# 603 – 699 Kingston Road, Town of Pickering

# Functional Servicing and Stormwater Management Report

**October 2023**


**Submitted by:**

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## Submission History

| Submission | Date | In Support Of | Distributed To |
|---|---|---|---|
| 1st | October, 2023 | Re-Zoning | City of Pickering, Region, Region of Durham, Toronto Region Conservation Authority (TRCA), Ministry of Transportation (MTO), MECP, Sorbara Development Group |

# 1.0 Introduction

SCS Consulting Group Ltd. has been retained by Sorbara Development Group to prepare a Functional Servicing and Stormwater Management (SWM) Report for a proposed residential concept development located at Kingston Road and Whites Road North in the City of Pickering.

## 1.1 Purpose of the Report

The Functional Servicing and SWM Report has been prepared in support of the re-zoning applications for the proposed development. The Site Plan is provided in **Appendix A**.

The purpose of this report is to demonstrate that the proposed development can be accommodated by the external storm, sanitary and water infrastructure and to establish servicing and grading expectations for the future site plan application in accordance with the Town of Pickering, Toronto Region Conservation Authority (TRCA), Ministry of Transportation Ontario (MTO), and the Ministry of Environment, Conservation and Parks (MECP) design criteria.

## 1.2 Study Area

The proposed development is comprised of existing commercial and open space areas located within the Petticoat Creek Watershed in the Town of Pickering. As shown on **Figure 1.1**, the study area is bound by:

- Kingston Road North to the north;
- Highway 401 to the south;
- White's Road North to the east; and
- Existing commercial development to the west.

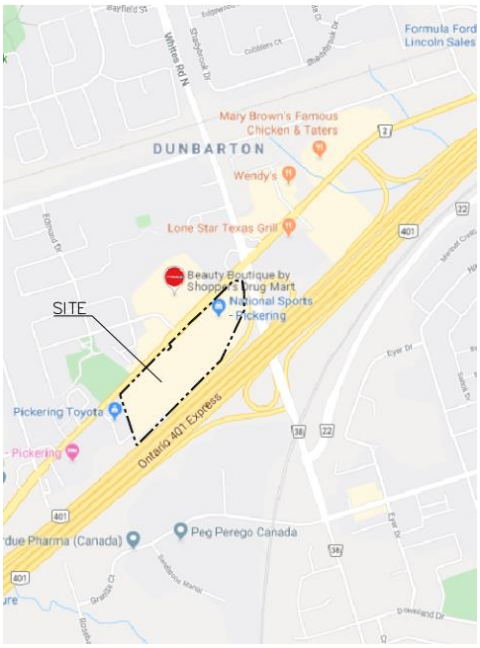


**Figure 1.1: Site Location Plan**

The proposed development is approximately 4.85 ha in size and consists of mid-rise and high-rise condo blocks, a park block, a proposed private or public (municipal) road running both east-west and north-south and a proposed private road running east-west (refer to the Site Plan in **Appendix A**). Access to the proposed development is proposed from Kingston Road via the proposed private or public (municipal) road extending south from the Steeple Hill/Kingston Road intersection.

## 1.3 Background Servicing Information

In preparation of the site servicing and SWM strategies, the following design guidelines and standards were used:

- City of Pickering Stormwater Management Design Guidelines (July 2019);
- Ontario Building Code (latest amendment);
- Toronto Region Conservation Authority Stormwater Management Criteria (August 2012); and
- Ministry of the Environment, Conservation and Parks (MECP) Stormwater Management Planning and Design Manual (March 2003).

The following reports have been referred to with regards to the proposed development (relevant excerpts are included in **Appendix B**):

- Functional Servicing Report – 603-643, 645-699 Kingston Road, prepared by WSP Canada Group Ltd. (April 2020);

- Updated Plan and Site Statistics – Whites Road & Hwy 401, prepared by Graziani & Corazza Architects (June 2023);
- Boundary & Topographical Survey – 603-643, 645-699 Kingston Road, prepared by R. Avis Surveying Inc. (November 2018);
- Phase One Environmental Site Assessment – 603-643, 645-699 Kingston Road, prepared by Toronto Inspection Ltd. (April 2020);
- Stormwater Management Report – 603-643, 645-699 Kingston Road, prepared by WSP Canada Group Ltd. (April 2020);

# 2.0 Storm Sewer System

## 2.1 Existing Storm Sewer System

As indicated in the Kingston Road plan and profiles (**Appendix B**), the sizes and locations of the existing storm sewers surrounding the site are:

- A 300 mm diameter PVC storm sewer on the north side of Kingston Road flowing southwest;
- A 300 mm diameter PVC storm sewer on the south side of Kingston Road flowing southwest;
- A 450 mm diameter PVC storm sewer on the south side of Kingston Road flowing northeast;
- A 450 mm diameter PVC storm sewer on the south side of Kingston Road flowing southwest; and
- A 1200 mm x 1200 mm concrete storm box culvert on Kingston Road flowing southeast

The 450 mm diameter storm sewers and the 1200 mm x 1200 mm box culvert on Kingston Road currently connect into an existing storm sewer within the subject site. This existing storm sewer outlets to an existing MTO drainage ditch via a headwall located at the southeast corner of the site.

## 2.2 Proposed Storm Sewer System

The storm sewer system (minor system) within the proposed development (**Figure 2.1** and **2.2**) is to be designed for the 5 year return storm per the City of Pickering standards. The storm sewer system will be designed in accordance with the City of Pickering, Ontario Building Code and MECP guidelines, including the following:

- Pipes to be sized to accommodate runoff from a 5 year storm event
- Minimum Pipe Size: 300 mm diameter
- Maximum Flow Velocity: 6.0 m/s
- Minimum Flow Velocity: 0.8 m/s
- Minimum Pipe Depth: 1.8 m to obvert

The existing storm sewers within the site will be removed and replaced with a proposed storm sewer system which will connect to the existing 1050 mm diameter concrete storm sewer located in the southeast corner of the site, as shown on **Figure 2.1 and 2.2.** The existing 1050 mm diameter concrete storm sewer currently connects to an existing headwall which outlets to the existing MTO drainage ditch. The proposed storm sewer will be installed within the Kingston Road R.O.W. directly fronting our site before entering the proposed development along the private or public road (north-south), and

then through a storm sewer easement (east-west, then north-south) within the private road, before connecting to the existing 1050 mm concrete storm sewer adjacent to the MTO setback limit. There will also be a storm sewer and storage system (box culvert) underneath the western portion of the private or public (municipal) road for stormwater management of the private or public road.

Each site plan block will be serviced by separate storm service connections to municipal sewers and will have individual on-site stormwater management facilities to control the storm flows.

Please refer to **Section 3.0** for details of the stormwater management strategy for the site.

# 3.0 Stormwater Management

## 3.1 Existing Drainage

The existing lands (4.85 ha) drain south to Highway 401 (Catchment 101 on **Figure 3.1** and **Figure 3.2**) via an existing internal storm sewer and overland flow. The storm sewer outlets to an existing ditch adjacent to Highway 401 which eventually outlets to a tributary of the Petticoat Creek.

External drainage north of the site (0.09 ha) from Kingston Road drains south via overland flow into the site where it is conveyed to the existing ditch system and tributary (Catchment EXT-1 on **Figure 3.1** and **Figure 3.2**).

## 3.2 Existing Peak Flows

The City of Pickering guidelines require the proposed release rates for the proposed development to be controlled to the existing peak runoff rates for the subject lands for the 2 through 100 year storm events. However, during a pre-consultation meeting on May 27th, 2019 with WSP Canada Group Ltd., it was noted that the 100 year post development flows shall be controlled to the 2 year pre-development level, refer to the SWM Report (April 2022) in **Appendix B**. The modified rational method was used to determine the target release rates from the site based on Intensity-Duration-Frequency (IDF) rainfall curves from the City of Pickering Design Standards. Supporting calculations are provided in **Appendix C**. **Table 2.1** summarizes the existing 2 year peak flow from the site to the Highway 401 outlet.

**Table 3-1: Summary of Existing Peak Flows**

| Return Period Storm | Highway 401 Outlet (L/s) |
|---|---|
| 2 Year | 959.7 |

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## 3.3 Stormwater Runoff Control Criteria

The following stormwater runoff control criteria have been established based on the City of Pickering design criteria (July 2019) and the MECP Stormwater Management Planning and Design Manual (2003). The stormwater runoff criteria are summarized below in **Table 2.2**.

**Table 3-2: Stormwater Runoff Control Criteria**

| Criteria | Control Measure |
|---|---|
| Quantity Control | Control proposed peak flows to existing peak flows for the 2 through 100 year storm events (City of Pickering, 2019). As per the pre-consultation meeting on May 27th, 2019 with WSP Canada Group Ltd., the 100 year post development flows shall be controlled to the 2 year pre-development level (WSP SWM Report, 2021). |
| Quality Control | Provide MECP Enhanced (Level 1) Protection for 80% TSS Removal. |
| Erosion Control | Detention of the 5 mm rainfall runoff will be retained on site (City of Pickering, 2019). |
| Water Budget | Maintain existing groundwater recharge rates and appropriate distribution, ensuring the protection of related hydrology ecologic functions. At a minimum retain the equivalent of 5 mm of rainfall over the development under the Erosion Control criteria (City of Pickering, 2019) |

## 3.4 Stormwater Best Management Practices Selection

In accordance with the Ministry of Environment Stormwater Management Planning and Design Manual (2003), a review of stormwater management best practices was completed using a treatment train approach, which evaluated at-source, conveyance system, and end-of-pipe alternatives. The potential best management practices were evaluated based on the stormwater management objectives listed in **Table 2.2**.

The following site characteristics were taken into consideration:

- Developable area of 4.85 ha consisting of existing commercial developments;
- The site drains south to Highway 401 which eventually outlets to a tributary of Petticoat Creek and Lake Ontario;
- The is located approximately 200 m north of Lake Ontario;
- Based on the Geotechnical Investigation (Nov 2023), the site is consists of asphalt pavement underlain by a fill of sandy silt till, sand, silty sand and sand and gravel deposits;
- Based on the Hydrogeological Investigation (Nov 2023), the water table on site ranges from 96.53 to 103.57 masl and a depth between 1.4 m and 8.9 m below the ground surface. The hydraulic conductivity was determined to be approximately 5.0x10-4 cm/s within the sand and gravel unit; and

- The majority of the development will consist of underground parking structures which limit opportunities for infiltration across the majority of the development outside the municipal ROW and private street.

The following are examples of at-source, conveyance and end-of-pipe controls that were evaluated for use in the proposed development. While evaluating the following controls, cost, feasibility, groundwater and grading constraints were taken into consideration.

**At-Source Controls**

At-source controls are at-source measures that reduce runoff prior to stormwater entering the conveyance system, such as:

- Increased topsoil depth;
- Roof leaders to grassed areas;
- At-source storage (i.e. rooftop or parking lot storage);
- Pervious pavements; and
- Infiltration trenches/soak-away pits.

**Conveyance Controls**

Conveyance controls provide treatment of stormwater during the transport of runoff from individual lots to the receiving watercourse or end-of-pipe facility. Examples of conveyance controls include:

- Grassed Swales;
- Pervious pipe system.

**End-of-Pipe Controls**

End-of-pipe stormwater management facilities receive stormwater flows from a conveyance system (i.e., storm sewers or ditches) and provide treatment of stormwater prior to discharging flows to the receiving watercourse. Typical end-of-pipe controls include:

- Wet ponds;
- Wetlands;
- Dry ponds;
- Infiltration basins; and
- Underground storage.

### 3.4.1 At-Source Controls Evaluation

It is noted these controls are proposed on private properties. Incorporating controls that require minimal routine maintenance can be an effective method in the treatment train approach to SWM. The following controls have been evaluated for use in the proposed development:

**Increased Topsoil Depth**

An increase in the proposed topsoil depth is recommended to promote at source infiltration (minimum 0.3 m depth). Increased topsoil depth will also contribute to at source quality and quantity control and will contribute to groundwater recharge. A topsoil depth of 0.30 m is proposed.

**Roof Leaders to Surface**

Roof drainage will be captured by the internal mechanical piping and directed to the sewers. Therefore, roof leaders directed to the surface are not feasible on the proposed residential towers.

**Permeable Pavers**

By encouraging infiltration and filtration, pervious pavement can contribute to water quality, balance and erosion control. Permeable pavers are proposed within the proposed municipal ROW.

**Passive Landscaping**

Planting of gardens and other vegetation designed to minimize local runoff or use rainwater as a watering source can be used to reduce rainwater runoff by increasing evaporation, transpiration, infiltration and contribute to groundwater recharge. Homeowner education should be encouraged to use passive landscaping practices as part of the homeowner turnover package of information. By promoting infiltration through passive landscaping, water quality and quantity control is provided for the volume of water infiltrated. Passive landscaping can provide significant stormwater management benefits as part of the overall treatment train approach for the proposed development.

### 3.4.2 Conveyance Controls Evaluation

Conveyance controls provide treatment of stormwater during the transport of runoff from individual lots to the receiving watercourse or end-of-pipe facility. The following conveyance controls have been evaluated for use in the proposed development:

**Grassed Swales**

Grassed swales conveying runoff promote infiltration, filtration, and evapotranspiration, contributing to water quality and quantity control, and contribute to groundwater recharge. Runoff from the proposed municipal park block will be conveyed to the municipal ROW via grassed swales. Additional details will be provided at the Site Plan Application stage.

### 3.4.3 Proposed End-of-Pipe Controls

While at-source and conveyance system controls are valuable components of the overall SWM plan, on their own they are not sufficient to meet the quantity and quality control objectives for the proposed development. End-of-pipe stormwater management facilities receive stormwater flows from a conveyance system (i.e., storm sewers or ditches) and provide treatment of stormwater prior to discharging flows to the receiving outlet. Accordingly, the following end-of-pipe controls have been evaluated for use in the proposed development:

**Underground Storage**

To meet quantity control targets, flow restrictors can be used to control stormwater release rates. To accommodate the reduced release rate, stormwater detention facilities are required to store stormwater runoff. Stormwater storage is proposed to be provided by on-site underground storage chambers (e.g., CULTEC or approved equivalent) and a proposed box culvert within the proposed development as shown on **Figure 3.3 and Figure 3.4**. Refer to **Section 3.5.2** for additional details.

**Manufactured Treatment Device**

A properly sized manufactured treatment device (MTD) can assist in providing MECP Enhanced (Level 1) treatment and can contribute to the treatment train approach for water quality control. **Appendix F.** It is recognized that TRCA policy only acknowledges 50% reduction of TSS by a gravity-based Oil-Grit Separator unit. Therefore, vortex-based HydroDome filtration units will be proposed to provide overall Enhanced quality control. Refer to **Section 3.5.1** for additional MTD details.

**Table 2.3** below summarizes the recommended stormwater management Best Management Practices (BMPs) for the proposed development.

**Table 3-3: Summary of the Recommended Stormwater Best Management Practices (BMPs)**

| Stormwater Management Control | Recommended BMP |
|---|---|
| At-Source Controls | Increased Topsoil Depth |
| | Permeable Pavers |
| | Passive Landscaping |
| Conveyance System Controls | Grassed Swales |
| End Of Pipe Controls | Underground Stormwater Detention System |
| | Manufactured Treatment Device |

## 3.5 Proposed Storm Drainage

The proposed major and minor system flow patterns and drainage areas are shown on **Figure 3.3** and **Figure 3.4**. As illustrated, the proposed development will convey runoff to underground storage facilities prior to outletting to Highway 401 which eventually outlets to a tributary of Petticoat Creek.

Major and minor system flows from Catchments 201, 203 – 206 and 208 (0.54 ha, 0.53 ha, 0.63 ha, 0.43 ha, 0.39 ha, and 0.69 ha, respectively, **Figure 3.3** and **Figure 3.4**) will be captured via a proposed internal storm sewer system and detained on-site in underground storage tanks before outletting to Highway 401. Drainage from the proposed municipal right-of-way (Catchment 202, 0.87 ha, **Figure 3.3** and **Figure 3.4**) will be captured via the proposed internal storm sewer system and retained within a proposed municipal 1.8 m x 0.9 m box culvert before outletting to Highway 401.

The remaining 0.78 ha of the proposed development (Catchment 207, **Figure 3.3** and **Figure 3.4**) will drain uncontrolled to Highway 401.

### 3.5.1 Quantity Control

The proposed total 100 year piped release rate from the development will be controlled to the existing 2 year peak runoff rate to Highway 401 via orifice plates located on the downstream faces of the control manholes (**Figure 3.3** and **Figure 3.4**). Allowable release rates for each proposed catchment and block have been determined using the total allowable release rate from the development and area-weighted calculations. Proposed release rates and required storage volumes were calculated using the modified rational method and the IDF rainfall curves from the City of Pickering Design Standards. Calculations are included in **Appendix C**.

To accommodate the controlled release rate, six (6) underground stormwater detention systems (tanks incorporated into the underground parking garages) and a 1.8 m x 0.9 m box culvert within the municipal right-of-way are proposed, and are shown on **Figure 3.3** and **Figure 3.4**. Orifice plates located on the downstream faces of the control manholes will control the release rates from the underground storage tanks within the proposed development. The underground storage systems (CULTEC Recharger V8HD Chamber System or approved equivalent) will provide approximately 808 $m^3$ of total detention storage in the underground detention tanks in the proposed parking garages and 122 $m^3$ in the box culvert. A hydraulic grade line (HGL) analysis will be completed during the detailed design stage to ensure that any tailwater effects from the superpipe are considered and further analysis of pumping the tanks will be completed at detailed design.

Additional details will be provided at the site plan application stage. Calculations are provided in **Appendix C**. A summary of the quantity control provided is listed in **Table 3.4** and **Table 3.5**.

**Table 3-4: Summary of 100 Year Release Rates**

| Catchment | 100 Year Allowable Release Rate to Storm Sewer (L/s)) | Controlled Site Release Rate (L/s) | Uncontrolled Site Release Rate (L/s) | Total Proposed Site Release Rate (L/s) |
|---|---|---|---|---|
| 201 | 99.28 | 99.28 | 0 | 99.28 |
| 202 | 375.85 | 375.85 | 0 | 375.85 |
| 203 | 97.76 | 97.76 | 0 | 97.76 |
| 204 | 116.21 | 116.21 | 0 | 116.21 |
| 205 | 79.32 | 79.32 | 0 | 79.32 |
| 206 | 71.94 | 71.94 | 0 | 71.94 |
| 207 | - | 0 | 207.6 | 207.6 |
| 208 | 127.26 | 127.26 | 0 | 127.26 |
| **Total:** | 959.7 | 725.1 | 207.6 | 959.7 |

**Table 3-5: Summary of 100 Year Storage Volumes**

| Catchment | Total Required 100 Year Storage ($m^3$) | Underground Storage System Provided ($m^3$) | Total Provided Storage ($m^3$) |
|---|---|---|---|
| 201 | 135.5 | 136.0 | 136.0 |
| 202 | 115.9 | 121.5 | 121.5 |

| Catchment | Total Required 100 Year Storage ($m^3$) | Underground Storage System Provided ($m^3$) | Total Provided Storage ($m^3$) |
|---|---|---|---|
| 203 | 133.4 | 135.0 | 135.0 |
| 204 | 158.6 | 160.0 | 160.0 |
| 205 | 108.2 | 110.0 | 110.0 |
| 206 | 98.2 | 100.0 | 100.0 |
| 208 | 173.7 | 175.0 | 175.0 |
| | | **Total:** | 937.5 |

### 3.5.2 Quality Control

Each site plan within the development is required to provide MECP Enhanced (Level 1) Protection (80% TSS removal). To contribute to the treatment train approach and to improve the level of quality control, six (6) MTD units, specifically six (6) Hydrodome filter units are provided to treat runoff from the proposed site plans prior to discharging to Highway 401. One (1) additional larger Hydrodome unit is proposed within the municipal R.O.W. to treat runoff from the municipal road, as well as provide additional treatment to the runoff from the site plans directly upstream of the unit. Summaries of the proposed MTD units for each private and municipal catchment is provided in **Table 3.6** and **Table 3.7** below.

**Table 3-6 Summary of Proposed Manufactured Treatment Devices (Site Plans)**

| Catchment | Proposed Manufactured Treatment Device (MTD) |
|---|---|
| 201 | Hydrodome HD 4 |
| 202 | Hydrodome HD 8 |
| 203 | Hydrodome HD 4 |
| 204 | Hydrodome HD 4 |
| 205 | Hydrodome HD 4 |
| 206 | Hydrodome HD 4 |
| 208 | Hydrodome HD 4 |

**Table 3-7 Summary of Proposed Manufactured Treatment Devices (Municipal ROW)**

| Catchment | Proposed Manufactured Treatment Device (MTD) |
|---|---|
| 202 | Hydrodome HD 8 |

Sizing calculations, as well as operation and maintenance information is provided in **Appendix F**. Additional details will be provided at the site plan application stage.

### 3.5.3 Water Balance

In order to achieve the City of Pickering water balance criteria, the equivalent of the 5 mm rainfall event is required to be retained on-site. To achieve this, the underground detention tanks and box culvert are proposed to capture and retain the required volume. The 5 mm rainfall volume across the proposed development is 208.2 $m^3$. Initial abstraction volumes will not be counted towards achieving the water budget, therefore retention of the total water balance volume of 208.2 $m^3$. The provided water balance volume is 208.2 $m^3$. Refer to calculations in **Appendix C**.

### 3.5.4 Erosion Control

The erosion control criteria is to retain the initial 5 mm runoff from the site. Where feasible, measures to retain the runoff volume from a 5 mm rainfall event will be incorporated.

### 3.5.5 Emergency Overflow

Perforated lids are proposed on the maintenance access manholes within the underground SWM tanks. In the event the proposed outlet structure becomes blocked, emergency flows will spill out of the manhole lid and be conveyed south to Highway 401. Refer to **Figure 3.3 and Figure 3.4**.

# 4.0 Sanitary Servicing

## 4.1 Existing Sanitary Servicing

As indicated in the Kingston Road plan and profiles **(Appendix B)**, the sizes and locations of the existing sanitary sewers surrounding the site are:

- A 300 mm asbestos cement sanitary sewer on the south side of Kingston Road, within a servicing easement on the property
- Two sanitary service connections servicing the existing property off the existing 300 mm asbestos cement sanitary sewer

The existing 300 mm asbestos cement on the property flows west parallel to Kingston Road and eventually to Rosebank Road where it turns south and flow under Highway 401. There are no existing sanitary sewers on Kingston Road except for an abandoned 150 mm PVC sanitary forcemain.

## 4.2 Proposed Sanitary Servicing

The sanitary servicing system within the proposed development **(Figure 4.1 to 4.5)** will be designed in accordance with the Durham Region and MECP criteria, including but not limited to:

- Residential Sanitary Generation Rate: 364 l/c/d
- Commercial Sanitary Generation Rate: 2.08 l/s/gross floor ha (including infiltration and peaking effect)
- Industrial/Schools & Institutions Sanitary Generation Rate: 1.04 l/s/gross ha (including infiltration and peaking effect)
- Population Density
    - Single Family (3.3 people/unit)
    - Townhouse (3.0 people/unit)
    - Apartments 1 Bedroom (1.5 people/unit)
    - Apartments 2 Bedroom (2.5 people/unit)
    - Apartments 3 Bedroom (3.5 people/unit)
    - Apartments 4 Bedroom or larger (4.5 people/unit)
- Peaking Factor: Harmon (Max. 3.8, Min. 1.5)
- Infiltration Rate: 0.26 L/s/ha
- Minimum Pipe Size: 200 mm diameter
- Minimum Pipe Cover: 2.75 m
- Minimum Actual Velocity: 0.60 m/s
- Maximum Velocity: 3.65 m/s

Through discussions with the Region of Durham, we were informed that the existing downstream sanitary sewer is already surcharging under existing conditions and an alternative sanitary solution along Kingston Road draining east should be explored to service the proposed development. Upon further review, it is determined that a new sanitary sewer along Kingston Road, draining east and connecting to the existing 750 mm sanitary trunk, located within an easement just east of the Highway 401 ramp is feasible to service the proposed development and any future developments in the area. A preliminary design of this sanitary solution has been prepared and submitted to the Region for review. The Region will confirm the downstream capacity of the 750 mm trunk sewer and the criteria to be used to detail design the proposed sanitary sewer. The preliminary layout of the proposed sanitary sewer on Kingston Road are shown on **Figures 4.1, 4.2, 4.3, 4.4 and 4.5.** The new sanitary trunk sewer within Kingston Road will have slopes ranging between 0.5% and 1.1% (typically) and will be provided at 3 m to 8.5 m deep, which is sufficient to service the proposed development. Refer to **Appendix D** for supporting calculations.

The existing 300 mm Asbestos Cement sanitary sewer within the subject site will be removed. New 200 mm, 300 mmm and 375 mm municipal PVC sanitary sewer system is proposed within the proposed municipal road and connect to the new sanitary sewer on Kingston Road, as shown on **Figures 4.1 and 4.2**. Each private development blocks will be serviced via separate sanitary service connections to the municipal sanitary sewers. The sanitary sewers within the site will have slopes ranging between 0.5% and 2% (typically) and will be provided at 3 m to 5 m deep, which is sufficient to service the proposed buildings within the development.

# 5.0 Water Servicing

## 5.1 Existing Water Servicing

As indicated in the Kingston Road plan and profiles (**Appendix B**), the following existing watermains surround the site:

- A 400 mm diameter ductile iron watermain on the north side of Kingston Road

There are two existing 300 mm PVC watermain connections currently servicing the site which will be reused. Any existing water servicing infrastructure located within the proposed development will be removed and decommissioned per City of Pickering/Durham Region's specifications and standards.

## 5.2 Proposed Water Servicing

Water supply for the proposed development will be provided from the existing 400 mm diameter ductile iron watermain on Kingston Road. A proposed 300mm diameter municipal watermain within the private or public (municipal) road shall service all private development blocks within the site via separate service connections, except for Tower 9 and 10 where existing service connections are being re-used. The municipal watermain shall be looped within the site and connect to the existing 400 mm diameter ductile iron watermain on Kingston Road in two locations.

The proposed municipal water distribution system will be designed in accordance with the Durham Region and MECP criteria, including but not limited to the following:

- Watermains shall be sized to carry the greater of maximum day plus fire flow or maximum hour demand
- Maximum Operating Pressures: 700 kPa
- Maximum Day and Fire Flow Minimum Pressures: 140 kPa
- Normal Operating Conditions Minimum Pressures: 275 kPa
- Population Density
    - Single Family (3.3 people/unit)
    - Townhouse (3.0 people/unit)
    - Apartments 1 Bedroom (1.5 people/unit)
    - Apartments 2 Bedroom (2.5 people/unit)
    - Apartments 3 Bedroom (3.5 people/unit)
    - Apartments 4 Bedroom or larger (4.5 people/unit)
- Minimum Pipe Size: 150 mm diameter (residential)
- Minimum Pipe Depth: 1.80 m
- Maximum Hydrant Spacing: 150 m (residential)

A hydrant flow test was completed on May 19, 2023 to determine existing flows and pressures for the Kingston Road watermain (**Appendix E**). The Domestic Water Modelling Analysis, prepared by Municipal Engineering Solutions (MES), and Fire Underwriters Survey 2020 calculations can be found in **Appendix E**. A summary of the domestic and fire demands in presented in **Table 5.1** below. The proposed watermain layout is shown on **Figures 5.1 and 5.2**.

**Table 5.1: Water Demands and Pressures**

| No. | Demand Type | Total Demand |
|---|---|---|
| 1 | Average Day | 45.45 L/s |
| 2 | Peak Hour | 136.35 L/s |
| 3 | Maximum Day | 90.90 L/s |
| 4 | Fire Flow | 150 L/s (9,000 L/min) |
| 5 | Maximum Day + Fire Flow | 240.90 L/s (14,454 L/min) |

According to the water model completed by MES, using the two (2) hydrant flow tests results as boundary conditions to calibrate the model, the available fire flow within the existing 400 mm diameter watermain on Kingston Road has a fire flow of 262.4 L/s at 20 psi (140 kPa) for Test A and 241.8 L/s at 20 psi (140 kPa) for Test B. Taking into account the maximum day demand of 90.90 L/s and pressure losses through water meters and appurtenances, the available fire flow of Test B in the existing watermain drops to 147 L/s, which is slightly below the fire flow demand of 150 L/s. However, the domestic flow calculations have been evaluated on a conservative unit bedroom count of 2.5 bedrooms per unit, assuming all units being a 2-bedroom apartment. This assumption was made due to detailed unit bedroom information being unavailable. More detailed unit bedroom type information will be available in later stages of the project and will reveal a more accurate domestic flow, which we anticipate will be lower than the current calculated demand. Therefore, we anticipate that there will be sufficient flow along the existing watermain to supply the proposed development with fire and domestic demands. Refer to **Appendix E** for the Domestic Water Modelling Analysis and Fire Underwriters Survey 2020 calculations, prepared by Municipal Engineering Solutions (MES).

# 6.0 Groundwater

A Hydrogeological Investigation was prepared by Toronto Inspection Ltd. to investigate the soil and groundwater conditions on site. The highest existing groundwater level was measured by Toronto Inspection Ltd. May 7, 2019 at 1.4 mbg, or 103.57 m in elevation.

The groundwater quality was also assessed, and with the exception of Total Suspended Solids (TSS), and was found to exceed the receiving sewer By-law criteria of the storm sewer system. Additionally, all parameters, including TSS were found to have met the criteria for the receiving sewer By-Law criteria for the sanitary sewer.

## 6.1 Proposed Short-term Construction Dewatering

During construction, Toronto Inspection Ltd. expects that dewatering will be required to draw the water level down to below the depth of excavation required for the parking and building foundations. Some water is expected to collect in the base of the excavation due to precipitation events and from perched groundwater conditions. The estimated daily short-term pumping rate was determined to be approximately 8.7 L/s. It is anticipated that construction dewatering will be discharged to the existing sanitary sewer system.

## 6.2 Proposed Long-term Groundwater Mitigation

As recommended by Toronto Inspection Ltd., the proposed building foundations are expected to require permanent foundation drainage. The building foundations are expected to extend below the seasonal high water table and therefore, a method of groundwater control may be required to manage groundwater seepage around the foundation floor and walls. If foundation drains are used as the management method, it is anticipated that approximately one-third the rate of short-term dewatering, 1.5 L/s may be required long-term to discharge to the City storm sewers. It is noted that this represents approximately 0.1% of the site release rate and therefore is negligible.

# 7.0 Grading

## 7.1 Existing Grading Conditions

Under existing conditions, the majority of the site drains from north to south towards Highway 401. The ground surface elevations through the site range on average from approximately 107.31 m to 103.85 m.

## 7.2 Proposed Grading Concept

In general, the proposed development will be graded in a manner which satisfies the following goals:

Satisfy the City of Pickering lot and road grading criteria, create required depth for sanitary sewer, as well as provision of an efficient earthworks program, including:

- Minimum Road Grade: 0.5%
- Maximum Road Grade: 6.0%
- Minimum Lot Grade: 2%
- Maximum Lot Grade: 5%
- Minimum Driveway Grade: 2%
- Maximum Driveway Grade: 8%
- Eliminate the need for retaining walls
- Minimize the volume of earth to be moved and minimize cut/fill differentials
- Achieve the stormwater management objectives required for the proposed development.

A preliminary grading plan is provided on **Figures 6.1 and 6.2**. The site will generally be graded to match existing elevations along the boundaries on all sides. As illustrated in **Figures 6.1 and 6.2**, the preliminary internal road grades will approximately range from 0.5% to 2.4%.

At the site plan application stage, the preliminary grading shown on **Figures 6.1 and 6.2** will be subject to a more in-depth analysis in an attempt to balance the cut and fill volumes and minimize slopes and retaining walls.

## 8.0 Erosion and Sediment Control During Construction

During the detailed design stage, erosion and sediment control measures will be designed with a focus on erosion control practices (such as stabilization, track walking, staged earthworks, etc.) as well as sediment controls (such as fencing, mud mats, catchbasin sediment control devices, rock check dams and temporary sediment control ponds). These measures will be designed and constructed as per the "Erosion and Sediment Control Guide for Urban Construction" document published by the Greater Golden Horseshoe Area Conservation Authorities (December 2019). A detailed erosion and sediment control plan will be prepared for review and approval by the City of Pickering and TRCA prior to any site grading being undertaken. This plan will address phasing, inspection and monitoring aspects of erosion and sediment control. All reasonable measures will be taken to ensure sediment loading to the adjacent watercourses and properties are minimized both during and following construction.

## 9.0 Summary

This Functional Servicing and Stormwater Management Report has outlined the means by which:

- The site can be serviced by full municipal services (storm, sanitary and water);
- The Site Plan layout supports the stormwater management requirements.

This Functional Servicing and Stormwater Management Report has outlined the means by which proposed development at 603 – 699 Kingston Road will meet the objectives of the City of Pickering Stormwater Management Guidelines through the following measures:

**Quantity Control**

- Runoff from the development during the 100 year storm event will be limited to the 2 year existing design flow rate;
- Stormwater quantity control will be achieved through orifice control with stormwater storage provided by six (6) underground storage chambers and a proposed box culvert in the municipal R.O.W.

**Quality Control**

- To provide enhanced level treatment (80% TSS Removal) six (6) HydroDome units are proposed within the proposed site plans and one (1) HydroDome is proposed within the municipal R.O.W.
- Additional treatment will be provided by permeable pavers within the municipal R.O.W.

**Water Balance**

- On-site retention of runoff from a 5 mm rainfall event is provided through storage in the proposed underground storage tanks.

**Erosion Control**

- The erosion control criteria is satisfied as the design meets the water balance criteria, and the site does not discharge directly or within 100 m of a natural watercourse.

Respectfully Submitted:

**SCS Consulting Group Ltd.**


Rebecca Bar, E.I.T.
rbar@scsconsultinggroup.com

Paige Turchet, P. Eng.
pturchet@scsconsultinggroup.com

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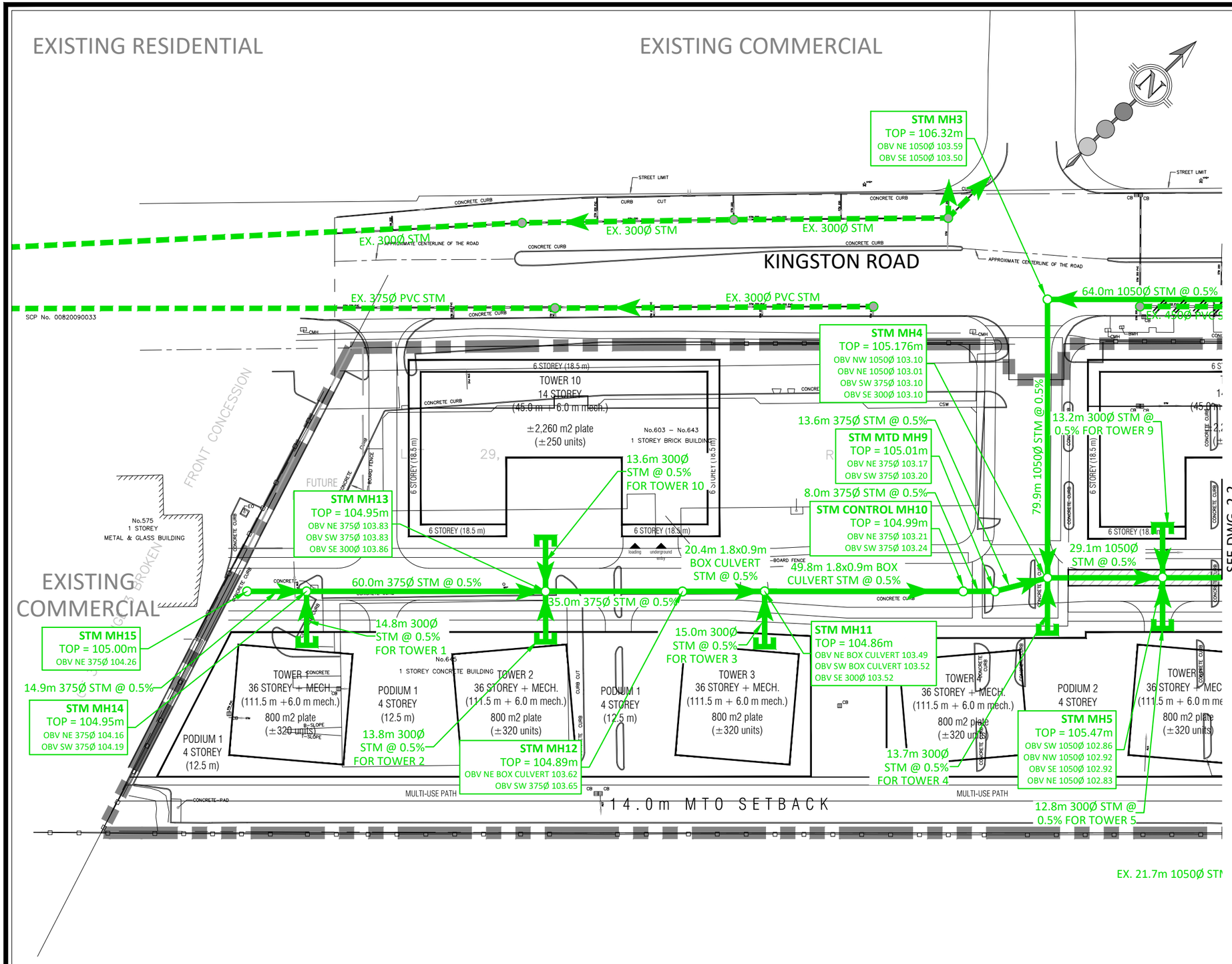


## LEGEND:

- LIMIT OF DEVELOPMENT
- STORM SEWER AND MAINTENANCE HOLE
- STORM SEWER PLUG
- EXISTING STORM SEWER AND MAINTENANCE HOLE
- EXISTING STORM SEWER AND MAINTENANCE HOLE TO BE REMOVED

*NOTE: LAYOUT IS SCHEMATIC ONLY, DETAILS TO BE PROVIDED AT DETAILED DESIGN STAGE.


SCS consulting group ltd
30 CENTURIAN DRIVE, SUITE 100
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FAX: (905) 475-8335

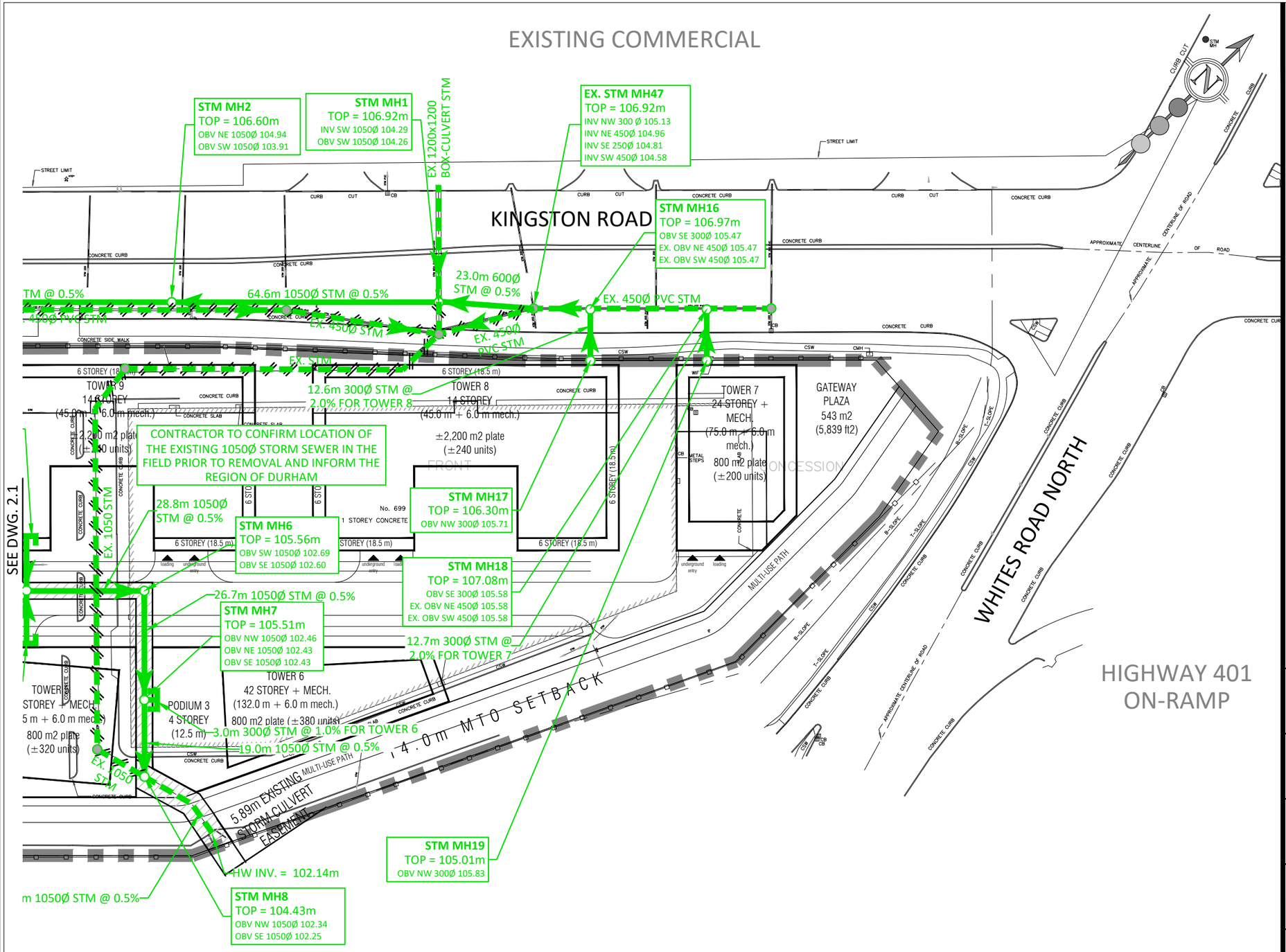

# SOBARA GROUP OF COMPANIES

# 603-699 KINGSTON ROAD

## PROPOSED STORM SERVICING FIGURE 1

| | | | |
|---|---|---|---|
| DESIGNED BY: | J.Y.L. | CHECKED BY: | P.C. |
| SCALE: | 1:1000 | DATE: | AUGUST 2023 |
| PROJECT No: | 2626 | FIGURE No: | 2.1 |

File: P:\2626 603-699 Kingston Road - Pickering\Drawings\FSP\Fig\Report Figures\2626P-2.1-2.2-SERV-STRM.dwg - Revised by <JLIM> : Wed, Aug 02 2023 - 3:13pm




## LEGEND:

- LIMIT OF DEVELOPMENT
- STORM SEWER AND MAINTENANCE HOLE
- STORM SEWER PLUG
- EXISTING STORM SEWER AND MAINTENANCE HOLE
- EXISTING STORM SEWER AND MAINTENANCE HOLE TO BE REMOVED

*NOTE: LAYOUT IS SCHEMATIC ONLY, DETAILS TO BE PROVIDED AT DETAILED DESIGN STAGE.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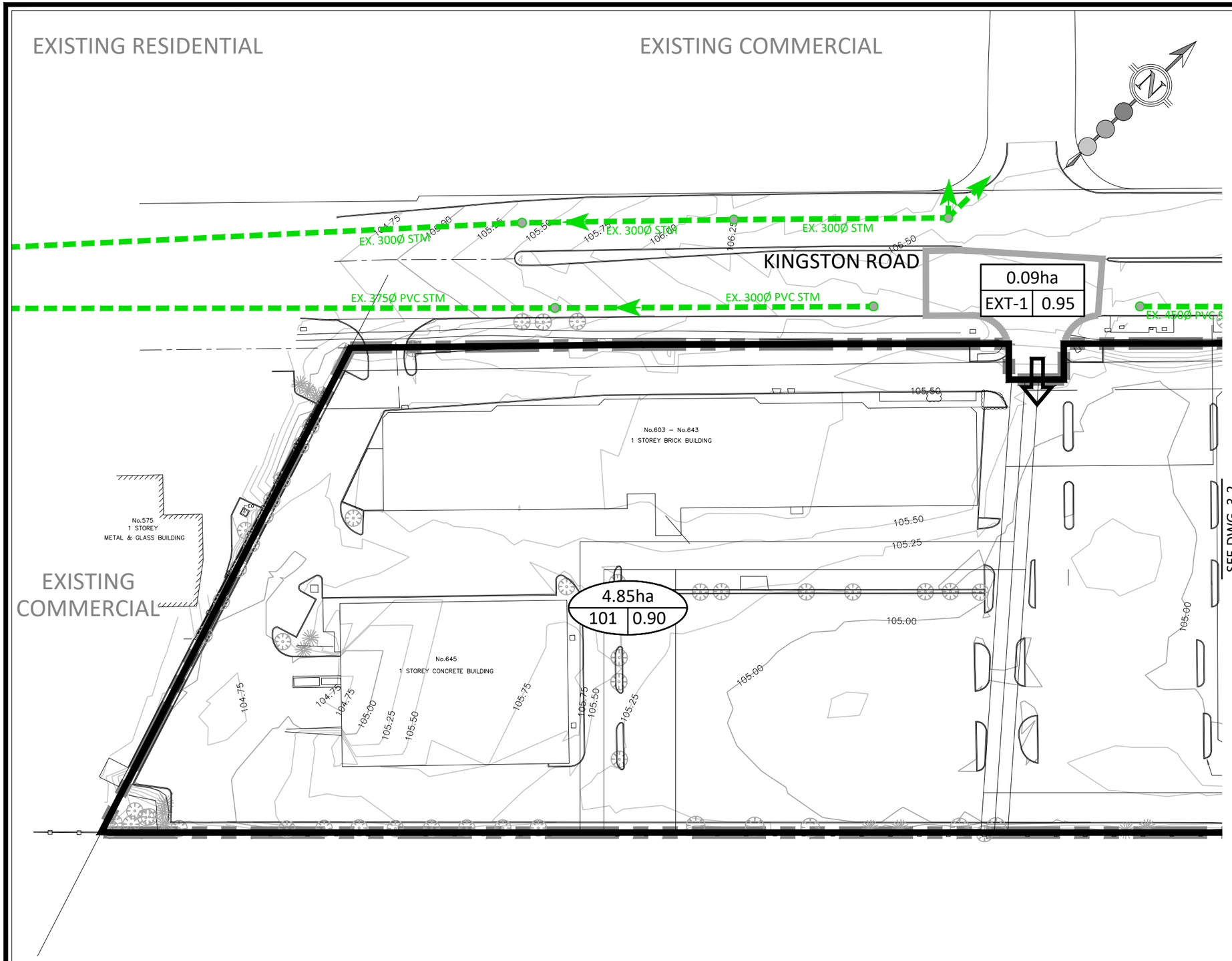
# SOBARA GROUP OF COMPANIES

# 603-699 KINGSTON ROAD

## PROPOSED STORM SERVICING FIGURE 2

| | | | |
|---|---|---|---|
| DESIGNED BY: | J.Y.L. | CHECKED BY: | P.C. |
| SCALE: | 1:1000 | DATE: | AUGUST 2023 |
| PROJECT No: | 2626 | FIGURE No: | 2.2 |




## LEGEND:

- LIMIT OF DEVELOPMENT
- STORM DRAINAGE BOUNDARY
- EXISTING STORM SEWER AND MAINTENANCE HOLE
- 105.00 EXISTING CONTOUR AND ELEVATIONS
- MAJOR SYSTEM - OVERLAND FLOW
- 1.22ha / 203 | 0.95 — DRAINAGE AREA (HECTARES); 5 YEAR RUNOFF COEFFICIENT; CATCHMENT ID
- 0.09ha / EXT-1 | 0.95 — EXTERNAL STORM DRAINAGE AREA (HECTARES); 5 YEAR RUNOFF COEFFICIENT; CATCHMENT ID

*NOTE: LAYOUT IS SCHEMATIC ONLY, DETAILS TO BE PROVIDED AT DETAILED DESIGN STAGE.

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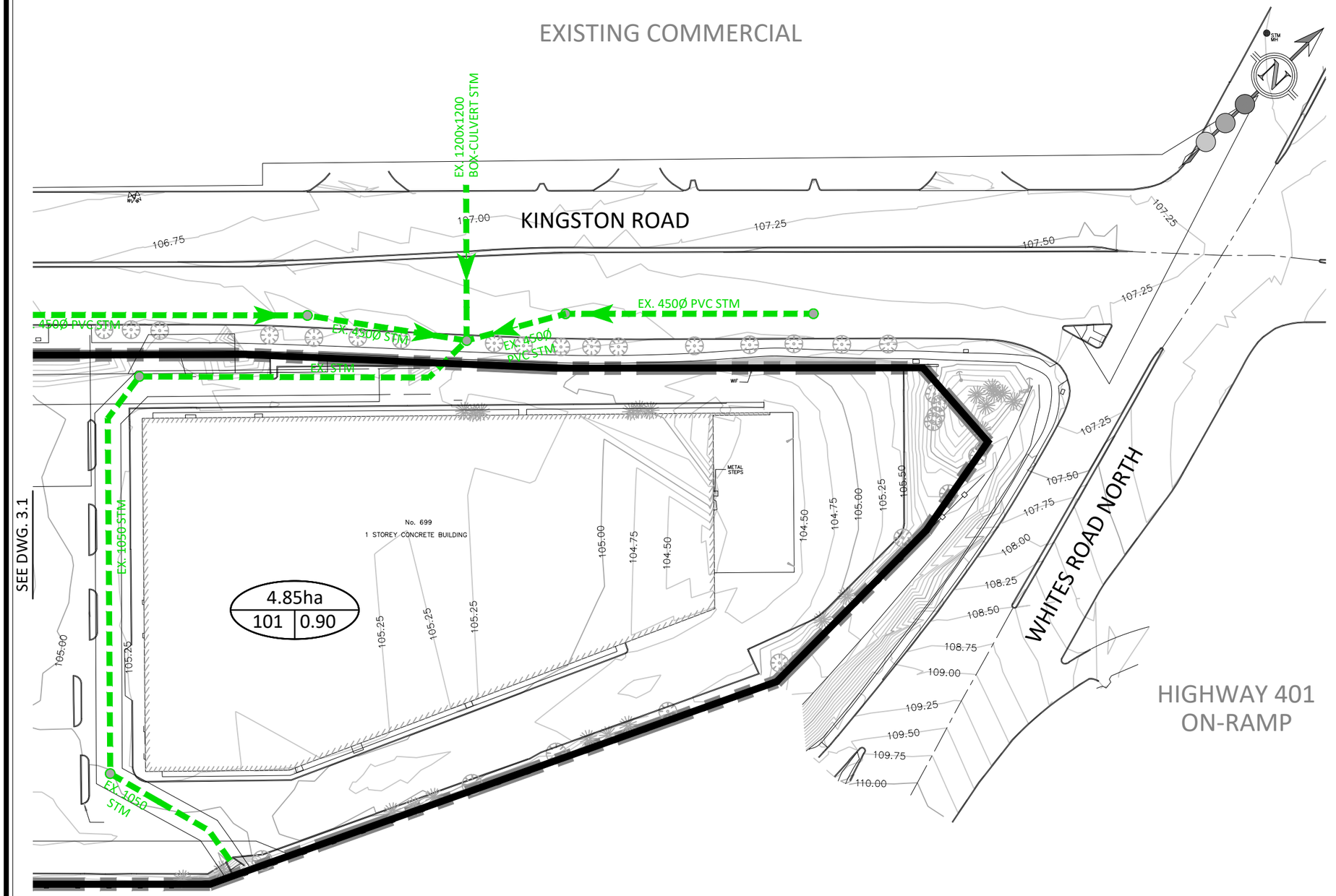
# SOBARA GROUP OF COMPANIES

# 603-699 KINGSTON ROAD

## EXISTING STORM DRAINAGE PLAN 1

| | | | |
|---|---|---|---|
| DESIGNED BY: | R.P.B. | CHECKED BY: | P.A.T |
| SCALE: | 1:1000 | DATE: | AUGUST 2023 |
| PROJECT No: | 2626 | FIGURE No: | 3.1 |




## LEGEND:

- LIMIT OF DEVELOPMENT
- STORM DRAINAGE BOUNDARY
- EXISTING STORM SEWER AND MAINTENANCE HOLE
- 105.00 EXISTING CONTOUR AND ELEVATIONS
- 1.22ha / 203 | 0.95 — DRAINAGE AREA (HECTARES); 5 YEAR RUNOFF COEFFICIENT; CATCHMENT ID

*NOTE: LAYOUT IS SCHEMATIC ONLY, DETAILS TO BE PROVIDED AT DETAILED DESIGN STAGE.

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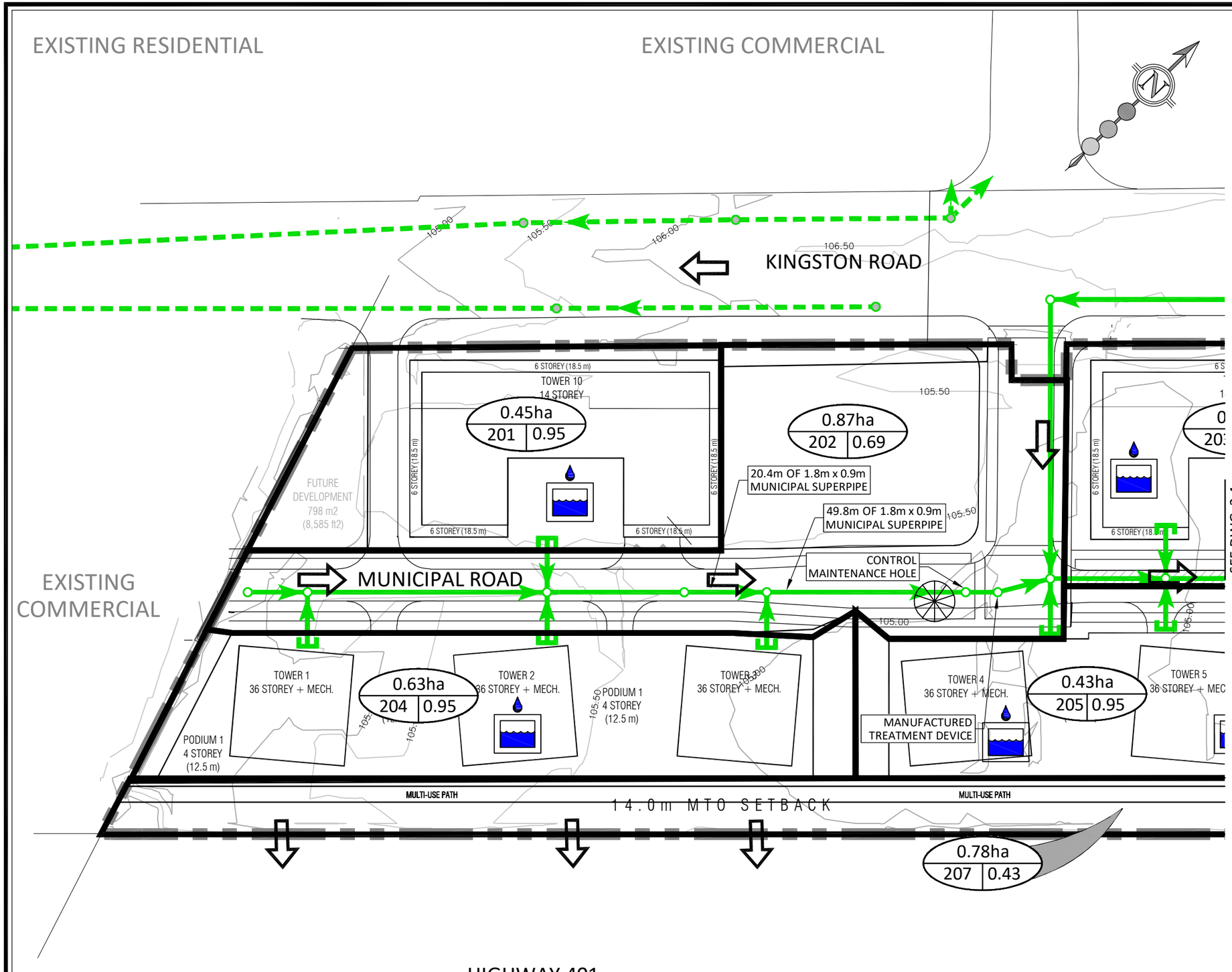
# SOBARA GROUP OF COMPANIES

## 603-699 KINGSTON ROAD

## EXISTING STORM DRAINAGE PLAN 2

| | | | |
|---|---|---|---|
| DESIGNED BY: | R.P.B. | CHECKED BY: | P.A.T |
| SCALE: | 1:1000 | DATE: | AUGUST 2023 |
| PROJECT No: | 2626 | FIGURE No: | 3.2 |

File: P:\2626 603-699 Kingston Road - Pickering\Drawings\FSP\Fig\Report Figures\2626P-3.1-3.2-STRM-EXST.dwg - Revised by <TMCNEIL> : Wed, Aug 02 2023 - 4:01pm




## LEGEND:

- LIMIT OF DEVELOPMENT
- STORM DRAINAGE BOUNDARY
- PROPOSED STORM SEWER AND MAINTENANCE HOLE
- EXISTING STORM SEWER AND MAINTENANCE HOLE
- 105.00 EXISTING CONTOUR AND ELEVATIONS
- MAJOR SYSTEM - OVERLAND FLOW
- 0.45ha / 201 | 0.95 — DRAINAGE AREA (HECTARES); 5 YEAR RUNOFF COEFFICIENT; CATCHMENT ID
- 100 YEAR CAPTURE LOCATION
- ON-SITE STORMWATER CONTROLS

*NOTE: LAYOUT IS SCHEMATIC ONLY, DETAILS TO BE PROVIDED AT DETAILED DESIGN STAGE.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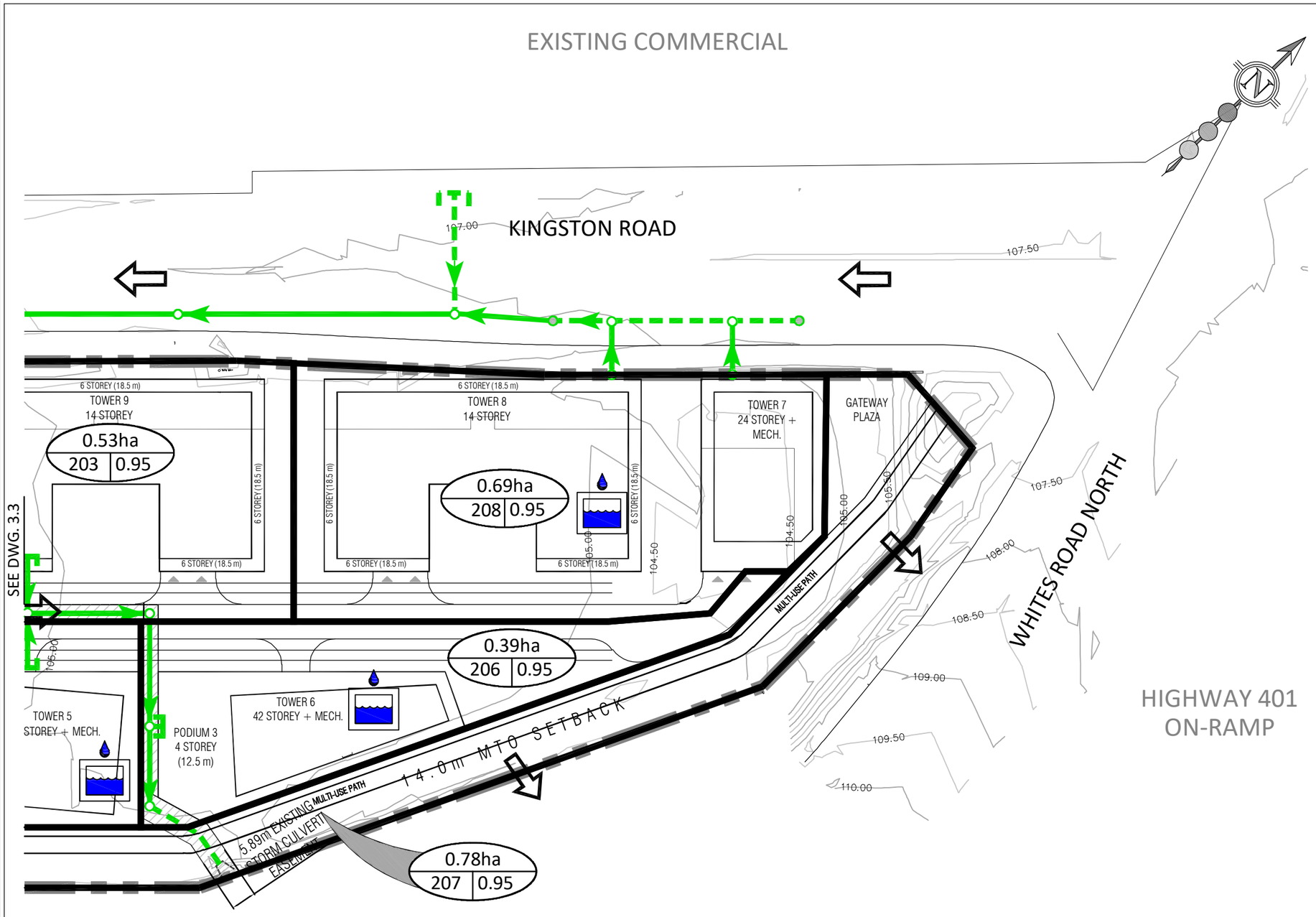
# SOBARA GROUP OF COMPANIES

## 603-699 KINGSTON ROAD

## PROPOSED STORM DRAINAGE PLAN 1

| | | | |
|---|---|---|---|
| DESIGNED BY: | R.P.B. | CHECKED BY: | P.A.T |
| SCALE: | 1:1000 | DATE: | AUGUST 2023 |
| PROJECT No: | 2626 | FIGURE No: | 3.3 |




## LEGEND:

- LIMIT OF DEVELOPMENT
- STORM DRAINAGE BOUNDARY
- PROPOSED STORM SEWER
- EXISTING STORM SEWER
- 105.00 — EXISTING CONTOUR AND ELEVATIONS
- MAJOR SYSTEM - OVERLAND FLOW
- 0.39ha / 206 | 0.95 — DRAINAGE AREA (HECTARES); 5 YEAR RUNOFF COEFFICIENT; CATCHMENT ID

*NOTE: LAYOUT IS SCHEMATIC ONLY, DETAILS TO BE PROVIDED AT DETAILED DESIGN STAGE.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# SOBARA GROUP OF COMPANIES

## 603-699 KINGSTON ROAD

## PROPOSED STORM DRAINAGE PLAN 2

| | | | |
|---|---|---|---|
| DESIGNED BY: | R.P.B. | CHECKED BY: | P.A.T |
| SCALE: | 1:1000 | DATE: | AUGUST 2023 |
| PROJECT No: | 2626 | FIGURE No: | 3.4 |

File: P:\2626 603-699 Kingston Road - Pickering\Drawings\FSP\Fig\Report Figures\2626P-3.3-3.4-STRM-PROP.dwg - Revised by <RBAR> : Mon, Jul 10 2023 - 5:23pm

EXISTING RESIDENTIAL

EXISTING COMMERCIAL

**SAN MH10A**
TOP = 106.47m
OBV SE 375Ø 100.19
OBV NE 375Ø 100.10

**SAN MH9A**
TOP = 106.00m
OBV SE 375Ø 100.39
OBV NW 375Ø 100.36
OBV NE 200Ø 100.45

EXISTING 300Ø AC SANITARY SEWER WITHIN PROPOSED DEVELOPMENT TO BE REMOVED

KINGSTON ROAD

75.9m-375Ø CONC SAN @ 0.5%

34.8m-375Ø PVC SAN @ 0.5%

EX. 300Ø AC SAN

EX. 300Ø AC SAN

**SAN MH2A**
TOP = 104.89m
OBV NE 200Ø 101.71
OBV SE 200Ø 101.71
OBV SW 200Ø 101.80

**SAN MH1A**
TOP = 104.98m
OBV NE 200Ø 101.89

**SAN MH5A**
TOP = 105.15m
OBV SE 200Ø 101.24

14.8m-200Ø PVC SAN @ 1.0% FOR TOWER 9

27.5m-375Ø PVC SAN @ 0.5%

13.9m-200Ø PVC SAN @ 1.0% FOR TOWER 10

14.0m-200Ø PVC SAN @ 1.0%

**SAN MH3A**
TOP = 105.01m
OBV SW 200Ø 101.41
OBV NW 200Ø 101.41
OBV SE 200Ø 101.41
OBV NE 300Ø 101.38

**SAN MH4A**
TOP = 104.89m
OBV SW 300Ø 101.10
OBV SE 200Ø 101.10
OBV NW 200Ø 101.10
OBV NE 300Ø 101.07

**SAN MH8A**
TOP = 105.43m
OBV SE 375Ø 100.56
OBV NW 375Ø 100.53
OBV NE 200Ø 100.62

14.8m-200Ø PVC SAN @ 1.0% FOR TOWER 6

43.3m-300Ø PVC SAN @ 0.5%

19.7m-375Ø PVC SAN @ 0.5%

13.4m-375Ø PVC SAN @ 0.5%

60.0m-200Ø PVC SAN @ 0.5%

55.0m-300Ø PVC SAN @ 0.5%

10.4m-200Ø PVC SAN @ 1.0% FOR TOWER 3

**SAN MH7A**
TOP = 105.15m
OBV SW 375Ø 100.72
OBV SE 200Ø 100.72
OBV NW 375Ø 100.63

15.5m-200Ø PVC SAN @ 1.0% FOR TOWER 5

17.9m 200Ø PVC SAN @ 1.0%

9.8m-200Ø PVC SAN @ 1.0% FOR TOWER 1

9.8m-200Ø PVC SAN @ 1.0% FOR TOWER 2

**SAN MH6A**
TOP = 104.90m
OBV SW 300Ø 100.85
OBV NE 375Ø 100.82
OBV SE 200Ø 100.85

14.8m-200Ø PVC SAN @ 1.0% FOR TOWER 4

TOWER 10
14 STOREY
(46.0 m + 6.0 m mech.)
±2,260 m2 plate
(±250 units)

TOWER 1
36 STOREY + MECH.
(111.5 m + 6.0 m mech.)
800 m2 plate
(±320 units)

TOWER 2
36 STOREY + MECH.
(111.5 m + 6.0 m mech.)
800 m2 plate
(±320 units)

TOWER 3
36 STOREY + MECH.
(111.5 m + 6.0 m mech.)
800 m2 plate
(±320 units)

TOWER 4
36 STOREY + MECH.
(111.5 m + 6.0 m mech.)
800 m2 plate
(±320 units)

PODIUM 1
4 STOREY
(12.5 m)

PODIUM 2
4 STOREY
(12.5 m)

No.575
1 STOREY
METAL & GLASS BUILDING

6 STOREY (18.5 m)

MULTI-USE PATH

14.0m SETBACK

HIGHWAY 401

SEE DWG. 4.1

SCP No. 00820090033

## LEGEND:

- LIMIT OF DEVELOPMENT
- SANITARY SEWER AND MAINTENANCE HOLE
- SANITARY SEWER PLUG
- EXISTING SANITARY SEWER AND MAINTENANCE HOLE
- EXISTING SANITARY SEWER AND MAINTENANCE HOLE TO BE REMOVED

*NOTE: LAYOUT IS SCHEMATIC ONLY, DETAILS TO BE PROVIDED AT DETAILED DESIGN STAGE.

SCS consulting group ltd
30 CENTURIAN DRIVE, SUITE 100
MARKHAM, ONTARIO L3R 8B8
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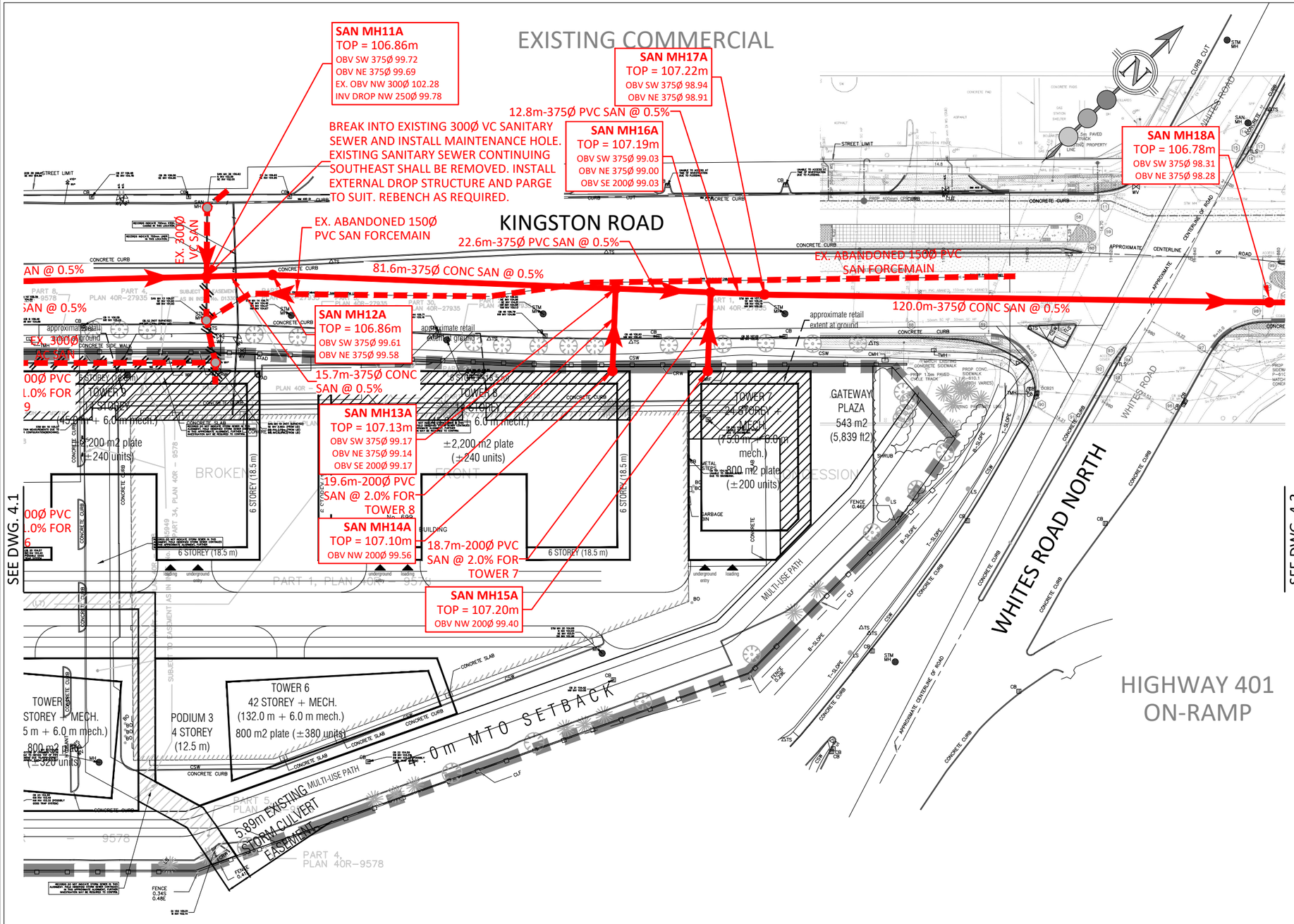
FAX: (905) 475-8335

# SOBARA GROUP OF COMPANIES

# 603-699 KINGSTON ROAD

## PROPOSED SANITARY SERVICING FIGURE 1

| | | | |
|---|---|---|---|
| DESIGNED BY: | J.Y.L. | CHECKED BY: | P.C. |
| SCALE: | 1:1000 | DATE: | AUGUST 2023 |
| PROJECT No: | 2626 | FIGURE No: | 4.1 |




## LEGEND:

- LIMIT OF DEVELOPMENT
- SANITARY SEWER AND MAINTENANCE HOLE
- SANITARY SEWER PLUG
- EXISTING SANITARY SEWER AND MAINTENANCE HOLE
- EXISTING SANITARY SEWER AND MAINTENANCE HOLE TO BE REMOVED

*NOTE: LAYOUT IS SCHEMATIC ONLY, DETAILS TO BE PROVIDED AT DETAILED DESIGN STAGE.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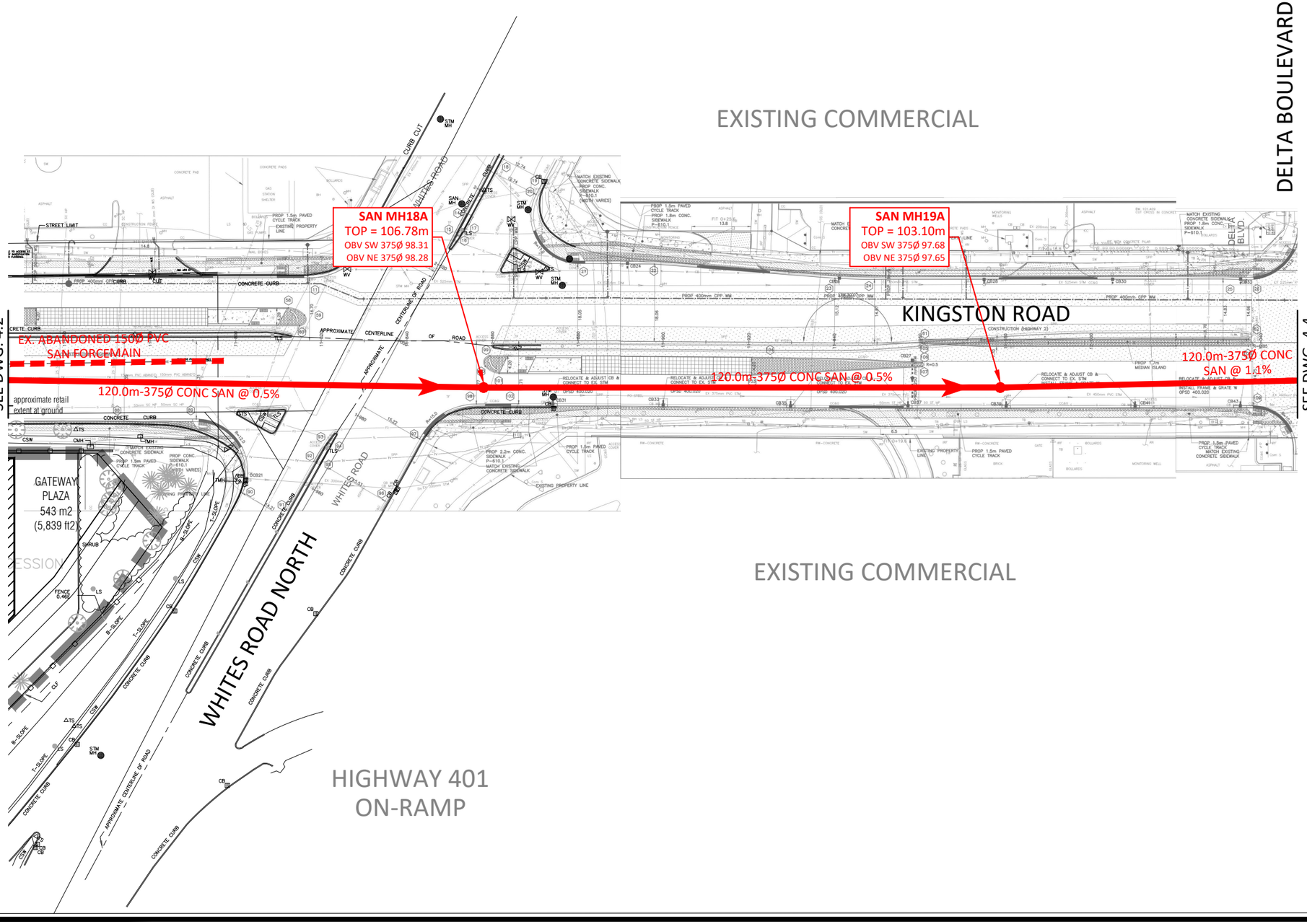
# SOBARA GROUP OF COMPANIES

## 603-699 KINGSTON ROAD

## PROPOSED SANITARY SERVICING FIGURE 2

| | | | |
|---|---|---|---|
| DESIGNED BY: | J.Y.L. | CHECKED BY: | P.C. |
| SCALE: | 1:1000 | DATE: | AUGUST 2023 |
| PROJECT No: | 2626 | FIGURE No: | 4.2 |




## LEGEND:

- LIMIT OF DEVELOPMENT
- SANITARY SEWER AND MAINTENANCE HOLE
- SANITARY SEWER PLUG
- EXISTING SANITARY SEWER AND MAINTENANCE HOLE
- EXISTING SANITARY SEWER AND MAINTENANCE HOLE TO BE REMOVED

*NOTE: LAYOUT IS SCHEMATIC ONLY, DETAILS TO BE PROVIDED AT DETAILED DESIGN STAGE.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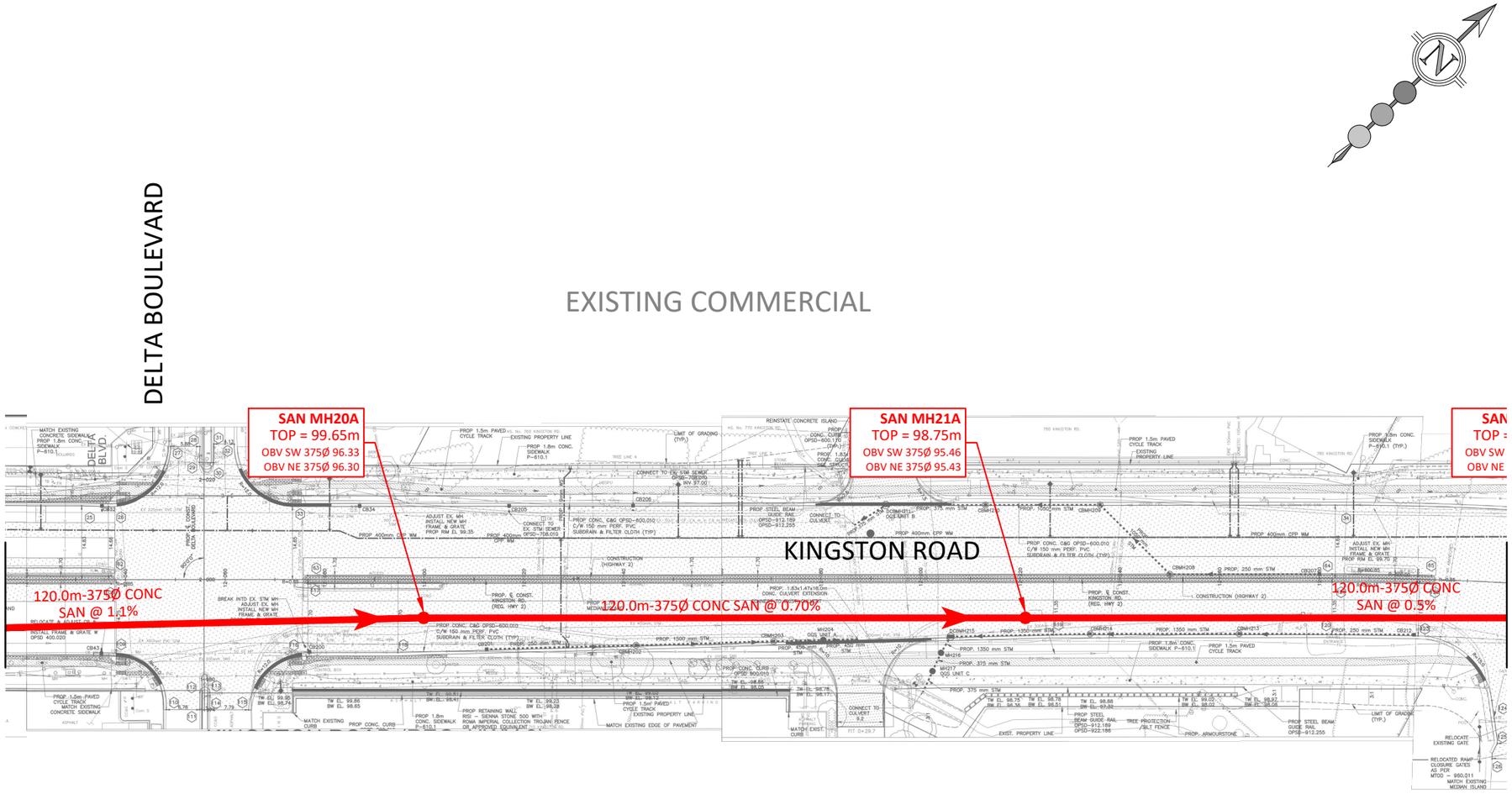
# SOBARA GROUP OF COMPANIES

## 603-699 KINGSTON ROAD

## PROPOSED SANITARY SERVICING FIGURE 3

| | | | |
|---|---|---|---|
| DESIGNED BY: | J.Y.L. | CHECKED BY: | P.C. |
| SCALE: | 1:1000 | DATE: | AUGUST 2023 |
| PROJECT No: | 2626 | FIGURE No: | 4.3 |

File: P:\2626 603-699 Kingston Road - Pickering\Drawings\FSP\Fig\Report Figures\2626P-4.1-4.5-SERV-SANI.dwg - Revised by <TMCNEIL> : Wed, Aug 02 2023 - 4:03pm




## LEGEND:

- LIMIT OF DEVELOPMENT
- SANITARY SEWER AND MAINTENANCE HOLE
- SANITARY SEWER PLUG
- EXISTING SANITARY SEWER AND MAINTENANCE HOLE
- EXISTING SANITARY SEWER AND MAINTENANCE HOLE TO BE REMOVED

*NOTE: LAYOUT IS SCHEMATIC ONLY, DETAILS TO BE PROVIDED AT DETAILED DESIGN STAGE.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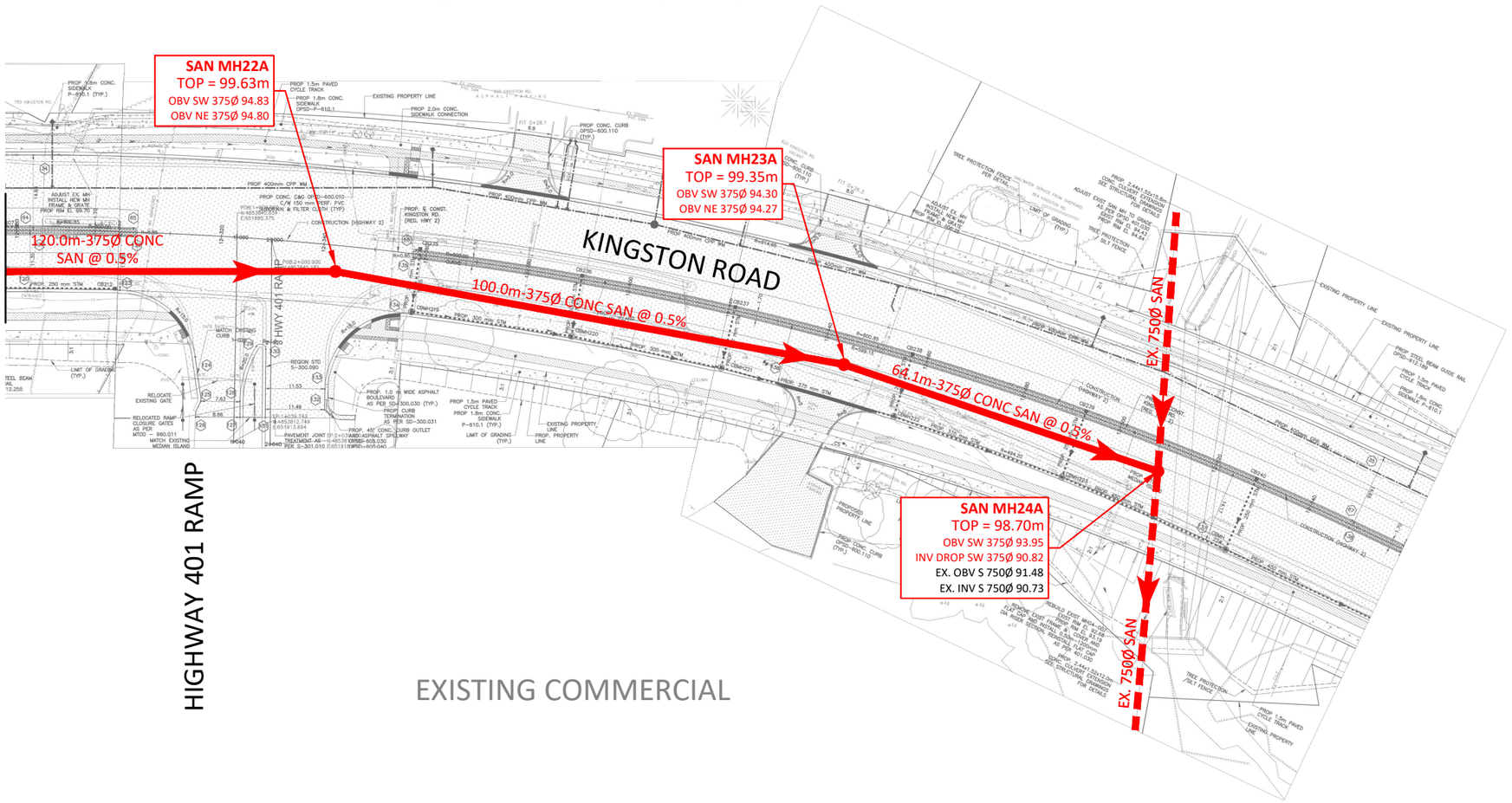
# SOBARA GROUP OF COMPANIES

## 603-699 KINGSTON ROAD

## PROPOSED SANITARY SERVICING FIGURE 4

| | | | |
|---|---|---|---|
| DESIGNED BY: | J.Y.L. | CHECKED BY: | P.C. |
| SCALE: | 1:1000 | DATE: | AUGUST 2023 |
| PROJECT No: | 2626 | FIGURE No: | 4.4 |

File: P:\2626 603-699 Kingston Road - Pickering\Drawings\FSP\Fig\Report Figures\2626P-4.1-4.5-SERV-SANI.dwg - Revised by <TMCNEIL> : Wed, Aug 02 2023 - 4:03pm




## LEGEND:

- LIMIT OF DEVELOPMENT
- SANITARY SEWER AND MAINTENANCE HOLE
- SANITARY SEWER PLUG
- EXISTING SANITARY SEWER AND MAINTENANCE HOLE
- EXISTING SANITARY SEWER AND MAINTENANCE HOLE TO BE REMOVED

*NOTE: LAYOUT IS SCHEMATIC ONLY, DETAILS TO BE PROVIDED AT DETAILED DESIGN STAGE.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# SOBARA GROUP OF COMPANIES

# 603-699 KINGSTON ROAD

## PROPOSED SANITARY SERVICING FIGURE 5

| | | | |
|---|---|---|---|
| DESIGNED BY: | J.Y.L. | CHECKED BY: | P.C. |
| SCALE: | 1:1000 | DATE: | AUGUST 2023 |
| PROJECT No: | 2626 | FIGURE No: | 4.5 |

EXISTING RESIDENTIAL

EXISTING COMMERCIAL

CONNECT PROPOSED 300Ø WATERMAIN TO EXISTING 400Ø WATERMAIN

EX. 400Ø DI WATERMAIN

EX. 400Ø DI WATERMAIN

EX. 300Ø PVC WATERMAIN

KINGSTON ROAD

SCP No. 00820090033

EX. WATERMAIN

300Ø PVC WATERMAIN

200Ø FIRE WATERMAIN (REUSED) FOR TOWER 10

150Ø DOMESTIC WATERMAIN (REUSED) FOR TOWER 10

200Ø FIRE WATERMAIN FOR TOWER 8

150Ø DOMESTIC WATERMAIN FOR TOWER 8

200Ø FIRE WATERMAIN FOR TOWER 7

150Ø DOMESTIC WATERMAIN FOR TOWER 7

200Ø FIRE WATERMAIN FOR TOWER 6

150Ø DOMESTIC WATERMAIN FOR TOWER 6

300Ø PVC WATERMAIN

EX. WATERMAIN

300Ø PVC WATERMAIN

EX. WATERMAIN

150 Ø DOMESTIC WATERMAIN FOR TOWER 1

150Ø DOMESTIC WATERMAIN FOR TOWER 2

150Ø DOMESTIC WATERMAIN FOR TOWER 3

150Ø DOMESTIC WATERMAIN FOR TOWER 5

200Ø FIRE WATERMAIN FOR TOWERS 1, 2, 3

200Ø FIRE WATERMAIN FOR TOWERS 1, 2, 3

200Ø FIRE WATERMAIN FOR TOWER 4 AND 5

150Ø DOMESTIC WATERMAIN FOR TOWER 4

TOWER 10
36 STOREY + MECH.
(111.5 m + 6.0 m mech.)
800 m2 plate
(±320 units)

PODIUM 1
4 STOREY
(12.5 m)

TOWER 1
36 STOREY + MECH.
(111.5 m + 6.0 m mech.)
800 m2 plate
(±320 units)

TOWER 2
36 STOREY + MECH.
(111.5 m + 6.0 m mech.)
800 m2 plate
(±320 units)

TOWER 3
36 STOREY + MECH.
(111.5 m + 6.0 m mech.)
800 m2 plate
(±320 units)

PODIUM 2
4 STOREY
(12.5 m)

±2,260 m2 plate
(±250 units)

6 STOREY (18.5 m)

No.575
1 STOREY
METAL & GLASS BUILDING

No.645
1 STOREY CONCRETE BUILDING

FUTURE DEVELOPMENT

FRONT CONCESSION

MULTI-USE PATH

4.0m MTO SETBACK

HIGHWAY 401

SEE DWG. 5.2

## LEGEND:

- LIMIT OF DEVELOPMENT
- WATERMAIN
- WATERMAIN PLUG
- EXISTING WATERMAIN
- EXISTING WATERMAIN TO BE REMOVED

*NOTE: LAYOUT IS SCHEMATIC ONLY, DETAILS TO BE PROVIDED AT DETAILED DESIGN STAGE.


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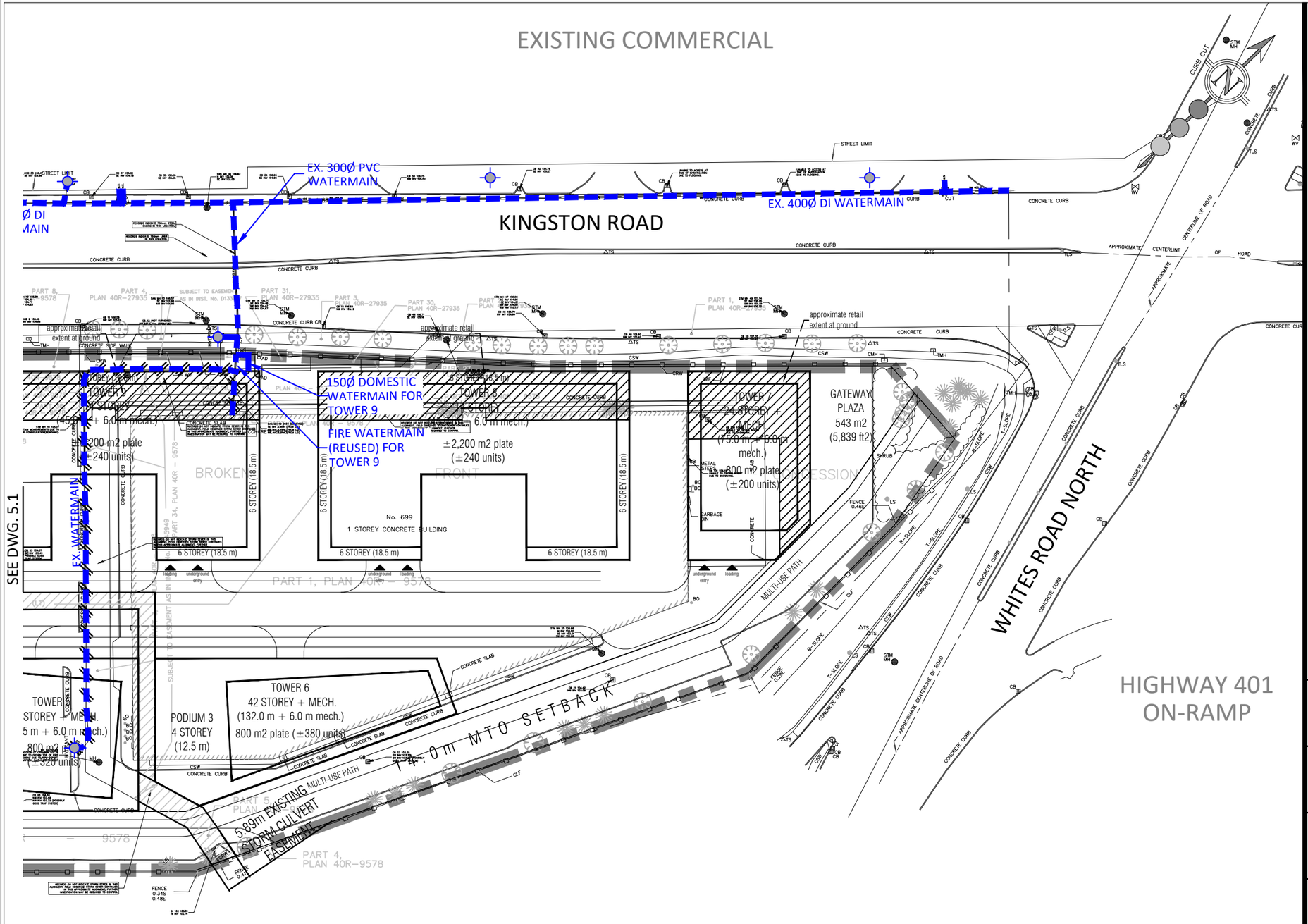
# SOBARA GROUP OF COMPANIES

# 603-699 KINGSTON ROAD

## PROPOSED WATERMAIN SERVICING FIGURE

| | | | |
|---|---|---|---|
| DESIGNED BY: | J.Y.L. | CHECKED BY: | P.C. |
| SCALE: | 1:1000 | DATE: | AUGUST 2023 |
| PROJECT No: | 2626 | FIGURE No: | 5.1 |




## LEGEND:

- LIMIT OF DEVELOPMENT
- WATERMAIN
- WATERMAIN PLUG
- EXISTING WATERMAIN
- EXISTING WATERMAIN TO BE REMOVED

*NOTE: LAYOUT IS SCHEMATIC ONLY, DETAILS TO BE PROVIDED AT DETAILED DESIGN STAGE.


SCS consulting group ltd
30 CENTURIAN DRIVE, SUITE 100
MARKHAM, ONTARIO L3R 8B8
TEL: (905) 475-1900
FAX: (905) 475-8335


# SOBARA GROUP OF COMPANIES

## 603-699 KINGSTON ROAD

## PROPOSED WATERMAIN SERVICING FIGURE

| | | | |
|---|---|---|---|
| DESIGNED BY: | J.Y.L. | CHECKED BY: | P.C. |
| SCALE: | 1:1000 | DATE: | AUGUST 2023 |
| PROJECT No: | 2626 | FIGURE No: | 5.2 |

EXISTING RESIDENTIAL

EXISTING COMMERCIAL

SCP No. 00820090033

KINGSTON ROAD

106.25 106.50 106.50 106.25 106.25 106.25 106.00 105.75 105.50 105.25 105.00 104.75

104.62EX 105.03EX 105.69EX 105.82EX 106.36EX 106.51EX 105.78EX 106.21EX 105.86EX 106.38

3.0% 2.5%

104.84

105.39EX 105.31EX 104.93EX 105.02 104.82EX 104.75EX 104.46EX

FRONT CONCESSION

LOT 30, RANGE 3 BROKEN

29, RANGE 3

FUTURE DEVELOPMENT 798 m2 (8,585 ft2)

6 STOREY (18.5 m) TOWER 10 14 STOREY (45.0 m + 6.0 m mech.)

6 STOREY (18.5 m)

105.55 105.24 105.14 104.69

0.5% 1.3% 1.7% 0.6%

105.29 105.20 105.01 104.92 105.30 105.20 105.11 105.46 105.50

1.0% 1.0% 1.0% 1.0%

0.5% 0.5% 0.5% 0.5% 0.6% 0.5%

104.84 105.00 104.82 104.96 104.66 104.92 104.96 105.00 104.87

105.13 105.20 105.13 105.20

2.1%

TOWER 1 36 STOREY + MECH. (111.5 m +6.0 m mech.)

PODIUM 1 4 STOREY (12.5 m)

TOWER 2 36 STOREY + MECH. (111.5 m + 6.0 m mech.)

PODIUM 1 4 STOREY (12.5 m)

TOWER 3 36 STOREY + MECH. (111.5 m + 6.0 m mech.)

TOWER 4 36 STOREY + MECH. (111.5 m + 6.0 m mech.)

PODIUM 2 4 STOREY (12.5 m)

TOWER 5 36 STOREY + MECH (111.5 m + 6.0 m mec

MULTI-USE PATH

CONCRETE PAD

14.0m MTO SETBACK

104.06EX 104.55EX 105.17EX 105.31EX 105.56EX 104.85EX 104.26EX 104.17EX

HIGHWAY 401

SEE DWG. 6.2

## LEGEND:

- LIMIT OF DEVELOPMENT
- × 223.91 — PROPOSED ELEVATION
- × 224.35EX — EXISTING ELEVATION
- × 112.75SW — SWALE ELEVATION
- 223.71 — PROPOSED ROAD ELEVATION
- MAX 3:1 SLOPE
- MAJOR SYSTEM - OVERLAND FLOW

*NOTE: LAYOUT IS SCHEMATIC ONLY, DETAILS TO BE PROVIDED AT DETAILED DESIGN STAGE.

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# SORBARA GROUP OF COMPANIES

# 603-699 KINGSTON ROAD

## PRELIMINARY GRADING FIGURE

| | | | |
|---|---|---|---|
| DESIGNED BY: | J.Y.L./P.C. | CHECKED BY: | P.C. |
| SCALE: | 1:1000 | DATE: | AUGUST 2023 |
| PROJECT No: | 2626 | FIGURE No: | 6.1 |

EXISTING COMMERCIAL

KINGSTON ROAD

HIGHWAY 401

HIGHWAY 401 ON-RAMP

WHITES ROAD NORTH

SEE DWG. 6.1

TOWER 9
14 STOREY
(45.0 m + 6.0 m mech.)

TOWER 8
14 STOREY
(45.0 m + 6.0 m mech.)

TOWER 7
24 STOREY + MECH.
(75.0 m + 6.0 m mech.)

GATEWAY PLAZA

TOWER 5
36 STOREY + MECH.
(111.5 m + 6.0 m mech.)

PODIUM 3
4 STOREY
(12.5 m)

TOWER 6
42 STOREY + MECH.
(132.0 m + 6.0 m mech.)

14.0m MTO SETBACK

5.89m EXISTING STORM CULVERT EASEMENT

MULTI-USE PATH

BROKEN FRONT CONCESSION

SCP No. 00819840013

## LEGEND:

- LIMIT OF DEVELOPMENT
- × 223.91 — PROPOSED ELEVATION
- × 224.35EX — EXISTING ELEVATION
- × 112.75SW — SWALE ELEVATION
- 223.71 — PROPOSED ROAD ELEVATION
- MAX 3:1 SLOPE

*NOTE: LAYOUT IS SCHEMATIC ONLY, DETAILS TO BE PROVIDED AT DETAILED DESIGN STAGE.

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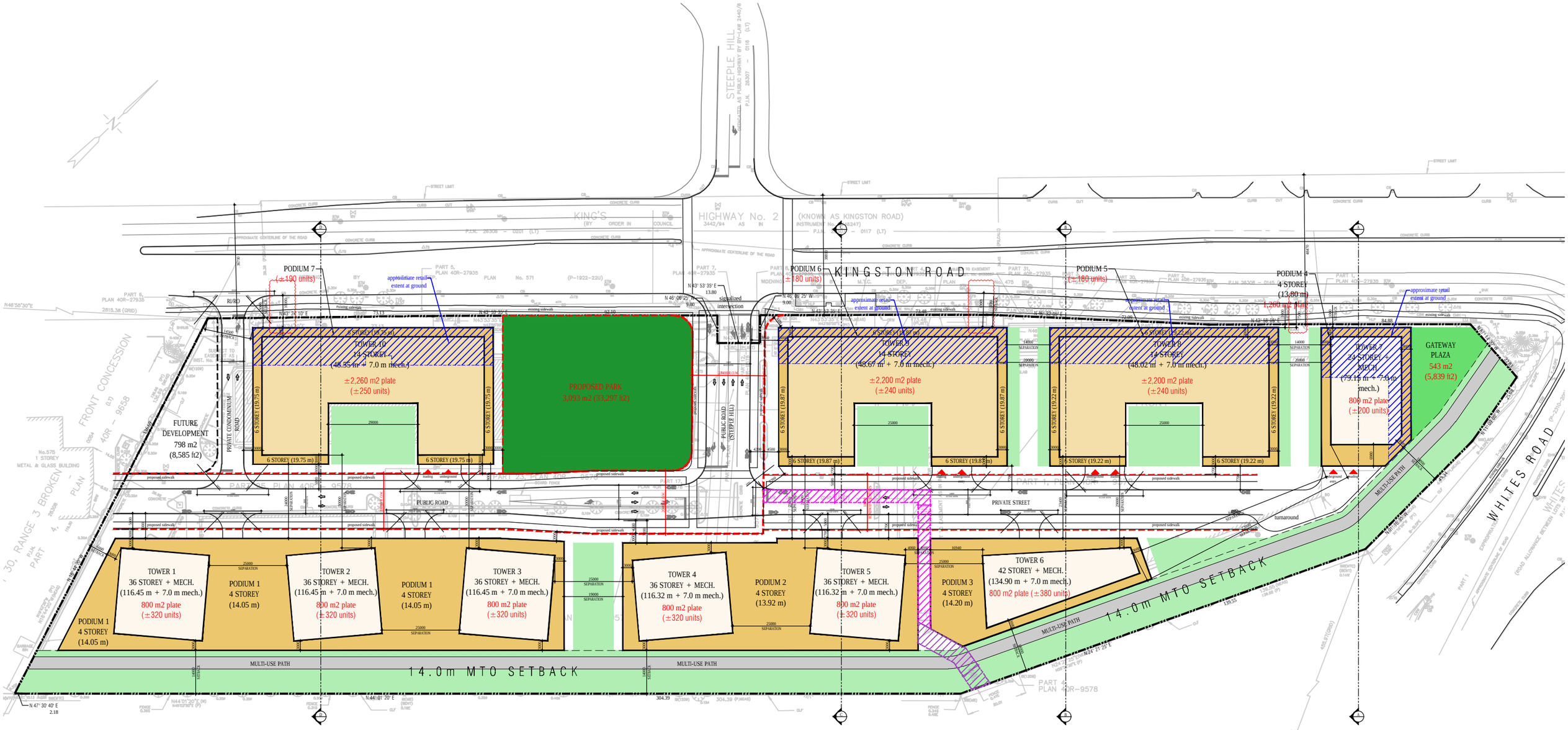
# SORBARA GROUP OF COMPANIES

# 603-699 KINGSTON ROAD

## PRELIMINARY GRADING FIGURE

| | | | |
|---|---|---|---|
| DESIGNED BY: | J.Y.L./P.C. | CHECKED BY: | P.C. |
| SCALE: | 1:1000 | DATE: | AUGUST 2023 |
| PROJECT No: | 2626 | FIGURE No: | 6.2 |

## Appendix A Site Plan




- WITHOUT PREJUDICE -

## CONCEPTUAL SITE PLAN

▪ Sorbara Group of Companies ▪ Whites Road & Hwy 401 ▪ 1682.19 ▪ Jul. 11, 2023

1:1200

GRAZIANI + CORAZZA ARCHITECTS

# Appendix B Excerpts from Background Reports

DIRECTOR INDUSTRIAL HOLDINGS LIMITED

# 603-643, 645-699 KINGSTON ROAD
## FUNCTIONAL SERVICING REPORT

APRIL 15, 2020

# 603-643, 645-699 KINGSTON ROAD

## FUNCTIONAL SERVICING REPORT

DIRECTOR INDUSTRIAL HOLDINGS LIMITED

FUNCTIONAL SERVICING REPORT

PROJECT NO.: 19M-00841
DATE: APRIL 15 2020

WSP CANADA GROUP LIMITED
SUITE 201
701 ROSSLAND ROAD EAST
WHITBY, ON, CANADA L1N 8Y9

T: +1 905 668-3022
F: +1 905 668-9443
WSP.COM

# SIGNATURES

PREPARED BY

Lisa Lovell

REVIEWED BY

Andrew Kerr, P.Eng
Senior Project Engineer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## FIGURES



## APPENDICES

# 1 INTRODUCTION

## 1.1 INTRODUCTION

This report has been prepared for the Director Industrial Holdings Limited Lands located at 603-643, 645-699 Kingston Road (hereinafter referred to as the "Site") in the City of Pickering, to identify any servicing or grading issues and to identify how these lands may be developed. The current development concept, as represented in the conceptual site plan drawings and development statistics prepared by Graziani + Corazza Architects, dated April 6, 2020, enclosed with this submission, is preliminary in nature and is subject to change. The development is bordered by Kingston Road to the north, Whites Road to the east, Highway 401 to the south and existing commercial lands to the west. The location of the development block is identified on **Figure No. 1**. The existing site conditions is shown on **Figure No. 2**, and details the Site Limits and the neighboring properties.

The current development concept, which represents a high-level master plan for a new mixed-use community, is primarily intended to form the basis of the proposed Draft Official Plan Amendment, which is required to facilitate the proposed density and Floor Space Index on the subject lands, as well as the proposed Draft Zoning By-law Amendment which is required to establish a new site-specific zoning framework that will implement the City's current land use vision for the subject lands.

This proposed official plan and zoning by-law amendment framework is intended to provide flexibility to ensure that the development of the lands responds to market conditions and can result in implementation of plans and alternative plans to achieve principles of intensification based on good planning and urban design principles. As such, it is anticipated that the development concept as presented be considered conceptual and will be revised, as necessary, to account for new and/or evolving considerations related to the master-planned community.

The purpose of this report is to describe the existing services in the vicinity of the Site in order to determine how these lands will be serviced by storm, sanitary and water. The report also reviews the site grading at a preliminary level to determine drainage boundaries and grading constraints. A separate Stormwater Management, also prepared by WSP, speaks to the Storm Water Management strategies including Low Impact Development (LIDs), Water Quality, and potential outfalls for this site.

## 1.2 SITE DESCRIPTION

The total Site area is 4.85 ha (11.98 acres). The Site generally fairly flat with existing localized low points to collect drainage. The existing overland flow route is to the south towards Highway 401. There is an existing retaining wall along the northeast portion of the site, adjacent to Kingston Road. The retaining wall is on the public right-of-way however it is understood from the projects pre-consultation that the City and Region would prefer for this wall to be removed as part of the development. Therefore, there will be a high point in the northwest corner of the site after development of the site. Existing Site grading is shown on the Topographic Survey, **Figure No 2**. The existing grades were established by field survey on November 12th, 2018 by R. Avis Surveying Inc. (Project No. 3230-0).

There are two existing active easements on the property. There is a sanitary sewer easement running parallel to Kingston Rd along the NE portion of the site (Inst No. D133028). Record drawings received from the Region of Durham indicate that this easement contains an active 300mm sanitary sewer. The second easement is a storm sewer easement that bisects the property and runs north-south from Kingston Rd to Highway 401 (Inst No. D245949). Neither the Region of Durham or the City of Pickering were able to provide drawings for the sewer in this easement, however based on the pre-consultation meeting minutes and surveyed at grade structures we believe that this easement contains a trunk storm sewer which conveys flow from the Kingston Rd Right-of-Way to a headwall which outlets to Highway 401.

## 1.3 DEVELOPMENT CONCEPT

The current concept development will consist of 6 high-rise towers, 2 mid-rise towers, and 4 townhouse blocks.

Four (4) of the proposed building are townhouse blocks in the northern portion of the site closest to Kingston Road (called Block 1 through Block 4). The townhouse blocks each contain 36 units, for a total of 144 residential townhouse units.

In addition to the townhouse blocks there are 5 proposed podiums containing a total of 8 residential towers. Podium 1 is a 4-storey podium in the southwest portion of the site and contains one 29-storey residential tower (Tower 1), one 32-storey residential tower (Tower 2), and one 36 storey residential tower (Tower 3) with 250 units, 280 units, and 320 units respectively. Podium 2 is a 6-storey residential podium in the northern portion of the site and contains one 18-storey residential tower with 360 units (Tower 4). Podium 2 contains 170 units. Podium 3 is a 6-storey residential podium in the northern portion of the site which contains an 18-storey residential tower with 360 units (Tower 5). Podium 3 contains 170 units. Podium 4 is a 4-storey residential podium in the southeast portion of the site and contains one 29-storey residential tower (Tower 6) and one 42-storey residential (Tower 7) with 250 units and 380 units respectively. Podium 5 is a 4-storey podium in the northeast corner of the site which contains 4-storeys of commercial and office space and a 24-storey residential tower (Tower 8) containing 200 units. In total between the 8 towers, 5 podiums, and the four townhouse blocks a total of 2884 residential units are proposed.

There are 4 separate below grade parking structures proposed on the site. Townhouse Block 1 and 2, and Podium 2 will share one below grade parking structure. Similarly, Townhouse Block 3 and 4, Podium 3, and Podium 5 will share one below grade parking structure. Podium 1 and Podium 2 will each have their own below grade parking structure.

The proposed development also includes three parks, one west of Podium 5 (0.14ha), one between Podium 1 and Podium 4 (0.14ha), and one at the west edge of the site (0.11ha), which is proposed to be a part of larger future park. In addition to the parks there is other proposed soft landscaped areas as shown on the architectural drawings.

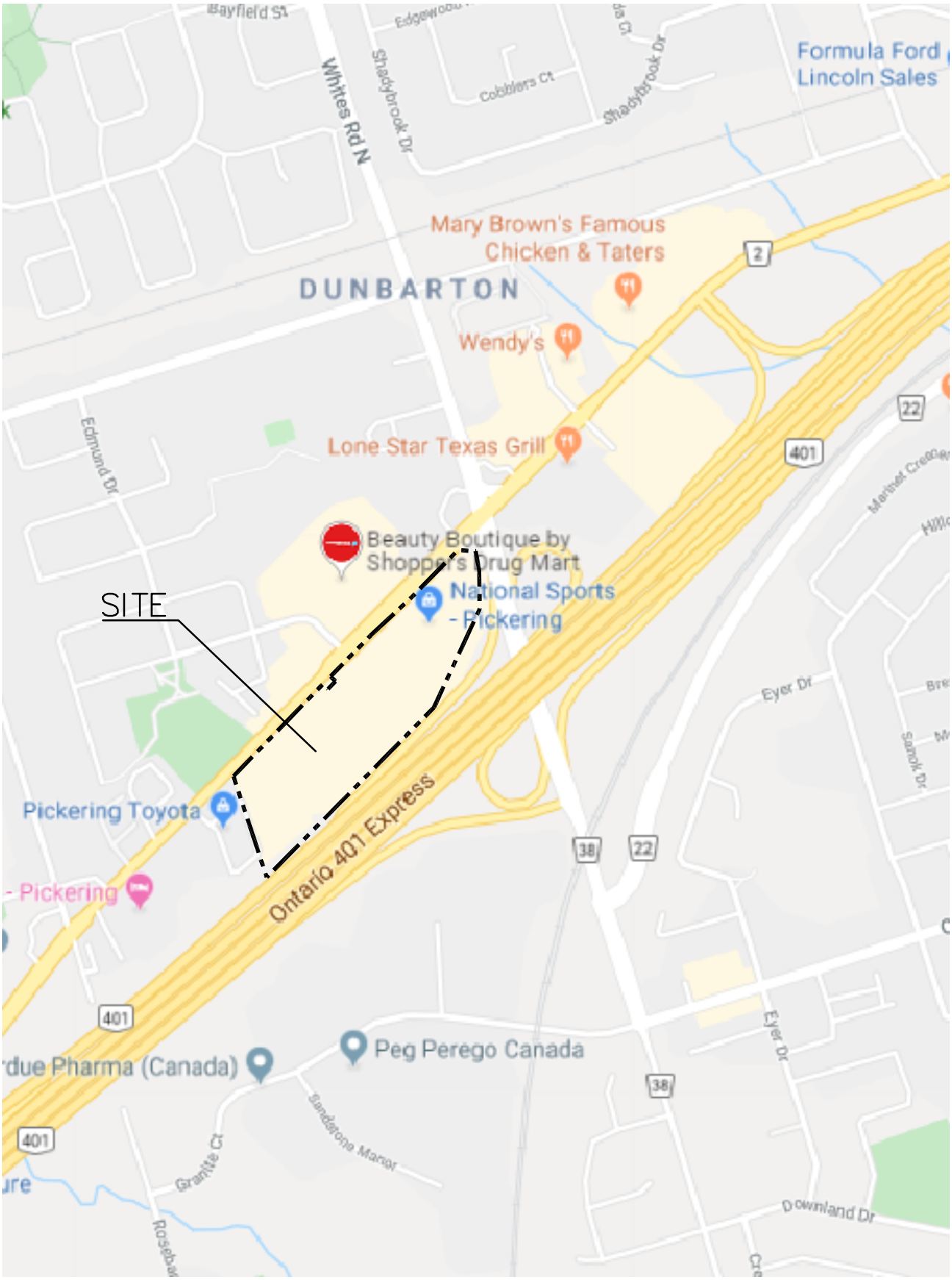
The proposed development plan is shown on **Figure No's. 3a** (above grade) and **3b** (below grade).

## 1.4 PHASING

The Site Plan is expected to be developed in multiple phases. The phasing of the site plan is to be determined at a later date.

## 1.5 REPORT OUTLINE

For the purpose of this report a number of preliminary figures have been prepared to clarify the servicing and grading issues and potential solutions. The Site limits are identified in **Figure No. 1** and discussed in Section 1.2 of this report. The development block is identified by the Topographic Survey in **Figure No. 2**. The Conceptual Site Plan is shown in both **Figure No's. 3a** and **3b**, each outlining the conceptual layout for both the surface Site Plan and the underground parking Site Plan respectively. The Preliminary Site Grading section of this report outlines the issues encountered with the existing grade and solutions to control the major and minor overland flow, as shown in **Figure No. 4**. The Preliminary Site Servicing outlines the proposed watermain, sanitary, and storm connections for the Site, and schematically lays out the proposed on-site servicing, and can be seen in **Figure No. 5**.




| | | | | |
|---|---|---|---|---|
| CLIENT<br>DIRECTOR INDUSTRIAL HOLDINGS LIMITED | TITLE<br>603–643, 645–699 KINGSTON ROAD, PICKERING, ONTARIO<br>SITE LOCATION PLAN | Suite 201 - 701 Rossland Road East<br>Whitby, ON L1N 8Y9<br>t. 905.668.3022<br>f. 905.668.9443<br>www.wsp-pb.com | Checked: AK<br>Date: FEB 2020<br>Scale: NTS | Drawn: LL<br>Proj. No.: 19M–00841<br>Figure No.: 1 |

KINGSTON ROAD

EXISTING SANITARY EASEMENT

SUBJECT TO EASEMENT AS IN INST. No. D533005

No.603 – No.643
1 STOREY BRICK BUILDING

No.575
1 STOREY
METAL & GLASS BUILDING

No.645
1 STOREY CONCRETE BUILDING

No. 699
1 STOREY CONCRETE BUILDING

EXISTING STORM EASEMENT

SUBJECT TO EASEMENT AS IN INST. No. D245949

PART 1, PLAN 40R – 9578

PART 2, PLAN 40R – 9578

PART 3, PLAN 40R – 9578

PART 4, PLAN 40R–9578

PART 5, PLAN 40R–9578

PART 6, PLAN 40R – 9578

PART 7, PLAN 40R–9578

PART 8, PLAN 40R–9578

PART 9, PLAN 40R – 9578

PART 10, PLAN 40R – 9578

PART 11, PLAN 40R – 9578

PART 12, PLAN 40R – 9578

PART 13, PLAN 40R – 9578

PART 14, PLAN 40R – 9578

PART 15, PLAN 40R – 9578

PART 16, PLAN 40R–9578

PART 17, PLAN 40R – 9578

PART 18, PLAN 40R – 9578

PART 19, PLAN 40R – 9578

PART 20, PLAN 40R – 9578

PART 23, PLAN 40R – 9578

PART 24, PLAN 40R – 9578

PART 25, PLAN 40R – 9578

PART 26, PLAN 40R – 9578

PART 27, PLAN 40R – 9578

PART 28, PLAN 40R – 9578

PART 29, PLAN 40R – 9578

PART 31, PLAN 40R–27935

PART 35, PLAN 40R–27935

PART 36, PLAN 40R – 9578

14.0m M.T.O. SETBACK

HIGHWAY 401

WHITES ROAD

## LEGEND

PROPERTY LINE

MTO SETBACK

CLIENT
DIRECTOR INDUSTRIAL HOLDINGS LIMITED

TITLE
603–643, 645–699 KINGSTON ROAD
PICKERING, ONTARIO
PRE–DEVELOPMENT
TOPOGRAPHIC SURVEY

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|---|---|
| AK | SAW |
| Date: FEBRUARY 2020 | Proj. No.: 19M–00841 |
| Scale: 1:1250 | Figure No.: 2 |

KINGSTON ROAD

EXISTING SANITARY EASEMENT TO BE RELOCATED

EXISTING STORM EASEMENT TO BE RELOCATED

PROPOSED PARK 1
1,137 m2
(12,240 ft2)

BLOCK 1
4 STOREY
36 units

BLOCK 2
4 STOREY
36 units

PODIUM 2
(170 units)

TOWER 4
18 STOREY
2,260 m2 plate
(360 units)

PODIUM 3
(170 units)

TOWER 5
18 STOREY
2,260 m2 plate
(360 units)

BLOCK 3
4 STOREY
36 units

BLOCK 4
4 STOREY
36 units

PROPOSED
PARK 3
1,423 m2
(15,320 ft2)

PODIUM 5
4 STOREY
1,650 m2 plate

TOWER 8
24 STOREY
+ MECH.
800 m2 plate
(200 units)

GATEWAY
PLAZA
977 m2
(10,525 ft2)

No.575
1 STOREY
METAL & GLASS BUILDING

TOWER 1
29 STOREY
+ MECH.
800 m2 plate
(250 units)

PODIUM 1
4 STOREY

TOWER 2
32 STOREY
+ MECH.
800 m2 plate
(280 units)

PODIUM 1
4 STOREY

TOWER 3
36 STOREY
+ MECH.
800 m2 plate
(320 units)

PROPOSED PARK 2
1,437 m2 (15,471 ft2)

TOWER 6
29 STOREY
+ MECH.
800 m2 plate
(250 units)

PODIUM 4
4 STOREY

TOWER 7 - 42 STOREY
+ MECH.
800 m2 plate (380 units)

PODIUM 4
4 STOREY

14.0m M.T.O. SETBACK

HIGHWAY 401

WHITES ROAD

## LEGEND

PROPERTY LINE

MTO SETBACK

UNDERGROUND
BUILDING ENVELOPE

CLIENT
DIRECTOR INDUSTRIAL
HOLDINGS LIMITED

TITLE
603-643, 645-699 KINGSTON ROAD
PICKERING, ONTARIO
POST-DEVELOPMENT
PRELIMINARY SITE PLAN

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|---|---|
| AK | SAW |
| Date | Proj. No. |
| FEBRUARY 2020 | 19M-00841 |
| Scale | Figure No. |
| 1:1250 | 3a |

KINGSTON ROAD

EXISTING SANITARY EASEMENT TO BE RELOCATED

EXISTING STORM EASEMENT TO BE RELOCATED

No.575
1 STOREY
METAL & GLASS BUILDING

14.0m M.T.O. SETBACK

HIGHWAY 401

WHITES ROAD

## LEGEND

PROPERTY LINE

MTO SETBACK

CLIENT
DIRECTOR INDUSTRIAL HOLDINGS LIMITED

TITLE
603–643, 645–699 KINGSTON ROAD
PICKERING, ONTARIO
POST–DEVELOPMENT
PRELIMINARY UNDERGROUND
SITE PLAN

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|---|---|
| AK | SAW |
| Date: FEBRUARY 2020 | Proj. No.: 19M–00841 |
| Scale: 1:1250 | Figure No.: 3b |

# 2 SITE GRADING

## 2.1 SITE GRADING

Site grading will be designed in accordance with the City of Pickering's Storm Sewer Servicing and Roads grading criteria with respect to minimum and maximum grades. The Site's predevelopment overland flow is directed south towards Highway 401. Minor storm flows are collected in various on-site drains and directed towards a headwall on the southeast edge of the site where it is discharged south towards Highway 401.

The proposed development will be graded to direct all storm drainage to localized on-site drains, and the overland flow route to Highway 401 will be maintained.

Preliminary internal road elevations are shown on **Figure 4** (Preliminary Grading Plan). Access to the site will be provided by two entrance off of Kingston Road, both southwest of the Kingston Rd and Whites Rd intersection. Based on the existing and preliminary proposed elevations, road grades will generally vary between 0.5% and 2.5%. The minor flow will be captured in drains and directed to a stormwater detention and retention facility located under the proposed park between Podium 1 and Podium 4. The major flow in excess of the 100-year storm will be directed to a proposed low point between Podium 1 and Podium 4, which would then flow south through the park to Highway 401, matching the existing pre-development overland flow route. All storm water will ultimately flow into Petticoat Creek to the west of the site.

The proposed site grading would eliminate the need for a retaining wall adjacent to Kingston Rd, as requested in the pre-consultation meeting minutes.

KINGSTON ROAD

HIGHWAY 401

WHITES ROAD

No.575
1 STOREY
METAL & GLASS BUILDING

No.603 – 643
1 STOREY BRICK BUILDING

No.645
1 STOREY CONCRETE BUILDING

No. 699
1 STOREY CONCRETE BUILDING

BLOCK 1
4 STOREY

BLOCK 2
4 STOREY

PODIUM 2
(170 units)

TOWER 4
18 STOREY

PODIUM 3
(170 units)

TOWER 5
18 STOREY

BLOCK 3
4 STOREY

BLOCK 4
4 STOREY

PODIUM 5
4 STOREY
1,650 m2 plate

TOWER 8
24 STOREY
+ MECH.

GATEWAY
PLAZA

PODIUM 1
4 STOREY

TOWER 1
29 STOREY
+ MECH.

PODIUM 1
4 STOREY

TOWER 2
32 STOREY
+ MECH.

PODIUM 1
4 STOREY

TOWER 3
36 STOREY
+ MECH.

TOWER 6
29 STOREY
+ MECH.

PODIUM 4
4 STOREY

TOWER 7 - 42 STOREY
+ MECH.

PODIUM 4
4 STOREY

14.0m M.T.O. SETBACK

## LEGEND

- PROPERTY LINE
- MTO SETBACK
- UNDERGROUND BUILDING ENVELOPE
- 105.84× PROPOSED ELEVATION
- EX ±105.52× EXISTING ELEVATION
- 2.0% PROPOSED GRADE
- ⇨ OVERLAND FLOW ROUTE

CLIENT
DIRECTOR INDUSTRIAL HOLDINGS LIMITED

TITLE
603–643, 645–699 KINGSTON ROAD
PICKERING, ONTARIO
PRELIMINARY SITE GRADING PLAN

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| Date: FEBRUARY 2020 | Proj. No.: 19M–00841 |
| Scale: 1:1250 | Figure No.: 4 |

# 3 STORMWATER MANAGEMENT

## 3.1 MINOR STORM SYSTEM

The on-site storm drains and sewers will be designed to convey the 100-year flow from the development. These storm flows are to be directed to an stormwater management system located beneath the park between Podiums 1 and 4. The schematic location of the stormwater management facility is shown in **Figure No. 5** (Preliminary Site Servicing Plan). The stormwater management facility will provide water quantity, water quality, erosion and sediment control and water balance requirements set out by the City of Pickering. Please see Stormwater Management Report, also prepared by WSP, for details of the proposed Stormwater Management System.

## 3.2 MAJOR STORM SYSTEM

The on-site storm drainage system will be designed to capture and convey to 100-year storm event. Any overland flows from storm events greater than the 100-year event will be directed to a low point on the south edge of the site, adjacent to the proposed park between Podium 1 and Podium 4. Overland flow from the Site, similar to the existing predevelopment flow, will continue to be directed southerly towards Highway 401, which ultimately conveys the flows to Petticoat Creek.

## 3.3 EXISTING EASEMENT

The proposed development site contains a storm sewer easement which runs north to south through the site. It is presumed that this easement contains a trunk storm sewer that conveys flows from Kingston Rd to High 401. The easement is in conflict with the proposed re-development of the site. As such the developer proposes that the existing storm sewer and easement be relocated to avoid the proposed structures. Detailed design of the relocated storm sewer will be completed at a later stage of the project. A preliminary schematic illustration of the proposed relocation is shown on **Figure 5.**

# 4 SANITARY DRAINAGE

## 4.1 INTRODUCTION

Based on the record drawings received from the Region of Durham there are a number of existing sanitary sewers in the vicinity of the site:

- A 300mm diameter sanitary sewer on the north side of Kingston Road
- A 150mm diameter sanitary forcemain on the south side of Kingston Road
- A 300mm diameter sanitary sewer in the easement in the north-west corner of the site.

The 300mm sanitary sewer on the north side of Kingston Road flows from east to west and crosses Kingston Road at approximately the mid-point of the site prior to entering the easement across the subject property. The 150mm sanitary force main discharges into the 300mm gravity sewer just prior to entering the easement. The 300mm sewer in the easement flows to the west ultimately draining off the site and continuing west parallel to Kingston Road.

## 4.2 EXISTING EASEMENT

The proposed development site contains a sanitary sewer easement in the northwest portion of the site. This easement contains a sanitary sewer that flows from east to west parallel to Kingston Rd. The easement is in conflict with the proposed re-development of the site. As such the developer proposes that the existing sanitary sewer be relocated into the Kingston Road right-of-way. Detailed design of the relocated sanitary sewer will be completed at a later stage of the project. A preliminary schematic illustration of the proposed relocation is shown on **Figure 5**.

## 4.3 PRE- AND POST-DEVELOPMENT FLOWS

The estimated pre- and post-development sanitary sewage flows are estimated based on the Region of Durham Sanitary design criteria.

In the pre-development condition the property contains 3 single storey commercial buildings with a combined GFA of approximately 15,250m$^2$. Based on an average flow rate of 180m$^3$/ha/d (including infiltration and peaking factor) the peak sanitary flow from the site in the existing condition is 3.18 L/s.

In the post-development condition the development is proposed to contain 144 townhouse units, 2,740 apartment units, 2,232m$^2$ of commercial space and 4,448m$^2$ of office space. The apartment units are broken down into approximately 30% one bedroom occupancy and 70% two bedroom occupancy. Based on these unit counts and floor areas and the Region of

Durham Design Criteria the peak post-development sanitary flow from the site, including infiltration is 75.34/s. Therefore the development of the site will increase the sanitary flow by approximately 72.2L/s.

For a detailed breakdown of the pre- and post-development flow calculations see **Appendix A**.

## 4.4 PROPOSED SANITARY CONNECTION

The proposed development will have one 300mm diameter connection to the existing 300mm diameter gravity sanitary sewer on Kingston Road northeast of the site's existing control manhole and westernmost entrance. This connection will have a control manhole immediately inside the property line and will be designed per the Region of Durham design criteria. Within the private site the individual buildings will have sanitary service connections to a common element sewer which is proposed to flow to the control manhole and ultimately the municipal sanitary sewer system. The proposed sanitary servicing for the site is shown on **Figure 5.**

## 4.5 DOWNSTREAM SANITARY SEWER ANALYSIS

At the project's pre-consultation meeting the Region advised that a sanitary sewer analysis is required to support this development proposal. WSP has previously completed a downstream sewer capacity analysis for the receiving sewers, which was previously presented to the Region. The receiving sanitary sewer on Whites Road flows to the west to Rosebank Road where it then flows south under Highway 401. From there the flow continues south in a sanitary sewer that flows south, parallel to Petticoat Creek. Prior to reaching Lake Ontario the sewer turns east and connects with a number of other sewers, including a force main from the west, at the intersection of Cliffview Rd and Park Cr. This forms the endpoint of our analysis.

Under the existing conditions there are 28 legs of sewer which are currently operating over capacity, including all the legs of sewer running underneath Highway 401 and parallel to Petticoat Creek. In the post-development condition, after the addition of the proposed development flows, the surcharging in the existing sewers is maintained. In order for this development to proceed there will need to be downstream sewer improvements which alleviate existing capacity issues and provide capacity to support proposed and future developments.

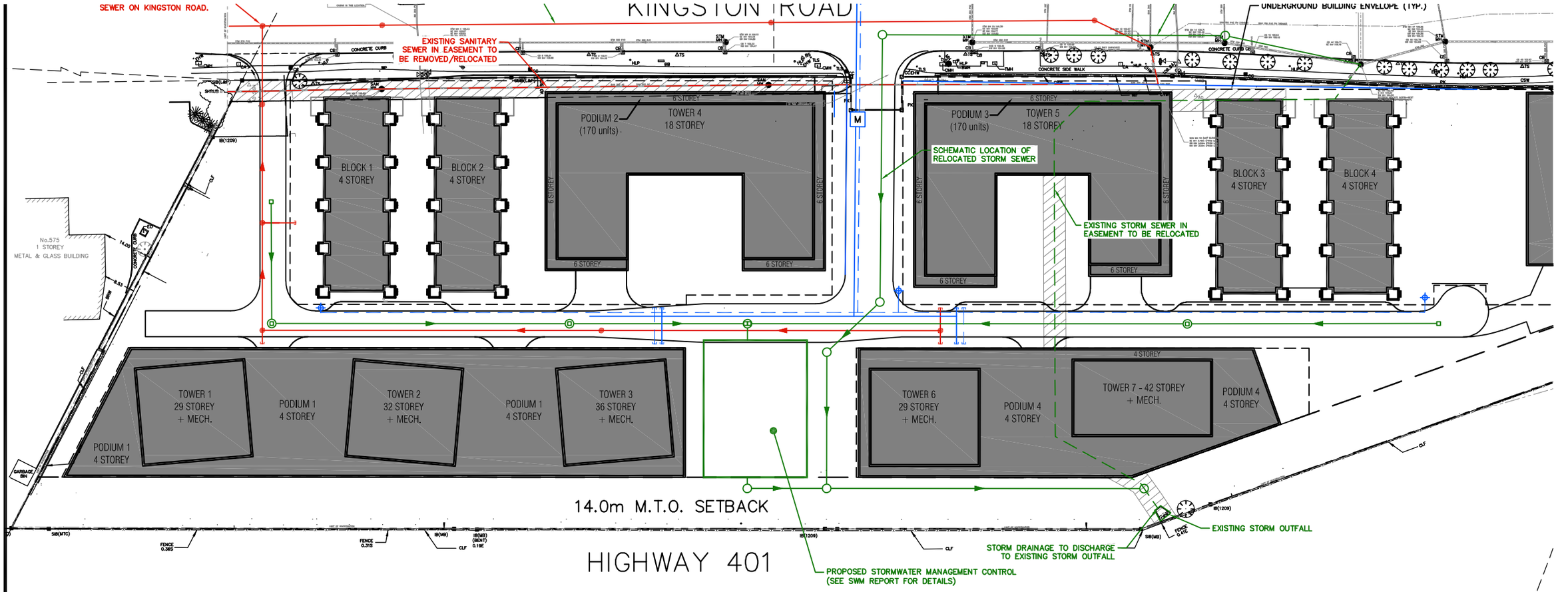
# 5 WATER SUPPLY

## 5.1 WATER SUPPLY

The proposed development is located within pressure district Zone A1. There is an existing 400mm feeder watermain on the north side of Kingston Road. There are no other watermains available adjacent to the site. The proposed development will have one 300mm diameter domestic connection and one 300mm diameter fire connection to the existing 400mm watermain on Kingston Road. The domestic line will connect to a chamber on the private property complete with a backflow preventer and flow meter per Region of Durham Standards. The fire line will connect to a separate chamber containing a double check valve assembly per Region of Durham standards.

Within the site the domestic line will be extended to provide a dedicated domestic service to each of the five Podiums (and associated towers) as well as all the townhome blocks. The fire line will form a 'T' along the new private road and provide dedicated fire service to each of the five Podiums (and associated towers) as well as all the townhome blocks. In addition the fire line will have 3 proposed hydrants to provide fire protection for the development. The domestic and fire servicing within the individual buildings is to be designed by the mechanical consultant.

The proposed water servicing layout for the site is shown in **Figure 5.**




## LEGEND

- PROPERTY LINE
- MTO SETBACK
- UNDERGROUND BUILDING ENVELOPE
- EXISTING WATERMAIN
- EXISTING SANITARY SEWER
- EXISTING STORM SEWER
- EXISTING SANITARY SEWER TO BE REMOVED/RELOCATED
- EXISTING STORM SEWER TO BE REMOVED/RELOCATED
- PROPOSED DOMESTIC WATERMAIN
- PROPOSED FIRE WATERMAIN
- PROPOSED SANITARY STRUCTURES AND SEWER
- PROPOSED STORM STRUCTURES AND SEWER
- PROPOSED CATCHBASINS AND CATCHBASIN MANHOLES
- EXISTING STORM OUTFALL
- PROPOSED FIRE HYDRANT
- M — WATER METER CHAMBER

# 6 CONCLUSIONS

The following point form list summarizes the opportunities for the servicing and grading of the proposed development at 603-643, 645-699 Kingston Road in Pickering, Ontario.

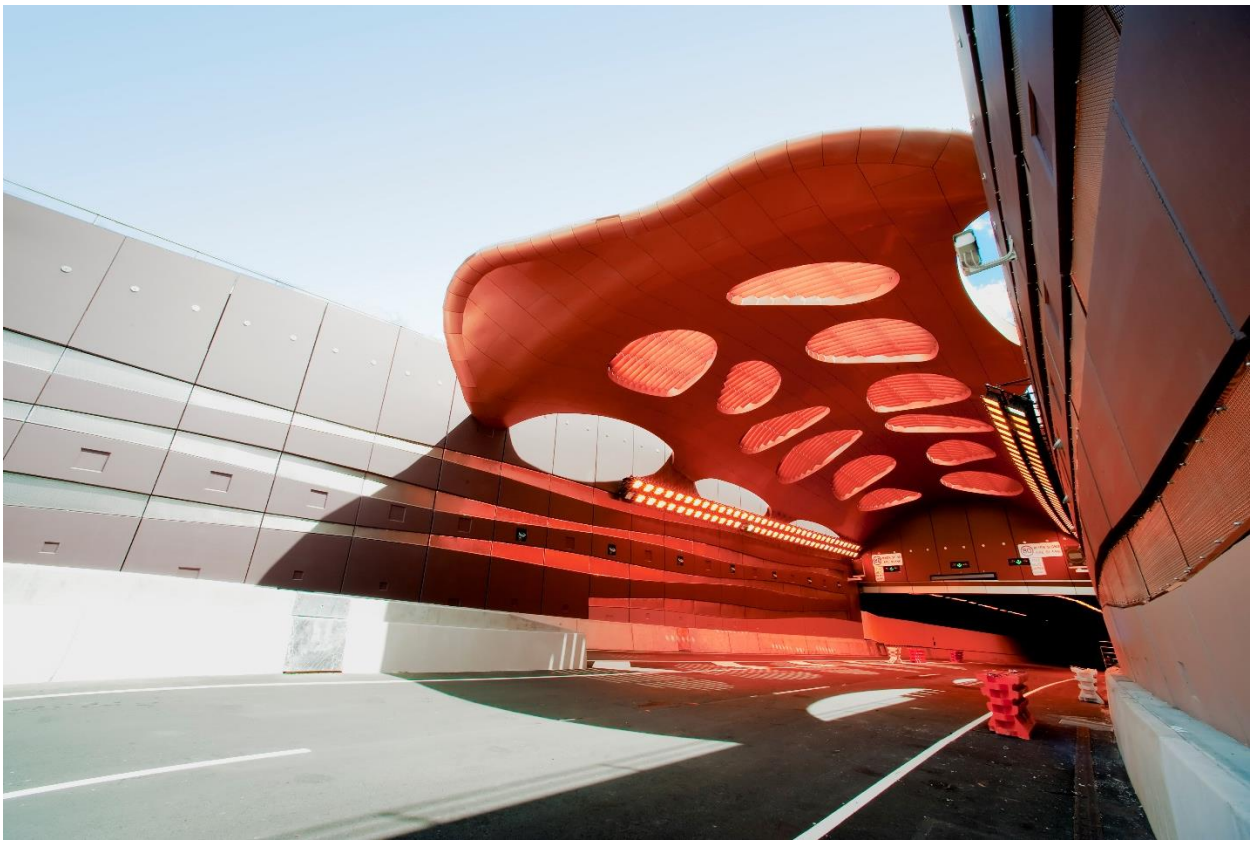
- Boundary grades will generally be matched.
- Road grades will generally range between 0.5% and 2.5%.
- Storm flows from the site will be directed to on-site drains and directed to a stormwater management facility under the proposed park between Podium 1 and Podium 4. The stormwater management facility will provide quantity, quality, erosion and water balance requirements.
- The overland flows for up to the 4 hour 25mm storm event will be detained internally on site using the various water retention methods described in the SWM report. All overland flows over this regulated volume will continue to approximately follow the existing travelled path to the south of the site flowing and discharging adjacent to Highway 401, ultimately contributing to Petticoat Creek.
- There is an existing storm sewer in an easement on site that will need to be relocated to facilitate the proposed development.
- Sanitary Flows from the site will be discharged though a new connection into the relocated sanitary sewer which is currently located within an on-site easement.
- The development is located in Region of Durham pressure district Zone 1A. There is an existing 400mm watermain of the north side of Kingston Road. Domestic and Fire Lines will be extended from this existing watermain to provide water service for the site. The water system within the underground parking structure will be designed by the mechanical consultant to meet the Ontario Building Code.

Director Industrial Holdings Limited

# 603-643, 645-699 Kingston Road Pickering, ON

## Stormwater Management Report

April 16, 2020



# 603-643, 645-699 Kingston Road Pickering, ON

## Stormwater Management Report

Director Industrial Holdings Limited

Rezoning Application

Project No.: 19M-00841-00
Date: April 16, 2020

WSP
100 Commerce Valley Drive West
Thornhill, ON, Canada L3T 0A1

wsp.com

# Revision History

**FIRST ISSUE**

| | | | | |
|---|---|---|---|---|
| 2020-01-31 | Rezoning Application (RZA) | | | |
| Prepared by | Reviewed and Approved by | | | |
| Gordon Wong, EIT | Iain Smith, P.Eng. | | | |
| **REVISION 1** | | | | |
| 2020-03-27 | Rezoning Application (RZA) | | | |
| Prepared by | Reviewed by | Approved By | | |
| Ivan Mock, EIT | Iain Smith, P.Eng. | | | |
| **REVISION 2** | | | | |
| 2020-04-16 | Rezoning Application (RZA) | | | |
| Prepared by | Reviewed by | Approved By | | |
| Ivan Mock, EIT | Iain Smith, P.Eng. | | | |
| **FINAL** | | | | |
| | | | | |
| Prepared by | Reviewed by | Approved By | | |
| | | | | |

# Signatures

Prepared by

04/16/2020

Ivan Mock, EIT
Designer, Water Resources

Date

Approved[1] by (must be reviewed for technical accuracy prior to approval)


Iain Smith, P.Eng.
Project Engineer

Date

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# Contributors

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Director Industrial Holdings Limited

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|---|---|
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| Designer | Gordon Wong, EIT |
| Project Engineer | Iain Smith, P.Eng. |

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## *Figures*



## *Appendices*

# 1 INTRODUCTION

## 1.1 Scope

WSP Canada Group Limited has been retained by Director Industrial Holdings Limited to prepare a Stormwater Management (SWM) report to support the rezoning application for the proposed development at 603-643, 645-699 Kingston Road Pickering, ON in the City of Pickering.

The current development concept, as represented in the conceptual site plan drawings and development statistics prepared by Graziani + Corazza Architects, dated April 6, 2020, enclosed with this submission, is preliminary in nature and subject to change.

The current development concept, which represents a high-level master plan for a new mixed-use community, is primarily intended to form the basis of the proposed Draft Official Plan Amendment, which is required to facilitate the proposed density and Floor Space Index on the subject lands, as well as the proposed Draft Zoning By-law Amendment which is required to establish a new site-specific zoning framework that will implement the City's current land use vision for the subjects lands.

This proposed official plan and zoning by-law amendment framework is intended to provide flexibility in order to ensure that the development of the lands responds to market conditions and can result in implementation of plans and alternative plans to achieve principles of intensification based on good planning and urban design principles.

As such, it is anticipated that the development concept as presented to be sconsidered conceptual and will be revised, as necessary, to account for new and/or evolving considerations related to the master-planned community.

This SWM report examines the potential water quality, water quantity, erosion control, and water balance impacts of the proposed development and summarizes how each parameter will be addressed in accordance with the City of Pickering Stormwater Management Design Guidelines dated July 2019.

## 1.2 Site Location

The site is located north of Highway 401, west of Whites Road North, and south of Kingston Road in the City of Pickering. The subject site is currently occupied by 42 municipal addresses which consist mainly of commercial/retail buildings and a restaurant. The location of the proposed re-development is illustrated in Figure 1.

## 1.3 Stormwater Management Plan Objectives

The objectives of the stormwater management plan are as follows:

– Determine site specific stormwater management requirements to ensure that the proposals are in conformance with the City of Pickering Stormwater Management Design Guidelines;

– Evaluate various stormwater management practices that meet the requirements of the City and recommend a preferred strategy; and

– Prepare a stormwater management report documenting the strategy along with the technical information necessary for the justification and preliminary sizing of the proposed stormwater management facilities.

## 1.4 Design Criteria

The City of Pickering issued the Stormwater Management Design Guidelines in July 2019 to provide direction on the management of rainfall and runoff inside the City's jurisdiction. A summary of the stormwater management criteria applicable to this project are as follows:

### 1.4.1 Water Quantity

The guideline requires the development to attenuate post-development flows for all storms up to and including the 100-year storm to pre-development levels. In a pre-consultation meeting on May 27th, 2019, the city noted that the 100-year post-development flow shall be controlled to the 2-year pre-development level.

### 1.4.2 Water Quality

The guideline requires the development to provide water quality measures that are designed to provide Enhanced (Level 1) level of protection as defined in the 2003 Stormwater Management Planning and Design Manual by the Ministry of the Environment, Conservation and Parks (MECP). This was also noted in the pre-consultation meeting with the municipality.

### 1.4.3 Erosion Control

The guideline states that for small sites (<5 ha), the minimum erosion control requirements are:

– Extended detention of the 4-hour, 25 mm Chicago distribution rainfall event for a minimum of 24 hours, or

– Runoff reduction from the site through infiltration, evapotranspiration and reuse of a minimum 5 mm of rainfall depth across all impervious surfaces

In addition, appropriate erosion and sediment controls shall be implemented and maintained during construction

### 1.4.4 Water Balance

The guideline does not explicitly state the requirements regarding water balance. It is encouraged to maintain the natural water balance of the site and to use SWM facilities that reduces runoff volumes, which will result in reduced loading of pollutants.


CLIENT

DIRECTOR INDUSTRIAL HOLDINGS LIMITED

TITLE

603–643, 645 & 699 KINGSTON ROAD PICKERING, ON

SITE LOCATION

| | |
|---|---|
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| Date APRIL 2020 | Proj. No. 19M–00841–00 |
| Scale AS SHOWN | Figure No. 1 / Gr.No. 00 |

FIGURE 1.dwg - 603-643_645 & 699 Kingston Rd - Site Location \\tfhier1.mmm.ca\ENGCAD$\DIV38\2019\19M-00841-00 603-643, 645 & 699 Kingston Road, Pickering\CAD\dwgs\ Apr 14, 2020 - 3:08pm

# 2 PRE-DEVELOPMENT CONDITIONS

## 2.1 General

The 4.85 ha site is currently occupied by mainly commercial/retail buildings and a restaurant. The existing runoff coefficient is estimated to be 0.90 as majority of the site is comprised of impervious surfaces. Based on the topographic survey, an external area of approximately 0.09 ha currently discharges into the site. This area will be accounted for in the post-development condition to meet the water quantity requirement. The existing condition of the site is shown in Figure 2.

## 2.2 Rainfall Information

The rainfall intensity for the site was calculated using the following equation as stated in the Section 6.2.4. of the City of Pickering Stormwater Management Design Guidelines:

$$I = \frac{A}{(t_c + B)^C}$$

Where;

I = Rainfall intensity in mm/hr

$T_c$ = Time of concentration in minutes

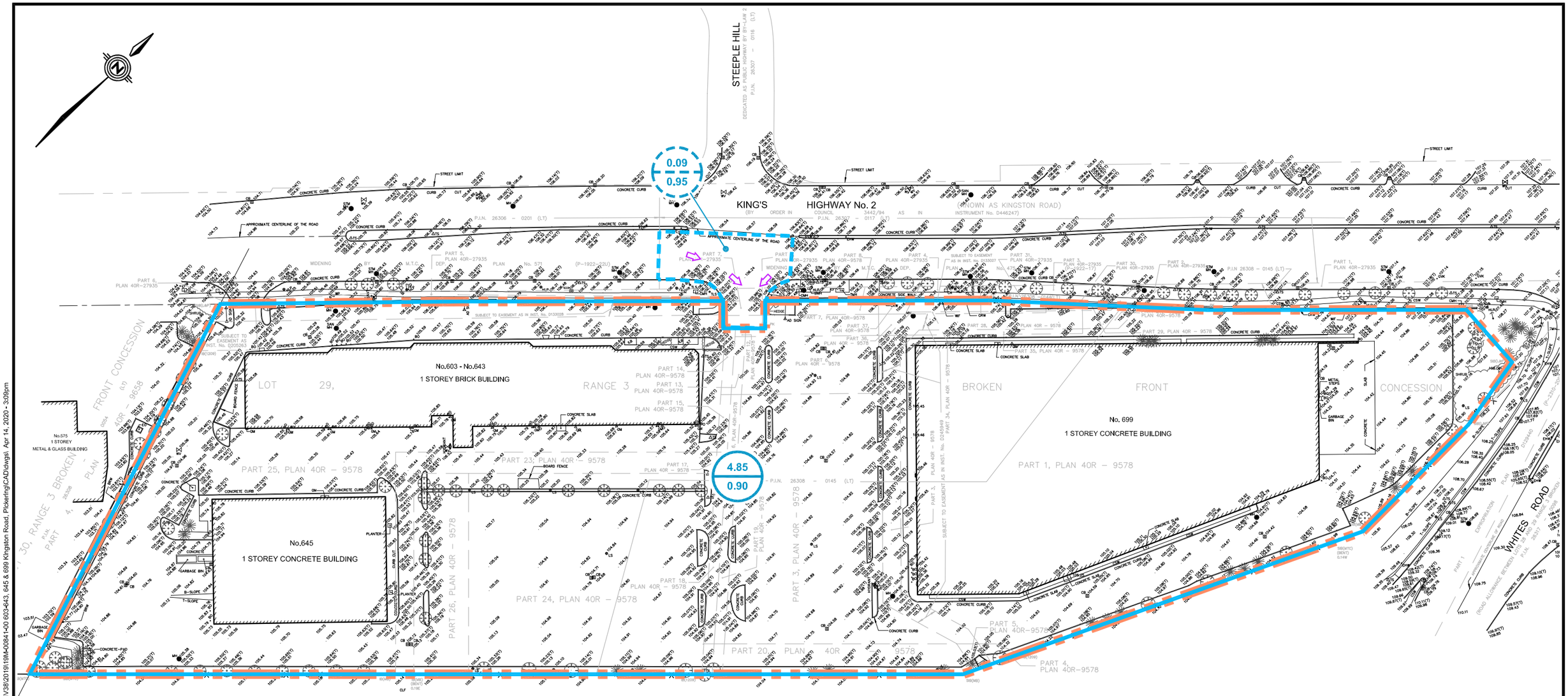
A, B and C = Constant parameters as stated in "Table 12 – Pickering IDF Parameters" in the City of Pickering Stormwater Management Design Guidelines. The parameters are summarized in Table 2-1.

**Table 2-1: IDF Parameters used by the City of Pickering**

| Return Period (Years) | 2 | 5 | 10 | 25 | 50 | 100 |
|---|---|---|---|---|---|---|
| A | 715.076 | 1,082.901 | 1,313.979 | 1,581.718 | 1,828.009 | 2,096.425 |
| B | 5.262 | 6.007 | 6.026 | 6.007 | 6.193 | 6.485 |
| C | 0.815 | 0.837 | 0.845 | 0.848 | 0.856 | 0.863 |

*Source: City of Pickering Stormwater Management Design Guidelines (July 2019)*

An initial time of concentration, $T_c$, of 10 minutes was assumed for the calculation for rainfall intensity.




## LEGEND

- PROPERTY BOUNDARY
- SUB-CATCHMENT BOUNDARY
- EXTERNAL SUB-CATCHMENT BOUNDARY
- 4.85 / 0.90 — DRAINAGE AREA (ha) / RUNOFF COEFFICIENT
- DRAINAGE DIRECTION

0 10 20 30 40 50m

CLIENT
DIRECTOR INDUSTRIAL HOLDINGS LIMITED

TITLE
603–643, 645 & 699 KINGSTON ROAD PICKERING, ON

# EXISTING CONDITIONS

wsp

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FIGURE 2.dwg - 603-643_645 & 699 Kingston Rd - Existing Conditions \\hfiler1.mmm.ca\ENGCAD$\DIV\38\2019\19M-00841+00 603-643, 645 & 699 Kingston Road, Pickering\CAD\dwgs\ Apr 14, 2020 - 3:09pm

## 2.3 Allowable Flow Rates

As noted in Section 1.4.2, from the City of Pickering Stormwater Management Design Guidelines and the pre-consultation meeting, the discharge rate from this site in the post-development condition shall be controlled to the allowable release rate which is defined as the 2-year pre-development discharge from the site.

This site is proposed to have permanent groundwater discharge rate of 0.8 Ls which will be detailed in section 2.4 of this report. This stormwater shall be discharged to the sanitary sewers and therefore, be subtracted from the flows exiting the site.

There is an external drainage area located north of the site. It is assumed that the runoff from this area will be collected by the onsite stormwater infrastructure and conveyed to the proposed system. This flow shall therefore be added to the allowable release rate.

The calculated pre-development peak flow rates for the existing site for the 2-year to 100-year storm events are summarized in Table 2-2. Detailed calculations are provided in Appendix A.

**Table 2-2: Pre-Development Peak Flow Rate and Maximum Allowable Site Discharge Rate**

| Return Period (Years) | Rainfall Intensity, I (mm/hr) | Runoff Coefficient Adjustment Factor, Ca* | Existing Peak Runoff Rates, Q (L/s)** | Proposed Permanent Dewatering Rate, $Q_{GW}$ (L/s) | External Area Release Rate $Q_{EX}$ (L/s)*** | Maximum Allowable Release Rate, $Q_p$ (L/s) |
|---|---|---|---|---|---|---|
| 2 | 77.6 | 1.00 | 943.4 | 0.8 | 18.8 | **961.4** |
| 5 | 106.3 | 1.00 | 1,292.9 | | 25.7 | |
| 10 | 126.3 | 1.00 | 1,532.8 | | 30.5 | |
| 25 | 150.6 | 1.10 | 2,014.8 | | 38.4 | |
| 50 | 168.6 | 1.20 | 2,274.7 | | 42.9 | |
| 100 | 186.7 | 1.25 | 2,519.2 | | 47.6 | |

**Runoff Coefficient Adjust Factor are required for storms greater than the 25-year storm event when calculating the peak flows using the Rational Method, as stated in Section 6.2.3 of the City of Pickering Stormwater Management Design Guidelines. Note the product of C and Ca cannot be larger than 1.00.*
***C = 0.90, pre-development catchment area of 4.85 ha and time of concentration of 10 minutes.*
****C = 0.95, catchment area of 0.09 ha and a time of concentration of 10 minutes.*

## 2.4 Groundwater, Hydrogeology and Groundwater Characterization

A Hydrogeological investigation was carried out by Toronto Inspections Ltd. in the spring and summer of 2019 to assess the groundwater conditions and soil characteristics of the development, and test the presence of groundwater contamination.

Based on the report dated June 19, 2019, the estimated permanent dewatering rate is approximately 69,471 L/day, which is equivalent to approximately 0.80 L/s. The groundwater quality for the discharge water during construction does not meet the City's Sewer By-Law requirements for discharge to the storm sewer but it does meet the requirements for discharge to the sanitary sewer. It was not stated where the groundwater will be discharged in the long-term scenario. As a conservative measure, it is assumed the groundwater will be discharged to the storm sewers after construction and will be accounted for when checking the water quantity requirement.

The subsurface of the site is composed of mainly sandy silt till. From in-situ hydraulic conductivity tests conducted at various monitoring wells, the hydraulic conductivity ranged between $1.6x10^{-6}$ cm/s and $1.8x10^{-5}$ cm/s with a geometric mean of $6.0x10^{-6}$ cm/s. The Credit Valley Conservation (CVC) Low Impact Development Stormwater Management Planning and Design Guide has a table from the Ontario Building Code relating the hydraulic conductivity and infiltration rate in its supplementary guideline, SG-6 Percolation Time and Soil Descriptions. The table has been summarized in Table 2-3.

**Table 2-3: Relationship between Hydraulic Conductivity and Infiltration Rate**

| Hydraulic Conductivity (cm/s) | Infiltration Rate (mm/hr) |
|---|---|
| 0.1 | 300 |
| 0.01 | 150 |
| 0.001 | 75 |
| 0.0001 | 50 |
| 0.00001 | 30 |
| 0.000001 | 12 |

*Source: CVC Low Impact Development Stormwater Management Planning and Design Guide – Appendix C (2011)*

Based on the table above, it is assumed that the infiltration rate of the sandy silt till ranges from 12 mm/hr and 30 mm/hr, with a geometric mean of approximately 22 mm/hr. This value is greater than the minimum infiltration rate, 15 mm/hr, for stormwater management system that uses infiltration, as recommended in the 2003 Stormwater Management

Planning and Design Manual created by the Ministry of the Environment, Conservation and Parks.

In addition, the water table level ranges from 96.53 and 103.57 m above sea level and the depth between the water table and the ground surfaces ranges from 1.4 m to 8.9 m. From the borehole testing, it is estimated that bedrock is located deeper than 20 m below the ground surfaces.

Based on the analysis above, stormwater management facilities that uses infiltration measures are recommended for this site since the soil has a favourable infiltration rate and there is sufficient distance from the ground surface to the water table and bedrock. However, more analysis would need to be taken at the location of the proposed stormwater management facilities before finalizing the design.

# 3 POST-DEVELOPMENT CONDITIONS

## 3.1 General

The total Site area is 4.85 ha (11.98 acres). The current concept development will consist of six high-rise towers, two mid-rise towers, and four townhouse blocks:

1. Blocks 1 to 4 are 4-storey townhouse blocks with stacked back-to-back units. Blocks 1 and 2 are located toward the northwest corner of the site. Blocks 3 and 4 are located toward the northeast corner of the site.

2. Towers 1, 2 and 3 are located along the south property line, at the west side for the site. The towers range in height from 29 to 36 storeys, which are connected by a 4-storey podium (Podium 1).

3. Towers 4 and 5 are each “U”-shaped buildings and are located along the north property line, at the centre of the site. Both mid-rise towers are 18 storeys.

4. Towers 6 and 7 are located along the south property line, near the centre of the site. Towers 6 and 7 are 29 and 42 storeys, respectively. The towers are connected by a 4-storey podium (Podium 4).

5. Tower 8 is located at the northeast corner of the site. The tower is 24 storeys, with a 4-storey commercial area located within a 4-storey podium (Podium 5).

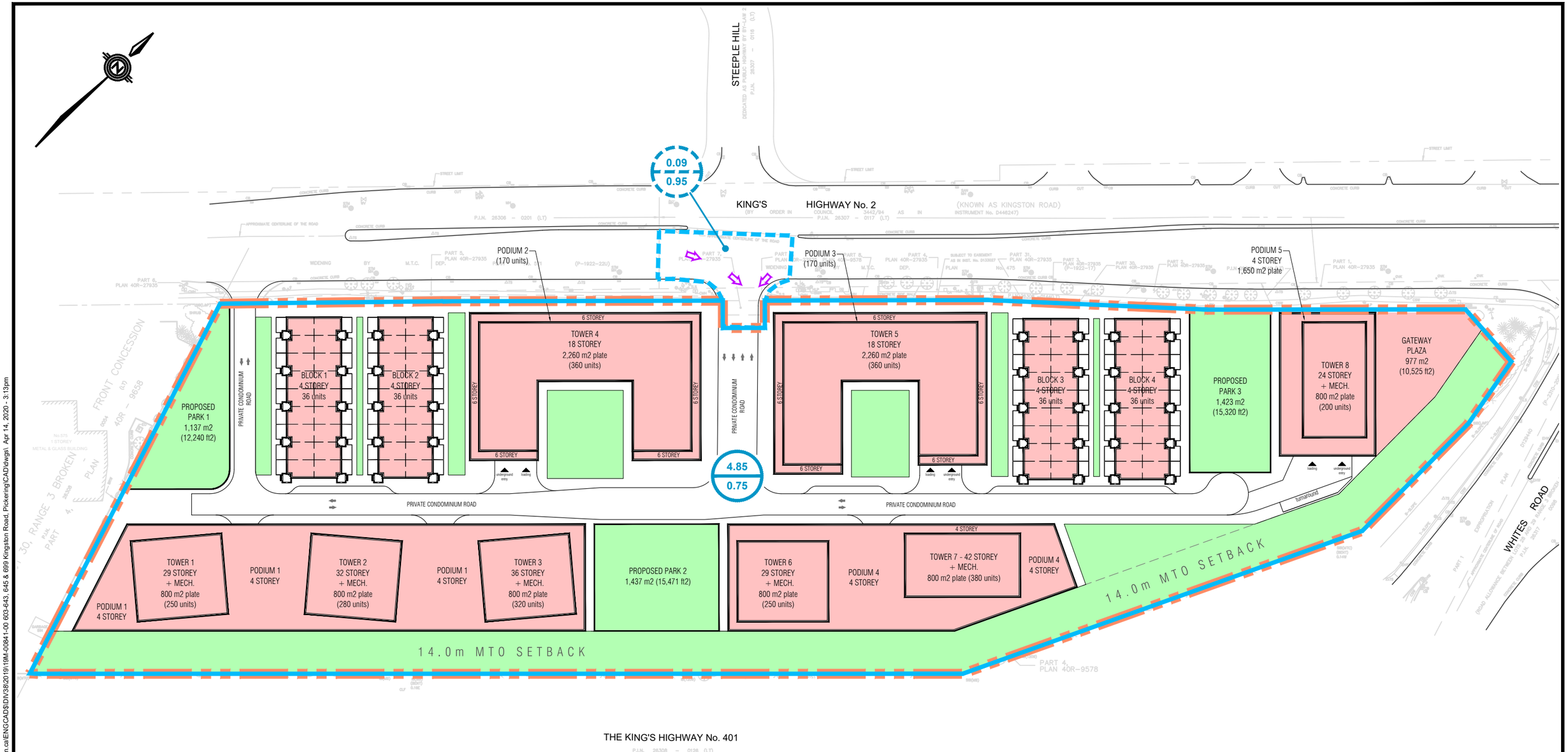
Grade-level parks will be provided at the south side of the site (between Towers 3 and 6) as well as the northeast and northwest corners of the site. A private internal road network with two access points off of Kingston Road and access to the below grade parking. The concept development includes two levels of underground parking with the exception of Podium 1, which will have one level of underground parking, as well as parking in Podiums 1 and 4.

As mentioned in Section 2.1, the site receives flows from a 916 $m^2$ asphalt external area north of the site. This area will be included in the hydrologic analysis to meet the water quantity requirements.

An area breakdown for the new layout is provided below in Table 3-1. Please refer to Figure 3 for details of the post-development conditions and land-uses. Detailed calculations can be found in Appendix A.

## Table 3-1: Proposed Land-Use Area Breakdown

| Land-Use | Area ($m^2$) | Runoff Coefficient (2,5,10 yr) | Runoff Coefficient (25 yr) | Runoff Coefficient (50 yr) | Runoff Coefficient (100 yr) | % Coverage |
|---|---|---|---|---|---|---|
| Impervious Roof Area | 19,757 | 0.95 | 1.00 | 1.00 | 1.00 | 41% |
| Soft Landscaping | 14,117 | 0.25 | 0.28 | 0.30 | 0.31 | 29% |
| At-Grade Impervious | 14,665 | 0.95 | 1.00 | 1.00 | 1.00 | 30% |
| **Total Site Area** | 48,539 | 0.75 | 0.79 | 0.80 | 0.80 | 100% |




## LEGEND

- PROPERTY BOUNDARY
- SUB-CATCHMENT BOUNDARY
- EXTERNAL SUB-CATCHMENT BOUNDARY
- 4.85 / 0.89 — DRAINAGE AREA (ha) / RUNOFF COEFFICIENT
- DRAINAGE DIRECTION
- LANDSCAPE
- IMPERVIOUS ROOF

0 10 20 30 40 50m

CLIENT
DIRECTOR INDUSTRIAL HOLDINGS LIMITED

TITLE
603–643, 645 & 699 KINGSTON ROAD PICKERING, ON

# PROPOSED CONDITIONS

| | |
|---|---|
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| Date APRIL 2020 | Proj. No. 19M–00841–00 |
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FIGURE 3.dwg - 603-643_645 & 699 Kingston Rd - Proposed Conditions \\hfiler1.mmm.ca\ENGCAD$\DIV38\2019\19M-00841-00 603-643, 645 & 699 Kingston Road, Pickering\CAD\dwgs\ Apr 14, 2020 - 3:13pm

## 3.2 Water Quantity Control

As mentioned in Section 1.4.1, the post-development discharge rates for all storms up to and including the 100-year storm event are to be attenuated to the 2-year pre-development discharge rate, less the groundwater discharge, plus the external drainage area which is equivalent to 961.4 L/s.

It is proposed that the runoff from the entire site will be collected into a subsurface storage system located underneath of the proposed park between Tower 3 and Tower 6. The subsurface storage system comprises of 60 rows of 40 Brentwood 48" StormTank® units. The system will have a stone base of 165 mm, stone cover of 305 mm and 305 mm wide wall of stone surrounding the system. The system will have a footprint of approximately 1,043 $m^2$ and provide a storage volume of approximately 1,238.5 $m^3$. The system will be gravity drained via a 600 mm diameter orifice tube set at 0.12 m above the internal bottom of the StormTank® units. The installation guide for the Brentwood StormTank® can be found in Appendix C.

The 'HydroCAD' sottware package (Version 10) has been used to model the behaviour of the proposed SWM system, and to determine its response under various storm events. This software utilises the Modified Rational Method to calculate flow rates and related storage values. Detailed output from the modelling is included in Appendix B. Please note the runoff coefficient adjustment factors were also considered for the modelled catchments in HydroCAD. Based on the criteria defined in Section 1.4.1, all stormwater runoff from events up to and including the 100-year storm must be contained on site and released at or below the allowable rate.

As mentioned before, the 916 $m^2$ asphalt external area located north of the site will be draining into the site. It is assumed that runoff from that area will be collected by onsite measures (i.e. catchbasins) and conveyed to the subsurface storage system. Therefore, the target release rate would be the addition of the 2-year pre-development release rate and the release rate from the external area for each storm event. In addition, as mentioned in Section 2.4, there is a flow of 0.8 L/s from the groundwater pumping system which would be discharged into the storm sewers and that amount would have to be subtracted from the allowable release rate as a conservative measure. These groundwater flows will not enter the subsurface chamber. Calculations for the release rate of the external area can be found in Appendix A.

Summaries of the modelled peak offsite discharge rates for the subsurface storage system are provided in Table 3-2.

## Table 3-2: Summary of Modelling Results

| Return Period (years) | Peak Elevation in system /1.54 (m) | System Storage /1238.5($m^3$) | System Discharge (L/s) | Allowable Release Rate (L/s) |
|---|---|---|---|---|
| 2 | 0.688 | 580.3 | 321.7 | **961.4** |
| 5 | 0.805 | 694.2 | 470.2 | |
| 10 | 0.885 | 772.3 | 549.7 | |
| 25 | 1.033 | 917.1 | 670.7 | |
| 50 | 1.129 | 1010.6 | 738.8 | |
| 100 | 1.225 | 1,104.9 | 801.7 | |

The modelling results demonstrate that the post-development peak flow rates for all events up to the 100-year storm are lower than the target release rate. The maximum required storage volume to control the 100-year post-development runoff is 1,104.9 $m^3$, while the provide storage volume is 1,238.5 $m^3$. Note that this total utilized storage volume includes the water quality/erosion control volume described in the following sections.

As most of the flow rates are controlled by the site's subsurface storage system, the rainfall intensity and storm duration resulting in the maximum utilized storage produces the largest flows. This has been iteratively determined at $t_d$ = 20 minutes (for the 100-year event).

## 3.3 Water Quality Control

As mentioned in Section 1.4.2, Enhanced Level of protection is required for the proposed development. The target is to treat 90% of the annual runoff volume and remove 80% of the total suspended solids (TSS). A treatment train which consists of an oil/grit separator upstream of the subsurface storage system is proposed.

The proposed treatment train approach consists of an OGS (Stormceptor EFO 12) which has been sized to capture approximately 60% of TSS and over 90% of the annual runoff volume. The OGS has been sized using Imbrium's online PCSWMM for Stormceptor tool with the CA ETV particle size distribution. Please refer to Appendix D for the sizing report. It is to be noted that from the pre-consultation meeting with the City of Pickering, OGS are credited for only 50% of TSS, this will be considered in the calculation of the overall TSS removal of the treatment train.

The OGS will act as a pre-treatment device for the runoff before it flows to the subsurface storage system. Using Table 3.2 of the 2003 Stormwater Management Planning and Design Manual from the Ministry of the Environment, Conservation and Parks, it was determined that an infiltration volume of 175.5 $m^3$ is required to achieve an 80% TSS removal for a 4.95 ha drainage area with an imperviousness of 71%. The subsurface storage system will provide 191.1 $m^3$ of infiltration volume which exceeds the requirement to achieve 80% TSS removal. By proposing the treatment train, it is expected the overall TSS removal efficiency is 90%. Please refer to Appendix A for the detailed calculations.

## 3.4 Erosion Control

As noted in Section 1.4.3, for site plans smaller than 5 ha there are minimum requirements that the development must meet. The site has been designed to meet the second requirement in the City of Pickering Stormwater Management Design Guidelines which states "runoff reduction from the site through infiltration, evapotranspiration and reuse of a minimum 5mm of rainfall depth across all impervious surfaces."

Allowing for an initial abstraction of 1 mm from impervious surfaces and 5 mm pervious surfaces (soft landscaping), a water balance volume for the post-development conditions is calculated. Table 3-3 outlines the water balance volume to retain the runoff from a 5 mm storm on site in the post-development condition. Detailed water balance calculations can be found in Appendix A of this report.

**Table 3-3: Water Balance Calculation for Post-Development Condition**

| Surface Type | Area ($m^2$) | Initial Abstraction ($m^3$) | Volume Abstracted ($m^3$) | 5 mm Volume ($m^3$) | Water Balance ($m^3$) |
|---|---|---|---|---|---|
| Impervious Roof Area | 19,757 | 0.001 | 19.76 | 98.78 | 79.03 |
| Soft Landscaping | 14,117 | 0.005 | 70.59 | 70.59 | 0.00 |
| At-Grade Impervious | 14,665 | 0.001 | 14.66 | 73.32 | 58.66 |
| **Total** | **48,539** | **-** | **105.01** | **242.69** | **137.69** |

The water balance volume of 137.69 $m^3$ shall be stored in the stone base and the bottom of the subsurface storage units. As stated in Section 3.3, a sump volume of 191.1 $m^3$ will be provided in the subsurface storage system to meet the water quality requirement therefore the erosion control requirement will also be satisfied. Detailed calculations can in found in Appendix A of this report. During construction, appropriate erosion and sediment controls shall be implemented to ensure the impact from construction of the proposed development is minimized.

It is assumed that the captured stormwater will infiltrate into the native soil below the subsurface storage system. Based on the information from Borehole 9, which was located between proposed Tower 3 and 6, the base of the subsurface storage system will be approximately 1.0 m above the water table and at least 20 m above the bedrock. It is recommended to conduct more site investigation to determine the infiltration capacity of the soil surrounding the subsurface storage system before further analysis and finalizing the design.

## 3.5 Water Balance

As noted in Section 1.4.4, the objective for water balance is that the water balance volume in the post-development conditions shall be equal to or lesser than the pre-development condition. To compare the water balance volume between the pre- and post-development conditions, the runoff volume from a 5 mm rainfall on site was calculated under both conditions.

Allowing for an initial abstraction of 1 mm from impervious surfaces and 5 mm pervious surfaces (soft landscaping), a water balance volume for the pre-development conditions is calculated. Table 3-4 outlines the water balance volume to retain the runoff from a 5 mm storm in the pre-development condition and Table 3-3 outlines the water balance volume to retain the runoff from a 5 mm storm in the post-development condition. Detailed water balance calculations can be found in Appendix A of this report.

**Table 3-4: Water Balance Calculation for Pre-Development Condition**

| Surface Type | Area ($m^2$) | Initial Abstraction ($m^3$) | Volume Abstracted ($m^3$) | 5 mm Volume ($m^3$) | Water Balance ($m^3$) |
|---|---|---|---|---|---|
| Impervious Roof Area | 15,249 | 0.001 | 15.25 | 76.25 | 61.00 |
| Soft Landscaping | 2,959 | 0.005 | 14.80 | 14.80 | 0 |
| At-Grade Impervious | 30,330 | 0.001 | 30.33 | 151.65 | 121.32 |
| **Total** | **48,539** | **-** | **60.38** | **242.66** | **182.32** |

As shown in Table 3-3 and Table 3-4, the post-development water balance (137.69 $m^3$) is smaller than the pre-development water balance volume (182.32 $m^3$) due to the increase in soft landscaping area in the post-development condition. The result illustrates that in 5 mm storms or for any other storms, there will be more runoff in the pre-development condition than in the post-development condition. It is also important to note that in the post-development condition, at least 191.1 $m^3$ of the runoff volume from any storm will be retained in the subsurface storage system and infiltrated into the native soil. Therefore, not only is the runoff volume lower in the post-development condition due to the increase in landscaped areas but a volume of 191.1 $m^3$ of the runoff will be infiltrated into the ground through the subsurface storage system.

# 4 CONCLUSIONS

A stormwater management plan has been prepared to support the rezoning application for the proposed redevelopment of 603-643, 645 and 699 Kingston Road in the City of Pickering. The key points are summarized below.

**Water Quantity**

Runoff from the entire site and external area will directed to the 1,238.5 $m^3$ Brentwood StormTank® subsurface storage system located in the proposed park between Tower 3 and 6. The maximum storage volume utilized is 1,104.9 $m^3$, including the sump volume for reuse and water quality. Outflow from the system will be controlled to below the 2-year pre-development discharge rate by a 600 mm orifice tube, while accounting for potential groundwater discharge and runoff from external area.

**Water Quality**

A treatment train consisting of an oil/grit separator and the subsurface storage system is proposed to achieve the required Enhanced level of water protection. The overall TSS removal of the treatment train is approximately 90%, which exceeds the 80% TSS requirement for Enhanced level of protection

**Erosion Control**

A minimum water reuse volume of 191.06 $m^3$ will be provided in a sump volume below the invert of the outlet of the subsurface storage system to store the required volume for reuse. It is proposed that the water stored in the sump volume will infiltrate into the native soil on site.

**Water Balance**

Due to the increase in pervious areas from pre- to post-development, the water balance volume has decreased when compared to post-development conditions. In addition, the 5 mm erosion control requirement has been addressed.

This report has demonstrated that the proposed SWM strategy will address stormwater management related impacts from this project and meet the intent of the City of Pickering Stormwater Management Design Guidelines.

Respectfully submitted,

**WSP Canada Group Limited**

# 5 BIBLIOGRAPHY


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# Appendix C Stormwater Management Calculations

# EXISTING WEIGHTED RUNOFF COEFFICIENT

**Catchment 101** Outlets to: Highway 401

| | Runoff Coefficient | Area (ha) | Weighted Runoff Coefficient |
|---|---|---|---|
| Commercial Area | 0.90 | 4.85 | 0.90 |
| **TOTAL** | | 4.85 | 0.90 |

**Catchment EXT-1** Outlets to: Highway 401

| | Runoff Coefficient | Area (ha) | Weighted Runoff Coefficient |
|---|---|---|---|
| Pavement | 0.95 | 0.09 | 0.95 |
| **TOTAL** | | 0.09 | 0.95 |

**Highway 401 Total**

| Catchment | Runoff Coefficient | Area | Weighted Runoff Coefficient |
|---|---|---|---|
| 101 | 0.90 | 4.85 | 0.88 |
| EXT-1 | 0.95 | 0.09 | 0.02 |
| **TOTAL** | | 4.94 | 0.90 |

# ALLOWABLE RELEASE RATE

603-699 Kingston Road - Pickering
Project Number: 2626
Date: August 2023
Designer Initials: R.P.B.

2 Year storm

IDF Parameters*
**a =** 715.076
**t =** 10 min
**b =** 5.26
**c =** 0.82

Runoff Coefficient: **C1 =** 0.90

| Allowable Release Rate Calculation | | | | |
|---|---|---|---|---|
| **Outlet ID** | **Area** | **time** | **Intensity** | **Flow** |
| | | **t** | **i=a/(t+b)^c** | **Q=CiA/360** |
| | ***ha*** | ***min*** | ***mm/hr*** | ***l/s*** |
| Highway 401 | 4.944 | 10.00 | 77.57 | 959.7 |

* a,b,c's per City of Pickering

# PROPOSED WEIGHTED RUNOFF COEFFICIENT

603-699 Kingston Road - Pickering
Project Number: 2626
Date: August 2023
Designer Initials: R.P.B.

**Catchment 201** Outlets to: Highway 401

| | Runoff Coefficient | Area (ha) | Weighted Runoff Coefficient | Weighted Runoff Coefficient (100 Year) |
|---|---|---|---|---|
| High Density | 0.95 | 0.54 | 0.95 | 1.00 |
| **TOTAL** | | 0.54 | 0.95 | 1.00 |

**Catchment 202** Outlets to: Highway 401

| | Runoff Coefficient | Area (ha) | Weighted Runoff Coefficient | Weighted Runoff Coefficient (100 Year) |
|---|---|---|---|---|
| R.O.W. | 0.77 | 0.54 | 0.49 | 0.61 |
| Park | 0.25 | 0.33 | 0.09 | 0.12 |
| **TOTAL** | | 0.87 | 0.58 | 0.72 |

**Catchment 203** Outlets to: Highway 401

| | Runoff Coefficient | Area (ha) | Weighted Runoff Coefficient | Weighted Runoff Coefficient (100 Year) |
|---|---|---|---|---|
| High Density | 0.95 | 0.53 | 0.95 | 1.00 |
| **TOTAL** | | 0.53 | 0.95 | 1.00 |

**Catchment 204** Outlets to: Highway 401

| | Runoff Coefficient | Area (ha) | Weighted Runoff Coefficient | Weighted Runoff Coefficient (100 Year) |
|---|---|---|---|---|
| High Density | 0.95 | 0.63 | 0.95 | 1.00 |
| **TOTAL** | | 0.63 | 0.95 | 1.00 |

**Catchment 205** Outlets to: Highway 401

| | Runoff Coefficient | Area (ha) | Weighted Runoff Coefficient | Weighted Runoff Coefficient (100 Year) |
|---|---|---|---|---|
| High Density | 0.95 | 0.43 | 0.95 | 1.00 |
| **TOTAL** | | 0.43 | 0.95 | 1.00 |

**Catchment 206** Outlets to: Highway 401

| | Runoff Coefficient | Area (ha) | Weighted Runoff Coefficient | Weighted Runoff Coefficient (100 Year) |
|---|---|---|---|---|
| High Density | 0.95 | 0.39 | 0.95 | 1.00 |
| **TOTAL** | | 0.39 | 0.95 | 1.00 |

# PROPOSED WEIGHTED RUNOFF COEFFICIENT

603-699 Kingston Road - Pickering
Project Number: 2626
Date: August 2023
Designer Initials: R.P.B.

**Catchment 207** Outlets to: Highway 401

| | Runoff Coefficient | Area (ha) | Weighted Runoff Coefficient | Weighted Runoff Coefficient (100 Year) |
|---|---|---|---|---|
| Asphalt | 0.95 | 0.20 | 0.25 | 0.26 |
| Grass | 0.20 | 0.57 | 0.15 | 0.18 |
| **TOTAL** | | 0.78 | 0.40 | 0.45 |

**Catchment 208** Outlets to: Highway 401

| | Runoff Coefficient | Area (ha) | Weighted Runoff Coefficient | Weighted Runoff Coefficient (100 Year) |
|---|---|---|---|---|
| High Density | 0.95 | 0.69 | 0.95 | 1.00 |
| **TOTAL** | | 0.69 | 0.95 | 1.00 |

**Highway 401 Total**

| Catchment | Runoff Coefficient | Area | Weighted Runoff Coefficient |
|---|---|---|---|
| 201 | 0.95 | 0.54 | 0.11 |
| 202 | 0.58 | 0.87 | 0.10 |
| 203 | 0.95 | 0.53 | 0.10 |
| 204 | 0.95 | 0.63 | 0.12 |
| 205 | 0.95 | 0.43 | 0.08 |
| 206 | 0.95 | 0.39 | 0.08 |
| 207 | 0.40 | 0.78 | 0.06 |
| 208 | 0.95 | 0.69 | 0.14 |
| **TOTAL** | | 4.85 | 0.79 |

# SUMMARY

603-699 Kingston Road - Pickering
Project Number: 2626
Date: August 2023
Designer Initials: R.P.B.

| | | | | | 100 Year | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Catchment ID | Routing | | Runoff Coef. | Area (ha) | Release Rate (L/s) | Storage Required ($m^3$) | Storage Available ($m^3$) [3] | Draw Down Time (mins) [3] | Orifice Size (mm) [2] | Uncontrolled Release Rate (L/s) | VERTICAL/TUBE Control |
| | | | | | | | | | | | |
| 201 | is routed through | 202 | 1.00 | 0.54 | 99.3 | 135.5 | 136.0 | 23 | 172 | | vertical |
| 202 | is routed through | | 0.72 | 0.87 | 375.8 | 115.9 | 121.5 | 0 | 338 | | vertical |
| 203 | is routed through | | 1.00 | 0.53 | 97.8 | 133.4 | 135.0 | 23 | 171 | | vertical |
| 204 | is routed through | 202 | 1.00 | 0.63 | 116.2 | 158.6 | 160.0 | 23 | 186 | | vertical |
| 205 | is routed through | | 1.00 | 0.43 | 79.3 | 108.2 | 110.0 | 23 | 154 | | vertical |
| 206 | is routed through | | 1.00 | 0.39 | 71.9 | 98.2 | 100.0 | 23 | 146 | | vertical |
| 207 | is routed through | | 0.45 | 0.78 | 207.6 | 0.0 | 0.0 | 0 | uncontrolled | 208 | - |
| 208 | is routed through | | 1.00 | 0.69 | 127.3 | 173.7 | 175.0 | 23 | 195 | | vertical |
| | | | | | | | | | | | |
| Total | | | | 4.85 | 1175.2 | 923.4 | 937.5 | | - | | |

| | | |
|---|---|---|
| Highway 401 Allowable Release Rate | **959.7** | L/s |
| Highway 401 Proposed Release Rate | 959.7 | L/s |

Notes:

[1] Per Modified Rational Calculations (attached)

[2] See attached for orifice details

[3] Draw down time calculated based on surface storage only

# MODIFIED RATIONAL METHOD

## Area ID: 201

Area = **0.538** ha
"C" = **1.00**
AC= **0.5382**
Tc = **10.0** min
Time Increment = **5.0** min

Release Rate = **99.28** l/s
Max.Storage = **135.5** $m^3$

City of Pickering — 100 Year
a= 2096.425
b= 6.485
c= 0.863

**NOTE: Catchment 201 is routed through Catchment 202**

| Time (min) | Rainfall Intensity (mm/hr) | Storm Runoff (l/s) | Runoff Volume ($m^3$) | Released Volume ($m^3$) | Storage Volume ($m^3$) | |
|---|---|---|---|---|---|---|
| 10.0 | 186.7 | 279.33 | 167.6 | 59.6 | 108.0 | |
| 15.0 | 148.5 | 222.25 | 200.0 | 74.5 | 125.6 | |
| 20.0 | 124.0 | 185.53 | 222.6 | 89.4 | 133.3 | |
| 25.0 | 106.8 | 159.81 | 239.7 | 104.2 | 135.5 | <<<< |
| 30.0 | 94.1 | 140.72 | 253.3 | 119.1 | 134.2 | |
| 35.0 | 84.2 | 125.96 | 264.5 | 134.0 | 130.5 | |
| 40.0 | 76.3 | 114.18 | 274.0 | 148.9 | 125.1 | |
| 45.0 | 69.9 | 104.54 | 282.3 | 163.8 | 118.4 | |
| 50.0 | 64.5 | 96.50 | 289.5 | 178.7 | 110.8 | |
| 55.0 | 59.9 | 89.69 | 296.0 | 193.6 | 102.4 | |
| 60.0 | 56.0 | 83.84 | 301.8 | 208.5 | 93.3 | |
| 65.0 | 52.6 | 78.76 | 307.1 | 223.4 | 83.8 | |
| 70.0 | 49.7 | 74.29 | 312.0 | 238.3 | 73.8 | |
| 75.0 | 47.0 | 70.34 | 316.5 | 253.2 | 63.4 | |
| 80.0 | 44.7 | 66.82 | 320.7 | 268.1 | 52.7 | |
| 85.0 | 42.5 | 63.65 | 324.6 | 282.9 | 41.7 | |
| 90.0 | 40.6 | 60.80 | 328.3 | 297.8 | 30.5 | |
| 95.0 | 38.9 | 58.20 | 331.8 | 312.7 | 19.0 | |
| 100.0 | 37.3 | 55.84 | 335.0 | 327.6 | 7.4 | |
| 105.0 | 35.9 | 53.67 | 338.1 | 342.5 | -4.4 | |
| 110.0 | 34.5 | 51.67 | 341.1 | 357.4 | -16.4 | |
| 115.0 | 33.3 | 49.83 | 343.9 | 372.3 | -28.4 | |
| 120.0 | 32.2 | 48.13 | 346.5 | 387.2 | -40.7 | |
| 125.0 | 31.1 | 46.55 | 349.1 | 402.1 | -53.0 | |

# ON-SITE DETENTION AND ORIFICE DETAILS

603-699 Kingston Road - Pickering
Project Number: 2626
Date: August 2023
Designer Initials: R.P.B.

**Area ID** 201

*Orifice Equation:* $Q = C_d A(2gh)^{1/2}$

| | | |
|---|---|---|
| *Orifice Diameter:* | 172 | mm |
| *Area:* | 0.023 | $m^2$ |
| g = | 9.81 | $m/sec^2$ |
| $C_d$ = | 0.62 | |

| | |
|---|---|
| *Type of Control:* | vertical |
| *Location:* | 1 |

## *Underground Storage*

Volume = 136 $m^3$

# MODIFIED RATIONAL METHOD

603-699 Kingston Road - Pickering
Project Number: 2626
Date: August 2023
Designer Initials: R.P.B.

## Area ID: 202

Area = **0.870** ha
"C" = **0.72**
AC= **0.6290**
Tc = **10.0** min
Time Increment = **5.0** min

Release Rate = **375.85** l/s
Max.Storage = **115.9** $m^3$

City of Pickering — 100 Year
a= 2096.425
b= 6.485
c= 0.863

**NOTE: Catchments 201, and 204 are routed through Catchment 202**

| Time (min) | Rainfall Intensity (mm/hr) | Storm Runoff (l/s) | Runoff Volume[1] ($m^3$) | Released Volume ($m^3$) | Storage Volume ($m^3$) | |
|---|---|---|---|---|---|---|
| 10.0 | 186.7 | 326.43 | 325.2 | 225.5 | 99.6 | |
| 15.0 | 148.5 | 259.72 | 395.4 | 281.9 | 113.5 | |
| 20.0 | 124.0 | 216.82 | 454.1 | 338.3 | 115.9 | <<<< |
| 25.0 | 106.8 | 186.76 | 506.4 | 394.6 | 111.8 | |
| 30.0 | 94.1 | 164.45 | 554.6 | 451.0 | 103.6 | |
| 35.0 | 84.2 | 147.20 | 600.0 | 507.4 | 92.6 | |
| 40.0 | 76.3 | 133.43 | 643.5 | 563.8 | 79.7 | |
| 45.0 | 69.9 | 122.17 | 685.4 | 620.2 | 65.3 | |
| 50.0 | 64.5 | 112.78 | 726.2 | 676.5 | 49.7 | |
| 55.0 | 59.9 | 104.82 | 766.1 | 732.9 | 33.2 | |
| 60.0 | 56.0 | 97.98 | 805.3 | 789.3 | 16.0 | |
| 65.0 | 52.6 | 92.04 | 843.8 | 845.7 | -1.9 | |
| 70.0 | 49.7 | 86.82 | 881.8 | 902.0 | -20.2 | |
| 75.0 | 47.0 | 82.20 | 919.4 | 958.4 | -39.0 | |
| 80.0 | 44.7 | 78.08 | 956.6 | 1014.8 | -58.2 | |
| 85.0 | 42.5 | 74.39 | 993.5 | 1071.2 | -77.7 | |
| 90.0 | 40.6 | 71.05 | 1030.1 | 1127.5 | -97.4 | |
| 95.0 | 38.9 | 68.02 | 1066.5 | 1183.9 | -117.4 | |
| 100.0 | 37.3 | 65.25 | 1102.6 | 1240.3 | -137.7 | |
| 105.0 | 35.9 | 62.72 | 1138.6 | 1296.7 | -158.1 | |
| 110.0 | 34.5 | 60.39 | 1174.3 | 1353.1 | -178.7 | |
| 115.0 | 33.3 | 58.24 | 1209.9 | 1409.4 | -199.5 | |
| 120.0 | 32.2 | 56.24 | 1245.4 | 1465.8 | -220.4 | |
| 125.0 | 31.1 | 54.39 | 1280.7 | 1522.2 | -241.5 | |

[1] **The released volume from Catchments 201 and 204 have been added to the runoff volume of Catchment 202**

# ON-SITE DETENTION AND ORIFICE DETAILS

**Area ID** 202

*Orifice Equation:* $Q = C_d A(2gh)^{1/2}$

| | | |
|---|---|---|
| *Orifice Diameter:* | 338 | mm |
| *Area:* | 0.090 | $m^2$ |
| g = | 9.81 | $m/sec^2$ |
| $C_d$ = | 0.62 | |

| | |
|---|---|
| *Type of Control:* | vertical |
| *Location:* | 2 |

## *Pipe Storage*

| Diameter (mm) | Area ($m^2$) | Length (m) | Volume ($m^3$) |
|---|---|---|---|
| 1.8 m x 0.9 m | 1.62 | 75 | 121.5 |
| | | Total Volume | **121.5** |

# MODIFIED RATIONAL METHOD

603-699 Kingston Road - Pickering
Project Number: 2626
Date: August 2023
Designer Initials: R.P.B.

## Area ID: 203

Area = **0.530** ha
"C" = **1.00**
AC= **0.5300**
Tc = **10.0** min
Time Increment = **5.0** min

Release Rate = **97.76** l/s
Max.Storage = **133.4** $m^3$

City of Pickering 100 Year
a= 2096.425
b= 6.485
c= 0.863

| Time (min) | Rainfall Intensity (mm/hr) | Storm Runoff (l/s) | Runoff Volume ($m^3$) | Released Volume ($m^3$) | Storage Volume ($m^3$) | |
|---|---|---|---|---|---|---|
| 10.0 | 186.7 | 275.08 | 165.0 | 58.7 | 106.4 | |
| 15.0 | 148.5 | 218.86 | 197.0 | 73.3 | 123.7 | |
| 20.0 | 124.0 | 182.71 | 219.2 | 88.0 | 131.3 | |
| 25.0 | 106.8 | 157.38 | 236.1 | 102.6 | 133.4 | <<<< |
| 30.0 | 94.1 | 138.58 | 249.4 | 117.3 | 132.1 | |
| 35.0 | 84.2 | 124.04 | 260.5 | 132.0 | 128.5 | |
| 40.0 | 76.3 | 112.44 | 269.8 | 146.6 | 123.2 | |
| 45.0 | 69.9 | 102.95 | 278.0 | 161.3 | 116.7 | |
| 50.0 | 64.5 | 95.03 | 285.1 | 176.0 | 109.1 | |
| 55.0 | 59.9 | 88.33 | 291.5 | 190.6 | 100.8 | |
| 60.0 | 56.0 | 82.56 | 297.2 | 205.3 | 91.9 | |
| 65.0 | 52.6 | 77.56 | 302.5 | 220.0 | 82.5 | |
| 70.0 | 49.7 | 73.16 | 307.3 | 234.6 | 72.6 | |
| 75.0 | 47.0 | 69.27 | 311.7 | 249.3 | 62.4 | |
| 80.0 | 44.7 | 65.80 | 315.8 | 264.0 | 51.9 | |
| 85.0 | 42.5 | 62.68 | 319.7 | 278.6 | 41.1 | |
| 90.0 | 40.6 | 59.87 | 323.3 | 293.3 | 30.0 | |
| 95.0 | 38.9 | 57.32 | 326.7 | 307.9 | 18.8 | |
| 100.0 | 37.3 | 54.99 | 329.9 | 322.6 | 7.3 | |
| 105.0 | 35.9 | 52.85 | 333.0 | 337.3 | -4.3 | |
| 110.0 | 34.5 | 50.89 | 335.9 | 351.9 | -16.1 | |
| 115.0 | 33.3 | 49.07 | 338.6 | 366.6 | -28.0 | |
| 120.0 | 32.2 | 47.40 | 341.3 | 381.3 | -40.0 | |
| 125.0 | 31.1 | 45.84 | 343.8 | 395.9 | -52.2 | |

# ON-SITE DETENTION AND ORIFICE DETAILS

603-699 Kingston Road - Pickering
Project Number: 2626
Date: August 2023
Designer Initials: R.P.B.

**Area ID** 203

*Orifice Equation:* $Q = C_d A(2gh)^{1/2}$

| | | |
|---|---|---|
| *Orifice Diameter:* | 171 | mm |
| *Area:* | 0.023 | $m^2$ |
| g = | 9.81 | $m/sec^2$ |
| $C_d$ = | 0.62 | |

| | |
|---|---|
| *Type of Control:* | vertical |
| *Location:* | 0 |

## *Underground Storage*

Volume = 135.0 $m^3$

# MODIFIED RATIONAL METHOD

## Area ID: 204

Area = **0.630** ha
"C" = **1.00**
AC= **0.6300**
Tc = **10.0** min
Time Increment = **5.0** min

Release Rate = **116.21** l/s
Max.Storage = **158.6** $m^3$

City of Pickering 100 Year
a= 2096.425
b= 6.485
c= 0.863

**NOTE: Catchment 204 is routed through Catchment 202**

| Time (min) | Rainfall Intensity (mm/hr) | Storm Runoff (l/s) | Runoff Volume ($m^3$) | Released Volume ($m^3$) | Storage Volume ($m^3$) | |
|---|---|---|---|---|---|---|
| 10.0 | 186.7 | 326.98 | 196.2 | 69.7 | 126.5 | |
| 15.0 | 148.5 | 260.15 | 234.1 | 87.2 | 147.0 | |
| 20.0 | 124.0 | 217.18 | 260.6 | 104.6 | 156.0 | |
| 25.0 | 106.8 | 187.07 | 280.6 | 122.0 | 158.6 | <<<< |
| 30.0 | 94.1 | 164.73 | 296.5 | 139.5 | 157.1 | |
| 35.0 | 84.2 | 147.44 | 309.6 | 156.9 | 152.7 | |
| 40.0 | 76.3 | 133.65 | 320.8 | 174.3 | 146.4 | |
| 45.0 | 69.9 | 122.37 | 330.4 | 191.7 | 138.7 | |
| 50.0 | 64.5 | 112.97 | 338.9 | 209.2 | 129.7 | |
| 55.0 | 59.9 | 104.99 | 346.5 | 226.6 | 119.9 | |
| 60.0 | 56.0 | 98.14 | 353.3 | 244.0 | 109.3 | |
| 65.0 | 52.6 | 92.19 | 359.5 | 261.5 | 98.1 | |
| 70.0 | 49.7 | 86.96 | 365.2 | 278.9 | 86.3 | |
| 75.0 | 47.0 | 82.34 | 370.5 | 296.3 | 74.2 | |
| 80.0 | 44.7 | 78.21 | 375.4 | 313.8 | 61.7 | |
| 85.0 | 42.5 | 74.51 | 380.0 | 331.2 | 48.8 | |
| 90.0 | 40.6 | 71.17 | 384.3 | 348.6 | 35.7 | |
| 95.0 | 38.9 | 68.13 | 388.3 | 366.1 | 22.3 | |
| 100.0 | 37.3 | 65.36 | 392.2 | 383.5 | 8.7 | |
| 105.0 | 35.9 | 62.82 | 395.8 | 400.9 | -5.1 | |
| 110.0 | 34.5 | 60.49 | 399.2 | 418.4 | -19.1 | |
| 115.0 | 33.3 | 58.33 | 402.5 | 435.8 | -33.3 | |
| 120.0 | 32.2 | 56.34 | 405.6 | 453.2 | -47.6 | |
| 125.0 | 31.1 | 54.48 | 408.6 | 470.7 | -62.0 | |

# ON-SITE DETENTION AND ORIFICE DETAILS

603-699 Kingston Road - Pickering
Project Number: 2626
Date: August 2023
Designer Initials: R.P.B.

**Area ID** 204

*Orifice Equation:* $Q = C_d A(2gh)^{1/2}$

| | | |
|---|---|---|
| *Orifice Diameter:* | 186 | mm |
| *Area:* | 0.027 | $m^2$ |
| g = | 9.81 | $m/sec^2$ |
| $C_d$ = | 0.62 | |

| | |
|---|---|
| *Type of Control:* | vertical |
| *Location:* | 0 |

## *Underground Storage*

Volume = 160.0 $m^3$

# MODIFIED RATIONAL METHOD

603-699 Kingston Road - Pickering
Project Number: 2626
Date: August 2023
Designer Initials: R.P.B.

## Area ID: 205

Area = **0.430** ha
"C" = **1.00**
AC= **0.4300**
Tc = **10.0** min
Time Increment = **5.0** min

Release Rate = **79.32** l/s
Max.Storage = **108.2** $m^3$

City of Pickering 100 Year
a= 2096.425
b= 6.485
c= 0.863

| Time (min) | Rainfall Intensity (mm/hr) | Storm Runoff (l/s) | Runoff Volume ($m^3$) | Released Volume ($m^3$) | Storage Volume ($m^3$) | |
|---|---|---|---|---|---|---|
| 10.0 | 186.7 | 223.17 | 133.9 | 47.6 | 86.3 | |
| 15.0 | 148.5 | 177.57 | 159.8 | 59.5 | 100.3 | |
| 20.0 | 124.0 | 148.23 | 177.9 | 71.4 | 106.5 | |
| 25.0 | 106.8 | 127.68 | 191.5 | 83.3 | 108.2 | <<<< |
| 30.0 | 94.1 | 112.43 | 202.4 | 95.2 | 107.2 | |
| 35.0 | 84.2 | 100.64 | 211.3 | 107.1 | 104.3 | |
| 40.0 | 76.3 | 91.22 | 218.9 | 119.0 | 100.0 | |
| 45.0 | 69.9 | 83.52 | 225.5 | 130.9 | 94.6 | |
| 50.0 | 64.5 | 77.10 | 231.3 | 142.8 | 88.5 | |
| 55.0 | 59.9 | 71.66 | 236.5 | 154.7 | 81.8 | |
| 60.0 | 56.0 | 66.99 | 241.1 | 166.6 | 74.6 | |
| 65.0 | 52.6 | 62.92 | 245.4 | 178.5 | 66.9 | |
| 70.0 | 49.7 | 59.36 | 249.3 | 190.4 | 58.9 | |
| 75.0 | 47.0 | 56.20 | 252.9 | 202.3 | 50.6 | |
| 80.0 | 44.7 | 53.38 | 256.2 | 214.2 | 42.1 | |
| 85.0 | 42.5 | 50.86 | 259.4 | 226.1 | 33.3 | |
| 90.0 | 40.6 | 48.57 | 262.3 | 238.0 | 24.3 | |
| 95.0 | 38.9 | 46.50 | 265.1 | 249.9 | 15.2 | |
| 100.0 | 37.3 | 44.61 | 267.7 | 261.8 | 5.9 | |
| 105.0 | 35.9 | 42.88 | 270.1 | 273.7 | -3.5 | |
| 110.0 | 34.5 | 41.29 | 272.5 | 285.6 | -13.1 | |
| 115.0 | 33.3 | 39.82 | 274.7 | 297.5 | -22.7 | |
| 120.0 | 32.2 | 38.45 | 276.9 | 309.4 | -32.5 | |
| 125.0 | 31.1 | 37.19 | 278.9 | 321.2 | -42.3 | |

# ON-SITE DETENTION AND ORIFICE DETAILS

603-699 Kingston Road - Pickering
Project Number: 2626
Date: August 2023
Designer Initials: R.P.B.

**Area ID** 205

*Orifice Equation:* $Q = C_d A(2gh)^{1/2}$

| | | |
|---|---|---|
| *Orifice Diameter:* | 154 | mm |
| *Area:* | 0.019 | $m^2$ |
| g = | 9.81 | $m/sec^2$ |
| $C_d$ = | 0.62 | |

| | |
|---|---|
| *Type of Control:* | vertical |
| *Location:* | 0 |

## *Underground Storage*

Volume = 110.0 $m^3$

# MODIFIED RATIONAL METHOD

603-699 Kingston Road - Pickering
Project Number: 2626
Date: August 2023
Designer Initials: R.P.B.

## Area ID: 206

Area = **0.390** ha
"C" = **1.00**
AC= **0.3900**
Tc = **10.0** min
Time Increment = **5.0** min

Release Rate = **71.94** l/s
Max.Storage = **98.2** $m^3$

City of Pickering 100 Year
a= 2096.425
b= 6.485
c= 0.863

| Time (min) | Rainfall Intensity (mm/hr) | Storm Runoff (l/s) | Runoff Volume ($m^3$) | Released Volume ($m^3$) | Storage Volume ($m^3$) | |
|---|---|---|---|---|---|---|
| 10.0 | 186.7 | 202.41 | 121.4 | 43.2 | 78.3 | |
| 15.0 | 148.5 | 161.05 | 144.9 | 54.0 | 91.0 | |
| 20.0 | 124.0 | 134.44 | 161.3 | 64.7 | 96.6 | |
| 25.0 | 106.8 | 115.80 | 173.7 | 75.5 | 98.2 | <<<< |
| 30.0 | 94.1 | 101.97 | 183.6 | 86.3 | 97.2 | |
| 35.0 | 84.2 | 91.27 | 191.7 | 97.1 | 94.6 | |
| 40.0 | 76.3 | 82.74 | 198.6 | 107.9 | 90.7 | |
| 45.0 | 69.9 | 75.75 | 204.5 | 118.7 | 85.8 | |
| 50.0 | 64.5 | 69.93 | 209.8 | 129.5 | 80.3 | |
| 55.0 | 59.9 | 65.00 | 214.5 | 140.3 | 74.2 | |
| 60.0 | 56.0 | 60.75 | 218.7 | 151.1 | 67.6 | |
| 65.0 | 52.6 | 57.07 | 222.6 | 161.9 | 60.7 | |
| 70.0 | 49.7 | 53.83 | 226.1 | 172.7 | 53.4 | |
| 75.0 | 47.0 | 50.97 | 229.4 | 183.4 | 45.9 | |
| 80.0 | 44.7 | 48.42 | 232.4 | 194.2 | 38.2 | |
| 85.0 | 42.5 | 46.13 | 235.2 | 205.0 | 30.2 | |
| 90.0 | 40.6 | 44.06 | 237.9 | 215.8 | 22.1 | |
| 95.0 | 38.9 | 42.18 | 240.4 | 226.6 | 13.8 | |
| 100.0 | 37.3 | 40.46 | 242.8 | 237.4 | 5.4 | |
| 105.0 | 35.9 | 38.89 | 245.0 | 248.2 | -3.2 | |
| 110.0 | 34.5 | 37.45 | 247.1 | 259.0 | -11.8 | |
| 115.0 | 33.3 | 36.11 | 249.2 | 269.8 | -20.6 | |
| 120.0 | 32.2 | 34.88 | 251.1 | 280.6 | -29.5 | |
| 125.0 | 31.1 | 33.73 | 253.0 | 291.4 | -38.4 | |

# ON-SITE DETENTION AND ORIFICE DETAILS

603-699 Kingston Road - Pickering
Project Number: 2626
Date: August 2023
Designer Initials: R.P.B.

**Area ID** 206

*Orifice Equation:* $Q = C_d A(2gh)^{1/2}$

| | | |
|---|---|---|
| *Orifice Diameter:* | 146 | mm |
| *Area:* | 0.017 | $m^2$ |
| g = | 9.81 | $m/sec^2$ |
| $C_d$ = | 0.62 | |

| | |
|---|---|
| *Type of Control:* | vertical |
| *Location:* | 0 |

## *Underground Storage*

Volume = 100.0 $m^3$

# MODIFIED RATIONAL METHOD

603-699 Kingston Road - Pickering
Project Number: 2626
Date: August 2023
Designer Initials: R.P.B.

## Area ID: 207

Area = **0.777** ha
"C" = **0.45**
AC= **0.3465**
Tc = **10.0** min
Time Increment = **5.0** min

Release Rate = **207.60** l/s
Max.Storage = **0.0** $m^3$

City of Pickering 100 Year
a= 2096.425
b= 6.485
c= 0.863

| Time (min) | Rainfall Intensity (mm/hr) | Storm Runoff (l/s) | Runoff Volume ($m^3$) | Released Volume ($m^3$) | Storage Volume ($m^3$) | |
|---|---|---|---|---|---|---|
| 10.0 | 186.7 | 179.81 | 107.9 | 124.6 | 0.0 | <<<< |

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# MODIFIED RATIONAL METHOD

603-699 Kingston Road - Pickering
Project Number: 2626
Date: August 2023
Designer Initials: R.P.B.

## Area ID: 208

| | | |
|---|---|---|
| Area = | **0.690** | ha |
| "C" = | **1.00** | |
| AC= | **0.6900** | |
| Tc = | **10.0** | min |
| Time Increment = | **5.0** | min |
| Release Rate = | **127.26** | l/s |
| Max.Storage = | **173.7** | $m^3$ |

City of Pickering 100 Year

| | |
|---|---|
| a= | 2096.425 |
| b= | 6.485 |
| c= | 0.863 |

| Time (min) | Rainfall Intensity (mm/hr) | Storm Runoff (l/s) | Runoff Volume ($m^3$) | Released Volume ($m^3$) | Storage Volume ($m^3$) | |
|---|---|---|---|---|---|---|
| 10.0 | 186.7 | 358.12 | 214.9 | 76.4 | 138.5 | |
| 15.0 | 148.5 | 284.93 | 256.4 | 95.4 | 161.0 | |
| 20.0 | 124.0 | 237.86 | 285.4 | 114.5 | 170.9 | |
| 25.0 | 106.8 | 204.88 | 307.3 | 133.6 | 173.7 | <<<< |
| 30.0 | 94.1 | 180.41 | 324.7 | 152.7 | 172.0 | |
| 35.0 | 84.2 | 161.49 | 339.1 | 171.8 | 167.3 | |
| 40.0 | 76.3 | 146.38 | 351.3 | 190.9 | 160.4 | |
| 45.0 | 69.9 | 134.03 | 361.9 | 210.0 | 151.9 | |
| 50.0 | 64.5 | 123.72 | 371.2 | 229.1 | 142.1 | |
| 55.0 | 59.9 | 114.99 | 379.5 | 248.2 | 131.3 | |
| 60.0 | 56.0 | 107.49 | 387.0 | 267.2 | 119.7 | |
| 65.0 | 52.6 | 100.97 | 393.8 | 286.3 | 107.4 | |
| 70.0 | 49.7 | 95.25 | 400.0 | 305.4 | 94.6 | |
| 75.0 | 47.0 | 90.18 | 405.8 | 324.5 | 81.3 | |
| 80.0 | 44.7 | 85.66 | 411.2 | 343.6 | 67.6 | |
| 85.0 | 42.5 | 81.61 | 416.2 | 362.7 | 53.5 | |
| 90.0 | 40.6 | 77.94 | 420.9 | 381.8 | 39.1 | |
| 95.0 | 38.9 | 74.62 | 425.3 | 400.9 | 24.5 | |
| 100.0 | 37.3 | 71.59 | 429.5 | 420.0 | 9.6 | |
| 105.0 | 35.9 | 68.81 | 433.5 | 439.0 | -5.6 | |
| 110.0 | 34.5 | 66.25 | 437.2 | 458.1 | -20.9 | |
| 115.0 | 33.3 | 63.89 | 440.8 | 477.2 | -36.4 | |
| 120.0 | 32.2 | 61.70 | 444.3 | 496.3 | -52.0 | |
| 125.0 | 31.1 | 59.67 | 447.6 | 515.4 | -67.9 | |

# ON-SITE DETENTION AND ORIFICE DETAILS

603-699 Kingston Road - Pickering
Project Number: 2626
Date: August 2023
Designer Initials: R.P.B.

**Area ID** 208

*Orifice Equation:* $Q = C_d A(2gh)^{1/2}$

| | | |
|---|---|---|
| *Orifice Diameter:* | 195 | mm |
| *Area:* | 0.030 | $m^2$ |
| g = | 9.81 | $m/sec^2$ |
| $C_d$ = | 0.62 | |

| | |
|---|---|
| *Type of Control:* | vertical |
| *Location:* | 0 |

### *Underground Storage*

Volume = 175.0 $m^3$

| | Stage (m) | Head (m) | Storage ($m^3$) | Discharge ($m^3/s$) |
|---|---|---|---|---|
| Invert E.L. | 100.00 | 0.00 | 0.0 | 0.00 |
| Ground E.L. | 102.50 | 2.40 | 0.0 | 0.127 |
| 100 Year WL | 102.50 | 2.40 | 175.0 | 0.127 |

# WATER BALANCE

603-699 Kingston Road - Pickering
Project Number: 2626
Date: August 2023
Designer Initials: R.P.B.

**Post Development Conditions**

| Catchment | Area (ha) | Rainfall Depth (mm) | Rainfall Volume ($m^3$) | Initial Abstraction Volume ($m^3$) | Runoff Volume ($m^3$) |
|---|---|---|---|---|---|
| | (1) | (2) | (3) = (2)x(1)x10 m3/ha-mm | (5) = (4)x(1)x10 m3/ha-mm | (6) = (3) - (5) |
| High Density | 2.52 | 5 | 125.9 | 0.0 | 125.9 |
| ROW | 0.54 | 5 | 27.2 | 0.0 | 27.2 |
| Park/Grass | 0.90 | 5 | 45.0 | 0.0 | 45.0 |
| Asphalt | 0.20 | 5 | 10.1 | 0.0 | 10.1 |
| **Total** | **4.16** | | **208.2** | **0.0** | **208.2** |

Therefore, water balance treatment of 208.2 cu.m is required.

# Appendix D Sanitary Sewer Capacity Analysis

**Sanitary Design Sheet**
**603-699 Kingston Road - Sorbara Group of Companies**
**Functional Servicing and Stormwater Management Report (FSSR)**
**Pickering, Durham Region**

| | | | |
|---|---|---|---|
| **Minimum Sewer Diameter (mm) =** | **200** | **Avg. Domestic Flow (l/cap/day) =** | **364** |
| **Mannings n =** | **0.013** | **Infiltration Rate (l/s/ha) =** | **2.08** |
| **Minimum Velocity (m/s) =** | **0.60** | **Max. Harmon Peaking Factor =** | **3.8** |
| **Maximum Velocity (m/s) =** | **3.65** | **Min. Harmon Peaking Factor =** | **1.5** |
| **Minimum Pipe Slope (%) =** | **0.50** | **NOMINAL PIPE SIZE USED** | |

**Project: 603-699 Kingston Road - Sorbara Group of Companies**
**Project No. 2626**
**Date: 24-Jul-23**
**Designed By: J.Y.L. / P.C.**
**Reviewed By: P.C.**

P:\2626\603-699 Kingston Road - Pickering\Design\Pipe Design\Sanitary\[2626P-Sanitary Sheet Design.xlsm]Design

| LOCATION | | | RESIDENTIAL | | | | | | | INDUSTRIAL/COMMERCIAL/INSTITUTIONAL | | | | | FLOW CALCULATIONS | | | | | | | | PIPE DATA | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STREET | MANHOLE | | AREA | ACCUM. AREA | UNITS | DENSITY | | RESIDENTIAL POPULATION | ACCUM. RESIDENTIAL POPULATION | AREA | ACCUM. AREA | POPULATION DENSITY | FLOW RATE | ACCUM. EQUIV. POPULATION | INFILTRATION | TOTAL ACCUM. POPULATION | AVG. DOMESTIC FLOW | ACCUM. AVG. DOMESTIC FLOW | PEAKING FACTOR | PEAKED RESIDENTIAL FLOW | ICI FLOW | TOTAL FLOW | LENGTH | PIPE DIAMETER | SLOPE | FULL FLOW CAPACITY | FULL FLOW VELOCITY |
| | FROM | TO | | | | PER UNIT | PER HA | | | | | | | | | | | | | | | | | | | | |
| | | | (ha) | (ha) | (#) | (p/unit) | (p/ha) | | | (ha) | (ha) | (p/ha) | (l/s/ha) | | (L/s) | | (L/s) | (L/s) | | (L/s) | (L/s) | (L/s) | (m) | (mm) | (%) | (L/s) | (m/s) |
| | | | 0 | 0 | 0 | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0.0 | 0.0 | 3.80 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0.00 | #DIV/0! | #DIV/0! |
| SITE | MH1A | MH2A | 0 | 0 | 0 | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0.0 | 0.0 | 3.80 | 0.0 | 0.0 | 0.0 | 17.9 | 200 | 1.00 | 32.8 | 1.04 |
| SITE | PLUG1 | MH2A | 0.369 | 0.369 | 320 | 2.5 | | 800 | 800 | 0 | 0 | 0 | 0 | 0 | 0.8 | 800 | 3.4 | 3.4 | 3.80 | 12.8 | 0.0 | 13.6 | 9.8 | 200 | 1.00 | 32.8 | 1.04 |
| SITE | MH2A | MH3A | 0 | 0.369 | 0 | | | 0 | 800 | 0 | 0 | 0 | 0 | 0 | 0.8 | 800 | 0.0 | 3.4 | 3.80 | 12.8 | 0.0 | 13.6 | 60.0 | 200 | 0.50 | 23.2 | 0.74 |
| SITE | PLUG2 | MH3A | 0.3506 | 0.3506 | 320 | 2.5 | | 800 | 800 | 0 | 0 | 0 | 0 | 0 | 0.7 | 800 | 3.4 | 3.4 | 3.80 | 12.8 | 0.0 | 13.5 | 9.8 | 200 | 1.00 | 32.8 | 1.04 |
| SITE | PLUG10 | MH3A | 1.0819 | 1.0819 | 440 | 2.5 | | 1100 | 1100 | 0 | 0 | 0 | 0 | 0 | 2.3 | 1100 | 4.6 | 4.6 | 3.77 | 17.5 | 0.0 | 19.7 | 13.9 | 200 | 1.00 | 32.8 | 1.04 |
| SITE | MH3A | MH4A | 0 | 1.8015 | 0 | | | 0 | 2700 | 0 | 0 | 0 | 0 | 0 | 3.7 | 2700 | 0.0 | 11.4 | 3.48 | 39.6 | 0.0 | 43.3 | 55.0 | 300 | 0.50 | 68.3 | 0.97 |
| SITE | MH5A | MH4A | 0 | 0 | 0 | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0 | 0.0 | 0.0 | 3.80 | 0.0 | 0.0 | 0.0 | 14.0 | 200 | 1.00 | 32.8 | 1.04 |
| SITE | PLUG3 | MH4A | 0.3707 | 0.3707 | 320 | 2.5 | | 800 | 800 | 0 | 0 | 0 | 0 | 0 | 0.8 | 800 | 3.4 | 3.4 | 3.80 | 12.8 | 0.0 | 13.6 | 10.4 | 200 | 1.00 | 32.8 | 1.04 |
| SITE | MH4A | MH6A | 0 | 2.1722 | 0 | | | 0 | 3500 | 0 | 0 | 0 | 0 | 0 | 4.5 | 3500 | 0.0 | 14.7 | 3.38 | 49.9 | 0.0 | 54.4 | 43.3 | 300 | 0.50 | 68.3 | 0.97 |
| SITE | PLUG4 | MH6A | 0.378 | 0.378 | 320 | 2.5 | | 800 | 800 | 0 | 0 | 0 | 0 | 0 | 0.8 | 800 | 3.4 | 3.4 | 3.80 | 12.8 | 0.0 | 13.6 | 14.8 | 200 | 1.00 | 32.8 | 1.04 |
| SITE | MH6A | MH7A | 0 | 2.5502 | 0 | | | 0 | 4300 | 0 | 0 | 0 | 0 | 0 | 5.3 | 4300 | 0.0 | 18.1 | 3.31 | 59.9 | 0.0 | 65.2 | 19.7 | 375 | 0.50 | 123.9 | 1.12 |
| SITE | PLUG5 | MH7A | 0.299 | 0.299 | 320 | 2.5 | | 800 | 800 | 0 | 0 | 0 | 0 | 0 | 0.6 | 800 | 3.4 | 3.4 | 3.80 | 12.8 | 0.0 | 13.4 | 15.5 | 200 | 1.00 | 32.8 | 1.04 |
| SITE | MH7A | MH8A | 0 | 2.8492 | 0 | | | 0 | 5100 | 0 | 0 | 0 | 0 | 0 | 5.9 | 5100 | 0.0 | 21.5 | 3.24 | 69.6 | 0.0 | 75.5 | 13.4 | 375 | 0.50 | 123.9 | 1.12 |
| SITE | PLUG6 | MH8A | 0.597 | 0.597 | 380 | 2.5 | | 950 | 950 | 0 | 0 | 0 | 0 | 0 | 1.2 | 950 | 4.0 | 4.0 | 3.80 | 15.2 | 0.0 | 16.5 | 14.8 | 200 | 1.00 | 32.8 | 1.04 |
| SITE | MH8A | MH9A | 0 | 3.4462 | 0 | | | 0 | 6050 | 0 | 0 | 0 | 0 | 0 | 7.2 | 6050 | 0.0 | 25.5 | 3.17 | 80.7 | 0.0 | 87.9 | 27.5 | 375 | 0.50 | 123.9 | 1.12 |
| SITE | PLUG9 | MH9A | 0.57 | 0.57 | 420 | 2.5 | | 1050 | 1050 | 0 | 0 | 0 | 0 | 0 | 1.2 | 1050 | 4.4 | 4.4 | 3.79 | 16.7 | 0.0 | 17.9 | 14.8 | 200 | 1.00 | 32.8 | 1.04 |
| SITE | MH9A | MH10A | 0 | 4.0162 | 0 | | | 0 | 7100 | 0 | 0 | 0 | 0 | 0 | 8.4 | 7100 | 0.0 | 29.9 | 3.10 | 92.7 | 0.0 | 101.1 | 34.8 | 375 | 0.50 | 123.9 | 1.12 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| KINGSTON ROAD | MH10A | MH11A | 0 | 4.0162 | 0 | | | 0 | 7100 | 0 | 0 | 0 | 0 | 0 | 8.4 | 7100 | 0.0 | 29.9 | 3.10 | 92.7 | 0.0 | 101.1 | 75.9 | 375 | 0.50 | 123.9 | 1.12 |
| KINGSTON ROAD | MH11A | MH12A | 0 | 4.0162 | 0 | | | 0 | 7100 | 0 | 0 | 0 | 0 | 0 | 8.4 | 7100 | 0.0 | 29.9 | 3.10 | 92.7 | 0.0 | 101.1 | 15.7 | 375 | 0.50 | 123.9 | 1.12 |
| KINGSTON ROAD | MH12A | MH13A | 0 | 4.0162 | 0 | | | 0 | 7100 | 0 | 0 | 0 | 0 | 0 | 8.4 | 7100 | 0.0 | 29.9 | 3.10 | 92.7 | 0.0 | 101.1 | 81.6 | 375 | 0.50 | 123.9 | 1.12 |
| SITE | PLUG8 | MH13A | 0.516 | 0.516 | 420 | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.1 | 0 | 0.0 | 0.0 | 3.80 | 0.0 | 0.0 | 1.1 | 19.6 | 200 | 2.00 | 46.4 | 1.48 |
| KINGSTON ROAD | MH13A | MH16A | 0 | 4.5322 | 0 | | | 0 | 7100 | 0 | 0 | 0 | 0 | 0 | 9.4 | 7100 | 0.0 | 29.9 | 3.10 | 92.7 | 0.0 | 102.2 | 22.6 | 375 | 0.50 | 123.9 | 1.12 |
| SITE | PLUG7 | MH16A | 0.329 | 0.329 | 200 | 2.5 | | 500 | 500 | 0 | 0 | 0 | 0 | 0 | 0.7 | 500 | 2.1 | 2.1 | 3.80 | 8.0 | 0.0 | 8.7 | 18.7 | 200 | 2.00 | 46.4 | 1.48 |
| KINGSTON ROAD | MH16A | MH17A | 0 | 4.8612 | 0 | | | 0 | 7600 | 0 | 0 | 0 | 0 | 0 | 10.1 | 7600 | 0.0 | 32.0 | 3.07 | 98.4 | 0.0 | 108.5 | 12.8 | 375 | 0.50 | 123.9 | 1.12 |
| KINGSTON ROAD | MH17A | MH18A | 0 | 4.8612 | 0 | | | 0 | 7600 | 0 | 0 | 0 | 0 | 0 | 10.1 | 7600 | 0.0 | 32.0 | 3.07 | 98.4 | 0.0 | 108.5 | 120.0 | 375 | 0.50 | 123.9 | 1.12 |
| KINGSTON ROAD | MH18A | MH19A | 0 | 4.8612 | 0 | | | 0 | 7600 | 0 | 0 | 0 | 0 | 0 | 10.1 | 7600 | 0.0 | 32.0 | 3.07 | 98.4 | 0.0 | 108.5 | 120.0 | 375 | 0.50 | 123.9 | 1.12 |
| KINGSTON ROAD | MH19A | MH20A | 0 | 4.8612 | 0 | | | 0 | 7600 | 0 | 0 | 0 | 0 | 0 | 10.1 | 7600 | 0.0 | 32.0 | 3.07 | 98.4 | 0.0 | 108.5 | 120.0 | 375 | 1.10 | 183.8 | 1.66 |
| KINGSTON ROAD | MH20A | MH21A | 0 | 4.8612 | 0 | | | 0 | 7600 | 0 | 0 | 0 | 0 | 0 | 10.1 | 7600 | 0.0 | 32.0 | 3.07 | 98.4 | 0.0 | 108.5 | 120.0 | 375 | 0.70 | 146.6 | 1.33 |
| KINGSTON ROAD | MH21A | MH22A | 0 | 4.8612 | 0 | | | 0 | 7600 | 0 | 0 | 0 | 0 | 0 | 10.1 | 7600 | 0.0 | 32.0 | 3.07 | 98.4 | 0.0 | 108.5 | 120.0 | 375 | 0.50 | 123.9 | 1.12 |
| KINGSTON ROAD | MH22A | MH23A | 0 | 4.8612 | 0 | | | 0 | 7600 | 0 | 0 | 0 | 0 | 0 | 10.1 | 7600 | 0.0 | 32.0 | 3.07 | 98.4 | 0.0 | 108.5 | 100.0 | 375 | 0.50 | 123.9 | 1.12 |
| KINGSTON ROAD | MH23A | MH24A | 0 | 4.8612 | 0 | | | 0 | 7600 | 0 | 0 | 0 | 0 | 0 | 10.1 | 7600 | 0.0 | 32.0 | 3.07 | 98.4 | 0.0 | 108.5 | 64.1 | 375 | 0.50 | 123.9 | 1.12 |

# Appendix E Water Distribution Analysis

# HYDRANT INSPECTION & FLOW REPORT

| SUGGESTED NFPA RATING | |
|---|---|
| BLUE | CLASS AA |
| 4159 gpm @ 20 psi (138 kPa) | |

ONTARIO CLEAN WATER AGENCY
AGENCE ONTARIENNE DES EAUX

Prepared By: The Ontario Clean Water Agency
Prepared For: Mr. James Bujak
Residual Hyd Andrew Cruickshank
Flow Hyd(s) Cody Flatt

Date: 19-May-23 Time: 11:45 AM

## HYDRANT DESCRIPTION

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Hydrant ID: | Private Hyd | Side of Street: | South | Make: | Canada Valve | Open Dir: | Left |
| Address: | 609 Kingston Road | | | Model: | Century | Latitude: | |
| Location: | Pickering Ontario | | | Year: | 2016 | Longitude: | |

## GENERAL INSPECTION

*OK - Good Condition* *FR - Future Repair Required* *N/A - Not Applicable* *CF - Component Failure*

| Upper Section | OK | FR | N/A | CF |
|---|---|---|---|---|
| Bonnet | ☐ | ☐ | ☑ | ☐ |
| Operating Nut | ☐ | ☐ | ☑ | ☐ |
| Gaskets / Bolts | ☐ | ☐ | ☑ | ☐ |
| O-Ring(s) | ☐ | ☐ | ☑ | ☐ |

| Mid Section | OK | FR | N/A | CF |
|---|---|---|---|---|
| Port Height | ☐ | ☐ | ☑ | ☐ |
| Caps / Nozzles | ☐ | ☐ | ☑ | ☐ |
| Chains | ☐ | ☐ | ☑ | ☐ |
| Traffic Flange | ☐ | ☐ | ☑ | ☐ |

| General | OK | FR | N/A | CF |
|---|---|---|---|---|
| Accessibility | ☐ | ☐ | ☑ | ☐ |
| Position / Height | ☐ | ☐ | ☑ | ☐ |
| Paint Cond | ☐ | ☐ | ☑ | ☐ |
| Drain Ports | ☐ | ☐ | ☑ | ☐ |

| Hydrostatic Leak Testing | | |
|---|---|---|
| *Hydrant Closed* | Above Grade Leak | No |
| | Subsurface Leak | No |
| *Hydrant Open* | Above Grade Leak | No |
| | Subsurface Leak | No |

| Maintenance | |
|---|---|
| Lubricate Operating Nut | N/A |
| Lubricate & Clean Nozzle Threads | N/A |
| Lubricate & Clean Cap Threads | N/A |
| Water Removed (if non-draining) | N/A |

| Auxiliary / Secondary Valve | |
|---|---|
| Located / Accessible | N/A |
| Operated/Exercised | N/A |
| Number of Turns | N/A |
| Open Direction | |

Comments:

Auxiliary Valve Location:

## FLUSHING

*If hydrants are being flow tested, inspections and flushing are completed prior to testing

| Hydrant Operated | Clear Flow Obtained | Cl2 Residual | Time Flushed | Flow | Total Flow | Dechlorinated |
|---|---|---|---|---|---|---|
| Yes - Easily Operated | Yes | | 5 minutes | 1202 gal | 6008 gal | Yes |

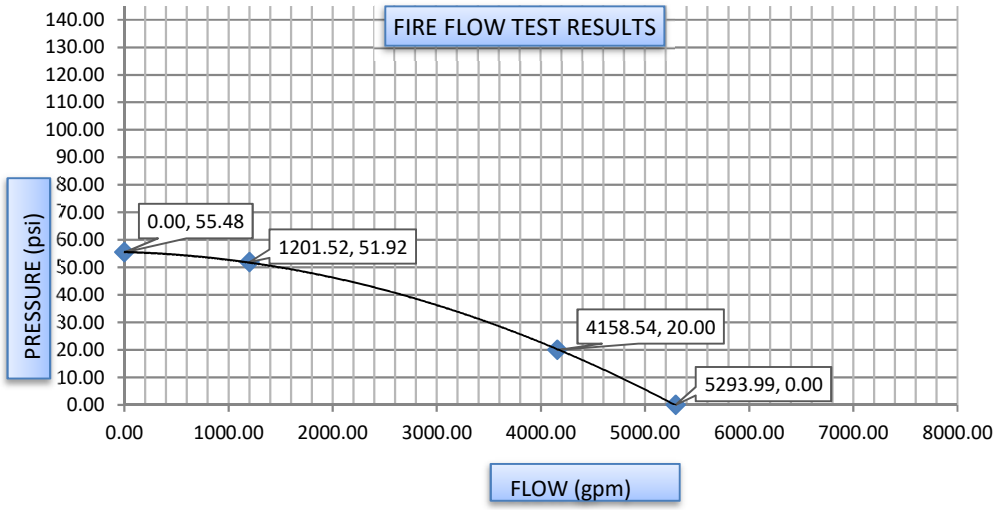
Comments: **STATIC AFTER FLOW TEST WAS PERFORMED 53.98 PSI**

## FLOW TESTING

*Flow testing results may be from previous year(s). Note date & time

Date: 19-May-23 Time: 11:45 AM

| Flow Hydrant | | | | | | | | Test Hydrant | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ID | Flow Device Used | Size | Coefficient | Time Flushed | Flow | Total Flow | Pitot | ID | Static | Residual |
| PE602 | Pollard Diffuser | 2.5" | 0.832 | 5.0 minutes | 601 gal | 3004 gal | 15 psi | Private Hyd | 55.48 | 51.92 |
| PE602 | Pollard Diffuser | 2.5" | 0.832 | 5.0 minutes | 601 gal | 3004 gal | 15 psi | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |




| Calculated Results | |
|---|---|
| Calculated Flow @ 20 psi | 4159 gpm |
| Calculated Flow @ 0 psi | 5294 gpm |
| Pressure Drop | 6.42% |

Comments:

# HYDRANT INSPECTION & FLOW REPORT

| SUGGESTED NFPA RATING | |
|---|---|
| BLUE | CLASS AA |
| 3832 gpm @ 20 psi (138 kPa) | |

ONTARIO CLEAN WATER AGENCY
AGENCE ONTARIENNE DES EAUX

Prepared By: The Ontario Clean Water Agency
Prepared For: Mr. James Bujak
Residual Hyd Andrew Cruickshank
Flow Hyd(s) Cody Flatt

Date: 19-May-23 Time: 12:00 PM

## HYDRANT DESCRIPTION

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Hydrant ID: | PE602 | Side of Street: | South | Make: | Canada Valve | Open Dir: | Left |
| Address: | Kingston Road (In front of Sport Check) | | | Model: | Century | Latitude: | |
| Location: | Pickering Ontario | | | Year: | 2016 | Longitude: | |

## GENERAL INSPECTION

*OK - Good Condition* *FR - Future Repair Required* *N/A - Not Applicable* *CF - Component Failure*

| Upper Section | OK | FR | N/A | CF |
|---|---|---|---|---|
| Bonnet | ☐ | ☐ | ☑ | ☐ |
| Operating Nut | ☐ | ☐ | ☑ | ☐ |
| Gaskets / Bolts | ☐ | ☐ | ☑ | ☐ |
| O-Ring(s) | ☐ | ☐ | ☑ | ☐ |

| Mid Section | OK | FR | N/A | CF |
|---|---|---|---|---|
| Port Height | ☐ | ☐ | ☑ | ☐ |
| Caps / Nozzles | ☐ | ☐ | ☑ | ☐ |
| Chains | ☐ | ☐ | ☑ | ☐ |
| Traffic Flange | ☐ | ☐ | ☑ | ☐ |

| General | OK | FR | N/A | CF |
|---|---|---|---|---|
| Accessibility | ☐ | ☐ | ☑ | ☐ |
| Position / Height | ☐ | ☐ | ☑ | ☐ |
| Paint Cond | ☐ | ☐ | ☑ | ☐ |
| Drain Ports | ☐ | ☐ | ☑ | ☐ |

| Hydrostatic Leak Testing | | |
|---|---|---|
| *Hydrant Closed* | Above Grade Leak | No |
| | Subsurface Leak | No |
| *Hydrant Open* | Above Grade Leak | No |
| | Subsurface Leak | No |

| Maintenance | |
|---|---|
| Lubricate Operating Nut | N/A |
| Lubricate & Clean Nozzle Threads | N/A |
| Lubricate & Clean Cap Threads | N/A |
| Water Removed (if non-draining) | N/A |

| Auxiliary / Secondary Valve | |
|---|---|
| Located / Accessible | N/A |
| Operated/Exercised | N/A |
| Number of Turns | N/A |
| Open Direction | |

Comments:

Auxiliary Valve Location:

## FLUSHING

*If hydrants are being flow tested, inspections and flushing are completed prior to testing

| Hydrant Operated | Clear Flow Obtained | Cl2 Residual | Time Flushed | Flow | Total Flow | Dechlorinated |
|---|---|---|---|---|---|---|
| Yes - Easily Operated | Yes | | 5 minutes | 1376 gal | 6882 gal | Yes |

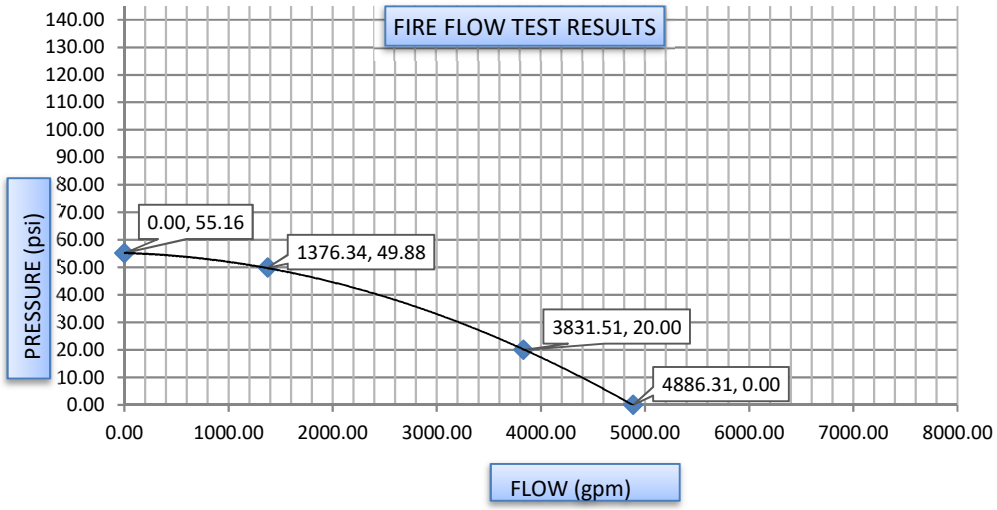
Comments: **STATIC AFTER FLOW TEST WAS PERFORMED 56.48 PSI**

## FLOW TESTING

*Flow testing results may be from previous year(s). Note date & time

Date: 19-May-23 Time: 12:00 PM

| Flow Hydrant | | | | | | | | Test Hydrant | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ID | Flow Device Used | Size | Coefficient | Time Flushed | Flow | Total Flow | Pitot | ID | Static | Residual |
| Private Hyd | Pollard Diffuser | 2.5" | 0.832 | 5.0 minutes | 776 gal | 3878 gal | 25 psi | PE602 | 55.16 | 49.88 |
| Private Hyd | Pollard Diffuser | 2.5" | 0.832 | 5.0 minutes | 601 gal | 3004 gal | 15 psi | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |




| Calculated Results | |
|---|---|
| Calculated Flow @ 20 psi | 3832 gpm |
| Calculated Flow @ 0 psi | 4886 gpm |
| Pressure Drop | 9.57% |

Comments:

Municipal Engineering Solutions

July 14, 2023 Project No. 17002-174

Sent via email
Mr. James Bujak
Sorbara Group of Companies
3700 Steeles Avenue West, Suite 800
Vaughan, ON L4L 8M9
c/o SCS Consulting Group Ltd.

**Subject: 603-699 Kingston Road Development**
**Water Distribution Modeling (Preliminary)**
**City of Pickering, Region of Durham**

Dear Mr. Bujak,

We are pleased to submit our report entitled "603-699 Kingston Road Development Watermain Analysis" outlining the results of our preliminary water distribution analysis for the proposed residential development in the City of Pickering, Region of Durham.

A WaterCAD model of the immediate area was developed utilizing the design information provided to Municipal Engineering Solutions and a hydrant test performed by the Ontario Clean Water Agency in May 2023. The findings of our analysis are summarized in the following report.

We trust you find this report satisfactory. Should you have any questions or require further clarification, please call.

Yours truly,

**Municipal Engineering Solutions**

Kristin St-Jean, P.Eng.

/KS

File Location: C:\Users\krist\Documents\Projects\17002-174 603-699 Kingston Rd, Pickering\5.0 Report\17002-174 603-699 Kingston Road Watermain Analysis_20230714.docx

55 Gilbank Drive, Aurora, Ontario L4G 6H9
Tel: 905.726.1016 Cell: 416.434.0186 Fax: 905.726.1225

# 603-699 KINGSTON ROAD DEVELOPMENT

# WATERMAIN ANALYSIS

**PREPARED BY:**

**MUNICIPAL ENGINEERING SOLUTIONS**

**FOR:**

**SORBARA GROUP OF COMPANIES**
**July 2023**

**Project Number: 17002-174**

# TABLE OF CONTENTS



## APPENDICES

# Section 1 – INTRODUCTION

Municipal Engineering Solutions ("MES") was retained by Sorbara Group of Companies to conduct a hydraulic water analysis for the proposed development located at 603-699 Kingston Road in the City of Pickering, Region of Durham. As part of this hydraulic assessment MES was requested to undertake the following:

1. Calculate/verify water demands for the proposed development using Region of Durham, provincial and industry design standards;
2. Add the subject watermains and boundary information to the development water model;
3. Run the model to size the subject mains to achieve service criteria during Minimum Hour, Peak Hour and fire flow during Maximum Day demand; and
4. Prepare a Report summarizing the modeling results for agency review and design purposes.

## 1.1 Development Background

The development site is located on the south side of Kingston Road, west of Whites Road in the City of Pickering. The development consists of seven buildings (10 towers) up to 42 storeys in height. The buildings will have a total of 3460 residential units, 2,817 $m^2$ of commercial space and 3,798 $m^2$ of office space. The breakdown of the units is shown in **Appendix A**. The proposed development is shown below on **Figure 1**.


**Figure 1 - Proposed 603-699 Kingston Road Development**

# Section 2 – WATERMAIN DESIGN CRITERIA

The design criteria utilized to estimate the water demands for the hydraulic water model follows general industry standards and is calculated using the design criteria and guidelines outlined in the Durham Region Water & Wastewater Design Specifications and the Ministry of the Environment, Conservation and Parks (MECP) Watermain Design Criteria.

The following sections summarize the specific design criteria used to carry out the hydraulic watermain assessment for this development.

### 2.1 Equivalent Population Densities & Water Design Factors

To calculate the equivalent population and water design factors for this development MES used Region of Durham standard population densities as noted in the *"Design Specifications for Sanitary Sewers, April 2023"*. **Table 1** summarizes the residential population densities. A detailed breakdown of the unit types in each building has not yet been completed. For this assessment, all units were assumed to be two-bedroom units with an equivalent population of 2.5 people/unit. This is a conservative approach, as the final unit breakdown will include a number of one-bedroom units, resulting in lower domestic demands. The actual unit breakdown and final population estimates will be confirmed in later submissions.

**Table 1 – Equivalent Population Density**

| Type of Development | Equivalent Population (Persons/Unit) |
|---|---|
| Apartments (All sizes) | 2.5 |

**Source: Design Specifications for Sanitary Sewers, April 2023**

**Table 2** summarizes the average daily demand and peaking factors used for this analysis. Average daily demand was based on the "*MECP Design Guidelines for Drinking Water Systems, 2008*".

**Table 2 - Water Design Factors**

| Type of Development | Average Daily Demand | Minimum Hourly Demand Peaking Factor | Maximum Daily Demand Peaking Factor | Peak Hourly Demand Peaking Factor |
|---|---|---|---|---|
| Residential | 450 L/capita/day | 0.5 | 2.00 | 3.00 |
| Commercial/Office | 5000 L/1000 $m^2$/day | 0.5 | 2.00 | 3.00 |

**Source: MECP Design Guidelines for Drinking-Water Systems, 2008**

Residential peaking factors were based on Table 3-1: Peaking Factors for populations of 3001-10000 people from the MECP Design Guidelines. While the water system serves a large population, and would experience more moderate changes in the daily demand, the demands within the development would have fluctuations similar to a small system.

## Section 3 –FLOW DEMANDS

Utilizing the equivalent population data from Table 1 and the corresponding Minimum Hour, Maximum Day and Peak Hour data from Table 2 the water demands for this development were calculated.

### 3.1 Equivalent Population Flow Demands

The calculated demands for the development are summarized in **Table 3**. For additional details on the development water demands and assigned demand nodes used in the water model see **Appendix A**.

**Table 3 – Water Demand for the 603-699 Kingston Road Development**

| | Average Day Demand (L/s) | Minimum Hour Demand (L/s) | Maximum Day Demand (L/s) | Peak Hour Demand (L/s) |
|---|---|---|---|---|
| Development | 45.45 | 22.77 | 90.90 | 136.35 |

### 3.2 Fire Flow Demands

The Region of Durham generally requires a minimum fire flow of 150 L/s for high density residential areas. For reference, the fire demand for this development was calculated using the Fire Underwriters Survey ("FUS") formula outlined in the *'Water Supply For Public Fire Protection Guideline',* dated 2020. The required fire flow calculated using the FUS formula is 200 L/s for the largest proposed building (calculations attached). A target minimum fire flow of 150 L/s was used for this site. The minimum required fire flow for the development is shown in **Table 4**.

**Table 4 - Fire Flow Requirements**

| Type of Development | Fire Flow (L/s) |
|---|---|
| High Density Residential | 150 |

**Source: Region of Durham**

The fire flow utilized in this analysis is based on the Region's minimum guidelines. As such, the fire flow noted in Table 4 must be reviewed and confirmed by the appropriate designer (architect) with detailed design data (floor area and type of construction) for these buildings prior to implementation and construction. Regardless, the buildings will need to be designed to suit the available flow and pressure. Any design/criteria changes are to be reported to MES.

### 3.3 External Demands

The hydrant test results would have considered the demands external to the development.

## Section 4 – OTHER SYSTEM REQUIREMENTS

### 4.1 System Pressure Requirements

In addition to meeting the various flow requirements, the system must also satisfy minimum and maximum pressure requirements as outlined by the Region of Durham. The Region's pressure requirements are outlined in the *"Design Specifications for Watermains, April 2023"* and stipulate the following:

1. The maximum sustained operating pressures shall not exceed 700 kPa (100 psi).
2. The minimum system pressure shall not be less than 140 kPa (20 psi) at any point in the water system under simultaneous maximum day and fire flow demands.
3. The normal operating pressure (Peak Hour) shall not be less than 275 kPa (40 psi).
4. The normal method of reduction of pressures to comply with the Ontario Building Code (reduction of pressures to 550 kPa, 80 psi) is by pressure reducing valves to be installed on individual services.

### 4.2 Watermain Sizing

The Region of Durham also stipulates minimum pipe sizes and requires that all watermains are adequately sized to maintain demand flows at the required pressures without causing excessive energy loss or result in water quality decay. The watermain system must therefore be designed to accommodate the greater of the following:

- Maximum day plus fire demand
- Peak hour demand

The minimum pipe size for commercial and industrial areas shall be 300 mm diameter and for residential areas the minimum pipe size shall be 150 mm diameter. For distribution systems providing fire protection the minimum pipe size shall be 150 mm diameter in accordance with Ministry of the Environment, Conservation and Parks (MECP) and NFPA requirements.

Domestic water and fire supply lines will be separated at the property boundary as required by the Region of Durham for this development.

To provide appropriate fire protection, reliable supply and pressures the water distribution system should be looped wherever possible to improve supply security and water quality.

### 4.3 Watermain C-Factor

In designing and modeling of the pipes the Coefficient of Roughness (C-Factor) factors from the Region's design criteria and as suggested by the MECP were utilized. The Coefficient of Roughness assigned to each pipe size is summarized in **Table 5** below.

**Table 5 - Hazen-Williams Coefficient of Roughness (C-Factors)**

| Size of Pipe (Diameter in mm) | Coefficient of Roughness (C) |
|---|---|
| 150 mm | 100 |
| 200 mm to 300 mm | 110 |
| 350 mm to 600 mm | 120 |
| Greater Than 600 mm | 130 |

**Source: Design Specifications for Watermains, April 2023**

## Section 5 – ANALYSIS & MODELING RESULTS

In order to conduct the hydraulic water analysis for the proposed development the water demands were estimated by MES using the design criteria previously discussed and incorporated into a WaterCAD model created for the immediate area using boundary conditions from a hydrant test. The following sections discuss the model setup and results.

### 5.1 Model Setup

Hydrant tests were performed on Kingston Road by the Ontario Clean Water Agency on May 19th, 2023. The hydrant test results are included in **Appendix B**. A model of the immediate area was created using the results of the hydrant tests. To check the adequacy of the model, a simulated hydrant curve (modeled flow) at the location of the test was graphed against the data points of the actual hydrant test. The comparison is included in **Appendix B**.

The development is located within the Durham Region water system in Pickering Ajax Zone 1. The development will be connected to the existing 400 mm watermain on Kingston Road. Each building will have separate domestic and fire connections.

The development was modeled under the existing planning scenario only. Friction factor for all new pipes added to the model were assigned according to Table 5. Service elevations within the development vary from approximately 104.6 m to 107.3 m. Minimum Fire flow requirements are based on the Region's guidelines.

### 5.2 Watermain Sizing and System Pressures

The analysis was conducted under existing servicing conditions for Minimum Hour, Maximum Day, Peak Hour and Maximum day plus Fire demands to size the watermains and meet the pressure requirements. The pipe sizes and layout are shown in **Appendix A**.

Modeled service pressures for the development are summarized in **Table 6**. All pressures lie within the required operating range under minimum hour, maximum day, maximum day plus fire flow and peak hour demands. Since modeling was done using a single demand scenario for boundary conditions (hydrant test), it is anticipated that

pressure will be lower during peak hour and higher during minimum hour than indicated in the modeling. The modelling indicates that pressures are not expected to exceed 550 kPa (80 psi) within the proposed development.

Detailed pipe and node tables for the various scenarios modeled are attached to this report in **Appendix C**.

**Table 6 - Modeled Service Pressures**

| Scenario | Average Day | Minimum Hour | Maximum Day | Peak Hour | Max. Day + Fire |
|---|---|---|---|---|---|
| **Existing** | 359 – 385 kPa (52.1 to 55.9 psi) | 366 – 392 kPa (53.0 to 56.8 psi) | 336 – 362 kPa (48.7 to 52.5 psi) | 299 – 326 kPa (43.4 to 47.4 psi) | 147 to 262 L/s @ 140 kPa |

The modelling indicates that the available fire flow is 147 L/s, slightly below the required fire flow of 150 L/s. A detailed breakdown of the unit types for each building has not yet been completed. Once the domestic demands have been calculated for the final building designs, the available fire flow will likely increase.

## Section 6 – CONCLUSIONS/RECOMMENDATIONS

The proposed watermain layout for the 603-699 Kingston Road Development can achieve hydraulic requirements as prescribed by the Region of Durham watermain design criteria as summarized below.

- The service pressures from the proposed watermain layout are expected to range between 299 kPa to 392 kPa (43.4 psi to 56.8 psi).
- The modelling indicates that the available fire flow is 147 L/s, slightly below the minimum fire flow demands utilized for this assessment (150 L/s) at the minimum pressure of 140 kPa.
- A detailed breakdown of the unit types in each building has not yet been completed. Until a more detailed breakdown of the units has been completed the findings of this report must be considered preliminary.
- The fire flows utilized in this analysis are based on 150 L/s based on discussions with the Region. Should it be determined, based on the final site and building design and/or through further discussions with the Region, that a greater fire flow is required (i.e. Building Code, City's Building Department, Fire Department, Building End User, Insurance company, Region) or that the fire flows need to be calculated using the Fire Underwriters Survey formula the pipe sizes may need to be upsized to suit the higher fire flows or the building construction design modified to suit the flow available.
- Once the building designs are completed and the specifics are known, the fire flow demands used in this analysis and summarized in Table 4, including all assumptions, must be reviewed and confirmed by the designer(s), architect and mechanical consultant to ensure the fire flows used within this report are still valid prior to implementation and construction and to confirm that the water supply is adequate.
- The hydrant tests used for the boundary conditions provides a snapshot of the system performance and does not capture the system variations as accurately as boundary information from a calibrated model or system monitoring. The Region of Durham must confirm that the results presented in this report are in keeping with the pressures currently measured in the area.
- This report, including all modeling assumptions used, is to be submitted to and reviewed by the water operating authority (municipality) to confirm that the modeling parameters used are acceptable to the operating authority and/or confirm if modified domestic or fire flow requirements are required or should be implemented for this particular development.

# Appendix A

## Demands

## The Regional Municipality of Durham

**Design Specifications for Watermains, April 2023 (unless otherwise stated)**

**Equivalent Population by Unit**

| Type of Development | Equivalent Population Density *(Person/Unit)* |
|---|---|
| Apartment - 1 Bedroom or smaller | 1.5 |
| Apartment - 2 Bedroom | 2.5 |
| Apartment - 3 Bedroom | 3.5 |
| Apartment - 4 Bedroom or larger | 4.5 |

**Note:** From Design Specifications for Sanitary Sewers

**Water Design Factors**

| | |
|---|---|
| Average Daily Demand (L/person/day) | 450 |
| Commercial (L/1000 sq.m/day) | 5000 |
| Minimum Hour Demand P.F. | 0.50 |
| Maximum Daily Demand P.F. | 2.00 |
| Maximum Hourly Demand P.F. | 3.00 |

**Note:** Demand Rates and Peaking Factors taken from MOECC Design Guidelines for Drinking Water Systems (2008). Peaking factors are for areas servicing 3001-10000 people.

**Coefficient of Roughness**

| Size of Pipe (mm Dia.) | Coefficient of Roughness (C) |
|---|---|
| 150 | 100 |
| 200-300 | 110 |
| 350-600 | 120 |
| Over 600 | 130 |

**Minimum Pipe Size**

| Type of Development | Size of Pipe (mm Dia.) |
|---|---|
| Residential | 150 |
| Commercial/Industrial/Institutional | 300 |

**Working Pressures**

| Parameter | Pressure |
|---|---|
| Normal Condition | |
| Minimum Max Hour Pressure | 275 kPa (40 psi) |
| Maximum (Building Code) | 550 kPa (80 psi) |
| Maximum recommended | 700 kPa (100 psi) |
| Fire Flow Conditions | |
| Minimum Pressure | 140 kPa (20 psi) |

**Water Demand**
**603-699 Kingston Road Development**
**July 2023**

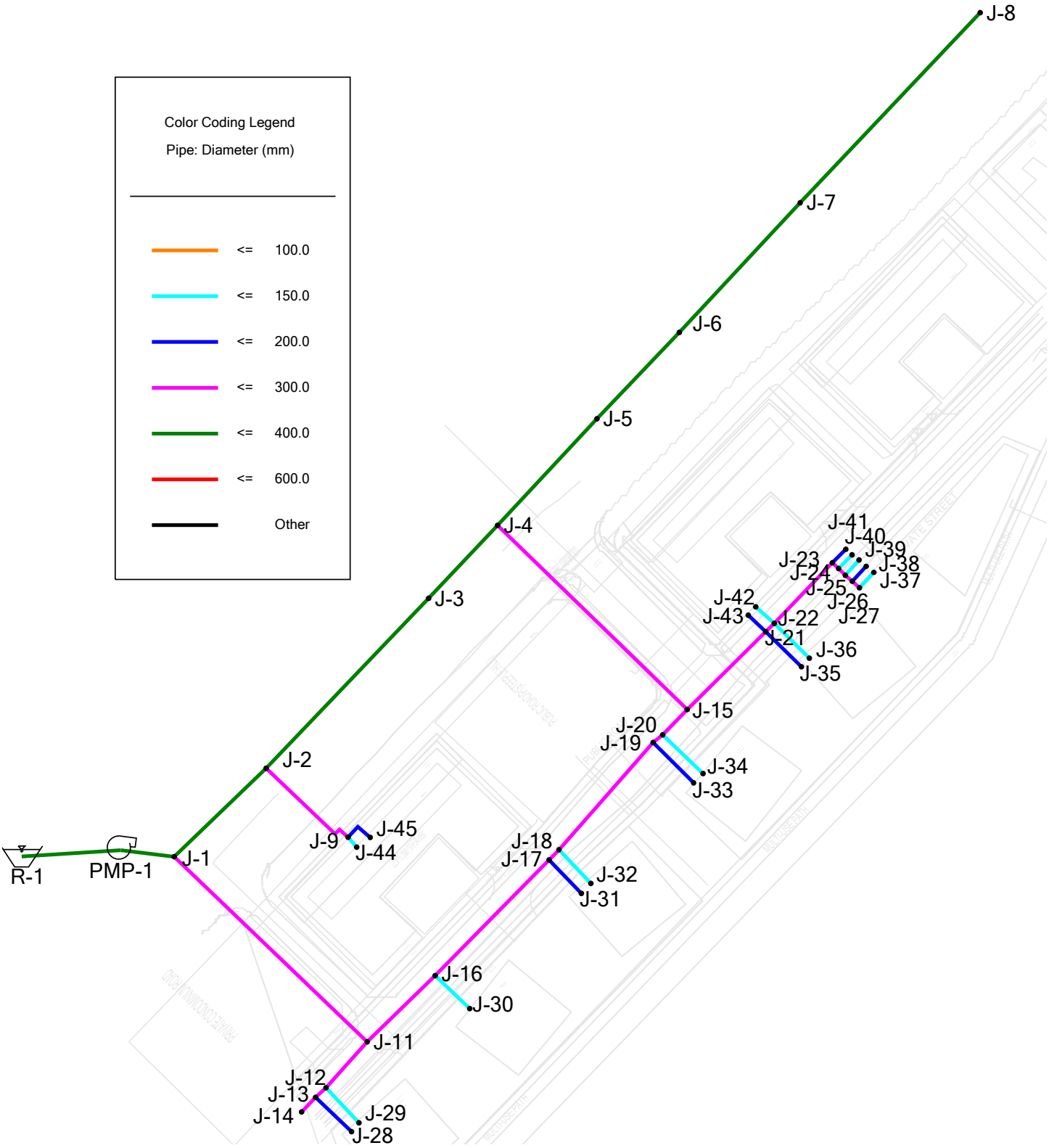
Municipal Engineering Solutions

**Development Demands**

| Node | Building | Type of Development | | | | | Equivalent Population | Demands | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Apartment (Bach/1 BD) | Apartment (2 BD) | Apartment (3 BD) | Retail | Office | Total Population | Average Day | Minimum Hour | Maximum Day | Peak Hour |
| | | *(units)* | *(units)* | *(units)* | *(sq.m)* | *(sq.m)* | *(Residential)* | *(L/s)* | *(L/s)* | *(L/s)* | *(L/s)* |
| J-29 | Podium 1, Tower 1 | *0* | *320* | *0* | *0* | *0* | 800 | 4.17 | 2.09 | 8.34 | 12.51 |
| J-30 | Podium 1, Tower 2 | *0* | *320* | *0* | *0* | *0* | 800 | 4.17 | 2.09 | 8.34 | 12.51 |
| J-32 | Podium 1, Tower 3 | *0* | *320* | *0* | *0* | *0* | 800 | 4.17 | 2.09 | 8.34 | 12.51 |
| J-34 | Podium 2, Tower 4 | *0* | *320* | *0* | *0* | *0* | 800 | 4.17 | 2.09 | 8.34 | 12.51 |
| J-36 | Podium 2, Tower 5 | *0* | *320* | *0* | *0* | *0* | 800 | 4.17 | 2.09 | 8.34 | 12.51 |
| J-37 | Podium 3, Tower 6 | *0* | *380* | *0* | *0* | *0* | 950 | 4.95 | 2.48 | 9.90 | 14.85 |
| J-39 | Podium 4, Tower 7 | *0* | *200* | *0* | *641* | *3798* | 500 | 2.86 | 1.43 | 5.72 | 8.58 |
| J-40 | Podium 5, Tower 8 | *0* | *420* | *0* | *703* | *0* | 1050 | 5.51 | 2.76 | 11.02 | 16.53 |
| J-42 | Podium 6, Tower 9 | *0* | *420* | *0* | *703* | *0* | 1050 | 5.51 | 2.76 | 11.02 | 16.53 |
| J-44 | Podium 7, Tower 10 | *0* | *440* | *0* | *770* | *0* | 1100 | 5.77 | 2.89 | 11.54 | 17.31 |
| **TOTAL** | | **0** | **3460** | **0** | **2817** | **3798** | **8650** | **45.45** | **22.77** | **90.90** | **136.35** |

**Total Residential Units 3460 units**
**Total Retail Space 2817 sq.m.**
**Total Office Space 3798 sq.m.**

# Node IDs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Pipe: Diameter (mm)
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<= 150.0
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Other
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J-7
J-6
J-5
J-4
J-3
J-2
J-1
R-1
PMP-1
J-9
J-45
J-44
J-41
J-40
J-39
J-38
J-37
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J-20
J-19
J-34
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J-18
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J-16
J-30
J-11
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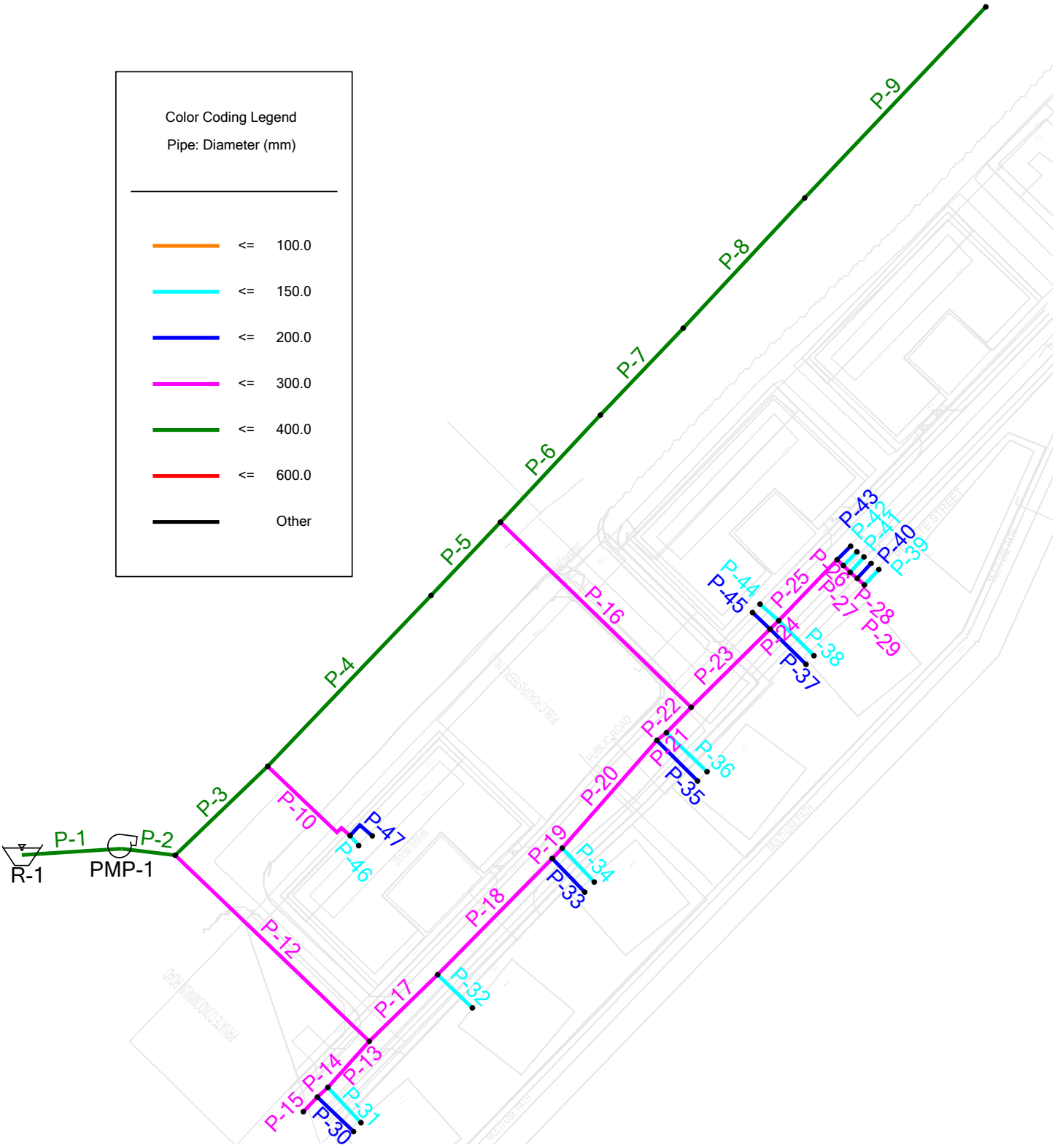
J-13
J-14
J-29
J-28

# Pipe IDs


Color Coding Legend
Pipe: Diameter (mm)
<= 100.0
<= 150.0
<= 200.0
<= 300.0
<= 400.0
<= 600.0
Other
R-1
PMP-1
P-1
P-2
P-3
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P-46
P-47

*Calculations are based on "Water Supply for Public Fire Protection Guide" by Fire Underwriters Survey Dated 2020*

Municipal Engineering Solutions

# FUS CALCULATION

**Project:**
**Project Number:**
**Project Location:**
**Date:** April 2023

**Building Type/Block #** Podium 1, Towers 1-3
**Firewalls/Sprinkler:** Sprinklered
**Number of Units/Unit #'s** 36 Storeys, 960 units

## 1.0 FUS Formula

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

where: RFF = required fire flow in litres per minute;
C = the Coefficient related to the type of construction; and
A = the Total Effective Floor Area ($m^2$) excluding basements at least 50% below grade) [a]

| | | |
|---|---|---|
| NBC Occupancy | Group C | |
| Type of Construction [b] | Fire-Resistive Construction | Type I |
| Protection (for C below 1.0) | Unprotected Openings | |
| Footprint area | 5610.2 | sq. metres |
| Storeys | 36 | |
| C = | 0.6 | |
| A = | 24023.7 | Total Effective Area [a] |
| **F =** | **20000** | **L/min** (rounded) |

## 2.0 Occupancy Adjustment

| | | |
|---|---|---|
| Type of Occupancy [c] | Limited Combustible | |
| Hazard Allowance | -0.15 | |
| | -3000 | L/min |
| **Adjusted Fire Flow** | **17000** | **L/min** |

## 3.0 Sprinkler Adjustment

| | | Credit | Total |
|---|---|---|---|
| NFPA 13 sprinkler standard | YES | 30% | 50% |
| Standard Water Supply | YES | 10% | |
| Fully Supervised system | YES | 10% | |

**Sprinkler Credit** **8500 L/min**

## 4.0 Exposure Adjustment

Construction Type of the Exposed Building Face: Type I-II (unprotected)

| | | Percent | Total* |
|---|---|---|---|
| *North Side* | | | |
| Distance to Building (m) | 20.1 to 30 | 4% | |
| Length (ft) by height in storeys | over 100 | | |
| *South Side* | | | |
| Distance to Building (m) | over 30 | 0% | |
| Length (ft) by height in storeys | na | | |
| *East Side* | | | 23% |
| Distance to Building (m) | 10.1 to 20 | 8% | |
| Length (ft) by height in storeys | over 100 | | |
| *West Side* | | | |
| Distance to Building (m) | 3.1 to 10 | 11% | |
| Length (ft) by height in storeys | over 100 | | |

*max 75%

**Exposures Surcharge** **3910 L/min**

**Total Required Fire Flow** (rounded) **12000 L/min** / **200 L/sec**

a) For buildings with a construction coefficient from 1.0 to 1.5, consider 100% of all floor areas. For buildings with a construction coefficient below 1.0 (vertical openings are inadequately protected), consider the two largest adjoining floors plus 50% of each of any floors immediately above them up to a maximum of eight. If the vertical openings and exterior vertical communications are properly protected, consider only the area of the largest floor plus 25% of each of the two immediately adjoining floors.
b) Wood Frame=1.5, Mass Timber= 0.8 to 1.5, Ordinary=1.0, Noncombustible=0.8, Fire-Resistive=0.6
c) Noncombustible=-25%, Limited Combustible=-15%, Combustible=0%, Free Burning=+15%, Rapid Burning=+25%

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Municipal Engineering Solutions

# FUS CALCULATION

**Project:**
**Project Number:**
**Project Location:**
**Date:** April 2023

**Building Type/Block #** Podium 2, Towers 4-5
**Firewalls/Sprinkler:** Sprinklered
**Number of Units/Unit #'s** 36 Storeys, 640 units

## 1.0 FUS Formula

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

where: RFF = required fire flow in litres per minute;
C = the Coefficient related to the type of construction; and
A = the Total Effective Floor Area ($m^2$) excluding basements at least 50% below grade) [a]

| | | |
|---|---|---|
| NBC Occupancy | Group C | |
| Type of Construction [b] | Fire-Resistive Construction | Type I |
| Protection (for C below 1.0) | Unprotected Openings | |
| Footprint area | 3400.7 | sq. metres |
| Storeys | 36 | |
| C = | 0.6 | |
| A = | 14997.8 | Total Effective Area [a] |
| **F =** | **16000** | **L/min** (rounded) |

## 2.0 Occupancy Adjustment

| | | |
|---|---|---|
| Type of Occupancy [c] | Limited Combustible | |
| Hazard Allowance | -0.15 | |
| | -2400 | L/min |
| **Adjusted Fire Flow** | **13600** | **L/min** |

## 3.0 Sprinkler Adjustment

| | | Credit | Total |
|---|---|---|---|
| NFPA 13 sprinkler standard | YES | 30% | 50% |
| Standard Water Supply | YES | 10% | |
| Fully Supervised system | YES | 10% | |

**Sprinkler Credit** **6800 L/min**

## 4.0 Exposure Adjustment

Construction Type of the Exposed Building Face: Type I-II (unprotected)

| | | Percent | Total* |
|---|---|---|---|
| *North Side* | | | |
| Distance to Building (m) | 20.1 to 30 | 4% | |
| Length (ft) by height in storeys | over 100 | | |
| *South Side* | | | |
| Distance to Building (m) | over 30 | 0% | |
| Length (ft) by height in storeys | na | | |
| *East Side* | | | 23% |
| Distance to Building (m) | 3.1 to 10 | 11% | |
| Length (ft) by height in storeys | na | | |
| *West Side* | | | |
| Distance to Building (m) | 10.1 to 20 | 8% | |
| Length (ft) by height in storeys | over 100 | | |

*max 75%

**Exposures Surcharge** **3130 L/min**

**Total Required Fire Flow** (rounded) **10000 L/min** / **167 L/sec**

a) For buildings with a construction coefficient from 1.0 to 1.5, consider 100% of all floor areas. For buildings with a construction coefficient below 1.0 (vertical openings are inadequately protected), consider the two largest adjoining floors plus 50% of each of any floors immediately above them up to a maximum of eight. If the vertical openings and exterior vertical communications are properly protected, consider only the area of the largest floor plus 25% of each of the two immediately adjoining floors.
b) Wood Frame=1.5, Mass Timber= 0.8 to 1.5, Ordinary=1.0, Noncombustible=0.8, Fire-Resistive=0.6
c) Noncombustible=-25%, Limited Combustible=-15%, Combustible=0%, Free Burning=+15%, Rapid Burning=+25%

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Municipal Engineering Solutions

# FUS CALCULATION

**Project:**
**Project Number:**
**Project Location:**
**Date:** April 2023

**Building Type/Block #** Podium 3, Tower 6
**Firewalls/Sprinkler:** Sprinklered
**Number of Units/Unit #'s** 42 Storeys, 380 units

## 1.0 FUS Formula

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

where: RFF = required fire flow in litres per minute;
C = the Coefficient related to the type of construction; and
A = the Total Effective Floor Area ($m^2$) excluding basements at least 50% below grade) [a]

| | | |
|---|---|---|
| NBC Occupancy | Group C | |
| Type of Construction [b] | Fire-Resistive Construction | Type I |
| Protection (for C below 1.0) | Unprotected Openings | |
| Footprint area | 1823.6 | sq. metres |
| Storeys | 42 | |
| C = | 0.6 | |
| A = | 7869.8 | Total Effective Area [a] |
| **F =** | **12000** | **L/min** (rounded) |

## 2.0 Occupancy Adjustment

| | |
|---|---|
| Type of Occupancy [c] | Limited Combustible |
| Hazard Allowance | -0.15 |
| | -1800 L/min |
| **Adjusted Fire Flow** | **10200 L/min** |

## 3.0 Sprinkler Adjustment

| | | Credit | Total |
|---|---|---|---|
| NFPA 13 sprinkler standard | YES | 30% | 50% |
| Standard Water Supply | YES | 10% | |
| Fully Supervised system | YES | 10% | |

**Sprinkler Credit** **5100 L/min**

## 4.0 Exposure Adjustment

Construction Type of the Exposed Building Face: Type I-II (unprotected)

| | | Percent | Total* |
|---|---|---|---|
| *North Side* | | | |
| Distance to Building (m) | 20.1 to 30 | 4% | |
| Length (ft) by height in storeys | over 100 | | |
| *South Side* | | | |
| Distance to Building (m) | over 30 | 0% | |
| Length (ft) by height in storeys | na | | |
| *East Side* | | | 15% |
| Distance to Building (m) | over 30 | 0% | |
| Length (ft) by height in storeys | over 100 | | |
| *West Side* | | | |
| Distance to Building (m) | 3.1 to 10 | 11% | |
| Length (ft) by height in storeys | over 100 | | |

*max 75%

**Exposures Surcharge** **1530 L/min**

| | |
|---|---|
| **Total Required Fire Flow** (rounded) | **7000 L/min** |
| | **117 L/sec** |

a) For buildings with a construction coefficient from 1.0 to 1.5, consider 100% of all floor areas. For buildings with a construction coefficient below 1.0 (vertical openings are inadequately protected), consider the two largest adjoining floors plus 50% of each of any floors immediately above them up to a maximum of eight. If the vertical openings and exterior vertical communications are properly protected, consider only the area of the largest floor plus 25% of each of the two immediately adjoining floors.
b) Wood Frame=1.5, Mass Timber= 0.8 to 1.5, Ordinary=1.0, Noncombustible=0.8, Fire-Resistive=0.6
c) Noncombustible=-25%, Limited Combustible=-15%, Combustible=0%, Free Burning=+15%, Rapid Burning=+25%

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Municipal Engineering Solutions

# FUS CALCULATION

**Project:**
**Project Number:**
**Project Location:**
**Date:** April 2023

**Building Type/Block #** Podium 4, Tower 7
**Firewalls/Sprinkler:** Sprinklered
**Number of Units/Unit #'s** 24 Storeys, 200 units

## 1.0 FUS Formula

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

where: RFF = required fire flow in litres per minute;
C = the Coefficient related to the type of construction; and
A = the Total Effective Floor Area ($m^2$) excluding basements at least 50% below grade) [a]

| | | |
|---|---|---|
| NBC Occupancy | Group C | |
| Type of Construction [b] | Fire-Resistive Construction | Type I |
| Protection (for C below 1.0) | Unprotected Openings | |
| Footprint area | 1266.1 sq. metres | |
| Storeys | 24 | |
| C = | 0.6 | |
| A = | 6195.4 Total Effective Area [a] | |
| **F =** | **10000 L/min** (rounded) | |

## 2.0 Occupancy Adjustment

| | |
|---|---|
| Type of Occupancy [c] | Limited Combustible |
| Hazard Allowance | -0.15 |
| | -1500 L/min |
| **Adjusted Fire Flow** | **8500 L/min** |

## 3.0 Sprinkler Adjustment

| | | Credit | Total |
|---|---|---|---|
| NFPA 13 sprinkler standard | YES | 30% | 50% |
| Standard Water Supply | YES | 10% | |
| Fully Supervised system | YES | 10% | |

**Sprinkler Credit** **4250 L/min**

## 4.0 Exposure Adjustment

Construction Type of the Exposed Building Face: Type I-II (unprotected)

| | | Percent | Total* |
|---|---|---|---|
| *North Side* | | | |
| Distance to Building (m) | over 30 | 0% | 8% |
| Length (ft) by height in storeys | na | | |
| *South Side* | | | |
| Distance to Building (m) | over 30 | 0% | |
| Length (ft) by height in storeys | over 100 | | |
| *East Side* | | | |
| Distance to Building (m) | over 30 | 0% | |
| Length (ft) by height in storeys | over 100 | | |
| *West Side* | | | |
| Distance to Building (m) | 10.1 to 20 | 8% | |
| Length (ft) by height in storeys | over 100 | | |

*max 75%

**Exposures Surcharge** **680 L/min**

| | |
|---|---|
| **Total Required Fire Flow** (rounded) | **5000 L/min** |
| | **83 L/sec** |

a) For buildings with a construction coefficient from 1.0 to 1.5, consider 100% of all floor areas. For buildings with a construction coefficient below 1.0 (vertical openings are inadequately protected), consider the two largest adjoining floors plus 50% of each of any floors immediately above them up to a maximum of eight. If the vertical openings and exterior vertical communications are properly protected, consider only the area of the largest floor plus 25% of each of the two immediately adjoining floors.
b) Wood Frame=1.5, Mass Timber= 0.8 to 1.5, Ordinary=1.0, Noncombustible=0.8, Fire-Resistive=0.6
c) Noncombustible=-25%, Limited Combustible=-15%, Combustible=0%, Free Burning=+15%, Rapid Burning=+25%

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# FUS CALCULATION

**Project:**
**Project Number:**
**Project Location:**
**Date:** April 2023

**Building Type/Block #** Podium 5, Tower 8
**Firewalls/Sprinkler:** Sprinklered
**Number of Units/Unit #'s** 14 Storeys, 420 units

## 1.0 FUS Formula

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

where: RFF = required fire flow in litres per minute;
C = the Coefficient related to the type of construction; and
A = the Total Effective Floor Area ($m^2$) excluding basements at least 50% below grade) [a]

| | | |
|---|---|---|
| NBC Occupancy | Group C | |
| Type of Construction [b] | Fire-Resistive Construction | Type I |
| Protection (for C below 1.0) | Unprotected Openings | |
| Footprint area | 2570.5 | sq. metres |
| Storeys | 14 | |
| C = | 0.6 | |
| A = | 14700.6 | Total Effective Area [a] |
| **F =** | **16000** | **L/min** (rounded) |

## 2.0 Occupancy Adjustment

| | |
|---|---|
| Type of Occupancy [c] | Limited Combustible |
| Hazard Allowance | -0.15 |
| | -2400 L/min |
| **Adjusted Fire Flow** | **13600 L/min** |

## 3.0 Sprinkler Adjustment

| | | Credit | Total |
|---|---|---|---|
| NFPA 13 sprinkler standard | YES | 30% | 50% |
| Standard Water Supply | YES | 10% | |
| Fully Supervised system | YES | 10% | |

**Sprinkler Credit** **6800 L/min**

## 4.0 Exposure Adjustment

Construction Type of the Exposed Building Face: Type I-II (unprotected)

| | | Percent | Total* |
|---|---|---|---|
| *North Side* | | | |
| Distance to Building (m) | over 30 | 0% | 20% |
| Length (ft) by height in storeys | na | | |
| *South Side* | | | |
| Distance to Building (m) | 20.1 to 30 | 4% | |
| Length (ft) by height in storeys | over 100 | | |
| *East Side* | | | |
| Distance to Building (m) | 10.1 to 20 | 8% | |
| Length (ft) by height in storeys | over 100 | | |
| *West Side* | | | |
| Distance to Building (m) | 10.1 to 20 | 8% | |
| Length (ft) by height in storeys | over 100 | | |

*max 75%

**Exposures Surcharge** **2720 L/min**

| | |
|---|---|
| **Total Required Fire Flow** (rounded) | **10000 L/min** |
| | **167 L/sec** |

a) For buildings with a construction coefficient from 1.0 to 1.5, consider 100% of all floor areas. For buildings with a construction coefficient below 1.0 (vertical openings are inadequately protected), consider the two largest adjoining floors plus 50% of each of any floors immediately above them up to a maximum of eight. If the vertical openings and exterior vertical communications are properly protected, consider only the area of the largest floor plus 25% of each of the two immediately adjoining floors.
b) Wood Frame=1.5, Mass Timber= 0.8 to 1.5, Ordinary=1.0, Noncombustible=0.8, Fire-Resistive=0.6
c) Noncombustible=-25%, Limited Combustible=-15%, Combustible=0%, Free Burning=+15%, Rapid Burning=+25%

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# FUS CALCULATION

**Project:**
**Project Number:**
**Project Location:**
**Date:** April 2023

**Building Type/Block #** Podium 6, Tower 9
**Firewalls/Sprinkler:** Sprinklered
**Number of Units/Unit #'s** 14 Storeys, 420 units

## 1.0 FUS Formula

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

where: RFF = required fire flow in litres per minute;
C = the Coefficient related to the type of construction; and
A = the Total Effective Floor Area ($m^2$) excluding basements at least 50% below grade) [a]

| | | |
|---|---|---|
| NBC Occupancy | Group C | |
| Type of Construction [b] | Fire-Resistive Construction | Type I |
| Protection (for C below 1.0) | Unprotected Openings | |
| Footprint area | 2570.5 | sq. metres |
| Storeys | 14 | |
| C = | 0.6 | |
| A = | 14700.6 | Total Effective Area [a] |
| **F =** | **16000** | **L/min** (rounded) |

## 2.0 Occupancy Adjustment

| | |
|---|---|
| Type of Occupancy [c] | Limited Combustible |
| Hazard Allowance | -0.15 |
| | -2400 L/min |
| **Adjusted Fire Flow** | **13600 L/min** |

## 3.0 Sprinkler Adjustment

| | | Credit | Total |
|---|---|---|---|
| NFPA 13 sprinkler standard | YES | 30% | 50% |
| Standard Water Supply | YES | 10% | |
| Fully Supervised system | YES | 10% | |

**Sprinkler Credit** **6800 L/min**

## 4.0 Exposure Adjustment

Construction Type of the Exposed Building Face: Type I-II (unprotected)

| | | Percent | Total* |
|---|---|---|---|
| *North Side* | | | |
| Distance to Building (m) | over 30 | 0% | 12% |
| Length (ft) by height in storeys | na | | |
| *South Side* | | | |
| Distance to Building (m) | 20.1 to 30 | 4% | |
| Length (ft) by height in storeys | over 100 | | |
| *East Side* | | | |
| Distance to Building (m) | 10.1 to 20 | 8% | |
| Length (ft) by height in storeys | over 100 | | |
| *West Side* | | | |
| Distance to Building (m) | over 30 | 0% | |
| Length (ft) by height in storeys | over 100 | | |

*max 75%

**Exposures Surcharge** **1630 L/min**

| | |
|---|---|
| **Total Required Fire Flow** (rounded) | **8000 L/min** |
| | **133 L/sec** |

a) For buildings with a construction coefficient from 1.0 to 1.5, consider 100% of all floor areas. For buildings with a construction coefficient below 1.0 (vertical openings are inadequately protected), consider the two largest adjoining floors plus 50% of each of any floors immediately above them up to a maximum of eight. If the vertical openings and exterior vertical communications are properly protected, consider only the area of the largest floor plus 25% of each of the two immediately adjoining floors.
b) Wood Frame=1.5, Mass Timber= 0.8 to 1.5, Ordinary=1.0, Noncombustible=0.8, Fire-Resistive=0.6
c) Noncombustible=-25%, Limited Combustible=-15%, Combustible=0%, Free Burning=+15%, Rapid Burning=+25%

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# FUS CALCULATION

**Project:**
**Project Number:**
**Project Location:**
**Date:** April 2023

**Building Type/Block #** Podium 7, Tower 10
**Firewalls/Sprinkler:** Sprinklered
**Number of Units/Unit #'s** 14 Storeys, 440 units

## 1.0 FUS Formula

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

where: RFF = required fire flow in litres per minute;
C = the Coefficient related to the type of construction; and
A = the Total Effective Floor Area ($m^2$) excluding basements at least 50% below grade) [a]

| | | |
|---|---|---|
| NBC Occupancy | Group C | |
| Type of Construction [b] | Fire-Resistive Construction | Type I |
| Protection (for C below 1.0) | Unprotected Openings | |
| Footprint area | 2634.9 sq. metres | |
| Storeys | 14 | |
| C = | 0.6 | |
| A = | 15078.6 Total Effective Area [a] | |
| **F =** | **16000 L/min** (rounded) | |

## 2.0 Occupancy Adjustment

| | |
|---|---|
| Type of Occupancy [c] | Limited Combustible |
| Hazard Allowance | -0.15 |
| | -2400 L/min |
| **Adjusted Fire Flow** | **13600 L/min** |

## 3.0 Sprinkler Adjustment

| | | Credit | Total |
|---|---|---|---|
| NFPA 13 sprinkler standard | YES | 30% | 50% |
| Standard Water Supply | YES | 10% | |
| Fully Supervised system | YES | 10% | |

**Sprinkler Credit** **6800 L/min**

## 4.0 Exposure Adjustment

Construction Type of the Exposed Building Face: Type I-II (unprotected)

| | | Percent | Total* |
|---|---|---|---|
| *North Side* | | | |
| Distance to Building (m) | over 30 | 0% | 12% |
| Length (ft) by height in storeys | na | | |
| *South Side* | | | |
| Distance to Building (m) | 20.1 to 30 | 4% | |
| Length (ft) by height in storeys | over 100 | | |
| *East Side* | | | |
| Distance to Building (m) | over 30 | 0% | |
| Length (ft) by height in storeys | over 100 | | |
| *West Side* | | | |
| Distance to Building (m) | 10.1 to 20 | 8% | |
| Length (ft) by height in storeys | over 100 | | |

*max 75%

**Exposures Surcharge** **1630 L/min**

| | |
|---|---|
| **Total Required Fire Flow** (rounded) | **8000 L/min** |
| | **133 L/sec** |

a) For buildings with a construction coefficient from 1.0 to 1.5, consider 100% of all floor areas. For buildings with a construction coefficient below 1.0 (vertical openings are inadequately protected), consider the two largest adjoining floors plus 50% of each of any floors immediately above them up to a maximum of eight. If the vertical openings and exterior vertical communications are properly protected, consider only the area of the largest floor plus 25% of each of the two immediately adjoining floors.
b) Wood Frame=1.5, Mass Timber= 0.8 to 1.5, Ordinary=1.0, Noncombustible=0.8, Fire-Resistive=0.6
c) Noncombustible=-25%, Limited Combustible=-15%, Combustible=0%, Free Burning=+15%, Rapid Burning=+25%

55 Gilbank Drive, Aurora, Ontario L4G 6H9
Tel: 905.726.1016 Cell: 416.434.0186 Fax: 905.726.1225

# Appendix B

## Boundary Information

# HYDRANT INSPECTION & FLOW REPORT

| SUGGESTED NFPA RATING | |
|---|---|
| BLUE | CLASS AA |
| 4159 gpm @ 20 psi (138 kPa) | |

ONTARIO CLEAN WATER AGENCY
AGENCE ONTARIENNE DES EAUX

Prepared By: The Ontario Clean Water Agency
Prepared For: Mr. James Bujak
Residual Hyd Andrew Cruickshank
Flow Hyd(s) Cody Flatt

Date: 19-May-23 Time: 11:45 AM

## HYDRANT DESCRIPTION

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Hydrant ID: | Private Hyd | Side of Street: | South | Make: | Canada Valve | Open Dir: | Left |
| Address: | 609 Kingston Road | | | Model: | Century | Latitude: | |
| Location: | Pickering Ontario | | | Year: | 2016 | Longitude: | |

## GENERAL INSPECTION

*OK - Good Condition* *FR - Future Repair Required* *N/A - Not Applicable* *CF - Component Failure*

| Upper Section | OK | FR | N/A | CF |
|---|---|---|---|---|
| Bonnet | ☐ | ☐ | ☑ | ☐ |
| Operating Nut | ☐ | ☐ | ☑ | ☐ |
| Gaskets / Bolts | ☐ | ☐ | ☑ | ☐ |
| O-Ring(s) | ☐ | ☐ | ☑ | ☐ |

| Mid Section | OK | FR | N/A | CF |
|---|---|---|---|---|
| Port Height | ☐ | ☐ | ☑ | ☐ |
| Caps / Nozzles | ☐ | ☐ | ☑ | ☐ |
| Chains | ☐ | ☐ | ☑ | ☐ |
| Traffic Flange | ☐ | ☐ | ☑ | ☐ |

| General | OK | FR | N/A | CF |
|---|---|---|---|---|
| Accessibility | ☐ | ☐ | ☑ | ☐ |
| Position / Height | ☐ | ☐ | ☑ | ☐ |
| Paint Cond | ☐ | ☐ | ☑ | ☐ |
| Drain Ports | ☐ | ☐ | ☑ | ☐ |

| Hydrostatic Leak Testing | | |
|---|---|---|
| *Hydrant Closed* | Above Grade Leak | No |
| | Subsurface Leak | No |
| *Hydrant Open* | Above Grade Leak | No |
| | Subsurface Leak | No |

| Maintenance | |
|---|---|
| Lubricate Operating Nut | N/A |
| Lubricate & Clean Nozzle Threads | N/A |
| Lubricate & Clean Cap Threads | N/A |
| Water Removed (if non-draining) | N/A |

| Auxiliary / Secondary Valve | |
|---|---|
| Located / Accessible | N/A |
| Operated/Exercised | N/A |
| Number of Turns | N/A |
| Open Direction | |

Comments:

Auxiliary Valve Location:

## FLUSHING

*If hydrants are being flow tested, inspections and flushing are completed prior to testing

| Hydrant Operated | Clear Flow Obtained | Cl2 Residual | Time Flushed | Flow | Total Flow | Dechlorinated |
|---|---|---|---|---|---|---|
| Yes - Easily Operated | Yes | | 5 minutes | 1202 gal | 6008 gal | Yes |

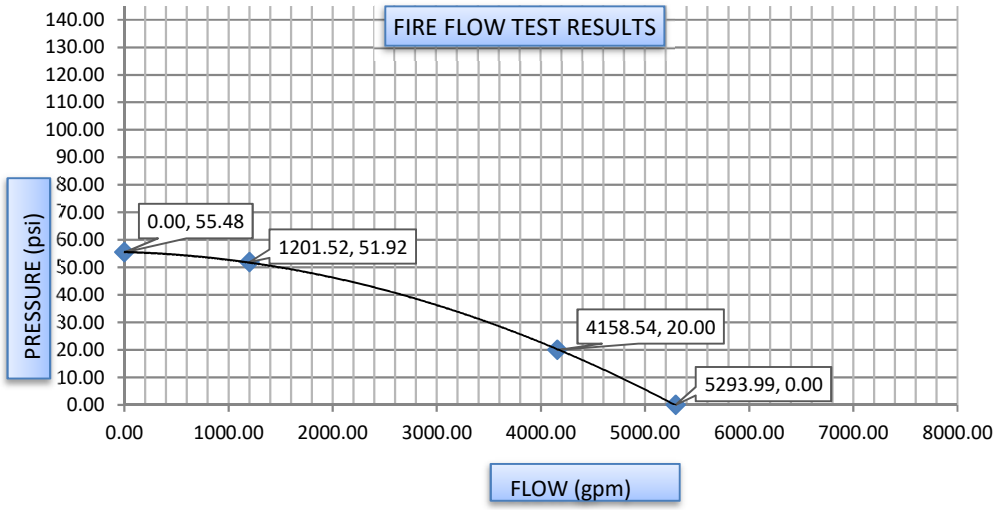
Comments: **STATIC AFTER FLOW TEST WAS PERFORMED 53.98 PSI**

## FLOW TESTING

*Flow testing results may be from previous year(s). Note date & time

Date: 19-May-23 Time: 11:45 AM

| Flow Hydrant | | | | | | | | Test Hydrant | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ID | Flow Device Used | Size | Coefficient | Time Flushed | Flow | Total Flow | Pitot | ID | Static | Residual |
| PE602 | Pollard Diffuser | 2.5" | 0.832 | 5.0 minutes | 601 gal | 3004 gal | 15 psi | Private Hyd | 55.48 | 51.92 |
| PE602 | Pollard Diffuser | 2.5" | 0.832 | 5.0 minutes | 601 gal | 3004 gal | 15 psi | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |




| Calculated Results | |
|---|---|
| Calculated Flow @ 20 psi | 4159 gpm |
| Calculated Flow @ 0 psi | 5294 gpm |
| Pressure Drop | 6.42% |

Comments:

# HYDRANT INSPECTION & FLOW REPORT

| SUGGESTED NFPA RATING | |
|---|---|
| BLUE | CLASS AA |
| 3832 gpm @ 20 psi (138 kPa) | |

ONTARIO CLEAN WATER AGENCY
AGENCE ONTARIENNE DES EAUX

Prepared By: The Ontario Clean Water Agency
Prepared For: Mr. James Bujak
Residual Hyd Andrew Cruickshank
Flow Hyd(s) Cody Flatt

Date: 19-May-23 Time: 12:00 PM

## HYDRANT DESCRIPTION

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Hydrant ID: | PE602 | Side of Street: | South | Make: | Canada Valve | Open Dir: | Left |
| Address: | Kingston Road (In front of Sport Check) | | | Model: | Century | Latitude: | |
| Location: | Pickering Ontario | | | Year: | 2016 | Longitude: | |

## GENERAL INSPECTION

*OK - Good Condition* *FR - Future Repair Required* *N/A - Not Applicable* *CF - Component Failure*

| Upper Section | OK | FR | N/A | CF |
|---|---|---|---|---|
| Bonnet | ☐ | ☐ | ☑ | ☐ |
| Operating Nut | ☐ | ☐ | ☑ | ☐ |
| Gaskets / Bolts | ☐ | ☐ | ☑ | ☐ |
| O-Ring(s) | ☐ | ☐ | ☑ | ☐ |

| Mid Section | OK | FR | N/A | CF |
|---|---|---|---|---|
| Port Height | ☐ | ☐ | ☑ | ☐ |
| Caps / Nozzles | ☐ | ☐ | ☑ | ☐ |
| Chains | ☐ | ☐ | ☑ | ☐ |
| Traffic Flange | ☐ | ☐ | ☑ | ☐ |

| General | OK | FR | N/A | CF |
|---|---|---|---|---|
| Accessibility | ☐ | ☐ | ☑ | ☐ |
| Position / Height | ☐ | ☐ | ☑ | ☐ |
| Paint Cond | ☐ | ☐ | ☑ | ☐ |
| Drain Ports | ☐ | ☐ | ☑ | ☐ |

| Hydrostatic Leak Testing | | |
|---|---|---|
| *Hydrant Closed* | Above Grade Leak | No |
| | Subsurface Leak | No |
| *Hydrant Open* | Above Grade Leak | No |
| | Subsurface Leak | No |

| Maintenance | |
|---|---|
| Lubricate Operating Nut | N/A |
| Lubricate & Clean Nozzle Threads | N/A |
| Lubricate & Clean Cap Threads | N/A |
| Water Removed (if non-draining) | N/A |

| Auxiliary / Secondary Valve | |
|---|---|
| Located / Accessible | N/A |
| Operated/Exercised | N/A |
| Number of Turns | N/A |
| Open Direction | |

Comments:

Auxiliary Valve Location:

## FLUSHING

*If hydrants are being flow tested, inspections and flushing are completed prior to testing

| Hydrant Operated | Clear Flow Obtained | Cl2 Residual | Time Flushed | Flow | Total Flow | Dechlorinated |
|---|---|---|---|---|---|---|
| Yes - Easily Operated | Yes | | 5 minutes | 1376 gal | 6882 gal | Yes |

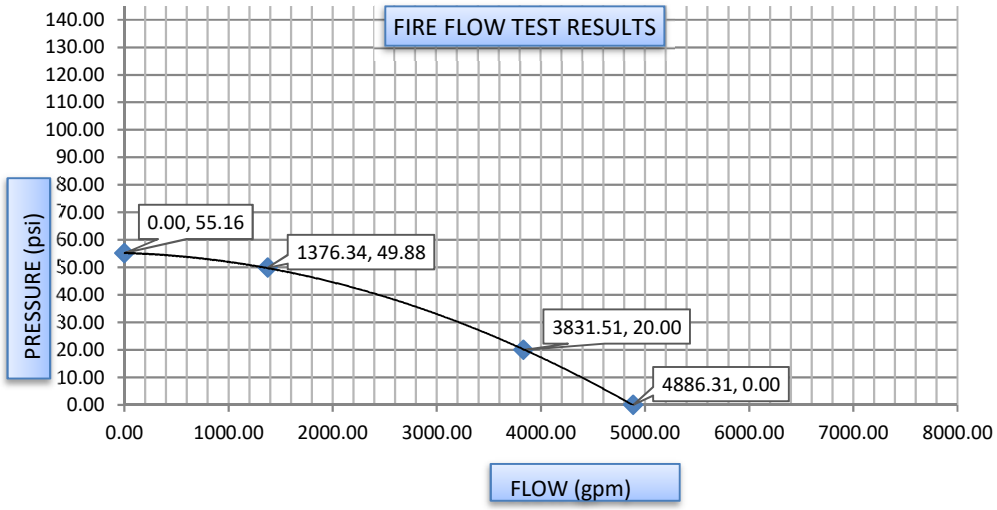
Comments: **STATIC AFTER FLOW TEST WAS PERFORMED 56.48 PSI**

## FLOW TESTING

*Flow testing results may be from previous year(s). Note date & time

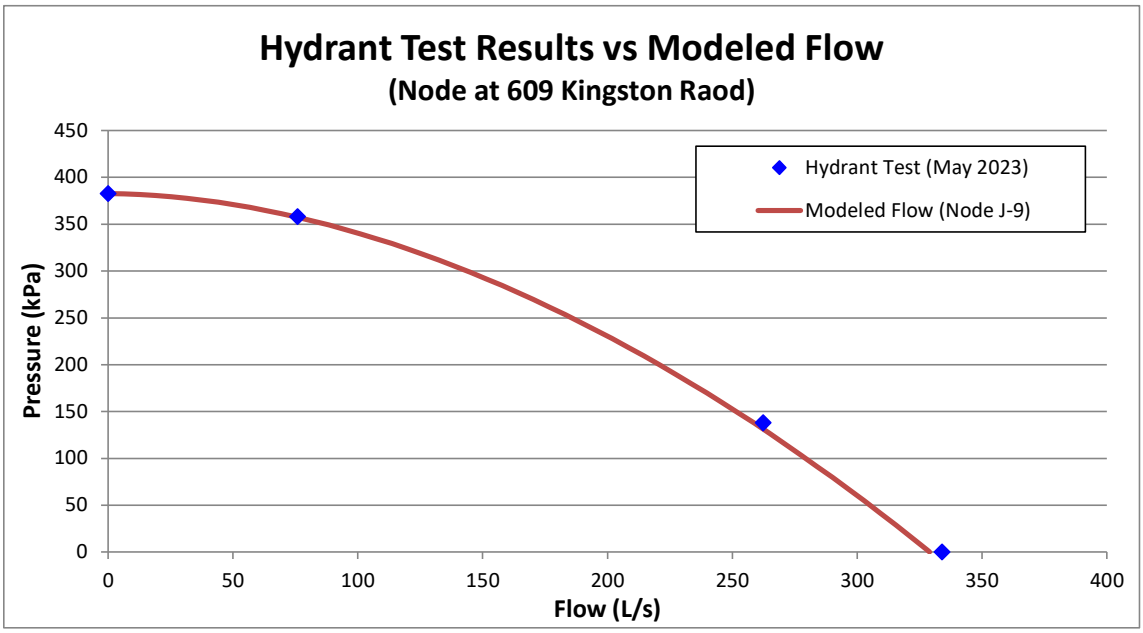
Date: 19-May-23 Time: 12:00 PM

| Flow Hydrant | | | | | | | | Test Hydrant | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ID | Flow Device Used | Size | Coefficient | Time Flushed | Flow | Total Flow | Pitot | ID | Static | Residual |
| Private Hyd | Pollard Diffuser | 2.5" | 0.832 | 5.0 minutes | 776 gal | 3878 gal | 25 psi | PE602 | 55.16 | 49.88 |
| Private Hyd | Pollard Diffuser | 2.5" | 0.832 | 5.0 minutes | 601 gal | 3004 gal | 15 psi | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

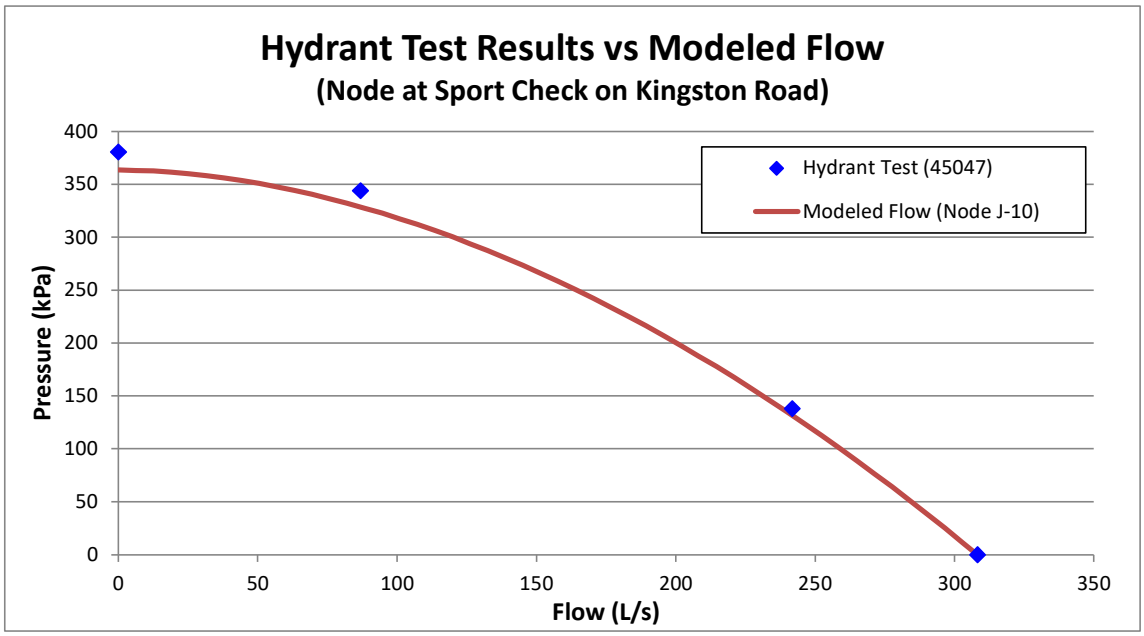



| Calculated Results | |
|---|---|
| Calculated Flow @ 20 psi | 3832 gpm |
| Calculated Flow @ 0 psi | 4886 gpm |
| Pressure Drop | 9.57% |

Comments:

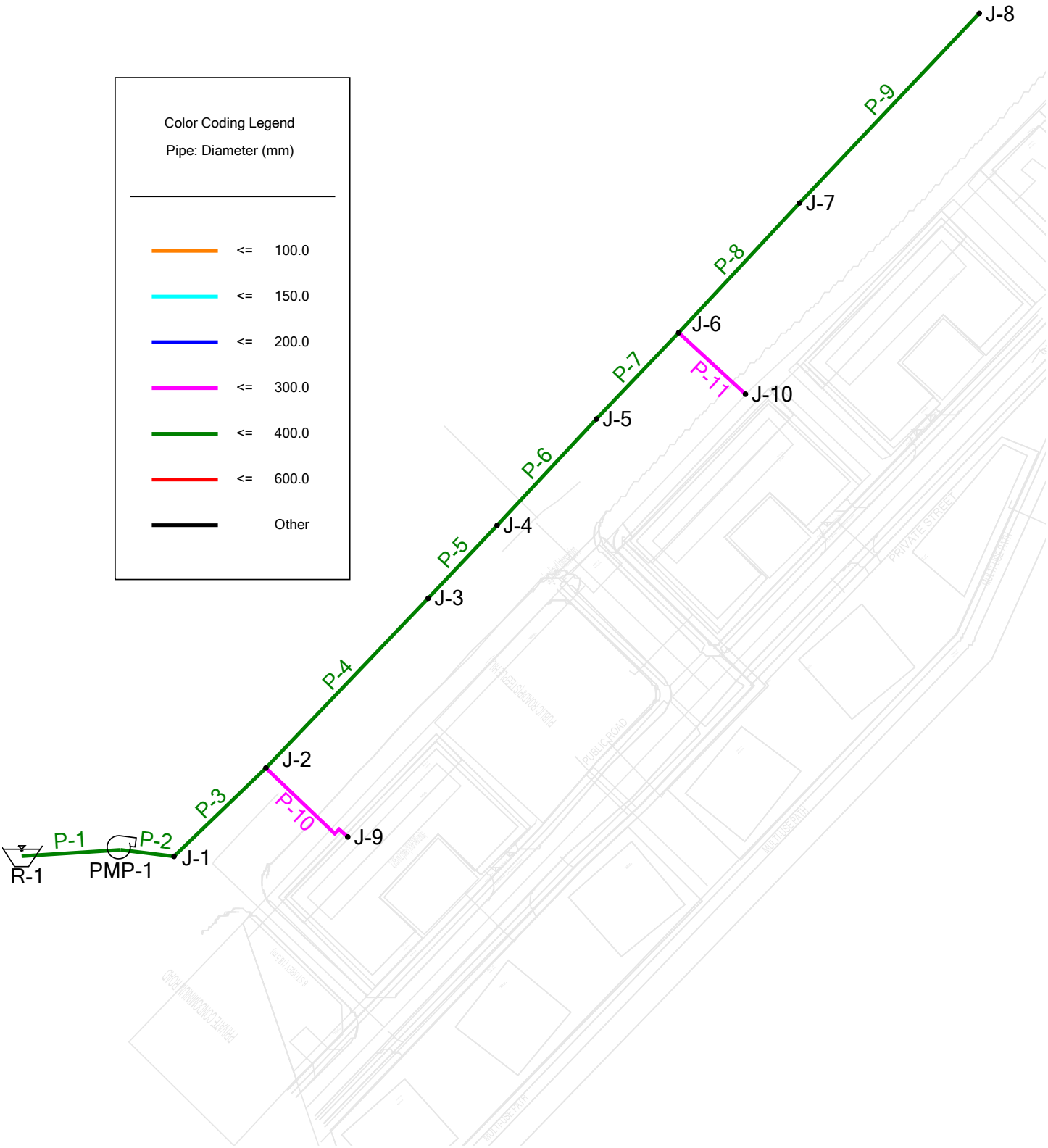



| | Static Pressure | Residual Pressure | Test Flow | Theoretical Flow at 140 kPa |
|---|---|---|---|---|
| | (kPa) | (kPa) | (L/s) | (L/s) |
| Hydrant Test | 382.5 | 358.0 | 75.8 | 262.4 |
| Model | 382.5 | 357.3 | 75.7 | 257.2 |




| | Static Pressure | Residual Pressure | Test Flow | Theoretical Flow at 140 kPa |
|---|---|---|---|---|
| | (kPa) | (kPa) | (L/s) | (L/s) |
| Hydrant Test | 380.3 | 343.9 | 86.8 | 241.8 |
| Model | 363.5 | 344.2 | 63.1 | 237.1 |

# Existing System



# Appendix C

## Model Results

## Average Day

### Node Table

| ID | Demand | Elevation | Head | Pressure |
|---|---|---|---|---|
| | *(L/s)* | *(m)* | *(m)* | *(kPa)* |
| J-1 | 0.00 | 104.62 | 143.98 | 385.19 |
| J-2 | 0.00 | 105.39 | 143.97 | 377.59 |
| J-3 | 0.00 | 106.21 | 143.96 | 369.49 |
| J-4 | 0.00 | 106.20 | 143.96 | 369.55 |
| J-5 | 0.00 | 106.58 | 143.96 | 365.83 |
| J-6 | 0.00 | 106.88 | 143.96 | 362.90 |
| J-7 | 0.00 | 106.79 | 143.96 | 363.78 |
| J-8 | 0.00 | 107.26 | 143.96 | 359.18 |
| J-9 | 0.00 | 105.80 | 143.97 | 373.56 |
| J-11 | 0.00 | 104.84 | 143.94 | 382.66 |
| J-12 | 0.00 | 105.00 | 143.94 | 381.09 |
| J-13 | 0.00 | 105.00 | 143.94 | 381.09 |
| J-14 | 0.00 | 105.02 | 143.94 | 380.89 |
| J-15 | 0.00 | 105.11 | 143.92 | 379.81 |
| J-16 | 0.00 | 105.00 | 143.93 | 381.01 |
| J-17 | 0.00 | 104.96 | 143.92 | 381.32 |
| J-18 | 0.00 | 104.96 | 143.92 | 381.31 |
| J-19 | 0.00 | 105.00 | 143.92 | 380.89 |
| J-20 | 0.00 | 105.00 | 143.92 | 380.89 |
| J-21 | 0.00 | 105.68 | 143.90 | 374.02 |
| J-22 | 0.00 | 105.68 | 143.89 | 374.00 |
| J-23 | 0.00 | 105.52 | 143.89 | 375.50 |
| J-24 | 0.00 | 105.52 | 143.89 | 375.50 |
| J-25 | 0.00 | 105.52 | 143.89 | 375.50 |
| J-26 | 0.00 | 105.52 | 143.89 | 375.49 |
| J-27 | 0.00 | 105.52 | 143.89 | 375.49 |
| J-28 | 0.00 | 105.20 | 143.94 | 379.13 |
| J-29 | 4.17 | 105.20 | 143.92 | 378.99 |
| J-30 | 4.17 | 105.20 | 143.92 | 378.92 |
| J-31 | 0.00 | 105.20 | 143.92 | 378.97 |
| J-32 | 4.17 | 105.20 | 143.91 | 378.83 |
| J-33 | 0.00 | 105.50 | 143.92 | 376.00 |
| J-34 | 4.17 | 104.85 | 143.90 | 382.20 |
| J-35 | 0.00 | 105.50 | 143.90 | 375.78 |
| J-36 | 4.17 | 105.50 | 143.88 | 375.62 |
| J-37 | 4.95 | 105.95 | 143.88 | 371.20 |
| J-38 | 0.00 | 106.45 | 143.89 | 366.39 |
| J-39 | 2.86 | 106.45 | 143.88 | 366.36 |
| J-40 | 5.51 | 106.45 | 143.88 | 366.30 |
| J-41 | 0.00 | 106.45 | 143.89 | 366.40 |
| J-42 | 5.51 | 105.25 | 143.88 | 378.09 |
| J-43 | 0.00 | 105.25 | 143.90 | 378.23 |
| J-44 | 5.77 | 105.55 | 143.96 | 375.94 |
| J-45 | 0.00 | 105.55 | 143.97 | 376.00 |
| **MIN** | | **104.6** | | **359.2** |
| **MAX** | | **107.3** | | **385.2** |

### Pipe Table

| ID | From Node | To Node | Length | Diameter | Roughness | Flow | Velocity |
|---|---|---|---|---|---|---|---|
| | | | *(m)* | *(mm)* | *(C)* | *(L/s)* | *(m/s)* |
| P-1 | R-1 | PMP-1 | 34.07 | 400 | 120 | 45.45 | 0.36 |
| P-2 | PMP-1 | J-1 | 18.46 | 400 | 120 | 45.45 | 0.36 |
| P-3 | J-1 | J-2 | 43.74 | 400 | 120 | 26.10 | 0.21 |
| P-4 | J-2 | J-3 | 80.63 | 400 | 120 | 20.33 | 0.16 |
| P-5 | J-3 | J-4 | 34.40 | 400 | 120 | 20.33 | 0.16 |
| P-6 | J-4 | J-5 | 49.96 | 400 | 120 | 0.00 | 0.00 |
| P-7 | J-5 | J-6 | 40.94 | 400 | 120 | 0.00 | 0.00 |
| P-8 | J-6 | J-7 | 60.79 | 400 | 120 | 0.00 | 0.00 |
| P-9 | J-7 | J-8 | 89.77 | 400 | 120 | 0.00 | 0.00 |
| P-10 | J-2 | J-9 | 38.79 | 300 | 110 | 5.77 | 0.08 |
| P-12 | J-1 | J-11 | 91.67 | 300 | 110 | 19.35 | 0.27 |
| P-13 | J-11 | J-12 | 21.17 | 300 | 110 | 4.17 | 0.06 |
| P-14 | J-12 | J-13 | 4.84 | 300 | 110 | 0.00 | 0.00 |
| P-15 | J-13 | J-14 | 6.95 | 300 | 110 | 0.00 | 0.00 |
| P-16 | J-4 | J-15 | 90.66 | 300 | 110 | 20.33 | 0.29 |
| P-17 | J-11 | J-16 | 32.48 | 300 | 110 | 15.18 | 0.21 |
| P-18 | J-16 | J-17 | 55.74 | 300 | 110 | 11.01 | 0.16 |
| P-19 | J-17 | J-18 | 4.87 | 300 | 110 | 11.01 | 0.16 |
| P-20 | J-18 | J-19 | 48.92 | 300 | 110 | 6.84 | 0.10 |
| P-21 | J-19 | J-20 | 4.20 | 300 | 110 | 6.84 | 0.10 |
| P-22 | J-20 | J-15 | 12.06 | 300 | 110 | 2.67 | 0.04 |
| P-23 | J-15 | J-21 | 37.91 | 300 | 110 | 23.00 | 0.33 |
| P-24 | J-21 | J-22 | 4.09 | 300 | 110 | 23.00 | 0.33 |
| P-25 | J-22 | J-23 | 28.80 | 300 | 110 | 13.32 | 0.19 |
| P-26 | J-23 | J-24 | 2.89 | 300 | 110 | 13.32 | 0.19 |
| P-27 | J-24 | J-25 | 3.26 | 300 | 110 | 7.81 | 0.11 |
| P-28 | J-25 | J-26 | 3.16 | 300 | 110 | 4.95 | 0.07 |
| P-29 | J-26 | J-27 | 3.33 | 300 | 110 | 4.95 | 0.07 |
| P-30 | J-13 | J-28 | 17.04 | 200 | 110 | 0.00 | 0.00 |
| P-31 | J-12 | J-29 | 16.50 | 150 | 100 | 4.17 | 0.24 |
| P-32 | J-16 | J-30 | 16.40 | 150 | 100 | 4.17 | 0.24 |
| P-33 | J-17 | J-31 | 15.90 | 200 | 110 | 0.00 | 0.00 |
| P-34 | J-18 | J-32 | 15.88 | 150 | 100 | 4.17 | 0.24 |
| P-35 | J-19 | J-33 | 19.63 | 200 | 110 | 0.00 | 0.00 |
| P-36 | J-20 | J-34 | 19.17 | 150 | 100 | 4.17 | 0.24 |
| P-37 | J-21 | J-35 | 17.16 | 200 | 110 | 0.00 | 0.00 |
| P-38 | J-22 | J-36 | 16.98 | 150 | 100 | 4.17 | 0.24 |
| P-39 | J-27 | J-37 | 7.24 | 150 | 100 | 4.95 | 0.28 |
| P-40 | J-26 | J-38 | 6.96 | 200 | 110 | 0.00 | 0.00 |
| P-41 | J-25 | J-39 | 7.10 | 150 | 100 | 2.86 | 0.16 |
| P-42 | J-24 | J-40 | 6.62 | 150 | 100 | 5.51 | 0.31 |
| P-43 | J-23 | J-41 | 6.52 | 200 | 110 | 0.00 | 0.00 |
| P-44 | J-22 | J-42 | 8.51 | 150 | 100 | 5.51 | 0.31 |
| P-45 | J-21 | J-43 | 8.21 | 200 | 110 | 0.00 | 0.00 |
| P-46 | J-9 | J-44 | 4.50 | 150 | 100 | 5.77 | 0.33 |
| P-47 | J-9 | J-45 | 10.56 | 200 | 110 | 0.00 | 0.00 |

## Minimum Hour

### Node Table

| ID | Demand | Elevation | Head | Pressure |
|---|---|---|---|---|
| | *(L/s)* | *(m)* | *(m)* | *(kPa)* |
| J-1 | 0.00 | 104.62 | 144.63 | 391.56 |
| J-2 | 0.00 | 105.39 | 144.63 | 384.01 |
| J-3 | 0.00 | 106.21 | 144.63 | 375.96 |
| J-4 | 0.00 | 106.20 | 144.62 | 376.05 |
| J-5 | 0.00 | 106.58 | 144.62 | 372.33 |
| J-6 | 0.00 | 106.88 | 144.62 | 369.40 |
| J-7 | 0.00 | 106.79 | 144.62 | 370.28 |
| J-8 | 0.00 | 107.26 | 144.62 | 365.68 |
| J-9 | 0.00 | 105.80 | 144.63 | 379.99 |
| J-11 | 0.00 | 104.84 | 144.62 | 389.31 |
| J-12 | 0.00 | 105.00 | 144.62 | 387.74 |
| J-13 | 0.00 | 105.00 | 144.62 | 387.74 |
| J-14 | 0.00 | 105.02 | 144.62 | 387.54 |
| J-15 | 0.00 | 105.11 | 144.61 | 386.61 |
| J-16 | 0.00 | 105.00 | 144.62 | 387.72 |
| J-17 | 0.00 | 104.96 | 144.61 | 388.09 |
| J-18 | 0.00 | 104.96 | 144.61 | 388.08 |
| J-19 | 0.00 | 105.00 | 144.61 | 387.68 |
| J-20 | 0.00 | 105.00 | 144.61 | 387.68 |
| J-21 | 0.00 | 105.68 | 144.61 | 380.97 |
| J-22 | 0.00 | 105.68 | 144.61 | 380.96 |
| J-23 | 0.00 | 105.52 | 144.60 | 382.51 |
| J-24 | 0.00 | 105.52 | 144.60 | 382.51 |
| J-25 | 0.00 | 105.52 | 144.60 | 382.51 |
| J-26 | 0.00 | 105.52 | 144.60 | 382.51 |
| J-27 | 0.00 | 105.52 | 144.60 | 382.51 |
| J-28 | 0.00 | 105.20 | 144.62 | 385.78 |
| J-29 | 2.09 | 105.20 | 144.61 | 385.74 |
| J-30 | 2.09 | 105.20 | 144.61 | 385.72 |
| J-31 | 0.00 | 105.20 | 144.61 | 385.74 |
| J-32 | 2.09 | 105.20 | 144.61 | 385.70 |
| J-33 | 0.00 | 105.50 | 144.61 | 382.79 |
| J-34 | 2.09 | 104.85 | 144.61 | 389.11 |
| J-35 | 0.00 | 105.50 | 144.61 | 382.73 |
| J-36 | 2.09 | 105.50 | 144.60 | 382.68 |
| J-37 | 2.48 | 105.95 | 144.60 | 378.28 |
| J-38 | 0.00 | 106.45 | 144.60 | 373.41 |
| J-39 | 1.43 | 106.45 | 144.60 | 373.40 |
| J-40 | 2.76 | 106.45 | 144.60 | 373.38 |
| J-41 | 0.00 | 106.45 | 144.60 | 373.41 |
| J-42 | 2.76 | 105.25 | 144.60 | 385.14 |
| J-43 | 0.00 | 105.25 | 144.61 | 385.18 |
| J-44 | 2.89 | 105.55 | 144.62 | 382.42 |
| J-45 | 0.00 | 105.55 | 144.63 | 382.44 |
| | | | | |
| **MIN** | | **104.6** | | **365.7** |
| **MAX** | | **107.3** | | **391.6** |

### Pipe Table

| ID | From Node | To Node | Length | Diameter | Roughness | Flow | Velocity |
|---|---|---|---|---|---|---|---|
| | | | *(m)* | *(mm)* | *(C)* | *(L/s)* | *(m/s)* |
| P-1 | R-1 | PMP-1 | 34.07 | 400 | 120 | 22.77 | 0.18 |
| P-2 | PMP-1 | J-1 | 18.46 | 400 | 120 | 22.77 | 0.18 |
| P-3 | J-1 | J-2 | 43.74 | 400 | 120 | 13.08 | 0.10 |
| P-4 | J-2 | J-3 | 80.63 | 400 | 120 | 10.19 | 0.08 |
| P-5 | J-3 | J-4 | 34.40 | 400 | 120 | 10.19 | 0.08 |
| P-6 | J-4 | J-5 | 49.96 | 400 | 120 | 0.00 | 0.00 |
| P-7 | J-5 | J-6 | 40.94 | 400 | 120 | 0.00 | 0.00 |
| P-8 | J-6 | J-7 | 60.79 | 400 | 120 | 0.00 | 0.00 |
| P-9 | J-7 | J-8 | 89.77 | 400 | 120 | 0.00 | 0.00 |
| P-10 | J-2 | J-9 | 38.79 | 300 | 110 | 2.89 | 0.04 |
| P-12 | J-1 | J-11 | 91.67 | 300 | 110 | 9.69 | 0.14 |
| P-13 | J-11 | J-12 | 21.17 | 300 | 110 | 2.09 | 0.03 |
| P-14 | J-12 | J-13 | 4.84 | 300 | 110 | 0.00 | 0.00 |
| P-15 | J-13 | J-14 | 6.95 | 300 | 110 | 0.00 | 0.00 |
| P-16 | J-4 | J-15 | 90.66 | 300 | 110 | 10.19 | 0.14 |
| P-17 | J-11 | J-16 | 32.48 | 300 | 110 | 7.60 | 0.11 |
| P-18 | J-16 | J-17 | 55.74 | 300 | 110 | 5.51 | 0.08 |
| P-19 | J-17 | J-18 | 4.87 | 300 | 110 | 5.51 | 0.08 |
| P-20 | J-18 | J-19 | 48.92 | 300 | 110 | 3.42 | 0.05 |
| P-21 | J-19 | J-20 | 4.20 | 300 | 110 | 3.42 | 0.05 |
| P-22 | J-20 | J-15 | 12.06 | 300 | 110 | 1.33 | 0.02 |
| P-23 | J-15 | J-21 | 37.91 | 300 | 110 | 11.52 | 0.16 |
| P-24 | J-21 | J-22 | 4.09 | 300 | 110 | 11.52 | 0.16 |
| P-25 | J-22 | J-23 | 28.80 | 300 | 110 | 6.67 | 0.09 |
| P-26 | J-23 | J-24 | 2.89 | 300 | 110 | 6.67 | 0.09 |
| P-27 | J-24 | J-25 | 3.26 | 300 | 110 | 3.91 | 0.06 |
| P-28 | J-25 | J-26 | 3.16 | 300 | 110 | 2.48 | 0.04 |
| P-29 | J-26 | J-27 | 3.33 | 300 | 110 | 2.48 | 0.04 |
| P-30 | J-13 | J-28 | 17.04 | 200 | 110 | 0.00 | 0.00 |
| P-31 | J-12 | J-29 | 16.50 | 150 | 100 | 2.09 | 0.12 |
| P-32 | J-16 | J-30 | 16.40 | 150 | 100 | 2.09 | 0.12 |
| P-33 | J-17 | J-31 | 15.90 | 200 | 110 | 0.00 | 0.00 |
| P-34 | J-18 | J-32 | 15.88 | 150 | 100 | 2.09 | 0.12 |
| P-35 | J-19 | J-33 | 19.63 | 200 | 110 | 0.00 | 0.00 |
| P-36 | J-20 | J-34 | 19.17 | 150 | 100 | 2.09 | 0.12 |
| P-37 | J-21 | J-35 | 17.16 | 200 | 110 | 0.00 | 0.00 |
| P-38 | J-22 | J-36 | 16.98 | 150 | 100 | 2.09 | 0.12 |
| P-39 | J-27 | J-37 | 7.24 | 150 | 100 | 2.48 | 0.14 |
| P-40 | J-26 | J-38 | 6.96 | 200 | 110 | 0.00 | 0.00 |
| P-41 | J-25 | J-39 | 7.10 | 150 | 100 | 1.43 | 0.08 |
| P-42 | J-24 | J-40 | 6.62 | 150 | 100 | 2.76 | 0.16 |
| P-43 | J-23 | J-41 | 6.52 | 200 | 110 | 0.00 | 0.00 |
| P-44 | J-22 | J-42 | 8.51 | 150 | 100 | 2.76 | 0.16 |
| P-45 | J-21 | J-43 | 8.21 | 200 | 110 | 0.00 | 0.00 |
| P-46 | J-9 | J-44 | 4.50 | 150 | 100 | 2.89 | 0.16 |
| P-47 | J-9 | J-45 | 10.56 | 200 | 110 | 0.00 | 0.00 |

## Maximum Day

### Node Table

| ID | Demand | Elevation | Head | Pressure |
|---|---|---|---|---|
| | *(L/s)* | *(m)* | *(m)* | *(kPa)* |
| J-1 | 0.00 | 104.62 | 141.62 | 362.14 |
| J-2 | 0.00 | 105.39 | 141.60 | 354.37 |
| J-3 | 0.00 | 106.21 | 141.57 | 346.07 |
| J-4 | 0.00 | 106.20 | 141.56 | 346.05 |
| J-5 | 0.00 | 106.58 | 141.56 | 342.33 |
| J-6 | 0.00 | 106.88 | 141.56 | 339.40 |
| J-7 | 0.00 | 106.79 | 141.56 | 340.28 |
| J-8 | 0.00 | 107.26 | 141.56 | 335.68 |
| J-9 | 0.00 | 105.80 | 141.59 | 350.30 |
| J-11 | 0.00 | 104.84 | 141.48 | 358.64 |
| J-12 | 0.00 | 105.00 | 141.48 | 357.05 |
| J-13 | 0.00 | 105.00 | 141.48 | 357.05 |
| J-14 | 0.00 | 105.02 | 141.48 | 356.86 |
| J-15 | 0.00 | 105.11 | 141.41 | 355.25 |
| J-16 | 0.00 | 105.00 | 141.45 | 356.76 |
| J-17 | 0.00 | 104.96 | 141.42 | 356.87 |
| J-18 | 0.00 | 104.96 | 141.42 | 356.84 |
| J-19 | 0.00 | 105.00 | 141.41 | 356.34 |
| J-20 | 0.00 | 105.00 | 141.41 | 356.33 |
| J-21 | 0.00 | 105.68 | 141.33 | 348.90 |
| J-22 | 0.00 | 105.68 | 141.32 | 348.82 |
| J-23 | 0.00 | 105.52 | 141.30 | 350.17 |
| J-24 | 0.00 | 105.52 | 141.30 | 350.15 |
| J-25 | 0.00 | 105.52 | 141.30 | 350.14 |
| J-26 | 0.00 | 105.52 | 141.30 | 350.14 |
| J-27 | 0.00 | 105.52 | 141.30 | 350.14 |
| J-28 | 0.00 | 105.20 | 141.48 | 355.09 |
| J-29 | 8.34 | 105.20 | 141.43 | 354.60 |
| J-30 | 8.34 | 105.20 | 141.40 | 354.31 |
| J-31 | 0.00 | 105.20 | 141.42 | 354.52 |
| J-32 | 8.34 | 105.20 | 141.37 | 354.01 |
| J-33 | 0.00 | 105.50 | 141.41 | 351.45 |
| J-34 | 8.34 | 104.85 | 141.35 | 357.23 |
| J-35 | 0.00 | 105.50 | 141.33 | 350.67 |
| J-36 | 8.34 | 105.50 | 141.27 | 350.07 |
| J-37 | 9.90 | 105.95 | 141.27 | 345.63 |
| J-38 | 0.00 | 106.45 | 141.30 | 341.04 |
| J-39 | 5.72 | 106.45 | 141.29 | 340.93 |
| J-40 | 11.02 | 106.45 | 141.26 | 340.72 |
| J-41 | 0.00 | 106.45 | 141.30 | 341.07 |
| J-42 | 11.02 | 105.25 | 141.28 | 352.60 |
| J-43 | 0.00 | 105.25 | 141.33 | 353.11 |
| J-44 | 11.54 | 105.55 | 141.57 | 352.50 |
| J-45 | 0.00 | 105.55 | 141.59 | 352.74 |
| **MIN** | | **104.6** | | **335.7** |
| **MAX** | | **107.3** | | **362.1** |

### Pipe Table

| ID | From Node | To Node | Length | Diameter | Roughness | Flow | Velocity |
|---|---|---|---|---|---|---|---|
| | | | *(m)* | *(mm)* | *(C)* | *(L/s)* | *(m/s)* |
| P-1 | R-1 | PMP-1 | 34.07 | 400 | 120 | 90.90 | 0.72 |
| P-2 | PMP-1 | J-1 | 18.46 | 400 | 120 | 90.90 | 0.72 |
| P-3 | J-1 | J-2 | 43.74 | 400 | 120 | 52.20 | 0.42 |
| P-4 | J-2 | J-3 | 80.63 | 400 | 120 | 40.66 | 0.32 |
| P-5 | J-3 | J-4 | 34.40 | 400 | 120 | 40.66 | 0.32 |
| P-6 | J-4 | J-5 | 49.96 | 400 | 120 | 0.00 | 0.00 |
| P-7 | J-5 | J-6 | 40.94 | 400 | 120 | 0.00 | 0.00 |
| P-8 | J-6 | J-7 | 60.79 | 400 | 120 | 0.00 | 0.00 |
| P-9 | J-7 | J-8 | 89.77 | 400 | 120 | 0.00 | 0.00 |
| P-10 | J-2 | J-9 | 38.79 | 300 | 110 | 11.54 | 0.16 |
| P-12 | J-1 | J-11 | 91.67 | 300 | 110 | 38.70 | 0.55 |
| P-13 | J-11 | J-12 | 21.17 | 300 | 110 | 8.34 | 0.12 |
| P-14 | J-12 | J-13 | 4.84 | 300 | 110 | 0.00 | 0.00 |
| P-15 | J-13 | J-14 | 6.95 | 300 | 110 | 0.00 | 0.00 |
| P-16 | J-4 | J-15 | 90.66 | 300 | 110 | 40.66 | 0.58 |
| P-17 | J-11 | J-16 | 32.48 | 300 | 110 | 30.36 | 0.43 |
| P-18 | J-16 | J-17 | 55.74 | 300 | 110 | 22.02 | 0.31 |
| P-19 | J-17 | J-18 | 4.87 | 300 | 110 | 22.02 | 0.31 |
| P-20 | J-18 | J-19 | 48.92 | 300 | 110 | 13.68 | 0.19 |
| P-21 | J-19 | J-20 | 4.20 | 300 | 110 | 13.68 | 0.19 |
| P-22 | J-20 | J-15 | 12.06 | 300 | 110 | 5.34 | 0.08 |
| P-23 | J-15 | J-21 | 37.91 | 300 | 110 | 46.00 | 0.65 |
| P-24 | J-21 | J-22 | 4.09 | 300 | 110 | 46.00 | 0.65 |
| P-25 | J-22 | J-23 | 28.80 | 300 | 110 | 26.64 | 0.38 |
| P-26 | J-23 | J-24 | 2.89 | 300 | 110 | 26.64 | 0.38 |
| P-27 | J-24 | J-25 | 3.26 | 300 | 110 | 15.62 | 0.22 |
| P-28 | J-25 | J-26 | 3.16 | 300 | 110 | 9.90 | 0.14 |
| P-29 | J-26 | J-27 | 3.33 | 300 | 110 | 9.90 | 0.14 |
| P-30 | J-13 | J-28 | 17.04 | 200 | 110 | 0.00 | 0.00 |
| P-31 | J-12 | J-29 | 16.50 | 150 | 100 | 8.34 | 0.47 |
| P-32 | J-16 | J-30 | 16.40 | 150 | 100 | 8.34 | 0.47 |
| P-33 | J-17 | J-31 | 15.90 | 200 | 110 | 0.00 | 0.00 |
| P-34 | J-18 | J-32 | 15.88 | 150 | 100 | 8.34 | 0.47 |
| P-35 | J-19 | J-33 | 19.63 | 200 | 110 | 0.00 | 0.00 |
| P-36 | J-20 | J-34 | 19.17 | 150 | 100 | 8.34 | 0.47 |
| P-37 | J-21 | J-35 | 17.16 | 200 | 110 | 0.00 | 0.00 |
| P-38 | J-22 | J-36 | 16.98 | 150 | 100 | 8.34 | 0.47 |
| P-39 | J-27 | J-37 | 7.24 | 150 | 100 | 9.90 | 0.56 |
| P-40 | J-26 | J-38 | 6.96 | 200 | 110 | 0.00 | 0.00 |
| P-41 | J-25 | J-39 | 7.10 | 150 | 100 | 5.72 | 0.32 |
| P-42 | J-24 | J-40 | 6.62 | 150 | 100 | 11.02 | 0.62 |
| P-43 | J-23 | J-41 | 6.52 | 200 | 110 | 0.00 | 0.00 |
| P-44 | J-22 | J-42 | 8.51 | 150 | 100 | 11.02 | 0.62 |
| P-45 | J-21 | J-43 | 8.21 | 200 | 110 | 0.00 | 0.00 |
| P-46 | J-9 | J-44 | 4.50 | 150 | 100 | 11.54 | 0.65 |
| P-47 | J-9 | J-45 | 10.56 | 200 | 110 | 0.00 | 0.00 |

## Peak Hour

### Node Table

| ID | Demand | Elevation | Head | Pressure |
|---|---|---|---|---|
| | *(L/s)* | *(m)* | *(m)* | *(kPa)* |
| J-1 | 0.00 | 104.62 | 137.98 | 326.48 |
| J-2 | 0.00 | 105.39 | 137.93 | 318.44 |
| J-3 | 0.00 | 106.21 | 137.87 | 309.84 |
| J-4 | 0.00 | 106.20 | 137.84 | 309.69 |
| J-5 | 0.00 | 106.58 | 137.84 | 305.97 |
| J-6 | 0.00 | 106.88 | 137.84 | 303.03 |
| J-7 | 0.00 | 106.79 | 137.84 | 303.92 |
| J-8 | 0.00 | 107.26 | 137.84 | 299.32 |
| J-9 | 0.00 | 105.80 | 137.91 | 314.30 |
| J-11 | 0.00 | 104.84 | 137.69 | 321.46 |
| J-12 | 0.00 | 105.00 | 137.68 | 319.85 |
| J-13 | 0.00 | 105.00 | 137.68 | 319.85 |
| J-14 | 0.00 | 105.02 | 137.68 | 319.66 |
| J-15 | 0.00 | 105.11 | 137.53 | 317.25 |
| J-16 | 0.00 | 105.00 | 137.62 | 319.24 |
| J-17 | 0.00 | 104.96 | 137.56 | 319.02 |
| J-18 | 0.00 | 104.96 | 137.55 | 318.97 |
| J-19 | 0.00 | 105.00 | 137.53 | 318.35 |
| J-20 | 0.00 | 105.00 | 137.53 | 318.33 |
| J-21 | 0.00 | 105.68 | 137.36 | 310.04 |
| J-22 | 0.00 | 105.68 | 137.34 | 309.86 |
| J-23 | 0.00 | 105.52 | 137.29 | 310.97 |
| J-24 | 0.00 | 105.52 | 137.29 | 310.93 |
| J-25 | 0.00 | 105.52 | 137.29 | 310.91 |
| J-26 | 0.00 | 105.52 | 137.29 | 310.90 |
| J-27 | 0.00 | 105.52 | 137.29 | 310.89 |
| J-28 | 0.00 | 105.20 | 137.68 | 317.90 |
| J-29 | 12.51 | 105.20 | 137.57 | 316.85 |
| J-30 | 12.51 | 105.20 | 137.51 | 316.24 |
| J-31 | 0.00 | 105.20 | 137.56 | 316.67 |
| J-32 | 12.51 | 105.20 | 137.45 | 315.61 |
| J-33 | 0.00 | 105.50 | 137.53 | 313.46 |
| J-34 | 12.51 | 104.85 | 137.40 | 318.58 |
| J-35 | 0.00 | 105.50 | 137.36 | 311.80 |
| J-36 | 12.51 | 105.50 | 137.23 | 310.54 |
| J-37 | 14.85 | 105.95 | 137.22 | 306.05 |
| J-38 | 0.00 | 106.45 | 137.29 | 301.80 |
| J-39 | 8.58 | 106.45 | 137.26 | 301.58 |
| J-40 | 16.53 | 106.45 | 137.22 | 301.12 |
| J-41 | 0.00 | 106.45 | 137.29 | 301.87 |
| J-42 | 16.53 | 105.25 | 137.25 | 313.16 |
| J-43 | 0.00 | 105.25 | 137.36 | 314.24 |
| J-44 | 17.31 | 105.55 | 137.86 | 316.23 |
| J-45 | 0.00 | 105.55 | 137.91 | 316.75 |
| **MIN** | | **104.6** | | **299.3** |
| **MAX** | | **107.3** | | **326.5** |

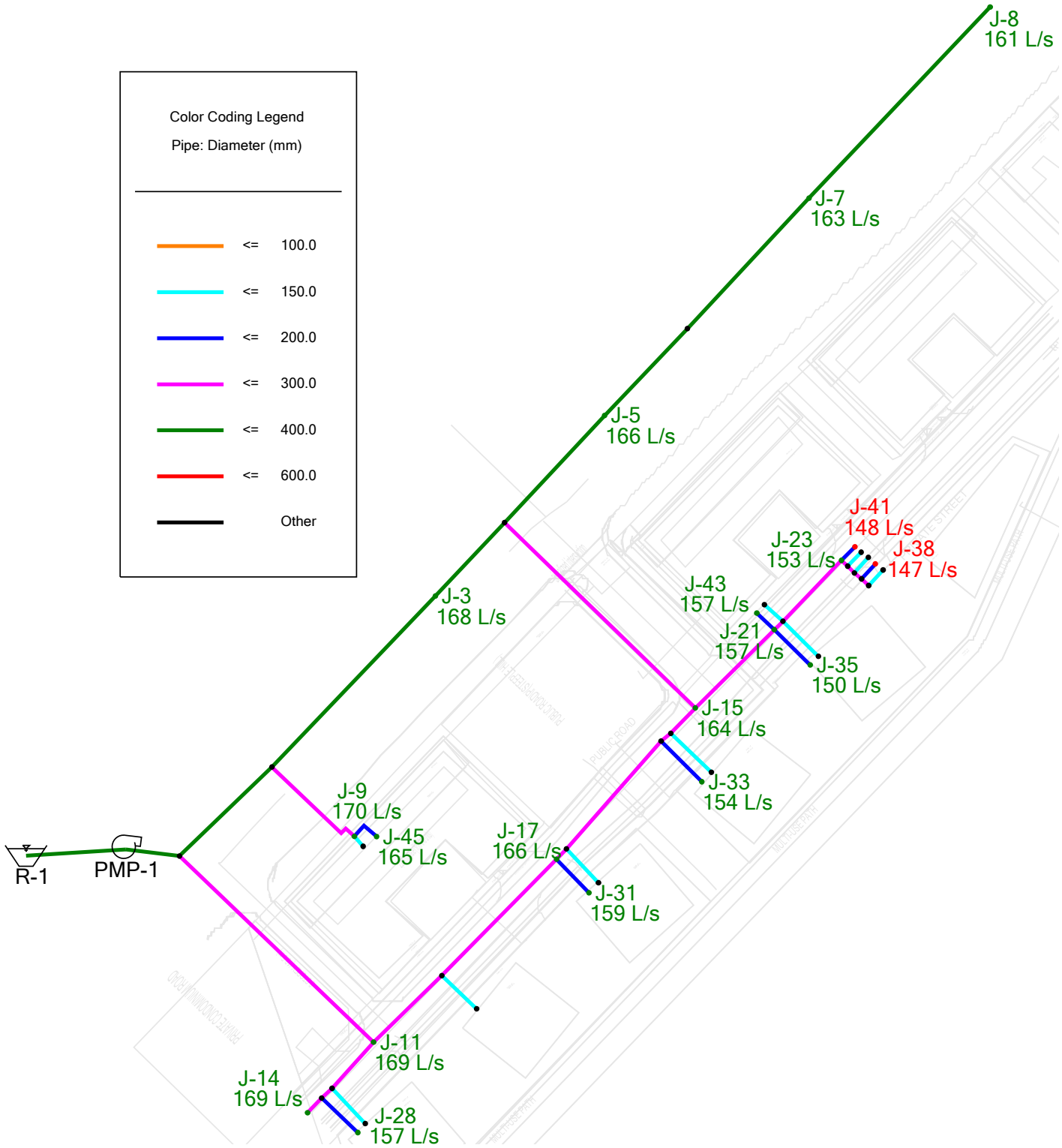
### Pipe Table

| ID | From Node | To Node | Length | Diameter | Roughness | Flow | Velocity |
|---|---|---|---|---|---|---|---|
| | | | *(m)* | *(mm)* | *(C)* | *(L/s)* | *(m/s)* |
| P-1 | R-1 | PMP-1 | 34.07 | 400 | 120 | 136.35 | 1.09 |
| P-2 | PMP-1 | J-1 | 18.46 | 400 | 120 | 136.35 | 1.09 |
| P-3 | J-1 | J-2 | 43.74 | 400 | 120 | 78.30 | 0.62 |
| P-4 | J-2 | J-3 | 80.63 | 400 | 120 | 60.99 | 0.49 |
| P-5 | J-3 | J-4 | 34.40 | 400 | 120 | 60.99 | 0.49 |
| P-6 | J-4 | J-5 | 49.96 | 400 | 120 | 0.00 | 0.00 |
| P-7 | J-5 | J-6 | 40.94 | 400 | 120 | 0.00 | 0.00 |
| P-8 | J-6 | J-7 | 60.79 | 400 | 120 | 0.00 | 0.00 |
| P-9 | J-7 | J-8 | 89.77 | 400 | 120 | 0.00 | 0.00 |
| P-10 | J-2 | J-9 | 38.79 | 300 | 110 | 17.31 | 0.24 |
| P-12 | J-1 | J-11 | 91.67 | 300 | 110 | 58.05 | 0.82 |
| P-13 | J-11 | J-12 | 21.17 | 300 | 110 | 12.51 | 0.18 |
| P-14 | J-12 | J-13 | 4.84 | 300 | 110 | 0.00 | 0.00 |
| P-15 | J-13 | J-14 | 6.95 | 300 | 110 | 0.00 | 0.00 |
| P-16 | J-4 | J-15 | 90.66 | 300 | 110 | 60.99 | 0.86 |
| P-17 | J-11 | J-16 | 32.48 | 300 | 110 | 45.54 | 0.64 |
| P-18 | J-16 | J-17 | 55.74 | 300 | 110 | 33.03 | 0.47 |
| P-19 | J-17 | J-18 | 4.87 | 300 | 110 | 33.03 | 0.47 |
| P-20 | J-18 | J-19 | 48.92 | 300 | 110 | 20.52 | 0.29 |
| P-21 | J-19 | J-20 | 4.20 | 300 | 110 | 20.52 | 0.29 |
| P-22 | J-20 | J-15 | 12.06 | 300 | 110 | 8.01 | 0.11 |
| P-23 | J-15 | J-21 | 37.91 | 300 | 110 | 69.00 | 0.98 |
| P-24 | J-21 | J-22 | 4.09 | 300 | 110 | 69.00 | 0.98 |
| P-25 | J-22 | J-23 | 28.80 | 300 | 110 | 39.96 | 0.57 |
| P-26 | J-23 | J-24 | 2.89 | 300 | 110 | 39.96 | 0.57 |
| P-27 | J-24 | J-25 | 3.26 | 300 | 110 | 23.43 | 0.33 |
| P-28 | J-25 | J-26 | 3.16 | 300 | 110 | 14.85 | 0.21 |
| P-29 | J-26 | J-27 | 3.33 | 300 | 110 | 14.85 | 0.21 |
| P-30 | J-13 | J-28 | 17.04 | 200 | 110 | 0.00 | 0.00 |
| P-31 | J-12 | J-29 | 16.50 | 150 | 100 | 12.51 | 0.71 |
| P-32 | J-16 | J-30 | 16.40 | 150 | 100 | 12.51 | 0.71 |
| P-33 | J-17 | J-31 | 15.90 | 200 | 110 | 0.00 | 0.00 |
| P-34 | J-18 | J-32 | 15.88 | 150 | 100 | 12.51 | 0.71 |
| P-35 | J-19 | J-33 | 19.63 | 200 | 110 | 0.00 | 0.00 |
| P-36 | J-20 | J-34 | 19.17 | 150 | 100 | 12.51 | 0.71 |
| P-37 | J-21 | J-35 | 17.16 | 200 | 110 | 0.00 | 0.00 |
| P-38 | J-22 | J-36 | 16.98 | 150 | 100 | 12.51 | 0.71 |
| P-39 | J-27 | J-37 | 7.24 | 150 | 100 | 14.85 | 0.84 |
| P-40 | J-26 | J-38 | 6.96 | 200 | 110 | 0.00 | 0.00 |
| P-41 | J-25 | J-39 | 7.10 | 150 | 100 | 8.58 | 0.49 |
| P-42 | J-24 | J-40 | 6.62 | 150 | 100 | 16.53 | 0.94 |
| P-43 | J-23 | J-41 | 6.52 | 200 | 110 | 0.00 | 0.00 |
| P-44 | J-22 | J-42 | 8.51 | 150 | 100 | 16.53 | 0.94 |
| P-45 | J-21 | J-43 | 8.21 | 200 | 110 | 0.00 | 0.00 |
| P-46 | J-9 | J-44 | 4.50 | 150 | 100 | 17.31 | 0.98 |
| P-47 | J-9 | J-45 | 10.56 | 200 | 110 | 0.00 | 0.00 |

| Fire Flow Table (Maximum Day plus Fire Flow) | | | | | |
|---|---|---|---|---|---|
| ID | Total Fire Demand | Total Demand | Total Available Fire Flow | Available Fire Flow | Fire Flow Met? |
| | *(L/s)* | *(L/s)* | *(L/s)* | *(L/s)* | |
| J-3 | 150.00 | 150.00 | 167.84 | 167.84 | TRUE |
| J-5 | 150.00 | 150.00 | 165.62 | 165.62 | TRUE |
| J-7 | 150.00 | 150.00 | 162.89 | 162.89 | TRUE |
| J-8 | 150.00 | 150.00 | 160.58 | 160.58 | TRUE |
| J-9 | 150.00 | 150.00 | 170.17 | 170.17 | TRUE |
| J-11 | 150.00 | 150.00 | 168.81 | 168.81 | TRUE |
| J-14 | 150.00 | 150.00 | 168.83 | 168.83 | TRUE |
| J-15 | 150.00 | 150.00 | 164.12 | 164.12 | TRUE |
| J-17 | 150.00 | 150.00 | 166.05 | 166.05 | TRUE |
| J-21 | 150.00 | 150.00 | 157.45 | 157.45 | TRUE |
| J-23 | 150.00 | 150.00 | 152.80 | 152.80 | TRUE |
| J-28 | 150.00 | 150.00 | 157.23 | 157.23 | TRUE |
| J-31 | 150.00 | 150.00 | 158.64 | 158.64 | TRUE |
| J-33 | 150.00 | 150.00 | 154.31 | 154.31 | TRUE |
| J-35 | 150.00 | 150.00 | 150.32 | 150.32 | TRUE |
| J-38 | 150.00 | 150.00 | 147.10 | 147.10 | FALSE |
| J-41 | 150.00 | 150.00 | 148.43 | 148.43 | FALSE |
| J-43 | 150.00 | 150.00 | 157.46 | 157.46 | TRUE |
| J-45 | 150.00 | 150.00 | 164.59 | 164.59 | TRUE |
| J-45 | 250.00 | 250.00 | 261.85 | 261.85 | TRUE |

| | |
|---|---|
| **MIN** | **147.1** |
| **MAX** | **261.9** |

# Scenario: Maximum Day
# Available Fire Flow



# Appendix F Manufactured Treatment Device Sizing and Maintenance Information

# Hydroworks Sizing Summary

# Kingston Road - OGS201
# Pickering, Ontario

**06-29-2023**

## Recommended Size: HydroDome HD 4

**A HydroDome HD 4 is recommended to provide 80 % annual TSS removal based on a drainage area of .54 (ha) with an imperviousness of 100 % and Toronto Central, Ontario rainfall for the 20 um to 2000 um particle size distribution.**

**The recommended HydroDome HD 4 treats 100 % of the annual runoff and provides 87 % annual TSS removal for the Toronto Central rainfall records and 20 um to 2000 um particle size distribution.**

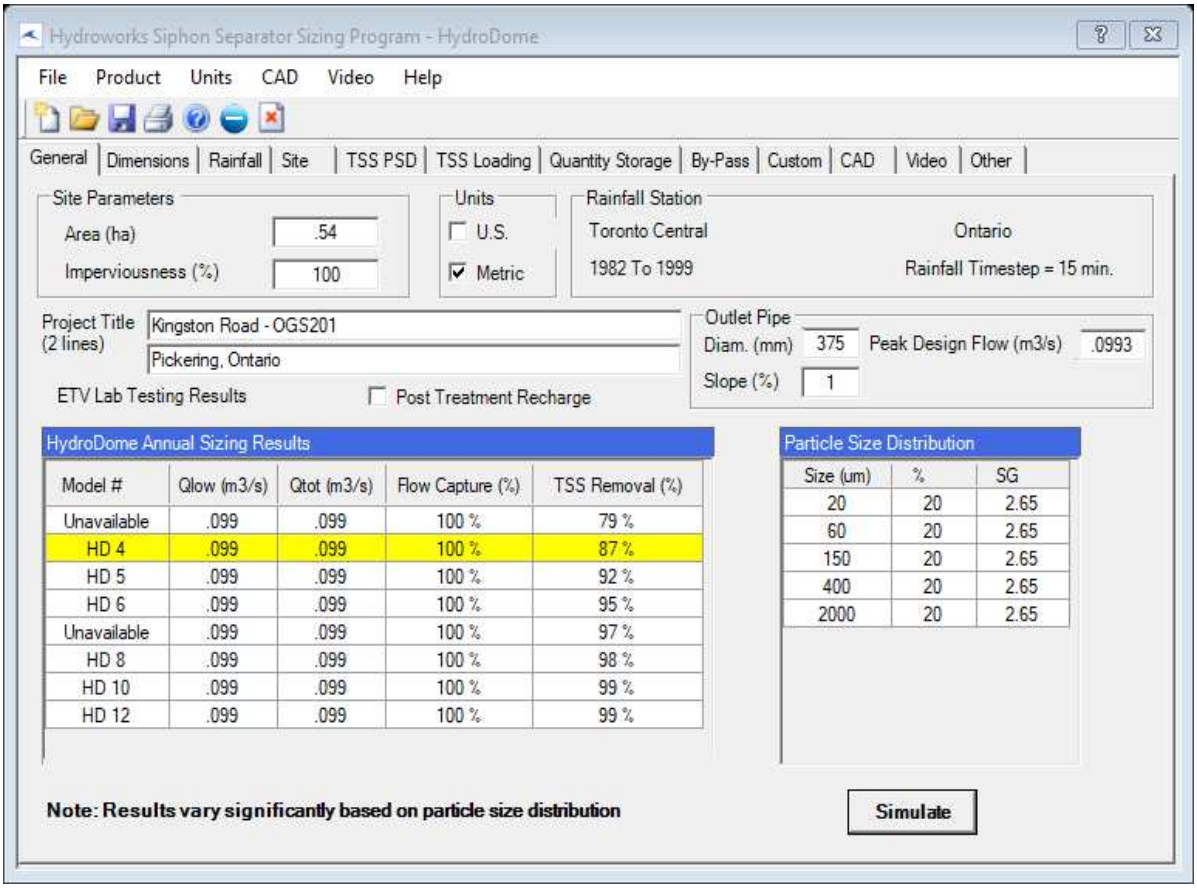
**The HydroDome has a siphon which creates a discontinuity in headloss. The given peak flow of .1 (m3/s) is greater than the full pipe flow of .01 (m3/s) indicating the pipe will be surcharged during the peak flow. Full pipe flow was assumed for the headloss calculations. The pressure head in the pipe was not evaluated since this would require a hydraulic gradeline analysis. The headloss was calculated to be 315 (mm) above the crown of the 375 (mm) outlet pipe.**

**This summary report provides the main parameters that were used for sizing. These parameters are shown on the summary tables and graphs provided in this report.**

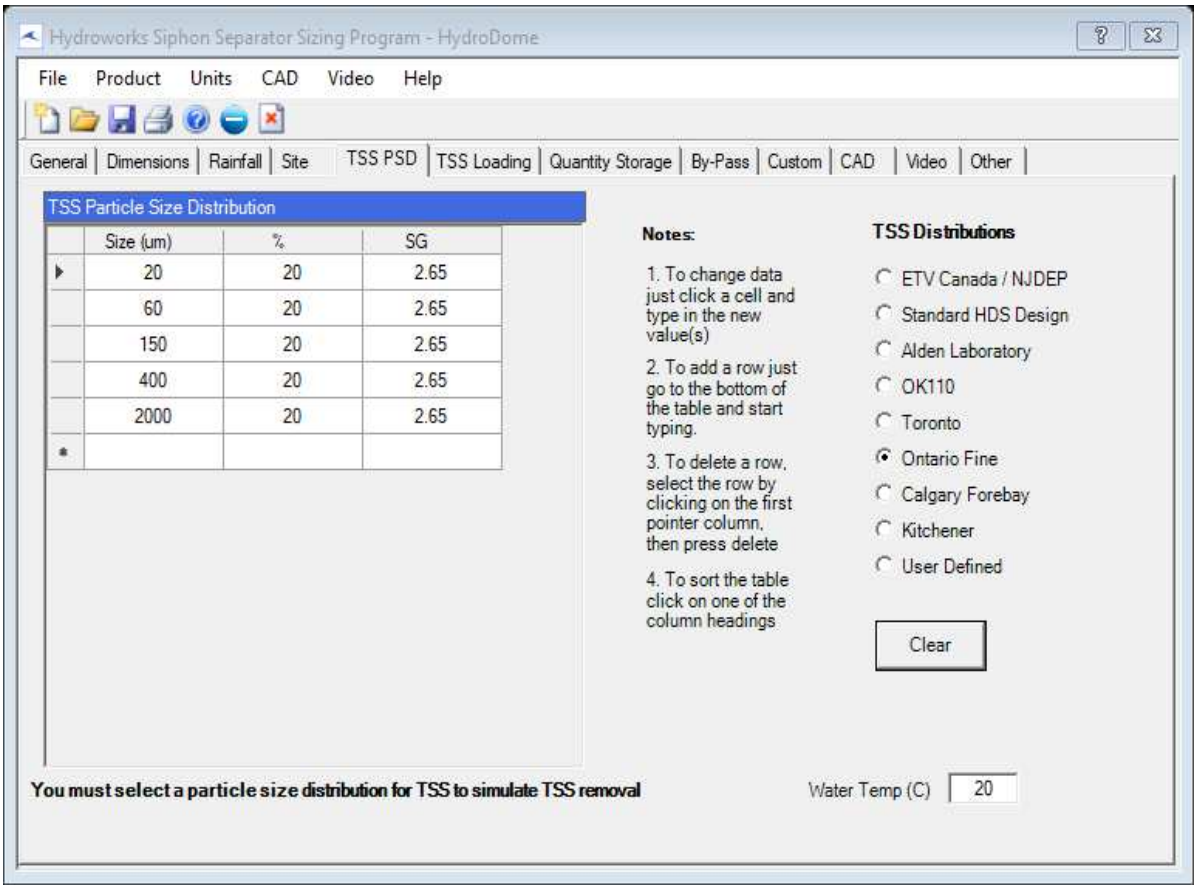
**If you have any questions regarding this sizing summary please do not hesitate to contact Hydroworks at 888-290-7900 or email us at support@hydroworks.com.**

The sizing program is for sizing purposes only and does not address any site specific parameters such as hydraulic gradeline, tailwater submergence, groundwater, soils bearing capacity, etc. Headloss calculations are not a hydraulic gradeline calculation since this requires a starting water level and an analysis of the entire system downstream of the HydroDome .

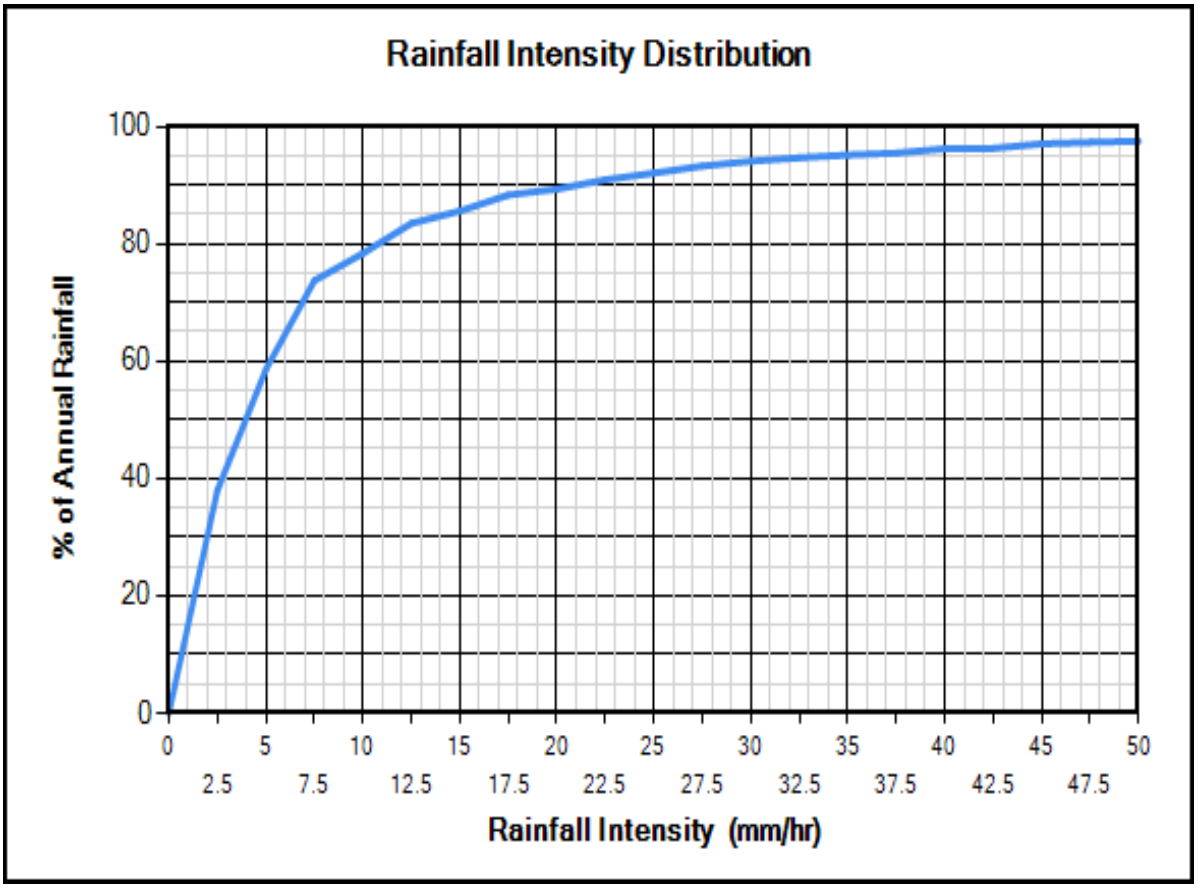
## TSS Removal Sizing Summary



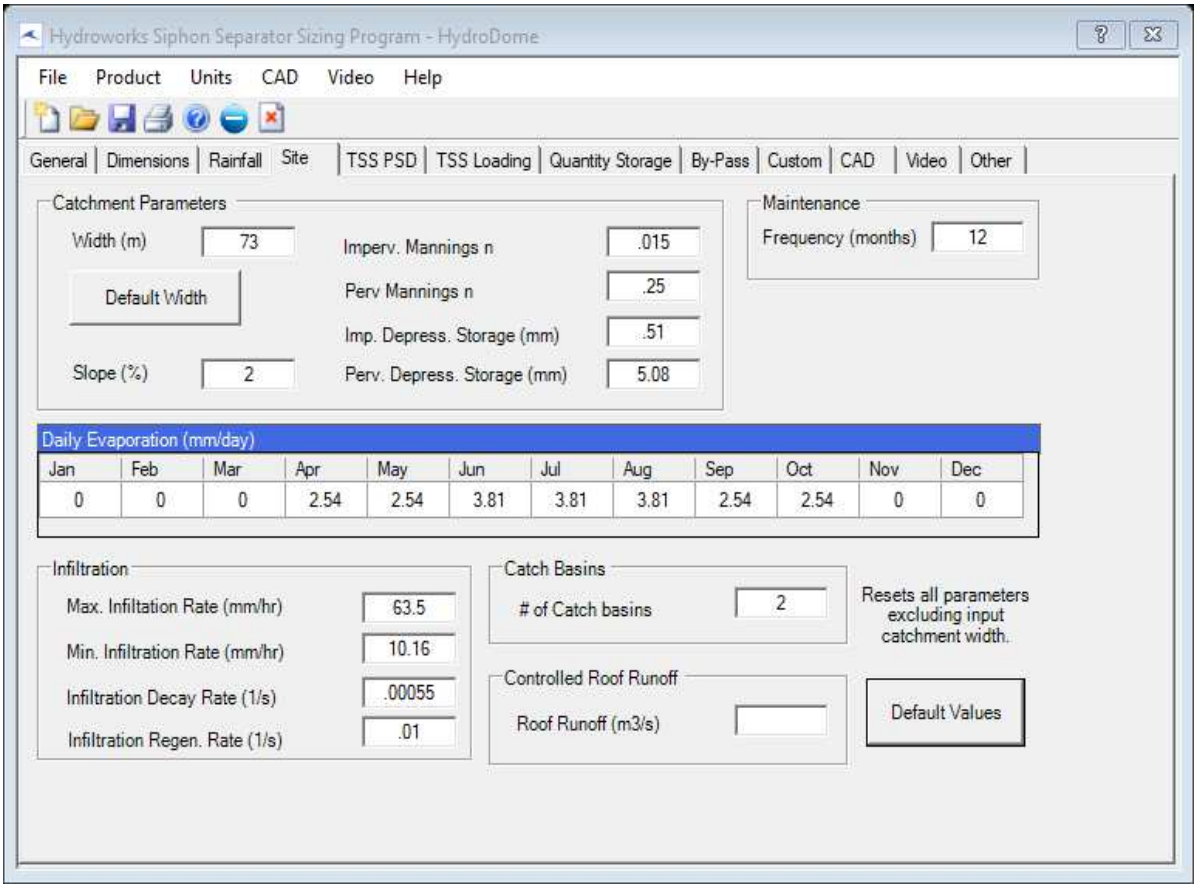

## TSS Particle Size Distribution



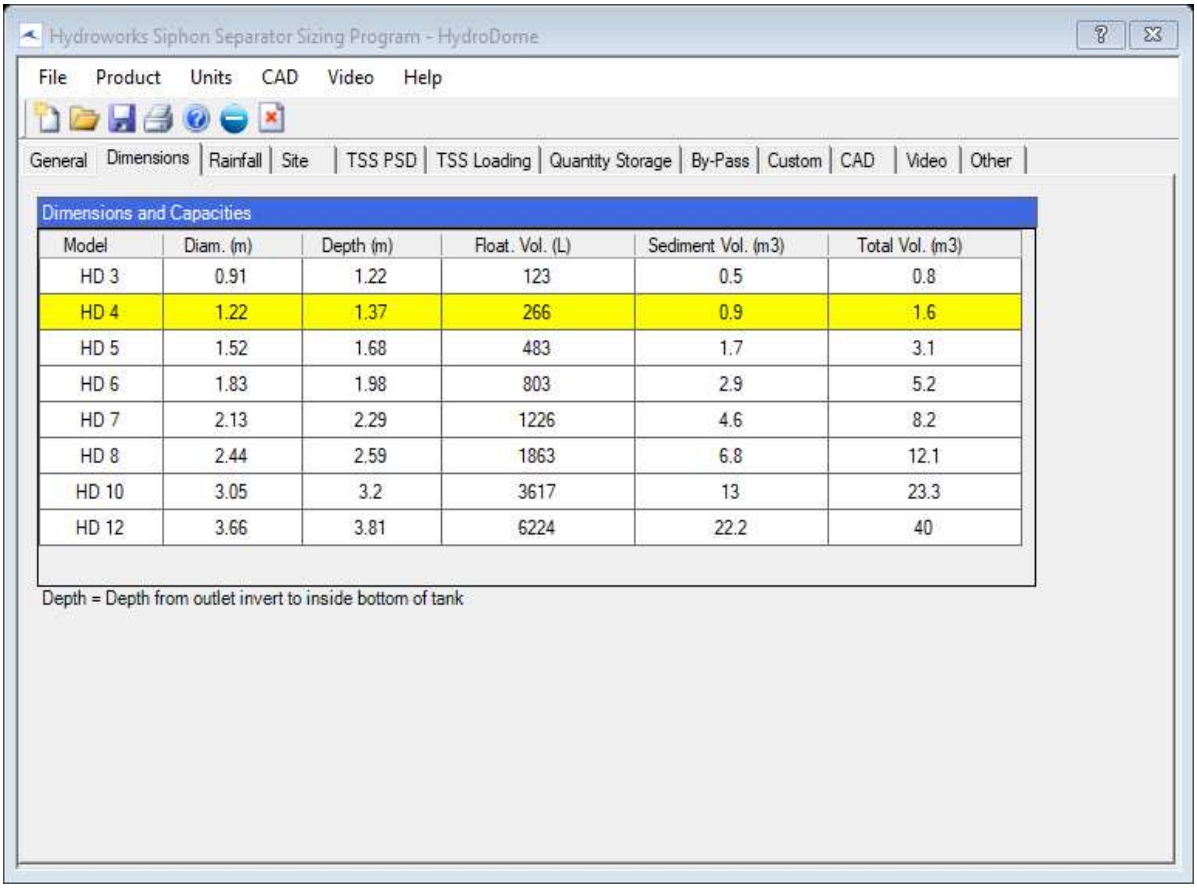
**Rainfall Station - Toronto Central, Ontario(1982 To 1999)**




**Site Physical Characteristics**



## Dimensions And Capacities

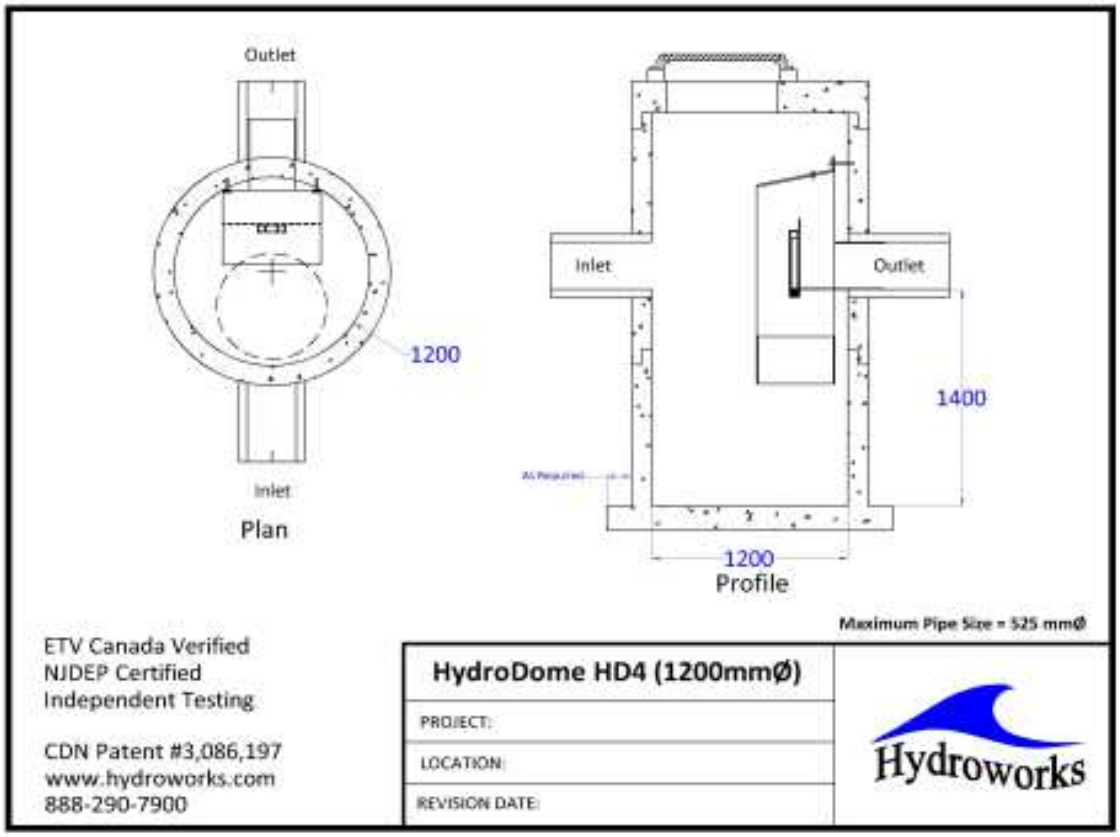



Dimensions and Capacities

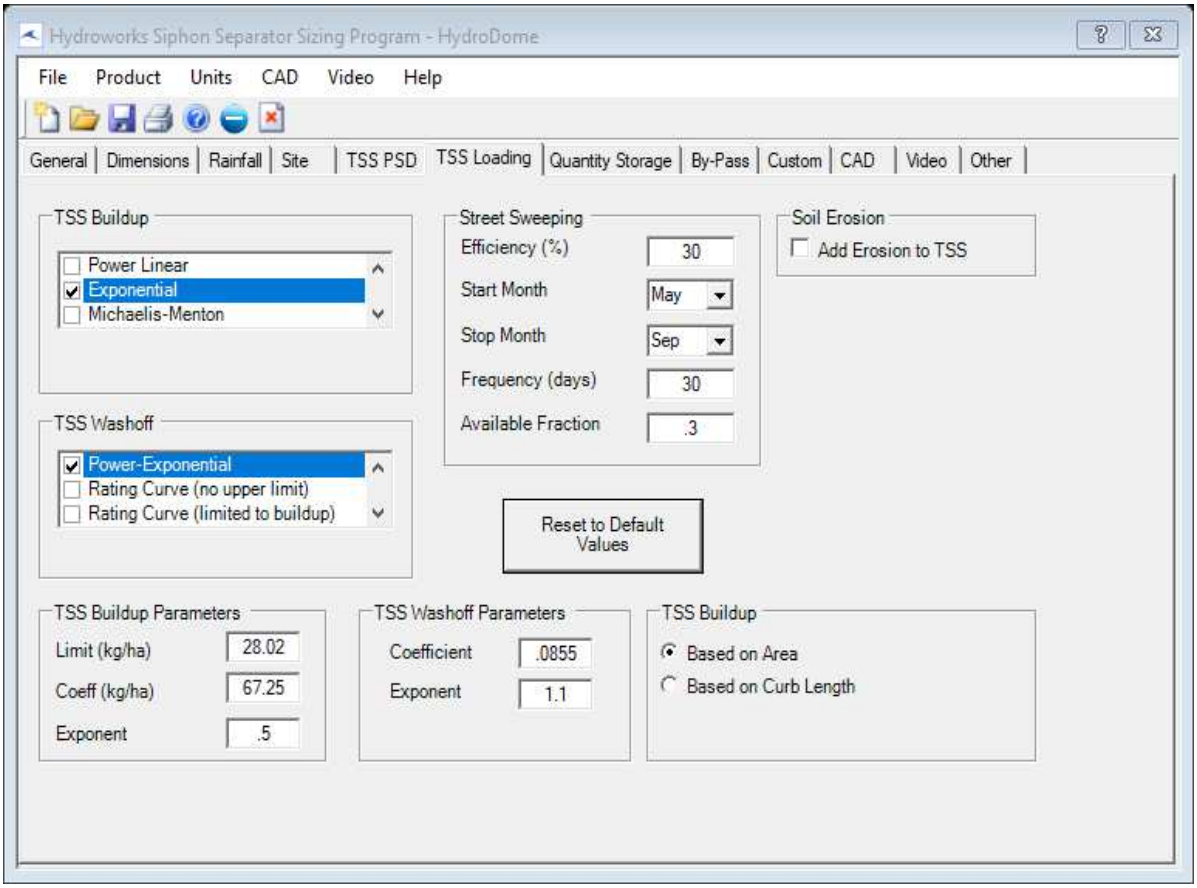
| Model | Diam. (m) | Depth (m) | Float. Vol. (L) | Sediment Vol. (m3) | Total Vol. (m3) |
|---|---|---|---|---|---|
| HD 3 | 0.91 | 1.22 | 123 | 0.5 | 0.8 |
| HD 4 | 1.22 | 1.37 | 266 | 0.9 | 1.6 |
| HD 5 | 1.52 | 1.68 | 483 | 1.7 | 3.1 |
| HD 6 | 1.83 | 1.98 | 803 | 2.9 | 5.2 |
| HD 7 | 2.13 | 2.29 | 1226 | 4.6 | 8.2 |
| HD 8 | 2.44 | 2.59 | 1863 | 6.8 | 12.1 |
| HD 10 | 3.05 | 3.2 | 3617 | 13 | 23.3 |
| HD 12 | 3.66 | 3.81 | 6224 | 22.2 | 40 |

Depth = Depth from outlet invert to inside bottom of tank

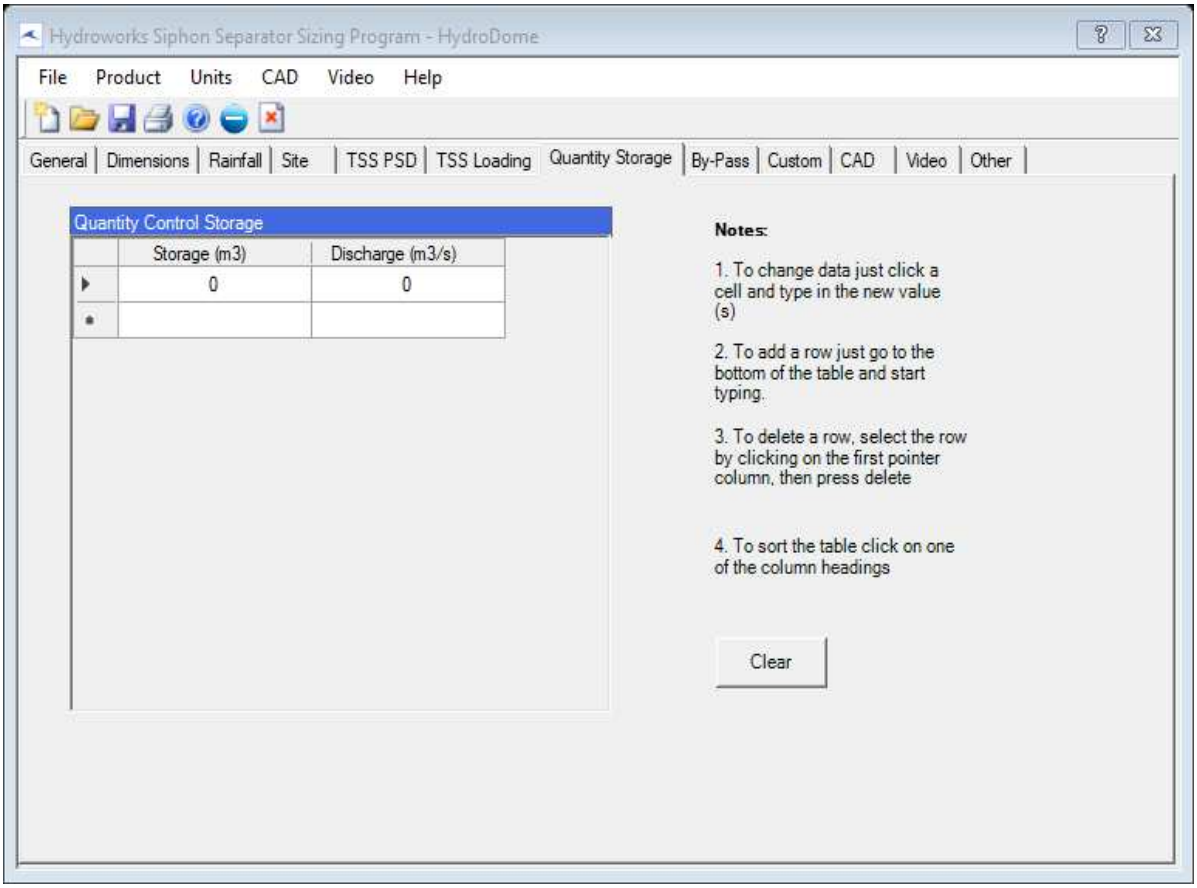
## Generic HD 4 CAD Drawing



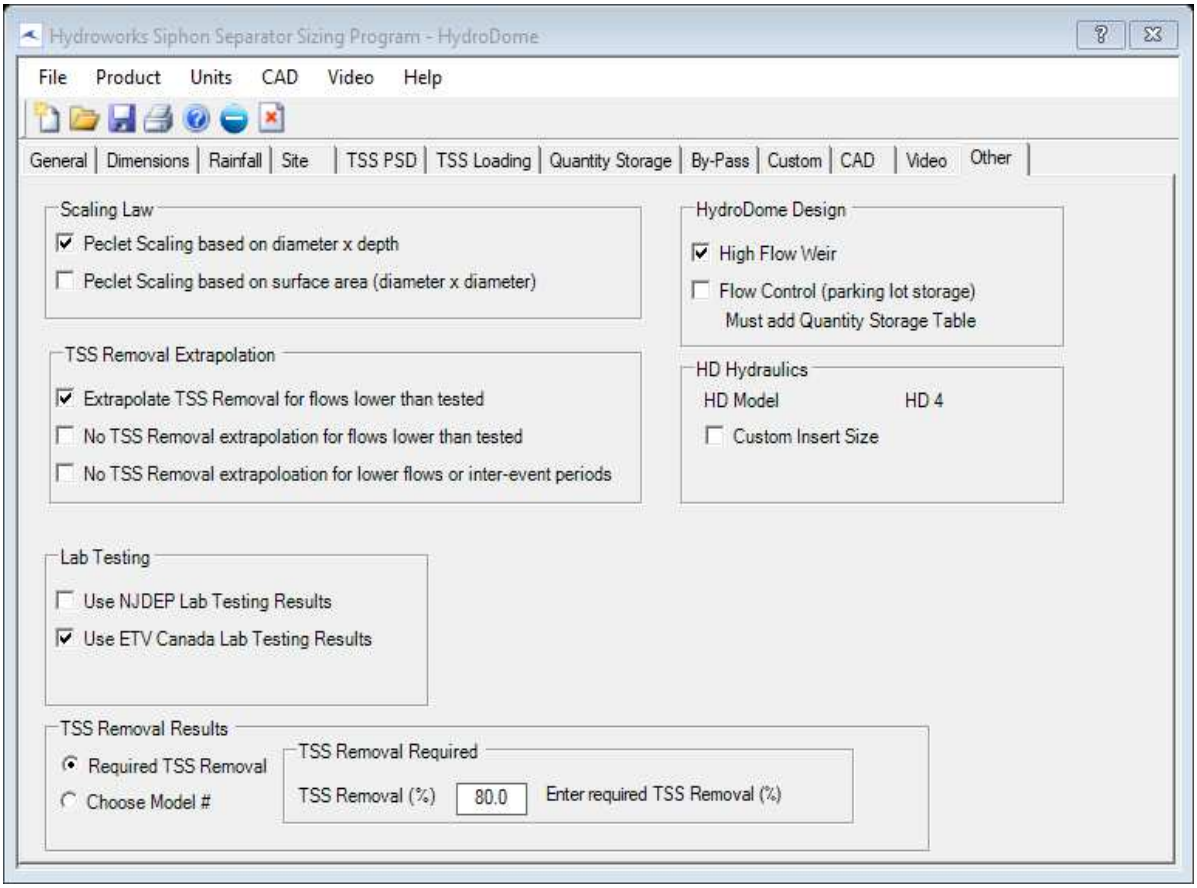
## TSS Buildup And Washoff




## Upstream Quantity Storage



**Other Parameters**




**Flagged Issues**

**If there is underground detention storage upstream of the HydroDome please contact Hydroworks to ensure it has been modeled correctly.**

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**www.hydroworks.com**

# Hydroworks Sizing Summary

# Kingston Road - OGS204
# Pickering, Ontario

**06-29-2023**

## Recommended Size: HydroDome HD 4

**A HydroDome HD 4 is recommended to provide 80 % annual TSS removal based on a drainage area of .63 (ha) with an imperviousness of 100 % and Toronto Central, Ontario rainfall for the 20 um to 2000 um particle size distribution.**

**The recommended HydroDome HD 4 treats 100 % of the annual runoff and provides 85 % annual TSS removal for the Toronto Central rainfall records and 20 um to 2000 um particle size distribution.**

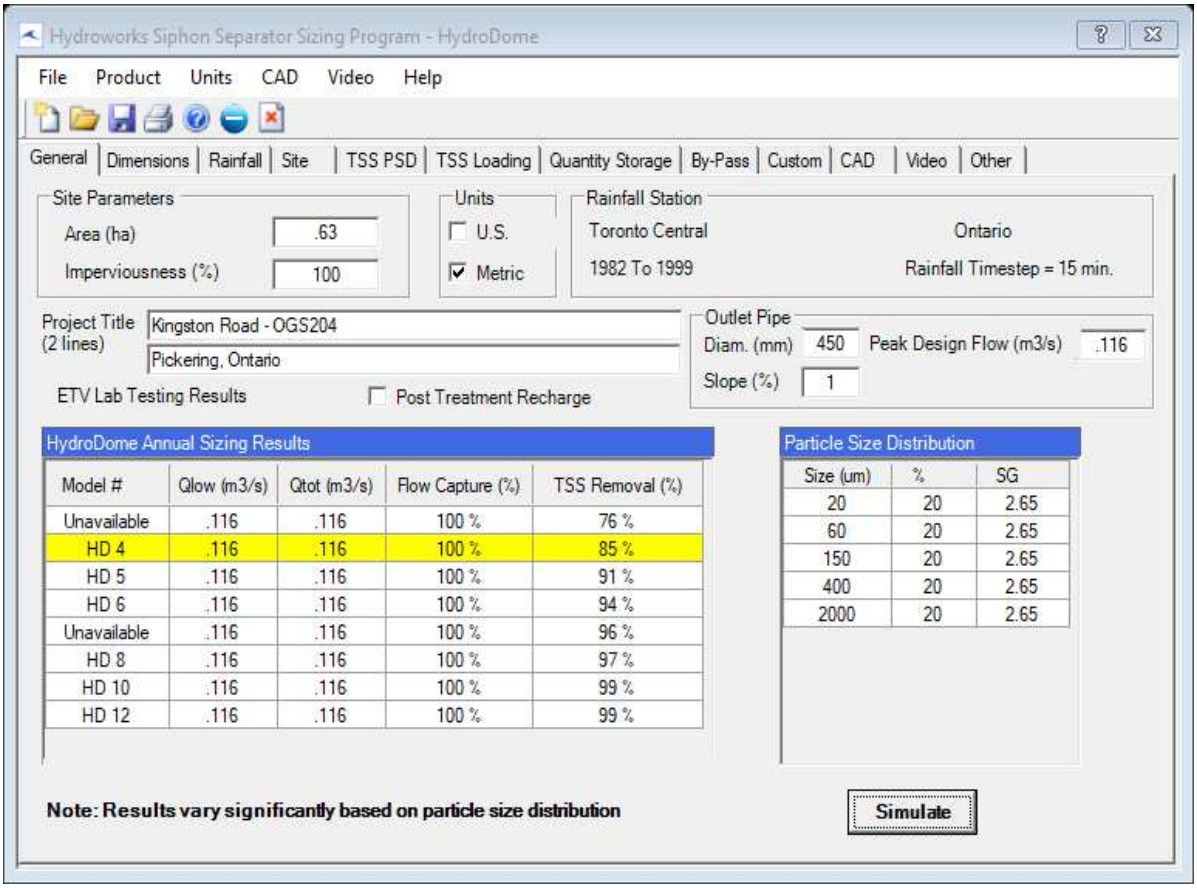
**The HydroDome has a siphon which creates a discontinuity in headloss. The given peak flow of .116 (m3/s) Is less than the full pipe flow of .29 (m3/s) indicating free flow in the pipe during the peak flow assuming no tailwater condition. Partial pipe flow was assumed for the headloss calculations. The headloss was calculated to be 332 (mm) above the crown of the 450 (mm) outlet pipe.**

**This summary report provides the main parameters that were used for sizing. These parameters are shown on the summary tables and graphs provided in this report.**

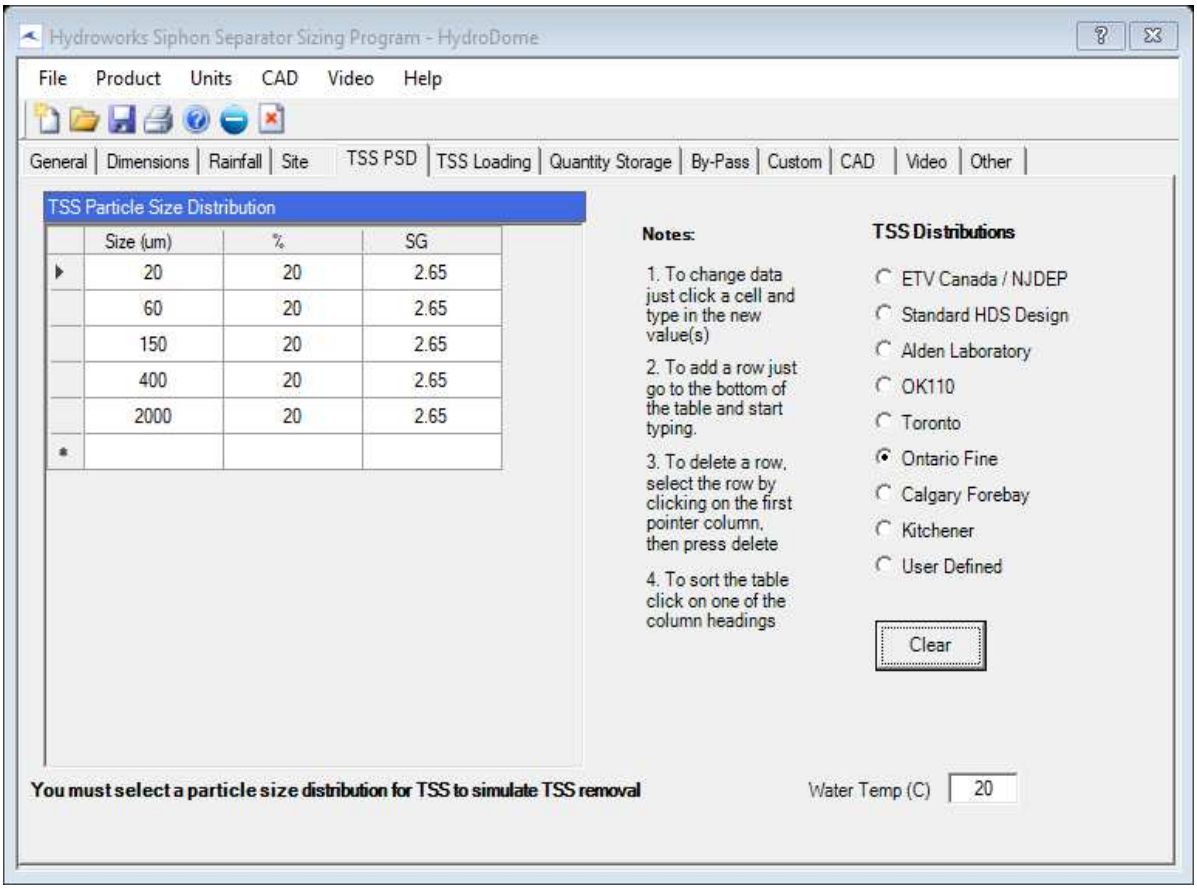
**If you have any questions regarding this sizing summary please do not hesitate to contact Hydroworks at 888-290-7900 or email us at support@hydroworks.com.**

The sizing program is for sizing purposes only and does not address any site specific parameters such as hydraulic gradeline, tailwater submergence, groundwater, soils bearing capacity, etc. Headloss calculations are not a hydraulic gradeline calculation since this requires a starting water level and an analysis of the entire system downstream of the HydroDome .

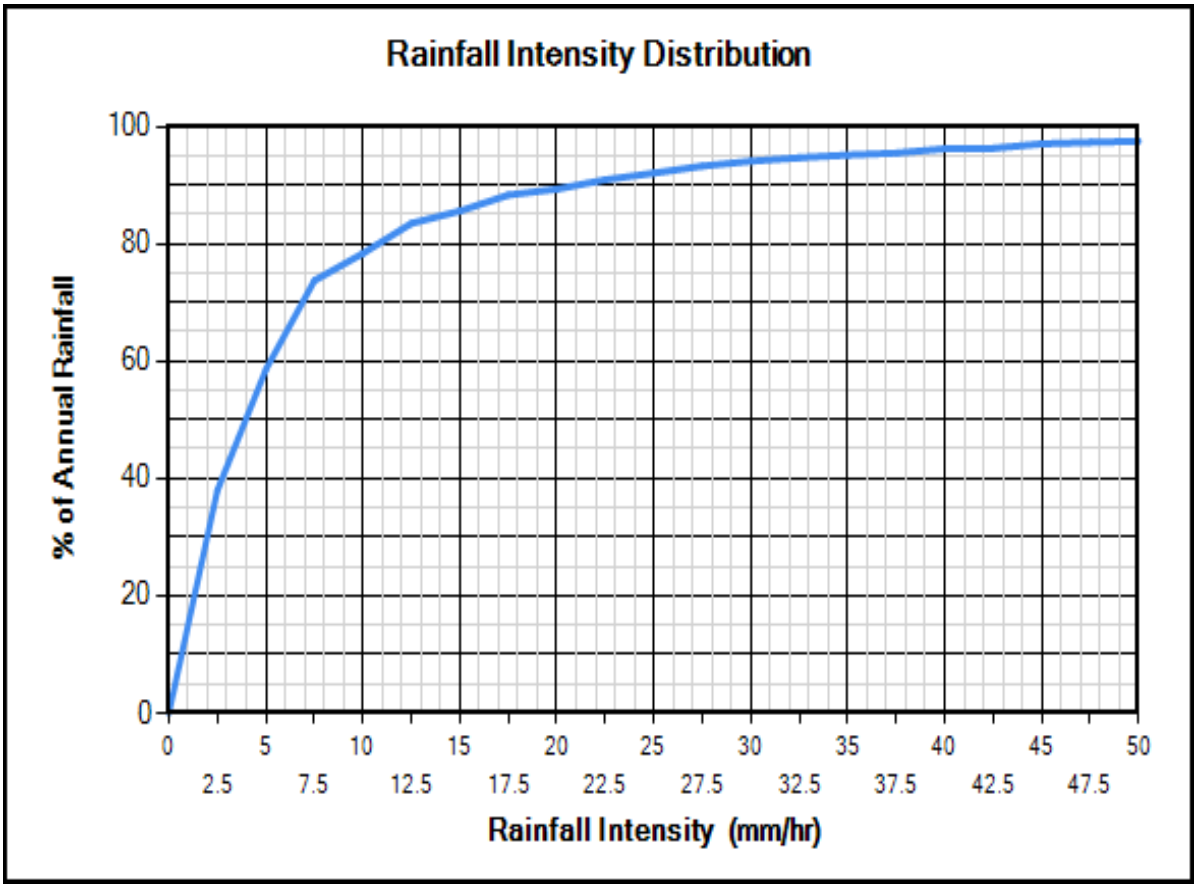
## TSS Removal Sizing Summary



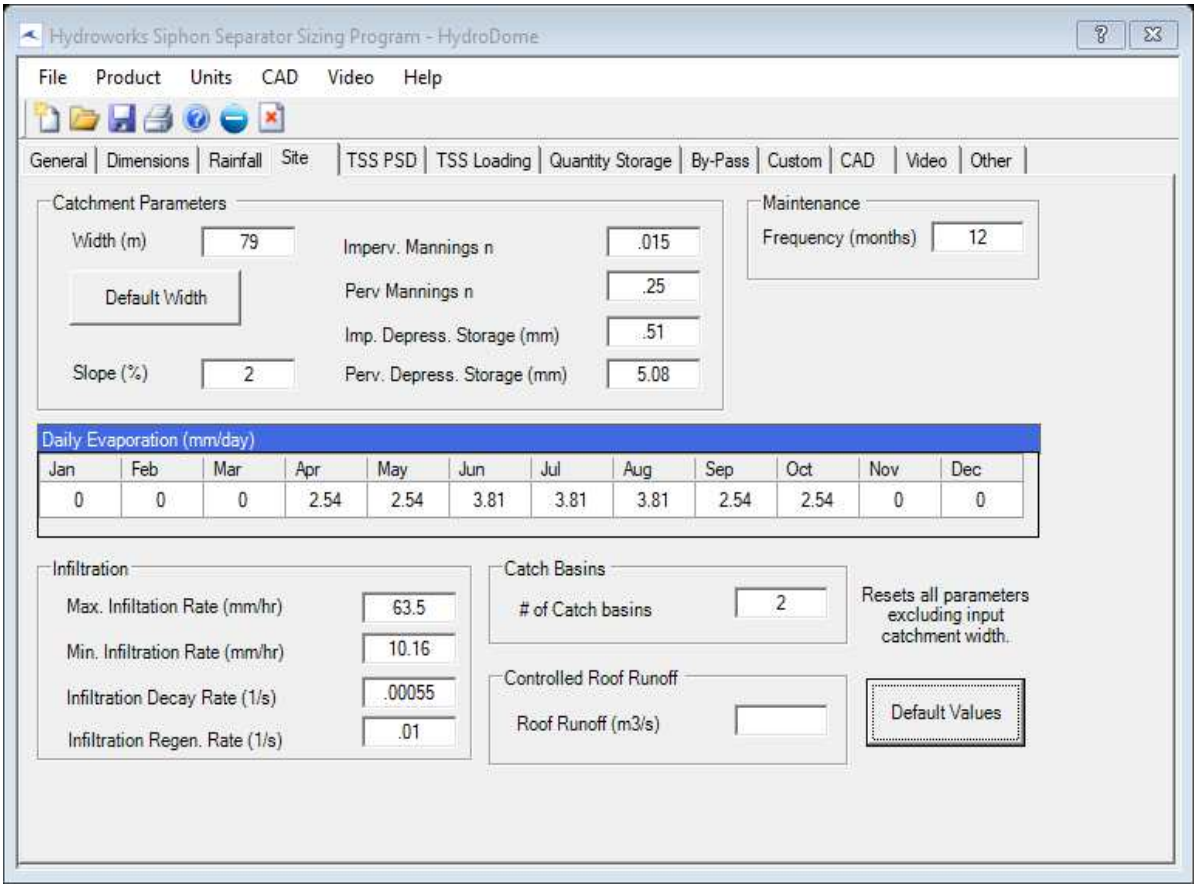

## TSS Particle Size Distribution



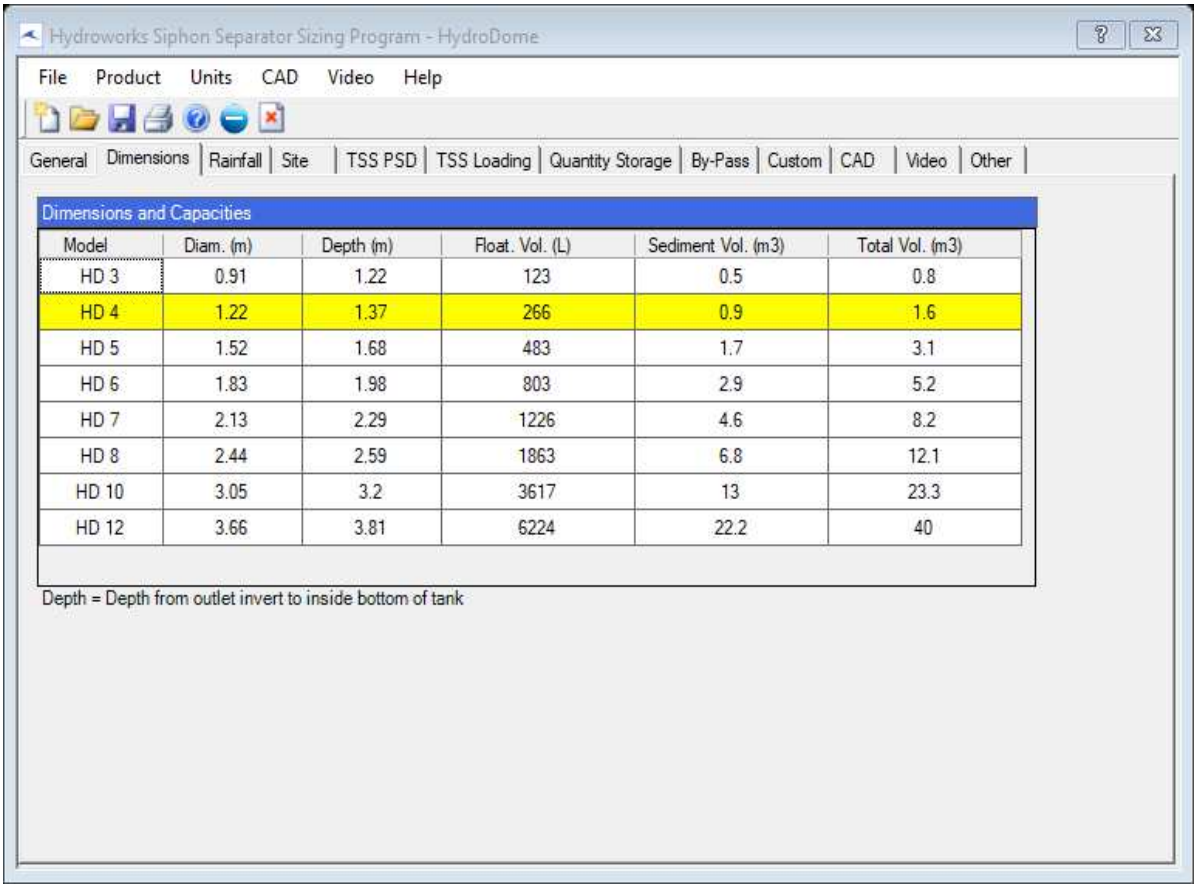
**Rainfall Station - Toronto Central, Ontario(1982 To 1999)**




**Site Physical Characteristics**



## Dimensions And Capacities

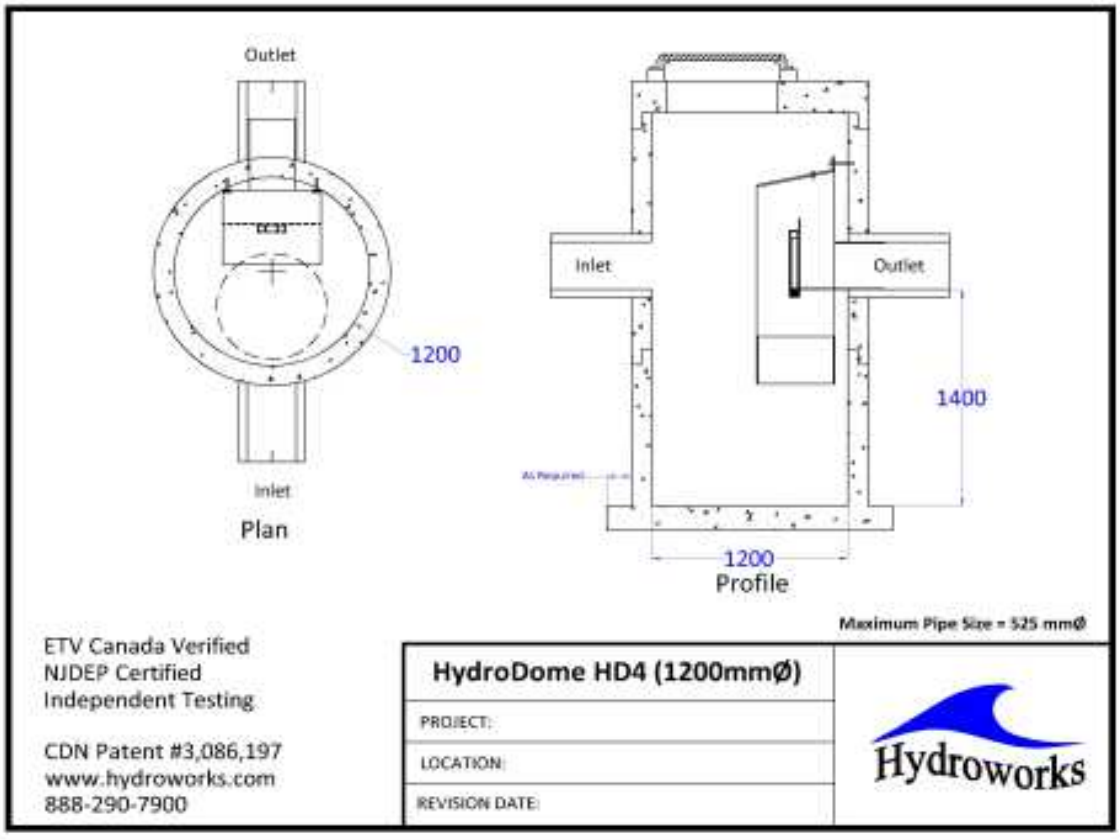



Dimensions and Capacities

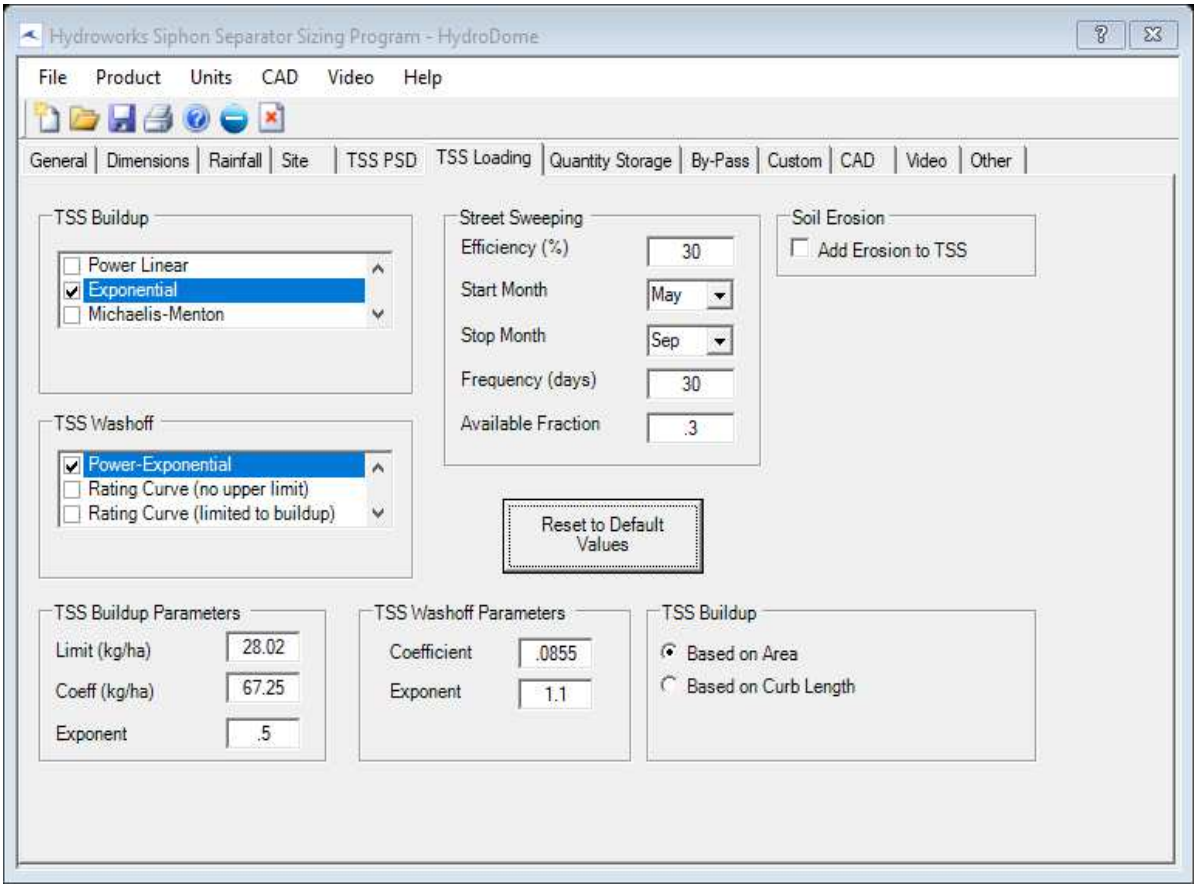
| Model | Diam. (m) | Depth (m) | Float. Vol. (L) | Sediment Vol. (m3) | Total Vol. (m3) |
|---|---|---|---|---|---|
| HD 3 | 0.91 | 1.22 | 123 | 0.5 | 0.8 |
| HD 4 | 1.22 | 1.37 | 266 | 0.9 | 1.6 |
| HD 5 | 1.52 | 1.68 | 483 | 1.7 | 3.1 |
| HD 6 | 1.83 | 1.98 | 803 | 2.9 | 5.2 |
| HD 7 | 2.13 | 2.29 | 1226 | 4.6 | 8.2 |
| HD 8 | 2.44 | 2.59 | 1863 | 6.8 | 12.1 |
| HD 10 | 3.05 | 3.2 | 3617 | 13 | 23.3 |
| HD 12 | 3.66 | 3.81 | 6224 | 22.2 | 40 |

Depth = Depth from outlet invert to inside bottom of tank

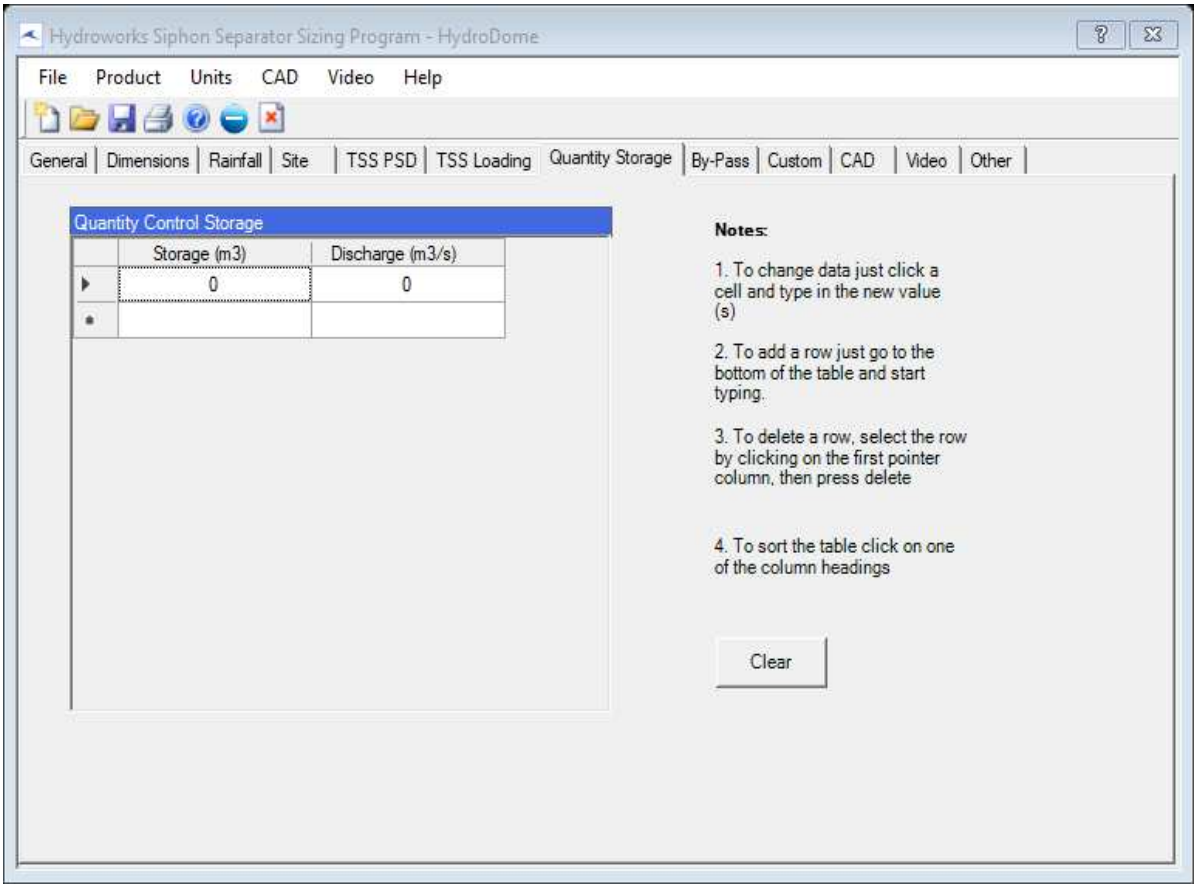
## Generic HD 4 CAD Drawing



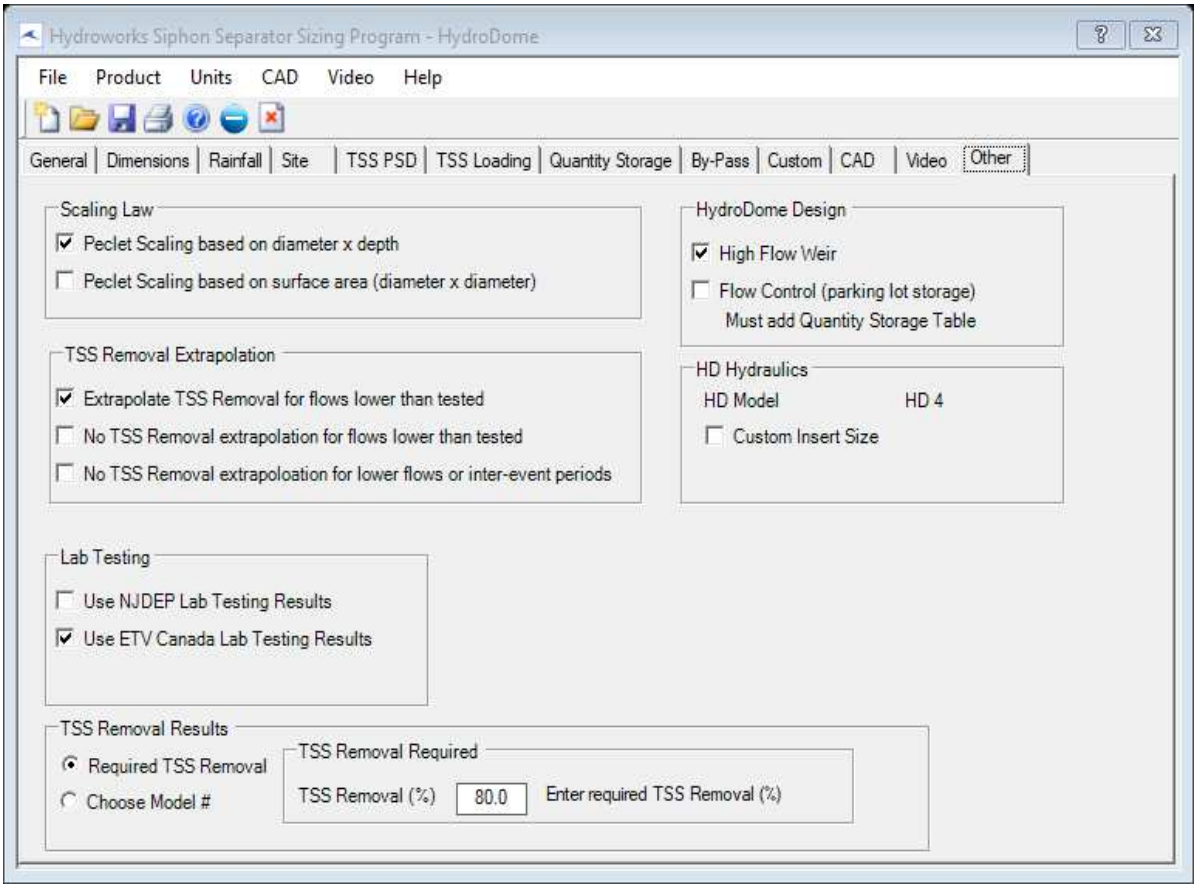
## TSS Buildup And Washoff




## Upstream Quantity Storage



**Other Parameters**




**Flagged Issues**

**If there is underground detention storage upstream of the HydroDome please contact Hydroworks to ensure it has been modeled correctly.**

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# Hydroworks Sizing Summary

# Kingston Road - OGS205
# Pickering, Ontario

**06-29-2023**

## Recommended Size: HydroDome HD 4

**A HydroDome HD 4 is recommended to provide 80 % annual TSS removal based on a drainage area of .43 (ha) with an imperviousness of 100 % and Toronto Central, Ontario rainfall for the 20 um to 2000 um particle size distribution.**

**The recommended HydroDome HD 4 treats 100 % of the annual runoff and provides 90 % annual TSS removal for the Toronto Central rainfall records and 20 um to 2000 um particle size distribution.**

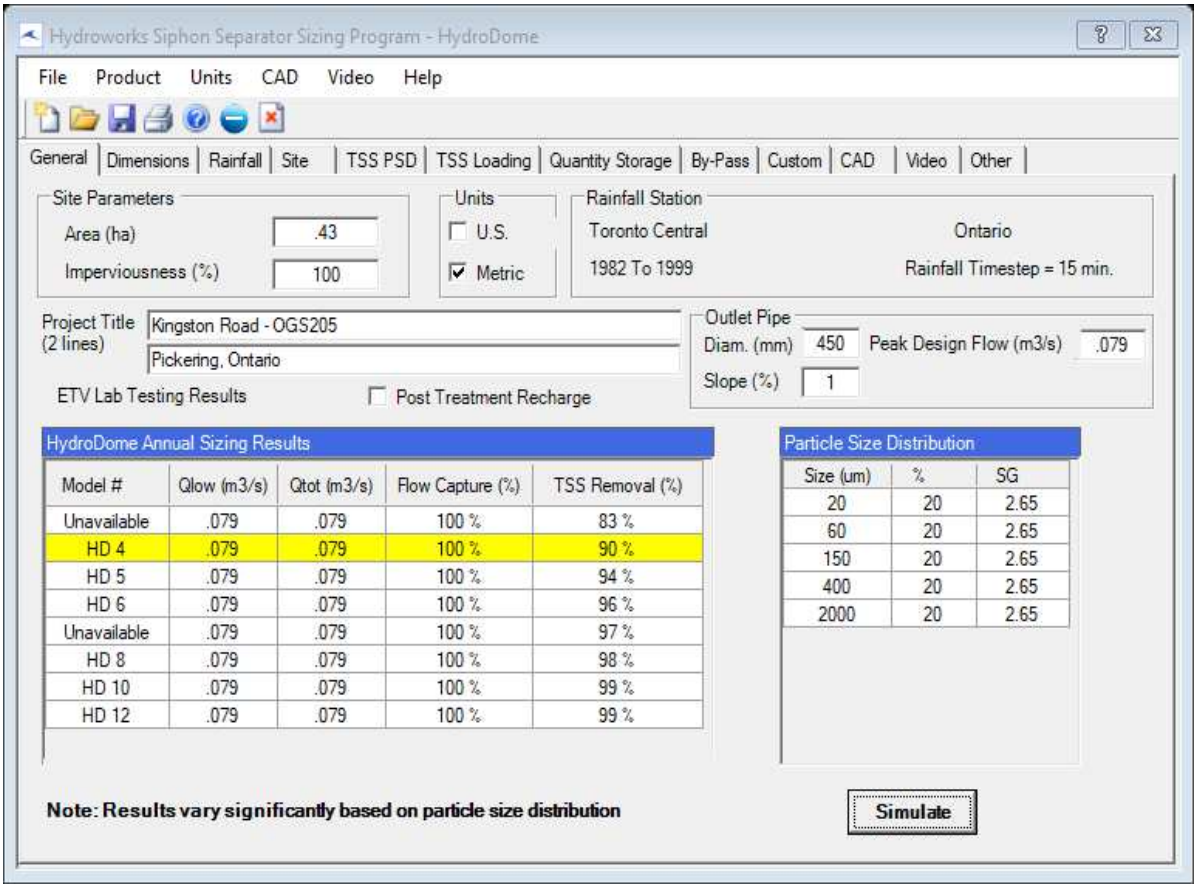
**The HydroDome has a siphon which creates a discontinuity in headloss. The given peak flow of .079 (m3/s) Is less than the full pipe flow of .29 (m3/s) indicating free flow in the pipe during the peak flow assuming no tailwater condition. Partial pipe flow was assumed for the headloss calculations. The headloss was calculated to be 292 (mm) above the crown of the 450 (mm) outlet pipe.**

**This summary report provides the main parameters that were used for sizing. These parameters are shown on the summary tables and graphs provided in this report.**

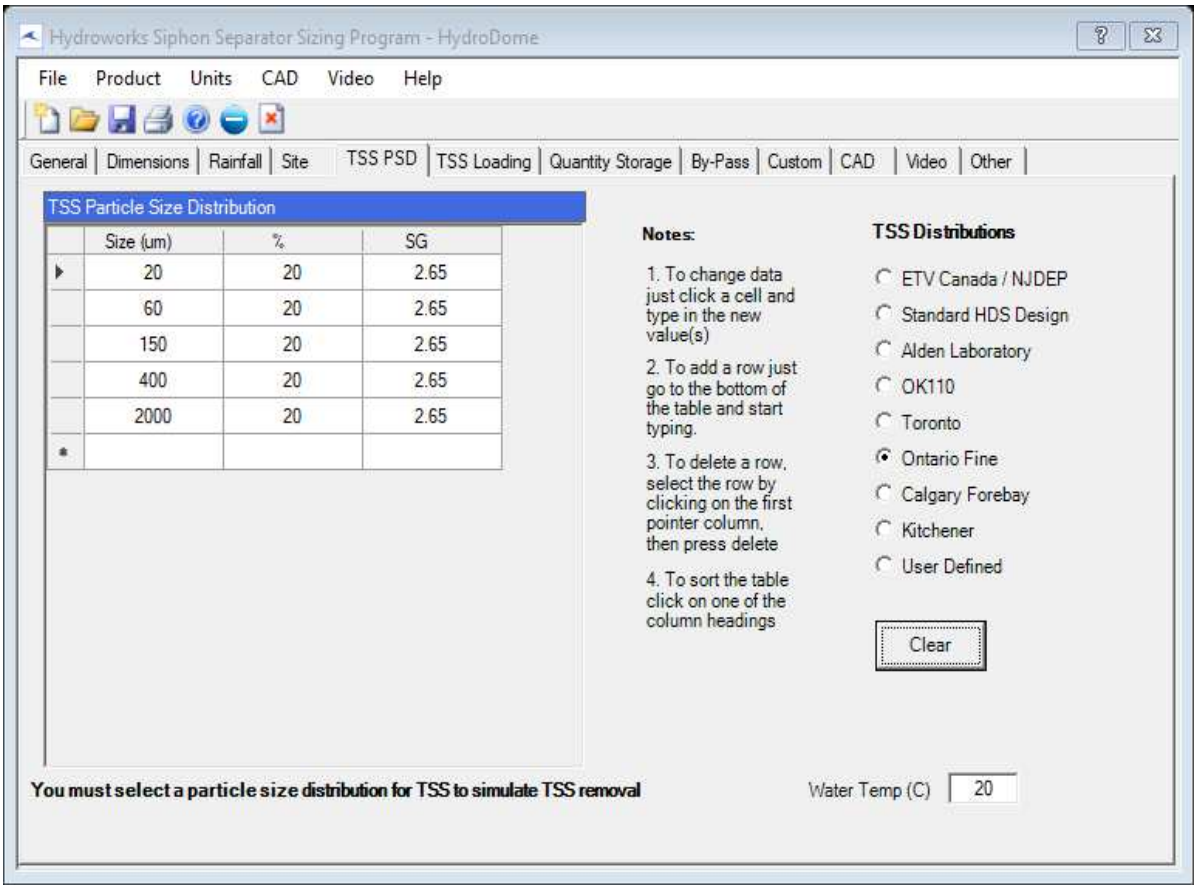
**If you have any questions regarding this sizing summary please do not hesitate to contact Hydroworks at 888-290-7900 or email us at support@hydroworks.com.**

The sizing program is for sizing purposes only and does not address any site specific parameters such as hydraulic gradeline, tailwater submergence, groundwater, soils bearing capacity, etc. Headloss calculations are not a hydraulic gradeline calculation since this requires a starting water level and an analysis of the entire system downstream of the HydroDome .

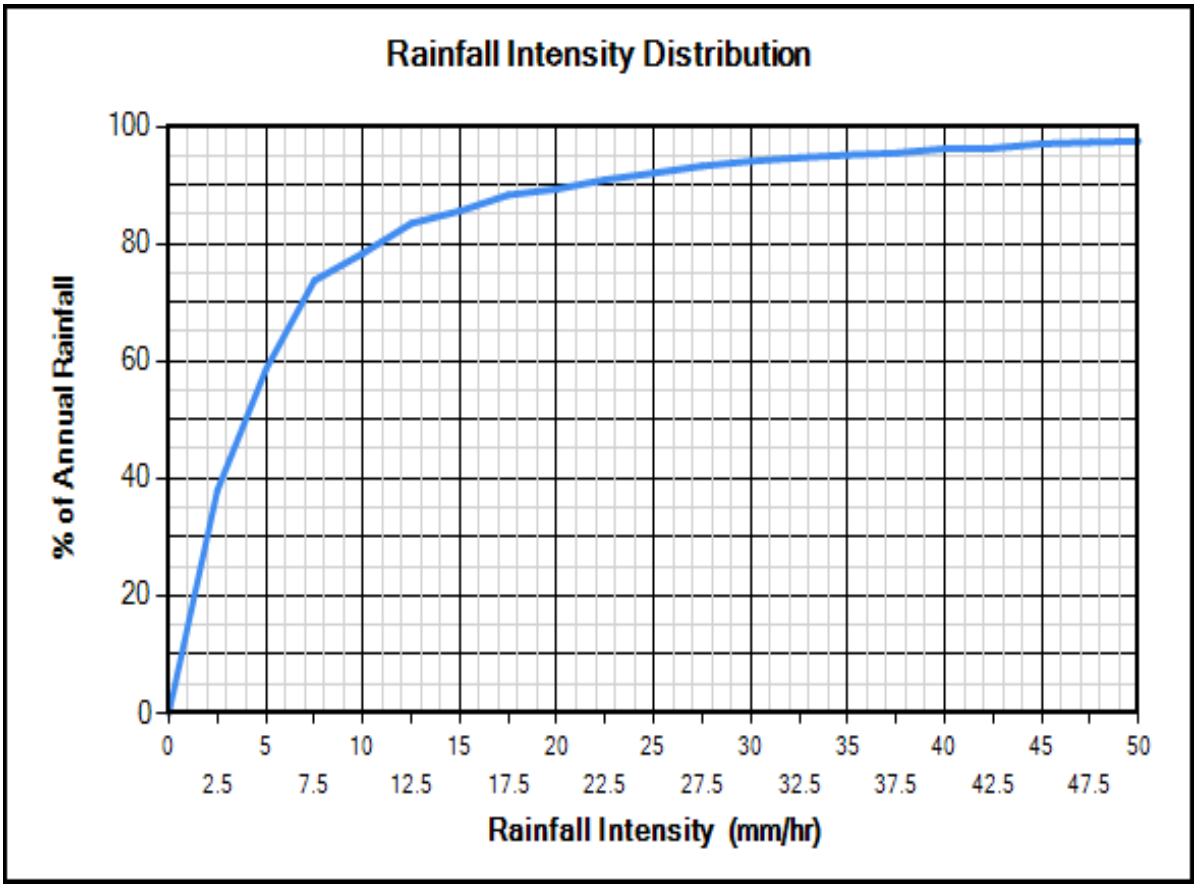
## TSS Removal Sizing Summary



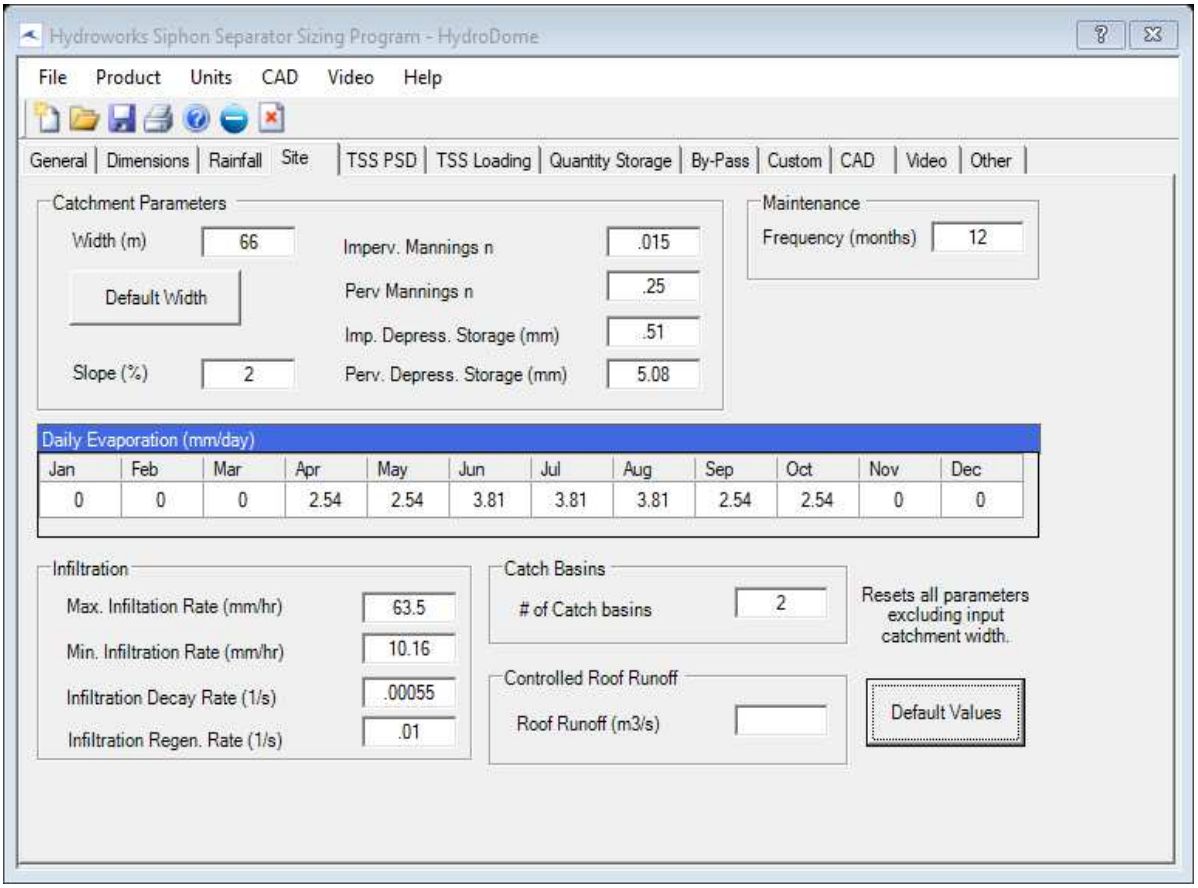

## TSS Particle Size Distribution



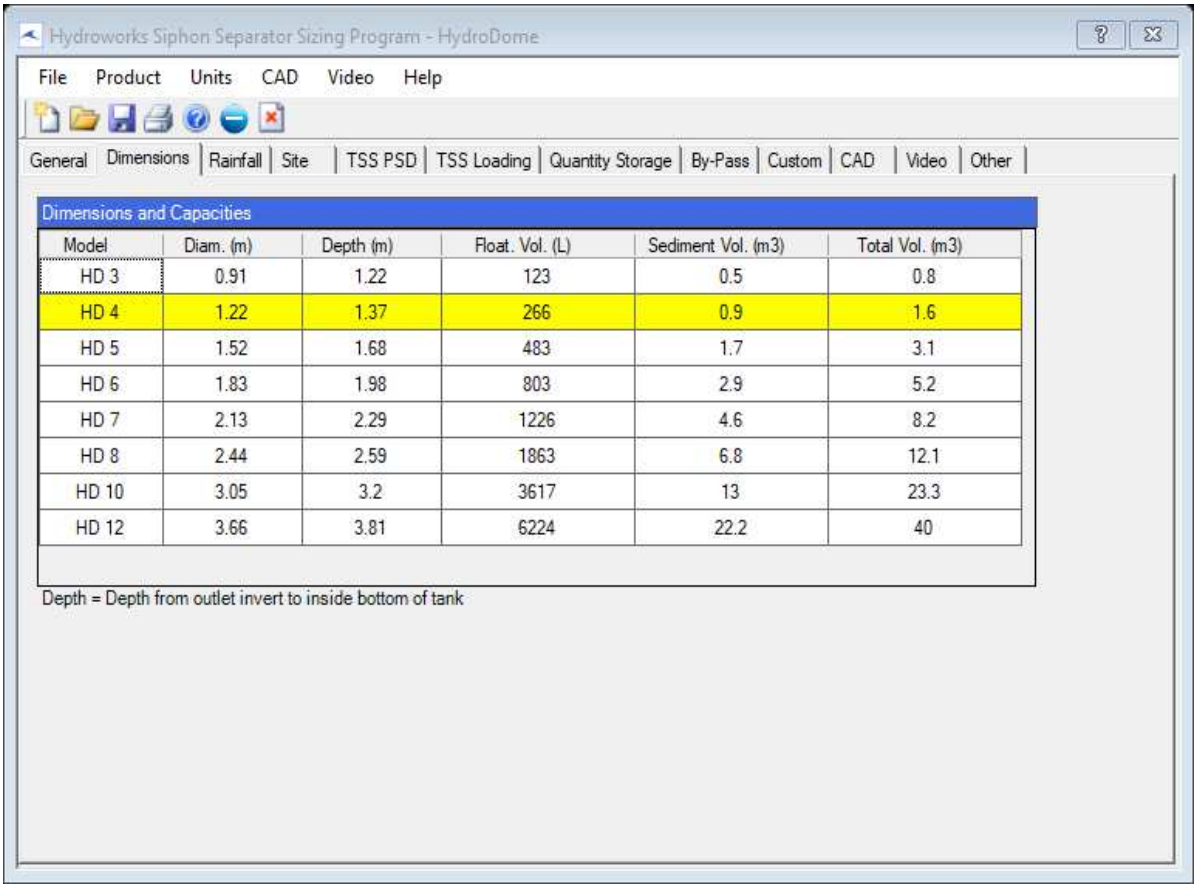
**Rainfall Station - Toronto Central, Ontario(1982 To 1999)**




**Site Physical Characteristics**



## Dimensions And Capacities

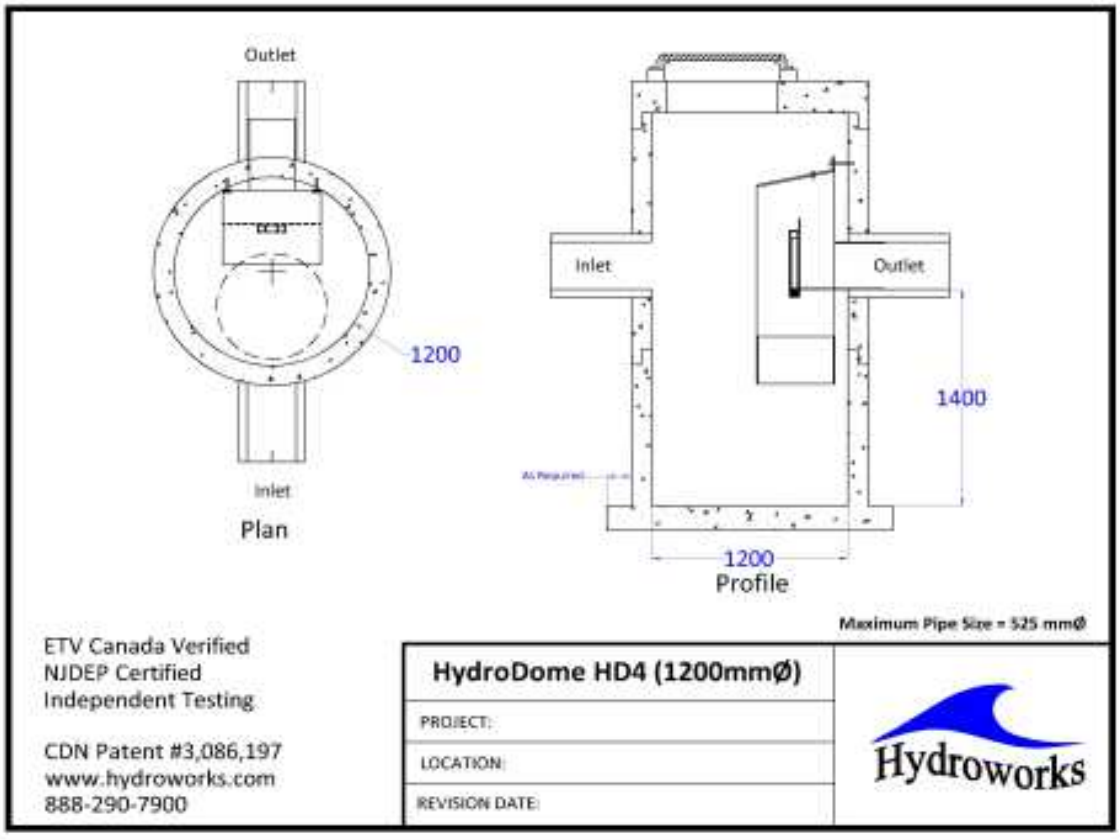



Dimensions and Capacities

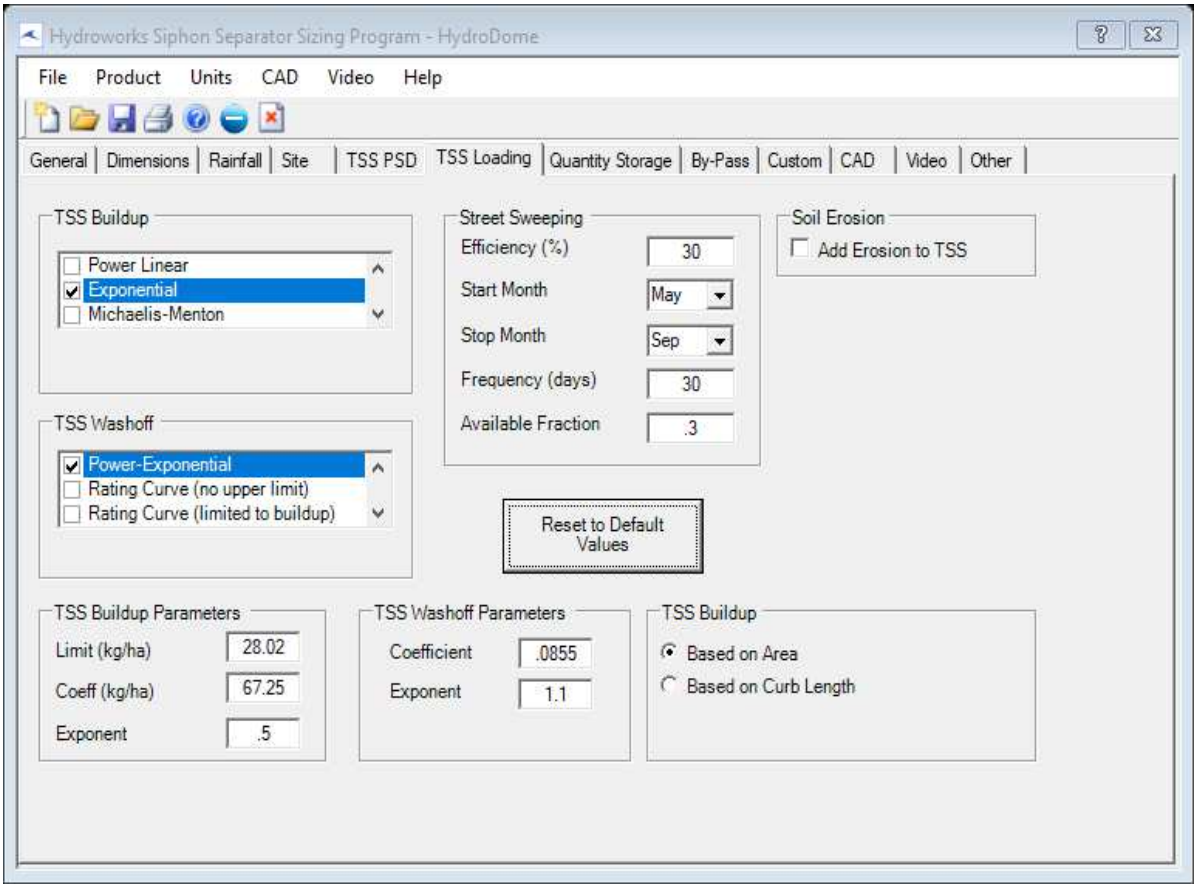
| Model | Diam. (m) | Depth (m) | Float. Vol. (L) | Sediment Vol. (m3) | Total Vol. (m3) |
|---|---|---|---|---|---|
| HD 3 | 0.91 | 1.22 | 123 | 0.5 | 0.8 |
| HD 4 | 1.22 | 1.37 | 266 | 0.9 | 1.6 |
| HD 5 | 1.52 | 1.68 | 483 | 1.7 | 3.1 |
| HD 6 | 1.83 | 1.98 | 803 | 2.9 | 5.2 |
| HD 7 | 2.13 | 2.29 | 1226 | 4.6 | 8.2 |
| HD 8 | 2.44 | 2.59 | 1863 | 6.8 | 12.1 |
| HD 10 | 3.05 | 3.2 | 3617 | 13 | 23.3 |
| HD 12 | 3.66 | 3.81 | 6224 | 22.2 | 40 |

Depth = Depth from outlet invert to inside bottom of tank

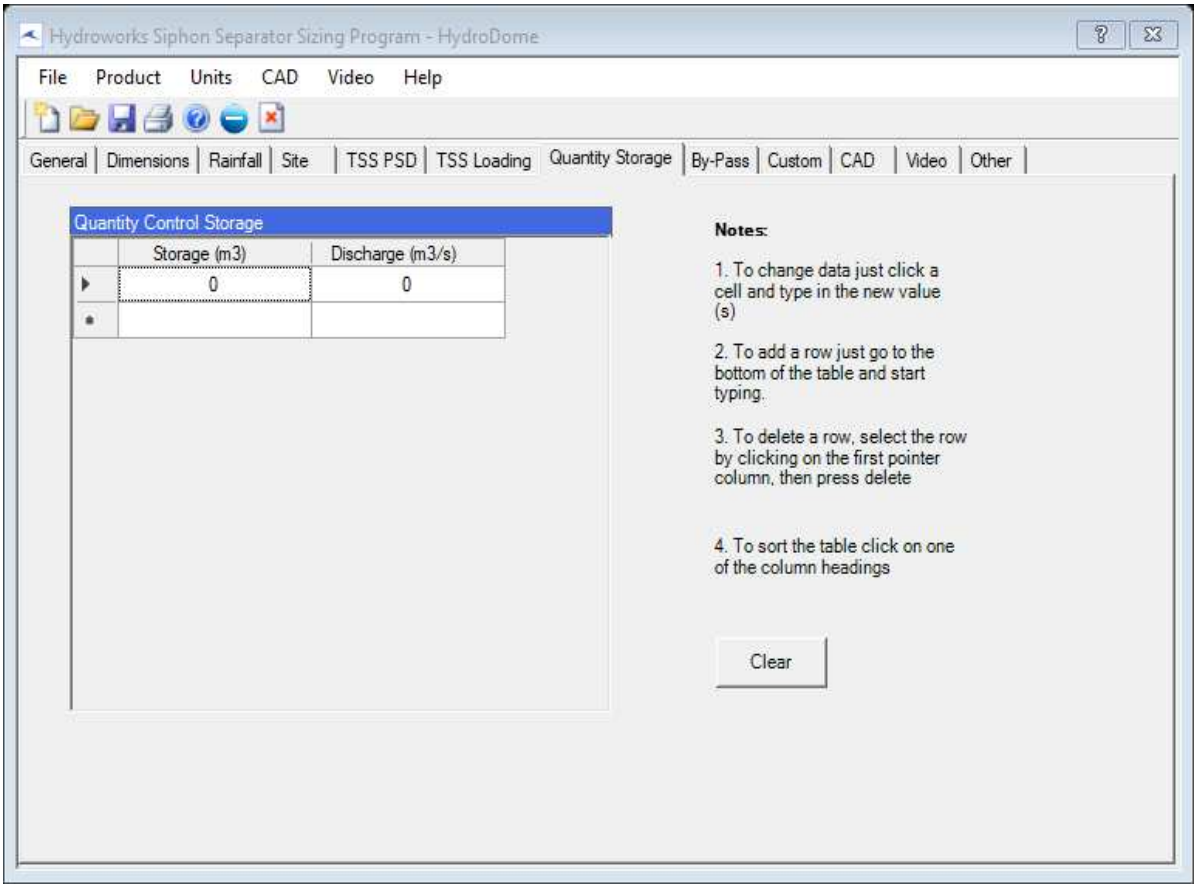
## Generic HD 4 CAD Drawing



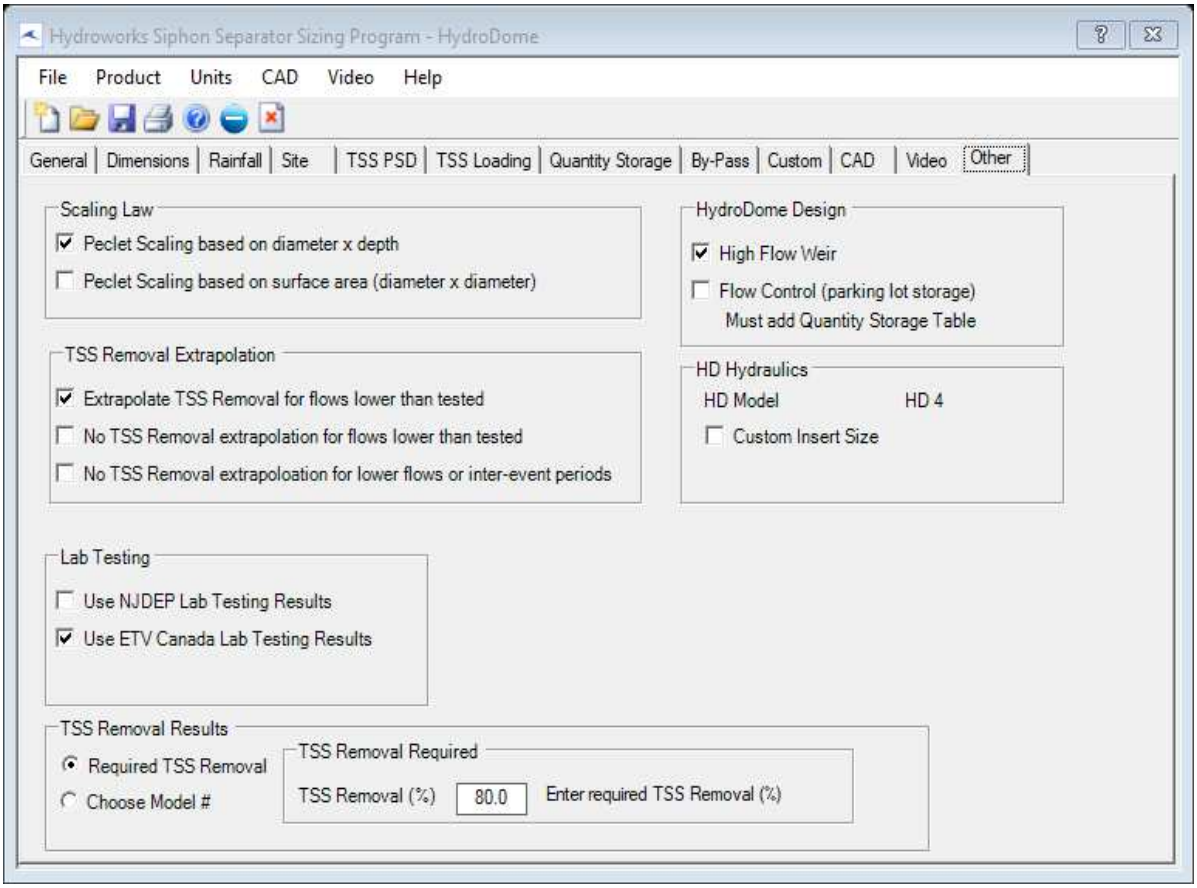
## TSS Buildup And Washoff




## Upstream Quantity Storage



**Other Parameters**




**Flagged Issues**

**If there is underground detention storage upstream of the HydroDome please contact Hydroworks to ensure it has been modeled correctly.**

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# Hydroworks Sizing Summary

# Kingston Road - OGS206
# Pickering, Ontario

**06-29-2023**

## Recommended Size: HydroDome HD 4

**A HydroDome HD 4 is recommended to provide 80 % annual TSS removal based on a drainage area of .39 (ha) with an imperviousness of 100 % and Toronto Central, Ontario rainfall for the 20 um to 2000 um particle size distribution.**

**The recommended HydroDome HD 4 treats 100 % of the annual runoff and provides 91 % annual TSS removal for the Toronto Central rainfall records and 20 um to 2000 um particle size distribution.**

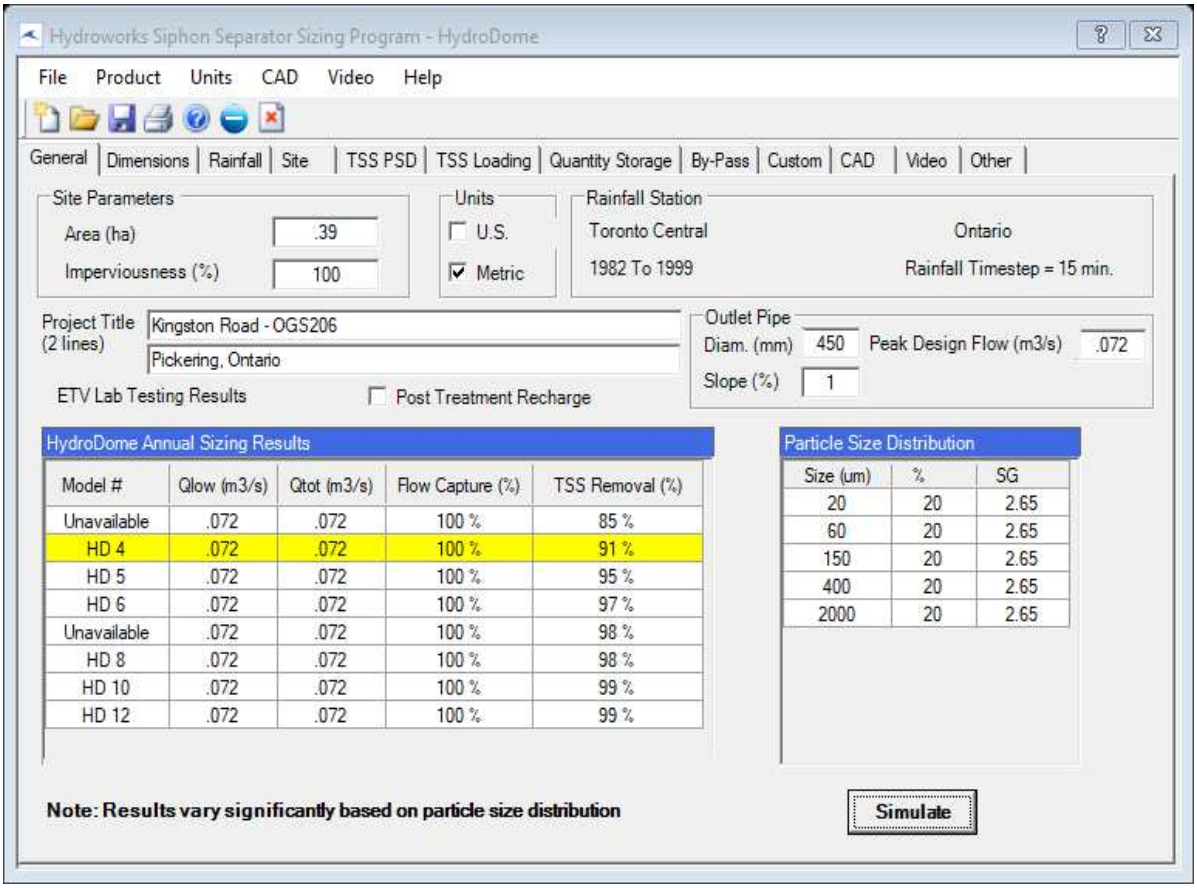
**The HydroDome has a siphon which creates a discontinuity in headloss. The given peak flow of .072 (m3/s) Is less than the full pipe flow of .29 (m3/s) indicating free flow in the pipe during the peak flow assuming no tailwater condition. Partial pipe flow was assumed for the headloss calculations. The headloss was calculated to be 283 (mm) above the crown of the 450 (mm) outlet pipe.**

**This summary report provides the main parameters that were used for sizing. These parameters are shown on the summary tables and graphs provided in this report.**

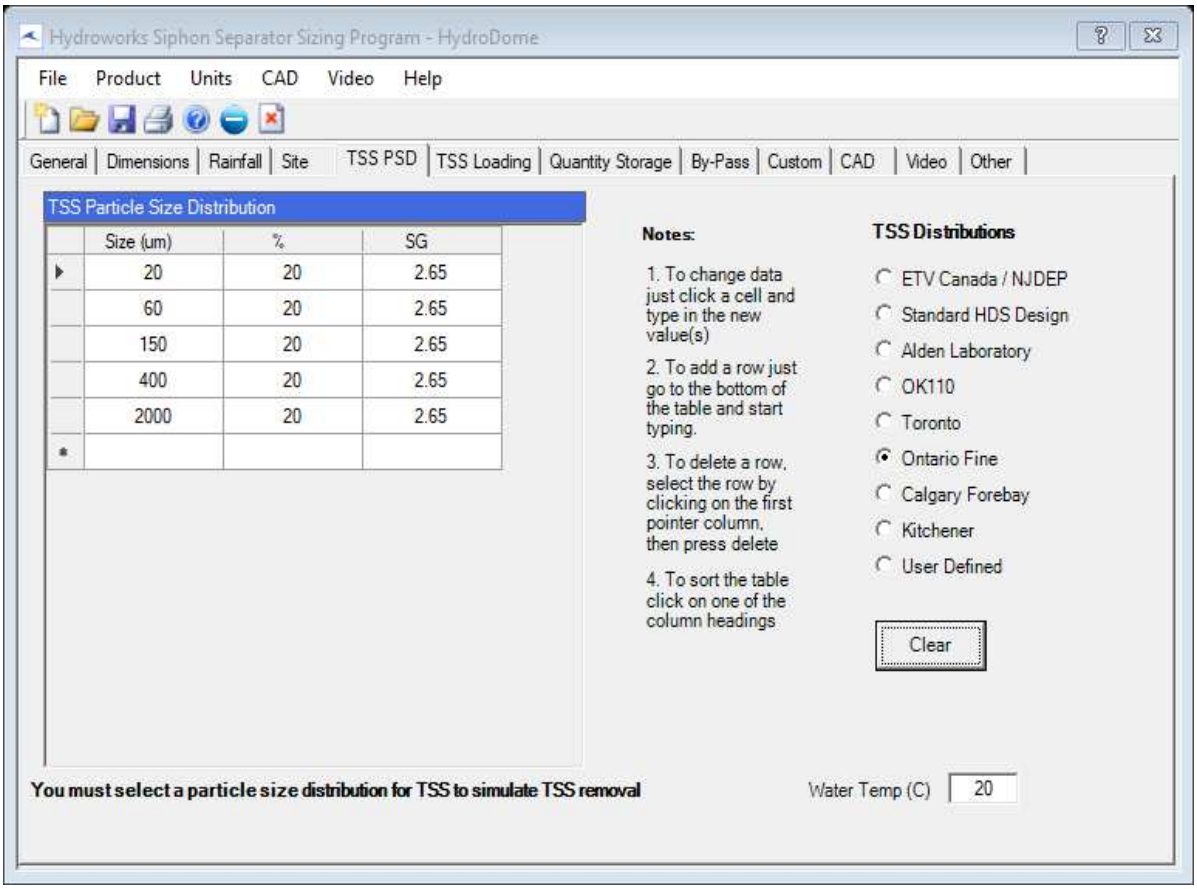
**If you have any questions regarding this sizing summary please do not hesitate to contact Hydroworks at 888-290-7900 or email us at support@hydroworks.com.**

The sizing program is for sizing purposes only and does not address any site specific parameters such as hydraulic gradeline, tailwater submergence, groundwater, soils bearing capacity, etc. Headloss calculations are not a hydraulic gradeline calculation since this requires a starting water level and an analysis of the entire system downstream of the HydroDome .

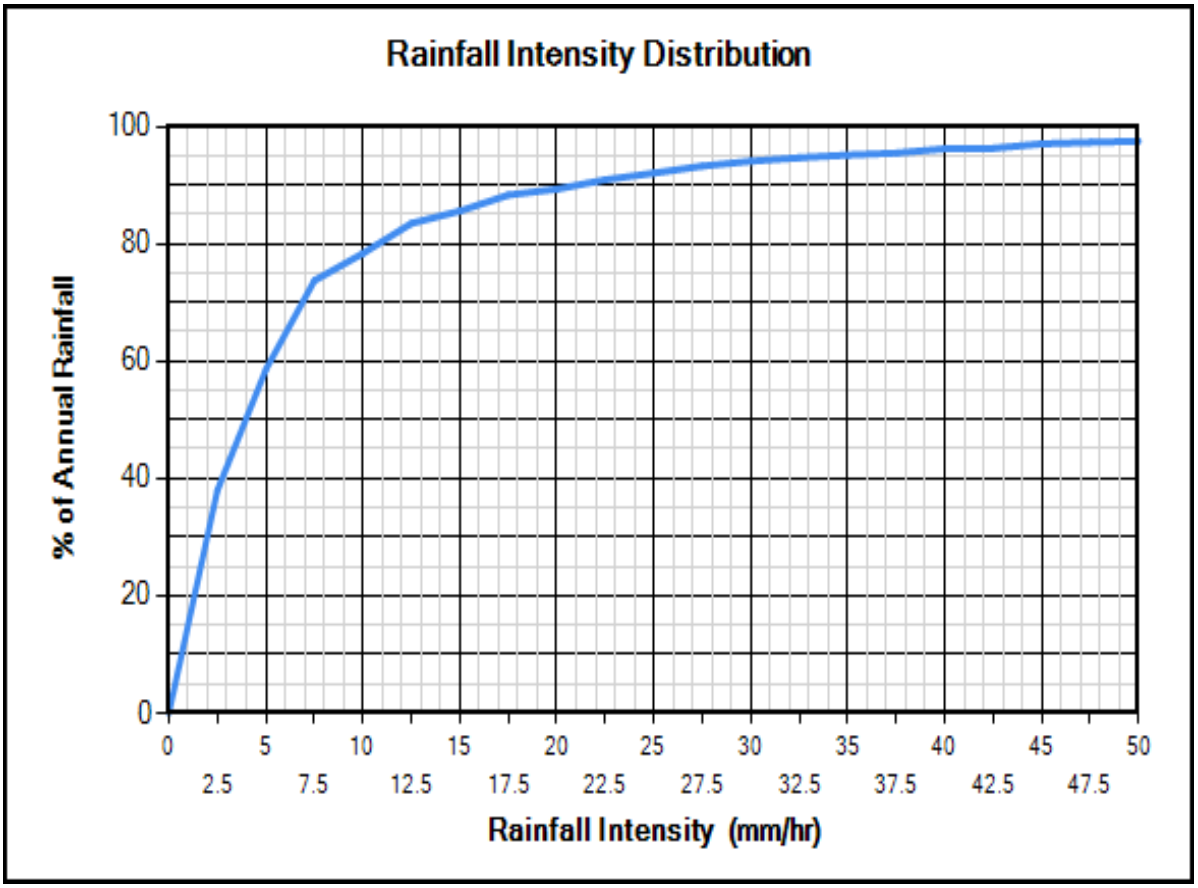
## TSS Removal Sizing Summary



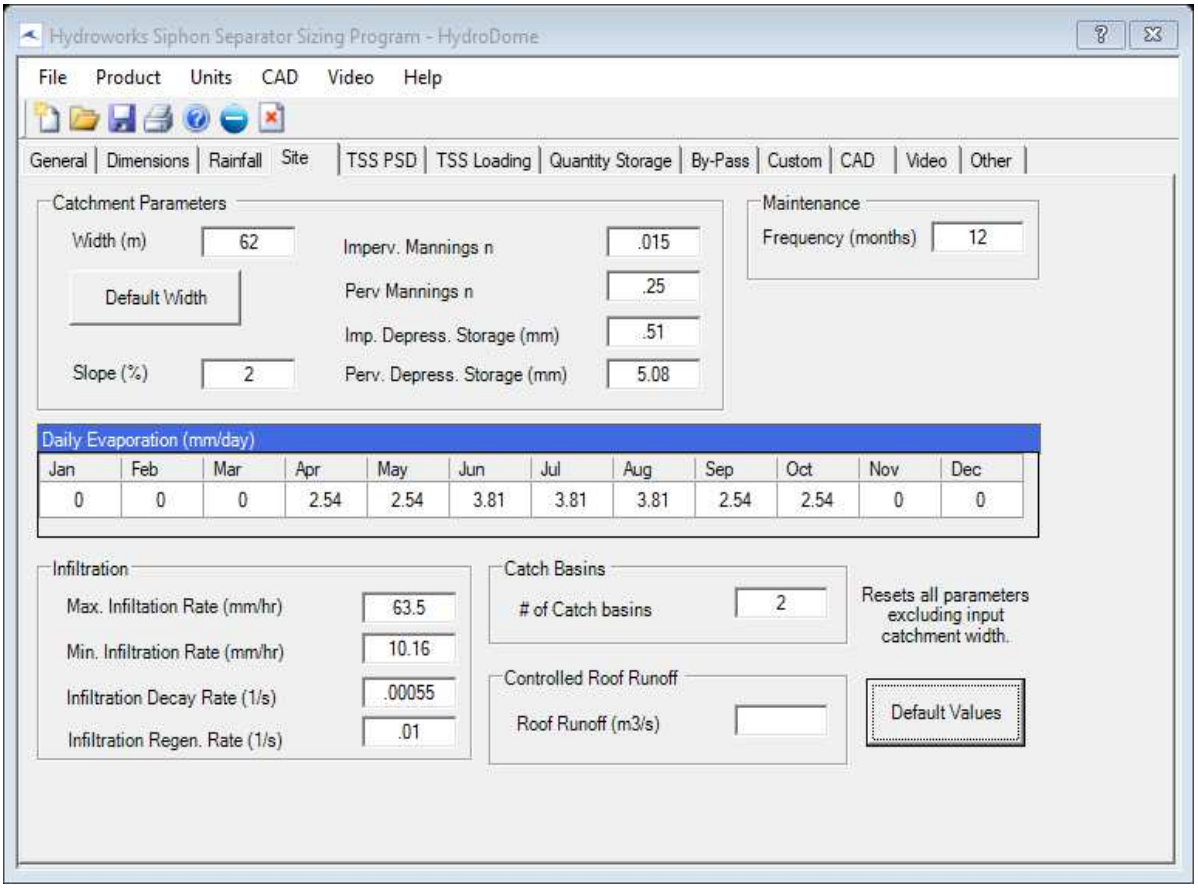

## TSS Particle Size Distribution



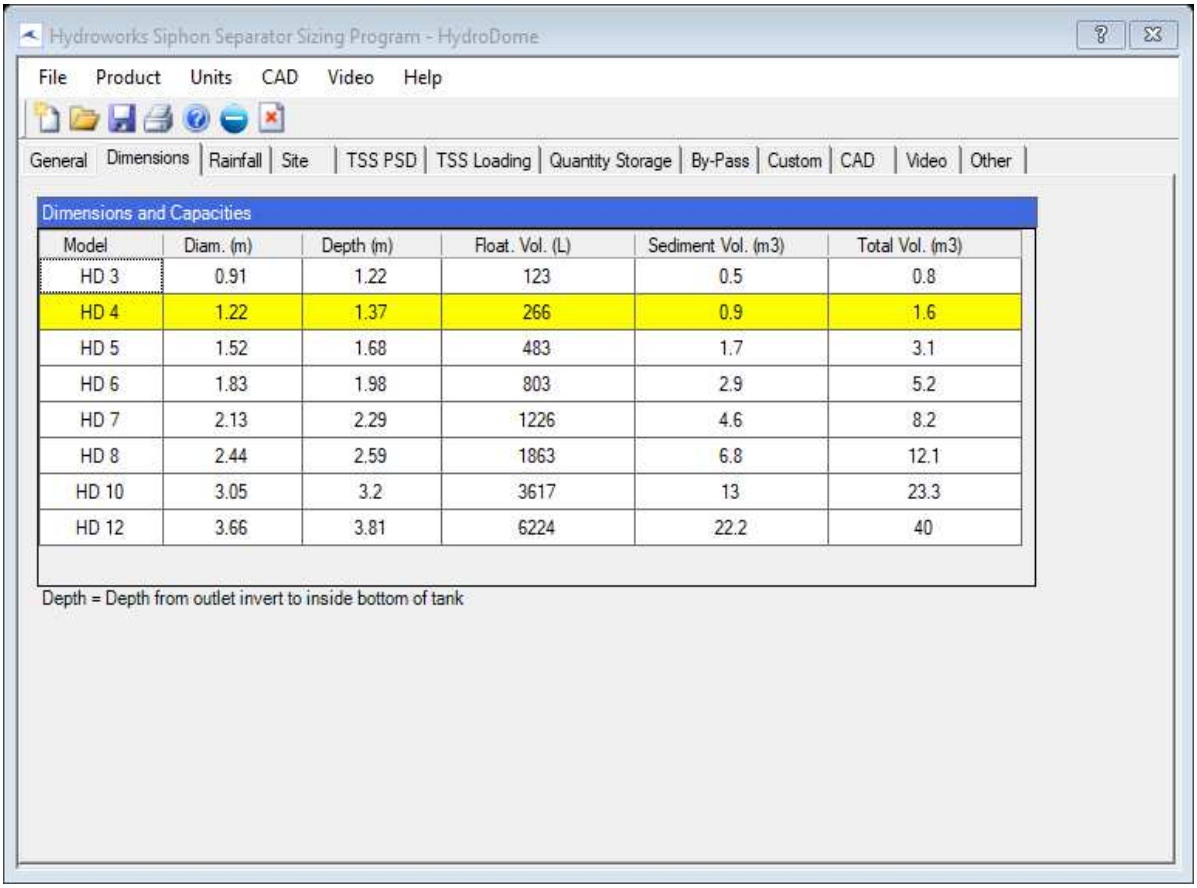
**Rainfall Station - Toronto Central, Ontario(1982 To 1999)**




**Site Physical Characteristics**



## Dimensions And Capacities

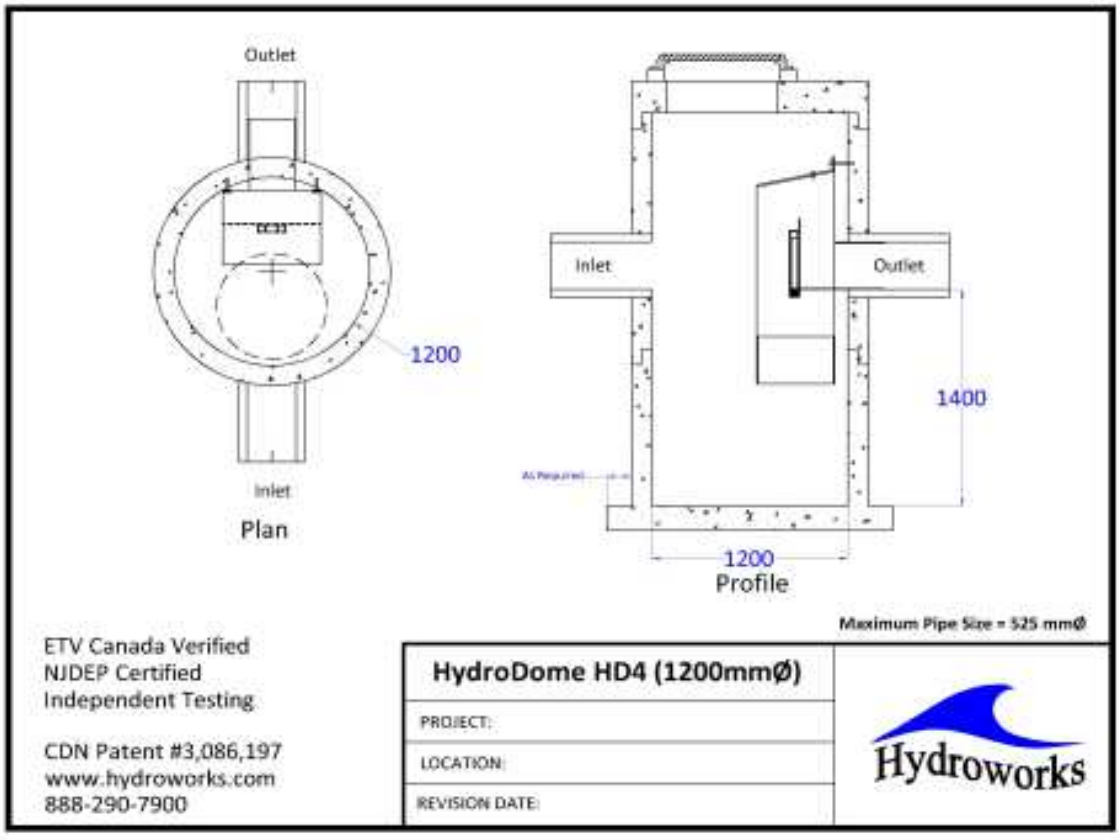



Dimensions and Capacities

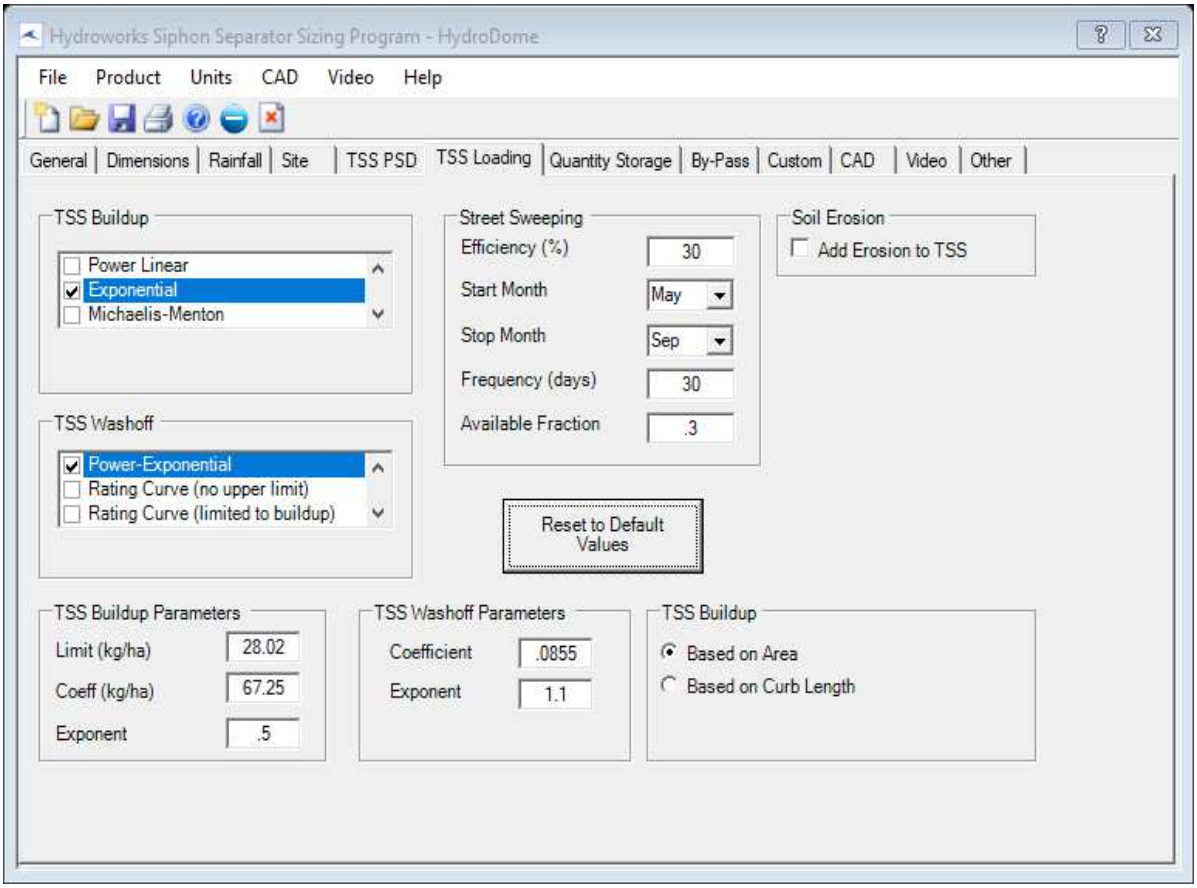
| Model | Diam. (m) | Depth (m) | Float. Vol. (L) | Sediment Vol. (m3) | Total Vol. (m3) |
|---|---|---|---|---|---|
| HD 3 | 0.91 | 1.22 | 123 | 0.5 | 0.8 |
| HD 4 | 1.22 | 1.37 | 266 | 0.9 | 1.6 |
| HD 5 | 1.52 | 1.68 | 483 | 1.7 | 3.1 |
| HD 6 | 1.83 | 1.98 | 803 | 2.9 | 5.2 |
| HD 7 | 2.13 | 2.29 | 1226 | 4.6 | 8.2 |
| HD 8 | 2.44 | 2.59 | 1863 | 6.8 | 12.1 |
| HD 10 | 3.05 | 3.2 | 3617 | 13 | 23.3 |
| HD 12 | 3.66 | 3.81 | 6224 | 22.2 | 40 |

Depth = Depth from outlet invert to inside bottom of tank

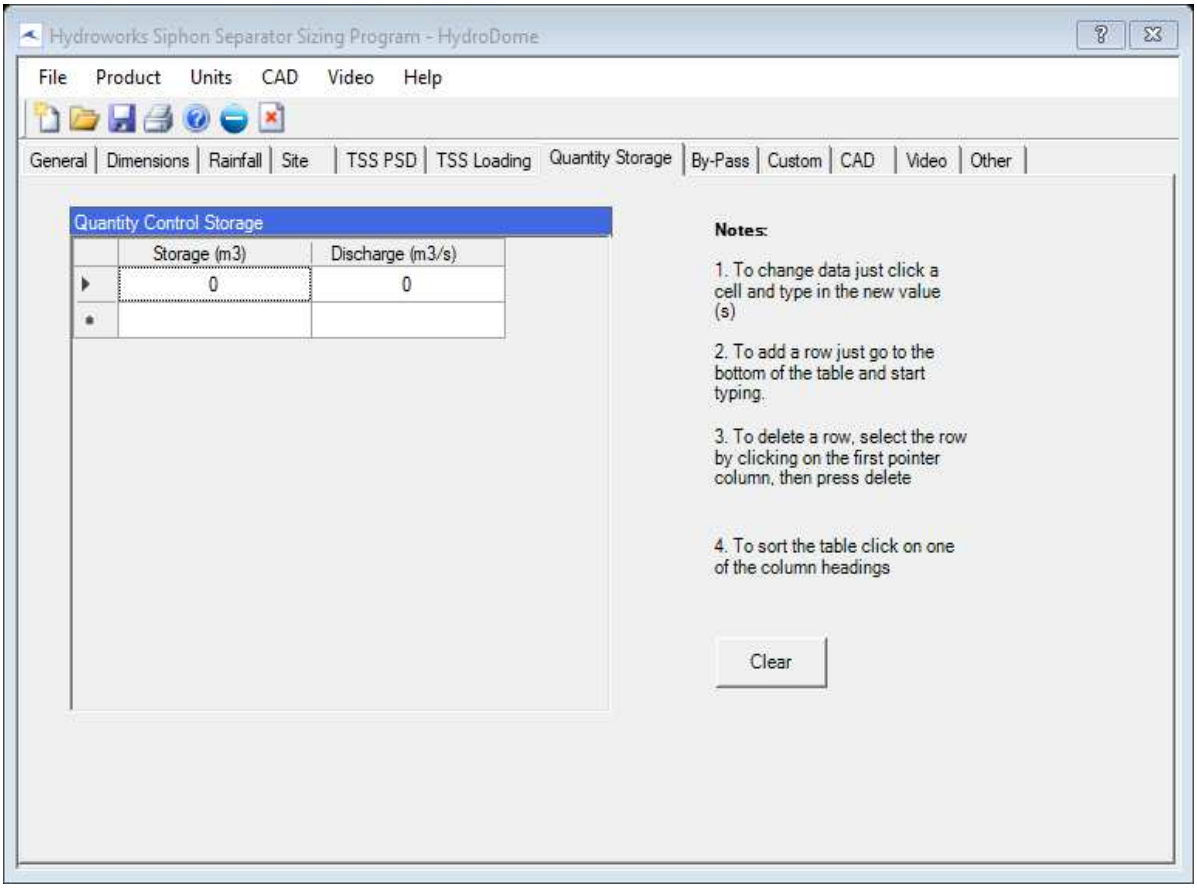
## Generic HD 4 CAD Drawing



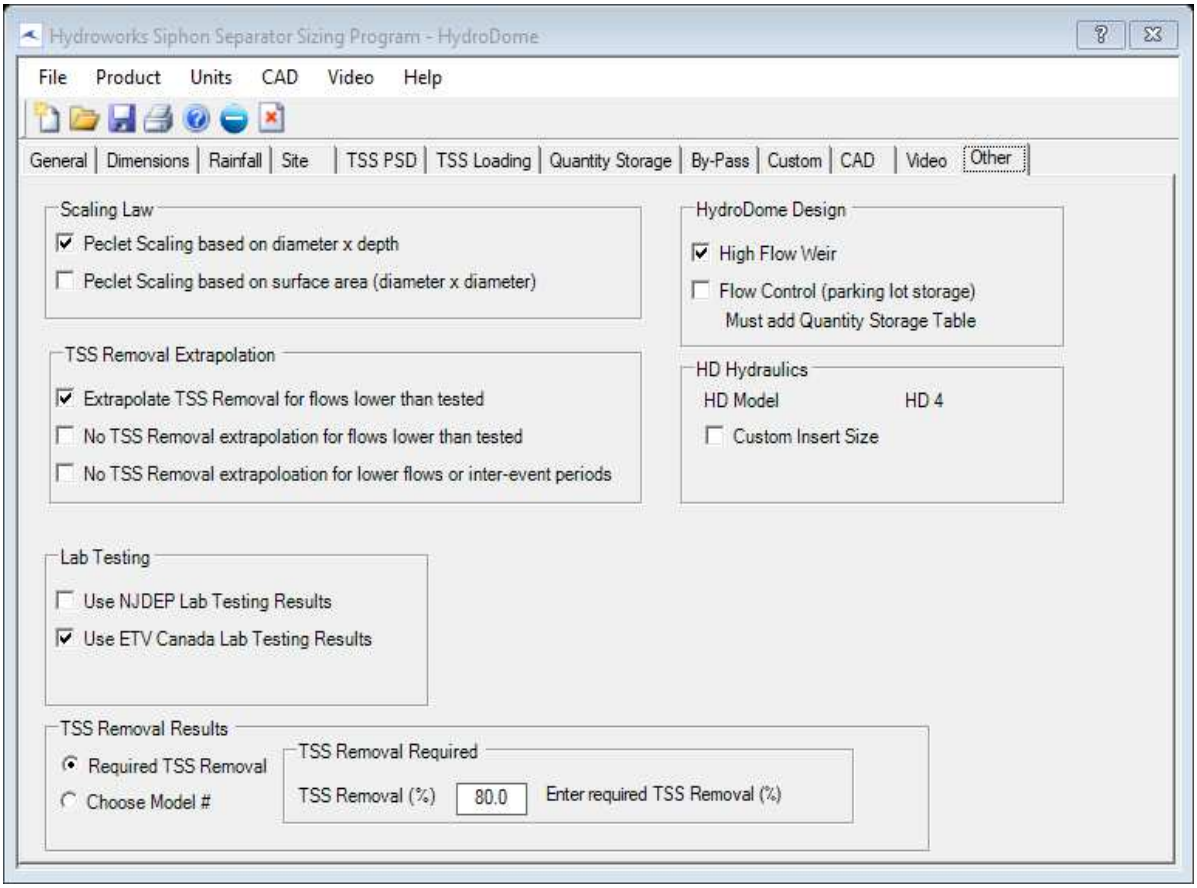
## TSS Buildup And Washoff




## Upstream Quantity Storage



**Other Parameters**




**Flagged Issues**

**If there is underground detention storage upstream of the HydroDome please contact Hydroworks to ensure it has been modeled correctly.**

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# Hydroworks Sizing Summary

# Kingston Road - OGS203
# Pickering, Ontario

**06-29-2023**

## Recommended Size: HydroDome HD 5

**A HydroDome HD 5 is recommended to provide 80 % annual TSS removal based on a drainage area of 1.22 (ha) with an imperviousness of 100 % and Toronto Central, Ontario rainfall for the 20 um to 2000 um particle size distribution.**

**The recommended HydroDome HD 5 treats 100 % of the annual runoff and provides 83 % annual TSS removal for the Toronto Central rainfall records and 20 um to 2000 um particle size distribution.**

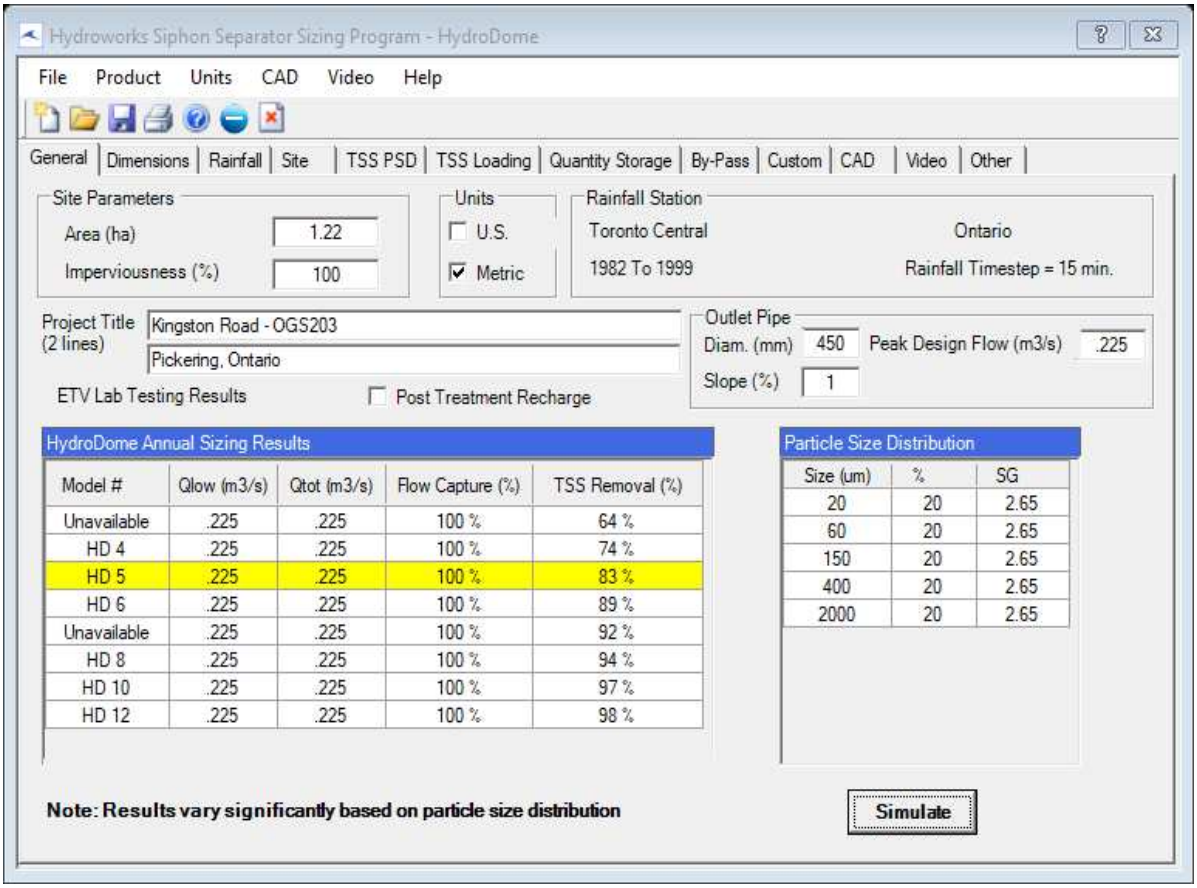
**The HydroDome has a siphon which creates a discontinuity in headloss. The given peak flow of .225 (m3/s) Is less than the full pipe flow of .29 (m3/s) indicating free flow in the pipe during the peak flow assuming no tailwater condition. Partial pipe flow was assumed for the headloss calculations. The headloss was calculated to be 393 (mm) above the crown of the 450 (mm) outlet pipe.**

**This summary report provides the main parameters that were used for sizing. These parameters are shown on the summary tables and graphs provided in this report.**

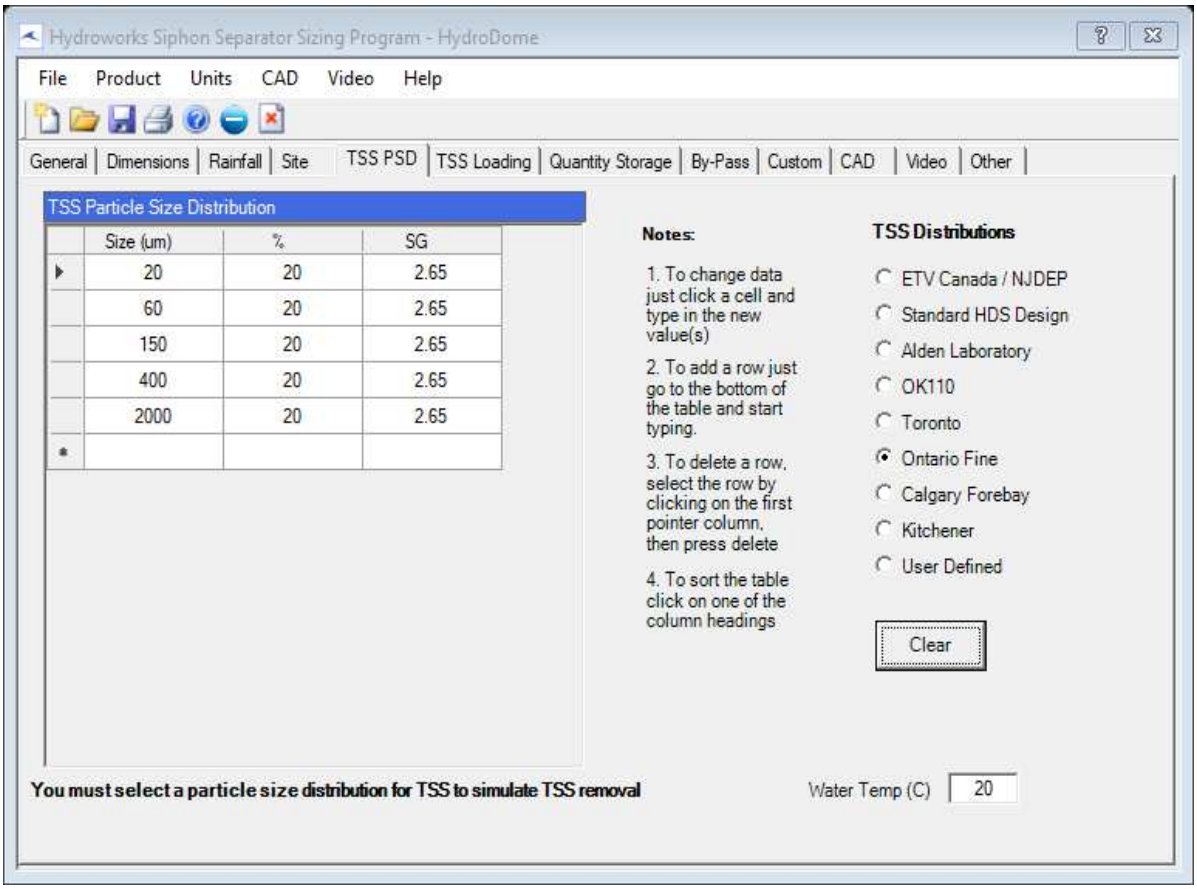
**If you have any questions regarding this sizing summary please do not hesitate to contact Hydroworks at 888-290-7900 or email us at support@hydroworks.com.**

The sizing program is for sizing purposes only and does not address any site specific parameters such as hydraulic gradeline, tailwater submergence, groundwater, soils bearing capacity, etc. Headloss calculations are not a hydraulic gradeline calculation since this requires a starting water level and an analysis of the entire system downstream of the HydroDome .

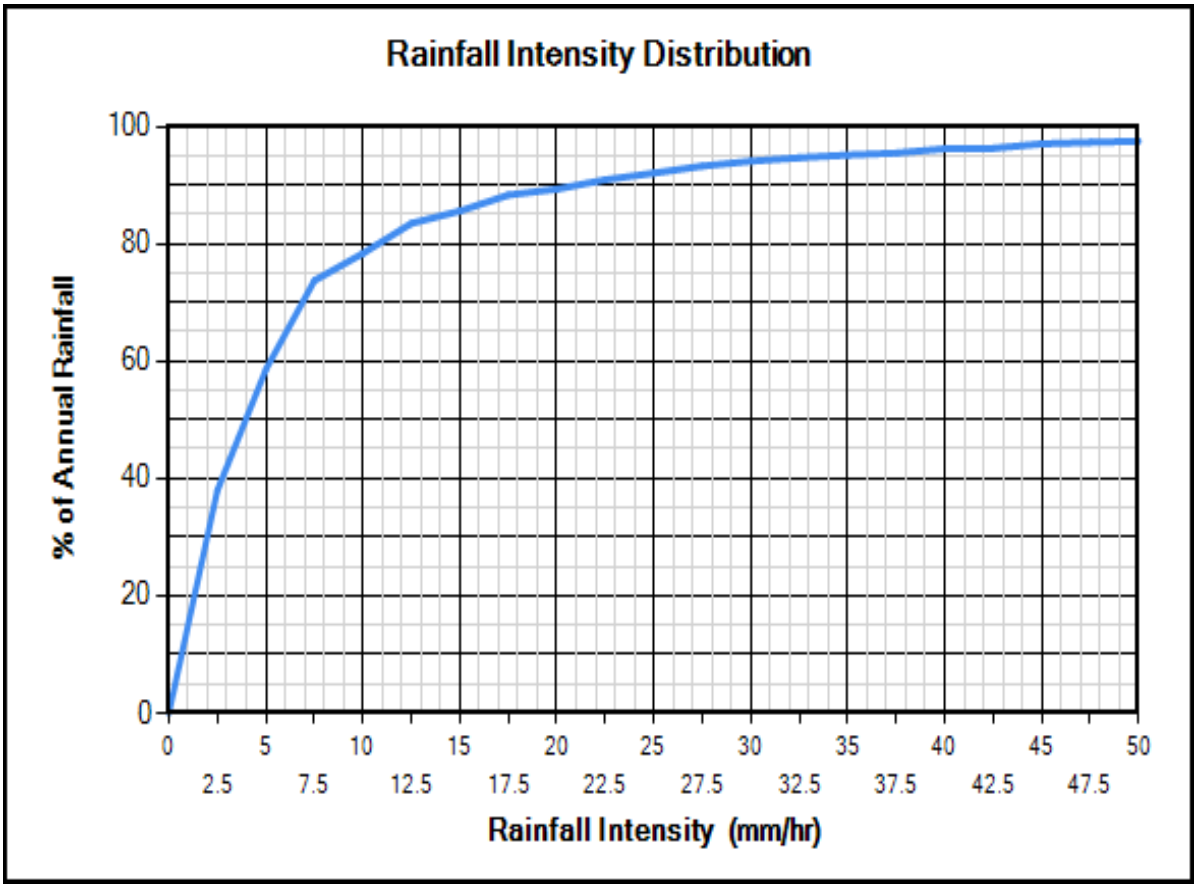
## TSS Removal Sizing Summary



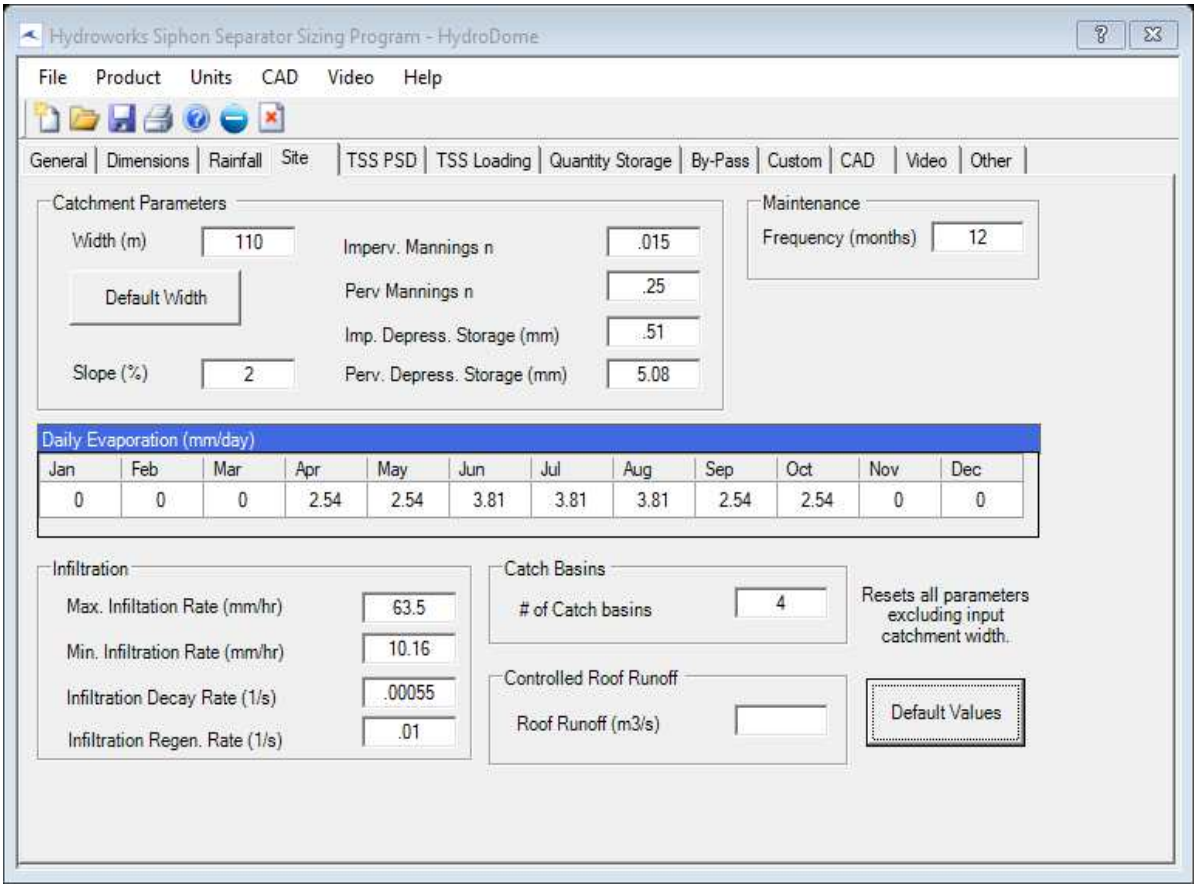

## TSS Particle Size Distribution



**Rainfall Station - Toronto Central, Ontario(1982 To 1999)**




**Site Physical Characteristics**



## Dimensions And Capacities

Hydroworks Siphon Separator Sizing Program - HydroDome

File Product Units CAD Video Help

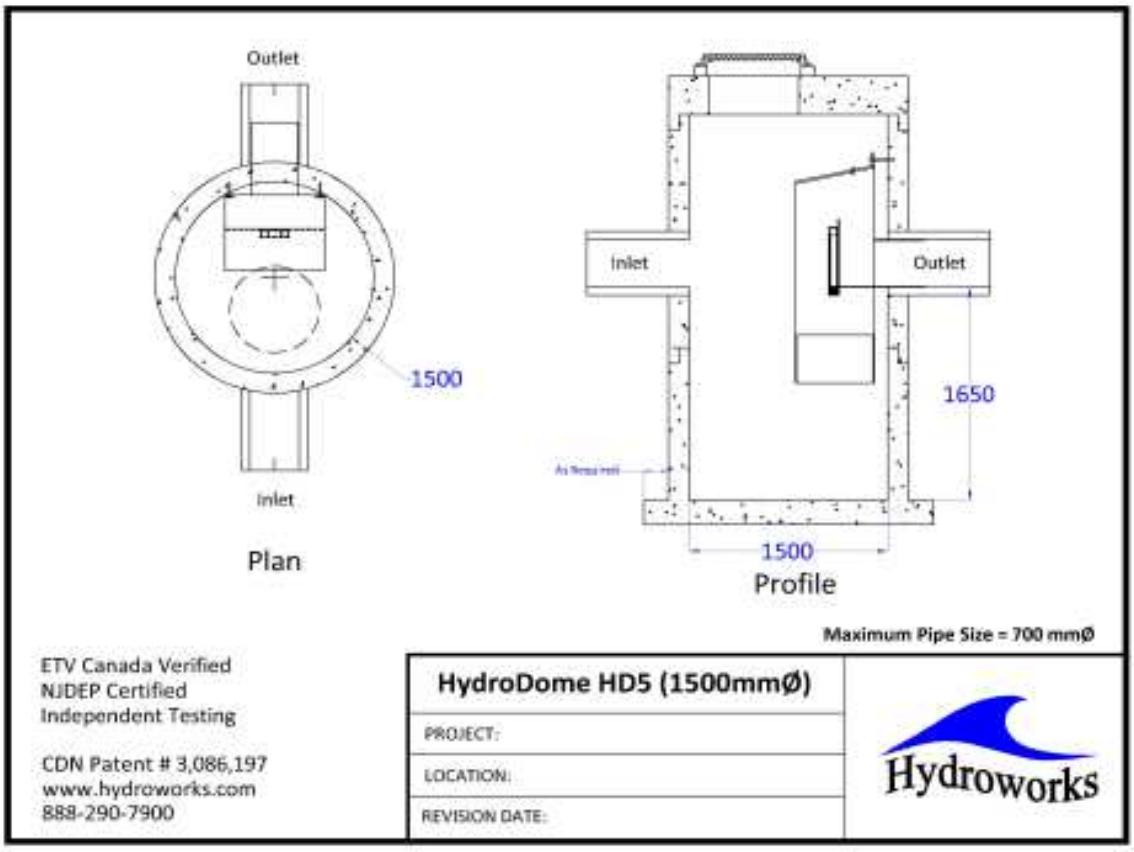
General | Dimensions | Rainfall | Site | TSS PSD | TSS Loading | Quantity Storage | By-Pass | Custom | CAD | Video | Other

**Dimensions and Capacities**

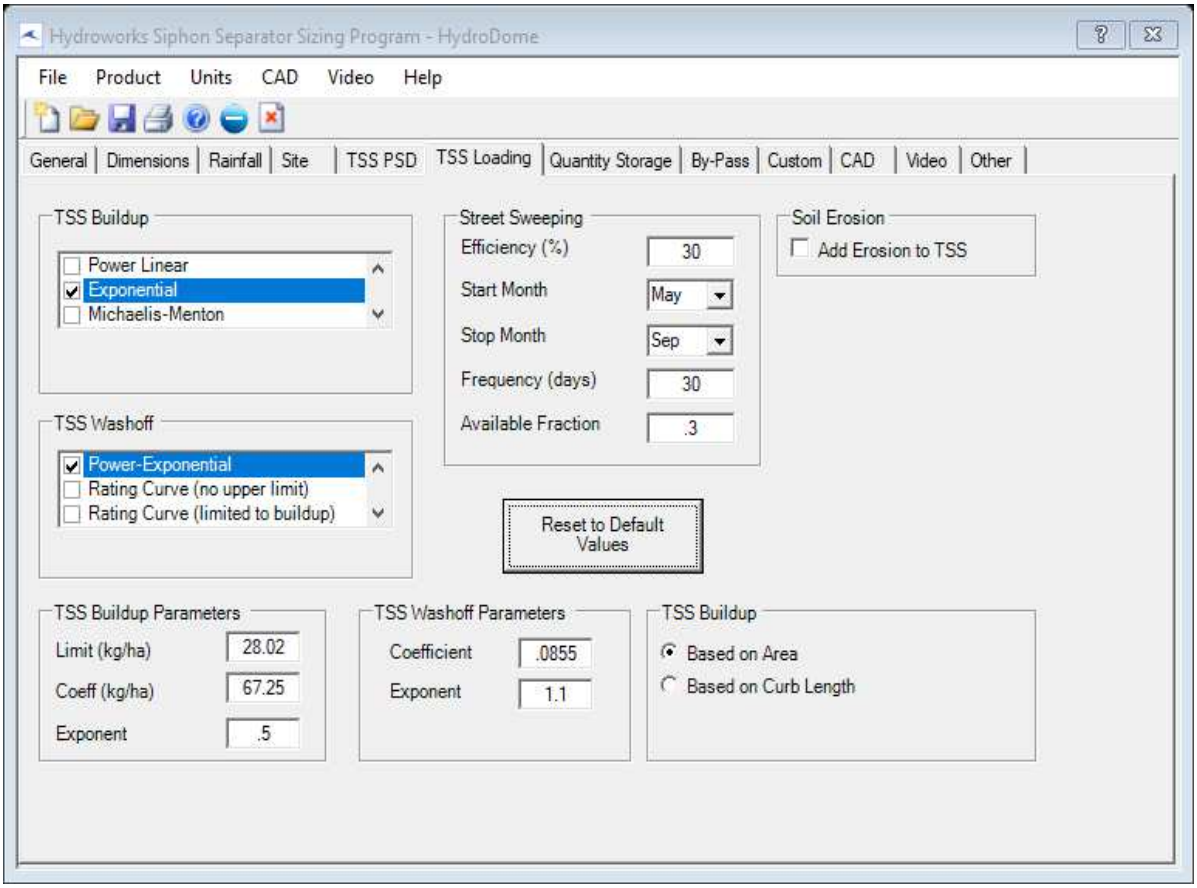
| Model | Diam. (m) | Depth (m) | Float. Vol. (L) | Sediment Vol. (m3) | Total Vol. (m3) |
|---|---|---|---|---|---|
| HD 3 | 0.91 | 1.22 | 123 | 0.5 | 0.8 |
| HD 4 | 1.22 | 1.37 | 266 | 0.9 | 1.6 |
| HD 5 | 1.52 | 1.68 | 483 | 1.7 | 3.1 |
| HD 6 | 1.83 | 1.98 | 803 | 2.9 | 5.2 |
| HD 7 | 2.13 | 2.29 | 1226 | 4.6 | 8.2 |
| HD 8 | 2.44 | 2.59 | 1863 | 6.8 | 12.1 |
| HD 10 | 3.05 | 3.2 | 3617 | 13 | 23.3 |
| HD 12 | 3.66 | 3.81 | 6224 | 22.2 | 40 |

Depth = Depth from outlet invert to inside bottom of tank

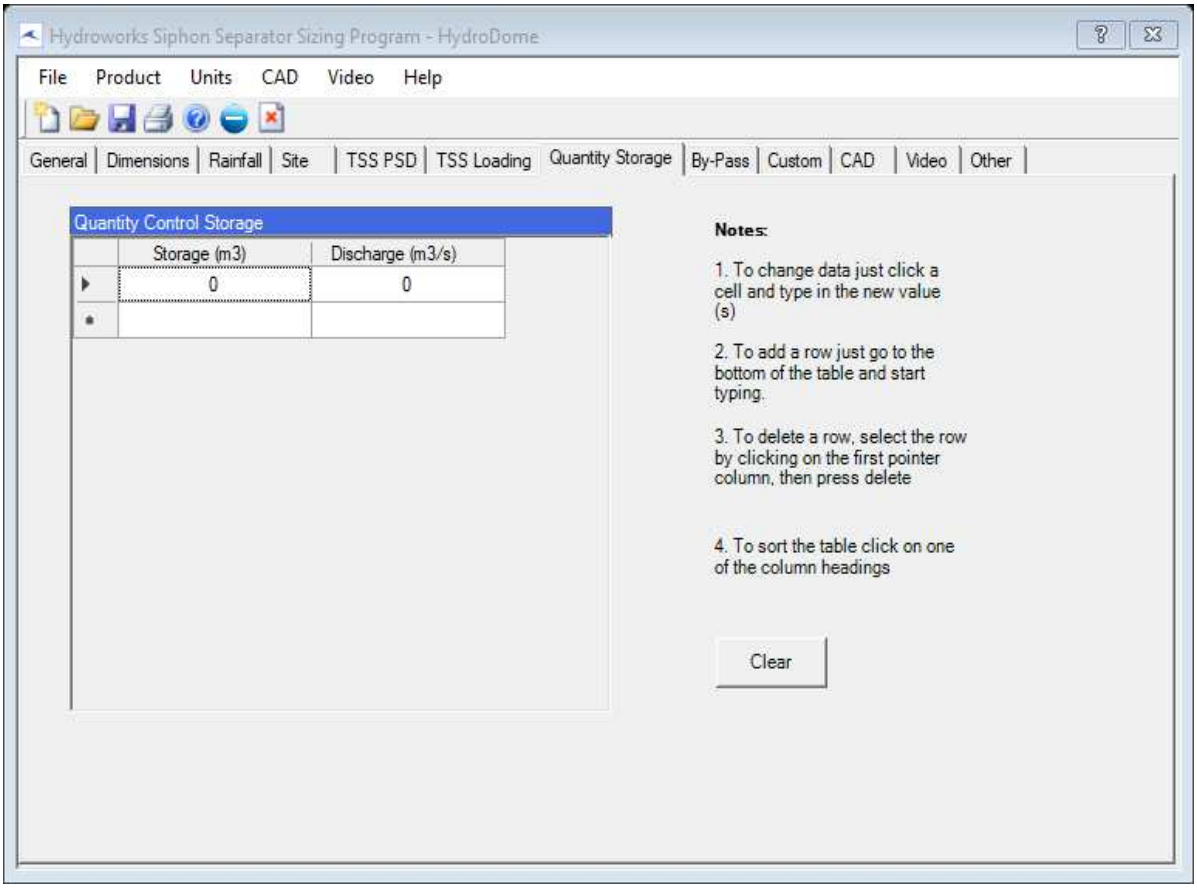
## Generic HD 5 CAD Drawing



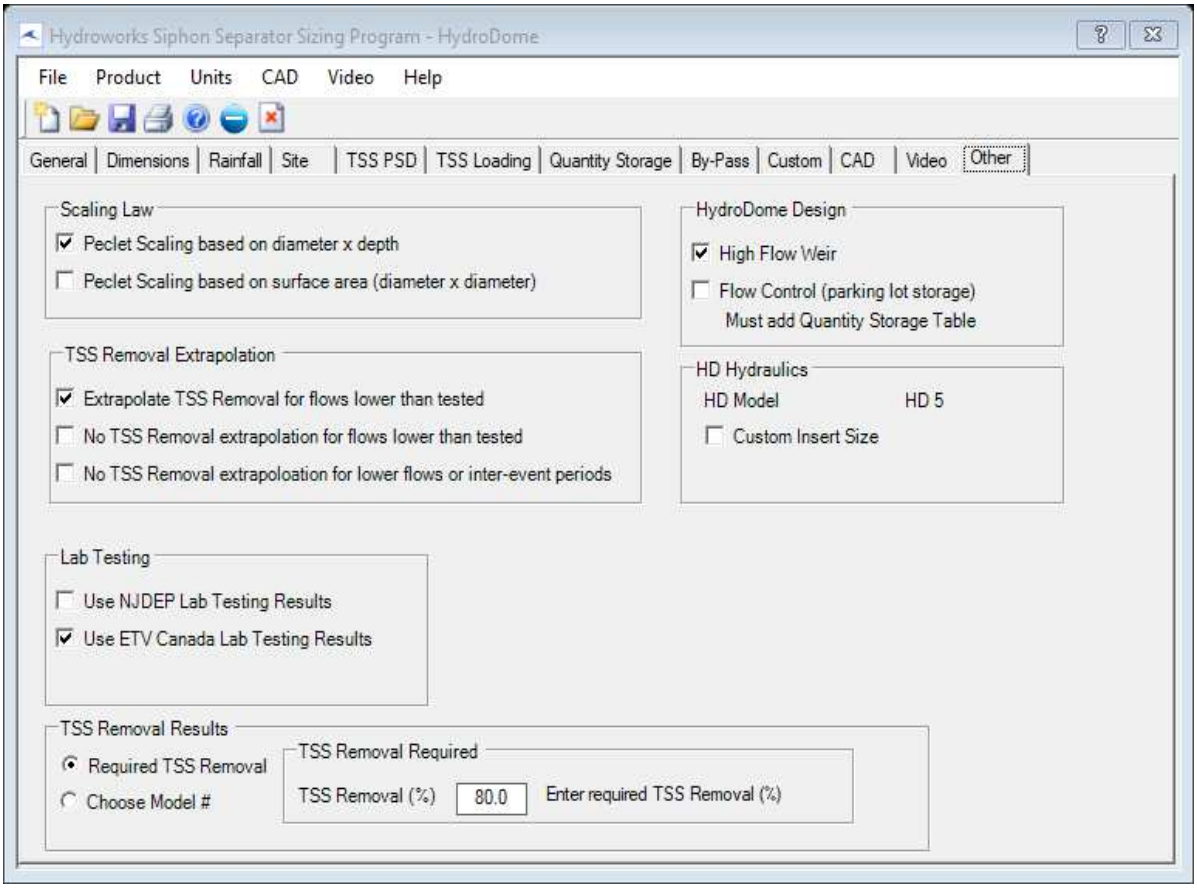
## TSS Buildup And Washoff




## Upstream Quantity Storage



**Other Parameters**




**Flagged Issues**

**If there is underground detention storage upstream of the HydroDome please contact Hydroworks to ensure it has been modeled correctly.**

**Hydroworks Sizing Program - Version 5.7**

**1-800-290-7900**
**www.hydroworks.com**

# Hydroworks Sizing Summary

# Kingston Road (Catchment 202)
# Pickering, ON

**07-04-2023**

## Recommended Size: HydroDome HD 8

**A HydroDome HD 8 is recommended to provide 80 % annual TSS removal based on a drainage area of 0.87 (ha) with an imperviousness of 54 % and Toronto Central, Ontario rainfall for the ETV/NJDEP particle size distribution (Alden).**

**The recommended HydroDome HD 8 treats 100 % of the annual runoff and provides 80 % annual TSS removal for the Toronto Central rainfall records and ETV/NJDEP particle size distribution (Alden).**

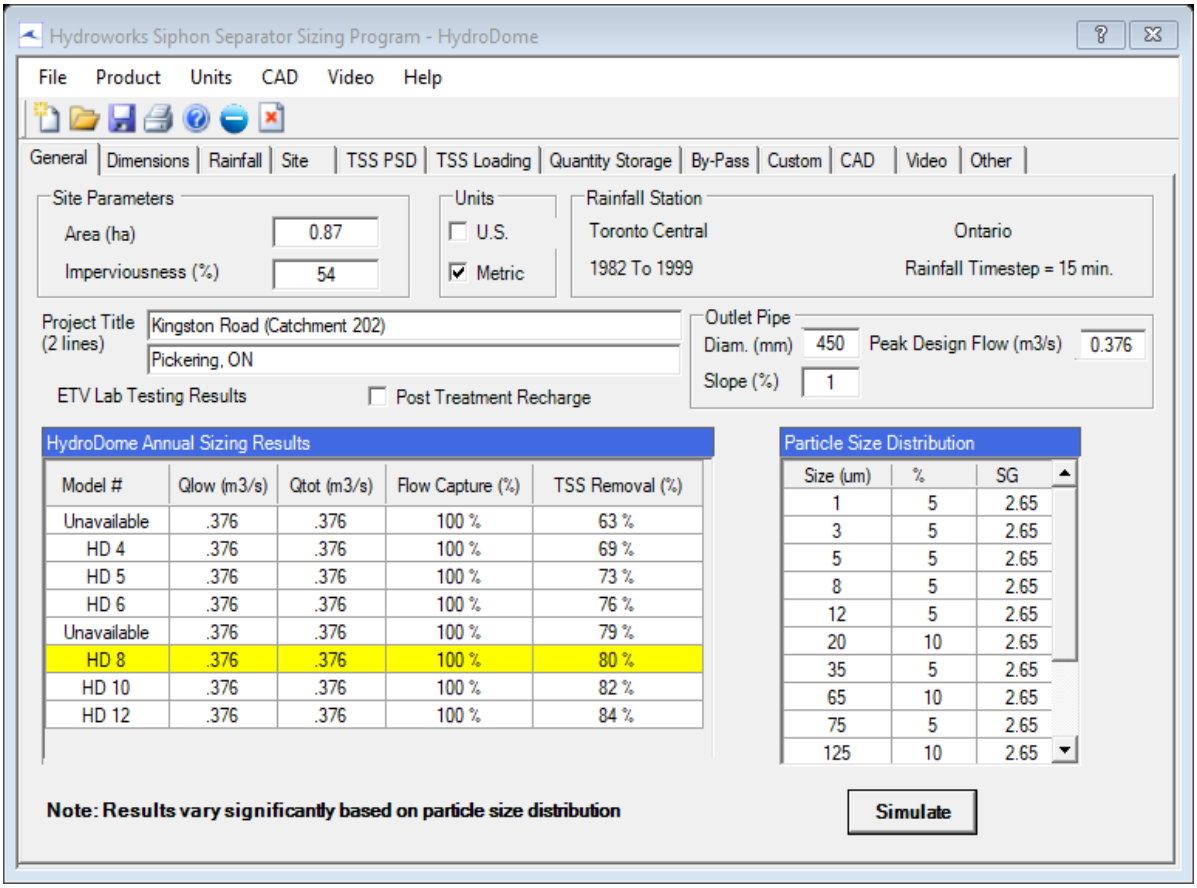
**The HydroDome has a siphon which creates a discontinuity in headloss. The given peak flow of .38 (m3/s) is greater than the full pipe flow of .29 (m3/s) indicating the pipe will be surcharged during the peak flow. Full pipe flow was assumed for the headloss calculations. The pressure head in the pipe was not evaluated since this would require a hydraulic gradeline analysis. The headloss was calculated to be 401 (mm) above the crown of the 450 (mm) outlet pipe.**

**This summary report provides the main parameters that were used for sizing. These parameters are shown on the summary tables and graphs provided in this report.**

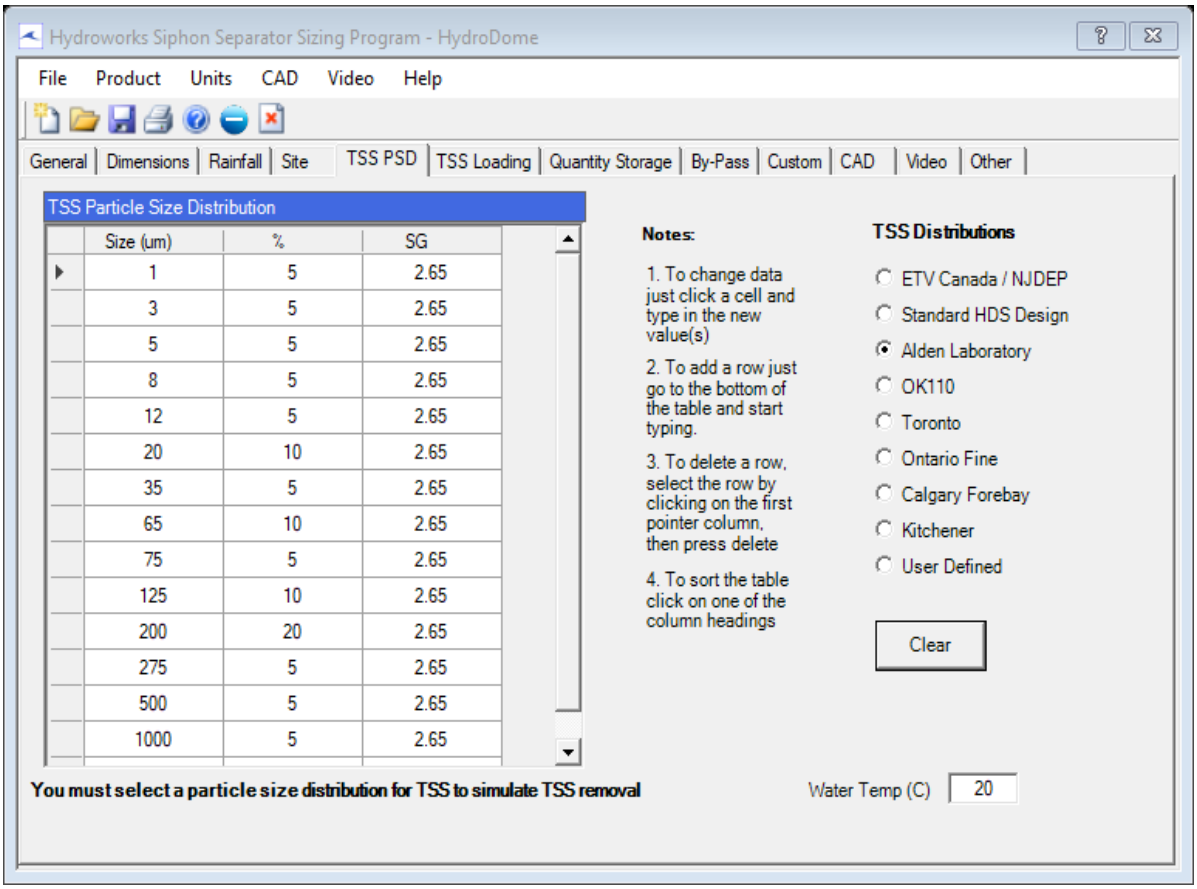
**If you have any questions regarding this sizing summary please do not hesitate to contact Hydroworks at 888-290-7900 or email us at support@hydroworks.com.**

The sizing program is for sizing purposes only and does not address any site specific parameters such as hydraulic gradeline, tailwater submergence, groundwater, soils bearing capacity, etc. Headloss calculations are not a hydraulic gradeline calculation since this requires a starting water level and an analysis of the entire system downstream of the HydroDome .

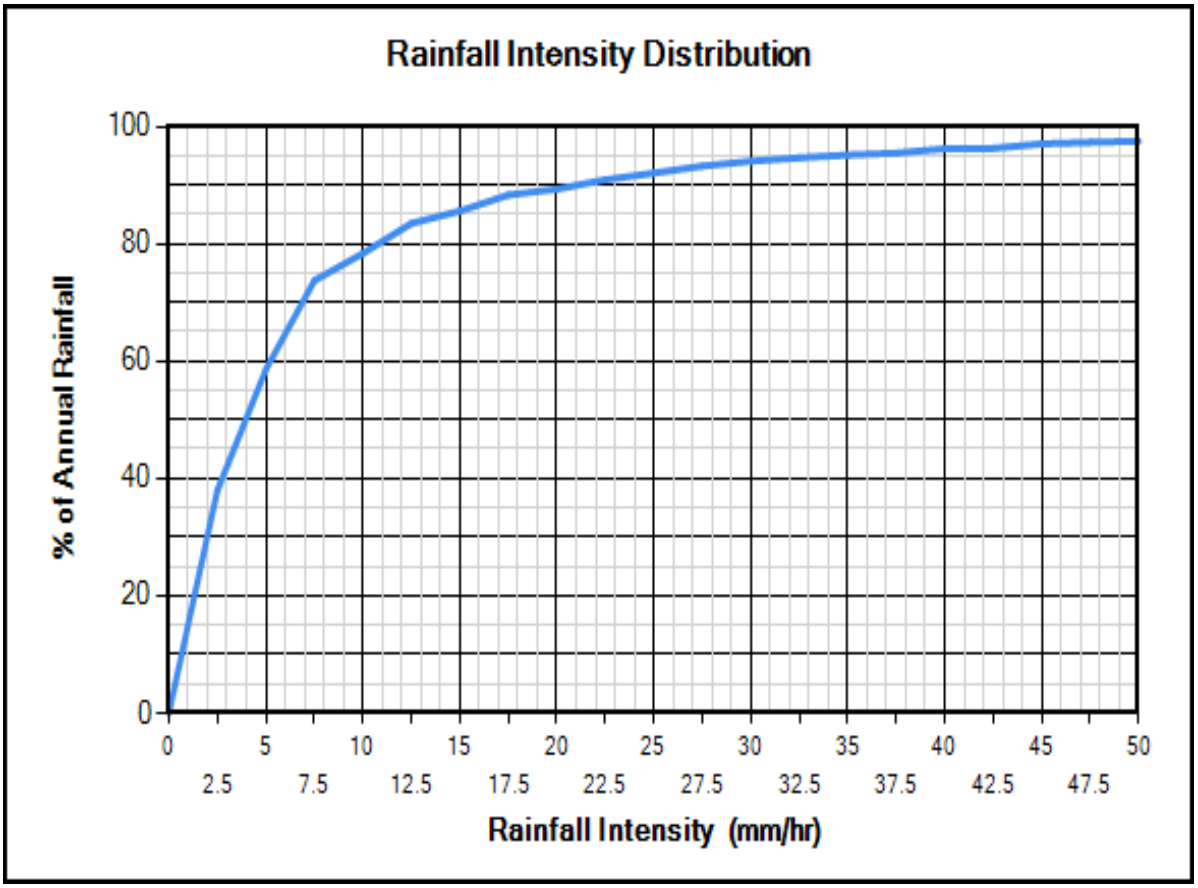
## TSS Removal Sizing Summary



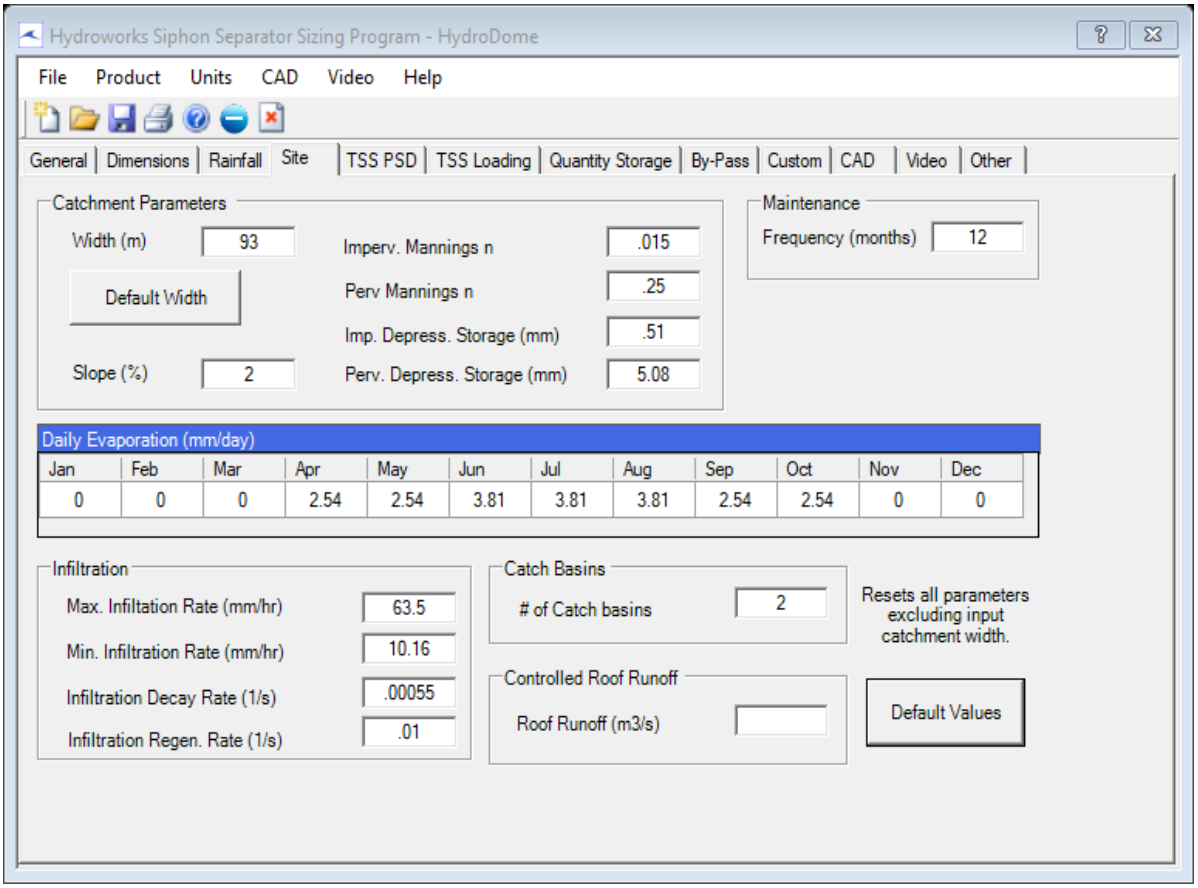

## TSS Particle Size Distribution



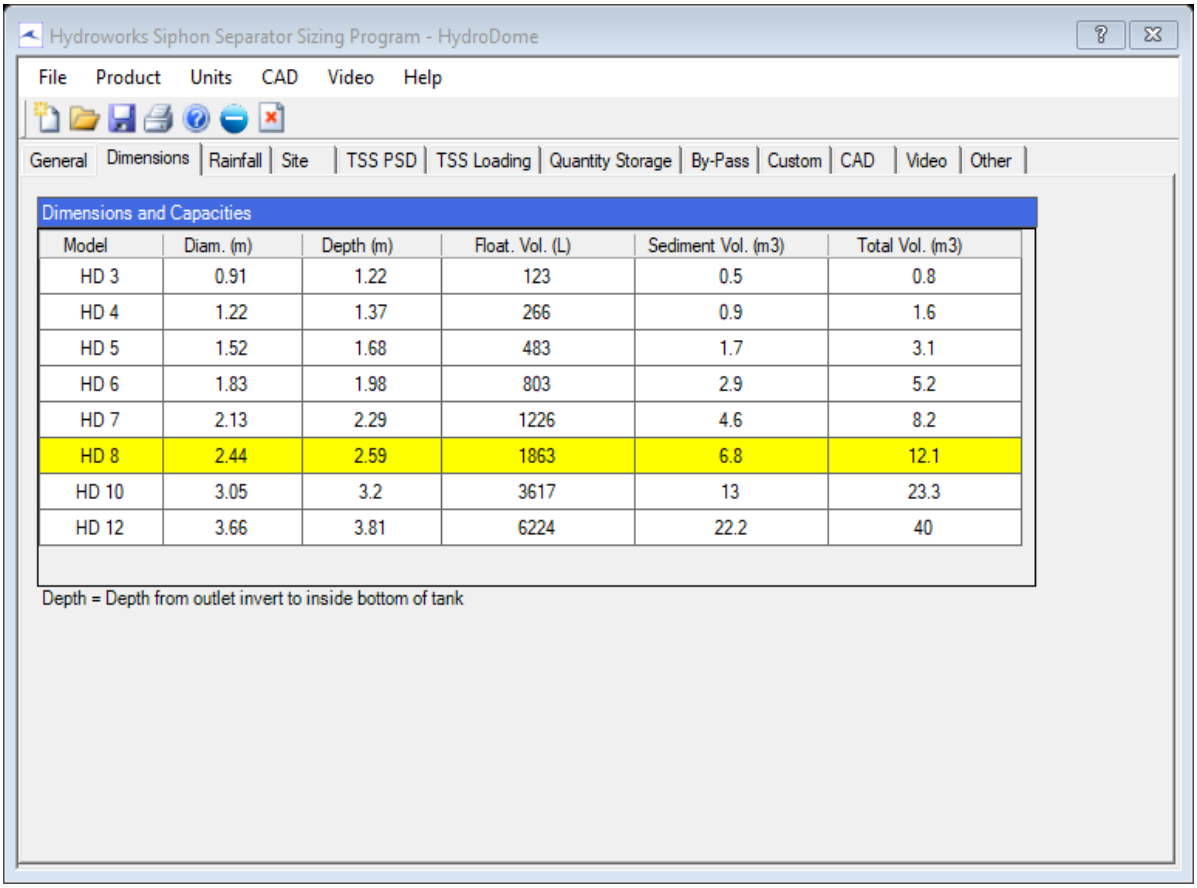
**Rainfall Station - Toronto Central, Ontario(1982 To 1999)**




**Site Physical Characteristics**



## Dimensions And Capacities

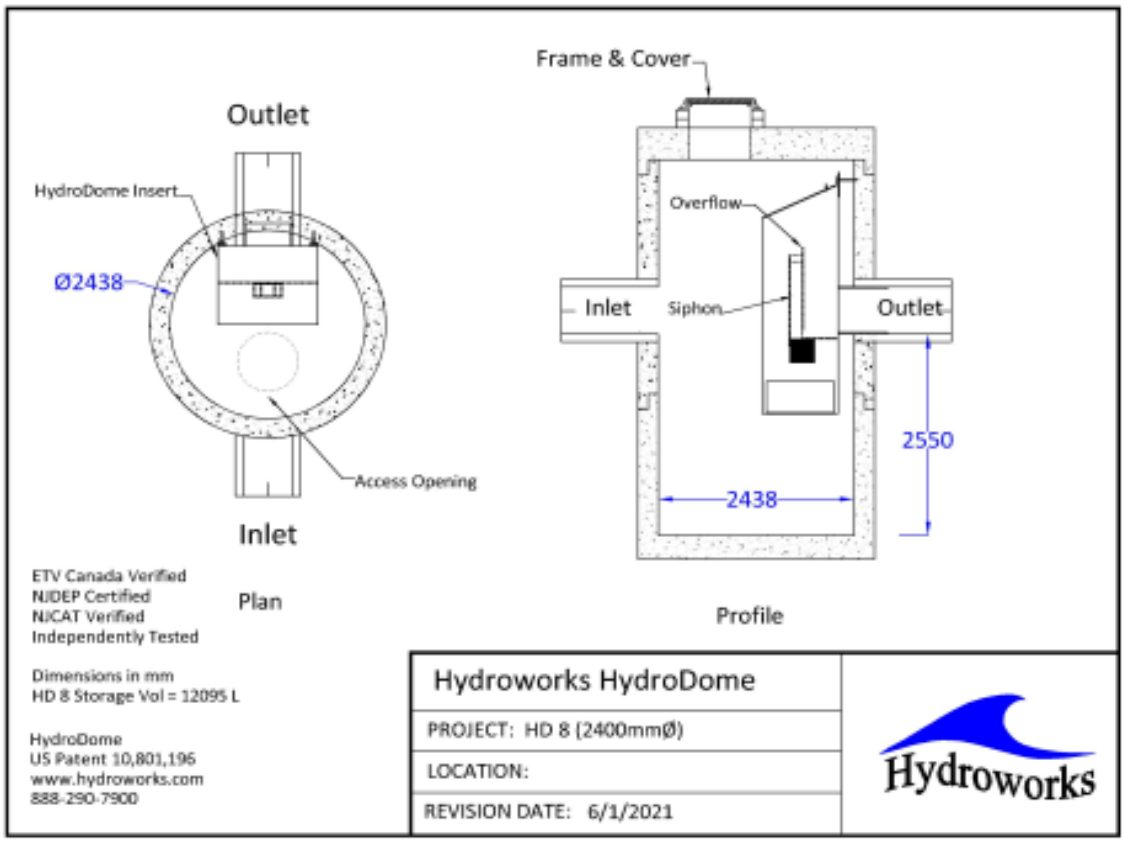



Dimensions and Capacities

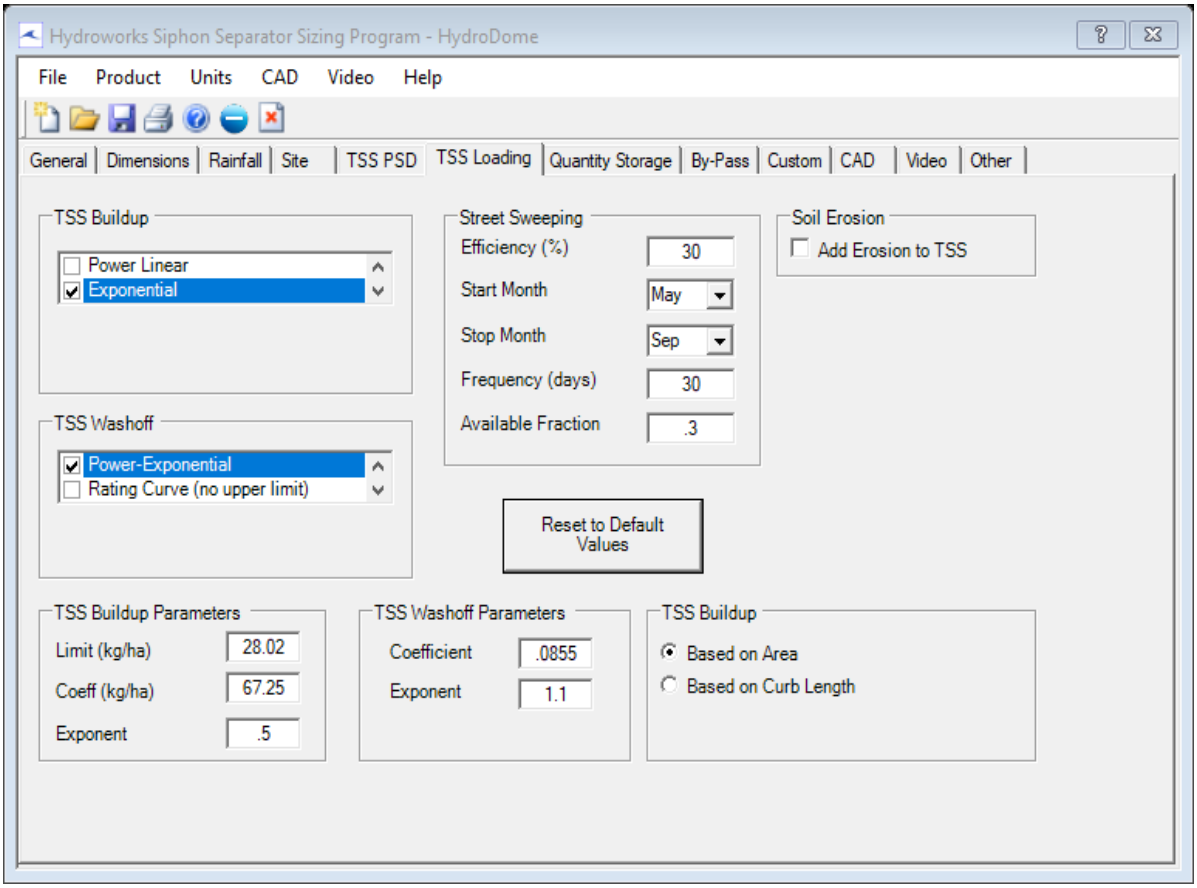
| Model | Diam. (m) | Depth (m) | Float. Vol. (L) | Sediment Vol. (m3) | Total Vol. (m3) |
|---|---|---|---|---|---|
| HD 3 | 0.91 | 1.22 | 123 | 0.5 | 0.8 |
| HD 4 | 1.22 | 1.37 | 266 | 0.9 | 1.6 |
| HD 5 | 1.52 | 1.68 | 483 | 1.7 | 3.1 |
| HD 6 | 1.83 | 1.98 | 803 | 2.9 | 5.2 |
| HD 7 | 2.13 | 2.29 | 1226 | 4.6 | 8.2 |
| HD 8 | 2.44 | 2.59 | 1863 | 6.8 | 12.1 |
| HD 10 | 3.05 | 3.2 | 3617 | 13 | 23.3 |
| HD 12 | 3.66 | 3.81 | 6224 | 22.2 | 40 |

Depth = Depth from outlet invert to inside bottom of tank

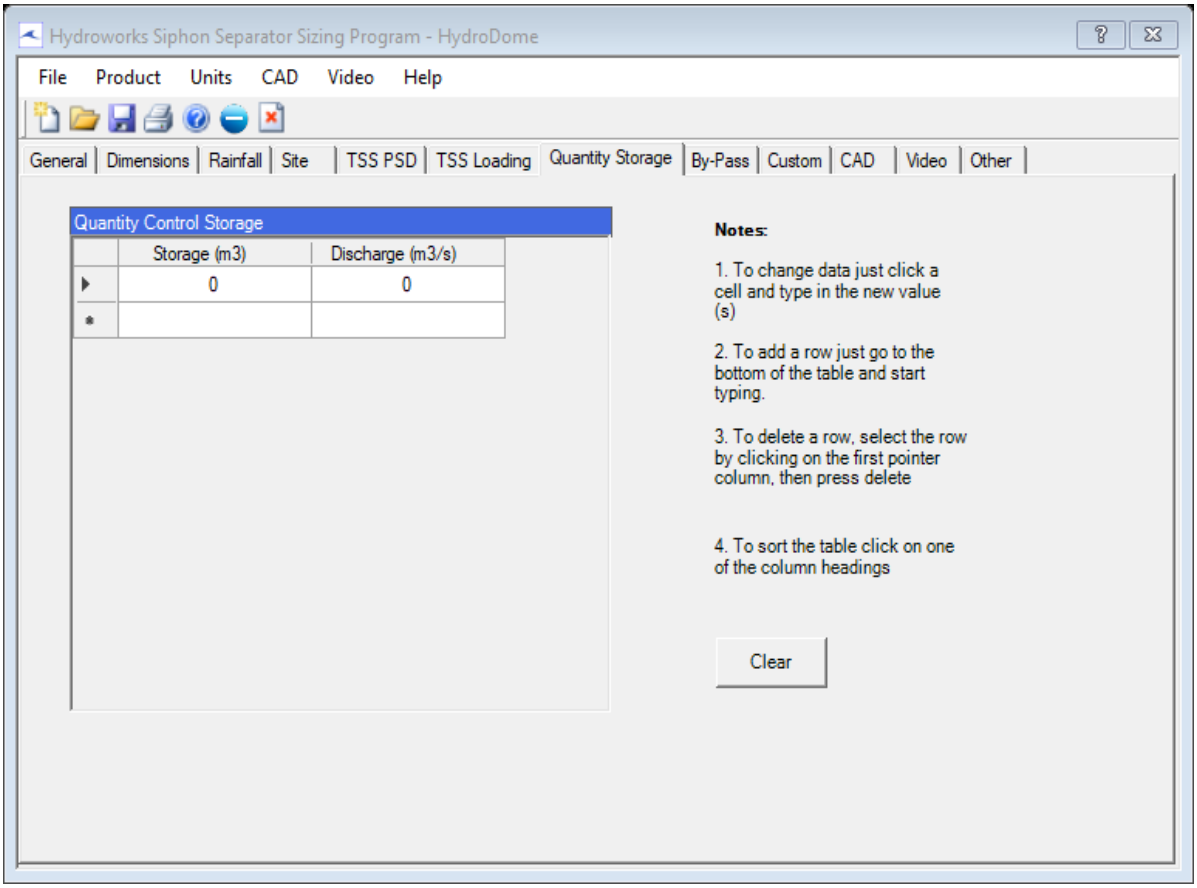
## Generic HD 8 CAD Drawing



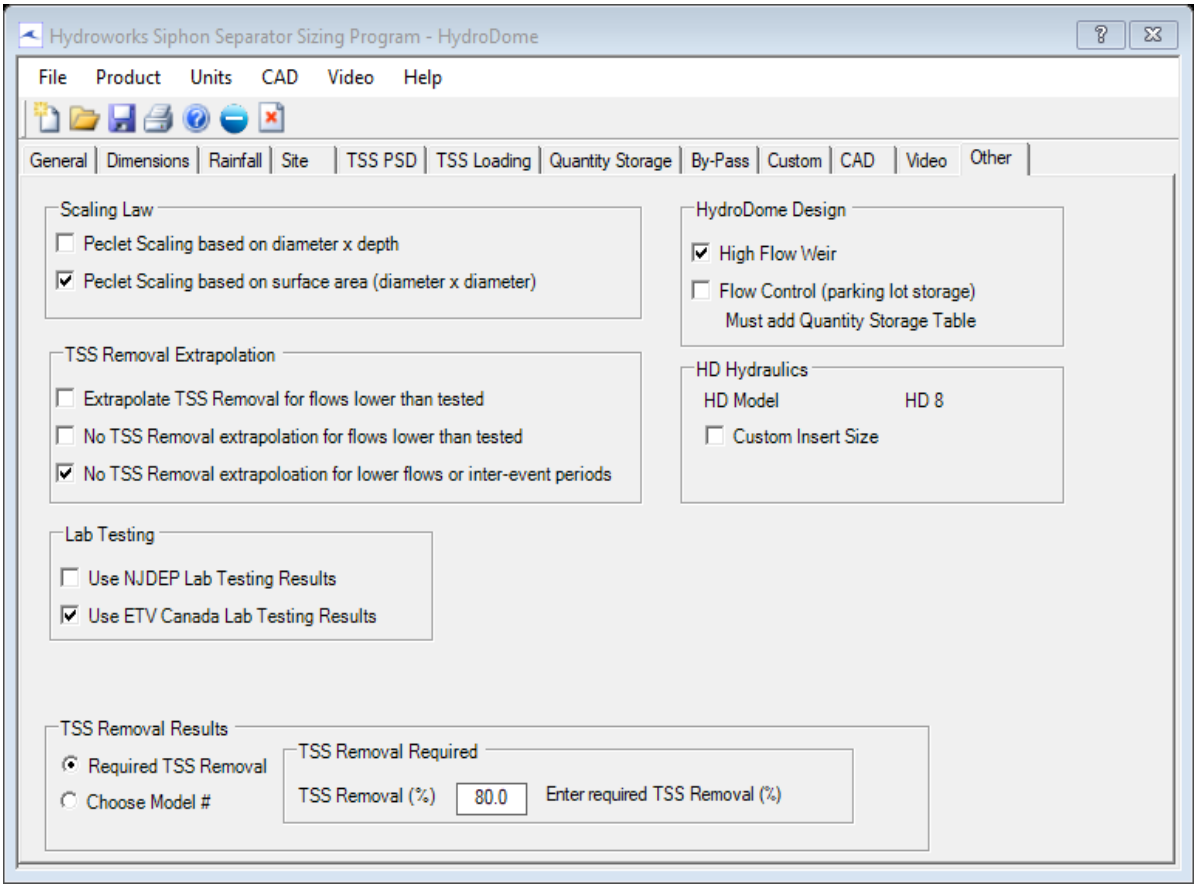
## TSS Buildup And Washoff




## Upstream Quantity Storage



**Other Parameters**

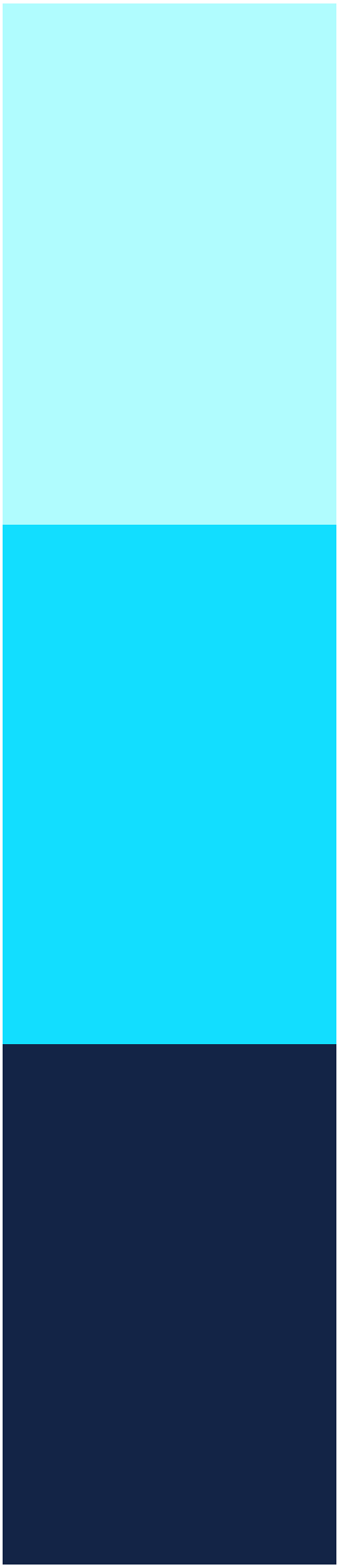



**Flagged Issues**

**If there is underground detention storage upstream of the HydroDome please contact Hydroworks to ensure it has been modeled correctly.**

**Hydroworks Sizing Program - Version 5.8**

**1-800-290-7900**
**www.hydroworks.com**



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