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Project Number 1981-001-23

## Functional Servicing Report

### Regarding:

Proposed Condominium Development  
152 Miller Drive  
Barrie, Ontario

### Prepared on behalf of:

Alliance Homes Ltd.

### By:

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## 1. Introduction

Gerrits Engineering Ltd. (GEL) has been retained by Alliance Homes Ltd. (Client) to provide engineering services for a proposed residential condominium development located in Barrie, Ontario. Included in the engineering services is the completion of this Functional Servicing Report (FSR), which is a requirement for draft plan of condominium approval. The FSR will assess the existing municipal infrastructure adjacent to the site and determine the servicing requirements with respect to water supply, sanitary sewage, and stormwater management.

### 1.1. Supporting & Reference Documents

The following documents have been referenced in the preparation of this report:

- Ministry of the Environment, Guidelines for the Design of Sanitary Sewage Works and Water Works – 2008
- Ministry of the Environment, Stormwater Management Planning and Design Manual, March 2003
- Ministry of the Environment, Design Guidelines for Drinking-Water Systems, 2008
- Water Transmission and Distribution Policies and Design Guidelines, City of Barrie, December 2021
- Sanitary Sewage Collection System Policies and Design Guidelines, City of Barrie, October 2017
- Storm Drainage & Stormwater Management Policies & Design Guidelines, City of Barrie, February 2022
- Lot Grading and Drainage Standards and Design Manual, City of Barrie, 2019
- NVCA Stormwater Technical Guide, Nottawasaga Valley Conservation Authority, December 2013
- Ontario Building Code 2012 (O.B.C.)



## 1.2. Subject Property

The subject site is approximately 1.44 ha in area, generally rectangular in shape and legally described as Part of Lot 23, Concession 8 in the City of Barrie in the County of Simcoe. The site was previously developed with a single-family home and an associated driveway with access to the property from Miller Drive. Most of the site area is undeveloped in the existing conditions and consists of a forested area, which has a mix of deciduous and coniferous trees, a large area of lawn/pasture lands and a small area of wetland and impervious area (dwelling/driveway).

An image of the subject site is included below:



Figure 1 - Subject Property (Red)



### 1.3. Proposed Land Use

The proposed site is a residential condominium development that will consist of the construction of 4 streets located within common elements and 10 townhome blocks totaling 54 units. Also considered within this functional servicing report is the proposed development of 4 single family detached homes fronting Miller Drive located within the subject site that are not to be developed as part of the plan of condominium.

## 2. Servicing

### 2.1. Overview

Miller Drive is presently developed as a semi-urban municipal road with no curbs, overhead hydro, roadside ditches and culverts, municipally owned watermain. Miller Drive is proposed to be redeveloped and will include the construction of a new municipally owned sanitary sewer. Off-site works and alterations to the Miller Drive Road allowance are required to service the development.

### 2.2. Design Criteria

As defined by the City of Barrie, a summary of the water and wastewater design criteria is as follows:

#### Serviced Population

- Density (Cluster and/or block townhouses) = 2.34 ppu
- Density (Single Family Detached) = 3.13 ppu
- Development Population = 139 pers

#### Wastewater Criteria

- Average Day Flow (ADF) Residential (New Development) = 225 L/c/d
- Extraneous flows (peak per developable ha) = 0.1 L/s/ha
- Peak Factor (residential) = Harmon

$$M = 1 + \frac{14}{4+p^{0.5}} = 4.2 > 4.0 \text{ (Maximum), therefore } M=4 \text{ (Harmon)}$$

#### Water Criteria

- Average Day Demand (ADD) Residential = 225 L/c/d
- Max Day Factor (MDD) – Table 3.3 MOECC, 2008 = 4.98
- Peak Hour factor (PH) – Table 3.3 MOECC, 2008 = 7.90
- Minimum pressure in system at MDD = 275 kPa
- Maximum pressure in system at MDD = 550 kPa
- Minimum pressure in system at Peak Hour demand = 275 kPa
- Minimum pressure in system at Fire + MDD = 140 kPa



### 3. Sanitary Servicing

The projected daily average and peak sewage flows from the subject property are summarized in the table below.

**Table 1 – Design Wastewater Flows**

|                               |       |                   |
|-------------------------------|-------|-------------------|
| Average Daily Demand (Design) | 31.1  | m <sup>3</sup> /d |
|                               | 0.36  | L/s               |
| Peak Hour Flow (Design)       | 258.3 | m <sup>3</sup> /d |
|                               | 2.99  | L/s               |

#### 3.1. Proposed Sanitary Sewers

Sanitary service to the subject site will be provided through the proposed re-development of Miller Drive. It is proposed to install a new 250mm PVC municipal sanitary sewer along Miller Drive from Ruffet Drive west approximately 225m that will drain by gravity. The sanitary system is proposed to be installed at standard Municipal depths and located as per the Municipal Standard Right-of-Way details. Design information provided by the City included the tributary areas for the sanitary sewer design, prepared by RG Robinson and attached in Appendix A. The information provided indicates that the proposed infrastructure development along Miller Drive will capture 57 existing residential dwellings in addition to the flows from the dwellings within the proposed condominium development. A detailed review of the proposed sewers indicates that there is sufficient capacity available for the flows tributary from the proposed and existing developments. Calculations are provided in Appendix A.

The internal collection system for the development is proposed to consist of a 100mm PVC E/One low pressure sanitary force main system with each unit having E/One pump stations either internally or externally of their structures. The on-site low-pressure system is proposed to lessen the depth of the sewer along Miller Drive. Implementing the forcemain system within the development site will reduce the depth required (5-6m) of sanitary manholes and sewers along Miller Drive, which would require extensive dewatering and potential long-term maintenance concerns for the municipally owned infrastructure.

### 4. Water Supply and Distribution

#### 4.1. Existing Water System Analysis

There are planned future upgrades to the municipal watermain along Miller Drive, that are to be completed as part of the City of Barrie Capital Projects. The municipal watermain along Miller Drive will be upgraded from an existing 150mm PVC watermain to a new 300mm PVC watermain. In the existing condition, a fire flow of approximately 85 L/s can be achieved for the development site. When the watermain along Miller Drive is upgraded, a fire flow of approximately 150 L/s is anticipated to be achievable for the development site. The existing water servicing for this Development has been considered from an internal perspective. An analysis of the onsite demands has been completed, as per the City of Barrie and the MOE guidelines and includes the design criteria previously discussed. The projected daily average, maximum day, and peak hourly flows from the subject property are summarized in the table below:

**Table 2 – Design Water Flows**

|                               |       |                   |
|-------------------------------|-------|-------------------|
| Average Daily Demand (Design) | 31.1  | m <sup>3</sup> /d |
|                               | 0.36  | L/s               |
| Maximum Day Demand (Design)   | 154.7 | m <sup>3</sup> /d |
|                               | 1.79  | L/s               |
| Peak Hour Flow (Design)       | 245.4 | m <sup>3</sup> /d |
|                               | 2.84  | L/s               |



#### 4.2. Internal Water Distribution System

It is proposed to service the development site with a 150mm water service connected to the existing municipal 150mm watermain located within the Miller Drive Road Allowance. The new 150mm water service for the development will be constructed within the common element roadways, providing service to three new fire hydrants and 25mm individual service branches for each townhome unit.

The internal distribution system of the condominium development will be installed at a minimum depth of 1.7m below finished grade. All systems will be constructed and tested in accordance with the City of Barrie Engineering Standards and MOE Guidelines.

#### 4.3. Fire Flow Requirement

The required fire flow for any new building in Ontario is calculated in accordance with the Fire Underwriters Survey (FUS) – Water Supply for Public Fire Protection – 2020. The estimated required fire flow is based on many variables such as effective floor area, adjacency to other buildings, type of construction, and fire suppression such as automatic sprinklers. The largest required fire flow for any structure within the development site will govern the required fire flows. In the case of this condominium development, Block 6 has the largest calculated required fire flow equivalent to 250 L/s. Detailed calculations are provided in Appendix A. It will be a requirement for the townhomes to have fire walls between units to reduce the required fire flow such that the development can be serviced by the adjacent infrastructure and on-site private hydrants. Detailed hydrant flow testing of the nearest hydrant to the site and the private hydrants once constructed will be required to confirm there is capacity within the system to meet the required fire flows prior to building permit issuance.

### 5. Storm Drainage and Stormwater Management

A key component of the Development is the need to address environmental and related Stormwater Management (SWM) issues. These are examined in a framework aimed at meeting the City of Barrie, Nottawasaga Valley Conservation Authority (NVCA) and MOE requirements. SWM parameters have evolved from an understanding of the location and sensitivity of the site's natural systems.

It is understood that the objectives of the SWM plan are to:

- Protect life and property from flooding and erosion.
- Maintain water quality for ecological integrity, recreational opportunities etc.
- Protect and maintain groundwater flow regime(s).
- Protect aquatic and fishery communities and habitats.
- Maintain and protect significant natural features.
- Protect and provide diverse recreational opportunities that are in harmony with the environment.

#### 5.1. Existing Drainage Conditions

The site is bound by Miller Drive to the east, residential development to the north and south, and a natural gas transmission corridor and wetland to the west. It is important to note that parts of the subject site are located within the Nottawasaga Valley Conservation Authority regulated areas. Topographic information for the site obtained from a survey completed by Dino Astri Surveying Ltd., dated February 7, 2101, aerial mapping from Simcoe County GIS and Google Imagery, indicates the site gradually slopes from the east to west at an approximate slope varying between 2% to 4%. The drainage from the site is by sheet flow to an existing watercourse located west of the site that flows southwest and is tributary to Bear Creek, as depicted in the Ontario Watershed Information Tool Sketch included in Appendix C.

In terms of the subsurface makeup of the site, the soil survey completed by Simcoe County (Report No. 29) indicates that the soils within the subject site are made up of a Tioga Sand Loam. These types of soils are described as having good drainage, are generally grey calcareous outwash sand, with aggregate size ranging from stone free to moderately



stony and having a hydrological soil classification “A”. A geotechnical investigation report has been completed by Cambium Inc., which confirmed the type of present soils within the subject property. The soil stratification on site is categorized as follows:

- Organic material (Topsoil) between 150mm to 450mm below grade
- Fill material consisting of reworked native sand soil 1.7m to 2.1m below grade.
- Native sand soils that terminated at 5m below grade.
- No bedrock was encountered, all boreholes were terminated in native material.
- Groundwater was encountered at depths between 0.6m and 4.6m below grade.

Using the runoff coefficients provided in the City of Barrie Stormwater Infrastructure Design Standards, the existing site statistics produce the following weighted runoff coefficient:

|               |   |                      |       |   |      |    |   |                |
|---------------|---|----------------------|-------|---|------|----|---|----------------|
| Grassed       | = | 7,294 m <sup>2</sup> | R     | = | 0.10 | AR | = | 729.4          |
| Asphalt       | = | 304 m <sup>2</sup>   | R     | = | 0.95 | AR | = | 288.8          |
| Woodlot       | = | 6,410 m <sup>2</sup> | R     | = | 0.08 | AR | = | 512.8          |
| Building Roof | = | 391 m <sup>2</sup>   | R     | = | 0.95 | AR | = | <u>371.5</u>   |
|               |   |                      | Total |   |      | AR | = | <u>1,902.5</u> |

Site Area = 14,400 m<sup>2</sup>      AR = 1,902.5 m<sup>2</sup>      Weighted R = 0.13

### 5.2. Proposed Drainage Conditions

The proposed development will largely increase the imperviousness of the site and it is important to quantify this change to determine the quantity control required for the site runoff. Using the runoff coefficients provided in the City of Barrie Stormwater Infrastructure Design Standards and NVCA Stormwater Management Guidelines, the proposed site statistics produce the following weighted runoff coefficient:

|               |   |                      |       |   |      |    |   |                |
|---------------|---|----------------------|-------|---|------|----|---|----------------|
| Grassed       | = | 5115 m <sup>2</sup>  | R     | = | 0.10 | AR | = | 511.5          |
| Asphalt       | = | 3600 m <sup>2</sup>  | R     | = | 0.95 | AR | = | 3420           |
| Concrete      | = | 605 m <sup>2</sup>   | R     | = | 0.95 | AR | = | 574.8          |
| Building Roof | = | 5,080 m <sup>2</sup> | R     | = | 0.95 | AR | = | <u>4826</u>    |
|               |   |                      | Total |   |      | AR | = | <u>9,332.3</u> |

Site Area = 14,400 m<sup>2</sup>      AR = 9,332.3 m<sup>2</sup>      Weighted R = 0.65

### 5.3. Hydrology Model Results

Given the size of the site, the Modified Rational Method will be used to determine the existing and anticipated SWM release rates:

|                            |   |                                                      |
|----------------------------|---|------------------------------------------------------|
| Catchment Area             | = | approx. 1.44 ha                                      |
| Runoff Coefficient         | = | 0.13 (existing condition)                            |
|                            | = | 0.65 (proposed condition)                            |
| Time of Concentration (tc) | = | 23 minutes (existing condition using airport method) |
|                            | = | 10 minutes (proposed condition)                      |
| Rainfall Intensity         | = | City of Barrie IDF Curve Parameters                  |
| Peaking Factor (Ci)        | = | 1.00 (2-10 year design periods)                      |
|                            | = | 1.10 (25 year design period)                         |
|                            | = | 1.20 (50 year design period)                         |



$$\text{Peak Runoff Rate (Qr)} = C \times I \times A \times 360^{-1} = 1.25 \text{ (100 year design period)}$$

Applying the above results in the following release rates:

**Table 3: Existing & Post Development Uncontrolled Release Rates**

|                                                | 2 year<br>(m <sup>3</sup> /s) | 5 year<br>(m <sup>3</sup> /s) | 10 year<br>(m <sup>3</sup> /s) | 25 year<br>(m <sup>3</sup> /s) | 50 year<br>(m <sup>3</sup> /s) | 100 year<br>(m <sup>3</sup> /s) |
|------------------------------------------------|-------------------------------|-------------------------------|--------------------------------|--------------------------------|--------------------------------|---------------------------------|
| Existing Condition<br>(allowable release rate) | .027                          | .035                          | .041                           | .053                           | .065                           | .074                            |
| Post Development<br>(uncontrolled rate)        | .215                          | .283                          | .328                           | .423                           | .511                           | .585                            |

Upon analysis of the existing condition (allowable) and post development release rates, it is determined that quantity control measures are to be implemented for the site such that the post development release rates are less than or equal to the allowable release rates.

#### 5.4. Stormwater Quantity Control

The proposed development increases the imperviousness of the site from the existing conditions, resulting in runoff release rates larger than the allowable runoff release rates summarized in Table 1 and calculated in Appendix A. Quantity controls are proposed to be implemented through a quantity control orifice pipe in conjunction with subsurface storage provided by an underground chamber system. The quantity control and storm infrastructure are provided entirely within the site boundary. To further reduce any adverse effects on adjacent lands and mimic the natural release from the site, a flow spreader is also proposed that will be constructed of a cable mat or similar construction material to ensure its structural integrity and shape is maintained.

Release from the subject site will be quantity controlled by an orifice outlet pipe sized using the following equation:

$$Q = cA\sqrt{2gh}$$

Q = allowable release rate  
 A = orifice area = 0.0177 m<sup>2</sup> (150mm dia)  
 c = orifice coefficient = 0.63  
 g = gravitational constant = 9.81m/s<sup>2</sup>  
 h = high water level over center of orifice

Applying the above equation, we find that a 100mm orifice pipe will restrict flows such that the post development controlled and uncontrolled stormwater runoff and release rates are less than or equal to the allowable release rates for all storm events ranging from the 2-year event to the 100-year event. The allowable release rates, controlled post development release rates and uncontrolled post development release rates are summarized in Table 4 below and calculated in Appendix A.

**Table 4: Existing & Post Development Controlled Release Rates**

|                                                | 2 year<br>(m <sup>3</sup> /s) | 5 year<br>(m <sup>3</sup> /s) | 10 year<br>(m <sup>3</sup> /s) | 25 year<br>(m <sup>3</sup> /s) | 50 year<br>(m <sup>3</sup> /s) | 100 year<br>(m <sup>3</sup> /s) |
|------------------------------------------------|-------------------------------|-------------------------------|--------------------------------|--------------------------------|--------------------------------|---------------------------------|
| Existing Condition<br>(allowable release rate) | .027                          | .035                          | .041                           | .053                           | .065                           | .074                            |
| Post Development<br>(uncontrolled rate)        | .005                          | .007                          | .009                           | .013                           | .015                           | .019                            |
| Post Development<br>(controlled rate)          | .017                          | .019                          | .020                           | .022                           | .025                           | .025                            |
| Post Development<br>(total release rate)       | .022                          | .026                          | .029                           | .035                           | .040                           | .044                            |

Comparison of the allowable release rates and the total post development controlled release rates, it is demonstrated that a pipe orifice of 100mm will provide the required quantity control for the site. Controlling the release rates from the site to such levels will require on-site storage which is proposed to be provided by a subsurface stormwater management chamber product manufactured by Stormcon called GreenStorm. The following maximum required storage volumes and corresponding release rates are summarized in Table 5 below and calculated in Appendix A.

**Table 5: Post Development Controlled Release Rates & Maximum Required Storage**

|                                                         | 2 year | 5 year | 10 year | 25 year | 50 year | 100 year |
|---------------------------------------------------------|--------|--------|---------|---------|---------|----------|
| Post Development<br>(controlled rate m <sup>3</sup> /s) | .019   | .022   | .024    | .028    | .031    | .033     |
| Storage Volume<br>Required (m <sup>3</sup> )            | 112.2  | 148.9  | 173.5   | 225.8   | 274.5   | 315.7    |

The proposed underground storage chamber system provides a maximum storage volume of 370.6m<sup>3</sup>, which exceeds the storage requirements. Calculations are provided in Appendix A.

### 5.5. Stormwater Quality Control During Construction

To ensure stormwater quality control during construction, it is imperative that effective environmental and sedimentation controls be in place throughout the entire area subject to construction activities (where applicable). If there is earth grading activity planned, there will be a potential of soil erosion. It is therefore recommended that the following be implemented to assist in achieving acceptable stormwater runoff quality:

- Restoration of exposed surfaces with vegetation and non-vegetative material as soon as construction schedules permit;
- Installation of temporary sediment ponds, filter strips, silt fences and rock check dams or other similar facilities throughout the site, and specifically during all construction activities;
- Reduce stormwater drainage velocities where possible;
- Ensure that disturbed areas that are left inactive for more than 30 days shall be vegetated and stabilized as instructed by the Engineer;
- Minimize the amount of existing vegetation removed.



## 5.6. Permanent Quality Control

The objective of the permanent SWM quality controls will be to ensure MOE's Enhanced Protection. The proposed development will largely increase the imperviousness of the site. It is important to quantify this increase to evaluate the potential downstream impacts. As per the site's assumed statistics for the developable area, the post development total imperviousness (TIMP) is:

$$\begin{array}{lcl} \text{Impervious Area} & = & 9,285 \text{ m}^2 \\ \text{Total Developable} & = & 14,400 \text{ m}^2 \end{array} \qquad \begin{array}{lcl} \text{TIMP} & = & (A_{\text{BLD}} + A_{\text{ASP}} + A_{\text{CON}}) / A_{\text{TOTAL}} \\ & = & 9,285 \text{ m}^2 / 14,400 \text{ m}^2 \\ & = & .645 \text{ (or 64.5\%)} \end{array}$$

It is proposed to provide quality control for the post development site runoff through the utilization of an Oil Grit Separator located downstream of the quantity control orifice prior to discharging from the site. A Stormcon OGS or equivalent treatment unit is proposed to treat the stormwater released from this site to the MOE's Enhanced or Level 1 Protection standard. This MOE standard stipulates a Total Suspended Solids (TSS) removal of at least 80%. The SDD3 1200 model will treat the post development flows to the required MOE quality standard, with a TSS removal rate of approximately 81.56%. The Stormcon unit will provide TSS removal for all storm flows entering the underground storage system. The design criteria and background information on how the OGS unit is sized is provided within Appendix B.

## 5.7. Water Balance

Referencing Section 3.2 of the MOE "Stormwater Management Planning and Design Manual (March 2003), and the historical rainfall distribution for the City of Barrie. The following review of the water balance has been completed. The site is 1.44 ha in area, and referencing the Soil Survey of Simcoe County (Report No. 29), the soils on the subject property are made up of a Tioga Sand Loam with a hydrologic soil group type A. Referencing Table 3.1 of the MOE manual, an Urban Lawn ground cover comprised of soil group A has an annual evapotranspiration of 515mm and a Forested ground cover comprised of soil group A has an annual evapotranspiration of 546mm. Using this information, we calculate about 4,712 m<sup>3</sup> of infiltration per year.

Calculating the anticipated uncontrolled post-development infiltration, it is anticipated that about 1,739 m<sup>3</sup> surface runoff will infiltrate per year. Therefore, additional onsite methods will be required to maintain the water balance. It is proposed that a minimum of 15mm of each rainfall event be infiltrated from the rooftop surfaces using soak away pits and a perforated pipe system. This volume will be retained/treated on site through the implementation of 58 soakaway pits each having a volume of 1.36m<sup>3</sup>. This volume has been computed as follows:

$$\begin{array}{lcl} \text{Volume} & = & \text{Impervious Area X 15mm Event} \\ & = & (5,080.00\text{m}^2) \text{ X } 0.015\text{m} \\ & = & \mathbf{76.2\text{m}^3} < 78.9 \text{ m}^3 \text{ (Soak Away Pits)} \end{array}$$

These methods, in addition to the pervious infiltration across the site, result in a volume of 4,795 m<sup>3</sup> to be infiltrated per year, which exceeds the current regime of the site. The following table details the various infiltration volumes per year with detailed calculations of these methods included in Appendix A.



|                               | Total Infiltration (m <sup>3</sup> /yr) |
|-------------------------------|-----------------------------------------|
| Pre-Development               | 4,712                                   |
| Uncontrolled Post Development | 1,739                                   |
| Controlled Post Development   | 4,795                                   |

### 5.8. Phosphorus Budget

The existing site generates approximately 0.21 kg of phosphorous annually and the proposed development will generate approximately 1.29 kg of phosphorous annually. The following chart details the anticipated phosphorous loadings for the pre- and uncontrolled post-development conditions.

|                               | Total P (kg/yr) |
|-------------------------------|-----------------|
| Pre-Development               | 0.21            |
| Uncontrolled Post Development | 1.29            |

As per the Phosphorous Budget Tool documentation as provided by the MOE, the removal efficiency of 100% was selected for the areas (rooftop surfaces) draining towards the infiltration soak away pits. The following chart details the anticipated phosphorous loading for the post-development treated condition. Phosphorous budget calculations have been included in Appendix A.

|                             | Total P (kg/yr) |
|-----------------------------|-----------------|
| Controlled Post-Development | 0.71            |

Based on the post development phosphorus release without the presence of BMP's of 1.29 kg annually, and post development release of 0.71 kg annually with the presence of BMP's, the subject site is able to achieve about 45% in total phosphorus reduction.

### 5.9. Erosion and Sediment Control

To ensure Stormwater runoff quality is controlled during construction, an erosion and sediment control strategy will be implemented to mitigate transportation of silt off-site to the existing roads and sewers. It is imperative that effective controls be put in place and maintained until all areas are stabilized with surface cover. All erosion and sediment control Best Management Practices (BMP) shall be designed, constructed and maintained in accordance with the City of Barrie and NVCA's erosion control requirements.

Items that will be addressed for both temporary and permanent erosion and sediment controls are based on the following:

- Site location description and area;
- Existing and proposed land use;
- Vegetative cover;



- Existing drainage routes;
- Proposed site works;
- Proposed outlets;
- Permits required;
- Sediment filters and barriers - silt fences;
- Construction entrance location;
- Protection to catch basins and ditch inlets;

To prevent construction generated sediments from entering the storm sewers or leaving the site by overland flow, the following measures should be implemented during the construction phase:

- Temporary sediment control fencing should be erected around the perimeter of the grading activities.
- Temporary sediment fabric and stone filters should be installed on existing and proposed catch basins until surface cover and vegetation has been stabilized.
- A temporary construction access mud mat should be implemented to reduce the amount of materials that may be transported off site.
- Construction during drier months should be monitored for wind-borne transport of sediments. At the direction of the engineer, the contractor may be directed to water down exposed earth areas with an aqueous solution of calcium chloride.
- All disturbed areas not under immediate construction for 30 days, or not intended for building activities within a 3-month time period, should be stabilized with seeding.
- Built up sediment should be removed and disposed off-site at least once a month, or more frequently as directed by the engineer.

In accordance with the NVCA's erosion control requirements, a minimum of the first 5mm of rainfall shall be retained on site to deal with the increase in runoff resulting from urbanization. The volume of storage has been calculated by multiplying the 5mm depth over the entire area to be treated by the proposed temporary ESC facility:

Site Area = 1.44 ha

Volume required to be retained for 5mm event = 72 m<sup>3</sup>

It is proposed to infiltrate this volume from a temporary ESC facility located at the northwest corner of the development. From the Hydrogeological Investigation Report completed by Cambium Ltd., we find the seasonal high groundwater table elevation as shallow as 0.13 meters below grade (Elev. 232.45m) in the southwestern parts of the subject site to as deep as 4.49 meters below grade (Elev. 234.33m) in the north part of the subject site. The wide variation in depth to water levels can be attributed to the ground elevation differences across the site. Therefore, for the north part of the site, the bottom elevation for the proposed temporary ESC facility shall not be lower than an elevation of 1m above the seasonal high ground water level to be used as infiltration. In the event the facility's infiltration storage is exceeded, a hickenbottom structure has been proposed to prevent the facility from overtopping. As for the southwestern part of the subject site, the bottom elevation for the proposed temporary ESC facility can not achieve a minimum distance of 1m above the seasonal high ground water level. As such, this facility will act as a buffer before discharging into the surrounding woodland areas. This ESC facility will be used as infiltration. Details have been provided on drawing ESC-1 and can be found in Appendix C.



## 6. Conclusions

A summary of the servicing recommendations are as follows:

- **Water**– A new internal 150mm diameter watermain system is proposed to be constructed within the development lands that will provide service to three private hydrants and branch 25mm services to each townhome unit. It is proposed to connect the internal 150mm watermain to the existing 150mm municipal watermain located within the Miller Drive Right-of-Way.
- **Sanitary Servicing** – The internal collection system for the development is proposed to consist of a 100mm PVC E/One low pressure sanitary force main system with each unit having E/One pump stations either internally or externally of their structures. It is proposed to discharge the forcemain to a new 250mm municipal sanitary sewer to be constructed as part of the Miller Drive redevelopment.
- **Stormwater Drainage and Management** – A new internal storm sewer system is proposed to capture the on-site flows and restrict the release rates to pre-development levels by implementing a quantity control orifice. The required storage volume is calculated as 315.7m<sup>3</sup> and the provided storage volume of the proposed underground chamber system is calculated as 370.6m<sup>3</sup>. Quality control is to be provided through an end of pipe treatment system consisting of an oil grit separator and flow spreader prior to discharging from the site.

The analysis and conceptual design outlined in this report demonstrates that the proposed Development is feasible, based on sound engineering principles and, the development will become a cohesive part of the City of Barrie.

All of which is respectfully submitted,

**Gerrits Engineering Ltd.**

Dan LeBlanc, P.Eng.  
Civil Engineer



May 15, 2024

## **Appendix A**

### **Design Calculations**



Project Number: 1981-001  
 Project Name: 152 Miller Drive  
 Location: Barrie, Ontario  
 Date: 5/14/2024

**1 FUS Formula**

$$RFF = 220 C \sqrt{A}$$

where: RFF = required fire flow in litres per minute  
 C= the Coefficient related to the type of construction; and  
 A = the total flow area in square metres (including all storeys but excluding basements at least 50% below grade)

Type of Construction: wood frame construction

C = 1.5  
 A = 1152  
 F = 11201 L/min  
 187 L/s

**2 Occupancy Adjustment**

Type of Occupancy: limited combustible  
 Hazard Allowance: -15%

Fire Flow Adjustment -1680 L/min  
 Revised RFF = 9520 L/min

**3 Sprinkler Adjustment**

NFPA 13 sprinkler standard: No 0%  
 Standard water supply: No 0%  
 Fully Supervised system: No 0%

Sprinkler Credit 0 L/min

**4 Exposure Adjustment**

|                        | Charge |       |
|------------------------|--------|-------|
| North Side 20.1 to 30m | 10%    |       |
| East Side 10.1 to 20m  | 15%    |       |
| South Side 0 to 3m     | 10%    |       |
| West Side 3.1 to 10m   | 20%    |       |
| Exposures Surcharge    | 5236   | L/min |

Total Required Fire Flow: 15000 L/min  
 250.0 L/sec

Target Duration 120 min  
**Volume** = Required Fire Flow (L/min) x Duration (min)  
 = 1800000 L  
**MINIMUM VOLUME** = 1800 cu.m

## WEIGHTED RUNOFF COEFFICIENTS

| Area ID                              | Total Area (m <sup>2</sup> ) | Grass 0.10  | Woodlot 0.08 | Asphalt 0.95 | Concrete 0.95 | Building 0.95 | Weighted Runoff Coefficient |
|--------------------------------------|------------------------------|-------------|--------------|--------------|---------------|---------------|-----------------------------|
| Predevelopment Sub Areas             |                              |             |              |              |               |               | 0.13                        |
| X-1                                  | 7300                         | 3763        | 3300         | 138          | 0             | 100           | 0.12                        |
| X-2                                  | 7100                         | 3531        | 3110         | 167          | 0             | 292           | 0.15                        |
| <b>Total</b>                         | <b>14400</b>                 | <b>7294</b> | <b>6410</b>  | <b>304</b>   | <b>0</b>      | <b>391</b>    | <b>0.13</b>                 |
| Post Development Sub Areas           |                              |             |              |              |               |               | 0.65                        |
| P-1                                  | 3800                         | 1635        | 0            | 905          | 120           | 1140          | 0.58                        |
| P-2                                  | 3080                         | 575         | 0            | 895          | 85            | 1525          | 0.79                        |
| P-3                                  | 1450                         | 165         | 0            | 535          | 125           | 625           | 0.85                        |
| P-4                                  | 2050                         | 205         | 0            | 660          | 115           | 1070          | 0.87                        |
| P-5                                  | 1510                         | 230         | 0            | 435          | 125           | 720           | 0.82                        |
| P-6                                  | 200                          | 200         | 0            | 0            | 0             | 0             | 0.10                        |
| P-7                                  | 640                          | 640         | 0            | 0            | 0             | 0             | 0.10                        |
| P-8                                  | 765                          | 765         | 0            | 0            | 0             | 0             | 0.10                        |
| P-9                                  | 605                          | 570         | 0            | 0            | 35            | 0             | 0.15                        |
| P-10                                 | 300                          | 130         | 0            | 170          | 0             | 0             | 0.58                        |
| <b>Total</b>                         | <b>14400</b>                 | <b>5115</b> | <b>0</b>     | <b>3600</b>  | <b>605</b>    | <b>5080</b>   | <b>0.65</b>                 |
| Controlled Sub Areas (P-1 to P-7)    |                              |             |              |              |               |               | 0.71                        |
| <b>Total</b>                         | <b>12730</b>                 | <b>3650</b> | <b>0</b>     | <b>3430</b>  | <b>570</b>    | <b>5080</b>   | <b>0.71</b>                 |
| Uncontrolled Sub Areas (P-8 to P-10) |                              |             |              |              |               |               | 0.20                        |
| <b>Total</b>                         | <b>1670</b>                  | <b>1465</b> | <b>0</b>     | <b>170</b>   | <b>35</b>     | <b>0</b>      | <b>0.20</b>                 |

## PRE AND POST DEVELOPMENT RELEASE RATES

### IDF Curve Parameters

| Storm Event | Coeff A  | Coeff B | Coeff C |
|-------------|----------|---------|---------|
| 2-Year      | 675.586  | 4.681   | 0.78    |
| 5-Year      | 843.019  | 4.582   | 0.763   |
| 10-Year     | 976.898  | 4.745   | 0.76    |
| 25-Year     | 1133.123 | 4.734   | 0.756   |
| 50-Year     | 1251.473 | 4.847   | 0.753   |
| 100-Year    | 1383.628 | 4.905   | 0.754   |

### Site Statistics

| Predevelopment               |      |
|------------------------------|------|
| Total Site Area (ha)         | 1.44 |
| Runoff Coefficient, C        | 0.13 |
| Time of Concentration (mins) | 23   |
| Post Development             |      |
| Total Site Area (ha)         | 1.44 |
| Runoff Coefficient, C        | 0.65 |
| Time of Concentration (mins) | 10   |

### Formulae

Rainfall Intensity, I (mm/hr) =  $A/(t_c+B)^C$   
 Release Rate, Q (m<sup>3</sup>/s) =  $C_i A I / 360$

Where:  $t_c$  = Time of Concentration (min)  
 $C_i$  = Peaking Coefficient  
 C = Runoff Coefficient  
 I = Rainfall Intensity (mm/hr)  
 A = Area (ha)

### PREDEVELOPMENT RELEASE RATES

| Return Rate | Peaking Coefficient, C <sub>i</sub> | Runoff Coefficient, C | Rainfall Intensity (mm/hr) | Release Rate (m <sup>3</sup> /s) | Release Rate (L/s) |
|-------------|-------------------------------------|-----------------------|----------------------------|----------------------------------|--------------------|
| 2-Year      | 1                                   | 0.13                  | 50.67                      | 0.027                            | 26.79              |
| 5-Year      | 1                                   | 0.13                  | 67.09                      | 0.035                            | 35.47              |
| 10-Year     | 1                                   | 0.13                  | 78.17                      | 0.041                            | 41.32              |
| 25-Year     | 1.1                                 | 0.13                  | 91.91                      | 0.053                            | 53.45              |
| 50-Year     | 1.2                                 | 0.13                  | 102.21                     | 0.065                            | 64.84              |
| 100-Year    | 1.25                                | 0.13                  | 112.45                     | 0.074                            | 74.31              |

### POST DEVELOPMENT RELEASE RATES

| Return Rate | Peaking Coefficient, C <sub>i</sub> | Runoff Coefficient, C | Rainfall Intensity (mm/hr) | Release Rate (m <sup>3</sup> /s) | Release Rate (L/s) |
|-------------|-------------------------------------|-----------------------|----------------------------|----------------------------------|--------------------|
| 2-Year      | 1                                   | 0.65                  | 83.10                      | 0.215                            | 215.42             |
| 5-Year      | 1                                   | 0.65                  | 109.11                     | 0.283                            | 282.83             |
| 10-Year     | 1                                   | 0.65                  | 126.38                     | 0.328                            | 327.61             |
| 25-Year     | 1.1                                 | 0.65                  | 148.26                     | 0.423                            | 422.77             |
| 50-Year     | 1.2                                 | 0.65                  | 164.13                     | 0.511                            | 510.56             |
| 100-Year    | 1.25                                | 0.65                  | 180.44                     | 0.585                            | 584.68             |

## SUB AREA POST DEVELOPMENT RELEASE RATES

| IDF Curve Parameters |          |         |         |
|----------------------|----------|---------|---------|
| Storm Event          | Coeff A  | Coeff B | Coeff C |
| 2-Year               | 675.586  | 4.681   | 0.78    |
| 5-Year               | 843.019  | 4.582   | 0.763   |
| 10-Year              | 976.898  | 4.745   | 0.76    |
| 25-Year              | 1133.123 | 4.734   | 0.756   |
| 50-Year              | 1251.473 | 4.847   | 0.753   |
| 100-Year             | 1383.628 | 4.905   | 0.754   |

| Site Statistics                    |      |
|------------------------------------|------|
| <b>Controlled (P1, P2, P3, P4)</b> |      |
| Total Site Area (ha)               | 1.27 |
| Runoff Coefficient, C              | 0.71 |
| Time of Concentration (mins)       | 10   |
| <b>Uncontrolled (P5)</b>           |      |
| Total Site Area (ha)               | 0.17 |
| Runoff Coefficient, C              | 0.20 |
| Time of Concentration (mins)       | 10   |

| Formulae                                             |                                    |
|------------------------------------------------------|------------------------------------|
| Rainfall Intensity, I (mm/hr)= $A/(t_c+B)^C$         |                                    |
| Release Rate, Q (m <sup>3</sup> /s)= $C_i A I / 360$ |                                    |
| Where:                                               | $t_c$ =Time of Concentration (min) |
|                                                      | $C_i$ = Peaking Coefficient        |
|                                                      | C= Runoff Coefficient              |
|                                                      | I= Rainfall Intensity (mm/hr)      |
|                                                      | A= Area (ha)                       |

## RELEASE RATES TRIBUTARY TO CONTROL SYSTEM (P1, P2, P3, P4, P5, P6, P7)

| Return Rate | Peaking Coefficient, C <sub>i</sub> | Runoff Coefficient, C | Rainfall Intensity (mm/hr) | Release Rate (m <sup>3</sup> /s) | Release Rate (L/s) |
|-------------|-------------------------------------|-----------------------|----------------------------|----------------------------------|--------------------|
| 2-Year      | 1                                   | 0.71                  | 83.10                      | 0.208                            | 207.55             |
| 5-Year      | 1                                   | 0.71                  | 109.11                     | 0.272                            | 272.49             |
| 10-Year     | 1                                   | 0.71                  | 126.38                     | 0.316                            | 315.63             |
| 25-Year     | 1.1                                 | 0.71                  | 148.26                     | 0.407                            | 407.31             |
| 50-Year     | 1.2                                 | 0.71                  | 164.13                     | 0.492                            | 491.89             |
| 100-Year    | 1.25                                | 0.71                  | 180.44                     | 0.563                            | 563.30             |

## RELEASE RATES FROM UNCONTROLLED AREAS (P8, P9, P10)

| Return Rate | Peaking Coefficient, C <sub>i</sub> | Runoff Coefficient, C | Rainfall Intensity (mm/hr) | Release Rate (m <sup>3</sup> /s) | Release Rate (L/s) |
|-------------|-------------------------------------|-----------------------|----------------------------|----------------------------------|--------------------|
| 2-Year      | 1                                   | 0.20                  | 83.10                      | 0.008                            | 7.88               |
| 5-Year      | 1                                   | 0.20                  | 109.11                     | 0.010                            | 10.34              |
| 10-Year     | 1                                   | 0.20                  | 126.38                     | 0.012                            | 11.98              |
| 25-Year     | 1.1                                 | 0.20                  | 148.26                     | 0.015                            | 15.46              |
| 50-Year     | 1.2                                 | 0.20                  | 164.13                     | 0.019                            | 18.67              |
| 100-Year    | 1.25                                | 0.20                  | 180.44                     | 0.021                            | 21.38              |

## STAGE STORAGE DISCHARGE FOR CONTROLLED AREA (P-1 to P-7)

| Elevation (m) | Incremental Depth (m) | Area (m <sup>2</sup> ) | Storage Volume (m <sup>3</sup> ) | Head Loss Across Orifice (m) | Calculated Release from Orifice (m <sup>3</sup> /s) | Depth of Flow Above Weir (m) | Overflow (x) | Rectangular 'C' | Calculated Release from Weir (m <sup>3</sup> /s) | Total Flow (m <sup>3</sup> /s) |
|---------------|-----------------------|------------------------|----------------------------------|------------------------------|-----------------------------------------------------|------------------------------|--------------|-----------------|--------------------------------------------------|--------------------------------|
| 235.72        | 0.12                  | 291.84                 | 0.00                             | 0.00                         | 0.000                                               | 0.00                         | 0.00         | 0.00            | 0.00                                             | 0.000                          |
| 235.84        | 0.12                  | 291.84                 | 26.30                            | 0.09                         | 0.008                                               | 0.00                         | 0.00         | 0.00            | 0.00                                             | 0.008                          |
| 235.96        | 0.12                  | 291.84                 | 52.50                            | 0.21                         | 0.013                                               | 0.00                         | 0.00         | 0.00            | 0.00                                             | 0.013                          |
| 236.08        | 0.12                  | 291.84                 | 78.80                            | 0.33                         | 0.016                                               | 0.00                         | 0.00         | 0.00            | 0.00                                             | 0.016                          |
| 236.20        | 0.12                  | 291.84                 | 105.10                           | 0.45                         | 0.019                                               | 0.00                         | 0.00         | 0.00            | 0.00                                             | 0.019                          |
| 236.32        | 0.12                  | 291.84                 | 131.30                           | 0.57                         | 0.021                                               | 0.00                         | 0.00         | 0.00            | 0.00                                             | 0.021                          |
| 236.44        | 0.12                  | 291.84                 | 157.60                           | 0.69                         | 0.023                                               | 0.00                         | 0.00         | 0.00            | 0.00                                             | 0.023                          |
| 236.56        | 0.12                  | 291.84                 | 183.90                           | 0.81                         | 0.025                                               | 0.00                         | 0.00         | 0.00            | 0.00                                             | 0.025                          |
| 236.68        | 0.12                  | 291.84                 | 210.10                           | 0.93                         | 0.027                                               | 0.00                         | 0.00         | 0.00            | 0.00                                             | 0.027                          |
| 236.80        | 0.12                  | 291.84                 | 236.40                           | 1.05                         | 0.029                                               | 0.00                         | 0.00         | 0.00            | 0.00                                             | 0.029                          |
| 236.92        | 0.12                  | 291.84                 | 262.70                           | 1.17                         | 0.030                                               | 0.00                         | 0.00         | 0.00            | 0.00                                             | 0.030                          |
| 237.04        | 0.12                  | 291.84                 | 288.90                           | 1.29                         | 0.032                                               | 0.00                         | 0.00         | 0.00            | 0.00                                             | 0.032                          |
| 237.16        | 0.12                  | 291.84                 | 315.20                           | 1.41                         | 0.033                                               | 0.00                         | 0.00         | 0.00            | 0.00                                             | 0.033                          |
| 237.28        | 0.00                  | 291.84                 | 341.50                           | 1.53                         | 0.034                                               | 0.00                         | 0.00         | 0.00            | 0.00                                             | 0.034                          |

### Formulae

#### Quantity Control Orifice

$$\text{Release Rate, } Q \text{ (m}^3\text{/s)} = c \cdot A \cdot (2 \cdot g \cdot h)^{0.5}$$

Where:

c= Orifice Constant

A= Area (m<sup>2</sup>)

g= gravitational constant (m/s<sup>2</sup>)

h= Head loss across orifice (m)

#### Over Flow Weir

$$\text{Release Rate, } Q \text{ (m}^3\text{/s)} = C \cdot (h^{3/2}) \cdot w$$

Where:

C= Rectangular C

h=Depth of flow above weir (m)

w=width of weir (m)

#### Rectangular C Equation

$$y = (a+bx)/(1+cx+dx^2)$$

Where:

a = -10383.48985

b = 3418997.012

c = 2131595.078

d = -235014.2466

### Quantity Control Systems

#### Quantity Control Orifice

Diameter (m): 0.100

Elevation (m): 235.70

Constant: 0.8

Centroid (m): 235.75

#### Over Flow Weir

Width (m): 0.5

Side Slopes: 3H:1V

Bottom Elevation (m): 238

Length of Weir (m): 1.00

### Storage Provided

Subsurface Storage: 0.00

Surface Storage: 0

Total Storage Provided: 0.00

### Rating Curve Data Points

| Elevation (m) | Outflow (m <sup>3</sup> /s) | Storage (m <sup>3</sup> ) |
|---------------|-----------------------------|---------------------------|
| 235.72        | 0.000                       | 0.00                      |
| 235.96        | 0.013                       | 52.50                     |
| 236.20        | 0.019                       | 105.10                    |
| 236.56        | 0.025                       | 183.90                    |
| 236.80        | 0.029                       | 236.40                    |
| 237.04        | 0.032                       | 288.90                    |
| 237.28        | 0.034                       | 341.50                    |

## 2-YEAR RELEASE RATES AND HYDROGRAPHS

| Site Statistics                         | Rating Curve Data Points |                             |                           | Formulae                                                                                                     |
|-----------------------------------------|--------------------------|-----------------------------|---------------------------|--------------------------------------------------------------------------------------------------------------|
| <b>Controlled (P1, P2, P3, P4)</b>      | Elevation (m)            | Outflow (m <sup>3</sup> /s) | Storage (m <sup>3</sup> ) | $Q_{in} = Q_o / (t_d/2) * t_i$                                                                               |
| Total Site Area (ha)                    | 235.72                   | 0.000                       | 0.00                      | $Q_{out} = \text{Computer Generated using rating curve data points}$                                         |
| Runoff Coefficient, C                   | 235.96                   | 0.013                       | 52.50                     | Storage (m <sup>3</sup> ) = Cumulative storage <sub>(i-1)</sub> + Δ Storage <sub>i</sub>                     |
| Storm Duration (mins)                   | 236.20                   | 0.019                       | 105.10                    | Δ Storage (m <sup>3</sup> ) = (Q <sub>in</sub> - Q <sub>out</sub> )(t <sub>i</sub> - t <sub>i-1</sub> ) * 60 |
| 2-Year Release Rate (m <sup>3</sup> /s) | 236.56                   | 0.025                       | 183.90                    | Where:                                                                                                       |
| <b>Uncontrolled (P5)</b>                | 236.80                   | 0.029                       | 236.40                    | Q <sub>in</sub> = Flow rate tributary to the system at a given time (m <sup>3</sup> /s)                      |
| Total Site Area (ha)                    | 237.04                   | 0.032                       | 288.90                    | Q <sub>out</sub> = Flow rate out of the system at a given time (m <sup>3</sup> /s)                           |
| Runoff Coefficient, C                   | 237.28                   | 0.034                       | 341.50                    | T <sub>o</sub> = Storm Duration (min)                                                                        |
| Storm Duration (mins)                   |                          |                             |                           | T <sub>i</sub> = Time (min)                                                                                  |
| 2-Year Release Rate (m <sup>3</sup> /s) |                          |                             |                           |                                                                                                              |

### Hydrograph Data (Controlled)

| Minute | In Flow (m <sup>3</sup> /s) | Out Flow (m <sup>3</sup> /s) | Delta-Storage (m <sup>3</sup> ) | Cummulative Storage (m <sup>3</sup> ) |
|--------|-----------------------------|------------------------------|---------------------------------|---------------------------------------|
| 0      | 0.000                       | 0.000                        | 0.00                            | 0.00                                  |
| 1      | 0.021                       | 0.000                        | 1.25                            | 1.25                                  |
| 2      | 0.042                       | 0.000                        | 2.47                            | 3.72                                  |
| 3      | 0.062                       | 0.001                        | 3.68                            | 7.40                                  |
| 4      | 0.083                       | 0.002                        | 4.87                            | 12.27                                 |
| 5      | 0.104                       | 0.003                        | 6.05                            | 18.32                                 |
| 6      | 0.125                       | 0.004                        | 7.20                            | 25.52                                 |
| 7      | 0.145                       | 0.006                        | 8.34                            | 33.87                                 |
| 8      | 0.166                       | 0.008                        | 9.47                            | 43.34                                 |
| 9      | 0.187                       | 0.011                        | 10.58                           | 53.91                                 |
| 10     | 0.208                       | 0.013                        | 11.68                           | 65.59                                 |
| 11     | 0.187                       | 0.014                        | 10.35                           | 75.95                                 |
| 12     | 0.166                       | 0.015                        | 9.04                            | 84.99                                 |
| 13     | 0.145                       | 0.016                        | 7.73                            | 92.72                                 |
| 14     | 0.125                       | 0.017                        | 6.44                            | 99.15                                 |
| 15     | 0.104                       | 0.018                        | 5.15                            | 104.30                                |
| 16     | 0.083                       | 0.019                        | 3.87                            | 108.17                                |
| 17     | 0.062                       | 0.019                        | 2.60                            | 110.77                                |
| 18     | 0.042                       | 0.019                        | 1.34                            | 112.11                                |
| 19     | 0.021                       | 0.019                        | 0.09                            | 112.20                                |
| 20     | 0.000                       | 0.019                        | -1.15                           | 111.05                                |
| 21     | 0.000                       | 0.019                        | -1.15                           | 109.90                                |
| 22     | 0.000                       | 0.019                        | -1.14                           | 108.75                                |
| 23     | 0.000                       | 0.019                        | -1.14                           | 107.62                                |
| 24     | 0.000                       | 0.019                        | -1.13                           | 106.48                                |
| 25     | 0.000                       | 0.019                        | -1.13                           | 105.36                                |
| 26     | 0.000                       | 0.019                        | -1.12                           | 104.23                                |
| 27     | 0.000                       | 0.019                        | -1.11                           | 103.12                                |
| 28     | 0.000                       | 0.018                        | -1.11                           | 102.01                                |
| 29     | 0.000                       | 0.018                        | -1.10                           | 100.91                                |
| 30     | 0.000                       | 0.018                        | -1.09                           | 99.82                                 |
| 31     | 0.000                       | 0.018                        | -1.08                           | 98.74                                 |
| 32     | 0.000                       | 0.018                        | -1.08                           | 97.66                                 |
| 33     | 0.000                       | 0.018                        | -1.07                           | 96.59                                 |
| 34     | 0.000                       | 0.018                        | -1.06                           | 95.53                                 |
| 35     | 0.000                       | 0.018                        | -1.06                           | 94.47                                 |
| 36     | 0.000                       | 0.017                        | -1.05                           | 93.42                                 |
| 37     | 0.000                       | 0.017                        | -1.04                           | 92.38                                 |
| 38     | 0.000                       | 0.017                        | -1.03                           | 91.35                                 |
| 39     | 0.000                       | 0.017                        | -1.03                           | 90.32                                 |
| 40     | 0.000                       | 0.017                        | -1.02                           | 89.30                                 |

Max Storage

### Hydrograph Data (Uncontrolled)

| Minute | In Flow (m <sup>3</sup> /s) | Out Flow (m <sup>3</sup> /s) | Delta-Storage (m <sup>3</sup> ) | Cummulative Storage (m <sup>3</sup> ) |
|--------|-----------------------------|------------------------------|---------------------------------|---------------------------------------|
| 0      | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 1      | 0.001                       | 0.001                        | 0.000                           | 0.000                                 |
| 2      | 0.002                       | 0.002                        | 0.000                           | 0.000                                 |
| 3      | 0.002                       | 0.002                        | 0.000                           | 0.000                                 |
| 4      | 0.003                       | 0.003                        | 0.000                           | 0.000                                 |
| 5      | 0.004                       | 0.004                        | 0.000                           | 0.000                                 |
| 6      | 0.005                       | 0.005                        | 0.000                           | 0.000                                 |
| 7      | 0.006                       | 0.006                        | 0.000                           | 0.000                                 |
| 8      | 0.006                       | 0.006                        | 0.000                           | 0.000                                 |
| 9      | 0.007                       | 0.007                        | 0.000                           | 0.000                                 |
| 10     | 0.008                       | 0.008                        | 0.000                           | 0.000                                 |
| 11     | 0.007                       | 0.007                        | 0.000                           | 0.000                                 |
| 12     | 0.006                       | 0.006                        | 0.000                           | 0.000                                 |
| 13     | 0.006                       | 0.006                        | 0.000                           | 0.000                                 |
| 14     | 0.005                       | 0.005                        | 0.000                           | 0.000                                 |
| 15     | 0.004                       | 0.004                        | 0.000                           | 0.000                                 |
| 16     | 0.003                       | 0.003                        | 0.000                           | 0.000                                 |
| 17     | 0.002                       | 0.002                        | 0.000                           | 0.000                                 |
| 18     | 0.002                       | 0.002                        | 0.000                           | 0.000                                 |
| 19     | 0.001                       | 0.001                        | 0.000                           | 0.000                                 |
| 20     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 21     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 22     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 23     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 24     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 25     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 26     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 27     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 28     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 29     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 30     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 31     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 32     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 33     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 34     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 35     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 36     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 37     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 38     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 39     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 40     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |

### Total Release from Site

| Minute | Out Flow (m <sup>3</sup> /s) |
|--------|------------------------------|
| 0      | 0.000                        |
| 1      | 0.001                        |
| 2      | 0.002                        |
| 3      | 0.003                        |
| 4      | 0.005                        |
| 5      | 0.007                        |
| 6      | 0.009                        |
| 7      | 0.012                        |
| 8      | 0.015                        |
| 9      | 0.018                        |
| 10     | 0.021                        |
| 11     | 0.021                        |
| 12     | 0.022                        |
| 13     | 0.022                        |
| 14     | 0.022                        |
| 15     | 0.022                        |
| 16     | 0.022                        |
| 17     | 0.021                        |
| 18     | 0.021                        |
| 19     | 0.020                        |
| 20     | 0.019                        |
| 21     | 0.019                        |
| 22     | 0.019                        |
| 23     | 0.019                        |
| 24     | 0.019                        |
| 25     | 0.019                        |
| 26     | 0.019                        |
| 27     | 0.019                        |
| 28     | 0.018                        |
| 29     | 0.018                        |
| 30     | 0.018                        |
| 31     | 0.018                        |
| 32     | 0.018                        |
| 33     | 0.018                        |
| 34     | 0.018                        |
| 35     | 0.018                        |
| 36     | 0.017                        |
| 37     | 0.017                        |
| 38     | 0.017                        |
| 39     | 0.017                        |
| 40     | 0.017                        |

Max Release

## 5-YEAR RELEASE RATES AND HYDROGRAPHS

| Site Statistics                         | Rating Curve Data Points |                             |                           | Formulae                                                                                                                                                                                                                                                                                                    |
|-----------------------------------------|--------------------------|-----------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Controlled (P1, P2, P3, P4)</b>      | Elevation (m)            | Outflow (m <sup>3</sup> /s) | Storage (m <sup>3</sup> ) | $Q_{in} = Q_o / (t_d/2)^{0.5}$<br>$Q_{out}$ = Computer Generated using rating curve data points<br>Storage (m <sup>3</sup> ) = Cumulative storage <sub>(t-1)</sub> + Δ Storage <sub>t</sub><br>Δ Storage (m <sup>3</sup> ) = (Q <sub>in</sub> - Q <sub>out</sub> )(t <sub>r</sub> - t <sub>r-1</sub> ) * 60 |
| Total Site Area (ha)                    | 235.72                   | 0.000                       | 0.00                      | Where:<br>$Q_{in}$ = Flow rate tributary to the system at a given time (m <sup>3</sup> /s)<br>$Q_{out}$ = Flow rate out of the system at a given time (m <sup>3</sup> /s)<br>$T_r$ = Storm Duration (min)<br>$T_r$ = Time (min)                                                                             |
| Runoff Coefficient, C                   | 235.96                   | 0.013                       | 52.50                     |                                                                                                                                                                                                                                                                                                             |
| Storm Duration (mins)                   | 236.20                   | 0.019                       | 105.10                    |                                                                                                                                                                                                                                                                                                             |
| 5-Year Release Rate (m <sup>3</sup> /s) | 236.56                   | 0.025                       | 183.90                    |                                                                                                                                                                                                                                                                                                             |
|                                         | 236.80                   | 0.029                       | 236.40                    |                                                                                                                                                                                                                                                                                                             |
| <b>Uncontrolled (P5)</b>                | 237.04                   | 0.032                       | 288.90                    |                                                                                                                                                                                                                                                                                                             |
| Total Site Area (ha)                    | 237.28                   | 0.034                       | 341.50                    |                                                                                                                                                                                                                                                                                                             |
| Runoff Coefficient, C                   |                          |                             |                           |                                                                                                                                                                                                                                                                                                             |
| Storm Duration (mins)                   |                          |                             |                           |                                                                                                                                                                                                                                                                                                             |
| 5-Year Release Rate (m <sup>3</sup> /s) |                          |                             |                           |                                                                                                                                                                                                                                                                                                             |

### Hydrograph Data (Controlled)

| Minute | In Flow (m <sup>3</sup> /s) | Out Flow (m <sup>3</sup> /s) | Delta-Storage (m <sup>3</sup> ) | Cummulative Storage (m <sup>3</sup> ) |
|--------|-----------------------------|------------------------------|---------------------------------|---------------------------------------|
| 0      | 0.000                       | 0.000                        | 0.00                            | 0.00                                  |
| 1      | 0.027                       | 0.000                        | 1.63                            | 1.63                                  |
| 2      | 0.054                       | 0.000                        | 3.25                            | 4.88                                  |
| 3      | 0.082                       | 0.001                        | 4.83                            | 9.71                                  |
| 4      | 0.109                       | 0.002                        | 6.40                            | 16.11                                 |
| 5      | 0.136                       | 0.004                        | 7.94                            | 24.05                                 |
| 6      | 0.163                       | 0.006                        | 9.46                            | 33.51                                 |
| 7      | 0.191                       | 0.008                        | 10.96                           | 44.47                                 |
| 8      | 0.218                       | 0.011                        | 12.43                           | 56.90                                 |
| 9      | 0.245                       | 0.013                        | 13.92                           | 70.82                                 |
| 10     | 0.272                       | 0.015                        | 15.46                           | 86.28                                 |
| 11     | 0.245                       | 0.017                        | 13.72                           | 100.00                                |
| 12     | 0.218                       | 0.018                        | 11.99                           | 111.99                                |
| 13     | 0.191                       | 0.019                        | 10.29                           | 122.29                                |
| 14     | 0.163                       | 0.020                        | 8.61                            | 130.89                                |
| 15     | 0.136                       | 0.021                        | 6.93                            | 137.82                                |
| 16     | 0.109                       | 0.021                        | 5.26                            | 143.08                                |
| 17     | 0.082                       | 0.022                        | 3.60                            | 146.68                                |
| 18     | 0.054                       | 0.022                        | 1.95                            | 148.63                                |
| 19     | 0.027                       | 0.022                        | 0.30                            | 148.93 <b>Max Storage</b>             |
| 20     | 0.000                       | 0.022                        | -1.33                           | 147.60                                |
| 21     | 0.000                       | 0.022                        | -1.33                           | 146.27                                |
| 22     | 0.000                       | 0.022                        | -1.32                           | 144.95                                |
| 23     | 0.000                       | 0.022                        | -1.31                           | 143.64                                |
| 24     | 0.000                       | 0.022                        | -1.31                           | 142.33                                |
| 25     | 0.000                       | 0.022                        | -1.30                           | 141.03                                |
| 26     | 0.000                       | 0.022                        | -1.29                           | 139.74                                |
| 27     | 0.000                       | 0.021                        | -1.29                           | 138.45                                |
| 28     | 0.000                       | 0.021                        | -1.28                           | 137.17                                |
| 29     | 0.000                       | 0.021                        | -1.28                           | 135.89                                |
| 30     | 0.000                       | 0.021                        | -1.27                           | 134.62                                |
| 31     | 0.000                       | 0.021                        | -1.26                           | 133.36                                |
| 32     | 0.000                       | 0.021                        | -1.26                           | 132.10                                |
| 33     | 0.000                       | 0.021                        | -1.25                           | 130.85                                |
| 34     | 0.000                       | 0.021                        | -1.25                           | 129.60                                |
| 35     | 0.000                       | 0.021                        | -1.24                           | 128.36                                |
| 36     | 0.000                       | 0.021                        | -1.23                           | 127.13                                |
| 37     | 0.000                       | 0.020                        | -1.23                           | 125.90                                |
| 38     | 0.000                       | 0.020                        | -1.22                           | 124.68                                |
| 39     | 0.000                       | 0.020                        | -1.22                           | 123.47                                |
| 40     | 0.000                       | 0.020                        | -1.21                           | 122.26                                |

### Hydrograph Data (Uncontrolled)

| Minute | In Flow (m <sup>3</sup> /s) | Out Flow (m <sup>3</sup> /s) | Delta-Storage (m <sup>3</sup> ) | Cummulative Storage (m <sup>3</sup> ) |
|--------|-----------------------------|------------------------------|---------------------------------|---------------------------------------|
| 0      | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 1      | 0.001                       | 0.001                        | 0.000                           | 0.000                                 |
| 2      | 0.002                       | 0.002                        | 0.000                           | 0.000                                 |
| 3      | 0.003                       | 0.003                        | 0.000                           | 0.000                                 |
| 4      | 0.004                       | 0.004                        | 0.000                           | 0.000                                 |
| 5      | 0.005                       | 0.005                        | 0.000                           | 0.000                                 |
| 6      | 0.006                       | 0.006                        | 0.000                           | 0.000                                 |
| 7      | 0.007                       | 0.007                        | 0.000                           | 0.000                                 |
| 8      | 0.008                       | 0.008                        | 0.000                           | 0.000                                 |
| 9      | 0.009                       | 0.009                        | 0.000                           | 0.000                                 |
| 10     | 0.010                       | 0.010                        | 0.000                           | 0.000                                 |
| 11     | 0.009                       | 0.009                        | 0.000                           | 0.000                                 |
| 12     | 0.008                       | 0.008                        | 0.000                           | 0.000                                 |
| 13     | 0.007                       | 0.007                        | 0.000                           | 0.000                                 |
| 14     | 0.006                       | 0.006                        | 0.000                           | 0.000                                 |
| 15     | 0.005                       | 0.005                        | 0.000                           | 0.000                                 |
| 16     | 0.004                       | 0.004                        | 0.000                           | 0.000                                 |
| 17     | 0.003                       | 0.003                        | 0.000                           | 0.000                                 |
| 18     | 0.002                       | 0.002                        | 0.000                           | 0.000                                 |
| 19     | 0.001                       | 0.001                        | 0.000                           | 0.000                                 |
| 20     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 21     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 22     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 23     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 24     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 25     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 26     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 27     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 28     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 29     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 30     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 31     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 32     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 33     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 34     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 35     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 36     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 37     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 38     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 39     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 40     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |

### Total Release from Site

| Minute | Out Flow (m <sup>3</sup> /s) |
|--------|------------------------------|
| 0      | 0.000                        |
| 1      | 0.001                        |
| 2      | 0.002                        |
| 3      | 0.004                        |
| 4      | 0.006                        |
| 5      | 0.009                        |
| 6      | 0.012                        |
| 7      | 0.015                        |
| 8      | 0.019                        |
| 9      | 0.023                        |
| 10     | 0.025                        |
| 11     | 0.026                        |
| 12     | 0.026                        |
| 13     | 0.026 <b>Max Release</b>     |
| 14     | 0.026                        |
| 15     | 0.026                        |
| 16     | 0.025                        |
| 17     | 0.025                        |
| 18     | 0.024                        |
| 19     | 0.023                        |
| 20     | 0.022                        |
| 21     | 0.022                        |
| 22     | 0.022                        |
| 23     | 0.022                        |
| 24     | 0.022                        |
| 25     | 0.022                        |
| 26     | 0.022                        |
| 27     | 0.021                        |
| 28     | 0.021                        |
| 29     | 0.021                        |
| 30     | 0.021                        |
| 31     | 0.021                        |
| 32     | 0.021                        |
| 33     | 0.021                        |
| 34     | 0.021                        |
| 35     | 0.021                        |
| 36     | 0.021                        |
| 37     | 0.020                        |
| 38     | 0.020                        |
| 39     | 0.020                        |
| 40     | 0.020                        |

## 10-YEAR RELEASE RATES AND HYDROGRAPHS

| Site Statistics                                | Rating Curve Data Points         | Formulae                                                                              |
|------------------------------------------------|----------------------------------|---------------------------------------------------------------------------------------|
| <b>Controlled (P1, P2, P3, P4)</b>             | <b>Elevation (m)</b>             | $Q_{in} = Q_p / (t_d / 2) * t_i$                                                      |
| Total Site Area (ha) 1.27                      | <b>Outflow (m<sup>3</sup>/s)</b> | $Q_{out} = \text{Computer Generated using rating curve data points}$                  |
| Runoff Coefficient, C 0.71                     | 235.72 0.000 0.00                | $\text{Storage (m}^3) = \text{Cumulative storage}_{(t-1)} + \Delta \text{ Storage}_t$ |
| Storm Duration (mins) 20                       | 235.96 0.013 52.50               | $\Delta \text{ Storage (m}^3) = (Q_{in} - Q_{out})(t_i - t_{i-1}) * 60$               |
| 10-Year Release Rate (m <sup>3</sup> /s) 0.316 | 236.20 0.019 105.10              | Where:                                                                                |
|                                                | 236.56 0.025 183.90              | $Q_{in} = \text{Flow rate tributary to the system at a given time (m}^3/\text{s)}$    |
| <b>Uncontrolled (P5)</b>                       | 236.80 0.029 236.40              | $Q_{out} = \text{Flow rate out of the system at a given time (m}^3/\text{s)}$         |
| Total Site Area (ha) 0.17                      | 237.04 0.032 288.90              | $T_d = \text{Storm Duration (min)}$                                                   |
| Runoff Coefficient, C 0.20                     | 237.28 0.034 341.50              | $T_i = \text{Time (min)}$                                                             |
| Storm Duration (mins) 20                       |                                  |                                                                                       |
| 10-Year Release Rate (m <sup>3</sup> /s) 0.012 |                                  |                                                                                       |

### Hydrograph Data (Controlled)

| Minute | In Flow (m <sup>3</sup> /s) | Out Flow (m <sup>3</sup> /s) | Delta-Storage (m <sup>3</sup> ) | Cummulative Storage (m <sup>3</sup> ) |
|--------|-----------------------------|------------------------------|---------------------------------|---------------------------------------|
| 0      | 0.000                       | 0.000                        | 0.00                            | 0.00                                  |
| 1      | 0.032                       | 0.000                        | 1.89                            | 1.89                                  |
| 2      | 0.063                       | 0.000                        | 3.76                            | 5.65                                  |
| 3      | 0.095                       | 0.001                        | 5.60                            | 11.25                                 |
| 4      | 0.126                       | 0.003                        | 7.41                            | 18.66                                 |
| 5      | 0.158                       | 0.005                        | 9.20                            | 27.86                                 |
| 6      | 0.189                       | 0.007                        | 10.96                           | 38.82                                 |
| 7      | 0.221                       | 0.009                        | 12.69                           | 51.51                                 |
| 8      | 0.253                       | 0.013                        | 14.40                           | 65.91                                 |
| 9      | 0.284                       | 0.014                        | 16.19                           | 82.10                                 |
| 10     | 0.316                       | 0.016                        | 17.97                           | 100.07                                |
| 11     | 0.284                       | 0.018                        | 15.96                           | 116.03                                |
| 12     | 0.253                       | 0.020                        | 13.98                           | 130.01                                |
| 13     | 0.221                       | 0.021                        | 12.02                           | 142.02                                |
| 14     | 0.189                       | 0.022                        | 10.06                           | 152.08                                |
| 15     | 0.158                       | 0.022                        | 8.12                            | 160.20                                |
| 16     | 0.126                       | 0.023                        | 6.19                            | 166.39                                |
| 17     | 0.095                       | 0.024                        | 4.26                            | 170.66                                |
| 18     | 0.063                       | 0.024                        | 2.35                            | 173.00                                |
| 19     | 0.032                       | 0.024                        | 0.44                            | 173.45 <b>Max Storage</b>             |
| 20     | 0.000                       | 0.024                        | -1.45                           | 172.00                                |
| 21     | 0.000                       | 0.024                        | -1.45                           | 170.55                                |
| 22     | 0.000                       | 0.024                        | -1.44                           | 169.11                                |
| 23     | 0.000                       | 0.024                        | -1.43                           | 167.68                                |
| 24     | 0.000                       | 0.024                        | -1.42                           | 166.26                                |
| 25     | 0.000                       | 0.024                        | -1.42                           | 164.84                                |
| 26     | 0.000                       | 0.024                        | -1.41                           | 163.43                                |
| 27     | 0.000                       | 0.023                        | -1.40                           | 162.03                                |
| 28     | 0.000                       | 0.023                        | -1.40                           | 160.63                                |
| 29     | 0.000                       | 0.023                        | -1.39                           | 159.24                                |
| 30     | 0.000                       | 0.023                        | -1.38                           | 157.86                                |
| 31     | 0.000                       | 0.023                        | -1.38                           | 156.48                                |
| 32     | 0.000                       | 0.023                        | -1.37                           | 155.11                                |
| 33     | 0.000                       | 0.023                        | -1.36                           | 153.75                                |
| 34     | 0.000                       | 0.023                        | -1.36                           | 152.39                                |
| 35     | 0.000                       | 0.022                        | -1.35                           | 151.04                                |
| 36     | 0.000                       | 0.022                        | -1.34                           | 149.70                                |
| 37     | 0.000                       | 0.022                        | -1.34                           | 148.36                                |
| 38     | 0.000                       | 0.022                        | -1.33                           | 147.03                                |
| 39     | 0.000                       | 0.022                        | -1.32                           | 145.71                                |
| 40     | 0.000                       | 0.022                        | -1.32                           | 144.39                                |

### Hydrograph Data (Uncontrolled)

| Minute | In Flow (m <sup>3</sup> /s) | Out Flow (m <sup>3</sup> /s) | Delta-Storage (m <sup>3</sup> ) | Cummulative Storage (m <sup>3</sup> ) |
|--------|-----------------------------|------------------------------|---------------------------------|---------------------------------------|
| 0      | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 1      | 0.001                       | 0.001                        | 0.000                           | 0.000                                 |
| 2      | 0.002                       | 0.002                        | 0.000                           | 0.000                                 |
| 3      | 0.004                       | 0.004                        | 0.000                           | 0.000                                 |
| 4      | 0.005                       | 0.005                        | 0.000                           | 0.000                                 |
| 5      | 0.006                       | 0.006                        | 0.000                           | 0.000                                 |
| 6      | 0.007                       | 0.007                        | 0.000                           | 0.000                                 |
| 7      | 0.008                       | 0.008                        | 0.000                           | 0.000                                 |
| 8      | 0.010                       | 0.010                        | 0.000                           | 0.000                                 |
| 9      | 0.011                       | 0.011                        | 0.000                           | 0.000                                 |
| 10     | 0.012                       | 0.012                        | 0.000                           | 0.000                                 |
| 11     | 0.011                       | 0.011                        | 0.000                           | 0.000                                 |
| 12     | 0.010                       | 0.010                        | 0.000                           | 0.000                                 |
| 13     | 0.008                       | 0.008                        | 0.000                           | 0.000                                 |
| 14     | 0.007                       | 0.007                        | 0.000                           | 0.000                                 |
| 15     | 0.006                       | 0.006                        | 0.000                           | 0.000                                 |
| 16     | 0.005                       | 0.005                        | 0.000                           | 0.000                                 |
| 17     | 0.004                       | 0.004                        | 0.000                           | 0.000                                 |
| 18     | 0.002                       | 0.002                        | 0.000                           | 0.000                                 |
| 19     | 0.001                       | 0.001                        | 0.000                           | 0.000                                 |
| 20     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 21     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 22     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 23     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 24     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 25     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 26     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 27     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 28     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 29     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 30     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 31     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 32     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 33     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 34     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 35     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 36     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 37     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 38     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 39     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 40     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |

### Total Release from Site

| Minute | Out Flow (m <sup>3</sup> /s) |
|--------|------------------------------|
| 0      | 0.000                        |
| 1      | 0.001                        |
| 2      | 0.003                        |
| 3      | 0.005                        |
| 4      | 0.008                        |
| 5      | 0.011                        |
| 6      | 0.014                        |
| 7      | 0.018                        |
| 8      | 0.022                        |
| 9      | 0.025                        |
| 10     | 0.028                        |
| 11     | 0.029                        |
| 12     | 0.029 <b>Max Release</b>     |
| 13     | 0.029                        |
| 14     | 0.029                        |
| 15     | 0.028                        |
| 16     | 0.028                        |
| 17     | 0.027                        |
| 18     | 0.026                        |
| 19     | 0.025                        |
| 20     | 0.024                        |
| 21     | 0.024                        |
| 22     | 0.024                        |
| 23     | 0.024                        |
| 24     | 0.024                        |
| 25     | 0.024                        |
| 26     | 0.024                        |
| 27     | 0.023                        |
| 28     | 0.023                        |
| 29     | 0.023                        |
| 30     | 0.023                        |
| 31     | 0.023                        |
| 32     | 0.023                        |
| 33     | 0.023                        |
| 34     | 0.023                        |
| 35     | 0.022                        |
| 36     | 0.022                        |
| 37     | 0.022                        |
| 38     | 0.022                        |
| 39     | 0.022                        |
| 40     | 0.022                        |

## 25-YEAR RELEASE RATES AND HYDROGRAPHS

| Site Statistics                                                                                                                                                             | Rating Curve Data Points                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Formulae                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Controlled (P1, P2, P3, P4)</b><br>Total Site Area (ha) 1.27<br>Runoff Coefficient, C 0.71<br>Storm Duration (mins) 20<br>25-Year Release Rate (m <sup>3</sup> /s) 0.407 | Elevation (m)      Outflow (m <sup>3</sup> /s)      Storage (m <sup>3</sup> )<br>235.72                  0.000                  0.00<br>235.96                  0.013                  52.50<br>236.20                  0.019                  105.10<br>236.56                  0.025                  183.90<br>236.80                  0.029                  236.40<br>237.04                  0.032                  288.90<br>237.28                  0.034                  341.50 | $Q_{in} = Q_p / (t_d / 2) * t_i$<br>$Q_{out} =$ Computer Generated using rating curve data points<br>Storage (m <sup>3</sup> ) = Cumulative storage <sub>(t-1)</sub> + Δ Storage <sub>t</sub><br>$\Delta \text{ Storage (m}^3) = (Q_{in} - Q_{out})(t - t_{i-1}) * 60$<br><br>Where:<br>$Q_{in}$ = Flow rate tributary to the system at a given time (m <sup>3</sup> /s)<br>$Q_{out}$ = Flow rate out of the system at a given time (m <sup>3</sup> /s)<br>$T_d$ = Storm Duration (min)<br>$T_i$ = Time (min) |
| <b>Uncontrolled (P5)</b><br>Total Site Area (ha) 0.17<br>Runoff Coefficient, C 0.20<br>Storm Duration (mins) 20<br>25-Year Release Rate (m <sup>3</sup> /s) 0.015           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

### Hydrograph Data (Controlled)

| Minute | In Flow (m <sup>3</sup> /s) | Out Flow (m <sup>3</sup> /s) | Delta-Storage (m <sup>3</sup> ) | Cumulative Storage (m <sup>3</sup> ) |
|--------|-----------------------------|------------------------------|---------------------------------|--------------------------------------|
| 0      | 0.000                       | 0.000                        | 0.00                            | 0.00                                 |
| 1      | 0.041                       | 0.000                        | 2.44                            | 2.44                                 |
| 2      | 0.081                       | 0.001                        | 4.85                            | 7.30                                 |
| 3      | 0.122                       | 0.002                        | 7.23                            | 14.52                                |
| 4      | 0.163                       | 0.004                        | 9.56                            | 24.08                                |
| 5      | 0.204                       | 0.006                        | 11.87                           | 35.95                                |
| 6      | 0.244                       | 0.009                        | 14.14                           | 50.09                                |
| 7      | 0.285                       | 0.012                        | 16.38                           | 66.47                                |
| 8      | 0.326                       | 0.014                        | 18.69                           | 85.16                                |
| 9      | 0.367                       | 0.016                        | 21.01                           | 106.17                               |
| 10     | 0.407                       | 0.019                        | 23.31                           | 129.48                               |
| 11     | 0.367                       | 0.021                        | 20.76                           | 150.24                               |
| 12     | 0.326                       | 0.022                        | 18.21                           | 168.45                               |
| 13     | 0.285                       | 0.024                        | 15.68                           | 184.13                               |
| 14     | 0.244                       | 0.025                        | 13.16                           | 197.29                               |
| 15     | 0.204                       | 0.026                        | 10.66                           | 207.95                               |
| 16     | 0.163                       | 0.027                        | 8.18                            | 216.13                               |
| 17     | 0.122                       | 0.027                        | 5.70                            | 221.83                               |
| 18     | 0.081                       | 0.028                        | 3.23                            | 225.06                               |
| 19     | 0.041                       | 0.028                        | 0.78                            | <b>225.84</b> Max Storage            |
| 20     | 0.000                       | 0.028                        | -1.67                           | 224.17                               |
| 21     | 0.000                       | 0.028                        | -1.66                           | 222.51                               |
| 22     | 0.000                       | 0.028                        | -1.66                           | 220.85                               |
| 23     | 0.000                       | 0.027                        | -1.65                           | 219.21                               |
| 24     | 0.000                       | 0.027                        | -1.64                           | 217.56                               |
| 25     | 0.000                       | 0.027                        | -1.64                           | 215.93                               |
| 26     | 0.000                       | 0.027                        | -1.63                           | 214.30                               |
| 27     | 0.000                       | 0.027                        | -1.62                           | 212.67                               |
| 28     | 0.000                       | 0.027                        | -1.62                           | 211.06                               |
| 29     | 0.000                       | 0.027                        | -1.61                           | 209.44                               |
| 30     | 0.000                       | 0.027                        | -1.60                           | 207.84                               |
| 31     | 0.000                       | 0.027                        | -1.60                           | 206.24                               |
| 32     | 0.000                       | 0.027                        | -1.59                           | 204.65                               |
| 33     | 0.000                       | 0.026                        | -1.59                           | 203.07                               |
| 34     | 0.000                       | 0.026                        | -1.58                           | 201.49                               |
| 35     | 0.000                       | 0.026                        | -1.57                           | 199.91                               |
| 36     | 0.000                       | 0.026                        | -1.57                           | 198.35                               |
| 37     | 0.000                       | 0.026                        | -1.56                           | 196.79                               |
| 38     | 0.000                       | 0.026                        | -1.55                           | 195.23                               |
| 39     | 0.000                       | 0.026                        | -1.55                           | 193.69                               |
| 40     | 0.000                       | 0.026                        | -1.54                           | 192.14                               |

### Hydrograph Data (Uncontrolled)

| Minute | In Flow (m <sup>3</sup> /s) | Out Flow (m <sup>3</sup> /s) | Delta-Storage (m <sup>3</sup> ) | Cumulative Storage (m <sup>3</sup> ) |
|--------|-----------------------------|------------------------------|---------------------------------|--------------------------------------|
| 0      | 0.000                       | 0.000                        | 0.000                           | 0.000                                |
| 1      | 0.002                       | 0.002                        | 0.000                           | 0.000                                |
| 2      | 0.003                       | 0.003                        | 0.000                           | 0.000                                |
| 3      | 0.005                       | 0.005                        | 0.000                           | 0.000                                |
| 4      | 0.006                       | 0.006                        | 0.000                           | 0.000                                |
| 5      | 0.008                       | 0.008                        | 0.000                           | 0.000                                |
| 6      | 0.009                       | 0.009                        | 0.000                           | 0.000                                |
| 7      | 0.011                       | 0.011                        | 0.000                           | 0.000                                |
| 8      | 0.012                       | 0.012                        | 0.000                           | 0.000                                |
| 9      | 0.014                       | 0.014                        | 0.000                           | 0.000                                |
| 10     | 0.015                       | 0.015                        | 0.000                           | 0.000                                |
| 11     | 0.014                       | 0.014                        | 0.000                           | 0.000                                |
| 12     | 0.012                       | 0.012                        | 0.000                           | 0.000                                |
| 13     | 0.011                       | 0.011                        | 0.000                           | 0.000                                |
| 14     | 0.009                       | 0.009                        | 0.000                           | 0.000                                |
| 15     | 0.008                       | 0.008                        | 0.000                           | 0.000                                |
| 16     | 0.006                       | 0.006                        | 0.000                           | 0.000                                |
| 17     | 0.005                       | 0.005                        | 0.000                           | 0.000                                |
| 18     | 0.003                       | 0.003                        | 0.000                           | 0.000                                |
| 19     | 0.002                       | 0.002                        | 0.000                           | 0.000                                |
| 20     | 0.000                       | 0.000                        | 0.000                           | 0.000                                |
| 21     | 0.000                       | 0.000                        | 0.000                           | 0.000                                |
| 22     | 0.000                       | 0.000                        | 0.000                           | 0.000                                |
| 23     | 0.000                       | 0.000                        | 0.000                           | 0.000                                |
| 24     | 0.000                       | 0.000                        | 0.000                           | 0.000                                |
| 25     | 0.000                       | 0.000                        | 0.000                           | 0.000                                |
| 26     | 0.000                       | 0.000                        | 0.000                           | 0.000                                |
| 27     | 0.000                       | 0.000                        | 0.000                           | 0.000                                |
| 28     | 0.000                       | 0.000                        | 0.000                           | 0.000                                |
| 29     | 0.000                       | 0.000                        | 0.000                           | 0.000                                |
| 30     | 0.000                       | 0.000                        | 0.000                           | 0.000                                |
| 31     | 0.000                       | 0.000                        | 0.000                           | 0.000                                |
| 32     | 0.000                       | 0.000                        | 0.000                           | 0.000                                |
| 33     | 0.000                       | 0.000                        | 0.000                           | 0.000                                |
| 34     | 0.000                       | 0.000                        | 0.000                           | 0.000                                |
| 35     | 0.000                       | 0.000                        | 0.000                           | 0.000                                |
| 36     | 0.000                       | 0.000                        | 0.000                           | 0.000                                |
| 37     | 0.000                       | 0.000                        | 0.000                           | 0.000                                |
| 38     | 0.000                       | 0.000                        | 0.000                           | 0.000                                |
| 39     | 0.000                       | 0.000                        | 0.000                           | 0.000                                |
| 40     | 0.000                       | 0.000                        | 0.000                           | 0.000                                |

### Total Release from Site

| Minute | Out Flow (m <sup>3</sup> /s) |
|--------|------------------------------|
| 0      | 0.000                        |
| 1      | 0.002                        |
| 2      | 0.004                        |
| 3      | 0.006                        |
| 4      | 0.010                        |
| 5      | 0.014                        |
| 6      | 0.018                        |
| 7      | 0.023                        |
| 8      | 0.027                        |
| 9      | 0.030                        |
| 10     | 0.034                        |
| 11     | 0.035                        |
| 12     | <b>0.035</b> Max Release     |
| 13     | 0.035                        |
| 14     | 0.034                        |
| 15     | 0.034                        |
| 16     | 0.033                        |
| 17     | 0.032                        |
| 18     | 0.031                        |
| 19     | 0.029                        |
| 20     | 0.028                        |
| 21     | 0.028                        |
| 22     | 0.028                        |
| 23     | 0.027                        |
| 24     | 0.027                        |
| 25     | 0.027                        |
| 26     | 0.027                        |
| 27     | 0.027                        |
| 28     | 0.027                        |
| 29     | 0.027                        |
| 30     | 0.027                        |
| 31     | 0.027                        |
| 32     | 0.027                        |
| 33     | 0.026                        |
| 34     | 0.026                        |
| 35     | 0.026                        |
| 36     | 0.026                        |
| 37     | 0.026                        |
| 38     | 0.026                        |
| 39     | 0.026                        |
| 40     | 0.026                        |

## 50-YEAR RELEASE RATES AND HYDROGRAPHS

| Site Statistics                                                                                                                                                             | Rating Curve Data Points                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Formulae                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Controlled (P1, P2, P3, P4)</b><br>Total Site Area (ha) 1.27<br>Runoff Coefficient, C 0.71<br>Storm Duration (mins) 20<br>50-Year Release Rate (m <sup>3</sup> /s) 0.492 | Elevation (m)      Outflow (m <sup>3</sup> /s)      Storage (m <sup>3</sup> )<br>235.72                  0.000                  0.00<br>235.96                  0.013                  52.50<br>236.20                  0.019                  105.10<br>236.56                  0.025                  183.90<br>236.80                  0.029                  236.40<br>237.04                  0.032                  288.90<br>237.28                  0.034                  341.50 | $Q_{in} = Q_p / (t_d / 2) * t_i$<br>$Q_{out} =$ Computer Generated using rating curve data points<br>Storage (m <sup>3</sup> ) = Cumulative storage <sub>(i-1)</sub> + Δ Storage <sub>i</sub><br>$\Delta \text{ Storage (m}^3) = (Q_{in} - Q_{out})(t_i - t_{i-1}) * 60$<br><br>Where:<br>$Q_{in}$ = Flow rate tributary to the system at a given time (m <sup>3</sup> /s)<br>$Q_{out}$ = Flow rate out of the system at a given time (m <sup>3</sup> /s)<br>$T_d$ = Storm Duration (min)<br>$T_i$ = Time (min) |
| <b>Uncontrolled (P5)</b><br>Total Site Area (ha) 0.17<br>Runoff Coefficient, C 0.20<br>Storm Duration (mins) 20<br>50-Year Release Rate (m <sup>3</sup> /s) 0.019           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

### Hydrograph Data (Controlled)

| Minute | In Flow (m <sup>3</sup> /s) | Out Flow (m <sup>3</sup> /s) | Delta-Storage (m <sup>3</sup> ) | Cummulative Storage (m <sup>3</sup> ) |
|--------|-----------------------------|------------------------------|---------------------------------|---------------------------------------|
| 0      | 0.000                       | 0.000                        | 0.00                            | 0.00                                  |
| 1      | 0.049                       | 0.000                        | 2.95                            | 2.95                                  |
| 2      | 0.098                       | 0.001                        | 5.86                            | 8.81                                  |
| 3      | 0.148                       | 0.002                        | 8.73                            | 17.54                                 |
| 4      | 0.197                       | 0.004                        | 11.55                           | 29.09                                 |
| 5      | 0.246                       | 0.007                        | 14.33                           | 43.42                                 |
| 6      | 0.295                       | 0.011                        | 17.08                           | 60.49                                 |
| 7      | 0.344                       | 0.014                        | 19.84                           | 80.33                                 |
| 8      | 0.394                       | 0.016                        | 22.66                           | 102.99                                |
| 9      | 0.443                       | 0.018                        | 25.46                           | 128.45                                |
| 10     | 0.492                       | 0.021                        | 28.28                           | 156.73                                |
| 11     | 0.443                       | 0.023                        | 25.19                           | 181.92                                |
| 12     | 0.394                       | 0.025                        | 22.12                           | 204.03                                |
| 13     | 0.344                       | 0.026                        | 19.08                           | 223.11                                |
| 14     | 0.295                       | 0.028                        | 16.05                           | 239.16                                |
| 15     | 0.246                       | 0.029                        | 13.04                           | 252.20                                |
| 16     | 0.197                       | 0.029                        | 10.04                           | 262.23                                |
| 17     | 0.148                       | 0.030                        | 7.05                            | 269.29                                |
| 18     | 0.098                       | 0.030                        | 4.08                            | 273.36                                |
| 19     | 0.049                       | 0.031                        | 1.11                            | 274.47                                |
| 20     | 0.000                       | 0.031                        | -1.85                           | 272.63                                |
| 21     | 0.000                       | 0.031                        | -1.84                           | 270.79                                |
| 22     | 0.000                       | 0.031                        | -1.83                           | 268.95                                |
| 23     | 0.000                       | 0.030                        | -1.83                           | 267.13                                |
| 24     | 0.000                       | 0.030                        | -1.82                           | 265.31                                |
| 25     | 0.000                       | 0.030                        | -1.81                           | 263.50                                |
| 26     | 0.000                       | 0.030                        | -1.81                           | 261.69                                |
| 27     | 0.000                       | 0.030                        | -1.80                           | 259.89                                |
| 28     | 0.000                       | 0.030                        | -1.79                           | 258.09                                |
| 29     | 0.000                       | 0.030                        | -1.79                           | 256.31                                |
| 30     | 0.000                       | 0.030                        | -1.78                           | 254.52                                |
| 31     | 0.000                       | 0.030                        | -1.78                           | 252.75                                |
| 32     | 0.000                       | 0.029                        | -1.77                           | 250.98                                |
| 33     | 0.000                       | 0.029                        | -1.76                           | 249.22                                |
| 34     | 0.000                       | 0.029                        | -1.76                           | 247.46                                |
| 35     | 0.000                       | 0.029                        | -1.75                           | 245.71                                |
| 36     | 0.000                       | 0.029                        | -1.74                           | 243.97                                |
| 37     | 0.000                       | 0.029                        | -1.74                           | 242.23                                |
| 38     | 0.000                       | 0.029                        | -1.73                           | 240.50                                |
| 39     | 0.000                       | 0.029                        | -1.73                           | 238.77                                |
| 40     | 0.000                       | 0.029                        | -1.72                           | 237.05                                |

### Hydrograph Data (Uncontrolled)

| Minute | In Flow (m <sup>3</sup> /s) | Out Flow (m <sup>3</sup> /s) | Delta-Storage (m <sup>3</sup> ) | Cummulative Storage (m <sup>3</sup> ) |
|--------|-----------------------------|------------------------------|---------------------------------|---------------------------------------|
| 0      | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 1      | 0.002                       | 0.002                        | 0.000                           | 0.000                                 |
| 2      | 0.004                       | 0.004                        | 0.000                           | 0.000                                 |
| 3      | 0.006                       | 0.006                        | 0.000                           | 0.000                                 |
| 4      | 0.007                       | 0.007                        | 0.000                           | 0.000                                 |
| 5      | 0.009                       | 0.009                        | 0.000                           | 0.000                                 |
| 6      | 0.011                       | 0.011                        | 0.000                           | 0.000                                 |
| 7      | 0.013                       | 0.013                        | 0.000                           | 0.000                                 |
| 8      | 0.015                       | 0.015                        | 0.000                           | 0.000                                 |
| 9      | 0.017                       | 0.017                        | 0.000                           | 0.000                                 |
| 10     | 0.019                       | 0.019                        | 0.000                           | 0.000                                 |
| 11     | 0.017                       | 0.017                        | 0.000                           | 0.000                                 |
| 12     | 0.015                       | 0.015                        | 0.000                           | 0.000                                 |
| 13     | 0.013                       | 0.013                        | 0.000                           | 0.000                                 |
| 14     | 0.011                       | 0.011                        | 0.000                           | 0.000                                 |
| 15     | 0.009                       | 0.009                        | 0.000                           | 0.000                                 |
| 16     | 0.007                       | 0.007                        | 0.000                           | 0.000                                 |
| 17     | 0.006                       | 0.006                        | 0.000                           | 0.000                                 |
| 18     | 0.004                       | 0.004                        | 0.000                           | 0.000                                 |
| 19     | 0.002                       | 0.002                        | 0.000                           | 0.000                                 |
| 20     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 21     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 22     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 23     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 24     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 25     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 26     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 27     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 28     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 29     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 30     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 31     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 32     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 33     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 34     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 35     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 36     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 37     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 38     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 39     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 40     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |

### Total Release from Site

| Minute | Out Flow (m <sup>3</sup> /s) |
|--------|------------------------------|
| 0      | 0.000                        |
| 1      | 0.002                        |
| 2      | 0.004                        |
| 3      | 0.008                        |
| 4      | 0.012                        |
| 5      | 0.016                        |
| 6      | 0.022                        |
| 7      | 0.027                        |
| 8      | 0.031                        |
| 9      | 0.035                        |
| 10     | 0.039                        |
| 11     | 0.040                        |
| 12     | 0.040 Max Release            |
| 13     | 0.039                        |
| 14     | 0.039                        |
| 15     | 0.038                        |
| 16     | 0.037                        |
| 17     | 0.036                        |
| 18     | 0.034                        |
| 19     | 0.033                        |
| 20     | 0.031                        |
| 21     | 0.031                        |
| 22     | 0.031                        |
| 23     | 0.030                        |
| 24     | 0.030                        |
| 25     | 0.030                        |
| 26     | 0.030                        |
| 27     | 0.030                        |
| 28     | 0.030                        |
| 29     | 0.030                        |
| 30     | 0.030                        |
| 31     | 0.030                        |
| 32     | 0.029                        |
| 33     | 0.029                        |
| 34     | 0.029                        |
| 35     | 0.029                        |
| 36     | 0.029                        |
| 37     | 0.029                        |
| 38     | 0.029                        |
| 39     | 0.029                        |
| 40     | 0.029                        |

## 100-YEAR RELEASE RATES AND HYDROGRAPHS

| Site Statistics                           |       | Rating Curve Data Points |                             |                           | Formulae                                                                                     |
|-------------------------------------------|-------|--------------------------|-----------------------------|---------------------------|----------------------------------------------------------------------------------------------|
| <b>Controlled (P1, P2, P3, P4)</b>        |       | Elevation (m)            | Outflow (m <sup>3</sup> /s) | Storage (m <sup>3</sup> ) | $Q_{in} = Q_p / (t_p / 2) * t_i$                                                             |
| Total Site Area (ha)                      | 1.27  | 235.72                   | 0.000                       | 0.00                      | $Q_{out} = \text{Computer Generated using rating curve data points}$                         |
| Runoff Coefficient, C                     | 0.71  | 235.96                   | 0.013                       | 52.50                     | $\text{Storage (m}^3\text{)} = \text{Cumulative storage}_{(i-1)} + \Delta \text{ Storage}_i$ |
| Storm Duration (mins)                     | 20    | 236.20                   | 0.019                       | 105.10                    | $\Delta \text{ Storage (m}^3\text{)} = (Q_{in} - Q_{out})(t_i - t_{(i-1)}) * 60$             |
| 100-Year Release Rate (m <sup>3</sup> /s) | 0.563 | 236.56                   | 0.025                       | 183.90                    | Where:                                                                                       |
| <b>Uncontrolled (P5)</b>                  |       | 236.80                   | 0.029                       | 236.40                    | $Q_{in} = \text{Flow rate tributary to the system at a given time (m}^3\text{/s)}$           |
| Total Site Area (ha)                      | 0.17  | 237.04                   | 0.032                       | 288.90                    | $Q_{out} = \text{Flow rate out of the system at a given time (m}^3\text{/s)}$                |
| Runoff Coefficient, C                     | 0.20  | 237.28                   | 0.034                       | 341.50                    | $T_d = \text{Storm Duration (min)}$                                                          |
| Storm Duration (mins)                     | 20    |                          |                             |                           | $T_r = \text{Time (min)}$                                                                    |
| 100-Year Release Rate (m <sup>3</sup> /s) | 0.021 |                          |                             |                           |                                                                                              |

### Hydrograph Data (Controlled)

| Minute | In Flow (m <sup>3</sup> /s) | Out Flow (m <sup>3</sup> /s) | Delta-Storage (m <sup>3</sup> ) | Cummulative Storage (m <sup>3</sup> ) |
|--------|-----------------------------|------------------------------|---------------------------------|---------------------------------------|
| 0      | 0.000                       | 0.000                        | 0.00                            | 0.00                                  |
| 1      | 0.056                       | 0.000                        | 3.38                            | 3.38                                  |
| 2      | 0.113                       | 0.001                        | 6.71                            | 10.09                                 |
| 3      | 0.169                       | 0.002                        | 9.99                            | 20.08                                 |
| 4      | 0.225                       | 0.005                        | 13.23                           | 33.31                                 |
| 5      | 0.282                       | 0.008                        | 16.41                           | 49.72                                 |
| 6      | 0.338                       | 0.012                        | 19.55                           | 69.28                                 |
| 7      | 0.394                       | 0.015                        | 22.78                           | 92.06                                 |
| 8      | 0.451                       | 0.017                        | 26.01                           | 118.06                                |
| 9      | 0.507                       | 0.020                        | 29.24                           | 147.30                                |
| 10     | 0.563                       | 0.022                        | 32.47                           | 179.77                                |
| 11     | 0.507                       | 0.025                        | 28.94                           | 208.71                                |
| 12     | 0.451                       | 0.027                        | 25.44                           | 234.14                                |
| 13     | 0.394                       | 0.028                        | 21.96                           | 256.10                                |
| 14     | 0.338                       | 0.030                        | 18.50                           | 274.60                                |
| 15     | 0.282                       | 0.031                        | 15.05                           | 289.65                                |
| 16     | 0.225                       | 0.032                        | 11.62                           | 301.27                                |
| 17     | 0.169                       | 0.032                        | 8.20                            | 309.48                                |
| 18     | 0.113                       | 0.033                        | 4.80                            | 314.27                                |
| 19     | 0.056                       | 0.033                        | 1.40                            | 315.67                                |
| 20     | 0.000                       | 0.033                        | -1.98                           | 313.69                                |
| 21     | 0.000                       | 0.033                        | -1.98                           | 311.72                                |
| 22     | 0.000                       | 0.033                        | -1.97                           | 309.75                                |
| 23     | 0.000                       | 0.033                        | -1.96                           | 307.78                                |
| 24     | 0.000                       | 0.033                        | -1.96                           | 305.83                                |
| 25     | 0.000                       | 0.033                        | -1.95                           | 303.87                                |
| 26     | 0.000                       | 0.032                        | -1.94                           | 301.93                                |
| 27     | 0.000                       | 0.032                        | -1.94                           | 299.99                                |
| 28     | 0.000                       | 0.032                        | -1.93                           | 298.06                                |
| 29     | 0.000                       | 0.032                        | -1.93                           | 296.13                                |
| 30     | 0.000                       | 0.032                        | -1.92                           | 294.21                                |
| 31     | 0.000                       | 0.032                        | -1.91                           | 292.30                                |
| 32     | 0.000                       | 0.032                        | -1.91                           | 290.39                                |
| 33     | 0.000                       | 0.032                        | -1.90                           | 288.49                                |
| 34     | 0.000                       | 0.032                        | -1.90                           | 286.60                                |
| 35     | 0.000                       | 0.031                        | -1.89                           | 284.71                                |
| 36     | 0.000                       | 0.031                        | -1.88                           | 282.83                                |
| 37     | 0.000                       | 0.031                        | -1.88                           | 280.95                                |
| 38     | 0.000                       | 0.031                        | -1.87                           | 279.08                                |
| 39     | 0.000                       | 0.031                        | -1.86                           | 277.22                                |
| 40     | 0.000                       | 0.031                        | -1.86                           | 275.36                                |

### Hydrograph Data (Uncontrolled)

| Minute | In Flow (m <sup>3</sup> /s) | Out Flow (m <sup>3</sup> /s) | Delta-Storage (m <sup>3</sup> ) | Cummulative Storage (m <sup>3</sup> ) |
|--------|-----------------------------|------------------------------|---------------------------------|---------------------------------------|
| 0      | 0.000                       | 0.000                        | 0.00                            | 0.00                                  |
| 1      | 0.002                       | 0.002                        | 0.000                           | 0.000                                 |
| 2      | 0.004                       | 0.004                        | 0.000                           | 0.000                                 |
| 3      | 0.006                       | 0.006                        | 0.000                           | 0.000                                 |
| 4      | 0.009                       | 0.009                        | 0.000                           | 0.000                                 |
| 5      | 0.011                       | 0.011                        | 0.000                           | 0.000                                 |
| 6      | 0.013                       | 0.013                        | 0.000                           | 0.000                                 |
| 7      | 0.015                       | 0.015                        | 0.000                           | 0.000                                 |
| 8      | 0.017                       | 0.017                        | 0.000                           | 0.000                                 |
| 9      | 0.019                       | 0.019                        | 0.000                           | 0.000                                 |
| 10     | 0.021                       | 0.021                        | 0.000                           | 0.000                                 |
| 11     | 0.019                       | 0.019                        | 0.000                           | 0.000                                 |
| 12     | 0.017                       | 0.017                        | 0.000                           | 0.000                                 |
| 13     | 0.015                       | 0.015                        | 0.000                           | 0.000                                 |
| 14     | 0.013                       | 0.013                        | 0.000                           | 0.000                                 |
| 15     | 0.011                       | 0.011                        | 0.000                           | 0.000                                 |
| 16     | 0.009                       | 0.009                        | 0.000                           | 0.000                                 |
| 17     | 0.006                       | 0.006                        | 0.000                           | 0.000                                 |
| 18     | 0.004                       | 0.004                        | 0.000                           | 0.000                                 |
| 19     | 0.002                       | 0.002                        | 0.000                           | 0.000                                 |
| 20     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 21     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 22     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 23     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 24     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 25     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 26     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 27     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 28     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 29     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 30     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 31     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 32     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 33     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 34     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 35     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 36     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 37     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 38     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 39     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |
| 40     | 0.000                       | 0.000                        | 0.000                           | 0.000                                 |

### Total Release from Site

| Minute | Out Flow (m <sup>3</sup> /s) |
|--------|------------------------------|
| 0      | 0.000                        |
| 1      | 0.002                        |
| 2      | 0.005                        |
| 3      | 0.009                        |
| 4      | 0.013                        |
| 5      | 0.019                        |
| 6      | 0.025                        |
| 7      | 0.030                        |
| 8      | 0.034                        |
| 9      | 0.039                        |
| 10     | 0.043                        |
| 11     | 0.044                        |
| 12     | 0.044                        |
| 13     | 0.043                        |
| 14     | 0.043                        |
| 15     | 0.041                        |
| 16     | 0.040                        |
| 17     | 0.039                        |
| 18     | 0.037                        |
| 19     | 0.035                        |
| 20     | 0.033                        |
| 21     | 0.033                        |
| 22     | 0.033                        |
| 23     | 0.033                        |
| 24     | 0.033                        |
| 25     | 0.033                        |
| 26     | 0.032                        |
| 27     | 0.032                        |
| 28     | 0.032                        |
| 29     | 0.032                        |
| 30     | 0.032                        |
| 31     | 0.032                        |
| 32     | 0.032                        |
| 33     | 0.032                        |
| 34     | 0.032                        |
| 35     | 0.031                        |
| 36     | 0.031                        |
| 37     | 0.031                        |
| 38     | 0.031                        |
| 39     | 0.031                        |
| 40     | 0.031                        |

## WATER BALANCE CALCULATIONS

### Reference Material

MECP Stormwater Management Planning & Design Manual (2003)  
 Table 3.1: Hydrologic Cycle Component Values  
 City of Toronto Wet Weather Flows Figure 1a

### Site Statistics

Total Site Area (m<sup>2</sup>): 14400  
 Soil Type & Hydrologic Group: Fine Sandy Loam, A  
 Target Rainfall Event (mm): 15

### PREDEVELOPMENT WATER BALANCE

#### Site Areas

|                                   | Mature Forest | Lawn  | Wetlands | Impervious | TOTALS |
|-----------------------------------|---------------|-------|----------|------------|--------|
| Area (m <sup>2</sup> )            | 3,600         | 8,104 | 2,000    | 696        | 14,400 |
| Pervious Area (m <sup>2</sup> )   | 3,600         | 8,104 | 2,000    | 0          | 13,704 |
| Impervious Area (m <sup>2</sup> ) | 0             | 0     | 0        | 696        | 696    |

#### MOE Infiltration Factors

|                                 |      |      |      |      |
|---------------------------------|------|------|------|------|
| Topography Infiltration Factor  | 0.30 | 0.30 | 0.30 | 0.30 |
| Soil Infiltration Factor        | 0.40 | 0.40 | 0.40 | 0.40 |
| Land Cover Infiltration Factor  | 0.10 | 0.10 | 0.10 | 0.10 |
| MOE Total Infiltration Factor   | 0.90 | 0.80 | 0.80 | 0.00 |
| Runoff Coefficient              | 0.10 | 0.20 | 0.20 | 1.00 |
| Runoff from Impervious Surfaces | 0    | 0    | 0    | 0.8  |

#### Inputs (per Unit Area)

|                             |     |     |     |     |
|-----------------------------|-----|-----|-----|-----|
| Precipitation (mm/yr)       | 940 | 940 | 940 | 940 |
| <b>TOTAL INPUTS (mm/yr)</b> | 940 | 940 | 940 | 940 |

#### Outputs (per Unit Area)

|                                 |     |     |     |     |
|---------------------------------|-----|-----|-----|-----|
| Precipitation Surplus (mm/yr)   | 394 | 425 | 425 | 752 |
| Evapotranspiration (mm/yr)      | 546 | 515 | 515 | 188 |
| Infiltration (mm/yr)            | 355 | 340 | 340 | 0   |
| Rooftop Infiltration (mm/yr)    | 0   | 0   | 0   | 0   |
| Total Infiltration (mm/yr)      | 355 | 340 | 340 | 0   |
| Runoff Pervious Areas (mm/yr)   | 39  | 85  | 85  | 0   |
| Runoff Impervious Areas (mm/yr) | 0   | 0   | 0   | 752 |
| Total Runoff (mm/yr)            | 39  | 85  | 85  | 752 |
| <b>TOTAL OUTPUTS (mm/yr)</b>    | 940 | 940 | 940 | 940 |
| Difference (INPUTS-OUTPUTS)     | 0   | 0   | 0   | 0   |

#### Inputs (Volumes)

|                                        |       |       |       |     |        |
|----------------------------------------|-------|-------|-------|-----|--------|
| Precipitation (m <sup>3</sup> /yr)     | 3,384 | 7,618 | 1,880 | 654 | 0      |
| <b>TOTAL INPUTS (m<sup>3</sup>/yr)</b> | 3,384 | 7,618 | 1,880 | 654 | 13,536 |

#### Outputs (Volumes)

|                                              |       |       |       |     |        |
|----------------------------------------------|-------|-------|-------|-----|--------|
| Precipitation Surplus (m <sup>3</sup> /yr)   | 1,418 | 3,444 | 850   | 523 | 6,236  |
| Evapotranspiration (m <sup>3</sup> /yr)      | 1,966 | 4,174 | 1,030 | 131 | 7,300  |
| Infiltration (m <sup>3</sup> /yr)            | 1,277 | 2,755 | 680   | 0   | 4,712  |
| Rooftop Infiltration (m <sup>3</sup> /yr)    | 0     | 0     | 0     | 0   | 0      |
| <b>Total Infiltration (m<sup>3</sup>/yr)</b> | 1,277 | 2,755 | 680   | 0   | 4,712  |
| Runoff Pervious Areas (m <sup>3</sup> /yr)   | 142   | 689   | 170   | 0   | 1,001  |
| Runoff Impervious Areas (m <sup>3</sup> /yr) | 0     | 0     | 0     | 523 | 523    |
| Total Runoff (m <sup>3</sup> /yr)            | 142   | 689   | 170   | 523 | 1,524  |
| <b>TOTAL OUTPUTS (m<sup>3</sup>/yr)</b>      | 3,384 | 7,618 | 1,880 | 654 | 13,536 |
| Difference (INPUTS-OUTPUTS)                  | 0     | 0     | 0     | 0   | 0      |

### POST DEVELOPMENT WATER BALANCE

#### Site Areas

|                                   | Grass/Open | Space | Impervious | TOTALS |
|-----------------------------------|------------|-------|------------|--------|
| Area (m <sup>2</sup> )            | 5,115      | 5,115 | 9,285      | 14,400 |
| Pervious Area (m <sup>2</sup> )   | 5,115      | 0     | 0          | 5,115  |
| Impervious Area (m <sup>2</sup> ) | 0          | 0     | 9,285      | 9,285  |

#### MOE Infiltration Factors

|                                 |      |      |      |
|---------------------------------|------|------|------|
| Topography Infiltration Factor  | 0.30 | 0.30 | 0.30 |
| Soil Infiltration Factor        | 0.40 | 0.40 | 0.40 |
| Land Cover Infiltration Factor  | 0.10 | 0.10 | 0.10 |
| MOE Total Infiltration Factor   | 0.80 | 0    | 0    |
| Runoff Coefficient              | 0.20 | 1    | 1    |
| Runoff from Impervious Surfaces | 0    | 0.8  | 0.8  |

#### Inputs (per Unit Area)

|                             |     |     |
|-----------------------------|-----|-----|
| Precipitation (mm/yr)       | 940 | 940 |
| <b>TOTAL INPUTS (mm/yr)</b> | 940 | 940 |

#### Outputs (per Unit Area)

|                                 |     |     |
|---------------------------------|-----|-----|
| Precipitation Surplus (mm/yr)   | 425 | 752 |
| Evapotranspiration (mm/yr)      | 515 | 188 |
| Infiltration (mm/yr)            | 340 | 0   |
| Rooftop Infiltration (mm/yr)    | 0   | 0   |
| Total Infiltration (mm/yr)      | 340 | 0   |
| Runoff Pervious Areas (mm/yr)   | 85  | 0   |
| Runoff Impervious Areas (mm/yr) | 0   | 752 |
| Total Runoff (mm/yr)            | 85  | 752 |
| <b>TOTAL OUTPUTS (mm/yr)</b>    | 940 | 940 |
| Difference (INPUTS-OUTPUTS)     | 0   | 0   |

#### Inputs (Volumes)

|                                        |       |       |        |
|----------------------------------------|-------|-------|--------|
| Precipitation (m <sup>3</sup> /yr)     | 4,808 | 8,728 | 13,536 |
| <b>TOTAL INPUTS (m<sup>3</sup>/yr)</b> | 4,808 | 8,728 | 13,536 |

#### Outputs (Volumes)

|                                              |       |       |        |
|----------------------------------------------|-------|-------|--------|
| Precipitation Surplus (m <sup>3</sup> /yr)   | 2,174 | 6,982 | 9,156  |
| Evapotranspiration (m <sup>3</sup> /yr)      | 2,634 | 1,746 | 4,380  |
| Infiltration (m <sup>3</sup> /yr)            | 1,739 | 0     | 1,739  |
| Rooftop Infiltration (m <sup>3</sup> /yr)    | 0     | 0     | 0      |
| <b>Total Infiltration (m<sup>3</sup>/yr)</b> | 1,739 | 0     | 1,739  |
| Runoff Pervious Areas (m <sup>3</sup> /yr)   | 435   | 0     | 435    |
| Runoff Impervious Areas (m <sup>3</sup> /yr) | 0     | 6,982 | 6,982  |
| Total Runoff (m <sup>3</sup> /yr)            | 435   | 6,982 | 7,417  |
| <b>TOTAL OUTPUTS (m<sup>3</sup>/yr)</b>      | 4,808 | 8,728 | 13,536 |
| Difference (INPUTS-OUTPUTS)                  | 0     | 0     | 0      |

### POST DEVELOPMENT WATER BALANCE WITH MITIGATION

#### Site Areas

|                                   | Grass/Open | Space | Impervious | Building Roof | TOTALS |
|-----------------------------------|------------|-------|------------|---------------|--------|
| Area (m <sup>2</sup> )            | 5,115      | 5,115 | 4,205      | 5,080         | 14,400 |
| Pervious Area (m <sup>2</sup> )   | 5,115      | 0     | 0          | 0             | 5,115  |
| Impervious Area (m <sup>2</sup> ) | 0          | 0     | 4,205      | 5,080         | 9,285  |

#### MOE Infiltration Factors

|                                 |      |      |      |      |
|---------------------------------|------|------|------|------|
| Topography Infiltration Factor  | 0.30 | 0.30 | 0.30 | 0.30 |
| Soil Infiltration Factor        | 0.40 | 0.40 | 0.40 | 0.40 |
| Land Cover Infiltration Factor  | 0.10 | 0.10 | 0.10 | 0.10 |
| MOE Total Infiltration Factor   | 0.8  | 0    | 0    | 0    |
| Runoff Coefficient              | 0.2  | 1    | 1    | 1    |
| Runoff from Impervious Surfaces | 0    | 0.8  | 0.8  | 0.8  |

#### Inputs (per Unit Area)

|                             |     |     |     |
|-----------------------------|-----|-----|-----|
| Precipitation (mm/yr)       | 940 | 940 | 940 |
| <b>TOTAL INPUTS (mm/yr)</b> | 940 | 940 | 940 |

#### Outputs (per Unit Area)

|                                 |     |     |     |
|---------------------------------|-----|-----|-----|
| Precipitation Surplus (mm/yr)   | 425 | 752 | 752 |
| Evapotranspiration (mm/yr)      | 515 | 188 | 188 |
| Infiltration (mm/yr)            | 340 | 0   | 0   |
| Rooftop Infiltration (mm/yr)    | 0   | 0   | 602 |
| Total Infiltration (mm/yr)      | 340 | 0   | 602 |
| Runoff Pervious Areas (mm/yr)   | 85  | 0   | 0   |
| Runoff Impervious Areas (mm/yr) | 0   | 752 | 752 |
| Total Runoff (mm/yr)            | 85  | 752 | 752 |
| <b>TOTAL OUTPUTS (mm/yr)</b>    | 940 | 940 | 940 |
| Difference (INPUTS-OUTPUTS)     | 0   | 0   | 0   |

#### Inputs (Volumes)

|                                        |       |       |       |        |
|----------------------------------------|-------|-------|-------|--------|
| Precipitation (m <sup>3</sup> /yr)     | 4,808 | 3,953 | 4,775 | 13,536 |
| <b>TOTAL INPUTS (m<sup>3</sup>/yr)</b> | 4,808 | 3,953 | 4,775 | 13,536 |

#### Outputs (Volumes)

|                                              |       |       |       |        |
|----------------------------------------------|-------|-------|-------|--------|
| Precipitation Surplus (m <sup>3</sup> /yr)   | 2,174 | 3,162 | 3,820 | 9,156  |
| Evapotranspiration (m <sup>3</sup> /yr)      | 2,634 | 791   | 955   | 4,380  |
| Infiltration (m <sup>3</sup> /yr)            | 1,739 | 0     | 0     | 1,739  |
| Rooftop Infiltration (m <sup>3</sup> /yr)    | 0     | 0     | 3,056 | 3,056  |
| <b>Total Infiltration (m<sup>3</sup>/yr)</b> | 1,739 | 0     | 3,056 | 4,795  |
| Runoff Pervious Areas (m <sup>3</sup> /yr)   | 435   | 0     | 0     | 435    |
| Runoff Impervious Areas (m <sup>3</sup> /yr) | 0     | 3,162 | 3,820 | 6,982  |
| Total Runoff (m <sup>3</sup> /yr)            | 435   | 3,162 | 3,820 | 7,417  |
| <b>TOTAL OUTPUTS (m<sup>3</sup>/yr)</b>      | 4,808 | 3,953 | 4,775 | 13,536 |
| Difference (INPUTS-OUTPUTS)                  | 0     | 0     | 0     | 0      |

## PHOSPHORUS BUDGET

### Site Statistics

| Predevelopment       |               | Post Development     |      |
|----------------------|---------------|----------------------|------|
| Total Site Area (ha) | 1.44          | Total Site Area (ha) | 1.44 |
| High                 | 0.07          | High                 | 0.42 |
| Low                  | 0.81          | Low                  | 0.51 |
| Wetland              | 0.20          | Dwelling             | 0.51 |
| Forest               | 0.36          |                      |      |
| Subwatershed         | Barrie Creeks |                      |      |

### Formulae

Total P (kg/yr) = Intensity(kg/ha/yr) \* Area (ha)

Where:

|                |      |
|----------------|------|
| High Intesity= | 1.32 |
| Low Intensity= | 0.13 |
| Wetland=       | 0.05 |
| Forest=        | 0.05 |
| Dwelling=      | 1.32 |

Fee = 2.5 \* ΔPhosphorus (kg/yr) \* \$35,700 + 15% Admin Fee

| Parameter       | Pre Development Condition |      |         |        | Post Development Condon |      |          | Post Development (Treated) |      |          |
|-----------------|---------------------------|------|---------|--------|-------------------------|------|----------|----------------------------|------|----------|
|                 | High                      | Low  | Wetland | Forest | High                    | Low  | Dwelling | High                       | Low  | Dwelling |
| Area (ha)       | 0.07                      | 0.81 | 0.20    | 0.36   | 0.42                    | 0.51 | 0.51     | 0.93                       | 0.00 | 0.51     |
| P (kg/yr)       | 1.32                      | 0.13 | 0.05    | 0.05   | 1.32                    | 0.13 | 1.32     | 1.32                       | 0.13 | 1.32     |
| Total P (kg/yr) | 0.09                      | 0.11 | 0.01    | 0.02   | 0.56                    | 0.07 | 0.67     | 1.23                       | 0.00 | 0.68     |

Predevelopment P (kg/yr) = 0.21

Post Development P (kg.yr) = 1.29

Phosphorus removal from the site in the post development conditions is provided through roof downspouts discharging to soakaway pits as shown on the servicing plans included in Appendix C. Using this removal method results in 87% removal efficiency and the following annual phosphorus removal:

|                    | High | Dwelling | Low  |
|--------------------|------|----------|------|
| Removal Efficiency | 0%   | 87%      | 0%   |
| P Removed (kg/yr)  | 0.00 | 0.59     | 0.00 |

Treated Post Development P (kg/yr) = 0.705

Fee Caclulation: \$ 20,424.22

# 152 MILLER DRIVE BARRIE, ON

## DRAWING INDEX

| TITLE                                        | SHEET NO |
|----------------------------------------------|----------|
| COVER SHEET                                  | 1 OF 5   |
| SYSTEM LAYOUT SHEET&SYSTEM CALCULATION SHEET | 2-3 OF 5 |
| SYSTEM OVERLAY SHEET                         | 4 OF 5   |
| DETAIL SHEET                                 | 5 OF 5   |

| PROJECT INFORMATION             |                 |              |                       |    |
|---------------------------------|-----------------|--------------|-----------------------|----|
| SITE CONTACT                    | PHIL ALLEN      | 416-286-5990 | PHILALLEN@STORMCON.CA |    |
| ENGINEER / TECHNICAL SPECIALIST | ERIC CUMISKEY   | 289-380-3742 | ECUMISKEY@STORMCON.CA |    |
| SALES REP:                      | GREG DZIEWIECKI | 437-231-6080 | GREGD@STORMCON.CA     |    |
| PROJECT NO:                     | 2024-070        |              |                       |    |
| COMMENTS:                       | REVISION        | DATE         | COMMENT               | BY |
|                                 |                 |              |                       |    |
|                                 |                 |              |                       |    |
|                                 |                 |              |                       |    |
|                                 |                 |              |                       |    |
|                                 |                 |              |                       |    |
|                                 |                 |              |                       |    |

### GENERAL NOTES

- COORDINATE WITH MANUFACTURER'S REPRESENTATIVE/DISTRIBUTOR FOR PRE-CONSTRUCTION MEETING AND SITE INSPECTION DURING INSTALLATION.
- ENGINEERING DRAWINGS SUPERSEDE ALL PROVIDED DOCUMENTATION. REFER TO SITE ENGINEERS FOR ADDITIONAL INSTRUCTIONS.
- COORDINATE GREENSTORM INSTALLATION ACTIVITIES WITH OTHER SITE ACTIVITIES
- ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE
- THE SUB-GRADE AND SIDE BACKFILL TO BE COMPACTED TO 95% SPD OR AS DIRECTED BY THE QUALIFIED ENGINEER.
- PRESENCE OF GROUND WATER ABOVE THE BASE OF THE SYSTEM MUST BE IDENTIFIED TO STORMCON. ALL PUBLISHED MAXIMUM AND MINIMUM INSTALLATION DEPTHS ASSUME THE GROUND WATER IS AT OR BELOW THE BASE OF THE SYSTEM UNLESS OTHERWISE NOTED.
- CONFIRM GEOTECHNICAL SOIL EVALUATION BY A QUALIFIED ENGINEER TO DETERMINE SUITABILITY OF STRUCTURAL INSTALLATION
- CONFIRM FOR BURIED UNDERGROUND UTILITIES INCLUDING GAS, ELECTRICAL, PIPELINES OR CONDUITS
- ROOTS FROM SURROUNDING TREES MAY DAMAGE THE SYSTEM. DESIGN ENGINEER TO ENSURE ADEQUATE SEPARATION FROM ALL TREES
- WHEN INSTALLED IN CONFORMANCE TO THE INSTALLATION GUIDELINES, GREENSTORM-ST CAN HANDLE STANDARD CL-625 TRUCK LOADING AFTER 0.80m COVER. FOR NON-STANDARD LOADS AND INSTALLATION WITHIN GROUNDWATER, CONTACT MANUFACTURER'S REPRESENTATIVE/DISTRIBUTOR
- PROTECT THE INSTALLATION AGAINST DAMAGE WITH CONSTRUCTION TAPE, FENCING OR OTHER MEANS TILL THE CONSTRUCTION IS COMPLETE.
- ENSURE THAT CONSTRUCTION FOLLOWS APPLICABLE FEDERAL, PROVINCIAL, LOCAL, MUNICIPAL AND LOCAL LAWS, ORDINANCES, REGULATIONS AND SAFETY REQUIREMENTS.
- VEHICULAR LOADING IS PROHIBITED UNTIL BACKFILLED AS PER MANUFACTURER'S INSTALLATION GUIDELINES. THE USE OF EQUIPMENT OVER GREENSTORM CHAMBERS IS LIMITED:
  - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
  - NO RUBBER TIERED LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE CONSTRUCTION GUIDE.
  - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE CONSTRUCTION GUIDE.

### CHECK - REQUIRED MATERIALS AND EQUIPMENT

- ALL GREENSTORM CHAMBERS AND ACCESSORIES AS SPECIFIED IN THE ENGINEER'S PLANS INCLUDING NON-WOVEN GEOTEXTILE, CONNECTORS, QUADS, SIDEWALLS ADAPTER, RISER AND LINER WHERE APPLICABLE.
- RECIPROCATING SAW OR ROUTER
- TRANSIT OR LASER LEVEL MEASURING DEVICE
- COMPACTION EQUIPMENT WITH MAXIMUM GROSS VEHICLE WEIGHT OF 12,000 LBS (5,440 KGS).
- ACCEPTABLE FILL MATERIAL AS SHOWN IN INSTALLATION INSTRUCTIONS.
- QUANTITIES FOR GEOSYNTHETIC ARE APPROXIMATE AND MAY VARY BASED ON OVERLAP, WASTAGE.
- CHECK GREENSTORM CHAMBERS FOR DAMAGE PRIOR TO INSTALLATION. DO NOT USE DAMAGED CHAMBERS, CONTACT YOUR SUPPLIER IMMEDIATELY TO REPORT DAMAGE OR PACKING-LIST DISCREPANCIES.**

### NOTES FOR BIDDING AND INSTALLATIONS

- CONTRACTORS ARE EXPECTED TO COMPREHEND AND USE THE MOST CURRENT INSTALLATION INSTRUCTIONS PRIOR TO BEGINNING A SYSTEM INSTALLATION. FOR THE MOST CURRENT INSTRUCTIONS, CONTACT STORMCON AT (289) 380-3742 OR VISIT WWW.STORMCON.CA.
- CONTACT STORMCON AT LEAST TWO WEEKS PRIOR TO SYSTEM INSTALLATION TO ARRANGE FOR A PRE-CONSTRUCTION MEETING.
- USE GREENSTORM INSTALLATION INSTRUCTIONS AS A GUIDELINE ONLY FOR MINIMUM/MAXIMUM REQUIREMENTS. ACTUAL DESIGN MAY VARY. REFER TO APPROVED CONSTRUCTION DRAWINGS FOR JOB-SPECIFIC DETAILS. ENGINEERING DRAWINGS SUPERSEDE ALL PROVIDED DOCUMENTATION.
- THE FOUNDATION STONE SHALL BE LEVEL AND COMPACTED PRIOR TO CHAMBER INSTALLATION.
- ANY DISCREPANCIES WITH THE SYSTEM SUB-GRADE SOIL'S BEARING CAPACITY MUST BE REPORTED TO THE GEOTECHNICAL ENGINEER.
- CONTRACTOR TO REFER TO GREENSTORM INSTALLATION INSTRUCTIONS CONCERNING VEHICULAR TRAFFIC. RESPONSIBILITY FOR PREVENTING VEHICLES THAT EXCEED REQUIREMENTS SPECIFIED FROM TRAVELING ACROSS OR PARKING OVER THE CHAMBER SYSTEM LIES SOLELY WITH THE CONTRACTOR THROUGHOUT THE ENTIRE SITE CONSTRUCTION PROCESS. THE PLACEMENT OF WARNING TAPE, TEMPORARY FENCING, AND/OR APPROPRIATELY LOCATED SIGNS IS HIGHLY RECOMMENDED.
- TRAFFIC OF INSTALLATION EQUIPMENT OR OTHER VEHICULAR TRAFFIC OVER TOP OF THE GREENSTORM STORMWATER SYSTEM IS STRICTLY RESTRICTED AND PROHIBITED UNTIL SATISFACTORY COVER AND COMPACTION IS ACHIEVED ACCORDING TO MANUFACTURER'S INSTALLATION INSTRUCTIONS.
- EROSION AND SEDIMENT-CONTROL MEASURES MUST MEET LOCAL CODES AND THE DESIGN ENGINEER'S SPECIFICATIONS THROUGHOUT THE ENTIRE SITE CONSTRUCTION PROCESS.
- GREENSTORM SYSTEMS MUST BE DESIGNED AND INSTALLED IN ACCORDANCE WITH STORMCON'S MINIMUM REQUIREMENTS. FAILURE TO DO SO WILL VOID THE LIMITED WARRANTY.



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**NOTE: THESE SHOP DRAWINGS MAY CONTAIN COMPONENTS INCLUDING BUT NOT LIMITED TO MANHOLES, CATCH BASINS, STORM PIPES AND FITTINGS, MANIFOLDS, CASTINGS AND OTHER NECESSARY APPURTENANCES THAT MAY NOT BE SUPPLIED BY STORMCON. IT IS THE RESPONSIBILITY OF THE CONTRACTOR AND/OR SUPPLIER TO CONFIRM THE MATERIALS PROVIDED.**

THIS DRAWING WAS PREPARED TO SUPPORT THE PROJECT ENGINEER OF RECORD FOR THE PROPOSED SYSTEM. IT IS THE ULTIMATE RESPONSIBILITY OF THE PROJECT ENGINEER OF RECORD TO ENSURE THAT THE GREENSTORM SYSTEM'S DESIGN IS IN FULL COMPLIANCE WITH ALL APPLICABLE LAWS AND REGULATIONS. IT IS THE CONTRACTOR OF RECORD'S RESPONSIBILITY TO ENSURE THAT THE STORMCON PRODUCTS ARE DESIGNED IN ACCORDANCE WITH STORMCON'S MINIMUM REQUIREMENTS. STORMCON DOES NOT APPROVE PLANS, SIZING, OR SYSTEM DESIGNS.

# PROPOSED SYSTEM ELEVATIONS

(TO BE APPROVED BY ENGINEER)

\*ENGINEER TO CONFIRM MINIMUM AND MAXIMUM BURIAL REQUIREMENTS ARE MET

|         |                                                   |
|---------|---------------------------------------------------|
| 241.00  | MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED) |
| 237.60  | MINIMUM ALLOWABLE GRADE                           |
| 237.00  | GREENSTORM STORAGE TOP ELEVATION LEVEL 2          |
| 236.34  | GREENSTORM STORAGE TOP ELEVATION LEVEL 1          |
| 235.68  | GREENSTORM BASE ELEVATION                         |
| 235.53  | BOTTOM OF EXCAVATION                              |
| <235.68 | SEASONAL HIGH GROUNDWATER ELEVATION               |

# GREENSTORM STORMWATER MANAGEMENT SYSTEM

TOTAL STORAGE PROVIDED: 370.63 m<sup>3</sup>

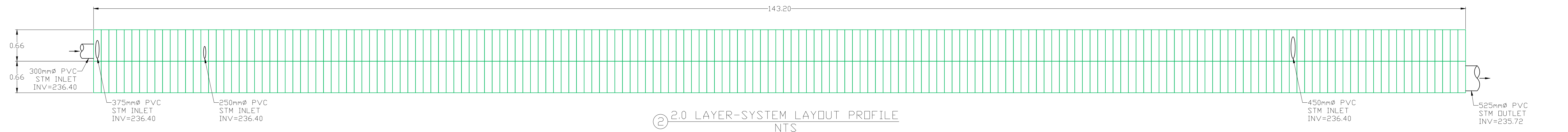
STORAGE VOID RATIO: 0.96

SYSTEM AREA: 292.48 m<sup>2</sup>

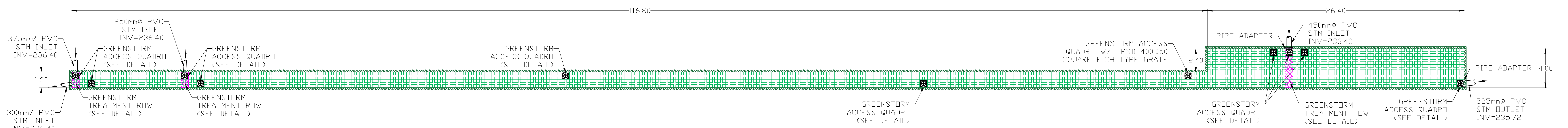
DEPTH OF EMBEDMENT STONE: 0.00 m

DEPTH OF BEDDING STONE: 0.00 m

STONE PERIMETER: 0.00 m



2.0 LAYER-SYSTEM LAYOUT PROFILE  
NTS



1.0 SYSTEM LAYOUT PLAN  
NTS

NOTE: \*ALL EXTERNAL SYSTEM STRUCTURES, INLET/OUTLET PIPES, AND PROPOSED ELEVATIONS MUST BE DESIGNED AND APPROVED BY PROJECT ENGINEER OF RECORD. PROJECT ENGINEER OF RECORD MUST ENSURE CHAMBER BURIAL REQUIREMENTS ARE MET.

### MATERIALS LIST SUPPLIED BY STORMCON

(SYSTEM MATERIALS LIST - SEE COVER SHEET FOR COMBINED PROJECT MATERIALS LIST)

| ITEM                                   | QUANTITY | UNIT      |
|----------------------------------------|----------|-----------|
| GREENSTORM-ST 80x80x66 cm              | 914      | BLOCKS    |
| GREENSTORM-ST 80x80x35 cm (HALF BLOCK) | 0        | BLOCKS    |
| SINGLE LAYER-CONNECTOR                 | 800      | PIECES    |
| MULTI LAYER-CONNECTOR                  | 800      | PIECES    |
| SIDEWALL GRID                          | 736      | PIECES    |
| SIDEWALL GRID HALF BLOCK               | 0        | PIECES    |
| HALF BLOCK COVER PLATE                 | 0        | PIECES    |
| HALF BLOCK COVER PLATE QUADRO-CONTROL  | 0        | PIECES    |
| QUADRO-CONTROL                         | 33       | PIECES    |
| QUADRO ADAPTERS                        | 11       | PIECES    |
| EXTENSION PIPE                         | 22       | METER     |
| CAST IRON COVER                        | 10       | PIECES    |
| OPSD 400.050 SQUARE FISH TYPE GRATE    | 1        | PIECES    |
| NO. OF PIPE ADAPTER                    | 2        | PIECES    |
| MIDDLE GRIDS                           | 0        | PIECES    |
| 8 OZ NON-WOVEN GEOTEXTILE              | 1370     | SQ. METER |
| 30MIL PVC IMPERMEABLE LINER            | 0        | SQ. METER |
| LINER TAPE                             | 0        | METER     |
| GREENSTORM TREATMENT ROW               | 16       | PIECES    |
| 100MM SUBDRAIN                         | 0        | METER     |

### GREENSTORM LEGEND

|  |                                                         |
|--|---------------------------------------------------------|
|  | GREENSTORM ST BLOCK                                     |
|  | GREENSTORM SIDEWALL GRID WITH 8 OZ NON-WOVEN GEOTEXTILE |
|  | GREENSTORM TREATMENT ROW                                |
|  | GREENSTORM ACCESS QUADRO                                |
|  | PIPE ADAPTER                                            |

NOTE:\*

1) USE OF VEHICLES WHEN APPLYING THE FIRST COVER LAYER :

THE FIRST COVER LAYER CAN BE APPLIED FOR EXAMPLE USING A WHEEL LOADER OR A FRONT-TYPE MOBILE EXCAVATOR. FOR A WHEEL LOADER OR MOBILE EXCAVATOR WITH A MAXIMUM TOTAL WEIGHT OF 15TONS(CHAIN,WHEELS,TWIN-TYRES), A COMPACTED COVER OF AT LEAST 30CM MUST BE PLACED OVER THE STORAGE/INFILTRATION SYSTEM. POSSIBLE FORMATION OF RUTS MUST BE TAKEN INTO ACCOUNT! AVOID STEERING MANOEUVRES AT THIS CONSTRUCTION STAGE

2) USE OF CONSTRUCTION VEHICLES:

DRIVING OVER THE COVER WITH HEAVY CONSTRUCTION VEHICLES WITH A WHEEL LOAD OF UP TO 50KN (E.G. HGV 30) IS POSSIBLE IF THE THICKNESS OF THE COMPACTED COVER IS NOT LESS THAN 60CM. POSSIBLE FORMATION OF RUTS MUST BE TAKEN INTO ACCOUNT! WHEN DUMPING THE EARTHQUAKE MATERIAL, THE WHEEL LOAD OF 140KN MUST NOT BE EXCEEDED;IF NECESSARY,LOAD DISTRIBUTION PLATES MUST BE USED.



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152 MILLER DRIVE  
BARRIE, ON

SYSTEM LAYOUT SHEET STORAGE TANK


### GREENSTORM STORMWATER CHAMBER

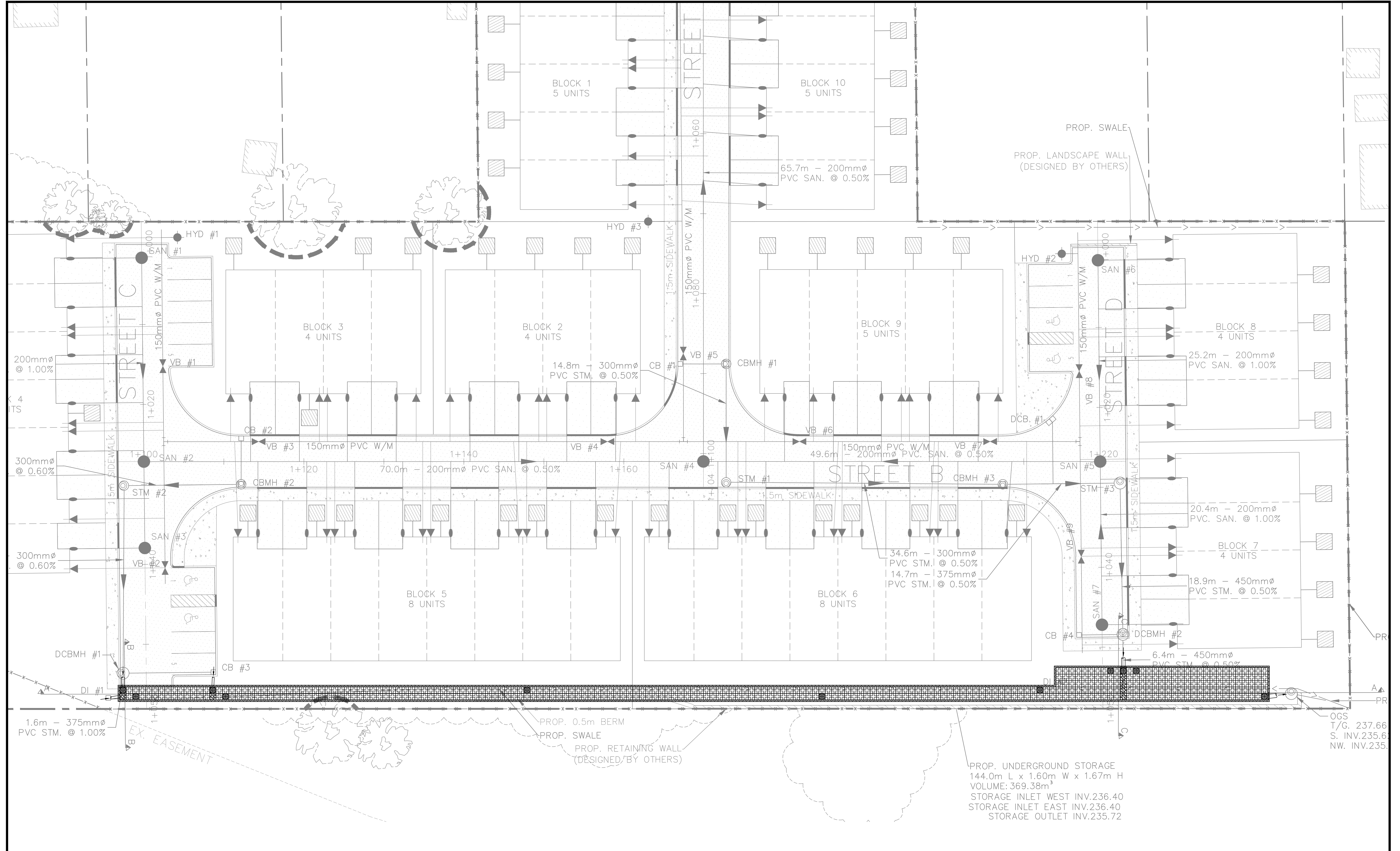
|                      |                  |
|----------------------|------------------|
| PROJECT NO: 2024-070 | DATE: 05/07/2024 |
| DESIGNED BY: JD      | CHECKED BY: EC   |
| SCALE: N.T.S.        | SHEET NO: 2 OF 5 |

|                             |                  |                |                  |        |                |
|-----------------------------|------------------|----------------|------------------|--------|----------------|
| Project Name                | 152 Miller Drive |                |                  |        |                |
| Location                    | Barrie, ON       |                |                  |        |                |
| Date                        | May 8, 2024      |                |                  |        |                |
| Chamber Model               | GreenStorm-ST    |                |                  |        |                |
| Number of Layers            | 2.0              |                | Top Stone        | 0.00   | m              |
| Height of Chambers          | 1.32             | m              | Bottom Stone     | 0.00   | m              |
| Storage Void Ratio          | 0.96             |                | Perimeter Stone  | 0.00   | m              |
| GreenStorm Perimeter        | 294.40           | m              | Stone Qty        | 0.00   | m <sup>3</sup> |
| System Perimeter With Stone | 294.40           |                | Stone Void Ratio | 40.00% |                |
| GreenStorm Area             | 292.48           | m <sup>2</sup> |                  |        |                |
| System Area With Stone      | 292.48           | m <sup>2</sup> |                  |        |                |
| GreenStorm Base Elevation   | 235.68           | m              | Liner            | No     |                |

| Height of System | GreenStorm Volume | Top Stone Volume | Bottom Stone Volume | Perimeter Stone Volume | Cumulative Storage Volume | Elevation |
|------------------|-------------------|------------------|---------------------|------------------------|---------------------------|-----------|
| mm               | m <sup>3</sup>    | m <sup>3</sup>   | m <sup>3</sup>      | m <sup>3</sup>         | m <sup>3</sup>            | m         |
| 1320             | 12.64             | 0.00             | 0.00                | 0.00                   | 370.63                    | 237.000   |
| 1275             | 7.02              | 0.00             | 0.00                | 0.00                   | 358.00                    | 236.955   |
| 1250             | 7.02              | 0.00             | 0.00                | 0.00                   | 350.98                    | 236.930   |
| 1225             | 7.02              | 0.00             | 0.00                | 0.00                   | 343.96                    | 236.905   |
| 1200             | 7.02              | 0.00             | 0.00                | 0.00                   | 336.94                    | 236.880   |
| 1175             | 7.02              | 0.00             | 0.00                | 0.00                   | 329.92                    | 236.855   |
| 1150             | 7.02              | 0.00             | 0.00                | 0.00                   | 322.90                    | 236.830   |
| 1125             | 7.02              | 0.00             | 0.00                | 0.00                   | 315.88                    | 236.805   |
| 1100             | 7.02              | 0.00             | 0.00                | 0.00                   | 308.86                    | 236.780   |
| 1075             | 7.02              | 0.00             | 0.00                | 0.00                   | 301.84                    | 236.755   |
| 1050             | 7.02              | 0.00             | 0.00                | 0.00                   | 294.82                    | 236.730   |
| 1025             | 7.02              | 0.00             | 0.00                | 0.00                   | 287.80                    | 236.705   |
| 1000             | 7.02              | 0.00             | 0.00                | 0.00                   | 280.78                    | 236.680   |
| 975              | 7.02              | 0.00             | 0.00                | 0.00                   | 273.76                    | 236.655   |
| 950              | 7.02              | 0.00             | 0.00                | 0.00                   | 266.74                    | 236.630   |
| 925              | 7.02              | 0.00             | 0.00                | 0.00                   | 259.72                    | 236.605   |
| 900              | 7.02              | 0.00             | 0.00                | 0.00                   | 252.70                    | 236.580   |
| 875              | 7.02              | 0.00             | 0.00                | 0.00                   | 245.68                    | 236.555   |
| 850              | 7.02              | 0.00             | 0.00                | 0.00                   | 238.66                    | 236.530   |
| 825              | 7.02              | 0.00             | 0.00                | 0.00                   | 231.64                    | 236.505   |
| 800              | 7.02              | 0.00             | 0.00                | 0.00                   | 224.62                    | 236.480   |
| 775              | 7.02              | 0.00             | 0.00                | 0.00                   | 217.61                    | 236.455   |
| 750              | 7.02              | 0.00             | 0.00                | 0.00                   | 210.59                    | 236.430   |
| 725              | 7.02              | 0.00             | 0.00                | 0.00                   | 203.57                    | 236.405   |
| 700              | 7.02              | 0.00             | 0.00                | 0.00                   | 196.55                    | 236.380   |
| 675              | 7.02              | 0.00             | 0.00                | 0.00                   | 189.53                    | 236.355   |
| 650              | 7.02              | 0.00             | 0.00                | 0.00                   | 182.51                    | 236.330   |
| 625              | 7.02              | 0.00             | 0.00                | 0.00                   | 175.49                    | 236.305   |
| 600              | 7.02              | 0.00             | 0.00                | 0.00                   | 168.47                    | 236.280   |
| 575              | 7.02              | 0.00             | 0.00                | 0.00                   | 161.45                    | 236.255   |
| 550              | 7.02              | 0.00             | 0.00                | 0.00                   | 154.43                    | 236.230   |
| 525              | 7.02              | 0.00             | 0.00                | 0.00                   | 147.41                    | 236.205   |
| 500              | 7.02              | 0.00             | 0.00                | 0.00                   | 140.39                    | 236.180   |
| 475              | 7.02              | 0.00             | 0.00                | 0.00                   | 133.37                    | 236.155   |
| 450              | 7.02              | 0.00             | 0.00                | 0.00                   | 126.35                    | 236.130   |
| 425              | 7.02              | 0.00             | 0.00                | 0.00                   | 119.33                    | 236.105   |
| 400              | 7.02              | 0.00             | 0.00                | 0.00                   | 112.31                    | 236.080   |
| 375              | 7.02              | 0.00             | 0.00                | 0.00                   | 105.29                    | 236.055   |
| 350              | 7.02              | 0.00             | 0.00                | 0.00                   | 98.27                     | 236.030   |
| 325              | 7.02              | 0.00             | 0.00                | 0.00                   | 91.25                     | 236.005   |
| 300              | 7.02              | 0.00             | 0.00                | 0.00                   | 84.23                     | 235.980   |
| 275              | 7.02              | 0.00             | 0.00                | 0.00                   | 77.21                     | 235.955   |
| 250              | 7.02              | 0.00             | 0.00                | 0.00                   | 70.20                     | 235.930   |
| 225              | 7.02              | 0.00             | 0.00                | 0.00                   | 63.18                     | 235.905   |
| 200              | 7.02              | 0.00             | 0.00                | 0.00                   | 56.16                     | 235.880   |
| 175              | 7.02              | 0.00             | 0.00                | 0.00                   | 49.14                     | 235.855   |
| 150              | 7.02              | 0.00             | 0.00                | 0.00                   | 42.12                     | 235.830   |
| 125              | 7.02              | 0.00             | 0.00                | 0.00                   | 35.10                     | 235.805   |
| 100              | 7.02              | 0.00             | 0.00                | 0.00                   | 28.08                     | 235.780   |
| 75               | 7.02              | 0.00             | 0.00                | 0.00                   | 21.06                     | 235.755   |
| 50               | 7.02              | 0.00             | 0.00                | 0.00                   | 14.04                     | 235.730   |
| 25               | 7.02              | 0.00             | 0.00                | 0.00                   | 7.02                      | 235.705   |
| 0                | 0.00              | 0.00             | 0.00                | 0.00                   | 0.00                      | 235.680   |

2.0-LAYER GREENSTORM CALCULATION SHEET (SYSTEM STAGE-STORAGE TABLE)

|                                                                                                                                          |                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                |                                      |                  |
|------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|--------------------------------------|------------------|
|  <b>69 CONNIE CRESCENT<br/>CONCORD, ON<br/>L4K 1L3</b> | <b>SALES@STORMCON.CA</b><br><b>www.STORMCON.CA</b> | THIS DRAWING WAS PREPARED TO SUPPORT THE PROJECT ENGINEER OF RECORD FOR THE PROPOSED SYSTEM. IT IS THE ULTIMATE RESPONSIBILITY OF THE PROJECT ENGINEER OF RECORD TO ENSURE THAT THE GREENSTORM SYSTEM'S DESIGN IS IN FULL COMPLIANCE WITH ALL APPLICABLE LAWS AND REGULATIONS. IT IS THE CONTRACTOR OF RECORD'S RESPONSIBILITY TO ENSURE THAT THE STORMCON PRODUCTS ARE DESIGNED IN ACCORDANCE WITH STORMCONS MINIMUM REQUIREMENTS. STORMCON DOES NOT APPROVE PLANS, SIZING, OR SYSTEM DESIGNS. | 152 MILLER DRIVE<br>BARRIE, ON<br><br>SYSTEM CALCULATION SHEET | <b>GREENSTORM STORMWATER CHAMBER</b> |                  |
|                                                                                                                                          |                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                | PROJECT NO: 2024-070                 | DATE: 05/07/2024 |
|                                                                                                                                          |                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                | DESIGNED BY: JD                      | CHECKED BY: EC   |
|                                                                                                                                          |                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                | SCALE: N.T.S.                        | SHEET NO: 3 OF 5 |



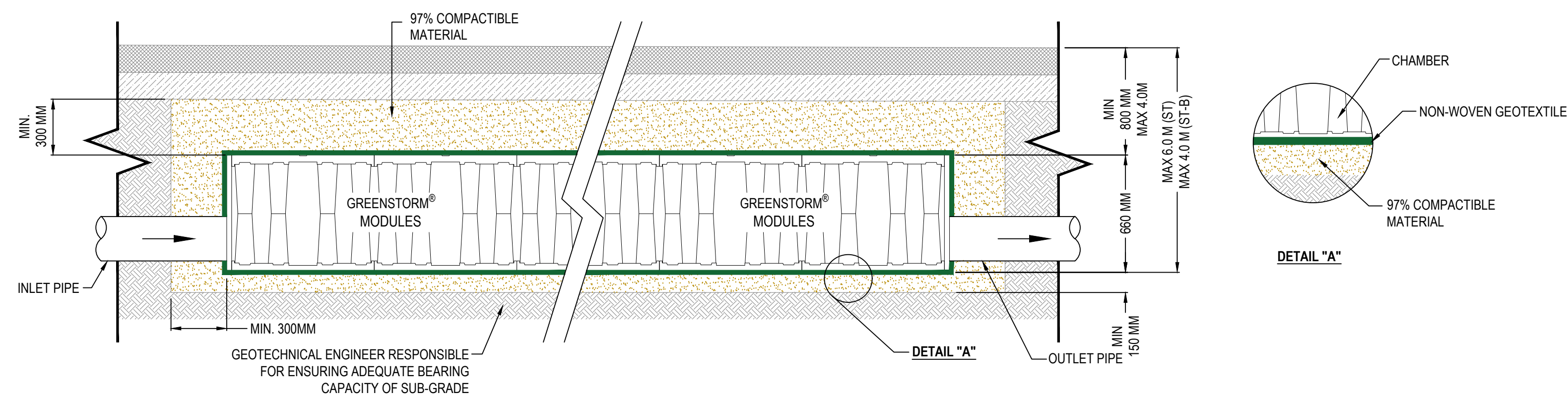

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152 MILLER DRIVE  
 BARRIE, ON  
  
 SYSTEM OVERLAY SHEET

| GREENSTORM STORMWATER CHAMBER |          |             |            |
|-------------------------------|----------|-------------|------------|
| PROJECT NO:                   | 2024-070 | DATE:       | 05/07/2024 |
| DESIGNED BY:                  | JD       | CHECKED BY: | EC         |
| SCALE:                        | N.T.S.   | SHEET NO:   | 4 OF 5     |

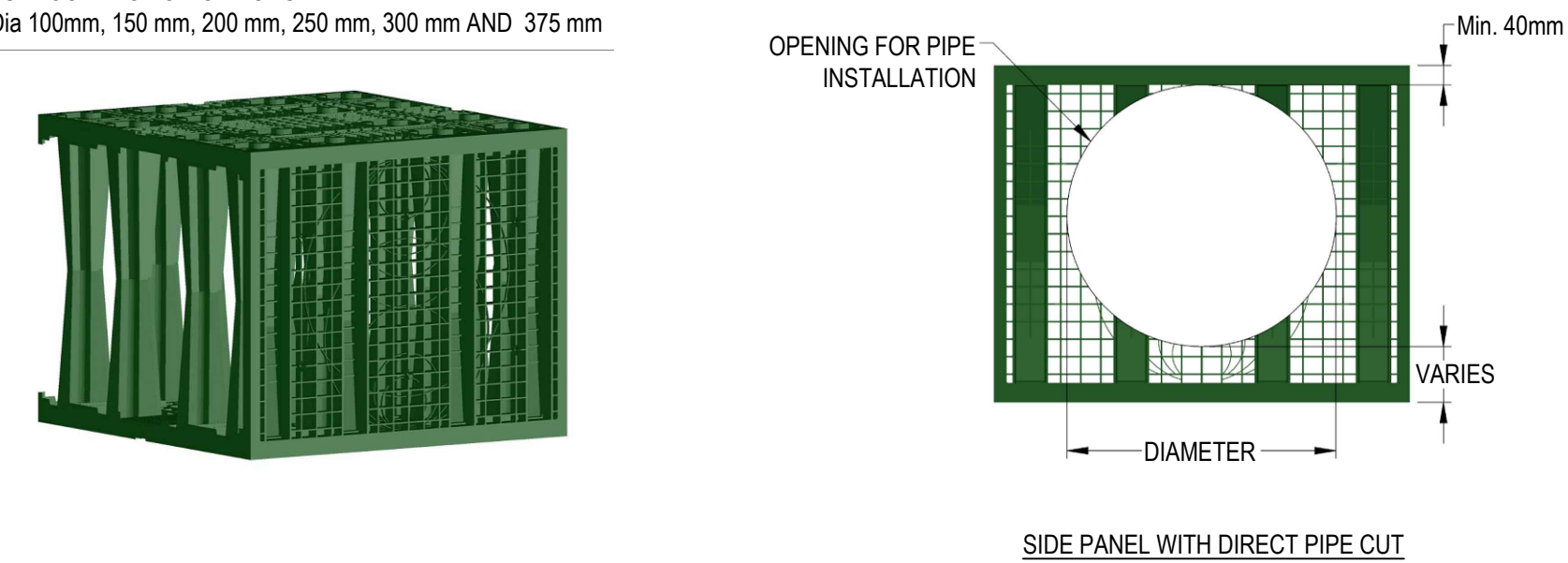


\*\*Recommended bedding materials : HPB

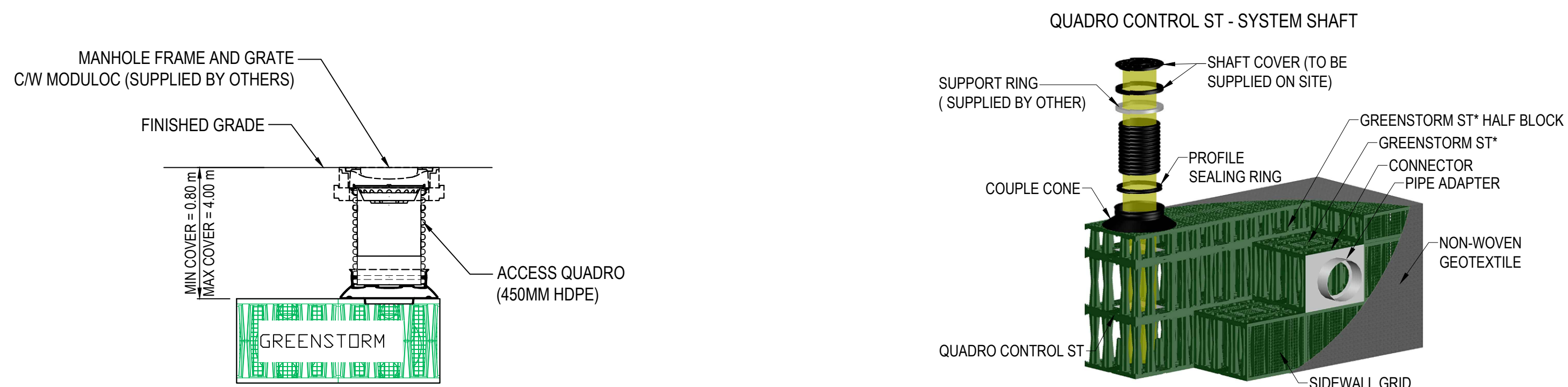
| COMPACTIBLE MATERIAL LIST        | LEGEND                    |
|----------------------------------|---------------------------|
| • GRANULAR A                     | 8 OZ NON-WOVEN GEOTEXTILE |
| • GRANULAR B                     |                           |
| • 19mm CLEAR ANGULAR STONE       |                           |
| • HIGH PERFORMANCE BEDDING (HPB) |                           |
| • HL6                            |                           |

TYPICAL ONE LAYER GREENSTORM CROSS SECTION

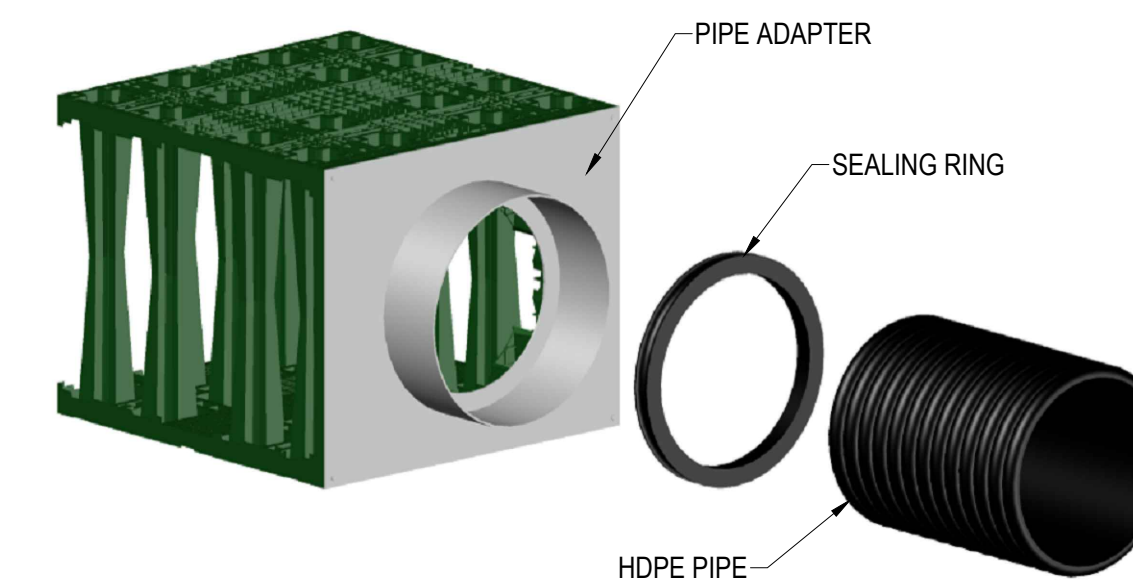
FULL CONNECTION OPTIONS  
Dia 100mm, 150 mm, 200 mm, 250 mm, 300 mm AND 375 mm



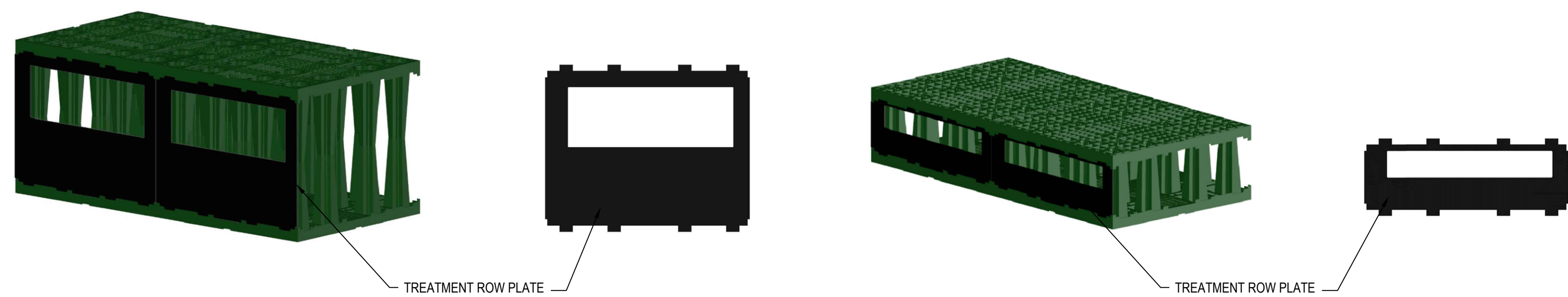
STANDARD SIDE PANEL WITH DIRECT PIPE CUT



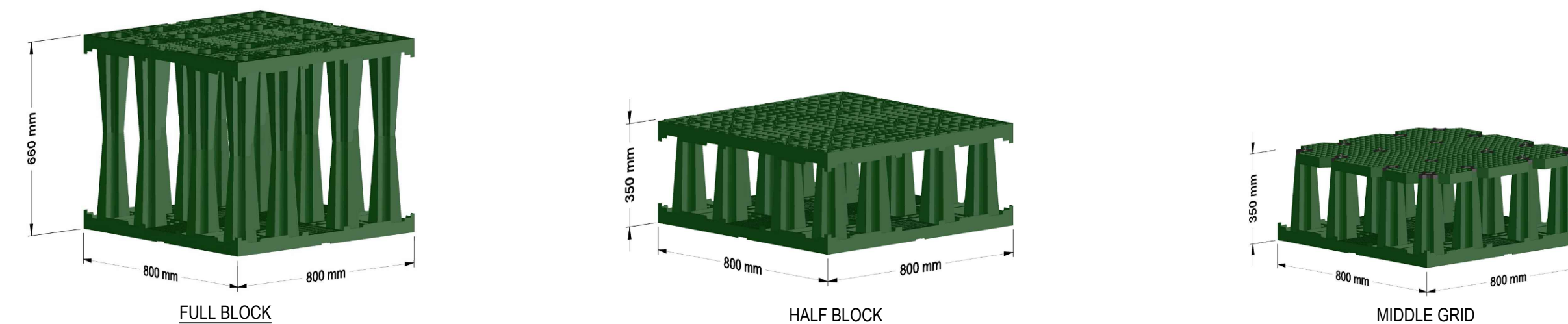
GREENSTORM ACCESS QUADRO DETAIL (WHERE APPLICABLE)



STANDARD ADAPTER PANEL WITH DIA 450 AND 525



STANDARD TREATMENT ROW DETAIL (WHERE APPLICABLE)



STANDARD GREENSTORM BLOCK DETAIL



May 15, 2024

## **Appendix B**

### **Oil & Grit Separator**

# 152 MILLER DRIVE

## BARRIE, ON

### DRAWING INDEX

| TITLE         | SHEET NO |
|---------------|----------|
| COVER SHEET   | 1 OF 4   |
| SIZING REPORT | 2 OF 4   |
| SDD PLAN      | 3 OF 4   |
| OVERLAY SHEET | 4 OF 4   |

| PROJECT INFORMATION             |                 |              |                       |
|---------------------------------|-----------------|--------------|-----------------------|
| SITE CONTACT                    | PHIL ALLEN      | 416-286-5990 | PHILALLEN@STORMCON.CA |
| ENGINEER / TECHNICAL SPECIALIST | ERIC CUMISKEY   | 289-380-3742 | ECUMISKEY@STORMCON.CA |
| SALES REP:                      | GREG DZIEWIECKI | 437-231-6080 | GREGD@STORMCON.CA     |
| PROJECT NO:                     | 220114-01       |              |                       |

#### NOTES FOR BIDDING AND INSTALLATIONS

- CONTRACTORS ARE EXPECTED TO COMPREHEND AND USE THE MOST CURRENT INSTALLATION INSTRUCTIONS PRIOR TO BEGINNING A SYSTEM INSTALLATION. FOR THE MOST CURRENT INSTRUCTIONS, CONTACT STORMCON AT (647) 463-9803 OR VISIT WWW.STORMCON.CA.
- CONTACT STORMCON AT LEAST TWO WEEKS PRIOR TO SYSTEM INSTALLATION TO ARRANGE FOR A PRE-CONSTRUCTION MEETING.
- USE SDD3 INSTALLATION INSTRUCTIONS AS A GUIDELINE ONLY FOR MINIMUM/MAXIMUM REQUIREMENTS. ACTUAL DESIGN MAY VARY. REFER TO APPROVED CONSTRUCTION DRAWINGS FOR JOB-SPECIFIC DETAILS. ENGINEERING DRAWINGS SUPERSEDE ALL PROVIDED DOCUMENTATION.
- ANY DISCREPANCIES WITH THE SYSTEM SUB-GRADE SOIL'S BEARING CAPACITY MUST BE REPORTED TO THE GEOTECHNICAL ENGINEER.
- EROSION AND SEDIMENT-CONTROL MEASURES MUST MEET LOCAL CODES AND THE DESIGN ENGINEER'S SPECIFICATIONS THROUGHOUT THE ENTIRE SITE CONSTRUCTION PROCESS.

NOTE: THESE SHOP DRAWINGS MAY CONTAIN COMPONENTS INCLUDING BUT NOT LIMITED TO MANHOLES, CATCH BASINS, STORM PIPES AND FITTINGS, MANIFOLDS, CASTINGS AND OTHER NECESSARY APPURTENANCES THAT MAY NOT BE SUPPLIED BY STORMCON. IT IS THE RESPONSIBILITY OF THE CONTRACTOR AND/OR SUPPLIER TO CONFIRM THE MATERIALS PROVIDED.



#### GENERAL NOTES

- MANHOLES AND APPURTENANCES TO FOLLOW DIVISION 700 OF OPSD OR APPLICABLE LOCAL STANDARDS.
- COORDINATE WITH MANUFACTURER'S REPRESENTATIVE/DISTRIBUTOR FOR PRE-CONSTRUCTION MEETING AND SITE INSPECTION DURING INSTALLATION.
- ENGINEERING DRAWINGS SUPERSEDE ALL PROVIDED DOCUMENTATION. REFER TO SITE ENGINEERS FOR ADDITIONAL INSTRUCTIONS.
- COORDINATE SDD3 INSTALLATION ACTIVITIES WITH OTHER SITE ACTIVITIES
- ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE
- THE SUB-GRADE AND SIDE BACKFILL TO BE COMPACTED TO 95% SPD OR AS DIRECTED BY THE QUALIFIED ENGINEER.
- CONFIRM GEOTECHNICAL SOIL EVALUATION BY A QUALIFIED ENGINEER TO DETERMINE SUITABILITY OF STRUCTURAL INSTALLATION
- CONFIRM FOR BURIED UNDERGROUND UTILITIES INCLUDING GAS, ELECTRICAL, PIPELINES OR CONDUITS
- WHEN INSTALLED IN CONFORMANCE TO THE INSTALLATION GUIDELINES, SDD3 CAN HANDLE STANDARD CL-625 TRUCK LOADING. FOR NON-STANDARD LOADS CONTACT MANUFACTURER'S REPRESENTATIVE/DISTRIBUTOR
- PROTECT THE INSTALLATION AGAINST DAMAGE WITH CONSTRUCTION TAPE, FENCING OR OTHER MEANS TILL THE CONSTRUCTION IS COMPLETE.
- ENSURE THAT CONSTRUCTION FOLLOWS APPLICABLE FEDERAL, PROVINCIAL, LOCAL, MUNICIPAL AND LOCAL LAWS, ORDNANCES, REGULATIONS AND SAFETY REQUIREMENTS.

#### CHECK - REQUIRED MATERIALS AND EQUIPMENT

- ALL SDD3 COMPONENTS AND ACCESSORIES AS SPECIFIED IN THE ENGINEER'S PLANS INCLUDING FRAME AND COVER, LADDER ND RISER .
- RECIPROCATING SAW OR ROUTER
- TRANSIT OR LASER LEVEL MEASURING DEVICE
- COMPACTION EQUIPMENT
- ACCEPTABLE FILL MATERIAL AS SHOWN IN INSTALLATION INSTRUCTIONS.

THIS DRAWING WAS PREPARED TO SUPPORT THE PROJECT ENGINEER OF RECORD FOR THE PROPOSED SYSTEM. IT IS THE ULTIMATE RESPONSIBILITY OF THE PROJECT ENGINEER OF RECORD TO ENSURE THAT THE SDD3 SYSTEM'S DESIGN IS IN FULL COMPLIANCE WITH ALL APPLICABLE LAWS AND REGULATIONS. IT IS THE CONTRACTOR OF RECORD'S RESPONSIBILITY TO ENSURE THAT THE STORMCON PRODUCTS ARE DESIGNED IN ACCORDANCE WITH STORMCON'S MINIMUM REQUIREMENTS. STORMCON DOES NOT APPROVE PLANS, SIZING, OR SYSTEM DESIGNS.

|   | ISSUED FOR APPROVAL - ANGLE | 07/03/2022 | M.S |
|---------------------------------------------------------------------------------------|-----------------------------|------------|-----|
|  | ISSUED FOR APPROVAL         | 07/03/2022 | M.S |
| NO.                                                                                   | REVISION                    | DATE       | BY  |

ISSUED FOR APPROVAL  
NOT FOR CONSTRUCTION  
02/03/2022

COVER SHEET

SDD3 1200 - OGS 1

PROJECT NAME: 152 MILLER DRIVE

PROJECT NO: 220301-03 DATE: 02/03/2022

DESIGNED BY: MS CHECKED BY: AH

SCALE: NTS SHEET NO: 1/4



10 CEDAR AVE  
THORNHILL, ON  
L3T 3W1

SALES@STORMCON.CA  
WWW.STORMCON.CA



NEXT STORM

1625, boul. Mgr. Langlois  
Salaberry-de-Valleyfield,  
Québec, Canada, J6S 1G2  
T: (450) 322-6260  
F: (450) 373-3360



## StormCon SDD3 SIZING REPORT

### PROJECT INFORMATION

|                |                  |
|----------------|------------------|
| Project Name : | 152 Miller Drive |
| Location       | Barrie, ON       |
| Unit :         | OGS Unit 1       |

### SITE INFORMATION AND SIZING CRITERIA

|                            |              |
|----------------------------|--------------|
| Site Area (hectares)       | 1.15         |
| Imperviousness %           | 55%          |
| Target TSS removal (%)     | 80%          |
| Rainfall station :         | Toronto, ONT |
| Particle Size Distribution | ETV          |

### STORMWATER TREATMENT RECOMMENDATION

| RESULTS SUMMARY |        |        |
|-----------------|--------|--------|
| Model           | TSS    | Volume |
| SDD3-1200       | 81.56% | 98.4%  |
| SDD3-1500       | 83.83% | 99.6%  |
| SDD3-1800       | 86.05% | 99.7%  |
| SDD3-2400       | 88.33% | 100.0% |
| SDD3-3000       | 89.34% | 100.0% |
| SDD3-3200       | 89.58% | 100.0% |
| SDD3-3600       | 90.21% | 100.0% |
| SDD3-4000       | 90.59% | 100.0% |

Recommended Model **SDD3-1200**

| Annual TSS removal efficiency (%) <sup>1</sup> | Manhole Diameter (mm) | No Bypass Flow (lps) | Maximum Flow (lps) | Maximum Pipe Diameter (mm) | Oil Storage Capacity (L) | Sediment Storage Capacity (m3) | Height from invert to SDD floor (m) | Treatment area (m2) |
|------------------------------------------------|-----------------------|----------------------|--------------------|----------------------------|--------------------------|--------------------------------|-------------------------------------|---------------------|
| 81.56%                                         | 1220                  | 27                   | 51                 | 475                        | 284.00                   | 0.98                           | 1.74                                | 1.17                |

### DETAILED SDD3 SIZING REPORT

| Rainfall Interval Point (mm/hr) <sup>2</sup> | Flow Rate (Lps) | Loading Rate (Lps/m2) | Loading Rate (Lpm/m2) | Total Rainfall (%) | Removal Efficiency (%) | Cumulative rainfall volume (%) | Relative Efficiency (%) |
|----------------------------------------------|-----------------|-----------------------|-----------------------|--------------------|------------------------|--------------------------------|-------------------------|
| 0.50                                         | 1.0             | 0.9                   | 51.6                  | 0.19%              | 91.38                  | 0.19%                          | 0.18%                   |
| 1.00                                         | 2.0             | 1.7                   | 103.3                 | 13.38%             | 90.21                  | 13.57%                         | 12.07%                  |
| 1.50                                         | 3.0             | 2.6                   | 154.9                 | 16.44%             | 88.80                  | 30.01%                         | 14.60%                  |
| 2.00                                         | 4.0             | 3.4                   | 206.6                 | 13.68%             | 87.22                  | 43.69%                         | 11.93%                  |
| 2.50                                         | 5.0             | 4.3                   | 258.2                 | 3.36%              | 84.41                  | 47.05%                         | 2.84%                   |
| 3.00                                         | 6.0             | 5.2                   | 309.9                 | 1.37%              | 81.60                  | 48.43%                         | 1.12%                   |
| 3.50                                         | 7.0             | 6.0                   | 361.5                 | 8.99%              | 78.79                  | 57.41%                         | 7.08%                   |
| 4.00                                         | 8.1             | 6.9                   | 413.2                 | 5.39%              | 76.71                  | 62.80%                         | 4.13%                   |
| 4.50                                         | 9.1             | 7.7                   | 464.8                 | 1.33%              | 76.75                  | 64.13%                         | 1.02%                   |
| 5.00                                         | 10.1            | 8.6                   | 516.5                 | 5.16%              | 76.79                  | 69.29%                         | 3.96%                   |
| 6.00                                         | 12.1            | 10.3                  | 619.8                 | 4.23%              | 76.79                  | 73.52%                         | 3.25%                   |
| 7.00                                         | 14.1            | 12.1                  | 723.1                 | 4.48%              | 76.48                  | 78.00%                         | 3.43%                   |
| 8.00                                         | 16.1            | 13.8                  | 826.4                 | 3.17%              | 76.16                  | 81.17%                         | 2.42%                   |
| 9.00                                         | 18.1            | 15.5                  | 929.7                 | 2.31%              | 75.85                  | 83.48%                         | 1.76%                   |
| 10.00                                        | 20.1            | 17.2                  | 1032.9                | 2.18%              | 75.23                  | 85.66%                         | 1.64%                   |
| 20.00                                        | 40.3            | 34.4                  | 2065.9                | 9.37%              | 70.73                  | 95.03%                         | 6.63%                   |
| 30.00                                        | 60.4            | 51.6                  | 3098.8                | 2.72%              | 70.73                  | 97.75%                         | 1.92%                   |
| 40.00                                        | 80.5            | 68.9                  | 4131.8                | 1.13%              | 70.73                  | 98.88%                         | 0.80%                   |
| 50.00                                        | 100.6           | 86.1                  | 5164.7                | 0.46%              | 70.73                  | 99.35%                         | 0.33%                   |
| 100.0                                        | 201.3           | 172.2                 | 10329.5               | 0.56%              | 70.73                  | 99.91%                         | 0.40%                   |
| 150.0                                        | 301.9           | 258.2                 | 15494.2               | 0.08%              | 70.73                  | 99.99%                         | 0.06%                   |
| 200.0                                        | 402.5           | 344.3                 | 20658.9               | 0.01%              | 70.73                  | 100.01%                        | 0.01%                   |
|                                              |                 |                       |                       |                    | 70.73                  |                                |                         |
| Total cumulative rainfall (%) <sup>4</sup> : |                 |                       |                       | 100.0%             | Net Annual (%) :       |                                | 81.56%                  |

Performance based on 50-1000 um PSD and ETV verification protocol

### NOTES:-

| B   | ISSUED FOR APPROVAL - ANGLE | 07/03/2022 | M.S |
|-----|-----------------------------|------------|-----|
| A   | ISSUED FOR APPROVAL         | 07/03/2022 | M.S |
| NO. | REVISION                    | DATE       | BY  |

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NOT FOR CONSTRUCTION  
02/03/2022**

**SIZING REPORT**

**SDD3 1200 - OGS 1**

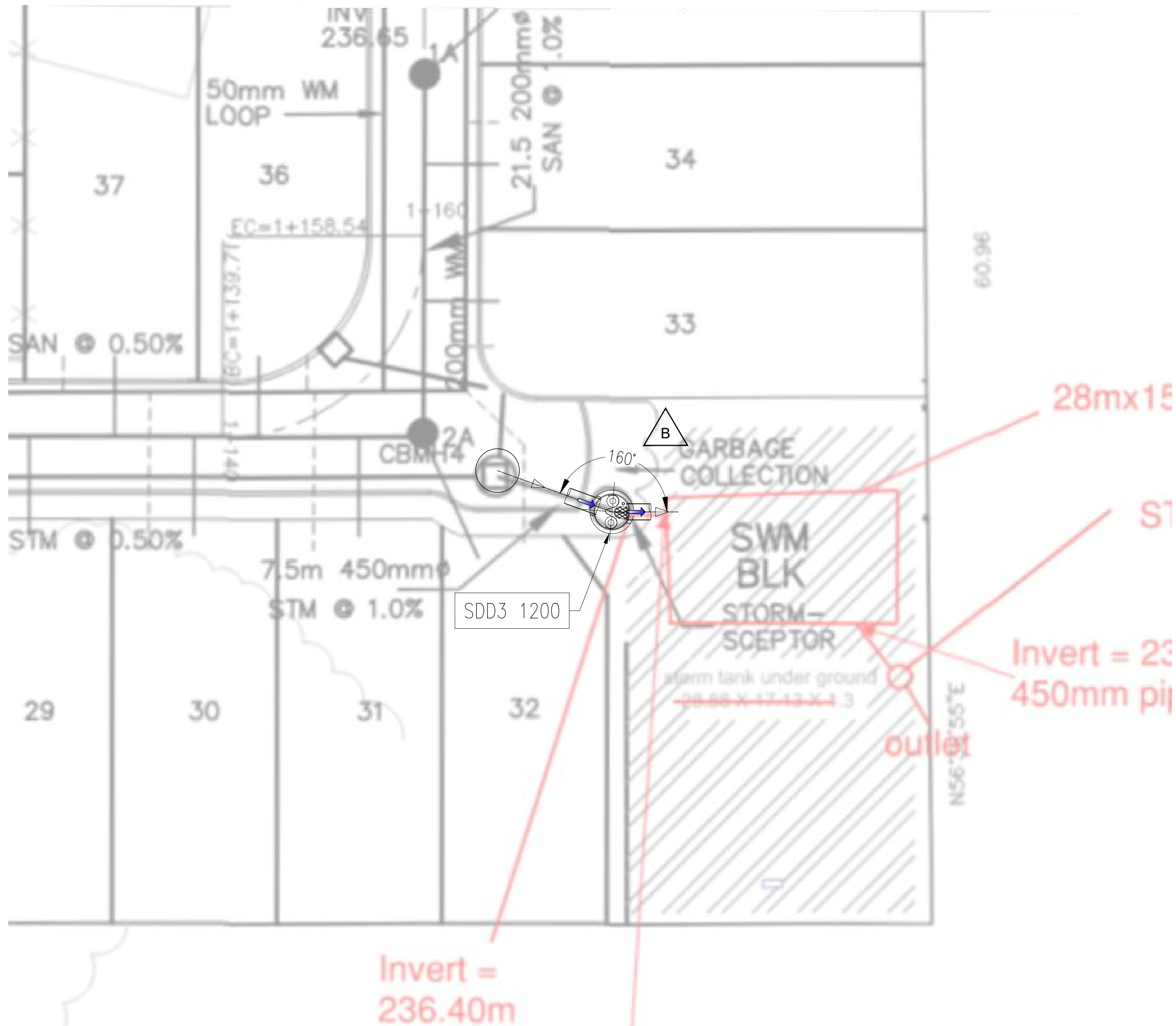
PROJECT NAME: **152 MILLER DRIVE**

PROJECT NO: 220301-03      DATE: 02/03/2022

DESIGNED BY: MS      CHECKED BY: AH

SCALE: SCALE      SHEET NO: SN

|                                                                                  |                                                                                                                                                                         |
|----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br><b>STORMCON</b><br><small>10 CEDAR AVE<br/>THORNHILL, ON<br/>L3T 3W1</small> | <br><b>NEXT STORM</b><br><small>1625, boul. Mgr. Langlois<br/>Salaberry-de-Valleyfield,<br/>Québec, Canada, J6S 1G2<br/>T: (450) 322-6260<br/>F: (450) 373-3360</small> |
|----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



|     |                             |            |     |
|-----|-----------------------------|------------|-----|
| B   | ISSUED FOR APPROVAL - ANGLE | 07/03/2022 | M.S |
| A   | ISSUED FOR APPROVAL         | 07/03/2022 | M.S |
| NO. | REVISION                    | DATE       | BY  |

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02/03/2022

OVERLAY SHEET

SDD3 1200 - OGS 1

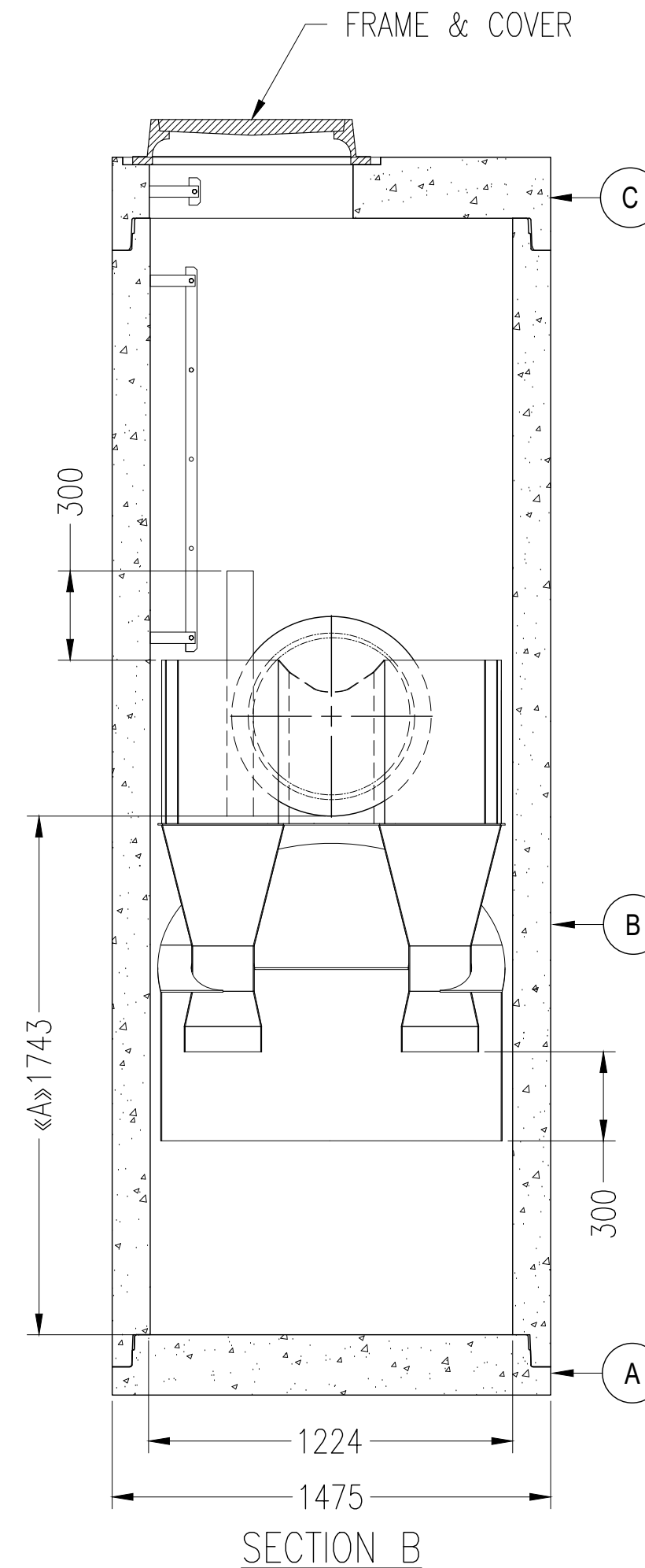
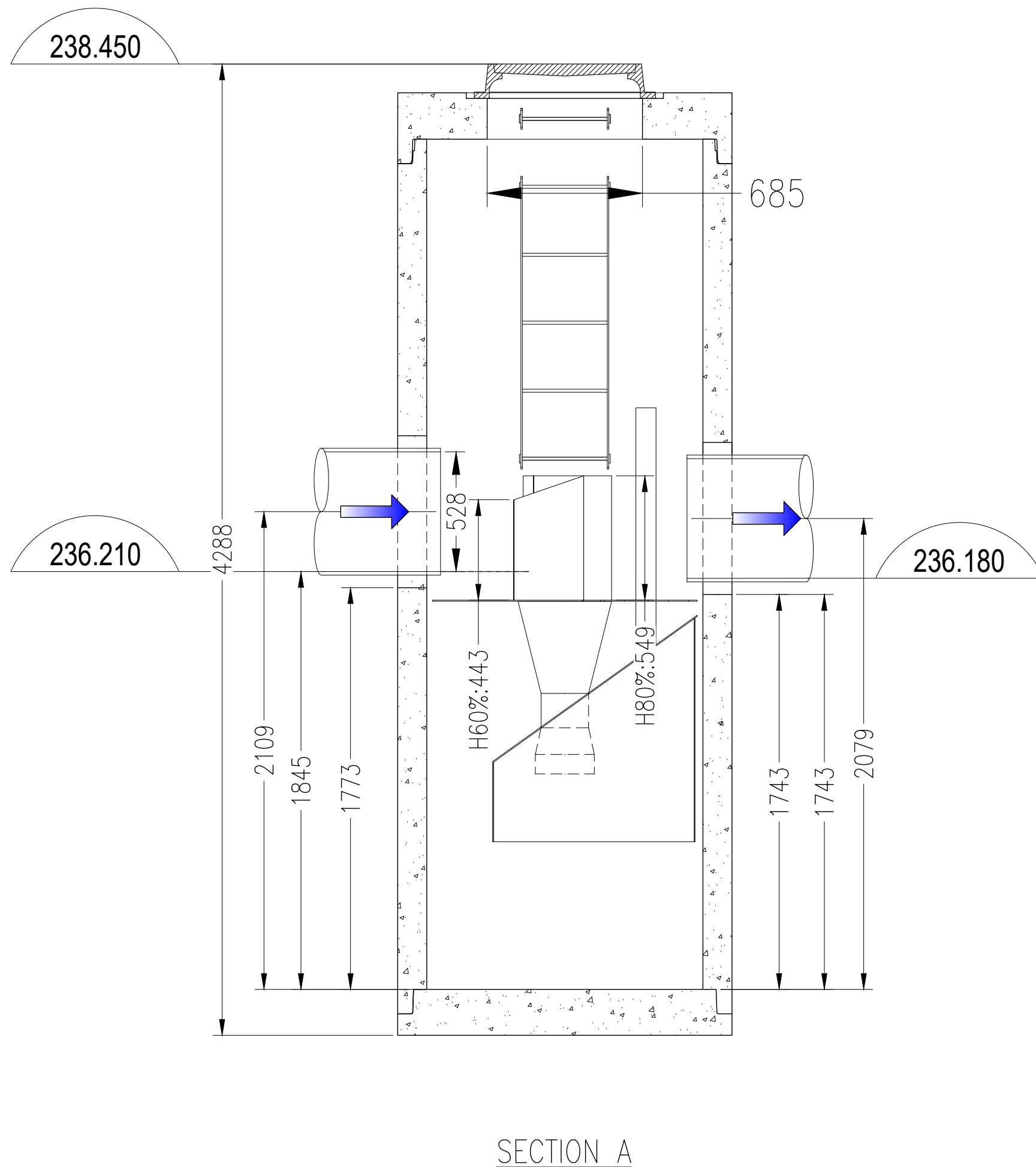
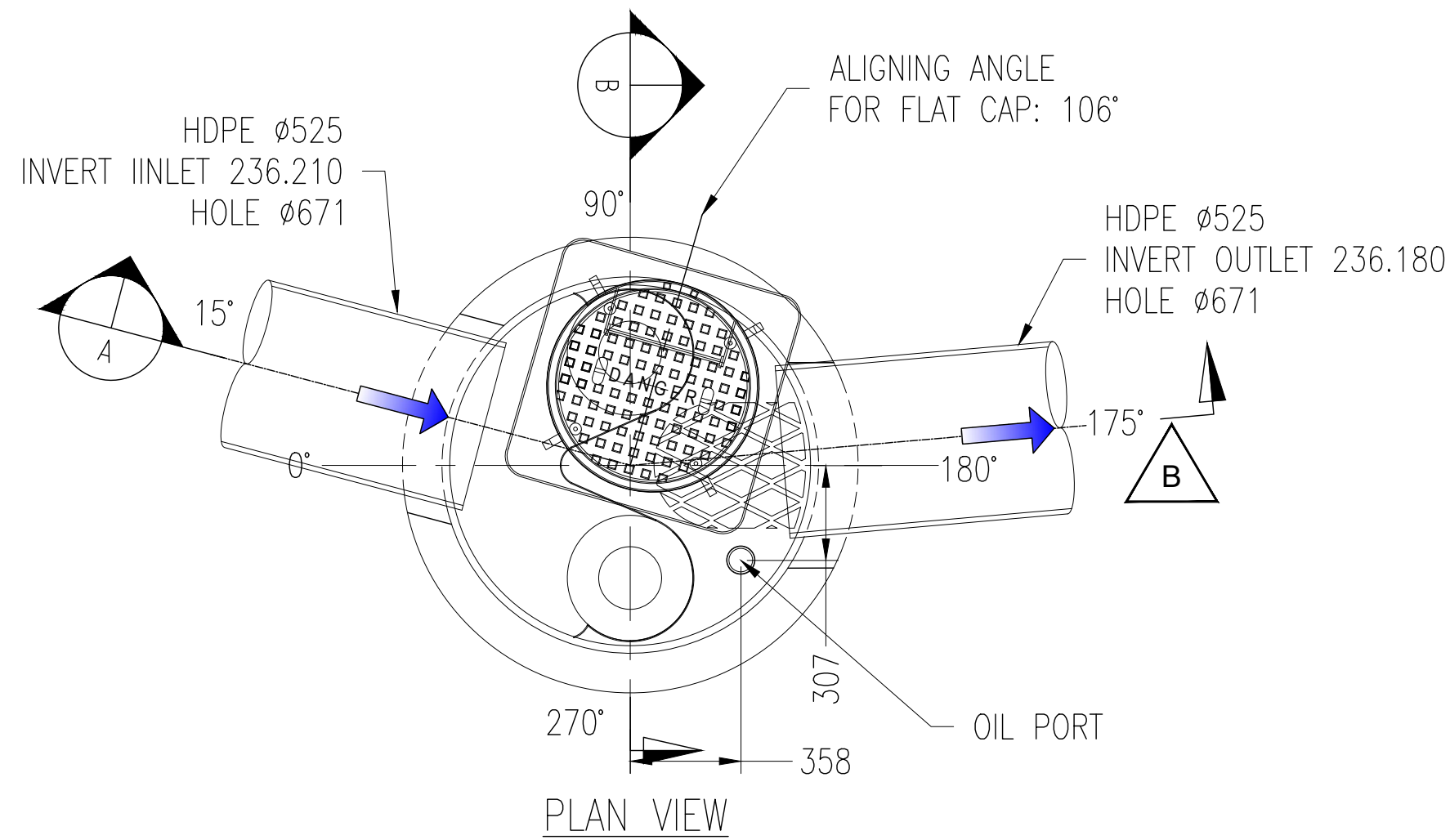
PROJECT NAME: 152 MILLER DRIVE

PROJECT NO: 220301-03      DATE: 02/03/2022

DESIGNED BY: MS      CHECKED BY: AH

SCALE: 1:50      SHEET NO: SN

|                                                                                                                                                   |                                                                                                                                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| <br><small>10 CEDAR AVE<br/>THORWILL, ON<br/>L3T 3W1</small> | <br><small>NEXT STORM</small>                             |
| <small>SALES@STORMCON.CA<br/>WWW.STORMCON.CA</small>                                                                                              | <small>1625, boul. Mgr. Langlois<br/>Salaberry-de-Valleyfield,<br/>Québec, Canada, J6S 1C2<br/>T: (450) 322-6260<br/>F: (450) 373-3360</small> |



**NOTES:-**

- PRECAST CONCRETE COMPONENTS SHALL BE ACCORDING TO OPSD 701.031, AND 701.032
- STRUCTURE EXCEEDING 5.0m IN DEPTH SHALL INCLUDE SAFETY PLATFORM ACCORDING TO OPSD 404.020.
- FOR ADJUSTMENT UNIT AND FRAME INSTALLATION, SEE OPSD 704.010.
- ALL REINFORCING STEEL HAS 30mm MIN. COVER
- ALL CAST-IN GASKET CONNECTORS ASTM C-923, F-2510
- GALVANIZE STEEL LADDER ACCORDING TO CSA 257.4
- ALL DIMENSIONS ARE NOMINAL.
- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN

**FLOW AND POLLUTANTS**

- TARGETED POLLUTANTS:
  - SEDIMENTS (50-1000 MICRONS)
  - OILS DENSITY (0.85 G/CM<sup>3</sup>)
- H: PIPE DIAMETER
- NEGLIGIBLE HEAD LOSS
- UNIT CONFIGURATION: IN-LINE

**MODEL B - NOT STANDARD HEIGHT**

| B   | ISSUED FOR APPROVAL - ANGLE | 07/03/2022 | M.S |
|-----|-----------------------------|------------|-----|
| A   | ISSUED FOR APPROVAL         | 07/03/2022 | M.S |
| NO. | REVISION                    | DATE       | BY  |

**ISSUED FOR APPROVAL  
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02/03/2022**

|                          |                  |
|--------------------------|------------------|
| <b>SDD PLAN</b>          |                  |
| <b>SDD3 1200 - OGS 1</b> |                  |
| PROJECT NAME:            | 152 MILLER DRIVE |
| PROJECT NO:              | 220301-03        |
| DATE:                    | 02/03/2022       |
| DESIGNED BY:             | MS               |
| CHECKED BY:              | AH               |
| SCALE:                   | 1:20             |
| SHEET NO:                | SN               |



10 CEDAR AVE  
THORNHILL, ON  
L3T 3W1



1625, boul. Mgr. Langlois  
Salaberry-de-Valleyfield,  
Québec, Canada, J6S 1C2  
T: (450) 322-6260  
F: (450) 373-3360

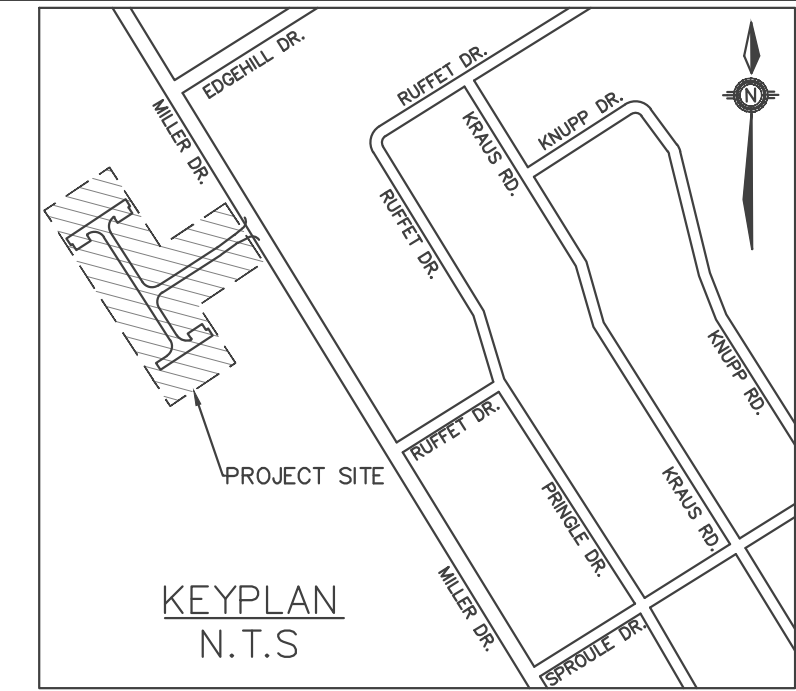
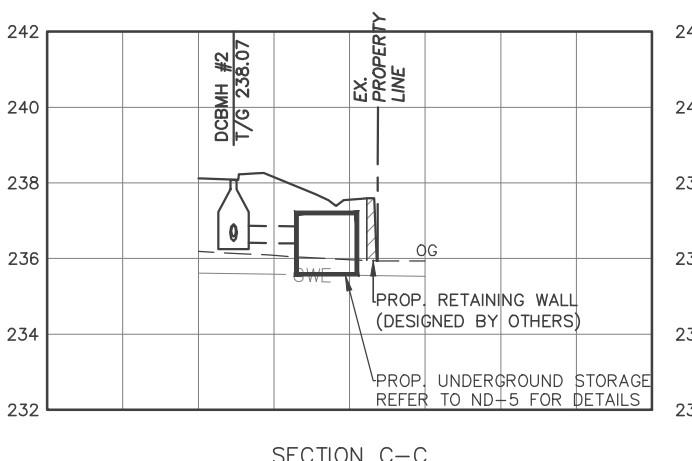
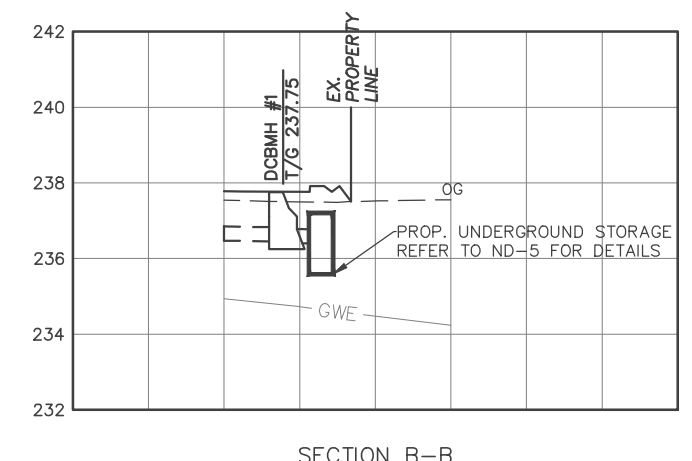
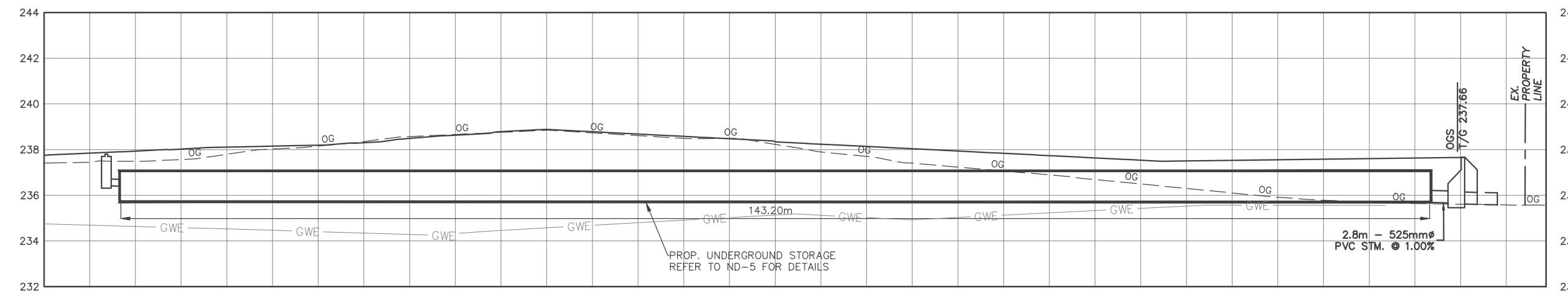


## **Appendix C**

### **Figures & Drawings**

**LEGEND**

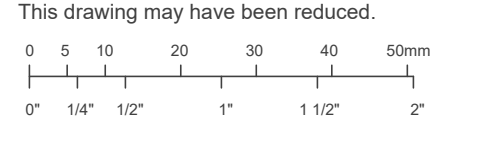
- PRIVACY FENCE
  - ACOUSTIC FENCE
  - x—x— CHAIN LINK FENCE
  - - - - TREE PRESERVATION
  - EXISTING SANITARY MAINTENANCE HOLE
  - PROPOSED SANITARY MAINTENANCE HOLE
  - CB EXISTING CATCH BASIN
  - PROPOSED CATCH BASIN
  - EXISTING STORM MAINTENANCE HOLE
  - PROPOSED STORM MAINTENANCE HOLE
  - SERVICE CAP
  - ⊕ EXISTING FIRE HYDRANT
  - ◆ PROPOSED FIRE HYDRANT
  - VB# EXISTING WATER VALVE
  - VB# PROPOSED WATER VALVE
  - ⊗ PROPOSED STREET LIGHTING POLE
- PROPOSED SERVICE LATERAL LOCATIONS:**
- SINGLE SERVICES**
- SANITARY SERVICE
  - CLEAN-OUT AT PROPERTY LINE
  - ▲ WATER SERVICE
- SEMI-DETACHED & TOWNHOUSE SERVICES**
- SANITARY SERVICE
  - ▲ WATER SERVICE
- ▭ ASPHALT AREA
  - ▭ CONCRETE AREA
  - ▭ INFILTRATION GALLERY  
1.3mW x 1.3mL x 2.0mD  
VOLUME = 1.36m<sup>3</sup>
  - ▨ PIPE INSULATION  
AS PER OPSD 1109.030



222 Mapleview Drive West, Suite 300  
 Barrie, ON L4N 8E7 Canada  
 Tel: 705.737.3303  
 Fax: 705.737.1772  
 www.gerrits.com

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| No. | Issuance Description | YYMMDD   |
|-----|----------------------|----------|
| 1.  | CLIENT REVIEW        | 22/02/18 |
| 2.  | SITE PLAN APPROVAL   | xx/xx/xx |

Issued For:  
**SITE PLAN APPROVAL**

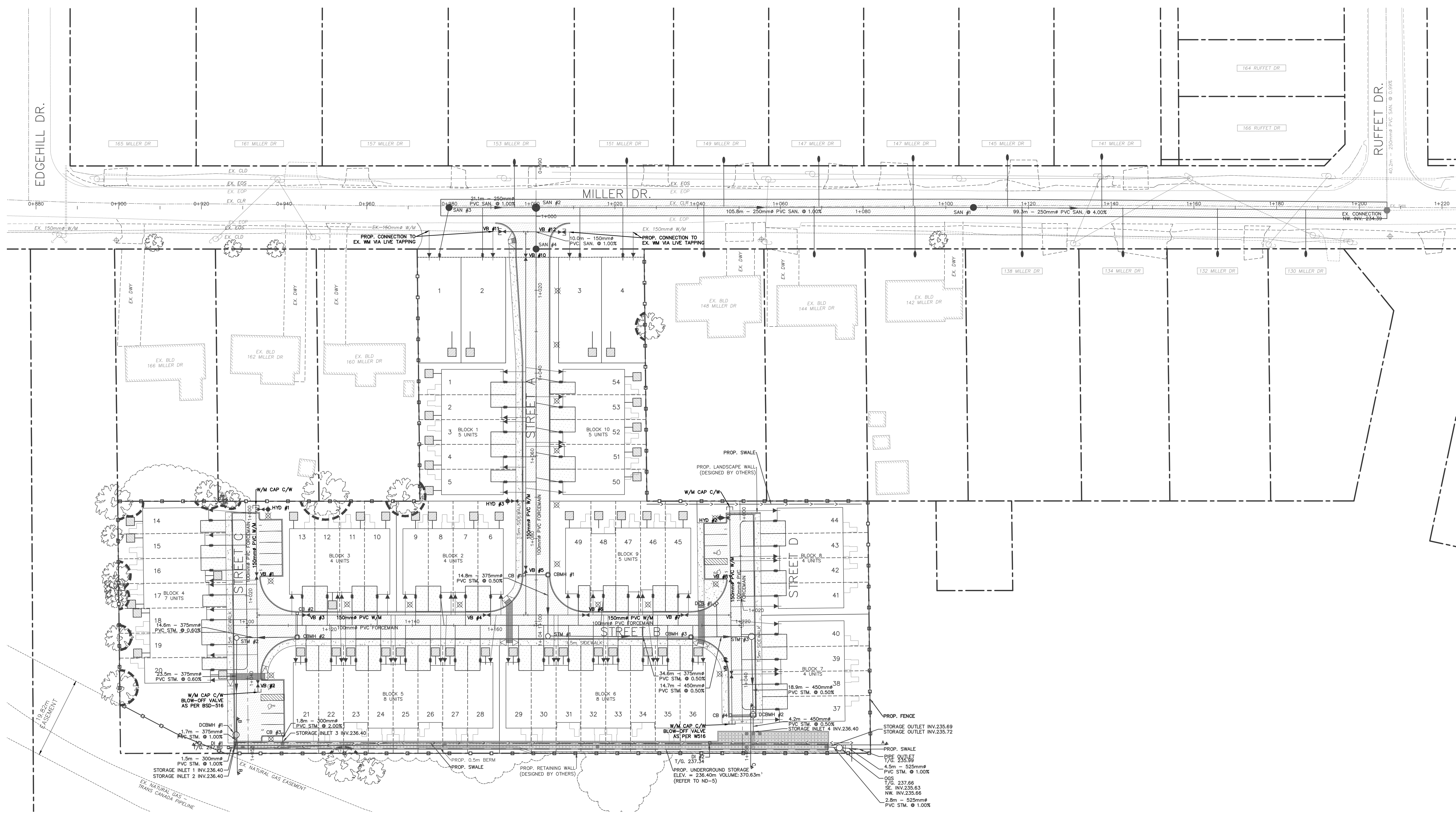
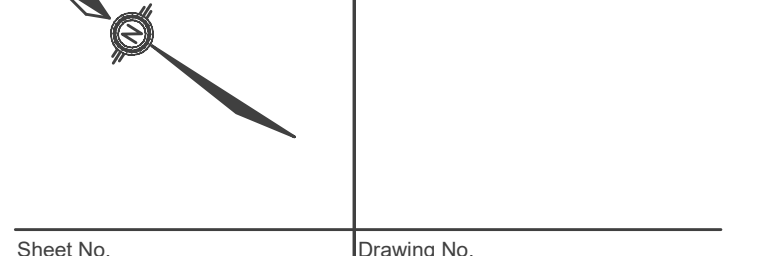


Client  
**152 MILLER DRIVE**  
 BARRIE, ON L4N 9X3  
 TOWN FILE: D28-014-2024

Drawing:  
**UNDERGROUND SERVICES PLAN**

Project No. 1981-001-23    Designed by: RM    Checked by: DL  
 Scale: 1:500    Drawn by: RM    Approved by: JM

Orientation    Stamp



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This drawing may have been reduced.  
0 5 10 20 30 40 50mm  
0" 1/4" 1/2" 1" 1 1/2" 2"

| No. | Issuance Description | YYMMDD   |
|-----|----------------------|----------|
| 1.  | CLIENT REVIEW        | 22/02/18 |
| 2.  | SITE PLAN APPROVAL   | xx/xx/xx |

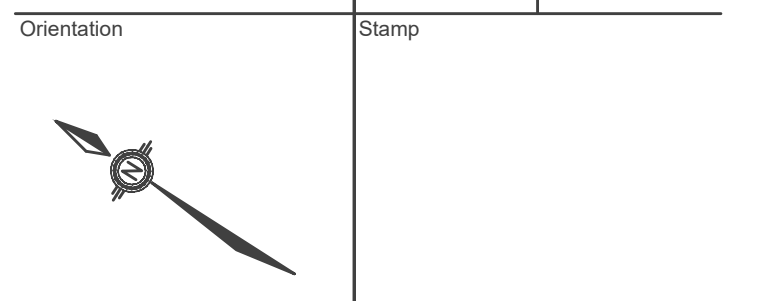
Issued For:  
**SITE PLAN APPROVAL**



Project  
**152 MILLER DRIVE**  
BARRIE, ON L4N 9X3  
TOWN FILE: D28-014-2024

Drawing:  
**PRE-DEVELOPMENT  
STORMWATER  
MANAGEMENT PLAN**

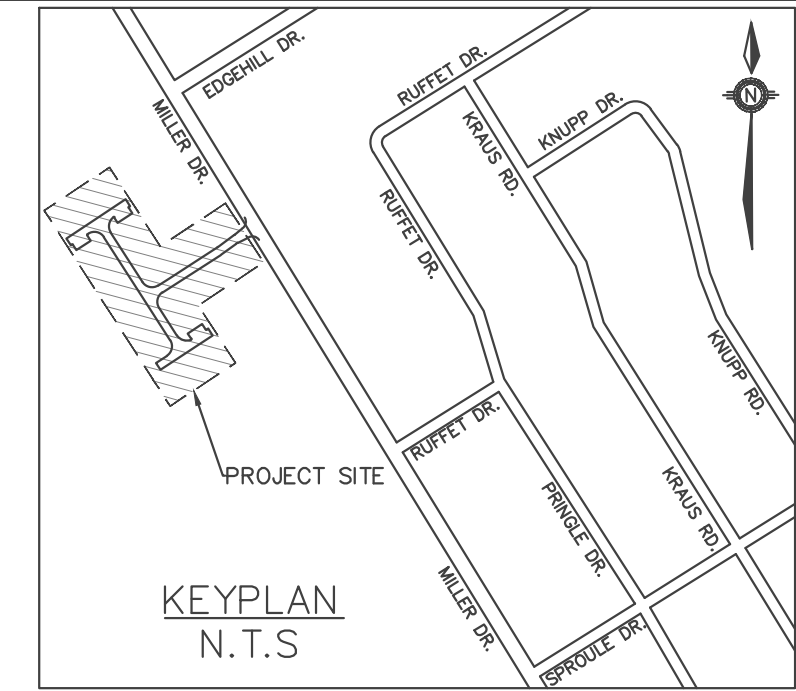
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|-------------|-------------|--------------|----|--------------|----|
| Project No. | 1981-001-23 | Designed by: | RM | Checked by:  | DL |
| Scale:      | 1:1000      | Drawn by:    | RM | Approved by: | JM |



Sheet No. **3 OF 22** Drawing No. **SWM-1**

**LEGEND**

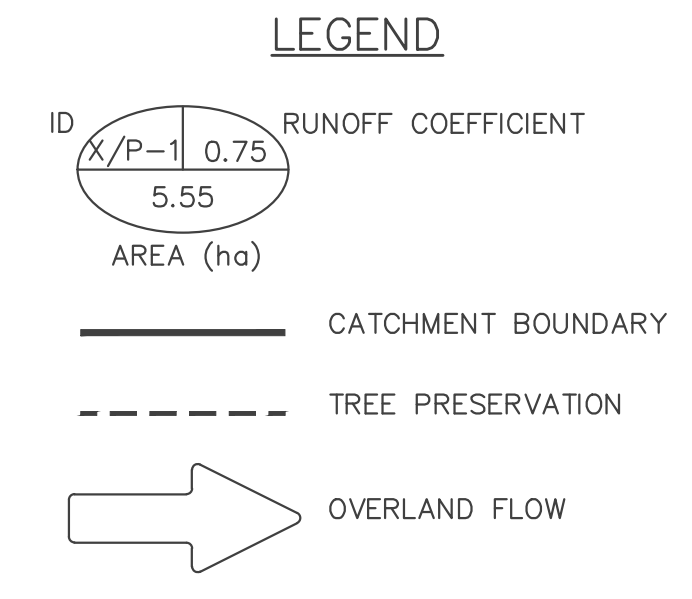
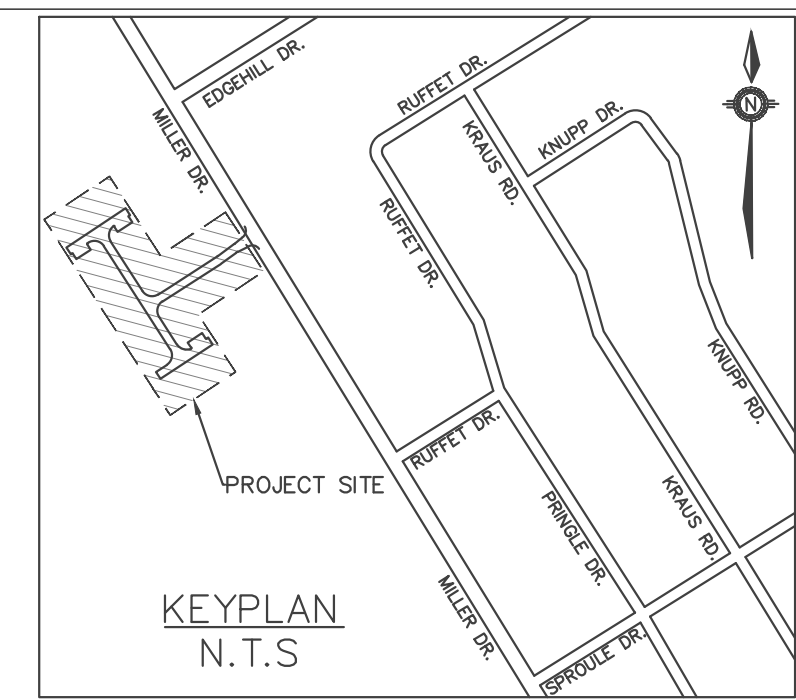
- ID  $\frac{X/P-1}{5.55}$  RUNOFF COEFFICIENT
- AREA (ha)
- CATCHMENT BOUNDARY
- - - - - TREE PRESERVATION
- ➔ OVERLAND FLOW



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This drawing may have been reduced.  
0 5 10 20 30 40 50mm  
0" 1/4" 1/2" 1" 1 1/2" 2"



| No. | Issuance Description | YYMMDD   |
|-----|----------------------|----------|
| 1.  | CLIENT REVIEW        | 22/02/18 |
| 2.  | SITE PLAN APPROVAL   | xx/xx/xx |

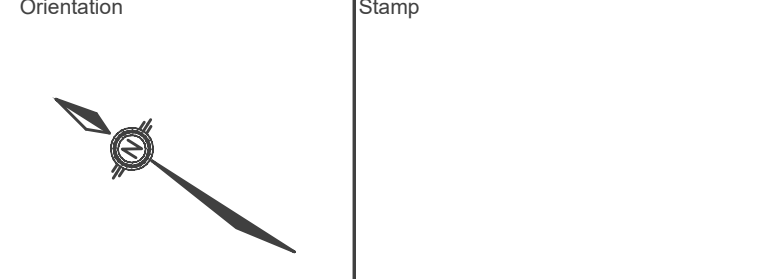
Issued For:  
**SITE PLAN APPROVAL**



Project  
**152 MILLER DRIVE**  
BARRIE, ON L4N 9X3  
TOWN FILE:D28-014-2024

Drawing:  
**POST-DEVELOPMENT  
STORMWATER  
MANAGEMENT PLAN**

|             |             |              |    |              |    |
|-------------|-------------|--------------|----|--------------|----|
| Project No. | 1981-001-23 | Designed by: | RM | Checked by:  | DL |
| Scale:      | 1:1000      | Drawn by:    | RM | Approved by: | JM |







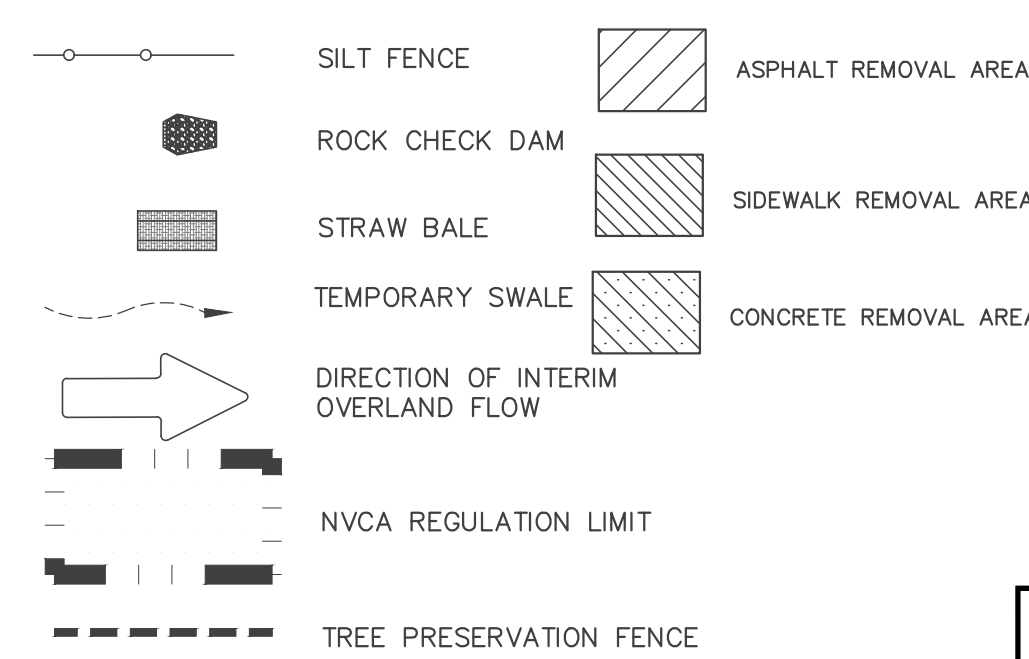
**NOTES FOR SEDIMENT & EROSION CONTROL**

- DISTURBED AREAS THAT HAVE FAILED TO HAVE STABLE GROUND COVER ESTABLISHED BY OCTOBER 30TH SHALL BE PROTECTED WITH A SILTATION CONTROL FENCE OR STRAW MULCH ETC. AND MAINTAINED BY THE CONTRACTOR UNTIL VEGETATION BECOMES ESTABLISHED IN THE SUBSEQUENT GROWING SEASON.
- ANY Dewatering WASTE SHALL BE DISCHARGED TO A VEGETATED AREA AT LEAST 30 M FROM ANY WATERCOURSE AND FILTERED. FILTERING METHODS MUST BE APPROVED BY THE SITE ADMINISTRATOR.
- SILT FENCE SHALL BE PUT IN PLACE PRIOR TO AND MAINTAINED DURING ALL GRADING. SILT FENCE SHALL COMPLY WITH OPSD 219.110 FOR LIGHT DUTY AND / OR OPSD 219.130 FOR HEAVY DUTY, UNLESS NOTED OTHERWISE. SILT FENCE TO BE INSPECTED PRIOR TO COMMENCEMENT OF EARTH GRADING ACTIVITIES. SILT FENCE TO BE INSPECTED AND REPAIRED OR REPLACED IF DAMAGED AS DIRECTED BY THE SITE ADMINISTRATOR. SILT CONTROLS TO BE INSPECTED ON A REGULAR BASIS AND AFTER EVERY RAIN EVENT. INSTALLATION SHALL BE TO THE MANUFACTURER'S SUGGESTED SPECIFICATIONS.
- THE CONTRACTOR SHALL BE PREPARED FOR UNEXPECTED CONDITIONS AND ACCORDINGLY HAVE STOCKPILED MATERIALS ON SITE FOR NECESSARY REPAIRS AS A RESULT OF FAILED OR INADEQUATE CONTROL MEASURES. ALL SEDIMENT AND EROSION CONTROL MEASURES SHALL BE INSPECTED AT LEAST ONCE A WEEK, AND AFTER EVERY RAINFALL EVENT.
- MUD MATS WHERE CONSTRUCTION TRAFFIC ENTERS OR LEAVES THE SITE SHALL BE USED. MUD MATS TO BE 300mm IN DEPTH, 6.0m WIDE BY 20.0m LONG, FIRST 10.0m TO 150mm CLEAR STONE WITH THE REMAINING 10.0m CONSISTING OF 50mm CLEAR STONE, OR MEET MUNICIPAL STANDARDS WHERE IDENTIFIED.
- CONTRACTOR SHALL OBTAIN A CURRENT COPY AND BECOME FAMILIAR WITH OPSS 805, CONSTRUCTION SPECIFICATION FOR TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES AS WELL AS ALL APPLICABLE MUNICIPAL STANDARDS.
- THE CONTRACTOR MAY CONSIDER ALTERNATIVE SEDIMENT AND EROSION CONTROL MEASURES. SUCH MEASURES SHOULD BE PRESENTED IN WRITING FOR APPROVAL OF THE SITE ADMINISTRATOR AND MUST BE APPROVED IN WRITING BY THE CONSERVATION AUTHORITY.
- THE TOPS OF ALL FILTER FABRIC MUST BE A MINIMUM OF 1.0 METRES ABOVE THE GROUND LEVEL AND ATTACHED TO THE FENCE WITH A CONTINUOUS STEEL WIRE. ALTERNATIVELY, THE FILTER FABRIC MUST BE FOLDED OVER THE TOP OF THE FENCE AND ATTACHED TO THE FENCE WITH WIRE LOOPED THROUGH THE FABRIC ON BOTH SIDES OF THE FENCE. FILTER FABRIC IS TO BE TERRAFIX 270R OR EQUIVALENT.
- ALL DISTURBED GROUND LEFT INACTIVE SHALL BE STABILIZED BY SEEDING, SODDING, MULCHING, OR COVERING OR OTHER EQUIVALENT CONTROL MEASURES. THIS PERIOD OF INACTIVITY SHALL BE AT THE DISCRETION OF THE MUNICIPAL DIRECTOR OF ENGINEERING BUT SHALL NOT EXCEED (30) DAYS OR SUCH LONGER PERIOD DEEMED ADVISABLE BY THE MUNICIPAL DIRECTOR OF ENGINEERING.
- CONTRACTOR SHALL INSTALL AND MAINTAIN CATCHBASIN SEDIMENT BARRIERS THROUGHOUT THE SITE DURING ALL CONSTRUCTION ACTIVITIES IN ORDER TO MITIGATE SEDIMENT ENTERING THE STORM SEWERS.
- NO FUEL TO BE STORED ON SITE. IN CASE OF A SPILL PLEASE CONTACT: MOECC SPILLS ACTION CENTER 1-800-268-6060.
- SEDIMENT CONTROLS ARE TO REMAIN IN PLACE UNTIL WRITTEN DIRECTION IS RECEIVED FROM THE ENGINEER REGARDING THEIR REMOVAL.
- EROSION AND SEDIMENT CONTROLS WILL BE INSPECTED ON AS PER MUNICIPAL REQUIREMENTS OR AFTER SIGNIFICANT RAINFALL EVENTS.

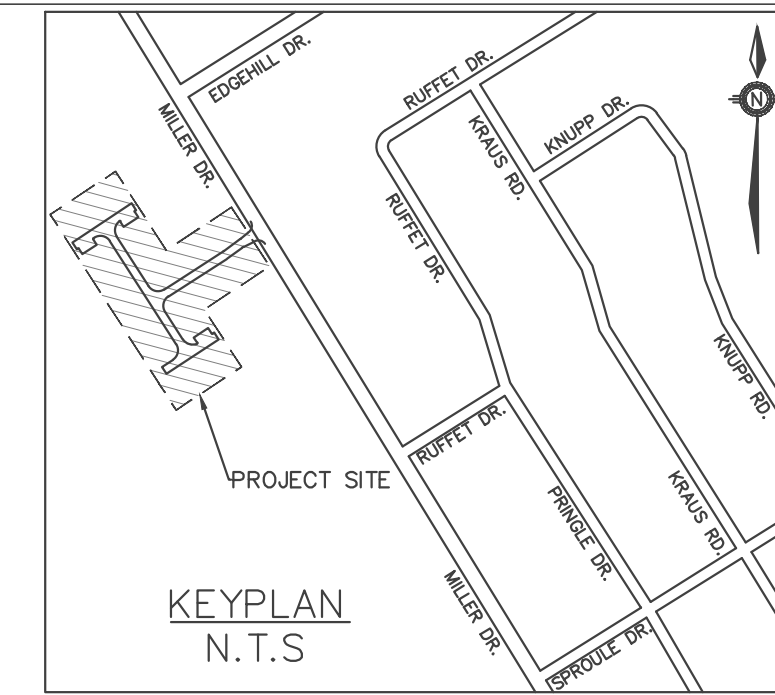
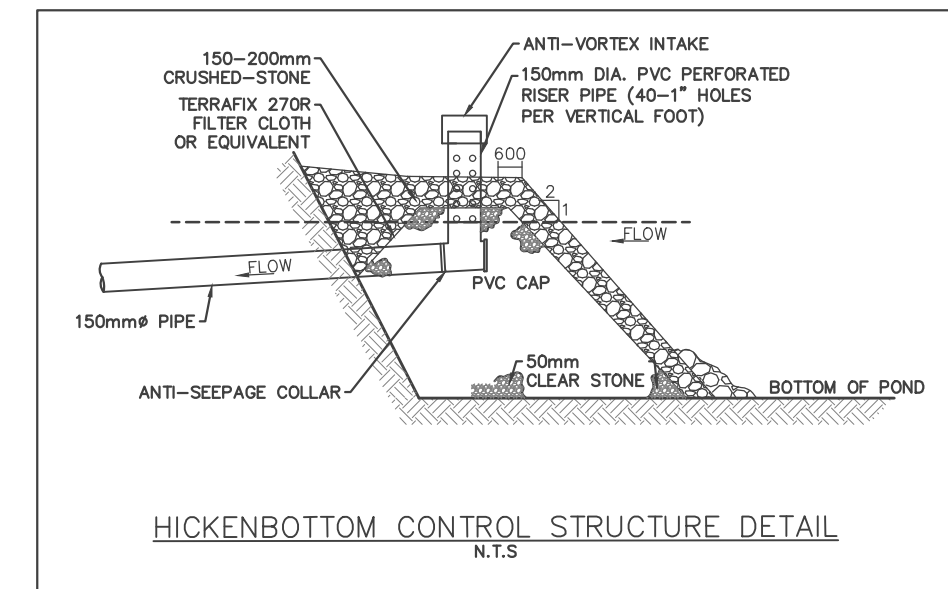
**SEQUENCE OF CONSTRUCTION**

- ENGINEER TO BE NOTIFIED PRIOR TO INITIATION OF ANY ON SITE WORKS.
- SILT FENCE AND CONSTRUCTION ACCESS MATS TO BE INSTALLED PRIOR TO THE COMMENCEMENT OF ANY WORKS ON SITE.
- VEGETATION REMOVAL MAY COMMENCE AFTER ALL SILT FENCE IS INSTALLED AND APPROVED BY THE ENGINEER.
- COMMENCE WITH EARTH EXCAVATION AND SITE SERVICING (TO BE REMOVED FROM SITE - NO STOCKPILE).
- EROSION CONTROL MEASURES TO BE MAINTAINED AS DIRECTED BY THE ENGINEER DURING THE CONSTRUCTION PERIOD. ADDITIONAL CONTROL MEASURES MAY BE REQUIRED AT THE DISCRETION OF THE ENGINEER.
- ALL DISTURBED GROUND LEFT INACTIVE FOR MORE THAN 30 DAYS SHALL BE STABILIZED WITH SEED, SOD, MULCH OR OTHER ADEQUATE COVERING, AS INSTRUCTED BY THE ENGINEER.

**LEGEND**



|                            |                  |
|----------------------------|------------------|
| Site Area                  | 14400.0 sq.m.    |
| Area of Alteration         | 14400.0 sq.m.    |
| Existing Land Use          | RESIDENTIAL (R)  |
| Aspiring Property Land Use | RESIDENTIAL (R)  |
| Soil Type                  | Sandy Loam (Ans) |

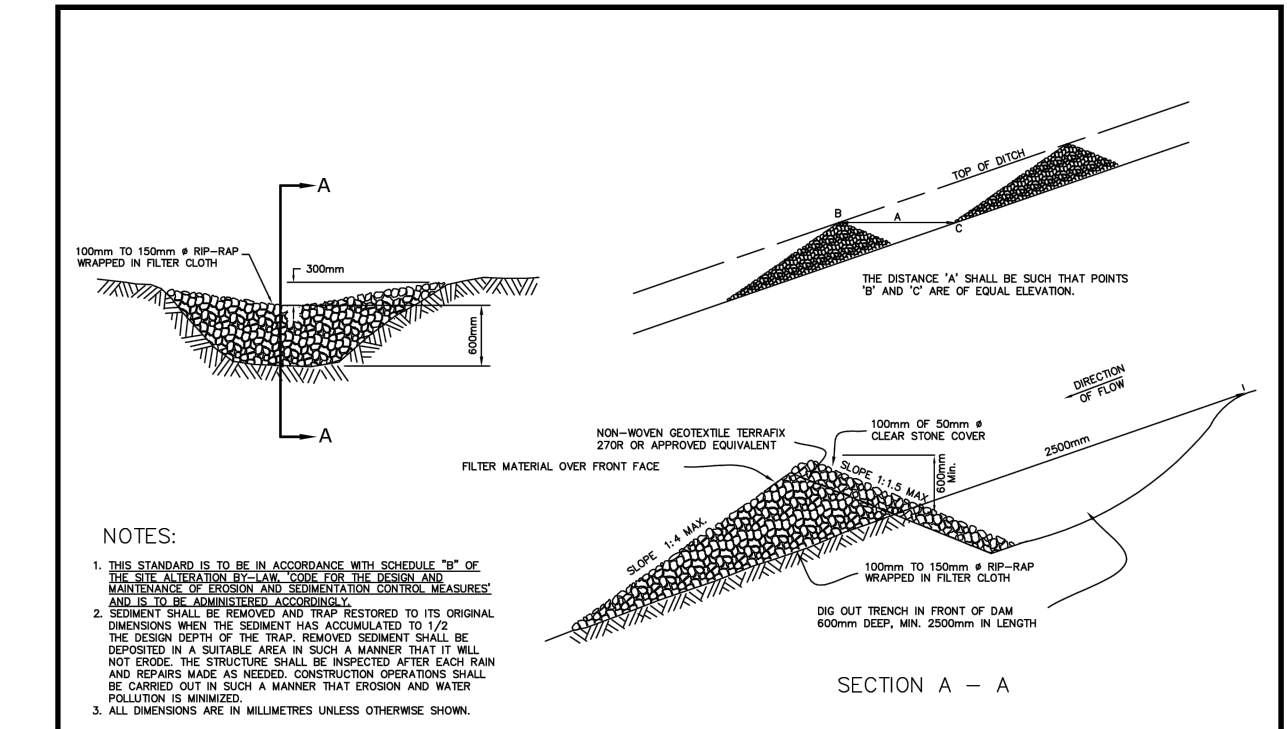
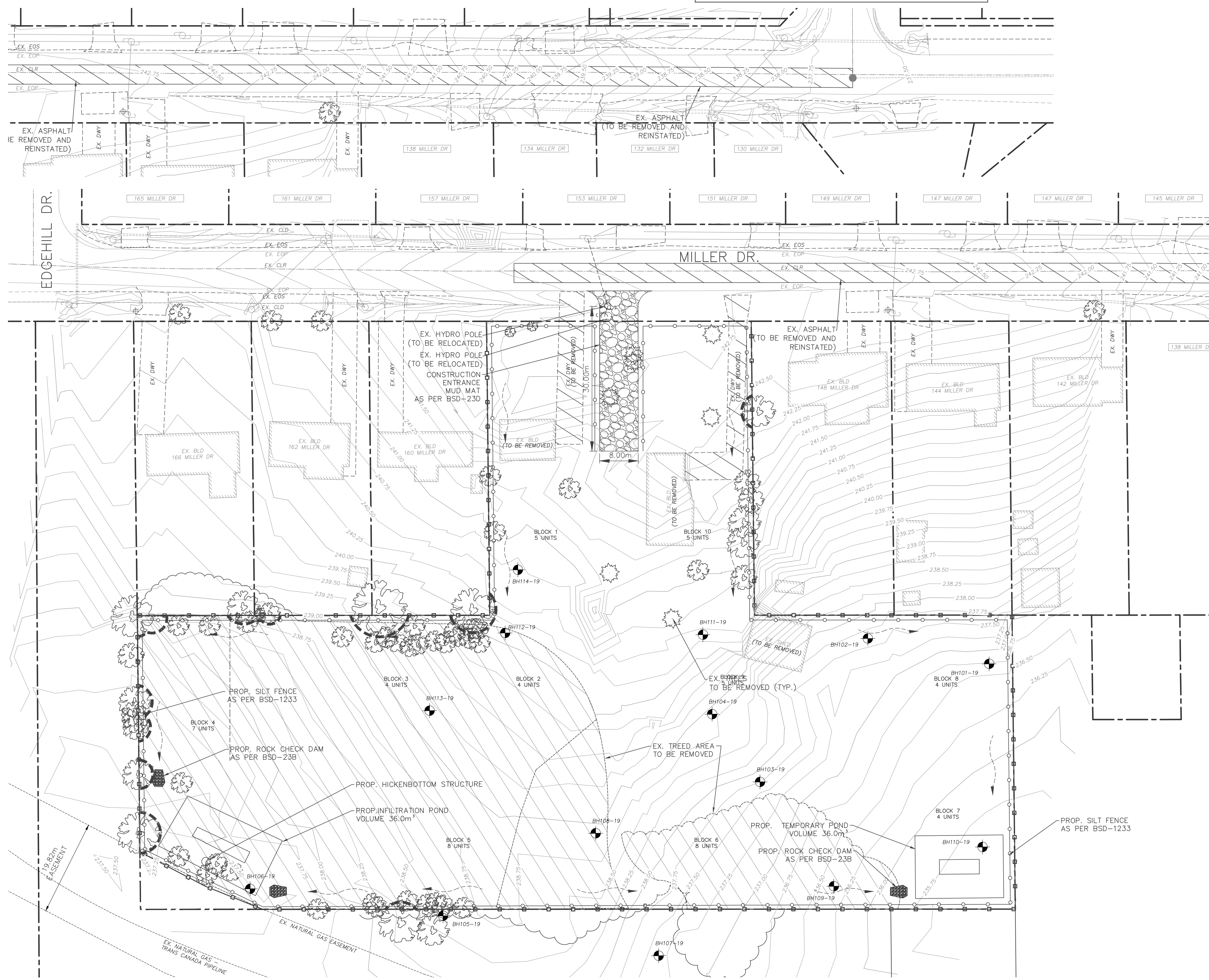
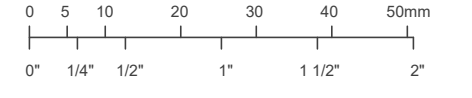


222 Mapleview Drive West, Suite 300  
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 Tel: 705.737.3303  
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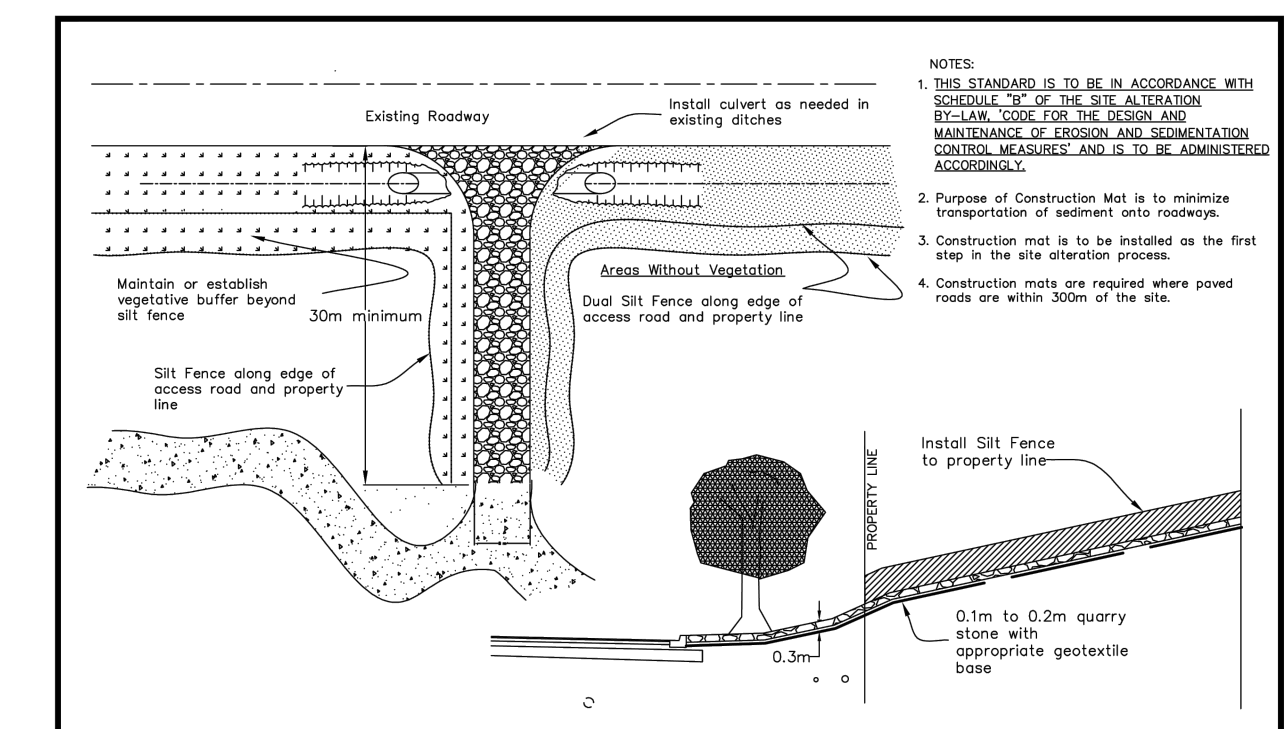
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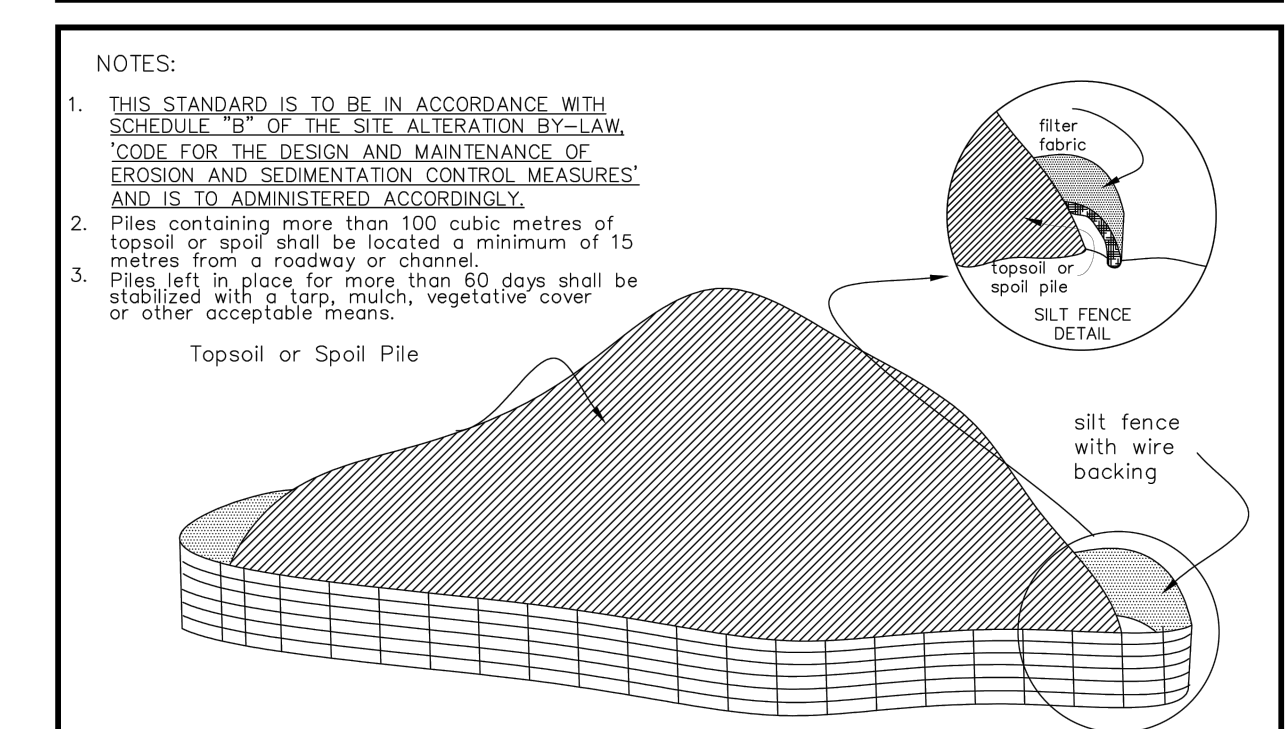
This drawing may have been reduced.



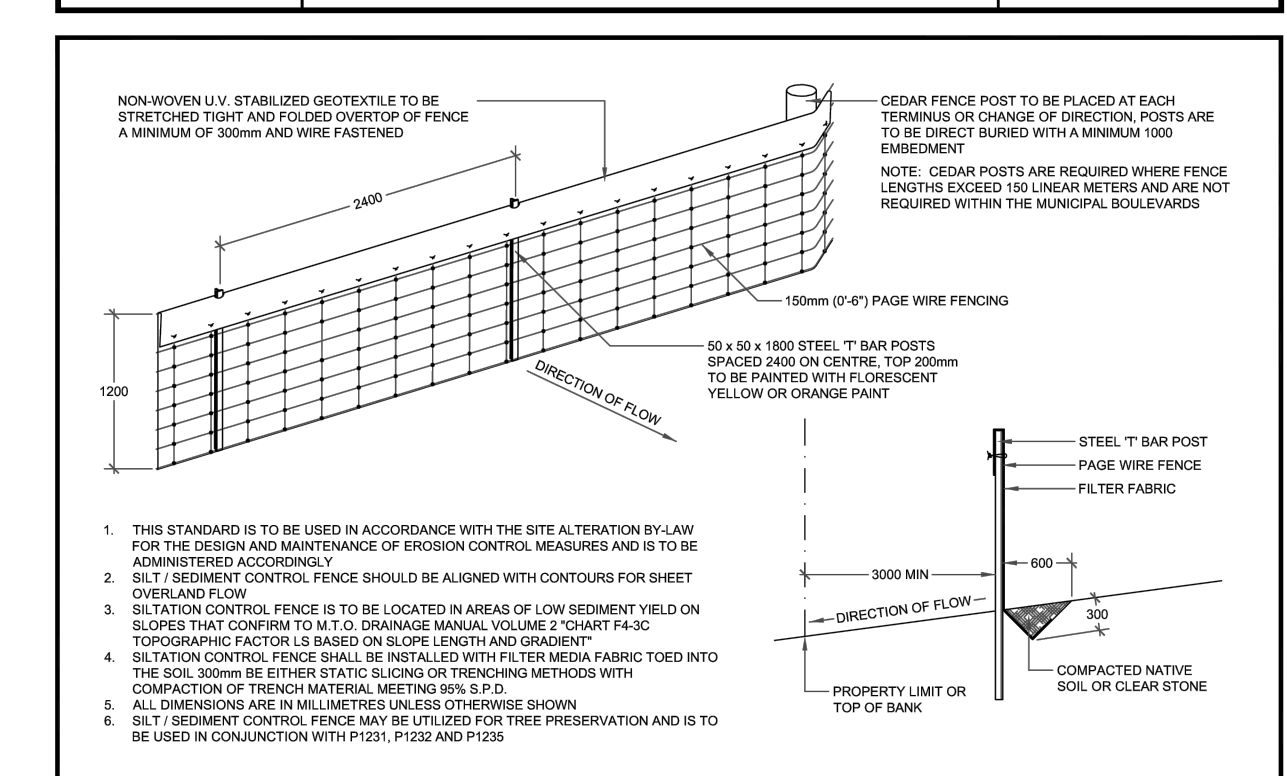
|        |                                 |                          |
|--------|---------------------------------|--------------------------|
| Barrie | Granular Erosion Control Device | REV No. 3 DATE: APR 2023 |
|        |                                 | D786                     |



|        |                       |                          |
|--------|-----------------------|--------------------------|
| Barrie | Construction Entrance | REV No. 2 DATE: APR 2023 |
|        |                       | D710                     |



|        |                   |                          |
|--------|-------------------|--------------------------|
| Barrie | Siltation Control | REV No. 1 DATE: APR 2023 |
|        |                   | D711                     |



|        |                         |                          |
|--------|-------------------------|--------------------------|
| Barrie | FENCE SILTATION CONTROL | REV No. 3 DATE: APR 2023 |
|        |                         | P1233                    |

| No. | Issuance Description | YYMMDD   |
|-----|----------------------|----------|
| 1.  | CLIENT REVIEW        | 22/02/18 |
| 2.  | SITE PLAN APPROVAL   | xx/xx/xx |

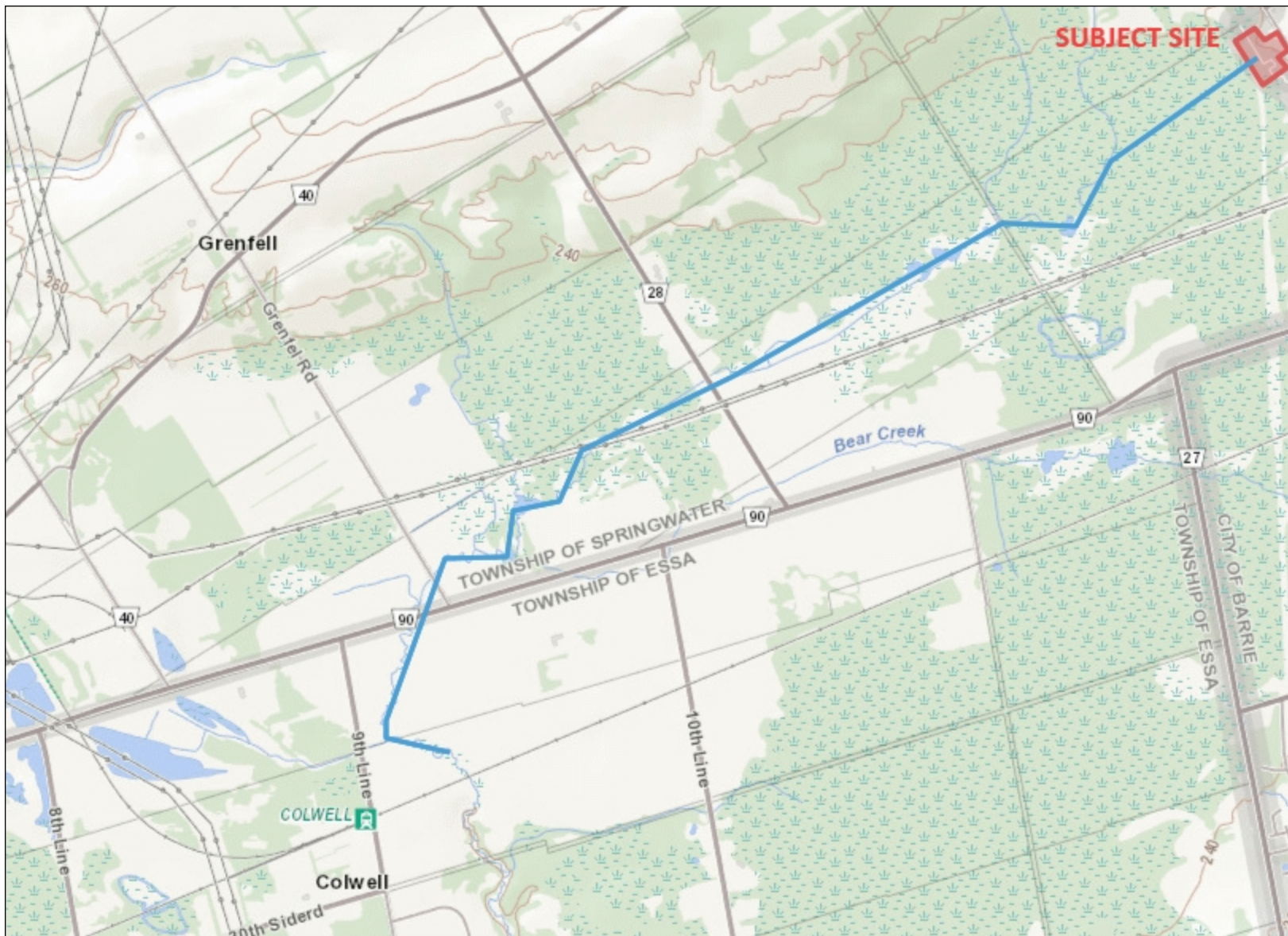
**SITE PLAN APPROVAL**



















Client  
 Project  
 152 MILLER DRIVE  
 BARRIE, ON L4N 9X3  
 TOWN FILE: D28-014-2024

**EROSION & SEDIMENT CONTROL & REMOVAL PLAN**































Project No. 1981-001-23 Designed by: RM Checked by: DL  
 Scale: 1:500 Drawn by: RM Approved by: JM  
 Orientation Stamp

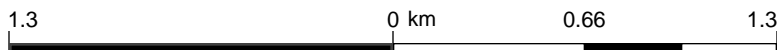


**Legend**

-  Assessment Parcel
-  Secondary Watershed
-  Tertiary Watershed
-  Quaternary Watershed
-  Great Lakes - St. Lawrence Basin
-  Hudson - James Bay Basin
-  Nelson River Basin
-  Hydrometric Monitoring Station
-  Diversions
-  Waterbody Outlet
-  Conservation Authority Dam
-  Provincial Dam
-  Federal Dam
-  OPG Dam
-  Other Dam
-  Virtual Flow Segment

**Land Cover Compilation**

-  Other
-  Cloud/Shadow
-  Clear Open Water
-  Turbid Water
-  Shoreline
-  Mudflats
-  Marsh
-  Swamp
-  Fen
-  Bog
-  Heath
-  Sparse Tree
-  Treed Upland
-  Deciduous Tree
-  Mixed Tree
-  Coniferous Tree
-  Plantations - Treed Cultivated
-  Hedge Rows
-  Disturbance
-  Open Cliff and Talus
-  Alvar
-  Sand Barren and Dune
-  Open Tallgrass Prairie
-  Tallgrass Savannah
-  Tallgrass Woodland
-  Sand/Gravel/Mine
-  Tailings/Extraction
-  Bedrock
-  Community/Infrastructure
-  Agriculture and Undifferentiated Rural Land Use



Scale: 1 : 25,819

Projection: Web Mercator



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