



# Marco Polo 100 Design Challenge

## Stormwater Management Design Brief

Fourth Street  
GANANOQUE, ONTARIO

Prepared for: **Horizon Legacy**

Project No. **GW-21050**

Date: **07 December 2021**

Revised: **29 April 2022**

**GEOTECHNICAL • CIVIL • STORMWATER • ONSITE WASTEWATER**

Unit 640-654 Norris Court, Kingston, ON K7P 2R9  
Tel: (613)-634-1789

[www.groundengineer.ca](http://www.groundengineer.ca)

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## 1.0 Introduction

This report is written in support of the proposed residential development on Fourth Street, Gananoque, Ontario. There are five (5) residential buildings proposed with build size ranging from 84 m<sup>2</sup> to 125 m<sup>2</sup>. The property is approximately 0.83 ha and is currently undeveloped. Horizon Legacy (Client) has retained the services of Groundwork Engineering Limited (GEL) to complete the civil design for the facility. This includes completion of a stormwater management plan, site servicing plan, lot grading plan, and sediment and erosion control plan.

## 2.0 Site Overview

The property can be legally described as Lot 161 W Gananoque River, 162 W Gananoque River, 163 W Gananoque River, 165 W Gananoque River, 167 W Gananoque River, 169 W Gananoque River, 171 W Gananoque River, 173 W Gananoque River, 175 W Gananoque River, 177 W Gananoque River, 179 W Gananoque River, 180 W Gananoque River PL 86; Town of Gananoque. The site is bordered by Fourth Street to the north, residential buildings to the east, and unopened road allowances to the west and south.

The site topography generally slopes from south to north. The site currently has no approved stormwater management. Stormwater runoff currently exits the property at five (5) different locations. The majority of the runoff is directed to the north.

## 3.0 Stormwater Management

Post-development stormwater management protects receiving watercourses. The Town of Gananoque and the Cataraqui Region Conservation Authority (CRCA) standard practices require the post-development flows must be equal to, or less than, pre-development flows for the 2-year through 100-year storm events.

Using the Ministry of Environment, Conservation, and Parks (MECP) Stormwater Management Planning and Design Manual and the CRCA Guidelines for Stormwater Management, the development has been designed to provide adequate stormwater management control and improve runoff quality. It is our goal to utilize low sloping swales and a storage area to provide stormwater quality and quantity control.

### 3.1 Pre-Development Drainage Areas

Using 3-D modelling of the existing topographic information pre-development drainage areas are determined. The site consists of five (5) pre-development drainage areas.

Area P-1 is located in the north eastern portion of the site. This area contains a portion of the neighboring property that drains onto the subject site, along with a portion of Fourth Street. This area is a lower elevation than the ditch line which causes water to collect and does not outlet into the ditch.

Area P-2 is located along the western property line and a small portion along the north property line. This area drains by sheet flow into the unopened Birch Street road allowance.

Area P-3 is located along the eastern property line. This area drains by sheet flow to the eastern property line into an existing drainage swale on the neighboring property.

Area P-4 is located in the southwestern corner of the site. This area drains by sheet flow to the southern property line and onto the undeveloped Third Street and Birch Street road allowance.

Area P-5 is located in the southeastern corner of the site. This area drains by sheet flow to the southeast corner of the property and onto the adjacent property.

The pre-development drainage areas are illustrated in Appendix A.

### 3.2 Design Methodology

Surface water runoff calculations in this brief are derived using the Rational Method. The Rational Method calculates the peak flow rate of a catchment area due to the runoff contributing from the upstream catchment area. The peak flow rate is calculated by the following equation:

$$Q = 0.0028 \cdot A \cdot I \cdot C$$

Where:

C = Runoff Coefficient

I = Rainfall Intensity (mm/hr)

A = Drainage Area (ha)

Based on the proposed site conditions the following runoff coefficients were used to develop a weighted coefficient for each drainage area and to determine runoff flow rates:

Gravel	0.90
Asphalt	0.90
Concrete	0.90
Grassed Areas	0.25
Building Roof Areas	0.90

A time of concentration ( $T_c$ ) using the Airport Method was calculated for each pre and post-development area. A minimum inlet time of concentration of 15 min was used. The time of concentration is calculated with the following equation:

$$T_c = \frac{3.26(1.1-C)L^{0.5}}{S_w^{0.33}}$$

Where:

L = Length of Flow (m)

C = Rational Method Coefficient

$S_w$  = Watershed Slope (%)

Rainfall intensities were derived from Intensity-Duration-Frequency (IDF) curves from Ministry of Transportation (MTO) Rainfall data. IDF data was obtained from MTO Lookup. (Appendix B). Detailed stormwater calculation sheets are provided in Appendix C.

### **3.3 Post-Development Drainage Areas**

Using 3-D modelling of the proposed topographic information, post-development drainage areas were established. The post-development drainage areas can be found in Appendix D.

Area A-1 encompasses the northeastern corner of the subject site and a portion of the neighboring properties. This area is at a lower elevation than the roadside ditch and does not flow off the site.

Area A-2 encompasses a majority of the proposed developed area and a portion of the neighboring property to the east. This area will utilize sheet flow and grassed swales to convey the stormwater to the proposed dry pond adjacent to the northern property line before it outlets into the Fourth Street roadside ditch.

Area A-3 encompasses the area between the edge of the proposed parking lot and the western property line. This area will sheet flow into the unopened road allowance to the west.

Area A-4 encompasses the area in the southeastern corner of the property. This area will remain undeveloped. The area runoff will follow the drainage path of pre-development area P-5.

Area A-5 encompasses the southwestern corner of the property. This area will remain undeveloped and will follow the drainage path of pre-development area P-4.

Area A-6 encompasses a portion of Fourth Street and the ditch line. This area will drain into the roadside ditch and follow the existing drainage path south, through the proposed driveway culvert, to the existing cross culvert.

Area A-7 is located along the eastern property line. This area drains by sheet flow to the eastern property line into an existing drainage swale on the neighboring property. This area is unchanged from area P-3.

### **3.4 Stormwater Quantity Control**

To achieve pre-development release rates the stormwater management system for the proposed development will restrict the 2-year storm release rate of stormwater into the roadside ditch adjacent to Fourth Street. The release of post-development area A-2 will be equal to or less than the release rate of pre-development area P-2. This will ensure that there will be no change in flow rate into the drainage ditch. The pre-development release rate for area P-2 was determined to be 15.57 L/s

### 3.4.1 Post-Development Area A-2

Area A-2 encompasses portions of pre-development areas P-1 and P-2. This area will utilize sheet flow, culverts and grassed swales to convey flow to the storage area.

The post-development release rate will be restricted to less than the pre-development rate of area P-2. An 110mm diameter orifice plate will be used to restrict the 100-year release rate to 14.4 L/s. The site release rate will be over-restricted to reduce effects on the downstream receiver.

The swales will be a minimum 0.3 m deep and will be at slopes ranging between 0.5% and 5%. The ditches will be vegetated.

The ditches will drain into a flat-bottomed dry swale, with a 100-year storage depth of 0.40 m. The required 100-year storage volume of the pond is 63.33 m<sup>3</sup>. The pond will have 300 mm freeboard and drain through a 110 mm diameter orifice plate affixed to a 300 mm diameter culvert. The culvert will outlet into the roadside ditch along Fourth Street where it will flow west to a 500mm diameter cross culvert and ultimately via ditching into the Gananoque River.

Stormwater management calculation sheets are provided in Appendix C. For more detailed information on the planned lot grading and overall project stormwater drainage please refer to drawing C-102 in the design drawing set provided in Appendix E.

### 3.5 Quality Control

The stormwater management system will achieve “Normal” 70% total suspended solids (TSS) removal with the use of a dry pond and an enhanced swale.

The pond was designed based on guidelines presented in the 2003 MECP Stormwater Management Planning and Design Manual. Based on the MECP Design Manual the required storage volume per hectare is 150 m<sup>3</sup> for sites with an impervious level less than 55%. Post-development area A-2 has an impervious level of 48% and an area of 0.52 ha resulting in a required storage volume of 73.5 m<sup>3</sup>. The dry pond has a designed storage volume of 77.52 m<sup>3</sup> exceeding the required storage volume to meet quality requirements.

The enhanced swale was designed based on the Credit Valley Conservation Stormwater Management Planning and Design Guide. The swale will have a bottom width of 0.75m with 4:1 side slopes. It will be rip rap lined to reduce erosion and will have an average slope of 1.0%. The swale will convey the 2-year and 5-year storms at velocities less than 0.5 m/s.

The combination of the dry pond designed to provide 60% TSS reduction in combination with the enhanced swale will provide the required 70% TSS removal.

The entire development will employ Best Management Practices (BMPs) wherever possible. The intent of implementing stormwater BMPs throughout the development is to ensure that

water quality concerns are addressed at all stages of developments. BMPs will be implemented at the lot, conveyance and end of pipe levels.

Lot level BMPs include the minimizing of ground slopes and maintaining as much of the lot as possible in a natural state. Recent recommendations by a number of Conservation Authorities and the MECP suggest that yard grading as flat as 0.5% be implemented to promote infiltration. The target range for finished ground slopes on this development is recommended to be between 0.5% - 3% where possible for ease of grading. This range of slope will provide a significant opportunity for the absorption and filtration process. The side slope of all swales and drainage ditches shall not exceed 3:1. Side slopes steeper than 3:1 are prone to erosion and are difficult to maintain. In addition, swales are to be built with minimum depth and slope to allow for the opportunity for filtration and settlement of Total Suspended Solids (TSS) in grassed swales. All vegetation is to be maintained at a minimum height of 15 cm for optimum filtration.

The conveyance methods to be used in the development are grassed swales and overland flow. All swales will be constructed at minimal gradient where possible, thus promoting absorption and infiltration.

### **3.6 Maintenance**

As the stormwater swales are on private property, it will be the responsibility of the Contractor to carry out routine visual inspections of the swale on a quarterly basis as well as after major storm events, until all vegetation is well established. The inspection should also check for sediment build up. Sediment removal is to be included with regular maintenance. Sediment build up should not exceed 5 cm in height. Once vegetation is established it will be the responsibility of the owner to carry out the maintenance. This will aid in the long-term performance of the stormwater swales. It is recommended that all drainage swales be kept clear of debris.

### **4.0 Temporary Sediment and Erosion Control**

During construction the risk of contamination by sediment to the stormwater receiver increases. Temporary sediment and erosion control measures will be implemented before construction and remain in place until construction and reinstatement of the lands are completed.

Suitable areas shall be designated and agreed upon for the disposal of any accumulated sediment or other debris, or disposed of in accordance with OPSS 180.

In accordance with Ontario Provincial Standard Drawing 219.110, light duty silt fence will be placed around the construction area. Straw bale flow check dams will be placed at drainage outlets. The sediment and erosion control measures will be inspected periodically and maintained during construction by the Contractor. These measures will be removed upon completion of the permanent quality control devices and establishment of vegetation in ditches and swales.

All areas disturbed by construction are to be reinstated as soon as possible. Damage to existing vegetated areas is to be minimized by fencing the work area to maintain construction activities to the pre-defined areas.

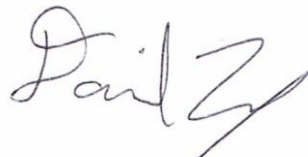
Stockpiles of excavated material or stockpiled granular are to be located to minimize the possibility of runoff beyond the construction zone. Silt fences may be required to contain runoff from stockpiles.

If dewatering is required the base of excavations should be shaped to drain to one or more sumps and pumped as required. Any water discharged from site should meet all applicable regulatory requirements including those related to erosion and sediment control.

## 5.0 Summary

This project entails the development of a proposed multi-building residential property. Stormwater management techniques have been designed to provide quantity and quality control to the subject property.

The plan will require the construction of a stormwater dry swale with restrictive outlet pipe to provide runoff quantity and quality control measures. The proposed stormwater management plan will over restrict the 100-year release rate to 14.4 L/s and provide increased storage of 77.52 m<sup>3</sup> to address quantity and quality control. Over-restricting will reduce downstream effects on pre-existing drainage conditions at the existing 500mm diameter Fourth St. cross culvert.



Report prepared by:

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Daniel Fox, Engineering Technologist



Report Reviewed by:

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Martin Burger, M.Eng., P.Eng.



## Statement of Qualifications and Limitations

The attached Report has been prepared by Groundwork Engineering Limited (the Consultant) for the benefit of the Client in accordance with their Agreement.

The information, data, recommendations and conclusions contained in the Report:

1. is subject to the scope, schedule, and other constraints and limitations in the Agreement and the qualifications contained in the Report;
2. represents the Consultant's judgement in light of the limitations and industry standards for the preparation of similar reports;
3. may be based on information provided to Consultant which has not been independently verified;
4. has not been updated since the date of issuance of the Report and its accuracy is limited to the time and circumstances in which it was prepared; and
5. Must be read as a whole and sections should not be read out of context.

The Consultant shall be entitled to rely upon the accuracy and completeness of information that was provided to it and has no obligation to update such information. Consultant accepts no responsibility for any events or circumstances that may have occurred since the date on which the Report was prepared.

Any estimates or opinions regarding expected construction costs or construction schedule provided by Consultant represent Consultant's judgement in light of its experience and the knowledge and information available to it at the time of preparation. The Consultant does not make any representations, with respect to such estimates or opinions, and accepts no responsibility for any loss or damage arising from them. Persons relying on such estimates or opinions do so at their own risk.

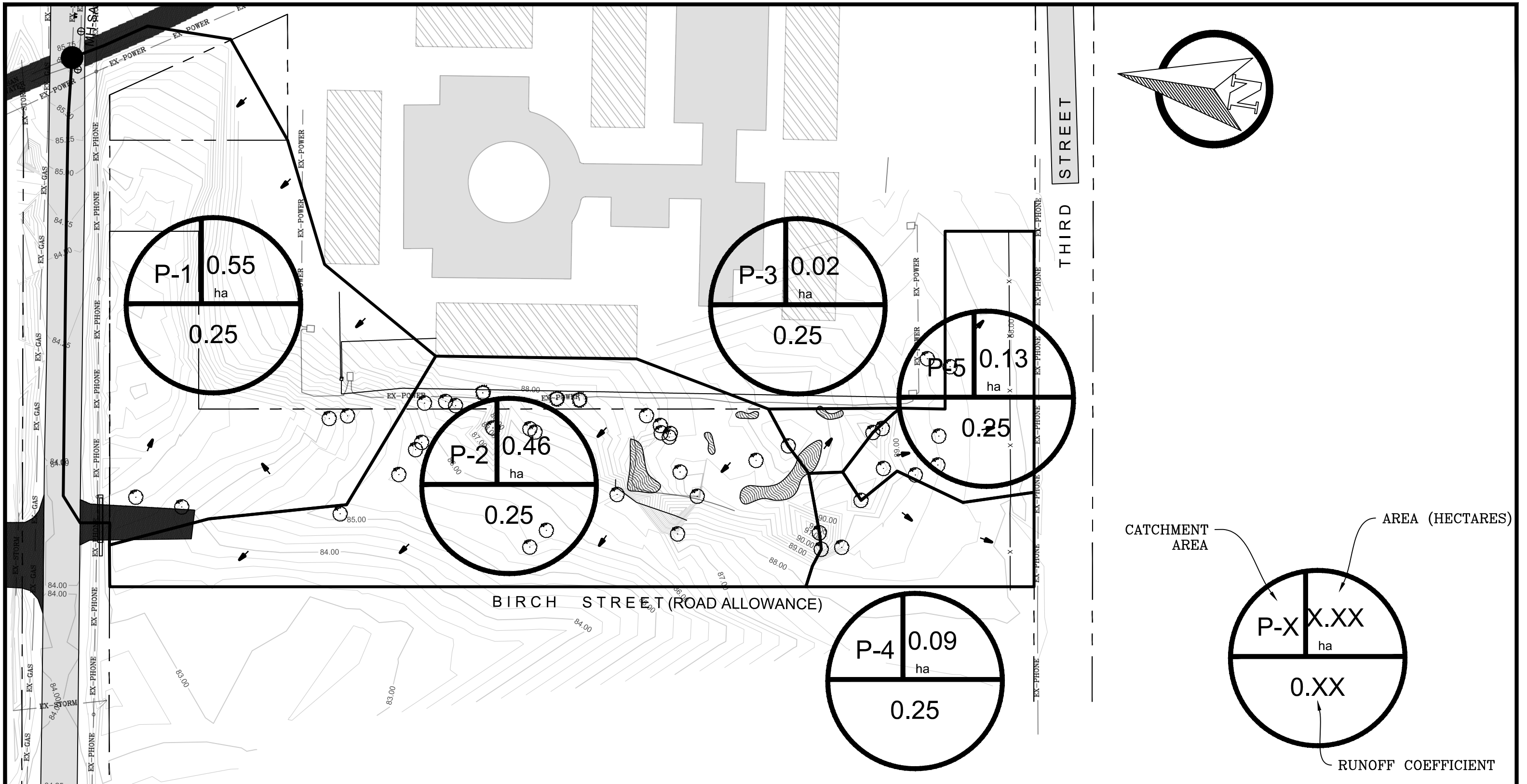
Except as agreed to in writing by the Consultant and the Client; as required by-law; or to the extent used by governmental reviewing agencies for the purpose of obtaining permits or approvals, the Report and the Information may be used and relied upon only by the Client.

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## Appendix A

### Pre-Development Drainage Areas



UNIT 640 - 654 NORRIS COURT  
KINGSTON ONTARIO  
OFFICE (613) 634-1788  
www.groundwork.ca

Client / Land Owner:  
 HORIZON LEGACY  
 Project:  
 MARCO POLO 100 DESIGN CHALLENGE  
 GANANOQUE ONTARIO

Drawing Title:  
 PRE-DEVELOPMENT DRAINAGE AREAS  
 Project Number:  
 GW-21050  
 Drawing Number:  
 SK-PRE  
 SHEET 1 of 1

Drawn by: DF  
 Checked By: MB  
 Scale: 1:500  
 Date: OCT 26, 2021

REVISIONS		
No.	Description	Date
1.	ISSUED FOR REPORT	2021/11/16



## Appendix B

### MTO IDF Data

## Active coordinate

44° 19' 45" N, 76° 10' 15" W (44.329167,-76.170833)

Retrieved: Tue, 02 Nov 2021 13:03:24 GMT



### Location summary

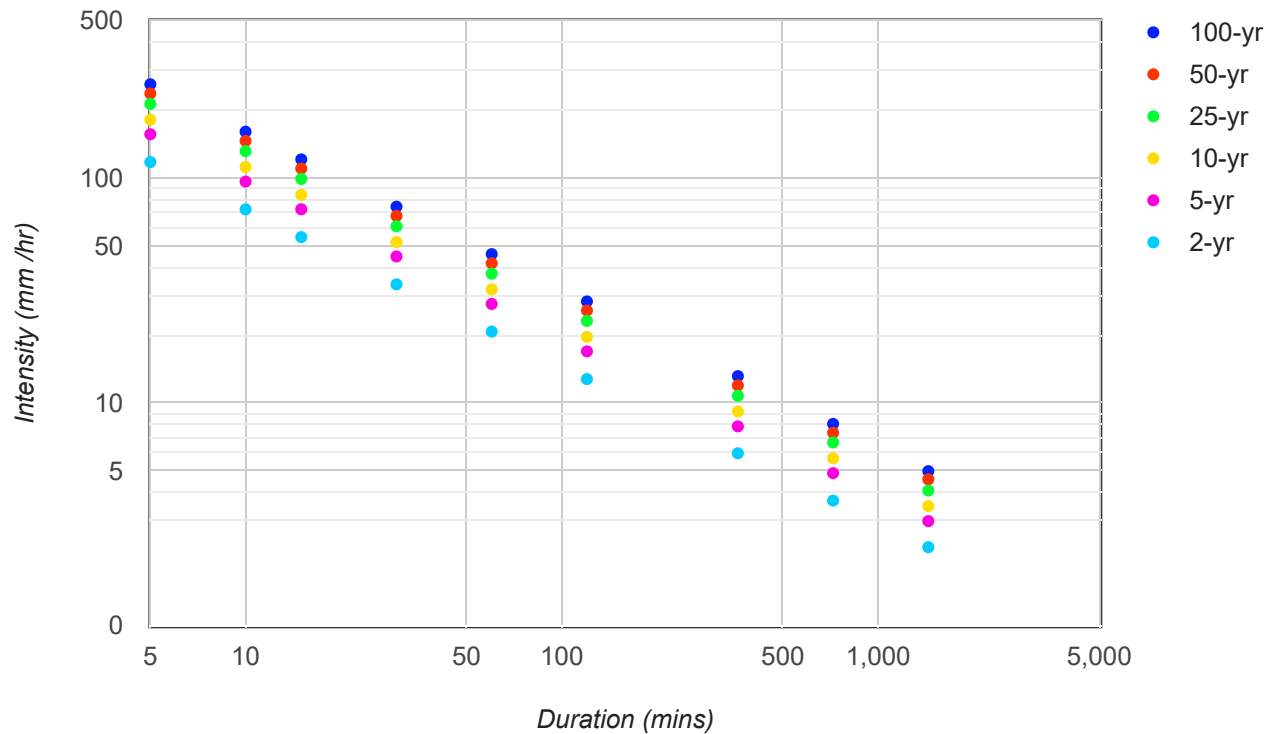
These are the locations in the selection.

**IDF Curve:** 44° 19' 45" N, 76° 10' 15" W (44.329167,-76.170833)

### Results

An IDF curve was found.

Coordinate: 44.329167, -76.170833  
IDF curve year: 2021



## Coefficient summary

**IDF Curve:** 44° 19' 45" N, 76° 10' 15" W (44.329167,-76.170833)

Retrieved: Tue, 02 Nov 2021 13:03:24 GMT

**Data year:** 2010

**IDF curve year:** 2021

## Statistics

### Rainfall intensity (mm hr<sup>-1</sup>)

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
<b>2-yr</b>	117.5	72.5	54.6	33.7	20.8	12.8	6.0	3.7	2.3
<b>5-yr</b>	156.1	96.3	72.6	44.8	27.6	17.0	7.9	4.9	3.0
<b>10-yr</b>	181.1	111.7	84.1	51.9	32.0	19.7	9.2	5.7	3.5
<b>25-yr</b>	212.9	131.3	98.9	61.0	37.6	23.2	10.8	6.7	4.1
<b>50-yr</b>	236.8	145.9	110.0	67.8	41.8	25.8	12.0	7.4	4.6
<b>100-yr</b>	260.1	160.3	120.8	74.5	45.9	28.3	13.2	8.1	5.0

### Rainfall depth (mm)

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
<b>2-yr</b>	9.8	12.1	13.7	16.9	20.8	25.6	36.0	44.4	55.2
<b>5-yr</b>	13.0	16.1	18.1	22.4	27.6	34.0	47.4	58.8	72.0
<b>10-yr</b>	15.1	18.6	21.0	25.9	32.0	39.4	55.2	68.4	84.0
<b>25-yr</b>	17.7	21.9	24.7	30.5	37.6	46.4	64.8	80.4	98.4
<b>50-yr</b>	19.7	24.3	27.5	33.9	41.8	51.6	72.0	88.8	110.4
<b>100-yr</b>	21.7	26.7	30.2	37.3	45.9	56.6	79.2	97.2	120.0

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Last Modified: September 2016



## Appendix C

### Stormwater Calculation Sheets



## Storm Water Management - Marco Polo Development

**Project Number:** 21050      **Prepared for:** Horizon Marco Polo LP  
**Prepared by:** Daniel Fox      **Checked by:** Martin Burger

2 - Year Pre-Development																
Drainage Area ID	Total Area (m <sup>2</sup> )	Land Use & Topography								Grassed Area, Parkland		Product ha (AxR)	Average C	Time of Concentration	Intensity	Q (L/s)
		Roof (m <sup>2</sup> )	C	Asphalt (m <sup>2</sup> )	C	Gravel(m <sup>2</sup> )	C	Concrete (m <sup>2</sup> )	C	Area (m <sup>2</sup> )	C*					
P-1	5546.00	0.00	0.90	322.00	0.90	41.00	0.90	0.00	0.90	5183.00	0.25	0.16	0.29	15.00	54.60	24.63
P-2	4613.00	0.00	0.90	0.00	0.90	0.00	0.90	0.00	0.90	4613.00	0.25	0.12	0.25	19.33	48.57	15.57
P-3	222.00	0.00	0.90	0.00	0.90	0.00	0.90	0.00	0.90	222.00	0.25	0.01	0.25	15.00	54.60	0.84
P-4	917.00	0.00	0.90	0.00	0.90	0.00	0.90	0.00	0.90	917.00	0.25	0.02	0.25	15.00	54.60	3.48
P-5	1263.00	0.00	0.90	0.00	0.90	0.00	0.90	0.00	0.90	1263.00	0.25	0.03	0.25	15.00	54.60	4.79
<b>TOTAL</b>	<b>12561.00</b>	<b>0.00</b>	<b>0.90</b>	<b>322.00</b>	<b>0.90</b>	<b>41.00</b>	<b>0.90</b>	<b>0.00</b>	<b>0.90</b>	<b>12198.00</b>	<b>0.25</b>	<b>0.34</b>	<b>0.27</b>			<b>51.25</b>

2-Year Intensity = 54.60       $Q = 2.78CIA$

2 - Year Post-Development																
Drainage Area ID	Total Area (m <sup>2</sup> )	Land Use & Topography								Grassed Area, Parkland		Product ha (AxR)	Average C	Time of Concentration	Intensity	Q (L/s)
		Roof (m <sup>2</sup> )	C	Asphalt (m <sup>2</sup> )	C	Gravel(m <sup>2</sup> )	C	Concrete (m <sup>2</sup> )	C	Area (m <sup>2</sup> )	C*					
A-1	3305.00	0.00	0.90	136.00	0.90	0.00	0.90	0.00	0.90	3169.00	0.25	0.09	0.28	15.00	54.60	13.88
A-2	4901.00	540.26	0.90	960.61	0.90	0.00	0.90	297.23	0.90	3102.90	0.25	0.24	0.49	18.00	50.42	33.56
A-3	1465.00	0.00	0.90	0.00	0.90	0.00	0.90	0.00	0.90	1465.00	0.25	0.04	0.25	15.00	54.60	5.56
A-4	1265.00	0.00	0.90	0.00	0.90	0.00	0.90	0.00	0.90	1265.00	0.25	0.03	0.25	15.00	54.60	4.80
A-5	920.00	0.00	0.90	0.00	0.90	0.00	0.90	0.00	0.90	920.00	0.25	0.02	0.25	15.00	54.60	3.49
A-6	483.00	0.00	0.90	200.00	0.90	0.00	0.90	0.00	0.90	283.00	0.25	0.03	0.52	15.00	54.60	3.81
A-7	222.00	0.00	0.90	0.00	0.90	0.00	0.90	0.00	0.90	222.00	0.25	0.01	0.25	15.00	54.60	0.84
<b>TOTAL</b>	<b>12561.00</b>	<b>540.26</b>	<b>0.90</b>	<b>1296.61</b>	<b>0.90</b>	<b>0.00</b>	<b>0.90</b>	<b>297.23</b>	<b>0.90</b>	<b>10426.90</b>	<b>0.25</b>	<b>0.46</b>	<b>0.37</b>			<b>70.39</b>

2-Year Intensity = 54.60       $Q = 2.78CIA$

2-yr Return Period (Area A - 2)					
Time (min)	Intensity (mm/hr)	Peak Flow (L/s)	Release Rate (L/s) Pre-Post	Storage Rate (L/s)	Storage Volume (m <sup>3</sup> )
10.00	72.50	48.25	8.90	39.35	23.61
15.00	54.60	36.34	8.90	27.44	24.69
30.00	33.70	22.43	8.90	13.53	24.35
60.00	20.80	13.84	8.90	4.94	17.80
120.00	12.80	8.52	8.90	-0.38	-2.74
			<b>Approx. Storage</b>		<b>24.69</b>

100-yr Return Period (Area A - 2)					
Time (min)	Intensity (mm/hr)	Peak Flow (L/s)	Release Rate (L/s) Pre-Post	Storage Rate (L/s)	Storage Volume (m <sup>3</sup> )
10.00	160.30	106.69	14.40	92.29	55.37
15.00	120.80	80.40	14.40	66.00	59.40
30.00	74.50	49.58	14.40	35.18	63.33
60.00	45.90	30.55	14.40	16.15	58.13
120.00	28.30	18.83	14.40	4.43	31.93
			<b>Approx. Storage</b>		<b>63.33</b>

5-yr Return Period (Area A - 2)					
Time (min)	Intensity (mm/hr)	Peak Flow (L/s)	Release Rate (L/s) Pre-Post	Storage Rate (L/s)	Storage Volume (m <sup>3</sup> )
10.00	96.30	64.09	10.90	53.19	31.91
15.00	72.60	48.32	10.90	37.42	33.68
30.00	44.80	29.82	10.90	18.92	34.05
60.00	27.60	18.37	10.90	7.47	26.89
120.00	17.00	11.31	10.90	0.41	2.98
			<b>Approx. Storage</b>		<b>34.05</b>

A-2 Release Rate selected to over restrict area P-2 and ensure no additional flow added to north ditch



## Orifice Diameter Calculation

Orifice Equation:

$$Q = CA\sqrt{2gH}$$

Where

C = orifice coefficient  
 A = Area of orifice opening (m<sup>2</sup>)  
 g = Gravitational constant (9.81 m/s<sup>2</sup>)  
 H = Head from orifice center (m)  
 Q = Release Rate (m<sup>3</sup>/s)

Re-Arranged for Area

$$A = \frac{Q}{C\sqrt{2gH}}$$

### Input Parameters

Orifice Coefficient, C	0.63
Gravitational Constant, g	9.81 m/s <sup>2</sup>
Head from Orifice Centre, h	0.32 m
Release Rate, Q	0.014 m <sup>3</sup> /s

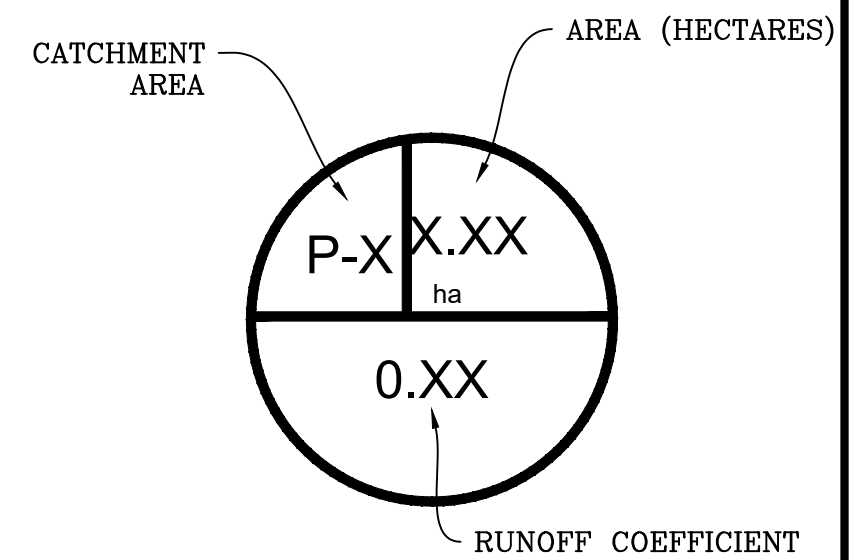
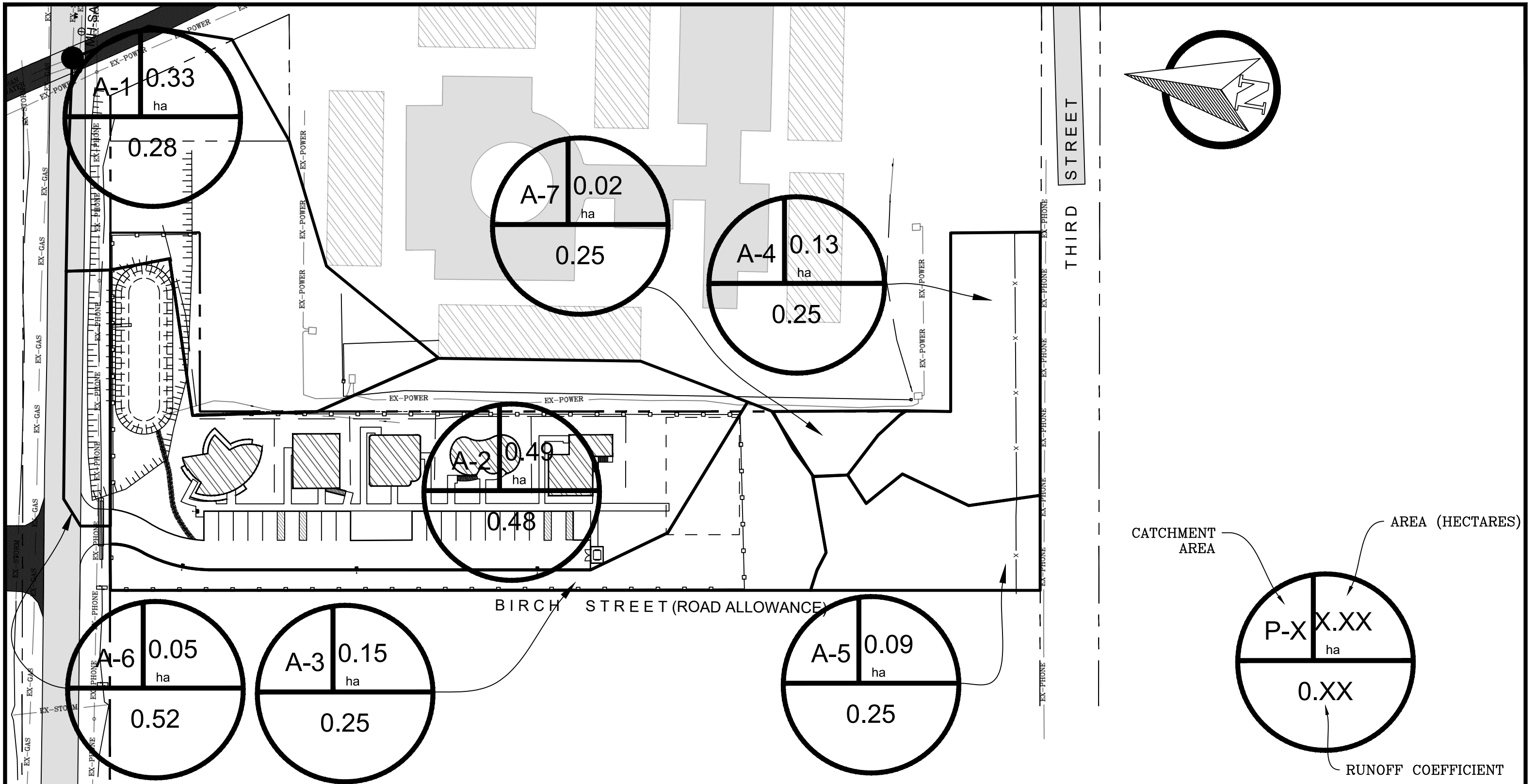
### Computed Values

Cross Sectional Orifice Area, A	0.009 m <sup>2</sup>
Radius	<input style="border: 2px solid black;" type="text" value="54"/> mm
Diameter	108 mm



## Appendix D

### Post Development Drainage Areas



**GROUNDWORK  
ENGINEERING  
LIMITED**

GEOTECHNICAL • CIVIL • STORMWATER • ON-SITE WASTEWATER

UNIT 640 - 654 NORRIS COURT  
KINGSTON ONTARIO  
OFFICE (613) 634-1788  
www.groundworkeng.ca

Client / Land Owner:  
**HORIZON  
LEGACY**

Project:  
 MARCO POLO 100 DESIGN CHALLENGE

GANANOQUE ONTARIO

Drawing Title:  
 POST-DEVELOPMENT DRAINAGE AREAS

Project Number:  
 GW-21050

Drawing Number:  
 SK-POST

SHEET 1 of 1

Drawn by: LM

Checked By: MB

Scale: 1:500

Date: OCT 26, 2021

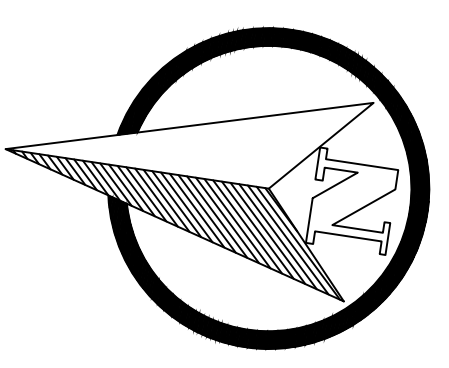
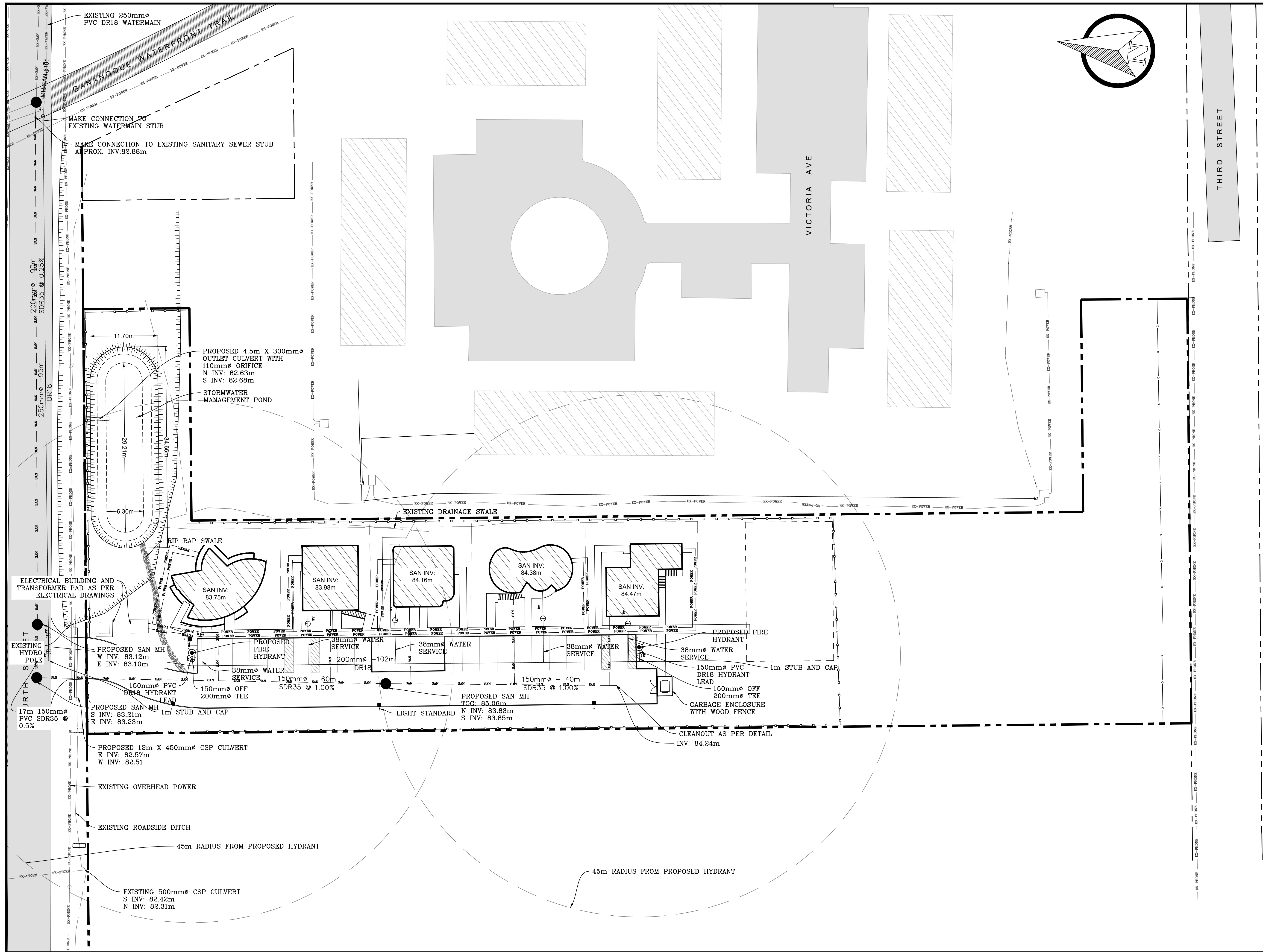
REVISIONS		
No.	Description	Date
1.	ISSUED FOR REPORT	2021/11/16
2.	REVISED AS PER APRIL 2022 RE-DESIGN	2022/04/21



## Appendix E

### Design Drawings





**GROUNDWORK ENGINEERING LIMITED**  
 GEOTECHNICAL • CIVIL • STORMWATER • ONSITE WASTEWATER

**UNIT 640 - 654 NORRIS COURT  
 KINGSTON ONTARIO  
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- BUILDING SANITARY SERVICES TO BE 125mmØ PVC SDR28 @ MINIMUM 2% SLOPE
- ELECTRICAL AND COMMUNICATIONS CONDUIT SIZING AS PER MECHANICAL DRAWINGS

REVISIONS

No.	Description	Date
1.	ISSUED FOR SUBMISSION	2021/12/07
2.	REVISED AS PER TOWN COMMENTS	2022/01/20
3.	REVISED AS PER TOWN COMMENTS	2022/02/07
4.	REVISED AS PER CRCA COMMENTS	2022/03/21
5.	REVISED AS PER APRIL 2022 RE-DESIGN	2022/04/29

BENCHMARK:

No.	DESCRIPTION	ELEVATION
##.	XXX	XXX.XX

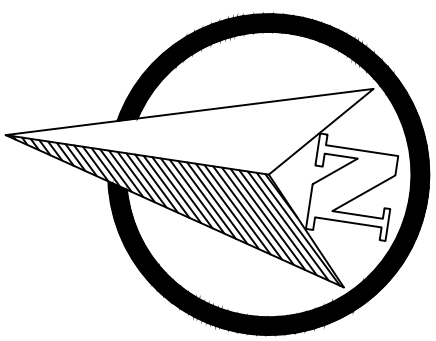
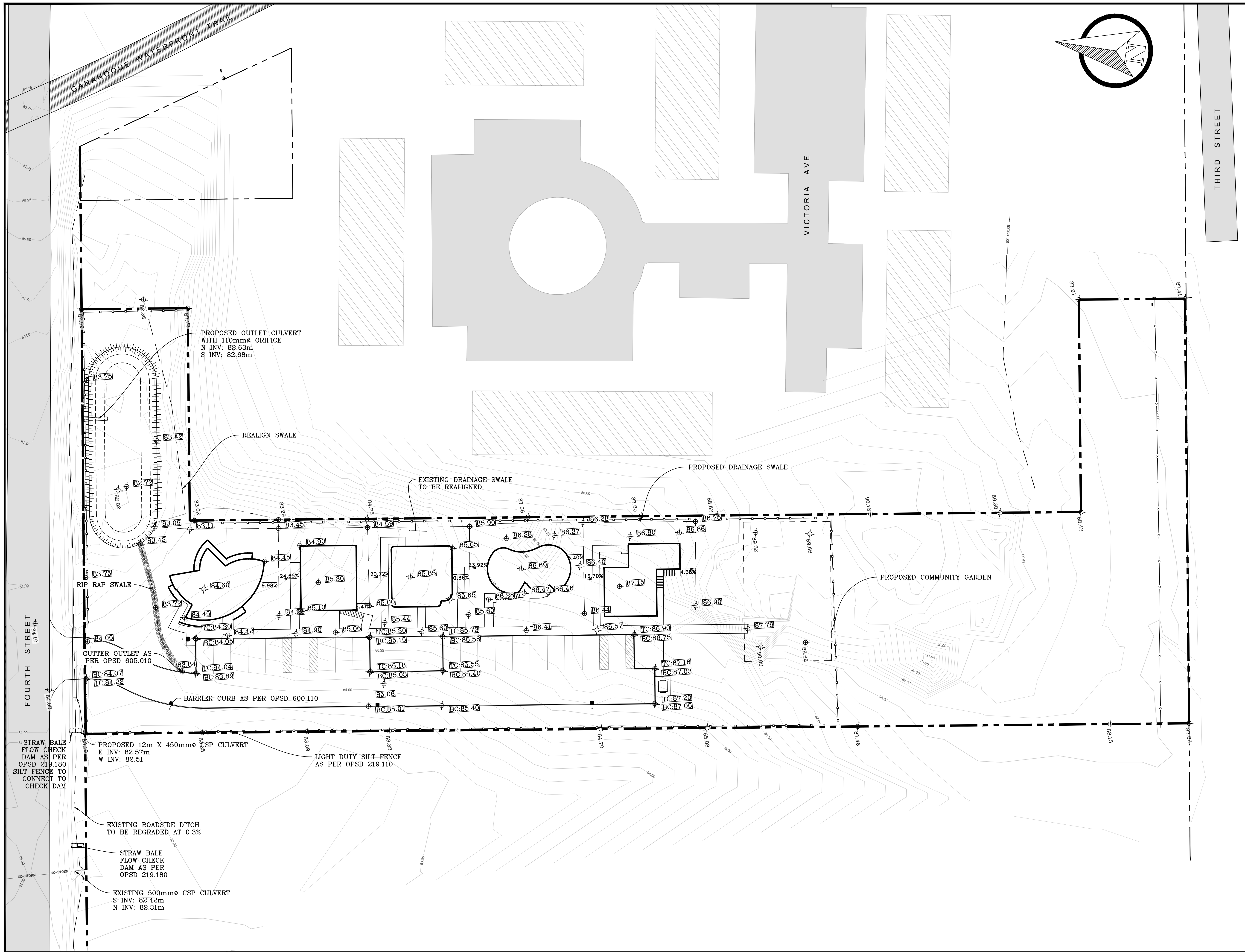
**M. H. BURGER**  
 LICENSED PROFESSIONAL ENGINEER  
 PROVINCE OF ONTARIO

Client / Land Owner:

Project: **MARCO POLO 100 DESIGN CHALLENGE**  
 425 FOURTH ST. GANANOQUE ONTARIO  
 Drawing Title: **SITE SERVICING PLAN**

Drawn by: LM	Project Number: GW-21050
Checked By: MB	Drawing Number: C-101
Scale: 24"x36" 1:300	Date: OCT 25, 2021
Date: OCT 25, 2021	SHEET 1 of 3

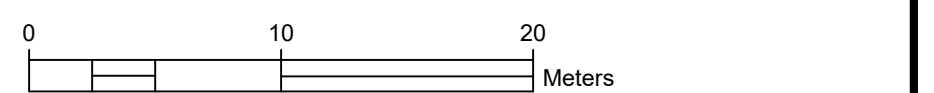




**GROUNDWORK ENGINEERING LIMITED**  
 GEOTECHNICAL • CIVIL • STORMWATER • ONSITE WASTEWATER  
**UNIT 640 - 654 NORRIS COURT**  
**KINGSTON ONTARIO**  
**OFFICE (613) 634-1789**  
[www.groundengineer.ca](http://www.groundengineer.ca)



- ⊕ **XX.XX** PROPOSED ELEVATION
- ⊕ **xx.xx** EXISTING ELEVATION
- ⊕ **TC:XX.XX** TOP OF GRATE ELEVATION
- ⊕ **TC:XX.XX** TOP OF CONCRETE / CURB
- ⊕ **BC:XX.XX** BOTTOM OF CONCRETE / CURB
- **xxx.xx** EXISTING MAJOR CONTOUR (1m)
- **xxx.xx** EXISTING MINOR CONTOUR (0.25m)



REVISIONS		
No.	Description	Date
1.	ISSUED FOR SUBMISSION	2021/12/07
2.	REVISED AS PER TOWN COMMENTS	2022/01/20
3.	REVISED AS PER TOWN COMMENTS	2022/02/07
4.	REVISED AS PER CRCA COMMENTS	2022/03/21
5.	REVISED AS PER APRIL 2022 RE-DESIGN	2022/04/29

BENCHMARK:		
No.	DESCRIPTION	ELEVATION
##.	XXX	XXX.XX



Client / Land Owner:  
**HORIZON LEGACY**  
 Project: **MARCO POLO 100 DESIGN CHALLENGE**  
 425 FOURTH ST. GANANOQUE ONTARIO  
 Drawing Title: **LOT GRADING PLAN**

Drawn by: LM	Project Number: GW-21050
Checked By: MB	Drawing Number: C-102
Scale: 24"x36" 1:300	Date: OCT 25, 2021
Date: OCT 25, 2021	SHEET 2 of 3



**GENERAL NOTES:**

- THE ORIGINAL TOPOGRAPHY AND GROUND ELEVATIONS, SERVICING AND SURVEY DATA SHOWN ON THIS PLAN ARE SUPPLIED FOR INFORMATION PURPOSES ONLY. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE ACCURACY OF ALL INFORMATION OBTAINED FROM THESE PLANS. ALL DIMENSIONS AND INVERTS MUST BE VERIFIED PRIOR TO CONSTRUCTION. IF THERE IS ANY DISCREPANCY THE CONTRACTOR IS TO NOTIFY THE ENGINEER PROMPTLY.
- ALL ELEVATIONS ARE GEODETIC AND UTILIZE METRIC UNITS UNLESS OTHERWISE NOTED.
- THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE EXACT LOCATION, SIZE, MATERIAL AND ELEVATIONS OF ALL EXISTING UTILITIES PRIOR TO COMMENCING CONSTRUCTION. PROTECT AND ASSUME ALL RESPONSIBILITY FOR EXISTING UTILITIES WHETHER OR NOT SHOWN ON THE DRAWINGS. IF THERE ARE ANY DISCREPANCIES THE CONTRACTOR IS TO NOTIFY THE ENGINEER PROMPTLY. GAS, HYDRO, CABLE, TELEPHONE, OR ANY OTHER UTILITY THAT MAY EXIST ON SITE MUST BE LOCATED BY ITS OWN UTILITIES AND VERIFIED.
- ALL UNDERGROUND SERVICES, MATERIALS AND INSTALLATIONS TO BE IN ACCORDANCE WITH ONTARIO PROVINCIAL STANDARDS AND SPECIFICATIONS UNLESS OTHERWISE STATED (OPSS).
- ALL DISTURBED AREAS TO BE RESTORED TO ORIGINAL CONDITION OR BETTER UNLESS OTHERWISE SPECIFIED. ANY GRASSED AREAS DISTURBED ARE TO BE REINSTATED WITH MINIMUM 100MM TOPSOIL AND SEED.
- THE CONTRACTOR IS RESPONSIBLE FOR ALL LAYOUT FOR CONSTRUCTION PURPOSES.
- TREES DESIGNATED BY THE ENGINEER MUST BE PROTECTED AND MAINTAINED DURING CONSTRUCTION.
- CONTRACTOR TO OBTAIN AND PAY FOR ALL NECESSARY PERMITS FROM THE COUNTY, MUNICIPALITY AND/OR CONSERVATION AUTHORITY PRIOR TO COMMENCING CONSTRUCTION.
- CONTRACTOR TO PROVIDE SHOP DRAWINGS FOR REVIEW AND APPROVAL.
- ALL CURBS TO BE AS PER OPSD 600.110 UNLESS OTHERWISE SPECIFIED.
- ALL SIDEWALKS SHALL BE A MIN OF 1.5M WIDE CONSTRUCTED AS PER OPSD 310.010. UNLESS OTHERWISE SPECIFIED.
- ALL SIDEWALKS ADJACENT TO ASPHALT PAVING TO HAVE MINIMUM 150MM BURNED FACE.
- HOT MIX, HOT LAID ASPHALT AS PER OPSS 1150. MIX DESIGNS SHALL CONTAIN A MINIMUM OF 5.4% ASPHALT CEMENT WITH A PERFORMANCE GRADE OF PG58-28 AND 3.5% AIR VOIDS.
- PAINT LINES FOR STANDARD PARKING SPACES TO BE CANICGSB-174-2001, ALKYD TRAFFIC PAINT, PAVEMENT SURFACE TO BE DRY, FREE FROM PONDED WATER, FROST, ICE, DUST, OIL, GREASE AND OTHER FOREIGN MATERIALS PRIOR TO PAINTING. PAINT LINES TO BE UNIFORM COLOUR AND DENSITY WITH SHARP EDGES. PROTECT PAVEMENT MARKINGS UNTIL DRY.
- GRADES TO MATCH ADJACENT PROPERTIES AT PROPERTY LINE.
- AT PIPE CROSSING WHERE SEPARATION CANNOT BE MET, CONTRACTOR SHALL PROVIDE A MINIMUM OF 250MM NON SHRINK CONCRETE PIPE SURROUND.
- SLOPES IN LANDSCAPED AREAS SHALL NOT EXCEED 3:1 (3 HORIZONTAL TO 1 VERTICAL).
- ALL SIGNS ARE TO COMPLY WITH TOWN OF GANANOQUE, THE ONTARIO TRAFFIC ACT, AND THE MINISTRY OF TRANSPORTATION BOOK 5 REGULATORY SIGNS.

**ENVIRONMENTAL**

- EROSION AND SEDIMENT CONTROLS SHALL BE INSTALLED PRIOR TO CONSTRUCTION AND MONITORED AND MAINTAINED BY THE CONTRACTOR UNTIL COMPLETION. THE TEMPORARY SEDIMENT AND EROSION CONTROL MEASURES MUST BE REMOVED ONCE THE SITE HAS BEEN STABILIZED AND SITE WORKS COMPLETED.
- ALL TREE PROTECTION SHALL BE IN PLACE PRIOR TO ANY SITE ALTERATION AND REMAIN UNDISTURBED FOR THE REMAINDER OF THE PROJECT.
- REGARDLESS OF SITE SPECIFIC ITEMS DETAILED ON THE PLANS, THE CONTRACTOR SHALL INSTALL EROSION CONTROL MEASURES TO SUIT THE PROPOSED WORK METHODS TO CONTROL SEDIMENT FROM RUNNING OFF THE SITE OR INTO WATER BEARING FEATURES PRIOR TO ANY DISTURBANCE. FOLLOWING CONSTRUCTION, DISTURBED AREAS, AS WELL AS PROPOSED GRASSED AND VEGETATED SURFACES SHALL BE REINSTATED.
- IN THE EVENT THAT HUMAN REMAINS ARE ENCOUNTERED DURING CONSTRUCTION, THE MINISTRY OF CITIZENSHIP, CULTURE AND RECREATION SHALL BE NOTIFIED IMMEDIATELY AND THE REGISTRAR OR DEPUTY REGISTRAR OF THE CEMETERIES REGULATION UNIT OF THE MINISTRY OF CONSUMER AND COMMERCIAL RELATIONS (416) 362-8392, SHALL BE NOTIFIED IMMEDIATELY.
- IN THE EVENT THAT BURIED ARCHAEOLOGICAL REMAINS ARE FOUND DURING CONSTRUCTION ACTIVITIES, THE MINISTRY OF CITIZENSHIP, CULTURE AND RECREATION SHALL BE NOTIFIED IMMEDIATELY.
- WHILE UNDERTAKING CLEARING, DEMOLITION, EXCAVATION OR CONSTRUCTION THE OWNER AND THEIR CONTRACTORS SHALL BE VIGILANT FOR THE POTENTIAL PRESENCE OF UNDERGROUND FUEL TANKS, CONTAMINATED SOIL OR GROUNDWATER, BURIED WASTE OR ABANDONED WATER WELLS. IF ANY OF THE ABOVE ARE ENCOUNTERED OR SUSPECTED, THE OWNER SHALL ENSURE THAT:
  - THE TOWN OF GANANOQUE'S ENVIRONMENT DEPARTMENT IS ADVISED THAT CONTAMINANTS OR WASTES HAVE BEEN DISCOVERED OR ARE SUSPECTED.
  - ANY SOIL OR GROUNDWATER CONTAMINATION ENCOUNTERED IS REMEDIATED TO APPLICABLE STANDARDS AS DEFINED WITHIN O REG OR AS REVISED.
  - ANY WASTES GENERATED BY SITE CLEAN-UPS ARE MANAGED IN ACCORDANCE WITH APPLICABLE LAWS AND STANDARDS;
  - ANY ABANDONED FUEL TANKS ENCOUNTERED ARE DECOMMISSIONED IN ACCORDANCE WITH APPLICABLE LAWS AND STANDARDS;
  - ANY UNUSED WATER WELLS (DRILLED OR DUG) ARE PROPERLY ABANDONED IN ACCORDANCE WITH ONTARIO REGULATIONS 903 - WELLS OR AS ADVISED.
  - IF IT APPEARS LIKELY THAT CONTAMINATION EXTENDS BEYOND THE BOUNDARIES OF THE SUBJECT PROPERTY, THE OWNER NOTIFIES THE LOCAL OFFICE OF THE MINISTRY OF ENVIRONMENT AND THE TOWN OF GANANOQUE'S ENVIRONMENT DEPARTMENT.
  - CONSTRUCTION WASTES ARE NOT TO BE BURIED WITHIN THE PROPERTY THAT IS THE SUBJECT OF THIS AGREEMENT, AND
  - THE OWNER AND THEIR CONTRACTORS REPORT ALL SPILLS TO THE MINISTRY OF THE ENVIRONMENT'S SPILLS ACTION CENTRE (1-800-268-6060) AND TO THE MUNICIPALITY FORTHWITH.

**STORM**

- ALL TEMPORARY SEDIMENT AND EROSION CONTROL MEASURES SHALL BE INSTALLED PRIOR TO CONSTRUCTION. CONTRACTOR TO MAINTAIN SILT FENCE AND STRAW BALE FLOW CHECK DAMS.
- RIP RAP TO BE AS PER OPSD 810.010. RIP RAP TO BE PLACED ON GEOTEXTILE. GEOTEXTILE TO BE TERRAFIX 270R OR EQUIVALENT.

**SANITARY**

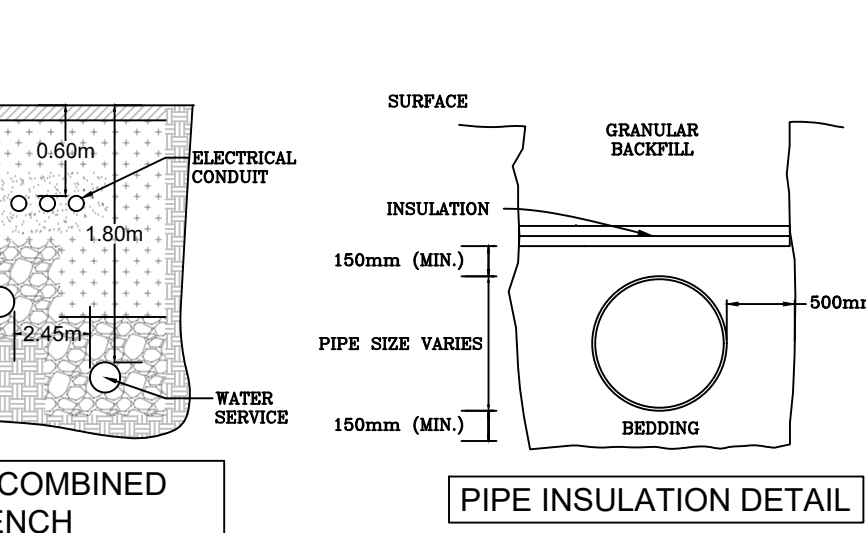
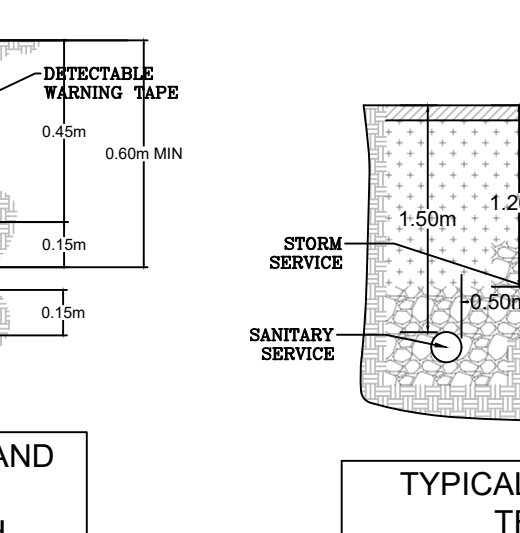
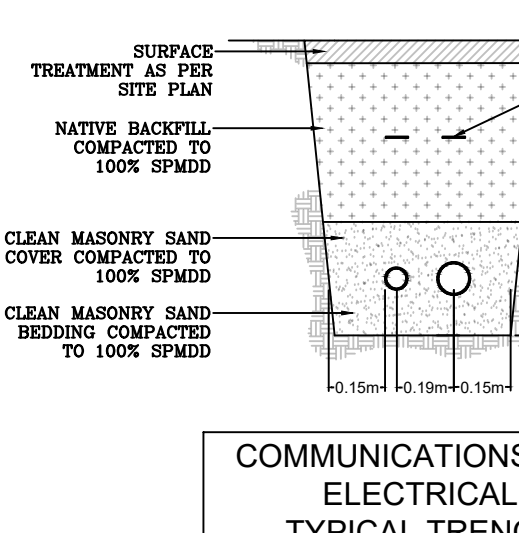
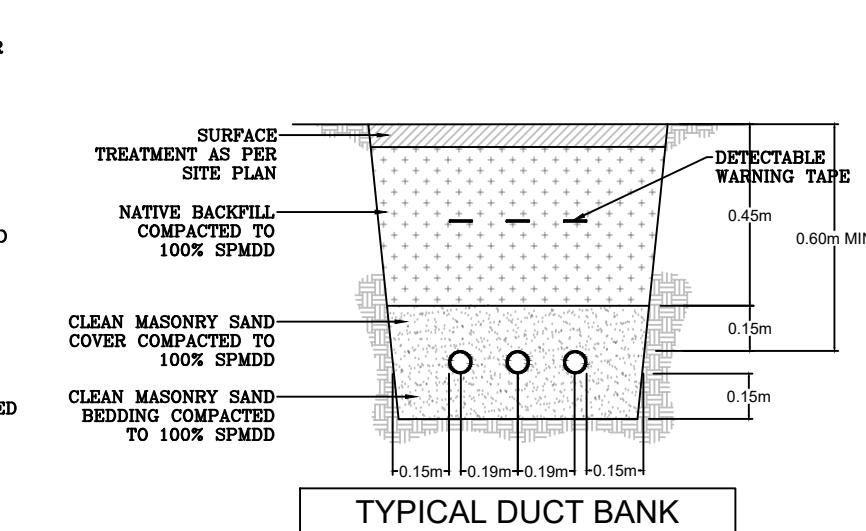
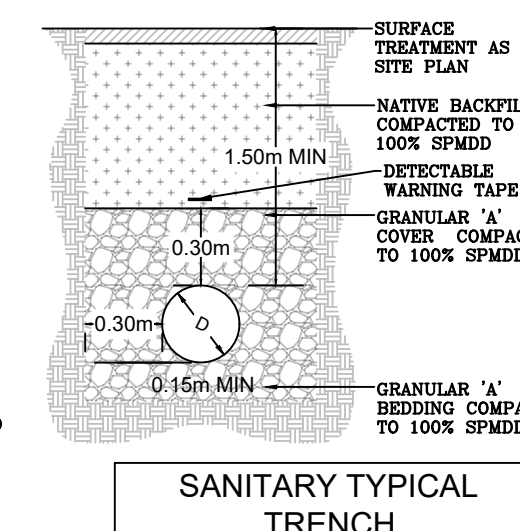
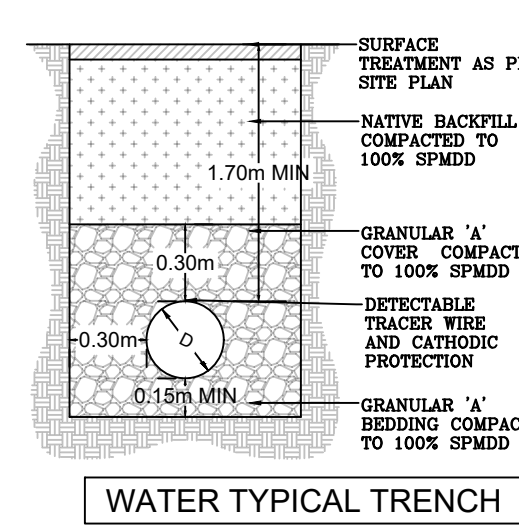
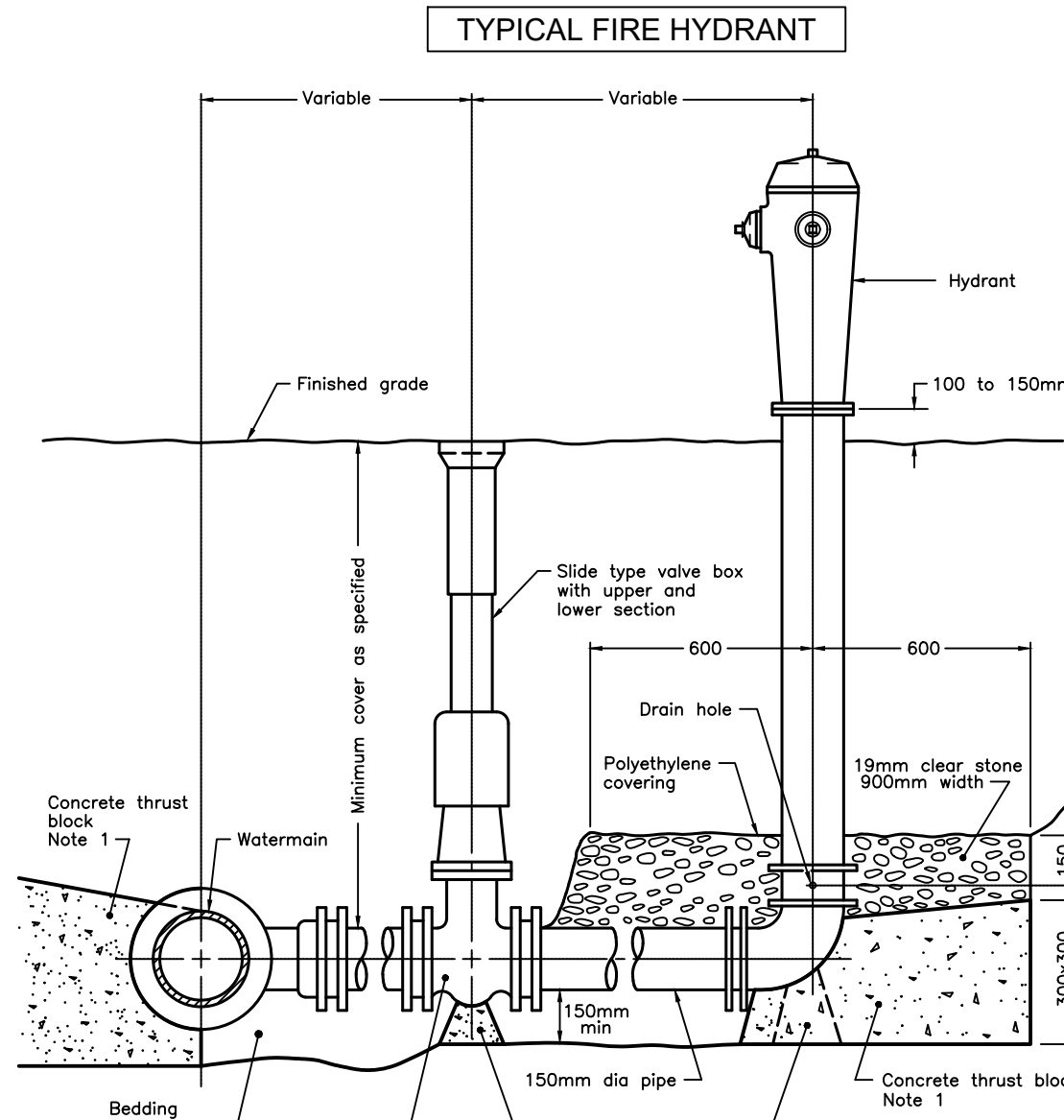
- CONSTRUCT ALL SEWER AND APPURTENANCES TO ONTARIO PROVINCIAL STANDARD SPECIFICATIONS AND DRAWINGS, AS WELL AS THE TOWN OF GANANOQUE STANDARDS AS INDICATED.
- SEWER TRENCHING AND BEDDING SHALL CONFORM TO OPSD 802.010 AND 802.013 UNLESS NOTED OTHERWISE.
- SEWERS AND CONNECTIONS 150MM DIAMETER AND SMALLER TO BE PVC SDR 28 OR APPROVED EQUIVALENT.
- INSULATE ALL SEWERS/SERVICES THAT HAVE LESS THAN 1.5M OF COVER WITH THERMAL INSULATION.
- ALL SANITARY MAN HOLES SHALL HAVE FRAME AND GRATE AS PER OPSD 401.010 TYPE A.
- SANITARY SEWERS TO BE PRESSURE TESTED AS PER OPSS AND TOWN OF GANANOQUE STANDARDS.
- ALL MAN HOLES TO BE LEAK TESTED AS PER OPSS AND TOWN OF GANANOQUE STANDARDS.
- MANHOLES TO BE 1200mmØ AND CONSTRUCTED AS PER OPSD 701.010, 701.011, 701.012, AS INDICATED.
- CONTRACTOR TO VERIFY INVERT ELEVATION OF SANITARY STUB.

**TRENCHING**

- BEDDING SHALL BE A MINIMUM 150MM OF GRANULAR "A", COMPACTED TO MINIMUM 98% STANDARD PROCTOR DRY DENSITY. CLEAR STONE BEDDING SHALL NOT BE PERMITTED.
- SUB-BEDDING, IF REQUIRED SHALL BE AS PER THE DIRECTION GEOTECHNICAL ENGINEER.
- BACKFILL TO AT LEAST 300MM ABOVE TOP OF PIPE WITH GRANULAR "A".
- TO MINIMIZE DIFFERENTIAL FROST HEAVING, TRENCH BACKFILL (FROM PAVEMENT SUBGRADE TO 2 METRES BELOW FINISHED GRADE) SHALL MATCH EXISTING SOIL CONDITIONS.
- ALL ELECTRICAL AND COMMUNICATIONS DUCTS TO HAVE A MINIMUM OF 150MM SAND BEDDING AND COVER AS PER DETAIL.
- MINIMUM OF 600MM COVER MUST BE PROVIDED ON ALL ELECTRICAL AND COMMS SERVICES.

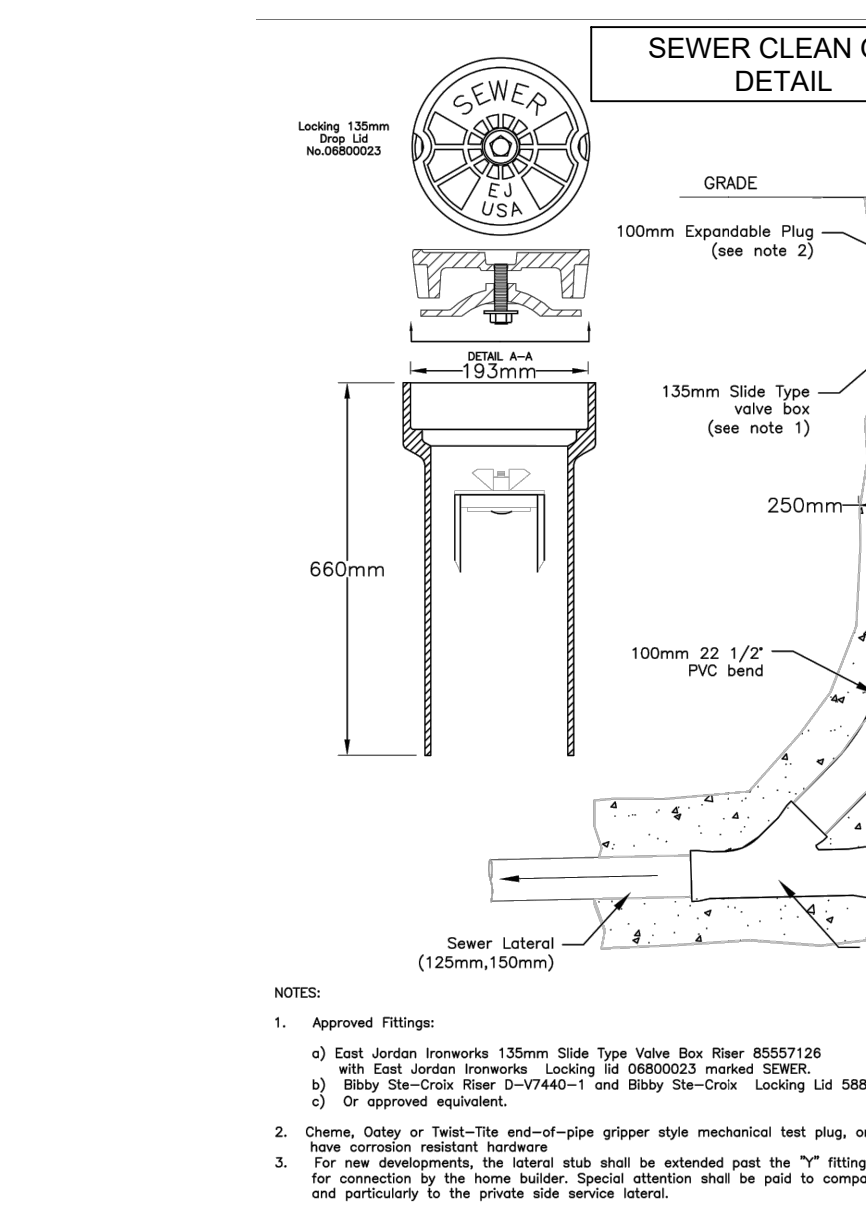
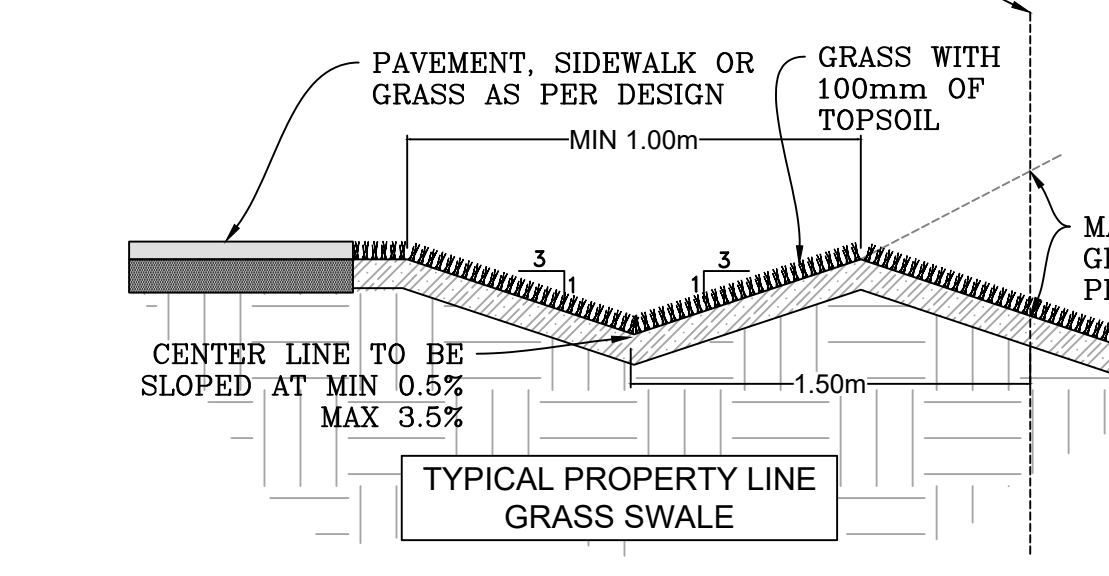
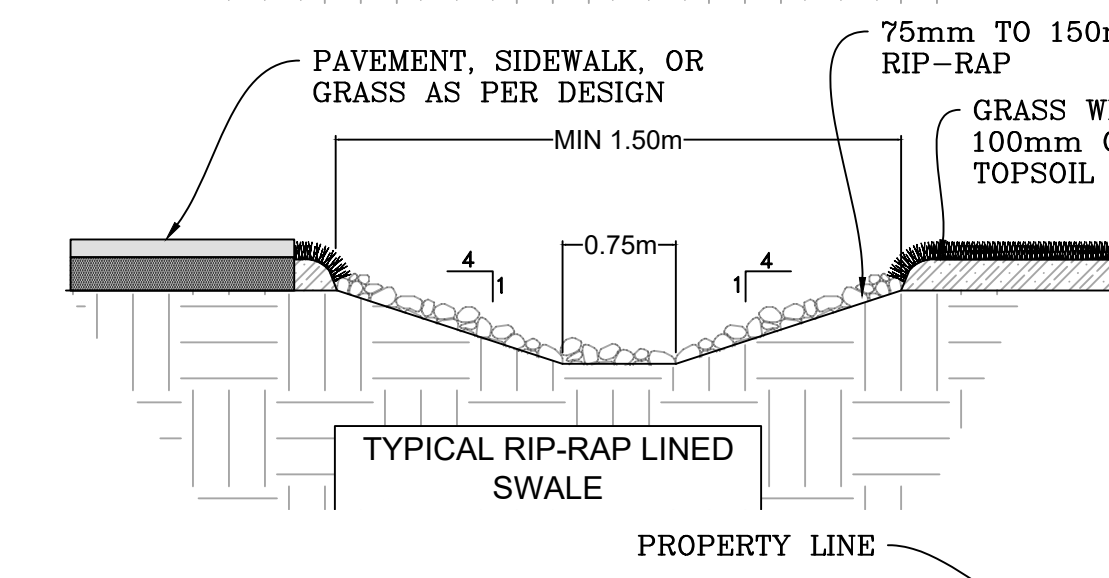
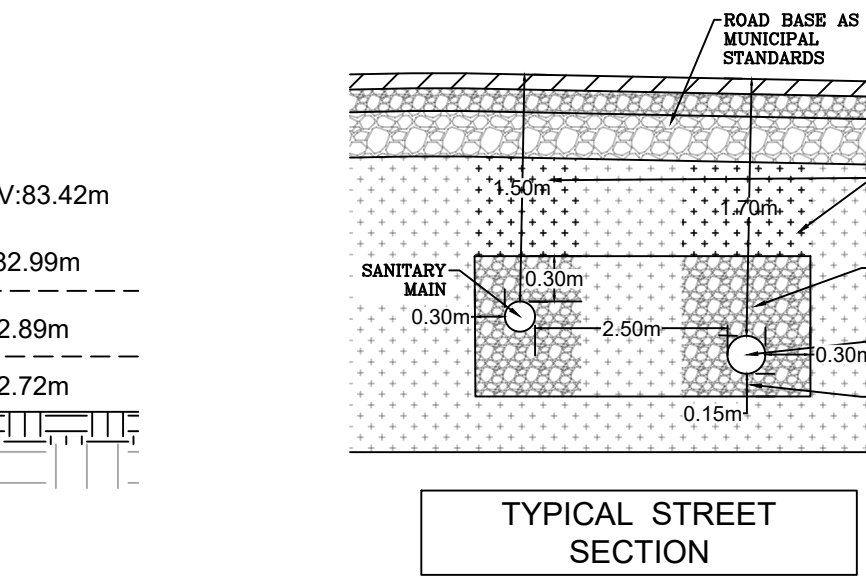
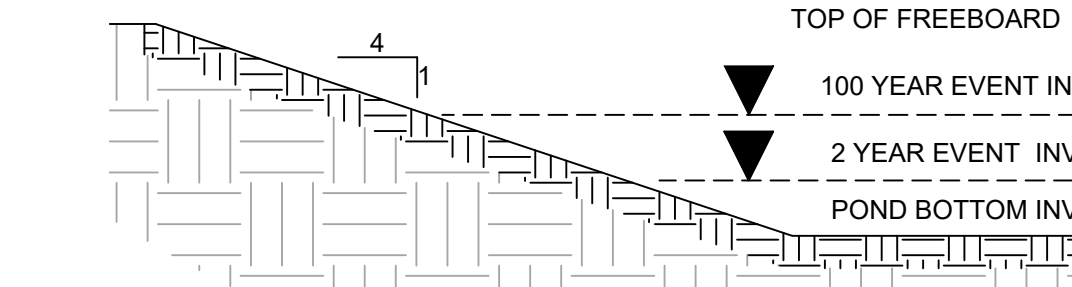
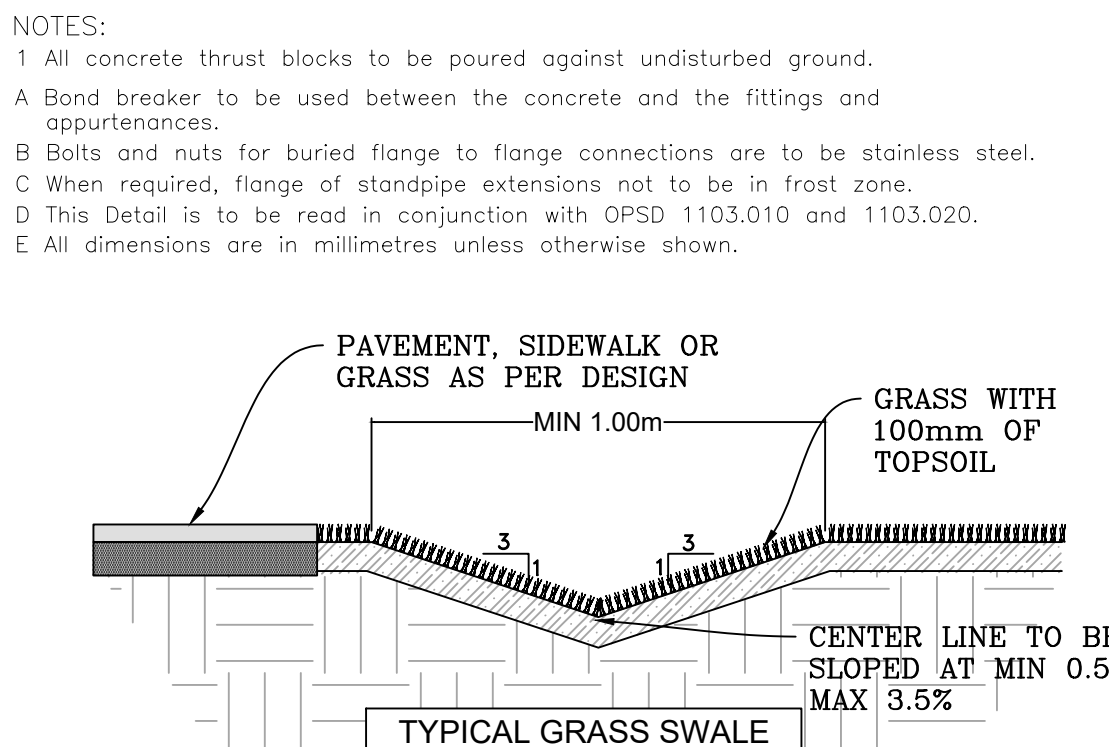
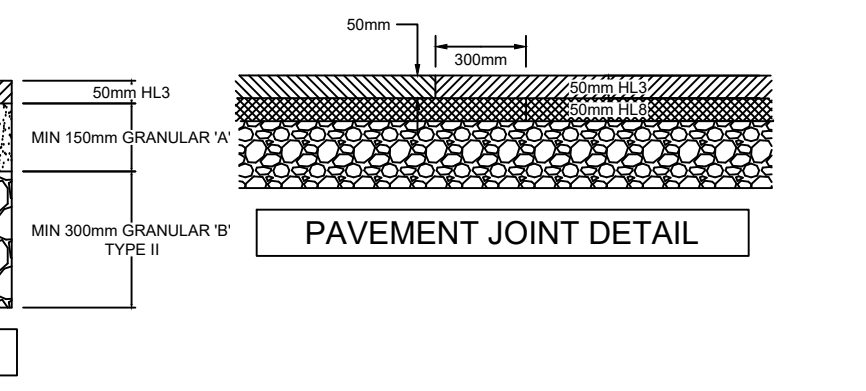
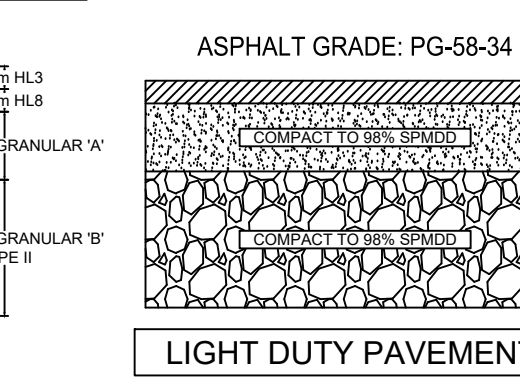
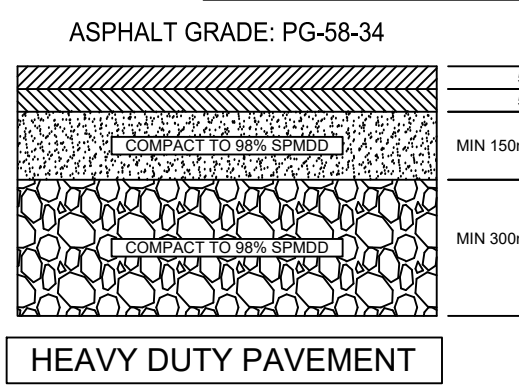
**WATERMAIN**

- WATERMAIN TO BE BLUE BRUTE CLASS 150 PVC DR18 OR APPROVED EQUIVALENT.
- CONSTRUCT ALL WATERMANS AND APPURTENANCES IN ACCORDANCE WITH OPSS STANDARDS AND SPECIFICATIONS AS WELL AS TOWN OF GANANOQUE STANDARDS.
- WATERMAIN AND/OR WATER SERVICES ARE TO HAVE A MINIMUM COVER OF 1.8M. OTHERWISE INSULATION IS REQUIRED AS PER DETAIL.
- IF THE WATERMAIN MUST BE DEFLECTED TO MEET ALIGNMENT, ENSURE THAT THE AMOUNT OF DEFLECTION USED IS EQUAL TO OR LESS THAN THAT WHICH IS RECOMMENDED BY THE MANUFACTURER.
- COORDINATE WATERMAIN CONNECTION WITH TOWN OF GANANOQUE. CONNECTION TO BE DONE BY COMPETENT CONTRACTOR. EXCAVATION, BACKFILLING AND REINSTATEMENT ALSO TO BE DONE BY CONTRACTOR.
- WATER QUALITY TESTING AND DISINFECTION FOLLOWING CONSTRUCTION TO MEET TOWN OF GANANOQUE, AWWA, MECP, AND BUILDING CODE STANDARDS. THE CONTRACTOR IS RESPONSIBLE FOR COMPLETING ALL REQUIRED TESTING.
- WATERMANS TO BE PRESSURE TESTED AS PER OPSS AND TOWN OF GANANOQUE STANDARDS.
- WATERMAIN THRUST BLOCKS TO BE CONSTRUCTED AS PER OPSD 1103.010.
- CORROSION PROTECTION AS PER OPSS MUNI 442.
- CONTRACTOR TO SUPPLY AND INSTALL WATERMAIN PIPE RESTRAINTS AT ALL ELBOWS AND TEES, BEFORE AND AFTER FITTINGS.
- WATER SERVICE TO BE BLUE BRUTE 904 SDR9 OR APPROVED EQUIVALENT.
- CURB STOP VALVES TO BE MUELLER ROTO-SEAL OR APPROVED EQUIVALENT. INVERTED KEY TYPE NOT ACCEPTABLE.
- VALVES TO BE NO DEEPER THAN 1.7m BELOW FINISHED GRADE.
- TRACER WIRE TO BE INSTALLED ON ALL WATERMANS AND WATER SERVICES AS PER OPSS AND TOWN OF GANANOQUE STANDARDS.
- GATE VALVES TO BE MUELLER RWGV OR EQUIVALENT.



NOTES:  
 1. INCREMENTS OF THICKNESS SHALL BE 50MM.  
 2. INSULATION TO BE STYROFOAM SM HI-40 OR EQUIVALENT.  
 3. TO BE USED WHEN GROUND COVER IS LESS THAN 1.5m FOR STORM SEWER, 1.5m FOR SANITARY SEWER AND 1.5m FOR WATERMAIN.

GROUND COVER	INSULATION THICKNESS (mm)
500 OR LESS	150
500 to 1500mm	100
1500mm and over	50



- NOTES:  
 1. Approved fittings:  
 a) East Jordan Ironworks 135mm Slide Type Valve Box Riser 85557128 with East Jordan Ironworks Locking Lid 06800033 marked SEWER.  
 b) Bloy Blue-Cone Riser 20" (508mm) and Bloy Blue-Cone Locking Lid 58830.  
 c) Or approved equivalent.  
 2. Check: Okay or Field-File end-of-pipe (type) style mechanical test plug, or approved equivalent.  
 3. For new developments, the listed plug shall be extended past the "Y" fitting to the property for connection by the home builder. Special attention shall be paid to connection adjacent to the clean-out and particularly to the private side service lateral.

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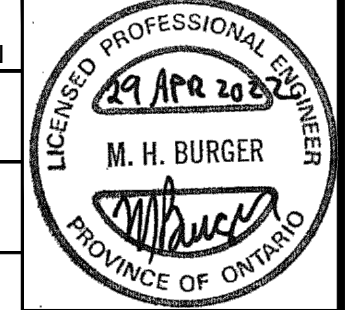


**REVISIONS**

No.	Description	Date
1.	ISSUED FOR SUBMISSION	2021/12/07
2.	REVISED AS PER TOWN COMMENTS	2022/01/20
3.	REVISED AS PER TOWN COMMENTS	2022/02/07
4.	REVISED AS PER CRCA COMMENTS	2022/03/21
5.	REVISED AS PER APRIL 2022 RE-DESIGN	2022/04/29

**BENCHMARK:**

No.	DESCRIPTION	ELEVATION
##.	XXX	XXX.XX



Client / Land Owner:

Project:  
**MARCO POLO 100 DESIGN CHALLENGE**

425 FOURTH ST. GANANOQUE ONTARIO

Drawing Title:  
**NOTES & DETAILS**

Drawn by: DF  
 Checked by: MB  
 Scale: 24"x36"  
 Date: OCT 25, 2021

Project Number:  
**GW-21050**

Drawing Number:  
**C-103**

SHEET 3 of 3