2.05	-2.30	
5		-0.37	-3.20	1.15	-3.20	Material of structure
		1.15	-2.74	1.19	-2.74	
		1.19	-2.29	1.23	-2.29	
		1.23	-1.83	0.78	-1.83	
		-0.25	-1.83	-0.29	-1.83	
		-0.29	-2.29	-0.33	-2.29	
		-0.33	-2.74	-0.37	-2.74	
		-0.37	-2.90			

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
6		1.23	-2.29	1.19	-2.29	GB2
		1.19	-2.74	1.15	-2.74	
		1.15	-3.20	2.05	-2.30	
		2.06	-2.29			
7		10.00	-3.20	10.00	-2.30	Sandy Silt
		2.05	-2.30	1.15	-3.20	
		1.45	-3.20			
8		-0.67	-3.50	-0.67	-3.20	Sandy Silt
		-0.37	-3.20	-0.37	-2.90	
		-10.00	-2.90	-10.00	-3.50	
9		1.45	-3.50	1.45	-3.20	GB2
		1.15	-3.20	-0.37	-3.20	
		-0.67	-3.20	-0.67	-3.50	
10		10.00	-4.30	10.00	-3.20	Sandy Silt
		1.45	-3.20	1.45	-3.50	
		-0.67	-3.50	-10.00	-3.50	
		-10.00	-4.30			
11		-10.00	-4.30	-10.00	-9.30	Till
		10.00	-9.30	10.00	-4.30	

Surcharge

No.	Surcharge		Type	Type of action	Location	Origin	Length	Width	Slope	Magnitude		
	new	change			z [m]	x [m]	l [m]	b [m]	α [°]	q, q_1, f, F, x	q_2, z	unit
1	No	No	strip	permanent	on terrain	x = 1.80	l = 8.00		0.00	17.50		kN/m^2

Surcharges

No.	Name
1	Traffic Loading

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Horizontal seismic coefficient : K_h = 0.1500
Vertical seismic coefficient : K_v = 0.0000

Settings of the stage of construction

Design situation : Extreme I

Results (Construction stage 2)

Analysis 1 (stage 2)

Circular slip surface

Slip surface parameters							
Center :	x =	-1.05	[m]	Angles :	α_1 =	-30.89	[°]
	z =	1.76	[m]		α_2 =	71.09	[°]
Radius :	R =	5.43	[m]				
The slip surface after optimization.							

Total weight of soil above the slip surface: 262.61 kN/m

Slope stability verification (Bishop)

Sum of active forces : F_a = 157.58 kN/m
Sum of passive forces : F_p = 212.50 kN/m

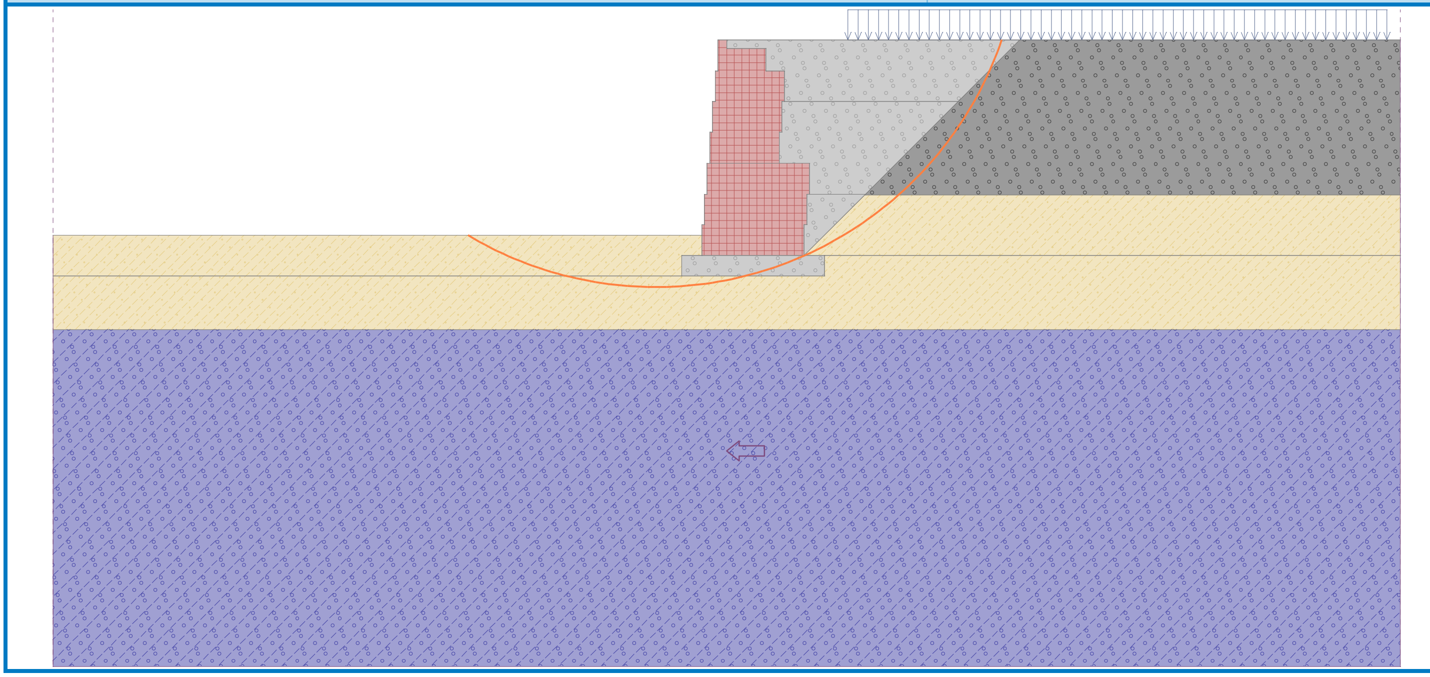
Sliding moment : M_a = 855.67 kNm/m
Resisting moment : M_p = 1038.51 kNm/m
Utilization : 82.4 %

Capacity demand ratio CDR: 1.214

Factor of Safety : 1.349

Slope stability ACCEPTABLE

Name : Global Analysis - Seismic Conditions | **Stage - analysis : 2 - 1**



Input data (Stage of construction 2)

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	2.30	0.00 .. 2.30	pavement structure (engineered fill)	
2	2.00	2.30 .. 4.30	Sandy Silt	
3	-	4.30 .. ∞	Till	

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge new	Surcharge change	Action	Mag.1 [kN/m^2]	Mag.2 [kN/m^2]	Ord.x x [m]	Length l [m]	Depth z [m]
1	No	No	permanent	17.50		1.80	8.00	on terrain

No.	Name
1	Traffic Loading

Resistance on front face of the structure

Resistance on front face of the structure: at rest

Soil on front face of the structure - Sandy Silt

Soil thickness in front of structure h = 0.60 m

Terrain in front of structure is flat.

Settings of the stage of construction

Design situation : Extreme I

Reduction of soil/soil friction angle : do not reduce

Verification No. 1 (Stage of construction 2)

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.00	-1.39	88.07	1.05	0.900	0.900	1.100
FF resistance	-1.55	-0.20	0.01	-0.15	0.800	0.800	1.250
Weight - earth wedge	0.00	-0.48	1.76	1.93	0.800	0.800	1.500
Weight - earth wedge	0.00	-1.95	4.15	1.62	0.800	0.800	1.500
Weight - earth wedge	0.00	-3.33	3.29	1.16	0.800	0.800	1.500
Active pressure	28.70	-1.15	36.54	1.87	1.250	1.250	1.250
Traffic Loading	6.92	-1.19	6.78	1.84	1.250	1.250	1.250

Verification of complete wall

Check for overturning stability

Resisting moment M_{res} = 195.27 kNm/m

Overturning moment M_{ovr} = 51.20 kNm/m

Capacity demand ratio CDR = 3.81

Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 95.51 kN/m

Active horizontal force H_{act} = 43.28 kN/m

Capacity demand ratio CDR = 2.21

Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1 (Stage of construction 2)

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.00	-1.33	74.07	0.75	0.900	0.900	1.100
FF resistance	-0.39	-0.10	0.00	0.00	0.800	0.800	1.250
Weight - earth wedge	0.00	-1.65	4.15	1.32	0.800	0.800	1.500
Weight - earth wedge	0.00	-3.03	3.29	0.86	0.800	0.800	1.500
Active pressure	21.73	-1.13	20.27	1.44	1.250	1.250	1.250

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Traffic Loading	6.61	-1.00	5.20	1.46	1.250	1.250	1.250

Verification of most stressed block No. 1

Check for overturning stability

Resisting moment M_{res} = 102.39 kNm/m
Overturning moment M_{ovr} = 38.88 kNm/m

Capacity demand ratio CDR = 2.63

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 81.62 kN/m
Active horizontal force H_{act} = 35.12 kN/m

Capacity demand ratio CDR = 2.32

Joint for verification is SATISFACTORY

Bearing capacity of foundation soil (Stage of construction 2)

Design load acting at the center of footing bottom

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]	Eccentricity [–]	Stress [kPa]
1	2.29	164.82	42.58	0.007	78.78
2	5.14	140.76	43.28	0.017	68.77

Service load acting at the center of footing bottom

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]
1	2.80	140.58	34.06

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.017
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 78.78 kPa
Allowable bearing capacity of foundation soil R_d = 150.00 kPa
Capacity demand ratio CDR = 1.90

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Input data (Stage of construction 3)

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	2.30	0.00 .. 2.30	pavement structure (engineered fill)	
2	2.00	2.30 .. 4.30	Sandy Silt	
3	-	4.30 .. ∞	Till	

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge new	Surcharge change	Action	Mag.1 [kN/m2]	Mag.2 [kN/m2]	Ord.x x [m]	Length l [m]	Depth z [m]
1	No	No	permanent	17.50		1.80	8.00	on terrain

No.	Name
1	Traffic Loading

Resistance on front face of the structure

Resistance on front face of the structure: at rest

Soil on front face of the structure - Sandy Silt

Soil thickness in front of structure h = 0.60 m

Terrain in front of structure is flat.

Earthquake

Factor of horizontal acceleration K_h = 0.1500

Factor of vertical acceleration K_v = 0.0000

Water below the GWT is restricted.

Settings of the stage of construction

Design situation : Extreme I

Reduction of soil/soil friction angle : do not reduce

Verification No. 1 (Stage of construction 3)

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.00	-1.39	88.07	1.05	0.900	0.900	1.100
Earthq.- constr.	13.19	-1.43	0.00	1.04	1.000	1.000	1.000

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
FF resistance	-1.55	-0.20	0.01	-0.15	0.800	0.800	1.250
Weight - earth wedge	0.00	-0.48	1.76	1.93	0.800	0.800	1.500
Earthquake - soil wedge	0.26	-0.48	0.00	1.93	1.000	1.000	1.000
Weight - earth wedge	0.00	-1.95	4.15	1.62	0.800	0.800	1.500
Earthquake - soil wedge	0.62	-1.95	0.00	1.62	1.000	1.000	1.000
Weight - earth wedge	0.00	-3.33	3.29	1.16	0.800	0.800	1.500
Earthquake - soil wedge	0.49	-3.33	0.00	1.16	1.000	1.000	1.000
Active pressure	28.70	-1.15	36.54	1.87	1.250	1.250	1.250
Earthq.- act.pressure	11.99	-2.36	17.22	1.61	1.000	1.000	1.000
Traffic Loading	6.92	-1.19	6.78	1.84	1.250	1.250	1.250

Verification of complete wall

Check for overturning stability

Resisting moment M_{res} = 222.93 kNm/m
Overturning moment M_{ovr} = 101.33 kNm/m

Capacity demand ratio CDR = 2.20

Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 105.67 kN/m
Active horizontal force H_{act} = 69.84 kN/m

Capacity demand ratio CDR = 1.51

Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1 (Stage of construction 3)

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.00	-1.33	74.07	0.75	0.900	0.900	1.100
Earthq.- constr.	11.28	-1.35	0.00	0.74	1.000	1.000	1.000
FF resistance	-0.39	-0.10	0.00	0.00	0.800	0.800	1.250
Weight - earth wedge	0.00	-1.65	4.15	1.32	0.800	0.800	1.500
Earthquake - soil wedge	0.62	-1.65	0.00	1.32	1.000	1.000	1.000
Weight - earth wedge	0.00	-3.03	3.29	0.86	0.800	0.800	1.500
Earthquake - soil wedge	0.49	-3.03	0.00	0.86	1.000	1.000	1.000
Active pressure	21.73	-1.13	20.27	1.44	1.250	1.250	1.250
Earthq.- act.pressure	10.20	-2.16	14.29	1.27	1.000	1.000	1.000
Traffic Loading	6.61	-1.00	5.20	1.46	1.250	1.250	1.250

Verification of most stressed block No. 1

Check for overturning stability

Resisting moment M_{res} = 120.58 kNm/m
Overturning moment M_{ovr} = 78.61 kNm/m

Capacity demand ratio CDR = 1.53

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 92.78 kN/m
Active horizontal force H_{act} = 57.72 kN/m

Capacity demand ratio CDR = 1.61

Joint for verification is SATISFACTORY

Bearing capacity of foundation soil (Stage of construction 3)

Design load acting at the center of footing bottom

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]	Eccentricity [–]	Stress [kPa]
1	43.02	182.04	69.14	0.111	110.50
2	45.87	157.98	69.84	0.137	102.63

Service load acting at the center of footing bottom

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]
1	43.53	157.80	60.63

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.137
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 110.50 kPa
Allowable bearing capacity of foundation soil R_d = 150.00 kPa
Capacity demand ratio CDR = 1.36

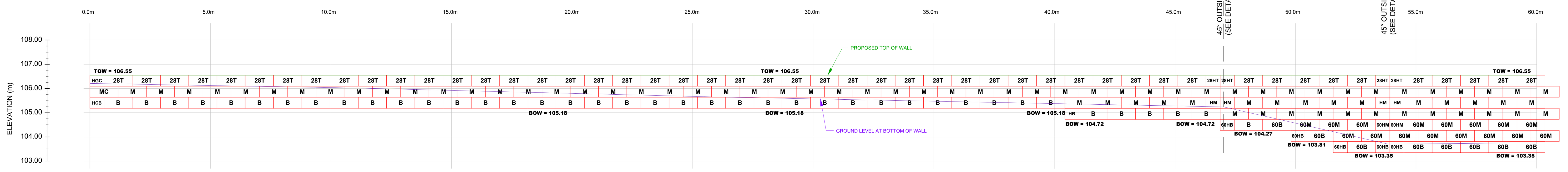
Bearing capacity of foundation soil is SATISFACTORY

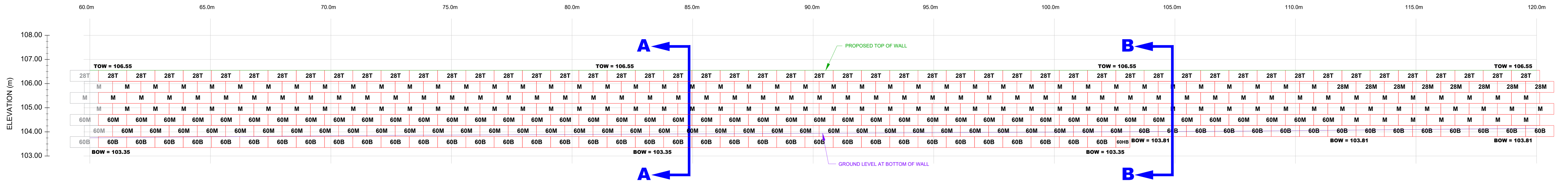
Overall verification - bearing capacity of found. soil is SATISFACTORY

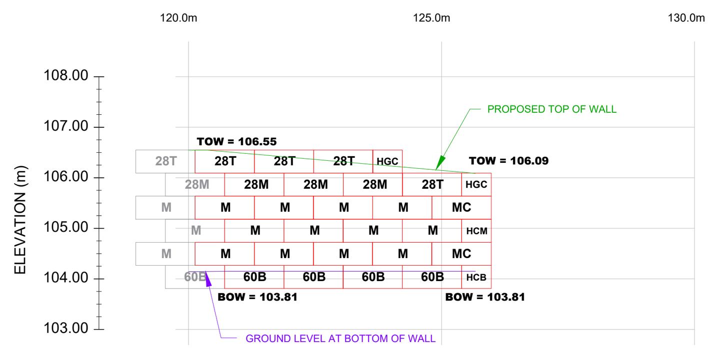
PROFILE VIEW (RR1):

SCALE 1:125

ISSUED FOR REVIEW







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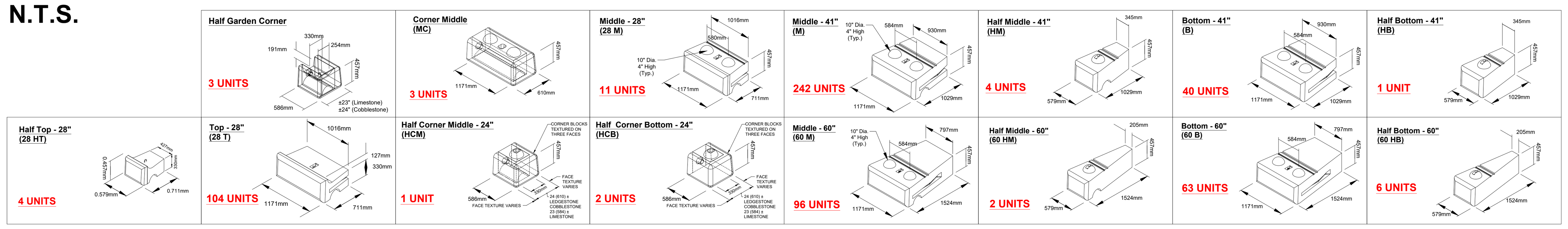
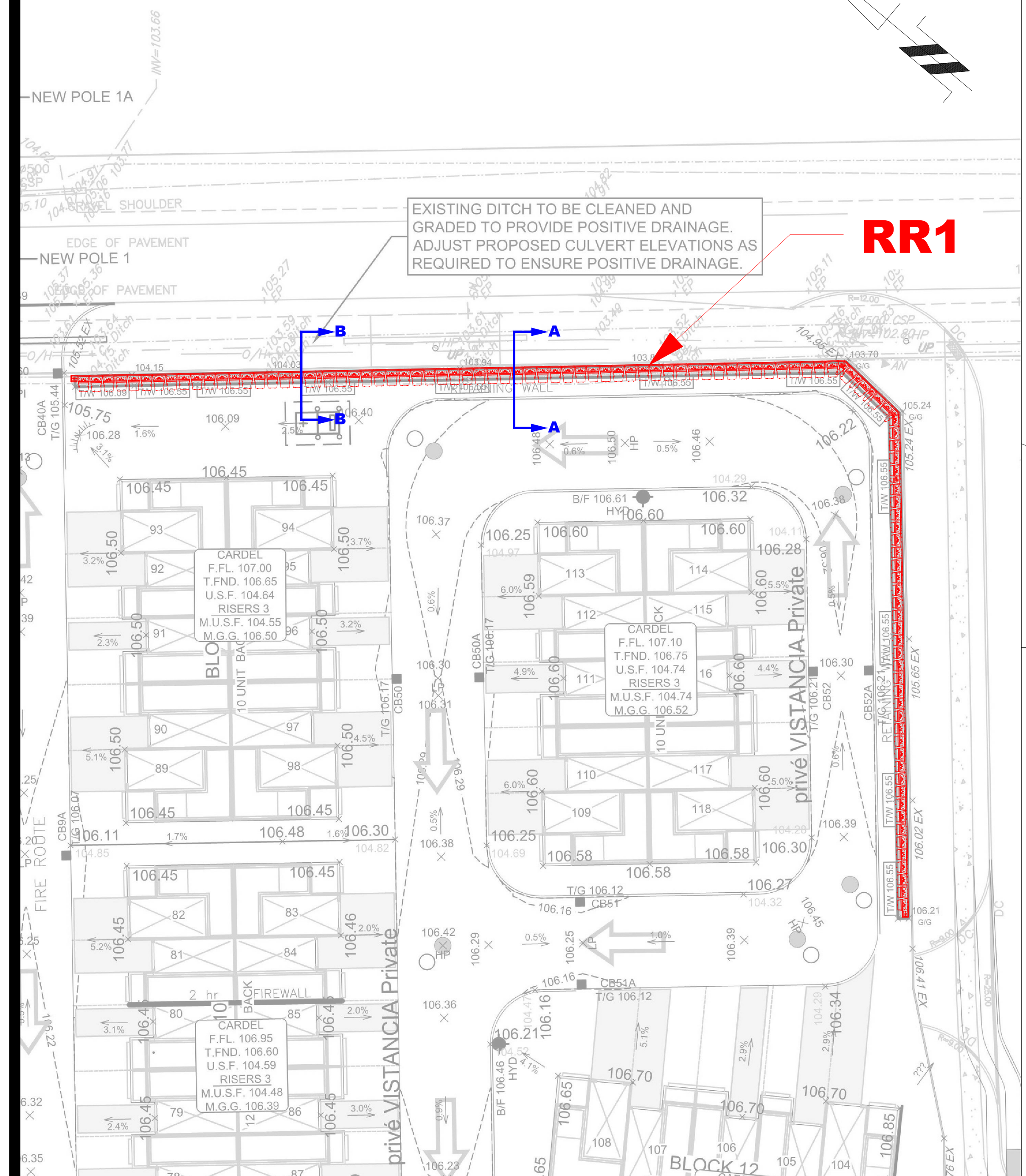


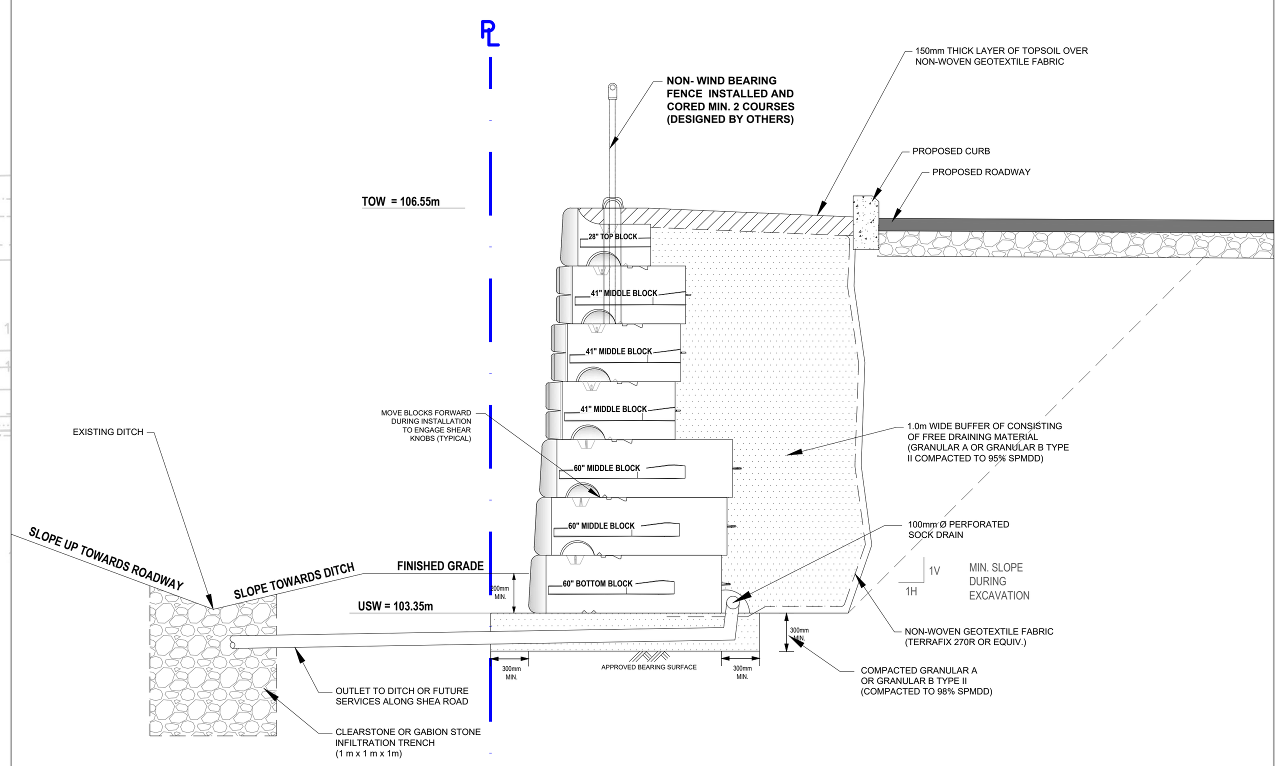
GRADING PLAN:

SCALE 1:500



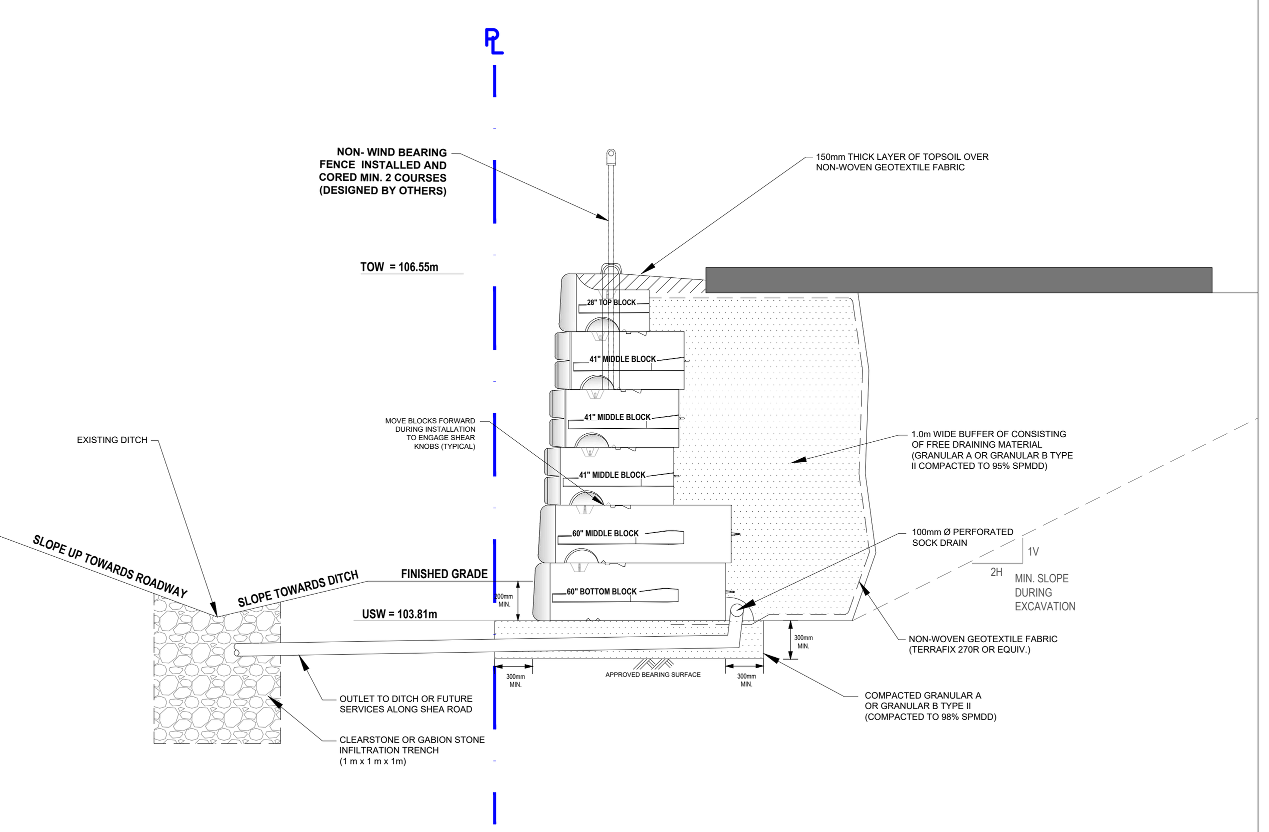
CROSS SECTION A-A:

SCALE 1:50



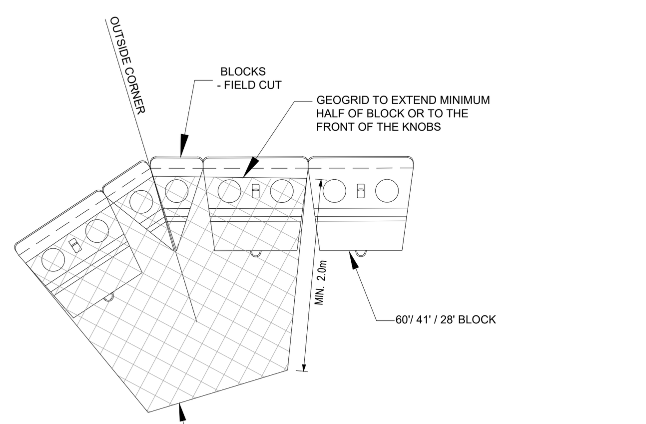
CROSS SECTION B-B:

SCALE 1:50



DETAIL 1:

N.T.S.



NOTES:

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2. THIS DESIGN IS BASED ON THE FOLLOWING SOIL PROPERTIES:

PROPERTY	RETAINED FILL	FOUNDATION MEDIUM
FRICTION ANGLE - ϕ	40°	33°
UNIT WEIGHT - γ	22 kN/m3	19 kN/m3
COHESION - C	0	0 kPa
SOIL TYPE	OPSS GRANULAR B TYPE II	SILTY SAND

MATERIAL PROPERTIES ARE BASED ON SITE EVALUATION BY PATERSON GROUP AND DISCUSSIONS WITH CONTRACTOR. SEISMIC LOADING WAS EVALUATED ACCORDING TO THE CURRENT CHBDC WITH A PEAK GROUND ACCELERATION VALUE OF 0.251. WALL DESIGN WITH OPEN RAILING OR FENCING SUCH AS CHAINLINK

3. THE DESIGN ELEVATIONS USED WERE BASED ON A GRADING PLAN DRAWN BY IBI GROUP PROJECT NO. 139185 SHEET NUMBER 200, REV.3 DATED 21/03/2025. THE WALL BASE DESIGN ASSUMES A BEARING RESISTANCE AT SLS OF 125 kPa ON SILTY SAND. PATERSON GROUP ENGINEER SHOULD OBSERVE THE BEARING CONDITIONS AND ADJUST THE THICKNESS OF THE GRANULAR BASE TO ACCOMMODATE THE SITE CONDITIONS, IF NECESSARY.

4. THE DESIGN HAS BEEN REVIEWED FOR THE STABILITY OF THE PRECAST MODULAR RETAINING WALL SYSTEM AND GLOBAL STABILITY WITH A FACTOR OF SAFETY OF 1.5 FOR STATIC CONDITIONS AND 1.1 UNDER SEISMIC CONDITIONS. WALL GEOMETRY AND GRADE ELEVATIONS ABOVE AND BELOW THE WALL SHOULD CONFORM WITH THE GRADING PLAN PROVIDED HERE IN. IF ACTUAL SITE GRADES VARY SIGNIFICANTLY FROM THOSE SHOWN OR IF THE BACK SLOPE DOES NOT CONFORM, INSTALLATION SHALL NOT PROCEED UNTIL THE DESIGN IS VERIFIED OR MODIFIED IN THE APPLICABLE AREA.

5. PRECAST UNITS SHALL BE REDI-ROCK RETAINING WALL UNITS MANUFACTURED UNDER LICENSE FROM REDI-ROCK.

6. THE WALL BASE FOR THE WALL SHALL CONSIST OF A MIN. 300mm THICK OPSS GRANULAR A COMPACTED TO MIN. 98% OF THE MATERIALS SPMDD AND TESTED BY PATERSONGROUP GEOTECHNICAL PERSONNEL AT THE TIME OF CONSTRUCTION. SURFACE OF GRANULAR BASE MAY BE DRESSED WITH FINER AGGREGATE TO AID LEVELING. ENSURE GRADATION OF DRESSING MATERIAL IS SUCH AS TO PRECLUDE LOSS OF FINES INTO BASE. THE THICKNESS OF DRESSING LAYER SHOULD NOT EXCEED 3 TIMES THE MAXIMUM PARTICLE SIZE USED.

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8. INSTALL 100mm DIAMETER PERFORATED PIPE WRAPPED WITH A GEOSOCK DRAIN BEHIND HEEL OR UNDER THE WALL. PROVIDE CLEAR STONE SURROUND TO PROTECT PIPE FROM CLOGGING AND DAMAGE. PROVIDE OUTLETS THROUGH WALL, NO FURTHER APART THAN 30.0m ON CENTRES. THE DRAINAGE PIPE SHOULD BE CONNECTED TO A POSITIVE OUTLET ON BOTH ENDS OF THE RETAINING WALL SUCH AS AN EXISTING DITCH OR CATCH BASIN.

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10. ALIGNMENT OF THE BOTTOM WALL UNIT COURSE SHOULD BE PLANNED TO CONSIDER THAT A NOMINAL 41mm AUTOMATIC SETBACK WILL OCCUR WITH EACH 0.46m INCREMENT OF HEIGHT.

11. BACKFILL MATERIAL SHALL BE APPROVED BY THE SITE GEOTECHNICAL ENGINEER PRIOR TO USE AND SHOULD CONSIST OF OPSS GRANULAR A OR B TYPE II FOLLOWED BY SUITABLE BACKFILL MATERIAL. ALL FILL WITHIN A 1H:1V ZONE UP AND BACK FROM THE HEEL SHOULD ALSO BE COMPACTED. BACKFILL SHALL BE PLACED IN MAXIMUM 300mm LOOSE LIFTS AND COMPACTED TO A MINIMUM OF 95% OF SPMDD. MOISTURE CONTENT SHOULD BE CONTROLLED AND MAINTAINED WITHIN -3 TO +4 PERCENT OF OPTIMUM.

12. MAINTAIN TEMPORARY GRADES TO DIVERT SURFACE WATER AWAY FROM THE RETAINING WALL EXCAVATION. SLOPE FINAL BACKFILL TO PROVIDE POSITIVE DRAINAGE AND TO ELIMINATE PONDING.

13. BACKSLOPE SHOULD BE CUT BACK TO A MINIMUM OF 2H:1V TO 3H:1V TO MAINTAIN A LONG TERM SAFE SLOPE BEHIND THE RETAINING WALL. IT SHOULD BE NOTED THAT WHERE TREES ARE PRESENT WITHIN THE TOP OF SLOPE. A MINIMUM 1.0m SET BACK IS REQUIRED FOR EXCAVATION FROM THE EDGE OF THE TREE LINE WHERE PRESENT.

14. EXCAVATION SIDE SLOPES SHOULD BE PROTECTED TEMPORARILY DURING CONSTRUCTION FROM PRECIPITATION EVENTS BY PLACEMENT OF TARPS.

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18. THE CONTRACTOR SHOULD REFER TO THE INSTALLATION MANUAL PROVIDED FOR THE RETAINING WALL BLOCK TYPE PROVIDED HEREIN FOR ADDITIONAL DETAILS ON ACCEPTABLE INSTALLATION PRACTICES.

PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL
3	UPDATED GRADING PLAN	22/05/2025	JV
2	OPENED TYPE FENCE	14/11/2024	JV
1	AS PER UPDATED GRADING PLAN	02/10/2024	JV

ARCADIS IBI GROUP

PROPOSED RETAINING WALLS
DAVIDSON LANDS SUBDIVISION - 1650 SHEA ROAD

OTTAWA, ONTARIO

Title:
REDI-ROCK RETAINING WALL DESIGN (RR1)

Stamp: LICENSED PROFESSIONAL ENGINEER — 22/05/2025 — J. R. VILLENEUVE — 100504344 — PROVINCE OF ONTARIO

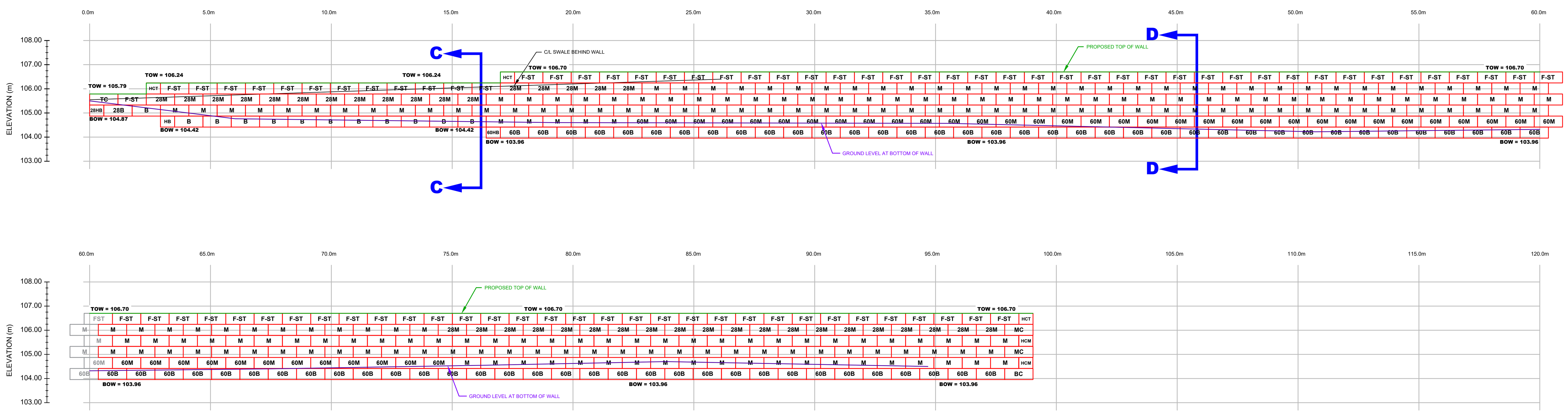
Stamp: LICENSED PROFESSIONAL ENGINEER — 22/05/2025 — F. I. ABOU-SEIDO — 100156744 — PROVINCE OF ONTARIO

Scale:	AS SHOWN
Drawn by:	CT
Checked by:	JV
Approved by:	FA
Date:	03/2023
File No.:	PG6633
Drawing No.:	PG6633-1
Revision No.:	3

PROFILE VIEW (RR2):

SCALE 1:125

ISSUED FOR REVIEW



BLOCK COUNT:

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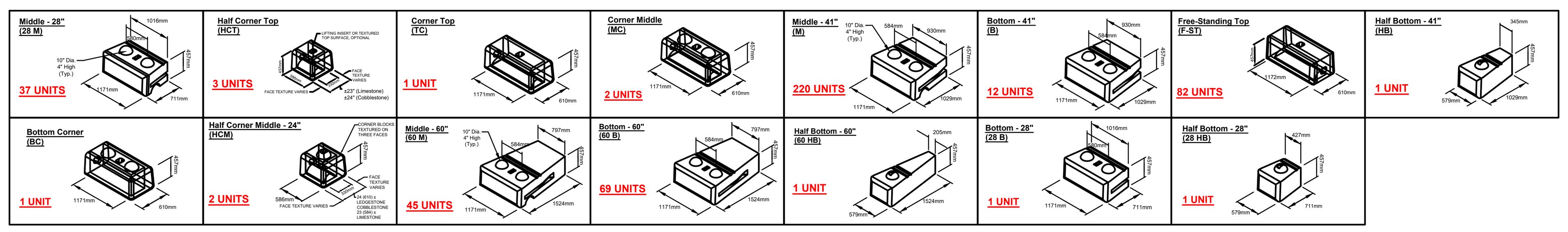
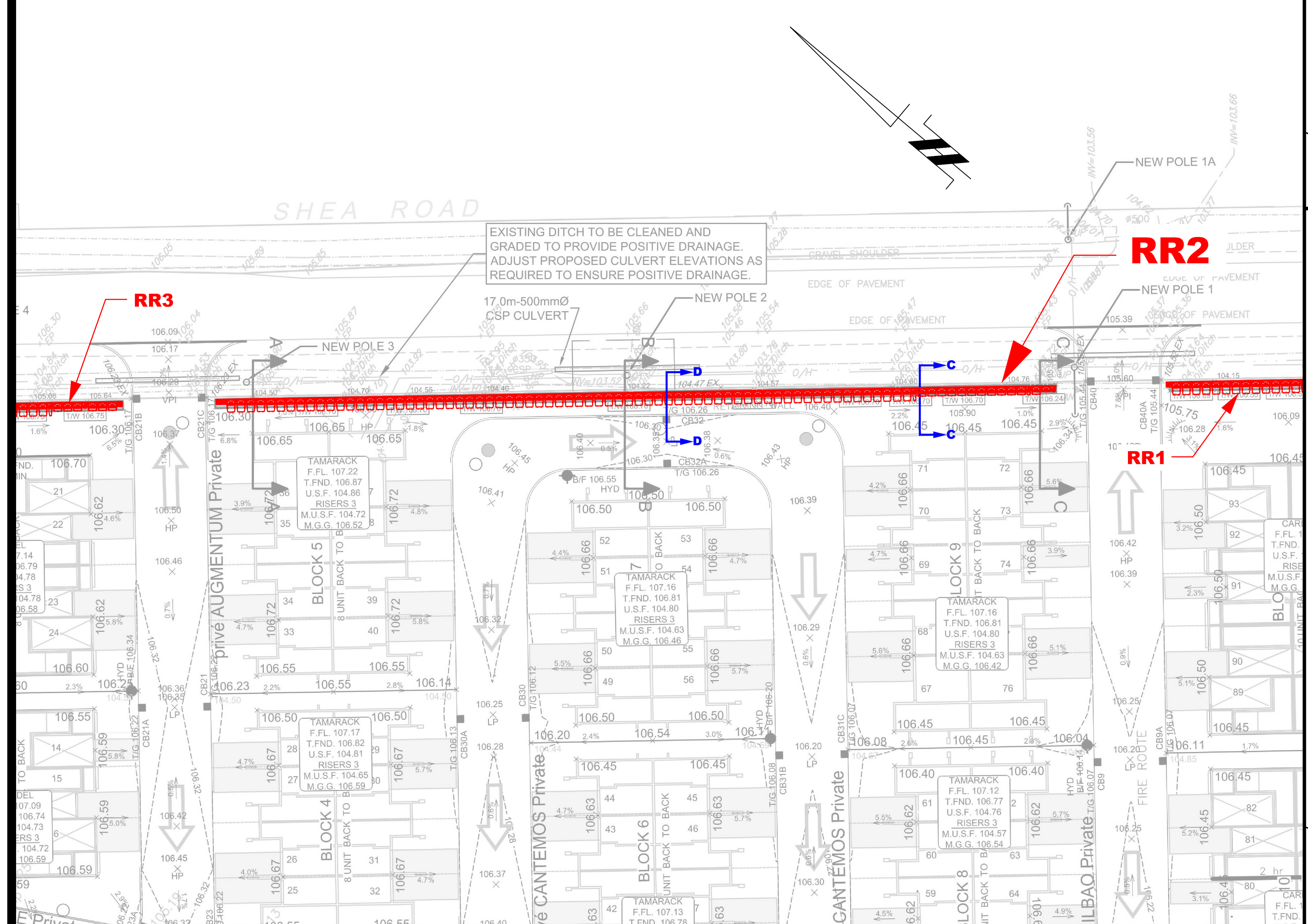


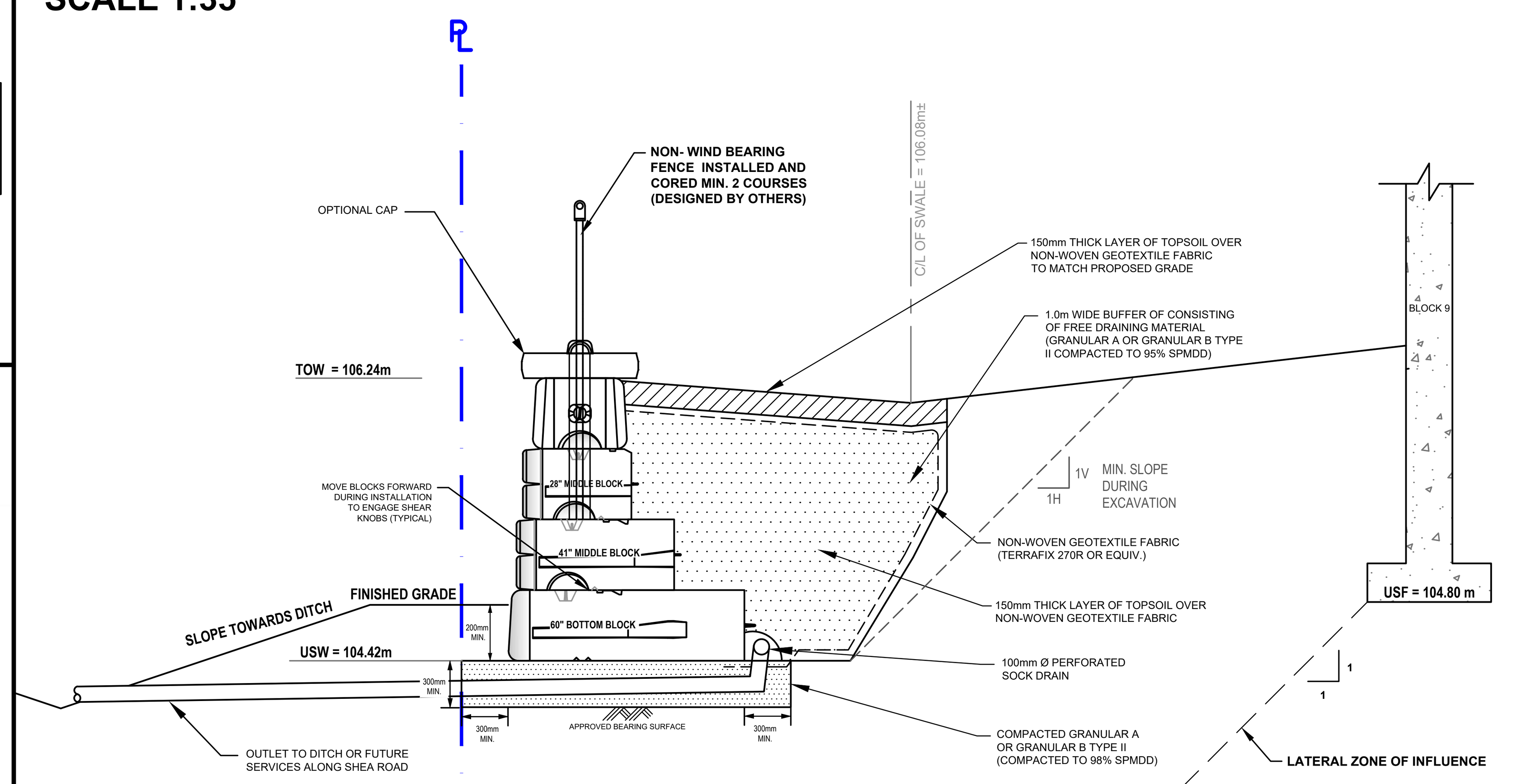
GRADING PLAN:

SCALE 1:500



CROSS SECTION C-C:

SCALE 1:35



CROSS SECTION D-D:

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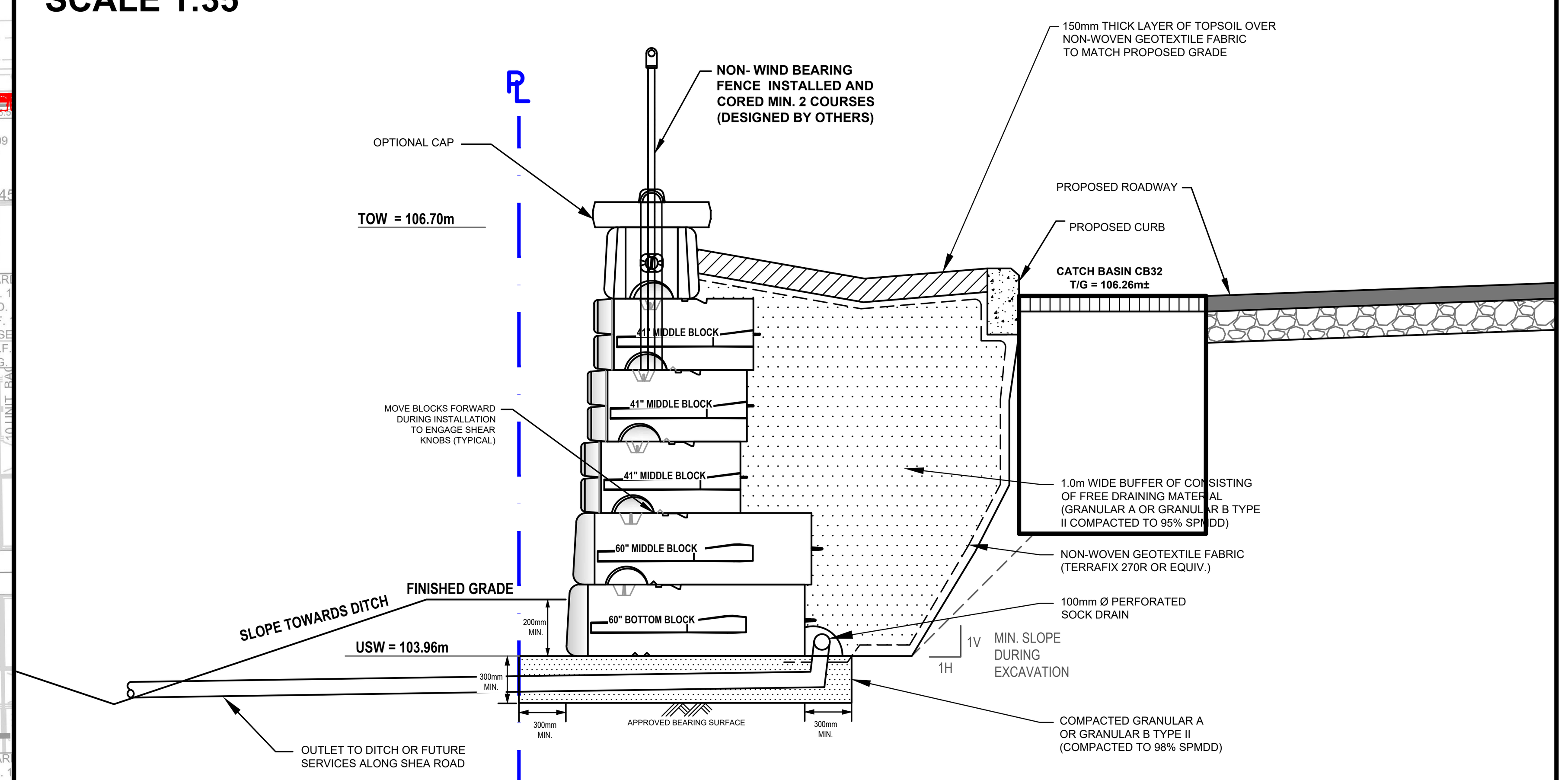

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PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL
4	FREE STANDING BLOCKS AS PER CONSULTANT COMMENT	27/05/2025	JV
3	UPDATED GRADING PLAN	22/05/2025	JV
2	OPENED TYPE FENCE	14/11/2024	JV
1	AS PER UPDATED GRADING PLAN	02/10/2024	JV

ARCADIS IBI GROUP

PROPOSED RETAINING WALLS
DAVIDSON LANDS SUBDIVISION - 1650 SHEA ROAD

OTTAWA, ONTARIO

Title: REDI-ROCK RETAINING WALL DESIGN (RR2)

Stamp: LICENSED PROFESSIONAL ENGINEER 27/05/2025 J. R. VILLENEUVE 100504344 PROVINCE OF ONTARIO

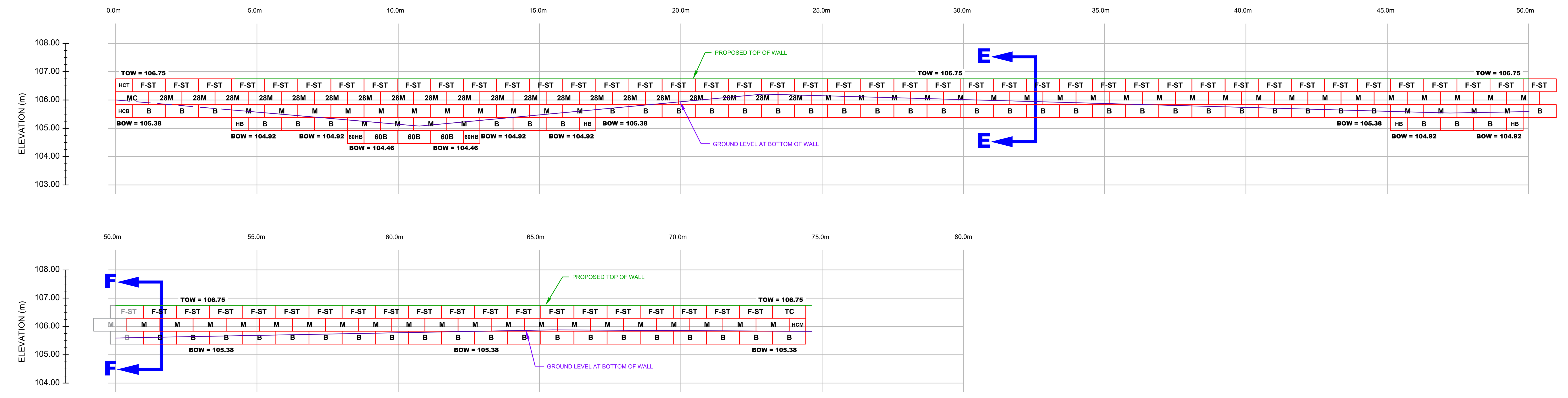
Stamp: LICENSED PROFESSIONAL ENGINEER 27/05/2025 F. I. ABOU-SEIDO 100156744 PROVINCE OF ONTARIO

Scale:	AS SHOWN
Drawn by:	CT
Checked by:	JV
Approved by:	FA
Date:	03/2023
File No.:	PG6633
Drawing No.:	PG6633-2
Revision No.:	4

PROFILE VIEW (RR3):

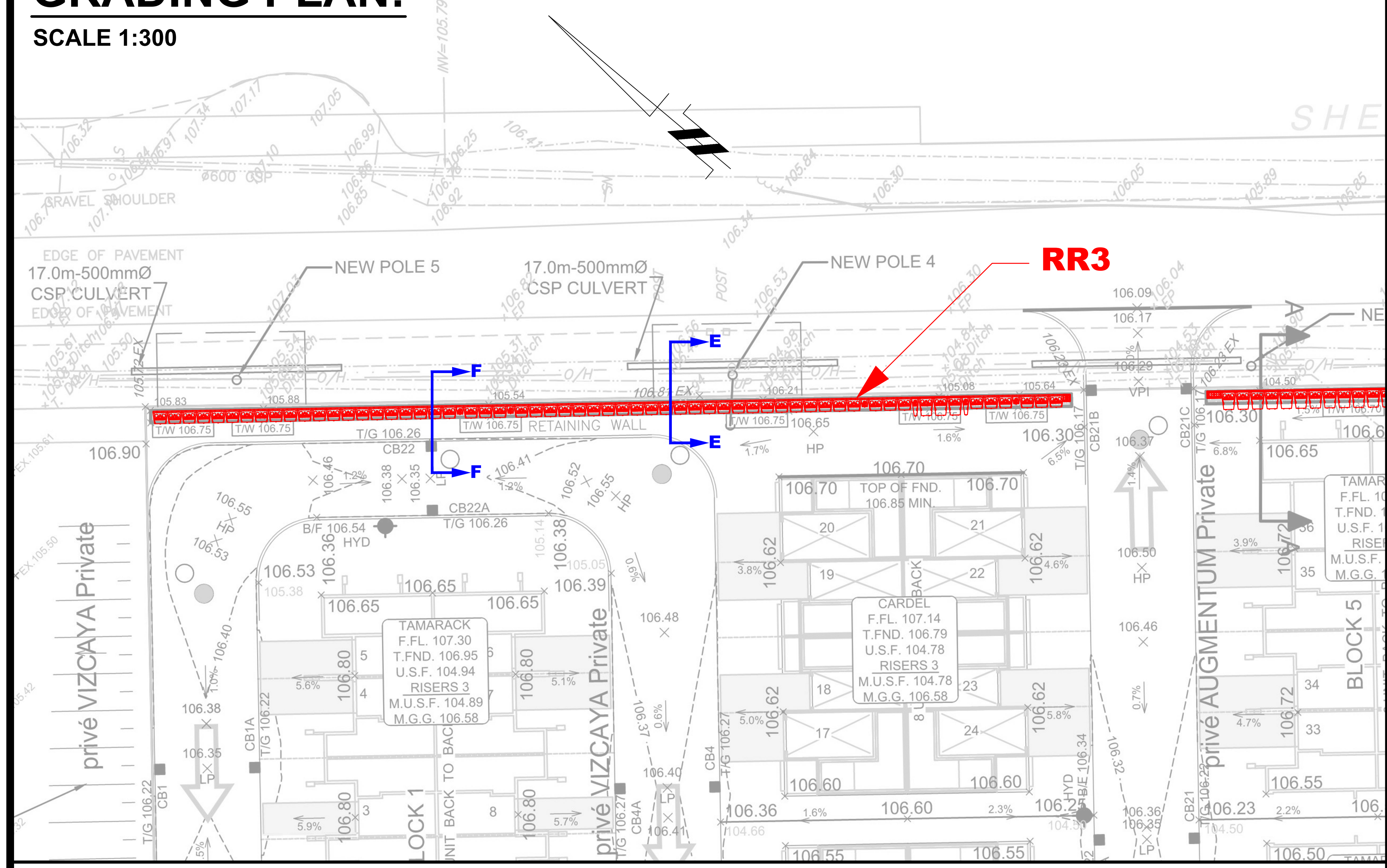
SCALE 1:100

ISSUED FOR REVIEW



GRADING PLAN:

SCALE 1:300



CROSS SECTION E-E:

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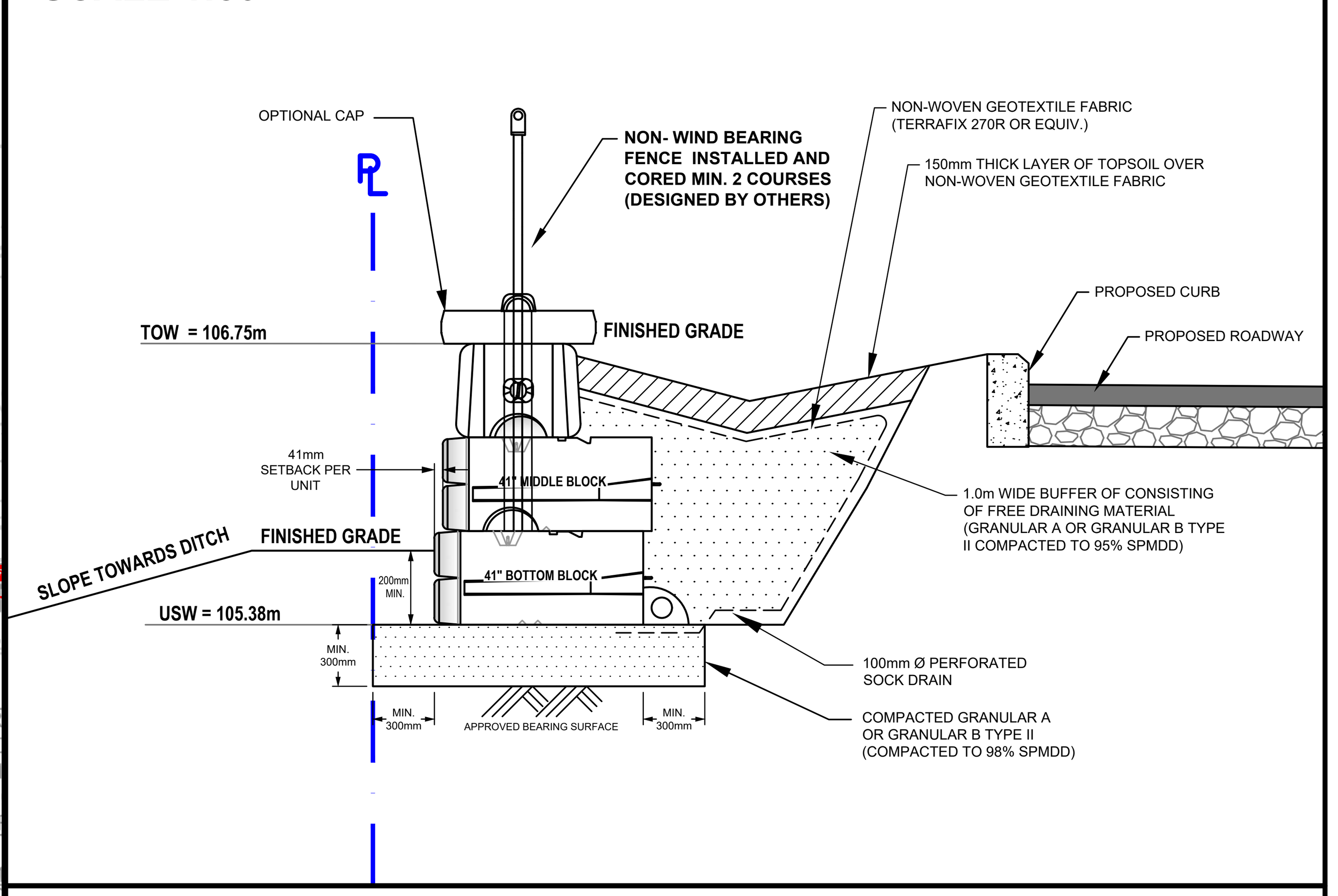
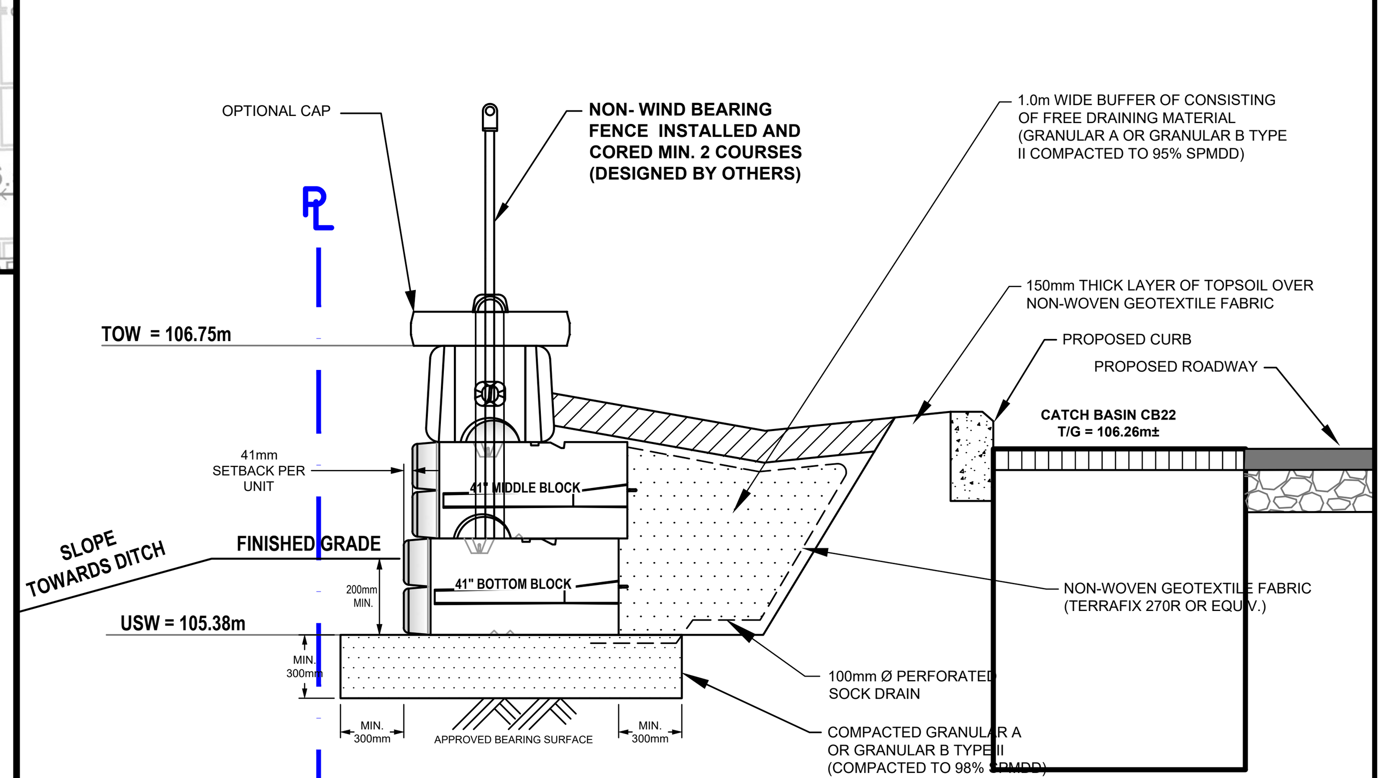


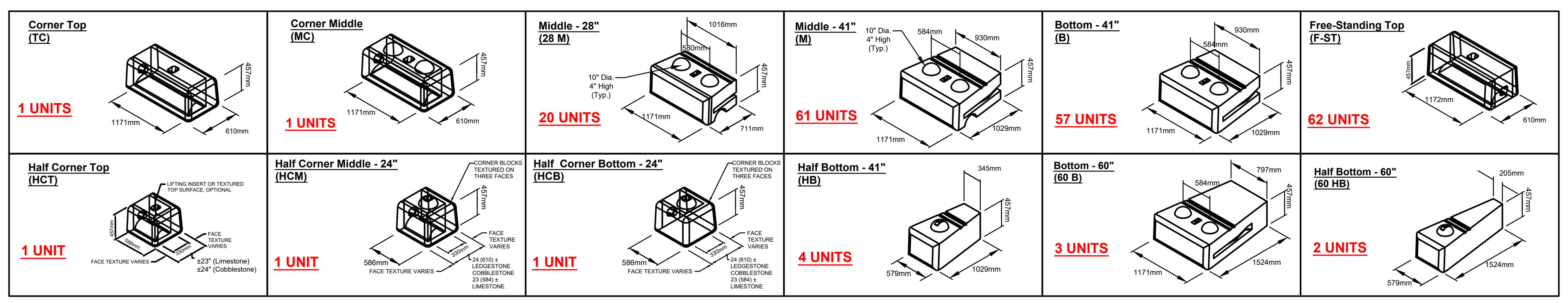
CROSS SECTION F-F:

SCALE 1:30



BLOCK COUNT:

N.T.S.



NOTES:

1. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR UTILITY CLEARANCES AND CONSTRUCTION SITE SAFETY. PATERSON GROUP SHALL NOT BE RESPONSIBLE FOR MEANS OR METHODS OF CONSTRUCTION OR FOR SAFETY OF WORKERS OR OF THE PUBLIC.
2. THIS DESIGN IS BASED ON THE FOLLOWING SOIL PROPERTIES:

PROPERTY	RETAINED FILL	FOUNDATION MEDIUM
FRICTION ANGLE - ϕ	40°	33°
UNIT WEIGHT - γ	22 kN/m3	19 kN/m3
COHESION - C	0	0 kPa
SOIL TYPE	OPSS GRANULAR B TYPE II	SILTY SAND

MATERIAL PROPERTIES ARE BASED ON SITE EVALUATION BY PATERSON GROUP AND DISCUSSIONS WITH CONTRACTOR. SEISMIC LOADING WAS EVALUATED ACCORDING TO THE CURRENT CHBDC WITH A PEAK GROUND ACCELERATION VALUE OF 0.251. WALL DESIGN WITH OPEN RAILING OR FENCING SUCH AS CHAINLINK.

3. THE DESIGN ELEVATIONS USED WERE BASED ON A GRADING PLAN DRAWN BY IBI GROUP PROJECT NO. 139185 SHEET NUMBER 200, REV.3 DATED 21/03/2025. THE WALL BASE DESIGN ASSUMES A BEARING RESISTANCE AT SLS OF 125 kPa ON SILTY SAND. PATERSON GROUP ENGINEER SHOULD OBSERVE THE BEARING CONDITIONS AND ADJUST THE THICKNESS OF THE GRANULAR BASE TO ACCOMMODATE THE SITE CONDITIONS, IF NECESSARY.
4. THE DESIGN HAS BEEN REVIEWED FOR THE STABILITY OF THE PRECAST MODULAR RETAINING WALL SYSTEM AND GLOBAL STABILITY WITH A FACTOR OF SAFETY OF 1.5 FOR STATIC CONDITIONS AND 1.1 UNDER SEISMIC CONDITIONS. WALL GEOMETRY AND GRADE ELEVATIONS ABOVE AND BELOW THE WALL SHOULD CONFORM WITH THE GRADING PLAN PROVIDED HERE IN. IF ACTUAL SITE GRADES VARY SIGNIFICANTLY FROM THOSE SHOWN OR IF THE BACK SLOPE DOES NOT CONFORM, INSTALLATION SHALL NOT PROCEED UNTIL THE DESIGN IS VERIFIED OR MODIFIED IN THE APPLICABLE AREA.
5. PRECAST UNITS SHALL BE REDI-ROCK RETAINING WALL UNITS MANUFACTURED UNDER LICENSE FROM REDI-ROCK.
6. THE WALL BASE FOR THE WALL SHALL CONSIST OF A MIN. 300mm THICK OPSS GRANULAR A COMPACTED TO MIN. 98% OF THE MATERIALS SPMDD AND TESTED BY PATERSONGROUP GEOTECHNICAL PERSONNEL AT THE TIME OF CONSTRUCTION. SURFACE OF GRANULAR BASE MAY BE DRESSED WITH FINER AGGREGATE TO AID LEVELING. ENSURE GRADATION OF DRESSING MATERIAL IS SUCH AS TO PRECLUDE LOSS OF FINES INTO BASE. THE THICKNESS OF DRESSING LAYER SHOULD NOT EXCEED 3 TIMES THE MAXIMUM PARTICLE SIZE USED.
7. WALL IS DESIGNED WITH A MIN. 300mm TOE EMBEDMENT WITH A MIN. HORIZONTAL LEDGE WITH A GRANULAR BEDDING LAYER EXTENDING A MIN. 300mm BEYOND THE FACE AND HEEL OF THE BASE BLOCK
8. INSTALL 100mm DIAMETER PERFORATED PIPE WRAPPED WITH A GEOSOCK DRAIN BEHIND HEEL OR UNDER THE WALL. PROVIDE CLEAR STONE SURROUND TO PROTECT PIPE FROM CLOGGING AND DAMAGE. PROVIDE OUTLETS THROUGH WALL, NO FURTHER APART THAN 30.0m ON CENTRES. THE DRAINAGE PIPE SHOULD BE CONNECTED TO A POSITIVE OUTLET ON BOTH ENDS OF THE RETAINING WALL SUCH AS AN EXISTING DITCH OR CATCH BASIN.
9. THE CONDITIONS WILL BE EVALUATED BY THE GEOTECHNICAL ENGINEER DURING PREPARATION FOR WALL CONSTRUCTION IN EACH AREA. WHERE GRANULAR BEDDING WILL NOT BE SUFFICIENT THE USE OF CONCRETE BEDDING MAY BE REQUIRED.
10. ALIGNMENT OF THE BOTTOM WALL UNIT COURSE SHOULD BE PLANNED TO CONSIDER THAT A NOMINAL 41mm AUTOMATIC SETBACK WILL OCCUR WITH EACH 0.46m INCREMENT OF HEIGHT.
11. BACKFILL MATERIAL SHALL BE APPROVED BY THE SITE GEOTECHNICAL ENGINEER PRIOR TO USE AND SHOULD CONSIST OF OPSS GRANULAR A OR B TYPE II FOLLOWED BY SUITABLE BACKFILL MATERIAL. ALL FILL WITHIN A 1H:1V ZONE UP AND BACK FROM THE HEEL SHOULD ALSO BE COMPACTED. BACKFILL SHALL BE PLACED IN MAXIMUM 300mm LOOSE LIFTS AND COMPACTED TO A MINIMUM OF 95% OF SPMDD. MOISTURE CONTENT SHOULD BE CONTROLLED AND MAINTAINED WITHIN -3 TO +4 PERCENT OF OPTIMUM.
12. MAINTAIN TEMPORARY GRADES TO DIVERT SURFACE WATER AWAY FROM THE RETAINING WALL EXCAVATION. SLOPE FINAL BACKFILL TO PROVIDE POSITIVE DRAINAGE AND TO ELIMINATE PONDING.
13. BACKSLOPE SHOULD BE CUT BACK TO A MINIMUM OF 2H:1V TO 3H:1V TO MAINTAIN A LONG TERM SAFE SLOPE BEHIND THE RETAINING WALL. IT SHOULD BE NOTED THAT WHERE TREES ARE PRESENT WITHIN THE TOP OF SLOPE. A MINIMUM 1.0m SET BACK IS REQUIRED FOR EXCAVATION FROM THE EDGE OF THE TREE LINE WHERE PRESENT.
14. EXCAVATION SIDE SLOPES SHOULD BE PROTECTED TEMPORARILY DURING CONSTRUCTION FROM PRECIPITATION EVENTS BY PLACEMENT OF TARPS.
15. ALL RETAINING WALL RELATED INSPECTIONS (BEARING SURFACE, COMPACTION, BLOCK INSTALLATION, ETC.) MUST BE COMPLETED BY PATERSON GROUP. ONCE THE WALL CONSTRUCTION IS COMPLETED AND REVIEWED BY PATERSON DURING CONSTRUCTION, A CERTIFICATE LETTER WILL BE ISSUED BY PATERSON GROUP.
16. ANY CUTTING OF BLOCKS TO SUIT SITE CONDITIONS OR WALL DESIGN WILL BE RESPONSIBILITY OF THE CONTRACTOR.
17. IF WINTER CONSTRUCTION IS CONSIDERED, HEAT MUST BE MAINTAINED WHEN THE BASE IS EXPOSED. THE WALL BASE MUST COVERED WITH HIGH GRADE INSULATION TARPS TO MAINTAIN HEAT AND PROTECT THE BASE FROM POTENTIAL FROST HEAVE. ONCE THE BASE IS BACKFILLED, THE TOP OF THE WALL MUST BE COVERED WITH INSULATION TARPS OVERNIGHT UNTIL THE WALL CONSTRUCTION IS COMPLETED. ADDITIONAL INSPECTIONS WILL BE REQUIRED DURING WINTER CONSTRUCTION TO ENSURE THE WALL CONSTRUCTION IS IN GENERAL CONFORMANCE WITH PATERSON'S RECOMMENDATIONS.
18. THE CONTRACTOR SHOULD REFER TO THE INSTALLATION MANUAL PROVIDED FOR THE RETAINING WALL BLOCK TYPE PROVIDED HEREIN FOR ADDITIONAL DETAILS ON ACCEPTABLE INSTALLATION PRACTICES.

PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL
4	FREE STANDING BLOCKS AS PER CONSULTANT COMMENT	27/05/2025	JV
3	UPDATED GRADING PLAN	22/05/2025	JV
2	OPENED TYPE FENCE	14/11/2024	JV
1	AS PER UPDATED GRADING PLAN	02/10/2024	JV

ARCADIS IBI GROUP

PROPOSED RETAINING WALLS
DAVIDSON LANDS SUBDIVISION - 1650 SHEA ROAD

OTTAWA, ONTARIO

Title: REDI-ROCK RETAINING WALL DESIGN (RR3)

Stamp: LICENSED PROFESSIONAL ENGINEER 27/05/2025 J. R. VILLENEUVE PROVINCE OF ONTARIO

Stamp: LICENSED PROFESSIONAL ENGINEER 27/05/2025 F. I. ABOU-SEIDO PROVINCE OF ONTARIO

Scale:	AS SHOWN
Drawn by:	NFRV
Checked by:	JV
Approved by:	FA
Date:	03/2023
File No.:	PG6633
Drawing No.:	PG6633-3
Revision No.:	4