HALIBURTON COMMERCIAL DEVELOPMENT
5065 COUNTY ROAD 21
COUNTY OF HALIBURTON
STORM WATER MANAGEMENT AND CONSTRUCTION MITIGATION PLAN

PINESTONE ENGINEERING LTD.

Prepared by:

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Table of Contents

APPENDICES

1.0 INTRODUCTION

1.1 General

The property owner is proposing to construct a commercial development on an unaddressed lot to the rear of 5065 County Road 21, in the County of Haliburton. The property is approximately 3.67 ha in size and is legally described as Parts 1 and 2, Plan 19R-7918, in the Geographic Township of Dysart, County of Haliburton. The property is bounded by Mallard Road to the North-east, vacant forested lands to the west, and commercial development to the south and east. (see Figure 1).

Development on the property is proposed to include industrial or commercial buildings with associated surface parking. The development plans for each individual lot are unknown at this stage and will be determined as lots are sold and developed. Access to the site will be provided by the extension of a proposed road off of Mallard Road.

Pinestone Engineering Ltd. has been retained by the property owner to prepare a storm water management report and construction mitigation plan for the proposed development in support of the site plan and building permit approvals.

1.2 Purpose and Scope

This report has been prepared in order to outline the storm water management requirements of the proposed development and provide the design details of the required quantity and quality control facilities necessary to address the SWM criteria.

The report has been prepared to satisfy the requirements of the Municipality of Dysart et al, and the Ministry of the Environment, Conservation and Parks (MECP).

The following objectives have been identified in the preparation of this report:

- Determine the appropriate storm water management criteria for the subject property.
- Determine if a reduction of peak runoff flows through structural controls is required to control potential flooding downstream from the development.
- Outline an appropriate set of quality control techniques that can be implemented to meet current MECP standards for this type of development.
- Provide design details of the proposed storm water management and conveyance facilities.
- Identify methods to control sedimentation and erosion during construction and in the long term.

CAMPBELL COMMERCIAL			
LOCATION PLAN			
DATE: MARCH 2023	SCALE: 1:5000	PROJECT No. 20-11523-M	FIGURE No. FIGURE 1

1.3 Reference Reports

The following reports and studies have been used for reference in the preparation of this Storm Water Management Plan:

i) *Ministry of the Environment and Energy's Storm Water Management Planning and Design Manual, March 2003.*

ii) *Sediment Control Planning Central Region Group, prepared by the Ministry of Natural Resources.*

2.0 EXISTING SITE CONDITIONS

2.1 General

The subject site is approximately 3.67 hectares in size. Access is provided by a gravel driveway extending off of Mallard Road. The majority of the site is currently vacant and heavily vegetated with grasses and trees. A gravel yard and parking area are currently constructed in the southern portion of the site.

There is a well-defined intermittent watercourse that crosses the center of the property, flowing from west to east. An existing 500mm dia. culvert and swale convey the watercourse to adjacent lands east of the property.

2.2 Topography

A topographic survey was completed by PEL in August 2020. The topography across the majority of the site is generally moderate to severe, sloping toward the existing water course at an average slope of approximately 5-10%. The southern portion of the site slopes southerly towards adjacent lands. Elevations across the site range from 346.0m ASL along the northwest property limit to 332.50m ASL at the south property limit.

2.3 Drainage Conditions

Pre-development flows from the majority of the site drain overland in the form of sheet flow towards the existing water course. The water course conveys drainage easterly towards a downstream wetland area, and ultimately outlets to Grass Lake. A southern portion of the site drains overland in the form of sheet flow towards south adjacent lands and ultimately outlets to Grass Lake. A small northern portion of the site drains northerly to Mallard Road.

2.4 Site Geology

Based on our site reconnaissance and review of the topographic survey and Quarternary Geology of the Haliburton area published by the Soil Associations of Southern Ontario, the geology in the area of the lot is described as:

Sandy Loam Soils Overlying Shallow Precambrian Bedrock

Based on our review of the soils descriptions outlined in the MTO Drainage Manual on Chart 1.08, we have classified the site material as a Type B under the Soil Conservation Service, hydrologic soil group.

Adjustment of the curve numbers for the pervious component of the lands have been carried out in the computer model to represent Type B soils.

A copy of the soils mapping, and chart 1.09 from the MTO Drainage Manual are included in Appendix A.

2.5 Traffic

A Traffic Corridor Assessment Study of County Road 21, prepared by Aecom in 2017, raised concerns about existing drive-through traffic from CR21to Mallard Road. Many residents in the area avoid the intersection at Industrial Park Road and use the private road access on the Curry Chevrolet Buick GMC Ltd property.

To address traffic concerns, a barrier has been installed on the northern entrance of the Curry Chevrolet Buick GMC Ltd property by the GMC property owners.

2.6 Fish Habitat

The existing water course ultimately outlets to Grass Lake, which provides habitat for aquatic species. Accordingly, the receiving outlet should be considered “sensitive” and a “enhanced” level of quality control applied, in accordance with the MECP Storm Water Management Planning and Design Manual (MECP, 2003).

3.0 HYDROLOGY

A hydrologic model has been prepared for the site. The intent of the model was to provide quantitative estimates of runoff rates under both existing and proposed development conditions. These estimates can then be compared to determine the impact of the proposed development on the study area.

3.1 Model Selection

The rainfall runoff event simulation model MIDUSS (Microcomputer Interactive Design of Urban Storm water Management Systems) was used to simulate watershed response to design rainfall events.

3.2 Design Storms

The following design storms were modelled as part of our evaluation:

- 100-year design storm

The selected storm water management criteria are discussed further in *Section 5.1* of this report.

Rainfall intensity - duration frequency (IDF) values for the Muskoka Area were entered into an equation that expresses the time relationship intensity for specific frequency, in the form of:

$$i = \frac{a}{(t+b)^c}$$

where:
- i = intensity, mm/hr.
- t = Time of concentration, minutes
- a,b,c = constants developed to fit published IDF curves

The storm events were applied to the hydrologic model. Derivation of the design storm hyetographs were based on the "Chicago" 3-hour distribution using Muskoka Area intensity, duration, frequency (IDF) data.

The design storm parameters utilized in the modelling, are outlined in Table 1, below:

Table 1
Design Storm Parameters
Chicago Rainfall Distribution

Rainfall Event	Parameter			Duration (min)
	A	B	C	
5 Yr	950.0	6.75	0.820	180
10 Yr	1221.0	7.38	0.843	180
25 Yr	1452.0	7.30	0.848	180
100 Yr	1499.0	5.81	0.825	180

4.0 PROPOSED DEVELOPMENT

Development on the property is proposed to include industrial or commercial buildings with associated surface parking. The configurations for each lot are unknown at this stage and will be determined as individual lots are sold and developed. Access to the site will be provided by the extension of a proposed road off of Mallard Road. It is anticipated that Site Plan Approval (SPA) will be required for each individual lot development.

Drainage from the proposed buildings and surface parking facility of each individual lot will be directed to a parking lot ponding storage area or storm water management pond to attenuate peak flows. Where parking lot storage is utilized, site drainage will be directed to an oil/grit separator unit designed to provide an enhanced level of quality control for each lot, prior to discharging to the proposed municipal ditches and ultimately to Grass Lake.

An existing intermittent watercourse current traverses the site across lot 2 and a small portion of lot 3. The watercourse will be relocated along the lot 2 and lot 3 property line with a proposed ditch of 2.0m depth and 3:1 side slopes.

5.0 STORM WATER MANAGEMENT PLAN

5.1 Storm Water Management Criteria

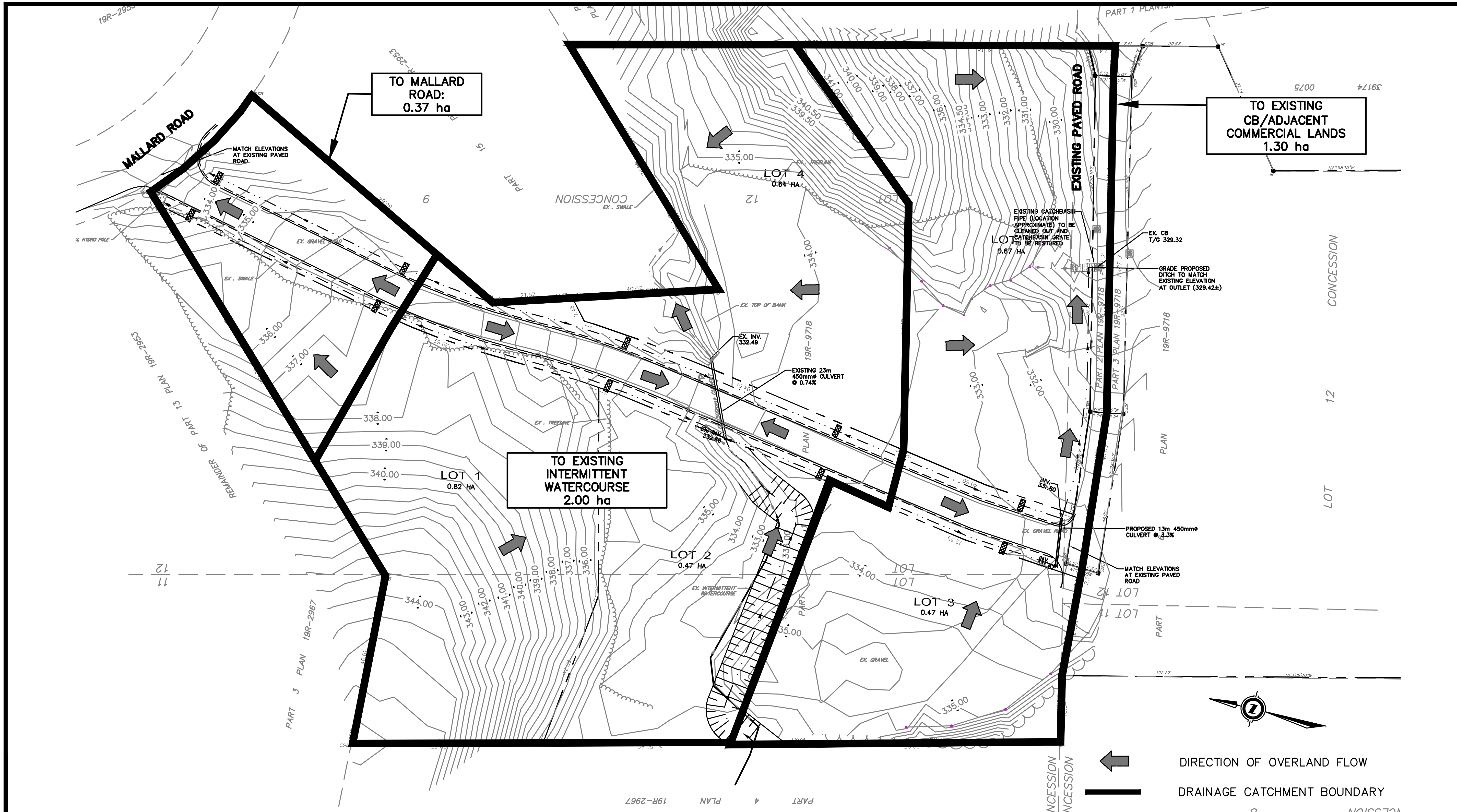
Drainage from the proposed buildings and surface parking facility of each individual lot will be directed to a parking lot ponding storage area, or storm water management pond, to attenuate peak flows prior to discharge to the roadside ditch constructed on the proposed road.

Existing drainage patterns will generally be maintained, with the majority of the site drainage (Lots 1,2 and 4) being conveyed to the existing intermittent watercourse in the centre of the site. A small northern portion of the site comprised of the proposed roadway will continue to drain to Mallard Road as in the existing condition. The southern portion of the site (lots 3 and 5) will continue to drain to the adjacent commercial development south of the site. Currently an existing rip-rap channel captures and conveys site drainage to an existing catchbasin on the adjacent commercial property. A proposed ditch will convey drainage from the proposed development along the southern border of lot 5 and outlet to the existing catchbasin. All drainage ultimately outlets to Grass Lake. The drainage catchment concept plan is illustrated on Figure 2.

Using the MIDUSS hydrologic model, pre-development and post development run-off hydrographs were generated for the site in response to the 100 year design storm events. Based on our calculations, assuming 60% impervious value in the post-development scenario, and comparing the total rainfall volumes in each scenario, detention storage of approximately 272cu.m. per hectare will be required on each lot, to be designed and approved as part of the site plan approval process for each lot. The MIDUSS files are included in Appendix B.

Site drainage will be directed to an oil/grit separator unit, where parking lot storage is utilized, designed to provide an enhanced level of quality control for each lot, prior to discharging to the proposed ditches and ultimately to Grass Lake.

The proposed ditches are sized to accommodate the 100yr post-development flows from the road and lots (assuming 60% impervious value).



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CAMPBELL COMMERCIAL

DRAINAGE CATCHMENT CONCEPT PLAN

PROJECT NO. 20-11523-M	
SCALE: 1:1000	DATE: APRIL 2023
FIGURE 2	

The Storm Water Management Planning and Design Manual (MOE, 2003) recommends a number of suitable water quality enhancement techniques such as detention storage, enhanced grass swales, level spreaders, infiltration facilities, and oil/grit removers.

Water quality enhancement of post development run-off from the development will be achieved through the implementation of a “treatment train” of approved measures, as follows:

- Enhanced swales behind lots to promote cleaning and infiltration of storm water
- Provision of at least 272 cu.m/ha of detention storage, using either parking lot storage or private storm water management ponds within each lot.
- Installation of oil/grit separator units sized to provide an enhanced level of quality control
- Rip-rap treatment at storm outlet to prevent migration of sediment
- Maintenance of lot line vegetation to filter runoff
- Suitable construction mitigation measures to be utilized during the site development

6.0 EROSION AND SEDIMENT CONTROL

Sedimentation and erosion control measures are required during construction and until such a time that site development has been completed and the parking area has been paved and vegetation established.

The use of various siltation control measures will be implemented to protect the adjacent properties and receiving waterbodies from migrating sediments.

These works include but may not be limited to:

- Installation of siltation fencing along down gradient portion of the development area.
- Installation of rock check dams along proposed ditching.
- Installation of a mud mat to control vehicle debris tracking onto public roads.

The location of the siltation control measures, and typical details, are shown on the engineering plans included in Appendix C.

6.1 During Construction

Prior to carrying out site grading, the siltation barriers noted above shall be in place. The storm sewer works will not be permitted to outlet from the site until the site has been stabilized. Other temporary installations of silt fence or other appropriate measures may be required during grading to minimize silt migration from the site. The measures will need to be removed, replaced and relocated as required during the construction period until the site works have been completed and vegetation established. During construction all stockpiled material will be placed up-gradient of the siltation controls with additional siltation fencing installed around the stockpiles.

If site works are to continue through the winter and spring, the engineer shall be contacted by the owner to review the measures in place with the contractor on a regular basis to ensure that the facilities are adequate and in good working order. All reasonable methods to control erosion and sedimentation are to be taken during construction.

6.2 Monitoring and Maintenance

It is the responsibility of the contractor and owner to maintain the siltation control devices until suitable grass cover has been established. A regular review of the facilities by the contractor shall be carried out during the construction period to ensure that the facilities are being properly maintained, and if necessary, replaced.

The contractor should inspect the siltation devices immediately after each rainfall. Damaged devices should be repaired immediately, and additional devices installed if necessary. Silt should be removed from the fencing and related siltation devices when deposits are noticeable.

6.3 Contingency Plan

Should the erosion control measures fail, and sediment migrate beyond the limits of the control works, the following tasks are required to be completed:

- The Municipality of Dysart et al and the County of Haliburton should be notified of the event. The area will be assessed and cleaned up to the satisfaction of the agencies.
- Additional sedimentation facilities be installed in the area of the migration and down gradient to contain the sediment.

7.0 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions are based on the information and analysis presented in this report:

1) The comparison of pre-development and post-development stormwater flowrates indicate that peak flows will increase during all the major storm events as a result of the proposed development of the property.
2) The use of parking lot storage or storm water management ponds has been proposed to attenuate post-development flows to pre-development levels on a lot-by-lot basis. It is anticipated that each lot will be subject to Site Plan Control and the detailed design of detention facilities will be completed at that time.
3) Storm water quality enhancement to the receiving storm sewer system can be achieved using a “treatment train” of quality control techniques including utilization of parking lot or pond storage volume, installation of oil/grit separator units sized to

achieve 80% TSS removal, and suitable construction mitigation measures to be utilized during the site development.

4) Suitable measures can be implemented during construction to protect the adjacent properties from migrating sediments.

It is recommended that:

1) This report and drawings be submitted to the County of Haliburton and the Municipality of Dysart et al for review and approval.
2) The stormwater management works shall be constructed in accordance with the design details presented in this report.
3) The construction mitigation measures outlined in this report are utilized as a guideline for construction mitigation management on this site.

All of which is respectfully submitted,

PINESTONE ENGINEERING LTD.

Lauren Trividic, P.Eng.

APPENDIX A

Soil Analysis

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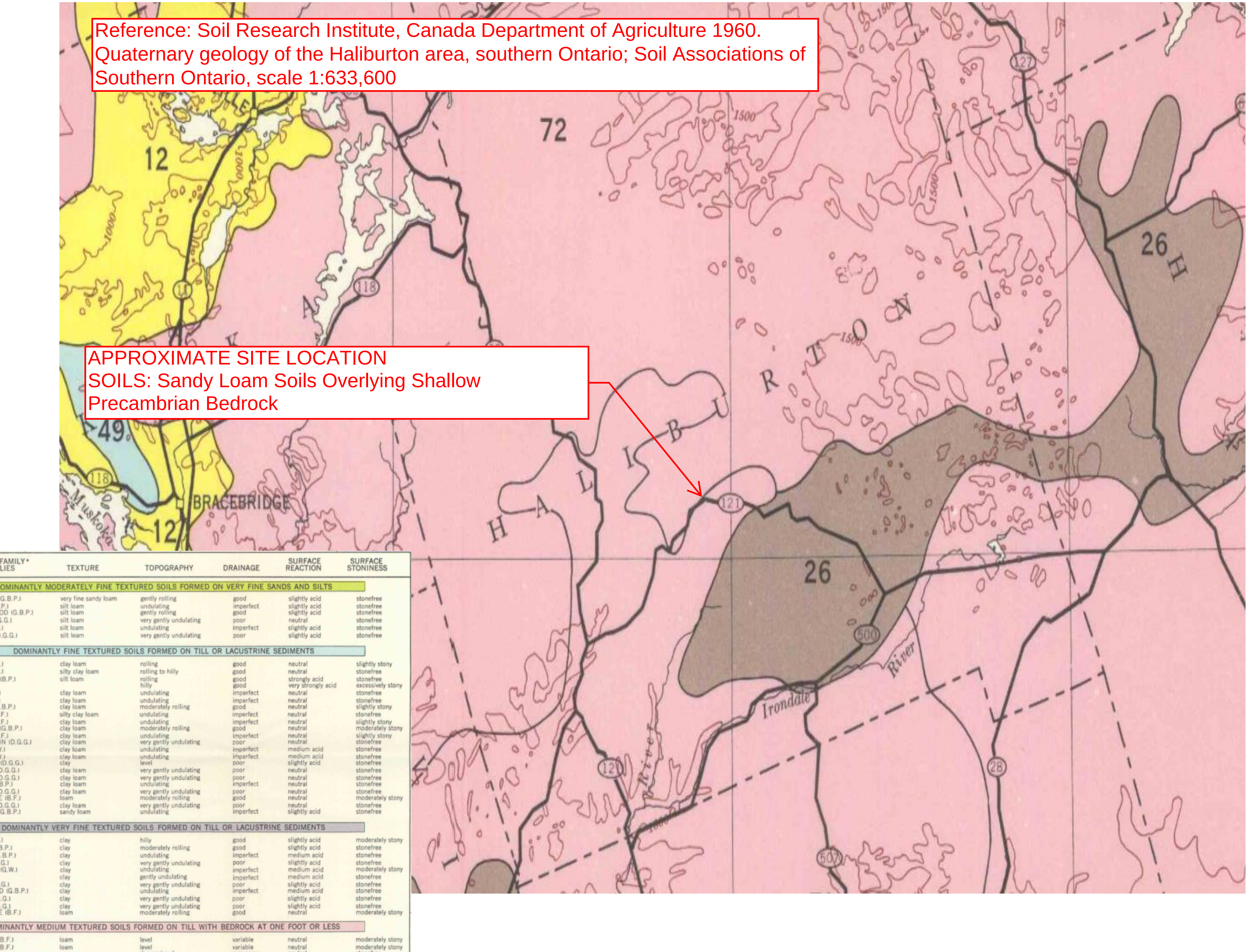
Reference: Soil Research Institute, Canada Department of Agriculture 1960.
Quaternary geology of the Haliburton area, southern Ontario; Soil Associations of
Southern Ontario, scale 1:633,600
APPROXIMATE SITE LOCATION
SOILS: Sandy Loam Soils Overlying Shallow
Precambrian Bedrock
72
12
26
49
HALIBURTON
BRACEBRIDGE
Irondale
River
1500
1000
118
121
127
500
28
507
TEXTURE
TOPOGRAPHY
DRAINAGE
SURFACE REACTION
SURFACE STONINESS
DOMINANTLY FINE TEXTURED SOILS FORMED ON TILL OR LACUSTRINE SEDIMENTS
DOMINANTLY VERY FINE TEXTURED SOILS FORMED ON TILL OR LACUSTRINE SEDIMENTS

Design Chart 1.08: Hydrologic Soil Groups

- Based on Surficial Geology Maps

Map Ref.No.	Soil Type or Texture	Hydrologic Soil Group (Tentative)
	Ground Moraine	
1a	Usually sandy till, stony, varying depth. (Most widespread type in Shield).	Usually B (shallow); may be A or AB
1b	Clayey till, varying depth.	BC-C
	End or Interlobate Moraine	
2a	Sand & stones, deep. (May be rough topography).	A
2b	Sand & stones capped by till, deep.	A-C depending on type of till.
2c	Sand & stones, deep. (Smoother topography).	A
	Kames & Eskers	
3a	Sand & stones, deep. (May be rough topography).	A
3b	Sand & stones capped by till, deep.	A-C depending on type of till.
3c	Sand & stones, deep. (Smoother topography).	A
	Lacustrine	
4a	Clay & silt, in lowlands.	BC-C
4b	Fine sand, in lowlands.	AB-B
4c	Sand, in lowlands.	AB
4d	Sand (deltas & valley trains).	A-AB
	Outwash	
5	Sand, some gravel, deep.	A
	Aeolian	
6	Very fine sand & silt, shallow. (Loess)	B
	Bedrock	
7	Bare bedrock (normally negligible areas).	Varies according to rock type.

Source: Ministry of Natural Resources - MNR

Design Chart 1.08: Hydrologic Soil Groups (Continued)

- Based on Soil Texture

Sands, Sandy Loams and Gravels	
- overlying sand, gravel or limestone bedrock, very well drained	A
- ditto, imperfectly drained	AB
- shallow, overlying Precambrian bedrock or clay subsoil	B
Medium to Coarse Loams	
- overlying sand, gravel or limestone, well drained	AB
- shallow, overlying Precambrian bedrock or clay subsoil	B
Medium Textured Loams	
- shallow, overlying limestone bedrock	B
- overlying medium textured subsoil	BC
Silt Loams, Some Loams	
- with good internal drainage	BC
- with slow internal drainage and good external drainage	C
Clays, Clay Loams, Silty Clay Loams	
- with good internal drainage	C
- with imperfect or poor external drainage	C
- with slow internal drainage and good external drainage	D

Source: U.S. Department of Agriculture (1972)

Design Chart 1.09: Soil/Land Use Curve Numbers

Land Use	Treatment or Practice	Hydrologic Condition[4]	Hydrologic Soil Group			
			A	B	C	D
Fallow	Straight row	---	77	86	91	94
Row crops	"	Poor	72	81	88	91
	"	Good	67	78	85	89
	Contoured	Poor	70	79	84	88
	"	Good	65	75	82	86
	" and terraced	Poor	66	74	8	82
	" " "	Good	62	71	78	81
Small grain	Straight row	Poor	65	76	84	88
		Good	63	75	83	87
	Contoured	Poor	63	74	82	85
		Good	61	73	81	84
	" and terraced	Poor	61	72	79	82
		Good	59	70	78	81
Close-seeded	Straight row	Poor	66	77	85	89
legumes[2]	" "	Good	58	72	81	85
or	Contoured	Poor	64	75	83	85
rotation	"	Good	55	69	78	83
meadow	" and terraced	Poor	63	73	80	83
	" and terraced	Good	51	67	76	80
Pasture		Poor	68	79	86	89
or range		Fair	49	69	79	84
	Contoured	Good	39	61	74	80
	"	Poor	47	67	81	88
	"	Fair	25	59	75	83
		Good	6	35	70	79
Meadow		Good	30	58	71	78
Woods		Poor	45	66	77	83
		Fair	36	60	73	79
		Good	25	55	70	77
Farmsteads		---	59	74	82	86
		---	72	82	87	89
		---	74	84	90	92

For average anticedent soil moisture condition (AMC II)
[2] Close-drilled or broadcast.

[4] The hydrologic condition of cropland is good if a good crop rotation practice is used; it is poor if one crop is grown continuously.

Source: U.S. Department of Agriculture (1972)

APPENDIX B

Design Calculations

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"        0.000   Impervious length"
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"       16.933   Pervious Initial abstraction"
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"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
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"                    0.017     0.000     0.000     0.000 c.m/sec"
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"       0.100   Pervious Ia/S coefficient"
"      16.933   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.000   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                    0.011     0.000     0.000     0.000 c.m/sec"
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"               Time to Centroid       139.403    90.069     94.914     minutes"
"               Rainfall depth         60.387     60.387     60.387     mm"
"               Rainfall volume        198.07     297.10     495.17     c.m"
"               Rainfall losses        51.517     6.086      24.258     mm"
"               Runoff depth           8.870      54.301     36.128     mm"
"               Runoff volume          29.09      267.16     296.25     c.m"
"               Runoff coefficient     0.147      0.899      0.598      "
"               Maximum flow           0.007      0.199      0.200      c.m/sec"
" 40            HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                       0.200     0.200     0.000     0.000"
" 40            HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                       0.200     0.000     0.000     0.000"
" 33            CATCHMENT 203"
"             1   Triangular SCS"
"             2   Proportional to %"
"             1   SCS method"
"           203   203 - LOT 3 POST DEVELOPMENT"
"        60.000   % Impervious"
"         0.470   Total Area"
"        50.000   Flow length"
"         4.000   Overland Slope"
"         0.188   Pervious Area"
"        50.000   Pervious length"
"         4.000   Pervious slope"
"         0.282   Impervious Area"
"        75.000   Impervious length"
"         4.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        60.000   Pervious SCS Curve No."
"         0.147   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"        16.933   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.897   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                       0.121     0.000     0.000     0.000 c.m/sec"
"               Catchment 203          Pervious   Impervious Total Area "
"               Surface Area           0.188      0.282      0.470      hectare"
"               Time of concentration  25.118     2.349      4.589      minutes"
"               Time to Centroid       132.516    89.216     93.476     minutes"
"               Rainfall depth         60.387     60.387     60.387     mm"
"               Rainfall volume        113.53     170.29     283.82     c.m"
```

```
"             Rainfall losses        51.521     6.220      24.341     mm"
"             Runoff depth           8.865      54.166     36.046     mm"
"             Runoff volume          16.67      152.75     169.42     c.m"
"             Runoff coefficient     0.147      0.897      0.597      "
"             Maximum flow           0.004      0.121      0.121      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.121     0.121     0.000     0.000"
" 38          START/RE-START TOTALS 203"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                        1.290    hectare"
"             Total Impervious area                       0.774    hectare"
"             Total % impervious                         60.000"
" 19          EXIT"
```

CAMPBELL COMMERCIAL - ROAD SIDE SWALES
RATIONAL METHOD CALCULATIONS
Bracebridge, Ontario

Project Number: 20-11523M
Date: November 5, 2020
Design By: LT
File: Z:\Project Documents\11523M Campbell Commercial\11523 Trapezoidal Channel.xls

PINESTONE ENGINEERING LTD.

Chicago Storm Parameters

Design Storm	a	b	c	Intensity (mm/hr)
5 Year	950	6.75	0.82	129.876
10 Year	1221	7.38	0.843	150.818
25 Year	1452	7.3	0.848	178.152
50 Year	1466	6.55	0.832	197.575
100 Year	1499	5.81	0.825	217.467

* Based on District of Muskoka IDF Data

Rational Coefficient

DOWNTOWN BUSINESS	0.70-0.95
SINGLE FAMILY RESIDNTL	0.30-0.50
ASPHALT/CONCRETE	0.70-0.95
SANDY SOIL LAWN	0.05-0.20
HEAVY SOIL LAWN	0.13-0.35
BRICK	0.70-0.85

Time of Concentration(Tc) Calculator

WATERSHED AREA	=	2.25	ha
LENGTH OF OVERLAND FLOW	=	120	m
SLOPE	=	0.05	m/m
RATIONAL COEFFICIENT	=	0.6	see table

Time of Concetration Results

BRANSBY WILLIAMS FORMULA	=	**4.6**	min.
(use for C>=0.4)			
AIROPORT FORMULA	=	**10.5**	min.
(use for C<0.4)			

Design Flows (Q=CiA/360) m^3/sec

5 Year	**0.487**
10 Year	**0.566**
25 Year	**0.668**
50 Year	**0.741**
100 Year	**0.815**

CAMPBELL COMMERCIAL - ROAD SIDE SWALES
TRAPEZOIDAL CHANNEL DESIGN
Bracebridge, Ontario

Project Number: 20-11523M
Date: November 5, 2020
Design By: LT
File: Z:\Project Documents\11523M Campbell Commercial\11523 Trapezoidal Channel.xls

PINESTONE ENGINEERING LTD.

Calculation of discharge, Q, and average velocity, V (S.I. Units)

Using the Manning Equation for Uniform Open Channel Flow

$A = by + zy^2$	(cross-sectional area)
$P = b + 2y(1 + z^2)^{1/2}$	(wetted perimeter)
$R = A/P$	(hydraulic radius)
$Q = (1.0/n)(A)(R^{2/3})(S^{1/2})$	(Manning Equation)
$V = Q/A$	(average velocity)

Instructions: *Enter values in blue boxes. Spreadsheet calculates values in yellow boxes*

Inputs			**Calculations**		
Bottom width, **b** =	0.5	m	Cross-Sect. Area, **A** =	1.680	m^2
Depth of Channel, **y** =	0.8	m	Wetted Perimeter, **P** =	4.08	m
Side Slope, **z** = (H:V = **z**:1)	2		Hydraulic Radius, **R** =	0.41	m
Manning roughness, **n** =	0.03		Discharge, **Q** =	3.10	m^3/s
Channel bottom slope, **S** =	0.01	m/m	Ave. Velocity, **V** =	1.85	m/s
Required Flow, **Q** =	0.815	m^3/s			

Design Check: **Size of Channel is adequate and can carry required flow**

Manning Roughness Coefficient Values

Channel Surface	Manning Roughness Coefficient, n
Asbestos cement	0.011
Brass	0.011
Brick	0.015
Cast-iron, new	0.012
Concrete, steel forms	0.011
Concrete, wooden forms	0.015
Concrete, centrifugally spun	0.013
Copper	0.011
Corrugated metal	0.022
Galvanized Iron	0.016
Lead	0.011
Plastic	0.009
Steel - Coal-tar enamel	0.01
Steel - New unlined	0.011
Steel - Riveted	0.019
Wood stave	0.012

CAMPBELL COMMERCIAL - ROAD SIDE SWALES

Erodibilty Review

Bracebridge, Ontario

Project Number:	20-11523M
Date:	November 5, 2020
Design By:	LT
File:	Z:\Project Documents\11523M Campbell Commercial\11523 Trapezoidal Channel.xls

Maximum Flow Rate in Channel = 0.815 (100 Year Design Storm)
Mamimum Permitted Velocity = 1.2 (see charts)

Flow Area A (Q/V) = 0.679583 m^2

Calculate Flow Depth in Channel	Quadratic Function		
Area = (bottom width)d+(slope)d^2	**a**	**b**	**c**
	2	**0.5**	**-0.67958294**
Root 1 =	0.471168157		
Root 2 =	-0.72116816		
Thefore, depth of flow in the channel =	**0.471 m**	**OK**	

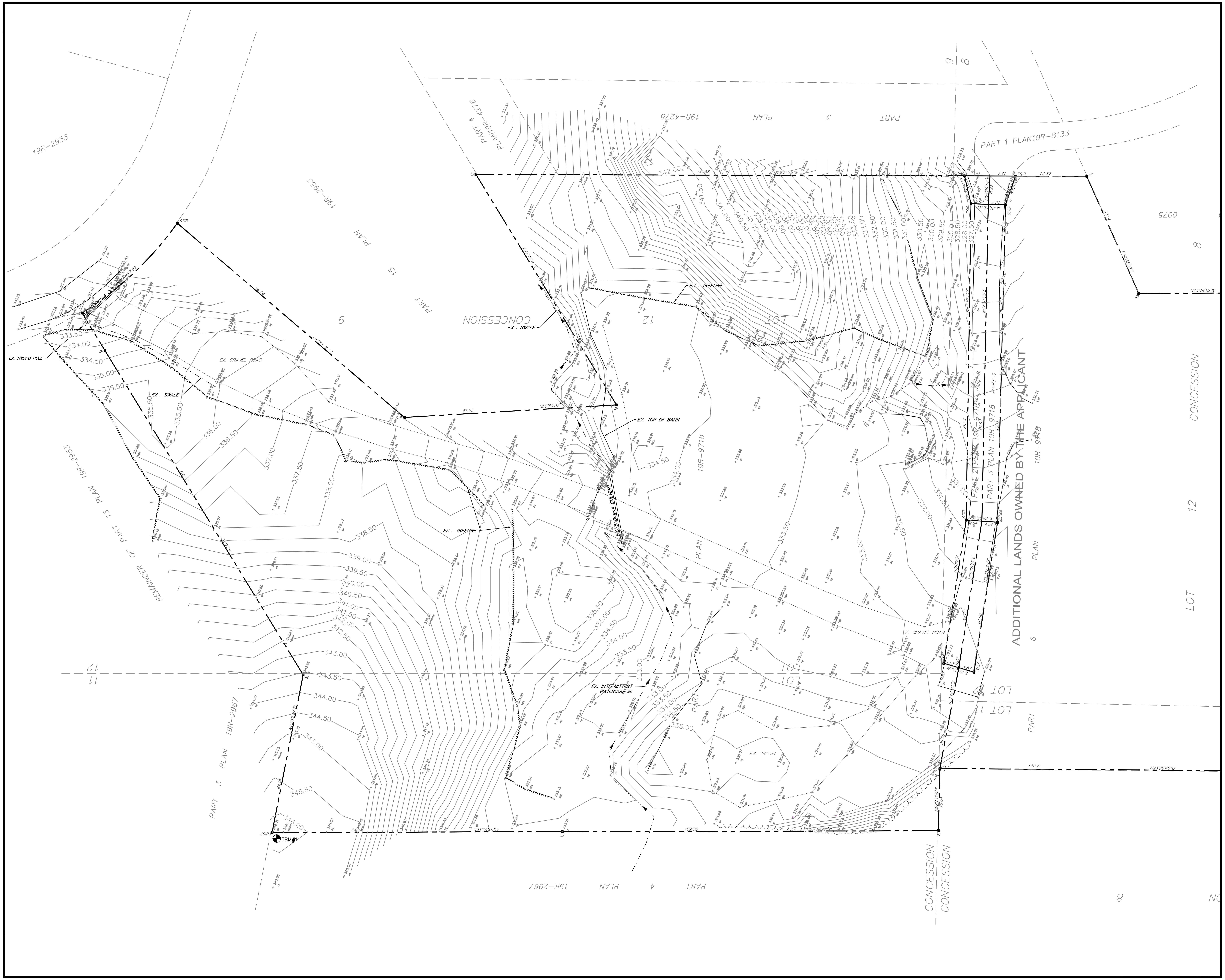
Calculate Maximum Slope at which Erosion Protection is Required		
Smax =	**$(Vmax \times N/R^{2/3})^2$**	
N =	0.03	(Rip-Rap)
Wetted Perimeter	2.607	m
Hydraulic Radius	0.261	m
Smax =	0.008	m/m
Smax =	0.778	%

Channel Design Summary	
Bottom Width	**0.5 m**
Side Slopes (H:1)	**2**
Depth of Channel	**0.8 m**
Depth of Flow	**0.471 m**
Erosion Protection when slope of Channel exceeds	**0.78 %**

APPENDIX C

Drawings

PEL
PINESTONE ENGINEERING LTD.



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The position of existing above ground and underground utilities and facilities are not necessarily shown on the drawings, and where shown, the accuracy of the position of such utilities and facilities is not guaranteed. Before starting work, the contractor shall confirm the exact location of all existing utilities and facilities, and shall assume all liability for damage to them

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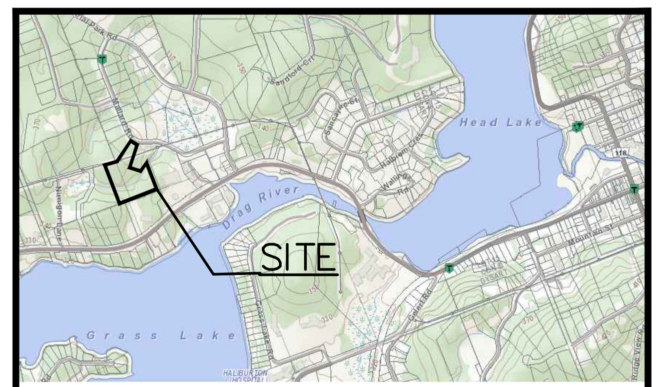


KEY MAP

NOTES

1. TOPOGRAPHIC SURVEY COMPLETED BY PINESTONE ENGINEERING, AUGUST 2020.

LEGEND

221.0	CONTOUR
	EXISTING HYDRO POLE
	EXISTING TREELINE
	EXISTING SANITARY MANHOLE
	DITCH CENTERLINE
	DIRECTION OF OVERLAND FLOW

BENCHMARK

TBM#1 TOP OF SIB IN NORWEST CORNER OF PROPERTY. ELEVATION: 346.21

NO.	YY.MM.DD	REVISION	BY

SEAL

LICENSED PROFESSIONAL ENGINEER
L M TRIVIDIC
100220753
MAR 2023
PROVINCE OF ONTARIO

NORTH ARROW

DESIGN BY:	L.T.
DRAWN BY:	M.B.
CHECKED	L.T.
DATE:	MARCH 2023
SCALE:	1:500

CLIENT/PROJECT

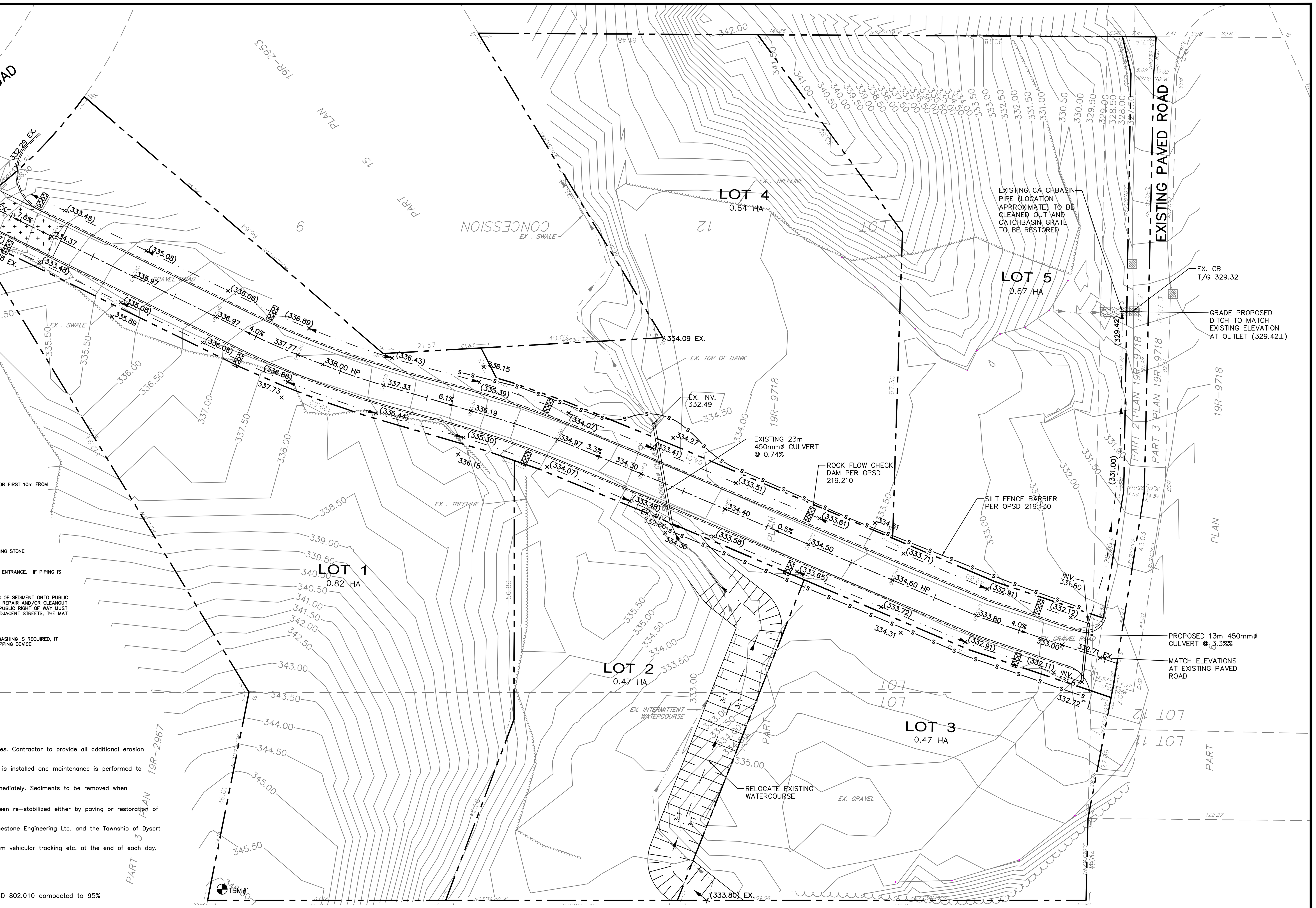
CAMPBELL COMMERCIAL

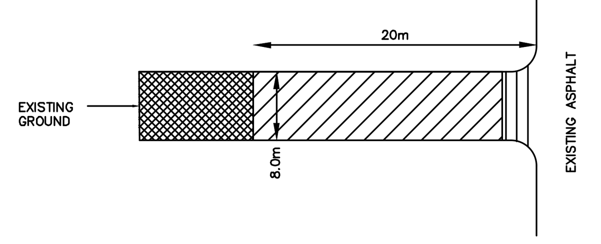
DRAWING TITLE

EXISTING CONDITIONS PLAN

PROJECT NO.	DRAWING NO.	REVISION
20-11523M	EX-1	0

DWG NAME





STONE SIZE

- THE STONE PAD SHALL BE A MIN. 150mm THICK. USE 50mmø STONE OR RECLAIMED CONCRETE EQUIVALENT FOR FIRST 10m FROM ADJACENT ROAD AND 150mmø STONE FOR REMAINDER OF STONE PAD.

LENGTH

- AS REQUIRED BUT NOT LESS THAN 20m

WIDTH

- 8m WIDTH

GEOTEXTILE FABRIC

- GEOTEXTILE FABRIC (TERRAFIX 270R OR EQUIVALENT) WILL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING STONE

SURFACE WATER

- ALL SURFACE WATER FLOWING OR DIRECTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED ACROSS THE ENTRANCE. IF PIPING IS IMPRACTICAL A MOUNTABLE BERM WITH 5:1 SLOPES WILL BE PERMITTED.

MAINTENANCE

- THE CONTRACTOR SHALL MAINTAIN THE ENTRANCE IN A CONDITION WHICH WILL PREVENT TRACKING OF FLOWING OF SEDIMENT ONTO PUBLIC RIGHT–OF–WAY. THIS MAY REQUIRE PERIODIC DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHT OF WAY MUST BE REMOVED IMMEDIATELY BY THE CONTRACTOR. UPON OBSERVATION OF CONTINUOUS MUD TRACKING ONTO ADJACENT STREETS, THE MAT IS TO BE FULLY REPLACED.

WASHING

- WHEELS SHALL BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTRANCE ONTO PUBLIC RIGHT OF WAY. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AND APPROVED SEDIMENT TRAPPING DEVICE
- INSPECTION AND REQUIRED MAINTENANCE AFTER EACH RAIN SHALL BE PROVIDED BY THE CONTRACTOR.

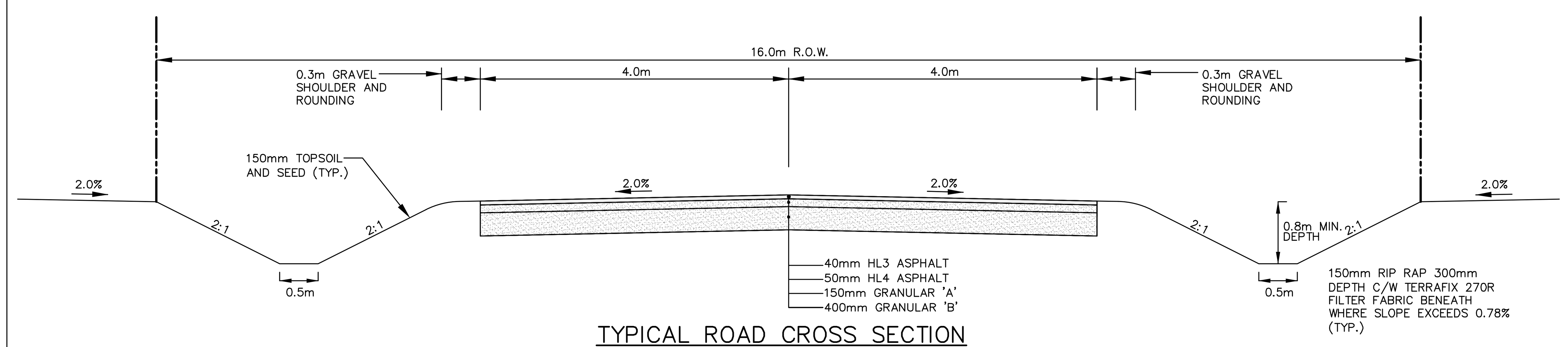
20m x 8m STONE MUDMAT DETAIL

EROSION CONTROL NOTES:

1. All silt fencing to be installed prior to any grading or excavation.
2. Erosion control fencing to be installed around the base of all stockpiles.
3. Additional erosion control measures may be required as site development progresses. Contractor to provide all additional erosion control structures as directed by the engineer.
4. Pinestone Engineering Ltd. to monitor erosion control structures to ensure fencing is installed and maintenance is performed to municipal requirements.
5. Erosion control structures to be monitored regularly and any damage repaired immediately. Sediments to be removed when occumulations reach a maximum of 1/2 the height of the fence.
6. All erosion control structures to remain in place until all disturbed ground have been re-stabilized either by paving or restoration of vegetative ground cover.
7. No alternate methods of erosion protection shall be permitted unless approved Pinestone Engineering Ltd. and the Township of Dysort et all Department of Public Works.
8. Contractor is responsible for municipal roadway to be cleared of all sediments from vehicular tracking etc. at the end of each day.

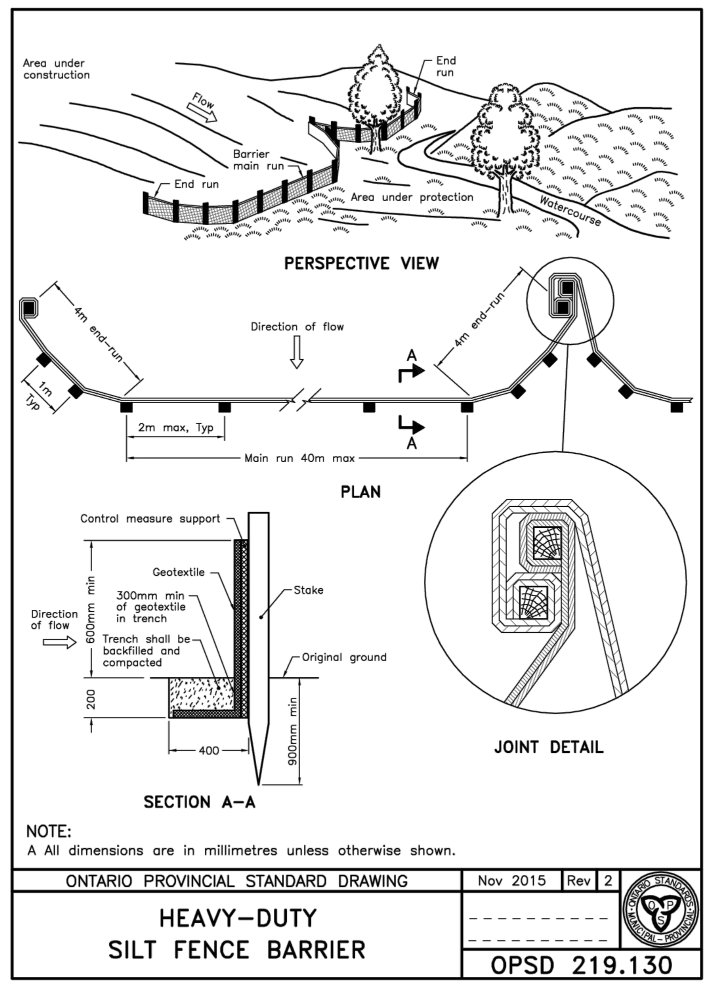
CULVERT NOTES

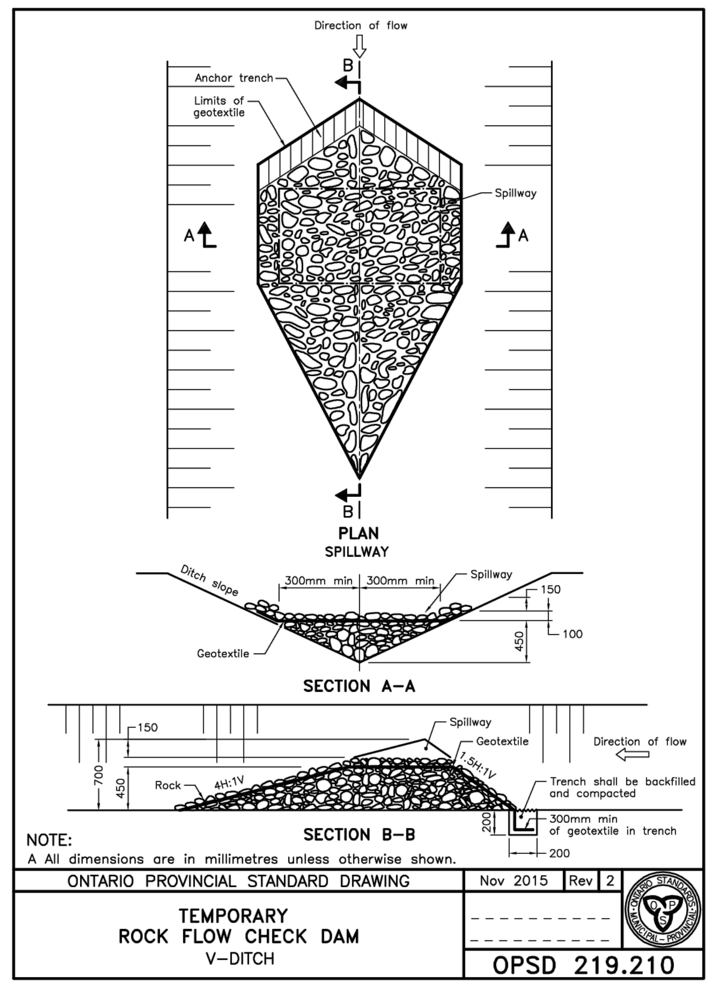
1. Culverts shall be 320KPa. HDPE pipe. Bedding shall be granular 'A' to OPSD 802.010 compacted to 95% SPD.
2. Place 150mm dia. rip rap at all culvert inlets and outlets per OPSD 810.01.
3. Frost topers at culverts to be per OPSD.803.030
4. All culvert installations for entrances to municipal roads shall conform to OPSS.421 and OPSD.802.013 and 803.030.



TYPICAL ROAD CROSS SECTION

1:50





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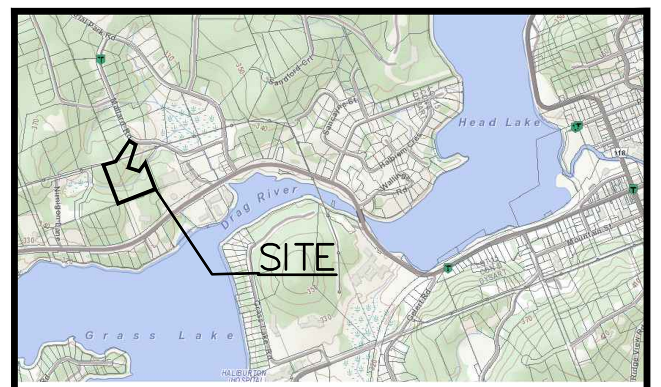


KEY MAP

NOTES

1. TOPOGRAPHIC SURVEY COMPLETED BY PINESTONE ENGINEERING, AUGUST 2020.

LEGEND

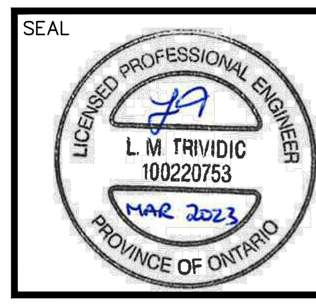
220.00	PROPOSED ELEVATION
(220.00)	PROPOSED SWALE ELEVATION
220.00 EX.	EXISTING ELEVATION
	PROPOSED GRAVEL
	DIRECTION OF OVERLAND FLOW
3.0%	DIRECTION OF OVERLAND FLOW AND GRADIENT
S —— S	SILT FENCE
	RIP–RAP
	LIMIT OF TREE CLEARING
	DITCH CENTERLINE

BENCHMARK

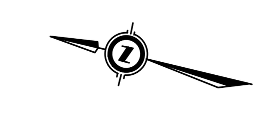
TBM#1 TOP OF SIB IN NORWEST CORNER OF PROPERTY. ELEVATION: 346.21

NO.	YY.MM.DD	REVISION	BY

SEAL



NORTH ARROW



DESIGN BY:	L.T.
DRAWN BY:	M.B.
CHECKED	L.T.
DATE:	MARCH 2023
SCALE:	1:500

CLIENT/PROJECT

CAMPBELL COMMERCIAL

DRAWING TITLE

PRELIMINARY STORMWATER MANAGEMENT PLAN

PROJECT NO.	DRAWING NO.	REVISION
20-11523M	SWM-1	0