FUNCTIONAL SERVICING REPORT

DEVELOPMENT OF 10, WATSON ROAD IN THE TOWN OF GRAND VALLEY, DUFFERIN COUNTY

PREPARED FOR: CEPE INTERNATIONAL (CEPE)
RAE PROJECT NUMBER: 21081601
DATE: 05/27/2022

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DOCUMENT REVISION HISTORY

VERSION	DATE	AUTHOR(S)	REVISION NOTES
0	05/27/2022	ABI RAJAGOPAL, M.A.SC RAGU NATHAN, P.ENG.	REPORT SUBMITTED FOR SITE PLAN APPLICATION

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1 INTRODUCTION

1.1 Purpose

RA Engineering Inc. (RAE) is retained by CEPE International (CEPE) to prepare engineering designs in support of the Site Plan and zoning Applications for the site located in the Lot 3, 10 Watson Road, Town of Grand Valley (Town), Dufferin County (County). The proposed development consists primarily of a warehouse building with an office with associated loading docks and parking spaces. As part of the engineering design, this Functional Servicing Report (FSR) for the proposed facility development has been prepared by RAE. Additionally, refer to the proposed Overall Site Plan (DWG 21081601_C101) provided in **Appendix A**.

This FSR assesses the sanitary sewer conveyance network, water distribution network and storm sewer conveyance network in the vicinity of the subject property, analyzes servicing and infrastructure capacity and recommends servicing schemes for each of the three servicing needs to accommodate the proposed development's requirements in accordance with the Town of Grand Valley, Dufferin County, Grand River Conservation Authority and Ministry of the Environment and Climate Change (MOECC) standards and guidelines.

The creation of this FSR is intended for review by the Town of Grand Valley (Town), The County of Dufferin (County) and The Grand River Conservation Authority (GRCA) for approval of the proposed site access, sanitary, storm and water service schemes and details identified in this report.

1.2 Background Information

The following background information was referenced for the creation of this report:

- Parking Study validating the proposed number of parking spaces (RA Engineering Inc., 2021)
- Grand River Conservation Authority: Policies for the Administration of the Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulations, effective October 23, 2015
- Engineering Standards, Town of Grand Valley, November 2013, Consolidated May 2016
- Design Requirements for Drinking-Water Systems, MECP, 2008
- Design Guidelines for Sewage Works 2008
- Grand Valley Water and Wastewater Master Plan 2019 Class Environmental Assessment, RJ Burnside, March 2019
- Grand Valley Master Servicing Plan (MSP) Update, RJ Burnside, May 30, 2014
- Geotechnical Investigation (Toronto Inspection Ltd., November 2021)
- Phase 1 ESA on 10, Watson Road (Toronto Inspection Ltd., November 2021)

1.3 Site Description

The proposed development is to occur within the Lot 3, 10 Watson Road, Town of Grand Valley, Dufferin County which is currently a vacant property covered by dense grass. This property is bounded by Watson Road (a storage facility across Watson Road) to the south, Upper Grand Trailway to the north, undeveloped property & Grand Valley Wastewater Treatment Plant to the east and Grand Valley Fire Station to the west. Grand river is located approximately 80 m north of the site. Figure 1 outlines the pre-development area of the proposed development (Project Site).

The development will consist primarily of a warehouse and an office building with associated loading docks and an internal roadway. As shown on the Overall Site Plan in **Appendix A**, the proposed development is to be constructed within the 0.405 ha (1 ac) Project Site (Site). Currently the surface runoff from precipitation is expected to infiltrate into the ground on the site or to flow towards an existing ditch along the east side of the site prior to discharging to Grand River.

This report will cover the servicing design of this development area. The Site will ultimately be serviced by sanitary sewers and a storm sewer collection system which will be constructed during the Watson Road re-construction and by an existing watermain. Since it is uncertain that the road re-construction will be completed before the completion of the development of this facility, RAE has designed a septic system to collect and treat the effluent discharged from the facility and a summary of the system design is included in **Section 3.3** of this report and detailed calculations has been attached in **Appendix B** of this report. RAE has also designed a storm system to divert the run off to the existing ditch at the east side of the property. The sanitary, water, and storm servicing are discussed in more detail within the following sections of this report.

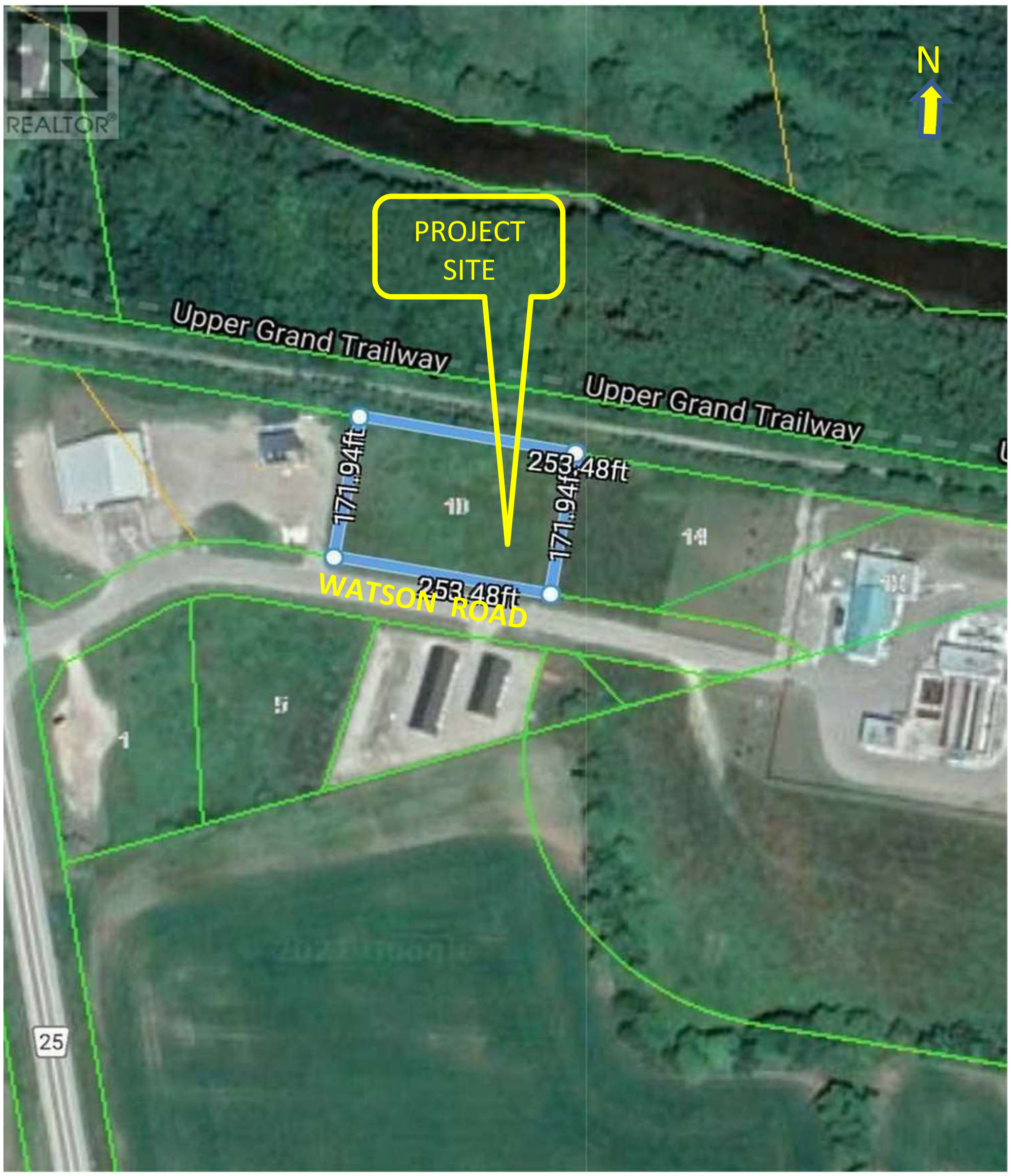


Figure 1: Pre-Development Area

2 SITE ACCESS

Access to the Site is to be provided by a single entrance from Watson Road.

The internal roadway of the development will consist of parking spaces (8), truck loading docks (2), small truck loading docks (2) and provides sufficient space to allow for truck turning. Pavement structure recommendations are provided in the Geotechnical Investigation (Toronto Inspection Ltd.) and Site Servicing & Grading Plan (**Drawing 21081601_C200 & Drawing 21081601_C300**) are included as **Appendix C** in this report.

3 SANITARY SEWAGE SYSTEM

The Town of Grand Valley Sanitary Sewer Design Criteria was referenced to provide design guidelines for the sanitary sewage design. These guidelines include:

- Minimum depth of cover of 2.0 m from the crown of the pipe when the sewer does not have service connection.
- Minimum sewer grade of 0.5% except on an end-run sewers on which minimum grade shall be 1%
- Minimum flushing velocity of 0.60 m/s when the pipe is flowing full.

3.1 Existing Sanitary Services

The Site currently does not have any municipal sanitary services located on-site.

3.2 Proposed Sanitary Servicing

As interim, the sewage from the warehouse will temporarily be conveyed to the septic tank at the front side (South – west corner) of the lot where it will be treated and percolated into the ground via a leaching bed. Ultimate sanitary servicing design will include sanitary sewer line from the warehouse to the service connection available at the sanitary sewer to be built during the Watson Road reconstruction. A sanitary sewer design sheet has been created to ensure the sanitary sewers can convey flows while meeting municipal standards.

The preliminary sanitary demands for the Site were estimated using the following assumptions from the Town of Grand Valley Engineering Standard November 2013, Consolidated May 2016 and Design Requirements for Drinking-Water Systems, MOE, 2008:

- Average Daily Sewage Generation Rate for light industrial – 0.405 L/s/ha
- Infiltration Allowance – 0.20 L/s/ha

The pipe capacity (Q, m^3/s) was calculated using Manning's roughness coefficient (n), cross sectional area (A, m^2), pipe diameter (D, m), hydraulic radius of conduit (R=D/4, m) and the slope of the pipe (S,m/m). The formula can be seen below as shown in the Design Guidelines for Sewage Works 2008.

$$Q = \frac{1}{n} * A * R^{\frac{2}{3}} * S^{\frac{1}{2}}$$

The Harmon Peaking Factor (K) is used for determining the maximum flow in the pipes. It is calculated from the population (p), in thousands. The formula can be seen below.

$$K = 1 + \frac{14}{4 + sqrt(p)}$$

Refer to **Appendix D** for the sanitary demand and sanitary sewer design sheet. **Table 1** summarizes the sanitary demand calculations.

Table 1: Summary of Sanitary Demand Calculations

Building Area (ha)	Light Industrial Flow		Infiltration		Peak Factor	Total Peak Daily Flow (L/s)
	Unit Flow (L/s/ha)	Average Flow (L/s)	Unit Flow (L/s/ha)	Total Flow[1] (L/s)		
0.144	0.405	0.06	0.20	0.01	4.00	0.24

1 Total infiltration flow based on a cumulative drainage area of 0.057 ha.

The design sewage total peak daily flow from the development is approximately 0.24 L/s. A 200 mm diameter sanitary sewer network running along the south side of the property is proposed to service the development and convey sanitary flows internally from the proposed industrial building by gravity via SAN MH1 to SAN MH2 to SAN MH3 and finally to proposed Septic Tank where it will be treated. Ultimately, as soon as the service connection to be built during the Watson Road reconstruction is available at the proposed SAN MH4 at the entrance of the property, the pipes from SAN MH2 to the septic tank will be disconnected and the sewage will be directed from SAN MH2 to SAN MH4.

Between Septic and the connection to the building, the pipe runs inside the property and has a minimum depth cover of 2.0 m with the minimum slope of 0.5% except at the end-run at which the slope is 1% to satisfy the Town's standard.

Refer to **Drawing 21081601_C200** for the proposed sanitary servicing for the development. **Drawing 21081601_C500** illustrates the sanitary drainage areas for the proposed sewer. These drawings can be found in **Appendix C**.

3.3 Proposed Septic Tank & Leachate Bed Design

Since there is no sanitary sewer connection available on Watson Road yet, the proposed development will be serviced by a septic tank system until the future connection is available. The following background information was used for the design of the septic system:

- Ontario Building Code 2020 (OBC) Table 8.2.1.3.B for the flow calculation
- Geotechnical Report dated November 2021 by Toronto Inspection Ltd
- Ontario Building Code 2020 (OBC) Section 8.7.3.1 for the design of absorption trench
- Ontario Building Code 2020 (OBC) Section 8.6.2.2 for the selection of treatment units
- CAN/BNQ 3680-600 Certified Treatment Technologies

A septic system comprised of advanced treatment units together with absorption trench of area 133m^2 (13m wide and 11m long) is proposed to treat the flow domestic flow generated from the proposed facility. The length of distribution pipe is 88m. 8 rows of 11m long pipe at 1.6m centres are proposed. The advanced treatment units, primary treatment tank and the reactor are as the per the technologies certified under the standard CAN/BNQ 3680-600. The calculation is attached in **Appendix B**.

4 WATER SUPPLY AND DISTRIBUTION

4.1 Existing Water Servicing

The Site currently does not have any municipal water services located on-site.

4.2 Proposed Water Servicing

4.2.1 External Watermain Extension

The existing 200 mm diameter water main on Watson Road will be connected to the building for municipal water supply.

Drawing 21081601_C200 in **Appendix C** illustrates the layout of the proposed watermain system.

4.2.2 Internal Water Servicing

The preliminary water supply demands for the Site were established using the following assumptions from the Design Guidelines for Drinking-Water Systems, MOE, 2008 :

- Peak Day Factor – 2.75
- Peak Hour Factor – 4.13

Table 2 summarizes the water demand (based on usage) calculations, which are also summarized in **Appendix E**.

Table 2: Summary of Water Demand Calculations

Building Area (ha)	Average Day		Maximum Day			Peak Hour	
	Flow (L/s)	Volume (m^3/day)	Peak Factor	Flow (L/s)	Volume (m^3/day)	Peak Factor	Flow (L/s)
0.14	0.03	0.75	2.75	0.07	2.06	4.13	0.11

The maximum day and peak hour water demands from the development are approximately 0.07 and 0.11 L/s, respectively. From the average daily flow of 0.03 L/s, the average daily demand volume is 0.75 m^3/day. Additionally, from the maximum daily demand flow of 0.07 L/s, the maximum daily demand volume is 2.06 m^3/day. When determining water demand, process water was not included, as the new facility does not require water. The development is to be serviced via connection to the existing 200 mm diameter municipal watermain on Watson Road. A 100 mm diameter domestic service is proposed to service the development. A 150 mm service is provided for development fire protection, as shown in Drawing C200.

Fire flow calculations, found in **Appendix E**, were completed using the Ontario Building Code (OBC) Compendium and the Fire Underwriters Survey to determine the required water flows needed for fire protection. Based on the OBC Compendium, the estimated fire flow required for the development was determined to be 75 L/s for 1.6 hours. The Fire Underwriters Survey determined that the required fire flow should be 83 L/s which is greater than the Town's standard for a minimum fire flow of 79 L/s to the highest lot in the development with a 140 kPa (20 psi) residual pressure and with the maximum day demand elsewhere in the Town's overall system. For this reason, a fire flow of 83 L/s is being proposed for 1.75 hours with a required fire storage volume of 525 m^3. Fire protection will be provided through sprinklers in the proposed building and on-site hydrants. A separate fire service has been provided to the building and has been sized to provide this required fire flow. An internal 150 mm diameter fire line is proposed to service the on-site hydrant.

Water pressure calculations in **Appendix E** were prepared using the Hazen-Williams formula to estimate the pressure losses due to pipe friction for the fire flow water pressure within the extended municipal watermain at the proposed development. Fire flow rates must be supplied at a minimum of 140 kPa, according to the Town's Engineering Standard. Using the fire flow of 83 L/s, the estimated pressure is: 154.28 kPa at the proposed hydrant in the development. This pressure will provide adequate flows to provide the required fire flow and maximum daily demand to the development during the maximum day demand as recommended in the Engineering Standards, Town of Grand Valley, November 2013, Consolidated May 2016.

5 STORM SERVICING

The Town of Grand Valley Sanitary Drainage Design Criteria was referenced to provide design guidelines for the storm sewer design. These guidelines include:

- The minimum storm sewer size shall be 300 mm.
- The minimum slope on a storm sewer shall be adequate to create a flow velocity of 0.75 m/sec under pipe full flow conditions. The maximum slope on a storm sewer shall be such that the pipe full velocity does not exceed 4.5 m/sec.
  Storm sewers that do not have services connected to them shall be installed with a minimum 1.5 meters of cover.

5.1 Existing Storm Sewers

The Site currently does not have any storm services located on-site.

Surface runoff from precipitation is expected to infiltrate into the ground on the site and/or to flow towards the existing ditch at the east side of the property and finally discharged into Grand River. Pre – Development design flow calculations and results are described below.

5.1.1 Pre-Development Design Flows

Pre-development runoff quantities were estimated using the Rational Formula, as outlined in the Ontario Design Guidelines for Sewage Works 2008, where: Refer **Drawing 21081601_C401** in **Appendix C** for Pre-Development Drainage Plan.

Q = 2.778*C*I*A

Q = Peak flow rate (l/s)

C = Runoff coefficient

I = Rainfall intensity (mm/hr)

A = Drainage area (ha)

The values of the runoff coefficient (C) and rainfall intensity were taken from the Town's Engineering standard and from Ministry of Transportation Drainage Management Manual Design Chart 1.07: Runoff Coefficients included in **Appendix F**. Composite run-off coefficient for the site for the pre-development conditions was estimated using the following formula:

$$C_w = \frac{\sum_{j=1}^{n} C_j A_j}{\sum_{j=1}^{n} A_j}$$

Estimated composite run-off coefficient for the pre-development conditions is 0.25 as detailed in the **Table 3**.

Table 3: Composite Run-off Coefficient for Pre-Development Conditions

Areas	Land Use	A_j (ha)	C_j	A_j x C_j	C_w
101	Grass	0.1873	0.25	0.04683	
103	Grass	0.1872	0.25	0.04680	
103	Grass	0.0317	0.25	0.00793	
Total		0.4062		0.10155	**0.25**

The average rainfall intensity (I, mm/hr) is calculated using the time of concentration (T_C, hr) and coefficients from the intensity duration frequency curve (IDF) at a time period of five (5) years as per Town's standard.

As recommended in the Town's Engineering Design Standards, the time of concentration used was 10 minutes and IDF coefficients for 5 – year from Fergus Shand Dam are as follows: A = 31.3, B = -0.698. The formula can be seen below.

$$I = A * (T_C/60)^B$$

The pre-development design peak flow discharge rate from the subject land for the storm return periods of 5 years is estimated to be 31 L/s as detailed in **Table 4**.

Table 4: Pre-Development Design Flows

Catchment Area	Land Use	Area, A (ha)	Runoff Coefficient, C*	Intensity, I	Peak Flow, Q
				(mm/hr)	(l/s)
			5 year	5 year	5 year
10 Watson Road	Grass	0.4062	0.25	109.51	31

5.2 Proposed Conditions

The proposed development of the site is shown on the Overall Site Plan in **Appendix A**. As per the site plan, since the ditch at the east side of the property is paved to use as parking lots and truck movement area, a culvert has been proposed under the paved area along the ditch to convey the post development flow from the development. This culvert will only be used to convey the interim, post development flow and will be discontinued as soon as the service connection to be built during the Watson Road reconstruction is available at the proposed STM MH immediately adjacent to the south side of the property (ultimate storm service connection).

5.2.1 Post-Development Design Flows

Figure 2 provides post-development catchment areas and run-off coefficients. The composite run-off coefficient for the post-development conditions is estimated to be 0.73 as detailed in **Table 5** and composite run-off coefficient of the areas contributing to the proposed culvert at the east side of the property is estimated to 0.83 as shown in **Table 6**. Refer **Drawing 21081601_C402** in **Appendix C** for Post-Development Drainage Plan.

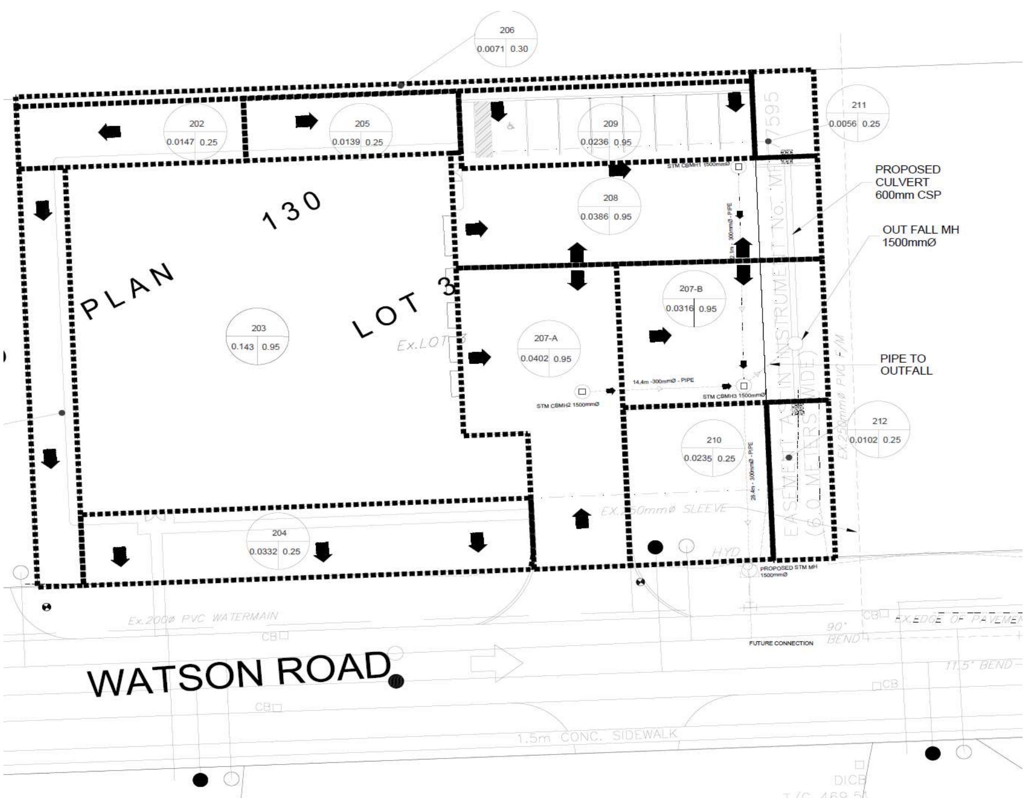


Figure 2: Post-Development Catchment Areas and Run-off Coefficients

Table 5: Overall Composite Run-off Coefficient for Post-Development Conditions

Areas	Land Use	A_j (ha)	C_j	A_jxC_j	C_w
201	Grass	0.0200	0.25	0.005	
202	Grass	0.0147	0.25	0.003675	
203	Roof	0.1439	0.95	0.136705	
204	Grass	0.0332	0.25	0.0083	
205	Grass	0.0139	0.25	0.003475	
206	Gabion Wall	0.0071	0.3	0.00213	
207	Asphalt	0.0718	0.95	0.06821	
208	Asphalt	0.0386	0.95	0.03667	
209	Asphalt	0.0236	0.95	0.02242	
210	Grass	0.0235	0.25	0.005875	
211	Grass	0.0056	0.25	0.0014	
212	Grass	0.0112	0.25	0.0028	
Total		0.4071		0.29666	**0.73**

Table 6: Composite Run-off Coefficient of Areas contributing to the proposed culvert at the east side of the property (Post-Development Conditions)

Areas	Land Use	A_j (ha)	C_j	A_jxC_j	C_w
203	Roof	0.1439	0.95	0.134045	**0.83**
205	Grass	0.0139	0.25	0.003475	
206	Gabion Wall	0.0071	0.3	0.00213	
207	Asphalt	0.0718	0.95	0.06821	
208	Asphalt	0.0386	0.95	0.03667	
209	Asphalt	0.0236	0.95	0.02242	
210	Grass	0.0235	0.25	0.005875	
212	Grass	0.0112	0.25	0.0028	
Total		0.3336		0.2756	

The post-development design peak flow discharge rate into the proposed culvert via outfall MH from the subject land for the storm return periods of 5 years is estimated to be 85 L/s as detailed in **Table 7**.

Table 7 Post-Development Design Flows contributed to proposed culvert

Catchment Area	Land Use	Area, A (ha)	Peak Flow, Q (L/s)					
			2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
10 Watson Road	Grass/Asphalt/Roof	0.3336	61.40	84.66	100.08	131.21	152.17	168.50

The total post development flow from grassed area 201,202 & 204 as shown in the Table 8 below is expected to infiltrate into the grass like the pre-development conditions.

Table 8 Post-Development Design Flows infiltrate into the grassed area

Catchment Area	Land Use	Area, A (ha)	Peak flow (L/s)					
			2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
10 Watson Road	Grass	0.0679	3.75	5.16	6.10	8.00	9.78	11.28

Pre and Post development release rate calculations are provided in **Appendix F**.

5.2.2 Proposed Storm Sewer

Catch basins and storm sewer system are proposed to service the development. The sewers have been sized to convey the five-year storm event for local streets as per the Engineering Standards, Town of Grand Valley, November 2013, Consolidated May 2016. Internal runoff will be collected in this system and conveyed to a proposed outfall MH at the proposed culvert at the east side of the property.

Refer to **Drawing 21081601_C400** in **Appendix C** which illustrates the proposed storm sewer systems. For the storm sewer design calculations, the following formulas were used.

The pipe capacity and size (Q, m^3/s) was calculated using Manning's roughness coefficient (n), cross sectional area (A, m^2), pipe diameter (D, m), hydraulic radius of conduit (R=D/4, m) and the slope of the pipe (m/m). The formula can be seen below.

$$Q = \frac{1}{n} * A * R^{\frac{2}{3}} * S^{\frac{1}{2}}$$

The run-off flow rate (Q, L/s) is based on the run-off coefficient (C), average rainfall intensity (I, mm/hr), area (A, ha) and a unit correction coefficient of 2.778. The formula can be seen below.

$$Q = 2.778 * C * I * A$$

The average rainfall intensity (I, mm/hr) is calculated using the time of concentration (T_C, hr) and coefficients from the intensity duration frequency curve (IDF) at a time period of five (5) years. As per Town's standard, the time of concentration used was 10 minutes and IDF coefficients from Fergus Shand Dam are as follows: A = 31.3, B = -0.698. The formula can be seen below.

$$I = A * (T_C/60)^\wedge B$$

The time of flow (T_t, min) is determined using the distance between two points (L, m) and the velocity between the same points (m/s). The formula can be seen below.

$$T_t = \frac{L}{60V}$$

Pipe velocity (V, m/s) is calculated using Manning's roughness coefficient (n), the hydraulic radius of conduit (R=D/4, m) and the slope of the pipe (m/m). Three formulas are shown below to indicate how velocity was calculated, since flow is area*volume and area cancels out. Therefore, a formula for the velocity, itself was used.

$$Q = \frac{A * R^{\frac{2}{3}} * S^{0.5}}{n}, \quad Q = A * V, \quad V = \frac{R^{\frac{2}{3}} * S^{0.5}}{n}$$

The site will be graded to maintain the existing topography (high point in the middle with an average slope of 2% to 6% towards the east side of the property) so that all surface runoff will be collected via proposed catch basins, CBMH1, CBMH2 & CBMH3, conveyed via proposed 300 mm PVC pipes and eventually to the outfall MH at the proposed culvert on the ditch at the east side of the property. 600 mm CSP culvert has been proposed to convey the runoff to the swale.

Ultimately, as soon as the service connection to be built during the Watson Road reconstruction is available at the proposed STM MH immediately adjacent to the south side of the property, the pipe from CBMH3 to Outfall MH will be disconnected and the runoff will be directed from CBMH3 to STM MH. The internal storm sewer net work has been designed to support both interim and ultimate drainage requirements.

Post release rate for 100-yr event via Culvert and Storm sewer design sheets are provided in **Appendix F**.

As shown in the storm sewer calculation sheet, approximately 42 m of pipe for interim and 62.6 m of pipe for ultimate conditions will require insulation as per OPSD 1109.030 since the minimum 1.5 meters of cover has not met as per the Town's standard.

6 STORM WATER MANAGEMENT

RAE contacted GRCA to confirm if Stormwater management design is required to get their permit. An email dated February 9th, 2022 from GRCA confirms that the subject property contains the regulated allowance to a slope valley hazard which is located on the other side of Watson Road. Since this hazard is not located on the property, only a detailed site plan will be required as part of the permit application. An E-mail Correspondence with GRCA confirming the requirements for site plan approval can be found in Appendix G.

7 EROSION CONTROL AND SEDIMENT CONTROLS

Erosion and sediment controls will be implemented prior to the commencement of any site servicing works and maintained throughout construction until the site is stabilized as mentioned in the Town's Engineering standard. Erosion and sediment controls are to be inspected regularly, after each significant rainfall, and maintained in proper working condition.

The proposed erosion and sediment controls include silt fencing, mud mats and silt socks. The need for additional controls will be based on the field conditions at the discretion of the Engineer and implemented as necessary. Refer **Drawing 21081601_C600** in **Appendix C.**

- **Silt Fencing**: Silt fence will be constructed in accordance with the Typical Detail of Silt/Sediment Fence (Refer **Drawing 21081601_C701** in **Appendix C)** . It should be noted that additional silt fence may be added based on field decisions by the Engineer and Developer prior to, during and following the earth works.

- **Rock Flow Check Dams**: Temporary straw bale and rock check dams will be utilized on-site in to prevent any silt migration off site during and after construction activities. These dams will promote settling of suspended solids and will reduce flow velocities. Sediment accumulation will be monitored and removed as necessary. The temporary rock check dams will be constructed in accordance with OPSD 219.210/OPSD 219.211.
- **Mud Mat**: A mud mat will be maintained at the site entrance until base asphalt is placed to limit mud tracking from the site onto Watson Road. The Contractor shall ensure mud mat maintenance (cleaning / additional stone) is completed on an as needed basis to ensure proper operation.
- **Silt-Socks:** Silt-Socks are proposed within the existing ditch at the east side of the property to control sediment discharging from the work site into the downstream receiving waters.

8 PROVISION OF UTILITIES

The Site requires the services of hydro, gas and telecommunications. These service requirements will be quantified and coordination with the utility companies will be initiated in due course.

9 CONCLUSIONS AND RECOMMENDATIONS

The proposed development is compromised of 0.406 ha of land. The development includes a single warehouse building with an office, an internal paved roadway and a single site entrance.

The analysis presented in this report provides a comprehensive municipal servicing assessment and design for the proposed development. Our conclusions and recommendations include:

Site Access

- Access to the development will be provided by a single entrance from Watson Road.

Sanitary Servicing

- The proposed 200 mm sanitary sewer with septic tank will be servicing the sanitary as interim.
- When the municipal sanitary sewer is built during the Watson Road reconstruction, the proposed sewer will be connected to its service connection. This sewer has been designed to accommodate sanitary flows from the proposed development.

Potable Water Servicing

- The existing 200mm municipal watermain located south of the subject property is to be used to supply water to the development.
- Fire Underwriters Survey and Ontario Building Code Compendium fire flow calculations were completed to determine required flows for fire protection. Fire protection is to be provided by an internal sprinkler system within the proposed building and on-site hydrant.

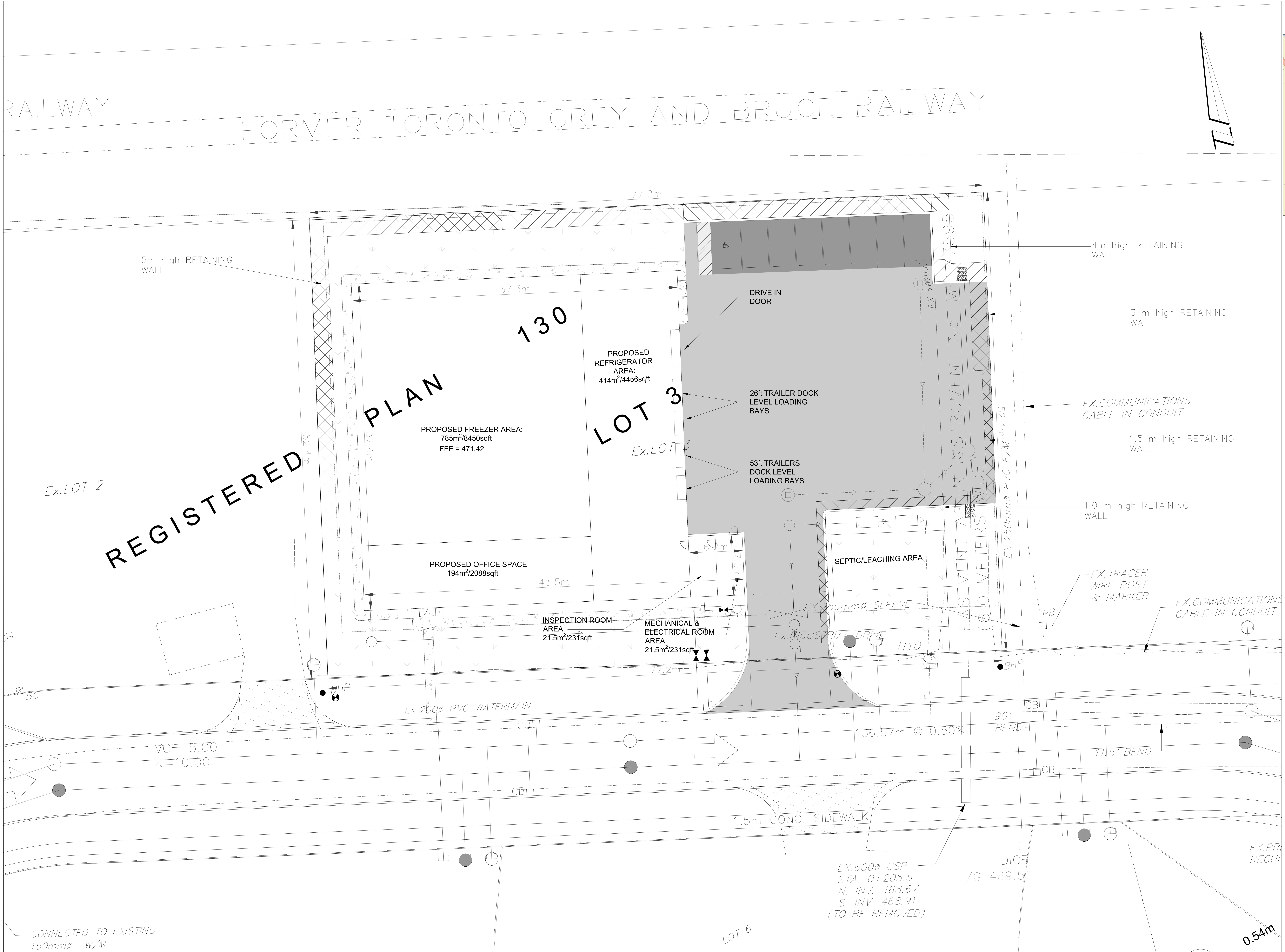
Storm Servicing

- The proposed 300 mm storm sewer with proposed outfall MH at the proposed culvert at the east side of the property will be servicing the storm as interim.

- When the municipal storm sewer is built during the Watson Road reconstruction, the proposed sewer will be connected to its service connection. This sewer has been designed to accommodate storm flows from the proposed development.
- Catch basins are proposed to collect internal runoff from the development.

Based on the detailed design of the sanitary/storm sewer and watermain infrastructure for the proposed development, all servicing objectives will be met.

APPENDIX A
OVERALL SITE PLAN



METRIC

KEYPLAN

LEGEND

- SITE BOUNDARY/PROPERTY LINE
- BUILDING SETBACK
- PROPOSED BUILDING
- LIGHT DUTY ASPHALT
- HEAVY DUTY ASPHALT
- LANDSCAPED AREA
- SIDEWALK

No.	DATE MM.DD.YY	REVISIONS	BY
1.	05.31.22	ISSUED FOR SPA APPROVAL.	R.N.

SCALE 1:200
DLW FILE REFERENCE 21081601
DATE 01.11.22

LICENSED PROFESSIONAL ENGINEER R.SATGUNANATHAN 100110922 01/06/2022 PROVINCE OF ONTARIO

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Web :www.raengineer.com

WAREHOUSE FACILITY FOR CEPE

DRAWN BY A.N./Y.R.
DESIGNER Y.R./A.R.
CHECKED BY R.N.

10 WATSON ROAD WAREHOUSE FACILITY

OVERALL SITE PLAN

DWG NO. 21081601-C-101
CONTRACT NO. 00000000
SHEET NO. C101

Plotted By: YajnaRamphul Layout-Sheet Name: C101 Plot File Date Created: Jun/01/2022 3:29 PM

Filename: C:\USERS\YAJNARAMPHUL\RA ENGINEERING INC\PROJECTS – DOCUMENTS\21081601 10 WATSON ROAD FOR CEPE\CAD\ZBA STAGE\21081601_10 WATSON ROAD_C_200+300_SERVICING & GRADING PLAN-V2.DWG

APPENDIX B

SEPTIC DESIGN CALCULATIONS

RA ENGINEERING
A Solution Provider for Industries & Agencies
18075 Leslie Street - Unit 210
Newmarket
Ontario L3Y 9A4

Project:	10 Watson Road Warehouse facility				
Element:	**Septic System Design**			CALCULATION NO.:	
Made By:	YR	DATE:	26-May-2022		
Checked by:	RN	DATE:	26-May-2022		
		Page NO:	1	OF	1
		JOB NO.:	21081601	Rev:	0

Flow Calculation

No of employees	10		
Volume per employees	75	L	From OBC 2020 - Table 8.2.1.3.B
Total Volume	**750**	L	

Percolation Rate	**35**	min/cm	From Geotechnical Report_5823-21-GB Dated Nov. 12 -2021

For Absorption Trench (Conventional) With advanced treatment , L=(QT/300)_OBC 8.7.3.1(3)

Length of distribution pipe L	**88**	**m**	
Minimum_OBC 8.7.3.1_(1B)	40	m	
Max. Length of Absorption trench	11	m	(As per availability of land)
No. of 11m pipes	**8**	**No.**	
C/C between the pipes	1.6	m	From OBC 2020 - Section 8.7.3.2
Width of leaching field	**13**	**m**	

∴ A 13m wide and 11m long leaching bed is proposed.

Advanced units from Bionest Technologies - Certified under CAN/BNQ 3680-600 Standard:

Primary Treatment Model	BTT-1325	
Minimal Volume	1.3	m^3
Bionest Reactor Model	BTT-1325	
Minimal Volume	2.7	m^3

APPENDIX C

CIVIL DRAWINGS

Drawing 21081601_C200: Site Servicing Plan

Drawing 21081601_C300: Site Grading Plan

Drawing 21081601_C400: Storm Drainage Plan

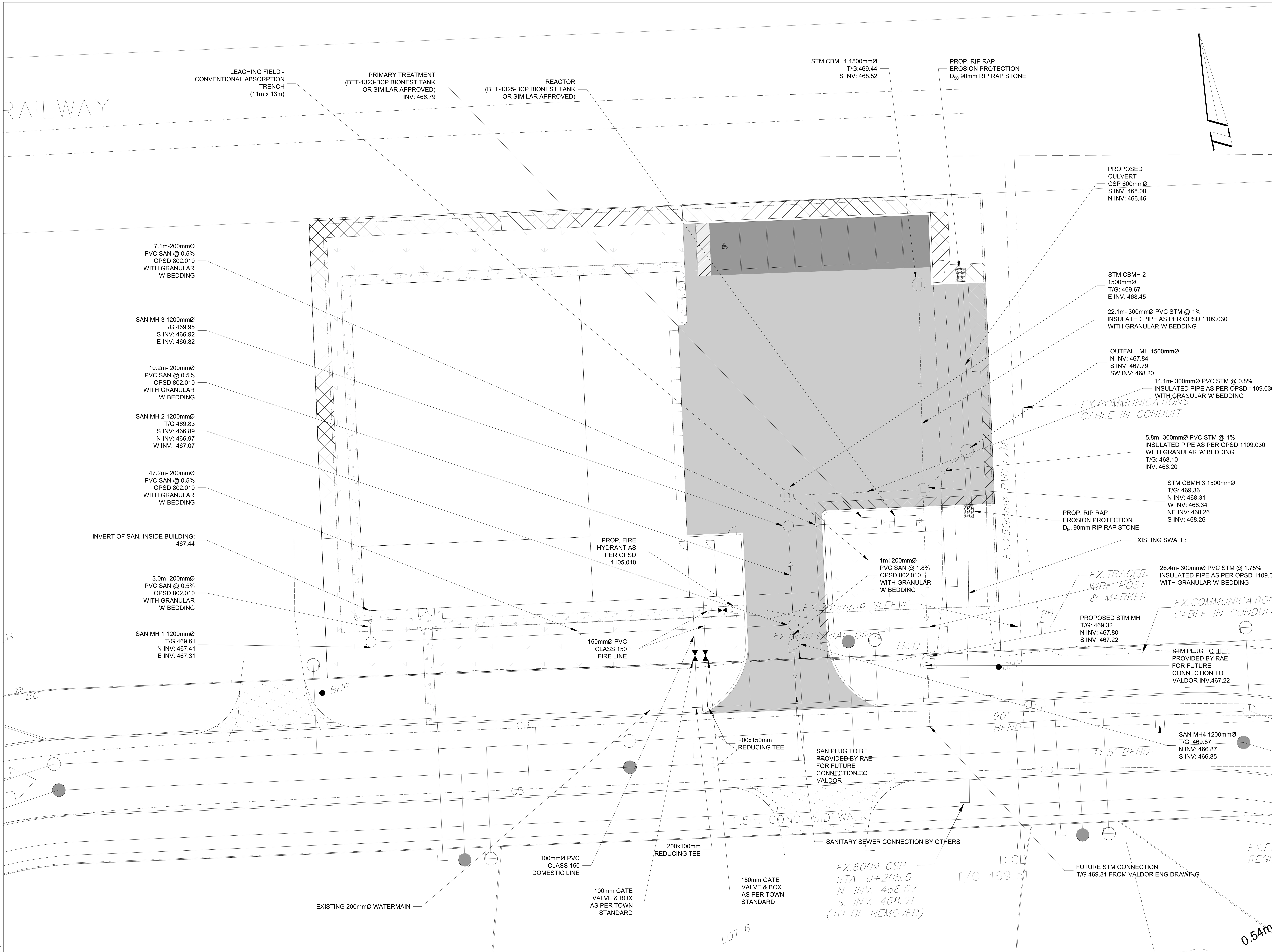
Drawing 21081601_C401: Pre-Development Drainage Plan

Drawing 21081601_C402: Post-Development Drainage Plan

Drawing 21081601_C500: Sanitary Drainage Plan

Drawing 21081601_C600: Erosion & Sedimentation Plan

METRIC



KEYPLAN

LEGEND
- SITE BOUNDARY/PROPERTY LINE
- BUILDING SETBACK
- PR. BUILDING
- PR. STORMWATER SEWER
- PR. STORM CATCHBASIN MANHOLE
- PR. SANITARY SEWER
- PR. SANITARY MANHOLE
- PR. WATER VALVE & BOX
- PR. FIRE HYDRANT & VALVE
- LIGHT DUTY ASPHALT
- HEAVY DUTY ASPHALT
- LANDSCAPED AREA
- SIDEWALK

No.	DATE MM.DD.YY	REVISIONS	BY
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SCALE 1:200
DLW FILE REFERENCE 21081601
DATE 01.11.22

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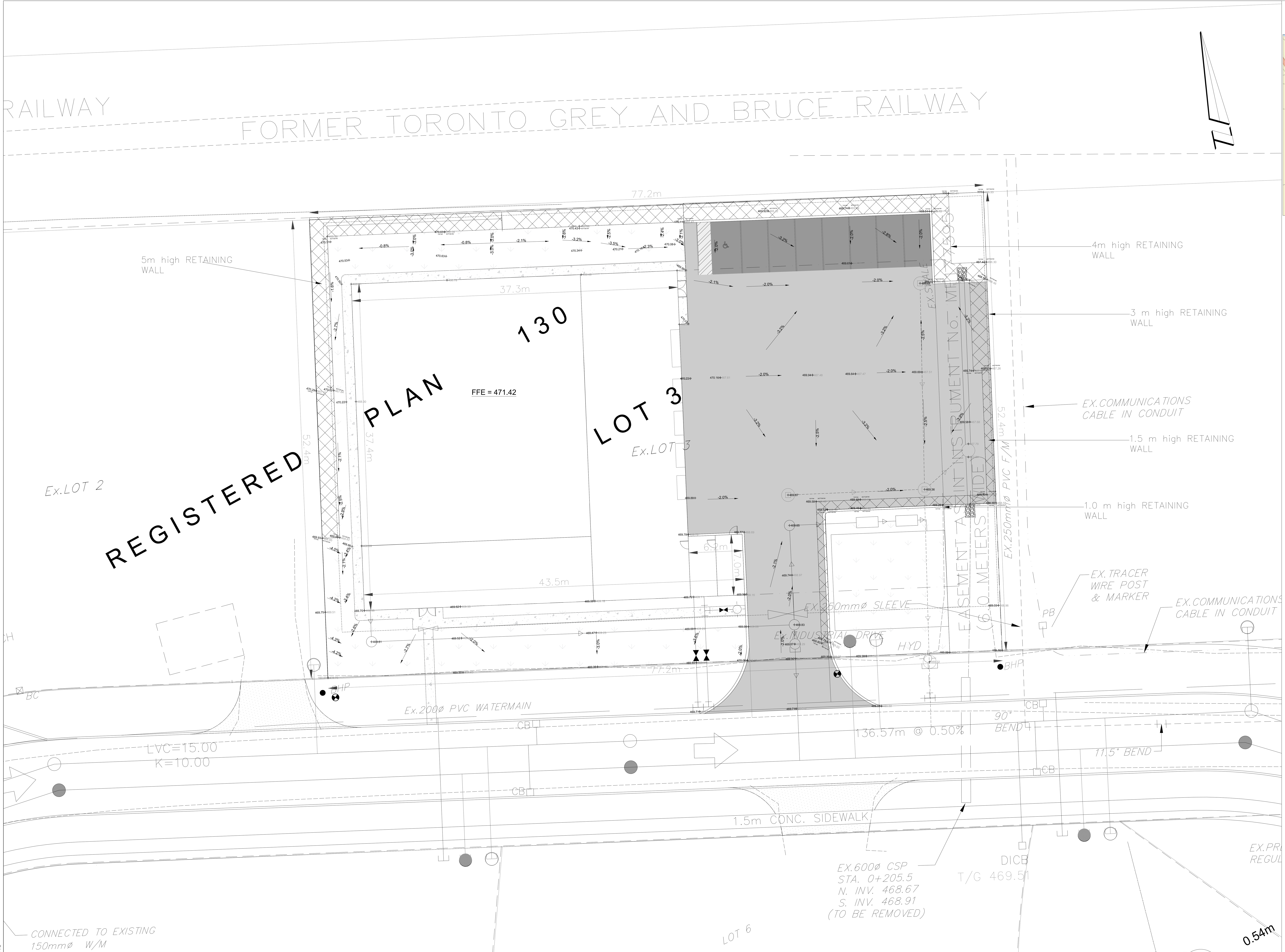
DESIGNER Y.R./A.R.
CHECKED BY R.N.

10 WATSON ROAD WAREHOUSE FACILITY

SERVICING PLAN

DWG NO. 21081601-C-200
CONTRACT NO. 00000000
SHEET NO. C200

Filename: C:\USERS\YAJNARAMPHUL\RA ENGINEERING INC\PROJECTS - DOCUMENTS\21081601 10 WATSON ROAD FOR CEPE\CAD\ZBA STAGE\21081601_10 WATSON ROAD_C_200+300_SERVICING & GRADING PLAN-V2.DWG



METRIC

KEYPLAN

LEGEND

- SITE BOUNDARY/PROPERTY LINE
- BUILDING SETBACK
- PROPOSED BUILDING
- PR. STORMWATER SEWER
- PR. STORM CATCHBASIN MANHOLE
- PR. SANITARY SEWER
- PR. SANITARY MANHOLE
- PR. WATER VALVE & BOX
- PR. FIRE HYDRANT & VALVE
- PR. MAJOR OVERLAND FLOW DIRECTION
- 465.82 EXISTING SURFACE ELEVATION
- 469.54 PR. SURFACE ELEVATION
- -3.2% PR. SLOPE
- LIGHT DUTY ASPHALT
- HEAVY DUTY ASPHALT
- LANDSCAPED AREA
- SIDEWALK

No.	DATE MM.DD.YY	REVISIONS	BY
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SCALE 1:200

DLW FILE REFERENCE 21081601

DATE 01.11.22

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DESIGNER Y.R./A.R.

CHECKED BY R.N.

10 WATSON ROAD
WAREHOUSE FACILITY

GRADING PLAN

DWG NO. 21081601-C-300

CONTRACT NO. 00000000

SHEET NO. C300

Plotted By: YajnaRamphul
Layout-Sheet Name: C300
Plot File Date Created: Jun/01/2022 3:28 PM

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No.	DATE MM.DD.YY	REVISIONS	BY
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SCALE 1:200

RAE FILE REFERENCE 21081601

DATE 01.11.22

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DRAWN BY A.N./Y.R.

DESIGNER Y.R./A.R

CHECKED BY R.N.

10 WATSON ROAD WAREHOUSE FACILITY

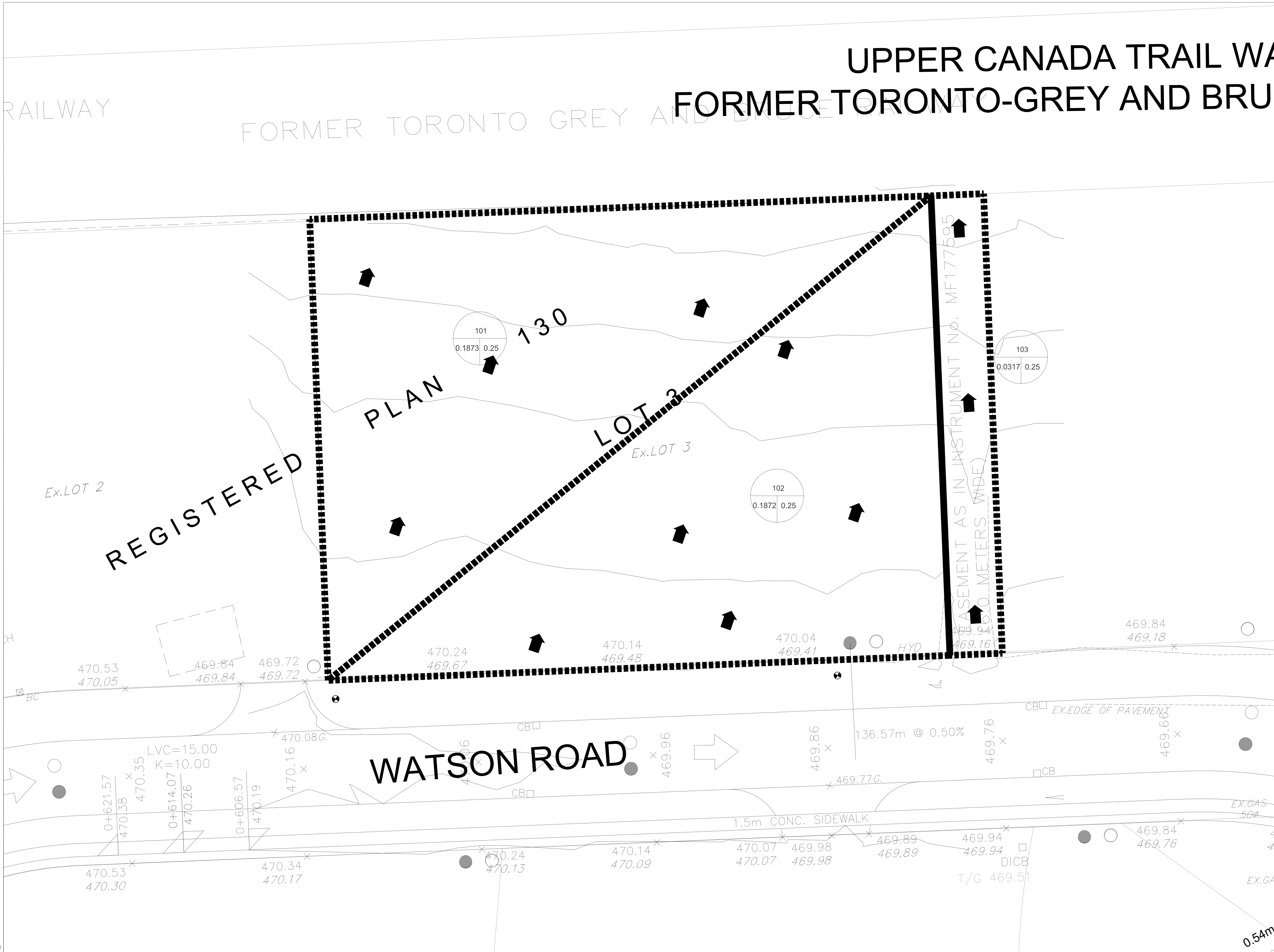
STORM DRAINAGE PLAN

DWG NO. 21081601-C-400

CONTRACT NO. 21081601

SHEET NO. C400

METRIC



KEYPLAN

LEGEND

- SITE BOUNDARY / PROPERTY LINE
- MAJOR OVERLAND FLOW ARROW
- CATCHMENTS AREA BOUNDARY
- DRAINAGE AREA ID
- RUNOFF COEFFICIENT
- DRAINAGE AREA (HA)

No.	DATE MM.DD.YY	REVISIONS	BY
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SCALE 1:200
RAE FILE REFERENCE 21081601
DATE 01.11.22

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10 WATSON ROAD WAREHOUSE FACILITY

PRE DEVELOPMENT DRAINAGE PLAN

DWG NO. 21081601-C-401
CONTRACT NO. 00000000
SHEET NO. C401

Plotted By: YajnaRamphul Layout-Sheet Name: C401 Plot File Date Created: Jun/01/2022 11:09 AM

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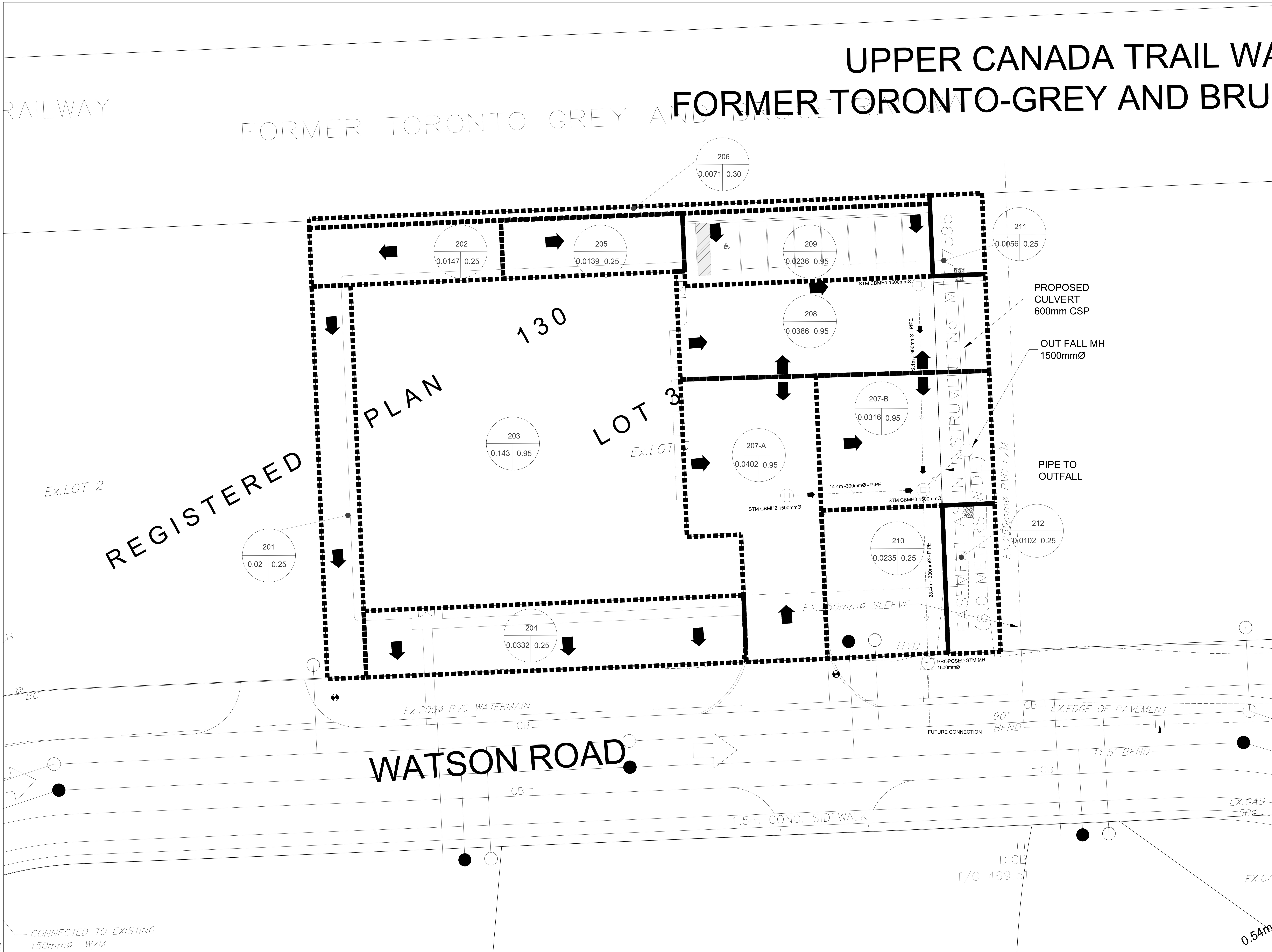
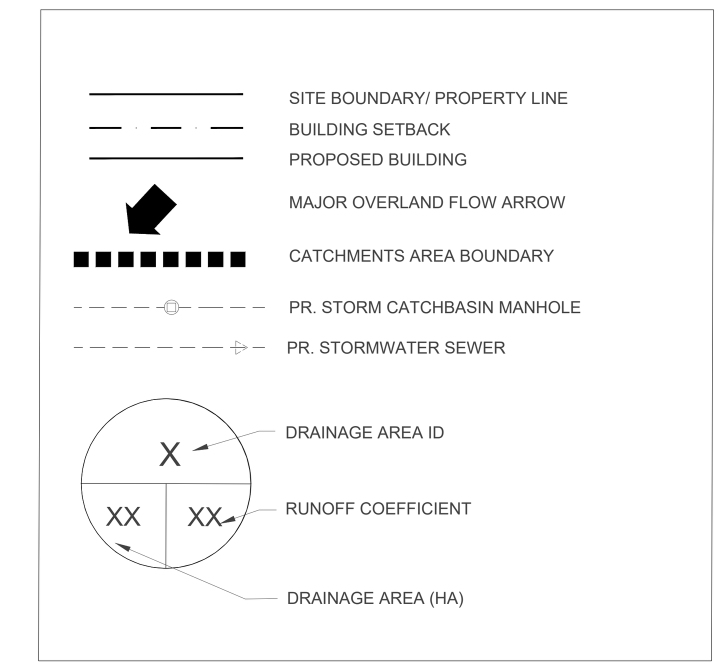


METRIC

KEYPLAN



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SCALE 1:200
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DESIGNER Y.R./A.R
CHECKED BY R.N.

10 WATSON ROAD WAREHOUSE FACILITY

POST DEVELOPMENT DRAINAGE PLAN

DWG NO. 21081601-C-402
CONTRACT NO. 00000000
SHEET NO. C402

No.	DATE MM.DD.YY	REVISIONS	BY
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SCALE 1:200
RAE FILE REFERENCE 21081601
DATE 01.11.22

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WAREHOUSE FACILITY FOR CEPE

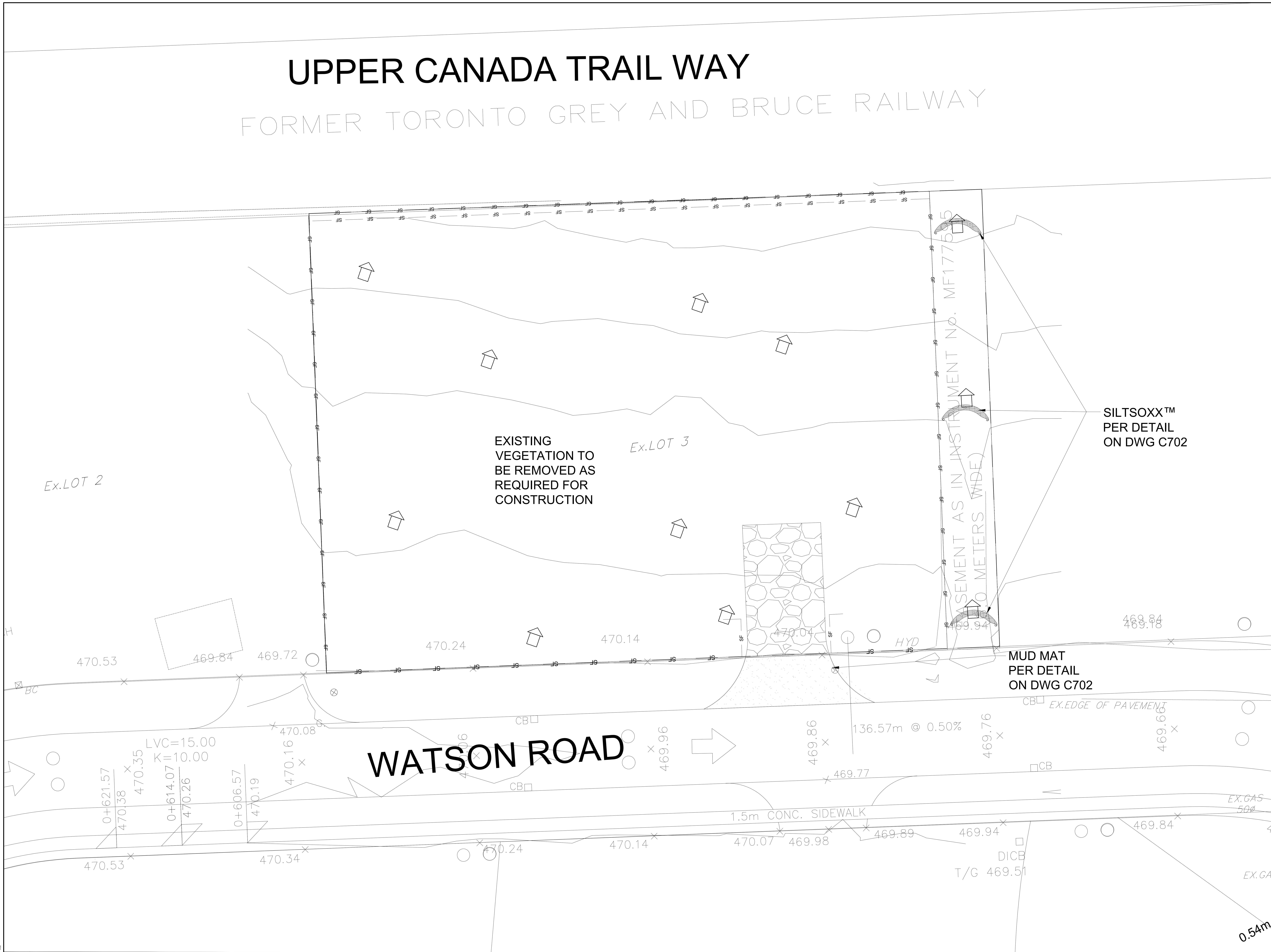
DRAWN BY A.N./Y.R.
DESIGNER Y.R./A.R.
CHECKED BY R.N.

10 WATSON ROAD
WAREHOUSE FACILITY

SANITARY DRAINAGE PLAN

DWG NO. 21081601-C-500
CONTRACT NO. 00000000
SHEET NO. C500

METRIC



KEYPLAN

LEGEND

SITE BOUNDARY/PROPERTY LINE	
SF — SF — SF	SINGLE LAYER HEAVY DUTY SILT FENCE
SF — SF — SF / SF — SF — SF	DOUBLE LAYER HEAVY DUTY SILT FENCE
	PR. MUD MAT DETAIL ON DWG C702
	PR. SILTSOXX™ DETAIL ON DWG C702
+250.50	EXISTING ELEVATION
	EXISTING OVERLAND FLOW DIRECTION

No.	DATE MM.DD.YY	REVISIONS	BY
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DLW FILE REFERENCE 21081601
DATE 01.11.22

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WAREHOUSE FACILITY FOR CEPE

DRAWN BY A.N.
DESIGNER A.N./Y.R.
CHECKED BY R.N.

10 WATSON ROAD WAREHOUSE FACILITY

EROSION AND SEDIMENTATION PLAN

DWG NO. 21081601-C-600
CONTRACT NO. 00000000
SHEET NO. C600

APPENDIX D

SANITARY DEMAND

&

SANITARY SEWER DESIGN CALCULATIONS

RA Engineering Inc.
18075 Leslie Street - Unit 210
Newmarket
ON L3Y 9A4
Phone:(905)235-9105

10 Watson Road Facility Approvals for CEPE International Sanitary Demand Calculations Sheet_VER0

Prepared By: Abi Rajagopal, M.A.Sc.
Checked By: Ragu Nathan, P.Eng.
Date: May 24, 2022

10 Watson Road - Sanitary Demand			References
(1)Total Gross Floor Area	0.144	ha	Site Plan - Prepared by RA Engineering Inc., Appendix A
(2)Total Drainage Area	0.057	ha	See: Sanitary Sewer Calculation Sheet

Light Industrial Water Design Flows

(a)Light Industrial	0.405	L/s/ha	Design Requirements for Drinking-Water Systems, MOE, 2008
(b)Infiltration/Inflow	0.200	L/s/ha	Engineering Standards, Town of Grand Valley, November 2013, Consolidated May 2016

Total Light Industrial Water Design Flows

Average Light Industrial Daily Flow	0.06	L/sec	(1) x (a)
Infiltration/Inflow	0.01	L/sec	(2) x (b)
Harmon Peak Factor, M	4.00		$M = 1 + \frac{14}{4 + sqrt(p)}$
Peak Daily Flow	0.24	L/sec	See: Sanitary Sewer Calculation Sheet
	21.13	m3/day	L/sec to m3/day

Table 1: Summary of Sanitary Demand Calculations

Building Area	Light Industrial Flow		Infiltration		Peak Factor	Total Peak Daily Flow (L/s)
(ha)	Unit Flow (L/s/ha)	Average Flow (L/s)	Unit Flow (L/s/ha)	Total Flow[1] (L/s)		
0.144	0.405	0.06	0.20	0.01	4.00	0.24

1 Total infiltration flow based on a cumulative drainage area of 0.057 ha.

RA Engineering Inc.
18075 Leslie Street - Unit 210
Newmarket
ON L3Y 9A4
Phone:(905)235-9105

10 Watson Road Facility Approvals for CEPE International. Sanitary Sewer Design Model Calculations Sheet_VER0

Prepared By: Abi Rajagopal, M.A.Sc.
Checked By: Ragu Nathan, P.Eng.
Date: May 24, 2022

Constants

Building Area:	0.144	ha	
Avg Flow:	0.405	L/s/ha	Design Requirements for Drinking-Water Systems,MECP,2008
Q infiltration:	0.2	L/s/ha	Engineering Standards, Town of Grand Valley
Manning's "n":	0.013	(Concrete/PVC pipe)	Engineering Standards, Town of Grand Valley

Location																									
Catchment Area	From	To	Length	Included Drainage Area	Cumulative Area	Population (1000s)	Harmon Peaking Factor	Average Flow	Maximum Flow	Infiltration	Total Infiltration	Total Flow	Pipe Diameter	Drop	Upper Inv. El.	Lower Inv. El.	Slope	Capacity	Percent Full	Velocity	Ground Upper	Ground Lower	Cover Upper	Cover Lower
	MH#	MH#	m	ha	ha		-	L/sec	L/sec	L/sec	L/sec	L/sec	mm	m	-	-	%	L/sec	%	m/s	-	-	-	-
501	Building	MH1	3.0	0.0060	0.0060	0.014	4.00	0.06	0.23	0.0012	0.0012	0.2345	200	0.03	467.44	467.41	1.0	32.80	0.7	1.04	470.10	469.61	2.46	2.00
502	MH1	MH2	47.2	0.0383	0.0443	0.014	4.00	0.06	0.23	0.0077	0.0089	0.2421	200	0.24	467.31	467.07	0.5	23.39	1.0	0.74	469.61	469.83	2.10	2.56
Interim																								
503	MH2	MH3	10.2	0.0122	0.0565	0.014	4.00	0.06	0.23	0.0024	0.0113	0.2446	200	0.05	466.97	466.92	0.5	22.96	1.1	0.73	469.83	469.95	2.66	2.83
	MH3	Septic	7.1			0.014	4.00	0.06	0.23	0.0024	0.0113	0.2446	200	0.03	466.82	466.79	0.5	23.03	1.1	0.73	469.95	469.90	2.93	2.91
Ultimate																								
503	MH2	Proposed SAN MH4 for future connection	1.1	0.0443	0.0443	0.014	4.00	0.06	0.23	0.0089	0.0089	0.2421	200	0.02	466.89	466.87	1.8	44.23	0.5	1.41	469.90	469.87	2.81	2.80

APPENDIX E

WATER DEMAND CALCULATIONS

RA Engineering Inc.
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ON L3Y 9A4
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10 Watson Road Facility Approvals for CEPE International. Water Demand Usage Calculations Sheet_VER0

Prepared By: Abi Rajagopal, M.A.Sc.
Checked By: Ragu Nathan, P.Eng.
Date: May 24, 2022

10 Watson Road - Average Water Demand (Based on Usage)

			References
Domestic Water Demand			
(1) Warehouse Workers	6	Daily (8 hr shift)	Site Plan - Prepared by RA Engineering Inc., Appendix A
(2) Office staff	2	Daily (8 hr shift)	Site Plan - Prepared by RA Engineering Inc., Appendix A
(3) Visitors	2	Daily (8 hr shift)	Historical data of the subject business
Domestic Water Design Flows			
(a) Warehouse (excl. process water) without show	75.00	L/Day	Ontario Building Code Table 8.2.1.3.B - Other Occupancies
(b) Office Staff	75.00	L/Day	Ontario Building Code Table 8.2.1.3.B - Other Occupancies
(c) Visitors	75.00	L/Day	Assumed as Office Staff consumption rates
Average Day Demand			
(i)Average Day Demand - Warehouse Workers	0.45	m^3/day	(1) x (a)
(ii)Average Day Demand - Office Staff	0.15	m^3/day	(2) x (b)
(iii)Average Day Demand - Visitors	0.15	m^3/day	(3) x (c)
Total Average Day Demand	**0.75**	**m^3/day**	**Daily Average (8 hour shift)**
	0.03	L/sec	Conversion
Max Day Peak Factor	2.75		Design Guidelines for Drinking-Water Systems, MOE, 2008
Max Day Demand Flow	0.07	L/sec	
Max Day Demand Volume	2.06	m^3/day	L/sec to m^3/day (8 hour shift)
Peak Hour Factor	4.13		Design Guidelines for Drinking-Water Systems, MOE, 2008
Peak Hourly Flow	0.11	L/sec	

Table 2: Summary of Water Demand Calculations

Building Area (ha)	Average Day		Maximum Day			Peak Hour	
	Flow (L/s)	Volume (m^3/day)	Peak Factor	Flow (L/s)	Volume (m^3/day)	Peak Factor	Flow (L/s)
0.14	0.03	0.75	2.75	0.07	2.06	4.13	0.11

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10 Watson Road Facility Approvals for CEPE International Fire Protection Volume Calculations Sheet_VER0

Prepared By: Abi Rajagopal, M.A.Sc.
Checked By: Ragu Nathan, P.Eng.
Date: May 24, 2022

Based on Fire Underwriters Survey: Part II - Guide for Determination of Required Fire Flow

1 F = 220*C*sqrt(A)

Where F = Fire flow in litres per minute (L/min)
C = construction type coefficient
0.8 = ordinary construction
A = total floor area in square metres (m2), excluding basements

Floor	Area (m2)	%
1	1,440	100%

Floor Area = 1,440 m2
F = 6,678 L/min

Fire flow determined shall not exceed:
30,000 L/min for wood frame construction
30,000 L/min for ordinary construction
25,000 L/min for non-combustible construction
25,000 L/min for fire-resistive construction

2 Occupancy Reduction

0% reduction for low fire hazard occupancy for dwellings
Reduction = 0 L/min
F = 6,678 L/min
Note: Flow determined shall not be less than 2,000 L/min

Occupancy values:

-25%	Non-combustible
-15%	Limited combustible
0%	Combustible
15%	Free burning
25%	Rapidly burning

3 Sprinkler Reduction

The value from 2 above may be reduced by up to 50% for complete automatic sprinkler protection.
30% reduction for automatic sprinklers (typical 30% reduction)
Reduction = 2,003 L/min

4 Separation Charge

0%	Front	45m +
0%	Back	45m +
0%	Left	45m +
0%	Right	45m +
0%	Total Separation Charge	

Note: Maximum Total Separation Charge is 75%

Separation Charge values:

25%	0 to 3m
20%	3.1 to 10m
15%	10.1 to 20m
10%	20.1 to 30m
5%	30.1 to 45m
0%	45m +

Required Fire Flow

1	6,678					
2	0	reduction				
3	2,003	reduction				
4	0	surcharge				
Total	4,674	L/min				
Round to nearest 1000 L/min	5,000	L/min	83.3	L/sec	1,321	US GPM
	9540	L/min	159.0	L/sec	Grand Valley Master Servicing Plan (MSP) Update,RJ Burnside,May 30,2014	

Required Fire Storage Volume

Flow from above	9,540	L/min			
Required duration	3	hours	3	hrs	Grand Valley Master Servicing Plan (MSP) Update,RJ Burnside,May 30,2014
Therefore	1,717,200	Litres	1,717	m3	

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ON L3Y 9A4
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10 Watson Road Facility Approvals for CEPE International OBC Fire Water Supply Calculations Sheet_VER0

Prepared By: Abi Rajagopal, M.A.Sc.
Checked By: Ragu Nathan, P.Eng.
Date: May 24, 2022

Based on 2012 Building Code Compendium, Appendix A, Volume 2, p.31-35

Water Supply for Firefighting Purposes

Q minimum supply of water (L)
K water supply coefficient from Table 1
V total building volume (m^3)
S_{tot} total spatial coefficient values from property line exposures on all sides as obtained from:

$$S_{tot} = 1.0 + [S_{side1} + S_{side2} + S_{side3} + \cdots etc.]$$

Note: S_{side} values are established from Figure 1 and S_{tot} may not exceed 2.0.

Parameters

Q	TBD	L
K	10	
V	10969.4	m3
S_{tot}	1.25	

Notes

Using the smallest possible "K" value, the minimum water supply is still much above 270,000 L. Increasing the "K" value only increases the water supply more. Regardless of "K", the flow rate is capped at 150 L/sec.

Building Area	1439.56	m2	
Building Height	7.62	m	Assume 25 ft building height
	25	ft	

Exposure Distance from Property Line

S_{side1}	0.25	Side 1	7.5	m	Front Yard	7.5
S_{side2}	0	Side 2	>10	m	Left Side	11.7
S_{side3}	0	Side 3	>10	m	Right Side	11.5,17,24
S_{side4}	0	Side 4	>10	m	Rear Yard	14.3
S_{side5}	0	Side 5	>10	m		
S_{side6}	0	Side 6	>10	m		
S_{side7}	0	Side 7	>10	m		
S_{side8}	0	Side 8	>10	m		
S_{side9}	0	Side 9	>10	m		
S_{side10}	0	Side 10	>10	m		

Calculate Q

$$Q = K * V * S_{tot}$$

Note: According to the 2012 Building Code Compendium, Appendix A, Section 6.3 (b), the required flow rate should be supplied at a minimum pressure of 140 kPa.

Q	137118.09	L
	137.12	m3

Minimum Water Supply Flow Rate, Based on Q

Q	137118.09	L		
Flow Rate	4500	L/min	75	L/sec

Based on the OBC Compendium

Duration of Fire Flow

From Fire Underwriters Survey Table		
Flow Rate	4,500	L/min
Duration	1.6	hours

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Phone:(905)235-9105

10 Watson Road Facility Approvals for CEPE International
Hydraulic Modelling
Calculations Sheet_VER0

Prepared By: Abi Rajagopal, M.A.Sc.
Checked By: Ragu Nathan, P.Eng.
Revision Date: May 24, 2022

Hazen-Williams Formula for Losses Due to Pipe Friction

$$h_f = 10.7\left(\frac{Q}{C}\right)^{1.852}\left(\frac{L}{d^{4.87}}\right)$$

$$\Delta P = h_f * weight\ of\ water$$

$$\Delta P = h_f * \rho * g$$

Where,

h_f	head loss due to friction (m)
Q	Flow Rate (m3/s)
C	Hazen-Williams Coefficient
d	Pipe Diameter (m)
L	Pipe Length (m)

Proposed hydrant on ROW

Q	0.159	m3/s
C	150	
d	0.15	m
L	14.15	m

h_f	4.82	m

ρ	998	kg/m3
g	9.81	m/s2

ΔP	47232.59	Pa
	47.23	kPa

P_1	485.00	kPa	Maximum existing water pressure:Grand Valley Master Servicing Plan (MSP) Update, RJ Burnside, May 30, 2014
P_2	437.77	kPa	

APPENDIX F

PRE/POST RELEASE RATES

&

STORM SEWER DESIGN CALCULATIONS

RA Engineering Inc.
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10 Watson Road Facility Approvals for CEPE International Pre Post-Development Release Rates Calculations Sheet_VER0

Prepared By: Abi Rajagopal
Reviewed By: Ragu Nathan
Date: May 22, 2024

T_c	10	minutes	$I=(A*(T_c/60)^B)$
Summary of Design Storm: Fergus Shand Dam			
Return Period	**IDF Equation Constants**		**Peak Intensity, mm/hr**
	A	**B**	**I**
2-yr	22.7	-0.702	79.85
5-yr	31.3	-0.698	109.32
10-yr	37.0	-0.697	129.00
25-yr	44.1	-0.695	153.20
50-yr	49.4	-0.694	171.30
100-yr	54.7	-0.694	189.68

Pre - development Condition

Catchment ID	Land Use	Area (ha)	Runoff Coefficient as per Town's Standard (RC)	Time of Concentration as per Town's Standard (min)
Existing (101)	Grass	0.1873	0.25	10
Existing (102)	Grass	0.1872	0.25	10
Existing (103)	Grass	0.0326	0.25	10
Total Area		**0.4071**		

Post - development Condition

Catchment ID	Land Use	Area (ha)	Coefficient as per Town's Standard (RC)	Time of Concentration (min)
201	Grass	0.0200	0.25	10
202	Grass	0.0147	0.25	10
203	Roof	0.1439	0.95	10
204	Grass	0.0332	0.25	10
205	Grass	0.0139	0.25	10
206	Gabion Wall	0.0071	0.30	10
207-A & 207-B	Asphalt	0.0718	0.95	10
208	Asphalt	0.0386	0.95	10
209	Asphalt	0.0236	0.95	10
210	Grass	0.0235	0.25	10
211	Grass	0.0056	0.25	10
212	Grass	0.0112	0.25	10
Total Area		**0.4071**		

Adjusted Runoff Coefficient (C_{adj}) = Adjustment Factor * Runoff Coefficient(RC) ;

Adjusted Runoff Coefficient (C_{adj}) for all return period for all areas for pre & post- development

		Pre-Development		Post-Development							
Area (Land Use)		**Existing (Grass)**		**201,202, 204,205, 210, 211, 212 (Grass)**		**203(Roof)**		**207-A & 207-B, 208, 209 (Asphalt)**		**206 (Gabion Wall)**	
Return Period	**Adjustment Factor**	**Runoff Coefficient (RC)**	**Adjusted Runoff Coefficient (C_{adj})**	**Runoff Coefficient(RC)**	**Adjusted Runoff Coefficient (C_{adj})**	**Runoff Coefficient(RC)**	**Adjusted Runoff Coefficient (C_{adj})**	**Runoff Coefficient(RC)**	**Adjusted Runoff Coefficient (C_{adj})**	**Runoff Coefficient (RC)**	**Adjusted Runoff Coefficient (C_{adj})**
2-yr	1	0.25	0.25	0.25	0.25	0.95	0.95	0.95	0.95	0.30	0.30
5-yr	1	0.25	0.25	0.25	0.25	0.95	0.95	0.95	0.95	0.30	0.30
10-yr	1	0.25	0.25	0.25	0.25	0.95	0.95	0.95	0.95	0.30	0.30
25-yr	1.1	0.25	0.28	0.25	0.28	0.95	0.95	0.95	0.95	0.30	0.33
50-yr	1.2	0.25	0.30	0.25	0.30	0.95	0.95	0.95	0.95	0.30	0.36
100-yr	1.25	0.25	0.31	0.25	0.31	0.95	0.95	0.95	0.95	0.30	0.38

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10 Watson Road Facility Approvals for CEPE International
Pre Post-Development Release Rates Calculations Sheet_VER0

$Q=2.778*C_{adj}*I*Area$

Pre & Post - Development Release Rates

	Catchment ID	Target Flow Rates (L/s)						Outlet locations
		2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
Pre-Development Flow	Existing (101,102, 103)	22.58	30.91	36.47	47.65	58.12	67.04	Existing ditch at the east side of the property & Grand River at the north side of the property
Post-Development Flow	210, 211, 212 (Grass)	2.23	3.06	3.61	4.72	5.75	6.64	Existing ditch at the east side of the property
	201,202,204 (Grass)	3.77	5.16	6.08	7.95	9.69	11.18	Expected to infiltrate into the grass
	205(Grass)	0.77	1.06	1.25	1.63	1.98	2.29	Via catch basins to the out fall MH (to be built) via proposed culvert at the existing ditch at the east side of the property
	203(Roof)	30.33	41.52	48.99	58.18	65.05	72.03	Via catch basins to the out fall MH (to be built) via proposed culvert at the existing ditch at the east side of the property
	207-A & 207-B, 208, 209 (Asphalt)	28.24	38.66	45.62	54.18	60.58	67.08	Via catch basins to the out fall MH (to be built) via proposed culvert at the existing ditch at the east side of the property
	206 (Gabion Wall)	0.47	0.65	0.76	1.00	1.22	1.40	Via catch basins to the out fall MH (to be built) via proposed culvert at the existing ditch at the east side of the property

Design Chart 1.07: Runoff Coefficients

- Urban for 5 to 10-Year Storms

Land Use	Runoff Coefficient	
	Min.	Max.
Pavement - asphalt or concrete	0.80	0.95
- brick	0.70	0.85
Gravel roads and shoulders	0.40	0.60
Roofs	0.70	0.95
Business - downtown	0.70	0.95
- neighbourhood	0.50	0.70
- light	0.50	0.80
- heavy	0.60	0.90
Residential - single family urban	0.30	0.50
- multiple, detached	0.40	0.60
- multiple, attached	0.60	0.75
- suburban	0.25	0.40
Industrial - light	0.50	0.80
- heavy	0.60	0.90
Apartments	0.50	0.70
Parks, cemeteries	0.10	0.25
Playgrounds (unpaved)	0.20	0.35
Railroad yards	0.20	0.35
Unimproved areas	0.10	0.30
Lawns - Sandy soil		
- flat, to 2%	0.05	0.10
- average, 2 to 7%	0.10	0.15
- steep, over 7%	0.15	0.20
- Clayey soil		
- flat, to 2%	0.13	0.17
- average, 2 to 7%	0.18	0.22
- steep, over 7%	0.25	0.35

For flat or permeable surfaces, use the lower values. For steeper or more impervious surfaces, use the higher values. For return period of more than 10 years, increase above values as 25-year - add 10%, 50-year - add 20%, 100-year - add 25%.

The coefficients listed above are for unfrozen ground.

Design Chart 1.07: Runoff Coefficients (Continued)

- Rural

Land Use & Topography[3]	Soil Texture		
	Open Sand Loam	Loam or Silt Loam	Clay Loam or Clay
CULTIVATED			
Flat 0 - 5% Slopes	0.22	0.35	0.55
Rolling 5 - 10% Slopes	0.30	0.45	0.60
Hilly 10- 30% Slopes	0.40	0.65	0.70
PASTURE			
Flat 0 - 5% Slopes	0.10	0.28	0.40
Rolling 5 - 10% Slopes	0.15	0.35	0.45
Hilly 10- 30% Slopes	0.22	0.40	0.55
WOODLAND OR CUTOVER			
Flat 0 - 5% Slopes	0.08	0.25	0.35
Rolling 5 - 10% Slopes	0.12	0.30	0.42
Hilly 10- 30% Slopes	0.18	0.35	0.52
BARE ROCK	COVERAGE[3]		
	30%	50%	70%
Flat 0 - 5% Slopes	0.40	0.55	0.75
Rolling 5 - 10% Slopes	0.50	0.65	0.80
Hilly 10- 30% Slopes	0.55	0.70	0.85
LAKES AND WETLANDS	0.05		

2 Terrain Slopes

3 Interpolate for other values of % imperviousness

Sources: American Society of Civil Engineers - ASCE (1960)
U.S. Department of Agriculture (1972)

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10 Watson Road Facility Approvals for CEPE International
Post Flow Rate via Culvert Calculations Sheet_VER0

Prepared By: Abi Rajagopal
Reviewed By: Ragu Nathan
Date: May 22, 2024

Summary of Design Storm			
T_c	10	minutes	$I=(A*(T_c/60)^B)$
	IDF Equation Constants		Peak Intensity, mm/hr
Return Period	A	B	I=(A*(Tc/60)^B)
2-yr	22.7	-0.702	79.85
5-yr	31.3	-0.698	109.32
10-yr	37.0	-0.697	129.00
25-yr	44.1	-0.695	153.20
50-yr	49.4	-0.694	171.30
100-yr	54.7	-0.694	189.68

Weighted Runoff Coefficient =[(Area1*Runoff Coefficient for Area1 + Area2*Runoff Coefficient for Area2…..) / (Area 1+Area2+…...)]

Estimated weighted run-off coefficient (RC) for post-development				
Land Use	Area (ha)	Runoff Coefficient (C)	Weighted Runoff Coefficient(C_{ave})	Time of Concentration (min)
203	0.1439	0.95	0.83	10
205	0.0139	0.25		
206	0.0071	0.30		
207	0.0718	0.95		
208	0.0386	0.95		
209	0.0236	0.95		
210	0.0235	0.25		
212	0.0112	0.25		
Total Area	0.3336			

Adjusted Runoff Coefficient (C_{adj}) = Adjustment Factor * Weighted Runoff Coefficient(C_{ave})

Adjusted runoff coefficient for all return period for Combined Land use			
Area (Land Use)		Combined Roadway & Landscape	
Return Period	Adjustment Factor	Weighted Runoff Coefficient (C_{ave})	Adjusted Runoff Coefficient (C_{adj})*
2-yr	1	0.83	0.83
5-yr	1	0.83	0.83
10-yr	1	0.83	0.83
25-yr	1.1	0.83	0.92
50-yr	1.2	0.83	0.95
100-yr	1.25	0.83	0.95

*Max C_{adj} of 0.95

$Q=2.778*C_{adj}*I*Area/1000$; Where C_{ave} is weighted RC for up to 1:10 year design, for $C_{25}=1.10*C_{ave}$; $C_{50}=1.20*C_{ave}$; $C_{100}=1.25*C_{ave}$

Post- Development Release Rates to Outfall MH at the Culvert						
Land Use	Peak Flow,Q (m^3/s)					
	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Roof,Roadway & Grass	61.73	84.51	99.72	130.28	150.82	167.00

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10 Watson Road Facility Approvals for CEPE International Catchbasin Ponding Calculations Sheet_VER0

Prepared By: Abi Rajagopal
Reviewed By: Ragu Nathan
Date: May 22, 2024

CATCH BASIN CALCULATIONS

Objective:
Verify that the 100 year storm ponding on the site will not exceed 0.3 m

1) Data
MTO Drainage Management Manual, Design Chart 4.20
Proposed grating : OPSD 403.010, OPSD 400.010
Assumptions: The depth of ponding at each catchbasin manhole (CBMH) is calculated similarly to the depth at the ditch inlets using Design Chart 4.20

2) Calculations
Givens for 100 year Storm Event in the Town of Grand Valley   Blockage %   10%
Data from Storm Sewer Design Sheet
2.1) Flow calculations for Stormwater Drainage Plan (Dwg. 19112501-C-003) Catchment Areas (100 year storm event)

	Catchment Area	Total Flow (L/s)	Required Inlet Capacity (m3/s)	Capacity Reduction Due to Blockage (m3/s)	CBMH Width (m) OPSD 403.010	Required Capacity per m Width (m3/s)	Grate Slope	Depth of Flow (m) MTO Design Chart 4.20
CBMH1	205+209+208+33% of 203	32.67	0.033	0.036	0.820	0.044	1 : 1	0.04
CBMH2	207-A+67% of 203	39.31	0.039	0.044	0.820	0.053	3 : 1	0.06
CBMH3	207-B	9.13	0.009	0.010	0.820	0.012	1 : 1	0.00

Note: No ponding will occur at manholes without a grate, so those have been omitted from the ponding depth calculation. All points of ponding on the proposed site are included.

2.2) Depth of Flow (Ponding)
The depth of flow (ponding) has been determined using Design Chart 4.20 in the MTO Drainage Manual. It is included in the table above.

3) Conclusion
The depth of ponding at each catch basin does not exceed 0.3 m

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10 Watson Road Facility Approvals for CEPE International
Storm Sewer Design Sheet
Calculations Sheet_VER0

Prepared By: Abi Rajagopal, M.A.Sc.
Checked By: Ragu Nathan, P.Eng.
Date: May 24, 2022

Intensity Duration Frequency Curve 5 Years
Coef. A = 31.300
Coef. B = -0.699

Time of Concentration 10.00 min Per Town of Grand Valley standards
Mannings "n" 0.013 (Concrete/PVC pipe)

Catchment Area	From	To	Area (A)	Run-off Coeff.	A x C	Cumul. A x C	Time of Conc.	Rainfall Intensity (I)	Q (Run-off)	Slope	Pipe Diameter	Velocity	Length	Time of Flow	Capacity	Percent Full	Pipe Inv. Elev.		Pipe Obv. Elev.		Ground Elev.		Cover	
	MH #	**MH #**	**ha**	**C_5**			**min**	**mm/hr**	**L/sec**	**%**	**mm**	**m/sec**	**m**	**min**	**L/sec**		**Upper End**	**Lower End**	**Upper End**	**Lower End**	**Upper End**	**Lower End**	**Upper End**	**Lower End**
205+209+208+33% of 203	STM CBMH1	STM CBMH3	0.12	0.87	0.11	0.11	10.00	109.51	32.67	1.0	300	1.34	22.1	0.27	94.71	34.50	468.52	468.31	468.82	468.61	469.44	469.36	0.62	0.75
207-A+67% of 203	STM CBMH2	STM CBMH3	0.14	0.95	0.13	0.13	10.00	109.51	39.31	0.8	300	1.22	14.1	0.19	86.18	45.61	468.45	468.34	468.75	468.64	469.67	469.36	0.92	0.72
207-B		STM CBMH3	0.03	0.95	0.03	0.03	10.00	109.51	9.13															
Interim																								
205+209+208+ 203+ 207-A+207-B	STM CBMH3	STM OUTFALL MH							81.12	1.00	300	1.37	5.8	0.07066	96.70	83.88	468.26	468.20	468.56	468.50	469.36	468.10	0.802	0.00
Ultimate																								
	STM CBMH3	Proposed STM MH for future connection							81.12	1.75	300	1.81	26.4	0.24287	128.06	63.34	468.26	467.80	468.56	468.10	469.36	468.10	0.797	0.00

Note: Catchement area 203 has 0.143 ha of roof area. This has been divided evenly into catchment areas 207 & 208 since that is where the roof drains. This will ensure that the 0.143 ha of the roof area is accounted for.
Note: Weighted runoff coefficients are used for catchment area 203,205,209 and 208

APPENDIX G

E-MAIL CORRESPONDENCE WITH GRCA

Abi Rajagopal

From:	Laura Warner <lwarner@grandriver.ca>
Sent:	February 9, 2022 1:50 PM
To:	Abi Rajagopal
Cc:	Ragu Nathan
Subject:	RE: Required technical reports/plans for permit application for Property at 10 Watson Road (Formally known as Industrial Drive) Lot 3- in Town of Grand Valley
Attachments:	10 Watson Road_GRCA Mapping.pdf

Hi Abi,

The GRCA only regulates the back portion of the property, but it appears the proposed development will fall partially within this area triggering the need for a GRCA permit. The subject property contains the regulated allowance to a slope valley hazard which is located on the other side of Watson Road. Since this hazard is not located on the property, only a detailed site plan will be required as part of your permit application.

You can apply for the GRCA permit online at the following link: https://apps.grandriver.ca/Permits

Kind regards,

Laura Warner
Resource Planner
Grand River Conservation Authority

400 Clyde Road, PO Box 729
Cambridge, ON N1R 5W6
Office: 519-621-2763 ext. 2231
Toll-free: 1-866-900-4722
Email: lwarner@grandriver.ca
www.grandriver.ca | Connect with us on social media

From: Abi Rajagopal <abir@raengineer.com>
Sent: Monday, February 7, 2022 11:21 AM
To: Laura Warner <lwarner@grandriver.ca>
Cc: Ragu Nathan <ragun@raengineer.com>
Subject: RE: Required technical reports/plans for permit application for Property at 10 Watson Road (Formally known as Industrial Drive) Lot 3- in Town of Grand Valley

Hi Laura,

Thanks for your immediate response in this regard. It’s greatly appreciated!

As per your request, please find the draft version of preliminary site plan as an attachment for 10 Watson Road.

Thanks

Abi

Abi Rajagopal,M.A.Sc. (Eng)

Vice President
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RAE has moved. Please note our new address above.

Market Focus: Land Development (Design-Build) | Transit & Transportation | Process Plants (Design-Build) | Automation (Design-Build) | Water & Wastewater (Design-Build) | Tunnelling | Pipe Rehabilitation | Utility | Environment | Renewable Energy (Design-Build)

Our Core Values: Solution Focus | Collaboration | Continuous Improvement | Environmental Care | Ethics & Regulatory Compliance | Leader in Engineering & Technology.

From: Laura Warner <lwarner@grandriver.ca>
Sent: February 7, 2022 11:04 AM
To: Abi Rajagopal <abir@raengineer.com>
Cc: Ragu Nathan <ragun@raengineer.com>
Subject: RE: Required technical reports/plans for permit application for Property at 10 Watson Road (Formally known as Industrial Drive) Lot 3- in Town of Grand Valley

Hi Abi,

Do you have a concept drawing of the development proposed for the site?

Thanks,
Laura

Laura Warner | Resource Planner
Grand River Conservation Authority
400 Clyde Road, Cambridge ON N1R 5W6
P: (519) 621-2763 x 2231 | F: (519) 621-4844
lwarner@grandriver.ca | www.grandriver.ca

From: Abi Rajagopal <abir@raengineer.com>
Sent: Monday, February 7, 2022 9:56 AM
To: Laura Warner <lwarner@grandriver.ca>
Cc: Ragu Nathan <ragun@raengineer.com>

Subject: Required technical reports/plans for permit application for Property at 10 Watson Road (Formally known as Industrial Drive) Lot 3- in Town of Grand Valley

Good morning Laura,

We, RA Engineering Inc. has been retained by the owner of the subject property as consultant for the development of this site. As per GRCA Permit Application Checklist, it is mentioned that we need to contact Resource Planner for the needs of the technical reports/plans to be included with the permit application. Could you please let me know the required reports for the permit application for this site? If you need any other information regarding the site, please let me know.

Thanks, and you have a great day.

Abi

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