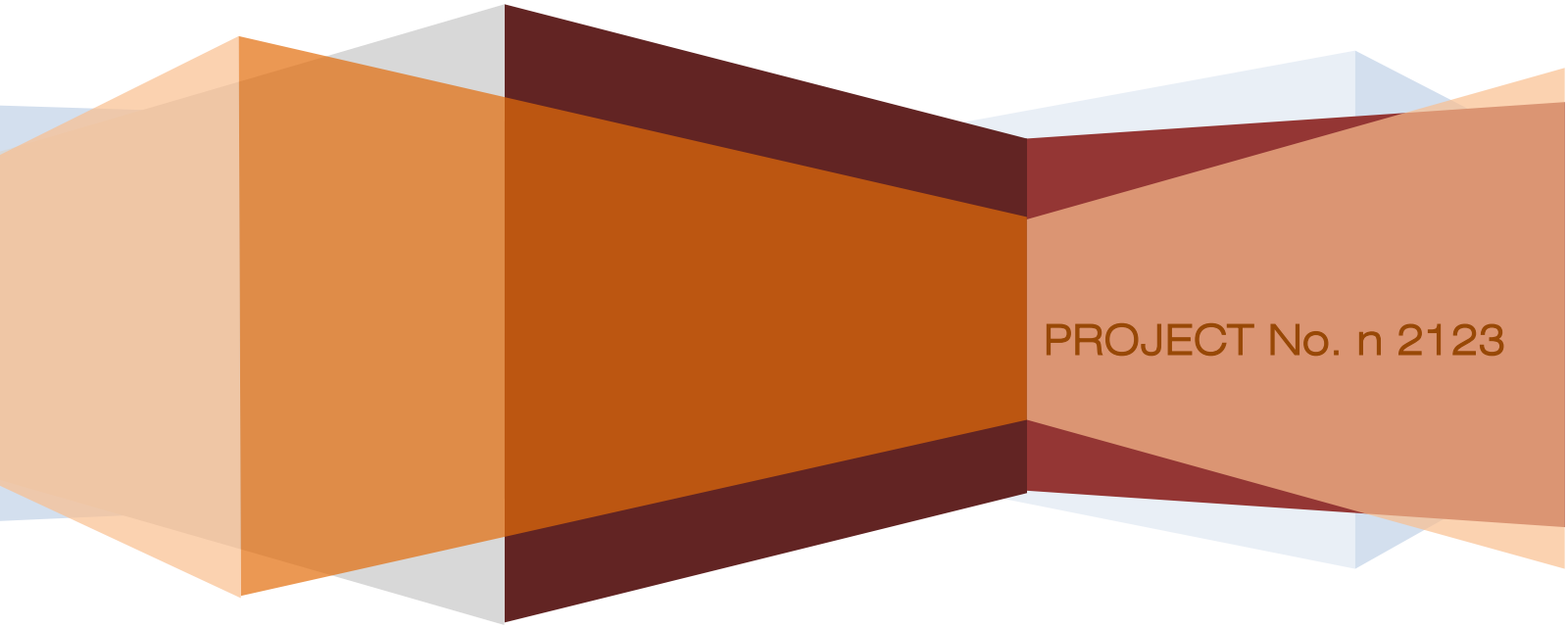
**PROPOSED CONDOMINIUM**

**233, 249, 261 COLDWATER ROAD**

**ORILLIA, ON**

# Servicing and Stormwater Management Report




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## Version History

| Version Number | Date of Update | Comments |
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| 06 | June 10, 2026 | Issued For SPA5 |
| 05 | February 10, 2026 | Issued For SPA 4 |
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| 03 | May 16, 2024 | Issued For SPA 2 |
| 02 | September 30, 2022 | Issued For SPA 1 |
| 01 | June 17, 2022 | Draft For Review |

## REFERENCES

The Engineering Design Criteria, City of Orillia (Revision #4: February, 2024) remains as primary guiding document for SWM criteria and submissions.

The preferred stormwater management for the proposed development utilizes the criteria and guidelines provided in the following reference documents:

- City of Orillia Official Plan;
- MOE Stormwater Planning and Design Manual;
- MTO Drainage Management Manual,(Online);
- LSRCA Phosphorus Offsetting Policy
- LSRCA Technical Guidelines for Stormwater Management Submissions

Some technical reports further provide data while selecting appropriate procedure in SWM:

- Plan and Profile, Coldwater Road and Westmount Dr. N.
- Survey Report for the site by ‘Richmond Surveying Inc., dated 20th October 2024’
- Geotechnical Investigation Report, Prepared by Palmer
- Hydrogeological Assessment Report, Prepared by SLR dated May 21, 2026.

# 1 INTRODUCTION

n Engineering Inc. was retained by the client to undertake the servicing and Storm Water Management (SWM) design for the proposed property development. The purpose of this report is to present SWM plan and proposed storm connections to mitigate the impact of increased storm runoff from the proposed development. The site falls under the jurisdiction of the City of Orillia, Ontario.

Proposed site grading, servicing and storm drainage plans are submitted separately as full-size drawings with this report.

# 2 STUDY AREA

The subject site has a street address of 233, 249, 261 Coldwater Road West, Orillia, ON. The property is located on Coldwater Rd W between Emily St and Collegiate Dr. The location of the subject site is shown below in Figure 1.

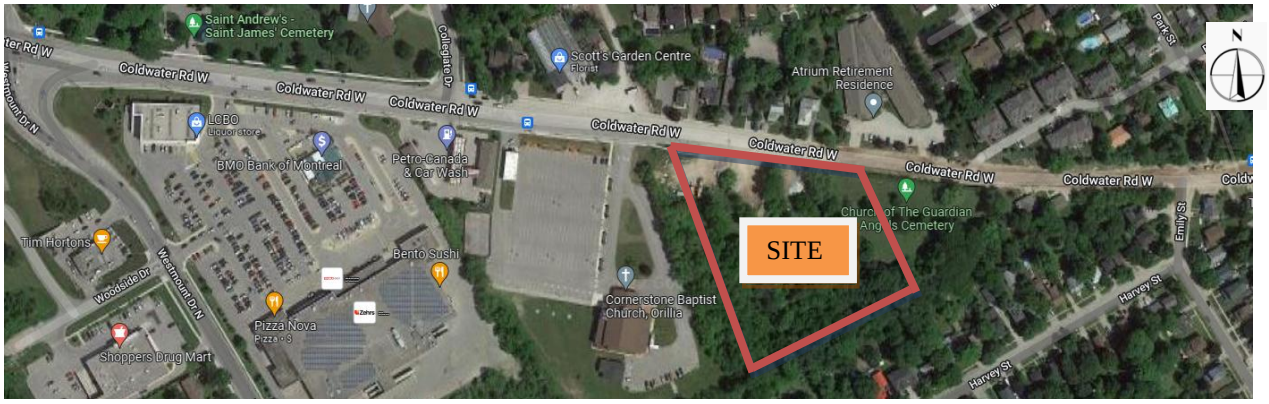



**Figure 1- Key Plan**

# 3 OBJECTIVES OF STUDY

The SWM strategies to mitigate any potential impacts and ensure that the hydraulic design comply with the current municipal guidelines required an investigation of the following:

a. Identifying existing runoff pattern and quantity of runoff discharge from existing undeveloped areas; and

b. Identifying post-development runoff from the site towards the existing municipal right of way.

# 4 EXISTING TOPOGRAPHY AND DRAINAGE PATTERN

A topographic information plan has been prepared by Richmond Surveying Inc., dated 20th October 2024, which identifies the site as Part of Lot 7 Concession 1, City of Orillia, and County of Simcoe. Please refer to Appendix A for the topographical survey information.

The site is approximately 1.5 ha in area. The property is not currently being used nor any development built. The property is covered with grass and trees. A photo of the site at present time is shown below as Figure 2.



**Figure 2- Existing Site Conditions**

The topographical information indicates that the site is sloped from the north to the south. The lowest elevation of the site is at the south side of the property, and the highest at the North side of the property.

The storm water drains through two outlets located at the southwest and southeast corners of the site. Due to the low elevation near the boundaries at southwest corner, runoff currently flows towards the southwest corner of the site, where it connects to a storm and sanitary easement. This easement leads to a ditch inlet catch basin and a 450 mm diameter storm sewer. The runoff from the eastern portion of the site flows southward, ultimately draining towards Harvey Street (between 256 Harvey Street and 288 Harvey Street).

A Civil 3D analysis, using survey data, was conducted to determine the catchment areas, which are shown in detail on the pre-development site drainage plan (Figure DR-101). The area located in the southwest part of the property, draining towards the existing ditch on the western side, is designated as Catchment A. The area draining towards the southern side is designated as Catchment B. In the pre-development condition, runoff from Catchment B (refer to Figure DR-101) discharges from the site at the lowest elevation point (EL. 265.07) located at the southeast corner of the property, flowing toward the adjacent Residential Zone (R2) and ultimately draining to the Harvey Street right-of-way. For further details, refer to the pre-development site drainage map in Figure DR-101 presented in Appendix A, and the certification of registration for the easement with the Province of Ontario presented in Appendix J.

## 5 PROPOSED DEVELOPMENT AND GRADING

The subject site is proposed to be developed as a residential 8 story Apartment building with 200 units with a proposed three different level of finished floor elevation for Level (0) is 275.30,

level (-1) is 271.80 and level (-2) is 268.30. The proposed parking lot will consist of a total of 256 parking spots with a single entrance at Coldwater road.

There are no external flows entering the site from the adjacent property, as a ditch runs along the property line and conveys runoff toward the ditch located on the southwest side of the property.

Grades around the site are proposed to match the boundary limits. Overland flows under developed conditions during large storms up to 100 year will directed towards the South-West corner of the site. Refer to Appendix A for the post-development site drainage plan DR-102 and Drawing No. C1: Grading Plan.

## 6 STORMWATER MANAGEMENT CRITERIA

The SWM criteria for the proposed development site were established based on the requirements of the City of Orillia. The proposed development shall follow the criteria and guidelines presented in the Engineering Design Criteria, City of Orillia (Revision #4: February 2024) and the LSRCA Technical Guidelines for Stormwater Management Submission (January 2026). The applicable criteria are summarized below:

- **Water Quantity Control:** Peak post-development flow rates shall not exceed pre-development peak flow rates for storm events with return periods ranging from **2-year to 100-year**.
- **Water Quality Control:** Water quality treatment shall achieve a minimum **80% TSS removal** (Enhanced / Level 1), in accordance with the **MOE SWMPD Manual** and **LSRCA standards**.
- **Water Balance:** A site-specific water balance analysis shall be completed in accordance with the **City of Orillia Official Plan (2024), Section 6.2.3**, to maintain **pre-development water balance conditions** under post-development conditions.
- **Volume Control:** As per **LSRCA Technical Guidelines for Stormwater Management Submissions, Section 3.2.4**, for new non-linear developments, the post-construction direct runoff volume generated from a **25 mm rainfall event** from all **impervious surfaces** shall be captured and retained/treated on-site (where unrestricted).
- **Erosion and Sediment Control:** The erosion potential of the study area shall be assessed using methods described in the **MOECP Manual**, **OPSS**, and **OPSD**, and appropriate temporary erosion and sediment control measures shall be implemented for construction activities, particularly near major roads.
- **Phosphorus Balance:** Phosphorus reduction measures shall be provided to meet **pre-development phosphorus loading conditions** in the post-development scenario, in accordance with **City of Orillia requirements** and the **LSRCA Phosphorus Offsetting Policy**.

# 7 STORMWATER MANAGEMENT STUDY

The following sections describe the steps taken to ensure that the above mentioned criteria of the City of Orillia will be satisfied.

## 7.1 Comparison between Existing and Proposed Land-use Conditions

Land-use characteristics under the proposed development are compared to land-use under existing conditions to assess the changes in runoff from the site. The comparison is presented below in Table 1.

**Table 1– Comparison between Existing and Proposed Land-use**

| Land-use Type | Gravel/Asphalt | Green Roof | Roof Area | Landscape | Total Area |
|---|---|---|---|---|---|
| **Existing Condition ($m^2$)** | 108.77 | 0.00 | 0.00 | 14967.41 | 15076.18 |
| **Existing Condition (%)** | 1% | 0% | 0% | 99% | 100% |
| **Proposed Condition ($m^2$)** | 7543.56 | 985.55 | 2510.65 | 4036.42 | 15076.18 |
| **Proposed Condition (%)** | 50% | 7% | 17% | 27% | 100% |
| **Increase/Decrease (%)** | 49% | 7% | 17% | -73% | 0% |

As can be seen above in Table 1, there will be an overall increase in 73% in imperviousness under the proposed development conditions in contrast of about 73% decrease in grassed area. An increase in imperviousness is expected under most urban developments.

## 7.2 Runoff Coefficients

Catchments that have more than one land use or soil type are represented by composite runoff coefficients determined by using area breakdowns of the different land cover as weighting factors. The copposite runoff coefficients are calculated for the site under both existing and proposed conditions using coefficients designated for particular land-use characteristics based on City of Orillia, Engineering Design Criteria (Revision #4: February, 2024). The designated Runoff Coefficients are shown in Table 2 below.

**Table 2–Runoff Coefficients**

| Land Use | Runoff Coefficient |
|---|---|
| Landscape | 0.25 |
| Building | 0.95 |
| Paved Area | 0.95 |
| Gravel Area | 0.65 |
| Green Roof [1] | 0.40 |

Pre and Post development composite runoff coefficients are calculated based on existing and proposed land-use, respectively, and are presented in Appendix B (Calculation Sheets 1A, 1B & 2, respectively). The pre- and post development composite runoff coefficients are summarized below in Table 3.

[1] Sedum roof with fixo Drain XD20 generally provided Runoff as 0.25-0.45

**Table 3– Composite Runoff Coefficients**

| Drainage Area | Pre-Development Runoff Coefficient C (Catchment A) | Pre-Development Runoff Coefficient C (Catchment B) | Post- Development Composite Runoff Coefficient "C" |
|---|---|---|---|
| Site | 0.25 | 0.25 | 0.73 |

## 7.3 Peak Flow Rates

Given the size and characteristics of the site and catchment (or drainage) areas, the Rational Method was used to determine the peak flows from the subject site under pre- and post development conditions. The rainfall-runoff relationship is as follows:

$$Q = 0.002778(C)(i)(A)$$

Where:
Q = Design flow (l/sec);
C = Runoff coefficient (Table 3);
i = Average rainfall intensity (mm/hr).
A = Catchment (or Drainage) area (ha);

The hydrograph time of concentration 10 minutes was determined as per the Municipalities Criteria.

Rainfall intensities are based on data published in the City of Orillia Engineering design Criteria (Revision #4: February, 2024). The rainfall data for the site is Table 4.

**Table 4– IDF Curve Parameters**

| Return Period | 2 -Year | 5-Year | 10 -Year | 25 -Year | 50 -Year | 100-Year |
|---|---|---|---|---|---|---|
| **A** | 22.5 | 29.9 | 34.8 | 40.9 | 45.5 | 50.0 |
| **B** | -0.728 | -0.725 | -0.724 | -0.723 | -0.722 | -0.722 |

## 7.4 Pre-development Peak Flows

Catchment areas and hydrological parameters are determined using the available land-use information and topographic map (as shown in Figures DR-101 in Appendix A). Pre-development peak flows are calculated based on existing land-use and presented in Appendix B titled Calculation Sheet 1A and Calculation Sheet 1B respectively for Catchment A and Catchment B. The results are summarized below in Table 5.

**Table 5– Pre-development Peak Flows (L/sec)**

| Return Period | 2 -Years | 5-Years | 10 -Years | 25 -Years | 50 -Years | 100-Years |
|---|---|---|---|---|---|---|
| Peak Flow **(Catchment A)** | 4.18 | 5.53 | 6.42 | 8.29 | 10.04 | 11.50 |
| Peak Flow **(Catchment B)** | 83.64 | 110.55 | 128.43 | 150.68 | 167.32 | 183.87 |

## 7.5 Post Development Peak Runoff Flow Rate

Under post development condition, the site has been divided into sub catchments as shown in Figure DR-102 (Appendix A). The subcatchment areas and hydrological parameters are determined using the proposed land-use information on site plan and proposed Grading Plan (as shown in Figure DR-102 in Appendix A and Drawing C1: Site Grading Plan). The propose stormwater drainage (minor flow) presented in Site Servicing Plan (DWG C2).

Post development peak flows for the entire site are calculated using the Rational Method based on proposed land-use and presented in Appendix B titled Calculation Sheet 2. The results from Calculation Sheet 2 are summarized below in Table 6.

**Table 6– Post Development Peak Flows (L/sec)**

| Return Period | 2 -Year | 5-Year | 10 -Year | 25 -Year | 50 -Year | 100-Year |
|---|---|---|---|---|---|---|
| **Peak Flow** | 252.34 | 333.53 | 387.49 | 500.06 | 605.79 | 693.44 |

## 7.6 Comparison of Existing and Proposed Runoff Rates

The primary goal of the hydrological analysis was to examine the effect of the proposed development on local storm drainage. This analysis was used to create goals for the SWM design. Table 7 presents the comparison between the calculated peak flow rates for both existing and proposed conditions for the entire site.

**Table 7– Comparison between Pre and Post Development Peak Flows (L/sec)**

| Return Period | 2 -Year | 5-Year | 10 -Year | 25 -Year | 50 -Year | 100-Year |
|---|---|---|---|---|---|---|
| Peak Flow (Catchment A) | 4.18 | 5.53 | 6.42 | 8.29 | 10.04 | 11.50 |
| Post Development Flow | 252.62 | 333.90 | 387.92 | 500.62 | 606.46 | 694.21 |
| Increase/Decrease | 248.15 | 328.00 | 381.07 | 491.77 | 595.74 | 681.94 |

The post development flows in Tables 6 and 7 represent the impact of the development only, and do not represent the final SWM design flows from the site. The design controlled stormwater discharge calculations are described in Section 7.7 and presented in Table 8.

## 7.7 Quantity Control Measure

As outlined in Section 6, Post development runoff from the proposed site proposed to be comtrolled under Pre-development run-off for the rainfall events from 2 to 100 years. As discussed in Section 4, the existing site is divided into two sub-catchments: Catchment A and Catchment B.

The predevelopment flow from Catchment A considered as allowable discharge rate in post developmet condition for the site and quantity measure proposed controlling post development flow form the site under the allowable flow rate. Grading plan also ensure that there will be no run-off to the adjacent properties.

### 7.7.1 Controlled Flow

Post-development flows from the site will be controlled to the allowable discharge rates as described in Section 7.7. As per the City of Orillia Engineering Design Criteria (Section 6.3.2), controlling post-development discharge to the allowable rates cannot be achieved using a minimum-size 75 mm diameter orifice device. Therefore, a Vortex Flow Regulator device (Model ACO-QuAD-VFC OR EQ) is proposed to be installed at the outlet of the CBMH5 (CONTROL). Due to the vortex flow configuration, the proposed vortex flow regulator to be installed at the outlet of the catch basin manhole (CBMH5-CONTROL). The storm sewer downstream of the vortex flow regulator, leading to the proposed storm manhole (MH3), has been sized smaller than the downstream sewer as a result, in the event of a failure or malfunction of the vortex flow regulator, the smaller downstream pipe will act as a backup flow control measure, restricting discharge and providing a contingency mechanism to help maintain the intended flow control function. Detailed vortex sizing Technical Data Sheets provided in Appendix D. The allowable discharge rates and the corresponding controlled flows are summarized in Table 8.

**Table 8 –Controlled Flows (L/sec)**

| Return Period | 2 -Year | 5-Year | 10 -Year | 25 -Year | 50 -Year | 100-Year |
|---|---|---|---|---|---|---|
| **Allowable Flows** | 4.18 | 5.53 | 6.42 | 8.29 | 10.04 | 11.50 |
| **Controlled Flows** | 4.14 | 5.49 | 6.38 | 8.25 | 10.00 | 11.46 |

### 7.7.2 Storage for Quantity Control

The required detention storage was calculated based on the vortex controlled flow at CBMH5-Control and is presented in Appendix D (Tables 2A to 2F). For the 100 year design storm event, the proposed controlled flow requires a maximum of 890.65 $m^3$ storage. The proposed pipe invert elevations are higher than the HWL in some part of the system and as such the full capacity of the pipes can be considered as detention storage in those areas. The volumes of the catch basins and manholes have been calculated based on the HWL. A Stormwater Detention Chamber (Model: ACO-STORMBRIXX OR EQ) along with impermeable liner is proposed for detention storage. The detention chamber detail is available in Appendix H.

The proposed detention storage calculations for the available storm are presented as Table 3A to Table 3F in Appendix D. A summary of the required and proposed detention storage for the 2-years to 100-year storm event is presented below in Table 9.

**Table 9– Summary of Detention Storage ($m^3$)**

| Return Period | 2 years | 5 years | 10 years | 25 years | 50 years | 100 years |
|---|---|---|---|---|---|---|
| Storage used in MH | 0.95 | 1.23 | 1.48 | 1.99 | 2.46 | 3.08 |
| Storage used in Pipe | 5.48 | 5.48 | 7.47 | 9.10 | 9.10 | 10.86 |
| Storage in Storm Chamber | 321.77 | 424.15 | 497.28 | 643.54 | 775.17 | 892.17 |
| Detention Storage Required | **314.71** | **422.16** | **493.06** | **639.23** | **778.41** | **890.65** |
| Proposed Available Storage | **328.20** | **430.86** | **506.23** | **654.63** | **786.73** | **906.12** |

### 7.7.3 Roof Flow

Runoff from the impervious roofs R1, R2, and R3 proposed to be connected to the infiltration chamber via roof drain designed my mechanical engineer.

Further more, the runoff from roofs R4 and R5 proposed to be discharged to the surface via roof drain leader. Roof R6 designated as a green roof and accounted for water balance. Roof storage calculation, green roof details and roof drainage plan DR103 are presented in Appendix E.

## 7.8 Water Balance

According to the Hydrogeological Assessment Report prepared by SLR dated May 21, 2026, section 4, the post-development water balance shows a deficit of 2365m³/year compared to pre-development conditions.

- **Post-Development Recharge Calculation:**

As per the Hydrogeological investigation report, the average annual precipitation for the site is 968 mm/year.

Deficit in Infiltration: 2365 m3/year

Total Area: 15076.18 $m^2$

Deficit in Infiltration: 2365 x 1000 / (15076.18) = 156.87 mm/year

Annual precipitation percentage require for precipitation depth is calculated as:

Annual precipitation for the site = 968 mm/year (Hydogelogical study report)

Dificit of % of Annual Rainfall = 156.87 / 968 = 16.20 %

Based on Percentage (%) of total annual rainfall depth vs. daily rainfall amount curve derived from 1991 Toronto rainfall data from 16 rain gauge stations, statistically 100% of average rainfall event depths are 40mm and less, which means that if the proposed infiltration facility can capture 40mm rainfall event, it will capture 100% of total annual rainfall volume. (Refer to Appendix E rainfall chart and calculations).

Using the Chart: For 16.20% annual rainfall event the daily rainfall depth is 1.0 mm. Therefore, required quantity for water balance = 15076.18x (1 / 1000) = 15.10 $m^3$

### 7.8.1 Initial Abstraction (Green Roof)

Area of the green roof has taken in to consideration in calculation of water balance initial abstraction as shwon in Table 10.

**Table 10- Initial Abstraction (Green Roofs)**

| Description | Area($m^2$) | Initial abstraction | Volume($m^3$) |
|---|---|---|---|
| Green Roof[2] | 985.55 | 37-44 L/$m^2$ | 35.65 |
| Total | | | 35.65 |

Required water balance quantity: 15.10 $m^3$ (Refer Section 7.8)
Proposed water balance quantity: 35.65 $m^3$ (Refer: Table 11)

From Table 10, it can be concluded that the proposed green roof has sufficient capacity to retain the required water balance volume from the site. "Sedum Roof" with Fixo Drain XD20 manufactured by ZinCo Canada Inc. proposed to use for the proposed development. Specification and detail drawing of green roof attached in Appendix E.

## 7.9 Water Quality Control

Long term average removal of 80% of Total Suspended Solids (TSS) on an annual basis from all runoff leaving the site is required. To substantially improve the water quality of the water leaving the site, a StormFilter SFPD0822 device has 45 Phosphosorb Cartridges (18") has been proposed that will be installed for water quality treatment. (Detail Sizing Report, Operation and Maintenance Plan and Qualification Certification are attached in Appendix F).

## 7.10 Phosphorus Loading

A Phosphorus Loading analysis has carried out using the 'Low Impact Development Treatment Train Tool (LID TTT)' developed by Lake Simcoe Region Conservation Authority (LSRCA). The proposed StormFilter SFPD0822 has 45 Phosphosorb Cartridges (18") with an accepted LSRCA rating for 79% Phosphorus removal. (Refer: Appendix F). The target is to reduce phosphorus loading under proposed conditions to meet pre development conditions. Summary of the phosphorus loading analyses under and pre and post development scenarios have been presented in Appendix G. The output of the LID TTT model is summarized below in Table 11. LID TTT model indicates that phosphorus loading under the post development scenario will decrease.

[2] Sedum Roof by Zinco

**Table 11 – Phosphorus Loading**

| Description | Total Load |
|---|---|
| Pre-Development (kg) | 0.956 |
| Post-development with LID (kg) | 0.424 |
| Total Reduction with LID (kg) | 0.532 |
| % Reduction | 55.65 |

## 7.11 Volume Control

According to LSRCA Technical Guidelines for Stormwater Management Submissions section 3.2.4, for new nonlinear developments, onsite without restrictions, shall capture and retain/treat on site, the post –construction direct runoff volume from 25 mm rainfall from the impervious surfaces. The required volume control is calculated as below:

Required Volume Control = IMPERVIOUS AREA x 25 mm
= 10054.21 $m^2$ x (25.0mm/1000)
= 251.35 $m^3$

However, due to site constrain such as high ground water level & low infiltration rates (Hydrogeological assessment report prepared by SLR, dated May 21, 2026) and infrastructure restriction (as per LSRCA guidelines Appendix D, all L.I.D. measures should have a minimum 4m setback from building structure) the stormwater volume control techniques such as L.I.D features/ BMPs are not feasible for the site. To achieve the target volume control, as outlined in section 3.2.6 of the LSRCA technical guidelines, the flexible treatment alternatives were explored. The most suitable alternatives for the site were indentified and implemented.

### 7.11.1 Alternative #1

Retain runoff from a 12.5 mm event from all impervious surfaces.

Required Volume Control = IMPERVIOUS AREA x 12.5 mm
= 10054.21 $m^2$ x (12.5 mm/1000)
= 125.67 $m^3$

The required volume control, as evaluated in Alternative #1, is not feasible for the site due to low infiltration rates of 16mm/hr, limited avaiablity of space and high groundwater table as identified in the Hydrogeological assessment report prepared by SLR, dated May 21, 2026. As a result, the required infiltration volume cannot fully infiltrate within the required 48-hour drawdown period. Therefore, Alternative #2 has been analyzed in following section (7.11.2).

### 7.11.2 Alternative #2

Achieve volume reduction to the maximum extent practicable minimum 5 mm event from all impervious surfaces.

Required Volume Control = IMPERVIOUS AREA x 5 mm
= 10054.12$m^2$ x (5.0mm/1000)
= 50.27 m3

The required volume control, as evaluated in Alternative #2, can be achieved on site. An infiltration chamber system (Model: ACO STORMBRIXX OR EQ) with a bed area of 280.80$m^2$ proposed to be installed , which will provide more than the required 5mm retention volume. The details of the infiltration chamber system presented in Appendix H and layout illustrated on DWG. C2.

Additionally, the stormwater management system designed to capture runoff from all imperious areas and convey it through a proposed stormwater filtration device (StormFilter SFPD0822) with an 80% TSS removal efficiency. The filtration system will also contribute towards meeting the LSRCA volume control requirement.

## 7.12 Stormwater Infiltration Chamber

According to the Hydrogeological assessment report prepared by SLR, dated May 21, 2026, Section 4.5, it is recommended that an infiltration rate of 16 mm/hr to 17mm/hr be used for the site when designing any stormwater infiltration facilities. Based on this recommendation, the installation of a Storm Chamber (Model: ACO STORMBRIXX OR EQ) with a total retention capacity of 129.52 m³ is proposed. The roof controlled flow via. Zurn Z105 from roofs (R1, R2 and R3) proposed to be directed to the retention chamber. This retention system is intended to help maintain the hydrological cycle in the post-development condition.

The storm chamber will have a bed size of 280.80 m² (23.40 m x 12.0 m), and its location is shown on Drawing C2. Detailed specifications of the storm chamber presented in Appendix H. A summary of the Volume control quantity is provided in Table 12.

**Table 12 –Volume Control Summary**

| **Water Balance Item** | **Quantity($m^3$)** |
|---|---|
| Required Volume Control Quantity ($m^3$) | 50.27 |
| Total Storage Capacity of the stormwater infiltration cahmber ($m^3$) | 134.22 |
| Availabe Retention storage Capacity ($m^3$) | 129.52 |

### 7.12.1 Percolation Calculation

To accommodate the necessary retention storage a storm water chamber is proposed. Sizing and outlet location of the storm water chamber was selected in a manner to ensure sufficient retention volume is provided.

Based on the value of Percolation from the Hydro geological Assessment – Percolation rate of the surrounding native soil = 16 mm/hr (with a safety factor of 2.5)

- Runoff volume to be infiltrate = 50.27 $m^3$

According to Ministry of Environment`s Storm water Management and Planning Manual the required bed area for the required volume to be infiltrated with 48 hours is calculated by applying the following equation:

$$A = \frac{1000V}{Pn\Delta t}$$

Where:

A = Bottom area of the infiltration trench ($m^2$)
V = Runoff volume to be infiltrated ($m^3$)
P = Percolation rate of surrounding native soil (mm / hr.)
n = Porosity of the storage media (0.40 for storm chambers)
$\Delta t$ = Retention time (48 hours)

Substituting the values in the above equation:

A = (1000 x 50.27 $m^3$) / (16 mm per hour x 0.40 x 48 hours) = 163.64 $m^2$

The runoff from roof (R1, R2 and R3) directed to the proposed LID to achieve the volume control requirement.

The proposed stormwater chamber features an outlet invert that allows for a required retention volume of 50.27m³, with a bottom surface area of 280.80 m². The drawdown time for this chamber is 27.97 hours.

Thus, the stormwater retention chamber is capable of achieving proposed volume control of 50.27 m³.

As per Hydrogeological Study Report prepared by SLR the seasonal high groundwater table estimated at elevation 267.69 and bottom of the proposed storm water chamber designed at elevation 269.15 .which is 1.46m above the groundwater table.

## 8 EROSION AND SEDIMENT CONTROL (ESC) DURING CONSTRUCTION

During site construction, various temporary measures will be implemented to prevent the discharge of sediment laden stormwater from the site. Please refer to Drawing No. C3, for the ESC Plan. These proposed measures include the installment of a mud-mat, silt fencing, and catch basin/catch basin manhole sediment traps. In addition, the following 'good housekeeping' measures are recommended:

- All exposed soil shall be stabilized as soon as possible with a seed and mulch application as directed by the Engineer;
- All construction vehicles shall leave the site via the designated location (mud mat) as shown on the ESC plan (Drawing No. C3)
- No construction activity or machinery shall intrude beyond the silt/snow fence or limit of construction area;
- Cleaning and repairs of the mud mat and any other temporary sediment control measures shall be completed as deemed necessary through regular inspection;
- Sediment/silt shall be removed from the sediment control devices after storm events and deposited in areas as approved by the engineer; and
- All re-graded areas within the development which will not be occupied by roadways, and parking spots shall be top-soiled and sodded/seeded immediately after completion of final grading operations as directed by the engineer.

## 9 MINOR SYSTEM DRAINAGE

The minor storm drainage system designed to convey stormwater from the proposed development to the existing catch basin (CB) on the easement. As part of the proposed works, the existing CB will be replaced with a catch basin manhole (CBMH) situated within the easement. The proposed CBMH will be connected to the storm sewer network, extending from the storm manhole (MH3) to the location of the existing CB. For detailed design parameters, refer to the Storm Sewer Design Chart in Appendix C. The layout of the proposed storm sewer network is illustrated on the Site Servicing Plan (Drawings C2 and C6).

## 10 MAJOR SYSTEM DRAINAGE

Overland flow will not adversely impact the proposed or existing adjacent structures, as the site grading has been designed to safely convey stormwater runoff, up to the 100-year storm event, to the proposed ditch inlet located at the southwest corner of the property, as illustrated in Figure DR102(Appendix A ) and Drawing C1. To minimize erosion and mitigate potential impacts, riprap protection is proposed at the lowest elevation of the proposed parking lot. Overland flow from the parking area will subsequently drain to the ditch inlet via a swale, which ultimately outlets to the proposed storm sewer downstream of the manhole (MH3) during storm events up to and including the 100-year rainfall event. Refer to Appendix C for the downstream sewer capacity and swale capacity analysis.

# 11 SERVICE CONNECTION

## 11.1 Sanitary

According to record drawings (as-built information) obtained from the City of Orillia, the site proposed be connected to an existing Sanitary manhole on Coldwater Rd. through proposed 200 mm diameter sanitary service connections . (Refer DWG. C2).

## 11.2 Water

Following the record drawings (as-built information) obtained from the City of Orillia, the site will be servered with the existing 150 mm at the property line which is ultimately connected to the existing 200 mm watermain on Coldwater Rd. (Refer DWG. C2).

# 12 SANITARY SEWAGE FLOW

The total peak flow design flow for the sanitary system has been calculated using the Engineering Design Criteria, City of Orillia. The total peak flow design flow for the sanitary system was determined to be 8.35 L/sec; the detailed analysis is available in Appendix I. A Sanitary design sheet is presented in the Appendix C.

# 13 WATER DEMAND

The estimated water consumption for the proposed development was calculated based on the Engineering Criteria of City of Orillia, July 2012.

## 13.1 Domestic Water Demand

The domestic water demand was determined and is presented in Appendix I.

a) Maximum Day Demand 3.28 L/sec
b) Maximum Hour Demand 9.22 L/sec

## 13.2 Fire Water Demand

Fire Water Demand calculated as per Fire Underwriter Survey is 100.0 L/sec. The analysis is presented in Appendix I.

The existing and proposed fire hydrants ensure that all proposed buildings are within 45 meters of a fire hydrant.

***Fire Flow Demand:***

As per Fire Underwriter Survey, Fire flow demand calculated as presented in Table 6, Appendix I.

- Required Fire Flow: 100 L/Sec
- Design Fire Flow Duration: 1.0 hr

According to above calculations, 150 mm and 100mm pipe are recommended to be used for the fire and domestic line respectively.

### 13.3 Maximum Water Demand

The total water demand is based on the required fire flow plus maximum day flow or peak hour flow, whichever is greatest.

a) Maximum Day Demand Plus Fire Flow 103.28 L/sec
b) Maximum Hour Demand 9.22 L/sec

The maximum water demand is 103.21 L/sec.

### 13.4 Hydrant Flow Calculations:

Calculate Flow at 20 P.S.I. Residual Pressure

$$Q_A = Q_T \left(\frac{h_t}{h_a}\right)^{0.54}$$

Where:

$Q_A$ = Flow at 20 P.S.I.
$Q_T$ = Flow at Test Pressure
$h_a$ = Pressure Drop Available (Static – 20 P.S.I Residual pressure)
$h_t$ = Pressure Drop at Test (Static - Residual pressure)

A hydrant flow test was carried out on the closest hydrant in front of the property (As shown in Key Map. Results are attached in Appendix I, These hydrant flow calculations are as follows,

$Q_A = 1463\ ((45-20)/\ (45-34))^{0.54}$
$= 2279.00$ GPM
**= 143.78 L/sec**

The water supply available is enough for the proposed site.

Considering the height of the building and number of units – booster pumps and site storge for water supply recommended to install and to be design by Mechanical Engineer.

## 14 INSPECTION AND MAINTENACE OF STORM WATER MANAGEMENT WORK

Regular monitoring and periodic cleaning will have to be undertaken to ensure that the stormwater management works are functioning properly. Inspections of erosion and sediment control devices must be done weekly, after every rainfall event and on a precautionary basis following inclement weather forecasts. Property owners have the obligation to maintain and inspect oil and grit separators located on their sites and parking lots. Oil and Grits separator manufacturer's guidelines for its maintenance must be strictly adhered to for its efficient operation. Owner's manual for operation and maintenance for Oil and Grits separators enclosed in Appendix F.

To ensure the inspection and maintenance for the Oil and Grits Separators following steps are recommended to be taken by own of the gas station:

a) Owners of the property to enter into a service & maintenance agreement for installed oil and grease Separator with Certified Maintenance Operator to clean oil and grease interceptor at least once annually;

b) Provisions in the agreement should include a defined inspection frequency, a commitment to maintain and structured reporting protocols;

c) Owner or operator should ensure inception of installed interceptor regularly to ensure performance is maintained to the manufacturer's specifications for performance and to ensure the surface oil and sediment levels do not exceed the recommended level;

d) Tanks, lids, baffles & Vents to be inspected with solid & oil/grease pumped out each 3 months, or adjusted to suit use(but not less than once per year);

e) The use of solvents, hot water or other agents to facilitate passage of oil & grease through the interceptor in not permitted;

f) In case of failure to adequately maintain the oil and grease interceptor to the satisfaction of the municipality, the municipality may require an alarmed monitoring device to be installed, at the expense of the owner.

g) All manholes catch basin to be inspected periodically to ensure no clogging;

h) After every rainfall event – parking lot ponding to be observed to ensure flows are not restricted by clogging;

i) Immediate repair work to be under taken to clean any obstruction in the storm and Sanitary sewer system;

All documentation of inspector inspection, clean-out, and sediment disposal shall be retained for a minimum of two years as proof for municipal inspections purpose.

## 15 SUMMARY & CONCLUSIONS

This analysis presents a detailed stormwater management control plan addressing both quantity and quality controls required to meet all design criteria. Drainage boundaries are established to estimate flows for the proposed drainage collection system of the site in order to develop a comprehensive surface drainage and SWM plan. There will be no negative impacts or increase in stormwater peak flows under the proposed controlled conditions.

A summary of the findings and drainage analyses for the subject property is as follows:

The hydrological and hydraulic analyses presented in this report address the existing and proposed site conditions;

- SWM criteria of external agencies are collected and reviewed during the course of the study and all other available information have been retrieved and reviewed;
- Impervious areas are calculated under both existing and proposed conditions and a significant increase in impervious areas was found;
- A proposed storm sewer network has been designed to convey the minor system;
- Recommended quantity control measures for the site will be achieved through the installation of a Vortex Flow Regulator: Model: ACO-QuAD-VFC OR EQ.
- Adequate storm water runoff storage for large design storms will be achieved through pipes, manhole/catch basins and stormwater detention chamber;
- A SFPD0822 with 45 Phosphorus cartridges (18”) unit has been recommended to ensure water quality control, and Phosphorus removal from site.

We trust that this proposed stormwater management plan will provide appropriate service for the proposed site.

Respectfully Submitted,

**n Engineering Inc.**




Abu. S. Ziauddin M. Eng P. Eng.
Head of Engineering




Lekhnath Upadhyaya- M.Eng P.Eng
Municipal Engineer

# Appendix A
# Figures

| | |
|---|---|
| LOT(SITE) AREA (m²) | 15426.96 (3.81 ACRE) |
| ROAD WIDENING | 350.78 SQM. |
| NET LOT AREA | 15076.18 SQM. (3.72 ACRE) |

## LEGEND

- DRAINAGE AREA IDENTIFICATION — EX. B; 1.006 (AREA IN HA.); 0.500 (RUNOFF COEFFICIENT)
- DRAINAGE BOUNDARY
- SITE BOUNDARY
- OVERLAND FLOW




### PRE DEVELOPMENT LAND USE TABLE

| LAND COVER | HATCH | AREA (SQ.M.) | RUNOFF CO-EFFICCIENT |
|---|---|---|---|
| ROOF | | – | 0.95 |
| CONCRETE/ ASPHALT | | – | 0.95 |
| GRAVEL | | 108.77 | 0.65 |
| LANDSCAPING | | 14967.41 | 0.25 |

### PRE DEVELOPMENT LAND USE TABLE : CATCHMENT–A FLOW TOWARDS DITCH

| LAND COVER | HATCH | AREA (SQ.M.) | RUNOFF CO-EFFICCIENT |
|---|---|---|---|
| ROOF | | – | 0.95 |
| CONCRETE/ ASPHALT | | – | 0.95 |
| GRAVEL | | 0 | 0.65 |
| LANDSCAPING | | 726.51 | 0.25 |

### PRE DEVELOPMENT LAND USE TABLE: CATCHMENT–B FLOW TOWARDS SOUTH

| LAND COVER | HATCH | AREA (SQ.M.) | RUNOFF CO-EFFICCIENT |
|---|---|---|---|
| ROOF | | – | 0.95 |
| CONCRETE/ ASPHALT | | – | 0.95 |
| GRAVEL | | 108.77 | 0.65 |
| LANDSCAPING | | 14240.90 | 0.25 |


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PROJECT:

**CONDOMINIUM**
**233,249,261**
**COLDWATER ROAD, WEST, ORILLIA**

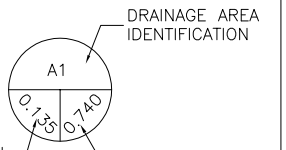
DRAWING TITLE:

**PRE-DEVELOPMENT SITE DRAINAGE PLAN**

| | |
|---|---|
| DRAWN BY: AZ | DATE: 29 MARCH 2022 |
| CHECKED BY: AZ | SCALE: NTS |
| PROJECT NO.: **21-23** | DRAWING NO.: **DR-101** |

N (GEODETIC NORTH)
PROJECT NORTH

## LEGEND




SITE BOUNDARY

DRAINAGE BOUNDARY

OVERLAND FLOW

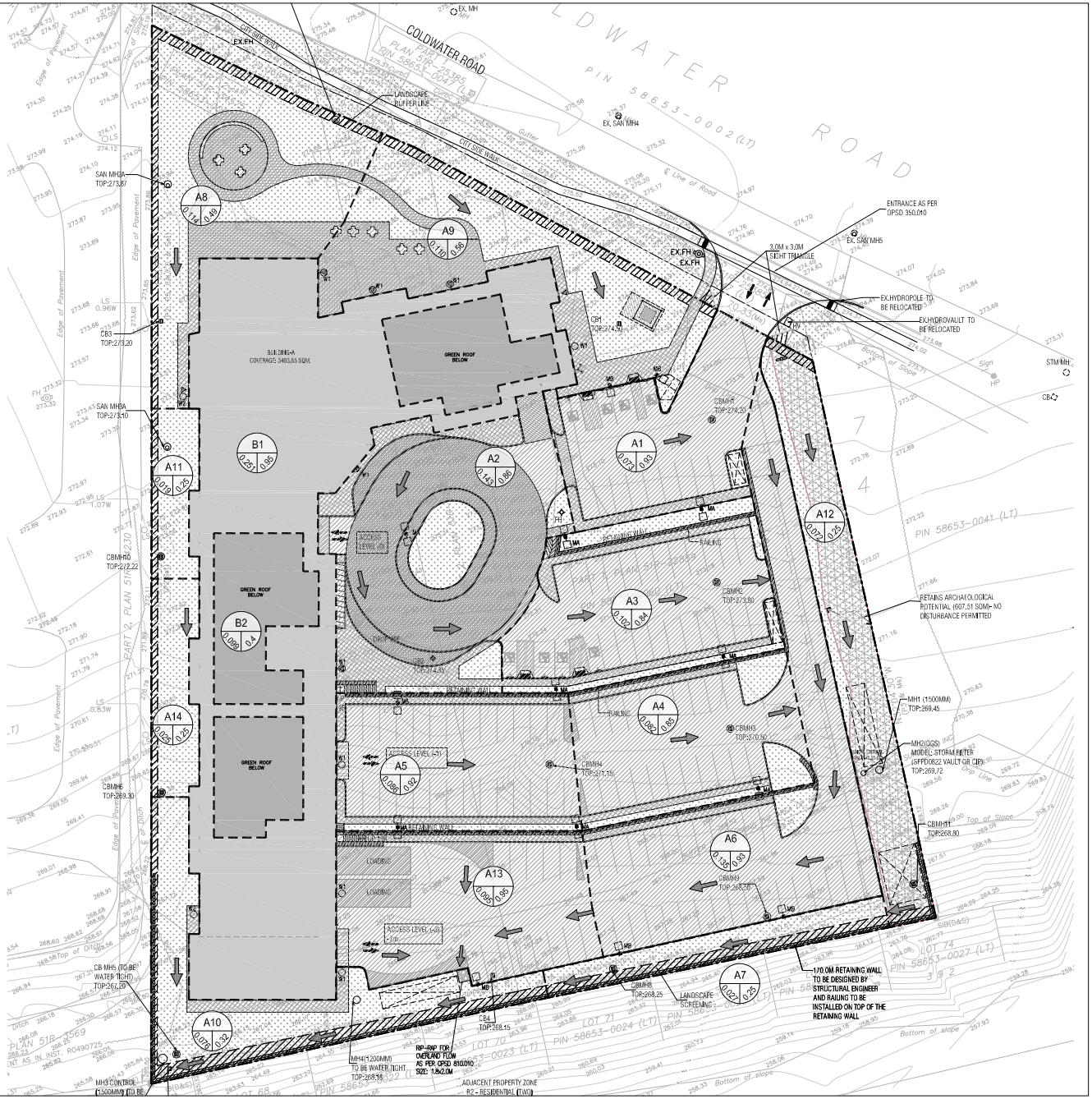
| | |
|---|---|
| LOT(SITE) AREA (m²) | 15426.96 (3.81 ACRE) |
| ROAD WIDENING | 350.78 SQM. |
| NET LOT AREA | 15076.18 SQM. (3.72 ACRE) |

POST DEVELOPMENT LAND USE TABLE

| LAND COVER | HATCH | AREA (SQ.M.) | RUNOFF CO-EFFICCIENT |
|---|---|---|---|
| IMPERVIOUS ROOF | | 2510.65 | 0.95 |
| GREEN ROOF | | 985.55 | 0.4 |
| CONCRETE/ ASPHALT | | 7543.56 | 0.95 |
| LANDSCAPING | | 4036.42 | 0.25 |

SUBCATCHMENT AREA

| SUBCATCHMENT | ROOF | ASPHALT/ CONCRETE | GREEN | TOTAL | AREA (HA) | COMP (C) |
|---|---|---|---|---|---|---|
| A1 | 0.00 | 712.61 | 16.11 | 728.72 | 0.073 | 0.93 |
| A2 | 0.00 | 1236.10 | 191.54 | 1427.64 | 0.143 | 0.86 |
| A3 | 0.00 | 862.89 | 154.98 | 1017.87 | 0.102 | 0.84 |
| A4 | 0.00 | 701.48 | 120.38 | 821.86 | 0.082 | 0.85 |
| A5 | 0.00 | 813.12 | 42.12 | 855.24 | 0.086 | 0.92 |
| A6 | 0.00 | 1313.32 | 33.43 | 1346.75 | 0.135 | 0.93 |
| A7 | 0.00 | 0.00 | 269.44 | 269.44 | 0.027 | 0.25 |
| A8 | 0.00 | 391.04 | 746.20 | 1137.24 | 0.114 | 0.49 |
| A9 | 0.00 | 482.42 | 614.58 | 1097.00 | 0.110 | 0.56 |
| A10 | 0.00 | 76.85 | 681.89 | 758.74 | 0.076 | 0.32 |
| A11 | 0.00 | 0.00 | 193.60 | 193.60 | 0.019 | 0.25 |
| A12 | 0.00 | 0.00 | 720.55 | 720.55 | 0.072 | 0.25 |
| A13 | 0.00 | 953.73 | 00.00 | 953.73 | 0.095 | 0.95 |
| A14 | 0.00 | 0.00 | 251.60 | 251.60 | 0.025 | 0.25 |
| B1 (IMPERVIOUS ROOF) | 2510.65 | – | – | 2510.65 | 0.251 | 0.95 |
| B2 (GREEN ROOF) | 985.55 | – | – | 985.55 | 0.099 | 0.4 |
| TOTAL | 3496.20 | 7543.56 | 4036.42 | 15076.18 | 1.508 | 0.73 |





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PROJECT:

**CONDOMINIUM**
**233,249,261**
**COLDWATER ROAD, WEST, ORILLIA**

DRAWING TITLE:

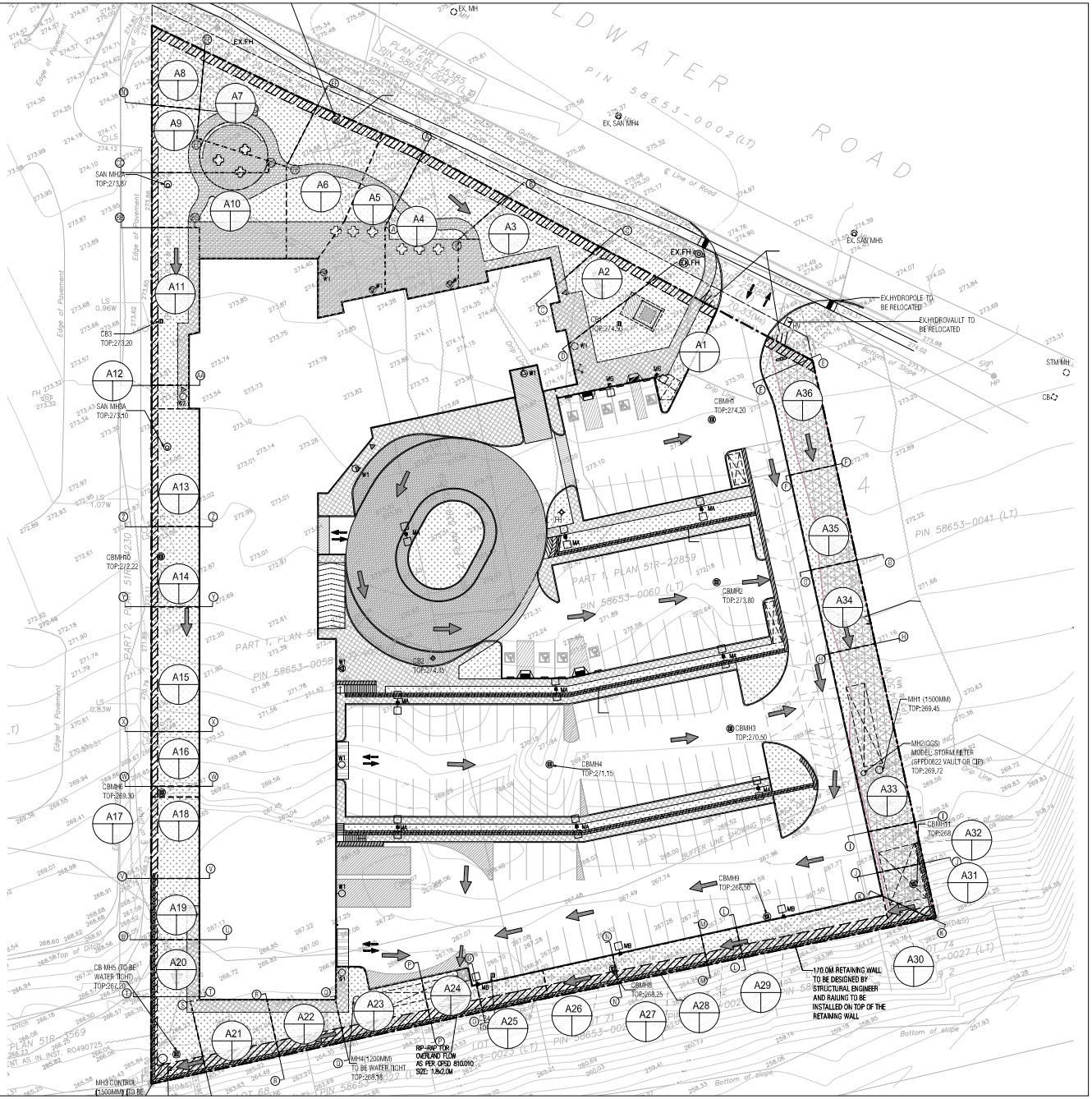
**POST-DEVELOPMENT SITE DRAINAGE PLAN**

| | |
|---|---|
| DRAWN BY: AZ | DATE: 29 MARCH 2022 |
| CHECKED BY: AZ | SCALE: NTS |
| PROJECT NO.: **21-23** | DRAWING NO.: **DR-102** |

N
(GEODETIC NORTH)
PROJECT NORTH

SWALE SUBCATCHMENT AREA

| SECTIONS | SUBCATCHMENT | ASPHALT/ CONCRETE | GREEN | TOTAL |
|---|---|---|---|---|
| D–D | A1 | 107.93 | 180.50 | 288.43 |
| C–C TO D–D | A2 | 37.50 | 92.89 | 130.39 |
| B–B TO C–C | A3 | 59.85 | 119.37 | 179.22 |
| A–A TO B–B | A4 | 126.62 | 138.67 | 265.29 |
| A–A | A5 | 142.84 | 83.51 | 226.35 |
| FF–FF | A6 | 65.64 | 175.36 | 241.00 |
| FF–FF TO EE–EE | A7 | 70.79 | 171.09 | 241.88 |
| EE–EE TO DD–DD | A8 | 0.00 | 90.85 | 90.85 |
| DD–DD TO CC–CC | A9 | 50.59 | 70.03 | 120.62 |
| CC–CC TO BB–BB | A10 | 147.94 | 116.58 | 264.52 |
| AA–AA TO BB–BB | A11 | 48.67 | 132.60 | 181.27 |
| AA–AA | A12 | 6.82 | 15.88 | 22.70 |
| Z–Z | A13 | 0.00 | 146.65 | 146.65 |
| Y–Y TO Z–Z | A14 | 0.00 | 99.68 | 99.68 |
| Y–Y TO X–X | A15 | 0.00 | 155.71 | 155.71 |
| X–X TO W–W | A16 | 0.00 | 64.48 | 64.48 |
| W–W | A17 | 0.00 | 13.44 | 13.44 |
| V–V | A18 | 0.00 | 101.89 | 101.89 |
| V–V TO U–U | A19 | 0.00 | 76.64 | 76.64 |
| U–U TO T–T | A20 | 24.92 | 147.36 | 172.28 |
| R–R TO S–S | A21 | 28.32 | 99.23 | 127.55 |
| Q–Q TO R–R | A22 | 25.28 | 61.76 | 87.04 |
| P–P TO Q–Q | A23 | 18.57 | 107.04 | 125.61 |
| O–O TO P–P | A24 | 2.54 | 57.38 | 59.92 |
| O–O | A25 | 3.26 | 44.69 | 47.95 |
| N–N | A26 | 3.47 | 48.85 | 52.32 |
| M–M TO N–N | A27 | 4.38 | 64.25 | 68.63 |
| L–L TO M–M | A28 | 1.74 | 26.31 | 28.05 |
| L–L | A29 | 7.24 | 114.20 | 121.44 |
| K–K | A30 | 1.89 | 15.52 | 17.41 |
| K–K TO J–J | A31 | 2.83 | 48.20 | 51.03 |
| I–I TO J–J | A32 | 1.02 | 50.35 | 51.37 |
| H–H TO I–I | A33 | 0.00 | 222.54 | 222.54 |
| G–G TO H–H | A34 | 0.00 | 104.03 | 104.03 |
| F–F TO G–G | A35 | 0.00 | 117.91 | 117.91 |
| E–E TO F–F | A36 | 0.00 | 156.03 | 156.03 |
| TOTAL | TOTAL | 990.65 | 3531.47 | 4522.12 |





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PROJECT:

**CONDOMINIUM**
**233,249,261**
**COLDWATER ROAD, WEST, ORILLIA**

DRAWING TITLE:

**SWALE CATCHMENT AREA**

| | |
|---|---|
| DRAWN BY: AZ | DATE: 29 MARCH 2022 |
| CHECKED BY: AZ | SCALE: NTS |
| PROJECT NO.: **21-23** | DRAWING NO.: **DR-104** |

N
(GEODETIC NORTH)
PROJECT NORTH

# SKETCH OF TOPOGRAPHY
# SHOWING TOPOGRAPHIC FEATURES
# PART OF LOT 7, CONCESSION 4
# (FORMERLY IN THE TOWNSHIP OF SOUTH ORILLIA)
# AND PART OF LOTS 54 TO 74
# REGISTERED PLAN 392
# CITY OF ORILLIA
# COUNTY OF SIMCOE

SCALE 1:400

20 0 20 40 Metres

RICHMOND SURVEYING INC.

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**NOTE:**

THIS IS NOT A LEGAL OR BOUNDARY SURVEY. ONLY THE AREAS SHOWN WITHIN THE BUFFER LINES WERE DONE BY RICHMOND SURVEYING INC. AND THE REST HAS PREVIOUSLY DONE BY A THIRD PARTY. OUR DATA WERE MERGED WITH THE PREVIOUS SURVEY AND WE ARE NOT LIABLE OF THE ACCURACY OF THE PREVIOUS SURVEY. DATA WERE MERGED TOGETHER WITH THE INSTRUCTION OF OUR CLIENT.

## METRIC

DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

## BEARING NOTE

BEARINGS ARE UTM GRID, BY REAL TIME NETWORK (TOPNET) OBSERVATIONS, UTM ZONE 17, NAD83 (ORIGINAL)(1997.0).

## BEARING ROTATION NOTE

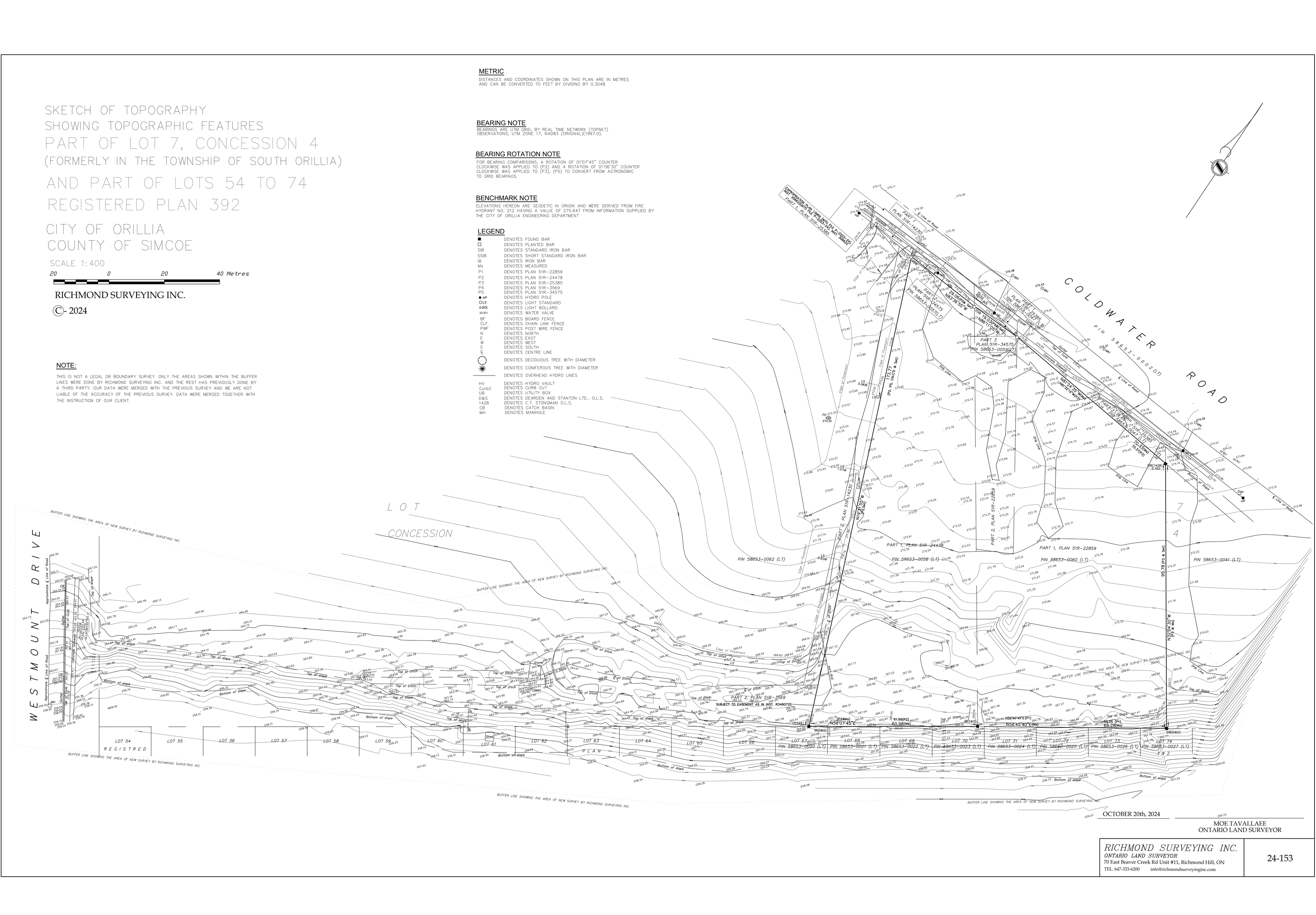
FOR BEARING COMPARISONS, A ROTATION OF 01°07'45" COUNTER CLOCKWISE WAS APPLIED TO (P2) AND A ROTATION OF 01°06'30" COUNTER CLOCKWISE WAS APPLIED TO (P3), (P5) TO CONVERT FROM ASTRONOMIC TO GRID BEARINGS.

## BENCHMARK NOTE

ELEVATIONS HEREON ARE GEODETIC IN ORIGIN AND WERE DERIVED FROM FIRE HYDRANT NO. 212 HAVING A VALUE OF 275.647 FROM INFORMATION SUPPLIED BY THE CITY OF ORILLIA ENGINEERING DEPARTMENT

## LEGEND

| | |
|---|---|
| ■ | DENOTES FOUND BAR |
| □ | DENOTES PLANTED BAR |
| SIB | DENOTES STANDARD IRON BAR |
| SSIB | DENOTES SHORT STANDARD IRON BAR |
| IB | DENOTES IRON BAR |
| Ms | DENOTES MEASURED |
| P1 | DENOTES PLAN 51R–22859 |
| P2 | DENOTES PLAN 51R–24478 |
| P3 | DENOTES PLAN 51R–25385 |
| P4 | DENOTES PLAN 51R–3569 |
| P5 | DENOTES PLAN 51R–34575 |
| HP | DENOTES HYDRO POLE |
| OLS | DENOTES LIGHT STANDARD |
| BOL | DENOTES LIGHT BOLLARD |
| WV | DENOTES WATER VALVE |
| BF | DENOTES BOARD FENCE |
| CLF | DENOTES CHAIN LINK FENCE |
| PWF | DENOTES POST WIRE FENCE |
| N | DENOTES NORTH |
| E | DENOTES EAST |
| W | DENOTES WEST |
| S | DENOTES SOUTH |
| ℄ | DENOTES CENTRE LINE |
| | DENOTES DECIDUOUS TREE WITH DIAMETER |
| | DENOTES CONIFEROUS TREE WITH DIAMETER |
| | DENOTES OVERHEAD HYDRO LINES |
| HV | DENOTES HYDRO VAULT |
| CurbC | DENOTES CURB CUT |
| UB | DENOTES UTILITY BOX |
| D&S | DENOTES DEARDEN AND STANTON LTD., O.L.S. |
| 1428 | DENOTES C.T. STONGMAN O.L.S. |
| CB | DENOTES CATCH BASIN |
| MH | DENOTES MANHOLE |




OCTOBER 20th, 2024

MOE TAVALLAEE
ONTARIO LAND SURVEYOR

*RICHMOND SURVEYING INC.*
*ONTARIO LAND SURVEYOR*
70 East Beaver Creek Rd Unit #11, Richmond Hill, ON
TEL. 647-333-6200 info@richmondsurveyinginc.com

24-153

**From:** Cameron Sellers [csellers@ipsconsultinginc.com]
**Sent:** July 23, 2025 8:47 AM
**To:** Prakash Venkataraman; Nithin MALHOTHRA ARCHITECT; 'Abu Ziauddin | nEngineering Inc. '; Sachin Panjwani | nEngineering Inc; John Albert
**Cc:** Sagar Aurora
**Subject:** RE: RE: Coldwater Road Stormwater Discussion

Fantastic work Prakash! So glad common sense prevailed.


**Cameron Sellers, B.B.A.**
PARTNER
**Barrie Office**
9-647 Welham Road
Barrie, ON L4N 0B7
705 - 812 - 3281 Ext. 24
csellers@ipsconsultinginc.com

**Vaughan Office**
200W-3800 Steeles Ave W
Vaughan, ON L4L 4G9
905 - 291 - 7525 Ext. 24
www.ipsconsultinginc.com


---

**From:** Prakash Venkataraman <prakash@rogers.com>
**Sent:** Tuesday, July 22, 2025 4:22 PM
**To:** Nithin MALHOTHRA ARCHITECT <nm@narchitecture.com>; Cameron Sellers <csellers@ipsconsultinginc.com>; 'Abu Ziauddin | nEngineering Inc. ' <az@nengineering.com>; Sachin Panjwani | nEngineering Inc <sp@nengineering.com>; John Albert <jalbert@ipsconsultinginc.com>
**Cc:** Sagar Aurora <sagar_aurora@hotmail.com>
**Subject:** FW: RE: Coldwater Road Stormwater Discussion

Bingo! :-)

Best Regards,

Prakash Venkataraman
226.218.1910

-------- Original message --------
From: Patrick MacDonald <PMacDonald@orillia.ca>
Date: 2025-07-22 4:13 p.m. (GMT-05:00)
To: Prakash Venkataraman <prakash@rogers.com>
Cc: Jeff Duggan <JDuggan@orillia.ca>, John Albert <jalbert@ipsconsultinginc.com>, Tracy Blanchard <TBlanchard@orillia.ca>, Katy Modaressi <KModaressi@orillia.ca>
Subject: RE: Coldwater Road Stormwater Discussion

Good Afternoon Prakash,

Thank you for your patience regarding my response.

City Staff have discussed this matter and agree that exploring/assessing alternate discharge options is appropriate for this proposed development, including options for a storm sewer pipe from the proposed development site (233, 249, and 261 Coldwater Road West) to the City's existing storm infrastructure (catch basin) within the City easement. As I noted in my previous email, several details need to be resolved before any approvals can be provided in addition to validating infrastructure locations. Preliminary items to be addressed are summarized below:

- The City would likely need to assume ownership over the proposed stormwater infrastructure within the easement to service the proposed development.
    - An agreement would be required documenting the approvals, supporting documentation, inspections, etc, for the construction of the storm sewer prior to the City taking ownership of the infrastructure.
- The City would likely need to obtain an easement from Coldwater Road West to the upstream end of the proposed infrastructure to facilitate access and maintenance of the proposed infrastructure.
- The existing infrastructure within the easement should not be impacted during or after construction.
- All proposed infrastructure assumed by the City should be constructed to the City's criteria.

Please advise if you have any questions.

Regards,
Pat

**Out of office alert: August 5, 2025, to August 15, 2025**

ORILLIA

**Patrick MacDonald, P.Eng.** *(he/him)* I Project Engineer - Stormwater
Development Services and Engineering
*Development and Infrastructure Planning Division*
**T:** 705-558-9538 **C:** 705-323-8483
orillia.ca

orilliaNOW

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**From:** Prakash Venkataraman <prakash@rogers.com>
**Sent:** July 15, 2025 9:00 PM
**To:** Patrick MacDonald <PMacDonald@orillia.ca>
**Cc:** Jeff Duggan <JDuggan@orillia.ca>; John Albert <jalbert@ipsconsultinginc.com>
**Subject:** RE: Coldwater Road Stormwater Discussion

Thank you, Patrick. We'll stand by to hear further from you. Wishing you a pleasant evening!

Best Regards,

Prakash Venkataraman
226.218.1910

-------- Original message --------
From: Patrick MacDonald <PMacDonald@orillia.ca>
Date: 2025-07-15 9:10 a.m. (GMT-05:00)
To: Prakash Venkataraman <prakash@rogers.com>
Cc: Jeff Duggan <JDuggan@orillia.ca>, John Albert <jalbert@ipsconsultinginc.com>
Subject: RE: Coldwater Road Stormwater Discussion

Good Morning Prakash,

Thank you for following up with me on this matter. Please ensure to include Jeff Duggan on all correspondence for this proposed development.

Jeff and I need to review your preliminary proposal with the City's Legal Staff for compliance with the easement agreement; we will advise when we have received legal guidance. Furthermore, considerably more detail is required for such a proposal and the email provided is not sufficient for a formal request/approval.

Regards,
Pat

ORILLIA

**Patrick MacDonald, P.Eng.** *(he/him)* I Project Engineer - Stormwater
Development Services and Engineering
*Development and Infrastructure Planning Division*
**T:** 705-558-9538 **C:** 705-323-8483
orillia.ca

orilliaNOW

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**From:** Prakash Venkataraman <prakash@rogers.com>
**Sent:** July 14, 2025 2:47 PM
**To:** Patrick MacDonald <PMacDonald@orillia.ca>
**Subject:** RE: Coldwater Road Stormwater Discussion

Good Afternoon Patrick,

Did you get chance to look at my July 7th request. Thank you.

Best Regards,

Prakash Venkataraman
226.218.1910

-------- Original message --------
From: prakash venkataraman <prakash@rogers.com>
Date: 2025-07-07 4:18 p.m. (GMT-05:00)
To: "PMacDonald@orillia.ca" <pmacdonald@orillia.ca>
Cc: PRAKASH VENKATARAMAN <prakash@rogers.com>
Subject: Coldwater Road Stormwater Discussion

**Subject:** Request for Easement Use to Install Stormwater Pipe – Auroville Development

Dear Patrick,

It was a real pleasure participating in the recent team meeting with you. I want to personally thank you for your time and, more importantly, for the clarity and depth of knowledge you bring to every discussion. Your dedication to ensuring decisions are made in the best interest of the City is truly commendable and appreciated.

Following our meeting, I'd like to respectfully submit the following request for your kind consideration: ( I have attached various relevant documents)

We are seeking permission to utilize the existing easement granted by the **Easement Agreement dated July 30, 1974**, relating to **Part 2 on Plan 51R-7558**, to install a dedicated underground pipe from our property (**Part 1 – Auroville lands**) to the municipal catch basin on **Westmount Drive**.

## Background

As you are aware, the 1974 Easement Agreement provides a legal right of passage over Part 2, which forms a logical and direct link between our lands and the municipal infrastructure. We are looking to responsibly utilize this access to implement a low-impact and environmentally sound solution.

## Purpose of the Request

We intend to install a **subsurface pipe** to direct approximately **10% of stormwater runoff** from our property to the City's stormwater system along Westmount Drive. This is part of our broader commitment to sustainable site development.

## Justification for Use

- **Alignment with Easement Intent**
  The proposed use is consistent with the original intent of the easement — to facilitate access and infrastructure connection between the properties and the roadway.
- **Minimal Disruption**
  The work will be limited to underground installation with no lasting impact on the surface of Part 2. All disturbed areas will be fully restored to their original condition.
- **Environmentally Responsible**
  Directing a portion of the stormwater via a controlled pipe helps reduce runoff impact, minimizes erosion, and supports long-term drainage management goals set by the City.
- **Fully Funded by Auroville**
  All costs related to design, construction, and restoration will be fully covered by us, with no burden placed on the City or neighboring properties.
- **Long-Term Infrastructure Planning**
  This installation complements the orderly development of the area and could support future servicing needs in the vicinity.

## Our Request

With this in mind, we respectfully request your formal acknowledgment and approval to proceed with the proposed underground pipe installation through Part 2, under the terms of the **1974 Easement Agreement**. We are happy to provide all necessary engineering documentation, coordinate site reviews, and comply with any reasonable conditions the City may require to approve this during the SPA process.

Thank you once again, Patrick, for your leadership, integrity, and collaborative approach. We truly value the opportunity to work with you and your team.

Best Regards,

Prakash Venkataraman
prakash@rogers.com
226 218 1910

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Appendix B

# Flow Analysis

# Calculation Sheet 1A

n Engineering Inc

| | |
|---|---|
| **Project:** | PROPOSED RESIDENTIAL BUILDING |
| **Address:** | 233, 249, 261 Coldwater Road West |
| **Town/City** | Orillia |
| **Project No.** | n2123 |
| **Proposed Development Area ($m^2$)** | 15076.18 |

**PRE-DEVELOPMENT RUNOFF COFFICENT (Catchment A)**

| AREA TYPE | AREA ($M^2$) | RUNOFF COEFFICIENT "C" | AREA x C |
|---|---|---|---|
| ASPHALT/CONC. | 0.00 | 0.95 | 0.00 |
| GRAVEL | 0.00 | 0.65 | 0.00 |
| LANDSCAPED AREA | 726.51 | 0.25 | 181.63 |
| ΣAREA X C | | | 181.63 |
| WEIGHTED AVERAGE "C" | | | **0.25** |
| AREA "A" (Hectares) | | | 0.072651 |

Rainfall Intensity:

$$I = AT^B$$

Where:

I = Rainfall Intensity (mm/hr)

A = coefficient

B = coefficient

T =Time of concentration (min)

Design Flow:

$$Q = CIA / 360$$

Where:

Q= design flow (m3/s)

C = runoff coefficient (dimensionless)

I= average rainfall intensity (mm/hr)

A = drainage area (ha)

| Return Period (Years) | 2 -Years | 5-Years | 10 -Years | 25 -Years | 50 -Years | 100-Years |
|---|---|---|---|---|---|---|
| A | 22.500 | 29.900 | 34.800 | 40.900 | 45.500 | 50.000 |
| B | -0.728 | -0.725 | -0.724 | -0.723 | -0.722 | -0.722 |
| t (mins) | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 |
| i (mm/hr) | 82.92 | 109.61 | 127.34 | 149.39 | 165.90 | 182.30 |
| Weighted Avg. C | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Adjustment Factor | 1.00 | 1.00 | 1.00 | 1.10 | 1.20 | 1.25 |
| C-Adjusted | 0.25 | 0.25 | 0.25 | 0.28 | 0.30 | 0.31 |
| Pre-development Flow(l/sec) | 4.18 | 5.53 | 6.42 | 8.29 | 10.04 | 11.50 |
| **Pre-development Flow($m^3$/sec)** | **0.004** | **0.006** | **0.006** | **0.008** | **0.010** | **0.011** |

# Calculation Sheet 1B

n Engineering Inc

| | |
|---|---|
| **Project:** | PROPOSED RESIDENTIAL BUILDING |
| **Address:** | 233, 249, 261 Coldwater Road West |
| **Town/City** | Orillia |
| **Project No.** | n2123 |
| **Proposed Development Area ($m^2$)** | 15076.18 |

**PRE-DEVELOPMENT RUNOFF COFFICENT (Catchment B)**

| AREA TYPE | AREA ($M^2$) | RUNOFF COEFFICIENT "C" | AREA x C |
|---|---|---|---|
| ASPHALT/CONC. | 0.00 | 0.95 | 0.00 |
| GRAVEL | 108.77 | 0.65 | 70.70 |
| LANDSCAPED AREA | 14240.90 | 0.25 | 3560.23 |
| ΣAREA X C | | | 3630.93 |
| WEIGHTED AVERAGE "C" | | | **0.25** |
| AREA "A" (Hectares) | | | 1.43 |

Rainfall Intensity:

$$I = AT^B$$

Where:

I = Rainfall Intensity (mm/hr)

A = coefficient

B = coefficient

T =Time of concentration (min)

Design Flow:

$$Q = CIA / 360$$

Where:

Q= design flow (m3/s)

C = runoff coefficient (dimensionless)

I= average rainfall intensity (mm/hr)

A = drainage area (ha)

| Return Period (Years) | 2 -Years | 5-Years | 10 -Years | 25 -Years | 50 -Years | 100-Years |
|---|---|---|---|---|---|---|
| A | 22.500 | 29.900 | 34.800 | 40.900 | 45.500 | 50.000 |
| B | -0.728 | -0.725 | -0.724 | -0.723 | -0.722 | -0.722 |
| t (mins) | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 |
| i (mm/hr) | 82.92 | 109.61 | 127.34 | 149.39 | 165.90 | 182.30 |
| Weighted Avg. C | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Adjustment Factor | 1.00 | 1.00 | 1.00 | 1.10 | 1.20 | 1.25 |
| C-Adjusted | 0.25 | 0.25 | 0.25 | 0.28 | 0.30 | 0.32 |
| Pre-development Flow(l/sec) | 83.64 | 110.55 | 128.43 | 150.68 | 167.32 | 183.87 |
| **Pre-development Flow($m^3$/sec)** | **0.084** | **0.111** | **0.128** | **0.151** | **0.167** | **0.184** |

# Calculation Sheet 2

n Engineering Inc

| | |
|---|---|
| **Project:** | PROPOSED RESIDENTIAL BUILDING |
| **Address:** | 233, 249, 261 Coldwater Road West |
| **Town/City** | Orillia |
| **Project No.** | n2123 |
| **Proposed Development Area ($m^2$)** | 15076.18 |

**POST DEVELOPMENT RUNOFF COFFICENT**

| AREA TYPE | AREA ($M^2$) | RUNOFF COEFFICIENT "C" | AREA x C |
|---|---|---|---|
| ASPHALT/CONC. | 7543.56 | 0.95 | 7166.38 |
| BUILDING | 2510.65 | 0.95 | 2385.12 |
| GREEN ROOF | 985.55 | 0.40 | 394.22 |
| LANDSCAPED AREA | 4036.42 | 0.25 | 1009.11 |
| ΣAREA X C | | | 10954.82 |
| WEIGHTED AVERAGE "C" | | | **0.73** |
| AREA "A" (Hectares) | | | 1.5076 |

Rainfall intensity:

$$I = AT^B$$

Where:
i = Rainfall Intensity (mm/hr)
A = coefficient
B = coefficient
C = coefficient
t =Time of concentration (min)
Design Flow:

$$Q = CIA / 360$$

Where:
Q= Design flow ($m^3/s$)
c = Runoff coefficient (dimensionless)
i = Average rainfall intensity (mm/hr)
A = Drainage area (ha)

| Return Period (Years) | 2 -Years | 5-Years | 10 -Years | 25 -Years | 50 -Years | 100-Years |
|---|---|---|---|---|---|---|
| A | 22.50 | 29.90 | 34.80 | 40.90 | 45.50 | 50.00 |
| B | -0.728 | -0.725 | -0.724 | -0.723 | -0.722 | -0.722 |
| t (mins) | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 |
| i (mm/hr) | 82.92 | 109.61 | 127.34 | 149.39 | 165.90 | 182.30 |
| Weighted Avg. C | 0.73 | 0.73 | 0.73 | 0.73 | 0.73 | 0.73 |
| Adjustment Factor | 1.00 | 1.00 | 1.00 | 1.10 | 1.20 | 1.25 |
| C-Adjusted | 0.73 | 0.73 | 0.73 | 0.80 | 0.87 | 0.91 |
| Q(l/sec) | 252.34 | 333.53 | 387.49 | 500.06 | 605.79 | 693.44 |
| Q($m^3$/sec) | 0.252 | 0.334 | 0.387 | 0.500 | 0.606 | 0.693 |

Appendix C

# Storm & Sanitary Drainage Design Sheet

PREPARED BY: LU

DATE PREPARED 10-Jun-26

# Storm Sewer Design Chart
## For Circular Drains Flowing Full
## PROPOSED CONDOMINIUM
## 233, 249, 261 Coldwater Road West
Orillia

n2123

| IDF CURVE | | |
|---|---|---|
| Constants | **5 -yrs** | **100 yrs** |
| a | 29.900 | 50.000 |
| b | -0.7250 | -0.7220 |

Tc (start): 10.00 min

| **Catchments** | | | | | | | | **Hydrology** | | **Hydraulics** | | | | | | **Comments** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Catchment ID** | **Total Area ($m^2$)** | **Captured By** | **Outlet to** | **Runoff Coeff. "R"** | **A x R** | **ACC. ΣA x R** | **$t_d$ (min)** | **Rainfall Intensity, I (mm/hr) $I_5$** | **Peak Flow ($m^3$/sec) $Q_{5\text{-yrs}}$** | **STORM SEWER DESIGN INFORMATION** | | | | | **TIME** | |
| | | | | | | | | | | **size (mm)** | **slope (%)** | **length (m)** | **Q full ($m^3$/s)** | **V full (m/s)** | **SECT. (min)** | **PIPE CAPACITY** |
| A9 | 1097.00 | CB1 | CBMH1 | 0.56 | 0.06 | 0.06 | 10.00 | 109.61 | 0.019 | 300 | 5.10 | 20.50 | 0.218 | 3.089 | 0.11 | **9%** |
| A1 | 728.72 | CBMH1 | CBMH2 | 0.93 | 0.07 | 0.13 | 10.11 | 108.73 | 0.039 | 300 | 6.50 | 25.00 | 0.247 | 3.488 | 0.12 | **16%** |
| A2 | 1427.64 | CB2 | CBMH4 | 0.86 | 0.12 | 0.12 | 10.00 | 109.61 | 0.037 | 300 | 6.50 | 24.50 | 0.247 | 3.488 | 0.12 | **15%** |
| A3 | 1017.87 | CBMH2 | CBMH3 | 0.84 | 0.09 | 0.22 | 10.23 | 107.81 | 0.064 | 300 | 5.50 | 22.50 | 0.227 | 3.208 | 0.12 | **28%** |
| A5 | 855.24 | CBMH4 | CBMH3 | 0.92 | 0.08 | 0.26 | 10.04 | 109.26 | 0.080 | 300 | 4.50 | 28.50 | 0.205 | 2.902 | 0.16 | **39%** |
| A4 | 821.86 | CBMH3 | MH1 | 0.85 | 0.07 | 0.55 | 10.39 | 106.58 | 0.162 | 375 | 1.60 | 24.00 | 0.222 | 2.008 | 0.20 | **73%** |
| A13 | 953.73 | CB4 | CBMH8 | 0.95 | 0.09 | 0.09 | 10.00 | 109.61 | 0.028 | 300 | 0.50 | 18.50 | 0.068 | 0.967 | 0.32 | **40%** |
| A7 | 269.44 | CBMH8 | CBMH9 | 0.25 | 0.01 | 0.10 | 10.32 | 107.14 | 0.029 | 300 | 0.50 | 25.00 | 0.068 | 0.967 | 0.43 | **42%** |
| A6 | 1346.75 | CBMH9 | CBMH11 | 0.93 | 0.13 | 0.22 | 10.75 | 104.01 | 0.064 | 300 | 0.50 | 23.00 | 0.068 | 0.967 | 0.40 | **94%** |
| A12 | 720.55 | CBMH11 | MH1 | 0.25 | 0.02 | 0.24 | 11.15 | 101.32 | 0.068 | 375 | 0.50 | 18.00 | 0.124 | 1.122 | 0.27 | **55%** |
| | | MH1 | MH2(OGS) | | | 0.79 | 11.41 | 99.59 | 0.218 | 450 | 0.65 | 1.50 | 0.230 | 1.445 | 0.02 | **95%** |
| | | MH2(OGS) | DETENTION TANK | | | 0.79 | 11.43 | 99.48 | 0.218 | 450 | 1.00 | 0.50 | 0.285 | 1.793 | 0.005 | **76%** |
| B1 | 2510.65 | STM ROOF PLUG | RETENTION TANK | 0.25 | 0.06 | 0.06 | 10.00 | 109.61 | 0.019 | 300 | 2.00 | 5.00 | 0.137 | 1.935 | 0.04 | **14%** |
| | | RETENTION TANK | CBMH4 | | | 0.06 | 10.04 | 109.26 | 0.019 | 300 | 6.50 | 4.60 | 0.247 | 3.488 | 0.02 | **8%** |
| | | DETENTION TANK | MH4 | | | 0.79 | 11.44 | 99.45 | 0.218 | 450 | 1.00 | 3.00 | 0.285 | 1.793 | 0.03 | **76%** |
| | | MH4 | CBMH5 | | | 0.79 | 11.46 | 99.28 | 0.218 | 450 | 0.70 | 29.50 | 0.239 | 1.500 | 0.33 | **91%** |
| A8 | 1137.24 | CB3 | CBMH10 | 0.49 | 0.06 | 0.06 | 10.00 | 109.61 | 0.017 | 300 | 4.50 | 37.00 | 0.205 | 2.902 | 0.21 | **8%** |
| A11 | 193.60 | CBMH10 | CBMH6 | 0.25 | 0.00 | 0.06 | 10.21 | 107.95 | 0.018 | 300 | 4.50 | 36.80 | 0.205 | 2.902 | 0.21 | **9%** |
| A14 | 251.60 | CBMH6 | CBMH5(CONTROL) | 0.25 | 0.01 | 0.07 | 10.42 | 106.36 | 0.020 | 300 | 2.00 | 41.00 | 0.137 | 1.935 | 0.35 | **14%** |
| A10* | 758.74 | CBMH5(CONTROL) | MH3 | 0.32 | 0.02 | 0.86 | 11.82 | 97.11 | 0.011 | 300 | 1.00 | 1.00 | 0.097 | 1.368 | 0.01 | **12%** |
| | | | | | | | | | | | | | | | | |
| **Downstrem storm sewer design based on the 100 years event** | | | | | | | | | | | | | | | | |
| **Site** | 15076.18 | DITCH INLET | MH3 | 0.73 | 1.10 | 1.10 | 11.83 | 161.49 | 0.491 | 450 | 3.30 | 1.00 | 0.518 | 3.256 | 0.01 | **95%** |
| | | MH3(CONTROL) | MH6 | | | 1.10 | 11.83 | 161.49 | 0.503 | 450 | 3.25 | 40.70 | 0.514 | 3.231 | 0.21 | **98%** |
| | | MH6 | MH7 | | | 1.10 | 12.04 | 159.45 | 0.503 | 450 | 3.25 | 50.50 | 0.514 | 3.231 | 0.26 | **98%** |
| | | MH7 | EX. CB TO BE REPLACED BY . CBMH6 | | | 1.10 | 12.30 | 157.01 | 0.503 | 450 | 3.25 | 69.00 | 0.514 | 3.231 | 0.36 | **98%** |

Note: * Sewer designed based on 100 years Vortex Control Flow 11.46 l/sec.

ADDRESS: 233, 249, 261 Coldwater Road West
CONSULTANT: n Engineering inc
PROJECT NO: n2123

## CITY OF ORILLIA

**DESIGNSHEET 2: SANITARY SEWER**

| Location (ID) | UPSTREAM MH | DOWNSTREAM MH | Area (ha.) | Cummulative Area Served (ha.) | Maximum Cumulative Flow (L/s) | PIPE | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | LENGTH | SIZE | GRADE | CAP. FULL (L/Sec) | (DES.)CAP. (%) | DES. VEL.FULL |
| **Building** | **SAN PLUG** | **SAN MH3A** | | **0.00** | **8.35** | ***4.3*** | ***200*** | ***1.00*** | **33** | **25.44%** | **0.46** |
| | SAN MH3A | SAN MH2A | | 0.00 | 8.35 | *41.0* | *200* | *0.50* | 23 | 35.98% | 0.29 |
| | SAN MH2A | SAN MH1A | | 0.00 | 8.35 | *27.8* | *200* | *0.50* | 23 | 35.98% | 0.29 |
| | SAN MH1A | EX.SAN MH3 | | 0.00 | 8.35 | *20.0* | *200* | *1.00* | 33 | 25.44% | 0.46 |
| | | | | | | | | | | | |

n Engineering Inc

PREPARED BY: LU

DATE PREPARED 10-Jun-26

# Storm Drainage Design Chart
## For Swale/Sewer Flowing Full
## Condominium 233, 249 , 261 Coldwater Road West
## Orillia

Intensity of Rainfall: (mm/hr)

$$I = AT^B$$

| IDF CURVE | |
|---|---|
| Constants | 100-yrs |
| A | 50 |
| B | -0.722 |
| | |

td (start): 10.00 min

| Catchments | | | | | | | | | Hydraulics | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sub Catchment ID | Section Catchment ID | Total Area ($m^2$) | Captured By | Outlet to | Comp. Runoff "R" | A x R | ACC. ΣA x R | $t_d$ (min) | Rainfall Intensity, I (mm/hr) $I_{100}$ | Peak Flow (m3/sec) $Q100_{-yrs}$ | SWALE DESIGN INFORMATION | | | | | | | | | TIME | Comments |
| | | | | | | | | | | | Wetted Perimeter (P) | Area (A) | Distance (m) | Swale Slope (%) | R = (A/P) | Manning Coefficient of Roughness (n) | V = Cross Sectional Mean Velocity (m/s) | Q = A * V (m3/S) | Capacity | SECT. (min) | |
| A5 | A-A | 226.35 | Swale | Swale | 0.69 | 0.016 | 0.016 | 10.00 | 182.30 | 0.0079 | 6.67 | 0.21 | 7.00 | 0.03 | 0.03 | 0.030 | 0.57 | 0.12 | 6.68% | 0.21 | |
| A4 | A-A to B-B | 265.29 | Swale | Swale | 0.58 | 0.015 | 0.031 | 10.21 | 179.64 | 0.0156 | 7.51 | 0.55 | 15.00 | 0.01 | 0.07 | 0.030 | 0.58 | 0.32 | 4.85% | 0.43 | |
| A3 | B-B to C-C | 179.22 | Swale | Swale | 0.48 | 0.009 | 0.040 | 10.63 | 174.38 | 0.0193 | 6.04 | 0.47 | 17.00 | 0.01 | 0.08 | 0.030 | 0.61 | 0.29 | 6.76% | 0.47 | |
| A2 | C-C to D-D | 130.39 | Swale | Swale | 0.45 | 0.006 | 0.046 | 11.10 | 169.06 | 0.0215 | 14.01 | 2.50 | 11.00 | 0.01 | 0.18 | 0.030 | 1.20 | 3.01 | 0.71% | 0.15 | |
| A1 | D-D | 288.43 | Swale | Swale | 0.51 | 0.015 | 0.015 | 11.25 | 167.41 | 0.0069 | 14.01 | 2.50 | 11.00 | 0.01 | 0.18 | 0.030 | 1.20 | 3.01 | 0.23% | 0.15 | |
| A36 | E-E to F-F | 156.03 | Swale | Swale | 0.25 | 0.004 | 0.004 | 10.00 | 182.30 | 0.0020 | 3.21 | 0.24 | 16.00 | 0.02 | 0.07 | 0.030 | 0.84 | 0.20 | 0.98% | 0.32 | SWALE #1 |
| A35 | F-F to G-G | 117.91 | Swale | Swale | 0.25 | 0.003 | 0.007 | 10.32 | 178.22 | 0.0034 | 4.62 | 0.29 | 15.00 | 0.06 | 0.06 | 0.030 | 1.27 | 0.37 | 0.92% | 0.20 | |
| A34 | G-G to H-H | 104.03 | Swale | Swale | 0.25 | 0.003 | 0.009 | 10.52 | 175.80 | 0.0046 | 5.09 | 0.27 | 14.00 | 0.07 | 0.05 | 0.030 | 1.20 | 0.32 | 1.43% | 0.19 | |
| A33 | H-H to I-I | 222.54 | Swale | Swale | 0.25 | 0.006 | 0.015 | 10.71 | 173.49 | 0.0072 | 3.79 | 0.07 | 29.00 | 0.07 | 0.02 | 0.030 | 0.60 | 0.04 | 17.17% | 0.80 | |
| A32 | I-I to J-J | 51.37 | Swale | Swale | 0.26 | 0.001 | 0.016 | 11.51 | 164.68 | 0.0075 | 5.39 | 0.19 | 6.80 | 0.02 | 0.04 | 0.030 | 0.51 | 0.10 | 7.78% | 0.22 | |
| A31 | K-K to J-J | 51.03 | Swale | Swale | 0.29 | 0.001 | 0.018 | 11.74 | 162.40 | 0.0081 | 6.28 | 0.15 | 4.00 | 0.07 | 0.02 | 0.030 | 0.72 | 0.11 | 7.45% | 0.09 | SWALE#2 |
| A30 | K-K | 17.41 | Swale | Swale | 0.33 | 0.001 | 0.001 | 10.00 | 182.30 | 0.0003 | 7.09 | 0.29 | 3.50 | 0.02 | 0.04 | 0.030 | 0.56 | 0.16 | 0.18% | 0.10 | |
| A29 | L-L | 121.44 | Swale | Swale | 0.29 | 0.004 | 0.004 | 10.00 | 182.30 | 0.0018 | 9.51 | 0.17 | 24.50 | 0.03 | 0.02 | 0.030 | 0.39 | 0.07 | 2.72% | 1.05 | |
| A28 | L-L to M-M | 28.05 | Swale | Swale | 0.29 | 0.001 | 0.004 | 11.05 | 169.60 | 0.0021 | 3.89 | 0.13 | 5.80 | 0.02 | 0.03 | 0.030 | 0.42 | 0.06 | 3.74% | 0.23 | |
| A27 | M-M to N-N | 68.63 | Swale | Swale | 0.29 | 0.002 | 0.006 | 11.28 | 167.12 | 0.0030 | 2.48 | 0.13 | 14.50 | 0.01 | 0.05 | 0.030 | 0.55 | 0.07 | 4.14% | 0.44 | |
| A26 | N-N | 52.32 | Swale | Swale | 0.296 | 0.002 | 0.00 | 10.00 | 182.3036 | 0.00 | 2.48 | 0.15 | 11.00 | 0.02 | 0.06 | 0.030 | 0.73 | 0.11 | 0.01 | 0.25 | SWALE#3 |
| A25 | O-O | 47.95 | Swale | Swale | 0.30 | 0.001 | 0.001 | 10.00 | 182.30 | 0.0007 | 2.61 | 0.11 | 11.50 | 0.02 | 0.04 | 0.030 | 0.57 | 0.06 | 1.15% | 0.34 | |
| A24 | O-O to P-P | 59.92 | Swale | Swale | 0.28 | 0.002 | 0.003 | 10.34 | 178.01 | 0.0015 | 5.42 | 0.22 | 9.00 | 0.02 | 0.04 | 0.030 | 0.56 | 0.12 | 1.25% | 0.27 | |
| A23 | P-P to Q-Q | 125.61 | Swale | Swale | 0.35 | 0.004 | 0.008 | 10.61 | 174.73 | 0.0037 | 3.40 | 0.20 | 14.00 | 0.02 | 0.06 | 0.030 | 0.75 | 0.15 | 2.45% | 0.31 | |
| A22 | Q-Q to R-R | 87.04 | Swale | Swale | 0.45 | 0.004 | 0.011 | 10.92 | 171.11 | 0.0055 | 3.62 | 0.36 | 11.50 | 0.02 | 0.10 | 0.030 | 1.11 | 0.40 | 1.37% | 0.17 | |
| A21 | R-R to S-S | 127.55 | Swale | Swale | 0.41 | 0.005 | 0.017 | 11.09 | 169.18 | 0.0078 | 3.77 | 0.18 | 11.50 | 0.02 | 0.05 | 0.030 | 0.68 | 0.12 | 6.41% | 0.28 | |
| A18 | V-V | 101.89 | Swale | Swale | 0.25 | 0.003 | 0.003 | 10.00 | 182.30 | 0.0013 | 2.89 | 0.15 | 13.20 | 0.05 | 0.05 | 0.030 | 1.08 | 0.16 | 0.80% | 0.20 | |
| A19 | V-V to U-U | 76.64 | Swale | Swale | 0.25 | 0.002 | 0.004 | 10.20 | 179.66 | 0.0022 | 4.51 | 0.07 | 10.00 | 0.06 | 0.02 | 0.030 | 0.49 | 0.03 | 6.49% | 0.34 | |
| A20 | U-U to T-T | 172.28 | Swale | Swale | 0.35 | 0.006 | 0.011 | 10.54 | 175.46 | 0.0051 | 2.42 | 0.06 | 9.00 | 0.04 | 0.02 | 0.030 | 0.59 | 0.04 | 14.55% | 0.26 | SWALE#4 |
| A17 | W-W | 13.44 | Swale | Swale | 0.25 | 0.000 | 0.000 | 10.00 | 182.30 | 0.0002 | 2.32 | 0.15 | 1.00 | 0.05 | 0.06 | 0.030 | 1.14 | 0.17 | 0.10% | 0.01 | |
| A15 | Y-Y to X- X | 155.71 | Swale | Swale | 0.25 | 0.004 | 0.004 | 10.00 | 182.30 | 0.0020 | 3.32 | 0.18 | 20.10 | 0.09 | 0.05 | 0.030 | 1.46 | 0.26 | 0.75% | 0.23 | |
| A16 | X-X to W-W | 64.48 | Swale | Swale | 0.25 | 0.002 | 0.006 | 10.23 | 179.33 | 0.0027 | 2.58 | 0.17 | 9.00 | 0.07 | 0.07 | 0.030 | 1.45 | 0.25 | 1.12% | 0.10 | SWALE#5 |
| A14 | Y-Yto Z-Z | 99.68 | Swale | Swale | 0.25 | 0.002 | 0.002 | 10.00 | 182.30 | 0.0013 | 2.72 | 0.19 | 3.00 | 0.01 | 0.07 | 0.030 | 0.57 | 0.11 | 1.18% | 0.09 | |
| A13 | Z-Z | 146.65 | Swale | Swale | 0.25 | 0.004 | 0.004 | 10.00 | 182.30 | 0.0019 | 5.30 | 0.42 | 23.00 | 0.04 | 0.08 | 0.030 | 1.20 | 0.50 | 0.37% | 0.32 | SWALE#6 |
| A12 | AA-AA | 22.70 | Swale | Swale | 0.46 | 0.001 | 0.001 | 10.00 | 182.30 | 0.0005 | 1.49 | 0.15 | 13.50 | 0.02 | 0.10 | 0.030 | 0.88 | 0.13 | 0.40% | 0.25 | |
| A6 | FF- FF | 241.00 | Swale | Swale | 0.44 | 0.011 | 0.012 | 10.25 | 179.02 | 0.0058 | 7.94 | 0.20 | 12.00 | 0.04 | 0.03 | 0.030 | 0.54 | 0.11 | 5.42% | 0.37 | |
| A7 | EE- EE to FF-FF | 241.88 | Swale | Swale | 0.45 | 0.011 | 0.023 | 10.63 | 174.46 | 0.0110 | 10.61 | 0.15 | 18.00 | 0.04 | 0.01 | 0.030 | 0.36 | 0.05 | 20.11% | 0.82 | |
| A8 | DD-DD to EE-EE | 90.85 | Swale | Swale | 0.25 | 0.002 | 0.025 | 11.45 | 165.32 | 0.0115 | 4.07 | 0.26 | 6.00 | 0.03 | 0.06 | 0.030 | 0.84 | 0.22 | 5.24% | 0.12 | |
| A9 | CC-CC to DD-DD | 120.62 | Swale | Swale | 0.54 | 0.007 | 0.031 | 11.57 | 164.09 | 0.0144 | 1.92 | 0.15 | 12.00 | 0.02 | 0.08 | 0.030 | 0.92 | 0.14 | 10.38% | 0.22 | |
| A10 | BB-BB to CC-CC | 264.52 | Swale | Swale | 0.64 | 0.017 | 0.048 | 11.79 | 161.90 | 0.0218 | 2.13 | 0.20 | 9.00 | 0.02 | 0.09 | 0.030 | 0.98 | 0.20 | 11.19% | 0.15 | |
| A11 | AA-AA to BB-BB | 181.27 | Swale | Swale | 0.44 | 0.008 | 0.056 | 11.94 | 160.40 | 0.0251 | 2.13 | 0.15 | 15.00 | 0.02 | 0.07 | 0.030 | 0.70 | 0.10 | 24.05% | 0.36 | SWALE#7 |

**Note: Refer Figure DR104 (Appendix A )and DWG. C1a for cross section details.**

Appendix D

# Onsite Detention Storage and Summary of Control Flow

n Engineering Inc

## Table 1
## Summary of Control Flow and Storage
## PROPOSED CONDOMINIUM

| | |
|---|---|
| **Address:** | 233, 249, 261 Coldwater Road West |
| **Town/Township/City** | Orillia |
| **Project No.** | n2123 |
| **Proposed Development Area ($m^2$)** | 15076.18 |

| | | |
|---|---|---|
| Orifice Location | MH4 | |
| Orifice Type | ACO- QuAD-VFC OR EQ | |
| Orifice Invert Elevation | **266.300** | m |
| Min. Ground Elevation | 267.200 | m |

Information on head and corresponding flow rates is presented in the Technical Data Sheet for the vortex flow regulator unit designed by Aco Group (refer to Appendix D).

| | 2 years | 5 years | 10 years | 25 years | 50 years | 100 years |
|---|---|---|---|---|---|---|
| Ponding Depth (m) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| Water Elevation | 266.82 | 266.89 | 266.94 | 267.04 | 267.13 | 267.21 |
| **Controlled Discharge (L/sec)** | **4.14** | **5.49** | **6.38** | **8.25** | **10.00** | **11.46** |
| Pre-development Flow(L/sec) | 4.18 | 5.53 | 6.42 | 8.29 | 10.04 | 11.50 |
| **Allowable Flow (L/sec)** | **4.18** | **5.53** | **6.42** | **8.29** | **10.04** | **11.50** |
| **Detention Storage Required ($m^3$)** | **314.71** | **422.16** | **493.06** | **639.23** | **778.41** | **890.65** |
| Storage Used in MH ($m^3$) | 0.95 | 1.23 | 1.48 | 1.99 | 2.46 | 3.08 |
| Storage Used in Pipe ($m^3$) | 5.48 | 5.48 | 7.47 | 9.10 | 9.10 | 10.86 |
| Storage by Tank ($m^3$) | 321.77 | 424.15 | 497.28 | 643.54 | 775.17 | 892.17 |
| **Proposed Available Storage** | **328.20** | **430.86** | **506.23** | **654.63** | **786.73** | **906.12** |

The allowable discharge rates cannot be achieve using an orifice device with a minimum diameter of 75mm. Therefore,Aco-QuAD-VFC Vortex flow regulator  is proposed to be installed at the inlet of control manhole (MH3-Control).

**Table 4**

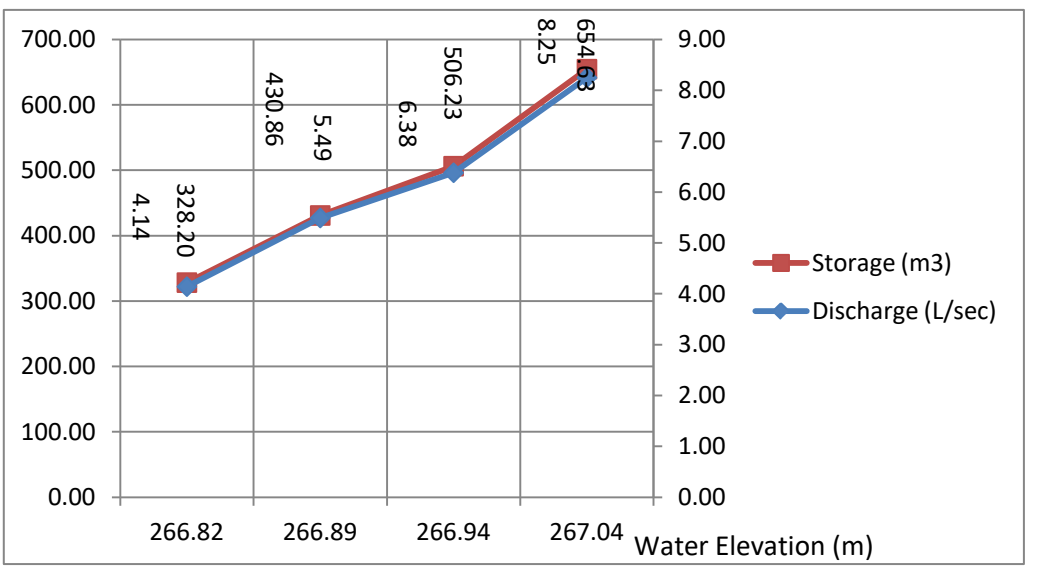
## Stage-Storage-Discharge

**(2 - 100 Years Rainfall Event)**

n Engineering Inc

| | |
|---|---|
| **Project:** | **233, 249, 261 Coldwater Road West** |
| **Address:** | **Orillia** |
| **Project No.** | **n2123** |
| **Proposed Development Area ($m^2$)** | **15076.18** |
| **Date:** | **6/10/2026** |

| Elevation | Storage ($m^3$) | Discharge (L/sec) |
|---|---|---|
| 266.82 | 328.20 | 4.14 |
| 266.89 | 430.86 | 5.49 |
| 266.94 | 506.23 | 6.38 |
| 267.04 | 654.63 | 8.25 |
| 267.13 | 786.73 | 10.00 |
| 267.21 | 906.12 | 11.46 |



n Engineering Inc

# On-Site Storage Calculator

**Project:** PROPOSED CONDOMINIUM
**Address:** 233, 249, 261 Coldwater Road West
**Town/City** Orillia
**Project No:** n2123

Table 2A - 2 Years Storage

Equation of IDF:

$$I = AT^{B}$$

I = Rainfall Intensity (mm/hr)
T = Time of Concentration (hr)

| | | | |
|---|---|---|---|
| *R* = | 0.73 | | |
| *A* = | 1.5076 | ha | |
| $*Q_{release}$ = | 0.004 | $m^3/s$ | |
| | 4.14 | L/s | |

A= 22.5
B= -0.728

Note : *Qrelease as per ACO-QuAD-VFC Control Flow

| | | | | Max. Storage Required ($m^3$) | 314.71 |
|---|---|---|---|---|---|
| $t_c$ | $i_{100}$ | $Q_{100}$ | $Q_{stored}$ | Peak Volume | Comments |
| (min) | (mm/hr) | ($m^3/s$) | ($m^3/s$) | ($m^3$) | |
| 10 | 82.92 | 0.252 | 0.248 | 148.918 | |
| 20 | 50.06 | 0.152 | 0.148 | 177.847 | |
| 30 | 37.27 | 0.113 | 0.109 | 196.678 | |
| 40 | 30.23 | 0.092 | 0.088 | 210.809 | |
| 50 | 25.69 | 0.078 | 0.074 | 222.138 | |
| 60 | 22.50 | 0.068 | 0.064 | 231.580 | |
| 70 | 20.11 | 0.061 | 0.057 | 239.650 | |
| 80 | 18.25 | 0.056 | 0.051 | 246.673 | |
| 90 | 16.75 | 0.051 | 0.047 | 252.867 | |
| 100 | 15.51 | 0.047 | 0.043 | 258.384 | |
| 110 | 14.47 | 0.044 | 0.040 | 263.339 | |
| 120 | 13.58 | 0.041 | 0.037 | 267.816 | |
| 130 | 12.82 | 0.039 | 0.035 | 271.883 | |
| 140 | 12.14 | 0.037 | 0.033 | 275.592 | |
| 150 | 11.55 | 0.035 | 0.031 | 278.988 | |
| 160 | 11.02 | 0.034 | 0.029 | 282.104 | |
| 170 | 10.54 | 0.032 | 0.028 | 284.972 | |
| 180 | 10.11 | 0.031 | 0.027 | 287.614 | |
| 190 | 9.72 | 0.030 | 0.025 | 290.054 | |
| 370 | 5.98 | 0.018 | 0.014 | 312.371 | |
| 380 | 5.87 | 0.018 | 0.014 | 312.831 | |
| 390 | 5.76 | 0.018 | 0.013 | 313.234 | |
| 400 | 5.65 | 0.017 | 0.013 | 313.584 | |
| 410 | 5.55 | 0.017 | 0.013 | 313.883 | |
| 420 | 5.46 | 0.017 | 0.012 | 314.133 | |
| 430 | 5.36 | 0.016 | 0.012 | 314.335 | |
| 440 | 5.28 | 0.016 | 0.012 | 314.493 | |
| 450 | 5.19 | 0.016 | 0.012 | 314.608 | |
| 460 | 5.11 | 0.016 | 0.011 | 314.680 | |
| 470 | 5.03 | 0.015 | 0.011 | 314.713 | MAX |
| 480 | 4.95 | 0.015 | 0.011 | 314.707 | |
| 490 | 4.88 | 0.015 | 0.011 | 314.663 | |
| 500 | 4.81 | 0.015 | 0.010 | 314.584 | |
| 510 | 4.74 | 0.014 | 0.010 | 314.470 | |
| 520 | 4.67 | 0.014 | 0.010 | 314.322 | |
| 530 | 4.61 | 0.014 | 0.010 | 314.142 | |
| 540 | 4.54 | 0.014 | 0.010 | 313.930 | |

n Engineering Inc

On-Site Storage Calculator

**Project:** PROPOSED CONDOMINIUM
**Address:** 233, 249, 261 Coldwater Road West
**Town/City** Orillia
**Project No:** n2123

Table 2B - 5 Years Storage

Equation of IDF:

$$I = AT^{B}$$

I = Rainfall Intensity (mm/hr)
T = Time of Concentration (hr)

$R$ = 0.73
$A$ = 1.51 ha
$Q_{release}$ = 0.005 $m^3/s$
5.49 L/s

A= 29.9
B= -0.725

Note : *Qrelease as per ACO-QuAD-VFC Control Flow

| | | | | Max. Storage Required ($m^3$) | 422.16 |
|---|---|---|---|---|---|
| $t_c$ | $i_{100}$ | $Q_{100}$ | $Q_{stored}$ | Peak Volume | Comments |
| (min) | (mm/hr) | ($m^3/s$) | ($m^3/s$) | ($m^3$) | |
| 10 | 109.61 | 0.334 | 0.328 | 196.823 | |
| 20 | 66.31 | 0.202 | 0.196 | 235.553 | |
| 30 | 49.42 | 0.150 | 0.145 | 260.821 | |
| 40 | 40.12 | 0.122 | 0.117 | 279.813 | |
| 50 | 34.13 | 0.104 | 0.098 | 295.061 | |
| 60 | 29.90 | 0.091 | 0.085 | 307.785 | |
| 70 | 26.74 | 0.081 | 0.076 | 318.675 | |
| 80 | 24.27 | 0.074 | 0.068 | 328.163 | |
| 90 | 22.28 | 0.068 | 0.062 | 336.540 | |
| 100 | 20.65 | 0.063 | 0.057 | 344.011 | |
| 110 | 19.27 | 0.059 | 0.053 | 350.728 | |
| 120 | 18.09 | 0.055 | 0.050 | 356.805 | |
| 130 | 17.07 | 0.052 | 0.046 | 362.331 | |
| 140 | 16.18 | 0.049 | 0.044 | 367.379 | |
| 150 | 15.39 | 0.047 | 0.041 | 372.005 | |
| 160 | 14.68 | 0.045 | 0.039 | 376.257 | |
| 170 | 14.05 | 0.043 | 0.037 | 380.175 | |
| 180 | 13.48 | 0.041 | 0.036 | 383.791 | |
| 190 | 12.96 | 0.039 | 0.034 | 387.134 | |
| 400 | 7.56 | 0.023 | 0.018 | 420.129 | |
| 410 | 7.42 | 0.023 | 0.017 | 420.595 | |
| 420 | 7.29 | 0.022 | 0.017 | 420.995 | |
| 430 | 7.17 | 0.022 | 0.016 | 421.333 | |
| 440 | 7.05 | 0.021 | 0.016 | 421.609 | |
| 450 | 6.94 | 0.021 | 0.016 | 421.827 | |
| 460 | 6.83 | 0.021 | 0.015 | 421.989 | |
| 470 | 6.72 | 0.020 | 0.015 | 422.097 | |
| 480 | 6.62 | 0.020 | 0.015 | 422.153 | |
| 490 | 6.52 | 0.020 | 0.014 | 422.159 | MAX |
| 500 | 6.43 | 0.020 | 0.014 | 422.116 | |
| 510 | 6.34 | 0.019 | 0.014 | 422.026 | |
| 520 | 6.25 | 0.019 | 0.014 | 421.891 | |
| 530 | 6.16 | 0.019 | 0.013 | 421.713 | |
| 540 | 6.08 | 0.018 | 0.013 | 421.492 | |
| 550 | 6.00 | 0.018 | 0.013 | 421.230 | |
| 560 | 5.92 | 0.018 | 0.013 | 420.928 | |
| 570 | 5.85 | 0.018 | 0.012 | 420.588 | |

n Engineering Inc

On-Site Storage Calculator

**Project:** PROPOSED CONDOMINIUM
**Address:** 233, 249, 261 Coldwater Road West
**Town/City** Orillia
**Project No:** n2123

Table 2C - 10 Years Storage

Equation of IDF:

$$I = AT^{B}$$

I = Rainfall Intensity (mm/hr)
T = Time of Concentration (hr)

$R$ = 0.73
$A$ = 1.51 ha
$Q_{release}$ = 0.006 $m^3/s$
6.38 L/s

A= 34.8
B= -0.724

Note : *Qrelease as per ACO-QuAD-VFC Control Flow

| | | | | Max. Storage Required ($m^3$) | 493.06 |
|---|---|---|---|---|---|
| $t_c$ | $i_{100}$ | $Q_{100}$ | $Q_{stored}$ | Peak Volume | Comments |
| (min) | (mm/hr) | ($m^3/s$) | ($m^3/s$) | ($m^3$) | |
| 10 | 127.34 | 0.387 | 0.381 | 228.668 | |
| 20 | 77.09 | 0.235 | 0.228 | 273.857 | |
| 30 | 57.48 | 0.175 | 0.169 | 303.364 | |
| 40 | 46.67 | 0.142 | 0.136 | 325.554 | |
| 50 | 39.71 | 0.121 | 0.114 | 343.379 | |
| 60 | 34.80 | 0.106 | 0.100 | 358.260 | |
| 70 | 31.13 | 0.095 | 0.088 | 371.001 | |
| 80 | 28.26 | 0.086 | 0.080 | 382.108 | |
| 90 | 25.95 | 0.079 | 0.073 | 391.917 | |
| 100 | 24.04 | 0.073 | 0.067 | 400.670 | |
| 110 | 22.44 | 0.068 | 0.062 | 408.542 | |
| 120 | 21.07 | 0.064 | 0.058 | 415.667 | |
| 130 | 19.88 | 0.061 | 0.054 | 422.150 | |
| 140 | 18.84 | 0.057 | 0.051 | 428.074 | |
| 150 | 17.93 | 0.055 | 0.048 | 433.506 | |
| 160 | 17.11 | 0.052 | 0.046 | 438.501 | |
| 170 | 16.37 | 0.050 | 0.043 | 443.105 | |
| 449 | 8.10 | 0.025 | 0.018 | 492.531 | |
| 450 | 8.09 | 0.025 | 0.018 | 492.556 | |
| 451 | 8.08 | 0.025 | 0.018 | 492.581 | |
| 452 | 8.07 | 0.025 | 0.018 | 492.605 | |
| 453 | 8.05 | 0.025 | 0.018 | 492.628 | |
| 454 | 8.04 | 0.024 | 0.018 | 492.651 | |
| 455 | 8.03 | 0.024 | 0.018 | 492.673 | |
| 456 | 8.01 | 0.024 | 0.018 | 492.694 | |
| 457 | 8.00 | 0.024 | 0.018 | 492.715 | |
| 458 | 7.99 | 0.024 | 0.018 | 492.735 | |
| 459 | 7.98 | 0.024 | 0.018 | 492.754 | |
| 460 | 7.96 | 0.024 | 0.018 | 492.773 | |
| 461 | 7.95 | 0.024 | 0.018 | 492.792 | |
| 462 | 7.94 | 0.024 | 0.018 | 492.809 | |
| 463 | 7.93 | 0.024 | 0.018 | 492.826 | |
| 464 | 7.91 | 0.024 | 0.018 | 492.842 | |
| 465 | 7.90 | 0.024 | 0.018 | 492.858 | |
| 466 | 7.89 | 0.024 | 0.018 | 492.873 | |
| 467 | 7.88 | 0.024 | 0.018 | 492.888 | |
| 468 | 7.87 | 0.024 | 0.018 | 492.901 | |
| 469 | 7.85 | 0.024 | 0.018 | 492.915 | |
| 470 | 7.84 | 0.024 | 0.017 | 492.927 | |
| 471 | 7.83 | 0.024 | 0.017 | 492.939 | |
| 472 | 7.82 | 0.024 | 0.017 | 492.951 | |
| 473 | 7.80 | 0.024 | 0.017 | 492.962 | |
| 474 | 7.79 | 0.024 | 0.017 | 492.972 | |
| 475 | 7.78 | 0.024 | 0.017 | 492.981 | |
| 476 | 7.77 | 0.024 | 0.017 | 492.990 | |
| 477 | 7.76 | 0.024 | 0.017 | 492.999 | |
| 478 | 7.75 | 0.024 | 0.017 | 493.007 | |
| 479 | 7.73 | 0.024 | 0.017 | 493.014 | |
| 480 | 7.72 | 0.023 | 0.017 | 493.020 | |
| 481 | 7.71 | 0.023 | 0.017 | 493.026 | |
| 482 | 7.70 | 0.023 | 0.017 | 493.032 | |
| 483 | 7.69 | 0.023 | 0.017 | 493.037 | |
| 484 | 7.68 | 0.023 | 0.017 | 493.041 | |
| 485 | 7.66 | 0.023 | 0.017 | 493.045 | |
| 486 | 7.65 | 0.023 | 0.017 | 493.048 | |
| 487 | 7.64 | 0.023 | 0.017 | 493.051 | |
| 488 | 7.63 | 0.023 | 0.017 | 493.053 | |
| 489 | 7.62 | 0.023 | 0.017 | 493.054 | |
| 490 | 7.61 | 0.023 | 0.017 | 493.055 | |
| 491 | 7.60 | 0.023 | 0.017 | 493.055 | MAX |
| 492 | 7.59 | 0.023 | 0.017 | 493.055 | |
| 493 | 7.57 | 0.023 | 0.017 | 493.054 | |
| 494 | 7.56 | 0.023 | 0.017 | 493.053 | |
| 495 | 7.55 | 0.023 | 0.017 | 493.051 | |
| 496 | 7.54 | 0.023 | 0.017 | 493.048 | |
| 497 | 7.53 | 0.023 | 0.017 | 493.045 | |

n Engineering Inc

# On-Site Storage Calculator

**Project:** PROPOSED CONDOMINIUM
**Address:** 233, 249, 261 Coldwater Road West
**Town/City** Orillia
**Project No:** n2123

Table 2D - 25 Years Storage

Equation of IDF:

$$I = AT^{B}$$

I = Rainfall Intensity (mm/hr)
T = Time of Concentration (hr)

$R$ = 0.80
$A$ = 1.51 ha
$Q_{release}$ = 0.008 $m^3/s$
8.25 L/s

A= 40.9
B= -0.723

Note : *Qrelease as per ACO-QuAD-VFC Control Flow

| | | | | Max. Storage Required ($m^3$) | 639.23 |
|---|---|---|---|---|---|
| $t_c$ | $i_{100}$ | $Q_{100}$ | $Q_{stored}$ | Peak Volume | Comments |
| (min) | (mm/hr) | ($m^3/s$) | ($m^3/s$) | ($m^3$) | |
| 10 | 149.39 | 0.500 | 0.492 | 295.086 | |
| 20 | 90.51 | 0.303 | 0.295 | 353.646 | |
| 30 | 67.51 | 0.226 | 0.218 | 391.908 | |
| 40 | 54.83 | 0.184 | 0.175 | 420.698 | |
| 50 | 46.66 | 0.156 | 0.148 | 443.835 | |
| 60 | 40.90 | 0.137 | 0.129 | 463.158 | |
| 70 | 36.59 | 0.122 | 0.114 | 479.708 | |
| 80 | 33.22 | 0.111 | 0.103 | 494.140 | |
| 90 | 30.51 | 0.102 | 0.094 | 506.891 | |
| 100 | 28.27 | 0.095 | 0.086 | 518.271 | |
| 110 | 26.39 | 0.088 | 0.080 | 528.511 | |
| 120 | 24.78 | 0.083 | 0.075 | 537.782 | |
| 130 | 23.39 | 0.078 | 0.070 | 546.221 | |
| 140 | 22.17 | 0.074 | 0.066 | 553.934 | |
| 150 | 21.09 | 0.071 | 0.062 | 561.009 | |
| 160 | 20.13 | 0.067 | 0.059 | 567.518 | |
| 170 | 19.26 | 0.064 | 0.056 | 573.520 | |
| 180 | 18.48 | 0.062 | 0.054 | 579.065 | |
| 190 | 17.77 | 0.059 | 0.051 | 584.198 | |
| 200 | 17.13 | 0.057 | 0.049 | 588.953 | |
| 210 | 16.53 | 0.055 | 0.047 | 593.364 | |
| 302 | 12.71 | 0.043 | 0.034 | 621.654 | |
| 482 | 9.07 | 0.030 | 0.022 | 639.174 | |
| 483 | 9.05 | 0.030 | 0.022 | 639.183 | |
| 484 | 9.04 | 0.030 | 0.022 | 639.191 | |
| 485 | 9.03 | 0.030 | 0.022 | 639.198 | |
| 486 | 9.01 | 0.030 | 0.022 | 639.205 | |
| 487 | 9.00 | 0.030 | 0.022 | 639.211 | |
| 488 | 8.99 | 0.030 | 0.022 | 639.217 | |
| 489 | 8.97 | 0.030 | 0.022 | 639.221 | |
| 490 | 8.96 | 0.030 | 0.022 | 639.225 | |
| 491 | 8.95 | 0.030 | 0.022 | 639.228 | |
| 492 | 8.93 | 0.030 | 0.022 | 639.231 | |
| 493 | 8.92 | 0.030 | 0.022 | 639.232 | |
| 494 | 8.91 | 0.030 | 0.022 | 639.233 | |
| 495 | 8.89 | 0.030 | 0.022 | 639.233 | MAX |
| 496 | 8.88 | 0.030 | 0.021 | 639.233 | |
| 497 | 8.87 | 0.030 | 0.021 | 639.232 | |
| 498 | 8.86 | 0.030 | 0.021 | 639.230 | |
| 499 | 8.84 | 0.030 | 0.021 | 639.227 | |
| 500 | 8.83 | 0.030 | 0.021 | 639.223 | |

n Engineering Inc

# On-Site Storage Calculator

**Project:** PROPOSED CONDOMINIUM
**Address:** 233, 249, 261 Coldwater Road West
**Town/City** Orillia
**Project No:** n2123

Table 2E - 50 Years Storage

Equation of IDF:

$$I = AT^{B}$$

I = Rainfall Intensity (mm/hr)
T = Time of Concentration (hr)

$R$ = 0.87
$A$ = 1.51 ha
$Q_{release}$ = 0.010 $m^3/s$
10.00 L/s

A= 45.5
B= -0.722

Note : *Qrelease as per ACO-QuAD-VFC Control Flow

| | | | | Max. Storage Required ($m^3$) | 778.41 |
|---|---|---|---|---|---|
| $t_c$ | $i_{100}$ | $Q_{100}$ | $Q_{stored}$ | Peak Volume | Comments |
| (min) | (mm/hr) | ($m^3/s$) | ($m^3/s$) | ($m^3$) | |
| 10 | 165.90 | 0.606 | 0.596 | 357.473 | |
| 20 | 100.58 | 0.367 | 0.357 | 428.716 | |
| 30 | 75.05 | 0.274 | 0.264 | 475.301 | |
| 40 | 60.97 | 0.223 | 0.213 | 510.373 | |
| 50 | 51.90 | 0.190 | 0.180 | 538.572 | |
| 60 | 45.50 | 0.166 | 0.156 | 562.133 | |
| 70 | 40.71 | 0.149 | 0.139 | 582.323 | |
| 80 | 36.97 | 0.135 | 0.125 | 599.934 | |
| 90 | 33.95 | 0.124 | 0.114 | 615.501 | |
| 100 | 31.47 | 0.115 | 0.105 | 629.401 | |
| 270 | 15.36 | 0.056 | 0.046 | 746.639 | |
| 280 | 14.96 | 0.055 | 0.045 | 749.872 | |
| 290 | 14.59 | 0.053 | 0.043 | 752.870 | |
| 300 | 14.23 | 0.052 | 0.042 | 755.646 | |
| 310 | 13.90 | 0.051 | 0.041 | 758.214 | |
| 320 | 13.59 | 0.050 | 0.040 | 760.585 | |
| 330 | 13.29 | 0.049 | 0.039 | 762.769 | |
| 340 | 13.00 | 0.047 | 0.037 | 764.776 | |
| 350 | 12.74 | 0.047 | 0.037 | 766.614 | |
| 360 | 12.48 | 0.046 | 0.036 | 768.292 | |
| 370 | 12.23 | 0.045 | 0.035 | 769.818 | |
| 380 | 12.00 | 0.044 | 0.034 | 771.199 | |
| 390 | 11.78 | 0.043 | 0.033 | 772.440 | |
| 400 | 11.57 | 0.042 | 0.032 | 773.549 | |
| 410 | 11.36 | 0.041 | 0.031 | 774.530 | |
| 420 | 11.16 | 0.041 | 0.031 | 775.390 | |
| 430 | 10.98 | 0.040 | 0.030 | 776.133 | |
| 440 | 10.80 | 0.039 | 0.029 | 776.763 | |
| 450 | 10.62 | 0.039 | 0.029 | 777.286 | |
| 460 | 10.46 | 0.038 | 0.028 | 777.704 | |
| 470 | 10.29 | 0.038 | 0.028 | 778.023 | |
| 480 | 10.14 | 0.037 | 0.027 | 778.245 | |
| 490 | 9.99 | 0.036 | 0.026 | 778.375 | |
| 500 | 9.84 | 0.036 | 0.026 | 778.414 | MAX |
| 510 | 9.70 | 0.035 | 0.025 | 778.368 | |
| 520 | 9.57 | 0.035 | 0.025 | 778.237 | |
| 530 | 9.44 | 0.034 | 0.024 | 778.026 | |
| 540 | 9.31 | 0.034 | 0.024 | 777.736 | |
| 550 | 9.19 | 0.034 | 0.024 | 777.370 | |
| 560 | 9.07 | 0.033 | 0.023 | 776.931 | |
| 570 | 8.96 | 0.033 | 0.023 | 776.421 | |
| 580 | 8.84 | 0.032 | 0.022 | 775.841 | |

n Engineering Inc

On-Site Storage Calculator

**Project:** PROPOSED CONDOMINIUM
**Address:** 233, 249, 261 Coldwater Road West
**Town/City** Orillia
**Project No:** n2123

Table 2F - 100 Years Storage

Equation of IDF:

$$I = AT^{B}$$

I = Rainfall Intensity (mm/hr)
T = Time of Concentration (hr)

$R$ = 0.91
$A$ = 1.51 ha
$Q_{release}$ = 0.011 $m^3/s$
11.46 L/s

A= 50
B= -0.722

Note : *Qrelease as per ACO-QuAD-VFC Control Flow

| | | | | Max. Storage Required ($m^3$) | 890.65 |
|---|---|---|---|---|---|
| $t_c$ (min) | $i_{100}$ (mm/hr) | $Q_{100}$ ($m^3/s$) | $Q_{stored}$ ($m^3/s$) | Peak Volume ($m^3$) | Comments |
| 10 | 182.30 | 0.693 | 0.682 | 409.187 | |
| 20 | 110.52 | 0.420 | 0.409 | 490.730 | |
| 30 | 82.47 | 0.314 | 0.302 | 544.048 | |
| 40 | 67.01 | 0.255 | 0.243 | 584.187 | |
| 50 | 57.03 | 0.217 | 0.205 | 616.458 | |
| 60 | 50.00 | 0.190 | 0.179 | 643.421 | |
| 70 | 44.73 | 0.170 | 0.159 | 666.523 | |
| 80 | 40.62 | 0.155 | 0.143 | 686.675 | |
| 90 | 37.31 | 0.142 | 0.130 | 704.487 | |
| 100 | 34.58 | 0.132 | 0.120 | 720.390 | |
| 110 | 32.28 | 0.123 | 0.111 | 734.703 | |
| 120 | 30.31 | 0.115 | 0.104 | 747.667 | |
| 130 | 28.61 | 0.109 | 0.097 | 759.471 | |
| 140 | 27.12 | 0.103 | 0.092 | 770.265 | |
| 150 | 25.80 | 0.098 | 0.087 | 780.169 | |
| 160 | 24.63 | 0.094 | 0.082 | 789.284 | |
| 170 | 23.57 | 0.090 | 0.078 | 797.693 | |
| 180 | 22.62 | 0.086 | 0.075 | 805.466 | |
| 190 | 21.75 | 0.083 | 0.071 | 812.663 | |
| 200 | 20.96 | 0.080 | 0.068 | 819.334 | |
| 210 | 20.24 | 0.077 | 0.066 | 825.525 | |
| 220 | 19.57 | 0.074 | 0.063 | 831.274 | |
| 230 | 18.95 | 0.072 | 0.061 | 836.615 | |
| 485 | 11.06 | 0.042 | 0.031 | 890.554 | |
| 486 | 11.04 | 0.042 | 0.031 | 890.567 | |
| 487 | 11.03 | 0.042 | 0.030 | 890.580 | |
| 488 | 11.01 | 0.042 | 0.030 | 890.591 | |
| 489 | 10.99 | 0.042 | 0.030 | 890.602 | |
| 490 | 10.98 | 0.042 | 0.030 | 890.611 | |
| 491 | 10.96 | 0.042 | 0.030 | 890.619 | |
| 496 | 10.88 | 0.041 | 0.030 | 890.646 | |
| 501 | 10.80 | 0.041 | 0.030 | 890.647 | MAX |
| 506 | 10.73 | 0.041 | 0.029 | 890.624 | |
| 511 | 10.65 | 0.041 | 0.029 | 890.576 | |
| 516 | 10.57 | 0.040 | 0.029 | 890.504 | |
| 521 | 10.50 | 0.040 | 0.028 | 890.409 | |
| 526 | 10.43 | 0.040 | 0.028 | 890.291 | |
| 531 | 10.36 | 0.039 | 0.028 | 890.150 | |

n Engineering Inc

# On-Site Avaiable Storage Calculator

## PROPOSED CONDOMINIUM

Table 3A - Available Storage (2 years Proposed)

| | |
|---|---|
| **Address:** | **233, 249, 261 Coldwater Road West** |
| **Town/City** | **Orillia** |
| **Project No.:** | **n2123** |

| **HWL** | 266.82 |
|---|---|

**CB/CBMH**

| Description | Length/dia. (m) | Width (m) | Top Elevation | Lowest Invert Elevation | Height (m) | Volume ($m^3$) |
|---|---|---|---|---|---|---|
| CB1 | 0.6 | 0.6 | 274.50 | 271.35 | -4.53 | 0 |
| CB2 | 0.6 | 0.6 | 274.35 | 270.28 | -3.46 | 0 |
| CB3 | 0.6 | 0.6 | 273.20 | 270.62 | -3.80 | 0 |
| CB4 | 0.6 | 0.6 | 268.15 | 267.31 | -0.49 | 0 |
| CBMH11 | 1.2 | - | 268.95 | 266.90 | -0.08 | 0 |
| CBMH1 | 1.2 | - | 274.20 | 270.22 | -3.40 | 0 |
| CBMH2 | 1.2 | - | 273.80 | 268.55 | -1.73 | 0 |
| CBMH3 | 1.2 | - | 270.50 | 267.25 | -0.43 | 0 |
| CBMH4 | 1.2 | - | 271.15 | 268.61 | -1.79 | 0 |
| CBMH5 | 1.2 | - | 267.20 | 266.31 | 0.51 | 0.58 |
| CBMH6 | 1.2 | - | 269.30 | 267.23 | -0.41 | 0 |
| CBMH8 | 1.2 | - | 268.25 | 267.19 | -0.37 | 0 |
| CBMH9 | 1.2 | - | 268.50 | 267.04 | -0.22 | 0 |
| CBMH10 | 1.2 | - | 272.30 | 268.92 | -2.10 | 0 |
| MH1 | 1.5 | - | 269.45 | 266.79 | 0.03 | 0.05 |
| MH4 | 1.2 | - | 268.18 | 266.54 | 0.28 | 0.32 |
| TOTAL | | | | | | 0.95 |

**PIPES**

| CAPTYRE BY | OUTLET TO | Length (m) | | DIA (mm) | Volume ($m^3$) |
|---|---|---|---|---|---|
| CB1 | CBMH1 | 20.5 | | 300 | 0.00 |
| CBMH1 | CBMH2 | 25.0 | | 300 | 0.00 |
| CB2 | CBMH4 | 24.5 | | 300 | 0.00 |
| CBMH2 | CBMH3 | 22.5 | | 300 | 0.00 |
| CBMH4 | CBMH3 | 28.5 | | 300 | 0.00 |
| CBMH3 | MH1 | 24.0 | | 375 | 0.00 |
| CB4 | CBMH8 | 18.5 | | 300 | 0.00 |
| CBMH8 | CBMH9 | 25.0 | | 300 | 0.00 |
| CBMH11 | MH1 | 18.0 | | 375 | 0.00 |
| CBMH9 | CBMH11 | 23.0 | | 300 | 0.00 |
| MH1 | MH2(OGS) | 1.5 | | 450 | 0.24 |
| MH2(OGS) | DETENTION TANK | 0.5 | | 450 | 0.08 |
| STM ROOF PLUG | RETENTION TANK | 5.0 | | 300 | 0.00 |
| RETENTION TANK | CBMH4 | 4.6 | | 300 | 0.00 |
| DETENTION TANK | MH4 | 3.0 | | 450 | 0.48 |
| MH4 | CBMH5 | 29.5 | | 450 | 4.69 |
| CB3 | CBMH10 | 37.0 | | 300 | 0.00 |
| CBMH10 | CBMH6 | 36.8 | | 300 | 0.00 |
| CBMH6 | CBMH5(CONTROL) | 41.0 | | 300 | 0.00 |
| TOTAL | | | | | 5.48 |

**STORM CHAMBER**

| Model | Area ($m^{2)}$ | Volume ($m^3$) |
|---|---|---|
| ACO-STORMBRIXX | 1523.52 | 321.77 |
| **TOTAL** | | **321.77** |

| | |
|---|---|
| **Total Provided Volume ($m^3$)** | **328.20** |
| **Maximum Required Volume ($m^3$)** | **314.71** |

Note: Only the catchbasin, manholesand sewer with the inverts greater than HWL is considered for avaialble storage.

n Engineering Inc

# On-Site Avaiable Storage Calculator

## PROPOSED CONDOMINIUM

Table 3B- Available Storage (5 years Proposed)

| | |
|---|---|
| **Address:** | **233, 249, 261 Coldwater Road West** |
| **Town/City** | **Orillia** |
| **Project No.:** | **n2123** |

| | |
|---|---|
| **HWL** | 266.89 |

**CB/CBMH**

| Description | Length/dia. (m) | Width (m) | Top Elevation | Lowest Invert Elevation | Height (m) | Volume ($m^3$) |
|---|---|---|---|---|---|---|
| CB1 | 0.6 | 0.6 | 274.50 | 271.35 | -4.46 | 0 |
| CB2 | 0.6 | 0.6 | 274.35 | 270.28 | -3.39 | 0 |
| CB3 | 0.6 | 0.6 | 273.20 | 270.62 | -3.73 | 0 |
| CB4 | 0.6 | 0.6 | 268.15 | 267.31 | -0.42 | 0 |
| CBMH11 | 1.2 | - | 268.95 | 266.90 | -0.01 | 0 |
| CBMH1 | 1.2 | - | 274.20 | 270.22 | -3.33 | 0 |
| CBMH2 | 1.2 | - | 273.80 | 268.55 | -1.66 | 0 |
| CBMH3 | 1.2 | - | 270.50 | 267.25 | -0.36 | 0 |
| CBMH4 | 1.2 | - | 271.15 | 268.61 | -1.72 | 0 |
| CBMH5 | 1.2 | - | 267.20 | 266.31 | 0.58 | 0.66 |
| CBMH6 | 1.2 | - | 269.30 | 267.23 | -0.34 | 0 |
| CBMH8 | 1.2 | - | 268.25 | 267.19 | -0.30 | 0 |
| CBMH9 | 1.2 | - | 268.50 | 267.04 | -0.15 | 0 |
| CBMH10 | 1.2 | - | 272.30 | 268.92 | -2.03 | 0 |
| MH1 | 1.5 | - | 269.45 | 266.79 | 0.10 | 0.18 |
| MH4 | 1.2 | - | 268.18 | 266.54 | 0.35 | 0.40 |
| TOTAL | | | | | | 1.23 |

**PIPES**

| CAPTYRE BY | OUTLET TO | Length (m) | | DIA (mm) | Volume ($m^3$) |
|---|---|---|---|---|---|
| CB1 | CBMH1 | 20.5 | | 300 | 0.00 |
| CBMH1 | CBMH2 | 25 | | 300 | 0.00 |
| CB2 | CBMH4 | 24.5 | | 300 | 0.00 |
| CBMH2 | CBMH3 | 22.5 | | 300 | 0.00 |
| CBMH4 | CBMH3 | 28.5 | | 300 | 0.00 |
| CBMH3 | MH1 | 24 | | 375 | 0.00 |
| CB4 | CBMH8 | 18.5 | | 300 | 0.00 |
| CBMH8 | CBMH9 | 25 | | 300 | 0.00 |
| CBMH11 | MH1 | 18 | | 375 | 0.00 |
| CBMH9 | CBMH11 | 23 | | 300 | 0.00 |
| MH1 | MH2(OGS) | 1.5 | | 450 | 0.24 |
| MH2(OGS) | DETENTION TANK | 0.5 | | 450 | 0.08 |
| STM ROOF PLUG | RETENTION TANK | 5 | | 300 | 0.00 |
| RETENTION TANK | CBMH4 | 4.6 | | 300 | 0.00 |
| DETENTION TANK | MH4 | 3 | | 450 | 0.48 |
| MH4 | CBMH5 | 29.5 | | 450 | 4.69 |
| CB3 | CBMH10 | 37 | | 300 | 0.00 |
| CBMH10 | CBMH6 | 36.8 | | 300 | 0.00 |
| CBMH6 | CBMH5(CONTROL) | 41 | | 300 | 0.00 |
| TOTAL | | | | | 5.48 |

**STORM CHAMBER**

| Model | Area ($m^{2)}$ | Ponding Volume |
|---|---|---|
| ACO-STORMBRIXX | 1523.52 | 424.15 |
| **TOTAL** | | **424.15** |

| | |
|---|---|
| **Total Provided Volume ($m^3$)** | **430.86** |
| **Maximum Required Volume ($m^3$)** | **422.16** |

Note: Only the catchbasin, manholesand sewer with the inverts greater than HWL is considered for avaialble storage.

n Engineering Inc

# On-Site Avaiable Storage Calculator

## PROPOSED CONDOMINIUM

Table 3C - Available Storage (10 years Proposed)

| | |
|---|---|
| **Address:** | **233, 249, 261 Coldwater Road West** |
| **Town/City** | **Orillia** |
| **Project No.:** | **n2123** |

| | |
|---|---|
| **HWL** | 266.94 |

**CB/CBMH**

| Description | Length/dia. (m) | Width (m) | Top Elevation | Lowest Invert Elevation | Height (m) | Volume ($m^3$) |
|---|---|---|---|---|---|---|
| CB1 | 0.6 | 0.6 | 274.50 | 271.35 | -4.41 | 0 |
| CB2 | 0.6 | 0.6 | 274.35 | 270.28 | -3.34 | 0 |
| CB3 | 0.6 | 0.6 | 273.20 | 270.62 | -3.68 | 0 |
| CB4 | 0.6 | 0.6 | 268.15 | 267.31 | -0.37 | 0 |
| CBMH11 | 1.2 | - | 268.95 | 266.90 | 0.04 | 0.05 |
| CBMH1 | 1.2 | - | 274.20 | 270.22 | -3.28 | 0 |
| CBMH2 | 1.2 | - | 273.80 | 268.55 | -1.61 | 0 |
| CBMH3 | 1.2 | - | 270.50 | 267.25 | -0.31 | 0 |
| CBMH4 | 1.2 | - | 271.15 | 268.61 | -1.67 | 0 |
| CBMH5 | 1.2 | - | 267.20 | 266.31 | 0.63 | 0.71 |
| CBMH6 | 1.2 | - | 269.30 | 267.23 | -0.29 | 0 |
| CBMH8 | 1.2 | - | 268.25 | 267.19 | -0.25 | 0 |
| CBMH9 | 1.2 | - | 268.50 | 267.04 | -0.10 | 0 |
| CBMH10 | 1.2 | - | 272.30 | 268.92 | -1.98 | 0 |
| MH1 | 1.5 | - | 269.45 | 266.79 | 0.15 | 0.27 |
| MH4 | 1.2 | - | 268.18 | 266.54 | 0.40 | 0.45 |
| TOTAL | | | | | | 1.48 |

**PIPES**

| CAPTYRE BY | OUTLET TO | Length (m) | | DIA (mm) | Volume ($m^3$) |
|---|---|---|---|---|---|
| CB1 | CBMH1 | 20.5 | | 300 | 0.00 |
| CBMH1 | CBMH2 | 25 | | 300 | 0.00 |
| CB2 | CBMH4 | 24.5 | | 300 | 0.00 |
| CBMH2 | CBMH3 | 22.5 | | 300 | 0.00 |
| CBMH4 | CBMH3 | 28.5 | | 300 | 0.00 |
| CBMH3 | MH1 | 24 | | 375 | 0.00 |
| CB4 | CBMH8 | 18.5 | | 300 | 0.00 |
| CBMH8 | CBMH9 | 25 | | 300 | 0.00 |
| CBMH11 | MH1 | 18 | | 375 | 1.99 |
| CBMH9 | CBMH11 | 23 | | 300 | 0.00 |
| MH1 | MH2(OGS) | 1.5 | | 450 | 0.24 |
| MH2(OGS) | DETENTION TANK | 0.5 | | 450 | 0.08 |
| STM ROOF PLUG | RETENTION TANK | 5 | | 300 | 0.00 |
| RETENTION TANK | CBMH4 | 4.6 | | 300 | 0.00 |
| DETENTION TANK | MH4 | 3 | | 450 | 0.48 |
| MH4 | CBMH5 | 29.5 | | 450 | 4.69 |
| CB3 | CBMH10 | 37 | | 300 | 0.00 |
| CBMH10 | CBMH6 | 36.8 | | 300 | 0.00 |
| CBMH6 | CBMH5(CONTROL) | 41 | | 300 | 0.00 |
| TOTAL | | | | | 7.47 |

**STORM CHAMBER**

| Model | Area ($m^{2)}$ | Ponding Volume |
|---|---|---|
| ACO-STORMBRIXX | 1523.52 | 497.28 |
| **TOTAL** | | **497.28** |

| | |
|---|---|
| **Total Provided Volume ($m^3$)** | **506.23** |
| **Maximum Required Volume ($m^3$)** | **493.06** |

Note: Only the catchbasin, manholesand sewer with the inverts greater than HWL is considered for avaialble storage.

n Engineering Inc

# On-Site Avaiable Storage Calculator

## PROPOSED CONDOMINIUM

Table 3D - Available Storage (25 years Proposed)

| | |
|---|---|
| **Address:** | **233, 249, 261 Coldwater Road West** |
| **Town/City** | **Orillia** |
| **Project No.:** | **n2123** |

| | |
|---|---|
| **HWL** | 267.04 |

**CB/CBMH**

| Description | Length/dia. (m) | Width (m) | Top Elevation | Lowest Invert Elevation | Height (m) | Volume ($m^3$) |
|---|---|---|---|---|---|---|
| CB1 | 0.6 | 0.6 | 274.50 | 271.35 | -4.31 | 0 |
| CB2 | 0.6 | 0.6 | 274.35 | 270.28 | -3.24 | 0 |
| CB3 | 0.6 | 0.6 | 273.20 | 270.62 | -3.58 | 0 |
| CB4 | 0.6 | 0.6 | 268.15 | 267.31 | -0.27 | 0 |
| CBMH11 | 1.2 | - | 268.95 | 266.90 | 0.14 | 0.16 |
| CBMH1 | 1.2 | - | 274.20 | 270.22 | -3.18 | 0 |
| CBMH2 | 1.2 | - | 273.80 | 268.55 | -1.51 | 0 |
| CBMH3 | 1.2 | - | 270.50 | 267.25 | -0.21 | 0 |
| CBMH4 | 1.2 | - | 271.15 | 268.61 | -1.57 | 0 |
| CBMH5 | 1.2 | - | 267.20 | 266.31 | 0.73 | 0.83 |
| CBMH6 | 1.2 | - | 269.30 | 267.23 | -0.19 | 0 |
| CBMH8 | 1.2 | - | 268.25 | 267.19 | -0.15 | 0 |
| CBMH9 | 1.2 | - | 268.50 | 267.04 | 0.00 | 0.00 |
| CBMH10 | 1.2 | - | 272.30 | 268.92 | -1.88 | 0 |
| MH1 | 1.5 | - | 269.45 | 266.79 | 0.25 | 0.44 |
| MH4 | 1.2 | - | 268.18 | 266.54 | 0.50 | 0.57 |
| TOTAL | | | | | | 1.99 |

**PIPES**

| CAPTYRE BY | OUTLET TO | Length (m) | | DIA (mm) | Volume ($m^3$) |
|---|---|---|---|---|---|
| CB1 | CBMH1 | 20.5 | | 300 | 0.00 |
| CBMH1 | CBMH2 | 25 | | 300 | 0.00 |
| CB2 | CBMH4 | 24.5 | | 300 | 0.00 |
| CBMH2 | CBMH3 | 22.5 | | 300 | 0.00 |
| CBMH4 | CBMH3 | 28.5 | | 300 | 0.00 |
| CBMH3 | MH1 | 24 | | 375 | 0.00 |
| CB4 | CBMH8 | 18.5 | | 300 | 0.00 |
| CBMH8 | CBMH9 | 25 | | 300 | 0.00 |
| CBMH11 | MH1 | 18 | | 375 | 1.99 |
| CBMH9 | CBMH11 | 23 | | 300 | 1.62 |
| MH1 | MH2(OGS) | 1.5 | | 450 | 0.24 |
| MH2(OGS) | DETENTION TANK | 0.5 | | 450 | 0.08 |
| STM ROOF PLUG | RETENTION TANK | 5 | | 300 | 0.00 |
| RETENTION TANK | CBMH4 | 4.6 | | 300 | 0.00 |
| DETENTION TANK | MH4 | 3 | | 450 | 0.48 |
| MH4 | CBMH5 | 29.5 | | 450 | 4.69 |
| CB3 | CBMH10 | 37 | | 300 | 0.00 |
| CBMH10 | CBMH6 | 36.8 | | 300 | 0.00 |
| CBMH6 | CBMH5(CONTROL) | 41 | | 300 | 0.00 |
| TOTAL | | | | | 9.10 |

**STORM CHAMBER**

| Model | Area ($m^{2)}$ | Volume ($m^3$) |
|---|---|---|
| ACO-STORMBRIXX | 1523.52 | 643.54 |
| **TOTAL** | | **643.54** |

| | |
|---|---|
| **Total Provided Volume ($m^3$)** | **654.63** |
| **Maximum Required Volume ($m^3$)** | **639.23** |

Note: Only the catchbasin, manholesand sewer with the inverts greater than HWL is considered for avaialble storage.

n Engineering Inc

# On-Site Avaiable Storage Calculator

## PROPOSED CONDOMINIUM

Table 3E - Available Storage (50 years Proposed)

| | |
|---|---|
| **Address:** | **233, 249, 261 Coldwater Road West** |
| **Town/City** | **Orillia** |
| **Project No.:** | **n2123** |

| | |
|---|---|
| **HWL** | 267.13 |

**CB/CBMH**

| Description | Length/dia. (m) | Width (m) | Top Elevation | Lowest Invert Elevation | Height (m) | Volume ($m^3$) |
|---|---|---|---|---|---|---|
| CB1 | 0.6 | 0.6 | 274.50 | 271.35 | -4.22 | 0 |
| CB2 | 0.6 | 0.6 | 274.35 | 270.28 | -3.15 | 0 |
| CB3 | 0.6 | 0.6 | 273.20 | 270.62 | -3.49 | 0 |
| CB4 | 0.6 | 0.6 | 268.15 | 267.31 | -0.18 | 0 |
| CBMH11 | 1.2 | 0.6 | 268.95 | 266.90 | 0.23 | 0.17 |
| CBMH1 | 1.2 | 0.6 | 274.20 | 270.22 | -3.09 | 0 |
| CBMH2 | 1.2 | 0.6 | 273.80 | 268.55 | -1.42 | 0 |
| CBMH3 | 1.2 | 0.6 | 270.50 | 267.25 | -0.12 | 0 |
| CBMH4 | 1.2 | 0.6 | 271.15 | 268.61 | -1.48 | 0 |
| CBMH5 | 1.2 | 0.6 | 267.20 | 266.31 | 0.82 | 0.93 |
| CBMH6 | 1.2 | 0.6 | 269.30 | 267.23 | -0.10 | 0 |
| CBMH8 | 1.2 | 0.6 | 268.25 | 267.19 | -0.06 | 0 |
| CBMH9 | 1.2 | 0.6 | 268.50 | 267.04 | 0.09 | 0.10 |
| CBMH10 | 1.2 | 0.6 | 272.30 | 268.92 | -1.79 | 0 |
| MH1 | 1.5 | 0.6 | 269.45 | 266.79 | 0.34 | 0.60 |
| MH4 | 1.2 | 0.6 | 268.18 | 266.54 | 0.59 | 0.67 |
| TOTAL | | | | | | 2.46 |

**PIPES**

| CAPTYRE BY | OUTLET TO | Length (m) | | DIA (mm) | Volume ($m^3$) |
|---|---|---|---|---|---|
| CB1 | CBMH1 | 20.5 | | 300 | 0.00 |
| CBMH1 | CBMH2 | 25 | | 300 | 0.00 |
| CB2 | CBMH4 | 24.5 | | 300 | 0.00 |
| CBMH2 | CBMH3 | 22.5 | | 300 | 0.00 |
| CBMH4 | CBMH3 | 28.5 | | 300 | 0.00 |
| CBMH3 | MH1 | 24 | | 375 | 0.00 |
| CB4 | CBMH8 | 18.5 | | 300 | 0.00 |
| CBMH8 | CBMH9 | 25 | | 300 | 0.00 |
| CBMH11 | MH1 | 18 | | 375 | 1.99 |
| CBMH9 | CBMH11 | 23 | | 300 | 1.62 |
| MH1 | MH2(OGS) | 1.5 | | 450 | 0.24 |
| MH2(OGS) | DETENTION TANK | 0.5 | | 450 | 0.08 |
| STM ROOF PLUG | RETENTION TANK | 5 | | 300 | 0.00 |
| RETENTION TANK | CBMH4 | 4.6 | | 300 | 0.00 |
| DETENTION TANK | MH4 | 3 | | 450 | 0.48 |
| MH4 | CBMH5 | 29.5 | | 450 | 4.69 |
| CB3 | CBMH10 | 37 | | 300 | 0.00 |
| CBMH10 | CBMH6 | 36.8 | | 300 | 0.00 |
| CBMH6 | CBMH5(CONTROL) | 41 | | 300 | 0.00 |
| TOTAL | | | | | 9.10 |

**STORM CHAMBER**

| Model | Area ($m^{2)}$ | Volume ($m^3$) |
|---|---|---|
| ACO-STORMBRIXX | 1523.52 | 775.17 |
| **TOTAL** | | **775.17** |

| | |
|---|---|
| **Total Provided Volume ($m^3$)** | **786.73** |
| **Maximum Required Volume ($m^3$)** | **778.41** |

Note: Only the catchbasin, manholesand sewer with the inverts greater than HWL is considered for avaialble storage.

n Engineering Inc

# On-Site Avaiable Storage Calculator

## PROPOSED CONDOMINIUM

Table 3F - Available Storage (100 years Proposed)

| | |
|---|---|
| **Address:** | **233, 249, 261 Coldwater Road West** |
| **Town/City** | **Orillia** |
| **Project No.:** | **n2123** |

| | |
|---|---|
| **HWL** | 267.21 |

**CB/CBMH**

| Description | Length/dia. (m) | Width (m) | Top Elevation | Lowest Invert Elevation | Height (m) | Volume ($m^3$) |
|---|---|---|---|---|---|---|
| CB1 | 0.6 | 0.6 | 274.50 | 271.35 | -4.14 | 0 |
| CB2 | 0.6 | 0.6 | 274.35 | 270.28 | -3.07 | 0 |
| CB3 | 0.6 | 0.6 | 273.20 | 270.62 | -3.41 | 0 |
| CB4 | 0.6 | 0.6 | 268.15 | 267.31 | -0.10 | 0 |
| CBMH11 | 1.2 | - | 268.95 | 266.90 | 0.31 | 0.35 |
| CBMH1 | 1.2 | - | 274.20 | 270.22 | -3.01 | 0 |
| CBMH2 | 1.2 | - | 273.80 | 268.55 | -1.34 | 0 |
| CBMH3 | 1.2 | - | 270.50 | 267.25 | -0.04 | 0 |
| CBMH4 | 1.2 | - | 271.15 | 268.61 | -1.40 | 0 |
| CBMH5 | 1.2 | - | 267.20 | 266.31 | 0.90 | 1.02 |
| CBMH6 | 1.2 | - | 269.30 | 267.23 | -0.02 | 0 |
| CBMH8 | 1.2 | - | 268.25 | 267.19 | 0.02 | 0.02 |
| CBMH9 | 1.2 | - | 268.50 | 267.04 | 0.17 | 0.19 |
| CBMH10 | 1.2 | - | 272.30 | 268.92 | -1.71 | 0 |
| MH1 | 1.5 | - | 269.45 | 266.79 | 0.42 | 0.74 |
| MH4 | 1.2 | - | 268.18 | 266.54 | 0.67 | 0.76 |
| TOTAL | | | | | | 3.08 |

**PIPES**

| CAPTYRE BY | OUTLET TO | Length (m) | | DIA (mm) | Volume ($m^3$) |
|---|---|---|---|---|---|
| CB1 | CBMH1 | 20.5 | | 300 | 0.00 |
| CBMH1 | CBMH2 | 25 | | 300 | 0.00 |
| CB2 | CBMH4 | 24.5 | | 300 | 0.00 |
| CBMH2 | CBMH3 | 22.5 | | 300 | 0.00 |
| CBMH4 | CBMH3 | 28.5 | | 300 | 0.00 |
| CBMH3 | MH1 | 24 | | 375 | 0.00 |
| CB4 | CBMH8 | 18.5 | | 300 | 0.00 |
| CBMH8 | CBMH9 | 25 | | 300 | 1.77 |
| CBMH11 | MH1 | 18 | | 375 | 1.99 |
| CBMH9 | CBMH11 | 23 | | 300 | 1.62 |
| MH1 | MH2(OGS) | 1.5 | | 450 | 0.24 |
| MH2(OGS) | DETENTION TANK | 0.5 | | 450 | 0.08 |
| STM ROOF PLUG | RETENTION TANK | 5 | | 300 | 0.00 |
| RETENTION TANK | CBMH4 | 4.6 | | 300 | 0.00 |
| DETENTION TANK | MH4 | 3 | | 450 | 0.48 |
| MH4 | CBMH5 | 29.5 | | 450 | 4.69 |
| CB3 | CBMH10 | 37 | | 300 | 0.00 |
| CBMH10 | CBMH6 | 36.8 | | 300 | 0.00 |
| CBMH6 | CBMH5(CONTROL) | 41 | | 300 | 0.00 |
| TOTAL | | | | | 10.86 |

**STORM CHAMBER**

| Model | Area ($m^{2)}$ | Volume ($m^3$) |
|---|---|---|
| ACO-STORMBRIXX | 1523.52 | 892.17 |
| **TOTAL** | | **892.17** |

| | |
|---|---|
| **Total Provided Volume ($m^3$)** | **906.12** |
| **Maximum Required Volume ($m^3$)** | **890.65** |

Note: Only the catchbasin, manholesand sewer with the inverts greater than HWL is considered for avaialble storage.

ACO QuAD-VFC

# Q-Brake Design and Performance Report

**Project Details**
Project : --
Chamber Number : 1
Chamber Name : New Chamber

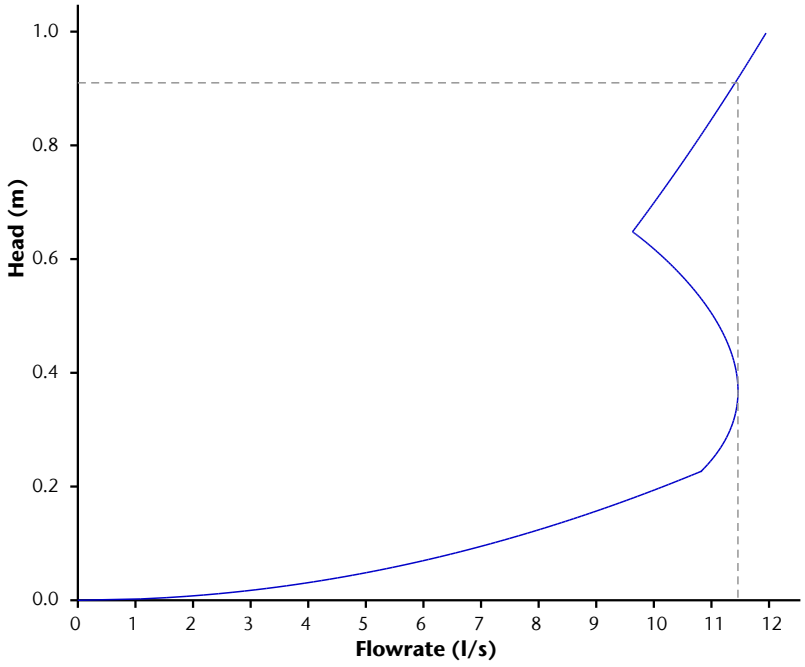
**Reference**
Design Reference : 00012849
Created by : Mohammed Sadriwala
Date Produced : 29-05-2026

## Design

| Description | Size [m] |
|---|---|
| Design Head | 0.910 |

| Description | Rate [l/s] |
|---|---|
| Design Flow Rate | 11.460 |

| Description | Model |
|---|---|
| Design Style | Curved Back |




| Head [m] | Flow [l/s] |
|---|---|
| 0.000 | 0.000 |
| 0.023 | 3.457 |
| 0.046 | 4.888 |
| 0.069 | 5.987 |
| 0.093 | 6.913 |
| 0.116 | 7.729 |
| 0.139 | 8.467 |
| 0.162 | 9.145 |
| 0.185 | 9.777 |
| 0.208 | 10.370 |
| 0.233 | 10.878 |
| 0.292 | 11.292 |
| 0.352 | 11.454 |
| 0.410 | 11.415 |
| 0.465 | 11.222 |
| 0.516 | 10.926 |
| 0.560 | 10.576 |
| 0.597 | 10.222 |
| 0.625 | 9.914 |
| 0.643 | 9.700 |
| 0.652 | 9.656 |
| 0.687 | 9.917 |
| 0.723 | 10.171 |
| 0.759 | 10.419 |
| 0.794 | 10.661 |
| 0.830 | 10.897 |
| 0.866 | 11.129 |
| 0.901 | 11.356 |
| 0.937 | 11.578 |
| 0.972 | 11.797 |
| 0.997 | 11.947 |

## Specification

| Description | Height [m] | Rate [l/s] |
|---|---|---|
| Flush Flow | 0.254 | 11.06 |
| Reattachment | 0.648 | 9.63 |

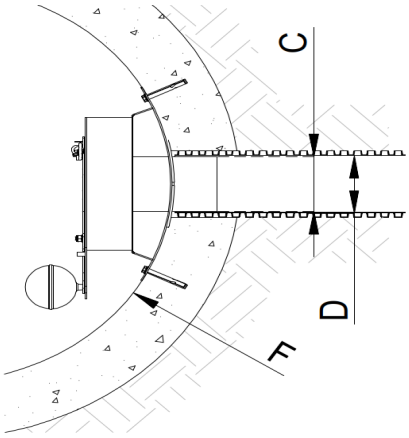
| Description | Size [mm] |
|---|---|
| Minimum Outlet Pipe Diameter | 225 |
| Minimum Sump Depth | 369 |
| Minimum Chamber Diameter | 1050 |

Disclaimer: This design only applies to ACO Q-Brake and ACO Q-Plate products and no other parties' products. It is the responsibility of the designer ('user') to verify that the design parameters have been entered correctly and that relevant industry standards and guidelines have been taken into consideration. ACO Q-Brake and Q-Plate are intended to be used with surface water only.

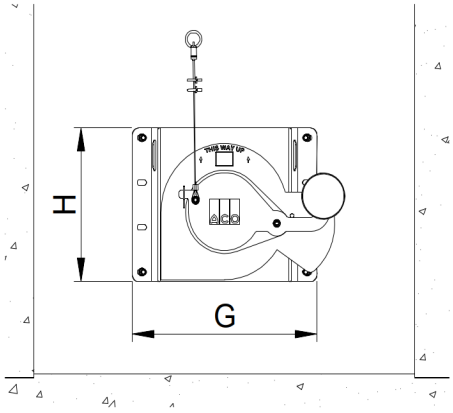
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Hitchin Road, Shefford, Bedfordshire. SG17 5TE Tel: +44(0)1462 816666

# ACO Q-Brake Dimensions

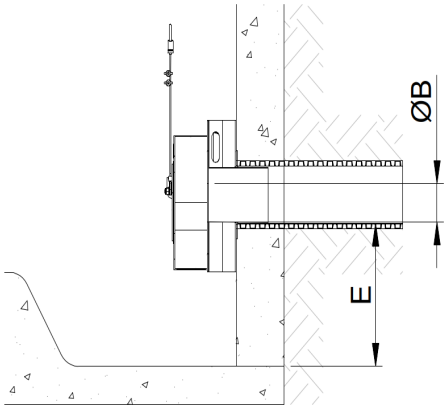
## Model: QB500




Plan View




Front View




Side View

### Flow Control Dimensions

| Key | Description | Size [mm] |
|---|---|---|
| B | Orifice diameter | 144 |
| C | Outlet Spigot OD | 295 |
| G | Overall width | 653 |
| H | Overall height | 491 |

### Chamber/Pipework Dimensions

| Key | Description | Min [mm] | Design [mm] |
|---|---|---|---|
| D | Outlet pipe DN | 225 | 300 |
| E | Sump depth | 369 | |
| F | Chamber diameter | 1050 | 1500 |

* Design dimensions shown are as selected by the designer.

Disclaimer: This design only applies to ACO Q-Brake and ACO Q-Plate products and no other parties' products. It is the responsibility of the designer ('user') to verify that the design parameters have been entered correctly and that relevant industry standards and guidelines have been taken into consideration. ACO Q-Brake and Q-Plate are intended to be used with surface water only.

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**ACO Water Management:**
Civils + Infrastructure

| Uniclass L7315 | EPIC J3413 |
|---|---|
| CI/SfB (52.5) | |







*Surface Water Flow Control Systems*

# ACO Q-Brake Vortex and ACO Q-Plate

# Introduction to the ACO Group

Throughout the world ACO branded drainage and surface water management systems are recognised for their innovative design, high quality manufacture, environmental excellence and industry leading performance.

Today the ACO Group has a research and production base that reaches across four continents. This unmatched resource pioneers the development of solutions that are tailored to individual applications, meeting the need for high performance, sustainable products that deliver optimum value throughout their operational life.



## ACO Technologies plc

ACO operates as ACO Technologies plc in the United Kingdom. Founded over 25 years ago, the company has grown quickly on a reputation for design innovation and customer service.

There are 2 core divisions, ACO Water Management and ACO Building Drainage, that serve every sector of the construction industry, providing solutions for applications as diverse as rail, highways, airports, landscaping, retail, distribution centres and environmentally sensitive projects.




To help architects, designers and contractors meet the legal requirements that now tightly control the way surface water is managed, ACO has created its unique 'Surface Water Management Cycle' – Collect, Clean, Hold, Release – the four core processes now required for the complete and sustainable management of surface water drainage.



# Contents


| | |
|---|---|
| Introduction to ACO's surface water control systems | 4 |
| Benefits of using a surface water control system | 6 |
| ACO Q-Brake Vortex features overview | 8 |
| ACO Q-Brake Vortex specification and design process | 10 |
| ACO Q-Brake Vortex Installation detail | 11 |
| Operation and maintenance recommendations | 12 |
| Introduction to ACO Q-Plate | 14 |

# Introduction to ACO's Surface Water Flow Control Systems

ACO's range of flow control systems are designed to regulate storm water flow before it discharges into the watercourse or sewer networks. ACO Q-Brake Vortex flow controls and ACO Q-Plate orifice plates are capable of regulating any flow for surface water applications and can be used in conjunction with retention and attenuation systems, such as ACO StormBrixx, as an integrated sustainable urban drainage (SuDS) scheme.

## What is a Q-Brake section?

ACO Q-Brake Vortex is a horizontal vortex flow control designed to regulate storm water flows from 2-100 litres per second. Manufactured from grade 304 stainless steel, each ACO Q-Brake Vortex is individually configured to suit specific performance criteria.

The design of a vortex flow control is based on the fluid mechanics principle of the forced vortex, which permits flow regulation without any moving parts.

ACO Q-Brake Vortex utilises the upstream head and discharge to generate a 'vortex' within the structure of the unit. The water is then released at a pre-determined controlled rate preventing downstream flooding.

Unlike more conventional methods, ACO Q-Brake Vortex is less prone to blockage, and permits higher flow at a lower head of water, as a vortex control allows an outlet 4-6 times larger in cross sectional area to be used.

ACO Q-Brake Vortex can form part of the design of any integrated drainage scheme for a wide range of infrastructure, industrial and other SuDS applications.



## What is ACO Q-Plate?

ACO Q-Plate orifice plates are designed for use where an ACO Q-Brake vortex is not the most effective solution.

To suit application requirements, the range is available with or without remote bypass and drain down and is designed to match a variety of manhole configurations.

Information regarding the specification of ACO Q –Plates can be found on page 14.



ACO Q-Plates with and without draindown

# Why choose ACO Q-Brake Vortex?



- **Planning and connection**

  ACO Q-Brake Vortex addresses the planning and connection requirements set out in the Floods and Water Management Act. Where a discharge restriction is in place, ACO Q-Brake Vortex regulates the surface water flow to the specified rate.

- **Tailored performance**

  Each ACO Q-Brake Vortex is tailored to the specific performance requirements of the application providing optimum efficiency within the system.

- **Optimum hydraulic efficiency**

  The mechanism employed within ACO Q-Brake Vortex provides superior hydraulic performance in comparison to traditional flow control systems.

- **Water Authority Approval**

  ACO Q-Brake Vortex has been approved for use by a number of water authorities including Severn Trent, Anglian and Scottish Water.

- **Proven performance**

  ACO Q-Brake Vortex is UK manufactured and has been independently laboratory tested to verified discharge rates.

- **Simplified access and maintenance**

  ACO Q-Brake Vortex has large clear openings making it less prone to blockage. The absence of any loose parts also reduces maintenance requirements.

  The patented bypass door and emergency drain down facility allows ACO Q-Brake Vortex to be remotely accessed from the surface to allow the upstream system to be independently drained, completely bypassing the inlet. Building Regulations 2000 Section H discourages direct man access to sewer manholes.

- **Reduces total installed cost**

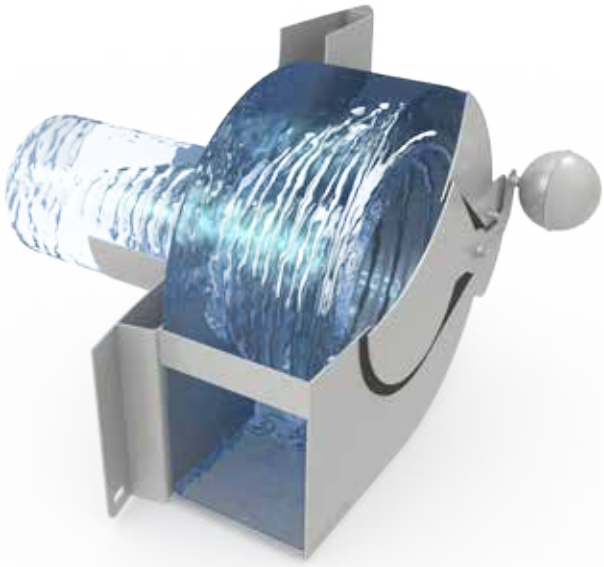
  ACO Q-Brake Vortex allows more flow at lower heads, reducing the need for on-site storage volume requirements and lowering installation costs.

- **Ease of installation**

  Each ACO Q-Brake Vortex unit is custom built to suit the profile of the chamber. Radius fixing options remove the need for additional benching - simplifying installation and reducing cost.

- **MicroDrainage**

  ACO Q-Brake Vortex can be sized and modelled on the latest version of the design software and can be incorporated into the overall hydraulic drainage design.



# Benefits of using a surface water flow control system

Storage and the controlled release of clean water into the natural environment is an important aspect of managing surface water in the SuDS approach. The Floods and Water Management Act now gives overall responsibility to the local regulatory body to impose, where appropriate, the discharge rate of a surface water flow control system.

ACO's range of flow control systems can be used in conjunction with ACO's award-winning attenuation and infiltration system, ACO StormBrixx, to provide a fully integrated storm water control system meeting the requirements of the regulations.

This diagram simulates how the ACO StormBrixx system is used to provide storm water attenuation, whilst the ACO Q-Brake Vortex is used to regulate the rate of discharge from the development into the watercourse or sewer network.

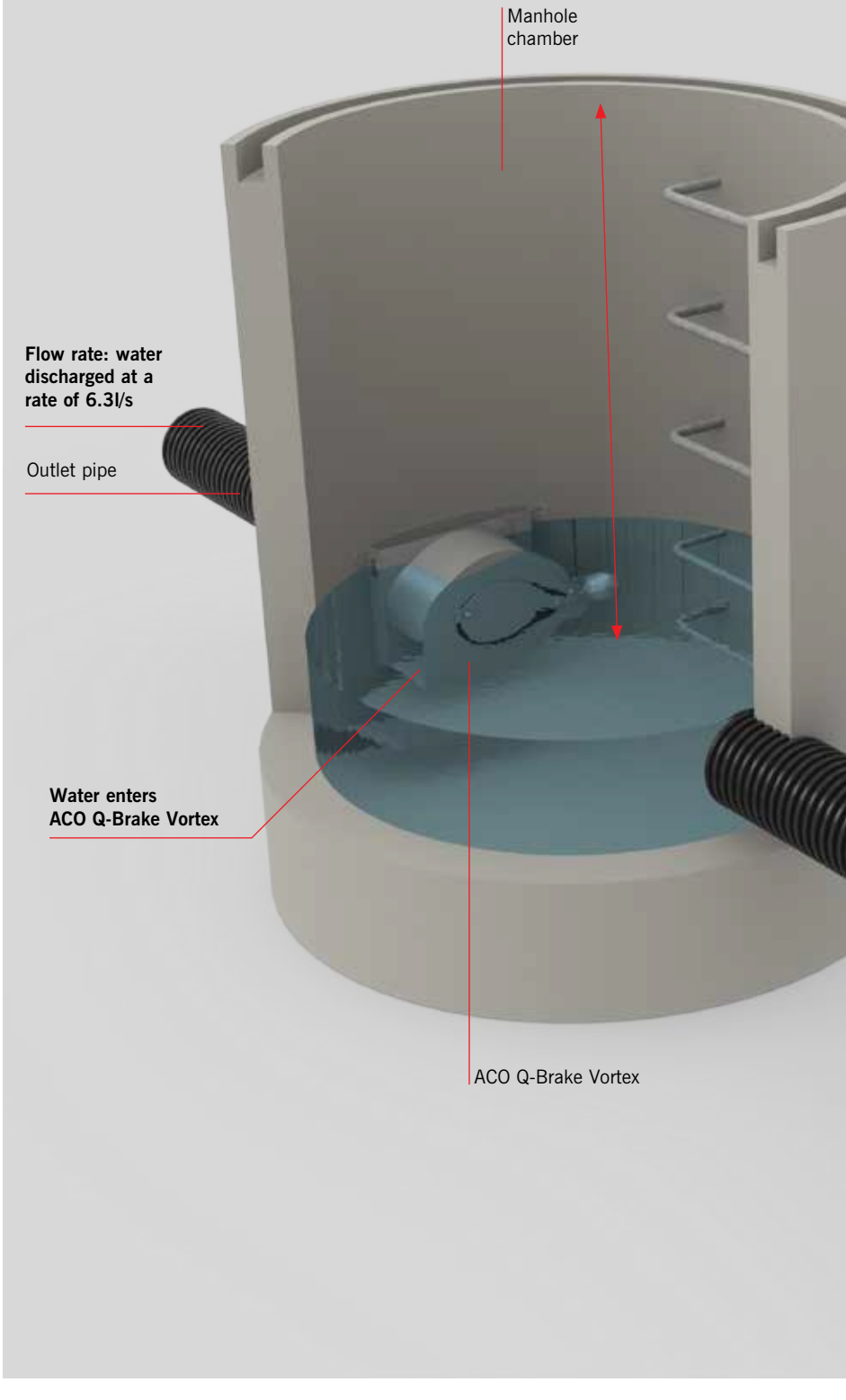
Compared to the use of traditional flow control systems, the combination of ACO StormBrixx and ACO Q-Brake Vortex can reduce the need for additional upstream storage lowering overall installation and maintenance costs.

This benefit is best demonstrated in the example opposite. The conclusion of the example means that upstream storage can be reduced by 11m$^3$ compared to using a traditional flow control system.

For more information on ACO's award winning attenuation and infiltration system, ACO StormBrixx, please go to www.aco.co.uk.

**Example:**

There is a project in Bedford, England with a catchment area of 13,000m$^2$. The project has design criteria of a 1 in 30 year storm and the runoff from the site must not exceed 6.3l/s at a design head of 1.3m.

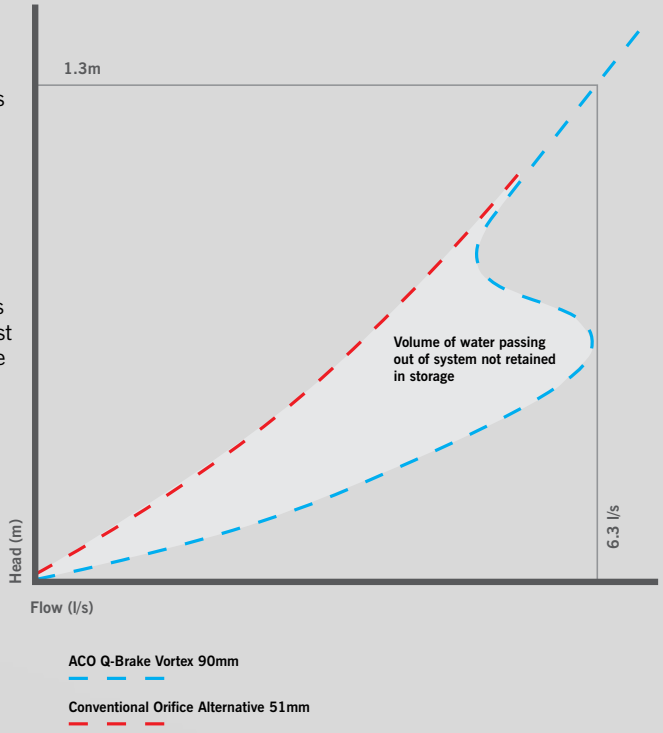


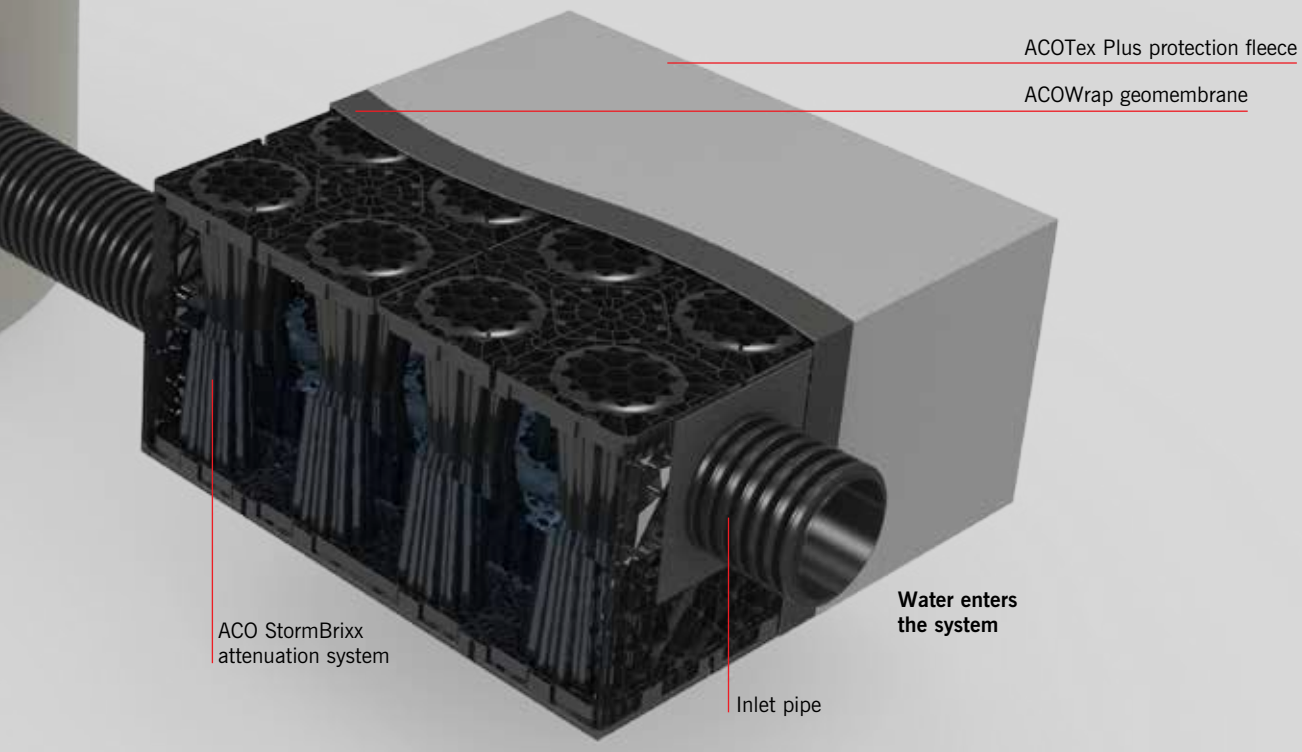
## Results:

Using MicroDrainage® software, ACO has compared the upstream storage requirements using ACO Q-Brake Vortex and a traditional orifice plate. The results are summarised below:

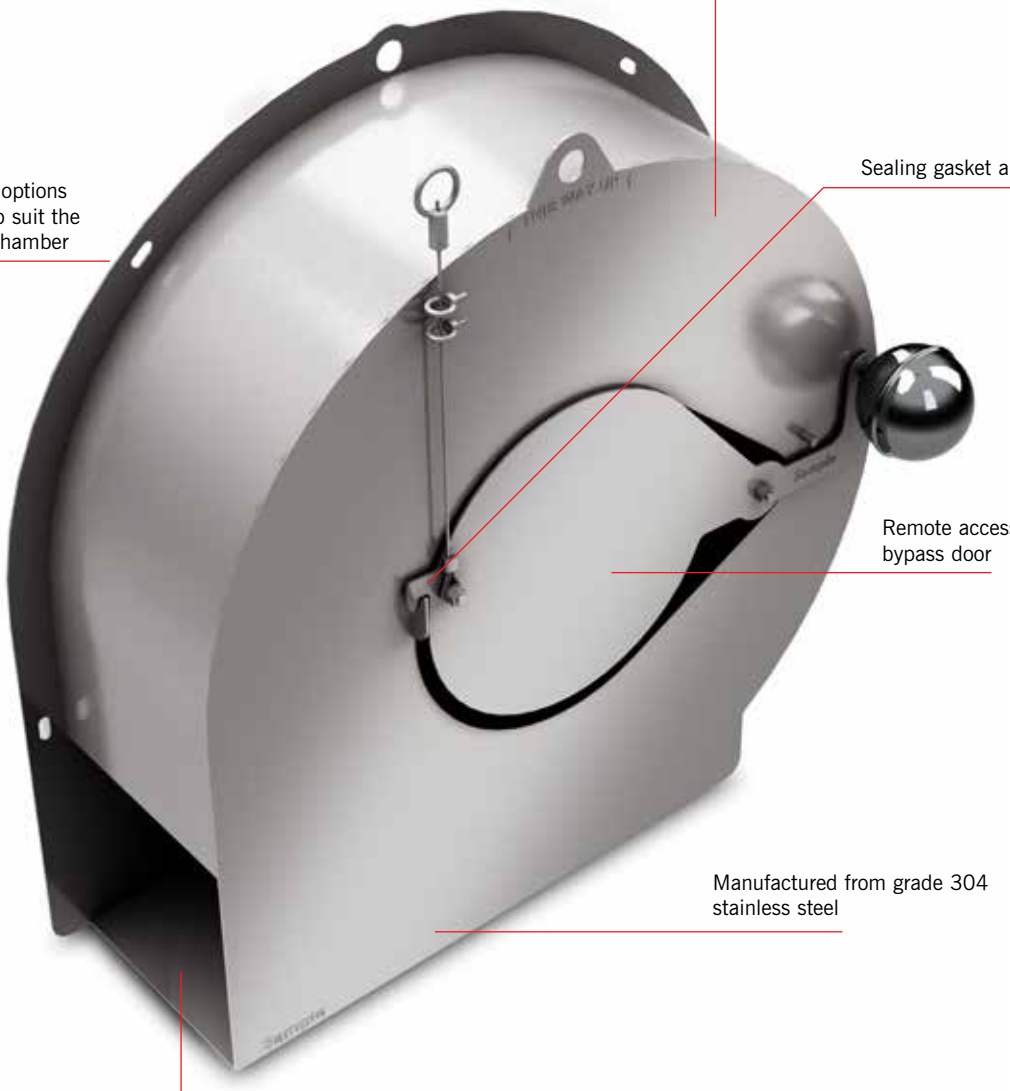
- ACO Q-Brake Vortex required Ø90mm. Upstream attenuation required 402m³.
- Orifice plate size required Ø 51mm. Upstream attenuation required 413m³. ACO Q-Brake Vortex reduces upstream attenuation by 11m3 whilst having an orifice over three times the area of the traditional orifice plate and making ACO Q-Brake Vortex more efficient and far less prone to blockage.

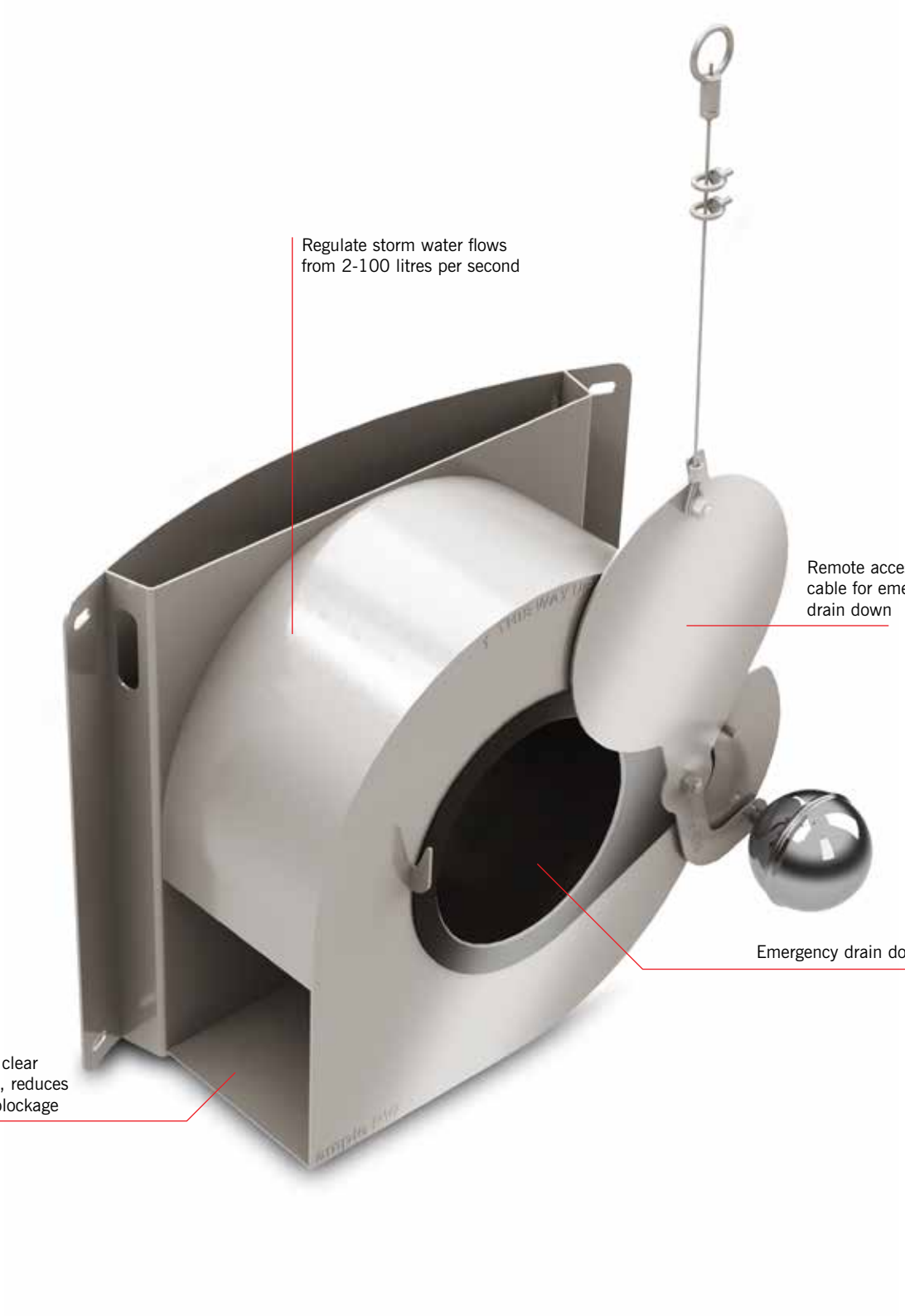
## Discharge characteristics



## ACO Q-BRAKE FLOW CONTROL FEATURES OVERVIEW




Regulate storm water flows
from 2-100 litres per second
Remote access
cable for emergency
drain down
Emergency drain down
Larger* clear
opening, reduces
risk of blockage

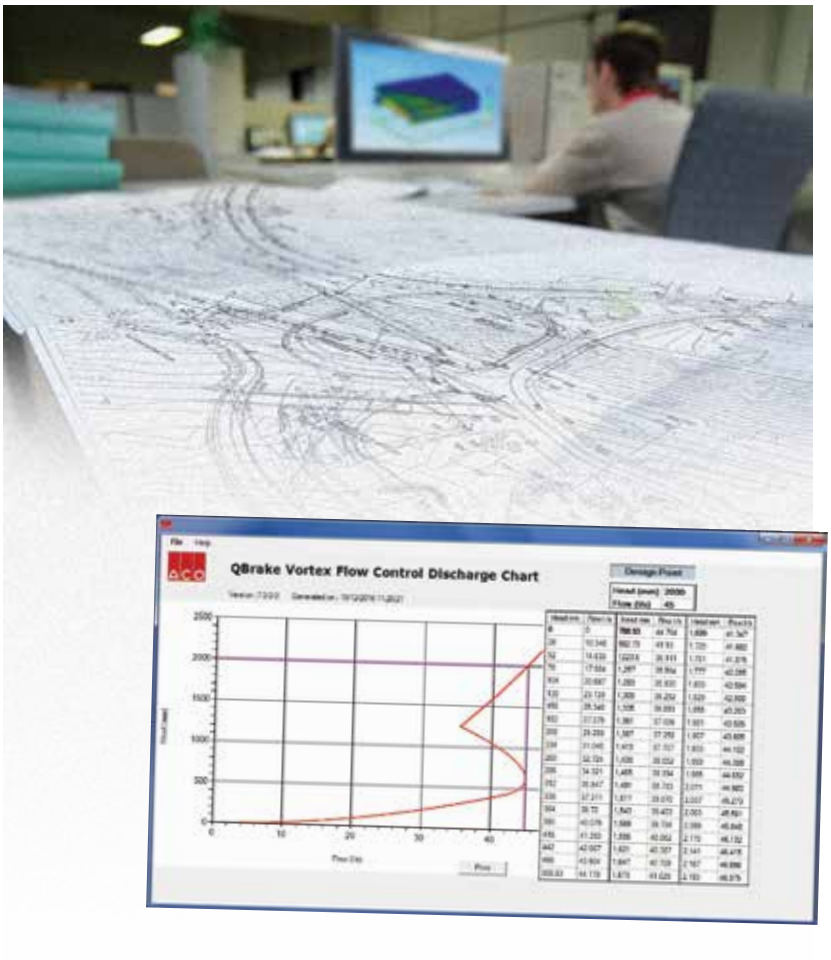
# ACO Q-Brake Vortex specification and design process

Manufactured from grade 304 stainless steel, each ACO Q-Brake Vortex is individually configured to suit specific performance criteria. Our engineers will use industry standard drainage software and hydraulic design calculations to ensure the system is correctly sized for any project requirement.

In order to complete this process and deliver the product options available, please provide the ACO engineers with the following information:

- The proposed design flow – maximum allowable discharge
- The proposed design head – invert of outlet pipe to top water level
- The proposed outlet pipe diameter
- The proposed type and size of outlet manhole

Before production can commerce, ALL of the above information must be verified on ACO's Contract Review Document issued at the time of order placement.




## Finished product

From this information ACO will size and design the ACO Q-Brake Vortex to meet the design criteria and to suit the proposed surface water application.

ACO will supply:

- Head discharge table & graph
- ACO Q-Brake Vortex installation details
- Information for manhole sizing



## ACO Water Management Design Services Team

ACO has embraced the concept of 'value engineering' – a totally new approach to on-site construction that saves both time and money. ACO will review any design to minimise the total scheme and life cost of a proposal.

By utilising ACO's portfolio of products, it is often possible to remove the need for conventional underground drainage.

ACO Water Management Design Services Team

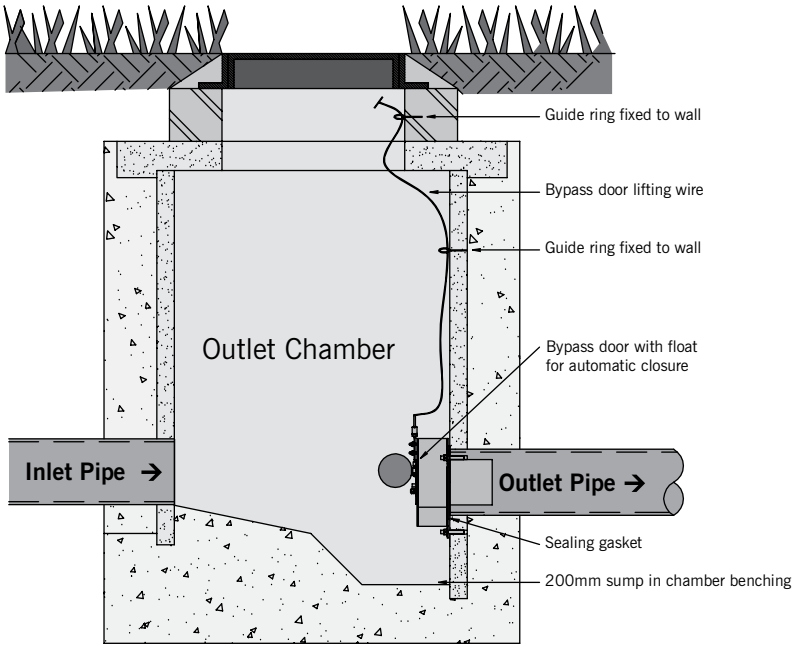
Tel: 01462 816666
Email: technical@aco.co.uk

### Micro Drainage Modelling

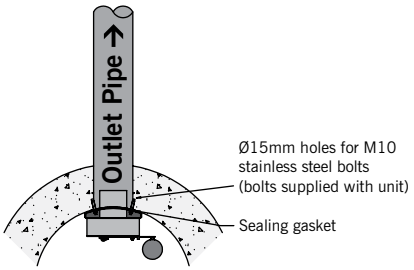
ACO Q-Brake Vortex can be sized and modelled on the latest version of Micro Drainage.

Micro Drainage. an XP Solutions company

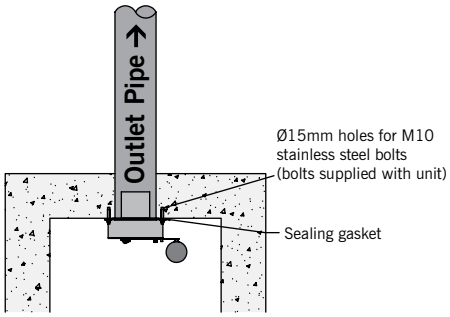
# Installation detail




### Fixing installation detail for round manhole chambers




### Fixing installation detail for flat sided manhole chambers




## Guide to installing ACO Q-Brake Vortex flow control regulator

**Step 1:**

Construct the chamber that is to house the ACO Q-Brake Vortex flow control. Note that if the chamber has a curved wall (e.g. a concrete ring manhole), the diameter of the chamber should be specified on the order and Contract Review Document for the ACO Q-Brake Vortex flow control unit.

**Step 2:**

The base of the chamber must be at a level 200mm below the bottom of the ACO Q-Brake Vortex flow control. When the chamber base is benched, there must be a 200mm deep sump below the bottom of the unit as shown on the sketch.

**Step 3:**

Offer the ACO Q-Brake Vortex flow control unit up to the outlet pipe using the lifting eyes where appropriate. Ensure the unit is upright (arrow pointing vertically up). Mark the position of the fixing holes on the chamber wall. Remove the unit and drill fixing holes to suit the M10 bolts supplied with the unit. (Note bolts are Rawlbolt R-XPT-S stainless steel M10 bolts requiring a hole 15mm diameter).

**Step 4:**

Place bolts into the drilled holes. Locate the ACO Q-Brake Vortex flow control onto the bolts (again check it is upright). Ensure that the gasket is flat against the wall. Fit the nuts and tighten them to pull the unit against the gasket and seal it against the wall.

**Step 5:**

Fix the two wire guide rings (supplied) to the chamber wall, one approx mid height and one just under the access cover. Thread the bypass door lifting wire through the rings. Adjust the length of the wire by fixing the handle in the correct position and cut to length if necessary.

An electronic version of the ACO Q-Brake Vortex installation detail is available to download from the ACO website. Visit www.aco.co.uk.

# Operation and maintenance recommendations

## Commissioning the product

Before the product is commissioned, the chamber containing the ACO Q-Brake Vortex should be inspected in line with normal practice. Any debris or silt should be removed. Any visible fixing bolts should be checked.

If an internal blockage is suspected, the control can be inspected internally and cleaned out by opening the inspection bypass door on the upstream end. The bypass door must be returned to the closed position before the control becomes operational or bolted shut.

## Frequency of inspection / maintenance

Inspections should be carried out at frequent and regular intervals (approximately every 3-6 months). The frequency will depend upon the location and the environment, and should be based on local knowledge. Action is only required in the event of a blockage or suspected blockage.

## Maintenance plan

ACO Q-Brake Vortex flow controls require no routine maintenance although inspections should be carried out at regular intervals (See frequency of inspection / maintenance section).

## Manual handling

ACO Q-Brake Vortex flow controls should be handled in accordance with current legislation and regulations:

- The Health and Safety at Work Act 1974
- The Management of Health and Safety at Work Regulations 1999
- The Manual Handling Operations Regulations 1992

## Service life

ACO Q-Brake Vortex flow controls have no moving parts to wear or fail. Manufactured from grade 304 stainless steel plate they will resist scour, degradation and chemical attack. The unit is designed to easily outlast the drainage system in which it is installed.

## COSHH

ACO Q-Brake Vortex flow controls are manufactured from grade 304 stainless steel. This material is not regarded as hazardous to health and demonstrates no chemical hazard when used for the stated applications.



## MODEL SPECIFICATION CLAUSE

The vortex flow control device shall be supplied by ACO Technologies plc; all materials and components within the scope of this system shall be obtained from this manufacturer.

All units shall be manufactured from grade 304 stainless steel incorporating rear mounted remote access bypass and emergency drain down door complete with stainless steel cable and fixings.

ACO Q-Brake Vortex is a vortex flow control device designed to suit a design head of #mm and design flow of # litres per second.

# Insert information as appropriate

### NBS Specification

ACO Q-Brake Vortex should be specified in section R12. Assistance in completing this clause can be found in the ACO Water Management entry in NBS Plus, or please contact the ACO Water Management Design Services Team.

Note: A specification in NBS format is available to download from www.thenbs.com or www.aco.co.uk

## RECYCLED CONTENT

ACO Technologies aims to incorporate as much recycled material or waste material as is practicable in its manufactured products.

Typically steel products contain between 25% and 33% recycled content by weight. Therefore the total recycled content of the ACO Brake Vortex will contain be at minimum approximately 25% by weight recycled material.

ACO Q-Brake Vortex is intended for a long life with low maintenance, to reduce the need to recycle, but when eventually the product is no longer needed, much of its content can be readily recycled with a very low risk of pollution to the environment.



## Product Testing

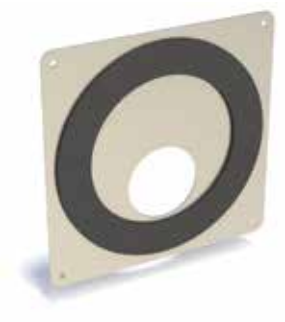
Through ACO's continual product development and refinement programme has led to an enhanced range of ACO Q-Brake Vortex flow controls. The range has been independently tested and complex software written to ensure that the best possible characteristics and curves are achieved to help reduce upstream storage requirements and installation costs.

# What is ACO Q-Plate?

ACO Q-Plate orifice plates are designed for use where an ACO Q-Brake vortex is not the most effective solution. To suit application requirements, the range is available with or without remote bypass and drain down and is designed to match a variety of manhole configurations. A neoprene sealing gasket and fixing holes are featured on each unit.



ACO Q-Plate with remote draindown and bypass recommended for all orifice apertures less than 100mm



ACO Q-Plate



## ACO Q-Plate Bypass features

- Manufactured from 304 stainless steel
- Orifice aperture up to 150mm
- Sealing pipe gasket
- Emergency drain-down and access cable
- Bypass door (with improved seal) and latch
- Flat or curved radius to suit manhole diameter
- Manhole fixings

## ACO Q-Plate features

- Manufactured from 304 stainless steel
- Four fixing positions
- Pipe sealing gasket
- Manhole fixings
- Flat or curved radius to suit manhole diameter

## ACO Q-Plate Specification and design process

To suit project requirements, two options of ACO Q-plate are available:

**ACO Q-Plate Bypass**
< 100mm orifice with remote drain-down and bypass (also available up to 150mm)

**ACO Q-Plate**
>100mm orifice without remote drain-down and bypass

In order to complete this process and deliver the product options available, please provide the ACO engineers with the following information:

- The proposed design flow – maximum allowable discharge
- The proposed design head – invert of outlet pipe to top water level
- The proposed outlet pipe diameter
- The proposed type and size of outlet manhole

Before production can commerce, ALL of the above information must be verified on ACO's Contract Review Document issued at the time of order placement.

### Finished product

From this information ACO will size and design the ACO Q-Plate to meet the design criteria and to suit the prosed surface water application.

ACO will supply:

- Head discharge table & graph
- ACO Q-Plate installation details
- Information for manhole sizing

## Guide to installing an ACO Q-Plate

**Step 1:**

Construct the chamber that is to house the ACO Q-Plate orifice control. Note that if the chamber has a curved wall (e.g. a concrete ring manhole), the diameter of the chamber should be specified on the order and Contract Review Document for the ACO Q-Plate Orifice control unit.

**Step 2:**

There should be a small sump under the outlet to ensure the orifice control does not easily block, ideally there should be upstream sediment and debris traps. When the chamber base is benched, there should be a minimum 200mm deep sump below the bottom of the unit as shown on the sketch.

**Step 3:**

Offer the ACO Q-Plate orifice control unit up to the outlet pipe. Ensure the unit is upright (arrow pointing vertically up) and that the orifice is correctly positioned at the invert of the outlet pipe.

Check there is a good seal between the orifice plate and the outlet pipe. Mark the position of the fixing holes on the chamber wall. Remove the unit and drill fixing holes to suit the bolts supplied with the unit.

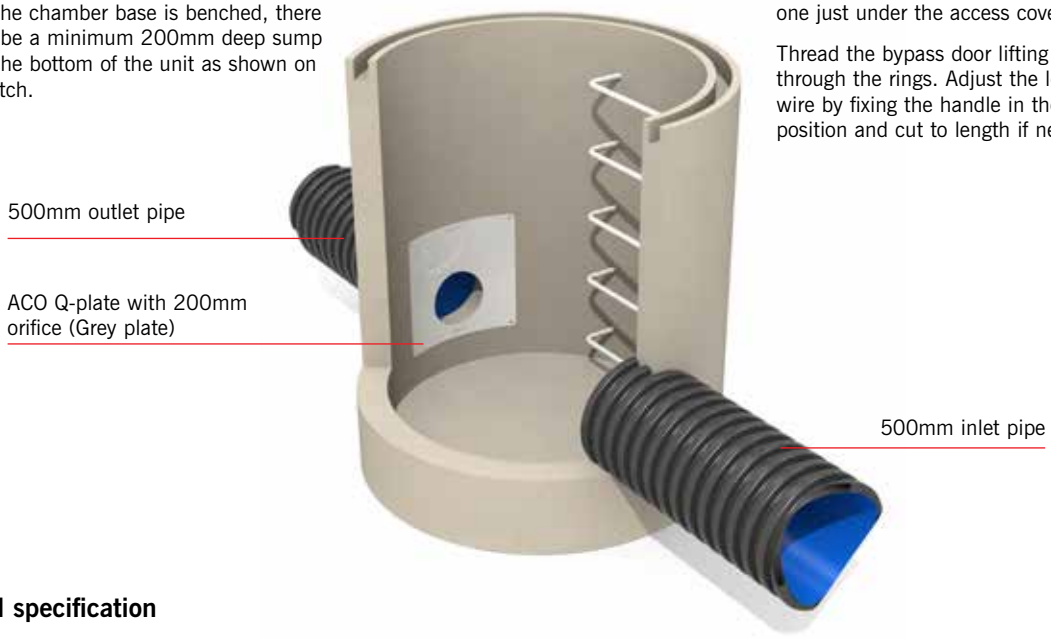
**Step 4:**

Place bolts into the drilled holes. Locate the ACO Q-Plate orifice control onto the bolts (again check it is correctly aligned). Ensure that the gasket is flat against the wall. Fit the nuts and tighten them to pull the unit against the gasket and seal it against the wall.

**Step 5:**

If you have been supplied the Q-Plate with the drain down and bypass door fix the two wire guide rings (supplied) to the chamber wall, one approx mid height and one just under the access cover.

Thread the bypass door lifting wire through the rings. Adjust the length of the wire by fixing the handle in the correct position and cut to length if necessary.




## Model specification

ACO Q-Plate orifice control *with remote drain down and bypass (delete as appropriate), ##mm orifice designed to suit a pipe outlet size of ###mm, a design head of ## mm and design flow of # litres per second.

**#insert information as appropriate.**

**ACO Technologies plc**

- ACO Water Management
  Civils + Infrastructure
  Building + Landscape
- ACO Building Drainage
- ACO Sport
- ACO Wildlife


**ACO Water Management**

A division of ACO Technologies plc
ACO Business Park,
Hitchin Road,
Shefford,
Bedfordshire
SG17 5TE

Tel: 01462 816666
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e-mail Enquiries: awmenquiries@aco.co.uk
e-mail Sales: customersupport@aco.co.uk
e-mail Technical: technical@aco.co.uk

website: www.aco.co.uk


**The ACO Group: A strong family you can depend on.**

ISO 9001
FM 13502

ISO 14001
EMS 538781

OHSAS 18001
OHS 524145


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*PC21724 2025*

**From:** El Khoury, Joy
**To:** Lekh Upadhyaya; Sadriwala, Mohammed
**Cc:** "Abu Ziauddin | nEngineering Inc."; "John Albert"; "Katie Pandey"; Parmar, Kalpit
**Subject:** RE: n2123| 233 Coldwater Ave, orillia 926-381
**Date:** Thursday, June 4, 2026 2:12:54 PM
**Attachments:** image001.png
image003.png
image004.png
image007.png
image008.png
image009.png
image010.png
image011.png
image012.png
image013.png
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QuAD-VFC-Report-QBRAKE - REV 2.pdf

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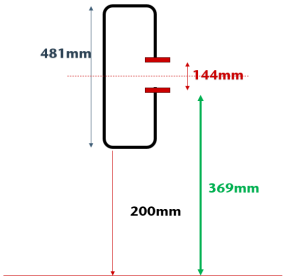
Hello Lekh,

Concerning the minimum sump depth below the vortex flow control :

The min recommended sump under Q-Brake is 200mm to allow potential buildup of silt under the unit without blocking the inlet to the Q-Brake.

The 369mm in our case comes from the size of the Q-brake itself as follows :

- 369mm (distance from the bottom of the outlet pipe to the base of the chamber) comes from body radius (481mm/2=240.5) + 200mm – orifice radius (144/2=72) = 368.5mm.




At 300mm, the sump will be 131mm, which is okay, but we must note that it might increase the risk of blockage, so it might require more regular inspection and maintenance.

The reduction in the sump depth will not affect the outlet flow rate.

I hope this helps.

Best,

Joy El Khoury | Specifications Consultant | Canada East Office
**ACO Systems Ltd.**
2910 Brighton Road
Oakville, ON L6H 5S3
Tel: +1 (905) 829-0665 x2214 | Fax: +1 (905) 829-2908

Cell: +1 (647) 280-1594
Joy.ElKhoury@aco.com | ACO Canada

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West Office: 311-3602 Gilmore Way, Burnaby, BC V5G 4W9 / Tel: +1 604 554-0688

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**From:** Lekh Upadhyaya <lu@nengineering.com>
**Sent:** June 1, 2026 2:09 PM
**To:** Sadriwala, Mohammed <Mohammed.Sadriwala@aco.com>
**Cc:** 'Abu Ziauddin | nEngineering Inc.' <az@nengineering.com>; 'John Albert' <jalbert@ipsconsultinginc.com>; 'Katie Pandey' <KPandey@ipsconsultinginc.com>; Parmar, Kalpit

Appendix E

# Roof Plan and Green Roof Details

LEGEND

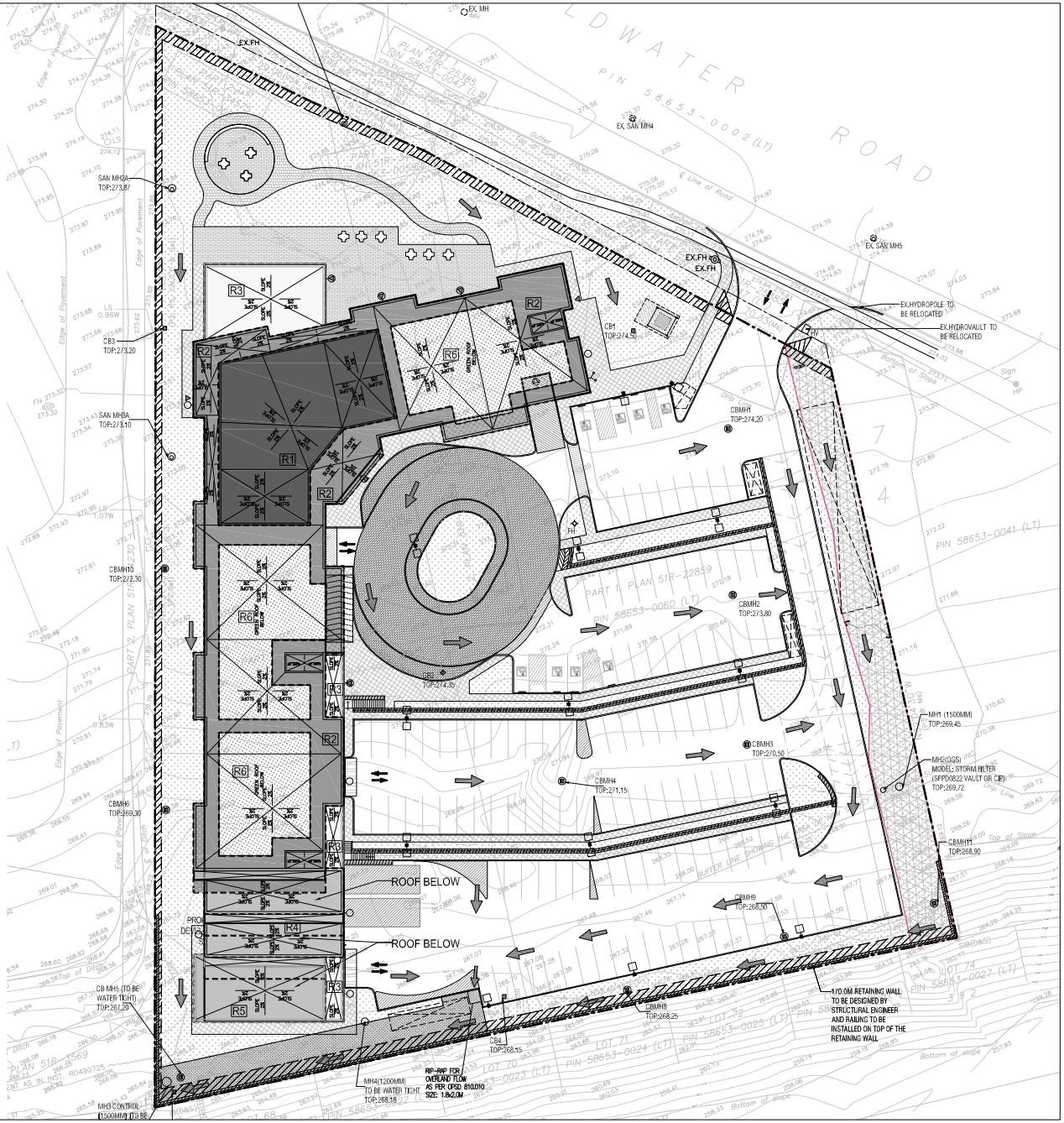
| | |
|---|---|
| R1 | ROOF DRAINAGE AREA IDENTIFICATION |
| | SITE BOUNDARY |
| | DRAINAGE BOUNDARY |
| | OVERLAND FLOW |

| | |
|---|---|
| LOT(SITE) AREA (m²) | 15426.96 (3.81 ACRE) |
| ROAD WIDENING | 350.78 SQM. |
| NET LOT AREA | 15076.18 SQM. (3.72 ACRE) |

ROOF DRAINAGE AREA

| SUBCATCHMENT | ROOF | ROOF | ROOF GREEN | TOTAL | NO. OF ROOF DRAIN |
|---|---|---|---|---|---|
| R1 | | 583.83 | – | 583.83 | 03 |
| R2 | | 1188.95 | – | 1188.95 | 08 |
| R3 | | 290.44 | – | 290.44 | 04 |
| R4 | | 235.56 | – | 235.56 | 02 |
| R5 | | 211.87 | – | 211.87 | 01 |
| R6 | | – | 985.55 | 985.55 | 05 |
| TOTAL | | 2510.65 | 985.55 | 3496.20 | 23 |

NOTE:
1. ROOF R1, R2 AND R3 ARE CONSIDERED FOR ROOF STORAGE AND THE CONTROLLED FLOW IS PROPOSED TO BE DIRECTED TO THE RETENTION CHAMBER TO ACHIEVE THE VOLUME CONTROL REQUIREMENT.
2. ROOF RUNOFF FROM ROOF R4 AND R5 PROPOSED TO BE DISCHARGED TO THE SURFACE.
3. ROOF R6 CONSIDERED AS GREEN ROOF, ACCOUNTED FOR WATER BALANCE CALCULATION.





n Engineering Inc
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Richmond Hill, Ontario. L4B 3J9
T : 4 1 6 . 2 5 6 . 9 7 4 1
E: info@nengineering.com
www.nengineering.com


PROJECT:

**CONDOMINIUM**
**233,249,261**
**COLDWATER ROAD, WEST, ORILLIA**

DRAWING TITLE:

**POST-DEVELOPMENT**
**ROOF DRAINAGE PLAN**

| | |
|---|---|
| DRAWN BY: AZ | DATE: 29 MARCH 2022 |
| CHECKED BY: AZ | SCALE: NTS |
| PROJECT NO.: **21-23** | DRAWING NO.: **DR-103** |

N
(GEODETIC NORTH)
PROJECT NORTH

On-Site Storage Calculator

**Project:** **PROPOSED CONDOMINIUM**

**Project No.:** **n2123**

**Date:** **2-Jun-26**

**Table 2G - 100 Years Storage (R1)**

Equation of IDF:

$$I = AT^{B}$$

I = Rainfall Intensity (mm/hr)
T = Time of Concentration (hr)

| | | | |
|---|---|---|---|
| *R* = | 0.95 | | |
| *A* = | 0.06 | ha | |
| $Q_{release}$ = | 0.004 | $m^3/s$ | |
| | 3.6 | L/s | |

*3 Roof Drains @1.2 L/sec Flow rate*

A= 50
B= -0.722

**Max Storage Required ($m^3$)** **16.39**

| $t_c$ (min) | $i_{100}$ (mm/hr) | $Q_{100}$ ($m^3/s$) | $Q_{stored}$ ($m^3/s$) | Peak Volume ($m^3$) | |
|---|---|---|---|---|---|
| 10 | 182.30 | 0.028 | 0.024 | 14.692 | |
| 20 | 110.52 | 0.017 | 0.013 | 16.113 | |
| 30 | 82.47 | 0.013 | 0.009 | 16.391 | *** |
| 40 | 67.01 | 0.010 | 0.007 | 16.136 | |
| 50 | 57.03 | 0.009 | 0.005 | 15.561 | |
| 60 | 50.00 | 0.008 | 0.004 | 14.772 | |
| 70 | 44.73 | 0.007 | 0.003 | 13.826 | |
| 80 | 40.62 | 0.006 | 0.003 | 12.761 | |
| 90 | 37.31 | 0.006 | 0.002 | 11.601 | |
| 100 | 34.58 | 0.005 | 0.002 | 10.363 | |
| 110 | 32.28 | 0.005 | 0.001 | 9.062 | |
| 120 | 30.31 | 0.005 | 0.001 | 7.705 | |
| 130 | 28.61 | 0.004 | 0.001 | 6.302 | |
| 140 | 27.12 | 0.004 | 0.001 | 4.858 | |
| 150 | 25.80 | 0.004 | 0.000 | 3.377 | |
| 160 | 24.63 | 0.004 | 0.000 | 1.865 | |
| 170 | 23.57 | 0.004 | 0.000 | 0.324 | |

On-Site Storage Calculator

**Project:** **PROPOSED CONDOMINIUM**

**Project No.:** **n2123**

**Date:** **2-Jun-26**

**Table 2H - 100 Years Storage (R2)**

Equation of IDF:

$$I = AT^{B}$$

I = Rainfall Intensity (mm/hr)
T = Time of Concentration (hr)

$R$ = 0.95
$A$ = 0.12 ha
$Q_{release}$ = 0.010 $m^3/s$
9.6 L/s
*8 Roof Drains @1.2 L/sec Flow rate*

A= 50
B= -0.722

**Max Storage Required ($m^3$)** **30.09**

| $t_c$ (min) | $i_{100}$ (mm/hr) | $Q_{100}$ ($m^3/s$) | $Q_{stored}$ ($m^3/s$) | Peak Volume ($m^3$) | |
|---|---|---|---|---|---|
| 10 | 182.30 | 0.057 | 0.048 | 28.556 | |
| 20 | 110.52 | 0.035 | 0.025 | 30.088 | *** |
| 30 | 82.47 | 0.026 | 0.016 | 29.293 | |
| 40 | 67.01 | 0.021 | 0.011 | 27.411 | |
| 50 | 57.03 | 0.018 | 0.008 | 24.879 | |
| 60 | 50.00 | 0.016 | 0.006 | 21.910 | |
| 70 | 44.73 | 0.014 | 0.004 | 18.623 | |
| 80 | 40.62 | 0.013 | 0.003 | 15.092 | |
| 90 | 37.31 | 0.012 | 0.002 | 11.368 | |
| 100 | 34.58 | 0.011 | 0.001 | 7.487 | |
| 110 | 32.28 | 0.010 | 0.001 | 3.475 | |

On-Site Storage Calculator

**Project:** **PROPOSED CONDOMINIUM**

**Project No.:** **n2123**

**Date:** **2-Jun-26**

**Table 2I - 100 Years Storage (R3)**

Equation of IDF:

$$I = AT^{B}$$

I = Rainfall Intensity (mm/hr)
T = Time of Concentration (hr)

| | | | |
|---|---|---|---|
| *R* = | 0.95 | | |
| *A* = | 0.03 | ha | |
| $Q_{release}$ = | 0.005 | $m^3/s$ | |
| | 4.8 | L/s | |

A= 50
B= -0.722

*4 Roof Drains @1.2 L/sec Flow rate*

| **Max Storage Required ($m^3$)** | **5.50** |
|---|---|

| $t_c$ (min) | $i_{100}$ (mm/hr) | $Q_{100}$ ($m^3/s$) | $Q_{stored}$ ($m^3/s$) | Peak Volume ($m^3$) | |
|---|---|---|---|---|---|
| 10 | 182.30 | 0.014 | 0.009 | 5.503 | *** |
| 20 | 110.52 | 0.008 | 0.004 | 4.405 | |
| 30 | 82.47 | 0.006 | 0.002 | 2.738 | |
| 40 | 67.01 | 0.005 | 0.000 | 0.805 | |

# Water Balance Calculation

**Project No: n2123**

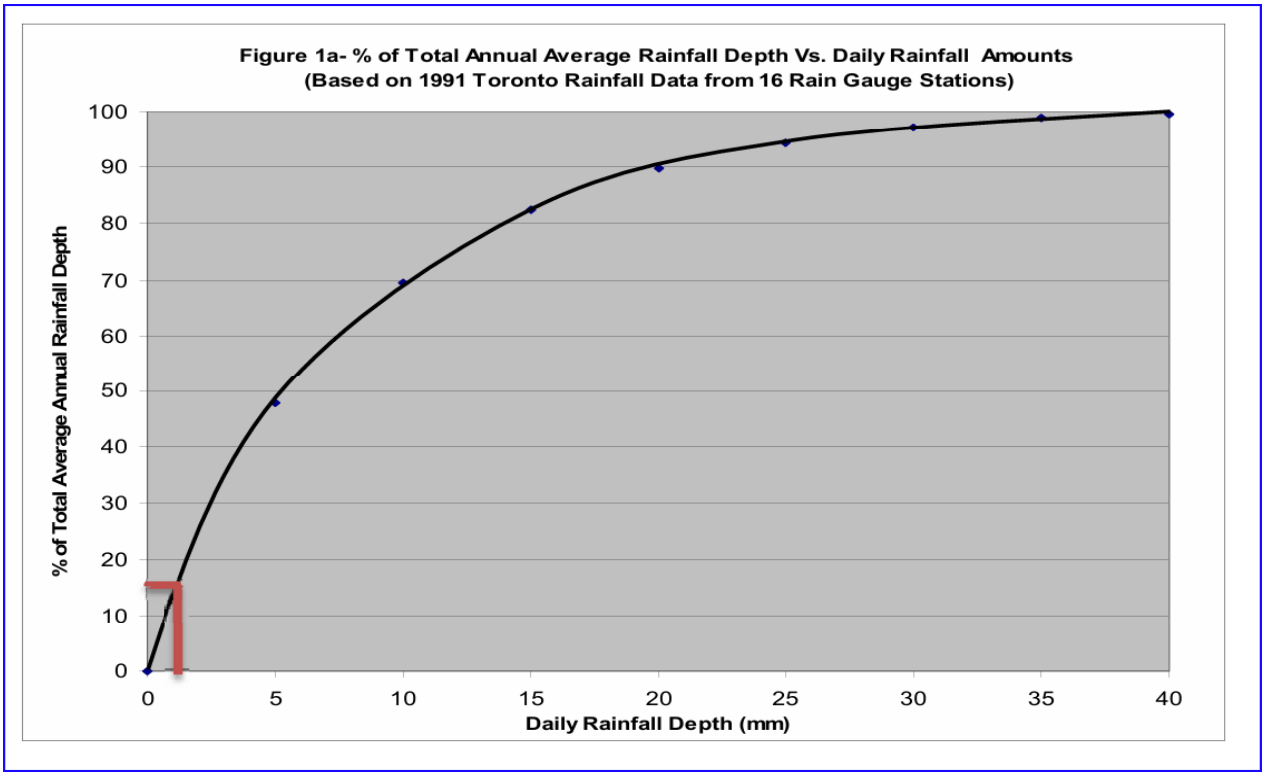
**Address: 233, 249, 261 Coldwater Road**

**6/1/2026**

| | | | |
|---|---|---|---|
| Water Balance Dificit | 2365 | $m^3/yr$ | Note - 1 |
| Total Area | 15076.18 | $m^2$ | Site Plan |
| Dificit | 156.87 | mm/year | Calculated |
| Total Annual Precipitation | 968 | mm/year | Note -1 |
| Percent of Annual Rainfall | 16.21 | % | Calculated |
| Depth of Max Rainfall Event | 40 | mm | Note -2 |
| Required Depth | 1.0 | mm | Figure 1a |
| Required Volume for Water Balance | 15.1 | $m^3$ | Calculated |

Note:

1. Hydrogeological Study - Prepared by SLR dated december 05,2025
2. Based on Percentage (%) of total annual rainfall depth vs. daily rainfall amount curve derived from 1991 Toronto rainfall data from 16 rain gauge stations, statistically 100% of average rainfall event depths are 40mm and less, which means that if the proposed infiltration facility can capture 40mm rainfall event,it will capture 100% of total annual rainfall volume.



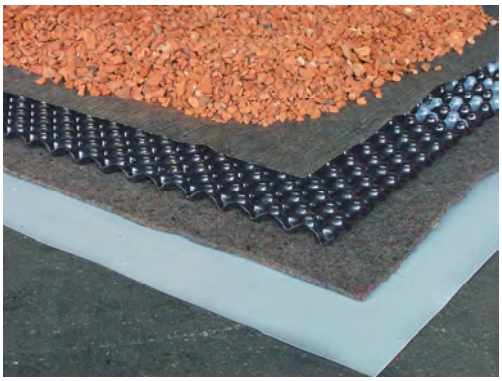
# Sedum Roof Plus (XL)

**The time-tested ecological protection layer**

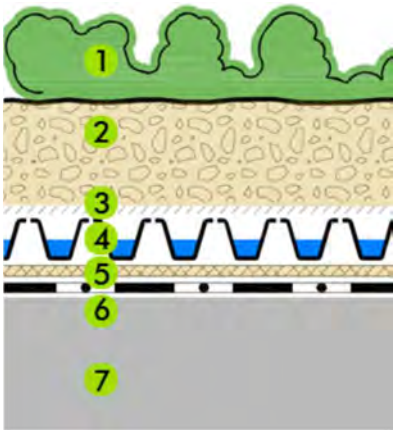
As the name suggests, this green roof system builds on a plant palette dominated by sedum species but in-cludes various drought tolerant upright perennials and grasses. Increased water retention and soil depth pro-vide for a wider range of plant choices and a more dynamic visual effect.

## FLORADRAIN FD25-E

The superior ZinCo Floradrain FD25 element creates a durable, proven and continuous layer underneath the growing medium that is able to store stormwater, carry off excess stormwater and provide air to the root system of the vegetation. It is made for easy installation without the use of heavy tools.



## Assembly:




1. Plant Material (Sedum + Uprights)
2. Growing Medium ZinCoblend E Depth 100-120 mm.
3. ZinCo Filter Sheet SF
4. ZinCo Floradrain ® FD25-E
5. Protection mat ZinCo TSM32
6. ZinCo Root Barrier WSF40

7. Roof Construction with Waterproofing Membrane




## Planting Options:



Plug Plants



Pre-grown vegetation mat

## Features:

- Compact and light weight
- Minimum maintenance
- No irrigation / simple irrigation
- Planting: sedum, perennials & grasses
- Easy installation
- More diverse plant palette

| | |
|---|---|
| Slope: | 2-5 degrees |
| Saturated weight: | 127 kg/m2 (30 psf) |
| Height: | 120 - 140mm (5 - 6") |
| Retention capacity: | 48 L/m2 |

**ZinCo Canada Inc.**
P.O. Box 29 · Carlisle · L0R 1H0 · Ontario
Phone 1-905-690-1661 · Fax 1-905-689-0432
greenroof@zinco.ca · www.zinco.ca

# Sedum Roof Plus (XL)

## The time-tested ecological protection layer



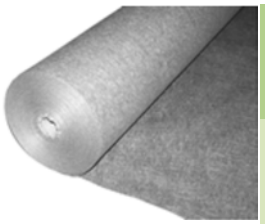
**Special plants for extensive green roofs.** Available species: sedums, grasses and drought resistant perennials. For information about plant lists see page 4-6 or contact us at: 905-690-1661 or e-mail: greenroof@zinco.ca

| Product | Art. Nr. | Size of Delivery |
|---|---|---|
| Sedum Cuttings | 8300 | Per pound |
| Plug plants tray of 50 | 8200 | Plug |
| Plug plants tray of 72 | 8220 | Plug |
| Pre-grown vegetation mat | 8100 | Approx. 1,0 x 2,00 m mats |



**Growing medium for extensive Green Roofs ZinCoblend –E** are produced using recycled materials and minerals, enriched with high quality compost elements, resistant to flying sparks, frost-resistant, stable structure. Special engineered by ZinCo Canada and meets the FLL-standards for Planning, Execution and Upkeep of Green Roof sites.

| Product | Art. Nr. | Size of Delivery |
|---|---|---|
| ZinCoblend-E - Bulk | 6110 | Per cubic meter |
| ZinCoblend-E - Big Bag | 6120 | Per cubic meter |



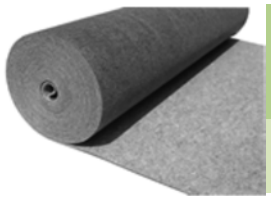
**ZinCo filter sheet SF** made of non-rotting thermally consolidated polypropylene. Used in combination with the Floradrain elements. Water flow rate: 70 l/(m2s) if there is a water column of 100 mm. Apparent opening size: d90%= 95 µm. Weight: 100 g/m2. Thickness: 0.60 mm. Penetration force: 1100 N.

| Product | Art. Nr. | Size of Delivery |
|---|---|---|
| Filter Sheet SF | 2100 | Approx. 2.00 m x 100.00 m roll |
| Filter Sheet SF | 2101 | Approx. 2.00 m x 10.00 m sheet |
| Filter Sheet SF | 2102 | Approx. 1.00 m x 100.00 m roll |



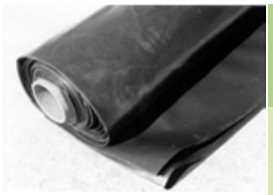
**ZinCo drainage and water retaining element Floradrain ® FD25-E** for extensive green roofs. Made of recycled polyethylene, with water retaining troughs and openings for ventilation and evaporation as well as a multidirectional drainage channel system. Bitumen resistant - Max. compressive strength > 270 kN/m2. Water storage capacity: 3 l/m2. Weight: approx. 1,7 kg/m2. Height: 25 mm

| Product | Art. Nr. | Size of Delivery |
|---|---|---|
| Floradrain® FD 25-E | 3028 | Approx. 1,00 x 2,00 m elements |
| Floradrain® FD 25-R | 3023 | Approx. 1,00 x 15,00 m roll |
| Floradrain® FD 25-RV | 3022 | Approx. 1,00 x 15,00 m roll (incl. Filter Sheet) |



**ZinCo moisture and protection mat TSM32** made of high quality recycled non-rotting polypropylene fibers for water- and nutrient retention as well as a protection layer. Thickness: 3 mm. Weight approx. 320 g/m2. Water retention capacity: 31/m2. Penetration force: > 2000 N. Bitumen resistant - Biologically and chemically neutral - tear proof

| Product | Art. Nr. | Size of Delivery |
|---|---|---|
| TSM 32 | 2032 | Approx. 2.00 m x 50.00 m roll |



**ZinCo root barrier WSF 40** (Optional item if non root-resistant waterproofing used.) made of high density polyethylene for extensive Green Roofs - Bitumen and polystyrol resistant - Without plasticizer - tear-proof - UV-stabilized. Thickness: 0,34 mm. Weight: 320 g/m2. Tensile strength: 40 - 47 N/mm$^{2.}$

| Product | Art. Nr. | Size of Delivery |
|---|---|---|
| WSF 40 | 1040 | Approx. 8.00 m x 25.00 m roll |
| WSF 40 | 1041 | Approx. 6.25 m x 20.00 m roll |
| WSF 40 | 1043 | Approx. 2.00 m x 50.00 m roll |
| WSF 40 | 1044 | Approx. 3.00 m x 33.50 m roll |
| WSF 40 | 41040 | Approx. 6.25 m x 3.20 m sheet |

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# Sedum Roof Plus (XL)

**The time-tested ecological protection layer**

## Plant Suggestions "Base Planting":

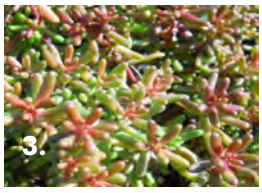
Quantity 20-25 plants/m2

| | Name: | Height: | Colour: | Zone: | Flower: | Size: |
|---|---|---|---|---|---|---|
| 1. | Sedum album | 15 cm | green | 4 | white | plug |
| 2. | Sedum album "Coral Carpet" | 5 cm | green/red | 4 | white | plug |
| 3. | Sedum album "Murale" | 5 cm | green | 4 | white | plug |
| 4. | Sedum floriferum "Weihenstephaner Gold | 10 cm | green | 3 | yellow | plug |
| 5. | Sedum hybridum "Immergrunchen" | 15 cm | red/green | 4 | yellow | plug |
| 6. | Sedum hybridum "Czar's Gold" | 15 cm | green | 3 | yellow | plug |
| 7. | Sedum kamschaticum | 10 cm | green | 4 | yellow | plug |
| 8. | Sedum reflexum | 15 cm | green/gray | 3 | yellow | plug |
| 9. | Sedum rupestre "Angelina" | 12 cm | yellow | 4 | yellow | plug |
| 10. | Sedum rupestre "Blue Spruce" | 15 cm | blue/gray | 3 | yellow | plug |
| 11. | Sedum rupestre "Green Spruce" | 15 cm | green | 3 | yellow | plug |
| 12. | Sedum sexangular | 10 cm | green | 4 | yellow | plug |
| 13. | Sedum spurium album | 15 cm | green | 4 | white | plug |
| 14. | Sedum spurium "Fuldaglut" | 15 cm | green/red | 3 | red | plug |
| 15. | Sedum spurium "John Creech" | 10 cm | green | 3 | pink | plug |
| 16. | Sedum spurium "Roseum" | 15 cm | green | 4 | pink | plug |
| 17. | Sedum spurium "Voodoo" | 10 cm | red | 4 | red | plug |

** note: for base planting no irrigation required*



















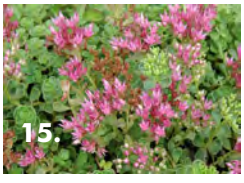

















(Plant list single uprights see next page)

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# Sedum Roof Plus (XL)

**The time-tested ecological protection layer**

## Plant suggestions "Single Uprights":

Quantity: 4-5 plants/m2

| | Name: | Height: | Colour: | Zone: | Flower: | Size: |
|---|---|---|---|---|---|---|
| 1. | Achillea tomentosa | 20 cm | gray/green | 2 | yellow | plug |
| 2. | Allium cernuum | 50 cm | green | 3 | pink | plug |
| 3. | Allium millennium | 40 cm | green | 4 | pink | plug |
| 4. | Antennaria dioica | 12 cm | silver/green | 2 | pink | plug |
| 5. | Aquilegia canadensis | 40 cm | green/blue | 2 | red | plug |
| 6. | Aster alpinus | 25 cm | green | 3 | purple | plug |
| 7. | Aurinia saxatilis "Compacta" | 15 cm | green | 3 | yellow | plug |
| 8. | Campanula portenschlagiana | 30 cm | green | 4 | blue | plug |
| 9. | Cerastium tomentosum | 15 cm | gray | 2 | white | plug |
| 10. | Coreopsis lanceolate | 50 cm | green | 4 | yellow | plug |
| 11. | Coreopsis verticillata 'Zagreb' | 40 cm | green | 4 | yellow | plug |
| 12. | Dalea candida | 50 cm | green | 3 | white | plug |
| 13. | Dalea purpurea | 50 cm | green | 3 | purple | plug |
| 14. | Dianthus gratianopolitanus | 25 cm | silver/blue | 3 | pink | plug |
| 15. | Erigeron glaucus | 30 cm | green | 2 | lilac | plug |
| 16. | Festuca glauca "Pepindale Blue" | 25 cm | blue | 3 | blue | plug |

** note: when using single upright plants a simple irrigation is recommended (see page 3)*





















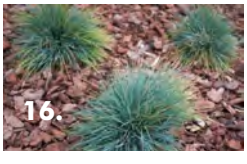













(Remaining list see next page)

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# Sedum Roof Plus (XL)

**The time-tested ecological protection layer**

## Plant suggestions "Single Uprights":

Quantity: 4-5 plants/m2

| Name: | | Height: | Colour: | Zone: | Flower: | Size: |
|---|---|---|---|---|---|---|
| 16. | Galium verum | 30 cm | green | 3 | yellow | plug |
| 17. | Gypsophila repens | 15 cm | blue/green | 3 | white/pink | plug |
| 18. | Helianthemum nummularium | 15 cm | green | 4 | orange | plug |
| 19. | Hieracium alpinum | 20 cm | green | 3 | yellow | plug |
| 20. | Koeleria macrantha | 30 cm | gray/green | 3 | green | plug |
| 21. | Phlox subulata "Emerald Blue" | 12 cm | green | 3 | lavender | plug |
| 22. | Phlox subulata "Snowflake" | 12 cm | green | 3 | white | plug |
| 23. | Potentilla verna nana | 15 cm | green | 3 | yellow | plug |
| 24. | Prunella grandiflora | 25 cm | green | 4 | white | plug |
| 25. | Rudbeckia hirta | 50 cm | green | 3 | yellow | plug |
| 26. | Saponaria ocymoides | 25 cm | green | 2 | pink | plug |
| 27. | Sedum spectabile "Autumn Fire" | 40 cm | green | 3 | pink | plug |
| 28. | Sesleria caerulea | 40 cm | blue/green | 4 | purple | plug |
| 29. | Silene acaulis | 10 cm | green | 2 | pink | plug |
| 30. | Sporobolus heterolepis | 60 cm | green | 3 | pink | plug |
| 31. | Veronica whitleyi | 5 cm | green | 3 | purple | plug |

** note: when using single upright plants a simple irrigation is recommended (see page 3)*

































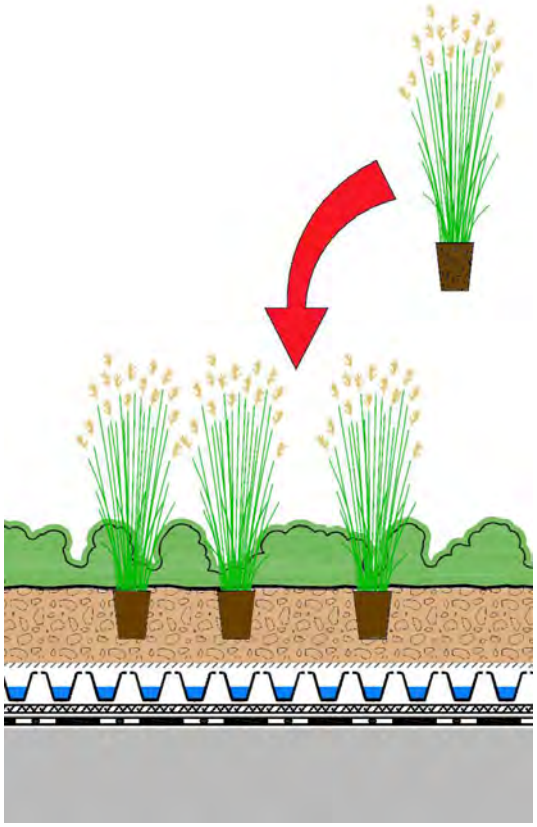

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# Sedum Roof Plus (XL)

**The time-tested ecological protection layer**

## COMBINATION OF SEDUM MATS AND SINGLE UPRIGHTS

To create more interest and height in the planting design, it is possible to combine the sedum mats and single upright perennials or grasses. The plug size single uprights can be planted through the sedum mat into the growing medium underneath.





*Plug size single uprights*



*Pre-grown sedum mat*

## FEATURES:

- Using standard nursery stock - No lead time.
- Cost effective.
- Full coverage right after installation.
- Provides design options.
- Creates interest and height.
- Recommended quantity: 5 plant/m2.



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# Sedum Roof

## The economic and attractive way of green roofing

With a plant palette consisting of hardy drought tolerant sedum species this is the green roof system with low cost, simple installation, light weight and low maintenance requirements. Colourful and long lasting, a green roof system with the perfect mix of low cost and durability.

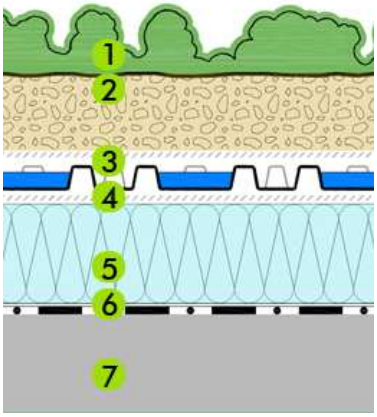
## FIXODRAIN XD20

The Fixodrain offers an economically attractive alternative without sacrificing quality. The Fixodrain XD 20 offer drainage, water retention and attached filter sheet for ease of installation. Fixodrain comes in rolls with interlocking side connectors for a fast continuous installation and is available for larger roof areas.



Fixodrain ® XD 20

## Assembly:




1. Plant Material (Sedum)
2. Growing Medium ZinCoblend E Depth 60-80 mm.
3. ZinCo Fixodrain ® XD20
4. Diffusion Membrane ZinCo TGV21
5. XPS Insulation
6. ZinCo Root Barrier WSF40
7. Roof Construction with Waterproofing Membrane

## Planting Options:



Plug Plants



Pre-grown vegetation mat




## Features:

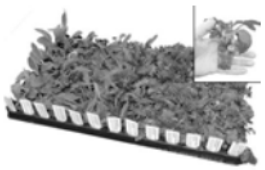
- Compact and light weight
- Minimum maintenance
- No irrigation
- Planting: low growing sedum
- Easy installation
- Economical and attractive

| | |
|---|---|
| **Slope:** | 2-5 degrees |
| **Saturated weight:** | 102 kg/m² (21 psf) |
| **Height:** | 80-100 mm (3"-5") |
| **Retention capacity:** | 37 - 44 L/m² |

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# Sedum Roof

## The economic and attractive way of green roofing



**Special plants for extensive green roofs**. Available species: Sedums. For information about plant lists and availability please contact us at: 905-690-1661 or e-mail: greenroof@zinco.ca

| Product | Art. Nr. | Size of Delivery |
|---|---|---|
| Sedum Cuttings | 8300 | Per pound |
| Plug plants tray of 50 | 8200 | Plug |
| Plug plants tray of 72 | 8220 | Plug |
| Pre-grown vegetation mat | 8100 | Approx. 1,0 x 2,00 m mats |



**Growing medium for extensive Green Roofs ZinCoblend –E** are produced using recycled materials and minerals, enriched with high quality compost elements, resistant to flying sparks, frost-resistant, stable structure. Special engineered by ZinCo Canada and meets the FLL-standards for Planning, Execution and Upkeep of Green Roof sites.

| Product | Art. Nr. | Size of Delivery |
|---|---|---|
| ZinCoblend-E - Bulk | 6110 | Per cubic meter |
| ZinCoblend-E - Big Bag | 6120 | Per cubic meter |



**ZinCo drainage, water retaining and protection element Fixodrain ® XD 20** for large scale extensive Green Roofs. Made of polypropylene with attached filter sheet. Max. compressive strength > 50 kN/m2. Water storage capacity: 3 l/m2. Weight: approx. 1.0 kg/m2. Height: 20 mm.

| Product | Art. Nr. | Size of Delivery |
|---|---|---|
| Fixodrain® XD 20 | 3021 | Approx. 1,00 x 20,00 m roll (incl. Filter Sheet) |




TO BE USED FOR INVERTED ROOFS

Air and vapour permeable membrane **ZinCo diffusion membrane TGV21** made of thermal consolidated Polypropylene. Bitumen resistant – Biologically and Chemically neutral. Vapour opening size Sd ≤ 0,01 m) Thickness: 0,55 mm. Weight: 80 g/m².

| Product | Art. Nr. | Size of Delivery |
|---|---|---|
| TGV21 | 2180 | Approx. 1,60 x 250,00 m roll |
| TGV21 | 2185 | Approx. 1.60 x 50 m roll |



TO BE USED FOR CONVENTIONAL ROOFS

**ZinCo separation and protection mat TSM 32** made of recycled non-rotting polyester fibers for water- and nutrient retention as well as a protection layer. Thickness: 3 mm. Weight approx. 320 g/m2. Water retention capacity: 3 L/m2. Bitumen resistant - Biologically and chemically neutral - Heat resistant.

| Product | Art. Nr. | Size of Delivery |
|---|---|---|
| TSM32 | 2032 | Approx. 2.00 m x 50.00 m roll |
| TSM32 | 42035 | Approx. 2.00 m x 10.00 m roll |



**ZinCo root barrier WSF 40** (Optional item if non root-resistant waterproofing used.) made of high density polyethylene for extensive Green Roofs - Bitumen and polystyrol resistant - Without plasticizer - tear-proof - UV-stabilized. Thickness: 0,40 mm. Weight: 380 g/m2

| Product | Art. Nr. | Size of Delivery |
|---|---|---|
| WSF 40 | 1040 | Approx. 8.00 m x 25.00 m roll |
| WSF 40 | 1041 | Approx. 6.25 m x 20.00 m roll |
| WSF 40 | 1043 | Approx. 2.00 m x 50.00 m roll |
| WSF 40 | 1044 | Approx. 3.00 m x 33.50 m roll |
| WSF 40 | 41040 | Approx. 6.25 m x 3.20 m sheet |

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# Sedum Roof

## The economic and attractive way of green roofing

### Plant Suggestions:

| | Name: | Height: | Colour: | Zone: | Flower: |
|---|---|---|---|---|---|
| 1. | Sedum album | 150 mm | green | 4 | white |
| 2. | Sedum album “Coral Carpet” | 50 mm | green/red | 4 | white |
| 3. | Sedum album “Murale” | 50 mm | green | 4 | white |
| 4. | Sedum floriferum “Weihenstephaner Gold | 100 mm | green | 3 | yellow |
| 5. | Sedum hybridum “Immergrunchen” | 150 mm | red/green | 4 | yellow |
| 6. | Sedum hybridum “Czar’s Gold” | 150 mm | green | 3 | yellow |
| 7. | Sedum kamschaticum | 100 mm | green | 4 | yellow |
| 8. | Sedum reflexum | 150 mm | green/gray | 3 | yellow |
| 9. | Sedum rupestre “Angelina” | 120 mm | yellow | 4 | yellow |
| 10. | Sedum rupestre “Blue Spruce” | 150 mm | blue/gray | 3 | yellow |
| 11. | Sedum rupestre “Green Spruce” | 150 mm | green | 3 | yellow |
| 12. | Sedum sexangular | 100 mm | green | 4 | yellow |
| 13. | Sedum spurium album | 150 mm | green | 4 | white |
| 14. | Sedum spurium “Fuldaglut” | 150 mm | green/red | 3 | red |
| 15. | Sedum spurium “John Creech” | 100 mm | green | 3 | pink |
| 16. | Sedum spurium “Roseum” | 150 mm | green | 4 | pink |
| 17. | Sedum spurium “Voodoo” | 100 mm | red | 4 | red |













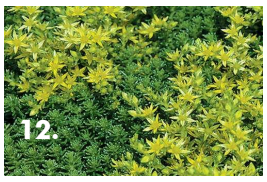























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# Specification Suggestion
# "Sedum Roof" with Fixodrain® XD 20



**SPEC NOTE:**

This guide specification gives general information about the ZinCo green roof assembly. It has to be clear, that the information that is shown must be understood as guide and recommendations.

It is possible that your green roof project need special technical requirements. Please contact us for further information regarding technical advice, specifications and budget cost.

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## PART 1 – GENERAL

### TECHNICAL DATA

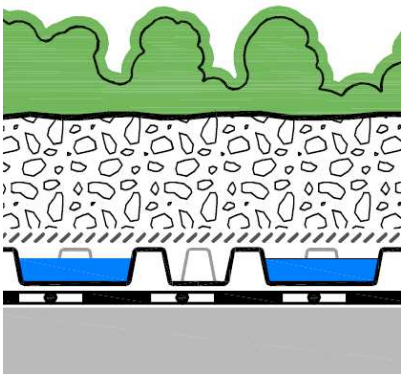
**Depth:**
80 or100 mm (3"-4")

**Saturated weight:**
102 kg/m$^2$ (21 lbs/ft$^2$)

**Water retention capacity:**
40 L/m$^2$

**Slope:**
2-5 degrees

*SECTION*




**Section includes:**

1. Plant Community: "Sedum Carpet"
2. Growing Medium ZinCo Blend-E. Depth: 60 or 80 mm (2.5 or 3.0")
3. Filter Sheet ZinCo SF
4. Drainage Element ZinCo Fixodrain® XD 20
5. Separation Sheet ZinCo TSM32
6. Related Materials:
   - ZinCo Root Barrier WSF40
   - Inspection Chamber KS6
   - Gravel Retainer KL60/80
   - Gravel Strip

### REFERENCES

- The ZinCo "Sedum Roof" assembly meets or exceed the requirements of the FLL-standards (Guideline for Planning, Execution and Upkeep of Green-Roof Sites, Release 2008).

- The ZinCo "Sedum Roof" meets or exceed the Toronto Green Roof Construction Standard (Toronto Municipal Code Chapter 492, Article IV).

### DEFINITIONS

- **Green Roof:** A Green Roof is an innovative, multi-layered system that covers all types of waterproofed roof surfaces with growing medium and plant material.

- **Extensive Green Roof:** A vegetated ecological protection that is light weight, has a low growing medium depth, has a natural/native plant selection, and has low maintenance and low installation costs.

- **Sedum:** Sedum is a large and diverse group of durable Green Roof plants known for its fleshy succulent foliage and stalks of yellow, pink or white flowers. Sedum is very easy to care for, low maintenance plants and once established are drought tolerant.

### SUBMITTALS

- Submit signed shop drawings showing that the roofing system, green roof assembly, materials, perimeter and penetration details and fall protection are accepted by the green roof manufacturer to ensure that the green roof system meets the necessary performance requirements.

- Submit a certification showing that all the components of the green roof assembly are supplied and warranted by the green roof manufacturer.

- Submit an inspection report, signed by the roof contractor and the green roof contractor, resulting from the quality control of the roofing system installation prior to the installation of the green roof assembly indicating that the roofing system is installed correctly.

- Submit references which indicate that the green roof manufacturer as well as the green roof contractor has recently successfully completed projects of similar scope and nature.

### QUALITY ASSURANCE

- **Installers Qualifications:** Work of this section shall be installed by a recognized green roof or landscape contractor, approved by ZinCo Canada Inc. The contractor shall have adequate equipment, skilled workers with extensive practical experience, skills and knowledge of plants horticulture techniques and overall landscape design requirements.

- Roof details such as flashing, roof edges, roof penetrations, outlets, roof fall and type of insulation must be adjusted to the Green Roof assembly used. ZinCo Canada Inc. provides consultation and engineering to (landscape) architects, roof contractors and green roof contractors to finalize these adjustments before construction of the roof commences, if requested.



Subject to technical aternations and printing errors – First edition 2007; Revised 10/2017

- Prior to the installation of the green roof system, test the water tightness of the roofing system by flood testing for at least a 48 hour period or an electronic leak detection process performed by a qualified testing agency.

- Submit documentation certifying that he load bearing capacity of the roof and building construction is tested and approved by an structual engineer, with regard to the extra weight of the Green Roof system.

- Submit Wind uplift study in conformance with the National Building Code of Canada, sealed and signed by Professional Engineer.

**ENVIRONMENTAL CONDITIONS**

- The plant community should be chosen in consideration of the climatic circumstances and hardiness zone. Please contact ZinCo Canada Inc. for more information.

- Proceed with planting between spring and early fall so as to enable plants to take root in order to survive the winter months.

- Provide a temporary fall protection (safety railing or fall arrest) during the installation to ensure a safe and healthy work environment.

- Provide a permanent fall protection (safety railing or fall arrest) for maintenance to ensure a safe and healthy work environment.

**DELIVERY, STORAGE & HANDLING**

- By storage on the roof makes sure that the load of the materials does not exceed the load bearing capacity of the roof and building construction
-

- Store the materials in a dry area, out of direct sunlight, protected from freezing, staining or damage.

- Stored plant materials have to be watched carefully. Watering the plants can be necessary during a long storage period.

**WARRANTY**

- Submit a 10-year (insurance backed) product manufacturing warranty according to the specifications of the green roof manufacturer which warrants all the components of the green roof assembly. (except the vegetation)

(EXTENDED WARRANTIES ARE AVAILABLE)

- Submit a 2-year workmanship warranty which warrants the installation of the green roof system according to the specifications.

- Submit a 2 year growing warranty to take effect immediately after the installation of the Green Roof. This warranty is to ensure that the vegetation properly encloses the roof area. After that a maintenance program has to be covering the full period of the warranty.

**MAINTENANCE**

- Provide a maintenance program for the duration of two growing seasons as per following maintenance measures:

  - Four visits in the first year.
  - Four visits in the second year.
  - The removal of coarse and unwanted weeds and the seedlings of trees; some 'newcomers' are quite acceptable.
  - The removal of vegetation from the gravel strips;
  - Visual inspection of the drain outlets; Maintaining a functioning drainage layer is critical to the establishment of the vegetation. Retained water will stagnate and is detrimental to proper plant growth;
  - Fertilizing the vegetation with a slow released chemical fertilizer; - type of fertilizer: slow release N-P-K: 20-6-11 75 % coated - recommended quantity: 25 gram per square meter. Soil testing may be required.
  - Replace plant material that dies, as necessary;
  - Replace lost growing medium from erosion through foot traffic, wind damage, or nesting animals. Use ZinCo growing medium.
  - Removal of unwanted debris to ensure no damage to the vegetation.
  - Irrigation if necessary;

  Submit maintenance report to the owner at the end of the growing season.

## PART 2 - PRODUCTS

**Specified green roof assembly:**
ZinCo Fixodrain ® XD20: Sedum Roof

Supplier:

**ZinCo Canada Inc.**
P.O. Box 29
Carlisle, ON Canada, L0R 1H0

Phone: 905-690-1661
E-mail: greenroof@zinco.ca
Website: www.zinco.ca

### 1. ROOT BARRIER

- **ZinCo root barrier WSF 40** (Optional item if non root-resistant is waterproofing used.) made of special-polyethylene – Bitumen and Polystyrol resistant - Without plasticizer - UV-stabilized. Thickness: 0,34 mm. Weight: 320 g/m$^2$. Tensile strength: 40 – 47 N/mm$^2$. Density: 940 kg/m$^3$.


Subject to technical aternations and printing errors – First edition 2007; Revised 10/2017

## 2. SEPARATION/PROTECTIVE LAYER

(PLEASE CHOOSE CONVENTIONAL OR INVERTED ASSEMBLY)

(CONVENTIONAL ROOF ASSEMBLY)

- **ZinCo separation and protection mat TSM 32** made of recycled non-rotting polyester fibers for water- and nutrient retention as well as a protection layer. Thickness: 3 mm. Weight approx. 350 g/m2. Water retention capacity: 3 L/m2. Bitumen resistant - Biologically and chemically neutral - Heat resistant. Melting Point: 260 °C. Penetration Force: > 2000 N.

Or

(INVERTED ROOF ASSEMBLY)

- Air and vapour permeable membrane **ZinCo diffusion membrane TGV21** made of thermal consolidated Polypropylene. Bitumen resistant – Biologically and Chemically neutral. Vapour opening size Sd ≤ 0,01 m) Thickness: 0,55 mm. Weight: 80 g/m$^2$. Tensile strength: 167 N/50 mm. Air permability at 1 mbar: 750 L/(m$^2$ x s). To be used as separation layer on inverted roofs and protection against small particle infiltration.

## 3. DRAINAGE – WATER STORAGE LAYER

- **ZinCo Drainage, water-storage and protection element Fixodrain ® XD 20** for large scale extensive Green Roofs. Made of recycled polypropylene with attached filter sheet. Max. compressive strength > 50 kN/m$^2$. Water storage capacity: 3 l/m$^2$. Weight: approx. 1.0 kg/m$^2$. Height: 20 mm. Dimensions: 1,00 x 20,00 x 0,02 m. Including connectors on its long side.

## 4. FILTER LAYER

- **ZinCo Filter Sheet SF** made of non-rotting thermal consolidated Polypropylene. Water flow rate: 155 /(m$^2$s) if there is a water column of 100 mm. Apparent Opening size: d90%= 110 $\mu$m. Weight: 100 g/m$^2$. The filter sheet is attached to the Fixodrain element.

## 5. GROWING MEDIUM

- **Growing medium for extensive Green Roofs - ZinCo Blend-E,** produced using light weight recycled or re-used materials and minerals, enriched with high quality compost elements, resistant to flying sparks, frost-resistant, stable structure. Specially engineered by ZinCo Canada and meets the FLL-Standards for Planning, Execution and Upkeep of Green Roof sites. Depth: 60 - 80 mm.

(PLEASE CHOOSE REQUIRED DEPTH)

**Particle Size Distribution**

Proportion of silting components (d < 0.063 mm): ≤ 15 Mass %

**Density Measurements**

Bulk Density (at max. water-holding capacity): 1100 – 1500 kg/m$^3$

Compression Factor: <20% Vol. %

**Water/Air Measurements**

Total Pore Volume: ≥ 65 Vol. %

Maximum water-holding capacity: ≥ *35%* Vol. %

Air-filled porosity at max water-holding: ≥ 10Vol. %

Water permeability (saturated hydraulic conductivity) *≥0.001* cm/sec

**pH**

6.5 – 9.5

**Organic Measurements**
Organic matter content: *≤ 8% mass%*

**Nutrients**

Phosphorus, P205 (CAL): ≤ 200mg/L

Potassium, K2O (CAL): ≤ 700mg/L

Magnesium, Mg (CaCl2): ≥200mg/L

Nitrate + Ammonium (CaCl2): ≤ 80mg/L

## 6. PLANT MATERIAL

(PLEASE CHOOSE ONE OF THE PLANTING OPTIONS)

### SEDUM CUTTINGS

- **Sedum cuttings** shall be harvested from healthy, vigorous plants while in a vegetative growth mode. They shall range in length from ½" to 3" and possess sufficient rooting nodes to allow for rapid root development once sown.

Sedum cuttings shall be mulched with a thin layer of compost.

### PLUG PLANTS

- **Plug plants:** Plant material potted in 50 or 72 tray plugs in a mix of Sedums. Quantity: 20 - 25 plants/m$^2$.

(PLEASE CHOOSE REQUIRED PLANT DENSITY)

### PRE-GROWN VEGETATION MATS

- **Pre-cultivated Vegetation Mats** with firmly rooted, for extensive green roofs suitable plant species, pre-cultivated over one growing season in the field. Delivery weight: approx. 16–20 kg/m$^2$ (3-5 lbs/ft2). Height: ca. 20–25 mm (0.75 -1 inch) Supplying quantity: minimum 2.00 m$^2$. Standard dimensions: ca. 1.20 m x 2.00 m.

**Plant types:**
The basis vegetation mats are 12–14 adapted Sedum types, e.g. Sedum album, Sedum acre, Sedum spurium, Sedum floriferum, Sedum kamschaticum, Sedum reflexum, Sedum sexangulare, and Sedum hybridum. Various herbs and grasses are also available for extensive green roofs.



Subject to technical aternations and printing errors – First edition 2007; Revised 10/2017

The coverage is at least 85% when shipped.

**7. RELATED PRODUCTS**

- **ZinCo inspection chamber KS 6** made of plastic coated galvanized steel with thermally insulated cover, resistant to compression. Height: 60 mm. To ensure accessibility of the roof drains at any time. Dimensions: 0.25 x 0.25 x 0.06 m. Weight: 3 kg.

- **ZinCo gravel retainer KL60/80** made of aluminum L-bracket with square slots for drainage. Designed as gravel retainer for gravel strips. Length: approx. 3 m. Height: 60 mm or 80 mm. Including joint connectors.

(PLEASE CHOOSE REQUIRED HEIGHT)

- **Gravel strip** to protect roofing details, using a 1"-2" round aggregate. Width: at least 30 cm. Depth: 60 or 80 mm.

(PLEASE CHOOSE REQUIRED DEPTH)

## PART 3 – EXECUTION

**1. INSPECTION**

- Clean up the waterproofing membrane carefully (well-swept)

- Careful inspection of the waterproofing membrane including seams, penetrations and details after flood testing or electronic leak detection. If the waterproofing system and the Green Roof system are not carried out by the same company, the acceptance of the method used for waterproofing quality should be agreed by all the parties. Identified defects are to be reported in written form. Do not proceed until corrected.

**2. ROOT BARRIER**

- Deliver and install the **ZinCo root barrier WSF40** on top of the non root-resistant waterproofing with a minimum overlap of 500 mm according to the manufacturer's instructions. The root barrier must be installed above the growing medium along the edges and roof penetrations.

**3. SEPARATION / PROTECTIVE LAYER**

(PLEASE CHOOSE CONVENTIONAL OR INVERTED ASSEMBLY)

(CONVENTIONAL ROOF ASSEMBLY)

Deliver and install the **ZinCo Separation Sheet TSM32** directly on the top of the root barrier with a minimum overlap of 100 mm, according to the manufacturer's instructions. The separation sheet must be installed above the growing medium along the edges and at roof penetrations.

Or

(INVERTED ROOF ASSEMBLY)

- In the case of an inverted roof: Deliver and install the **ZinCo diffusion membrane TGV21** directly on the top of the insulation with a minimum overlap of 100 mm, according to the manufacturer's instructions. The separation sheet must be installed above the growing medium along the edges and at roof penetrations.

**4. DRAINAGE & WATER STORAGE LAYER**

- Deliver and install the **ZinCo Drainage and water-storage element Fixodrain ® XD20** including attached **ZinCo filter sheet SF** directly on the separation / protective layer according to the manufacturer's instructions. Install the Fixodrain rolls side by side with filter sheet facing up and fix the elements together with available interlocking studs. Cut the drain elements in place along the edges and roof penetrations. Fill the water retention cups of the drain layer once with water.

**5. GROWING MEDIUM**

- Deliver and install the **growing medium for extensive Green Roofs ZinCo Blend-E** on the filter sheet. Spread out the growing medium equally to a depth of 60 mm – 80 mm. Check the depth on several places to ensure the right thickness. A tolerance of 1 cm is acceptable. Small amounts of growing medium will be delivered in big bags. Lager amounts will be delivered by a in bulk dumping trucks or blower truck.

**6. PLANT MATERIAL**

(PLEASE CHOOSE ONE OF THE PLANTING OPTIONS)

- Deliver and install the plant material in the growing medium according to the planting design and plant lists. Including one watering right after the installation.

**SEDUM CUTTINGS:**
Spread the sedum cuttings out over the growing medium at the recommended rate and apply them in the top 20 mm of the growing medium by raking. Cover the cuttings with a thin layer (10 mm) of compost mulch. Water the cuttings right after the installation. Keep the cuttings moist until they are firmly rooted in the growing medium.

**PLUG PLANTS:**
Take the plugs out of the plant trays and lay them out on the growing medium following the planting design. Dig a hole, the size of the root ball and apply the plug in the hole. Cover the root ball with growing medium and compact it gently in place. Water the plugs right after the installation. Keep the plugs moist until they are firmly rooted in the growing medium.

**PRE-GROWN VEGETATION MAT:**
Install mats same day as the delivery. Do not store without permission of the

grower. Do not place in full sun. During hot sunny days water/cool of the soil layer with 15-25 minutes of pre-watering. Hot scorching soil burns the roots and might damage the Sedum mats.

Starting in the corner, carefully place each roll at location and unroll the mats over the entire roof area. Make sure that the mats are in contact with the growing medium. Water immediately for 30-60 minutes after installation.

After installation: Water the first month according to the grower's specification depending on the season and time of year using automatic timers.

## 7. RELATED PRODUCTS

- **ZinCo inspection chamber KS 6**
  Deliver and install the ZinCo Inspection Chamber on top of the drainage layer above the roof outlets. Install the ZinCo filter sheet SF on the flange of the inspection chamber.

- **ZinCo gravel retainer KL60/80**
  Deliver and install the ZinCo gravel retainer on top of the filter fabric between the gravel strip and the growing medium.

- **Gravel strip**
  Deliver and install a gravel strip along roof edges, flashing details and roof penetrations using a 1"-2" round aggregate. Depth: 60 or 80 mm.

## 8. COMPLETION

- Upon completion, water the plant material and leave the site in a neat, clean and workmanlike condition.

## 9. MAINTENANCE

- Execute the maintenance program as described on page 2.

**END OF SECTION**

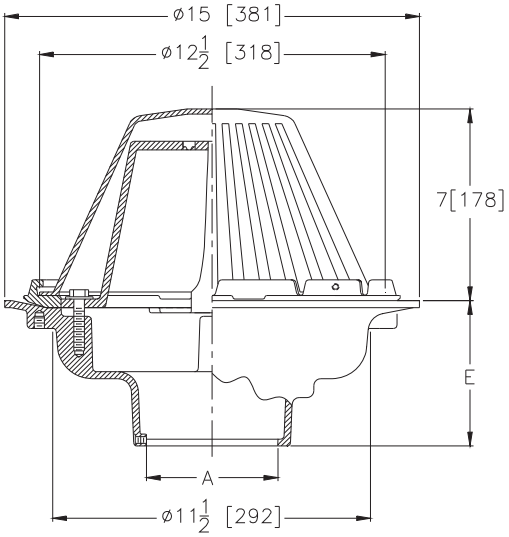

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# Z-105
## CONTROL-FLO ROOF DRAIN
## w/ Parabolic Weir

**SPECIFICATION SHEET**

TAG_____

Dimensional Data (inches and [mm]) are Subject to Manufacturing Tolerances and Change Without Notice




| A<br>Pipe Size<br>Inches / [mm] | Approx.<br>Wt.<br>Lbs. / [kg] | Dome<br>Open Area<br>Sq. In. / [sq cm] |
|---|---|---|
| 2 - 3 - 4<br>[51 - 76 - 102] | 34<br>[15] | 148<br>[955] |

**ENGINEERING SPECIFICATION:** ZURN Z-105 "Control-Flo" roof drain for dead -level roof construction, Dura-Coated cast iron body. "Control-Flo" weir shall be linear functioning with integral membrane flashing clamp/gravel guard and Poly-Dome. All data shall be verified proportional to flow rates.

**OPTIONS** (Check/specify appropriate options)

**PIPE SIZE**

2,3,4 [50,75,100]
2,3,4 [50,75,100]
2,3,4 [50,75,100]
2,3,4 [50,75,100]

(Specify size/type) **OUTLET**

_____ IC Inside Caulk
_____ IP Threaded
_____ NH No-Hub
_____ NL Neo-Loc

**E BODY HT. DIM.**

5 1/4 [133]
3 3/4 [95]
5 1/4 [133]
4 5/8 [117]

**PREFIXES**

____ Z- D.C.C.I. Body with Poly-Dome*
____ ZA- D.C.C.I. Body with Aluminum Dome

**SUFFIXES**

____ -A Waterproof Flange
____ -AR Acid Resistant Epoxy Coated Finish
____ -C Underdeck Clamp
____ -DP Top Set® Roof Deck Plate (Replaces both the -C and -R)
____ -DR Adjustable Drain Riser Extension Assembly 3-5/8" [92] to 7-1/4" [184]
____ -E Static Extension 1 [25] thru 4 [102] (Specify Ht.)
____ -EA Adjustable Extension Assembly 1 3/4 [44] thru 3 1/2 [89]
____ -EB Elevating Body Plate
____ -G Galvanized Cast Iron
____ -R Roof Sump Receiver
____ -VP Vandal Proof Secured Top
____ -90 90º Threaded Side Outlet Body

*REGULARLY FURNISHED UNLESS OTHERWISE SPECIFIED

**REV. A DATE: 09/14/05 C.N. NO. 89837**

**DWG. NO. 63601 PRODUCT NO. Z-105**

**ZURN INDUSTRIES LIMITED ♦ 3544 Nashua Drive ♦ Mississauga, Ontario L4V 1L2 ♦ Phone: 905/405-8272 Fax: 905/405-1292**
**In the U.S.: ZURN INDUSTRIES, INC. ♦ SPECIFICATION DRAINAGE OPERATION ♦ 1801 Pittsburgh Ave. ♦ Erie, PA 16514**
**Phone: 814/455-0921 ♦ Fax: 814/454-7929 ♦ World Wide Web: www.zurn.com**

# Selecta-Drain Chart

| LOCATION | SQUARE METRE (SQUARE FOOT) NOTCH AREA RATING | ROOF LOAD FACTOR KGS. (LBS.) | TOTAL ROOF SLOPE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | DEAD LEVEL | | | 51mm (2") RISE | | | 102mm (4") RISE | | | 152mm (6") RISE | | |
| | | | L.P.M. (G.P.M.) Discharge | Draindown Time Hrs. | mm (in.) Water Depth | L.P.M. (G.P.M.) Discharge | Draindown Time Hrs. | mm (in.) Water Depth | L.P.M. (G.P.M.) Discharge | Draindown Time Hrs. | mm (in.) Water Depth | L.P.M. (G.P.M.) Discharge | Draindown Time Hrs. | mm (in.) Water Depth |
| Ottawa, Ontario | 232 (2,500) | 4.7 (10.4) | 45.5 (10) | 7 | 51 (2) | 59 (13) | 6.5 | 66 (2.6) | 77.5 (17) | 4.5 | 86.5 (3.4) | 86.5 (19) | 3.2 | 96.5 (3.8) |
| | 465 (5,000) | 5.9 (13) | 57 (12.5) | 17 | 63.5 (2.5) | 68 (15) | 14 | 76 (3) | 86.5 (19) | 10 | 96.5 (3.8) | 100 (22) | 7.5 | 112 (4.4) |
| | 697 (7,500) | 6.4 (14) | 61.5 (13.5) | 27 | 68.5 (2.7) | 75 (16.5) | 23 | 84 (3.3) | 93 (20.5) | 16 | 104 (4.1) | 107 (23.5) | 12 | 119.5 (4.7) |
| | 929 (10,000) | 6.6 (14.6) | 63.5 (14) | 36 | 71 (2.8) | 79.5 (17.5) | 32 | 89 (3.5) | 97.5 (21.5) | 22 | 109 (4.3) | 113.5 (25) | 18 | 127 (5) |
| St. Thomas, Ontario | 232 (2,500) | 5.7 (12.5) | 54.5 (12) | 8 | 61 (2.4) | 68 (15) | 7 | 76 (3.0) | 86.5 (19) | 5 | 96.5 (3.8) | 104.5 (23) | 4 | 117 (4.6) |
| | 465 (5,000) | 6.6 (14.6) | 63.5 (14) | 19 | 71 (2.8) | 77.5 (17) | 16 | 86.5 (3.4) | 97.5 (21.5) | 11 | 109 (4.3) | 118 (26) | 9 | 132 (5.2) |
| | 697 (7,500) | 7.1 (16.6) | 68 (15) | 29 | 76 (3.0) | 82 (18) | 26 | 91.5 (3.6) | 102.5 (22.5) | 18 | 114.5 (4.5) | 125 (27.5) | 15 | 139.5 (5.5) |
| | 929 (10,000) | 7.5 (16.6) | 72.5 (16) | 40 | 81.5 (3.2) | 86.5 (19) | 34 | 96.5 (3.8) | 107 (23.5) | 24 | 119.5 (4.7) | 132 (29) | 20 | 147.5 (5.8) |
| Timmins, Ontario | 232 (2,500) | 4.3 (9.4) | 41 (9) | 7 | 45.5 (1.8) | 57 (12.5) | 6 | 63.5 (2.5) | 72.5 (16) | 4 | 81.5 (3.2) | 86.5 (19) | 3.3 | 96.5 (3.8) |
| | 465 (5,000) | 5.7 (12.5) | 54.5 (12) | 16 | 61 (2.4) | 63.5 (14) | 14 | 71 (2.8) | 82 (18) | 9 | 91.5 (3.6) | 97.5 (21.5) | 7.5 | 109 (4.3) |
| | 697 (7,500) | 6.4 (14) | 61.5 (13.5) | 27 | 68.5 (2.7) | 70.5 (15.5) | 22 | 78.5 (3.1) | 86.5 (19) | 15 | 96.5 (3.8) | 104.5 (23) | 12 | 117 (4.6) |
| | 929 (10,000) | 6.6 (14.6) | 63.5 (14) | 36 | 71 (2.8) | 72.5 (16) | 30 | 81.5 (3.2) | 91 (20) | 21 | 101.5 (4.0) | 109 (24) | 17 | 122 (4.8) |
| Toronto, Ontario | 232 (2,500) | 5.7 (12.5) | 54.5 (12) | 8 | 61 (2.4) | 66 (14.5) | 7 | 73.5 (2.9) | 82 (18) | 4.5 | 91.5 (3.6) | 97.5 (21.5) | 3.5 | 109 (4.3) |
| | 465 (5,000) | 6.8 (15.1) | 66 (14.5) | 19 | 73.5 (2.9) | 77.5 (17) | 16 | 86.5 (3.4) | 93 (20.5) | 11 | 104 (4.1) | 111.5 (24.5) | 9 | 124.5 (4.9) |
| | 697 (7,500) | 8.0 (17.7) | 77.5 (17) | 30 | 86.5 (3.4) | 84 (18.5) | 26 | 94 (3.7) | 100 (22) | 18 | 112 (4.4) | 120.5 (26.5) | 14 | 134.5 (5.3) |
| | 929 (10,000) | 8.7 (19.2) | 82 (18) | 42 | 91.5 (3.6) | 86.5 (19) | 34 | 96.5 (3.8) | 104.5 (23) | 24 | 117 (4.6) | 127.5 (28) | 20 | 142 (5.6) |
| Windsor, Ontario | 232 (2,500) | 6.1 (13.5) | 59 (13) | 8.5 | 66 (2.6) | 70.5 (15.5) | 7.5 | 78.5 (3.1) | 84 (18.5) | 4.5 | 94 (3.7) | 107 (23.5) | 4 | 119.5 (4.7) |
| | 465 (5,000) | 7.1 (15.6) | 68 (15) | 20 | 76 (3.0) | 79.5 (17.5) | 16 | 89 (3.5) | 97.5 (21.5) | 11 | 109 (4.3) | 118 (26) | 9 | 132 (5.2) |
| | 697 (7,500) | 8.0 (17.7) | 77.5 (17) | 30 | 86.5 (3.4) | 86.5 (19) | 26 | 96.5 (3.8) | 107 (23.5) | 18 | 119.5 (4.7) | 125 (27.5) | 15 | 139.5 (5.5) |
| | 929 (10,000) | 8.7 (19.2) | 82 (18) | 42 | 91.5 (3.6) | 91 (20) | 36 | 101.5 (4.0) | 113.5 (25) | 26 | 127 (5.0) | 129.5 (28.5) | 20 | 145 (5.7) |
| Charlottetown, Prince Edward Island | 232 (2,500) | 4.9 (10.9) | 47.5 (10.5) | 7.5 | 53.5 (2.1) | 57 (12.5) | 6 | 63.5 (2.5) | 68 (15) | 3.8 | 76 (3.0) | 79.5 (17.5) | 3 | 89 (3.5) |
| | 465 (5,000) | 6.6 (14.6) | 63.5 (14) | 19 | 71 (2.8) | 75 (16.5) | 15.5 | 84 (3.3) | 88.5 (19.5) | 10 | 99 (3.9) | 100 (22) | 7.5 | 112 (4.4) |
| | 697 (7,500) | 7.8 (17.2) | 75 (16.5) | 31 | 84 (3.3) | 86.5 (19) | 26 | 96.5 (3.8) | 102.5 (22.5) | 18 | 114.5 (4.5) | 113.5 (25) | 13 | 127 (5.0) |
| | 929 (10,000) | 8.7 (19.2) | 84 (18.5) | 42 | 94 (3.7) | 97.5 (21.5) | 37 | 106.5 (4.2) | 111.5 (24.5) | 26 | 124.5 (4.9) | 125 (27.5) | 20 | 139.5 (5.5) |
| Montreal, Quebec | 232 (2,500) | 5.2 (11.4) | 50 (11) | 7.5 | 56 (2.2) | 61.5 (13.5) | 7 | 68.5 (2.7) | 79.5 (17.5) | 4.5 | 89 (3.5) | 97.5 (21.5) | 3.5 | 109 (4.36) |
| | 465 (5,000) | 5.9 (13) | 57 (12.5) | 17 | 63.5 (2.5) | 70.5 (15.5) | 15 | 78.5 (3.1) | 88.5 (19.5) | 10 | 99 (3.9) | 109 (24) | 8 | 122 (4.8) |
| | 697 (7,500) | 6.1 (13.5) | 59 (13) | 27 | 66 (2.6) | 72.5 (16) | 23 | 81.5 (3.2) | 93 (20.5) | 16 | 104 (4.1) | 113.5 (25) | 13 | 127 (5.0) |
| | 929 (10,000) | 6.4 (14) | 61.5 (13.5) | 36 | 68.5 (2.7) | 77.5 (17) | 31 | 86.5 (3.4) | 95.5 (21) | 22 | 106.5 (4.2) | 120.5 (26.5) | 19 | 134.5 (5.3) |
| Quebec City, Quebec | 232 (2,500) | 5.4 (12) | 52.5 (11.5) | 8 | 58.5 (2.3) | 63.5 (14) | 7 | 71 (2.8) | 79.5 (17.5) | 4.5 | 89 (3.5) | 97.5 (21.5) | 3.5 | 109 (4.3) |
| | 465 (5,000) | 6.4 (14) | 61.5 (13.5) | 18 | 68.5 (2.7) | 70.5 (15.5) | 15 | 78.5 (3.1) | 84 (18.5) | 10 | 94 (3.7) | 104.5 (23) | 8 | 117 (4.6) |
| | 697 (7,500) | 6.6 (14.6) | 63.5 (14) | 28 | 71 (2.8) | 72.5 (16) | 23 | 81.5 (3.2) | 86.5 (19) | 15 | 96.5 (3.8) | 107 (23.5) | 12 | 119.5 (4.7) |
| | 929 (10,000) | 7.1 (15.6) | 68 (15) | 37 | 76 (3.0) | 77.5 (17) | 31 | 86.5 (3.4) | 88.5 (19.5) | 20 | 99 (3.9) | 109 (24) | 17 | 122 (4.8) |

ZURN CANADA

SPECIFICATION DRAINAGE

# Control-Flo

## Roof Drainage System



www.zurn.com

# Control-Flo...Today's Successful Answer to More

## THE ZURN "CONTROL-FLO CONCEPT"

Originally, Zurn introduced the scientifically-advanced "Control-Flo" drainage principle for dead-level roofs. Today, after thousands of successful applications in modern, large dead-level roof areas, Zurn engineers have adapted the comprehensive "Control-Flo" data to **sloped roof** areas.

## WHAT IS "CONTROL-FLO"?

It is an advanced method of removing rain water off dead-level or sloped roofs. As contrasted with conventional drainage practices, which attempt to drain off storm water as quickly as it falls on the roof's surface, "Control-Flo" drains the roof at a controlled rate. Excess water accumulates on the roof under controlled conditions...then drains off at a lower rate after a storm abates.

## CUTS DRAINAGE COSTS

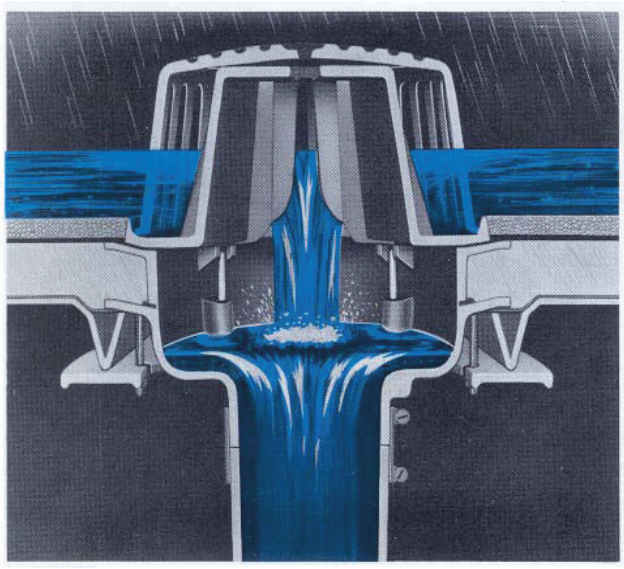
Fewer roof drains, smaller diameter piping, smaller sewer sizes, and lower installation costs are possible with a "Control-Flo" drainage system because roof areas are utilized as temporary storage reservoirs.

## REDUCES PROBABILITY OF STORM DAMAGE

Lightens load on combination sewers by reducing rate of water drained from roof tops during severe storms thereby reducing probability of flooded sewers, and consequent backflow into basements and other low areas.

## THANKS TO EXCLUSIVE ZURN "AQUA-WEIR" ACTION

Key to successful "Control-Flo" drainage is a unique scientifically-designed weir containing accurately calibrated notches with sides formed by parabolic curves which provide flow rates directly proportional to the head. Shape and size of notches are based on predetermined flow rates, and all factors involved in roof drainage to assure permanent regulation of drainage flow rates for specific geographic locations and rainfall intensities.

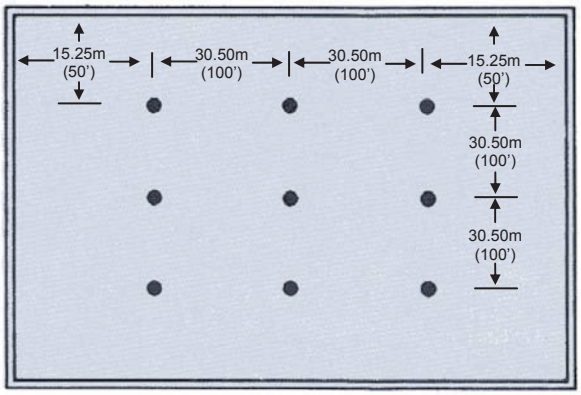


## DEFINITION

## DEAD LEVEL ROOFS

### DIAGRAM "A"

A dead-level roof for purposes of applying the Zurn "Control-Flo" drainage principle is one which has been designed for zero slope across its entire surface. Measurements shown are for maximum distances.




(Plan View)



(Section View)

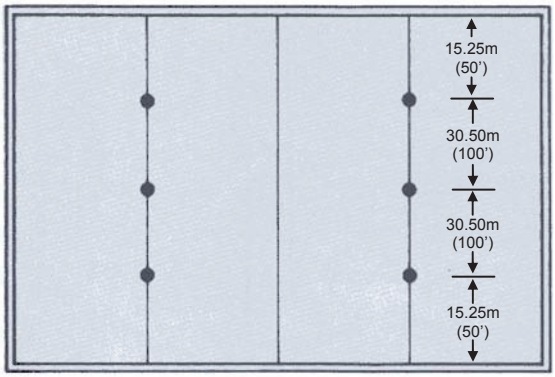
## SLOPED ROOFS

### DIAGRAM "B"

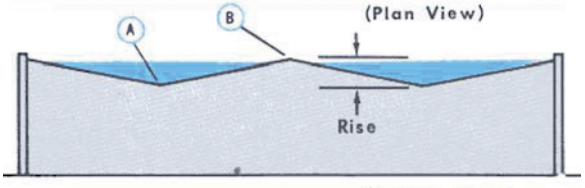
A sloped roof is one designed commonly with a shallow slope. The Zurn "Control-Flo" drainage system can be applied to any slope which results in a total rise up to 152mm (6").

The total rise of a roof as calculated for "Control-Flo" application is defined as the vertical increase in height in inches, from the low point or valley of a sloping roof (A) to the top of the sloping section (B). (Example: a roof that slopes 3mm (1/8") per foot having a 7.25m (24') span would have a rise of 7.25m x 3mm or 76mm (24' x 1/8" or 3")).

Measurements shown are for maximum distances.




(Plan View)

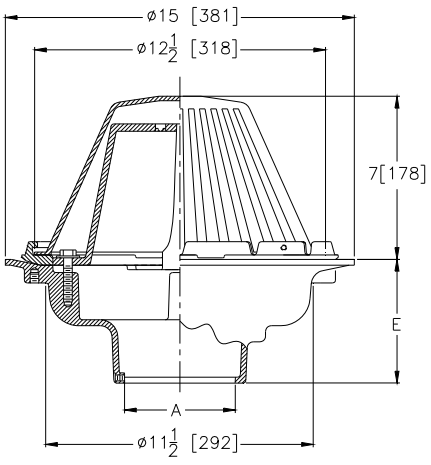



(Section View)

**Dimensions and other measurements given in metric and imperial forms.**

# Economical Roof Drainage Installations

## SPECIFICATION DATA




**ENGINEERING SPECIFICATION:** ZURN Z-105 "Control-Flo" roof drain for dead -level or sloped roof construction, Dura-Coated cast iron body. "Control-Flo" weir shall be linear functioning with integral membrane flashing clamp/ gravel guard and Poly-Dome. All data shall be verified proportional to flow rates.

## ROOF DESIGN RECOMMENDATIONS

Basic roofing design should incorporate protection that will prevent roof overloading by installing adequate over-flow scuppers in parapet walls.

## GENERAL INFORMATION

The “Control-Flo” roof drainage data is tabulated for four areas (232.25m$^2$ (2500 sq. ft.), 464.502m$^2$ (5000 sq. ft.), 696.75m$^2$ (7500 sq. ft.), 929m$^2$ (10,000 sq. ft.) notch areas ratings) for each locality. For each notch area rating the maximum discharge in L.P.M. (G.P.M.) - draindown in hours, and maximum water depth at the drain in inches for a dead level roof — 51mm (2 inch) rise — 102mm (4 inch) rise and 152mm (6 inch) rise—are tabulated. The rise is the total change in elevation from the valley to the peak. Values for areas, rise or combination thereof other than those listed, can be arrived at by extrapolation. All data listed is based on the fifty-year return frequency storm. In other words the maximum conditions as listed will occur on the average of once every fifty years.

**NOTE**: The tabulated “Control-Flo” data enables the individual engineer to select his own design limiting condition. The limiting condition can be draindown time, roof load factor, or maximum water depth at the drain. If draindown time is the limiting factor because of possible freezing conditions, it must be recognized that the maximum time listed will occur on the average of once every 50 years and would most likely be during a heavy summer thunder storm. Average winter draindown times would be much shorter in duration than those listed.

## GENERAL RECOMMENDATIONS

On sloping roofs, we recommend a design depth referred to as an equivalent depth. An equivalent depth is the depth of water attained at the drains that results in the same roof stresses as those realized on a dead-level roof. In all cases this equivalent depth is almost equal to that attained by using the same notch area rating for the different rises to 152mm (6”). With the same depth of water at the drain the roof stresses will decrease with increasing total rise. Therefore, it would be possible to have a depth in excess of 152mm (6”) at the drain on a sloping roof without exceeding stresses normally encountered in a 152mm (6”) depth on a dead-level roof. However, it is recommended that scuppers be placed to limit the maximum water depth on any roof to 152mm (6”) to prevent the overflow of the weirs on the drains and consequent overloading of drain piping. In the few cases where the data shows a flow rate in excess of 136 L.P.M. (30 G.P.M.) if all drains and drain lines are sized according to recommendations, and the one storm in fifty years occurs, the only consequence will be a brief flow through the scuppers or over-flow drains.

**NOTE**: An equivalent depth is that depth of water attained at the drains at the lowest line or valley of the roof with all other conditions such as notch area and rainfall intensity being equal. For Toronto, Ontario a notch area rating of 464.50m$^2$ (5,000 sq. ft.) results in a 74mm (2.9 inch) depth on a dead level roof for a 50-year storm. For the same notch area and conditions, equivalent depths for a 51mm (2”), 102mm (4”) and 152mm (6”) rise respectively on a sloped roof would be 86mm (3.4”), 104mm (4.1”) and 124mm (4.9”). Roof stresses will be approximately equal in all cases.

# Control-Flo Drain Selection Is Quick and Easy...

The exclusive Zurn “Selecta-Drain” Chart (pages 8—11) tabulates selection data for 34 localities in Canada. Proper use of this chart constitutes your best assurance of sure, safe, economical application of Zurn “Control-Flo” systems for your specific geographical area. If the “Selecta-Drain Chart does not cover your specific design criteria, contact Zurn Industries Limited, Mississauga, Ontario, for additional data for your locality. Listed below is additional information pertinent to proper engineering of the “Control-Flo” system.

## ROOF USED AS TEMPORARY RETENTION

The key to economical “Control-Flo” is the utilization of large roof areas to temporarily store the maximum amount of water without overloading average roofs or creating excessive draindown time during periods of heavy rainfall. The data shown in the “Selecta-Drain” Chart enables the engineer to select notch area ratings from 232.25 $m^2$ (2,500 $ft.^2$) to 929$m^2$ (10,000 $ft.^2$) and to accurately predict all other design factors such as maximum roof load, L.P.M. (G.P.M.) discharge, draindown time and water depth at the drain. Obviously, as design factors permit the notch area rating to increase the resulting money saved in being able to use small leaders and drain lines will also increase.

## ROOF LOADING AND RUN-OFF RATES

The four values listed in the “Selecta-Drain” Chart for notch area ratings for different localities will normally span the range of good design. If areas per notch below 232.25$m^2$ (2,500 $ft.^2$) are used considerable economy of the “Control-Flo” concept is being lost. The area per notch is limited to 929$m^2$ (10,000 $ft.^2$) to keep the draindown time within reasonable limits. Extensive studies show that stresses due to water load on a sloping roof for any fixed set of conditions are very nearly the same as those on a dead-level roof. A sloping roof tends to concentrate more water in the valleys and increase the water depth at this point. The greater depth around the drain leads to a faster run-off rate, particularly a faster early run -off rate. As a result, the total volume of water stored on the roof is less, and the total load on the sloping roof is less. By using the same area on the sloping roof as on the dead-level roof the increase in roof stresses due to increased water depth in the valleys is offset by the decrease in the total load due to less water stored. The net result of the maximum roof stress is approximately the same for any single span rise and fixed set of conditions. A fixed set of conditions, would be the same notch area, the same frequency store, and the same locality.

**SPECIAL CONSIDERATIONS FOR STRUCTURAL SAFETY: Normal practice of roof design is based on 18kg (40 lbs.) per 929 $cm^2$ ( sq ft.). (Subject to local codes and by-laws.) Thus it is extremely important that design is in accordance with normal load factors so deflection will be slight enough in any bay to prevent progressive deflection which could cause water depths to load the roof beyond its design limits.**

## ADDITIONAL NOTCH RATINGS

The ‘Selecta-Drain” Chart along with Tables I and II enables the engineer to select “Control-Flo” Drains and drain pipe sizes for most Canadian applications. These calculations are computed for a proportional flow weir that is sized to give a flow of 23 L.P.M. (5 G.P.M.) per inch of head. The 23 L.P.M. (5 G.P.M.) per inch of head notch opening is selected as the bases of design as it offers the most economical installation as applied to actual rainfall experienced in Canada.

Should you require design criteria for locations outside of Canada or for special project applications please contact Zurn Industries Limited, Mississauga, Ontario.

## LEADER AND DRAIN PIPE SIZING

Since all data in the “Selecta-Drain” Chart is based on the 50-year-storm it is possible to exceed the water depth listed in these charts if a 100-year or 1000-year storm would occur. Therefore, for good design it is recommended that scuppers or other methods be used to limit water depth to the design depth and tables I and II be used to size the leaders and drain pipes. If the roof is capable of supporting more water than the design depth it is permissible to locate the scuppers or other overflow means at a height that will allow a greater water depth on the roof. However, in this case the leader and drain pipes should be sized to handle the higher flow rates possible based on a flow rate of 23 L.P.M. (5 G.P.M.) per inch of depth at the drain.

## PROPER DRAIN LOCATION

The following good design practice is recommended for selecting the proper number of “Control-Flo” drains for a given area. **On dead-level roofs**, drains should be located no further than 15.25m (50 feet) from edge of roof and no further than 30.50m (100 feet) between drains. See diagram “A” page 2. **On sloping roofs**, drains should be located in the valleys at a distance no greater than 15.25m (50 feet) from each end of the valleys and no further than 30.50m (100 feet) between drains. See diagram “B” page 2. Compliance with these recommendations will assure good run off regardless of wind direction.

# Saves Specification Time, Assures Proper Application

## QUICK, EASY SELECTION

Using the "Selecta-Drain" Chart (pages 9—13) in combination with the steps and examples appearing below, should save you countless hours in engineering specification time. This vast compilation of data is related to the proper selection of drains for 34 cities. All cities in alphabetical order by province. If a specific city does not appear in the tabulation, chooses the city nearest your area and select the proper drain using these factors.

## 3 EASY STEPS…

**AND 3 TYPICAL EXAMPLES FOR APPLICATION OF SURE, SCIENTIFIC CONTROL OF DRAINAGE FROM DEAD-LEVEL AND SLOPING ROOFS WITH THE ZURN CONCEPT.**

**NOTE**: Where roof area to be drained is adjacent to one or more vertical walls projecting above the roof, then a percentage of the of the wall(s) must be added to the roof area in determining total roof area to be drained.

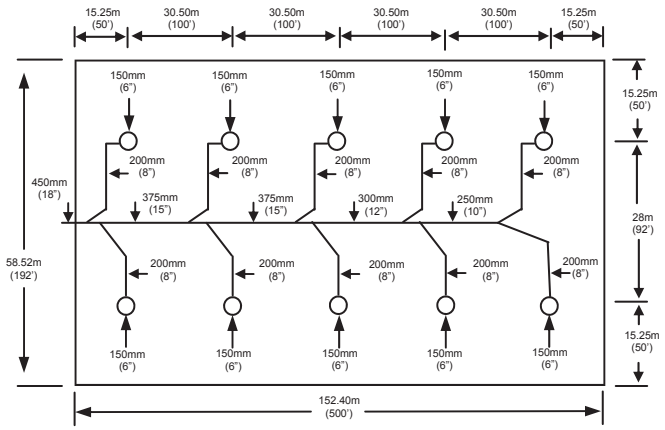
| | TORONTO, ONTARIO | DEAD-LEVEL ROOF | 102mm (4 INCH) SLOPE | 152mm (6 INCH) SLOPE |
|---|---|---|---|---|
| **1** | Determine total roof area or individual areas when roof is divided by expansion joints or peaks in the case of sloping roof. | Roof Area:<br>56.52m x 152.40m = 8918.40m$^2$<br>(192ft x 500ft = 96,000 sq. ft.)<br>(See Z105 layout bottom of this page.) | 3 Individual Roof Areas:<br>19.50m x 152.40m = 2972.80m$^2$<br>(64ft x 500ft = 32,000 sq. ft.)<br>Valleys 152.40m (500ft) long<br>3 x 2972.80 = 8918.40m$^2$<br>(3 x 32,000 = 96,000 sq. ft.) | 2 Individual Roof Areas:<br>29.87m x 152.40m = 4552m$^2$<br>(98ft x 500ft = 49,000 sq. ft.)<br>Valleys 152.40m (500ft) long<br>2 x 4552 = 9104m$^2$<br>(2 x 49,000 = 98,000 sq. ft.) |
| **2** | Divide roof area or individual areas by Zurn Notch Area Rating selected to obtain the total number of notches required. | Zurn Notch Area Rating selected for Toronto = 464.50m$^2$ (5,000 sq. ft.) from "Selecta-Drain Chart, page 11.<br>Total Roof Area = 8918.40m$^2$ (96,000 sq. ft.) Entire roof. 464.50m$^2$ (5,000 sq. ft.) notch area = 19.2 notches—USE 20. | Zurn Notch Area Rating selected for Toronto = 464.50m$^2$ (5,000 sq. ft.) from "Selecta-Drain Chart, page 11.<br>Total Roof Area = 2972.80m$^2$ (32,000 sq. ft.) Each area. 464.50m$^2$ (5,000 sq. ft.) notch area = 6.4 notches—USE 7 PER AREA. | Zurn Notch Area Rating selected for Toronto = 464.50m$^2$ (5,000 sq. ft.) from "Selecta-Drain Chart, page 11.<br>Total Roof Area = 4552m$^2$ (49,000 sq. ft.) Each area. 464.50m$^2$ (5,000 sq. ft.) notch area = 9.8 notches—USE 10 PER AREA. |
| **3** | Determine total number of drains required by not exceeding maximum spacing dimensions in the preceding instructions. See Diagrams "A" or "B", page 2.<br>Divide total number of notches required to determine the number of notches per drain.<br>Note maximum water depth at drain and use this dimension to determine scupper height. Maximum scupper height to be used is 152mm (6"). *Use this flow rate to size leaders and drain lines.* | *10 drains required. All drains must have two notches each for a total of 20 notches.<br>Flow rate is 66 L.P.M. (14.5 G.P.M.) per notch. Size leaders for 2 notch weirs for a flow rate of 66 L.P.M. (14.5 G.P.M.) 50 mm (two inch) pipe size leaders required. Maximum water depth and scupper height is 74mm (2.9"). Requires 19 hours draindown time maximum.<br>For drain, vertical and horizontal pipe sizing data see Tables I and II on page 6 and 7. | **5 drains per area required located in the valleys 15.25m (50ft.) from each end with 3 in the middle at 30.50m (100ft.) spacings. Two drains on ends with two notches—3 drains in middle on notch each for a total of 7 notches.<br>Maximum flow rate 93 L.P.M. (20.5 G.P.M.) per notch. Leader size 50mm (2") for single notch weirs—75mm (3") notch weirs. Maximum water depth and scupper height is 104mm (4.1"). Requires 11 hours draindown time maximum.<br>For drain, vertical and horizontal pipe sizing data see Tables I and II on page 6 and 7. | **5 drains per area required located in the valleys 15.25m (50ft.) from each end with 3 in the middle at 30.50m (100ft.) spacing in the middle. 10 notches are required therefore all drains must have two notches.<br>Flow rate is 111 L.P.M. (24.5 G.P.M.) per notch. Size all leaders for 2 notch weirs. 75mm (3") pipe size required. Maximum water depth and scupper height is 124mm (4.9"). Requires 9 hours draindown time maximum.<br>For drain, vertical and horizontal pipe sizing data see Tables I and II on page 6 and 7. |

*See Diagram "A" page 2 for recommended drain placement.
**See Diagram "B" page 2 for recommended drain placement.

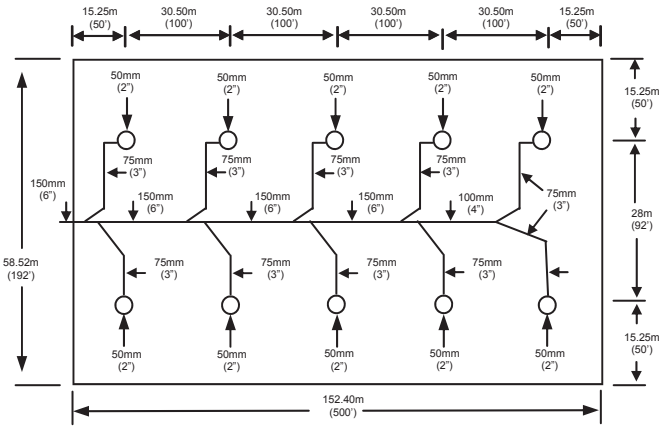
**DEAD LEVEL ROOF**

**6mm (1/4") PER FT. SLOPE STORM DRAIN**

**CONVENTIONAL — "UNCONTROLLED" — RUN OFF**




**"CONTROL-FLO" — RUN OFF**



# Select The Proper Vertical Drain Leaders

## ROOF DRAINAGE DATA

The flow rate for any design condition can be easily read from the data contained on the following pages; the tabulations shown below (and on the opposite page) can be used to simplify selection of drain line sizes.

**TABLE 1 -** SUGGESTED RELATION OF DRAIN OUTLET AND VERTICAL LEADER SIZE TO ZURN CONTROL-FLO ROOF DRAINS (BASED ON NATIONAL PLUMBING CODE ASA -A40.8 DATA ON VERTICAL LEADERS).

| No. of Notches in Drain | Max. Flow per Notch in L.P.M. (G.P.M.) | | |
|---|---|---|---|
| | Pipe Size | | |
| | 50mm (2") | 75mm (3") | 100mm (4") |
| **1** | 136* (30*) | — | — |
| **2** | 68 (15) | 136* (30*) | — |
| **3** | 45 (10) | 136* (30*) | — |
| **4** | — | 105 (23) | 136* (30*) |
| **5** | — | 82 (18) | 136* (30*) |
| **6** | — | 68 (15) | 136* (30*) |

*Maximum flow obtainable from 1 notch with 152mm (6") water depth at drain.

**Table 1** should be used to select **vertical drain** leaders which at the same time establishes the drain outlet size. This table illustrates the minimum flow per notch in L.P.M. (G.P.M.) Since the Z-105 drain is available with a minimum of one and a maximum of six notches, calculations have already been a made and are listed in this table for any quantity of weir notch openings established in your design. It was determined ten drains with two notches each weir would be required in the Dead-Level Roof example on page 5. A 66 L.P.M. (14.5 G.P.M.) discharge per notch flow rate was also established.

Once this design criteria has been determined it will be the key to the proper selection of all drain outlet sizes, vertical and horizontal storm drain sizes in Table I and II. Enter the column "Number of Notches in Drain", Table I, read down the column to the figure 2 which indicates two notches in weir, then read across until you reach a figure equal to or closest figure in excess of 66 L.P.M. (14.5 G.P.M.) You will find fifteen in the column under 50mm (2") which represents the pipe size. Therefore all drain outlets and vertical leaders are 50mm (2") size.

Let us digress for a moment assuming a specific structure requires a total of six drains each containing a weir with a different number of notches. One with 1, one with 2, etc. Table 1 discloses the pipe size for one notch is 50mm (2"), two notch is 50mm (2"), three notch is 75mm (3"), four notch is 75mm (3"), five notch is 75mm (3") and six notch is 75mm (3") as they all equal or closely exceed the 66 L.P.M. (14.5 G.P.M.) design.

NOTE: Although pipe size calculations should be based on accumulated flow rate, local by-laws should be referred to for minimum pipe size requirements and roof drain spacing.

**TABLE II** should be used to select **horizontal** storm drain piping. Use the same flow rate 66 L.P.M. (14.5 G.P.M.) used to establish the vertical leaders to size the storm drainage system and main storm drain. Let us assume the ten drains each with two notch weirs were actually on the roof in two separate lines of five drains each and joined at a common point before leaving the building. Since Table II includes 3mm (1/8"), 6mm (1/4") and 13mm (1/2") per foot slope, let **us use 6mm (1/4") as our basis for selection** which will take us to the centre section. Starting with the first of five drains we enter the extreme left column in Table II and read down to the figure 2 since this drain has two notches in weir, read across horizontally and the size of first section of horizontal storm drain is 75mm (3") between 1st and 2nd drain, return to left hand column proceed reading down until you reach figure 4 then read across horizontally and the pipe size will be 100mm (4") between 2nd and 3rd drain, 100mm (4") between 3rd and 4th and 125mm (5") (if available) between 4th and 5th. If not available use 150mm (6"). (You may be tempted to use 100mm (4") since the capacity is close. We recommend you go to the larger size.) Pipe size leaving 5th drain would be 150mm (6"). The same sizing would hold true for the second line of five drains. Since both columns of five drains each are being joined together before leaving the building there will be total of twenty notches discharging into the main building storm sewer. Enter left hand column Table II, read down until you reach the figure twenty, then read across horizontally to the 6mm (1/4") per 305mm (1') slope column and you will see a 150mm (6") storm drain will handle the job adequately. The same procedure should be followed for sloped roof installations. The above method of sizing was done to better acquaint you with Table II and its use. The more economical and practical way of laying out and installing this same job is illustrated in the control-flo layout shown on bottom of page 5.

NOTE: Although pipe size calculations should be based on accumulated flow rates, local by-laws should be referred to for minimum pipe size requirements and roof drain spacing.

# Select Proper Horizontal Storm Drain Piping

**Table II — SUGGESTED RELATION OF HORIZONTAL STORM DRAIN SIZE TO ZURN CONTROL-FLO ROOF DRAINAGE**

| Total No. of Notches Discharging to Storm Drain | MAX. FLOW PER NOTCH IN L.P.M. (G.P.M.) Storm Drain Size 3mm (1/8") per 305mm (1') Slope | | | | | | | | MAX. FLOW PER NOTCH IN L.P.M. (G.P.M.) Storm Drain Size 6mm (1/4") per 305mm (1') Slope | | | | | | | MAX. FLOW PER NOTCH IN L.P.M. (G.P.M.) Storm Drain Size 13mm (1/2") per 305mm (1') Slope | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 75 (3") | 100 (4") | 125 (5") | 150 (6") | 200 (8") | 250 (10") | 300 (12") | 375 (15") | 75 (3") | 100 (4") | 125 (5") | 150 (6") | 200 (8") | 250 (10") | 300 (12") | 75 (3") | 100 (4") | 125 (5") | 150 (6") | 200 (8") | 250 (10") | 300 (12") |
| 1 | 136* (30*) | — | — | — | — | — | — | — | 136* (30*) | — | — | — | — | — | — | 136* (30*) | — | — | — | — | — | — |
| 2 | 77 (17) | 136* (30*) | — | — | — | — | — | — | 109 (24) | 136* (30*) | — | — | — | — | — | 136* (30*) | — | — | — | — | — | — |
| 3 | 50 (11) | 118 (26) | 136* (30*) | — | — | — | — | — | 73 (16) | 136* (30*) | — | — | — | — | — | 100 (22) | 136* (30*) | — | — | — | — | — |
| 4 | 36 (8) | 86 (19) | 136* (30*) | — | — | — | — | — | 55 (12) | 127 (28) | 136* (30*) | — | — | — | — | 77 (17) | 136* (30*) | — | — | — | — | — |
| 5 | — | 65 (15) | 127* (28*) | 136* (30*) | — | — | — | — | — | 100 (22) | 136* (30*) | — | — | — | — | 59 (13) | 136* (30*) | — | — | — | — | — |
| 6 | — | 59 (13) | 105 (23) | 136* (30*) | — | — | — | — | — | 82 (18) | 136* (30*) | — | — | — | — | 50 (11) | 118 (26) | 136* (30*) | — | — | — | — |
| 7 | — | 50 (11) | 91 (20) | 136* (30*) | — | — | — | — | — | 73 (16) | 127 (28) | 136* (30*) | — | — | — | — | 100 (22) | 136* (30*) | — | — | — | — |
| 8 | — | — | 77 (17) | 127 (28) | 136* (30*) | — | — | — | — | 64 (14) | 114 (25) | 136* (30*) | — | — | — | — | 86 (19) | 136* (30*) | — | — | — | — |
| 9 | — | — | 68 (15) | 114 (25) | 136* (30*) | — | — | — | — | 55 (12) | 100 (22) | 136* (30*) | — | — | — | — | 77 (17) | 136* (30*) | — | — | — | — |
| 10 | — | — | 64 (14) | 100 (22) | 136* (30*) | — | — | — | — | — | 91 (20) | 136* (30*) | — | — | — | — | 68 (15) | 123 (27) | 136* (30*) | — | — | — |
| 11 | — | — | 55 (12) | 91 (20) | 136* (30*) | — | — | — | — | — | 82 (18) | 132 (29) | 136* (30*) | — | — | — | 64 (14) | 114 (25) | 136* (30*) | — | — | — |
| 12 | — | — | — | 82 (18) | 136* (30*) | — | — | — | — | — | 73 (16) | 118 (26) | 136* (30*) | — | — | — | 59 (13) | 105 (23) | 136* (30*) | — | — | — |
| 13 | — | — | — | 77 (17) | 136* (30*) | — | — | — | — | — | 68 (15) | 109 (24) | 136* (30*) | — | — | — | 55 (12) | 95 (21) | 136* (30*) | — | — | — |
| 14 | — | — | — | 73 (16) | 136* (30*) | — | — | — | — | — | 64 (14) | 100 (22) | 136* (30*) | — | — | — | — | 86 (19) | 136* (30*) | — | — | — |
| 15 | — | — | — | 68 (15) | 136* (30*) | — | — | — | — | — | 59 (13) | 95 (21) | 136* (30*) | — | — | — | — | 82 (18) | 132 (29) | 136* (30*) | — | — |
| 16 | — | — | — | 64 (14) | 136* (30*) | — | — | — | — | — | — | 91 (20) | 136* (30*) | — | — | — | — | 77 (17) | 123 (27) | 136* (30*) | — | — |
| 17 | — | — | — | 59 (13) | 127 (28) | 136* (30*) | — | — | — | — | — | 82 (18) | 136* (30*) | — | — | — | — | 73 (16) | 118 (26) | 136* (30*) | — | — |
| 18 | — | — | — | 55 (12) | 118 (26) | 136* (30*) | — | — | — | — | — | 77 (17) | 136* (30*) | — | — | — | — | 68 (15) | 109 (24) | 136* (30*) | — | — |
| 19 | — | — | — | — | 114 (25) | 136* (30*) | — | — | — | — | — | 73 (16) | 136* (30*) | — | — | — | — | 64 (14) | 105 (23) | 136* (30*) | — | — |
| 20 | — | — | — | — | 109 (24) | 136* (30*) | — | — | — | — | — | 68 (15) | 136* (30*) | — | — | — | — | 59 (13) | 100 (22) | 136* (30*) | — | — |
| 23 | — | — | — | — | 91 (20) | 136* (30*) | — | — | — | — | — | 64 (14) | 132 (29) | 136* (30*) | — | — | — | 55 (12) | 86 (19) | 136* (30*) | — | — |
| 25 | — | — | — | — | 86 (19) | 136* (30*) | — | — | — | — | — | 59 (13) | 123 (27) | 136* (30*) | — | — | — | — | 77 (17) | 136* (30*) | — | — |
| 30 | — | — | — | — | 73 (16) | 127 (28) | 136* (30*) | — | — | — | — | — | 100 (22) | 136* (30*) | — | — | — | — | 64 (14) | 136* (30*) | — | — |
| 35 | — | — | — | — | 59 (13) | 109 (24) | 136* (30*) | — | — | — | — | — | 86 (19) | 136* (30*) | — | — | — | — | 55 (12) | 123 (27) | 136* (30*) | — |
| 40 | — | — | — | — | 55 (12) | 95 (21) | 136* (30*) | — | — | — | — | — | 77 (17) | 136* (30*) | — | — | — | — | — | 105 (23) | 136* (30*) | — |
| 45 | — | — | — | — | — | 86 (19) | 136* (30*) | — | — | — | — | — | 68 (15) | 123 (27) | 136* (30*) | — | — | — | — | 95 (21) | 136* (30*) | — |
| 50 | — | — | — | — | — | 77 (17) | 123 (27) | 136* (30*) | — | — | — | — | 59 (13) | 109 (24) | 136* (30*) | — | — | — | — | 86 (19) | 136* (30*) | — |
| 55 | — | — | — | — | — | 68 (15) | 114 (25) | 136* (30*) | — | — | — | — | — | 100 (22) | 136* (30*) | — | — | — | — | 77 (17) | 136* (30*) | — |
| 60 | — | — | — | — | — | 64 (14) | 105 (23) | 136* (30*) | — | — | — | — | — | 91 (20) | 136* (30*) | — | — | — | — | 68 (15) | 127 (28) | 136* (30*) |
| 65 | — | — | — | — | — | 59 (13) | 95 (21) | 136* (30*) | — | — | — | — | — | 82 (18) | 136* (30*) | — | — | — | — | 64 (14) | 118 (26) | 136* (30*) |
| 70 | — | — | — | — | — | 55 (12) | 91 (20) | 136* (30*) | — | — | — | — | — | 77 (17) | 127 (28) | — | — | — | — | 59 (13) | 109 (24) | 136* (30*) |

*Maximum flow obtainable from 1 notch with 152mm (6") water depth at drain.

**TABLE III -** TO BE USED WHEN ROOF STORM WATER RUN OFF AND OTHER SURFACE WATER RUN OFF IS BEING CONSOLIDATED INTO ONE COMMON MAIN HORIZONTAL STORM SEWER.

Flow capacity of vertical leaders litres per minute (gallons per minute)

| Pipe Size | Maximum Capacity L.P.M. (G.P.M.) |
|---|---|
| 50mm (2”) | 136 (30) |
| 75mm (3”) | 409 (90) |
| 100mm (4”) | 864 (190) |
| †125mm (5”) | 1582 (348) |
| 150mm (6”) | 2550 (561) |

†In some areas 125mm (5”) drainage pipe may not be available.

Flow capacity of horizontal storm sewers litres per minute (gallons per minute).

| Pipe Size | Slope per 305mm (1’0”) | | |
|---|---|---|---|
| | 3mm (1/8”) | 6mm (1/4”) | 13mm (1/2”) |
| 75mm (3”) | 163 (36) | 232 (51) | 327 (72) |
| 100mm (4”) | 355 (78) | 505 (111) | 714 (157) |
| †125mm (5”) | 646 (142) | 914 (201) | 1291 (284) |
| 150mm (6”) | 1050 (231) | 1487 (327) | 2100 (462) |
| 200mm (8”) | 2264 (498) | 3205 (705) | 4528 (996) |
| 250mm (10”) | 4100 (902) | 5796 (1275) | 8201 (1804) |
| 300mm (12”) | 6669 (1467) | 9437 (2076) | 13338 (2934) |
| 375mm (15”) | 12120 (2666) | 17157 (3774) | 24239 (5332) |

Note: Although pipe size calculations should be based on accumulated flow rate, local by-laws should be referred to for minimum pipe size requirements and roof drain spacing.

## SCUPPER AND OVERFLOW DRAINS

Roofing members and understructures, weakened by seepage and rot resulting from improper drainage and roof construction can give away under the weight of rapidly accumulated water during flash storms. Thus, it is recommended, and often required by building codes, to install scuppers and overflow drains in parapet-type roofs. Properly selected and sized scuppers and overflow drains are vital to a well-engineered drainage system to prevent excessive loading, erosion, seepage and rotting.

# Selecta-Drain Chart

| LOCATION | SQUARE METRE (SQUARE FOOT) NOTCH AREA RATING | ROOF LOAD FACTOR KGS. (LBS.) | TOTAL ROOF SLOPE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | DEAD LEVEL | | | 51mm (2") RISE | | | 102mm (4") RISE | | | 152mm (6") RISE | | |
| | | | L.P.M. (G.P.M.) Discharge | Draindown Time Hrs. | mm (in.) Water Depth | L.P.M. (G.P.M.) Discharge | Draindown Time Hrs. | mm (in.) Water Depth | L.P.M. (G.P.M.) Discharge | Draindown Time Hrs. | mm (in.) Water Depth | L.P.M. (G.P.M.) Discharge | Draindown Time Hrs. | mm (in.) Water Depth |
| Calgary, Alberta | 232 (2,500) | 4.7 (10.4) | 45.5 (10) | 7 | 51 (2) | 57 (12.5) | 6 | 63.5 (2.5) | 72.5 (16) | 4 | 81.5 (3.2) | 86.5 (19) | 3.2 | 96.5 (3.8) |
| | 465 (5,000) | 5.9 (13) | 57 (12.5) | 17 | 63.5 (2.5) | 66 (14.5) | 14 | 73.5 (2.9) | 82 (18) | 9 | 91.5 (3.6) | 97.5 (21.5) | 7.5 | 109 (4.3) |
| | 697 (7,500) | 6.4 (14) | 61.5 (13.5) | 28 | 68.5 (2.7) | 72.5 (16) | 22 | 81.5 (3.2) | 88.5 (19.5) | 15 | 99 (3.9) | 104.5 (23) | 12 | 117 (4.6) |
| | 929 (10,000) | 6.8 (15.1) | 66 (14.5) | 38 | 73.5 (2.9) | 77.5 (17) | 31 | 86.5 (3.4) | 93 (20.5) | 22 | 104 (4.1) | 109 (24) | 17 | 122 (4.8) |
| Edmonton, Alberta | 232 (2,500) | 4.5 (9.9) | 43 (9.5) | 7 | 48.5 (1.9) | 57 (12.5) | 6 | 63.5 (2.5) | 72.5 (16) | 4 | 81.5 (3.2) | 82 (18) | 3 | 91.5 (3.6) |
| | 465 (5,000) | 5.9 (13) | 57 (12.5) | 17 | 63.5 (2.5) | 68 (15) | 14.5 | 76 (3) | 84 (18.5) | 9.5 | 94 (3.7) | 97.5 (21.5) | 7.5 | 109 (4.3) |
| | 697 (7,500) | 6.6 (14.5) | 63.5 (14) | 28 | 71 (2.8) | 75 (16.5) | 24 | 84 (3.3) | 97.5 (21.5) | 16 | 104 (4.1) | 107 (23.5) | 12 | 119.5 (4.7) |
| | 929 (10,000) | 7.1 (15.6) | 68 (15) | 38 | 76 (3.0) | 79.5 (17.5) | 32 | 89 (3.5) | 100 (22) | 22 | 112 (4.4) | 113.5 (25) | 18 | 127 (5.0) |
| Penticton, British Columbia | 232 (2,500) | 3.8 (8.3) | 36.5 (8) | 6 | 40.5 (1.6) | 38.5 (8.5) | 4 | 43 (1.7) | 52.5 (11.5) | 3 | 58.5 (2.3) | 61.5 (13.5) | 2.3 | 68.5 (2.7) |
| | 465 (5,000) | 4.0 (8.8) | 38.5 (8.5) | 13 | 43 (1.7) | 41 (9) | 9 | 45.5 (1.8) | 57 (12.5) | 6 | 63.5 (2.5) | 68 (15) | 5 | 76 (3) |
| | 697 (7,500) | 4.2 (9.3) | 41 (9) | 21 | 45.5 (1.8) | 43 (9.5) | 14.5 | 48.5 (1.9) | 61.5 (13.5) | 10.5 | 68.5 (2.7) | 72.5 (16) | 8 | 81.5 (3.2) |
| | 929 (10,000) | 4.2 (9.3) | 41 (9) | 27 | 45.5 (1.8) | 45.5 (10) | 20 | 51 (2) | 63.5 (14) | 14 | 71 (2.8) | 75 (16.5) | 11 | 84 (3.3) |
| Vancouver, British Columbia | 232 (2,500) | 3.3 (7.3) | 32 (7) | 5.5 | 35.5 (1.4) | 38.5 (8.5) | 4 | 43 (1.7) | 47.5 (10.5) | 2.8 | 53.5 (2.1) | 57 (12.5) | 2 | 63.5 (2.5) |
| | 465 (5,000) | 4.0 (8.8) | 38.5 (8.5) | 13 | 43 (1.7) | 45.5 (10) | 10 | 51 (2) | 57 (12.5) | 6 | 63.5 (2.5) | 68 (15) | 5 | 76 (3) |
| | 697 (7,500) | 4.5 (9.9) | 43 (9.5) | 22 | 48.5 (1.9) | 50 (11) | 17 | 56 (2.2) | 63.5 (14) | 11 | 71 (2.8) | 75 (16.5) | 8.5 | 84 (3.3) |
| | 929 (10,000) | 4.9 (10.9) | 47.5 (10.5) | 30 | 53.5 (2.1) | 54.5 (12) | 24 | 61 (2.4) | 68 (15) | 15 | 76 (3) | 79.5 (17.5) | 12 | 89 (3.5) |
| Victoria, British Columbia | 232 (2,500) | 3.3 (7.3) | 32 (7) | 5.5 | 35.5 (1.4) | 38.5 (8.5) | 4 | 43 (1.7) | 43 (9.5) | 2.5 | 48.5 (1.9) | 54.5 (12) | 2 | 61 (2.4) |
| | 465 (5,000) | 4.0 (8.8) | 38.5 (8.5) | 13 | 43 (1.7) | 45.5 (10) | 10 | 51 (2) | 54.5 (12) | 6 | 61 (2.4) | 68 (15) | 5 | 76 (3) |
| | 697 (7,500) | 4.5 (9.9) | 43 (9.5) | 22 | 48.5 (1.9) | 50 (11) | 16 | 56 (2.2) | 59 (13) | 10 | 66 (2.6) | 75 (16.5) | 8 | 84 (3.3) |
| | 929 (10,000) | 4.7 (10.4) | 45.5 (10) | 30 | 51 (2) | 54.5 (12) | 23 | 61 (2.4) | 63.5 (14) | 14 | 71 (2.8) | 79.5 (17.5) | 12 | 89 (3.5) |
| Brandon, Manitoba | 232 (2,500) | 5.9 (13) | 57 (12.5) | 8 | 63.5 (2.5) | 68 (15) | 7 | 76 (3) | 82 (18) | 4.5 | 91.5 (3.6) | 92.5 (21) | 3.5 | 106.5 (4.2) |
| | 465 (5,000) | 7.3 (16.1) | 73 (16) | 20 | 81.5 (3.2) | 84 (18.5) | 17 | 94 (3.7) | 97.5 (21.5) | 11 | 109 (4.3) | 113.5 (25) | 8.5 | 127 (5) |
| | 697 (7,500) | 8.3 (18.2) | 79.5 (17.5) | 32 | 89 (3.5) | 93 (20.5) | 27 | 104 (4.1) | 107 (23.5) | 19 | 119.5 (4.7) | 125 (27.5) | 15 | 139.5 (5.5) |
| | 929 (10,000) | 9.0 (19.8) | 86.5 (19) | 43 | 96.5 (3.8) | 100 (22) | 38 | 112 (4.4) | 113.5 (25) | 26 | 127 (5.0) | 132 (29) | 21 | 147.5 (5.8) |
| Winnipeg, Manitoba | 232 (2,500) | 4.7 (10.4) | 45.5 (10) | 7 | 51 (2) | 57 (12.5) | 6 | 63.5 (2.5) | 75 (16.5) | 4 | 84 (3.3) | 86.5 (19) | 3.2 | 96.5 (3.8) |
| | 465 (5,000) | 5.9 (13) | 57 (12.5) | 17 | 63.5 (2.5) | 68 (15) | 15 | 76 (3) | 84 (18.5) | 10 | 94 (3.7) | 100 (22) | 7.5 | 112 (4.4) |
| | 697 (7,500) | 6.6 (14.5) | 63.5 (14) | 28 | 71 (2.8) | 75 (16.5) | 24 | 84 (3.3) | 93 (20.5) | 16 | 104 (4.1) | 107 (23.5) | 12 | 119.5 (4.7) |
| | 929 (10,000) | 7.1 (15.6) | 68 (15) | 39 | 76 (3) | 82 (18) | 32 | 91.5 (3.6) | 97.5 (21.5) | 22 | 109 (4.3) | 113.5 (25) | 17 | 127 (5.0) |
| Campbellton, New Brunswick | 232 (2,500) | 6.4 (14) | 62 (13.5) | 9 | 68.5 (2.7) | 70.5 (15.5) | 7 | 78.5 (3.1) | 79.5 (17.5) | 4.5 | 89 (3.5) | 91 (20) | 3.5 | 101.5 (4.0) |
| | 465 (5,000) | 9.0 (19.8) | 86.5 (19) | 22 | 96.5 (3.8) | 91 (20) | 18 | 101.5 (4) | 102.5 (22.5) | 12 | 115 (4.5) | 113.5 (25) | 9 | 127 (5.0) |
| | 697 (7,500) | 10.4 (22.9) | 100 (22) | 35 | 112 (4.4) | 102.5 (22.5) | 28 | 114.5 (4.5) | 118 (26) | 20 | 132 (5.2) | 132 (29) | 15 | 147.5 (5.8) |
| | 929 (10,000) | 11.3 (25) | 109 (24) | 47 | 122 (4.8) | 111.5 (24.5) | 40 | 124.5 (4.9) | 127.5 (28) | 29 | 142 (5.6) | 141 (31) | 22 | 157.5 (6.2) |

# Selecta-Drain Chart

| LOCATION | SQUARE METRE (SQUARE FOOT) NOTCH AREA RATING | ROOF LOAD FACTOR KGS. (LBS.) | TOTAL ROOF SLOPE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | DEAD LEVEL | | | 51mm (2") RISE | | | 102mm (4") RISE | | | 152mm (6") RISE | | |
| | | | L.P.M. (G.P.M.) Discharge | Draindown Time Hrs. | mm (in.) Water Depth | L.P.M. (G.P.M.) Discharge | Draindown Time Hrs. | mm (in.) Water Depth | L.P.M. (G.P.M.) Discharge | Draindown Time Hrs. | mm (in.) Water Depth | L.P.M. (G.P.M.) Discharge | Draindown Time Hrs. | mm (in.) Water Depth |
| Chatham, New Brunswick | 232 (2,500) | 4.5 (9.9) | 43 (9.5) | 7 | 48.5 (1.9) | 52.5 (11.5) | 5.5 | 58.5 (2.3) | 63.5 (14) | 3.5 | 71 (2.8) | 77.5 (17) | 2.9 | 86.5 (3.4) |
| | 465 (5,000) | 5.7 (12.5) | 54.5 (12) | 16 | 61 (2.4) | 63.5 (14) | 13 | 71 (2.8) | 77.5 (17) | 9 | 86.5 (3.4) | 91 (20) | 7 | 101.5 (4.0) |
| | 697 (7,500) | 6.4 (14) | 61.5 (13.5) | 27 | 68.5 (2.7) | 68 (15) | 22 | 76 (3) | 84 (18.5) | 14 | 94 (3.7) | 102.5 (22.5) | 12 | 114.5 (4.5) |
| | 929 (10,000) | 6.6 (14.6) | 63.5 (14) | 37 | 71 (2.8) | 75 (16.5) | 30 | 84 (3.3) | 91 (20) | 20 | 101.5 (4.0) | 107 (23.5) | 16 | 119.5 (4.7) |
| Moncton, New Brunswick | 232 (2,500) | 4.3 (9.4) | 41 (9) | 7 | 45.5 (1.8) | 54.5 (12) | 6 | 61 (2.4) | 63.5 (14) | 3.5 | 71 (2.8) | 72.5 (16) | 2.7 | 81.5 (3.2) |
| | 465 (5,000) | 5.9 (13) | 57 (12.5) | 17 | 63.5 (2.5) | 68 (15) | 14 | 76 (3) | 82 (18) | 9 | 91.5 (3.6) | 93 (20.5) | 7 | 104 (4.1) |
| | 697 (7,500) | 6.6 (14.6) | 63.5 (14) | 28 | 71 (2.8) | 79.5 (17.5) | 24 | 89 (3.5) | 93 (20.5) | 16 | 104 (4.1) | 104.5 (23) | 12 | 117 (4.6) |
| | 929 (10,000) | 7.5 (16.6) | 73.5 (16) | 39 | 81.5 (3.2) | 84 (18.5) | 34 | 94 (3.7) | 100 (22) | 23 | 112 (4.4) | 113.5 (25) | 17 | 127 (5.0) |
| Saint John, New Brunswick | 232 (2,500) | 5.7 (12.5) | 54.5 (12) | 8 | 61 (2.4) | 57 (12.5) | 6 | 63.5 (2.5) | 75 (16.5) | 4 | 84 (3.3) | 86.5 (19) | 3 | 96.5 (3.8) |
| | 465 (5,000) | 7.5 (16.6) | 72.5 (16) | 20 | 81.5 (3.2) | 79.5 (17.5) | 16 | 89 (3.5) | 95.5 (21) | 11 | 106.5 (4.2) | 104.5 (23) | 8 | 117 (4.6) |
| | 697 (7,500) | 8.7 (19.2) | 84 (18.5) | 32 | 94 (3.7) | 93 (20.5) | 27 | 104 (4.1) | 107 (23.5) | 19 | 119.5 (4.7) | 118 (26) | 13.5 | 132 (5.2) |
| | 929 (10,000) | 9.7 (21.3) | 93 (20.5) | 44 | 104 (4.1) | 104.5 (23) | 38 | 117 (4.6) | 113.5 (25) | 27 | 127 (5.0) | 127.5 (28) | 20 | 142 (5.6) |
| Gander, Newfound-land | 232 (2,500) | 3.5 (7.8) | 34 (7.5) | 5.5 | 38 (1.5) | 45.5 (10) | 5 | 51 (2.0) | 57 (12.5) | 3.5 | 63.5 (2.5) | 68 (15) | 2.5 | 76 (3.0) |
| | 465 (5,000) | 4.7 (10.4) | 45.5 (10) | 15 | 51 (2.0) | 57 (12.5) | 12 | 63.5 (2.5) | 72.5 (16) | 8 | 81.5 (3.2) | 82 (18) | 6.5 | 91.5 (3.6) |
| | 697 (7,500) | 5.7 (12.5) | 54.5 (12) | 25 | 61 (2.4) | 63.5 (14) | 21 | 71 (2.8) | 79.5 (17.5) | 13.5 | 89 (3.5) | 93 (20.5) | 11 | 104 (4.1) |
| | 929 (10,000) | 6.1 (13.5) | 59 (13) | 35 | 66 (2.6) | 70.5 (15.5) | 29 | 78.5 (3.1) | 84 (18.5) | 19 | 94 (3.7) | 100 (22) | 15 | 112 (4.4) |
| St. Andrews, Newfound-land | 232 (2,500) | 3.5 (7.8) | 34 (7.5) | 5.5 | 38 (1.5) | 45.5 (10) | 5 | 51 (2.0) | 59 (13) | 3.5 | 66 (2.6) | 63.5 (14) | 2.5 | 71 (2.8) |
| | 465 (5,000) | 5.2 (11.4) | 47.5 (10.5) | 15 | 53.5 (2.1) | 59 (13) | 13 | 66 (2.6) | 72.5 (16) | 8 | 81.5 (3.2) | 79.5 (17.5) | 6 | 89 (3.5) |
| | 697 (7,500) | 5.9 (13) | 57 (12.5) | 26 | 63.5 (2.5) | 66 (14.5) | 21 | 73.5 (2.9) | 82 (18) | 14 | 91.5 (3.6) | 88.5 (19.5) | 10 | 99 (3.9) |
| | 929 (10,000) | 6.6 (14.6) | 63.5 (14) | 36 | 71 (2.8) | 72.5 (16) | 30 | 81.5 (3.2) | 86.5 (19) | 20 | 96.5 (3.8) | 95.5 (21) | 14.5 | 106.5 (4.2) |
| St. John's, Newfound-land | 232 (2,500) | 5.9 (13) | 57 (12.5) | 8 | 63.5 (2.6) | 68 (15) | 7 | 76 (3.0) | 77.5 (17) | 4.5 | 86.5 (3.4) | 86.5 (19) | 3.2 | 96.5 (3.8) |
| | 465 (5,000) | 8.5 (18.7) | 82 (18) | 21 | 91.5 (3.6) | 91 (20) | 18 | 101 (4.0) | 100 (22) | 11 | 112 (4.4) | 113.5 (25) | 9 | 127 (5.0) |
| | 697 (7,500) | 10.6 (23.4) | 102.5 (22.5) | 34 | 114.5 (4.5) | 109 (24) | 29 | 122 (4.8) | 122.5 (27) | 21 | 137 (5.4) | 132 (29) | 15 | 147.5 (5.8) |
| | 929 (10,000) | 11.8 (26) | 113.5 (25) | 48 | 127 (5.0) | 129.5 (28.5) | 43 | 145 (5.7) | 143 (31.5) | 33 | 160 (6.3) | 150 (33) | 24 | 167.5 (6.6) |
| Torbay, Newfound-land | 232 (2,500) | 4.9 (10.9) | 47.5 (10.5) | 7.5 | 53.5 (2.1) | 61.5 (13.5) | 6.5 | 68.5 (2.7) | 75 (16.5) | 4 | 84 (3.3) | 84 (18.5) | 3 | 94 (3.7) |
| | 465 (5,000) | 6.4 (14) | 61.5 (13.5) | 18 | 68.5 (2.7) | 75 (16.5) | 15.5 | 84 (3.3) | 88.5 (19.5) | 10 | 99 (3.9) | 102.5 (22.5) | 8 | 114.5 (4.5) |
| | 697 (7,500) | 7.3 (16.1) | 70.5 (15.5) | 29 | 78.5 (3.1) | 84 (18.5) | 25 | 94 (3.7) | 100 (22) | 17.5 | 112 (4.4) | 113.5 (25) | 13 | 127 (5) |
| | 929 (10,000) | 8.0 (17.7) | 77.5 (17) | 40 | 86.5 (3.4) | 88.5 (19.5) | 34 | 99 (3.9) | 107 (23.5) | 24 | 119.5 (4.7) | 122.5 (27) | 19 | 137 (5.4) |
| Halifax, Nova Scotia | 232 (2,500) | 5.9 (13) | 57 (12.5) | 8 | 63.5 (2.5) | 68 (15) | 7 | 76 (3.0) | 77.5 (17) | 4.5 | 86.5 (3.4) | 86.5 (19) | 3.2 | 96.5 (3.8) |
| | 465 (5,000) | 8.5 (18.7) | 82 (18) | 21 | 91.5 (3.6) | 91 (20) | 18 | 101.5 (4.0) | 100 (22) | 11 | 112 (4.4) | 113.5 (25) | 9 | 127 (5.0) |
| | 697 (7,500) | 10.6 (23.4) | 102.5 (22.5) | 34 | 114.5 (4.5) | 109 (24) | 29 | 122 (4.8) | 122.5 (27) | 21 | 137 (5.4) | 132 (29) | 15 | 147.5 (5.8) |
| | 929 (10,000) | 11.8 (26) | 113.5 (25) | 48 | 127 (5.0) | 129.5 (28.5) | 43 | 145 (5.7) | 143 (31.5) | 33 | 160 (6.3) | 150 (33) | 24 | 167.5 (6.6) |

# Selecta-Drain Chart

| LOCATION | SQUARE METRE (SQUARE FOOT) NOTCH AREA RATING | ROOF LOAD FACTOR KGS. (LBS.) | TOTAL ROOF SLOPE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | DEAD LEVEL | | | 51mm (2") RISE | | | 102mm (4") RISE | | | 152mm (6") RISE | | |
| | | | L.P.M. (G.P.M.) Discharge | Draindown Time Hrs. | mm (in.) Water Depth | L.P.M. (G.P.M.) Discharge | Draindown Time Hrs. | mm (in.) Water Depth | L.P.M. (G.P.M.) Discharge | Draindown Time Hrs. | mm (in.) Water Depth | L.P.M. (G.P.M.) Discharge | Draindown Time Hrs. | mm (in.) Water Depth |
| Sydney, Nova Scotia | 232 (2,500) | 4.3 (9.4) | 41 (9) | 6.5 | 45.5 (1.8) | 45.5 (10) | 5 | 51 (2.0) | 57 (12.5) | 3.5 | 6.5 (2.5) | 68 (15) | 2.5 | 76 (3) |
| | 465 (5,000) | 5.7 (12.5) | 54.5 (12) | 16 | 61 (2.4) | 59 (13) | 13 | 66 (2.6) | 75 (16.5) | 8 | 84 (3.3) | 84 (18.5) | 6.5 | 94 (3.7) |
| | 697 (7,500) | 6.4 (14) | 61.5 (13.5) | 28 | 68.5 (2.7) | 68 (15) | 22 | 76 (3) | 84 (18.5) | 14 | 94 (3.7) | 97.5 (21.5) | 11 | 109 (4.3) |
| | 929 (10,000) | 7.1 (15.6) | 68 (15) | 38 | 76 (3) | 75 (16.5) | 30 | 84 (3.3) | 91 (20) | 20 | 101.5 (4) | 104.5 (23) | 16 | 117 (4.6) |
| Yarmouth, Nova Scotia | 232 (2,500) | 6.4 (14) | 61.5 (13.5) | 9 | 68.5 (2.7) | 70.5 (15.5) | 7.5 | 78.5 (3.1) | 82 (18) | 4.5 | 91.5 (3.6) | 91 (20) | 3.5 | 101.5 (4) |
| | 465 (5,000) | 8.3 (18.2) | 79.5 (17.5) | 21 | 89 (3.5) | 88.5 (19.5) | 18 | 99 (3.9) | 104.5 (23) | 12 | 117 (4.6) | 116 (25.5) | 9 | 129.5 (5.1) |
| | 697 (7,500) | 9.4 (20.8) | 91 (20) | 34 | 101.5 (4) | 102.5 (22.5) | 29 | 114.5 (4.5) | 118 (26) | 21 | 132 (5.2) | 132 (29) | 15 | 147.5 (5.8) |
| | 929 (10,000) | 10.4 (22.9) | 100 (22) | 45 | 112 (4.4) | 109 (24) | 41 | 122 (4.8) | 129.5 (28.5) | 29 | 145 (5.7) | 141 (31) | 22 | 157.5 (6.2) |
| Thunder Bay, Ontario | 232 (2,500) | 4.9 (10.9) | 47.5 (10.5) | 7.5 | 53.5 (2.1) | 61.5 (13.5) | 6.5 | 68.5 (2.7) | 75 (16.5) | 4 | 84 (3.3) | 88.5 (19.5) | 3.5 | 91.5 (3.6) |
| | 465 (5,000) | 6.1 (13.5) | 59 (13) | 18 | 66 (2.6) | 72.5 (16) | 15 | 81.5 (3.2) | 86.5 (19) | 9.5 | 96.5 (3.8) | 102.5 (22.5) | 7.5 | 114.5 (4.5) |
| | 697 (7,500) | 6.6 (14.6) | 63.5 (14) | 28 | 71 (2.8) | 77.5 (17) | 24 | 86.5 (3.4) | 93 (20.5) | 16 | 104 (4.1) | 109 (24) | 13 | 122 (4.8) |
| | 929 (10,000) | 7.1 (15.6) | 68 (15) | 38 | 76 (3) | 84 (18.5) | 33 | 94 (3.7) | 97.5 (21.5) | 22 | 109 (4.3) | 116 (25.5) | 18 | 129.5 (5.1) |
| Guelph, Ontario | 232 (2,500) | 5.7 (12.5) | 54.5 (12) | 8 | 61 (2.4) | 63.5 (14) | 7 | 71 (2.8) | 86.5 (19) | 5 | 96.5 (3.8) | 100 (22) | 3.7 | 112 (4.4) |
| | 465 (5,000) | 6.6 (14.6) | 63.5 (14) | 19 | 71 (2.8) | 75 (16.5) | 15.5 | 84 (3.3) | 97.5 (21.5) | 11 | 109 (4.3) | 116 (25.5) | 9 | 129.5 (5.1) |
| | 697 (7,500) | 7.3 (16.1) | 70.5 (15.5) | 29 | 78.5 (3.1) | 82 (18) | 25 | 91.5 (3.6) | 104.5 (23) | 18 | 117 (4.6) | 125 (27.5) | 14 | 139.5 (5.5) |
| | 929 (10,000) | 8.0 (17.7) | 77.5 (17) | 40 | 86.5 (3.4) | 84 (18.5) | 34 | 94 (3.7) | 109 (24) | 26 | 122 (4.8) | 132 (29) | 20 | 147.5 (5.8) |
| Hamilton, Ontario | 232 (2,500) | 5.9 (13) | 57 (12.5) | 8.5 | 63.5 (2.5) | 72.5 (16) | 7.5 | 81.5 (3.2) | 93 (20.5) | 5 | 104 (4.1) | 109 (24) | 4 | 122 (4.8) |
| | 465 (5,000) | 6.6 (14.6) | 63.5 (14) | 19 | 71 (2.8) | 79.5 (17.5) | 16 | 89 (3.5) | 104.5 (23) | 12 | 117 (4.6) | 122.5 (27) | 9 | 137 (5.4) |
| | 697 (7,500) | 6.8 (15.1) | 66 (14.5) | 28 | 73.5 (2.9) | 84 (18.5) | 26 | 94 (3.7) | 111.5 (24.5) | 20 | 124.5 (4.9) | 127.5 (28) | 15 | 142 (5.6) |
| | 929 (10,000) | 7.1 (15.6) | 68 (15) | 39 | 76 (3) | 86.5 (19) | 34 | 96.5 (3.8) | 116 (25.5) | 27 | 129.5 (5.1) | 134 (29.5) | 21 | 150 (5.9) |
| Kingston, Ontario | 232 (2,500) | 6.4 (14) | 61.5 (13.5) | 9 | 68.5 (2.7) | 77.5 (17) | 8 | 86.5 (3.4) | 91 (20) | 5 | 101.5 (4) | 109 (24) | 4 | 122 (4.8) |
| | 465 (5,000) | 7.5 (16.6) | 72.5 (16) | 20 | 81.5 (3.2) | 86.5 (19) | 18 | 96.5 (3.8) | 104.5 (23) | 12 | 117 (4.6) | 122.5 (27) | 9.5 | 137 (5.4) |
| | 697 (7,500) | 8.5 (18.7) | 82 (18) | 31 | 91.5 (3.6) | 93 (20.5) | 28 | 104 (4.1) | 111.5 (24.5) | 20 | 124.5 (4.9) | 132 (29) | 15 | 147.5 (5.8) |
| | 929 (10,000) | 8.7 (19.2) | 86.5 (19) | 42 | 96.5 (3.8) | 97.5 (21.5) | 38 | 109 (4.3) | 116 (25.5) | 27 | 129.5 (5.1) | 68 (15) | 21 | 152.5 (6) |
| London, Ontario | 232 (2,500) | 6.1 (13.5) | 59 (13) | 8.5 | 66 (2.6) | 72.5 (16) | 7.5 | 81.5 (3.2) | 88.5 (19.5) | 5 | 99 (3.9) | 107 (23.5) | 4 | 119.5 (4.7) |
| | 465 (5,000) | 7.1 (15.6) | 68 (15) | 20 | 76 (3) | 84 (18.5) | 17 | 94 (3.7) | 102.5 (22.5) | 12 | 114.5 (4.5) | 122.5 (27) | 9.5 | 137 (5.4) |
| | 697 (7,500) | 8.0 (17.7) | 77.5 (17) | 30 | 86.5 (3.4) | 88.5 (19.5) | 27 | 99 (3.9) | 109 (24) | 19 | 122 (4.8) | 129.5 (28.5) | 15 | 145 (5.7) |
| | 929 (10,000) | 8.5 (18.7) | 82 (18) | 41 | 91.5 (3.6) | 91 (20) | 36 | 101.5 (4) | 113.5 (25) | 27 | 127 (5) | 134 (29.5) | 21 | 150 (5.9) |
| North Bay, Ontario | 232 (2,500) | 5.7 (12.5) | 54.5 (12) | 8 | 61 (2.4) | 68 (15) | 7 | 76 (3) | 86.5 (19) | 5 | 96.5 (3.8) | 100 (22) | 3.8 | 112 (4.4) |
| | 465 (5,000) | 6.6 (14.6) | 63.5 (14) | 19 | 71 (2.8) | 79.5 (17.5) | 16 | 89 (3.5) | 97.5 (21.5) | 11 | 109 (4.3) | 113.5 (25) | 9 | 127 (5) |
| | 697 (7,500) | 7.5 (16.6) | 72.5 (16) | 30 | 81.5 (3.2) | 86.5 (19) | 26 | 96.5 (3.8) | 107 (23.5) | 19 | 119.5 (4.7) | 122.5 (27) | 14 | 137 (5.4) |
| | 929 (10,000) | 8.3 (18.2) | 77.5 (17) | 40 | 86.5 (3.4) | 93 (20.5) | 36 | 104 (4.1) | 111.5 (24.5) | 26 | 124.5 (4.9) | 127.5 (28) | 20 | 142 (5.6) |

# Selecta-Drain Chart

| LOCATION | SQUARE METRE (SQUARE FOOT) NOTCH AREA RATING | ROOF LOAD FACTOR KGS. (LBS.) | TOTAL ROOF SLOPE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | DEAD LEVEL | | | 51mm (2") RISE | | | 102mm (4") RISE | | | 152mm (6") RISE | | |
| | | | L.P.M. (G.P.M.) Discharge | Draindown Time Hrs. | mm (in.) Water Depth | L.P.M. (G.P.M.) Discharge | Draindown Time Hrs. | mm (in.) Water Depth | L.P.M. (G.P.M.) Discharge | Draindown Time Hrs. | mm (in.) Water Depth | L.P.M. (G.P.M.) Discharge | Draindown Time Hrs. | mm (in.) Water Depth |
| Ottawa, Ontario | 232 (2,500) | 4.7 (10.4) | 45.5 (10) | 7 | 51 (2) | 59 (13) | 6.5 | 66 (2.6) | 77.5 (17) | 4.5 | 86.5 (3.4) | 86.5 (19) | 3.2 | 96.5 (3.8) |
| | 465 (5,000) | 5.9 (13) | 57 (12.5) | 17 | 63.5 (2.5) | 68 (15) | 14 | 76 (3) | 86.5 (19) | 10 | 96.5 (3.8) | 100 (22) | 7.5 | 112 (4.4) |
| | 697 (7,500) | 6.4 (14) | 61.5 (13.5) | 27 | 68.5 (2.7) | 75 (16.5) | 23 | 84 (3.3) | 93 (20.5) | 16 | 104 (4.1) | 107 (23.5) | 12 | 119.5 (4.7) |
| | 929 (10,000) | 6.6 (14.6) | 63.5 (14) | 36 | 71 (2.8) | 79.5 (17.5) | 32 | 89 (3.5) | 97.5 (21.5) | 22 | 109 (4.3) | 113.5 (25) | 18 | 127 (5) |
| St. Thomas, Ontario | 232 (2,500) | 5.7 (12.5) | 54.5 (12) | 8 | 61 (2.4) | 68 (15) | 7 | 76 (3.0) | 86.5 (19) | 5 | 96.5 (3.8) | 104.5 (23) | 4 | 117 (4.6) |
| | 465 (5,000) | 6.6 (14.6) | 63.5 (14) | 19 | 71 (2.8) | 77.5 (17) | 16 | 86.5 (3.4) | 97.5 (21.5) | 11 | 109 (4.3) | 118 (26) | 9 | 132 (5.2) |
| | 697 (7,500) | 7.1 (16.6) | 68 (15) | 29 | 76 (3.0) | 82 (18) | 26 | 91.5 (3.6) | 102.5 (22.5) | 18 | 114.5 (4.5) | 125 (27.5) | 15 | 139.5 (5.5) |
| | 929 (10,000) | 7.5 (16.6) | 72.5 (16) | 40 | 81.5 (3.2) | 86.5 (19) | 34 | 96.5 (3.8) | 107 (23.5) | 24 | 119.5 (4.7) | 132 (29) | 20 | 147.5 (5.8) |
| Timmins, Ontario | 232 (2,500) | 4.3 (9.4) | 41 (9) | 7 | 45.5 (1.8) | 57 (12.5) | 6 | 63.5 (2.5) | 72.5 (16) | 4 | 81.5 (3.2) | 86.5 (19) | 3.3 | 96.5 (3.8) |
| | 465 (5,000) | 5.7 (12.5) | 54.5 (12) | 16 | 61 (2.4) | 63.5 (14) | 14 | 71 (2.8) | 82 (18) | 9 | 91.5 (3.6) | 97.5 (21.5) | 7.5 | 109 (4.3) |
| | 697 (7,500) | 6.4 (14) | 61.5 (13.5) | 27 | 68.5 (2.7) | 70.5 (15.5) | 22 | 78.5 (3.1) | 86.5 (19) | 15 | 96.5 (3.8) | 104.5 (23) | 12 | 117 (4.6) |
| | 929 (10,000) | 6.6 (14.6) | 63.5 (14) | 36 | 71 (2.8) | 72.5 (16) | 30 | 81.5 (3.2) | 91 (20) | 21 | 101.5 (4.0) | 109 (24) | 17 | 122 (4.8) |
| Toronto, Ontario | 232 (2,500) | 5.7 (12.5) | 54.5 (12) | 8 | 61 (2.4) | 66 (14.5) | 7 | 73.5 (2.9) | 82 (18) | 4.5 | 91.5 (3.6) | 97.5 (21.5) | 3.5 | 109 (4.3) |
| | 465 (5,000) | 6.8 (15.1) | 66 (14.5) | 19 | 73.5 (2.9) | 77.5 (17) | 16 | 86.5 (3.4) | 93 (20.5) | 11 | 104 (4.1) | 111.5 (24.5) | 9 | 124.5 (4.9) |
| | 697 (7,500) | 8.0 (17.7) | 77.5 (17) | 30 | 86.5 (3.4) | 84 (18.5) | 26 | 94 (3.7) | 100 (22) | 18 | 112 (4.4) | 120.5 (26.5) | 14 | 134.5 (5.3) |
| | 929 (10,000) | 8.7 (19.2) | 82 (18) | 42 | 91.5 (3.6) | 86.5 (19) | 34 | 96.5 (3.8) | 104.5 (23) | 24 | 117 (4.6) | 127.5 (28) | 20 | 142 (5.6) |
| Windsor, Ontario | 232 (2,500) | 6.1 (13.5) | 59 (13) | 8.5 | 66 (2.6) | 70.5 (15.5) | 7.5 | 78.5 (3.1) | 84 (18.5) | 4.5 | 94 (3.7) | 107 (23.5) | 4 | 119.5 (4.7) |
| | 465 (5,000) | 7.1 (15.6) | 68 (15) | 20 | 76 (3.0) | 79.5 (17.5) | 16 | 89 (3.5) | 97.5 (21.5) | 11 | 109 (4.3) | 118 (26) | 9 | 132 (5.2) |
| | 697 (7,500) | 8.0 (17.7) | 77.5 (17) | 30 | 86.5 (3.4) | 86.5 (19) | 26 | 96.5 (3.8) | 107 (23.5) | 18 | 119.5 (4.7) | 125 (27.5) | 15 | 139.5 (5.5) |
| | 929 (10,000) | 8.7 (19.2) | 82 (18) | 42 | 91.5 (3.6) | 91 (20) | 36 | 101.5 (4.0) | 113.5 (25) | 26 | 127 (5.0) | 129.5 (28.5) | 20 | 145 (5.7) |
| Charlottetown, Prince Edward Island | 232 (2,500) | 4.9 (10.9) | 47.5 (10.5) | 7.5 | 53.5 (2.1) | 57 (12.5) | 6 | 63.5 (2.5) | 68 (15) | 3.8 | 76 (3.0) | 79.5 (17.5) | 3 | 89 (3.5) |
| | 465 (5,000) | 6.6 (14.6) | 63.5 (14) | 19 | 71 (2.8) | 75 (16.5) | 15.5 | 84 (3.3) | 88.5 (19.5) | 10 | 99 (3.9) | 100 (22) | 7.5 | 112 (4.4) |
| | 697 (7,500) | 7.8 (17.2) | 75 (16.5) | 31 | 84 (3.3) | 86.5 (19) | 26 | 96.5 (3.8) | 102.5 (22.5) | 18 | 114.5 (4.5) | 113.5 (25) | 13 | 127 (5.0) |
| | 929 (10,000) | 8.7 (19.2) | 84 (18.5) | 42 | 94 (3.7) | 97.5 (21.5) | 37 | 106.5 (4.2) | 111.5 (24.5) | 26 | 124.5 (4.9) | 125 (27.5) | 20 | 139.5 (5.5) |
| Montreal, Quebec | 232 (2,500) | 5.2 (11.4) | 50 (11) | 7.5 | 56 (2.2) | 61.5 (13.5) | 7 | 68.5 (2.7) | 79.5 (17.5) | 4.5 | 89 (3.5) | 97.5 (21.5) | 3.5 | 109 (4.36) |
| | 465 (5,000) | 5.9 (13) | 57 (12.5) | 17 | 63.5 (2.5) | 70.5 (15.5) | 15 | 78.5 (3.1) | 88.5 (19.5) | 10 | 99 (3.9) | 109 (24) | 8 | 122 (4.8) |
| | 697 (7,500) | 6.1 (13.5) | 59 (13) | 27 | 66 (2.6) | 72.5 (16) | 23 | 81.5 (3.2) | 93 (20.5) | 16 | 104 (4.1) | 113.5 (25) | 13 | 127 (5.0) |
| | 929 (10,000) | 6.4 (14) | 61.5 (13.5) | 36 | 68.5 (2.7) | 77.5 (17) | 31 | 86.5 (3.4) | 95.5 (21) | 22 | 106.5 (4.2) | 120.5 (26.5) | 19 | 134.5 (5.3) |
| Quebec City, Quebec | 232 (2,500) | 5.4 (12) | 52.5 (11.5) | 8 | 58.5 (2.3) | 63.5 (14) | 7 | 71 (2.8) | 79.5 (17.5) | 4.5 | 89 (3.5) | 97.5 (21.5) | 3.5 | 109 (4.3) |
| | 465 (5,000) | 6.4 (14) | 61.5 (13.5) | 18 | 68.5 (2.7) | 70.5 (15.5) | 15 | 78.5 (3.1) | 84 (18.5) | 10 | 94 (3.7) | 104.5 (23) | 8 | 117 (4.6) |
| | 697 (7,500) | 6.6 (14.6) | 63.5 (14) | 28 | 71 (2.8) | 72.5 (16) | 23 | 81.5 (3.2) | 86.5 (19) | 15 | 96.5 (3.8) | 107 (23.5) | 12 | 119.5 (4.7) |
| | 929 (10,000) | 7.1 (15.6) | 68 (15) | 37 | 76 (3.0) | 77.5 (17) | 31 | 86.5 (3.4) | 88.5 (19.5) | 20 | 99 (3.9) | 109 (24) | 17 | 122 (4.8) |

# Selecta-Drain Chart

| LOCATION | SQUARE METRE (SQUARE FOOT) NOTCH AREA RATING | ROOF LOAD FACTOR KGS. (LBS.) | TOTAL ROOF SLOPE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | DEAD LEVEL | | | 51mm (2") RISE | | | 102mm (4") RISE | | | 152mm (6") RISE | | |
| | | | L.P.M. (G.P.M.) Discharge | **Draindown Time Hrs.** | mm (in.) Water Depth | L.P.M. (G.P.M.) Discharge | **Draindown Time Hrs.** | mm (in.) Water Depth | L.P.M. (G.P.M.) Discharge | **Draindown Time Hrs.** | mm (in.) Water Depth | L.P.M. (G.P.M.) Discharge | **Draindown Time Hrs.** | mm (in.) Water Depth |
| Regina, Saskatchewan | 232 (2,500) | 4.5 (9.9) | 43 (9.5) | **7** | 48.5 (1.9) | 54.5 (12) | **6** | 61 (2.4) | 72.5 (16) | **4** | 81.5 (3.2) | 79.5 (17.5) | **3** | 89 (3.5) |
| | 465 (5,000) | 6.4 (14) | 61.5 (13.5) | **18** | 68.5 (2.7) | 68 (15) | **14** | 76 (3.0) | 86.5 (19) | **10** | 96.5 (3.8) | 97.5 (21.5) | **7.5** | 109 (4.3) |
| | 697 (7,500) | 7.3 (16.1) | 70.5 (15.5) | **29** | 78.5 (3.1) | 77.5 (17) | **24** | 86.5 (3.4) | 100 (22) | **17** | 112 (4.4) | 109 (24) | **12** | 122 (4.8) |
| | 929 (10,000) | 8.3 (18.2) | 79.5 (17.5) | **40** | 89 (3.5) | 82 (18) | **32** | 91.5 (3.6) | 104.5 (23) | **24** | 117 (4.6) | 118 (26) | **18** | 132 (5.2) |
| Saskatoon, Saskatchewan | 232 (2,500) | 4.0 (8.8) | 38.5 (8.5) | **6** | 43 (1.7) | 57 (12.5) | **6** | 63.5 (2.5) | 66 (14.5) | **3.8** | 73.5 (2.9) | 77.5 (17) | **2.8** | 86.5 (3.4) |
| | 465 (5,000) | 5.7 (12.5) | 54.5 (12) | **16** | 61 (2.4) | 68 (15) | **14.5** | 76 (3.0) | 82 (18) | **9** | 91.5 (3.6) | 95.5 (21) | **7** | 106.5 (4.2) |
| | 697 (7,500) | 6.6 (14.6) | 63.5 (14) | **28** | 71 (2.8) | 75 (16.5) | **24** | 84 (3.3) | 91 (20) | **16** | 101.5 (4.0) | 104.5 (23) | **12** | 117 (4.6) |
| | 929 (10,000) | 7.1 (15.6) | 68 (15) | **38** | 76 (3.0) | 82 (18) | **32** | 91.5 (3.6) | 97.5 (21.5) | **22** | 109 (4.3) | 113.5 (25) | **18** | 127 (5.0) |




***ZURN INDUSTRIES LIMITED***
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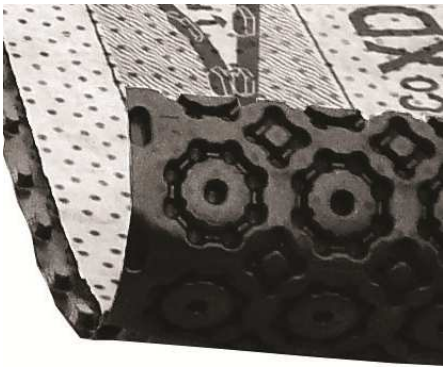
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Form 81-31, Rev. 9/10

**www.zurn.com**

# Product Data Sheet
# Fixodrain® XD 20

Order No. 3021



Economic drainage, water retention and protection mat for use as an alternative to single layered extensive green roof build-ups.



## Technical Data

**Fixodrain® XD 20**

Drainage, water retention and protection mat with attached filter sheet, openings for diffusion, connecting lengthwise on interlocking studs.

| | |
|---|---|
| Material: | PE-HD |
| Colour: | black / grey |
| Height: | ca. 20 mm |
| Weight: | ca. 1.0 kg/m² |
| Max. compressive strength: | 50 kN/m² |
| Water storage capacity: | ca. 3 l/m² |
| Vertical water flow to element level according to Standard EN ISO 11058: | ca. 70 l/s |
| In-plane water flow capacity (EN ISO 12958): | |
| roof slope 1 %: | ca. 0.36 l/(s·m) |
| roof slope 2 %: | ca. 0.52 l/(s·m) |
| roof slope 3 %: | ca. 0.65 l/(s·m) |
| Dimensions: | |
| Roll width: | ca. 1.00 m |
| Roll length: | ca. 20.00 m |

Upon request also available as single sheets without filter sheet.

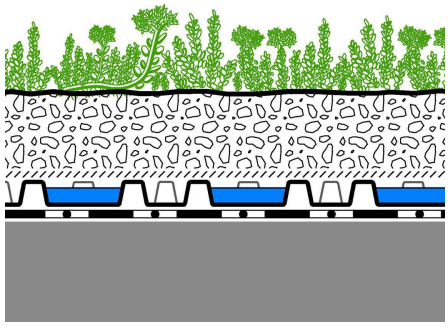
## Features

- interlocking studs for easy and durable installation
- water retention within the element
- tested drainage capacity according to EN ISO 12958
- quick and easy installation
- completely recyclable

Recycling for a better environment

## Application Example

"Industrial Green Roof"



Plant layer
"Sedum Carpet"

System Substrate
"Sedum Carpet"

Fixodrain® XD 20

Roof construction with
root resistant waterproofing

## Specification Suggestion

Drainage, water retention and protection mat with attached filter sheet made of PE-HD with openings for diffusion, connecting lengthwise on interlocking studs, height ca. 20 mm, max. compressive strength 50 kN/m², in-plane water flow capacity tested according to EN ISO 12958, delivery and installation according to manufacturer´s instructions.

Make: ZinCo Fixodrain® XD 20
Enquiries: ZinCo Canada Inc.
Phone: 1-905-690-1661

Subject to technical alterations and printing errors • First edition 12/2005; Revised 05/2012

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Life on Roofs

ZinCo



PLANNING GUIDE

# Water Retention with a "Stormwater Management Roof"

Life on Roofs



# More Options with ZinCo


The Definition of a Stormwater Management Roof 3



Flood Protection for All Types of Roof Use 4



Perfect Technology for Stormwater Management 5

System Build-up „Stormwater Management Roof" on an Extensive Green Roof 6



System Build-up „Stormwater Management Roof" Type "Roof Garden" 8



System Build-up "Sponge City Roof" 10

System Build-up "Driveways" with Retention Spacer RSX 100 12



Cascade-style Drainage on Underground Garages 13



Stormwater Management Roofs in Practice 14

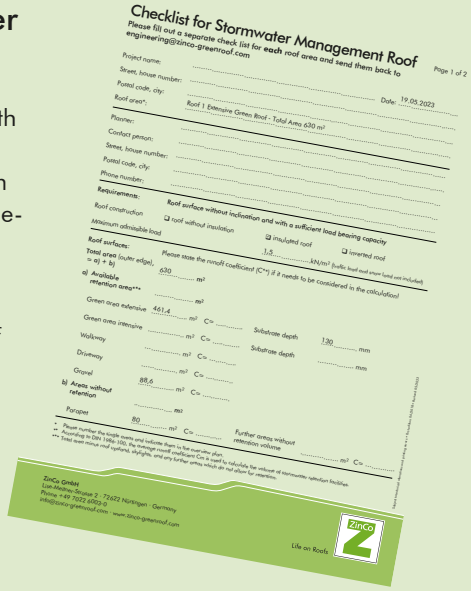
Building-specific Water Retention Calculation 15




## Checklist for Stormwater Management Roof

We will be happy to assist you with your calculations. Simply send us the necessary data using the form "Checklist for Stormwater Management Roof".

*https://zinco-greenroof.com/checklist_stormwater_management_roof*


Checklist for Stormwater Management Roof

Please fill out a separate check list for each roof area and send them back to engineering@zinco-greenroof.com

Page 1 of 2

Project name:

Street, house number:

Postal code, city:

Date: 19.05.2023

Roof area*: Roof 1 Extensive Green Roof - Total Area 630 m²

Planner:

Contact person:

Street, house number:

Postal code, city:

Phone number:

Requirements:

Roof construction: Roof surface without inclination and with a sufficient load bearing capacity

Minimum admissible load: ☐ roof without insulation ☐ insulated roof ☐ inverted roof

Roof surfaces: Please state the runoff coefficient (C∞) if it needs to be considered in the calculation!

Total area (outer edge), = a) + b): 630 m² 1.5 kN/m² (traffic load and snow load are included)

a) Available retention area**: m²

Green area extensive 461.4 m² C∞

Green area intensive m² C∞ Substrate depth 130 mm

Walkway m² C∞ Substrate depth mm

Driveway m² C∞

Gravel 88.6 m² C∞

b) Areas without retention: m²

Parapet 80 m² C∞ Further areas without retention volume m² C∞

* Please number the roofs, areas and volume them to be used on other plans.
** According to DIN 1986-100, the average runoff coefficient C∞ is used to calculate the volume of stormwater retention facilities.
*** Total area minus roof surfaces, skylights, and any further areas which do not allow for retention.

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Life on Roofs

# The Definition of a Stormwater Management Roof

**Why a Stormwater Management Roof?**

An increase in severe rainfall events, flooding and the reduction in the water table is making it very clear that the water cycle ecology has been seriously disrupted – due to climate change and ongoing land sealing. This results in stormwater no longer being able to seep into the ground and the municipal drainage systems becoming quickly overloaded during severe rain events.

Green roofs provide important, additional green areas in densely built-up areas. Each green roof stores a specific volume of rainwater and releases it with a time delay, or it evaporates on the roof. The ZinCo Stormwater Management Roof multiplies this specific retention effect while at the same time effectively balancing out precipitation peaks.

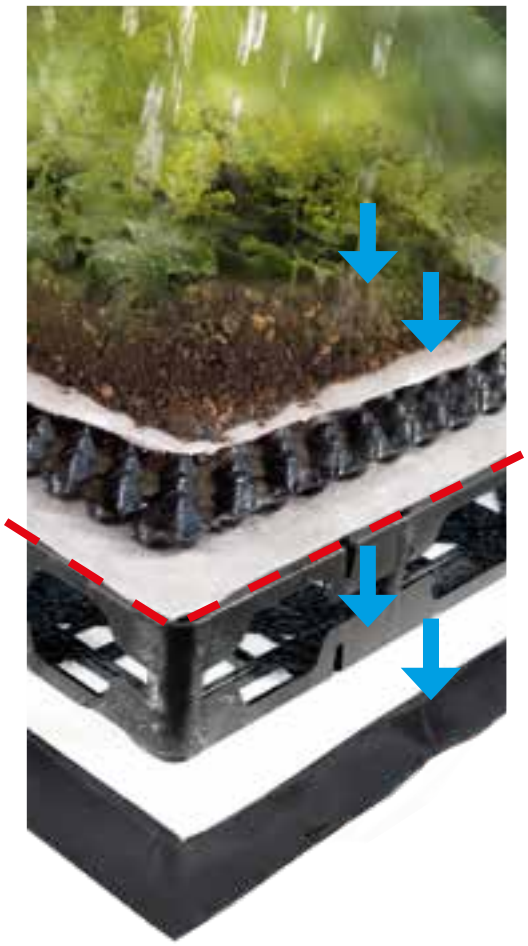


**What is a Stormwater Management Roof?**

In water management, retention refers to the balancing effect created by storage areas on stormwater run-off into waterways. There is an increasing demand for stormwater retention as changing weather conditions (i.e. more extreme local rain events) can result in an entire drainage system being overwhelmed.

With a Stormwater Management Roof, for the purposes of flood protection, a large portion of precipitation is detained on the roof area and is then released into the drainage system during a predefined period (between 24 hours and a few days). Meanwhile, all those elements (water storage for the plants, water-air balanace in the root area etc.) that are of vital importance for the proper functioning of the green roof are preserved.

## The principle of a Stormwater Management Roof



1 *1: The green roof build-up absorbs some of the stormwater and the excess water runs off.*

2 *2: A spacer is used to increase the quantity of retained stormwater. This takes the pressure off the sewer system during heavy rainfall.*

3 *3: The water flow is regulated using a run-off limiter and is released over a pre-defined period into the sewer system or, for example, into an infiltration system*



# Flood Protection for All Types of Roof Use

In principle, all types of green roof, from the simple Sedum Carpet to the complex Roof Garden can be implemented on Stormwater Management Roofs, including in combination with walkways and driveways.

The conditions required for the proper functioning of the green roof are provided by the green roof build-up overlying the spacer. This includes sufficient root space, a balanced air-water household for each plant community, and the quick run-off of excess water. Naturally, an intensive green roof will require greater quantities of water than an extensive green roof with its drought-resistant Sedum plants.

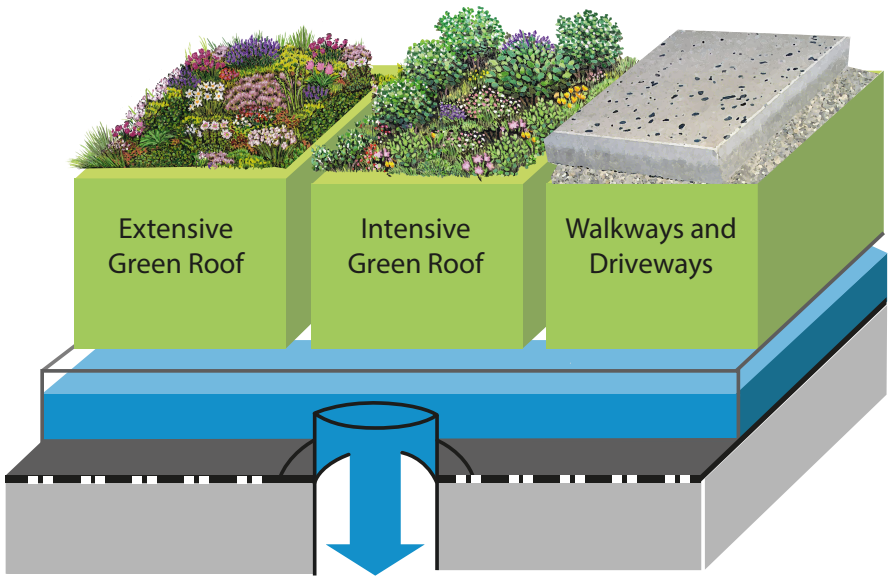
Additional storage space required is created with the ZinCo Stormwater Management Roof in a cavity beneath the actual green roof build-up. This cavity is created with spacer elements (usually RS 60) installed over the entire area, above which the required system build-up is then installed.

The division means that a lot of water can be stored, regardless of the quantity of water needed by the greenery itself.

Provided the Run-off Limiter or limiters are properly adjusted and the spacers are correctly sized, it is possible to avoid vegetation restructuring or an increase in the care and maintenance required which would result from an excess supply of water.

The limited run-off water can, of course, be collected in reservoirs and re-used to irrigate the green roof vegetation or for other purposes.

We do not recommend storing the water for plant irrigation on the roof area for an extended period of time, as on the one hand, the water supply would be limited. On the other hand, the water storage space has to be available again for the next precipitation event. Instead, a different solution should be found for irrigation during periods in which there is little precipitation.



# Perfect Technology for Stormwater Management

**Precise limitation of water run-off**

The flow rate of the rainwater that goes through the roof drain and into the down pipes has to be limited as required. ZinCo has developed a precision-adjustable run-off limiter element that is simply placed over the roof drain with a screw flange, regardless of the manufacture of the drain. The pre-calculated flow rate is easily pre-set and fixed. Adjusting rings are used for this. Generally speaking, the settings will ensure that the water storage element is empty again after 24 hours, but different settings are also possible.

Naturally, the limiter functions as an overflow element. It can be set to a certain overflow height using a screw thread, and ensures that excess rainwater flows into the downpipes where the precipitation is greater than can be accumulated on the roof.

In order to ensure the permanent and proper functioning of the system, the roof drain and limiter are protected beneath an inspection chamber that can be locked. It has narrow slots that prevent foreign matter from entering and allows for maintenance work to be carried out as part of the usual care and maintenance regime.



*The limiter element is protected beneath the inspection chamber and regulates the slow discharge of water. At the same time, it acts as an overflow.*



*Run-off Limiter set RDS 28 is suitable for flat roof drains with foam-sealed flashing.*



*The Retention Limiter Set RDS 48 is used for installations over flat roof outlets with a screw flange.*

**Adjusting the run-off limiters**

The choice of run-off limiter depends on the planner's specifications. Where the planner stipulates a specific water retention level, a spacer is chosen in relation to the relevant storage capacity. Some cities have a limitation on discharge for construction activities, i.e. a certain drainage rate (l/s) – up to an including properties with no drainage – must not be exceeded. The required spacer and the settings for the run-off limiter are then determined on this basis, also having regard to the time required to empty the water retention cavity.

The precipitation event (e.g. hundred-year event) and its duration are relevant for the calculations. Another factor that has to be taken into consideration is the point in time when the emergency overflows should spring into action. We recommend the following order: Once the pre-set water retention level has been exceeded, the water will drain into the overflow pipes of the limiter elements. Once these pipes are flooded to a specific, pre-defined level the emergency overflow will respond.

However, it is also possible to stipulate that the emergency overflows are the first to respond before the maximum pre-set water retention level is reached.

With the ZinCo Run-off Limiter, both the pre-set water retention level and the drainage cross-section can be infinitely adjusted post-installation.

If the discharge time is more than 24 hours and a pre-set water retention level of > 10 cm is required, please note that greater demands may be placed on the roof waterproof membrane.

**Required information for calculating the limiter opening:**

Precipitation event to be applied
\+ time it takes to empty storage area
\+ area dimensions and division
= maximum pre-set water retention capacity and maximum drainage rate per time unit

**Additional information**

One thing that must be taken into consideration is the possible additional load that might be incurred due to the Stormwater Management Roof, which, with the written permission of all parties involved, can be calculated in the place of snow loads.

The ZinCo Limiter RD 28 is suitable for use in all drains with foam-sealed flashing. Run-off Limiter RD 48 is available for roof drains with a screw flange.

Retention Spacer RS 60 is normally used here. If greater pressure resistance or a greater retention height is required, alternative products such as the heavy-duty Retention Spacer RSX 65 are available.

**Emergency discharge**

If the level of rainwater exceeds the maximum possible water retention height, water must be emergency released onto ground that can be flooded without causing damage. The emergency outlets should be placed at least 1 to 2 cm above the maximum water accumulation level in order to avoid water discharge during the retention phase.

For more information on emergency overflow, please see DN 1986-100:2016, point 14.2.6.



# System Build-up „Stormwater Management Roof" on an Extensive Green Roof

Low-maintenance extensive green roofs are well suited to be combined with additional water accumulation on the roof. The Retention Spacer RS 60 (100 % RC, EPD) in the ZinCo Stormwater Management Roof allows for additional storage of almost 57 l/m² of water on the roof. Installed right across the roof area, these spacer elements ensure a defined distance between the highest point of the accumulated water and the green roof build-up.

The height of this cavity will depend on the precipitation event on which it is based, the type of use, the run-off limitation or the discharge duration, among other things.

This type of construction requires an appropriate load-bearing flat roof without a slope and with sufficient connection height.

**Roofs with 0° slope**

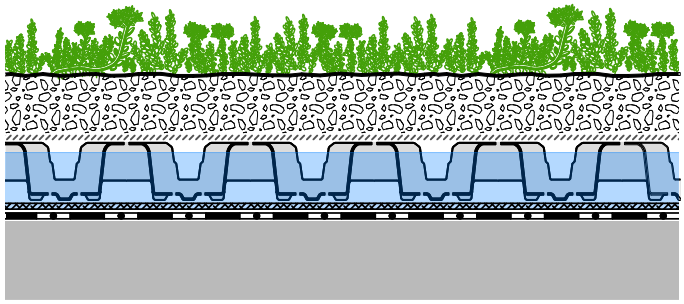
Roofs with 0° slope are no longer a "special construction" but, in certain justified cases, can also be planned and built in line with both the Flat Roof Guidelines and DIN 18531. In that case, the "heavy surface protection" required is automatically provided, for example, by the vegetation.





## System build-up “Extensive Green Roof” with Retention Spacer RS 60

| Weight kg/m² | | Height mm |
|---|---|---|
| dry | water-saturated | |
| 67 | 84 | 60 |
| 3 | 58 | 60 |
| 70 | 142 | |



Sedum cuttings or plug plants according to plant list “Sedum Carpet”

System Substrate “Sedum Carpet”

Filter Sheet PV
Retention Spacer RS 60
Filter Sheet PV
Roof construction with root resistant waterproofing

| | |
|---|---|
| Build-up height: | ca. 120 mm |
| Weight, saturated: | ca. 142 kg/m² * |
| Water storage capacity: | ca. 72 l/m² * |

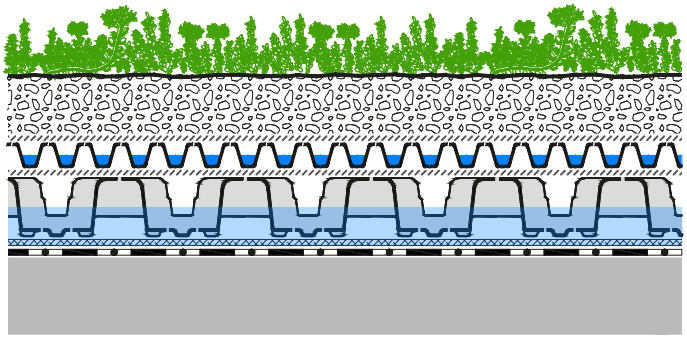
*(* Weight specifications refer only to build-up without vegetation and a maximum retention height of 60 mm).*

**System Build-up with EPD verification.**

## System build-up “Extensive Green Roof” with Retention Spacer RS 60 and Floradrain® FD 25-E

The additional drainage element allows for the storage capacity to be expanded as the drainage element can also be used to retain water (6 cm water accumulation becomes 8.5 cm). In addition, the Floradrain® element FD 25-E has a water storage capacity of approx. 3 l/m³ that is available for the plants.

| Weight kg/m² | | Height mm |
|---|---|---|
| dry | water-saturated | |
| 67 | 84 | 60 |
| 2 | 5 | 30 |
| 3 | 58 | 60 |
| 72 | 147 | |



Sedum cuttings or plug plants according to plant list “Sedum Carpet”

System Substrate “Sedum Carpet”, ca. 60 mm
Filter Sheet SF
Floradrain® FD 25-E
Filter Sheet PV
Retention Spacer RS 60
Filter Sheet PV
Roof construction with root resistant waterproofing

| | |
|---|---|
| Build-up height: | ca. 150 mm |
| Weight, saturated: | ca. 150 kg/m² * |
| Water storage capacity: | ca. 75 l/m² * |

*(* Weight specifications refer only to build-up without vegetation and a maximum retention height of 60 mm).*

**System Build-up with EPD verification.**

# System Build-up „Stormwater Management Roof" Type "Roof Garden"

**The sky is the limit**

The system build-up combines effective stormwater management with all possible variations of green roof and types of use of an intensive green roof.

This requires a roof with a 0° slope and water discharge limitation. Stormwater can accumulate up to a pre-defined level and it then runs off at the required limitation rate.

Due to its extreme pressure resistance, the Retention Spacer RSX 65 is particularly suited for use with greater substrate depths or, for example, where the substrate has to be applied to the roof of an underground garage using a wheel loader. In addition, the spacer is perfect for use beneath walkways and play areas.

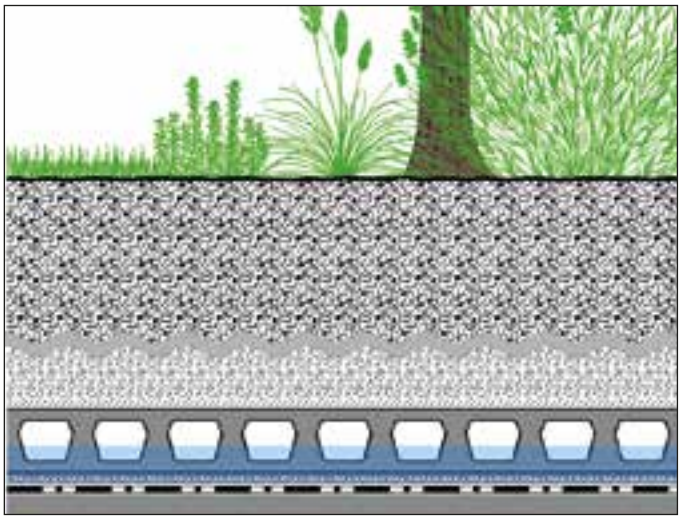






## System build-up “Roof Garden“ with Retention Spacer RSX 65

| Weight kg/m² | | Height mm |
|---|---|---|
| trocken | wasser-gesättigt | |
| from 200 | from 300 | from 200 |
| 6 | 67 | from 60 |
| 206 | 367 | |



Lawn, perennials, with deeper substrate layers also shrubs and small trees

System Substrate “Roof Garden” resp. System Substrate “Lawn” (in case of substrate depths > 350 mm in combination with mineral sub-substrate Zincolit® Plus)

Filter Sheet PV
Retention Spacer RSX 65

Filter Sheet PV
Roof construction with root resistant waterproofing

| | |
|---|---|
| Build-up height: | from ca. 260 mm |
| Weight, saturated: | from ca. 360 kg/m² * |
| Water storage capacity: | from ca. 160 l/m² * |

*(* Weight specifications refer only to build-up without vegetation and a maximum retention height of 65 mm).*

** At maximum retention height of 55 mm. The weight of the vegetation must be taken into account additionally (see FLL Green Roof Guidelines, table 26).*

# System Build-up "Sponge City Roof"

**Temporary water retention, maximum water storage and increased evaporation**

The system build-up combines the advantages of an insect-friendly, species-rich extensive green roof with an additional water storage element available to the plants and temporary water retention capacity with run-off limiter.

The accumulated water stored in the retention spacer on the waterproof membrane level is available to the plants through the wicking mat. Rainwater is collected above the retention spacer up to a pre-defined level and is discharged at the required flow rate.

This results in a dynamic development of the vegetation depending on the annual precipitation distribution. We recommend having the final and also the development care and maintenance regime carried out by specialists.

Additional irrigation may be necessary during long drought periods during the summer.

The accumulated water should be removed during the winter months and, depending on the geographic region, reinstated at the start of the following vegetation period.

A roof design with 0° slope is a basic requirement for this build-up.

Additional expert information in line with FLL Green Roof Guidelines, Chapter 9.3.5 "Additional Water Retention Capacity":

- this type of Stormwater Management Roof is a planned deviation from the usual type of drainage. This should be pointed out at the planning stage.
- The retained water must never result in a permanently wet green roof.
- Both the drainage elements located above the required pre-set water retention level and the emergency drainage system must be fully functional at all times.
- The required pre-set water retention capacity, maximum permissible discharge rate per time unit and the period after which the maximum pre-set retention capacity has to be available once again, are to be determined for each individual project.
- The waterproof membrane must be appropriate for the specific load.



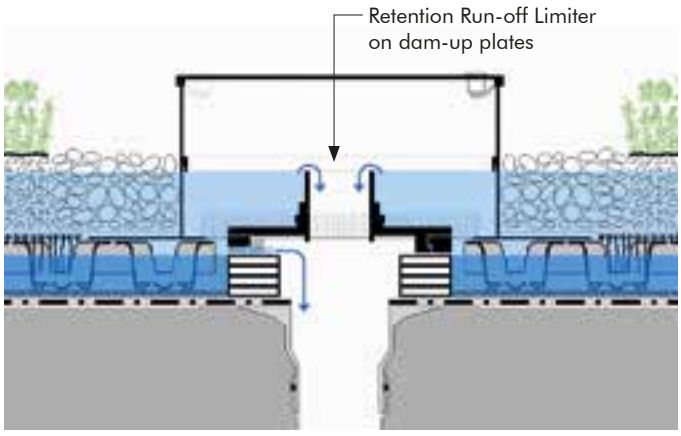


For further information about our plant mixture Bee Pasture, which is specially adapted to the needs of the bee population, please see our homepage at: *https://zinco-greenroof.com/bee-pasture*



## System build-up “Sponge-City-Roof“ with Retention Spacer RS 60

| Weight kg/m² | | Height mm |
|---|---|---|
| dry | water-saturated | |
| 100 | 152 | 100 |
| 3 | 58 | 6 |
| 103 | 210 | |




| | |
|---|---|
| Build-up height: | ca. 160 mm |
| Weight, saturated: | ca. 210 kg/m² * |
| Water storage capacity: | ca. 107 l/m² * |

**including max. periodically plant-available water accumulation (4 slices each 13 mm) and max. temporary retention volume up to 20 mm below substrate surface.*

Vegetation, e.g. “Bee Pasture“

System Substrate “Rockery Type Plants“, ca. 100 mm
Wicking Mat DV 40
Retention Spacer RS 60
Retention Run-off Limiter with dam-up plates
Filter Sheet PV
Roof construction with root resistant waterproofing

**Temporary water retention volume**

**Periodic plant available water accumulation**

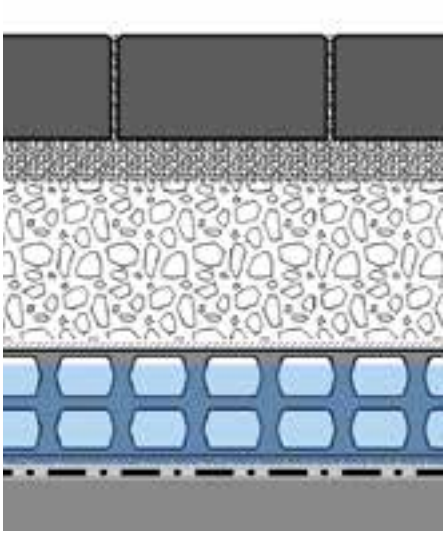


# System Build-up “Driveways” with Retention Spacer RSX 100

This system build-up is particularly suitable for roofs of underground carparks without inclination, if water retention is to be realized using a throttle element, e.g. under parking lots or fire brigade accesses. The overall height depends on the required load capacity. The system solution can be combined with greenery or otherwise utilized areas (e.g. play grounds or sports grounds).

The base of the build-up is formed by extremely stable spacer elements. Thanks to this, the substrate can be easily brought onto the underground garage roof with a wheel loader.

## System build-up “Driveways” with Retention Spacer RSX 100



Pavement:
Depth (Cars up to 3 t): ≥ 100 mm
Depth (Trucks up to 16 t): ≥ 120 mm
Depth (Trucks over 16 t): ≥ 140 mm

Bedding layer, lime-deficient, 30–50 mm

Gravel base layer, lime-deficient:
Depth (Cars up to 3 t): ≥ 150 mm
Depth (Trucks up to 16 t): ≥ 200 mm
Depth (Trucks over 16 t): ≥ 250 mm

Filter Sheet PV

Retention Spacer RSX 100

Filter Sheet PV

Roof construction with root resistant waterproofing

| | |
|---|---|
| Build-up height: | from ca. 38 cm |
| Dead load: | from ca. 595 kg/m² |
| Max. retention volume: | ca. 95 l/m² * |

*(* The indicated weights do not include the weight of the vegetation and a maximum retention height of 100 mm.)*

# Cascade-style Drainage on Underground Garages

Cascade-style drainage consists of rainwater cascading down from higher-placed roofs to lower-lying roof areas and possibly into an infiltration trench downstream.

This type of rainwater cascade allows for interim storage of precipitation, the discharge of the water at a time delay and, consequently, helps to avoid flooding.

The additional structural load is frequently easier represented on the roof of an underground garage than the roof of a building.

In order to avoid structural overload, the weight of the maximum pre-set water retention capacity must be taken into consideration in addition to the weight of the system build-up (saturated).



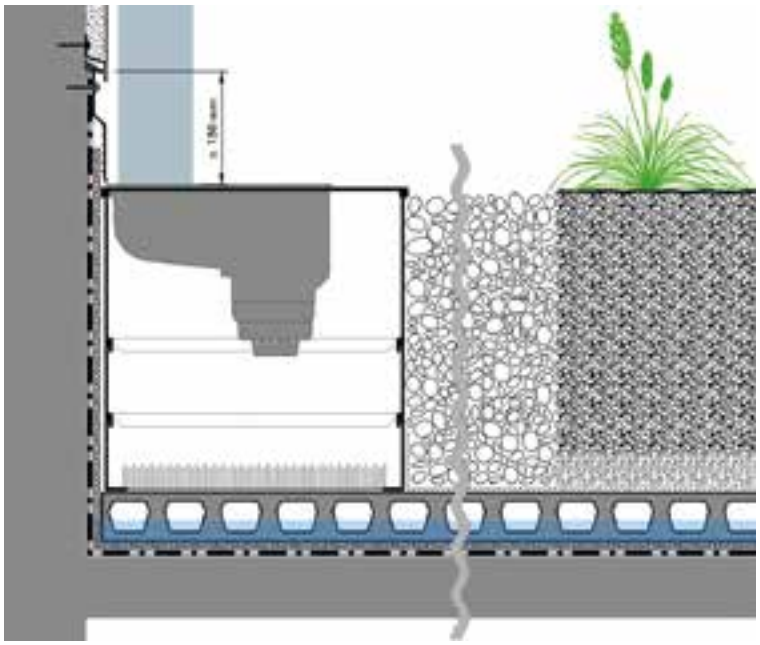
*© Generalunternehmer: Schmeing Bau GmbH, Bocholt. Bauherr: Caja 16 Projekt GmbH, Bocholt*

With the Cascade Inspection Chamber KKS 30/40, a down pipe, coming from an overlying area, can be integrated to allow for the discharge of run-off water into the drainage or retention level of a lower-lying roof.



*Cascade Inspection Chamber KKS 30/40*

## System build-up "Stormwater Management Roof" with Retention Spacer RSX 65



Lawn, perennials, with deeper substrate layers also shrubs and small trees

System Substrate "Roof Garden"
resp. System Substrate "Lawn"
(in case of substrate depths > 350 mm
in combination with mineral sub-substrate
Zincolit® Plus)

Filter Sheet PV
Retention Spacer RSX 65
Filter Sheet PV
Roof construction with root resistant waterproofing

# Stormwater Management Roofs in Practice

## Project Example: Underground garage with RSX 80

### Noltemeyer Hoefe in Braunschweig

The residential development, Noltemeyer Hoefe in Braunschweig, consisting of six apartment blocks with 242 apartments, illustrates how underground parking spaces are concealed beneath a landscaped terrain comprising green areas, terraces, playgrounds and driveways.

The trick is in the ZinCo system build-up "Stormwater Management Roof" which can store large volumes of water during heavy rain events and can release the water into the sewer system at a time delay. The special retention spacers RSX 80, together with the precision-adjustable run-off limiter elements, comprise this perfect technology.

Additionally there are 2,500 m² of extensive green roof with photovoltaic elements. The residential development, Noltemeyer Hoefe, is an impressive example of how "Stormwater Management Roofs" are a proven means of reducing the risk of flooding today.



*The planted and surface areas at Noltemeyer Hoefe conceal an impressive 5,780 m² of stormwater management area.*



*The fully installed stormwater management layer RSX 80 can store more than 75 l/m² of rainwater in its cavities.*

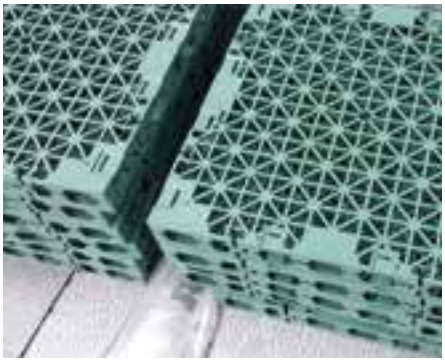


*Thanks to the stable ZinCo system build-up with RSX 80, using diggers to apply the substrate is not a problem. © Strassen- und Tiefbau Urban GmbH*

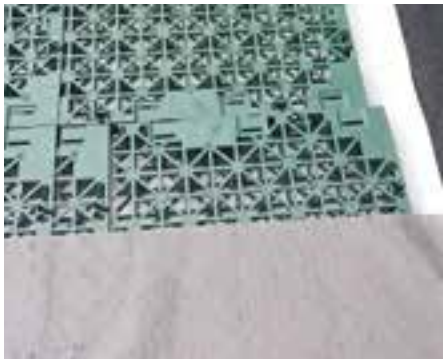
## Project Example: Roof Garden with RSX 65

### Soho House, Amsterdam

This protected building from the year 1934 was completely refurbished in 2018 and converted to an exclusive private club with hotel. The Roof Garden installed across an area of 900 m2, in addition, makes an invaluable contribution to ecology and sustainability. The special ZinCo system build-up "Stormwater Management Roof" used in Soho House stores up to 61,75 l of rainwater/m² of roof area and releases it with a time delay. In the event of heavy rain, this relieves the municipal sewage system and therefore provides protection against flooding. The roof consists of various roof areas at different various levels. The Stormwater Management Roof is on the lower-lying roof areas and can store more than 50,000 litres of rainwater at short notice.



*A tower crane was used to lift all the material onto the roof – here the stacked Retention Spacer elements RSX 65. © ZinCo Benelux B.V.*



*The Retention Spacer elements RSX 65 were covered entirely with the Filter Sheet PV, followed by an additional ZinCo System Build-up for the planted areas and walkways. © ZinCo Benelux B.V.*



*Any type of design is possible on a "Stormwater Management Roof" – planters, walkways and even this pool. © ZinCo Benelux B.V.*

# Building-specific Water Retention Calculation

The Stormwater Management Roof is designed to suit the specific building and takes into consideration the roof size, precipitation data (as per KOSTRA-DWD, meteorological data from Germany), required retention capacity, flow rate and discharge duration. Our ZinCo engineers in Application Technology will be happy to help you.

You can send us the details of your project and the local specifications such as discharge limitations. We will use this data to prepare your individually tailored water retention calculation together with our recommendation for the system build-up and the settings for the limiter elements.

The Checklist for Storm Management Roofs can be downloaded here and completed by inputting your data: ***https://zinco-greenroof.com/checklist_stormwater_management_roof***

## Example of a completed "Checklist for Storm Management Roofs"




## Example of an individual water retention calculation



# System Technology Provides for a Permanent and Perfect Green Roof!

This Planning Guide aims to give you a general overview of the technology involved in Stormwater Management Roofs.

Our technical experts will be pleased to advise you on specific solutions for your own individual building projects: from the planning phase right through to creating your specification texts.

More detailed information can be downloaded at www.zinco-greenroof.com.

Challenge us!







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05/2023 • Technical statements are subject to alterations and printing errors, 12258

Appendix F

# OGS (Stormfilter)

# Stormfilter Design
# Determining Number of Cartridges for Flow Based Systems

**Echelon Environmental**
**55 Albert Street, Suite #200 | Markham, ON, L3P 2T4**
www.echelonenvironmental.ca info@echelonenvironmental.ca 905-948-0000

| | | | |
|---|---|---|---|
| **Project Name:** | **233 249 261 Coldwater Rd W** | **Engineer:** | N Engineering |
| **Location:** | **Orillia, ON** | **Contact:** | lekh upadhyaya M.Eng- P.Eng. |
| **OGS ID:** | **OGS** | **Report Date:** | 3-Feb-26 |

**Site Data**

| | | | |
|---|---|---|---|
| Drainage Area, Ad | **2.84** | ac | (1.15 ha) |
| Runoff Coefficient, Rc | **0.88** | | |
| Treatment storm flow rate, $Q_{treat}$ | **1.24** | cfs | (35.14 L/s) |
| Peak storm flow rate, $Q_{peak}$ | **TBC** | cfs | |

**StormFilter System Configuration**

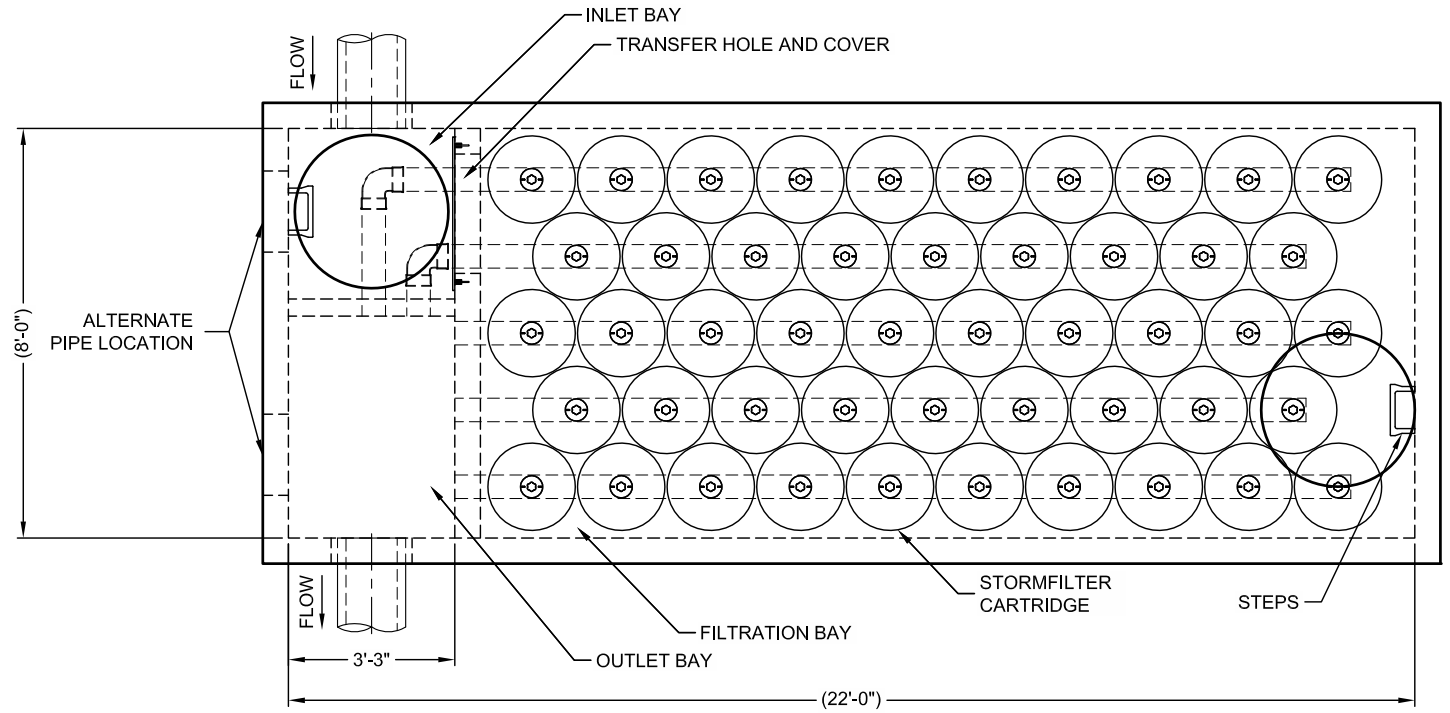
| | | |
|---|---|---|
| Filtration brand | **StormFilter** | |
| Cartridge height | **18** | in |
| Specific Flow Rate | **1.67** | gpm/ft$^2$ |
| Flow rate per cartridge | **12.53** | gpm |

**Treatment Summary**

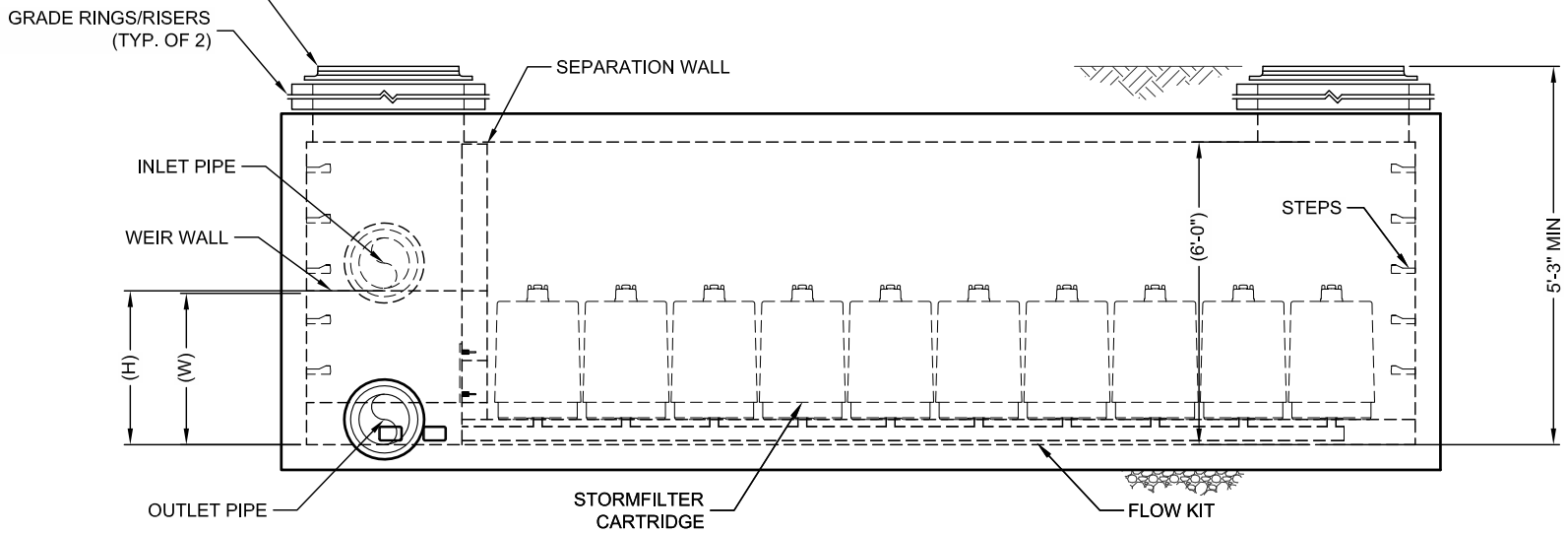
| | | |
|---|---|---|
| Number of Cartridges Required | 45 | |
| Filter Media Type | Phosphosorb | |
| Event Mean Concentration (EMC) | **120** | mg/L |
| Annual TSS Removal Efficency | **80%** | |
| Percent Annual Runoff Captured | **90%** | |

Recommended Unit: **Stormfilter SFPD0822 vault or CIP**

***Connecting pipe sizes, materials, and orientation to be confirmed prior to design finalization.**
****Refer to provided standard detail for minimum installation depths. For low cover designs reach out to Echelon Environmental for a custom proposal.**




**PLAN VIEW**

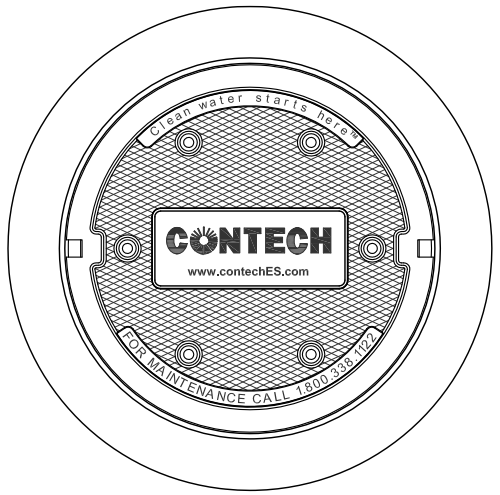



**ELEVATION**

## STORMFILTER DESIGN TABLE

- THE 8' x 22' PEAK DIVERSION STORMFILTER TREATMENT CAPACITY VARIES BY CARTRIDGE COUNT AND LOCALLY APPROVED SURFACE AREA SPECIFIC FLOW RATE. PEAK CONVEYANCE CAPACITY TO BE DETERMINED BY ENGINEER OF RECORD.
- THE PEAK DIVERSION STORMFILTER IS AVAILABLE IN A LEFT INLET (AS SHOWN) OR RIGHT INLET CONFIGURATION.
- ALL PARTS AND INTERNAL ASSEMBLY PROVIDED BY CONTECH UNLESS OTHERWISE NOTED.

| CARTRIDGE HEIGHT | 27" | | 18" | | LOW DROP | |
|---|---|---|---|---|---|---|
| SYSTEM HYDRAULIC DROP (H - REQ'D. MIN.) | 3.05' | | 2.3' | | 1.8' | |
| HEIGHT OF WEIR (W) | 3.00' | | 2.25' | | 1.75' | |
| TREATMENT BY MEDIA SURFACE AREA | 2 gpm/ft² | 1 gpm/ft² | 2 gpm/ft² | 1 gpm/ft² | 2 gpm/ft² | 1 gpm/ft² |
| CARTRIDGE FLOW RATE (gpm) | 22.5 | 11.25 | 15 | 7.5 | 10 | 5 |




**FRAME AND COVER**
(DIAMETER VARIES)
N.T.S.

## SITE SPECIFIC DATA REQUIREMENTS

| | |
|---|---|
| STRUCTURE ID | * |
| WATER QUALITY FLOW RATE (cfs) | * |
| PEAK FLOW RATE (cfs) | * |
| RETURN PERIOD OF PEAK FLOW (yrs) | * |
| # OF CARTRIDGES REQUIRED | * |
| CARTRIDGE FLOW RATE | * |
| MEDIA TYPE (CSF, PERLITE, ZPG) | * |

| PIPE DATA: | I.E. | MATERIAL | DIAMETER |
|---|---|---|---|
| INLET PIPE | * | * | * |
| OUTLET PIPE | * | * | * |

| | |
|---|---|
| INLET BAY RIM ELEVATION | * |
| FILTER BAY RIM ELEVATION | * |

| ANTI-FLOTATION BALLAST | WIDTH | HEIGHT |
|---|---|---|
| | * | * |

NOTES/SPECIAL REQUIREMENTS:

PERFORMANCE SPECIFICATION

FILTER CARTRIDGES SHALL BE MEDIA-FILLED, PASSIVE, SIPHON ACTUATED, RADIAL FLOW, AND SELF CLEANING. **RADIAL MEDIA DEPTH SHALL BE 7-INCHES**. FILTER MEDIA CONTACT TIME SHALL BE AT LEAST **37 SECONDS**.
SPECIFIC FLOW RATE SHALL BE **2 GPM/SF (MAXIMUM)**. SPECIFIC FLOW RATE IS THE MEASURE OF THE FLOW (GPM) DIVIDED BY THE MEDIA SURFACE CONTACT AREA (SF). MEDIA VOLUMETRIC FLOW RATE SHALL BE **6 GPM/CF OF MEDIA (MAXIMUM).**

GENERAL NOTES

1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH REPRESENTATIVE. www.contechES.com
4. STORMFILTER WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
5. STRUCTURE SHALL MEET AASHTO HS20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 5' AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.

INSTALLATION NOTES

A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STORMFILTER STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL SECTIONS AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH OUTLET PIPE INVERT WITH OUTLET BAY FLOOR.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.
F. CONTRACTOR TO REMOVE THE TRANSFER HOLE COVER WHEN THE SYSTEM IS BROUGHT ONLINE.

The Stormwater Management StormFilter®
THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 5,322,629; 5,543,039; 5,707,527; 5,985,157; 6,027,639; 6,649,048; AND RELATED FOREIGN PATENTS, OR OTHER PATENTS PENDING.

CONTECH® ENGINEERED SOLUTIONS LLC
www.contechES.com
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800-338-1122 513-645-7000 513-645-7993 FAX

# THE STORMWATER MANAGEMENT STORMFILTER 8' x 22' PEAK DIVERSION STORMFILTER STANDARD DETAIL

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# VERIFICATION STATEMENT

## GLOBE Performance Solutions

Verifies the performance of

## The Stormwater Management StormFilter®

Developed by CONTECH Engineered Solutions LLC
Scarborough, Maine, USA

**Registration: GPS-ETV_VR2023-06-30_TAPE**

In accordance with

## ISO 14034:2016

**Environmental Management —**
**Environmental Technology Verification (ETV)**

John D. Wiebe, PhD
Executive Chairman
GLOBE Performance Solutions

June 30, 2023
Vancouver, BC, Canada

Verification Body
GLOBE Performance Solutions
404 – 999 Canada Place | Vancouver, B.C | Canada |V6C 3E2

# Verification Overview

This Environmental Technology Verification (ETV) of The Stormwater Management StormFilter® (StormFilter) is the second part of a two-part verification process and entails the verification of performance claims (#3 – 9) based on field testing data collected in accordance with The Washington State Department of Ecology emerging stormwater treatment technologies, in accordance with guidelines identified by Ecology (2011) in the Technology Assessment Protocol – Ecology (TAPE). This complements the first part of the verification which verifies performance test data collected in accordance with the New Jersey Department of Environmental Protection (NJDEP) *Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device (January, 2013)*.

# Technology description and application

The Stormwater Management StormFilter® (StormFilter) is a manufactured treatment device that is provided by Contech Engineered Solutions LLC (Contech). The StormFilter improves the quality of stormwater runoff before it enters receiving waterways through the use of its customizable filter media, which removes non-point source pollutants. As illustrated in **Figure 1,** the StormFilter is typically comprised of a vault or manhole structure that houses rechargeable, media-filled filter cartridges. Stormwater entering the system percolates through these media-filled cartridges, which trap particulates and remove pollutants. Once filtered through the media, the treated stormwater is discharged through an outlet pipe to a storm sewer system or receiving water.

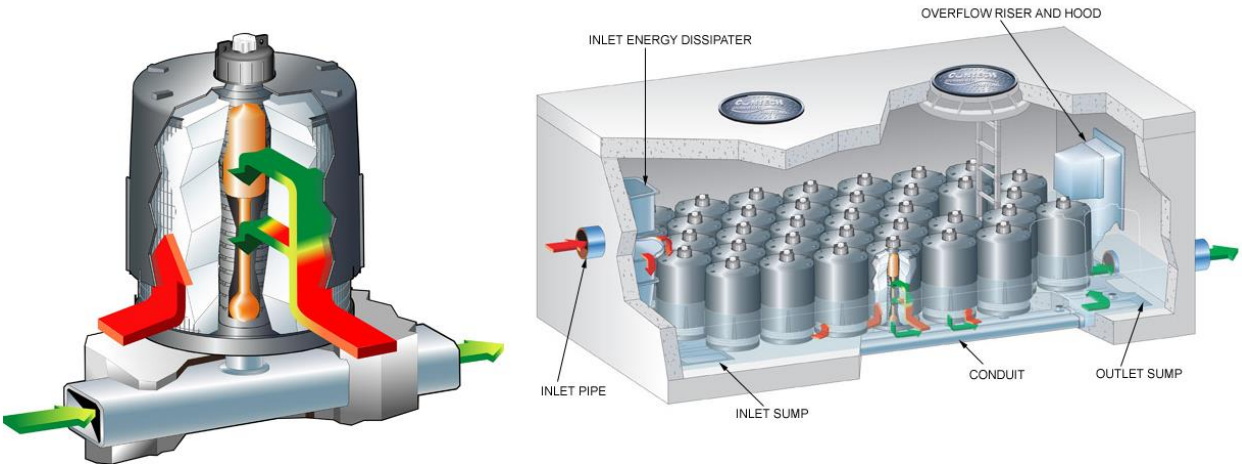



**Figure 1 Individual StormFilter Cartridge (Left) and Typical Vault StormFilter Installation (Right)**

Depending on the treatment requirements and expected pollutant characteristics at an individual site, the per cartridge filtration flow rate and driving head can be adjusted. The flow rate is individually controlled for each cartridge by a restrictor disc located at the connection point between the cartridge and the underdrain manifold.

Driving head is managed by positioning of the inlet, outlet, and overflow elevations. The StormFilter is typically designed so that the restrictor disc passes the design treatment rate once the water surface reaches the shoulder of the cartridge which is equivalent to the cartridge height. Since the StormFilter uses a restrictor disc to restrict treatment flows below the hydraulic capacity of the media the system

typically operates under consistent driving head for the useful life of the media. Site specific head constraints are also addressed by three different cartridge heights (low drop (effective height of 12 inches), 18, and 27 inches) which operate on the same principal and surface area specific loading rates.

The StormFilter requires a minimum of 1.8 ft, 2.3 ft and 3.05 ft of drop between inlet invert and outlet invert to accommodate the low drop, 18 and 27 inch cartridges, respectively, without backing up flow into the upstream piping during operation. When site conditions limit the amount of drop available across the StormFilter then flow is typically backed up into the upstream piping during operation to ensure sufficient driving head is provided. If desirable the StormFilter can be designed to operate under additional driving head.

The StormFilter is offered in multiple configurations including plastic, steel, and concrete catch basins; and precast concrete manholes, and vaults. Other configurations include panel vaults, CON/SPAN®, box culverts, and curb inlets. The filter cartridges operate consistently and act independently regardless of housing which enables linear scaling.

The StormFilter cartridge can house different types of media including perlite, zeolite, granular activated carbon (GAC), CSF® leaf media, MetalRx™, PhosphoSorb® or various media blends such as ZPG™ (perlite, zeolite and GAC). All of the media use processes associated with depth filtration to remove solids. Some media configurations also provide additional treatment mechanisms such as cation exchange, and/or adsorption, chelation, and precipitation. This verification is specific to a field evaluation of the StormFilter with PhosphoSorb® media.

# Performance conditions

The data and results published in this Verification Statement were obtained from the field testing conducted on The Stormwater Management StormFilter® device, in accordance with the requirements outlined by the Technical Guidance Manual for Evaluating Emerging Stormwater Treatment Technologies Technology Assessment Protocol – Ecology (TAPE) as written by the Washington State Department of Ecology, (WADOE, 2011). Prior to starting the performance testing program, a quality assurance project plan (QAPP) was submitted to and approved by the State of Washington Department of Ecology.

# Performance claim(s)

### Performance Claim 3 (TAPE)

During field testing under the Washington State TAPE Protocol (2011) which was composed of 23 qualifying storm events, The Stormwater Management StormFilter®, with PhosphoSorb® media, demonstrated at least 89% removal of total suspended solids at a range of treated flow rates up to the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm. This performance claim was verified at a 95% level of confidence.

### Performance Claim 4 (TAPE)

During field testing under the Washington State TAPE Protocol (2011) which was composed of 23 qualifying storm events, The Stormwater Management StormFilter®, with PhosphoSorb® media, demonstrated at least 79% removal of total phosphorus at a range of treated flow rates up to the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm. This performance claim was verified at a 95% level of confidence.

### Performance Claim 5 (TAPE)

During field testing under the Washington State TAPE Protocol (2011) which was composed of 23 qualifying storm events, The Stormwater Management StormFilter®, with PhosphoSorb® media, demonstrated at least 56% removal of total nitrogen at a range of treated flow rates up to the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm. This performance claim was verified at a 95% level of confidence.

### Performance Claim 6 (TAPE)

During field testing under the Washington State TAPE Protocol (2011) which was composed of 21 qualifying storm events, The Stormwater Management StormFilter®, with PhosphoSorb® media, demonstrated at least 77% removal of total copper at a range of treated flow rates up to the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm. This performance claim was verified at a 95% level of confidence.

### Performance Claim 7 (TAPE)

During field testing under the Washington State TAPE Protocol (2011) which was composed of 21 qualifying storm events, The Stormwater Management StormFilter®, with PhosphoSorb® media, demonstrated at least 75% removal of total zinc at a range of treated flow rates up to the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm. This performance claim was verified at a 95% level of confidence.

### Performance Claim 8 (TAPE)

During field testing under the Washington State TAPE Protocol (2011) which was composed of 21 qualifying storm events, The Stormwater Management StormFilter®, with PhosphoSorb® media, demonstrated at least 70% removal of total lead at a range of treated flow rates up to the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm. This performance claim was verified at a 95% level of confidence.

### Performance Claim 9 (TAPE)

During field testing under the Washington State TAPE Protocol (2011) which was composed of 21 qualifying storm events, The Stormwater Management StormFilter®, with PhosphoSorb® media, demonstrated at least 80% removal of total aluminium at a range of treated flow rates up to the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm. This performance claim was verified at a 95% level of confidence.

# Performance results

**Performance Claim 3 (TAPE):**

Raw data summarizing the percent removal of total suspended solids (TSS) by The Stormwater Management StormFilter®, with PhosphoSorb® media, at the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm for 23 qualifying storm events (bootstrapped data).

| Sample ID | Average Influent TSS (mg/L) | Average Effluent TSS (mg/L) | Percent Removal (%) |
|---|---|---|---|
| LPR021012 | 182 | 63.0 | 65.4 |
| LPR021412 | 539 | 32.0 | 94.1 |
| LPR021712 | 387 | 48.0 | 87.6 |
| LPR022012 | 246 | 5.0 | 98.0 |
| LPR022412 | 512 | 43.0 | 91.6 |
| LPR031012 | 360 | 27.0 | 92.5 |
| LPR031212a | 150 | 18.0 | 88.0 |
| LPR032912b | 370 | 47.0 | 87.3 |
| LPR052412 | 510 | 43.0 | 91.6 |
| LPR060112 | 780 | 16.0 | 98.0 |
| LPR060412 | 580 | 32.0 | 94.5 |
| LPR060712 | 570 | 120.0 | 79.0 |
| LPR110612 | 40.0 | 10.0 | 75.0 |
| LPR112312 | 110 | 5.0 | 95.5 |
| LPR113012 | 230 | 17.0 | 92.6 |
| LPR051713 | 94.0 | 6.0 | 93.6 |
| LPR052113 | 389 | 24.0 | 93.8 |
| LPR062513 | 308 | 21.0 | 93.2 |
| LPR013014 | 170 | 17.0 | 90.0 |
| LPR030314 | 280 | 95.0 | 66.1 |
| LPR030814a | 173 | 26.0 | 85.0 |
| LPR011815 | 529 | 72.8 | 86.2 |
| LPR020215 | 397 | 67.0 | 83.1 |
| **Sum** | 2022 | | |
| **N (COUNT)** | 23 | | |
| **Median** | 91.6 | | |
| **STDEV.s** | 8.99 | | |
| **VAR.s** | 80.7 | | |
| **Z (alpha)** | 1.65 | | |
| **Z (beta)** | 1.29 | | |
| **Hypothesized median** | 89.0 | | |

**Performance Claim 4 (TAPE):**

Raw data summarizing the percent removal of total phosphorus (TP) by The Stormwater Management StormFilter®, with PhosphoSorb® media, at the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm for 23 qualifying storm events (bootstrapped data).

| Sample ID | Average Influent TP (mg/L) | Average Effluent TP (mg/L) | Percent Removal (%) |
|---|---|---|---|
| LPR021012 | 0.141 | 0.104 | 26.2 |
| LPR021412 | 0.220 | 0.062 | 71.8 |
| LPR021712 | 0.310 | 0.067 | 78.3 |
| LPR022012 | 0.163 | 0.026 | 84.1 |
| LPR022412 | 0.424 | 0.070 | 83.5 |
| LPR031012 | 0.140 | 0.049 | 65.0 |
| LPR031212a | 0.150 | 0.037 | 75.3 |
| LPR032912b | 0.280 | 0.081 | 71.1 |
| LPR052412 | 0.170 | 0.070 | 58.8 |
| LPR060112 | 0.200 | 0.035 | 82.5 |
| LPR060412 | 0.210 | 0.043 | 79.5 |
| LPR060712 | 0.170 | 0.140 | 17.6 |
| LPR110612 | 0.068 | 0.025 | 63.2 |
| LPR112312 | 0.082 | 0.025 | 69.5 |
| LPR113012 | 0.170 | 0.025 | 85.3 |
| LPR051713 | 0.282 | 0.029 | 89.9 |
| LPR052113 | 0.558 | 0.050 | 91.1 |
| LPR062513 | 0.583 | 0.045 | 92.2 |
| LPR013014 | 0.317 | 0.053 | 83.3 |
| LPR030314 | 0.417 | 0.133 | 68.1 |
| LPR030814a | 0.261 | 0.051 | 80.3 |
| LPR011815 | 0.649 | 0.124 | 80.9 |
| LPR020215 | 0.693 | 0.100 | 85.6 |
| **Sum** | 1683 | | |
| **N (COUNT)** | 23 | | |
| **Median** | 79.5 | | |
| **STDEV.s** | 18.5 | | |
| **VAR.s** | 343.7 | | |
| **Z (alpha)** | 1.65 | | |
| **Z (beta)** | 1.29 | | |
| **Hypothesized median** | 79.0 | | |

**Performance Claim 5 (TAPE):**

Raw data summarizing the percent removal of total nitrogen (TN) by The Stormwater Management StormFilter®, with PhosphoSorb® media, at the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm for 23 qualifying storm events (bootstrapped data).

| Sample ID | Average Influent TN (mg/L) | Average Effluent TN (mg/L) | Percent Removal (%) |
|---|---|---|---|
| LPR021012 | 1.06 | 0.265 | 75.1 |
| LPR021412 | 1.20 | 0.531 | 55.9 |
| LPR021712 | 1.58 | 0.638 | 59.5 |
| LPR022012 | 0.696 | 0.265 | 61.9 |
| LPR022412 | 1.11 | 0.265 | 76.0 |
| LPR031012 | 1.72 | 0.265 | 84.5 |
| LPR031212a | 0.760 | 0.400 | 47.4 |
| LPR032912b | 1.23 | 0.265 | 78.5 |
| LPR052412 | 1.85 | 0.400 | 78.4 |
| LPR060112 | 2.40 | 0.872 | 63.7 |
| LPR060412 | 1.06 | 0.327 | 69.1 |
| LPR060712 | 0.579 | 0.555 | 4.1 |
| LPR110612 | 0.569 | 0.555 | 2.5 |
| LPR112312 | 0.515 | 0.515 | 0.0 |
| LPR113012 | 1.22 | 0.515 | 57.6 |
| LPR051713 | 1.37 | 0.250 | 81.8 |
| LPR052113 | 0.531 | 0.248 | 53.4 |
| LPR062513 | 0.619 | 0.253 | 59.2 |
| LPR013014 | 0.240 | 0.212 | 11.8 |
| LPR030314 | 0.530 | 0.230 | 56.6 |
| LPR030814a | 0.432 | 0.080 | 81.5 |
| LPR011815 | 0.180 | 0.110 | 38.9 |
| LPR020215 | 2.32 | 0.370 | 84.1 |
| **Sum** | 1281 | | |
| **N (COUNT)** | 23 | | |
| **Median** | 59.5 | | |
| **STDEV.s** | 27.0 | | |
| **VAR.s** | 727 | | |
| **Z (alpha)** | 1.65 | | |
| **Z (beta)** | 1.29 | | |
| **Hypothesized median** | 56.0 | | |

**Performance Claim 6 (TAPE):**

Raw data summarizing the percent removal of total copper (Cu) by The Stormwater Management StormFilter®, with PhosphoSorb® media, at the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm for 23 qualifying storm events (bootstrapped data).

| Sample ID | Average Influent Cu (mg/L) | Average Effluent Cu (mg/L) | Percent Removal (%) |
|---|---|---|---|
| LPR021012 | No data | No data | - |
| LPR021412 | No data | No data | - |
| LPR021712 | 0.032 | 0.006 | 81.3 |
| LPR022012 | 0.014 | 0.001 | 92.9 |
| LPR022412 | 0.032 | 0.005 | 84.4 |
| LPR031012 | 0.019 | 0.003 | 84.2 |
| LPR031212a | 0.012 | 0.003 | 75.0 |
| LPR032912b | 0.023 | 0.004 | 82.6 |
| LPR052412 | 0.050 | 0.050 | 0.0 |
| LPR060112 | 0.040 | 0.003 | 92.5 |
| LPR060412 | 0.021 | 0.003 | 85.7 |
| LPR060712 | 0.028 | 0.010 | 64.3 |
| LPR110612 | 0.006 | 0.003 | 50.0 |
| LPR112312 | 0.006 | 0.001 | 83.3 |
| LPR113012 | 0.016 | 0.002 | 87.5 |
| LPR051713 | 0.016 | 0.003 | 81.3 |
| LPR052113 | 0.027 | 0.006 | 77.8 |
| LPR062513 | 0.029 | 0.005 | 82.8 |
| LPR013014 | 0.021 | 0.004 | 81.0 |
| LPR030314 | 0.019 | 0.006 | 68.4 |
| LPR030814a | 0.018 | 0.002 | 88.9 |
| LPR011815 | 0.055 | 0.010 | 81.8 |
| LPR020215 | 0.044 | 0.007 | 84.1 |
| **Sum** | 1610 | | |
| **N (COUNT)** | 21 | | |
| **Median** | 82.6 | | |
| **STDEV.s** | 20.06 | | |
| **VAR.s** | 403 | | |
| **Z (alpha)** | 1.65 | | |
| **Z (beta)** | 1.29 | | |
| **Hypothesized median** | 77.0 | | |

**Performance Claim 7 (TAPE):**

Raw data summarizing the percent removal of total zinc (Zn) by The Stormwater Management StormFilter®, with PhosphoSorb® media, at the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm for 23 qualifying storm events (bootstrapped data).

| Sample ID | Average Influent Zn (mg/L) | Average Effluent Zn (mg/L) | Percent Removal (%) |
|---|---|---|---|
| LPR021012 | No data | No data | - |
| LPR021412 | No data | No data | - |
| LPR021712 | 0.151 | 0.034 | 77.8 |
| LPR022012 | 0.076 | 0.011 | 85.8 |
| LPR022412 | 0.191 | 0.031 | 84.0 |
| LPR031012 | 0.120 | 0.022 | 81.7 |
| LPR031212a | 0.068 | 0.017 | 75.0 |
| LPR032912b | 0.160 | 0.029 | 81.9 |
| LPR052412 | 0.250 | 0.250 | 0.0 |
| LPR060112 | 0.230 | 0.012 | 94.8 |
| LPR060412 | 0.130 | 0.015 | 88.5 |
| LPR060712 | 0.170 | 0.048 | 71.8 |
| LPR110612 | 0.022 | 0.014 | 36.4 |
| LPR112312 | 0.049 | 0.010 | 79.6 |
| LPR113012 | 0.110 | 0.016 | 85.5 |
| LPR051713 | 0.068 | 0.010 | 85.2 |
| LPR052113 | 0.126 | 0.021 | 83.5 |
| LPR062513 | 0.120 | 0.017 | 85.5 |
| LPR013014 | 0.108 | 0.026 | 76.1 |
| LPR030314 | 0.095 | 0.029 | 69.8 |
| LPR030814a | 0.088 | 0.013 | 84.8 |
| LPR011815 | 0.151 | 0.039 | 74.4 |
| LPR020215 | 0.192 | 0.038 | 80.2 |
| **Sum** | 1582 | | |
| **N (COUNT)** | 21 | | |
| **Median** | 81.7 | | |
| **STDEV.s** | 20.69 | | |
| **VAR.s** | 428 | | |
| **Z (alpha)** | 1.65 | | |
| **Z (beta)** | 1.29 | | |
| **Hypothesized median** | 75.0 | | |

**Performance Claim 8 (TAPE):**

Raw data summarizing the percent removal of total lead (Pb) by The Stormwater Management StormFilter®, with PhosphoSorb® media, at the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm for 23 qualifying storm events (bootstrapped data).

| Sample ID | Average Influent Pb (mg/L) | Average Effluent Pb (mg/L) | Percent Removal (%) |
|---|---|---|---|
| LPR021012 | No data | No data | - |
| LPR021412 | No data | No data | - |
| LPR021712 | 0.013 | 0.003 | 73.7 |
| LPR022012 | 0.005 | 0.001 | 79.6 |
| LPR022412 | 0.015 | 0.003 | 77.3 |
| LPR031012 | 0.009 | 0.002 | 78.5 |
| LPR031212a | 0.006 | 0.002 | 71.9 |
| LPR032912b | 0.012 | 0.003 | 75.0 |
| LPR052412 | 0.025 | 0.025 | 0.00 |
| LPR060112 | 0.016 | 0.005 | 68.8 |
| LPR060412 | 0.013 | 0.001 | 90.8 |
| LPR060712 | 0.013 | 0.005 | 62.3 |
| LPR110612 | 0.001 | 0.001 | 0.0 |
| LPR112312 | 0.002 | 0.001 | 50.0 |
| LPR113012 | 0.005 | 0.001 | 80.0 |
| LPR051713 | 0.004 | 0.001 | 74.8 |
| LPR052113 | 0.009 | 0.009 | 0.336 |
| LPR062513 | 0.009 | 0.002 | 82.5 |
| LPR013014 | 0.006 | 0.001 | 80.5 |
| LPR030314 | 0.007 | 0.003 | 62.1 |
| LPR030814a | 0.005 | 0.001 | 71.5 |
| LPR011815 | 0.015 | 0.003 | 81.4 |
| LPR020215 | 0.011 | 0.002 | 81.0 |
| **Sum** | 1342 | | |
| **N (COUNT)** | 21 | | |
| **Median** | 74.8 | | |
| **STDEV.s** | 28.05 | | |
| **VAR.s** | 787 | | |
| **Z (alpha)** | 1.65 | | |
| **Z (beta)** | 1.29 | | |
| **Hypothesized median** | 70.0 | | |

**Performance Claim 9 (TAPE):**

Raw data summarizing the percent removal of total aluminium (Al) by The Stormwater Management StormFilter®, with PhosphoSorb® media, at the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm for 23 qualifying storm events (bootstrapped data).

| Sample ID | Average Influent Pb (mg/L) | Average Effluent Pb (mg/L) | Percent Removal (%) |
|---|---|---|---|
| LPR021012 | No data | No data | - |
| LPR021412 | No data | No data | - |
| LPR021712 | 9.15 | 1.86 | 79.7 |
| LPR022012 | 2.62 | 0.319 | 87.8 |
| LPR022412 | 9.65 | 1.99 | 79.4 |
| LPR031012 | 6.20 | 1.10 | 82.3 |
| LPR031212a | 4.30 | 0.810 | 81.2 |
| LPR032912b | 6.40 | 1.70 | 73.4 |
| LPR052412 | 9.70 | 1.30 | 86.6 |
| LPR060112 | 11.0 | 0.370 | 96.6 |
| LPR060412 | 12.0 | 1.00 | 91.7 |
| LPR060712 | 9.60 | 4.10 | 57.3 |
| LPR110612 | 1.30 | 0.300 | 76.9 |
| LPR112312 | 1.20 | 0.190 | 84.2 |
| LPR113012 | 3.00 | 0.440 | 85.3 |
| LPR051713 | 1.44 | 0.134 | 90.7 |
| LPR052113 | 3.24 | 0.358 | 89.0 |
| LPR062513 | 3.94 | 0.466 | 88.2 |
| LPR013014 | 3.45 | 0.796 | 76.9 |
| LPR030314 | 2.64 | 1.13 | 57.2 |
| LPR030814a | 1.67 | 0.342 | 79.5 |
| LPR011815 | 5.32 | 1.17 | 78.0 |
| LPR020215 | 3.85 | 1.20 | 68.8 |
| **Sum** | 1691 | | |
| **N (COUNT)** | 21 | | |
| **Mean (AVE)** | 80.5 | | |
| **STDEV.s** | 10.13 | | |
| **VAR.s** | 103 | | |
| **Z (alpha)** | 1.65 | | |
| **Z (beta)** | 1.29 | | |
| **Hypothesized mean** | 80.0 | | |

# Verification

This verification was completed in June 2020 by the Verification Expert, the Centre for Advancement of Water and Wastewater Technologies ("CAWT"), contracted by GLOBE Performance Solutions, applying the International Standard ***ISO 14034:2016 Environmental management -- Environmental technology verification (ETV)***. Data and information provided by Contech Engineered Solutions LLC to support the performance claim included the following:

- Performance test report "The Stormwater Management StormFilter® - PhosphoSorb® at a Specific Flow Rate of 1.67 gpm/ft$^2$ – Performance Evaluation Report" prepared by Contech Engineered Solutions, November 8, 2017. This report is based on a field testing program conducted by Contech personnel at a roadway site in Zigzag, Oregon between January 2012 and February 2015. Testing was conducted in accordance with the 2011 version of the Washington Department of Ecology TAPE (TAPE, 2011).

# What is ISO14034:2016 Environmental management – Environmental technology verification (ETV)?

ISO 14034:2016 specifies principles, procedures and requirements for environmental technology verification (ETV) and was developed and published by the International Organization for Standardization (ISO). The objective of ETV is to provide credible, reliable and independent verification of the performance of environmental technologies. An environmental technology is a technology that either results in an environmental added value or measures parameters that indicate an environmental impact. Such technologies have an increasingly important role in addressing environmental challenges and achieving sustainable development.

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**Limitation of verification - Registration: GPS-ETV_2023-06-30_TAPE**

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CONTECH®
ENGINEERED SOLUTIONS

# StormFilter Inspection and Maintenance Procedures



The Stormwater Management StormFilter®

## Maintenance Guidelines

The primary purpose of the Stormwater Management StormFilter® is to filter and prevent pollutants from entering our waterways. Like any effective filtration system, periodically these pollutants must be removed to restore the StormFilter to its full efficiency and effectiveness.

Maintenance requirements and frequency are dependent on the pollutant load characteristics of each site. Maintenance activities may be required in the event of a chemical spill or due to excessive sediment loading from site erosion or extreme storms. It is a good practice to inspect the system after major storm events.

## Maintenance Procedures

Although there are many effective maintenance options, we believe the following procedure to be efficient, using common equipment and existing maintenance protocols. The following two-step procedure is recommended::

1. **Inspection**
   - Inspection of the vault interior to determine the need for maintenance.
2. **Maintenance**
   - Cartridge replacement
   - Sediment removal

## Inspection and Maintenance Timing

At least one scheduled inspection should take place per year with maintenance following as warranted.

First, an inspection should be done before the winter season. During the inspection the need for maintenance should be determined and, if disposal during maintenance will be required, samples of the accumulated sediments and media should be obtained.

Second, if warranted, a maintenance (replacement of the filter cartridges and removal of accumulated sediments) should be performed during periods of dry weather.



In addition to these two activities, it is important to check the condition of the StormFilter unit after major storms for potential damage caused by high flows and for high sediment accumulation that may be caused by localized erosion in the drainage area. It may be necessary to adjust the inspection/ maintenance schedule depending on the actual operating conditions encountered by the system. In general, inspection activities can be conducted at any time, and maintenance should occur, if warranted, during dryer months in late summer to early fall.

## Maintenance Frequency

The primary factor for determining frequency of maintenance for the StormFilter is sediment loading.

A properly functioning system will remove solids from water by trapping particulates in the porous structure of the filter media inside the cartridges. The flow through the system will naturally decrease as more and more particulates are trapped. Eventually the flow through the cartridges will be low enough to require replacement. It may be possible to extend the usable span of the cartridges by removing sediment from upstream trapping devices on a routine as-needed basis, in order to prevent material from being re-suspended and discharged to the StormFilter treatment system.

The average maintenance lifecycle is approximately 1-5 years. Site conditions greatly influence maintenance requirements. StormFilter units located in areas with erosion or active construction may need to be inspected and maintained more often than those with fully stabilized surface conditions.

Regulatory requirements or a chemical spill can shift maintenance timing as well. The maintenance frequency may be adjusted as additional monitoring information becomes available during the inspection program. Areas that develop known problems should be inspected more frequently than areas that demonstrate no problems, particularly after major storms. Ultimately, inspection and maintenance activities should be scheduled based on the historic records and characteristics of an individual StormFilter system or site. It is recommended that the site owner develop a database to properly manage StormFilter inspection and maintenance programs..



## Inspection Procedures

The primary goal of an inspection is to assess the condition of the cartridges relative to the level of visual sediment loading as it relates to decreased treatment capacity. It may be desirable to conduct this inspection during a storm to observe the relative flow through the filter cartridges. If the submerged cartridges are severely plugged, then typically large amounts of sediments will be present and very little flow will be discharged from the drainage pipes. If this is the case, then maintenance is warranted and the cartridges need to be replaced.

**Warning**: In the case of a spill, the worker should abort inspection activities until the proper guidance is obtained. Notify the local hazard control agency and Contech Engineered Solutions immediately.

To conduct an inspection:

**Important:** Inspection should be performed by a person who is familiar with the operation and configuration of the StormFilter treatment unit and the unit's role, relative to detention or retention facilities onsite.

1. If applicable, set up safety equipment to protect and notify surrounding vehicle and pedestrian traffic.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the access portals to the vault and allow the system vent.
4. Without entering the vault, visually inspect the inside of the unit, and note accumulations of liquids and solids.
5. Be sure to record the level of sediment build-up on the floor of the vault, in the forebay, and on top of the cartridges. If flow is occurring, note the flow of water per drainage pipe. Record all observations. Digital pictures are valuable for historical documentation.
6. Close and fasten the access portals.
7. Remove safety equipment.
8. If appropriate, make notes about the local drainage area relative to ongoing construction, erosion problems, or high loading of other materials to the system.
9. Discuss conditions that suggest maintenance and make decision as to whether or not maintenance is needed.

## Maintenance Decision Tree

The need for maintenance is typically based on results of the inspection. The following Maintenance Decision Tree should be used as a general guide. (Other factors, such as Regulatory Requirements, may need to be considered).

Please note Stormwater Management StormFilter devices installed downstream of, or integrated within, a stormwater storage facility typically have different operational parameters (i.e. draindown time). In these cases, the inspector must understand the relationship between the retention/detention facility and the treatment system by evaluating site specific civil engineering plans, or contacting the engineer of record, and make adjustments to the below guidance as necessary. Sediment deposition depths and patterns within the StormFilter are likely to be quite different compared to systems without upstream storage and therefore shouldn't be used exclusively to evaluate a need for maintenance.

1. Sediment loading on the vault floor.
   a. If >4" of accumulated sediment, maintenance is required.
2. Sediment loading on top of the cartridge.
   a. If >1/4" of accumulation, maintenance is required.
3. Submerged cartridges.
   a. If >4" of static water above cartridge bottom for more than 24 hours after end of rain event, maintenance is required. (Catch basins have standing water in the cartridge bay.)
4. Plugged media.
   a. While not required in all cases, inspection of the media within the cartridge may provide valuable additional information.
   b. If pore space between media granules is absent, maintenance is required.
5. Bypass condition.
   a. If inspection is conducted during an average rain fall event and StormFilter remains in bypass condition (water over the internal outlet baffle wall or submerged cartridges), maintenance is required.
6. Hazardous material release.
   a. If hazardous material release (automotive fluids or other) is reported, maintenance is required.
7. Pronounced scum line.
   a. If pronounced scum line (say ≥ 1/4" thick) is present above top cap, maintenance is required.

## Maintenance

Depending on the configuration of the particular system, maintenance personnel will be required to enter the vault to perform the maintenance.

**Important**: If vault entry is required, OSHA rules for confined space entry must be followed.

Filter cartridge replacement should occur during dry weather. It may be necessary to plug the filter inlet pipe if base flows is occurring.

Replacement cartridges can be delivered to the site or customers facility. Information concerning how to obtain the replacement cartridges is available from Contech Engineered Solutions.

**Warning**: In the case of a spill, the maintenance personnel should abort maintenance activities until the proper guidance is obtained. Notify the local hazard control agency and Contech Engineered Solutions immediately.

To conduct cartridge replacement and sediment removal maintenance:

1. If applicable, set up safety equipment to protect maintenance personnel and pedestrians from site hazards.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the doors (access portals) to the vault and allow the system to vent.
4. Without entering the vault, give the inside of the unit, including components, a general condition inspection.
5. Make notes about the external and internal condition of the vault. Give particular attention to recording the level of sediment build-up on the floor of the vault, in the forebay, and on top of the internal components.
6. Using appropriate equipment offload the replacement cartridges (up to 150 lbs. each) and set aside.
7. Remove used cartridges from the vault using one of the following methods:

## Method 1:

A. This activity will require that maintenance personnel enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Disconnect each filter cartridge from the underdrain connector by rotating counterclockwise 1/4 of a turn. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.

   Using appropriate hoisting equipment, attach a cable from the boom, crane, or tripod to the loose cartridge. Contact Contech Engineered Solutions for suggested attachment devices.

B. Remove the used cartridges (up to 250 lbs. each) from the vault.



**Important:** Care must be used to avoid damaging the cartridges during removal and installation. The cost of repairing components damaged during maintenance will be the responsibility of the owner.

C. Set the used cartridge aside or load onto the hauling truck.

D. Continue steps a through c until all cartridges have been removed.

## Method 2:

A. This activity will require that maintenance personnel enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Disconnect each filter cartridge from the underdrain connector by rotating counterclockwise 1/4 of a turn. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.

B. Unscrew the cartridge cap.

C. Remove the cartridge hood and float.

D. At location under structure access, tip the cartridge on its side.

E. Empty the cartridge onto the vault floor. Reassemble the empty cartridge.

F. Set the empty, used cartridge aside or load onto the hauling truck.

G. Continue steps a through e until all cartridges have been removed.

8. Remove accumulated sediment from the floor of the vault and from the forebay. This can most effectively be accomplished by use of a vacuum truck.
9. Once the sediments are removed, assess the condition of the vault and the condition of the connectors.
10. Using the vacuum truck boom, crane, or tripod, lower and install the new cartridges. Once again, take care not to damage connections.
11. Close and fasten the door.
12. Remove safety equipment.
13. Finally, dispose of the accumulated materials in accordance with applicable regulations. Make arrangements to return the used **empty** cartridges to Contech Engineered Solutions.

## Material Disposal

The accumulated sediment found in stormwater treatment and conveyance systems must be handled and disposed of in accordance with regulatory protocols. It is possible for sediments to contain measurable concentrations of heavy metals and organic chemicals (such as pesticides and petroleum products). Areas with the greatest potential for high pollutant loading include industrial areas and heavily traveled roads.

Sediments and water must be disposed of in accordance with all applicable waste disposal regulations. When scheduling maintenance, consideration must be made for the disposal of solid and liquid wastes. This typically requires coordination with a local landfill for solid waste disposal. For liquid waste disposal a number of options are available including a municipal vacuum truck decant facility, local waste water treatment plant or on-site treatment and discharge.

## Related Maintenance Activities - Performed on an as-needed basis

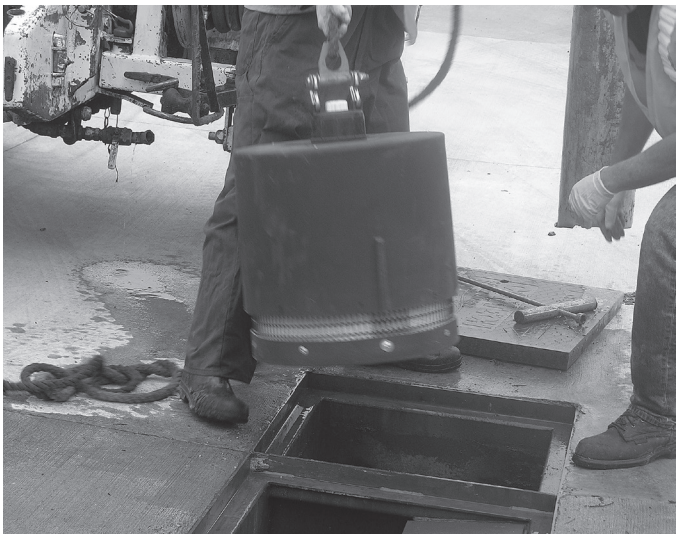
StormFilter units are often just one of many structures in a more comprehensive stormwater drainage and treatment system.

In order for maintenance of the StormFilter to be successful, it is imperative that all other components be properly maintained. The maintenance/repair of upstream facilities should be carried out prior to StormFilter maintenance activities.

In addition to considering upstream facilities, it is also important to correct any problems identified in the drainage area. Drainage area concerns may include: erosion problems, heavy oil loading, and discharges of inappropriate materials.







# Inspection Report

Date: _____ Personnel: _____

Location: _____ System Size: _____ Months in Service: _____

System Type: Vault ☐ Cast-In-Place ☐ Linear Catch Basin ☐ Manhole ☐ Other: _____

Sediment Thickness in Forebay: _____ Date: _____

Sediment Depth on Vault Floor: _____

Sediment Depth on Cartridge Top(s): _____

Structural Damage: _____

Estimated Flow from Drainage Pipes (if available): _____

Cartridges Submerged: Yes ☐ No ☐ Depth of Standing Water: _____

StormFilter Maintenance Activities (check off if done and give description)

☐ Trash and Debris Removal: _____

☐ Minor Structural Repairs: _____

☐ Drainage Area Report _____

Excessive Oil Loading: Yes ☐ No ☐ Source: _____

Sediment Accumulation on Pavement: Yes ☐ No ☐ Source: _____

Erosion of Landscaped Areas: Yes ☐ No ☐ Source: _____

Items Needing Further Work: _____

Owners should contact the local public works department and inquire about how the department disposes of their street waste residuals.

Other Comments:

_____

_____

_____

_____

_____

_____

_____

_____

Review the condition reports from the previous inspection visits.

# StormFilter Maintenance Report

Date: _____ Personnel: _____

Location: _____ System Size: _____

System Type: Vault ☐ Cast-In-Place ☐ Linear Catch Basin ☐ Manhole ☐ Other: _____

List Safety Procedures and Equipment Used: _____

_____

_____

## System Observations

Months in Service: _____

Oil in Forebay (if present): Yes ☐ No ☐

Sediment Depth in Forebay (if present): _____

Sediment Depth on Vault Floor: _____

Sediment Depth on Cartridge Top(s): _____

Structural Damage: _____

## Drainage Area Report

Excessive Oil Loading: Yes ☐ No ☐ Source: _____

Sediment Accumulation on Pavement: Yes ☐ No ☐ Source: _____

Erosion of Landscaped Areas: Yes ☐ No ☐ Source: _____

## StormFilter Cartridge Replacement Maintenance Activities

Remove Trash and Debris: Yes ☐ No ☐ Details: _____

Replace Cartridges: Yes ☐ No ☐ Details: _____

Sediment Removed: Yes ☐ No ☐ Details: _____

Quantity of Sediment Removed (estimate?):

Minor Structural Repairs: Yes ☐ No ☐ Details: _____

Residuals (debris, sediment) Disposal Methods: _____

Notes:

_____

_____

_____

_____

_____

_____

_____

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Support

- Drawings and specifications are available at www.conteches.com.
- Site-specific design support is available from our engineers.

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## Vin Vyas | nEngineering Inc

**From:** Mushfik Alam [mushfik@echelonenvironmental.ca]
**Sent:** February 5, 2024 2:37 PM
**To:** Ashok Bharathi | n Engineering Inc.'
**Cc:** 'Nitin Malhotra | n Architecture Inc.'; 'Abu Ziauddin | nEngineering Inc.'; Anuska Ghimire
**Subject:** RE: n2123 | Coldwater Orillia - OGS
**Attachments:** ISO-14034-ETV-Contech-StormFilter_TAPE_2023-06-30-Final.pdf

Good afternoon Ashok,

As per your request, please see the ETV test document for the StormFilter system. The phosphorus removal efficiency can be found on pg 3 under the Performance Claim 4 (TAPE) section.

Hope this helps, and please let me know if you have any other questions or concerns.

Thank you,

Mushfik Alam, P.Eng.
Project Manager
Echelon Environmental Inc.
55 Albert Street, Suite #200 | Markham, ON, L3P 2T4
C: 647-553-9494 | T: 905-948-0000 | F: 905-948-0577
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www.echelonenvironmental.ca

ECHELON ENVIRONMENTAL

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**From:** Ashok Bharathi | n Engineering Inc.' <ab@nengineering.com>
**Sent:** Monday, February 5, 2024 2:18 PM
**To:** Mushfik Alam <mushfik@echelonenvironmental.ca>
**Cc:** 'Nitin Malhotra | n Architecture Inc.' <nm@narchitecture.com>; 'Abu Ziauddin | nEngineering Inc.' <az@nengineering.com>; Anuska Ghimire <anuska@echelonenvironmental.ca>
**Subject:** RE: n2123 | Coldwater Orillia - OGS

Hello Mushfik,

As per the telephone conversation, can you please send me a document or mail to confirm the percentage of phosphorus removal by this OGS.

**Thanks and Regards,**

Appendix G

# Phosphorous Budget Summary

## Summary

| Site | Project Name | Project Title | Storm Type | Runoff Continuity Error (%) | Flow Routing Continuity Error (%) |
|---|---|---|---|---|---|
| pre-development | Coldwater road, Orillia | n2123 | avg-annual | -0.000 | -0.129 |
| post-development | Coldwater road, Orillia | n2123 | avg-annual | -0.001 | 0.482 |

These continuity errors represent the percent difference between initial storage+ total inflow for the entire drainage system versus final storage + total outflow for the entire drainage system. If the continuity error exceed some reasonable level, such as 10 percent, then the validity of the analysis results must be questioned. The most common reasons for an excessive continuity error are conduits that are too short, abrupt changes in storage (very small or very large storage areas), or flooding losses in the model (insufficient node depth).

## Water Balance Comparison

| Site | Site Area | Site Rainfall<br>(mm)<br>($m^3$) | Site Infiltration<br>(mm)<br>($m^3$) | Site Evapotranspiration<br>(mm)<br>($m^3$) | External Outflow<br>(mm)<br>($m^3$) | Rainfall Reduction<br>(mm)<br>(%) |
|---|---|---|---|---|---|---|
| n2123 Total | 1.51 ha | 944.7 mm<br>14,236.63 $m^3$ | 649.85 mm<br>9,793.24 $m^3$ | 95.58 mm<br>1,440.39 $m^3$ | 198.61 mm<br>2,993 $m^3$ | 746.09 mm<br>78.98 % |
| n2123 Total | 1.51 ha | 944.7 mm<br>14,246.08 $m^3$ | 171.96 mm<br>2,593.16 $m^3$ | 161.9 mm<br>2,441.45 $m^3$ | 606.3 mm<br>9,143 $m^3$ | 338.4 mm<br>35.82 % |
| **Difference** | **0 ha** | **-0 mm**<br>**9.45 $m^3$** | **-477.89 mm**<br>**-7,200.08 $m^3$** | **66.32 mm**<br>**1,001.06 $m^3$** | **407.69 mm**<br>**6,150 $m^3$** | **-407.69 mm**<br>**-43.16 %** |
| **Difference** | **0.07 %** | **-0 %** | **-73.54 %** | **69.39 %** | **205.28 %** | **-54.64 %** |

## Water Balance | n2123

| Catchment | Site Area | Site Rainfall (mm) ($m^3$) | Site Infiltration (mm) ($m^3$) | Site Evapotranspiration (mm) ($m^3$) | External Outflow (mm) ($m^3$) | Rainfall Reduction (mm) (%) |
|---|---|---|---|---|---|---|
| 1 | 1.51 ha | 944.70 mm<br>14,236.63 $m^3$ | 649.85 mm<br>9,793.24 $m^3$ | 95.58 mm<br>1,440.39 $m^3$ | 198.61 mm<br>2,993 $m^3$ | 746.09 mm<br>78.98 % |
| **TOTAL** | **1.51 ha** | **944.7 mm**<br>**14,236.63 $m^3$** | **649.85 mm**<br>**9,793.24 $m^3$** | **95.58 mm**<br>**1,440.39 $m^3$** | **198.61 mm**<br>**2,993 $m^3$** | **746.09 mm**<br>**78.98 %** |

## Water Balance | n2123

| Catchment | Site Area | Site Rainfall (mm) ($m^3$) | Site Infiltration (mm) ($m^3$) | Site Evapotranspiration (mm) ($m^3$) | External Outflow (mm) ($m^3$) | Rainfall Reduction (mm) (%) |
|---|---|---|---|---|---|---|
| 1 | 1.51 ha | 944.70 mm<br>14,246.08 $m^3$ | 171.96 mm<br>2,593.16 $m^3$ | 161.9 mm<br>2,441.45 $m^3$ | 606.3 mm<br>9,143 $m^3$ | 338.4 mm<br>35.82 % |
| **TOTAL** | **1.51 ha** | **944.7 mm** | **171.96 mm** | **161.9 mm** | **606.3 mm** | **338.4 mm** |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | 14,246.08 $m^3$ | 2,593.16 $m^3$ | 2,441.45 $m^3$ | 9,143 $m^3$ | 35.82 % |

## Storage Volumes | n2123

### Catchment 1

### Subatchment

| Name | Initial Soil Water (fraction) | Final Soil Water (fraction) |
|---|---|---|
| Site | 0.284 | 0.28 |

## Storage Volumes | n2123

### Catchment 1

### Subatchment

| Name | Initial Soil Water (fraction) | Final Soil Water (fraction) |
|---|---|---|
| Site | 0.284 | 0.28 |

## Map | n2123




## Map | n2123




COLDWATER ROAD WEST
249
261
233
279
265
Angel's
Guardian Parish
Cemetery
270 m
265 m
260 m
255 m
188
184
189
187
226
228
230
232
236
242
246
250
252
256
260
266
270
119
229
233
235
239
241
243
247
249

## LID Summary | n2123

| Element | Type | LID Area | Drawdown Time | Effective Impervious to Pervious Ratio | FLOW | TSS | TP |
|---|---|---|---|---|---|---|---|
| | | | | | Flow In ($m^3$) | Load In (kg) | Load In (kg) |
| | | | | | Flow Out ($m^3$) | Load Out (kg) | Load Out (kg) |
| | | | | | Actual Reduction (%) | Actual Reduction (%) | Actual Reduction (%) |

## LID Summary | n2123

| Element | Type | LID Area | Drawdown Time | Effective Impervious to Pervious Ratio | FLOW | TSS | TP |
|---|---|---|---|---|---|---|---|
| | | | | | Flow In ($m^3$) | Load In (kg) | Load In (kg) |
| | | | | | Flow Out ($m^3$) | Load Out (kg) | Load Out (kg) |
| | | | | | Actual Reduction (%) | Actual Reduction (%) | Actual Reduction (%) |
| OGS | Media-Filter | - | - | - | 9,190 $m^3$ | 674.604 kg | 2.035 kg |
| | | | | | 9,190 $m^3$ | 134.921 kg | 0.427 kg |
| | | | | | 0 % | 80 % | 79 % |

## Trees | n2123

| Element | Area | Rainfall | Infiltration | Evapotranspired | Runoff | Stored | Rainfall Reduction |
|---|---|---|---|---|---|---|---|
| | (ha) | (mm) | (mm) | (mm) | (mm) | (mm) | (mm) |
| | ($m^2$) | ($m^2$) | ($m^3$) | ($m^3$) | ($m^3$) | ($m^3$) | ($m^3$) |

## Trees | n2123

| Element | Area | Rainfall | Infiltration | Evapotranspired | Runoff | Stored | Rainfall Reduction |
|---|---|---|---|---|---|---|---|
| | (ha) | (mm) | (mm) | (mm) | (mm) | (mm) | (mm) |
| | ($m^2$) | ($m^2$) | ($m^3$) | ($m^3$) | ($m^3$) | ($m^3$) | ($m^3$) |

## Loading Summary TSS | n2123

| Catchment | Total Catchment TSS Removal | Peak Outflow | Incoming<br>Total Flow ($m^3$)<br>Average Concentration (mg/l)<br>Total Load (kg) | Outgoing<br>Total Flow ($m^3$)<br>Average Concentration (mg/l)<br>Total Load (kg) |
|---|---|---|---|---|
| Catchment 1 | 78.98 % | 0.09 $m^3/s$ | 14,236.629 $m^3$<br>99.93 mg/l<br>1,422.638 kg | 2,993 $m^3$<br>99.91 mg/l<br>299.045 kg |
| **Total** | **78.98 %** | **0.09 $m^3/s$** | **14,236.629 $m^3$**<br>**99.93 mg/l**<br>**1,422.638 kg** | **2,993 $m^3$**<br>**99.91 mg/l**<br>**299.045 kg** |

## Loading Summary TSS | n2123

| Catchment | Total Catchment TSS Removal | Peak Outflow | Incoming<br>Total Flow ($m^3$)<br>Average Concentration (mg/l)<br>Total Load (kg) | Outgoing<br>Total Flow ($m^3$)<br>Average Concentration (mg/l)<br>Total Load (kg) |
|---|---|---|---|---|
| Catchment 1 | 87.211 % | 0.189 $m^3/s$ | 14,246.076 $m^3$<br>73.41 mg/l<br>1,045.78 kg | 9,143 $m^3$<br>14.63 mg/l<br>133.747 kg |
| **Total** | **87.211 %** | **0.189 $m^3/s$** | **14,246.076 $m^3$**<br>**73.41 mg/l**<br>**1,045.78 kg** | **9,143 $m^3$**<br>**14.63 mg/l**<br>**133.747 kg** |

## Loading Summary TP | n2123

| Catchment | Total Catchment TP Removal | Peak Outflow | Incoming<br>Total Flow ($m^3$)<br>Average Concentration (mg/l)<br>Total Load (kg) | Outgoing<br>Total Flow ($m^3$)<br>Average Concentration (mg/l)<br>Total Load (kg) |
|---|---|---|---|---|
| Catchment 1 | 78.98 % | 0.09 $m^3/s$ | 14,236.629 $m^3$<br>0.32 mg/l<br>4.546 kg | 2,993 $m^3$<br>0.32 mg/l<br>0.956 kg |
| **Total** | **78.98 %** | **0.09 $m^3/s$** | **14,236.629 $m^3$**<br>**0.32 mg/l**<br>**4.546 kg** | **2,993 $m^3$**<br>**0.32 mg/l**<br>**0.956 kg** |

## Loading Summary TP | n2123

| Catchment | Total Catchment TP Removal | Peak Outflow | Incoming<br>Total Flow ($m^3$)<br>Average Concentration (mg/l)<br>Total Load (kg) | Outgoing<br>Total Flow ($m^3$)<br>Average Concentration (mg/l)<br>Total Load (kg) |
|---|---|---|---|---|
| Catchment 1 | 86.571 % | 0.189 $m^3/s$ | 14,246.076 $m^3$<br>0.22 mg/l<br>3.155 kg | 9,143 $m^3$<br>0.05 mg/l<br>0.424 kg |
| **Total** | **86.571 %** | **0.189 $m^3/s$** | **14,246.076 $m^3$**<br>**0.22 mg/l**<br>**3.155 kg** | **9,143 $m^3$**<br>**0.05 mg/l**<br>**0.424 kg** |

## Peak Flow | n2123

| Catchment | Element | Description | Peak outflow |
|---|---|---|---|
| 1 | Site | PEAK RUNOFF FLOW from | 0.09 $m^3/s$ |
| | Out let | MAXIMUM FLOW at | 0.090 $m^3/s$ |

## Peak Flow | n2123

| Catchment | Element | Description | Peak outflow |
|---|---|---|---|
| 1 | Site | PEAK RUNOFF FLOW from | 0.19 $m^3/s$ |
| | RIPRAP | MAXIMUM FLOW at | 0.189 $m^3/s$ |
| | OGS | MAXIMUM LATERAL INFLOW at | 0.190 $m^3/s$ |
| | Tank | MAXIMUM LATERAL INFLOW at | 0.190 $m^3/s$ |
| | Pipe1 | MAXIMUM FLOW in | 0.190 $m^3/s$ |
| | MH4( CONTROL) | MAXIMUM LATERAL INFLOW at | 0.189 $m^3/s$ |
| | PIPE2 | MAXIMUM FLOW in | 0.189 $m^3/s$ |
| | PIPE3 | MAXIMUM FLOW in | 0.189 $m^3/s$ |

## Detailed Loading TSS | n2123

### TSS - Catchment 1

| Name | LID Type (removal) | Peak Outflow | Incoming<br>Total Flow ($m^3$)<br>Concentration (mg/l)<br>Total Load (kg) | Outgoing<br>Total Flow ($m^3$)<br>Concentration (mg/l)<br>Total Load (kg) |
|---|---|---|---|---|
| Site | 0 % | 0.09 $m^3/s$ | 14,236.629 $m^3$<br>99.93 mg/l<br>1,422.638 kg | 2,992.601 $m^3$<br>99.93 mg/l<br>299.045 kg |
| Out let | 0 % | 0.09 $m^3/s$ | 2,993 $m^3$<br>99.91 mg/l<br>299.045 kg | 2,993 $m^3$<br>99.91 mg/l<br>299.045 kg |

## Detailed Loading TSS | n2123

### TSS - Catchment 1

| Name | LID Type (removal) | Peak Outflow | Incoming | Outgoing |
|---|---|---|---|---|
| | | | Total Flow ($m^3$) | Total Flow ($m^3$) |
| | | | Concentration (mg/l) | Concentration (mg/l) |
| | | | Total Load (kg) | Total Load (kg) |
| Site | 0 % | 0.19 $m^3/s$ | 14,246.076 $m^3$ | 9,189.752 $m^3$ |
| | | | 73.41 mg/l | 73.41 mg/l |
| | | | 1,045.78 kg | 674.604 kg |
| OGS | 80 % | 0.19 $m^3/s$ | 9,190 $m^3$ | 9,190 $m^3$ |
| | | | 73.41 mg/l | 14.68 mg/l |
| | | | 674.604 kg | 134.921 kg |
| Tank | 0 % | 0.19 $m^3/s$ | 9,120 $m^3$ | 9,120 $m^3$ |
| | | | 14.68 mg/l | 14.68 mg/l |
| | | | 133.893 kg | 133.893 kg |
| MH4( CONTROL) | 0 % | 0.189 $m^3/s$ | 9,150 $m^3$ | 9,150 $m^3$ |
| | | | 14.63 mg/l | 14.63 mg/l |

| | | | | |
|---|---|---|---|---|
| | | | 133.893 kg | 133.893 kg |
| Pipe1 | 0 % | 0.19 $m^3/s$ | 9,120 $m^3$ | 9,120 $m^3$ |
| | | | 14.68 mg/l | 14.68 mg/l |
| | | | 133.893 kg | 133.893 kg |
| PIPE2 | 0 % | 0.189 $m^3/s$ | 9,120 $m^3$ | 9,120 $m^3$ |
| | | | 14.68 mg/l | 14.68 mg/l |
| | | | 133.893 kg | 133.893 kg |
| PIPE3 | 0 % | 0.189 $m^3/s$ | 9,140 $m^3$ | 9,140 $m^3$ |
| | | | 14.63 mg/l | 14.63 mg/l |
| | | | 133.747 kg | 133.747 kg |
| RIPRAP | 0 % | 0.189 $m^3/s$ | 9,143 $m^3$ | 9,143 $m^3$ |
| | | | 14.63 mg/l | 14.63 mg/l |
| | | | 133.747 kg | 133.747 kg |

## Detailed Loading TP | n2123

### TP - Catchment 1

| Name | LID Type | Peak Outflow | Incoming<br>Total Flow ($m^3$)<br>Concentration (mg/l)<br>Total Load (kg) | Outgoing<br>Total Flow ($m^3$)<br>Concentration (mg/l)<br>Total Load (kg) |
|---|---|---|---|---|
| Site | 0 % | 0.09 $m^3/s$ | 14,236.629 $m^3$<br>0.319 mg/l<br>4.546 kg | 2,992.601 $m^3$<br>0.319 mg/l<br>0.956 kg |
| Out let | 0 % | 0.09 $m^3/s$ | 2,993 $m^3$<br>0.319 mg/l<br>0.956 kg | 2,993 $m^3$<br>0.319 mg/l<br>0.956 kg |

## Detailed Loading TP | n2123

### TP - Catchment 1

| Name | LID Type | Peak Outflow | Incoming<br>Total Flow ($m^3$)<br>Concentration (mg/l)<br>Total Load (kg) | Outgoing<br>Total Flow ($m^3$)<br>Concentration (mg/l)<br>Total Load (kg) |
|---|---|---|---|---|
| Site | 0 % | 0.19 $m^3/s$ | 14,246.076 $m^3$<br>0.221 mg/l<br>3.155 kg | 9,189.752 $m^3$<br>0.221 mg/l<br>2.035 kg |
| OGS | 79 % | 0.19 $m^3/s$ | 9,190 $m^3$<br>0.221 mg/l<br>2.035 kg | 9,190 $m^3$<br>0.047 mg/l<br>0.427 kg |
| Tank | 0 % | 0.19 $m^3/s$ | 9,120 $m^3$<br>0.047 mg/l<br>0.424 kg | 9,120 $m^3$<br>0.047 mg/l<br>0.424 kg |
| MH4( CONTROL) | 0 % | 0.189 $m^3/s$ | 9,150 $m^3$<br>0.046 mg/l | 9,150 $m^3$<br>0.046 mg/l |

| | | | | |
|---|---|---|---|---|
| | | | 0.424 kg | 0.424 kg |
| Pipe1 | 0 % | 0.19 $m^3/s$ | 9,120 $m^3$ | 9,120 $m^3$ |
| | | | 0.047 mg/l | 0.047 mg/l |
| | | | 0.424 kg | 0.424 kg |
| PIPE2 | 0 % | 0.189 $m^3/s$ | 9,120 $m^3$ | 9,120 $m^3$ |
| | | | 0.047 mg/l | 0.047 mg/l |
| | | | 0.424 kg | 0.424 kg |
| PIPE3 | 0 % | 0.189 $m^3/s$ | 9,140 $m^3$ | 9,140 $m^3$ |
| | | | 0.046 mg/l | 0.046 mg/l |
| | | | 0.424 kg | 0.424 kg |
| RIPRAP | 0 % | 0.189 $m^3/s$ | 9,143 $m^3$ | 9,143 $m^3$ |
| | | | 0.046 mg/l | 0.046 mg/l |
| | | | 0.424 kg | 0.424 kg |

## Detailed Report Parameters | n2123

### Site

| Field | Value |
|---|---|
| Subcatchment name | Site |
| Catchment | 1 |
| Soil type | Silt Loam |
| Weighted EMC TSS (mg/L) | 99.93 |
| Weighted EMC TP (mg/L) | 0.32 |
| Total AREA (HA) | 1.507 |
| Impervious area (HA) | 0.0108504 |
| Roof area (HA) | 0 |
| Landscaped area (HA) | 1.4961496 |
| Row Crop area (HA) | 0 |
| Open Space / Parkland area (HA) | 0 |
| Forest area (HA) | 0 |
| Wetland area (HA) | 0 |
| Other area (HA) | 0 |

| | |
|---|---|
| % Impervious (%) | 0.72 |
| Subcatchment Width (m) | 100 |
| Subcatchment Slope (%) | 1 |
| Manning's n for impervious areas | 0.01 |
| Manning's n for pervious areas | 0.1 |
| Depression storage for impervious areas (mm) | 2 |
| Depression storage for pervious areas (mm) | 2.54 |
| Weighted Curve Number | 82 |

### Out let

| Field | Value |
|---|---|
| Name | Out let |
| Catchment | 1 |
| Outfall Elevation (m) | 264.69 |

## Detailed Report Parameters | n2123

### Site

| Field | Value |
|---|---|

| | |
|---|---|
| Subcatchment name | Site |
| Catchment | 1 |
| Soil type | Silt Loam |
| Weighted EMC TSS (mg/L) | 73.41 |
| Weighted EMC TP (mg/L) | 0.22 |
| Total AREA (HA) | 1.508 |
| Impervious area (HA) | 0.75777 |
| Roof area (HA) | 0.3497052 |
| Landscaped area (HA) | 0.4005248 |
| Row Crop area (HA) | 0 |
| Open Space / Parkland area (HA) | 0 |
| Forest area (HA) | 0 |
| Wetland area (HA) | 0 |
| Other area (HA) | 0 |
| % Impervious (%) | 73.44 |
| Subcatchment Width (m) | 100 |
| Subcatchment Slope (%) | 1 |
| Manning's n for impervious areas | 0.01 |
| Manning's n for pervious areas | 0.1 |

| | |
|---|---|
| Depression storage for impervious areas (mm) | 2 |
| Depression storage for pervious areas (mm) | 2.54 |
| Weighted Curve Number | 82 |

## RIPRAP

| Field | Value |
|---|---|
| Name | RIPRAP |
| Catchment | 1 |
| Outfall Elevation (m) | 264.69 |

## OGS

| Field | Value |
|---|---|
| Name | OGS |
| Junction Type | Sand or Media Filters |
| Catchment | 1 |
| User defined TSS Removal Efficiency (fraction) | 0.8 |
| User defined TP Removal Efficiency (fraction) | 0.79 |
| Invert Elevation (m) | 266.25 |
| Depth to Surface (m) | 2.65 |
| Surcharge Depth (m) | 0 |

| | |
|---|---|
| Surface Ponding Area (m2) | 0 |
| External Flow? | constant |
| Constant Flow ($m^3/s$) | 0 |

## Tank

| Field | Value |
|---|---|
| Name | Tank |
| Junction Type | No Removal |
| Catchment | 1 |
| User defined TP Removal Efficiency (fraction) | 0 |
| Invert Elevation (m) | 266.64 |
| Depth to Surface (m) | 1.46 |
| Surcharge Depth (m) | 0 |
| Surface Ponding Area (m2) | 0 |
| External Flow? | |
| Constant Flow ($m^3/s$) | |

## Pipe1

| Field | Value |
|---|---|

| | |
|---|---|
| Name | Pipe1 |
| Catchment | 1 |
| Upstream Node | OGS |
| Downstream Node | Tank |
| Length (m) | 23 |
| Manning's Roughness | 0.013 |
| Upstream Invert (m) | 0 |
| Downstream Invert (m) | 0 |
| Pipe Diameter (m) | 0.3 |
| Seepage in MM per Hour | 0 |

## MH4( CONTROL)

| Field | Value |
|---|---|
| Name | MH4( CONTROL) |
| Junction Type | No Removal |
| Catchment | 1 |
| Invert Elevation (m) | 264.77 |
| Depth to Surface (m) | 1.68 |
| Surcharge Depth (m) | 0 |
| Surface Ponding Area (m2) | 0 |

| | |
|---|---|
| External Flow? | |
| Constant Flow ($m^3/s$) | |

## PIPE2

| Field | Value |
|---|---|
| Name | PIPE2 |
| Catchment | 1 |
| Upstream Node | Tank |
| Downstream Node | MH4-CONTROL |
| Length (m) | 25 |
| Manning's Roughness | 0.013 |
| Upstream Invert (m) | 0 |
| Downstream Invert (m) | 0 |
| Pipe Diameter (m) | 0.3 |
| Seepage in MM per Hour | 0 |

## PIPE3

| Field | Value |
|---|---|
| Name | PIPE3 |
| | |

| | |
|---|---|
| Catchment | 1 |
| Upstream Node | MH4-CONTROL |
| Downstream Node | RIPRAP |
| Length (m) | 16 |
| Manning's Roughness | 0.013 |
| Upstream Invert (m) | 0 |
| Downstream Invert (m) | 0 |
| Pipe Diameter (m) | 0.3 |
| Seepage in MM per Hour | 0 |

## Costing | n2123

| Name | Catchment | Green Infrastructure Type | Default Values/User Edited | Construction Cost | Annual Average Maintenance Cost | 25-year Maintenance Cost | Total life-cycle cost (excludes rehab) | User Comments |
|---|---|---|---|---|---|---|---|---|
| | all | all | all | | | | | |
| **Total** | | | | **$0.00** | **$0.00** | **$0.00** | **$0.00** | |

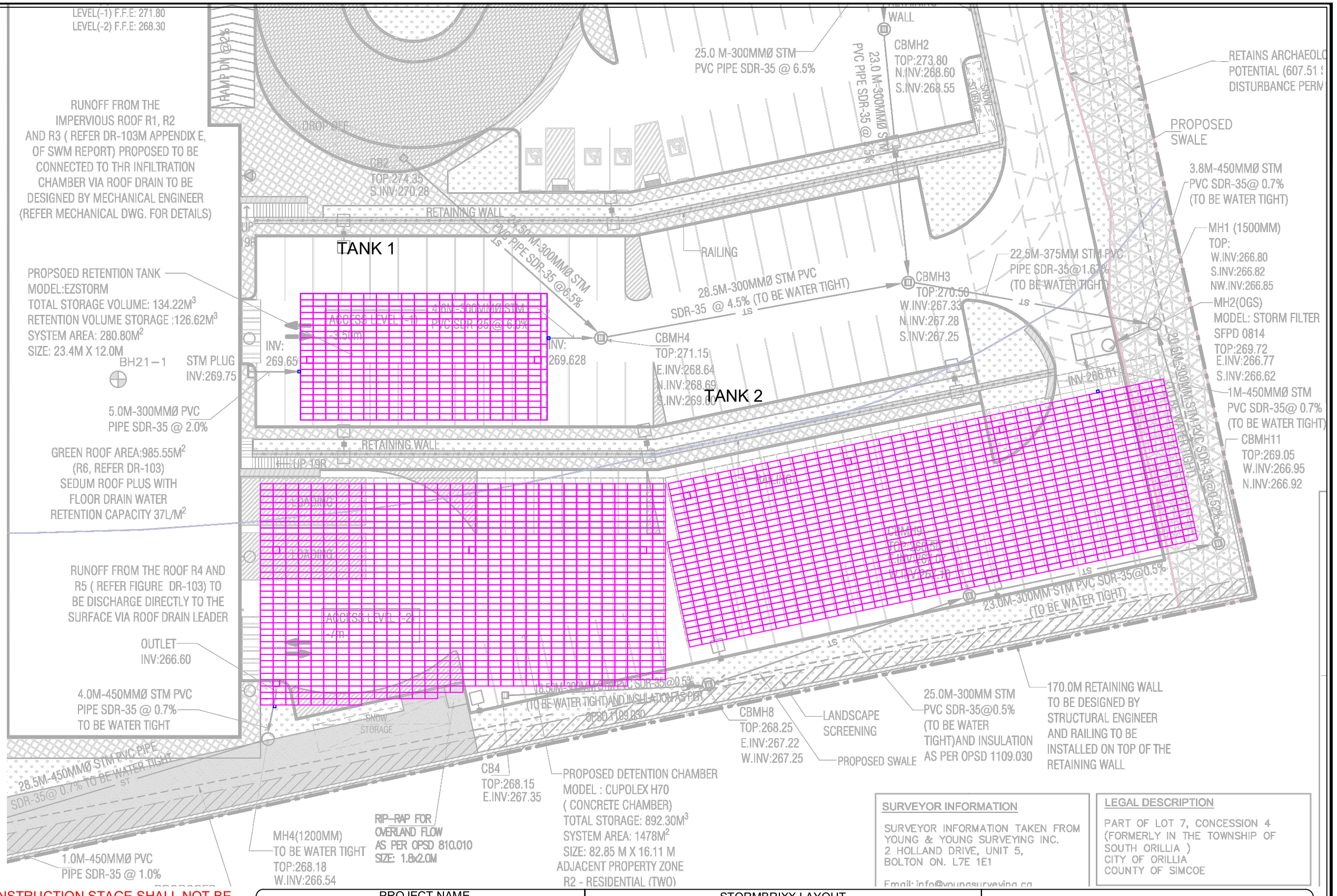
## Costing | n2123

| Name | Catchment | Green Infrastructure Type | Default Values/User Edited | Construction Cost | Annual Average Maintenance Cost | 25-year Maintenance Cost | Total life-cycle cost (excludes rehab) | User Comments |
|---|---|---|---|---|---|---|---|---|
| | all | all | all | | | | | |
| **Total** | | | | **$0.00** | **$0.00** | **$0.00** | **$0.00** | |

Appendix H

# Storm Chambers Details

# ACO STROMBRIXX SUBMITTAL PACKAGE




**SURVEYOR INFORMATION**

SURVEYOR INFORMATION TAKEN FROM YOUNG & YOUNG SURVEYING INC.
2 HOLLAND DRIVE, UNIT 5,
BOLTON ON. L7E 1E1

Email: info@youngsurveying.ca

**LEGAL DESCRIPTION**

PART OF LOT 7, CONCESSION 4
(FORMERLY IN THE TOWNSHIP OF SOUTH ORILLIA )
CITY OF ORILLIA
COUNTY OF SIMCOE

**WARNING:** VEHICLE TRAFFIC DURING CONSTRUCTION STAGE SHALL NOT BE ALOWED ON TOP OF THE TANK

**WARNING:** GROUNDWATER MAY CAUSE TANK FLOTATION. THIS RISK EXISTS EVEN WITH STRUCTURALLY SOUND TANKS, AS GEOTECHNICAL DATA MAY NOT REFLECT MAXIMUM WATER LEVELS.

| PROJECT NAME | | |
|---|---|---|
| 233 Coldwater Ave, orillia-ON-SB | | |
| SYSTEM(S) - SD & HD | | |
| DATE - 08-05-2026 | CHECKED BY - ---- | |
| SHEET NO. 0 | DESIGN SERV. NO. 926-381 | REV. E |

STORMBRIXX LAYOUT

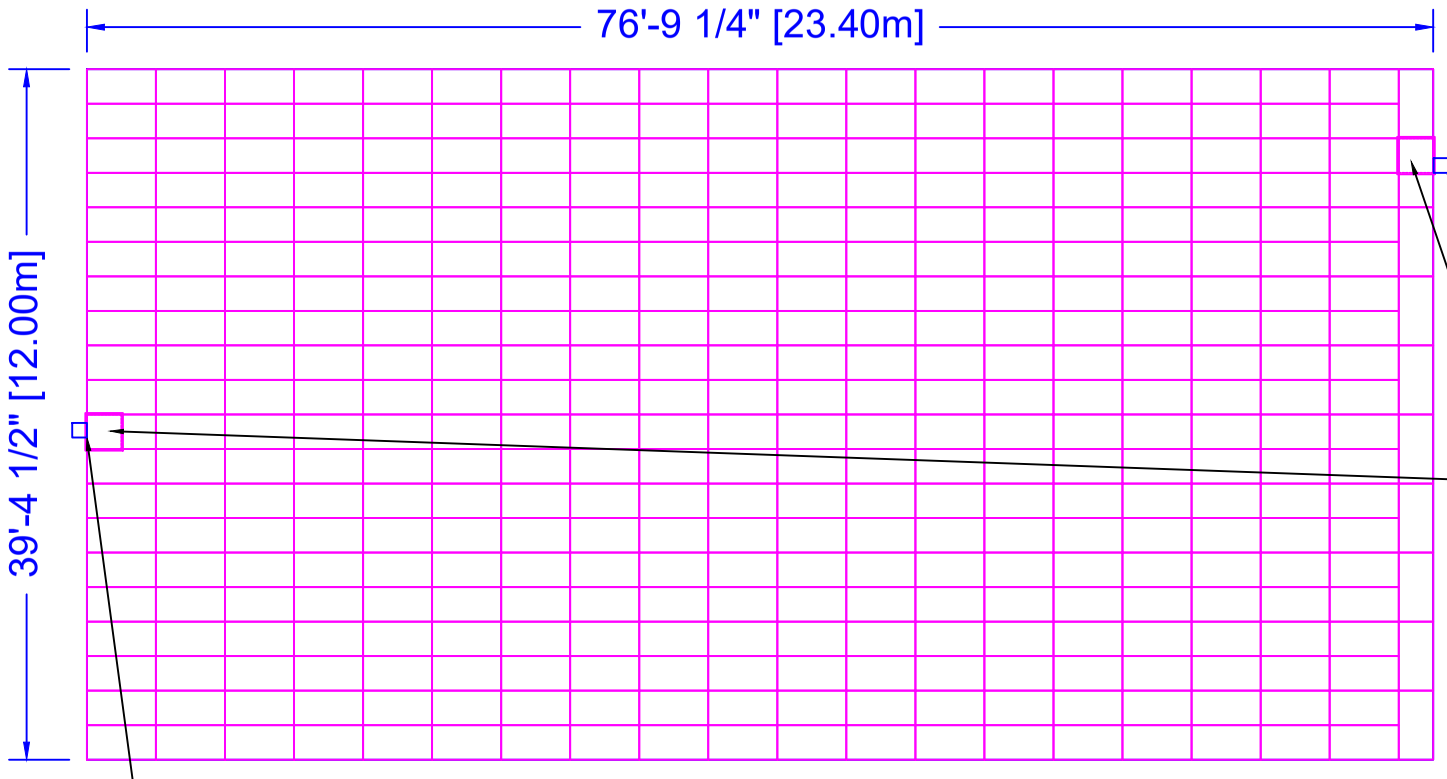
| NO. | REVISIONS DESCRIPTION | DATE | BY |
|---|---|---|---|
| A | TANK 2 UPDATED | 14-05-2026 | MD |
| B | TANK 2 UPDATED | 19-05-2026 | MD |
| C | TANK SECTION WITH ELEVATIONS ADDED | 21-05-2026 | MD |
| D | CROSS SECTION UPDATED | 25-05-2026 | MD |
| E | TANK SHAPE CHANGED | 27-05-2026 | MD |

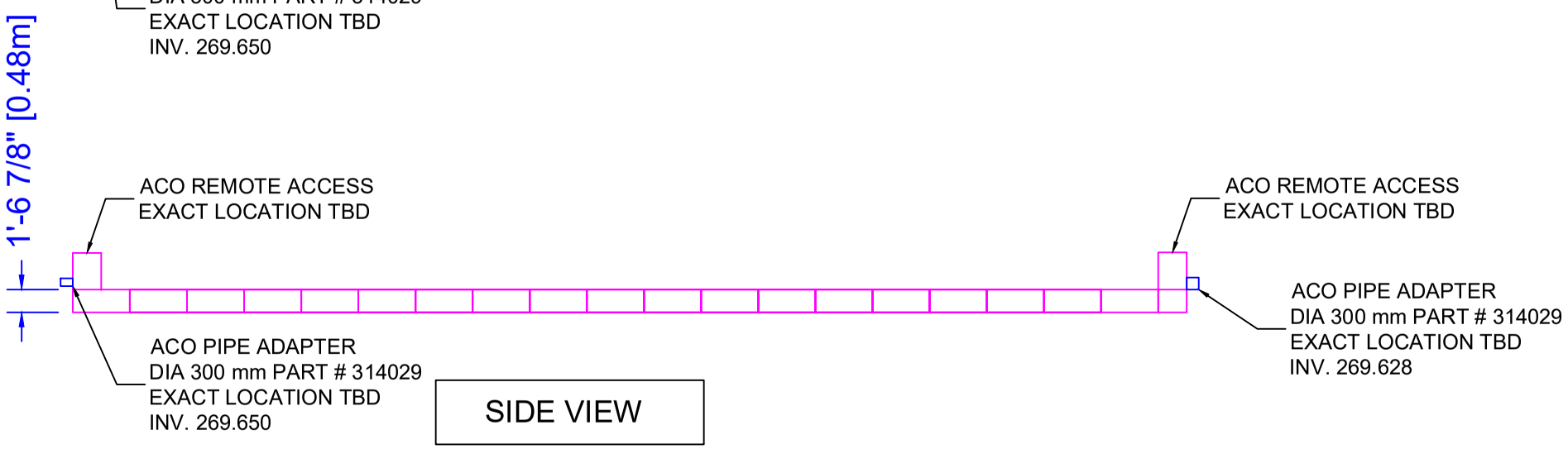

ACO SYSTEMS LTD.
2910 BRIGHTON RD
OAKVILLE, ON
L6H 5S3
TEL: (905)-829-0665
FAX: (905)-829-2908
EMAIL: info@acocan.ca
WEB: www.acocan.ca


CANADA

| DRAWN BY - MD | EMAIL - MOHAMMED.SADRIWALA@ACO.COM |
|---|---|

TOP VIEW




SIDE VIEW

## Tank 1 Configuration - SD

| | |
|---|---|
| Tank Function | Infiltration |
| Product | ACO Stormbrixx [1][2] SD |
| Number of Layer(s) | 0.5 |
| Tank Height (m) | 0.48 |
| Tank Footprint ($m^2$) | 280.80 |
| Tank Gross Volume ($m^3$) | 134.22 |
| Tank Net Volume ($m^3$) | 129.52 |
| Estimated Backfill Volume ($m^3$) | 101.10 |
| Backfill Type | Dense ϕ 38° |
| Traffic Load Expected | Serv. Veh. |
| **Elevations** | |
| Top of backfill | 269.778 |
| Top of tank | 269.628 |
| Tank Invert | 269.150 |
| Bottom of base layer | 269.000 |
| Finished Ground Highest Elevation | 271.650 |
| Finished Ground Lowest Elevation | 271.150 |
| Maximum Ground Water Elevation | 268.110 |

NOTES :

[1] Design Life of ACO Stormbrixx SD is 50 years.

[2] ACO Stormbrixx SD can meet AASHTO H-20 and HS-20 loading conditions.

**WARNING:** VEHICLE TRAFFIC DURING CONSTRUCTION STAGE SHALL NOT BE ALOWED ON TOP OF THE TANK

**WARNING:** GROUNDWATER MAY CAUSE TANK FLOTATION. THIS RISK EXISTS EVEN WITH STRUCTURALLY SOUND TANKS, AS GEOTECHNICAL DATA MAY NOT REFLECT MAXIMUM WATER LEVELS.

| PROJECT NAME | | |
|---|---|---|
| 233 Coldwater Ave, orillia-ON-SB | | |
| SYSTEM(S) - SD & HD | | |
| DATE - 08-05-2026 | CHECKED BY - ---- | |
| SHEET NO. 1 | DESIGN SERV. NO. 926-381 | REV. E |

STORMBRIXX LAYOUT

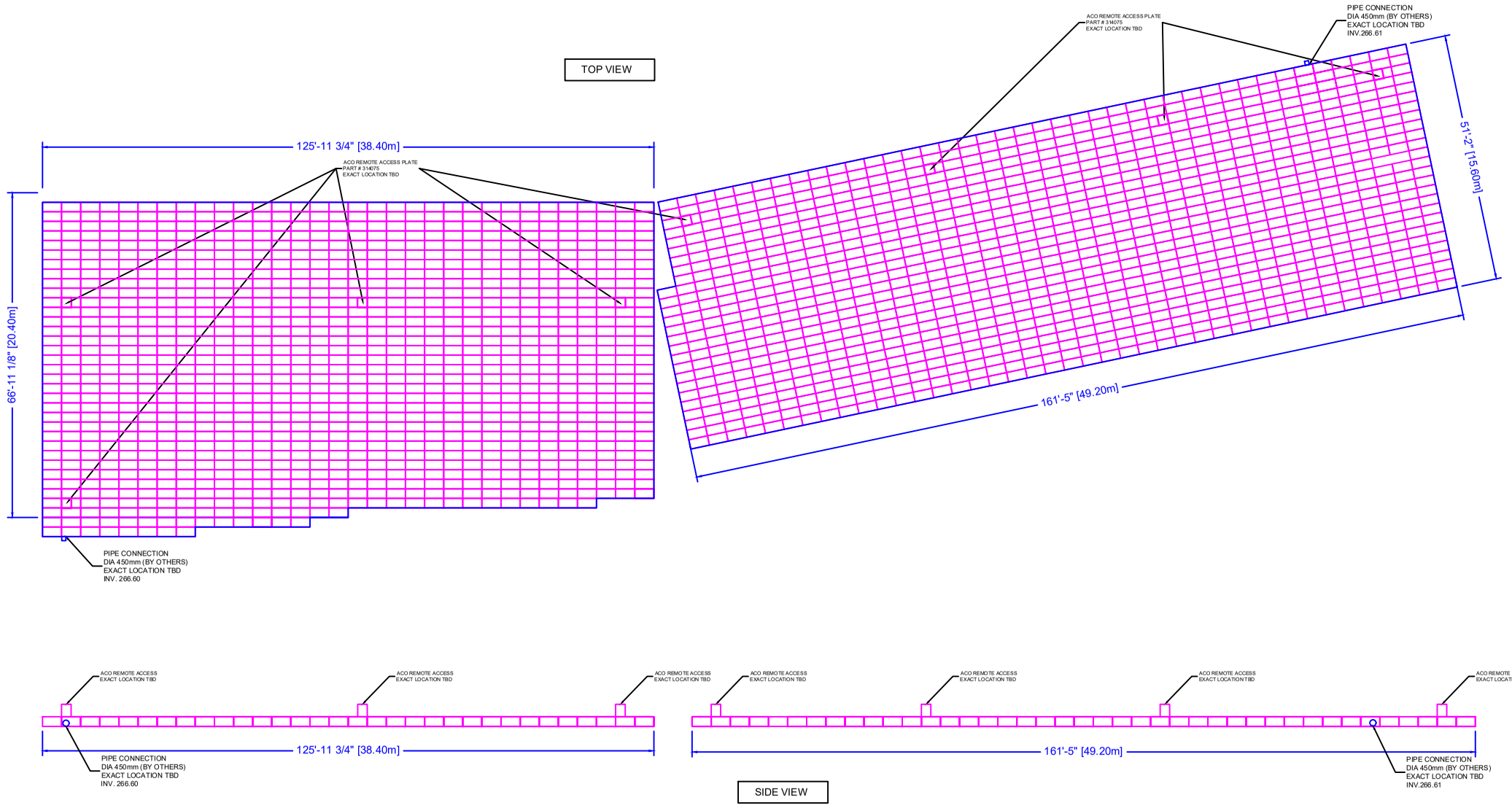
| NO. | REVISIONS DESCRIPTION | DATE | BY |
|---|---|---|---|
| A | TANK 2 UPDATED | 14-05-2026 | MD |
| B | TANK 2 UPDATED | 19-05-2026 | MD |
| C | TANK SECTION WITH ELEVATIONS ADDED | 21-05-2026 | MD |
| D | CROSS SECTION UPDATED | 25-05-2026 | MD |
| E | TANK SHAPE CHANGED | 27-05-2026 | MD |


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WEB: www.acocan.ca


CANADA

DRAWN BY - MD

EMAIL - MOHAMMED.SADRIWALA@ACO.COM




Note - Use Impermeable Geomembrane (inner) 40mil minimum& Geotextile fabric (outer) 6oz minimum around entire perimeter of tank

| Tank 2 Configuration - HD | |
|---|---|
| Tank Function | Detention |
| Product | ACO Stormbrixx [1][2] HD |
| Number of Layer(s) | 1.0 |
| Tank Height (m) | 0.61 |
| Tank Footprint ($m^2$) | 1523.52 |
| Tank Gross Volume ($m^3$) | 929.35 |
| Tank Net Volume ($m^3$) | 892.17 |
| Estimated Backfill Volume ($m^3$) | 525.20 |
| Backfill Type | Dense ϕ 38° |
| Traffic Load Expected | Serv. Veh. |
| Elevations | |
| Top of backfill | 267.360 |
| Top of tank | 267.210 |
| Tank Invert | 266.600 |
| Bottom of base layer | 266.450 |
| Finished Ground Highest Elevation | 269.700 |
| Finished Ground Lowest Elevation | 268.150 |
| Maximum Ground Water Elevation | 267.690 |

NOTES :
[1] Design Life of ACO Stormbrixx HD is 60 years.
[2] ACO Stormbrixx HD can meet AASHTO H-25 and HS-25 loading conditions.

**WARNING:** VEHICLE TRAFFIC DURING CONSTRUCTION STAGE SHALL NOT BE ALOWED ON TOP OF THE TANK

**WARNING:** GROUNDWATER MAY CAUSE TANK FLOTATION. THIS RISK EXISTS EVEN WITH STRUCTURALLY SOUND TANKS, AS GEOTECHNICAL DATA MAY NOT REFLECT MAXIMUM WATER LEVELS.

| PROJECT NAME<br>233 Coldwater Ave, orillia-ON-SB | | |
|---|---|---|
| SYSTEM(S) - SD & HD | | |
| DATE - 08-05-2026 | CHECKED BY - ---- | |
| SHEET NO. 2 | DESIGN SERV. NO.<br>926-381 | REV.<br>E |

STORMBRIXX LAYOUT

| NO. | REVISIONS DESCRIPTION | DATE | BY |
|---|---|---|---|
| A | TANK 2 UPDATED | 14-05-2026 | MD |
| B | TANK 2 UPDATED | 19-05-2026 | MD |
| C | TANK SECTION WITH ELEVATIONS ADDED | 21-05-2026 | MD |
| D | CROSS SECTION UPDATED | 25-05-2026 | MD |
| E | TANK SHAPE CHANGED | 27-05-2026 | MD |

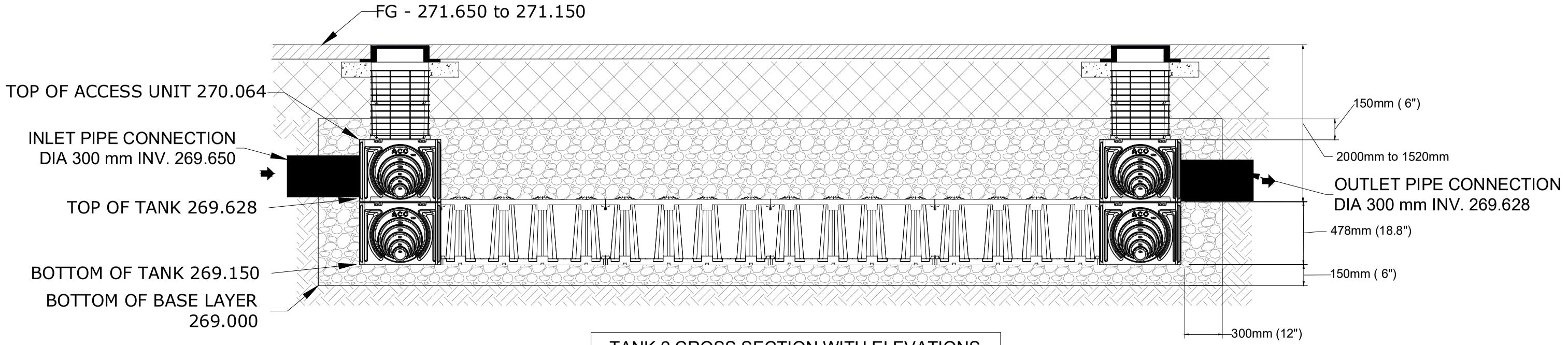
ACO SYSTEMS LTD.
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TEL: (905)-829-0665
FAX: (905)-829-2908
EMAIL: info@acocan.ca
WEB: www.acocan.ca

CANADA

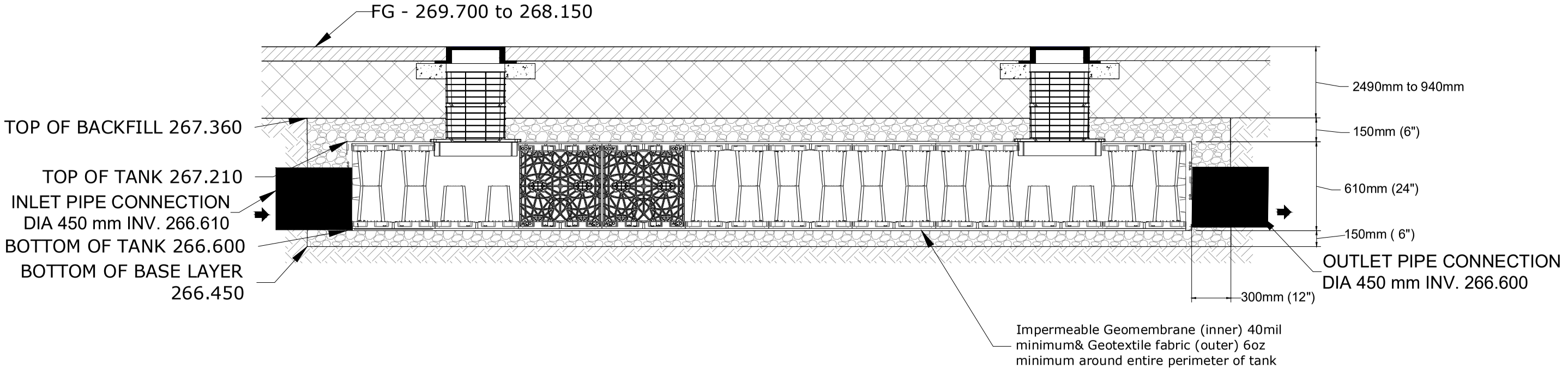
| DRAWN BY - MD | EMAIL - MOHAMMED.SADRIWALA@ACO.COM |
|---|---|

NOTE - CROSS SECTIONS NOT TO SCALE

## TANK 1 CROSS SECTION WITH ELEVATIONS




## TANK 2 CROSS SECTION WITH ELEVATIONS




**WARNING:** VEHICLE TRAFFIC DURING CONSTRUCTION STAGE SHALL NOT BE ALOWED ON TOP OF THE TANK

**WARNING:** GROUNDWATER MAY CAUSE TANK FLOTATION. THIS RISK EXISTS EVEN WITH STRUCTURALLY SOUND TANKS, AS GEOTECHNICAL DATA MAY NOT REFLECT MAXIMUM WATER LEVELS.

| PROJECT NAME<br>233 Coldwater Ave, orillia-ON-SB | | |
|---|---|---|
| SYSTEM(S) - SD & HD | | |
| DATE - 08-05-2026 | CHECKED BY - ---- | |
| SHEET NO. 3 | DESIGN SERV. NO.<br>926-381 | REV.<br>E |

STORMBRIXX LAYOUT

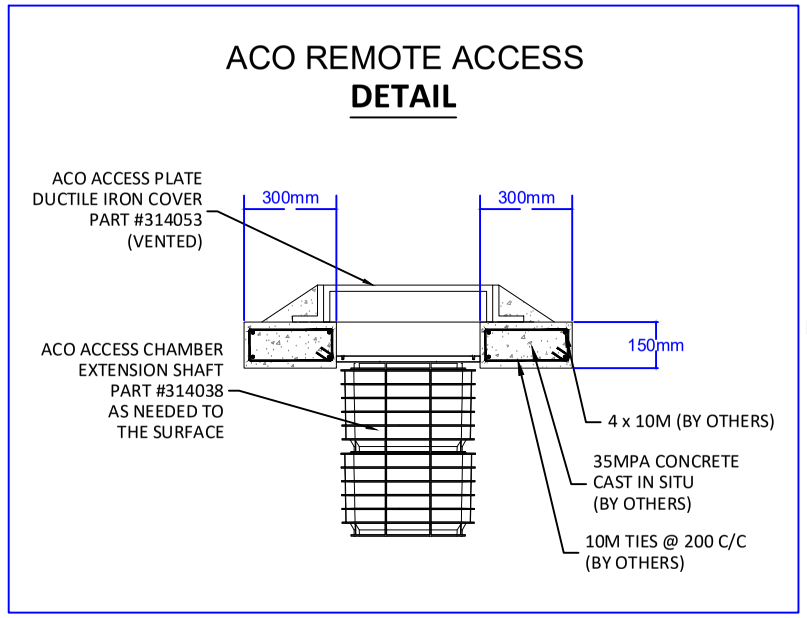
| NO. | REVISIONS DESCRIPTION | DATE | BY |
|---|---|---|---|
| A | TANK 2 UPDATED | 14-05-2026 | MD |
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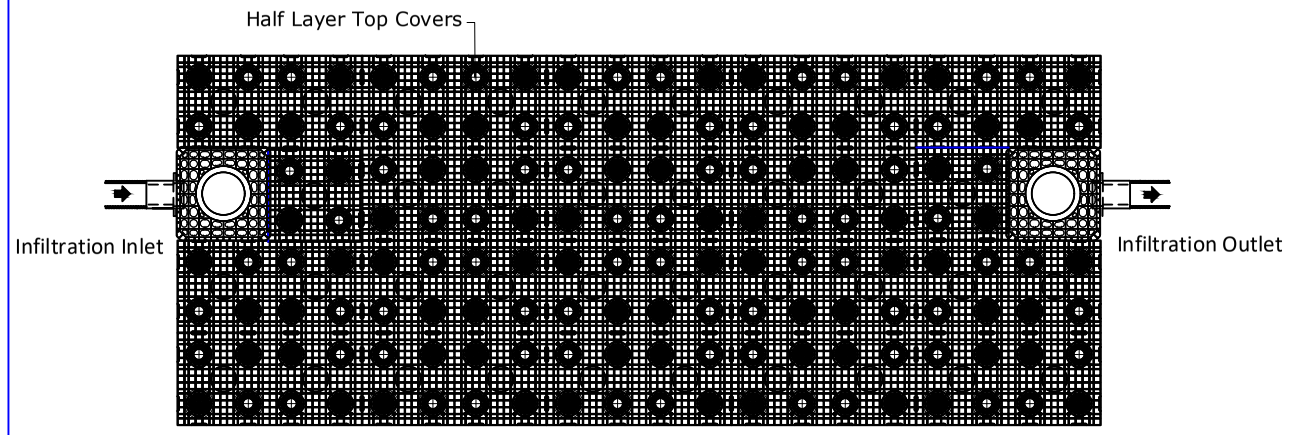

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CANADA

| DRAWN BY - MD | EMAIL - MOHAMMED.SADRIWALA@ACO.COM |
|---|---|

# HALF LAYER STORMBRIXX SD
# INFILTRATION
# TYPICAL SECTION PROFILE




**PLAN**

| Installation depths of ACO StormBrixx SD | |
|---|---|
| Installation Location | Minimum cover depth[4] ft (m) |
| Non-trafficked areas i.e. landscaping [2] | 1.65 (0.5) |
| Parking lots, vehicles up to 5,512lbs gross mass [1] | 1.8 (0.55) |
| Parking lots, occasional vehicles greater than 5,512lbs gross mass [3] | 2.0 (0.6) |
| Occasional heavy truck traffic up to HS-20 loading | Please consult with ACO |
| Maximum cover depth of ACO StormBrixx SD | 6.5 (2) |
| Maximum depth to invert of ACO StormBrixx SD half layer system | 9.56 (2.9) |

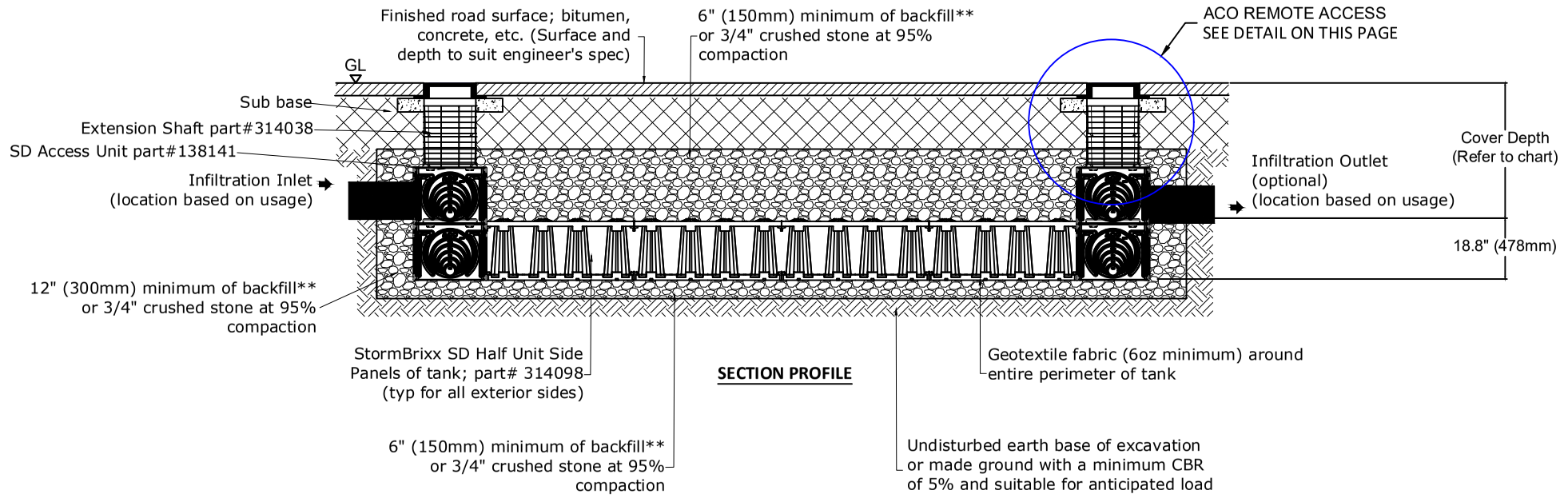
**Notes**

*(1) Assumes 27 degree load distribution through fill material and overlaying surface asphalt or block paving*

*(2) Minimum cover depth to avoid accidental damage from gardening/landscaping work*

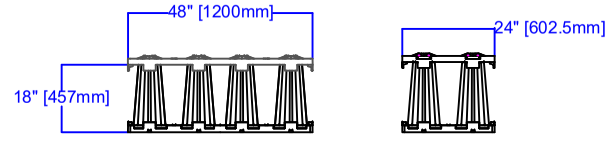
*(3) Occasional sanitation trucks or similar vehicles (typically one per week)*

*(4) Please check minimum frost cover depths and water table heights for geographical location*




**SECTION PROFILE**

**ACO StormBrixx SD Half Unit Module**
48"x24"x18" [1200x602.5x457mm (H)]
11.27cuft net volume per module
Brick or Cross Bonded (where applicable)
**Part Numbers**:
Tank Body-314090 & Top Cover-314094




*All systems must be designed and installed to meet or exceed ACO StormBrixx minimum requirements. Although ACO StormBrixx offers support during the design, review, and construction phases of the module system, it is the ultimate responsibility of the Engineer of Record to design the system in full compliance with all applicable engineering practices, laws, and regulations.

**Native soil must be free of organic material and have minimum angle friction of 28 degrees.

***The water table level is assumed to be below the invert of the tank.

**WARNING:** VEHICLE TRAFFIC DURING CONSTRUCTION STAGE SHALL NOT BE ALOWED ON TOP OF THE TANK

**WARNING:** GROUNDWATER MAY CAUSE TANK FLOTATION. THIS RISK EXISTS EVEN WITH STRUCTURALLY SOUND TANKS, AS GEOTECHNICAL DATA MAY NOT REFLECT MAXIMUM WATER LEVELS.

| PROJECT NAME 233 Coldwater Ave, orillia-ON-SB | | |
|---|---|---|
| SYSTEM(S) - SD & HD | | |
| DATE - 08-05-2026 | CHECKED BY - ---- | |
| SHEET NO. 4 | DESIGN SERV. NO. 926-381 | REV. E |

STORMBRIXX LAYOUT

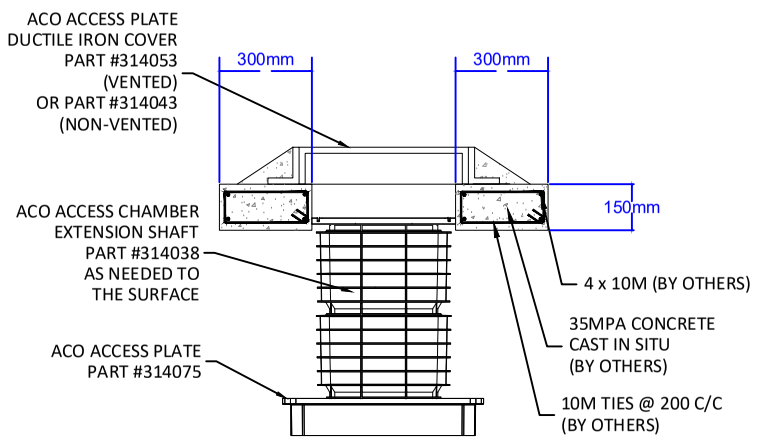
| NO. | REVISIONS DESCRIPTION | DATE | BY |
|---|---|---|---|
| A | TANK 2 UPDATED | 14-05-2026 | MD |
| B | TANK 2 UPDATED | 19-05-2026 | MD |
| C | TANK SECTION WITH ELEVATIONS ADDED | 21-05-2026 | MD |
| D | CROSS SECTION UPDATED | 25-05-2026 | MD |
| E | TANK SHAPE CHANGED | 27-05-2026 | MD |


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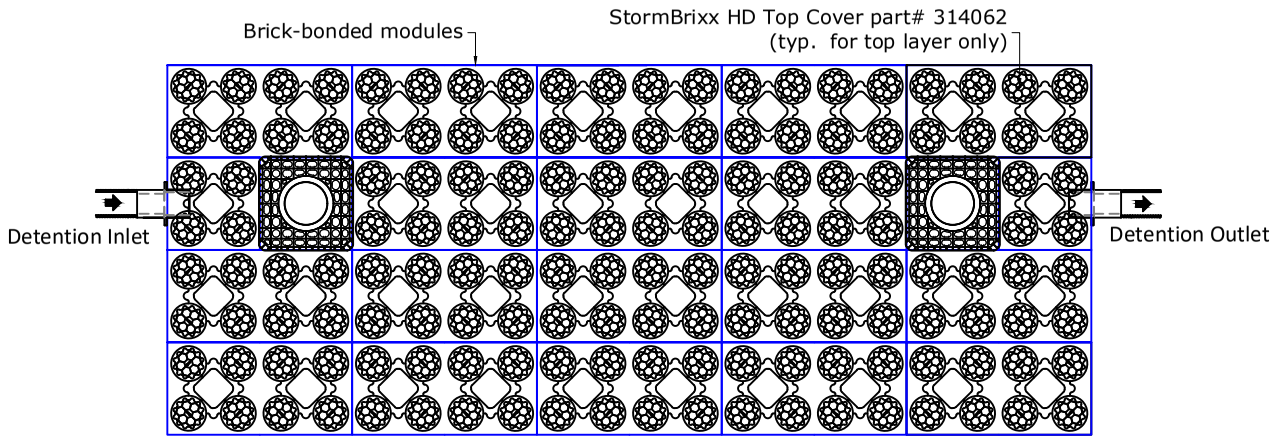

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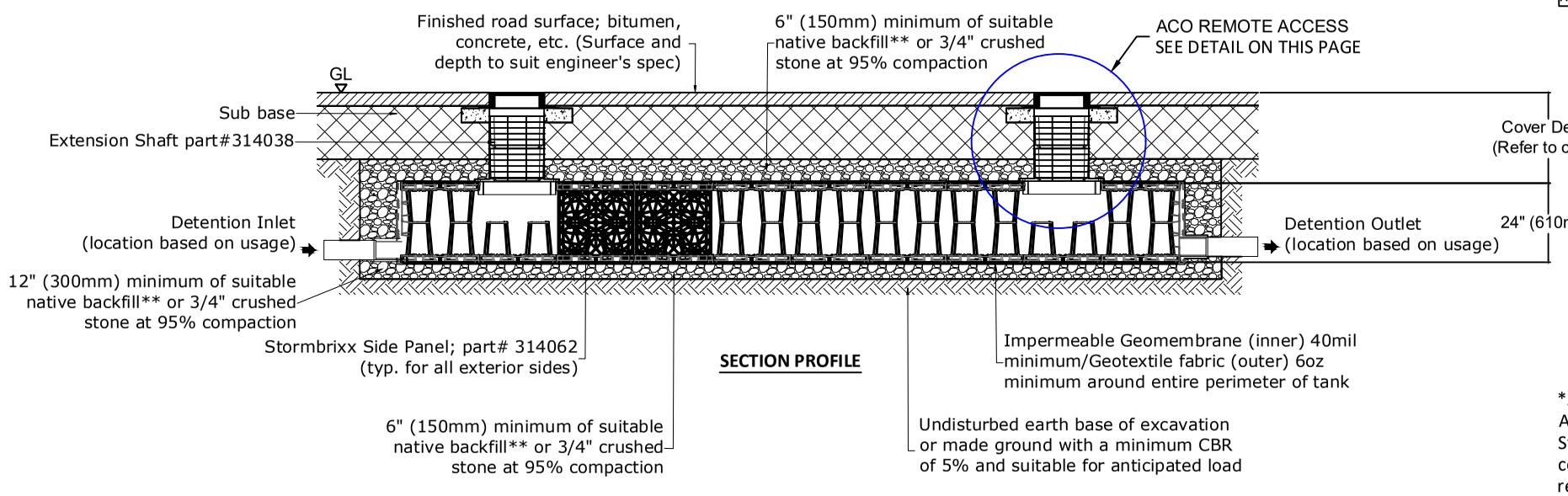
| DRAWN BY - MD | EMAIL - MOHAMMED.SADRIWALA@ACO.COM |
|---|---|

## ACO REMOTE ACCESS DETAIL




# 1 LAYER STORMBRIXX HD DETENTION TYPICAL SECTION PROFILE

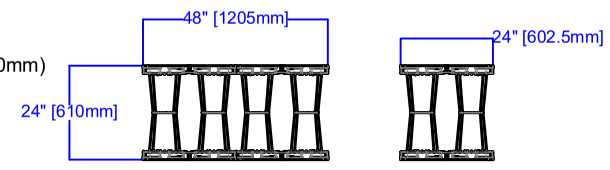



**SECTION PROFILE**

| Installation depths of ACO StormBrixx HD | |
|---|---|
| Installation Location | Minimum cover depth[4] ft (m) |
| Non-trafficked areas i.e. landscaping [2] | 1.65 (0.5) |
| Parking lots, vehicles up to 5,512lbs gross mass [1] | 1.8 (0.55) |
| Parking lots, occasional vehicles greater than 5,512lbs gross mass [3] | 2.00 (0.6) |
| Occasional heavy truck traffic up to HS-25 loading | Please consult with ACO |
| Maximum cover depth of ACO StormBrixx HD | 11.16 (3.4) |
| Maximum depth to invert of ACO StormBrixx HD one layer system | 13.16 (4) |
| **Notes** | |
| *(1) Assumes 27 degree load distribution through fill material and overlaying surface asphalt or block paving* | |
| *(2) Minimum cover depth to avoid accidental damage from gardening/landscaping work* | |
| *(3) Occasional sanitation trucks or similar vehicles (typically one per week)* | |
| *(4) Please check minimum frost cover depths and water table heights for geographical location* | |

**ACO StormBrixx HD Module**
48"x24"x36" [1205x602.5x914mm (H)]
14.85cuft [0.42m$^3$] net volume per completed module
Brick or Cross Bonded (where applicable)
part# 314061




*All systems must be designed and installed to meet or exceed ACO StormBrixx minimum requirements. Although ACO StormBrixx offers support during the design, review, and construction phases of the module system, it is the ultimate responsibility of the Engineer of Record to design the system in full compliance with all applicable engineering practices, laws, and regulations.

**Backfill soil must be free of organic material and have minimum angle friction of 38 degrees.

***The water table level is assumed to be below the invert of the tank.

**WARNING:** VEHICLE TRAFFIC DURING CONSTRUCTION STAGE SHALL NOT BE ALOWED ON TOP OF THE TANK

**WARNING:** GROUNDWATER MAY CAUSE TANK FLOTATION. THIS RISK EXISTS EVEN WITH STRUCTURALLY SOUND TANKS, AS GEOTECHNICAL DATA MAY NOT REFLECT MAXIMUM WATER LEVELS.

| PROJECT NAME 233 Coldwater Ave, orillia-ON-SB | | |
|---|---|---|
| SYSTEM(S) - SD & HD | | |
| DATE - 08-05-2026 | CHECKED BY - ---- | |
| SHEET NO. 5 | DESIGN SERV. NO. 926-381 | REV. E |

STORMBRIXX LAYOUT

| NO. | REVISIONS DESCRIPTION | DATE | BY |
|---|---|---|---|
| A | TANK 2 UPDATED | 14-05-2026 | MD |
| B | TANK 2 UPDATED | 19-05-2026 | MD |
| C | TANK SECTION WITH ELEVATIONS ADDED | 21-05-2026 | MD |
| D | CROSS SECTION UPDATED | 25-05-2026 | MD |
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|---|---|

## Brick-bonding structures

**Triple module unit**



**Quadruple module unit**



## Completing a brick-bonded structure

To finish the brick-bonded tank, one module will need to be cut in half in certain layouts. The images below detail and display the ease of creating the final piece.







## LAYER CONNECTORS

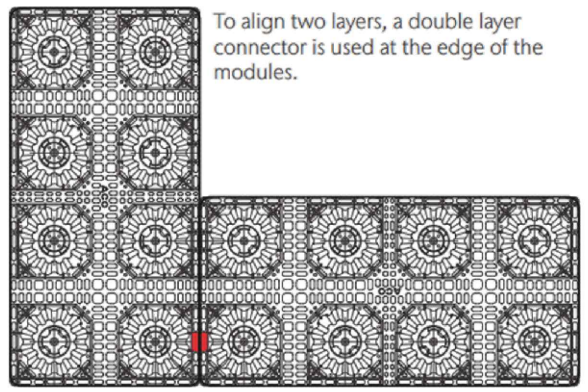
When assembling multiple layers of ACO StormBrixx SD, the layers are aligned and secured by means of two layer connectors clicked together. The exact positions of the modules and layer connectors within the overall infiltration system are shown in the installation diagram.

The layer connectors must each be mounted in the top of the module and positioned into the molded socket next to the column on the edge of the module.

### Multiple layers

Connectors are used if two or more layers of ACO StormBrixx SD are installed: **Two individual layer connectors** are pushed together to form one and are inserted between the individual layers as positional fixing. This helps achieve precise alignment of the columns within several layers.





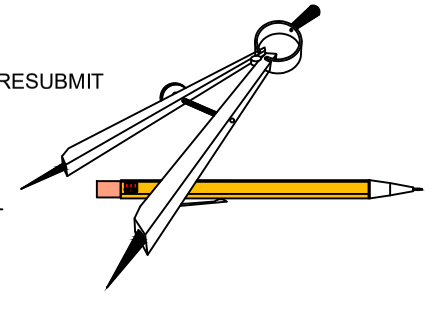
To align two layers, a double layer connector is used at the edge of the modules.

## GENERAL NOTES

1. IT IS THE CUSTOMER'S RESPONSIBILITY TO ENSURE THAT EACH PRODUCT IS FIT FOR ITS INTENDED PURPOSE AND THAT THE ACTUAL CONDITIONS ARE SUITABLE.
2. IT IS THE CUSTOMER'S RESPONSIBILITY TO FOLLOW ACO SYSTEMS LTD. INSTALLATION INSTRUCTIONS FOR EACH PRODUCT. SEEK ENGINEERING ADVICE FOR INSTALLATIONS NOT ILLUSTRATED IN THE INSTALLATION GUIDELINES.
3. FOR FURTHER PRODUCT INFORMATION, CUT SHEETS, SPECIFICATIONS AND INSTALLATION INSTRUCTIONS, PLEASE VISIT US AT OUR WEBSITE: WWW.ACOCAN.CA.
4. IS HIGHLY RECOMMENDED TO USE A GRIT INTERCEPTOR BEFORE THE WATER ENTERS THE TANK, TO AVOID DEBRIS ACCUMULATION IN THE UNIT AND ENSURE ITS DURABLE PERFORMANCE.

ALL DRAWINGS ARE AS ACCURATE AS THE INFORMATION SUPPLIED. ALL REASONABLE CARE HAS BEEN TAKEN IN COMPILING THE INFORMATION WITHIN. PLEASE REVIEW THIS INFORMATION FOR ACCURACY.

☐ APPROVED ☐ REVISE AND RESUBMIT
☐ APPROVED AS NOTED ☐ REJECTED



SIGNED: _____

DATE: _____

COMMENTS:

**WARNING:** VEHICLE TRAFFIC DURING CONSTRUCTION STAGE SHALL NOT BE ALOWED ON TOP OF THE TANK

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| PROJECT NAME<br>233 Coldwater Ave, orillia-ON-SB | | |
|---|---|---|
| SYSTEM(S) - SD & HD | | |
| DATE - 08-05-2026 | CHECKED BY - ---- | |
| SHEET NO. 6 | DESIGN SERV. NO.<br>926-381 | REV.<br>E |

STORMBRIXX LAYOUT

| NO. | REVISIONS DESCRIPTION | DATE | BY |
|---|---|---|---|
| A | TANK 2 UPDATED | 14-05-2026 | MD |
| B | TANK 2 UPDATED | 19-05-2026 | MD |
| C | TANK SECTION WITH ELEVATIONS ADDED | 21-05-2026 | MD |
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|---|---|

# ACO CAN Stage Storage Table Calculator

**Project Name**

926-381-233 Coldwater Ave, orillia-ON-SB

TANK 1

| | |
|---|---|
| **Tank Type:** | **SD** |
| Tank Void Ratio: | 97% |
| Single Layer Tank Height (m): | 0.914 |
| Number of Layers: | 0.5 |
| Stage Height Increment (cm): | 5 |
| **Tank Dimensions (m)** | |
| Length: | 23.4 |
| Width: | 12 |
| Tank Depth: | 0.478 |
| Tank Footprint ($m^2$): | 280.80 |

| | Depth (m) | Elevations (m) | Net ($m^3$) | Ac. ($m^3$) |
|---|---|---|---|---|
| **Top of SD Tank ↑** | **0.48** | **269.628** | **7.59** | **129.52** |
| | 0.45 | 269.600 | 13.55 | 121.94 |
| | 0.40 | 269.550 | 13.55 | 108.39 |
| | 0.35 | 269.500 | 13.55 | 94.84 |
| | 0.30 | 269.450 | 13.55 | 81.29 |
| | 0.25 | 269.400 | 13.55 | 67.74 |
| | 0.20 | 269.350 | 13.55 | 54.19 |
| | 0.15 | 269.300 | 13.55 | 40.65 |
| | 0.10 | 269.250 | 13.55 | 27.10 |
| | 0.05 | 269.200 | 13.55 | 13.55 |
| **Bottom of SD tank ↓** | **0** | **269.150** | **0** | **0** |

# ACO CAN Stage Storage Table Calculator

**Project Name**

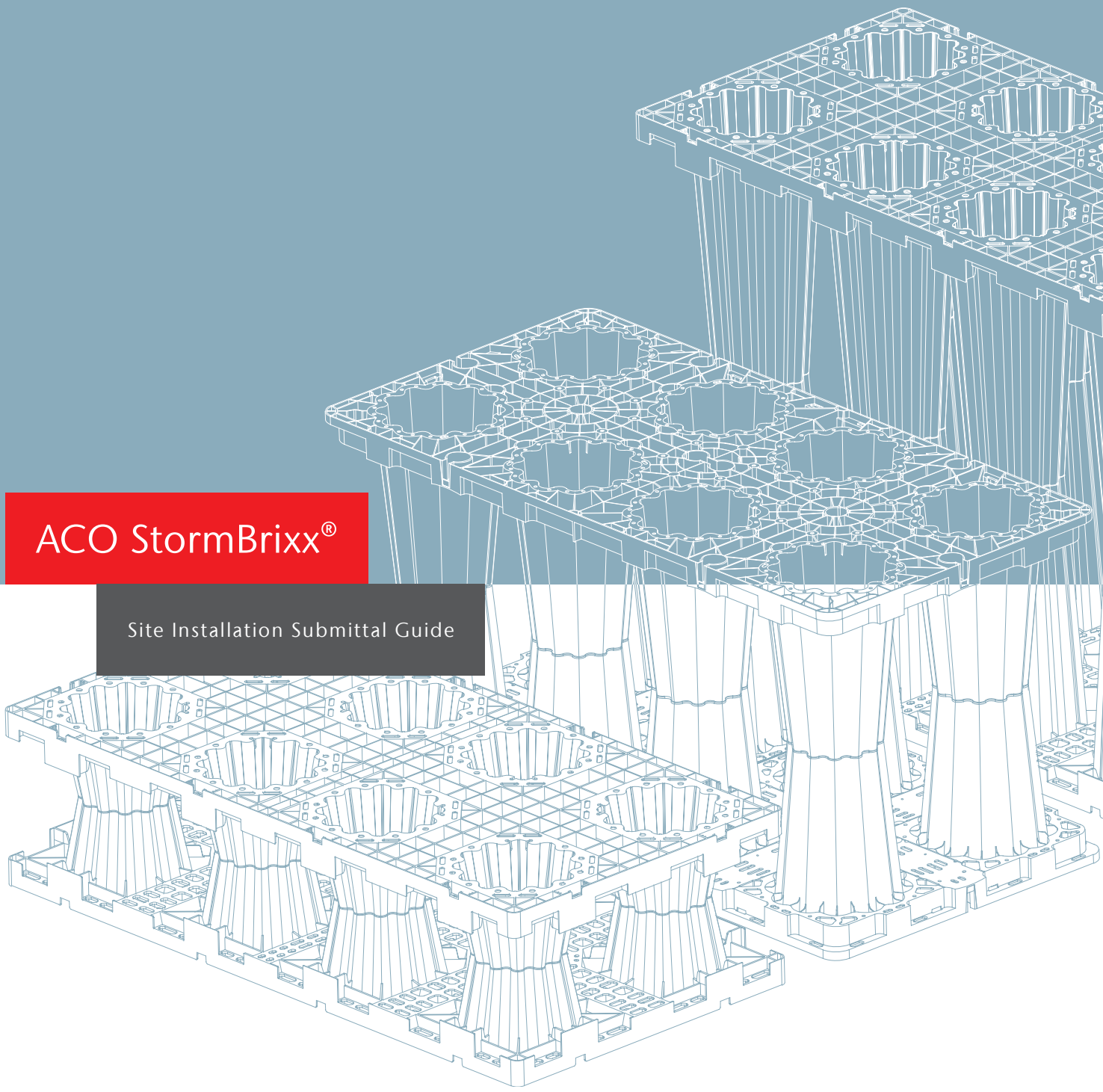
926-381-233 Coldwater Ave, orillia-ON-SB TANK 2

| | |
|---|---|
| **Tank Type:** | **HD** |
| Tank Void Ratio: | 96% |
| Single Layer Tank Height (m): | 0.61 |
| Number of Layers: | 1 |
| Stage Height Increment (cm): | 5 |
| **Tank Dimensions (m)** | |
| Length: | IRREGULAR |
| Width: | IRREGULAR |
| Tank Depth: | 0.61 |
| Tank Footprint ($m^2$): | 1523.52 |

| Return period | Depth (m) | Elevations (m) | Net ($m^3$) | Ac. ($m^3$) | |
|---|---|---|---|---|---|
| **100-years** | **0.61** | **267.21** | **14.63** | **892.17** | **Top of HD Tank ↑** |
| | 0.60 | 267.20 | 73.13 | 877.55 | |
| | 0.55 | 267.15 | 29.25 | 804.42 | |
| 50-years | 0.53 | 267.13 | 43.88 | 775.17 | |
| | 0.50 | 267.10 | 73.13 | 731.29 | |
| | 0.45 | 267.05 | 14.63 | 658.16 | |
| 25-years | 0.44 | 267.04 | 58.50 | 643.54 | |
| | 0.40 | 267.00 | 73.13 | 585.03 | |
| | 0.35 | 266.95 | 14.63 | 511.90 | |
| 10-years | 0.34 | 266.94 | 58.50 | 497.28 | |
| | 0.30 | 266.90 | 14.63 | 438.77 | |
| 5-years | 0.29 | 266.89 | 58.50 | 424.15 | |
| | 0.25 | 266.85 | 43.88 | 365.64 | |
| 2-years | 0.22 | 266.82 | 29.25 | 321.77 | |
| | 0.20 | 266.80 | 73.13 | 292.52 | |
| | 0.15 | 266.75 | 73.13 | 219.39 | |
| | 0.10 | 266.70 | 73.13 | 146.26 | |
| | 0.05 | 266.65 | 73.13 | 73.13 | |
| | **0** | **266.60** | **0** | **0** | **Bottom of HD tank ↓** |

# ACO StormBrixx®

## Site Installation Submittal Guide



StormBrixx® 300

StormBrixx® 600

StormBrixx® 900

# Outline


## Fill Material Considerations

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## Site Traffic Considerations

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Remote Access and Inspection Point Covers 14


ACO. we care for water

## Introduction

ACO StormBrixx Modules are easily assembled with each Half-module interlocking using our patented brick-bonding method to create the stormwater management tank. Side panels, top covers, and top plates are then used to enclose the tank. Accessories such as the Inspection Point, Remote Access Plate, and the remote access unit provide inspection and maintenance points.

Open design allows for easy access to clean. When properly designed, installed, and maintained, StormBrixx systems are engineered to achieve a 50+ year design life.

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## Getting Started

Tools Needed:

- Sand Bags or other stabilizing tools
- String Line
- Marking Paint
- Laser or transit
- Measuring Tools
- Razor knife (for cutting geosynthetics)
- Screw driver/nut driver set (for pipe boots)
- Reciprocating saw (to cut in pipe connections and Inspection Points)

Materials Needed:

- StormBrixx Modules and Accessories (See Bill of Materials)
- 6 oz/square yard Non-Woven Geotextile Fabric or otherwise specified
- 30 mil Impermeable Geomembrane or otherwise specified (if required by plans)
- Stainless Steel Bands (for pipe boots)
- Bedding & backfill material as required (see installation drawings)

Equipment Needed:

- Forklift and other equipment/tools to unload truck
- Pallet jack (to unload material from a box truck)
- Backfill placement and compaction equipment - see site traffic considerations

# Fill Material Considerations

## Fill Table

| Material Location | Description | Material Classification | Compaction/Density Requirement[4] |
|---|---|---|---|
| Final Fill[1,2]<br>Fill starting from top of the embedment fill layer | Suitable fill materials as noted in Project Geotechnical Report and Site Design Engineer Plans | See Project Geotechnical Report and Site Design Engineer Plans | Plate compact or static roll loose lifts to densify fill. Loose-lift thickness should be selected based on compaction equipment used. Use at least two full passes of eqipment to level layer. Continue until 24" of total fill thickness has been placed above the tank. For AASHTO M145 soils, a minimum of 95% of Standard Proctor Maximum Dry Density is recommended.<br><br>After 24" of fill is placed, place fill in accordance with the engineer of record's relative compaction requiremnt or the 95% of Standard Proctor Maximum Dry Density is recommended. |
| Embedment Fill[3]<br>Fill immediately surrounding sides and top of tank | Sand/gravel mixtures or open-graded crushed aggregate blends | AASHTO M145<br>A-1, A-2-4, A3<br><br>OR<br><br>AASHTO M43<br>3, 357, 4, 467, 5, 56, 57 | Plate compact or static roll loose lifts to densify fill. Loose-lift thickness should be selected based on the compaction equipment used. Use at least two full passes of eqipment to level layer. For AASHTO M145 soils, a minimum of 95% of Standard Proctor Maximum Dry Density is recommended. |
| Bedding Fill[3]<br>Fill immediately below tank | | | |

*Notes:*

1. *This layer can include pavement subbase*
2. *If open-graded aggregates are used for embedment fill, fines migration from the final to embedment fill layer may be reduced by installing a layer of 6 oz non-woven geotextile fabric at the final and embedment fill interface.*
3. *Import or native soils may be used if the soils meet the material classification listed. Fill material should be selected based on classification, groundwater conditions, and tank invert elevation.*
4. *See Construction Equipment Table (page 14) for more information for construction equipment limitations.*

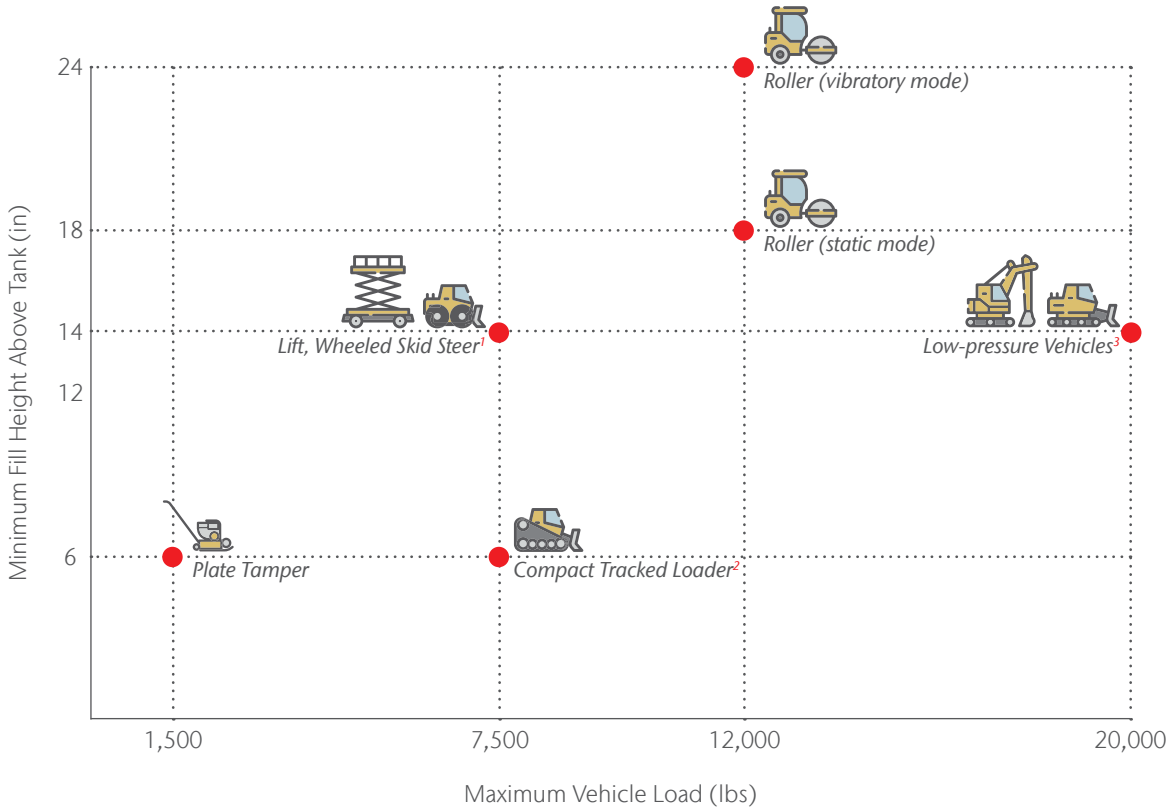
# Site Traffic Considerations

## Construction Loads

Construction loads are often the heaviest loads the system will experience. Care must be taken during backfilling and compaction, and post-installation construction traffic should be routed around the system if possible. If equipment must traffic the tank footprint, use the chart below to guide equipment selection to reduce risk of system damage.

ACO recommends dumptrucks, pans, and concrete trucks do not traverse system during construction. Contact ACO Technical Services for further guidance regarding these vehicles.

All vehicles should ONLY make straight runs across tank footprint.




*Notes:*

1. *Maximum axle load = 5,250 lbs for lift or wheeled skid steer*
2. *Maximum ground pressure = 5 psi for compact tracked loader*
3. *Maximum ground pressure = 7 psi for low-pressure tracked vehicles*

## Proofrolls During Construction

Proofrolling is an important process to approve subgrade conditions prior to pavement or slab construction. To protect the StormBrixx system, we recommend the following proofroll parameters:

| | |
|---|---|
| Fill Thickness ≤ 32" Above Tank at Time of Proofroll | Evaluate subgrade using hand tools such as t-handled probes or dynamic cone penetrometers taking care to not puncture geosynthetics. |
| Fill Thickness > 32" Above Tank at Time of Proofroll | Evaluate subgrade using a truck with a maximum axle weight of 32,000 lbs. |

# Site Preparation

## Excavation and Subgrade Preparation

### Excavation

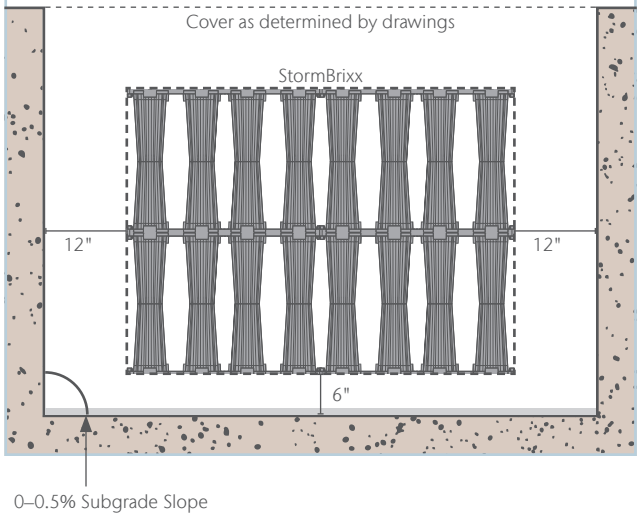
- Layout and excavate per approved plans. The excavation should follow all relevant local, state, federal and OSHA guidelines.
- Bottom of excavation elevation must be a minimum of 6" below designed StormBrixx invert.
- The excavation should extend a minimum of 12" laterally from the edge of the StormBrixx tank or large enough to accommodate selected compaction equipment, whichever is greater.

### Subgrade Preparation

- Subgrade conditions below the StormBrixx shall be evaluated as indicated in the project Geotechnical Report.
- Subgrade evaluation and preparation shall follow the recommendations in the Geotechnical Report and Civil Engineering Plan Set.
- Support conditions should be verified in the field by a qualified Geotechnical testing firm.

*NOTE: Subgrade preparation requirements will vary based on site conditions. Consult project Geotechnical Report and ACO for assistance.*

Excavation and Subgrade Preparation Section View



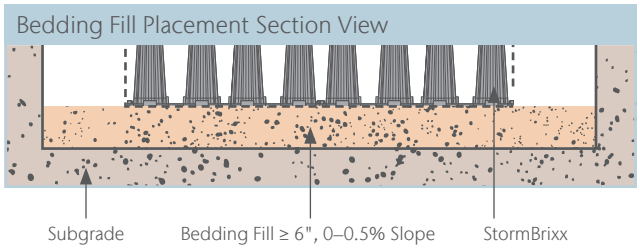



## Bedding Fill Placement

- Bedding fill shall meet material and compaction requirements in the Fill Chart (see "StormBrixx Backfill" section). ACO recommends a minimum bedding layer thickness of 6".

*NOTE: It is critical for system construction that the bedding fill surface be uniform and level (maximum of 0.5% slope). If bedding fill is loosened or disturbed during installation, the contractor should recompact and level the bedding fill.*

Bedding Fill Placement Section View



# Site Preparation (cont.)

## Geosynthetics Installation (Geotextiles and Geomembranes)

1. Install specified geomembrane and/or geotextile in panels of proper length, and place over subgrade on the bottom of the excavation. The geosynthetics should extend beyond the edge of the excavation such that adequate overlap can be provided when tank is wrapped. Adjacent panels of material should be overlapped by a minimum of 12" or as specified by geosynthetic manufacturer.

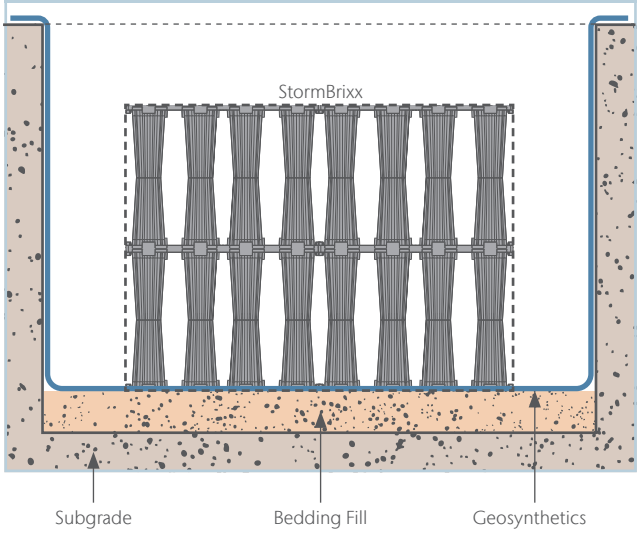
2. Use pins, staples, sandbags to hold geotextile in place, preventing it from blowing or sliding out of position.

3. Patch holes made in the geosynthetic by placing small patch of fabric over damaged area. The patch should be sized to provide adequate lap based on guidance from geosynthetic manufacturer.

4. If additional geosynthetics are required, install as shown on project plans.

*NOTE: ACO does not provide geosynthetics with StormBrixx systems. These materials should be purchased separately. Please consult with geosynthetics manufacturer for product selection and installation.*

Geosynthetics Installation Section View








# Tank Assembly

## 1 Determine Starting Location

ACO recommends using an inlet pipe, outlet pipe or control structure as a guide. Using a string line, establish two adjacent edges of the ACO StormBrixx footprint and ensure the corner is square. Mark these two edges with marking paint and remove string line.

*NOTE: Care should be taken to repair geosynthetics fabric that is punctured or torn during the layout process.*

## 2 Third-Party Concrete Control Structures

*(Skip this step if Third-Party Concrete Control Structures Units are not used.)*

Rectangular concrete control or similar structures may be placed within the tank footprint along the perimeter to allow system access for larger inlet pipes.

2.1 Place control structure directly onto geosynthetic layer(s) prior to placing StormBrixx Half-modules such that the Half-modules are flush with the control structure.

Figure 1: Module Install Plan View

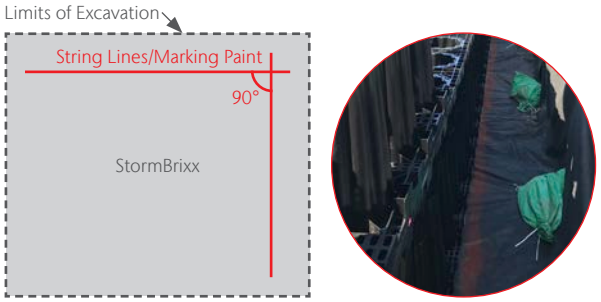
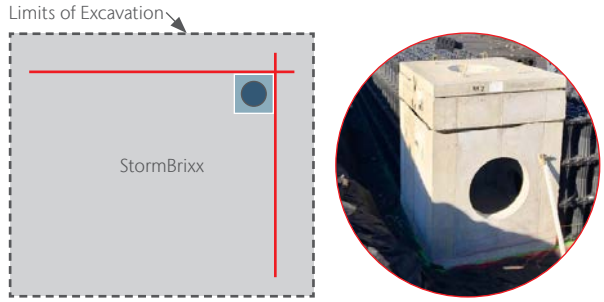



Figure 2: Module Install Plan View





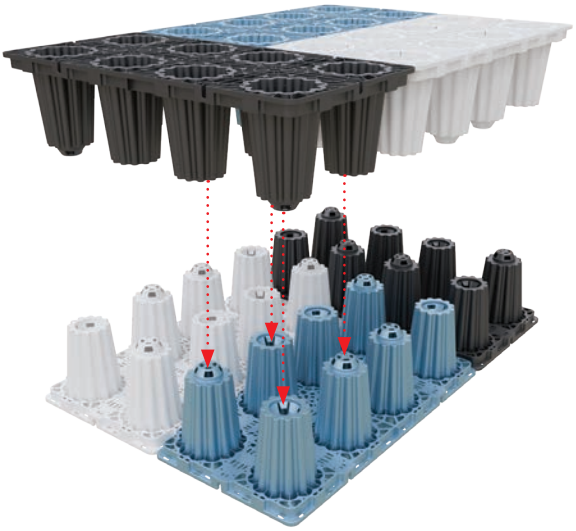


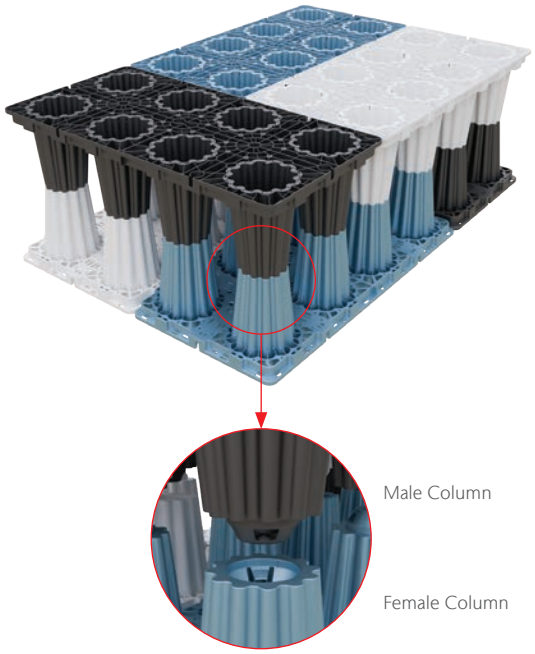

# Tank Assembly (cont.)

## 3 Placing the Modules

### Brick-bonding

ACO-provided layer orientation drawings are created with brick-bonding in mind. Brick-bonding is performed by connecting a bottom Half-module and a top Half-module perpendicular to one another by four end columns as seen below. Ensure that column connections align properly with all adjacent Half-modules to fit.



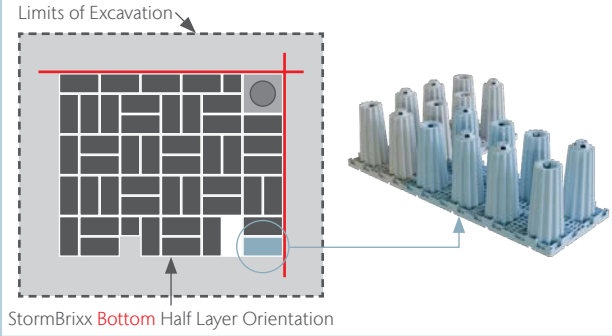



3.1 Place Half-modules in the corner of the marked area based on the ACO-provided layer orientation drawings.

*NOTE: Do NOT place units on their sides. Check plans to ensure the correct orientation of the system. StormBrixx units should fit together evenly, variations in the height of the layers (< ½") are acceptable, but reasonable efforts should be made to minimize these. If gaps or height variations persist through 3 or more adjacent units, remove Half-modules and pull back the textile to repair and flatten base.*

*Because Half-modules come palletized, they can be staged near or within the excavation to increase installation efficiency.*

Figure 3.1: Module Install Plan View






## 3 Placing the Modules (cont.)

3.2 As Half-modules are installed, take note of locations for Remote Access Unit(s) and Remote Access Plate(s), which may require Half-modules to be cut in half to create 2' by 2' voids for access. Vertical pipe penetrations for Inspection Points should be cut into each Half-module EXCEPT THE BOTTOM HALF LAYER prior to installation. Install Remote Access Plates and/or Remote Access Units as shown on the layer orientation drawings.

*NOTE: See the steps # and # for more information on Remote Access Plate and Remote Access Unit installation, respectively. See step # for Inspection Point installation.*

3.3 *(Skip to Step 6 if the tank has a 1-layer system height.)*

Continue to place Half-modules based on the layer orientation drawings to complete the first 1/2 layer. Install Remote Access Units as needed. The next 1/2 layer of Half-lodules may then be placed via brick-bonding method to achieve a 1-layer system height.

*NOTE: It is important to follow the ACO-provided layer orientation drawings to ensure brickbonding between Modules. See Figures 3.2 and 3.3 for examples of a bottom and top half layer orientation drawings.*

Figure 3.2: Module Install Plan View

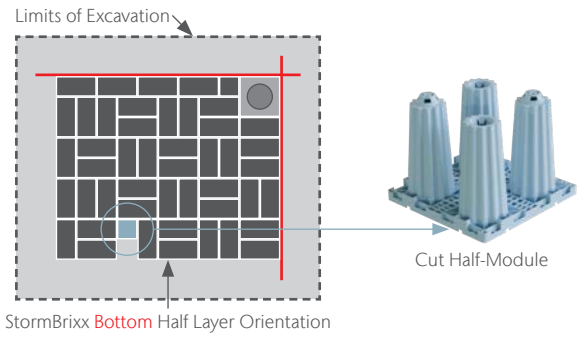
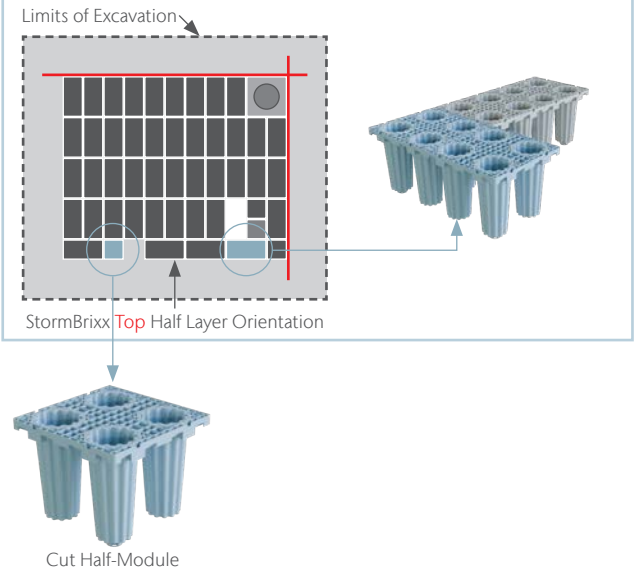
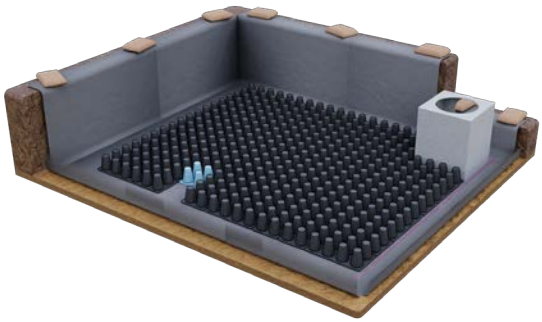
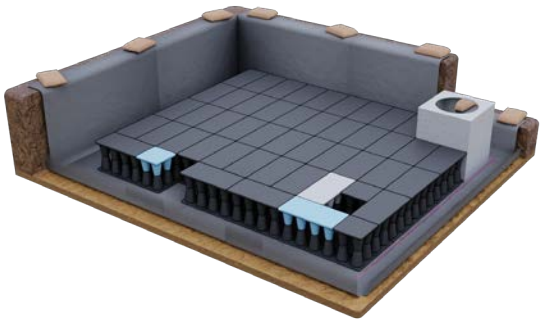



Figure 3.3: Module Install Plan View





# Tank Assembly (cont.)

## 4 Layer Connectors

*(System heights higher than 1 layer only.)*

Before starting a 2nd, 3rd, or 4th layer, install Layer Connectors to help prevent lateral movement during installation. A minimum of 2 Layer Connectors per Module around the tank perimeter and 2 Layer Connectors per Remote Access Unit are recommended. See Figures 4 and 5 for examples.

## 5 Remote Access Units

*(Skip this step if Remote Access Units are not used.)*

Remote Access Units are installed at designated locations where Half-module bodies have been cut in half (i.e. approximate 2' by 2' void)

5.1 Prior to Remote Access Unit installation, cut pipe penetrations into Unit sidewalls and/or bottom as indicated on project drawings.

*NOTE: Remote Access Units can accommodate up to 15" diameter pipe penetrations.*

5.2 Place Remote Access Units at designated locations, starting from bottom layer of tank and stacking up to the top of tank.

*NOTE: Use layer connectors at Remote Access Units (see step 4).*

Figure 4: Module Install Plan View

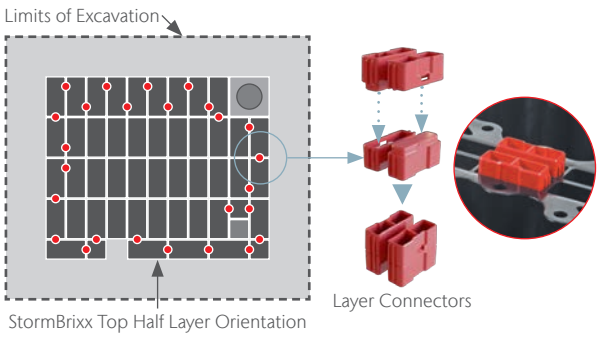
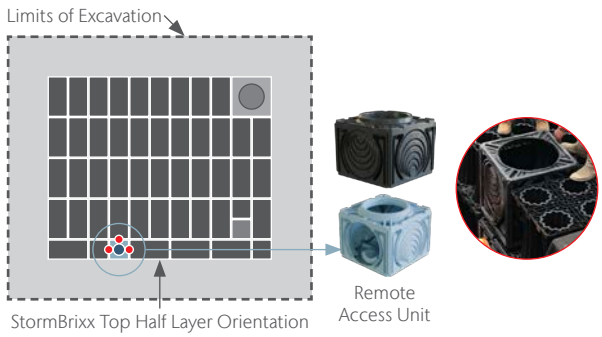
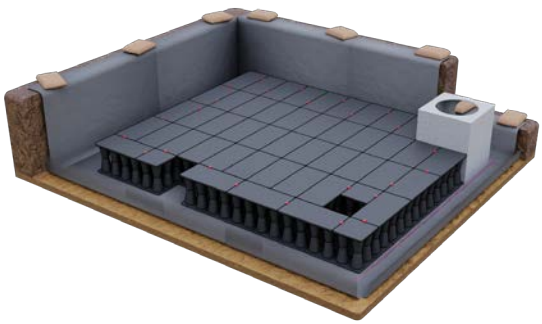
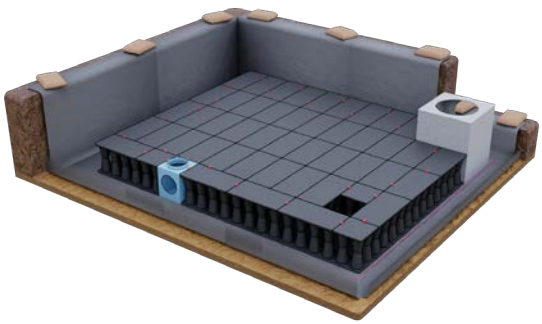



Figure 5: Module Install Plan View





# Tank Assembly (cont.)

## 6 Side Panels

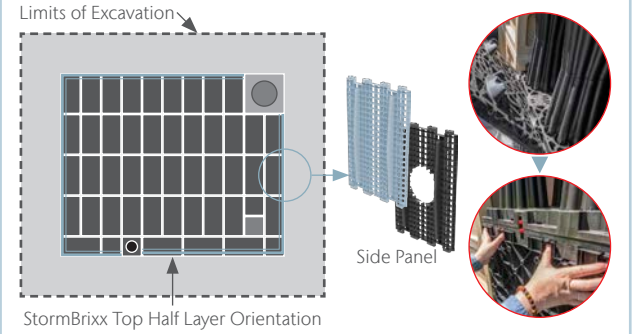
6.1 Side Panels are added to system perimeter by clicking them into place—bottom first then top—to enclose tank.

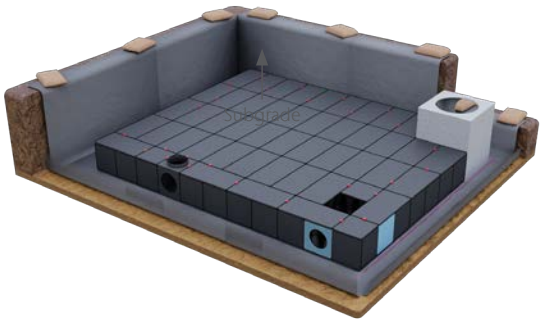
6.2 Cut pipe penetrations in side panels prior to installing Side Panel. See project drawings for pipe location and diameter.

*NOTE: StormBrixx System can accommodate larger pipe sizes through use of multiple Side Panels or concrete control structures.*

*Side Panels are NOT required between the stacked modules and adjacent concrete control structures. See your project-specific plan set or contact ACO for more information.*

Figure 6: Module Install Plan View




## 7 Top Covers or Half-Layer Top Plates

Top Covers or Half-Layer Top Plates cover the top system layer's pillars, ensuring vertical support for the cover fill material and avoids membrane being pushed into tank.

7.1 Top Covers are used for whole-number layer systems (e.g. 1-layer, 2-layer, etc). Half-Layer Top Plates are used for half-layer systems (e.g. 0.5-layer, 1.5-layer, etc.). Skip to step 7.3 if using Half-Layer Top Plates.

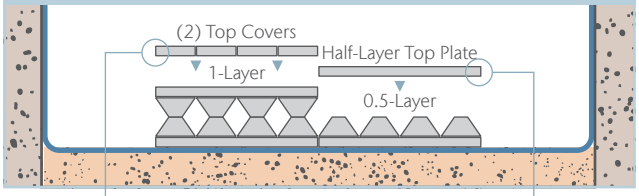
7.2 Each Half-module requires two Top Covers. Align the cover with four pillars on each half and push into place.

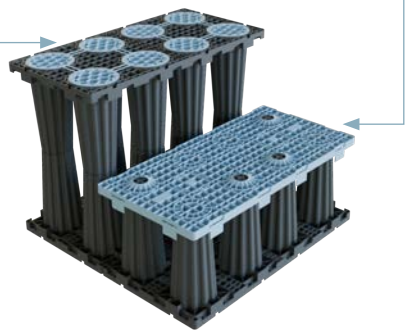
7.3 Each Half-module requires one Half-Layer Top Plate. Prior to installing, pre-cut plates to accommodate Remote Access Plate or remote access unit installation and any vertical pipe penetrations.

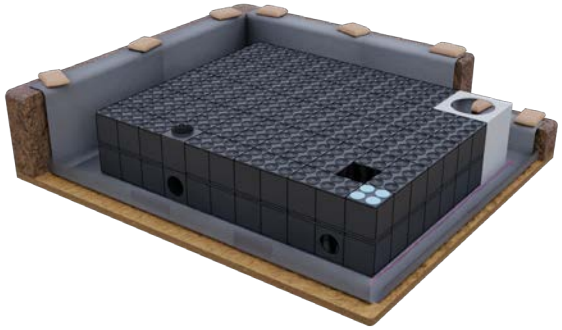
7.4 Align the plate with the pillar configuration on each Half-module and snap into place.

*Note: See step # for more information on Top Cover and Half-Layer Top Plate penetration for Inspection Points.*

Figure 7: Module Installation Section View





# Tank Assembly (cont.)

## 8 Remote Access Plates

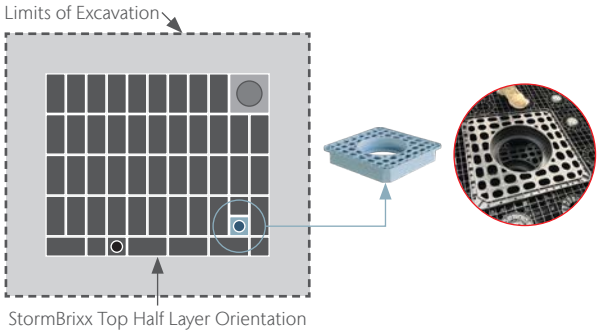
*(Skip this step if Remote Access Plates are not used.)*

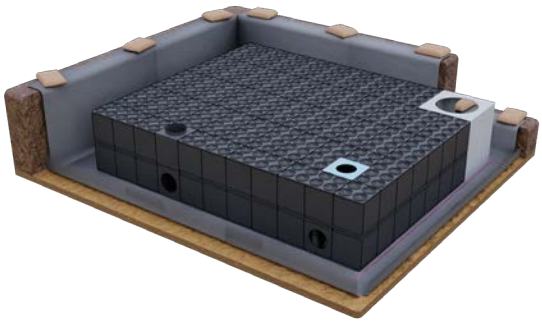
Remote access plates are installed at designated locations where Half-modules have been cut in half and an approximate 2' by 2' void is present at the top of the tank.

8.1 Place the access plate at the top of the tank at the designated location.

*NOTE: Remote Access Plates require support on all four sides. Do NOT install access plates along the perimeter of the tank.*

Figure 8: Module Install Plan View



# Wrap & Fill

## 9 Geosynthetic Wrap

Upon completion of ACO StormBrixx Tank assembly, complete geosynthetic wrap of the system. Geotextile fabric is wrapped and secured per the manufacturer's recommendations. Geomembrane seams shall be joined per manufacturer's recommendations.

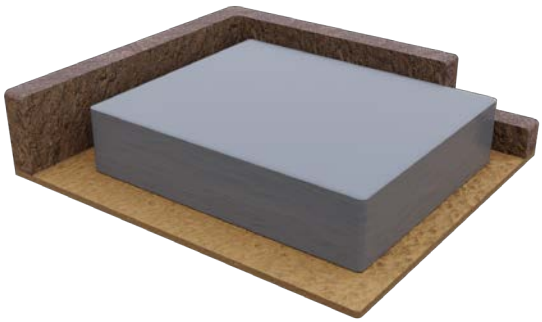
*If damage occurs to the geotextile fabric or impermeable membrane liner, repair material in accordance with the geotextile/liner manufacturer's recommendations.*

9.1 Cut panels of geosynthetics and install to provide full wrap of top and sides of tank. Fabric should be cut and installed to provide the minimum fabric lap per manufacturer.

9.2 If geomembrane is utilized, the seams shall be mechanically fastened or adhered per the manufacturer's installation instruction to provide sealed container. HEAT BONDING IS NOT AN ACCEPTABLE BONDING METHOD.

9.3 Fold geotextiles for outside corners and lay excess material flat against the StormBrixx tank. Leave corners loose to avoid creating weak spots in the material and temporarily secure excess fabric with duct tape. Use duct tape, sand bags or other ballast to temporarily secure overlaps.

9.4 Walk bottom edge of geotextile along sides of StormBrixx tank to eliminate gaps between the fabric and the bottom corner of the system.

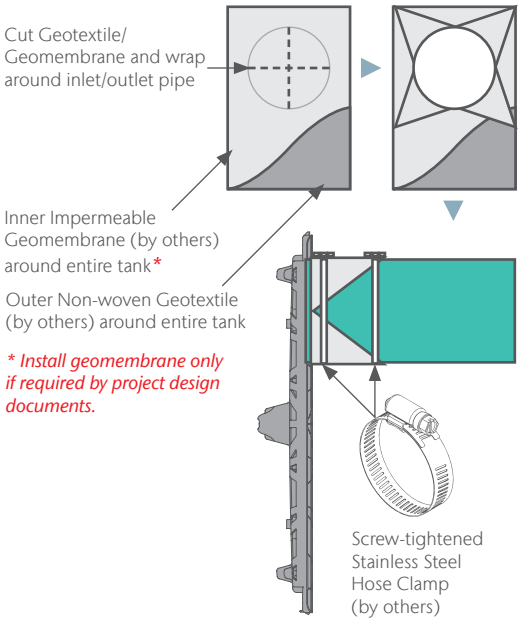


# Wrap & Fill (cont.)

## 9 Geosynthetic Wrap (cont.)

9.5 To allow for pipe, Inspection Points, and Extension Shaft perforations in the geosynthetic layers, follow Figure 9.4 pipe wrap detail. See Step 11 for pipe installation details.

Figure 9.4: Pipe Wrap Detail




## 10 Inspection Points

*(Skip this step if Inspection Points are not used.)*

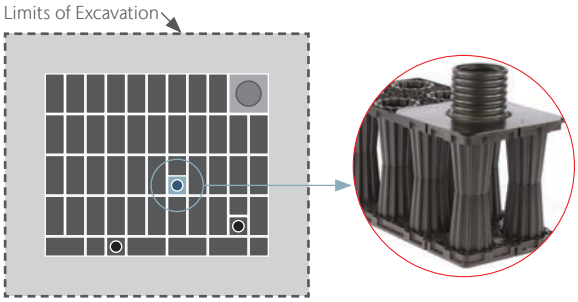
Inspection Points are installed at designated locations where holes have been cut in Half-Layer Top Plate or Half-module to provide inspection access into tank.

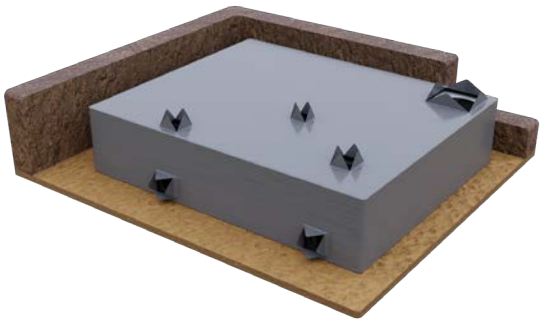
10.1 Place vertical Inspection Point connector over center of the hole, ensuring that its flange covers all four pillars.

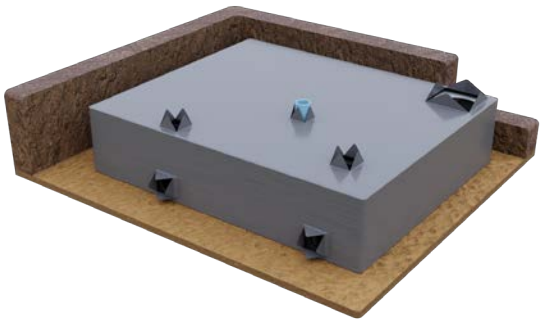
10.2 Using plastic rivets, fix flange to Half-Layer Top Plate or Half-module.

*NOTE: Inspection Points should be aligned with one half of a Half-module (See Rendering below). It should NOT be placed in the center of the Half-module.*

Figure 8: Module Install Plan View



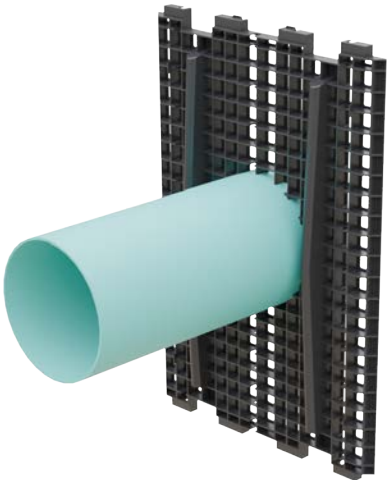





# Wrap & Fill (cont.)

## 11 Pipe Install

For horizontal pipe connections, slip-fit pipe into previously cut holes within Side Panel or Remote Access Unit. Extend pipe a minimum of 2" into the system.





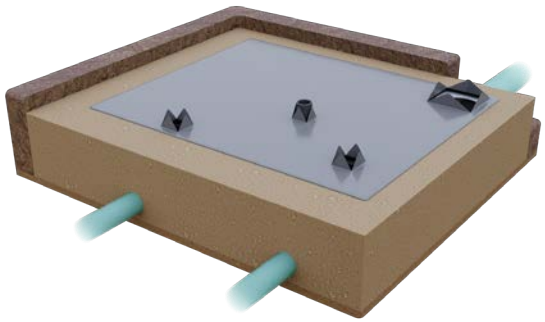
## 12 Backfill

Once geosynthetics are secured, begin to place backfill.

12.1 Place backfill material around perimeter of the ACO StormBrixx tank distributing material evenly to prevent movement of StormBrixx Modules. All backfill material must meet requirements listed in specifications.

12.2 Follow fill materials and compaction requirements as shown on page 13.





# Access and Inspection

## 13 Extension Shafts (with or without Pipe Socket)

Both types of extension shafts are installed at Remote Access Plate or Remote Access Unit locations to allow access from ground surface.

13.1 Fit Shaft into the Plate or Unit hole. It should be a snug fit.

13.2 Place the next shaft into the top of the previous shaft. It should be a snug fit.

13.3 Repeat step 13.2 until the desired Shaft height is achieved.

*NOTE: Prior to placing the final Shaft, cutting may be required to reach the desired total shaft height. If using the Extension Shaft with Pipe Socket, install pipes after installing the shaft. Extension Shafts are NOT used for Inspection Points.*

Figure 13.1: Module Installation Section View

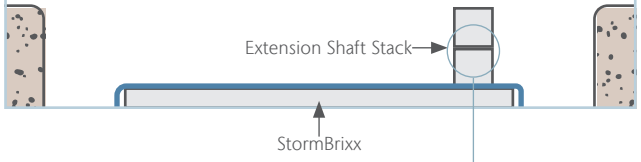
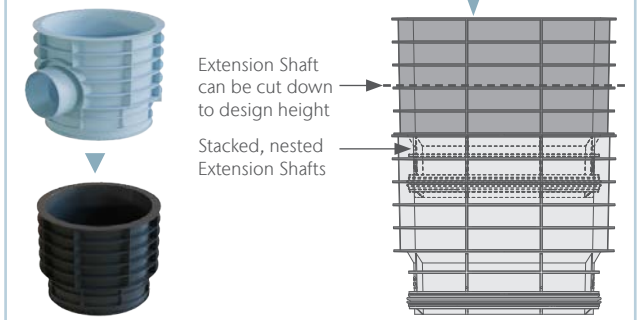
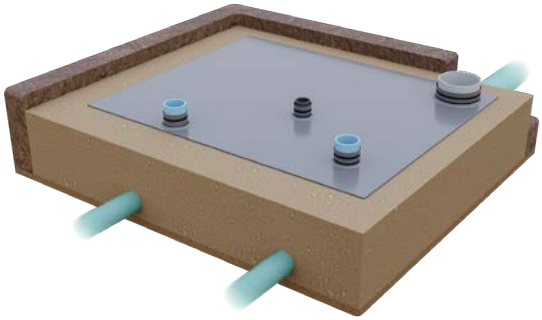



Figure 13.2: Extension Shaft Detail



## 14 Remote Access and Inspection Point Covers

14.1 Install third-party concrete load distribution ring as designed by civil engineer of record prior to installing covers.

14.2 Install cover at location indicated on project drawings.

*NOTE: Vented or Non-Vented Remote Access Covers should be specified by the designer.*

14.3 Follow other surface finishing details (e.g. surface concrete box-out) as specified by designer engineer of record.

Figure 14.1: Module Installation Section View

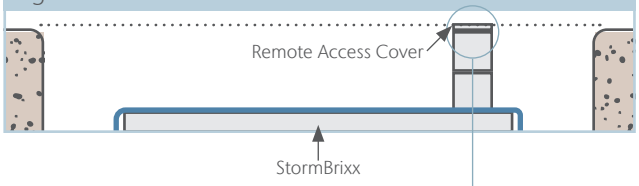
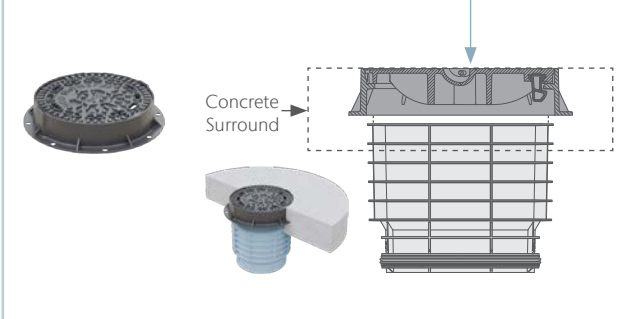
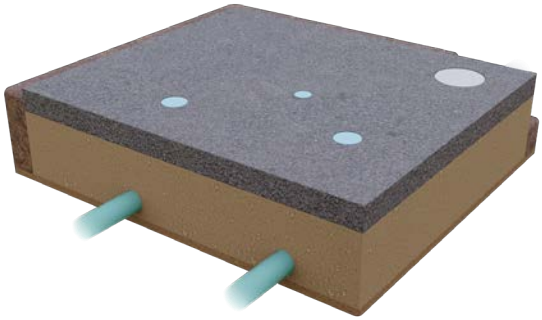



Figure 14.2: Remote Access Cover Detail



# ACO. we care for water


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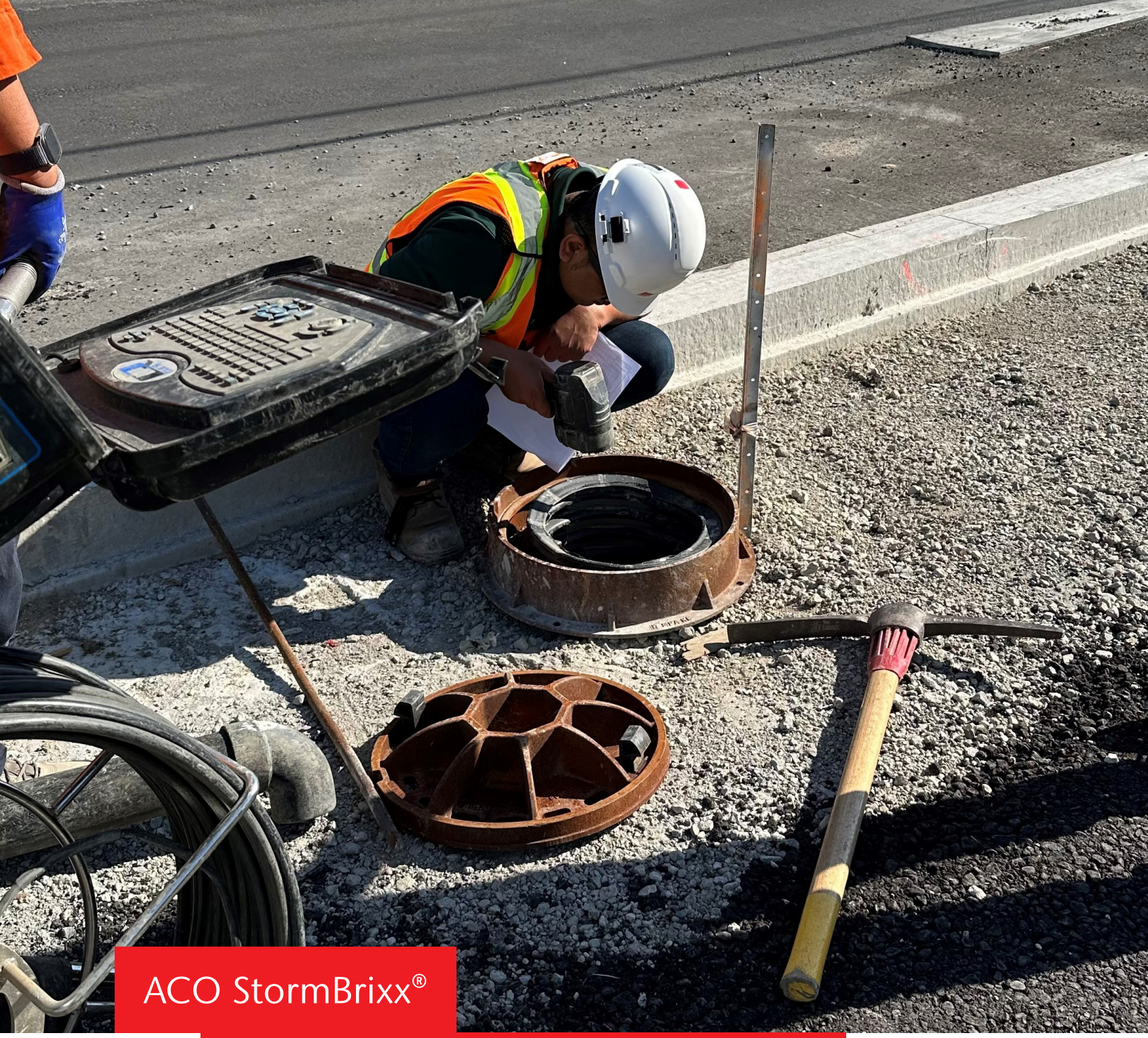
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# ACO StormBrixx®

# Inspection and Maintenance Guide

StormBrixx 300

StormBrixx 600

StormBrixx 900

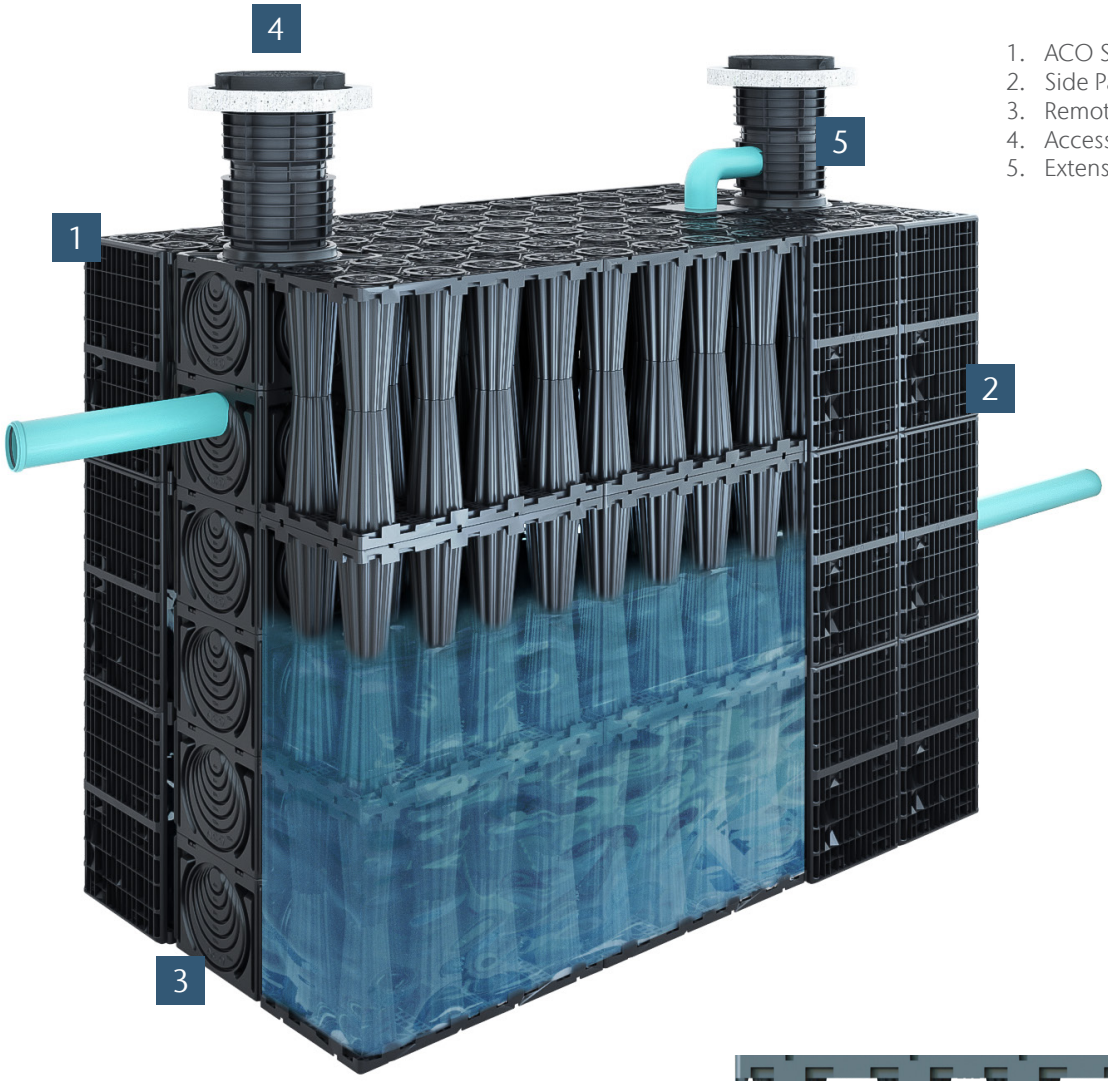
# Outline


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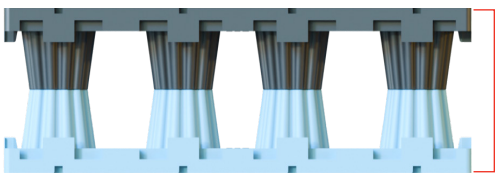
2 **Inspection and Maintenance Procedure** 03

**ACO StormBrixx® Inspection and Maintenance Form** 06


## ACO StormBrixx® System Components




1. ACO StormBrixx Tank*
2. Side Panel
3. Remote Access Unit**
4. Access Cover - Ductile Iron
5. Extension Shaft




Note: Image shown represents a typical ACO StormBrixx system.
*Tank refers to the assembled system of ACO StormBrixx components
**Some tanks will have a Remote Access Plate instead of a Remote Access Unit

# 1 Inspection Overview

The design life of underground stormwater systems of any type assumes that regular inspection and maintenance will occur.

This guide provides inspection and maintenance information for the ACO StormBrixx system.

It is the responsibility of all personnel to familiarize themselves with, understand and comply with all applicable local, state, and federal laws.

All information in this manual is current at the time of printing but is subject to change based on the development of new processes and procedures.

## 1.1 Construction Protection

During the construction phase, ACO recommends that site erosion controls and siltation prevention measures be implemented to reduce the risk of excessive siltation inside the tank. These measures should be designed and implemented in accordance with local, state, and federal Best Management Practices.

## 1.2 Inspection Frequency

ACO recommends inspections upon completion of site construction and after major rain events (as a guide rainfall >1" (25 mm) in a 24-hour period) with a minimum frequency of once per year. To help with this process, ACO has provided an Inspection and Maintenance form in this guide (See page 6) as well as the following step-by-step procedure.

## 1.3 Equipment Needed

In order to inspect and maintain the ACO StormBrixx tank, the following will be required:

- Tools to safely remove and place access covers
- Inspection camera proportioned for 4" diameter pipe inspection - length of 4" pipe with 45° elbow to guide camera
- Hydrovac equipment (maintenance only)
- Tank layout plan
- System logbook

# 2 Inspection and Maintenance Procedure

Inspection and maintenance can be performed from the surface simply by removing the Access Cover and performing the following steps. Care to conform to all local, state, and federal regulations should be taken.



## 2.1 Locate the Access Cover

Remove the lid, and safely place it to the side.

The lid has a push-fit locking and requires a vertical pulling force to remove.

# 2 Inspection and Maintenance Procedure (cont.)

## 2.2 Visual Inspection - External

Start the visual inspection by checking the external area above the tank as concerns here may indicate damage to the tank structure. Check the following:

- Condition of access covers
- Condition of access shafts
- Observe any unusual settlements of the surface above the tank area
- If the area above tank is paved, check for any excessive cracks in the pavement

If excessive pavement settling and/or cracks are noted during external inspection, ensure a thorough inspection of the internal area for cracks and/or damage.



Example of pavement distress

## 2.3 Visual Inspection - Internal

If the tank has standing water in it, you will need to vacuum the water first to enable internal inspection of the tank.

ACO recommends crawler or push camera proportioned for a 4" diameter pipe inspection. These units can have adjustable cameras and turning capabilities to assist with inspection.



Example of a small-diameter crawler for tight spaces





4" pipe with 45 ° elbow to guide push camera

The Remote Access Unit includes push camera guides molded into the bottom for easier camera alignment. Depending on the access point location, you may inspect the tank in up to four directions.

Best practice for use of a push camera is to use a 4" pipe with a 45° elbow at the end to help orient the camera in the direction intended for inspection.This is particularly beneficial for deeper tanks.

Perform a visual inspection of the tank using a sewer inspection camera starting with the bottom layer.

During bottom-layer inspection, cleaning is required if sediment has built up to ¼ of the tank height or 6"— whichever is shorter. See section 2.4.



Sediment in tank

If visible cracks are noted during inspection, contact ACO for structural inspection guidance.



Example of damaged column and base plate

## 2.4 Clean the Tank

It is a best practice to clean upstream structures, pipes, and pre-treatment system prior to cleaning the ACO StormBrixx Tank.

Clean the ACO StormBrixx Tank by utilizing Hydrovac equipment to loosen and suspend the debris and sediment.

ACO recommends a max jet pressure of 1,600 psi. The water level may be observed from the access point.

If the ACO StormBrixx Sediment Tunnel is utilized, cleaning will likely be isolated to those tunnel locations.

*Note: Completing cleaning within 24 hours of a storm event can help reduce the amount of water required for cleaning.*



## 2.5 Remove Sediment and Water

Once the sediment has been loosened and is suspended in the water, utilize the vacuum in the Hydrovac equipment to remove the water/sediments.

If additional cleaning is required after the water has been removed, repeat steps 2.4 and 2.5 until water runs clean.

*Note: If debris and sediment accumulates above the recommended maintenance levels for a prolonged time period without maintenance activities, difficulty of debris and sediment removal will increase.*

# 2 Inspection and Maintenance Procedure (cont.)

## 2.5 Final Inspection

After completing cleaning, perform a final tank inspection in accordance with step 2.3.






Camera view of clean tank

## 2.6 Replace Access Cover

After completion of inspection and cleaning of the ACO StormBrixx system, clean access cover and frame seating areas to remove dirt that may cause it to resist replacement. Push cover securely in place.

If additional access locations are present, repeat full maintenance procedure at every access location.



## 2.7 Update System Logbook

The results of the visual inspection, notes and repairs can be recorded in a System Logbook as a recommended best practice. These records will allow decisions to be made about the necessary frequency of future inspection and maintenance measures.

ACO has included an example form for your use in monitoring the StormBrixx system. See next page.

# ACO StormBrixx® Inspection and Maintenance Form

| | | | |
|---|---|---|---|
| Project Name: | | Project Address: | |
| System Owner: | | Inspection Date: | |
| Maintenance Company: | | Inspector Name: | |
| Inspector Phone #: | | Inspector Email: | |
| Access Location: | | Inspection Equipment Used: | |

| | |
|---|---|
| Sediment/Debris Accumulation > 6"? | ☐ Yes, Hydrovac cleaning recommended<br>☐ No |
| Inspection Condition Notes: | **Access cover conditions:**<br>☐ Yes, level and intact, no signs of settlement<br>☐ No, see comments<br>**Extension shaft conditions:**<br>☐ Yes, intact with no signs of settlement or cracking<br>☐ No, see comments<br>**Surface above tank shows localized settlement > 1"?**<br>☐ Yes, see comments<br>☐ No<br>**If asphalt paved, are unsealed cracks along the tank perimeter or alligator cracking observed above tank?**<br>☐ Yes, see comments<br>☐ No |
| Maintenance Performed? | ☐ Yes, final inspection showed sediment/debris accumulation <6"<br>☐ No, will complete at later date<br>☐ Not required at this time |
| Maintenance Equipment Used: | |
| Nozzle Pressure: | PSI |
| Nozzle Flow Rate: | GPM |
| Maintenance Notes: | |

# ACO. we care for water

**ACO, Inc.**

Surface Water Management Division

West Sales Office
825 W. Beechcraft St.
Casa Grande, AZ 85122
Tel: (520) 421-9988

Northeast Sales Office
9470 Pinecone Drive
Mentor, OH 44060
Tel: (440) 639-7230

Southeast Sales Office
481 Munn Rd. Ste 225
Fort Mill, SC 29715
Tel: (440) 639-7230

info@acousa.com
**www.acousa.com**

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All reasonable care has been taken in compiling the information in this document. All recommendations and suggestions on the use of ACO products are made without guarantee since the conditions of use are beyond the control of the company. It is the customer's responsibility to ensure that each product is fit for its intended purpose and that the actual conditions of use are suitable. ACO, Inc. reserves the right to the change products and specifications without notice.

Print #SB_IMG_01

Appendix I

# Sanitary, Fire and Water Demand

TABLE 4.1

# Sanitary Calculation

PROPOSED CONDOMINIUM

233, 249, 261 Coldwater Road West

Project No. n2123

| | | | | | |
|---|---|---|---|---|---|
| 1.0 | Proposed Site Statistics | | | | Notes |
| | 1.1 | No. of Units (Apartment) | 200 | units | Note 1 |
| | | | | | |
| 2.0 | Design Criteria | | | | |
| | 2.1 | Population Equivalent | | | |
| | | Apartments | **2.95** | Person/unit | Note 2 |
| 3.0 | Design Flows | | | | |
| | 3.1 | Average wastewater Flow | 300 | L/day/person | Note 2 |
| | 3.2 | Total Population | 590 | Persons | |
| | 3.3 | Residential Peaking Factor (Harman Eq.) | 3.94 | | Note 2 |
| | | Residential Peaking Factor to be used | 4.00 | | |
| | 3.4 | Peak Design Flows | 8.19 | L/sec | Note 2 |
| | | | | | |
| 4.0 | Extraneous Flows | | 0.1 | l/sec/ha. | Note 2 |
| | 4.1 | Total Area of the Site | 1.508 | ha. | |
| | 4.2 | Infiltration Allowance | 0.151 | l/sec | |
| | | | | | |
| **5.0** | **Total Peak Design Flow** | | **8.35** | **L/sec** | |

Note:

1. Site Plan, Preapred by n Architecture Inc.
2. City Of Orillia Engineering Design Criteria, Revision #4 dated February 2024

TABLE 4.2

# Water Demand Calculation

PROPOSED CONDOMINIUM
233, 249, 261 Coldwater Road West
Project No. n2123

| | | | |
|---|---|---|---|
| Average Consumption Rate | 300 | L/capita/day | |
| Max Day Factor | 1.6 | | |
| Peak Hour Factor | 4.5 | | *Section 4.4 (Note 1)* |
| | | | |
| Pop: Equivallent | 2.95 | Person/unit | Section 4.3.2.1 *(Note 1)* |
| Number of Unit | 200 | | Site Plan *(Note 2)* |
| Population | 590 | Person | |
| | | | |
| Average Domestic Water Deamnd | 177000.00 | l/day | |
| | 2.05 | L/sec | |
| | | | |
| Max Day Demand | 3.28 | L/sec | |
| Max Hour Deamd | 9.22 | L/sec | |

Note:

1. Site Plan, Preapred by n Architecture Inc.
2. City Of Orillia Engineering Design Criteria, Revision #4 dated February 2024

**TABLE 4.3.** **FIRE FLOW CALCULATION as per FIRE UNDERWRITERS SURVEY (2020)**

**PROJECT:** 233, 249, 261 Coldwater Road
Orillia

## 1. Fire Flow Equation

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

where F is the required fire flow [LPM]
C is the coefficient determined by type of construction [unitless]
A is the total protection area [sq.m]

## 2. Architecture Information

| | |
|---|---|
| Type of Construction | Ordinary |
| Fire Rating | Non-Combustible |
| Sprinkler Provided (Y/N) | Yes |

**Floor Area (Largest Unit)**

| | | |
|---|---|---|
| **Total Floor Area [sq.m]** | 4583 | The largest floor plus 25% of two immediately adjoining floors |
| Coefficient, C [1] | 0.8 | |
| Fire Flow, F [LPM] | 11915 | |
| | 12000 | |

## 3. Combustible Product Risk

| | | |
|---|---|---|
| Occupancy Adjustment | 85% | As per Table 3 of FUS 2020 |
| Fire Flow, F [LPM] | 10200 | |

## 4. Sprinkler Reduction

| | |
|---|---|
| Sprinkler Reduction | 0.50 |
| Sprinkler Reduction [LPM] | 5100 |

## 5. Exposure Adjustment

| | |
|---|---|
| North | 0% |
| East | 0% |
| South | 0% |
| West | 5% |
| **Total** | **5%** |
| Exposure Adjustment [LPM] | 510 |

## 6. Required Fire Flow, Duration & Volume

| | |
|---|---|
| Fire Flow, F [LPM] | 10200 |
| Sprinkler Reduction [LPM] | 5100 |
| Exposure Adjustment [LPM] | 510 |
| Required Fire Flow [LPM] | 5610 |
| Required Fire Flow [LPM] | **6000** |
| Required Fire Flow [LPS] | **100** |

**Round to 1000*

HYDRATEST

JOB NO. _____ DATE: November 16, 2023

LOCATION Orillia, ON

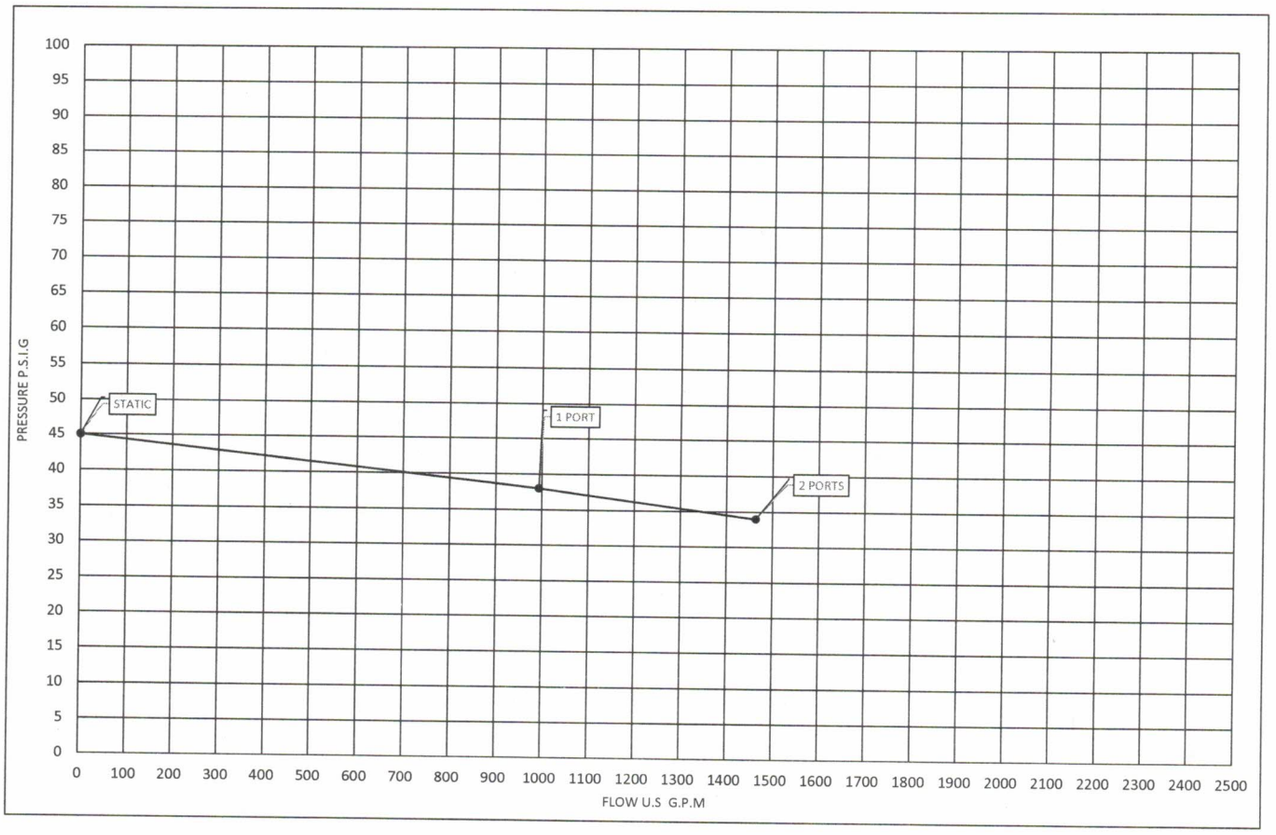
TIME OF TEST 10:55am

LOCATION OF TEST (FLOW) 233 Coldwater Rd. W. (Hyd 212)

(RESIDUAL) 251 Coldwater Rd. W. (Hyd 787)

MAIN SIZE: 200mm STATIC PRESSURE: 45

| Number of Outlets & Orifice Size | Pitot Presure | Flow (USGPM) | Residual Pressure |
|---|---|---|---|
| 1 X $2^{1/2"}$ PORT | 35 | 993 | 38 |
| 2 X $2^{1/2"}$ PORTS | 19 | 1463 | 34 |




COMMENTS: Class "A" Hydrant- Green

Authorized Signature: _____

Hydratest Signature: _____

Appendix J

# Easement Document & Reference

Deed with Dower
Form 113
Newtonse and Gilbert, Limited, Toronto

490725

5

# This Indenture

made in duplicate the 25th day of July
one thousand nine hundred and Seventy-four.
In Pursuance of the Short Forms of Conveyances Act:
**Between**

C. H. HEWSON BOURNE, of the City of Orillia, in the County of Simcoe, Solicitor, In Trust,

hereinafter called the Grantor of the FIRST PART

THE MUNICIPAL CORPORATION OF THE CITY OF ORILLIA,

hereinafter called the Grantee of the SECOND PART

~~Wife of the Grantor of the THIRD PART~~

**Witnesseth** that in consideration of other good and valuable consideration

and the sum of One----------($1.00)---------- dollar of lawful money of Canada now paid by the said grantee to the said grantor (the receipt whereof is hereby by him acknowledged) he the said grantor DO TH GRANT unto the said grantee in fee simple

ALL and Singular that certain parcel or tract of land and premises, situate, lying and being an easement to construct, operate and maintain ~~...~~ municipal services over a strip of land 50 feet in perpendicular width and which said strip may more particularly be described as follows:

ALL AND SINGULAR that certain parcel or tract of land and premises situate, lying and being composed of part of the west half of Lot 7, Concession 4, City of Orillia, in the County of Simcoe and designated as Part 2 on a reference description plan deposited in the Registry Office for the Registry Division of the County of Simcoe as Plan Number 51R-3569.

TO HAVE AND TO HOLD unto the said grantee its successors and assigns to and for its and their sole and only use forever,

SUBJECT NEVERTHELESS to the reservations, limitations, provisoes and conditions expressed in the original grant thereof from the Crown.

The said grantor COVENANTS with the said grantee THAT he has the right to convey the said lands to the said grantee notwithstanding any act of the said grantor

AND that the said grantee shall have quiet possession of the said lands free from all encumbrances.

AND the said grantor COVENANTS with the said grantee that he will execute such further assurances of the said lands as may be requisite.

AND the said grantor COVENANTS with the said grantee that he has done no act to encumber the said lands.

AND the said grantor RELEASES to the said grantee ALL his claims upon the said lands.

~~AND the said wife of the said Grantor hereby bars her Dower in the said lands.~~

IN WITNESS WHEREOF the said parties hereto have hereunto set their hands and seals.

Signed, Sealed and Delivered
IN THE PRESENCE OF

Richard Burton

C. H. Hewson Bourne.

United Stationery Co. Limited, Legal Department
30 Production Dr, Scarborough, Ontario

# IN THE MATTER OF SUBSECTION 3 OF SECTION 5 OF THE LAND SPECULATION TAX ACT, 1974

# Affidavit

I, C. H. Hewson Bourne of the City of
*(print name)*
Orillia, in the County of Simcoe
*(print address)*

MAKE OATH AND SAY THAT:

1. I verily believe that the disposition of designated land evidenced in the attached instrument or writing is exempt from the tax imposed by subsection 1 of section 2 of the above Act by virtue of the disposition being:
a disposition of designated land to a Municipality

describe nature of disposition

as provided for by section 4, clause j, subclause ____ of the above Act.

delete this paragraph if inapplicable

2. I am the transferor making the disposition referred to in paragraph 1 hereof.

delete this paragraph if inapplicable

3. ~~I am authorized in writing by the transferor making the disposition referred to in paragraph 1 hereof to make this affidavit.~~

Sworn before me
in the City of Orillia
County
of Simcoe
this 30
day of July 1974

C. H. Hewson Bourne
C. H. Hewson Bourne

Elizabeth D. Hatley

A Commissioner, etc.
ELIZABETH D. HATLEY, A Commissioner, etc.,
Counties of Simcoe and Ontario, for
Booth, Bourne & Emerson, Barristers.
Expires 12 Jan 1975

## AFFIDAVIT OF SUBSCRIBING WITNESS

Barbara Irene Burton

of the City of Orillia,

in the County of Simcoe, Secretary

make oath and say:

*See footnote I am a subscribing witness to the attached instrument and I was present and saw it executed at the City of Orillia by C. H. Hewson Bourne

*See footnote I verily believe that each person whose signature I witnessed is the party of the same name referred to in the instrument.

SWORN before me at the
City of Orillia
County of Simcoe
this 30 day of July 1974

Barbara Irene Burton

A COMMISSIONER FOR TAKING AFFIDAVITS, ETC.

ELIZABETH E. HATLEY, A Commissioner, etc., Counties of Simcoe and Ontario, for Booth, Bourne & Emerson, Barristers. Expires 12 Jan 1975

*Where a party is unable to read the instrument or where a party signs by making his mark or in foreign characters add "after instrument had been read to him and he appeared fully to understand it". Where executed under a power of attorney insert "(name of attorney) as attorney for (name of party)"; and for next clause substitute "I verily believe that the person whose signature I witnessed was authorized to execute the instrument as attorney for (name)".

Revised for October/73

# Affidavit, The Land Transfer Tax Act

IN THE MATTER OF THE LAND TRANSFER TAX ACT

Insert County, District, Regional Municipality etc. and name of same.

PROVINCE OF ONTARIO
COUNTY OF SIMCOE
To Wit:

I, C. H. Hewson Bourne
of the City of Orillia
in the County of Simcoe
named in the within (or annexed) transfer make oath and say:

This affidavit may be made by the purchaser or vendor or by any one acting for them under power of attorney or by an agent accredited in writing by the purchaser, or vendor or by the solicitor of either of them or by some other person approved by the Minister of Revenue.

1. I am the grantor named in the within (or annexed) transfer.
2. I have a personal knowledge of the facts stated in this affidavit.
3. (1) The total consideration for this transaction has been allocated as follows:
   (a) Land, buildings, fixtures and goodwill $ 1.00
   (b) Chattels—items of tangible personal property—See Note $ nil
   TOTAL CONSIDERATION $ 1.00

   (2) The true consideration for the transfer or conveyance for Land Transfer Tax purposes is as follows:
   (a) Monies paid in cash $ 1.00
   (b) Property transferred in exchange (Detail Below) $ nil
   (c) Securities transferred to the value of (Detail Below) $ nil
   (d) Balances of existing encumbrances with interest owing at date of transfer $ nil
   (e) Monies secured by mortgage under this transaction $ nil
   (f) Liens, legacies, annuities and maintenance charges to which transfer is subject $ nil
   (g) Other (Detail Below) $ nil
   TOTAL CONSIDERATION (should agree with 3(1)(a) above) $ 1.00

All blanks must be filled in.

4. If consideration is nominal, is the transfer for natural love and affection? n/a
5. If so, what is the relationship between Grantor and Grantee? n/a
6. Other remarks and explanations, if necessary an easement to the City of Orillia for municipal purposes as a condition of severance.

SWORN before me at the City of Orillia in the County of Simcoe this 30 day of July 1974

C. H. Hewson Bourne.

A COMMISSIONER FOR TAKING AFFIDAVITS, ETC.

ELIZABETH E. HATLEY, A Commissioner, etc., Counties of Simcoe and Ontario, for Booth, Bourne & Emerson, Barristers. Expires 12 Jan 1975.

NOTE TO PARAGRAPH 3(1)(b): Chattels: Retail sales tax is payable on the valuation of items shown in 3(1)(b) unless otherwise exempted under the provisions of The Retail Sales Tax Act. For the purpose of this affidavit insert above only the value of chattels, the total value of which in the opinion of the deponent exceeds $100.00. This does not enumerate a purchaser from the payment of Retail Sales Tax on any tangible personal property as part of this transaction. When chattels are purchased as part of this transaction with a value of less than $100.00, the applicable tax should be paid by the purchaser to the Treasurer of Ontario and remitted

Revised March/72

## AFFIDAVIT AS TO AGE AND MARITAL STATUS

I/We C. H. Hewson Bourne

of the City of Orillia

in the County of Simcoe

make oath and say: When I executed the attached instrument,

* If attorney see footnote

I/We was at least eighteen years old.

Strike out inapplicable clauses.

I was married / ~~divorced / widower~~

~~was my wife / husband.~~

~~We were married to each other.~~

I held the land in trust

~~We held the land as Joint Tenants / Trustees / Partnership Property.~~

Resident of Canada, etc.

I have been a resident of Canada as defined by the Income Tax Act of Canada since January 1, 1973, and will continue to be up to and including the date of closing of this transaction.

(SEVERALLY) SWORN before me at the
City of Orillia
County of Simcoe
this 30 day of July 19 74

C. H. Hewson Bourne

A COMMISSIONER FOR TAKING AFFIDAVITS, ETC.

ELIZABETH E. HATLEY, A Commissioner, etc.,
Counties of Simcoe and Ontario, for
Booth, Bourne & Emerson, Barristers,
Expires 12 Jan. 1975.

* Where affidavit made by attorney substitute: "When I executed the attached instrument as attorney for (name), he/she was (marital status, if married, name of spouse), and when he/she executed the power of attorney, he/she had attained the age of majority".

490725

Dated July 25th, 1974

C. H. HEWSON BOURNE

—TO—

THE MUNICIPAL CORPORATION OF THE CITY OF ORILLIA

City Hall,
Orillia, Ontario.

# Deed of Land

SITUATE

Part of Lot 7 Con 4
Orillia

Newcome and Gilbert, Toronto

ASSESSMENT ROLL NO.

ADDRESS OF PROPERTY

City of Orillia

BOOTH, BOURNE & EMERSON
BARRISTERS, ETC.
ORILLIA ONTARIO

PROPERTY OF THE REGISTRY OFFICE
1974 AUG 23 AM 10 00

No. 490725
Registry Division of Simcoe (No. 51)
I CERTIFY that this instrument is registered as of
10.00 a.m. AUG 23 1974 in the
Registry Office
at Barrie,
Ontario.

REGISTRAR

| | |
|---|---|
| REGISTRATION FEE | 10.00 |
| LAND TRANSFER TAX | — |
| RETAIL SALES TAX | — |

THIS SPACE TO BE RESERVED FOR CERTIFICATE OF REGISTRATION

DYE & DURHAM CO. LIMITED
Form No. 665

Province of Ontario

# Document General

Form 4 — Land Registration Reform Act, 1984

**D**

FOR OFFICE USE ONLY

No. **896271**

CERTIFICATE OF REGISTRATION

86 MAR 19 AM : 49

SIMCOE
No. 51
BARRIE

LAND REGISTRAR

(1) Registry ☒ Land Titles ☐ (2) Page 1 of 17 pages

(3) Property Identifier(s) Block Property Additional: See Schedule ☐

(4) Nature of Document

Development Agreement

(5) Consideration

Nil---------- Dollars $nil

(6) Description

Part of the West half Lot 7, Concession 4, City of Orillia, County of Simcoe, designated as Parts 1 and 2, Plan 51R-3569. *Formerly South Orillia*

SUBJECT TO an easement in favour of the Municipal Corporation of the City of Orillia, registered as Instrument No. 490725 on the 23rd day of August, 1974 over Part 2, Deposit Plan 51R-3569, for the City of Orillia.

New Property Identifiers Additional: See Schedule ☐

Executions Additional: See Schedule ☐

(7) This Document Contains: (a) Redescription New Easement Plan/Sketch ☐ (b) Schedule for: Description ☐ Additional Parties ☐ Other ☒

(8) This Document provides as follows:

Development Agreement attached.

Continued on Schedule ☐

(9) This Document relates to instrument number(s)

(10) Party(ies) (Set out Status or Interest)

| Name(s) | Signature(s) | Date of Signature Y | M | D |
|---|---|---|---|---|
| THE CORPORATION OF THE CITY OF ORILLIA | | 1986 | 03 | 17 |
| (Municipality) | R. Bruce Waite | | | |
| by its solicitors, RUSSELL, WAITE, CHRISTIE | | | | |
| & MILLER - R. Bruce Waite | | | | |

(11) Address for Service P.O. Box 340, Orillia, Ontario. L3V 6J1

(12) Party(ies) (Set out Status or Interest)

| Name(s) | Signature(s) | Date of Signature Y | M | D |
|---|---|---|---|---|
| FIRST BAPTIST CHURCH, ORILLIA | | | | |
| (Developer) | | | | |

(13) Address for Service

(14) Municipal Address of Property

265 Coldwater Road West,
Orillia, Ontario.
L3V 3L7

(15) Document Prepared by:

DOUGLAS S. CHRISTIE
RUSSELL, WAITE, CHRISTIE & MILLER
BARRISTERS & SOLICITORS
BOX 158, 76 COLDWATER STREET EAST
ORILLIA, ONTARIO L3V 6J3
(705) 325-1828

FOR OFFICE USE ONLY

| Fees and Tax | |
|---|---|
| Registration Fee | 16.00 |
| | |
| | |
| | |
| Total | 16.00 |

10174 (12/84)

# DEVELOPMENT AGREEMENT

THIS AGREEMENT made in quadruplicate this the 20th day of February, 1986.

BETWEEN:

FIRST BAPTIST CHURCH, ORILLIA,

hereinafter called the "Developer"

OF THE FIRST PART

AND

THE CORPORATION OF THE CITY OF ORILLIA,

hereinafter called the "Municipality"

OF THE SECOND PART

WHEREAS the lands affected by this Agreement are the lands described in Schedule "A" hereto annexed, and are also shown on a Site Plan attached hereto as Schedule "B" and which lands are collectively referred to herein as the "said lands";

AND WHEREAS the Developer proposes to construct a church hereinafter referred to as the "project" on the said lands;

NOW THEREFORE THIS AGREEMENT WITNESSETH that in consideration of the premises and for other good and valuable consideration, the parties hereto covenant and agree with one another as follows:

## 1. SCOPE OF AGREEMENT

.1 DESCRIPTION OF LANDS - The lands affected by this Agreement are the lands described in Schedule "A" hereto attached.

.2 CONFORMITY WITH AGREEMENT - The Developer covenants and agrees that all work performed on the said lands shall be in conformity with:

(a) the provisions of this Agreement;
(b) the Site Plan attached as Schedule "B";
(c) all additional Schedules hereto attached;
(d) the Plans and Specifications submitted to and accepted by the Municipal Engineer;
(e) all applicable Municipal By-laws and Provincial Legislation.

## 2. DEVELOPMENT CHANGES

.1 There shall be no changes in the Schedules attached hereto, or any additional Plans and Specifications filed with respect to this project unless such proposed changes have been first submitted to, and approved by the Municipal Engineer or other authorized representative.

## 3. CONDITIONS PRIOR TO EXECUTION OF AGREEMENT BY THE MUNICIPALITY

.1 Prior to the execution of this Agreement by the Municipality, the Developer shall:

(a) Taxes - have paid all municipal tax bills issued and outstanding on the said lands,

(b) Deeds and Easements - have delivered to the Municipality all transfers/deeds, discharges, and easement documents required by Schedule "D" and which shall be free and clear of all encumbrances,

(c) Cash Deposits, Capital Levies & Security - have delivered to the solicitor for the Municipality all cash deposits, capital levies and security required by Schedule "E" attached,

(d) Engineering Plans & Specifications - have supplied to the Municipal Engineer those Plans and Specifications necessary to identify the engineering aspects of the proposed development and have received acknowledgement of conformity with general design concepts of the Municipality;

(e) Hydro - have supplied to, and received the approval of, the applicable hydro officials, to those plans necessary to identify the electrical distribution system, lighting requirements, and power supply to each lot or building or unit, as the case may be, and these are to be to the required hydro standards which includes underground wiring,

(f) Liability Insurance - have filed with the Municipal Solicitor the insurance policies required herein,

(g) Architect and/or Consulting Engineer's Letter - have arranged for the architect and/or consulting engineer to file with the Municipality a letter confirming that he has been engaged by the Developer to perform all those professional services required under this Agreement and finally he will be responsible for issuing a Certificate stating that the development on completion is in conformity with the Grading Plan, Sewer and Water Services Plan, Storm Water Control Plan, and Site Plan,

(h) Private Utilities Confirmation - have obtained a letter from Bell Canada, Northern & Central Gas Corporation Limited, O.W.L.P., and Cable T.V., confirming that they have been advised of the development and that satisfactory arrangements have been made with them for servicing the development without expense or obligation to the Municipality.

(i) Land Ownership - be the registered owner in fee simple of the lands described in Schedule "A", and that there will be no encumbrances registered against the said lands save and except those specifically added hereto as parties to this Agreement.

4. CONDITIONS PRIOR TO THE ISSUANCE OF A BUILDING PERMIT

.1 On any application for a Building Permit and prior to the issuance thereof, the owner, or his agent, shall submit to the Municipality for the approval of the Municipal Engineer and/or the Chief Building Official the following:

(a) Architectural and/or engineering Plans and Specifications with respect to the following aspects of this project:

(i) architectural plans,
(ii) structural plans,
(iii) mechanical/electrical plans,
(iv) grading plan,
(v) exterior finish,
(vi) signs,
(vii) a complete electrical distribution system including transformers, street lighting and individual supply to each lot or unit,
(viii) parking and internal traffic patterns,
(ix) site plan,
(x) a plan showing existing and proposed final elevations and contours referring to a geodetic bench mark, showing area drainage, right-of-way drainage, finished first floor elevations. The Developer shall be responsible for the grading of the development as outlined in said drainage plan,
(xi) internal servicing layout for sanitary sewers, water and storm systems.

(b) Fire Chief Approval - an Approval from the Fire Chief of the Municipality confirming and approving of the proposed plans for fire protection, and specifying any hydrants, or other equipment or appurtenances required.

(c) Sanitary Sewer - an approved design for a sanitary sewer from Westmount Drive to the said lands.

(d) Storm Drainage System - an approved design for a storm sewer and drainage system to be constructed and it shall include erosion protection and restoration, and shall be controlled to the degree that future discharge from the said lands will not be greater in intensity and quantity than the discharge of storm water coming from the land in its natural state. The storm drainage shall be directed to an outlet approved by the Municipal Engineer.

(e) Sewer and Water Connections - file with the Municipality an application for Sewer and Water Connections.

(f) Certificate of Good Standing - Certificate of good standing from the Workers' Compensation Board.

(g) Compliance With Building By-law

.1 An application prepared and completed in accordance with The Building By-law requirements of the Municipality.

.2 On any Application for a Building Permit on the said lands shall be an implied covenant by the owner and his agent, that they have complied with all the provisions of this Agreement to the date of the issuance of the Building Permit.

(h) Execution of this Development Agreement by the Municipality.

(i) Foundation Forms - before issuing a building permit, the Engineer for the said project, either verbally or in correspondence, shall confirm with the chief building official that the elevation of the foundation forms will be in compliance with the Building Plans accepted by the Municipality, before proceeding with further construction.

5. MUNICIPAL SERVICES - ON MUNICIPAL EASEMENT

.1 The Developer will construct and install at its expense the hereinafter required Municipal Services in an easement of the Municipality being described as follows: Part of Lot 7, Concession IV, City of Orillia (formerly Township of South Orillia) more particularly described in Schedule "A" of Instrument No. 380728 registered in the Registry Office for the County of Simcoe. Such Services shall be constructed and installed in accordance with the Standards and Specifications required by the Municipality and these services may be summarized as follows:

a) sanitary sewer from Westmount Drive to the said lands;
b) a drainage ditch for storm water from Westmount Drive to the said lands.

6. SCHEDULE "C" - ENGINEERING AGREEMENT

.1 The parties hereto agree that Schedule "C" entitled "Engineering Agreement" and which sets out the General Provisions and Standards of the Municipality with respect to Subdivision and Development Agreements, shall be a separate Agreement which is incorporated into and forms part of this Agreement. A Copy of Schedule "C" shall be available at the Office of the Clerk of the Municipality.

.2 For reference purposes only, the following is a list of subject items contained in Schedule "C". Reference should be made to the "Engineering Agreement" for particulars of the items referred to.

8

1. Application.
2. Developers Consulting Engineer.
3. Contractor to be Approved.
4. Estimated Cost of Municipal Services.
5. Inspection by Municipality.
6. Incomplete or Faulty Work.
7. Declaration As To Accounts.
8. Certificate of Surveyor and/or Engineer.
9. As Constructed Drawings.
10. Land To Be Free of Debris.
11. Indemnification from Liability and Release.
12. Modification of Services.
13. Construction Liens.
14. Repair of Damage.
15. Notices.
16. Ownership of Municipal Services.
17. Connection to Services Before Occupancy.
18. Work and Inspection Charges to Developer.
19. Access During Construction.
20. Design and Specifications of Municipal Services.
21. Acceptance Dates, Guarantees and Maintenance Periods.
22. Location Plans.
23. Relocation of Services.
24. Requirements as of Execution Date.

7. MUNICIPAL LANDS AND EASEMENTS - SCHEDULE "D"

.1 The Developer agrees to convey to the Municipality in fee simple, free and clear of all encumbrances, the lands and easements more particularly described in Schedule "D" attached.

8. EMERGENCY SITUATION

.1 If as a result of any work undertaken by the Developer, or its servants, or agents, there exists in the opinion of the Municipal Engineer an emergency situation which requires immediate attention to avoid damage to private or public property or services owned by the Municipality, such work may be done immediately by the Municipal Engineer at the expense of the Developer, but notice shall be given to the Developer at the earliest possible time.

9. LIABILITY INSURANCE

.1 The Developer shall lodge with the Municipality on or prior to the execution of the Agreement, an insurance policy with an Insurance Company satisfactory to the Municipality, which said approval shall not be unreasonably withheld or delayed, and insuring for the joint benefit of the Developer and the Municipality, against any liability that may arise out of the construction or installation of any work to be performed pursuant to this Agreement and for a period of 1 year after completion and acceptance of the Municipal Services to be constructed herein.

.2 Such policy shall carry limits of liability in the amount to be specified by the Municipality, but in no event shall it be less than $2,000,000.00 inclusive comprehensive general liability and such policy shall contain a cross-liability clause and shall not have an exclusion pertaining to blasting or completed operations.

.3 The Developer shall from time to time as required by the Municipality provide confirmation that all premiums on such policy or policies of insurance have been paid and that the insurance is in full force and effect, and see that a copy of the policy is filed with the Municipality.

.4 The issuance of such Policy of Insurance shall not be construed as relieving the Developer from responsibility for other or larger claims, if any, for which it may be held responsible.

.5 This policy of insurance shall include the following additional names as insureds:

(a) The Corporation of the City of Orillia;

10. MODIFICATION OF SERVICES

.1 If at any time and from time to time during the construction of the Project, and at any stage thereof, the Municipal Engineer in his sole discretion, is of the opinion that a modification of design of any services required to be installed under the provisions of this Agreement is occasioned by site conditions, or is necessary to maintain the standard of any of the Municipal Services related thereto the Developer shall construct, install or perform such modifications of services as may be required.

11. REGISTRATION OF AGREEMENT AND OTHER DOCUMENTS

.1 The parties hereto consent to the registration of this Agreement by the Municipality upon the title of the said lands, which registration shall be included as a legal expense to the Developer. The Developer further agrees that he will execute such further and other documents, consents, or applications as may be reasonably required by the solicitor for the Municipality for the purpose of any registration against the said lands, or for the purpose of giving effect to the provisions required under this Development Agreement.

12. EXPENSES TO BE PAID BY DEVELOPER

.1 Every provision of this Agreement by which the Developer is obliged in any way shall be deemed to include the words "at the expense of the Developer" unless the context otherwise requires.

.2 The Developer shall pay such reasonable fees as may be invoiced to the Municipality by its Solicitor, in connection with all work to be performed as a result of the provisions of this Agreement.

.3 All expenses for which demand for payment has been made by the Municipality shall bear interest at the rate of 1½% per month commencing 30 days after demand.

.4 In the event that the Municipality finds it is necessary to engage the services of an engineer or technical personnel not permanently employed by the Municipality, to review the plans of the Developer, and/or carry out onsite inspections of the work performed, the Municipality will advise the Developer accordingly of this need, and the costs of such outside engineers so engaged shall be the responsibility of the Developer. The Municipality may require a deposit for this purpose.

12. CASH DEPOSITS, CAPITAL LEVIES AND SECURITY - SCHEDULE "E"

.1 The Developer shall lodge with the Municipality, those cash deposits, capital levies and security more particularly described in Schedule "E", and at the dates specified therein.

.2 In the event that the expenses of the Municipality exceed the amount of the cash deposits or security set out in Schedule "E" attached, the Developer shall pay such excess charges within 30 days after demand by the Municipality, or if less, such excess deposit shall be refunded upon the acceptance of the Municipal Services.

13. REALIZATION OF SECURITY

.1 In the event that it becomes necessary for the Municipality to realize on its security, as a result of default by the Developer, then the Municipality, its servants or agents or sub-contractors shall, if it so elects, have at all times the right and privilege to enter upon the lands covered by this Agreement for the purpose of completing any work or services required to be constructed under this Agreement.

.2 If the cost of completing such work or service, exceeds the amounts of security held by the Municipality, such excess shall be paid by the Developer to the Municipality 30 days after invoicing by the Municipality. All overdue accounts shall bear interest at the rate of 1½% per month.

.3 The Developer on behalf of itself, its successors and assigns agrees to indemnify and save harmless the Municipality from and against any and all claims, suits, actions and demands whatsoever which may arise either directly or indirectly by reason of any work or service performed by the Municipality, its servants or sub-contractors in order to complete the work or services required to be completed under this Agreement; provided the subject matter of such action, suits, claims or demands was not caused intentionally or through gross negligence on the part of the Municipality, its servants or agents or sub-contractors.

14. ATTACHED SCHEDULES

.1 It is agreed that everything included in this Agreement and the Schedules attached thereto, together with all engineering drawings, material and undertakings filed by the Developer and accepted by the Municipality shall be included in and form part of this Agreement.

15. COMMENCEMENT OF CONSTRUCTION AND COMPLETION

.1 The Developer agrees to obtain a building permit and commence construction of the said development within 6 months of the execution of this Agreement by the Municipality and to complete the said development within 24 months thereafter. In the event that the Developer does not obtain a building permit or commence construction within the 6 month period or complete construction within 24 months thereafter then the Municipality may at its option terminate this Agreement.

16. APPLICATION FOR REDUCTION OF LETTERS OF CREDIT OR FOR ASSUMPTION OF MUNICIPAL SERVICES

.1 The Developer may make application to the Municipality for a reduction of a Letter of Credit, or for the assumption of a Municipal Service, in the following manner:

(a) he shall file a letter of application with the Clerk of the Municipality;

(b) accompanying the letter of application shall be a letter from the consultants confirming that certain stages of the municipal work had been completed in accordance with the specification requirements of the Development Agreement and that such services are now at a stage for interim or final inspection;

(c) the Municipal Clerk shall then give notice of this application to the various municipal departments concerned and shall reply as quickly as is possible.

17. COMMENCEMENT OF 2 YEAR MAINTENANCE PERIOD

.1 A two-year maintenance period to guarantee against defects as required by this Agreement, shall commence not on the date that the service is assumed by the Municipality, or in the case of hydro, on the date that the system is energized, but shall commence, unless otherwise agreed upon, on the date that the last service is assumed by the Municipality.

18. APPLICATIONS OF LETTERS OF CREDIT

.1 Any Letter of Credit filed with the Municipality is based upon the estimated cost of completing matters set out in Schedule "F". However, any Letter of Credit given to the Municipality to cover these items, may be held by the Municipality to cover the estimated cost to complete any of the work required to be performed under the terms of this Agreement or for offsetting any cost incurred by the Municipality pursuant to the provisions of this Agreement.

.2 In the event that the amount of security remaining in the Letter of Credit is insufficient to complete the Municipal Services required under this Agreement, or to comply with the provisions of the Construction Lien Act, then the Municipality may give notice to the Developer that it proposes to cash the remaining Letter of Credit and to complete the Municipal Services, and the cost of completing such services in excess of the value of the Letter of Credit, shall be the responsibility of the Developer, and shall be invoiced to the Developer, which invoice shall be due and payable within 30 days of the invoice. All overdue accounts will bear interest at the rate of 1½% per month.

19. PLANS ATTACHED

.1 The Plans attached hereto as Schedules are either photographic or photostatic reductions of the original plans filed and accepted by the Municipality. Where uncertainty exists as to the content or accuracy of these exhibits, the reader should refer to the full scale drawings filed with the Municipality.

20. TIME OF THE ESSENCE

.1 The parties hereto agree that time shall be of the essence in this Agreement.

21. INTERPRETATION

.1 It is hereby agreed that in construing these presents the word "Developer" and the personal pronoun "he" or "his" relating thereto and used therewith, shall be read and construed as "Developer" and "his", "hers", "its" or "their" respectively as the number and gender of the party or parties referred to in each case requires and the number of the verb agreeing therewith shall be so construed as agreeing with the said word or pronoun so substituted.

.2 And that all covenants, rights, advantages, privileges, immunities, powers and things hereby secured to the Municipality shall be equally secured to and exercisable by its successors and assigns as the case may be.

.3 And that all covenants, liabilities and obligations entered into and imposed hereunder upon the Developer, shall be equally binding upon his, her, its or their heirs, executors, administrators and assigns, or successors and assigns as the case may

be, and that all such covenants and liabilities and obligations shall be joint and several.

THIS AGREEMENT shall enure to the benefit of and be binding upon each of the parties hereto and their respective heirs, executors, administrators, successors and assigns.

IN WITNESS WHEREOF the parties hereto have executed this Agreement on the following dates:

By the Developer on the 7th day of March, 1986.

FIRST BAPTIST CHURCH, ORILLIA

Per: _____
Harvey Kitchen - Trustee

Per: _____
Gordon Skinner - Committee Chairman

By The Corporation of the City of Orillia on the 11th day of March, 1986.

THE CORPORATION OF THE CITY OF ORILLIA

_____
MAYOR

_____
DEPUTY CLERK

SCHEDULE "A"

THIS IS SCHEDULE "A" TO THE DEVELOPMENT AGREEMENT BETWEEN THE CORPORATION OF THE CITY OF ORILLIA AND FIRST BAPTIST CHURCH, ORILLIA

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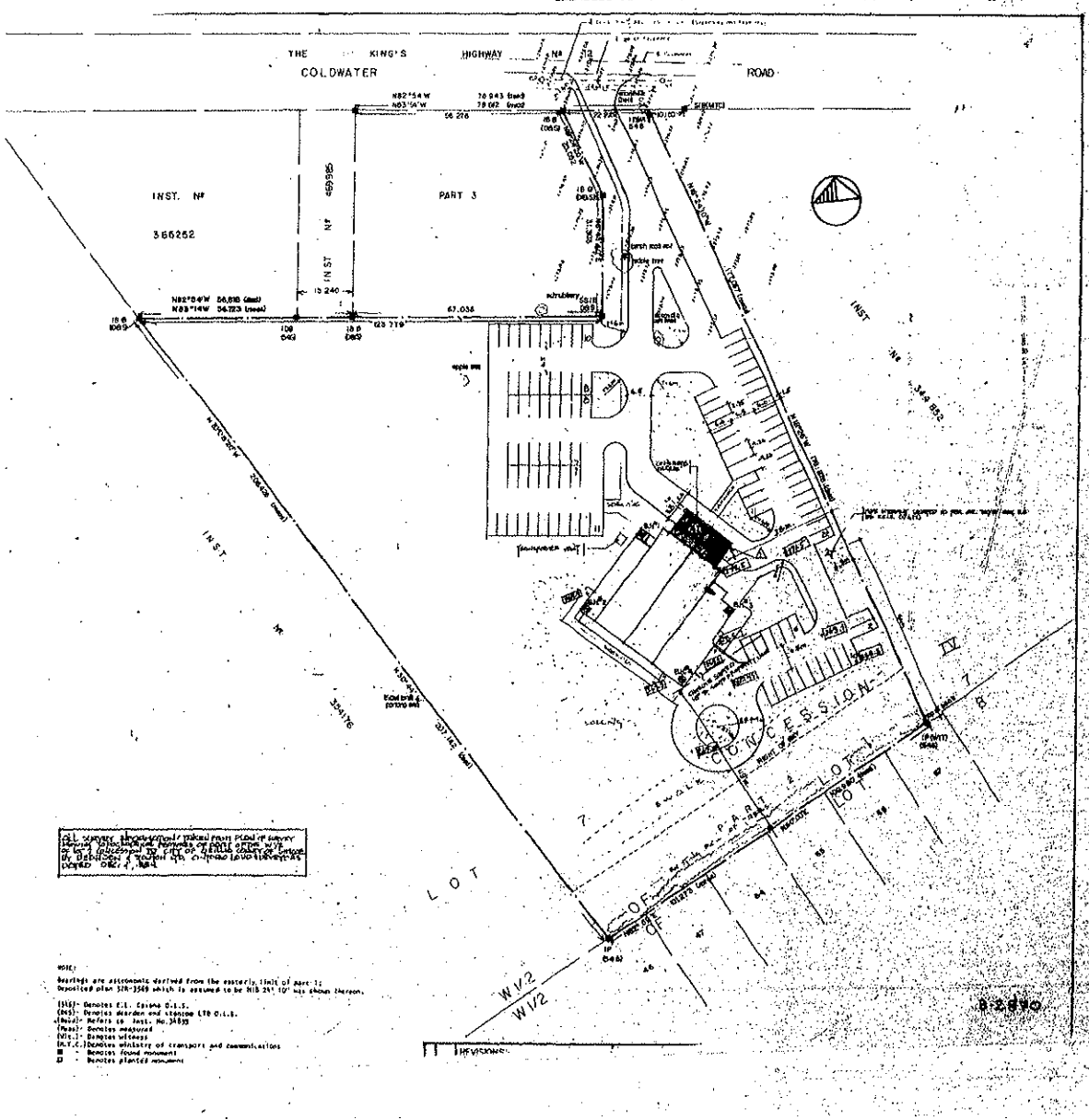
DESCRIPTION

ALL AND SINGULAR that certain parcel or tract of land and premises situate, lying and being composed of Part of the West half of Lot 7, Concession 4, in the City of Orillia, in the County of Simcoe, and designated as Parts 1 and 2 on a Reference Description Plan deposited in the Registry Office for the Registry Division of the County of Simcoe as Plan No. 51R-3569.

SUBJECT TO an easement in favour of the Municipal Corporation of the City of Orillia, registered as Instrument No. 490725 on the 23rd day of August, 1974 over Part 2, Deposit Plan 51R-3569, for the City of Orillia.

SCHEDULE "B"

THIS IS SCHEDULE "B" TO THE DEVELOPMENT AGREEMENT BETWEEN THE CORPORATION OF THE CITY OF ORILLIA AND FIRST BAPTIST CHURCH, ORILLIA



SCHEDULE "C"

THIS IS SCHEDULE "C" TO THE DEVELOPMENT AGREEMENT BETWEEN THE CORPORATION OF THE CITY OF ORILLIA AND FIRST BAPTIST CHURCH, ORILLIA

---

ENGINEERING AGREEMENT

The parties hereto agree that Schedule "C" entitled "Engineering Agreement "which sets out the General Provisions and Standards of the Municipality with respect to Subdivision and Development Agreements, shall be a separate Agreement which is incorporated into and forms part of this Agreement. A copy of Schedule "C" shall be available at the Office of the Clerk of the Municipality.

A list of subject items contained referred to in Schedule "C" is hereinbefore set out.

SCHEDULE "D"

THIS IS SCHEDULE "D" TO THE DEVELOPMENT AGREEMENT BETWEEN THE CORPORATION OF THE CITY OF ORILLIA AND FIRST BAPTIST CHURCH, ORILLIA

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## DEEDS AND EASEMENTS TO BE CONVEYED

All title documents to be exchanged shall:

(a) be properly drawn and executed by the parties;

(b) show a consideration of $2.00;

(c) any Transfer documents to the Municipality shall be prior approved by the solicitor for the Municipality;

(d) the cost of preparation, execution and registration of such documents shall be a financial responsibility of the Developer.

The following lands and easements are required:

1. Lands to be conveyed to the Municipality

a) a 2.942 metre road widening across the frontage of the said lands on Coldwater Road.

2. Easements to the Municipality

a) an easement 9.144 metres in width along the entire easterly boundary of the said lands for municipal sanitary sewer and water services. Such easement shall contain a provision that the Municipality when installing any services will use its best efforts to place the water main along the westerly side of the said easement if first installed leaving the most easterly part for any subsequent installation of a sanitary sewer.

SCHEDULE "E"

THIS IS SCHEDULE "E" TO THE DEVELOPMENT AGREEMENT BETWEEN THE CORPORATION OF THE CITY OF ORILLIA AND FIRST BAPTIST CHURCH, ORILLIA

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## CASH DEPOSITS, CAPITAL LEVIES AND SECURITY

The Developer shall, on the dates specified herein, lodge with the Municipality the following described cash deposits, capital levies and security.

### 1. TYPE OF SECURITY

Any security required to be filed under this Agreement shall be in cash, or by Letter of Credit valid for a period of 1 year with extension provisions and prepared in a form provided by the Municipality. It shall be drawn on a Chartered Bank of Canada and shall be for the amount hereinafter set out.

### 2. REDUCTION OF SECURITY

The Developer may, as portions of the work are completed, make application to the Municipality to reduce the security to such amount as, in the sole discretion of the Municipal Clerk, is sufficient to guarantee the due performance of all the terms of the Development Agreement including but not so as to limit the generality of the foregoing, Municipal Services, services and any other financial obligations required of the Developer under this Agreement, (the costs of which will be estimated by the Municipality for holdback purposes), and to cover any obligations of the Municipality that might arise under the Construction Lien Act, and this amount will also include the security holdback required for the 2 year maintenance period.

### 3. REFUNDABLE DEPOSITS

#### .1 Guarantee Of Obligations

A cash deposit or Letter of Credit, to an amount hereinafter set forth, shall be deposited by the Developer with the Municipality as a guarantee that the Developer will duly perform the work and carry out his obligations under this Agreement.

#### .2 Guarantee Against Defects In Municipal Services

In the event that the Developer by the terms of this Agreement is required to construct Municipal Services, a cash deposit or a Letter of Credit equal to 5% of the total value of the Municipal Services, shall be deposited with and retained by the Municipality for a period of 2 years after acceptance of the services, as a guarantee against any defects in the construction of such services, and also as a guarantee of due compliance of all provisions and obligations of this Agreement.

### 4. CASH DEPOSITS

The following cash deposits are preliminary estimates only and are to be paid to the Municipality prior to the execution of this Agreement by the Municipality. In the event that the actual costs incurred by the Municipality exceed the deposits, such excess shall be invoiced to the Developer and be due and payable 30 days after demand:

(a) For legal expenses and disbursements in connection with all negotiations and documentation prepared with respect to this Development until the matter is completed, a deposit of $ 1,500.00

5. SECURITY SUMMARY

Security to the following amounts shall be deposited with the Municipality to guarantee the due performance of all work and obligations required under this Agreement as follows:

(a) Estimated cost of Municipal Services to be constructed in accordance with Schedule "F" hereto attached. $29,500.00

(b) Amount of above deposit to be withheld by the Municipality as a guarantee against defects in construction of Municipal Services to extend for a period of 2 years after the Acceptance of the Services to cover all performance and obligations under this Agreement and included in Item 3.2 above. $ 1,475.00

6. ADDITIONS TO SECURITY

The parties hereto agree that in the event that the contract price for the Municipal Services set out in Schedule "F" attached, is greater by 10% than the estimates in the said Schedules, then the security provided for in paragraph 8 above shall be increased to an amount equal to the tendered contract price.

SCHEDULE "F"

THIS IS SCHEDULE "F" TO THE DEVELOPMENT AGREEMENT BETWEEN THE CORPORATION OF THE CITY OF ORILLIA AND FIRST BAPTIST CHURCH, ORILLIA

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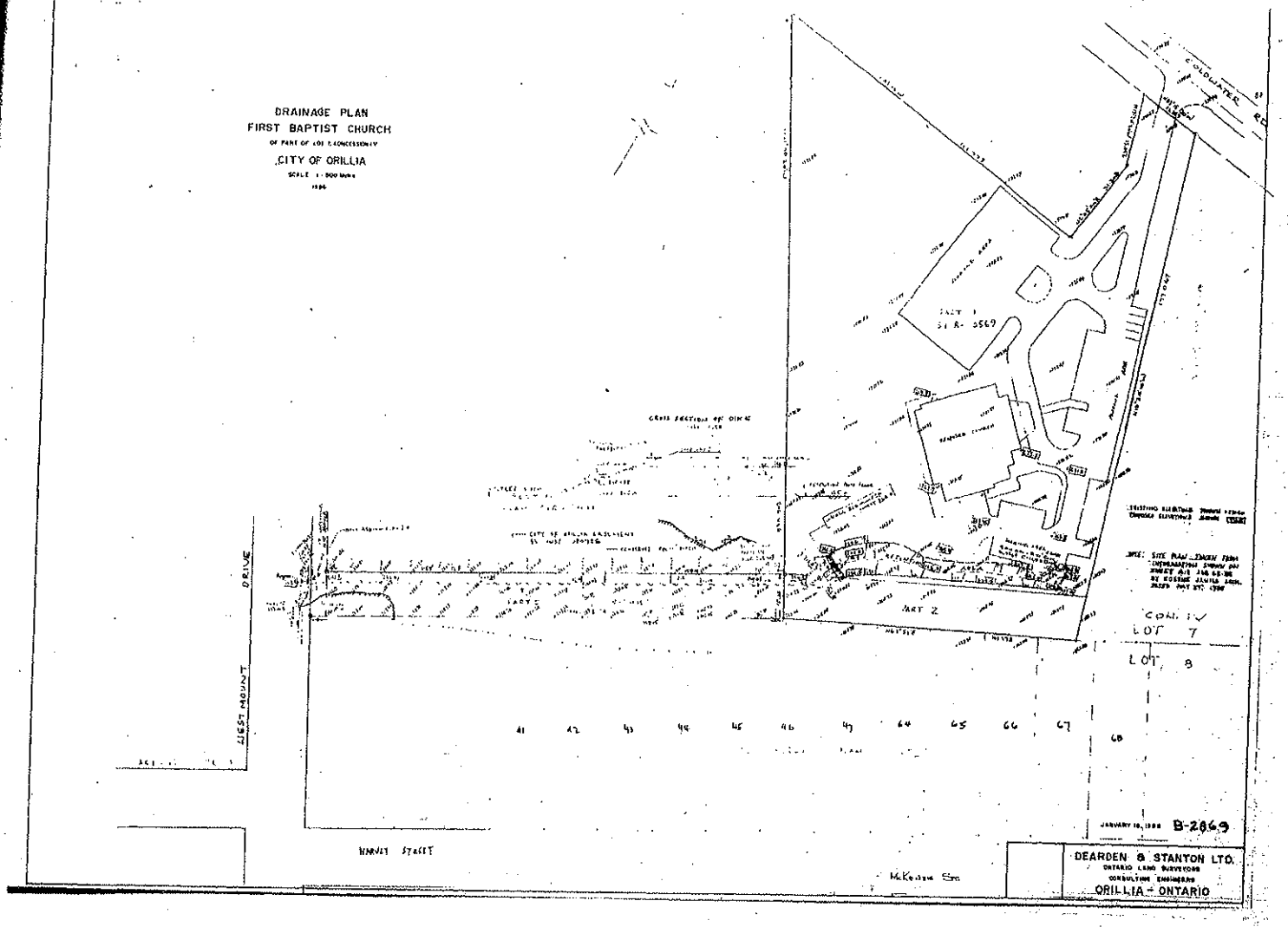
WORK COST ESTIMATES

All work cost estimates herein are preliminary only and are subject to an adjustment in the event that the Contract price exceeds the estimate by 10% or more.

| | | |
|---|---|---|
| 1. | Sanitary sewer installation including 200 metres of main and 3 manholes | $19,500.00 |
| 2. | Storm water drainage ditch | $10,000.00 |
| | TOTAL | $29,500.00 |

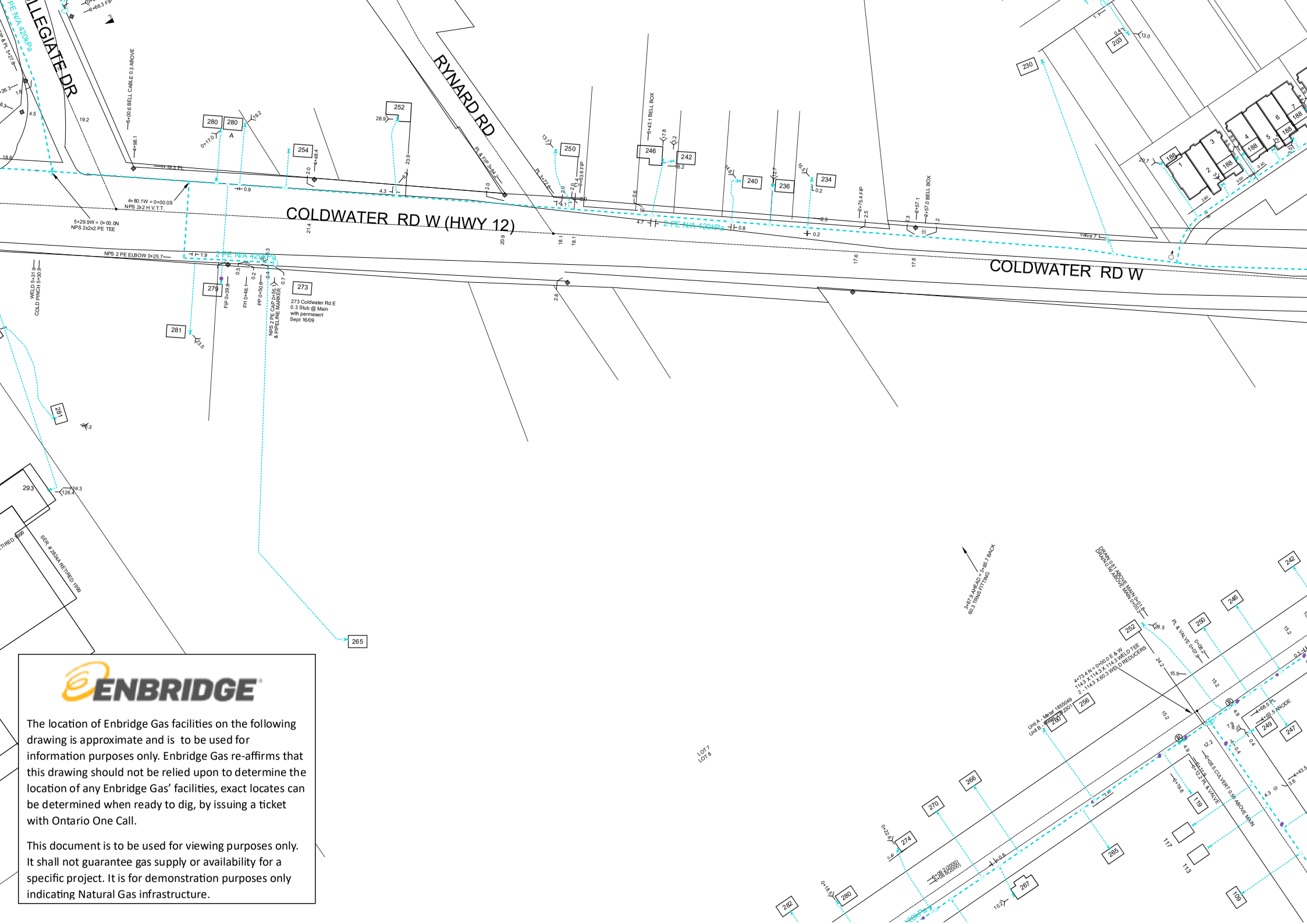
SCHEDULE "G"

THIS IS SCHEDULE "G" TO THE DEVELOPMENT AGREEMENT BETWEEN THE CORPORATION OF THE CITY OF ORILLIA AND FIRST BAPTIST CHURCH, ORILLIA



Appendix K

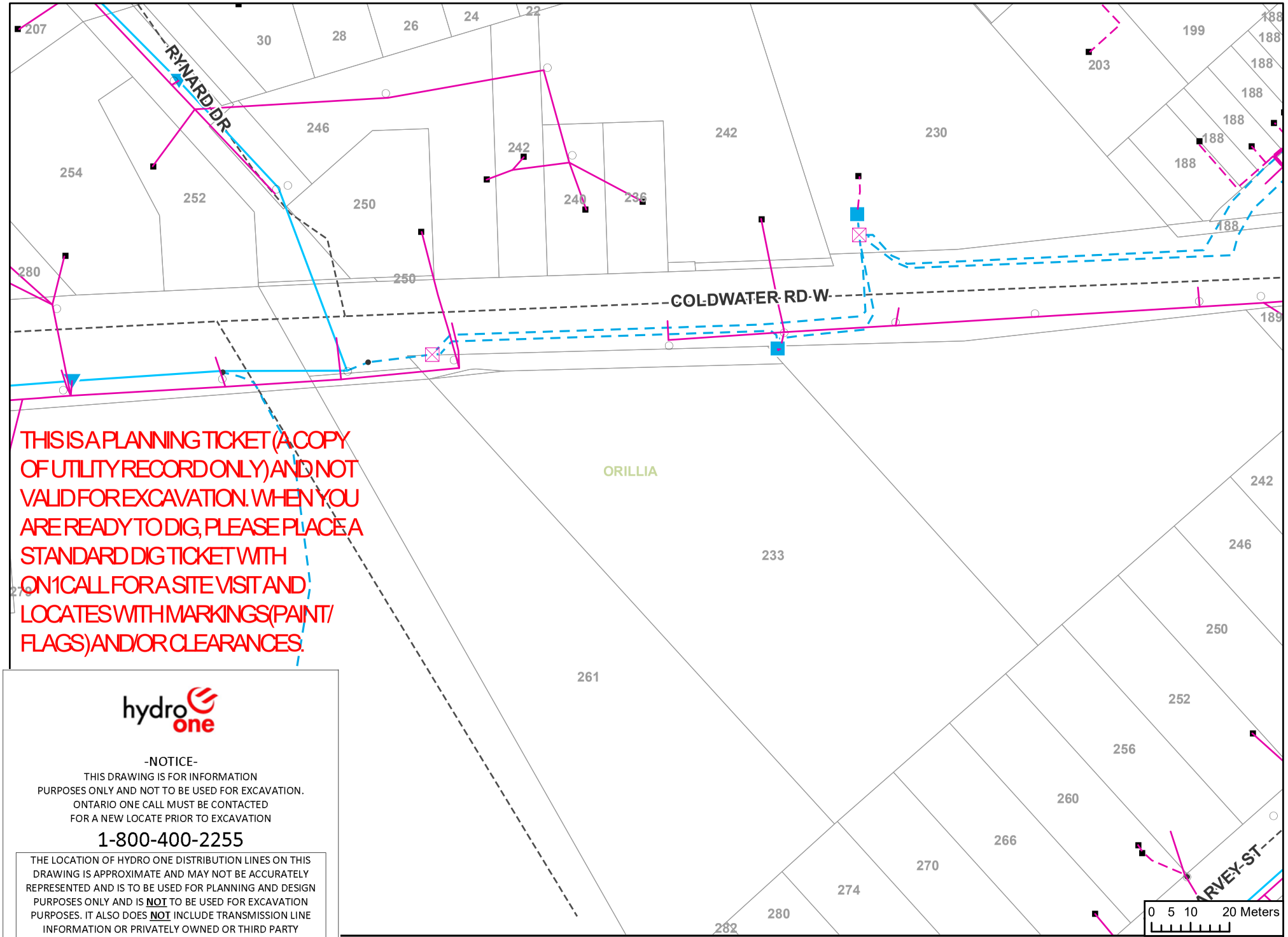
# Existing Services




ENBRIDGE

The location of Enbridge Gas facilities on the following drawing is approximate and is to be used for information purposes only. Enbridge Gas re-affirms that this drawing should not be relied upon to determine the location of any Enbridge Gas' facilities, exact locates can be determined when ready to dig, by issuing a ticket with Ontario One Call.

This document is to be used for viewing purposes only. It shall not guarantee gas supply or availability for a specific project. It is for demonstration purposes only indicating Natural Gas infrastructure.




hydro one

-NOTICE-

THIS DRAWING IS FOR INFORMATION PURPOSES ONLY AND NOT TO BE USED FOR EXCAVATION. ONTARIO ONE CALL MUST BE CONTACTED FOR A NEW LOCATE PRIOR TO EXCAVATION

1-800-400-2255

THE LOCATION OF HYDRO ONE DISTRIBUTION LINES ON THIS DRAWING IS APPROXIMATE AND MAY NOT BE ACCURATELY REPRESENTED AND IS TO BE USED FOR PLANNING AND DESIGN PURPOSES ONLY AND IS **NOT** TO BE USED FOR EXCAVATION PURPOSES. IT ALSO DOES **NOT** INCLUDE TRANSMISSION LINE INFORMATION OR PRIVATELY OWNED OR THIRD PARTY CONDUCTOR. FOR MORE DETAILS AND FOR YOUR EXCAVATION PURPOSES, PLEASE CONTACT ONTARIO ONE CALL A MINIMUM OF 5 BUSINESS PRIOR TO YOUR EXCAVATION NEEDS.

Territory:ONE01 Layers:Hydro One Vintage:2024-01-12 Date:2024-01-24 1:09:52 PM

# LEGEND

OCTOBER 13, 2020
(WATER DISTRIBUTION)

WATERMAIN

ABANDONED WATERMAIN

WV00000 VALVE

WV00000 VALVE IN CHAMBER

REDUCER

HYDRANT

BLOW-OFF

AIR RELIEF VALVE (ARV)

SAMPLE STATION (ON MAIN)

SAMPLE SITE

PROPOSED FUTURE WATER SAMPLE LOCATIONS

AUTOMATIC FLUSHING STATION

671 PROPERTY FABRIC
MUNICIPAL HOUSENUMBERS

LAKESHORE

ROADWAY

# LEGEND

OCTOBER 13, 2020
(STORM DRAINAGE)

STORM SEWER

STORM CULVERT

ABANDONED STORM SEWER

OPEN DITCH

PAVED GUTTER

CONC CURB AND GUTTER

STORM MANHOLE

CB CATCHBASIN AND CATCHBASIN LEADER

DI DITCH INLET

SPECIAL INLET

STEEL GRATE

CATCHBASIN MANHOLE

MAJOR DRAINAGE AREAS

MINOR DRAINAGE AREAS

DRAINAGE SUB AREAS

671 PROPERTY FABRIC
MUNICIPAL HOUSENUMBERS

39.46m-375mmØ CONC. @ 0.50% STORM SEWER INFORMATION

HIGH POINT ROAD GRADE HIGHPOINT

OUTLET 36 LAKE OUTLET

F2 SWM FACILITY

LAKESHORE

ROADWAY

LAKE SIMCOE/LAKE COUCHICHING FLOOD PRONE AREA (BELOW 220.5m CGD)

(1991 UMA Engineering Ltd.) MILL CREEK REGIONAL FLOOD PLAIN

(1991 UMA Engineering Ltd.) MILL CREEK FILL LINE

# LEGEND

OCTOBER 13, 2020
(SANITARY SEWER)

SANITARY SEWER (WITH FLOW DIRECTION)

200mm DIA. FM SANITARY FORCEMAIN (WITH FLOW DIRECTION)

ABANDONED 200mm DIA. ABANDONED SANITARY SEWER

1651 SANITARY MANHOLE

100014 SAN.PS.14 SANITARY PUMPING STATION

PRIVPMP PRIVATE SANITARY PUMPING STATION

SANITARY SERVICE ZONES

SANITARY PUMPING ZONES

SANITARY DRAINAGE AREAS

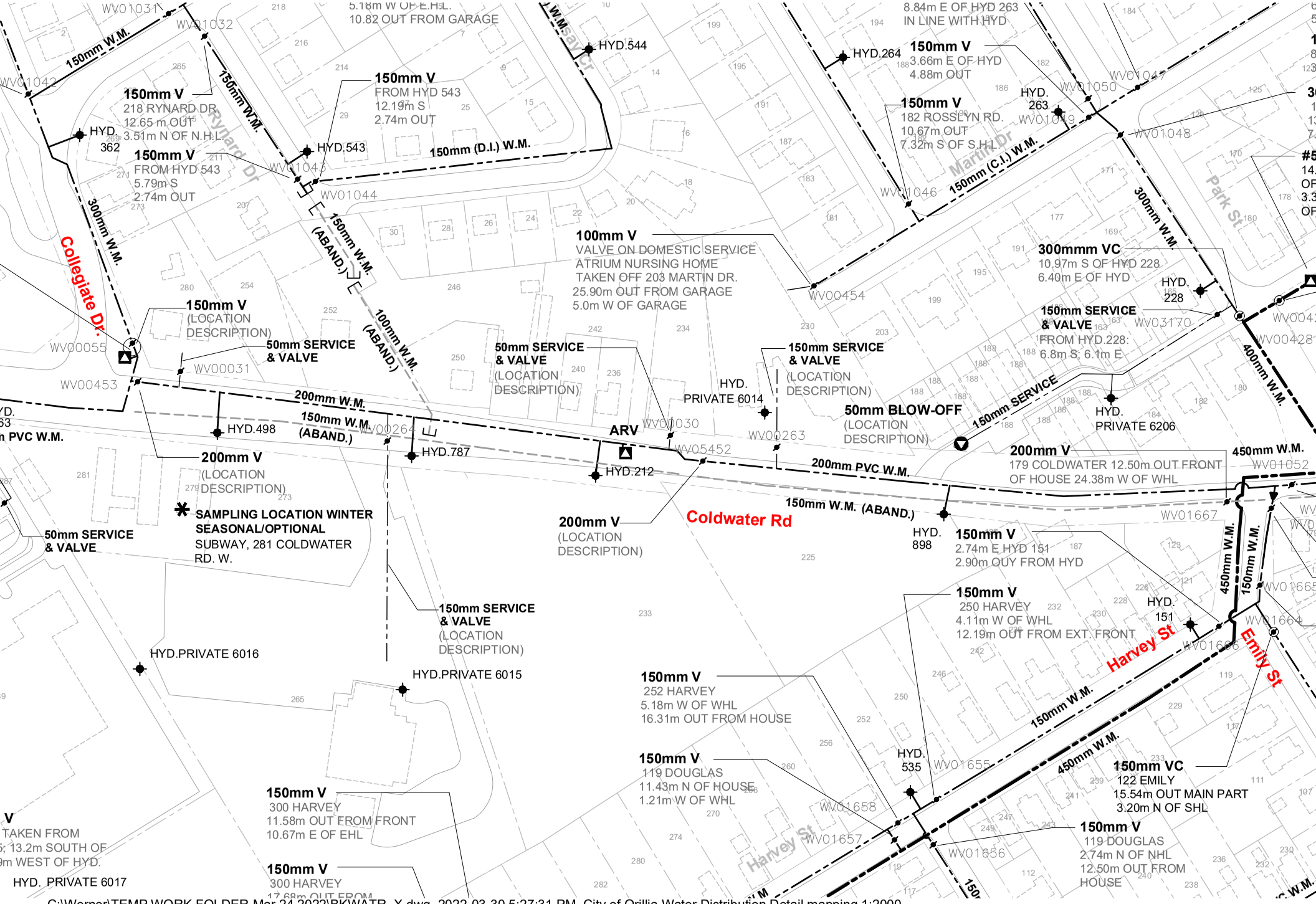
80.7m - 200mm DIA. AC SANITARY SEWER INFORMATION

ALL PIPES IN THIS AREA ARE 200mm DIA. SPECIAL NOTES

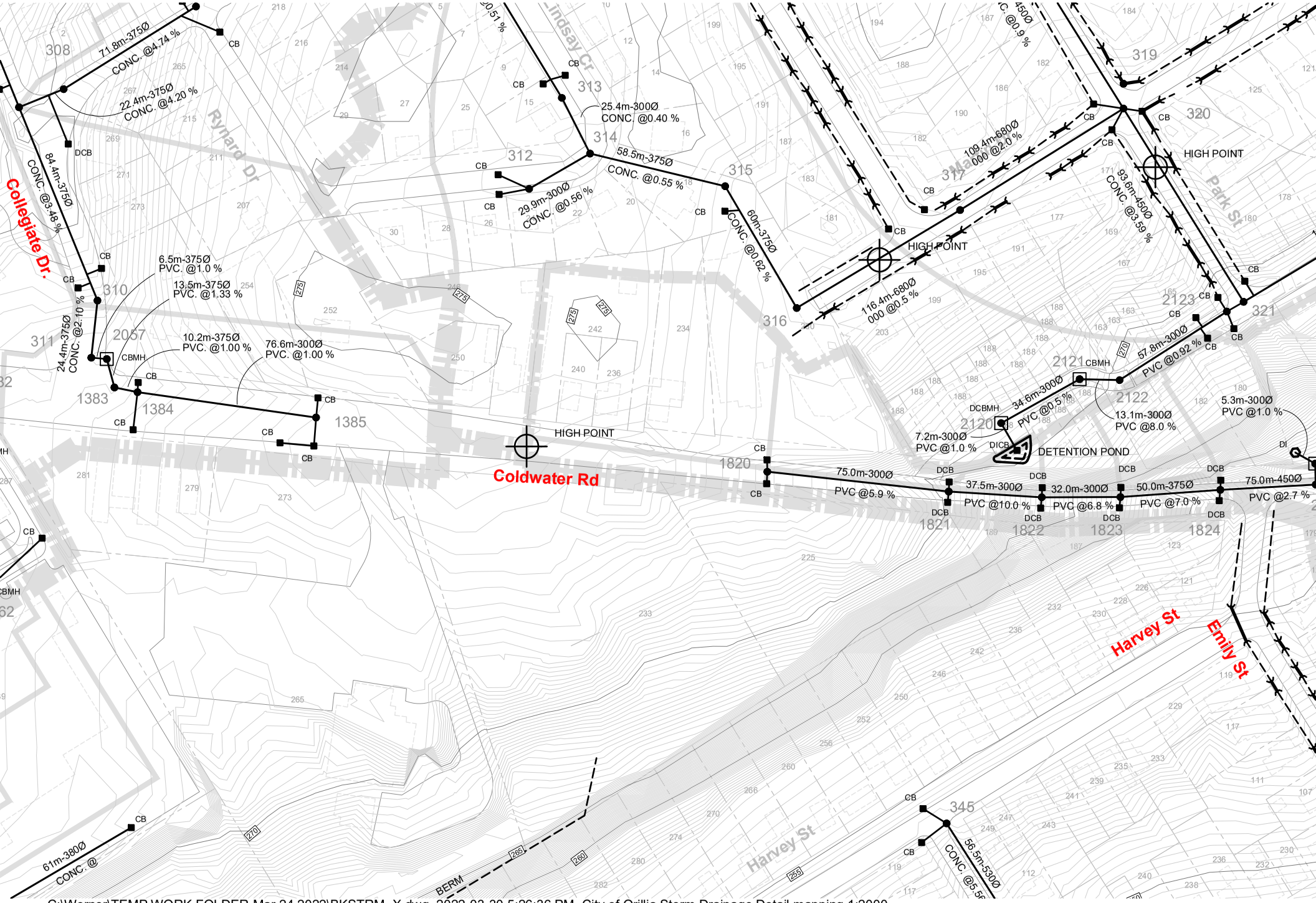
671 PROPERTY FABRIC
MUNICIPAL HOUSENUMBERS

LAKESHORE

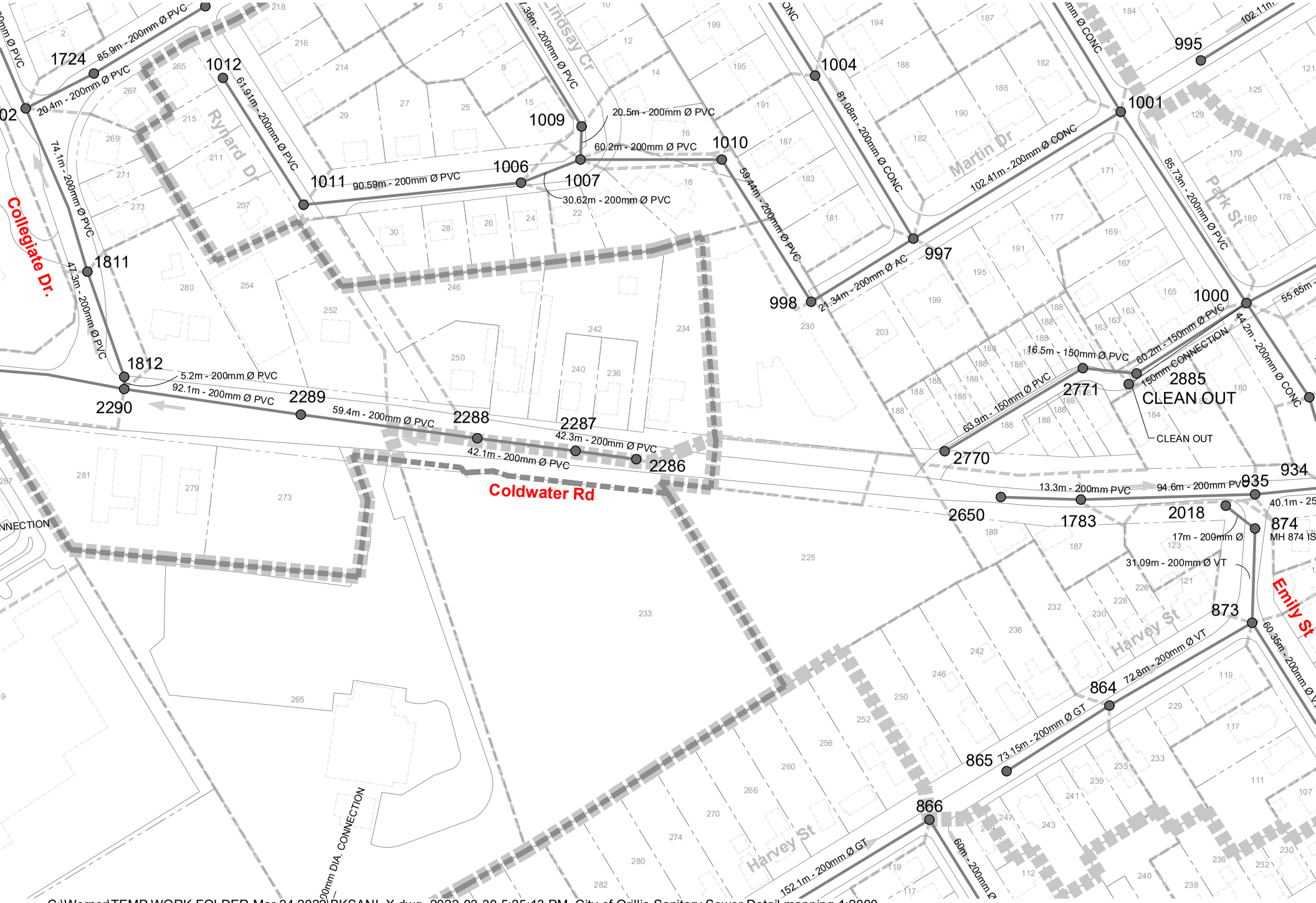
ROADWAY




C:\Werner\TEMP WORK FOLDER Mar 24 2022\BKWATR_X.dwg, 2022-03-30 5:27:31 PM, City of Orillia Water Distribution Detail mapping 1:2000




C:\Werner\TEMP WORK FOLDER Mar 24 2022\BKSTRM_X.dwg, 2022-03-30 5:26:36 PM, City of Orillia Storm Drainage Detail mapping 1:2000




C:\Werner\TEMP WORK FOLDER Mar 24 2022\BKSANI_X.dwg, 2022-03-30 5:25:13 PM, City of Orillia Sanitary Sewer Detail mapping 1:2000

W7-30-06

KEY PLAN
NOT TO SCALE

WESTMOUNT DRIVE

NOTTAWASAGA STREET

HOMEWOOD AVENUE

STA. 0+600

STA. 0+720

MATCH LINE

MATCH LINE

CONNECTED TO 100mmø W/M

MATCH TO EX. CURB

20.0m SWK. TRANSITION

REMOVED SECTION OF EX. 150mmø PIPE & CONNECTED TO STM. SEWER

CONNECTED TO EX. W/M

150mmø VALVE

EX. GAS MAIN LOWERED TO CROSS UNDER STM. SEWER

STM.MH.4A

1.5m CONC. SIDEWALK

300mmø W/M

300mmø WATERMAIN

300mmø VALVE P.E. BIG "O" BOSS 2000 STM. @ 1.0%

(R.I.V.) (REMOVE) 300mmø WATERMAIN (ABANDON)

100mmø WATERMAIN (ABANDON) 0+640

CB10 T/G 247.68 INV. 246.30

45° BENDS

59.3m–450mmø P.E. BIG "O" BOSS 2000 STM. @ 1.0%

(ADJUSTED) SAN. MH. MH 907

250mmø A/C SANITARY SEWER

0+620

0+660

(ADJUSTED) SAN. MH. MH 906

300mmø A/C SANITARY SEWER

13.4m–450mmø P.E. BIG "O" BOSS 2000 STM. @ 3.8%

STM.MH.6A

0+680

℄ CONSTRUCTION

℄ ROAD (CROWN)

(ADJUSTED) SAN. MH. MH 905

0+700

96.0m – 900mmø P.E. BIG "O" BOSS 2000 STM. @ 0.52%

PUP CB11 T/G 247.13 INV. 245.94

BURIED COAX CABLE (APPROX.)

CURB & GUTTER PER OPSD 600.040 (TYP.)

SEE DWG. 208032-PP4

SEE DWG. 208032-PP6

1.85m

3.4m

19.5m – 600mmø P.E. BIG "O" BOSS 2000 STM. @ 1.0%

400mmø WATERMAIN

450mmø WATERMAIN

60m – 525mmø P.E. BIG "O" BOSS 2000 STM. @ 4.75%

CBMH8A

STM.MH.5A

REPLACED FRAME & COVER

35.0m – 750mmø P.E. BIG "O" BOSS 2000 STM. @ 1.37%

8.0m–750mmø P.E. BIG "O" BOSS 2000 STM. @ 1.38%

CBMH10A

114.3mmø S. MP. CASMAIN (APPROX.)

OVERHEAD FIBRE OPTIC CABLE (APPROX.)

BURIED COAX CABLE (APPROX.)

1.5m CONC. SIDEWALK

20.0m SWK. TRANSITION EX. CURB

9.8m – 600mmø P.E. BIG "O" BOSS STM. @ 1.0%

c/w 75mm THICK STYROFOAM INSULATION PER DETAIL ON DWG DET1.

ADJUSTED

250mmø PVC SANITARY SEWER

450mmø CSP SANITARY SEWER

150mmø C.I. WATERMAIN

11.0m – 600mmø P.E. BIG "O" BOSS 2000 STM. @ 1.0%

BELL-1 BURIED CABLE, 62m 1-CONDUIT (APPROX.)

CONNECTED EX. CMP TO DCB5

DCB5 T/G 248.10 INV. 246.67

CURB TERMINATION AS PER OPSD. 608.010 (TYP.)

5m – 525mmø P.E. BIG "O" BOSS 2000 STM. @ 2%

CBMH9 1200ø T/G 248.05 E.INV. 246.57 N.INV. 246.58

EX. CSP TIED INTO CBMH9

RESIDENTIAL DRIVEWAY REINSTATEMENT 150mm GRANULAR 'A' 50mm HL3 ASPHALT (TYP.)

150mmø PVC DR28 SAN. SERVICE. CONNECTED TO EX. 300mmø SAN. SEWER INV. @ ± 245.15

50mmø WATER SERVICE CONNECTED TO EX. 450mmø WATERMAIN

105

103

101

99

95

252

251

250

249

248

247

246

245

244

243

242

L = 68m
K = 12.04
A.G. = 5.65%
PVI Sta. =621.24
PVI Elev. =247.87

STM.MH.4A
STA. 0+603 o/s 6.6m LT.
1200mmø, OPSD 701.010
T/G 249.12
N. INV. 247.13
S. INV. 246.54

INTERSECTION HOMEWOOD AVENUE

INTERSECTION NOTTAWASAGA STREET

60.0m – 525mmø P.E. BIG "O" BOSS 2000 STM. @ 4.75%

19.5m – 600mmø P.E. BIG "O" BOSS 2000 STM. @ 1.4%

75mm THICK STYROFOAM INSULATION OVER 600mmø STM. SEWER SEE DETAIL ON DWG. DET1.

STM.MH.5A
STA. 0+637.5 o/s 5.25m RT.
1800mmø, OPSD 701.012
T/G ELEV. 247.82
N. INV. 246.26
S. INV. 245.84
W. INV. 246.46

EVCS: 0+655.241
EVCE: 247.648

35.0m – 750mmø P.E. BIG "O" BOSS 2000 STM. @ 1.37%

75mm THICK STYROFOAM INSULATION OVER 750mmø STM. SEWER SEE DETAIL ON DWG. DET1.

59.76m @ –0.65%

23m @ –1.28%

CBMH10A
STA. 0+672 o/s 5.25m RT.
1800mmø, OPSD 701.012
T/G ELEV. 247.47
S.E. INV. 245.35
N. INV. 245.36

13.4m–450mmø P.E. BIG "O" BOSS 2000 STM. @ 3.8%

75mm THICK STYROFOAM INSULATION OVER 750mmø STM. SEWER SEE DETAIL ON DWG. DET1.

–0.65%

℄ ROAD (CROWN) PROFILE

PVI STA = 0+715

PVI ELEV = 247.260

75mm THICK STYROFOAM INSULATION OVER 900mmø STM. SEWER SEE DETAIL ON DWG. DET1.

96.0m – 900mmø P.E. BIG "O" BOSS 2000 STM. @ 0.52%

ABANDONED 100mmø WATERMAIN

CBMH8A
STA. 0+618 o/s 5.25m RT.
1500mmø, OPSD 701.011
T/G ELEV. 248.40
N. INV. 246.57
S. INV. 246.54

400mmø WATERMAIN

300mmø WATERMAIN

59.3m – 450mmø P.E. BIG "O" BOSS 2000 STM. @ 1.0%

250mmø SAN. SEWER

450mmø WATERMAIN

SANITARY MANHOLE

VALVE CHAMBER

VALVE CHAMBER

VALVE CHAMBER

400mmø WATERMAIN

SANITARY MANHOLE

300mmø SAN. SEWER

300mmø SAN. SEWER

SANITARY MANHOLE

CBMH9A
STA. 0+662.3 o/s 6.6m LT.
1200mmø, OPSD 701.010
T/G 247.49
N. INV. 245.93
S.W. INV. 245.90

STM.MH.6A
STA. 0+675 o/s 2.5m RT.
2400mmø, OPSD 701.013
T/G ELEV. 247.43
S. INV. 245.23
N.W. INV. 245.24
N.E. INV. 245.39

450mmø WATERMAIN

300mmø SAN. SEWER

249.275 | 248.793 | 248.393 | 248.077 | 247.844 | 247.694 | 247.648 | 247.618 | 247.488 | 247.358 | 247.260 | 247.198

0+600 | 0+620 | 0+640 | 0+660 | 0+680 | 0+700 | 0+720

PLOT 1=1

NOTES

TBM ELEV 249.042
TOP NUT OF FIRE HYDRANT ON SOUTHWEST CORNER OF WESTMOUNT DRIVE AND HOMEWOOD AVENUE.

W7-30-06

Plotted by: RCHAPMAN on January 20, 2011 at 11:13am
File: V:\208032\dwg\RECORD DRAWINGS\208032-Option-RD.DWG Layout: PP5RD

**RECORD DRAWING**

| | | | |
|---|---|---|---|
| COMPILED BY | N.A.M. | DATE | OCT. 2009 |
| CHECKED BY | T.F.H. | DATE | OCT. 2009 |
| DRAWN BY | J.R.C. | DATE | APR. 2010 |
| CHECKED BY | T.F.H. | DATE | APR. 2010 |

| NO. | REVISIONS | DATE | INITIAL |
|---|---|---|---|
| 6. | RECORD DRAWNGS | FEB. 2010 | T.F.H. |
| 5. | ISSUED FOR TENDER | MAR. 2009 | T.F.H. |
| 4. | REVISED AS PER CITY'S REVIEW COMMENTS | FEB. 2009 | T.F.H. |
| 3. | ISSUED FOR FINAL REVIEW | JAN. 2009 | T.F.H. |
| 2. | ISSUED FOR MOE APPROVAL | JAN. 2009 | T.F.H. |
| 1. | REVISED AS PER CITY'S REVIEW COMMENTS | DEC. 2008 | T.F.H. |

Not Valid Unless Signed And Dated

ORIGINALLY SIGNED BY W.D. BUTLER, P.ENG. MAR. 05 2009

SCALE: H: 1:200 V: 1:50
DESIGN: C.F.T.
DRAWN: J.D.C.
CHECKED: W.D.B.
DATE: JUNE 2008

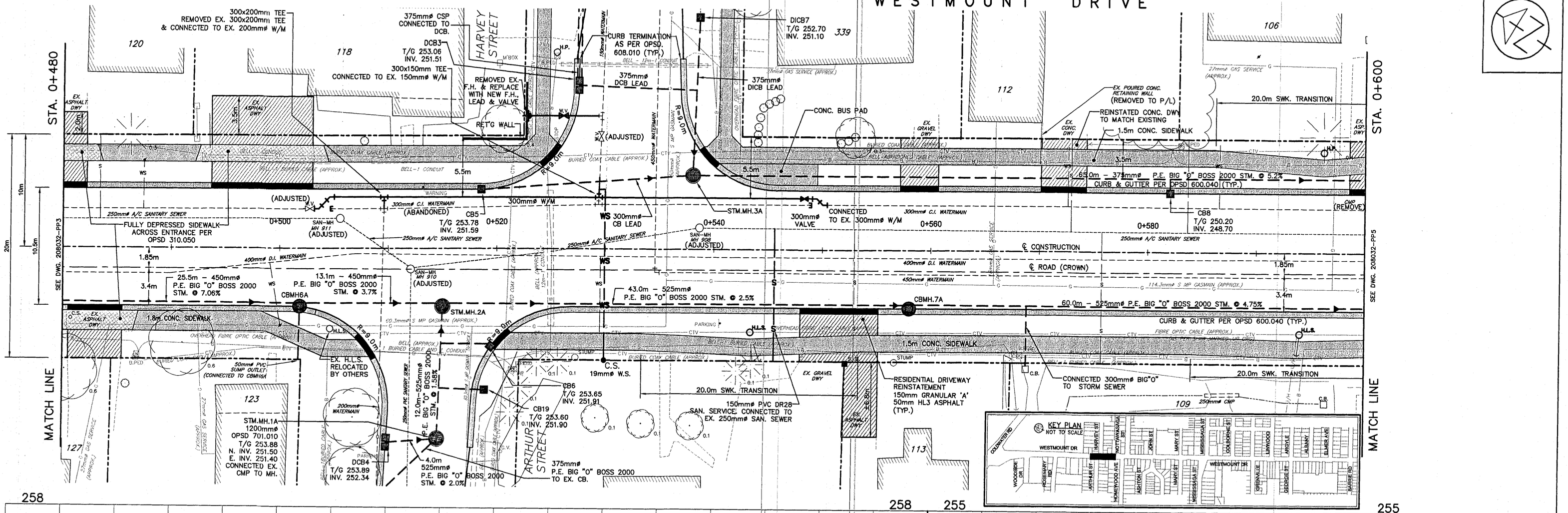
# CITY OF ORILLIA
## WESTMOUNT DRIVE ROAD RECONSTRUCTION

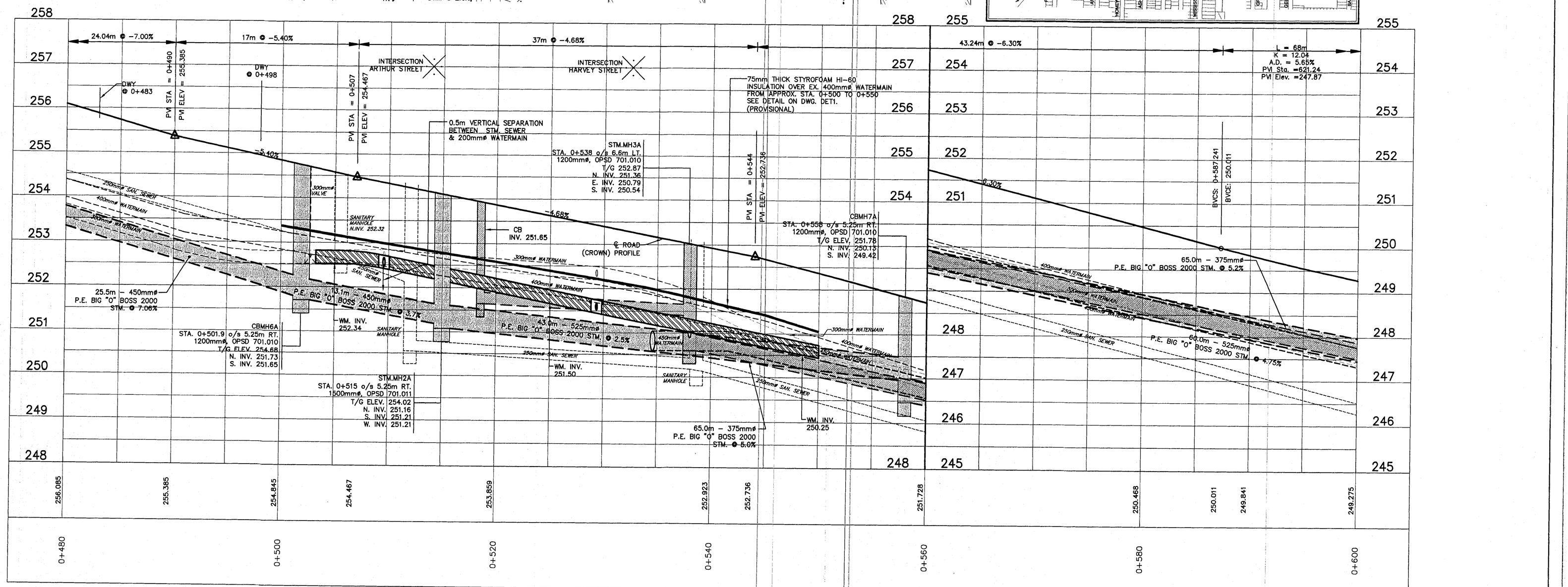
PLAN AND PROFILE
WESTMOUNT DRIVE
STA 0+600 TO 0+720

Ainley GROUP CONSULTING ENGINEERS PLANNERS

CONTRACT RWS-08-27 | DWG. No. 208032-PP5RD

W7-30-05




PLOT 1=1

NOTES

TBM ELEV 275.831
SPIKE IN SOUTH FACE OF HYDRO POLE LOCATED ON THE EAST SIDE OF WESTMOUNT DRIVE APPROX. 20m NORTH OF ROSEMARY ROAD.

W7-30-05

Plotted by: RCHAPMAN on March 10, 2011 at 4:12pm
File: V:\208032\dwg\RECORD DRAWINGS\208032-Oplan-RD.DWG Layout: PP4RD

**RECORD DRAWING**

| | | | |
|---|---|---|---|
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| CHECKED BY | T.F.H. | DATE | OCT. 2009 |
| DRAWN BY | J.R.C. | DATE | APR. 2010 |
| CHECKED BY | T.F.H. | DATE | APR. 2010 |

| NO. | REVISIONS | DATE | INITIAL |
|---|---|---|---|
| 6. | RECORD DRAWINGS | FEB. 2010 | T.F.H. |
| 5. | ISSUED FOR TENDER | MAR. 2009 | T.F.H. |
| 4. | REVISED AS PER CITY'S REVIEW COMMENTS | FEB. 2009 | T.F.H. |
| 3. | ISSUED FOR FINAL REVIEW | JAN. 2009 | T.F.H. |
| 2. | ISSUED FOR MOE APPROVAL | JAN. 2009 | T.F.H. |
| 1. | REVISED AS PER CITY'S REVIEW COMMENTS | DEC. 2008 | T.F.H. |

Not Valid Unless Signed And Dated

ORIGINALLY SIGNED BY W.D. BUTLER, P.ENG. MAR. 05 2009

| | |
|---|---|
| SCALE: H: 1:200 V: 1:50 | |
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| DRAWN: J.D.C. | |
| CHECKED: W.D.B. | |
| DATE: JUNE 2008 | |

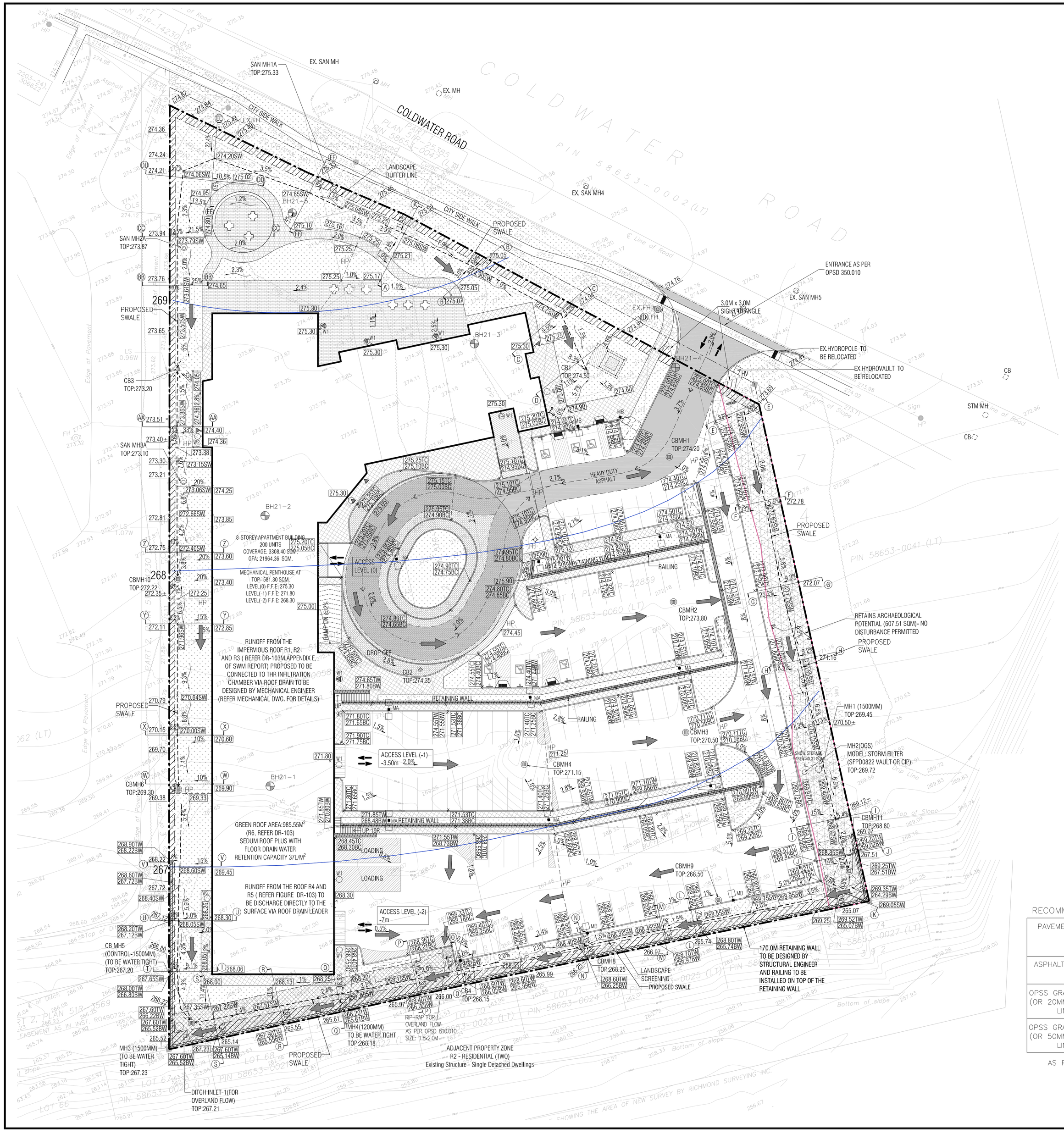
CITY OF ORILLIA
WESTMOUNT DRIVE
ROAD RECONSTRUCTION

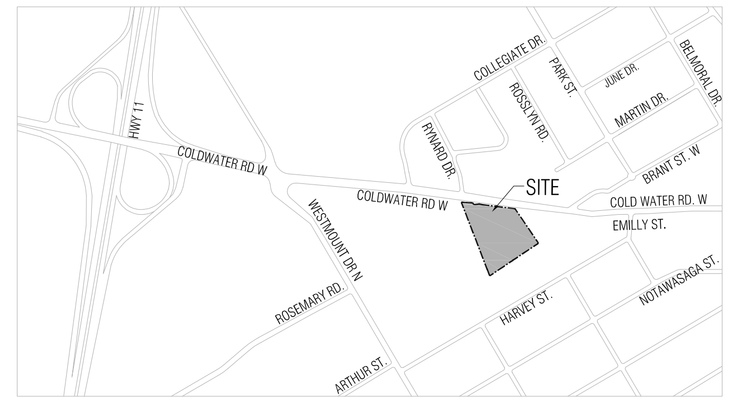
PLAN AND PROFILE
WESTMOUNT DRIVE
STA. 0+480 TO 0+600

Minley GROUP CONSULTING ENGINEERS PLANNERS

CONTRACT RWS-08-27 | DWG. No. 208032-PP4RD

# Appendix L
Civil Plans




## KEY PLAN
SCALE -NTS

GENERAL NOTES

1. READ THIS DRAWING IN CONJUNCTION WITH ARCHITECTURAL, MECHANICAL AND LANDSCAPING PLANS.
2. ALL WORK SHALL BE CARRIED OUT IN COMPLIANCE WITH THE APPLICABLE HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS.
3. ALL WORK, MATERIALS AND CONSTRUCTION METHODS TO CONFORM WITH THE LATEST STANDARDS, SPECIFICATIONS, POLICIES, REGULATIONS, GUIDELINES AND LAWS FOR THE CITY, THE ONTARIO BUILDING CODE (OBC), MINISTRY OF THE ENVIRONMENT (MOE), ONTARIO PROVINCIAL STANDARD DRAWINGS AND SPECIFICATIONS (OPSD AND OPSS), THE ENVIRONMENTAL PROTECTION ACT AND THE WATER RESOURCES ACT. THE MINISTRY OF TRANSPORTATION STANDARDS WILL APPLY WHERE REQUIRED.
4. THE INFORMATION SHOWN FOR EXISTING UTILITIES WAS COMPILED FROM LOCATES' INFORMATION AND RECORD DRAWINGS FROM THE CITY. THE INFORMATION IS SHOWN FOR GENERAL INFORMATION ONLY AND THE ACCURACY OR COMPLETENESS OF THE PROVIDED INFORMATION HAS NOT BEEN CONFIRMED. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING AND PROTECTING ALL UTILITIES DURING CONSTRUCTION. ALL EXISTING UTILITIES MUST BE LOCATED AND VERIFIED BY THE CONTRACTOR PRIOR TO COMMENCEMENT OF WORK. ANY VARIANCE IS TO BE IMMEDIATELY REPORTED TO THE ENGINEER. LOST TIME DUE TO FAILURE OF THE CONTRACTOR TO CONFIRM UTILITY LOCATIONS AND NOTIFY THE ENGINEER OF POSSIBLE CONFLICTS PRIOR TO CONSTRUCTION WILL BE AT THE CONTRACTOR'S EXPENSE.
5. THIS PLAN SHOULD BE READ IN CONJUNCTION WITH ALL OTHER CONSULTANTS' PLANS. ANY DISCREPANCIES SHALL BE CLARIFIED PRIOR TO CONSTRUCTION. INFORMATION RELATED TO DIMENSIONS FOR PRIVATE ROADS, PARKING, CURBING, BUILDING LOCATION AND SETBACKS SHALL BE TAKEN FROM THE SITE PLAN PREPARED BY THE ARCHITECT.
6. ALL DIMENSIONS AND ELEVATIONS TO BE VERIFIED PRIOR TO CONSTRUCTION AND ANY DISCREPANCIES FOUND PRIOR TO OR DURING CONSTRUCTION SHALL BE CLARIFIED WITH THE ENGINEER.

INSPECTIONS:

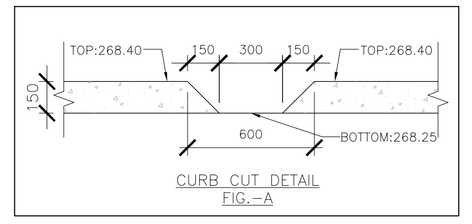
7. ALL WORK IN THE CITY'S RIGHT OF WAY AND EASEMENTS IS TO BE INSPECTED BY THE CITY PRIOR TO BACKFILLING. ALL WORK RELATING TO WATERMAINS AND SEWERS TO BE INSPECTED BY THE CITY AS PER THE SITE PLAN AGREEMENT.
8. ALL DISTURBED GRASSED AREAS TO BE RESTORED WITH MINIMUM 200MM TOPSOIL AND NO. 1 NURSERY SOD.
9. THE CONTRACTOR AGREES NOT TO MAKE A MATERIAL CHANGE OR CAUSE A MATERIAL CHANGE TO BE MADE TO A PLAN, SPECIFICATION, DOCUMENT OR OTHER INFORMATION, ON THE BASIS OF WHICH THIS DRAWING WAS APPROVED BY THE CITY, WITHOUT NOTIFYING, FILING DETAILS WITH AND OBTAINING WRITTEN AUTHORIZATION OF THE MUNICIPAL AND PROJECT ENGINEER.
10. SITE SPECIFIC DETAILED DESIGN AND PLAN PREPARED BY TEAM OF EXPERT ENGINEERS FROM N ENGINEERING INC. BASED ON THROUGH CONSULTATION WITH ALL AUTHORITIES OF JURISDICTION. IT IS MANDATORY THE PROJECT CONSTRUCTION BE SUPERVISED BY N ENGINEERING INC TO ENSURE THE ACCURACY, QUALITY OF EXECUTION OF THE PLAN AND ENSURE THE COMPLETION OF THE PROJECT
11. THE DEVELOPER/OWNER AGREES ALL STORMWATER MANAGEMENT WORK, WATER SERVICING WORK AND SANITARY SEWER WORK INSIDE THE BOUNDARY OF THE SITE IS TO BE INSPECTED BY N ENGINEERING INC. PRIOR TO BACKFILLING.
12. ALL WORK RELATING TO WATERMAINS AND SEWERS TO BE INSPECTED BY N ENGINEERING AS PER APPROVED PLANS BY THE CITY.
13. WATER & SANITARY TO BE LIVE TAPPED & INSTALLED BY AN APPROVED CONTRACTOR.

**CAUTION:**

**CONTRACTOR TO DETERMINE LOCATION AND INVERTS OF EXISTING UTILITIES PRIOR TO CONSTRUCTION. IF THEIR IS ANY DISCREPANCY. THE CONTRACTOR IS TO NOTIFY THE ENGINEER PROMPTLY.**

LEGEND

- PROPERTY LINE
- DEVELOPMENT LIMIT
- PROPOSED CONCRETE CURB
- 1M D/C — PROPOSED DEPRESSED CONCRETE CURB
- LANDSCAPED AREA
- CONCRETE WALKWAY/SIDEWALK
- PAINTED LINE
- BARRIER FREE PARKING
- MAIN ENTRANCE
- OVER HEAD DOOR
- RETAINING WALL / CONCRETE TOE WALL
- FFE — FINISHED FLOOR ELEVATION
- HP — EX. HYDRO POLE
- UP — UTILITY POLE
- EX.CB — EXISTING CATCH BASIN
- CB — PROPOSED CATCH BASIN MANHOLE
- DCBMH — PROPOSED DOUBLE CATCH BASIN MANHOLE
- CBMH — PROPOSED CATCH BASIN MANHOLE
- EX.MH — EXISTING STORM MANHOLE
- MH — PROPOSED STORM MANHOLE
- EX.MH — EXISTING SANITARY MANHOLE
- MH1A — PROPOSED SANITARY MANHOLE
- EXISTING FIRE HYDRANT
- PROPOSED FIRE HYDRANT
- EX.WV — EXISTING WATER VALVE
- WV — PROPOSED WATER VALVE
- OVERLAND FLOW ROUTE
- 173.52 — EXISTING ELEVATION TO REMAIN
- 174.00 — EXISTING ELEVATION
- 173.90TC — PROPOSED TOP/CURB ELEVATION
- 173.30 — PROPOSED ELEVATION
- x=2% — PROPOSED SURFACE SLOPE
- H.P — HIGH POINT (DRAINAGE DIVIDE)
- 100 YR. STORM HWL AREA
- HV — HYDRO VAULT




CURB CUT DETAIL
FIG.-A

RECOMMENDED PAVEMENT STRUCTURE

| PAVEMENT LAYER | COMPACTION REQUIREMENTS | LIGHT DUTY PAVEMENT (PARKING FOR CARS) | HEAVY DUTY PAVEMENT (ACESS ROAD, FIRE ROUTES & PARKING FOR DELIVERY TRUCKS) |
|---|---|---|---|
| ASPHALTIC CONCRETE | 92.0% MAXIMUM RELATIVE DENSITY(MRD) | 40MM HL 3<br>80MM HL 8 | 40MM HL 3<br>80MM HL 8 |
| OPSS GRANULAR 'A' BASE (OR 20MM CRUSHER RUN LIMESTONE) | 100% SPMDD* | 150MM | 150MM |
| OPSS GRANULAR 'B' BASE (OR 50MM CRUSHER RUN LIMESTONE) | 100% SPMDD* | 250MM | 350MM |

AS PER GEOTECHNICAL REPORT PREPARED BY PALMER DATED JAN 28,2022


**n Engineering Inc**
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Richmond Hill, Ontario. L4B 3J9
T : 4 1 6 . 2 5 6 . 9 7 4 1
E: info@nengineering.com
www.nengineering.com


LICENSED PROFESSIONAL ENGINEER
A.S.ZIAUDDIN
100233432
10JUNE2026
PROVINCE OF ONTARIO

N
GRID NORTH
PROJECT NORTH

| No. | Date | Version | Dwn. |
|---|---|---|---|
| 7. | 10 JUNE 2026 | ISSUED FOR SPA -5 | LU |
| 6. | 05 FEB 2026 | ISSUED FOR SPA -4 | LU |
| 5. | 18 DEC 2024 | ISSUED FOR SPA -3 | SP |
| 4. | 15 MAY 2024 | ISSUED FOR SPA -2 | SP |
| 3. | 15 JAN 2024 | ISSUED FOR CO-ORDINATION | AB |
| 2. | 01 NOV 2022 | ISSUED FOR SPA-1 | EH |
| 1. | 17JUNE2022 | DRAFT FOR REVIEW | EH |


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LEGAL DESCRIPTION

PART OF LOT 7, CONCESSION 4 (FORMERLY IN THE TOWNSHIP OF SOUTH ORILLIA ) CITY OF ORILLIA COUNTY OF SIMCOE

BEARING NOTE

BEARINGS ARE UTM GRID, BY REAL TIME NETWORK (TOPNET) OBSERVATIONS, UTM ZONE 17, NAD83 (ORIGINAL) (1997.0).

BENCHMARK NOTE

ELEVATIONS HEREON ARE GEODETIC IN ORIGIN AND WERE DERIVED FROM FIRE HYDRANT NO. 212 HAVING A VALUE OF 275.647 FROM INFORMATION SUPPLIED BY THE CITY OF ORILLIA ENGINEERING DEPARTMENT.

SURVEYOR INFORMATION

SURVEYOR INFORMATION TAKEN FROM YOUNG & YOUNG SURVEYING INC. 2 HOLLAND DRIVE, UNIT 5, BOLTON ON. L7E 1E1

Email: info@youngsurveying.ca
www.youngsurveying.ca

APPLICANT

n Architecture Inc
208– 9120 LESLIE STREET,
RICHMOND HILL, ON., L4B 3J9
T: 416. 256. 9741
E: Info@narchitecture.com
www.narchitecture.com

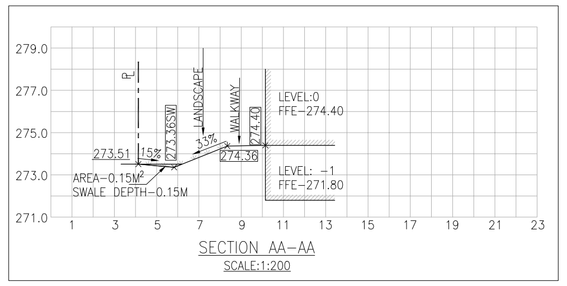
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# CONDOMINIUM 233,249,261 COLDWATER ROAD, WEST, ORILLIA

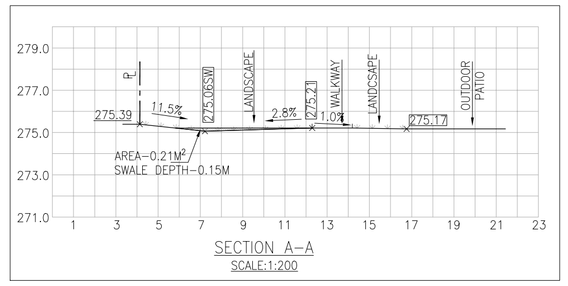
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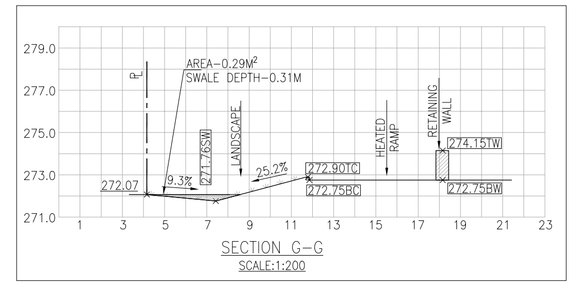
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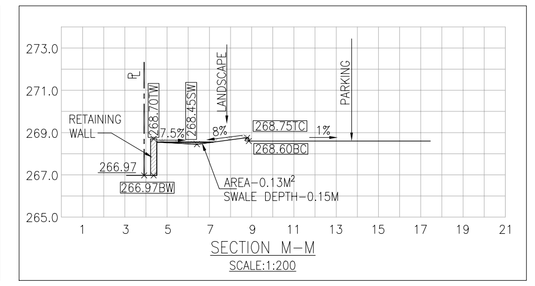

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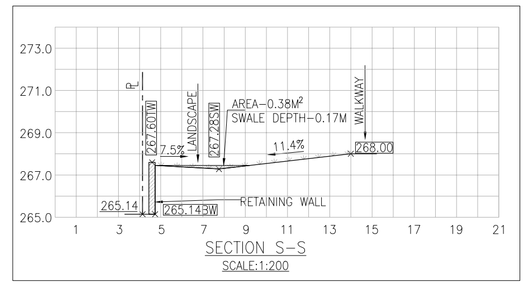

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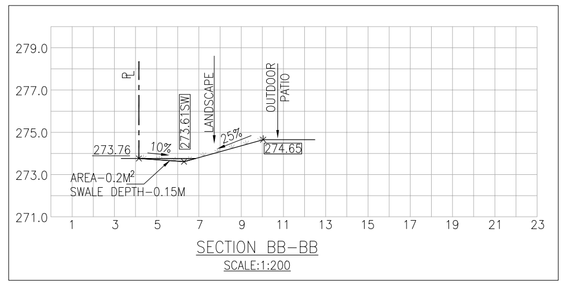

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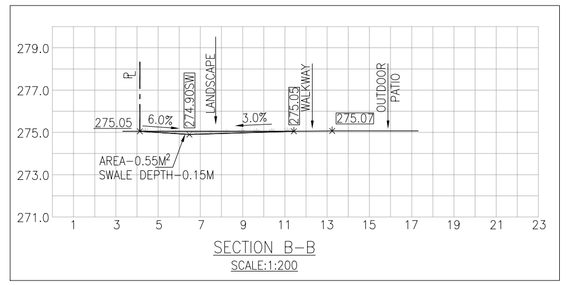

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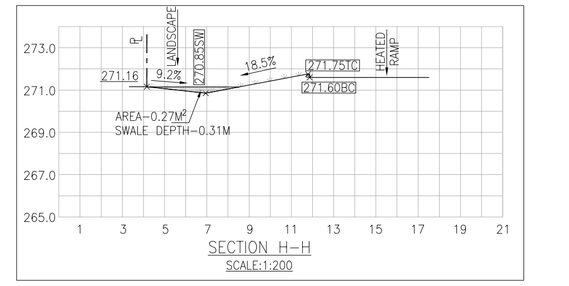

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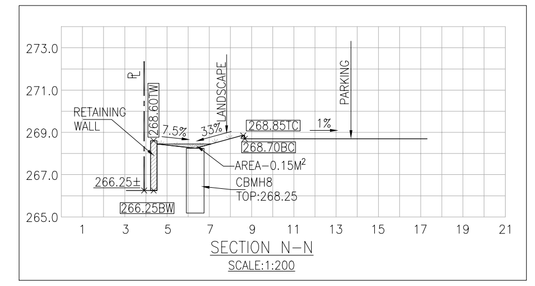

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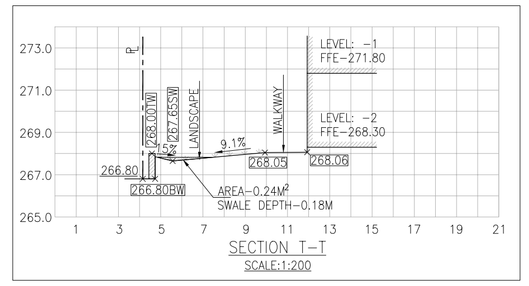

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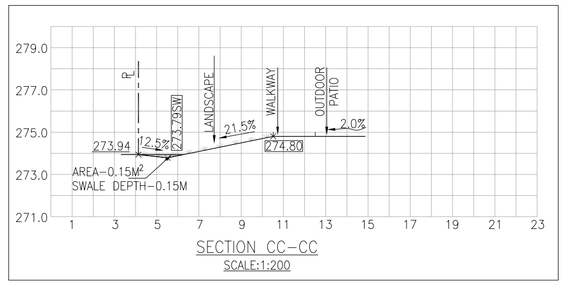

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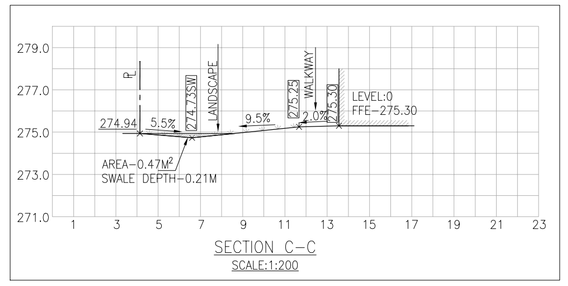

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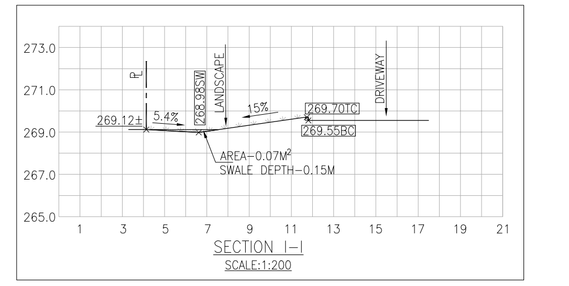

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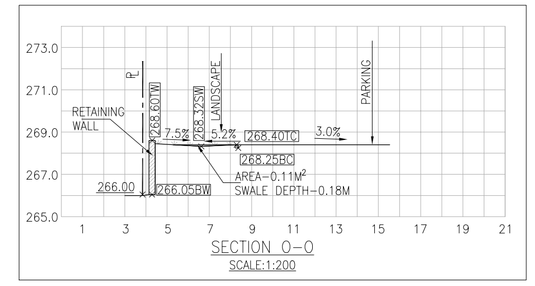

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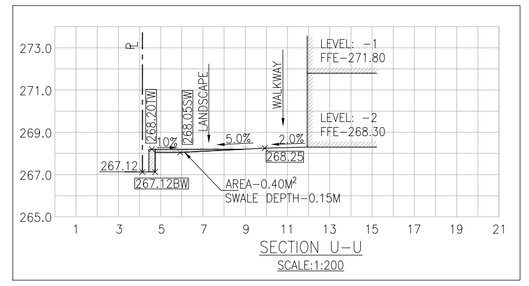

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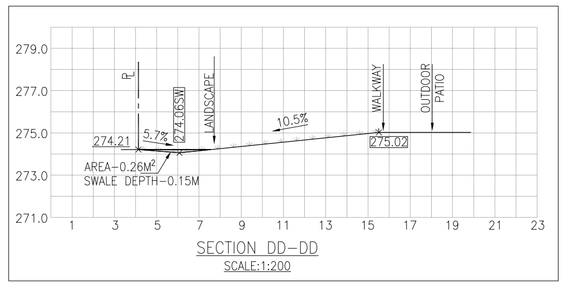

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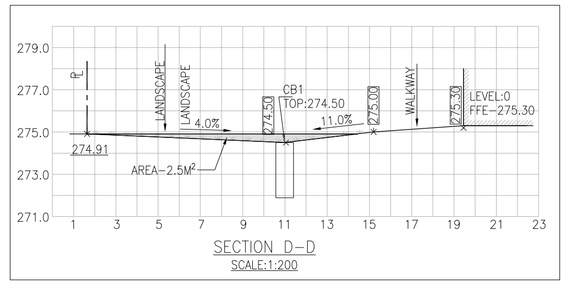

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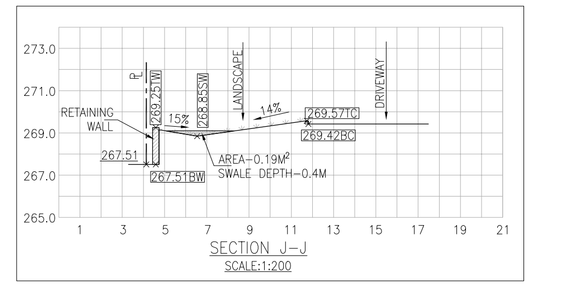

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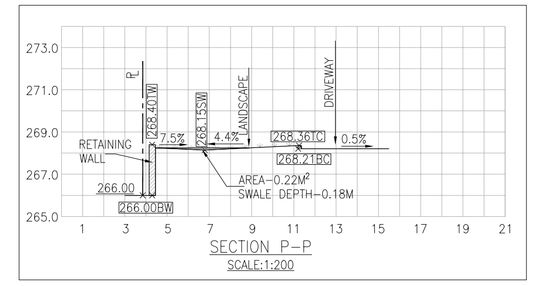

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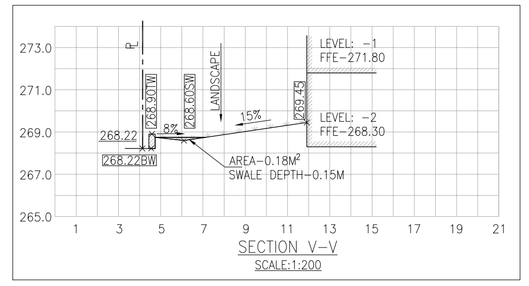

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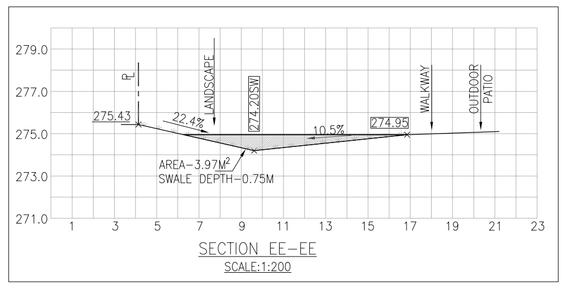

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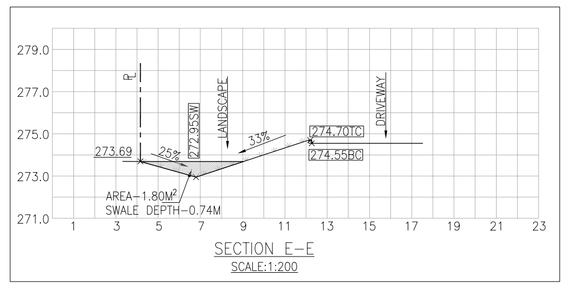

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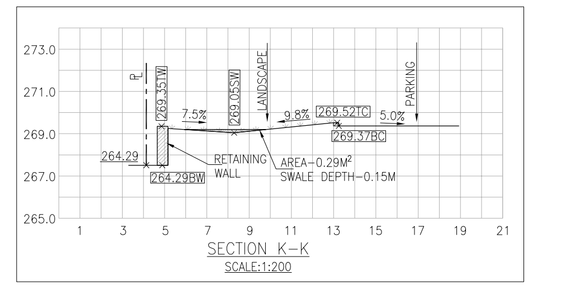

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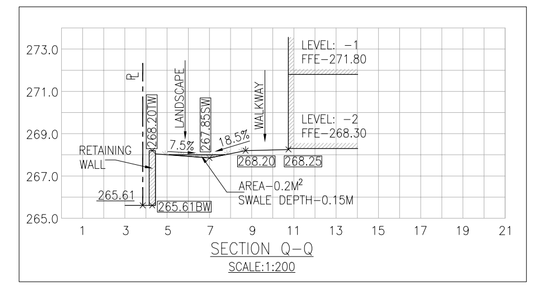

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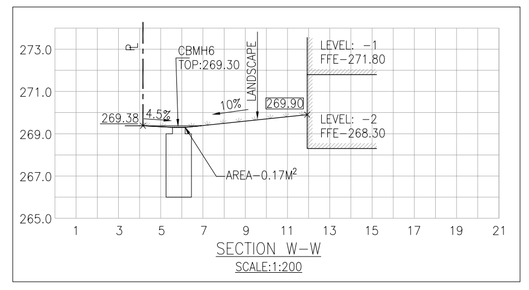

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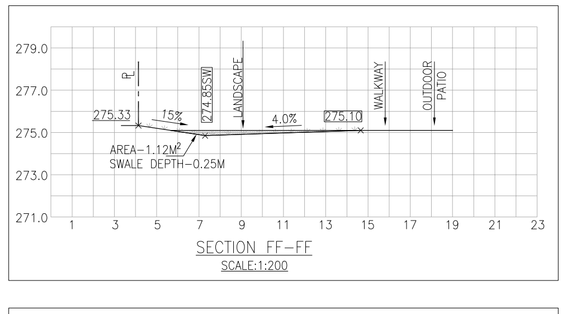

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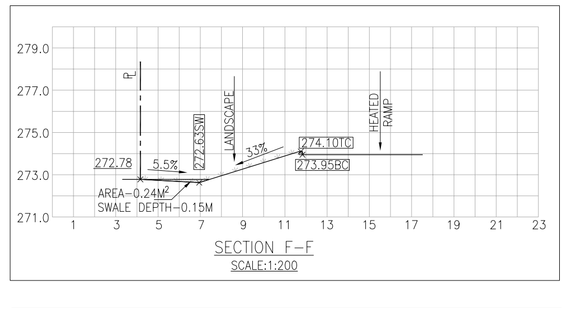

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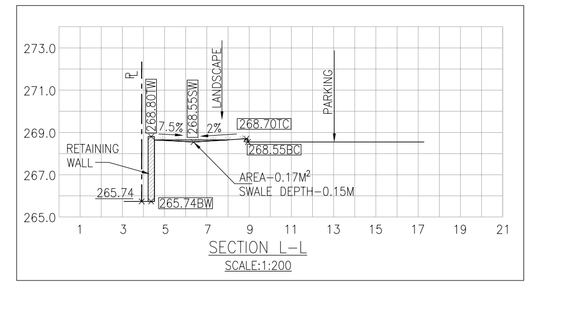

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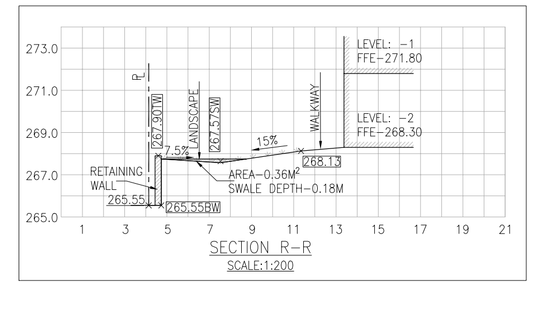

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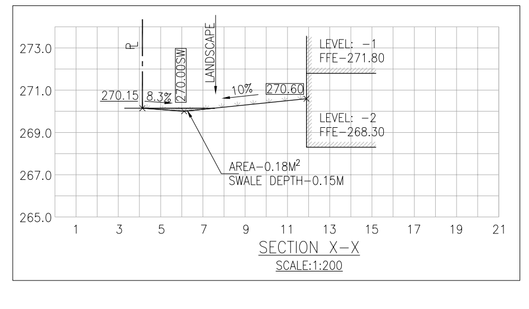

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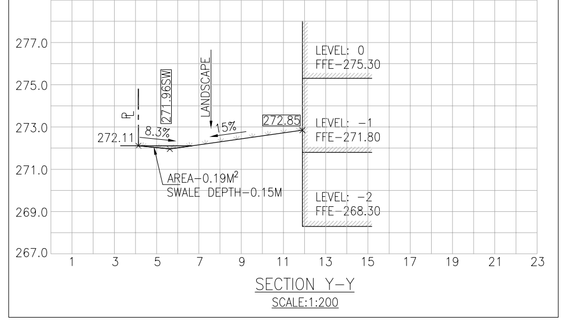

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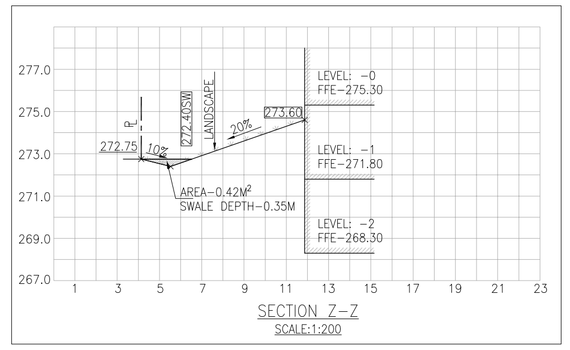

SECTION R–R
SCALE:1:200




SECTION X–X
SCALE:1:200




SECTION Y–Y
SCALE:1:200




SECTION Z–Z
SCALE:1:200


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LICENCED PROFESSIONAL ENGINEER
A.S.ZIAUDDIN
100233432
10JUNE2026
PROVINCE OF ONTARIO

| No. | Date | Version | Dwn. |
|---|---|---|---|
| 7. | 10 JUNE 2026 | ISSUED FOR SPA -5 | LU |
| 6. | 05 FEB 2026 | ISSUED FOR SPA -4 | LU |
| 5. | 18 DEC 2024 | ISSUED FOR SPA -3 | SP |
| 4. | 15 MAY 2024 | ISSUED FOR SPA -2 | SP |
| 3. | 15 JAN 2024 | ISSUED FOR CO-ORDINATION | AB |
| 2. | 01 NOV 2022 | ISSUED FOR SPA-1 | EH |
| 1. | 17JUNE2022 | DRAFT FOR REVIEW | EH |


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PROJECT:

**CONDOMINIUM 233,249,261 COLDWATER ROAD, WEST, ORILLIA**

DRAWING TITLE:

**CROSS SECTIONS**

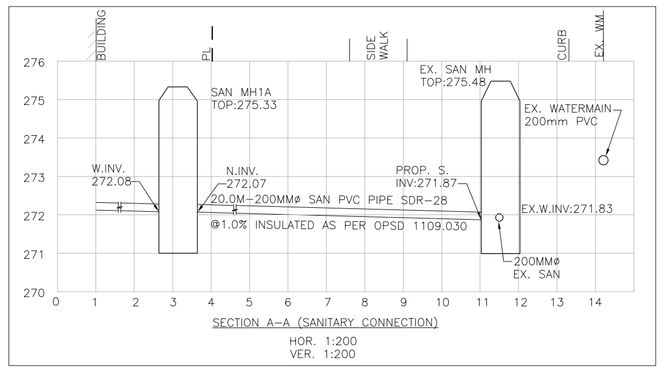
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|---|---|
| DRAWN BY: AB | DATE: 29 MAR. 2022 |
| CHECKED BY: AZ | SCALE: 1:350 |
| PROJECT NO.: **21-23** | DRAWING NO.: **C1a** |

CAUTION:

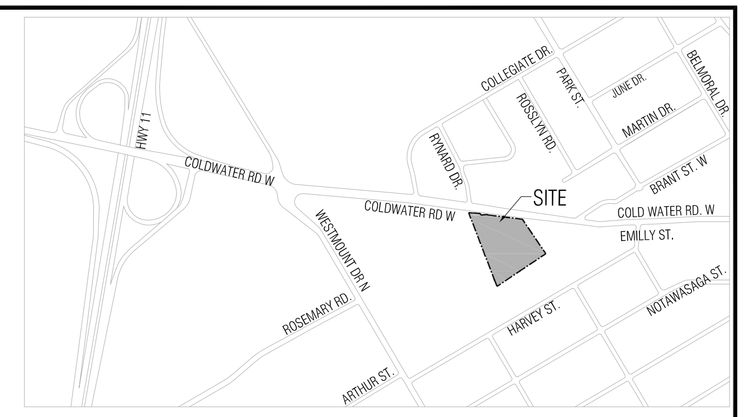
CONTRACTOR TO DETERMINE LOCATION AND INVERTS OF EXISTING UTILITIES PRIOR TO CONSTRUCTION. IF THEIR IS ANY DISCREPANCY, THE CONTRACTOR IS TO NOTIFY THE ENGINEER PROMPTLY.

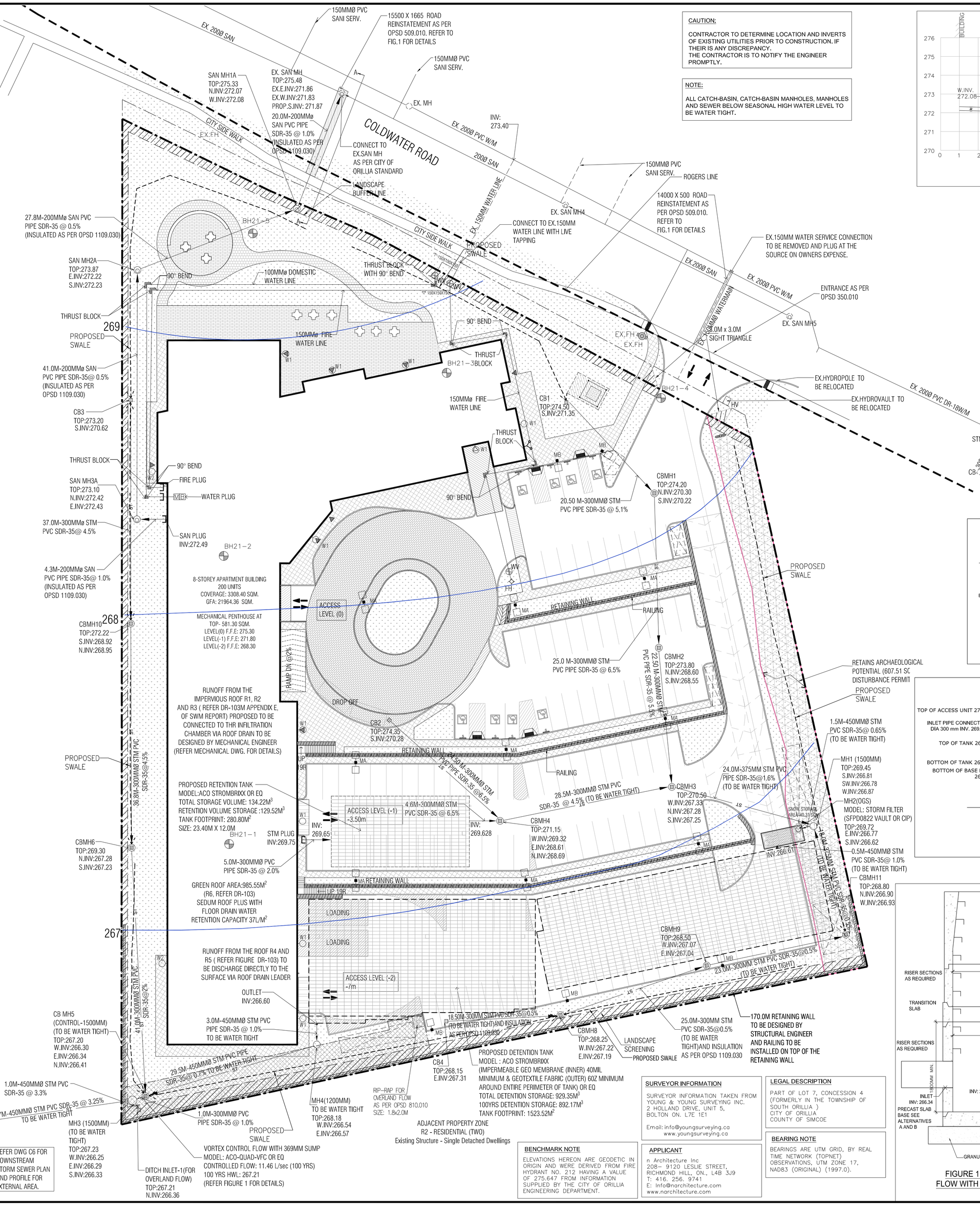
NOTE:

ALL CATCH-BASIN, CATCH-BASIN MANHOLES, MANHOLES AND SEWER BELOW SEASONAL HIGH WATER LEVEL TO BE WATER TIGHT.

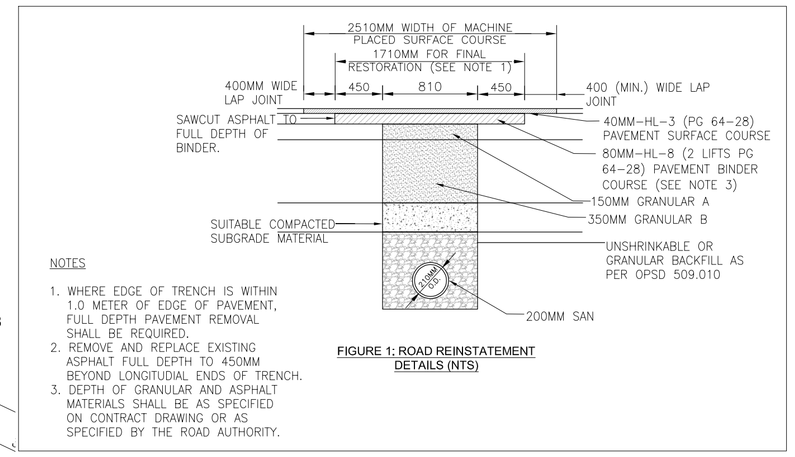



SECTION A–A (SANITARY CONNECTION)
HOR. 1:200
VER. 1:200



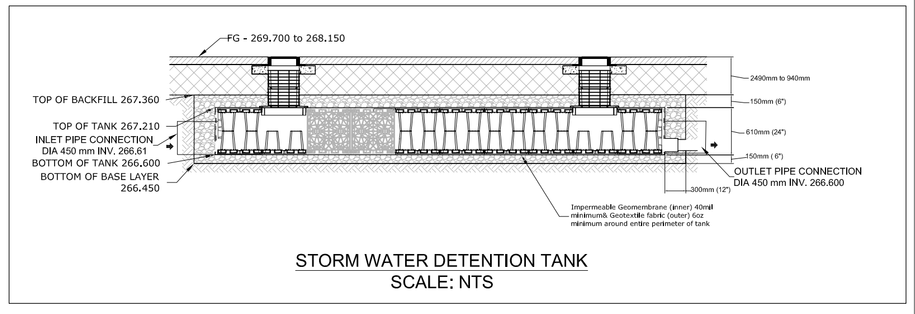

## KEY PLAN
SCALE -NTS



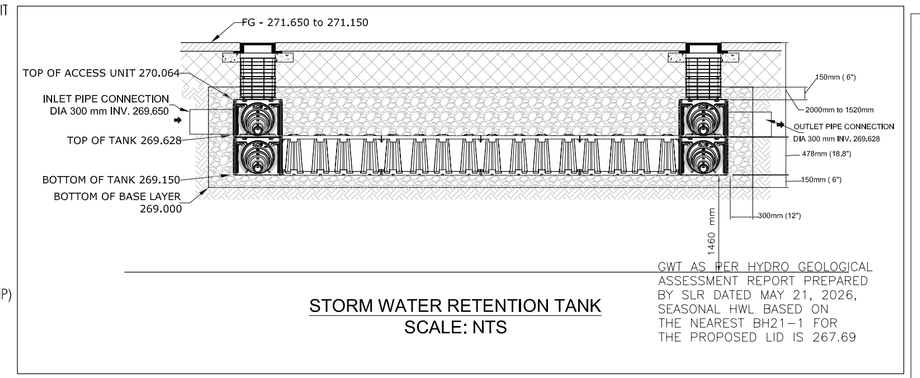

NOTES

1. WHERE EDGE OF TRENCH IS WITHIN 1.0 METER OF EDGE OF PAVEMENT, FULL DEPTH PAVEMENT REMOVAL SHALL BE REQUIRED.
2. REMOVE AND REPLACE EXISTING ASPHALT FULL DEPTH TO 450MM BEYOND LONGITUDIAL ENDS OF TRENCH.
3. DEPTH OF GRANULAR AND ASPHALT MATERIALS SHALL BE AS SPECIFIED ON CONTRACT DRAWING OR AS SPECIFIED BY THE ROAD AUTHORITY.

FIGURE 1: ROAD REINSTATEMENT DETAILS (NTS)




STORM WATER DETENTION TANK
SCALE: NTS




STORM WATER RETENTION TANK
SCALE: NTS

GWT AS PER HYDRO GEOLOGICAL ASSESSMENT REPORT PREPARED BY SLR DATED MAY 21, 2026, SEASONAL HWL BASED ON THE NEAREST BH21–1 FOR THE PROPOSED LID IS 267.69

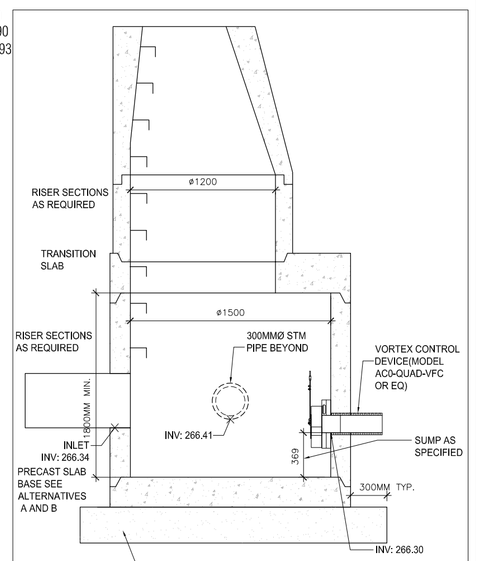
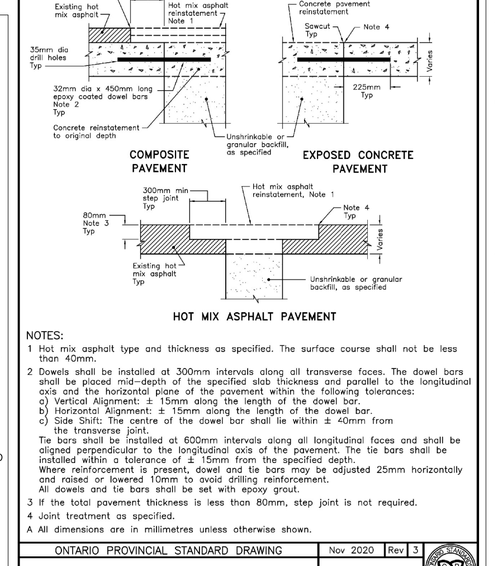



FIGURE 1 : VORTEX CONTROL FLOW WITH 369 MM SUMP DETAILS




NOTES:

1 Hot mix asphalt type and thickness as specified. The surface course shall not be less than 40mm.
2 Dowels shall be installed at 300mm intervals along all transverse faces. The dowel bars shall be placed mid-depth of the specified slab thickness and parallel to the longitudinal axis and the horizontal plane of the pavement within the following tolerances:
a) Vertical Alignment: ± 15mm along the length of the dowel bar.
b) Horizontal Alignment: ± 15mm along the length of the dowel bar.
c) Side Shift: The centre of the dowel bar shall lie within ± 40mm from the transverse joint.
3 Tie bars shall be installed at 600mm intervals along all longitudinal faces and shall be aligned perpendicular to the longitudinal axis of the pavement. The tie bars shall be installed within a tolerance of ± 15mm from the specified depth. Where reinforcement is present, dowel and tie bars may be adjusted 25mm horizontally and raised or lowered 10mm to avoid drilling reinforcement.
4 All dowels and tie bars shall be set with epoxy grout.
3 If the total pavement thickness is less than 80mm, step joint is not required.
4 Joint treatment as specified.
A All dimensions are in millimetres unless otherwise shown.

| ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2020 | Rev 3 |
|---|---|---|
| PAVEMENT REINSTATEMENT FOR UTILITY CUTS | | |
| | OPSD 509.010 | |

### LEGEND

- PROPERTY LINE
- DEVELOPMENT LIMIT
- PROPOSED CONCRETE CURB
- 1M D/C — PROPOSED DEPRESSED CONCRETE CURB
- LANDSCAPED AREA
- CONCRETE WALKWAY/SIDEWALK
- PAINTED LINE
- BARRIER FREE PARKING
- MAIN ENTRANCE
- OVER HEAD DOOR
- RETAINING WALL / CONCRETE TOE WALL
- FFE — FINISHED FLOOR ELEVATION
- HP — EX. HYDRO POLE
- UP — UTILITY POLE
- EX.CB — EXISTING CATCH BASIN
- CB — PROPOSED CATCH BASIN MANHOLE
- DCBMH — PROPOSED DOUBLE CATCH BASIN MANHOLE
- CBMH — PROPOSED CATCH BASIN MANHOLE
- EX.MH — EXISTING STORM MANHOLE
- MH — PROPOSED STORM MANHOLE
- EX.MH — EXISTING SANITARY MANHOLE
- MH1A — PROPOSED SANITARY MANHOLE
- EXISTING FIRE HYDRANT
- PROPOSED FIRE HYDRANT
- EX.WV — EXISTING WATER VALVE
- WV — PROPOSED WATER VALVE
- DD — DOUBLE CHECK DETECTOR ASSEMBLY
- M — WATER METER
- B — BACK FLOW PREVENTER


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LICENSED PROFESSIONAL ENGINEER
A.S.ZIAUDDIN
100233432
10JUNE2026
PROVINCE OF ONTARIO

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PROJECT NORTH

| No. | Date | Version | Dwn. |
|---|---|---|---|
| 7. | 10 JUNE 2026 | ISSUED FOR SPA -5 | LU |
| 6. | 05 FEB 2026 | ISSUED FOR SPA -4 | LU |
| 5. | 18 DEC 2024 | ISSUED FOR SPA -3 | SP |
| 4. | 15 MAY 2024 | ISSUED FOR SPA -2 | SP |
| 3. | 15 JAN 2024 | ISSUED FOR CO-ORDINATION | AB |
| 2. | 01 NOV 2022 | ISSUED FOR SPA-1 | EH |
| 1. | 17JUNE2022 | DRAFT FOR REVIEW | EH |


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PROJECT:

# CONDOMINIUM 233,249,261 COLDWATER ROAD, WEST, ORILLIA

DRAWING TITLE:

## SITE SERVICING PLAN

| DRAWN BY: AB | DATE: 29 MAR. 2022 |
|---|---|
| CHECKED BY: AZ | SCALE: 1:350 |
| PROJECT NO.: 21-23 | DRAWING NO.: C2 |

### BENCHMARK NOTE

ELEVATIONS HEREON ARE GEODETIC IN ORIGIN AND WERE DERIVED FROM FIRE HYDRANT NO. 212 HAVING A VALUE OF 275.647 FROM INFORMATION SUPPLIED BY THE CITY OF ORILLIA ENGINEERING DEPARTMENT.

### SURVEYOR INFORMATION

SURVEYOR INFORMATION TAKEN FROM YOUNG & YOUNG SURVEYING INC. 2 HOLLAND DRIVE, UNIT 5, BOLTON ON. L7E 1E1

Email: info@youngsurveying.ca
www.youngsurveying.ca

### APPLICANT

n Architecture Inc
208– 9120 LESLIE STREET, RICHMOND HILL, ON., L4B 3J9
T: 416. 256. 9741
E: info@narchitecture.com
www.narchitecture.com

### LEGAL DESCRIPTION

PART OF LOT 7, CONCESSION 4 (FORMERLY IN THE TOWNSHIP OF SOUTH ORILLIA ) CITY OF ORILLIA COUNTY OF SIMCOE

### BEARING NOTE

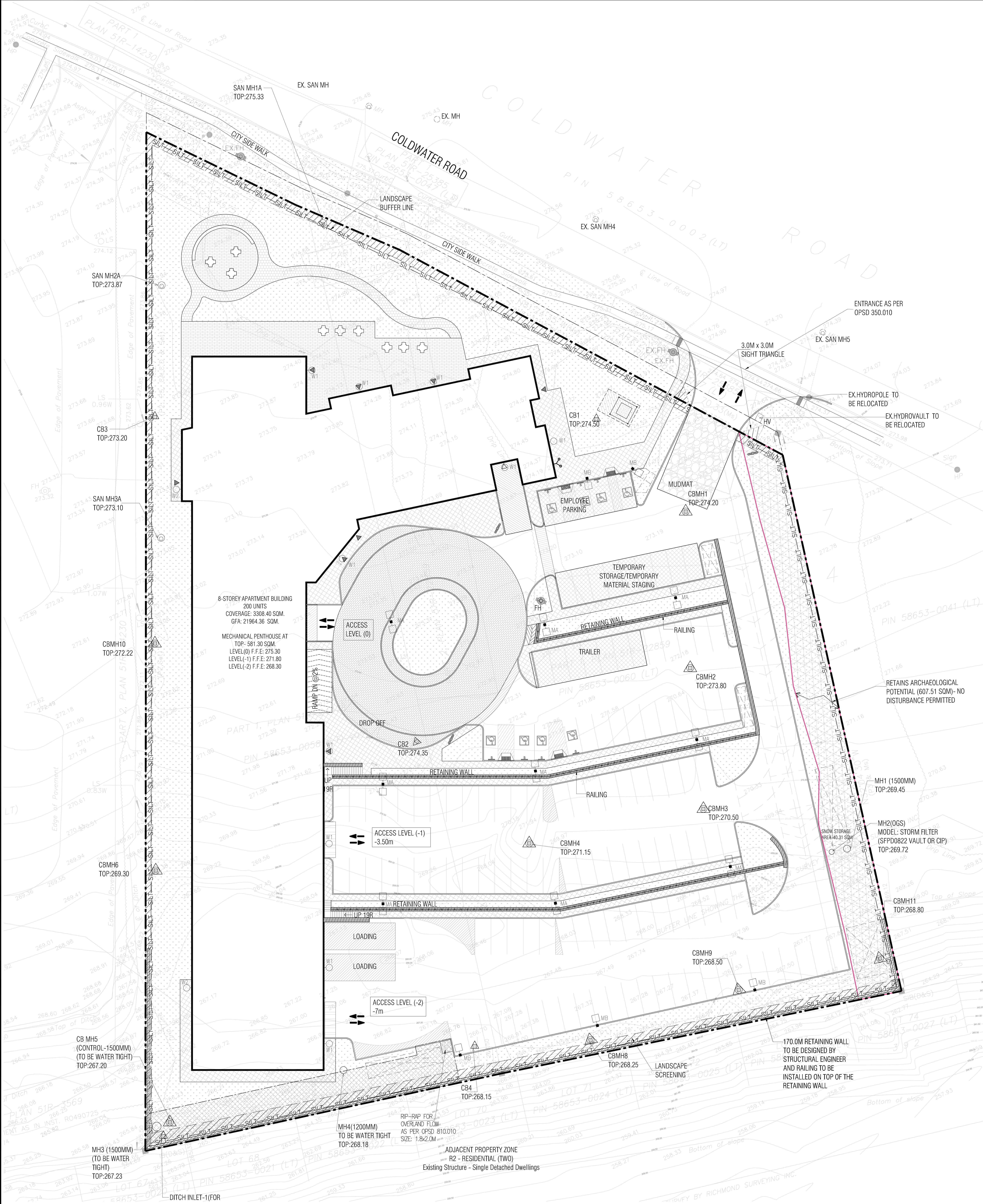
BEARINGS ARE UTM GRID, BY REAL TIME NETWORK (TOPNET) OBSERVATIONS, UTM ZONE 17, NAD83 (ORIGINAL) (1997.0).

### GENERAL NOTES

1. READ THIS DRAWING IN CONJUNCTION WITH ARCHITECTURAL, MECHANICAL AND LANDSCAPING PLANS.
2. ALL WORK SHALL BE CARRIED OUT IN COMPLIANCE WITH THE APPLICABLE HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS.
3. ALL WORK, MATERIALS AND CONSTRUCTION METHODS TO CONFORM WITH THE LATEST STANDARDS, SPECIFICATIONS, POLICIES, REGULATIONS, GUIDELINES AND LAWS FOR THE CITY, THE ONTARIO BUILDING CODE (OBC), MINISTRY OF THE ENVIRONMENT (MOE), ONTARIO PROVINCIAL STANDARD DRAWINGS AND SPECIFICATIONS (OPSD AND OPSS), THE ENVIRONMENTAL PROTECTION ACT AND THE WATER RESOURCES ACT. THE MINISTRY OF TRANSPORTATION STANDARDS WILL APPLY WHERE REQUIRED.
4. THE INFORMATION SHOWN FOR EXISTING UTILITIES WAS COMPILED FROM LOCATES INFORMATION AND RECORD DRAWINGS FROM THE CITY. THE INFORMATION IS SHOWN FOR GENERAL INFORMATION ONLY AND THE ACCURACY OR COMPLETENESS OF THE PROVIDED INFORMATION HAS NOT BEEN CONFIRMED. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING AND PROTECTING ALL UTILITIES DURING CONSTRUCTION. ALL EXISTING UTILITIES MUST BE LOCATED AND VERIFIED BY THE CONTRACTOR PRIOR TO COMMENCEMENT OF WORK. ANY VARIANCE IS TO BE IMMEDIATELY REPORTED TO THE ENGINEER. LOST TIME DUE TO FAILURE OF THE CONTRACTOR TO CONFIRM UTILITY LOCATIONS AND NOTIFY THE ENGINEER OF POSSIBLE CONFLICTS PRIOR TO CONSTRUCTION WILL BE AT THE CONTRACTOR'S EXPENSE.
5. THIS PLAN SHOULD BE READ IN CONJUNCTION WITH ALL OTHER CONSULTANTS' PLANS. ANY DISCREPANCIES SHALL BE CLARIFIED PRIOR TO CONSTRUCTION. INFORMATION RELATED TO DIMENSIONS FOR PRIVATE ROADS, PARKING, CURBING, BUILDING LOCATION AND SETBACKS SHALL BE TAKEN FROM THE SITE PLAN PREPARED BY THE ARCHITECT.
6. ALL DIMENSIONS AND ELEVATIONS TO BE VERIFIED PRIOR TO CONSTRUCTION AND ANY DISCREPANCIES FOUND PRIOR TO OR DURING CONSTRUCTION SHALL BE CLARIFIED WITH THE ENGINEER.

INSPECTIONS:

7. ALL WORK IN THE CITY'S RIGHT OF WAY AND EASEMENTS IS TO BE INSPECTED BY THE CITY PRIOR TO BACKFILLING. ALL WORK RELATING TO WATERMAINS AND SEWERS TO BE INSPECTED BY THE CITY AS PER THE SITE PLAN AGREEMENT.
8. ALL DISTURBED GRASSED AREAS TO BE RESTORED WITH MINIMUM 200MM TOPSOIL AND NO. 1 NURSERY SOD.
9. THE CONTRACTOR AGREES NOT TO MAKE A MATERIAL CHANGE OR CAUSE A MATERIAL CHANGE TO BE MADE TO A PLAN, SPECIFICATION, DOCUMENT OR OTHER INFORMATION, ON THE BASIS OF WHICH THIS DRAWING WAS APPROVED BY THE CITY, WITHOUT NOTIFYING, FILING DETAILS WITH AND OBTAINING WRITTEN AUTHORIZATION OF THE MUNICIPAL AND PROJECT ENGINEER.
10. SITE SPECIFIC DETAILED DESIGN AND PLAN PREPARED BY TEAM OF EXPERT ENGINEERS FROM N ENGINEERING INC. BASED ON THROUGH CONSULTATION WITH ALL AUTHORITIES OF JURISDICTION. IT IS MANDATORY THE PROJECT CONSTRUCTION BE SUPERVISED BY N ENGINEERING INC TO ENSURE THE ACCURACY, QUALITY OF EXECUTION OF THE PLAN AND ENSURE THE COMPLETION OF THE PROJECT
11. THE DEVELOPER/OWNER AGREES ALL STORMWATER MANAGEMENT WORK, WATER SERVICING WORK AND SANITARY SEWER WORK INSIDE THE BOUNDARY OF THE SITE IS TO BE INSPECTED BY N ENGINEERING INC. PRIOR TO BACKFILLING.
12. ALL WORK RELATING TO WATERMAINS AND SEWERS TO BE INSPECTED BY N ENGINEERING AS PER APPROVED PLANS BY THE CITY.
13. WATER & SANITARY TO BE LIVE TAPPED & INSTALLED BY AN APPROVED CONTRACTOR.




**SURVEYOR INFORMATION**

SURVEYOR INFORMATION TAKEN FROM YOUNG & YOUNG SURVEYING INC.
2 HOLLAND DRIVE, UNIT 5,
BOLTON ON. L7E 1E1

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www.youngsurveying.ca

**APPLICANT**

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RICHMOND HILL, ON., L4B 3J9
T: 416. 256. 9741
E: info@narchitecture.com
www.narchitecture.com

**LEGAL DESCRIPTION**

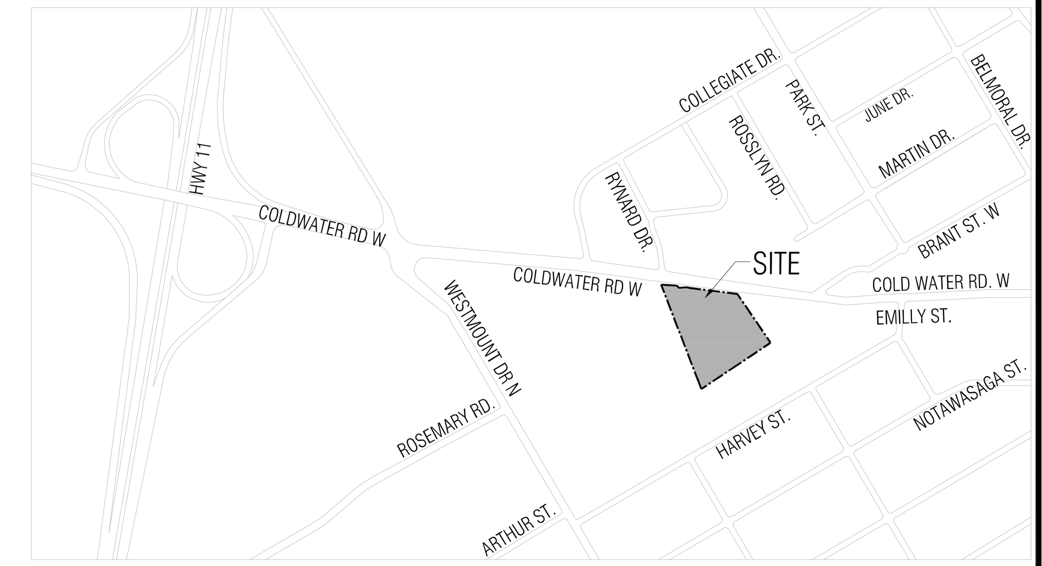
PART OF LOT 7, CONCESSION 4 (FORMERLY IN THE TOWNSHIP OF SOUTH ORILLIA )
CITY OF ORILLIA
COUNTY OF SIMCOE

**BEARING NOTE**

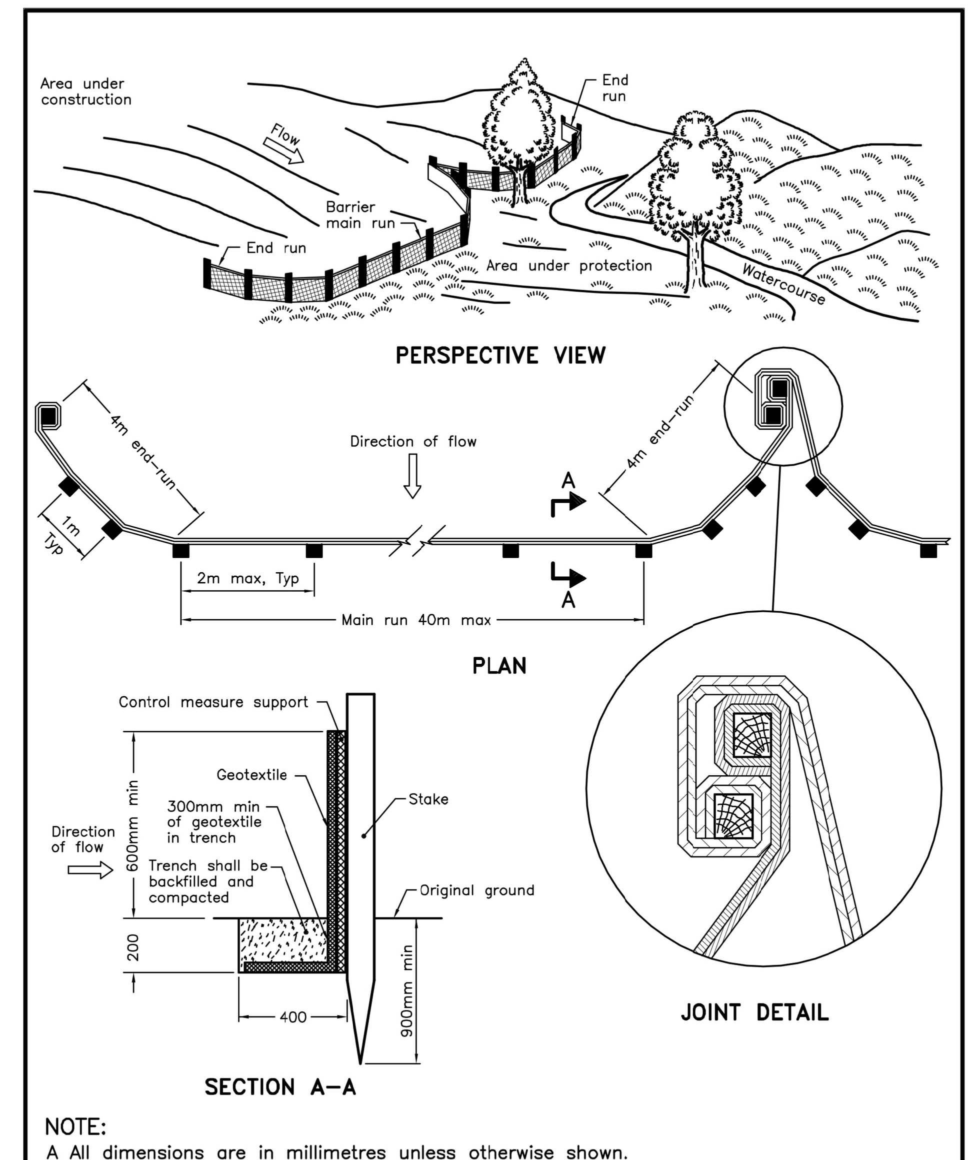
BEARINGS ARE UTM GRID, BY REAL TIME NETWORK (TOPNET) OBSERVATIONS, UTM ZONE 17, NAD83 (ORIGINAL) (1997.0).

**BENCHMARK NOTE**

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**KEY PLAN**
SCALE -NTS




NOTE:
A All dimensions are in millimetres unless otherwise shown.

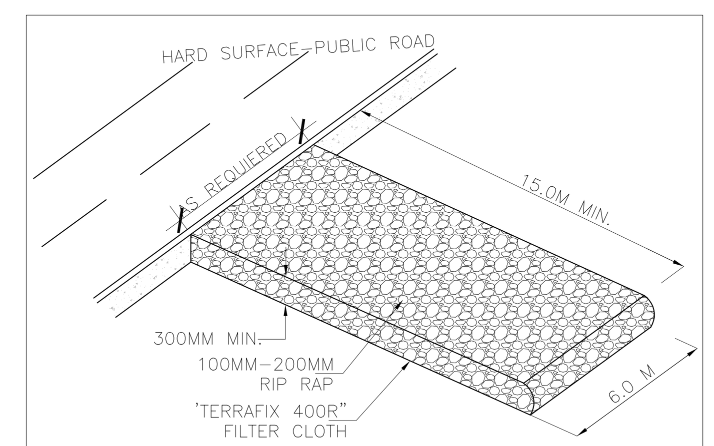
ONTARIO PROVINCIAL STANDARD DRAWING — Nov 2015 — Rev 2

HEAVY-DUTY SILT FENCE BARRIER

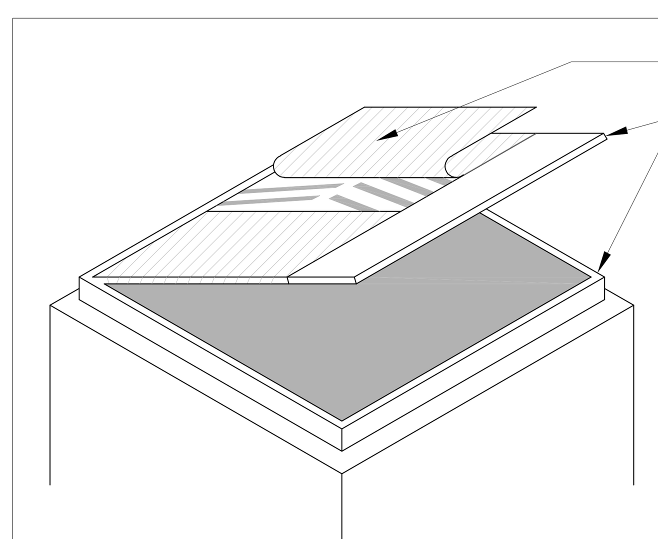
OPSD 219.130

**LEGEND**

| | |
|---|---|
| | PROPERTY LINE |
| | DEVELOPMENT LIMIT |
| | PROPOSED CONCRETE CURB |
| 1M D/C | PROPOSED DEPRESSED CONCRETE CURB |
| | LANDSCAPED AREA |
| | CONCRETE WALKWAY/SIDEWALK |
| | PAINTED LINE |
| | BARRIER FREE PARKING |
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| | PROPOSED FIRE HYDRANT |
| EX.WV | EXISTING WATER VALVE |
| WV | PROPOSED WATER VALVE |
| —SILT— | SILT FENCE |
| | STONE PAD CONSTRUCTION ENTRANCE |




TEMPORARY GRAVEL ACCESS PAD ('MUD')
SCALE: NOT TO SCALE




NOTES

1. WOVEN GEOTEXTILE TO HAVE A MINIMUM EQUIVALENT OPENING SIZE OF 0.15MM AND A MAXIMUM EQUIVALENT OPENING SIZE OF 0.25MM OR A NON WOVEN GEOTEXTILE TO BE CONSIDERED BASED ON SOIL PARAMETERS AND SITE CONDITIONS.
2. GEOTEXTILE TO BE REPLACED PERIODICALLY WHEN ACCUMULATED SEDIMENTS INTERFERES WITH DRAINAGE OR AS DIRECTED BY THE TRANSPORTATION AND WORKS DEPARTMENT.

CATCH BASIN & CATCH BASIN MANHOLE SEDIMENT CONTROL DEVICE
SCALE - N.T.S

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N
(GEODETIC NORTH)
PROJECT NORTH

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| 7. | 10 JUNE 2026 | ISSUED FOR SPA -5 | LU |
| 6. | 05 FEB 2026 | ISSUED FOR SPA -4 | LU |
| 5. | 18 DEC 2024 | ISSUED FOR SPA -3 | SP |
| 4. | 15 MAY 2024 | ISSUED FOR SPA -2 | SP |
| 3. | 15 JAN 2024 | ISSUED FOR CO-ORDINATION | AB |
| 2. | 01 NOV 2022 | ISSUED FOR SPA-1 | EH |
| 1. | 17JUNE2022 | DRAFT FOR REVIEW | EH |


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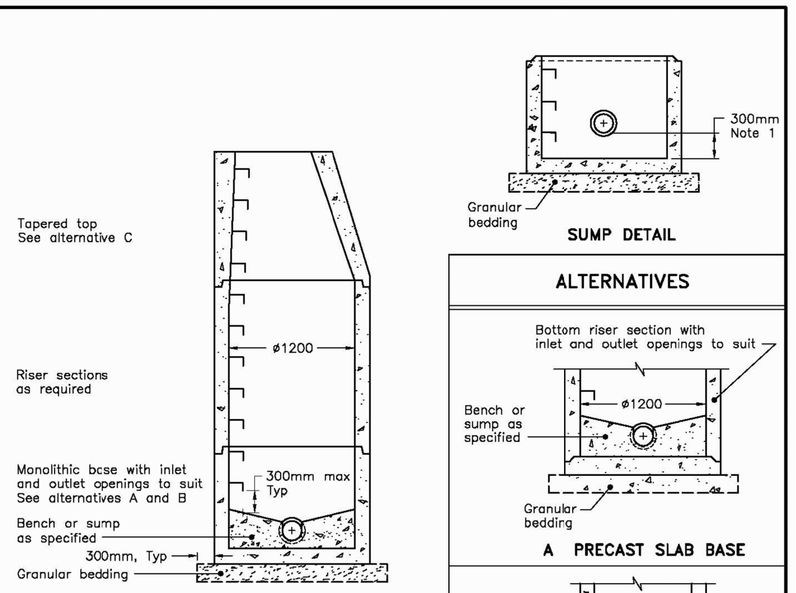

PROJECT:

**CONDOMINIUM 233,249,261 COLDWATER ROAD, WEST, ORILLIA**

DRAWING TITLE:

**CONSTRUCTION MITIGATION AND EROSION & SEDIMENT CONTROL PLAN**

DRAWN BY: AB — DATE: 29 MAR. 2022
CHECKED BY: AZ — SCALE: 1:350
PROJECT NO.: 21-23 — DRAWING NO.: C3





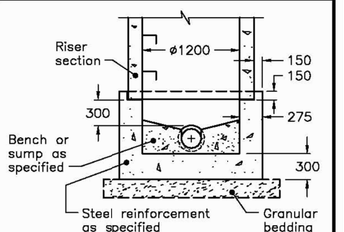


SUMP DETAIL

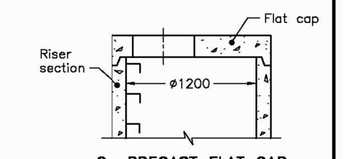
ALTERNATIVES




A PRECAST SLAB BASE



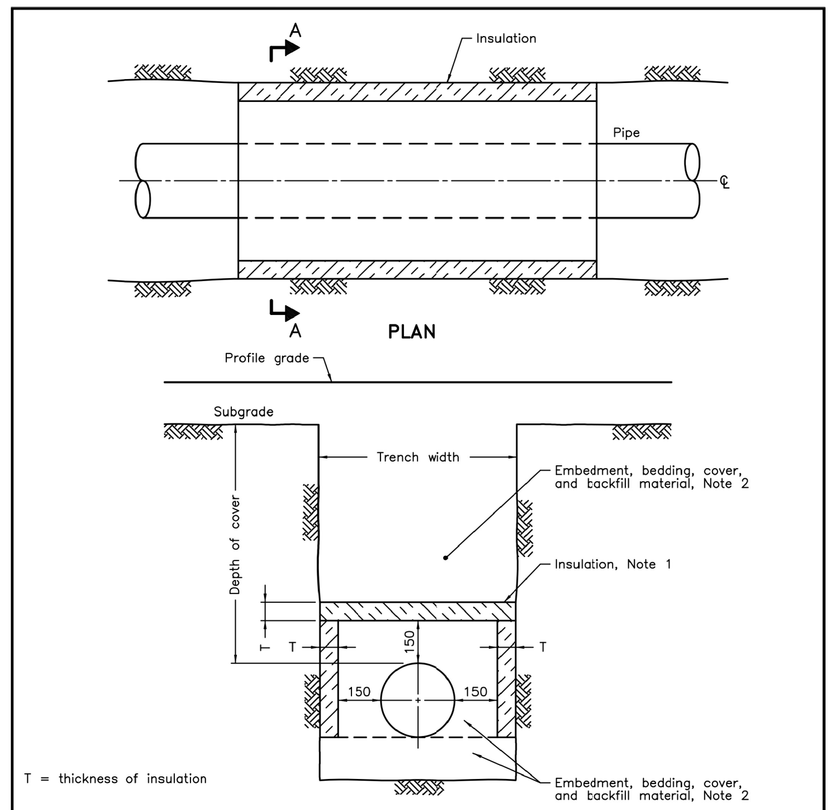

B CAST-IN-PLACE BASE




C PRECAST FLAT CAP

NOTES:
1 The sump is measured from the lowest invert.
A Granular backfill shall be placed to a minimum thickness of 300mm all around the maintenance hole.
B Precast concrete components shall be according to OPSD 701.030, 701.031, or 701.032.
C Structure exceeding 5.0m in depth shall include safety platform according to OPSD 404.020.
D Pipe support according to OPSD 708.020.
E For benching and pipe opening details, see OPSD 701.021.
F For adjustment unit and frame installation, see OPSD 704.010.
G All dimensions are nominal.
H All dimensions are in millimetres unless otherwise shown.

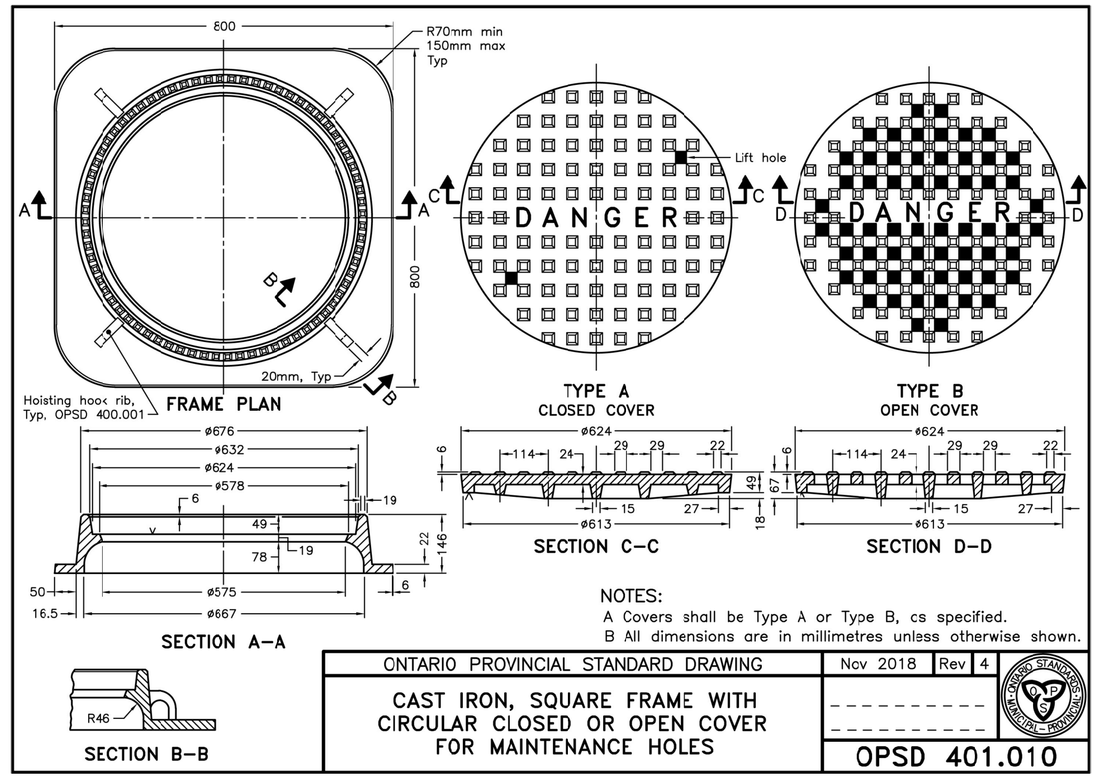
| ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2014 | Rev 5 |
|---|---|---|
| PRECAST CONCRETE MAINTENANCE HOLE 1200mm DIAMETER | | OPSD 701.010 |




SECTION A–A
TYPICAL PIPE INSULATION DETAIL

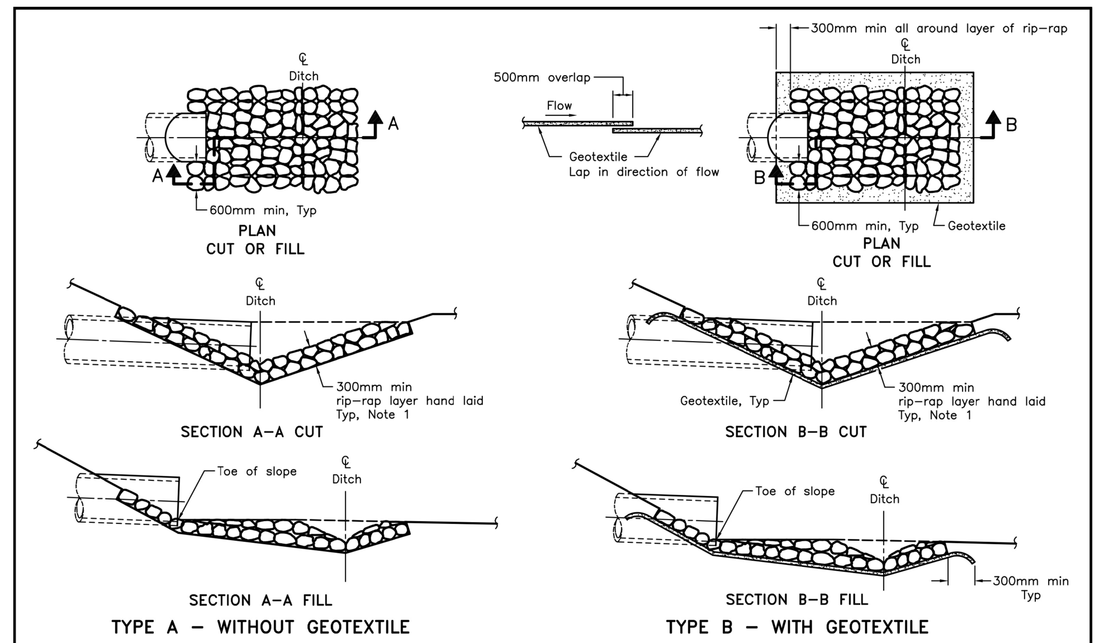
NOTES:
1 The insulation material shall be extruded polystyrene according to OPSS 1605 with a minimum compressive strength of 275 kPa.
2 Pipe embedment or bedding, cover, and backfill shall be according to:
a) Flexible OPSD 802.010, 802.013, 802.020, and 802.023.
b) Rigid – OPSD 802.030, 802.031, 802.032, 802.033, 802.050, 802.051, 802.052, and 802.053.
A Minimum insulation thickness shall be 50mm.
B Joints shall be staggered for multiple insulation sheets.
C This OPSD is to be read in conjunction with OPSD 3090.100 and 3090.101.
D All dimensions are in millimetres unless otherwise shown.

| ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2020 | Rev 1 |
|---|---|---|
| INSULATION FOR SEWERS AND WATERMAINS IN SHALLOW TRENCHES | | OPSD 1109.030 |




NOTES:
A Covers shall be Type A or Type B, as specified.
B All dimensions are in millimetres unless otherwise shown.

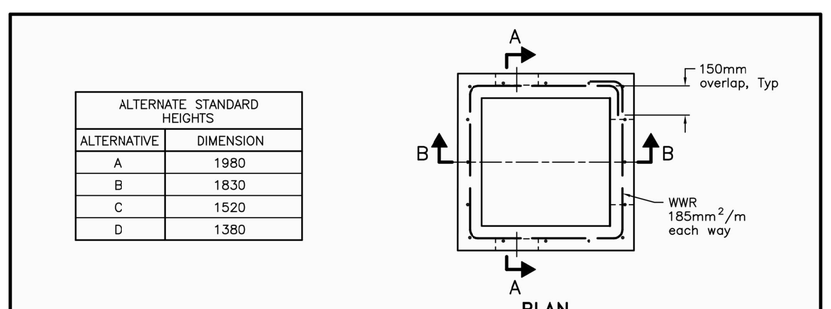
| ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2018 | Rev 4 |
|---|---|---|
| CAST IRON, SQUARE FRAME WITH CIRCULAR CLOSED OR OPEN COVER FOR MAINTENANCE HOLES | | OPSD 401.010 |




NOTES:
1 The thickness of the rip–rap layer shall be at least 1.5 times the rip–rap mean diameter.
A All dimensions are in millimetres unless otherwise shown.

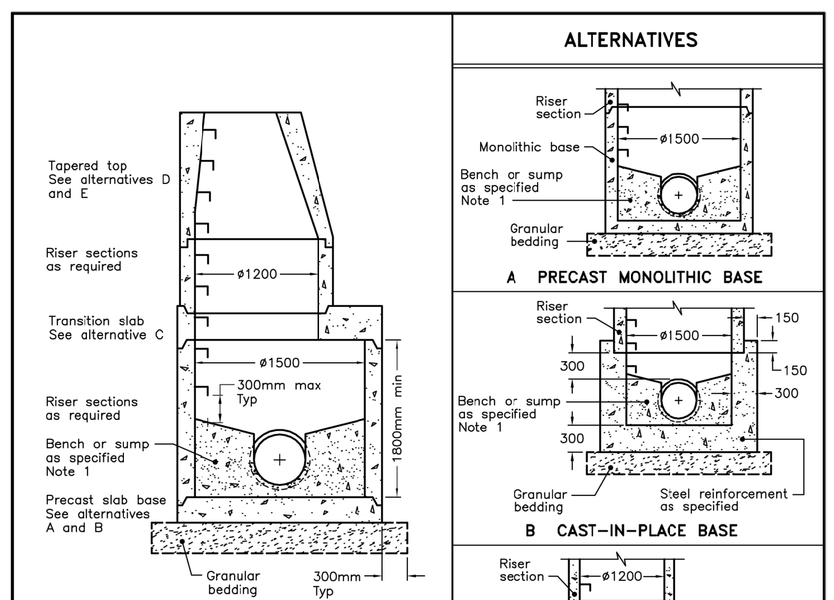
| ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2018 | Rev 3 |
|---|---|---|
| GENERAL RIP–RAP LAYOUT FOR SEWER AND CULVERT OUTLETS | | OPSD 810.010 |

| ALTERNATE STANDARD HEIGHTS | |
|---|---|
| ALTERNATIVE | DIMENSION |
| A | 1980 |
| B | 1830 |
| C | 1520 |
| D | 1380 |



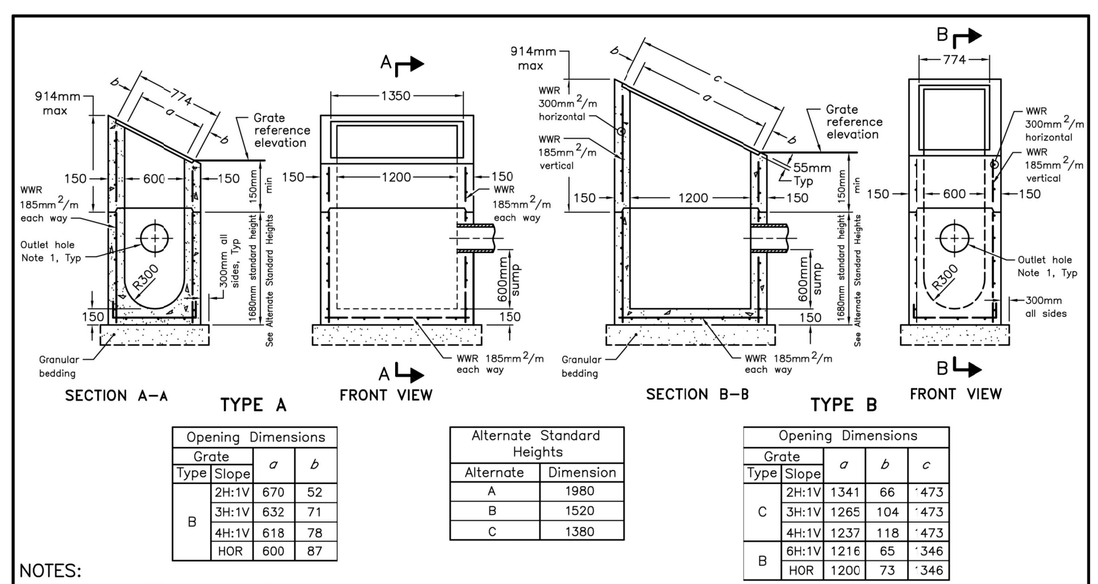

NOTES:
1 Outlet hole size 525mm diameter maximum, location as required.
2 200mm diameter knockout to accommodate subdrain. Knockout shall be 60mm deep.
A Centre reinforcing in base slab and walls ±20mm.
B Granular backfill shall be placed to a minimum thickness of 300mm all around the catch basin.
C Frame, grate, and adjustment units shall be installed according to OPSD 704.010.
D Pipe support shall be according to OPSD 708.020.
E All dimensions are nominal.
F All dimensions are in millimetres unless otherwise shown.

| ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2019 | Rev 4 |
|---|---|---|
| PRECAST CONCRETE CATCH BASIN 600x600mm | | OPSD 705.010 |




NOTES:
1 For sump detail, see OPSD 701.010.
A Granular backfill shall be placed to a minimum thickness of 300mm all around the maintenance hole.
B Precast concrete components shall be according to OPSD 701.030, 701.031, 701.040, 701.041, 703.011, 703.021, and 706.010.
C Structures exceeding 5.0m in depth shall include safety platform according to OPSD 404.020 or 404.021.
D Pipe support shall be according to OPSD 708.020.
E For benching and pipe opening details, see OPSD 701.021.
F For adjustment unit and frame installation, see OPSD 704.010.
G All dimensions are nominal.
H All dimensions are in millimetres unless otherwise shown.

| ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2014 | Rev 5 |
|---|---|---|
| PRECAST CONCRETE MAINTENANCE HOLE 1500mm DIAMETER | | OPSD 701.011 |




| Opening Dimensions | | | | |
|---|---|---|---|---|
| Grate Type | Slope | a | b | |
| B | 2H:1V | 670 | 52 | |
| | 3H:1V | 632 | 71 | |
| | 4H:1V | 618 | 78 | |
| | HOR | 600 | 87 | |

| Alternate Standard Heights | |
|---|---|
| Alternate | Dimension |
| A | 1980 |
| B | 1520 |
| C | 1380 |

| Opening Dimensions | | | | |
|---|---|---|---|---|
| Grate Type | Slope | a | b | c |
| C | 2H:1V | 1341 | 66 | 473 |
| | 3H:1V | 1265 | 104 | 473 |
| | 4H:1V | 1237 | 118 | 473 |
| | 6H:1V | 1216 | 65 | 346 |
| | HOR | 1200 | 73 | 346 |
| B | | | | |

NOTES:
1 Outlet hole size 525mm max diameter.
A Where inlet is placed across ditch and is accessible to vehicular traffic, grating slope shall be 6H:1V or flatter.
B Center reinforcing in wall and base slab ±25mm.
C Lap riser horizontal wires 300mm. Laps shall be placed at corners.
D Granular backfill shall be placed to a minimum thickness of 300mm all around the ditch inlet.
E Grating shall be according to OPSD 403.010.
F Pipe support shall be according to OPSD 708.020.
G All dimensions are nominal.
H All dimensions are in millimetres unless otherwise shown.

| ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2019 | Rev 4 |
|---|---|---|
| PRECAST CONCRETE DITCH INLETS 600 x 1200mm | | OPSD 705.040 |


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| 5. | 18 DEC 2024 | ISSUED FOR SPA -3 | SP |
| 4. | 15 MAY 2024 | ISSUED FOR SPA -2 | SP |
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PROJECT:

**CONDOMINIUM 233,249,261 COLDWATER ROAD, WEST, ORILLIA**

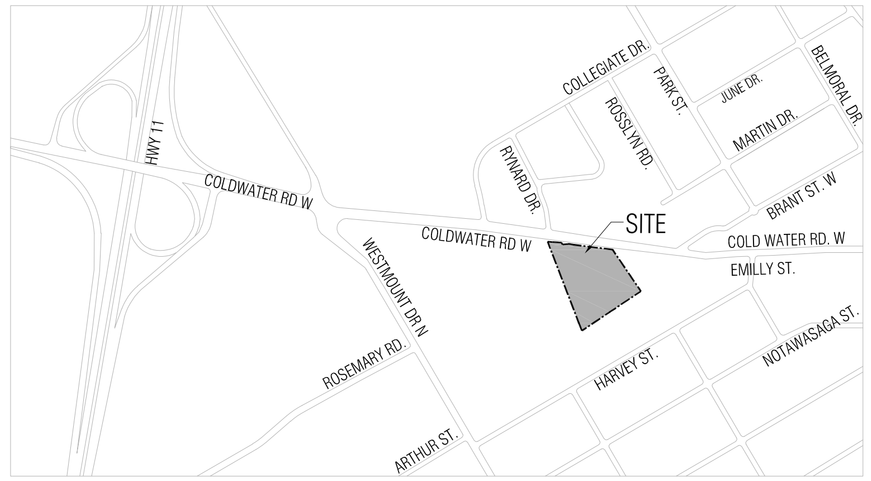
DRAWING TITLE:

**STANDARD DETAILS**

| DRAWN BY: AB | DATE: 29 MAR. 2022 |
|---|---|
| CHECKED BY: AZ | SCALE: N.T.S |
| PROJECT NO.: **21-23** | DRAWING NO.: **C4** |

NOTE

SIGHT TRIANGLES AS PER TAC MANUAL.




KEY PLAN
SCALE -NTS

SIGHT DISTANCE TABLE

| SIGHT TRIANGLE | DISTANCE TYPE | DISTANCE |
|---|---|---|
| RIGHT TURN | $a_1$ | 7.57m |
| | $b_1$ | 130.00m |
| LEFT TURN | $a_2$ | 19.57m |
| | $b_2$ | 130.00m |




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| 4. | 15 MAY 2024 | ISSUED FOR SPA -2 | AB |
| 3. | 14 DEC 2023 | ISSUED FOR CO-ORDINATION | AB |
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PROJECT:

# CONDOMINIUM 233,249,261 COLDWATER ROAD, WEST, ORILLIA

DRAWING TITLE:

# SIGHT DISTANCE TRIANGLES

LEGAL DESCRIPTION

PART OF LOT 7, CONCESSION 4 (FORMERLY IN THE TOWNSHIP OF SOUTH ORILLIA ) CITY OF ORILLIA COUNTY OF SIMCOE

BEARING NOTE

BEARINGS ARE UTM GRID, BY REAL TIME NETWORK (TOPNET) OBSERVATIONS, UTM ZONE 17, NAD83 (ORIGINAL) (1997.0).

BENCHMARK NOTE

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SURVEYOR INFORMATION

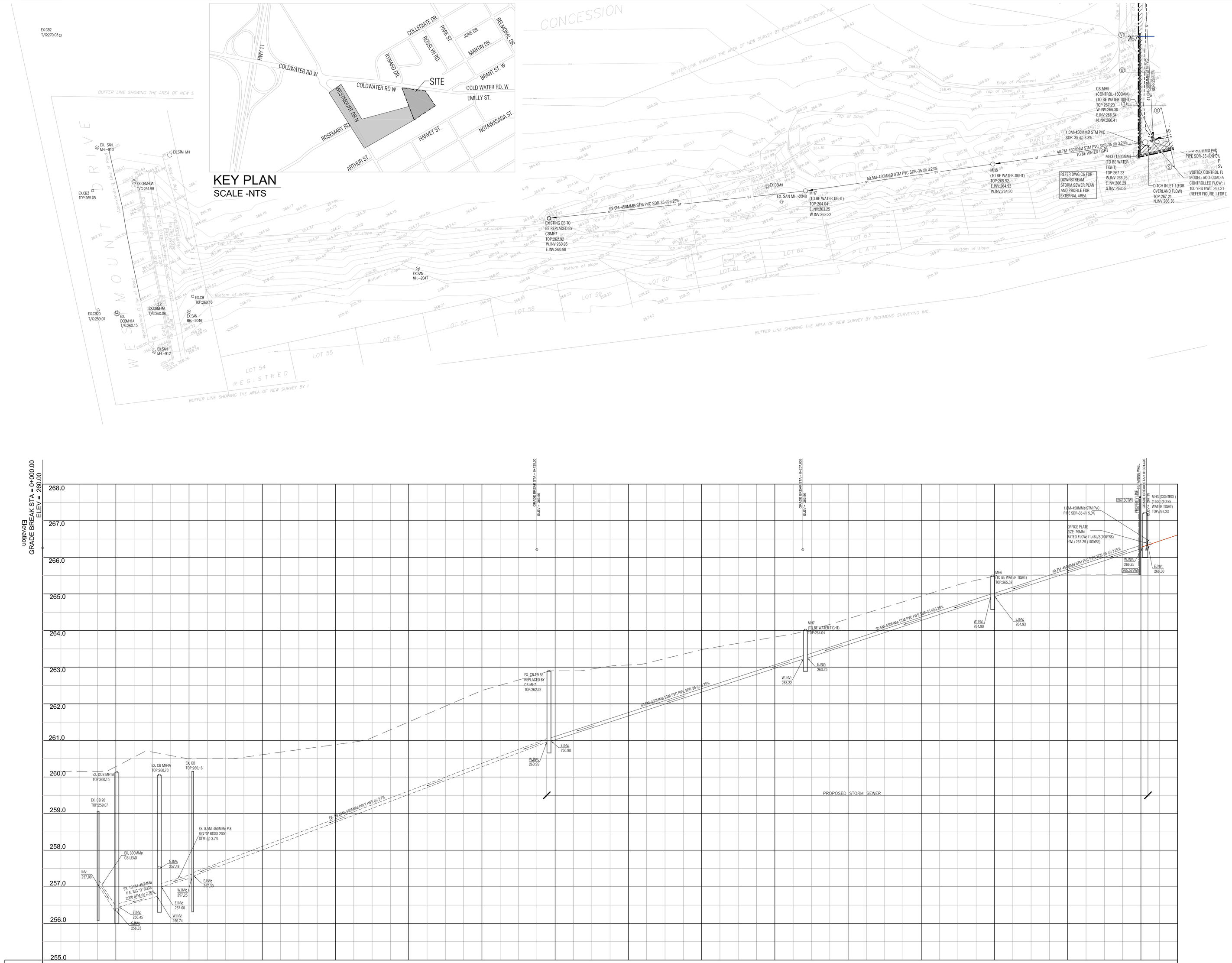
SURVEYOR INFORMATION TAKEN FROM YOUNG & YOUNG SURVEYING INC. 2 HOLLAND DRIVE, UNIT 5, BOLTON ON. L7E 1E1

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| DRAWN BY: EH | DATE: 28 SEP. 2022 |
|---|---|
| CHECKED BY: AZ | SCALE: |
| PROJECT NO.: 21-23 | DRAWING NO.: C5 |





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PROJECT:

**CONDOMINIUM 233,249,261 COLDWATER ROAD, WEST, ORILLIA**

DRAWING TITLE:

**PLAN AND PROFILE FOR EXTERNAL AREA UPTO THE WESTMOUNT DR.**

| | |
|---|---|
| DRAWN BY: AB | DATE: 29 MAR. 2022 |
| CHECKED BY: AZ | SCALE: V-1:500 H-1:100 |
| PROJECT NO.: **21-23** | DRAWING NO.: **C6** |

Appendix M

# Statement of Limiting Conditions and Assumptions

## Statement of Limiting Conditions and Assumptions

1. This Report/Study (the "Work") has been prepared at the request of, and for the exclusive use of, the Owner, and its affiliates (the "Intended Users"). No one other then the intended users has the right to use and rely on the work without first obtaining the written authorization of n Engineering and its Owners.
2. The comments, recommendations and material in this report reflect n Engineering best judgment in light of the information available to it at the time of preparation of this report. It is not qualified to and is not providing legal or planning advice in this work.
3. n Engineering expressly excludes liability to any third party except the Intended Users for any use of, and/or reliance upon, the work.
4. n Engineering notes that the following assumptions were made in completing the work
   a) The land use description(s) supplied n Engineer Inc. is correct;
   b) The surveys and other data supplied to n Engineering by the Owner are accurate;
   c) Market timing, approval delivery and secondary information are within the control of parties other then n Engineering;
   d) There are no encroachments, leases, covenants, binding agreements, restrictions, pledges, charges, liens or special assessments outstanding, or encumbrances, which would significantly affect the use or servicing;
   Investigations have not carried out to verify these assumptions. n Engineering deems the sources of data and statistical information contained herein to be reliable, but we extend no guarantee of accuracy in these respect.
5. All the plans, photographs, and sketches prepared and presented in this report/study are included solely to aid the visualizing the location of the property, the boundaries of the site, and the relative position of the improvements on the said lands are based on information provided by Owner
6. n Engineering accepts no responsibility for legal interpretations, questions of survey, opinion of title, hidden or inconspicuous conditions of the property, toxic wastes or contaminated materials, soil or sub soil conditions, environmental, engineering or other factual and technical matters disclosed by the owner, the clients, or any public agency, which by their nature, may change the outcome of the work.
7. In the preparation of this report, n Engineering have made investigations from secondary sources as documented in the work, but did not checked compliance with by laws, codes, agency and government regulations, etc., unless specifically noted in the work.
8. The value of proposed improvements should apply only with regard to the purpose and function of the work, as outlined in the body of this work. Any cost estimated set out in the work based on construction averages and subject to change.
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10. The work is only valid if it bears the Professional Engineer's seal and original signature of author, and if considered in its entity. Responsibility for unauthorized alteration to the Work is denied.

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End of the Statement

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