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FUNCTIONAL SERVICING / STORMWATER MANAGEMENT REPORT

Proposed Mixed Use Development

875 Kingston Road
City of Pickering
Region of Durham

May 2023

Prepared For: **Sphere Developments (Kingston) LP**

File: **22115**

VALDOR WATER RESOURCES

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1.0 INTRODUCTION

Valdor Engineering Inc. has been retained by Sphere Developments (Kingston) LP. to provide consulting engineering services for the proposed development of their site located at the southwest of Kingston Road and Fairport Road in the City of Pickering as indicated in **Figure 1**.

1.1 Existing Conditions

The site is approximately 0.529 hectares in size and is known municipally as 875 Kingston Road. The site currently consists of grasslands and a gravel pathway, the Amberlea Creek currently runs along the west side of the site.

The site is bound to the north by Kingston Road and to the west by the Bayfair Baptist Church, to the south by Highway 401 and to the east by a grassland.

1.2 Proposed Development

The proposed 0.529 hectare development will be in the form of a mix-used development consisting of two 17 storey mixed-use building with a shared 5 storey podium on top of a 4 level underground parking garage. The retail units are located on the ground floor with an area of 629.9 m^2.

A copy of the preliminary site plan and parking garage plan are included in **Appendix "A"** together with a calculation of the equivalent population contained in **Table A1**. The development statistics and the equivalent population data are summarized in **Table 1**.

Table 1. Development Statistics

Land Use	No of Units	Commercial Floor Area (sq.m)	Equivalent Population
One Bedroom Apartment	80		120
Two Bedroom Apartment	224		336
Three Bedroom Apartment	96		240
Commercial		629.9	6
Total:	400	629.9	702

1.3 Purpose of Report

This Functional Servicing Report has been prepared to demonstrate the servicing feasibility of the development in conjunction with the zoning by-law amendment application. It has been prepared based on a review of the topographic survey and information from servicing plans obtained from the municipal archives.

This report outlines the engineering design elements for the proposed development, including water supply, sanitary sewers, storm sewers and stormwater management as well as grading and driveway access all of which are presented in the following sections.

2.0 WATER SUPPLY

The Region of Durham owns and operates twelve drinking water systems using three supply sources including Lake Ontario, Lake Simcoe and groundwater wells. The Region is responsible for operating and maintaining every component of the water supply system including treatment, storage and distribution of potable water to consumers throughout the Region. In this regard, the Region operates and maintains 6 surface water supply plants, 22 water storage facilities, 18 pumping stations, 23 groundwater wells and approximately 2,400 km of watermains.

The subject site is serviced by the Oshawa / Whitby / Ajax distribution system which delivers treated water through approximately 2,000 kilometres of watermains to provide potable water to consumers in the City of Pickering as well as the City of Oshawa, Community of Courtice, Town of Ajax, Town of Whitby and Community of Brooklin. The source water for the treatment process is drawn from Lake Ontario. A plan of the various drinking water systems in the Region is included in **Appendix "B"**.

The following is a summary of the waster servicing requirements for the development.

2.1 Domestic Demand

The domestic demand is to be calculated using the Region of Durham engineering design standards which include the following parameters:

Residential Average Day Demand: 364 L/person/day
Residential Maximum Day Factor: 2.0
Residential Peak Hour Factor: 3.0

Commercial Average Day Demand: 364 L/person/day
Commercial Maximum Day Factor: 1.0
Commercial Peak Hour Factor: 1.5

Based on the above, it is anticipated that the development will have a water demand as summarized in **Table 2**. A detailed tabulation of the domestic water demand calculation is detailed in **Table B1** of **Appendix "B"**.

Table 2. Domestic Water & Fire Flow Demand

Land Use	Equivalent Population (Persons)	Average Day Demand (L/min)	Maximum Day Demand (L/min)	Peak Hour Demand (L/min)	Fire Flow (L/min)	Maximum Day Plus Fire Flow (L/min)	Maximum Day Plus Fire Flow (L/s)
Residential	696	175.9	351.9	527.8	3,000	3,351.9	55.9
Commercial	6	1.5	1.5	2.3	3,000	3,001.5	50.0
Total:	702	177.5	353.4	530.1	3,000	3,353.4	55.9

2.2 Watermains & Service Connections

The local watermain network consists of an existing 400mm diameter watermain located on Kingston Road, a 600mm diameter CPP watermain and a abandoned 350mm diameter watermain in the servicing easement on the east side of the site. The configuration of watermains in the area of the site is illustrated in **Figure 2**.

The proposed development will be serviced by a 200mm diameter fire line and a 150mm diameter domestic water service connecting off of the existing 400mm diameter watermain on Kingston Road. These water services will have valves at the street line and will extend into the mechanical room located in the P1 underground parking garage level.

The configuration of the existing and proposed water services is illustrated in **Figure 2**.

2.3 Water Meters

In accordance with Region of Durham criteria, the condominium development will have a bulk water meter which will be located within the mechanical room located on the P1 underground parking garage level. A backflow prevention device is to also be installed in accordance with Region standards. The backflow prevention device will ensure that quality of the Region's potable water system is protected against the potential for the reversal of the normal flow of water which can occur as a result of back siphonage or back pressure when the municipal watermain pressure drops during such events as watermain break or a firefighting operation.

Water meters are to be purchased from the Region of Durham. The location of the meter room is illustrated in **Figure 2**. A copy of the Region of Durham's standard water meter details is included in **Appendix "B"**.

2.4 Fire Protection

The fire flow required for the proposed buildings was calculated using the criteria indicated in the *Water Supply for Public Fire Protection Manual*, 2020, by the Fire Underwriters Survey (FUS). The calculation incorporates various parameters such as coefficient for fire-resistant construction, an area reduction accounting for a fire-resistant (one hour rating) protection, a reduction for low-hazard occupancies, an adjustment for sprinkler protection system, and a factor for neighbouring building proximity.

In accordance with the FUS, the required fire flow for the condominium development was calculated based on the area of the largest floor plate plus 25% of the floor area of the floor above and 25% of the floor area of the floor below. Based on the calculation, the proposed building requires a minimum fire suppression flow of 3,000 L/min.

The detailed fire flow calculation for the condominium development is provided in **Table B2** contained in **Appendix "B"**. This fire flow plus the maximum day demand must be available at the nearest hydrant with a minimum pressure of 140 KPa.

A flow test was completed by the Region of Durham on May 31, 2022. Based on the results of the flow test, the required fire flow plus maximum day demand is available at a pressure of 430.6 kPa (62.4 psi). The calculations for the available pressure are provided in **Table B3** which can be found in **Appendix "B"**.

A fire hydrant is to be located within 90m of the principal entrances to the building and within 45m of the siamese connection in accordance with the Ontario Building Code (OBC 2012). Based on the foregoing, the existing street fire hydrants will not provide sufficient coverage for the condominium development and therefore private site fire hydrants are required. The private hydrants will be supplied by the water distribution system within the underground parking garage.

The location of the existing fire hydrants and the private site fire hydrants is indicated in **Figure 2**.

3.0 WASTEWATER SERVICING

The Region of Durham is responsible for wastewater servicing provided to the residents and businesses within the Region including the City of Pickering. The Region operates and maintains 11 sewage treatment plants, 48 sewage pumping stations and approximately 1,400 km of sanitary sewers.

The subject site drains towards the Bayly Street Sanitary Sewer Pumping Station which is located within the service area of the Duffin Creek Water Pollution Control Plant (WPCP) which is located at 901 McKay Road in Pickering. This plant discharges fully treated water into Lake Ontario. The Duffin Creek WPCP, jointly owned and operated by The Regional Municipalities of York and Durham, is a critical component of the York Durham Sewage System (YDSS). In this regard, the plant treats sewage from the City of Pickering and Town of Ajax as well as sewage from York Region communities as far north as the Towns of Aurora and Newmarket, as far west as the City of Vaughan, and the Towns of Richmond Hill and Markham.

The following is a summary of the wastewater servicing analysis for the subject site.

3.1 Wastewater Loading

The wastewater loading has been calculated using the Region of Durham engineering design standards which include the following parameters:

Domestic Flow: Q = 364 L/person/day

Extraneous Flow: *I* = 0.26 L/s/Ha (Infiltration)

Peaking Factor: $K_H = 1 + \frac{14}{4 + \sqrt{P}}$ (K_H =1.5 min., 3.8 max.)

Where: K_H = Harmon Peaking Factor
P = Population in thousands

Design Flow, Q = Q x K_H + *I*

Design Flow Rate (Commercial): 2.08 L/s/day

Based on the above criteria the sewage flow calculations are provided in **Table C1** contained in **Appendix "C"** and the total flow is summarized in **Table 3**.

Table 3. Wastewater Loading Summary

Land Use	Area (Ha)	Equivalent Population (Persons)	Average Daily Flow (L/s)	Harmon Peaking Factor	Peak Daily Flow (L/s)	Infiltration Rate (L/s)	Total Flow (L/s)
Residential	0.529	696.0	2.932	3.8	11.14	0.138	11.28
Commercial	0.063	6.0	0.131	Incl.	Incl.	Incl.	0.13
Total:	0.529	702.0					11.41

3.2 Sanitary Sewers & Service Connections

The proposed building will be serviced by a 250mm diameter servicing connection. The proposed 250mm diameter service connection will be connected to a sanitary control manhole and discharge to the existing 900mm diameter sanitary trunk sewer located in an easement to the south of the site. The location of the sanitary service connection is illustrated in **Figure 3**.

3.3 Downstream Sanitary Sewer Capacity

The proposed sanitary service connection will be connected to the existing 900mm diameter sanitary trunk sewer in the easement. The Region of Durham is carrying out the sewer capacity analysis of the sewer shed. Based on the confirmation from the Region, there is sufficient capacity in the existing 900mm diameter trunk sewer to receive the wastewater flow from the proposed development. The email confirmation from the Region is included in **Appendix "C"**.

Based on the above, the existing wastewater infrastructure has sufficient capacity to accommodate the proposed development without the need for external upgrades or retrofits.

4.0 STORM DRAINAGE

The subject site is located in the Frenchman's Bay watershed which is under the jurisdiction of the Toronto & Region Conservation Authority (TRCA). The Frenchman's Bay watershed is consisted of Amberlea Creek, Dunbarton Creek, Pine Creek and Krosno Creek that drains an area of approximately 27 square kilometres including lands on the north shore of Lake Ontario in the City of Pickering. A copy of the TRCA's watershed map is included in **Appendix "D"**.

In accordance with City standards, a major / minor system storm conveyance concept has been incorporated into the functional servicing design for the subject development. The following sections provide a brief summary of the storm drainage components:

4.1 Minor System Design

As per the City engineering design criteria, the proposed development is to be serviced with a minor storm sewer system that is designed to convey runoff from all storm events from 2 year up to and including 100 year event, using a maximum pre-development runoff coefficient of 0.5. The rainfall intensity values, *I*, are calculated in accordance with the City standards as follows:

$$I_2 = \frac{715.076}{(t + 5.262)^{0.815}}$$

$$I_5 = \frac{1082.901}{(t + 6.007)^{0.837}}$$

$$I_{10} = \frac{1313.979}{(t + 6.026)^{0.845}}$$

$$I_{25} = \frac{1581.718}{(t + 6.007)^{0.848}}$$

$$I_{50} = \frac{1828.009}{(t + 6.193)^{0.856}}$$

$$I_{100} = \frac{2096.425}{(t + 6.485)^{0.863}}$$

The peak flows are calculated using the following formula:

$Q = R \times A \times I \times 2.778$

where: Q = peak flow (L/s)
A = area in hectares (Ha)
I = rainfall intensity (mm/hr)
R = composite runoff coefficient
t = time of concentration (min)

Based on the topographic survey, the west side of the subject site currently drains towards the Amberlea Creek and the east side of the site currently drains to the existing ditch located to the south of the subject site that flows easterly. The existing drainage is illustrated in **Figure 4**.

The proposed mixed-use development will be serviced by a site storm sewer which will discharge to the existing open ditch that drains to the existing box culvert running southernly under Highway 401. The site storm sewer will consist of catchbasins, area drains and manholes which will collect and convey runoff.

Runoff from the paved and landscaped ground surfaces located over the underground parking garage will be captured by a series of area drains which will connect to the storm service connection via an internal private storm drain. This storm drain will be located along the ceiling of the underground parking garage and will be designed by the mechanical engineer at the building permit stage.

The location of the storm service connection and site storm sewer is illustrated in **Figure 6**. The City of Pickering rainfall intensity duration frequency (IDF) curve data is included in **Appendix "D"**.

4.2 Major System Design

The major system will generally be comprised of an overland flow route through the proposed ground level parking which will direct drainage to the existing ditch located to the south of the subject site. This major system will convey flows which are in excess of the 100 year storm event. The major system flow route is illustrated in **Figure 6B**.

4.3 Foundation Drainage

The proposed development will have an underground parking garage that will have a foundation drainage system and a sump pump to discharge accumulated groundwater. The sump pump will be designed by the mechanical engineer at the building permit stage and will discharge to the storm service connection.

4.4 Roof Drainage

The roof drainage will discharge via an internal storm drain system which will discharge to the storm service connection. The roof drains will be designed by the mechanical engineer at the building permit stage.

4.5 Flood Plain

Part of the subject site is located within the floodplain of the of the Amberlea Creek that runs along the west side of the site. In order to mitigate flood risk, the proposed development will be located outside the flood plain. Based on the foregoing, no flood mitigation measures are required. The TRCA's flood plain mapping is included in **Appendix "D"**.

5.0 STORMWATER MANAGEMENT

In accordance with the requirements of the City of Pickering the following stormwater management criteria will be implemented:

- Quantity Control is to be provided such that the post-development peak flows will be controlled to the pre-development rates for rainfall events up to and including the 100 year storm.
- Level 1 (Enhanced) stormwater quality treatment is to be provided to achieve 80% TSS removal.

Based on the foregoing, the following is a summary of the stormwater mitigation measures that are to be incorporated into the design of the subject site.

5.1 Quantity Control

Stormwater quantity control is typically implemented to minimize the potential for downstream flooding, stream bank erosion and overflows of infrastructure. The impact of the proposed development has been analyzed as follows:

5.1.1 Pre-Development Flow

Pre-development surfaces consist of grassland and gravel area, which indicate that the existing site condition is relatively pervious with a composite runoff coefficient of 0.27. The pre-development surface conditions are illustrated in **Figure 4.**

Pre-development peak flow calculations were generated using the City's rainfall IDF data in accordance to the municipal standards. The calculation of the pre-development from 2 year to 100 year peak flows are provided on **Table E1** contained in **Appendix "E"** and summarized in the first and second row of **Table 4.**

Table 4: Storm Drainage Peak Flows

Condition	Peak Flows (L/s)					
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Pre-Development	57.0	78.2	92.6	121.8	148.7	171.6
Post-Development (Unmitigated)	94.7	129.7	153.8	202.2	246.9	284.8
Post-Development (Mitigated)	50.7	63.4	71.0	79.3	86.7	93.1

5.1.2 Post-Development Flow: Unmitigated

Based on a review of the architect's site plan, the post-development surface conditions for this site are illustrated in **Figure 5.** The surfaces consist mainly of the paved private road, surface parking area, walkways, buildings and landscaped areas. Based on these surfaces, the proposed development is more impervious than the existing site condition and the composite runoff coefficient increases from 0.27 to 0.83.

Based on this post-development runoff coefficient the unmitigated 2 year through 100 year post-development peak flow rates are calculated on **Table E2** and are summarized in the third row of **Table 4**.

5.1.3 Post-Development Flow: Mitigated

Given that the site storm sewer will discharge to the municipal storm sewer, the 2 year through 100 year post development peak flows are to be controlled to the 2 year through 100 year pre-development rates with 0.5 runoff coefficient. Based on the foregoing, on-site stormwater detention measures will be necessary.

The stormwater quantity control was modelled using the modified rational method. This method calculates the storage volume using the composite runoff coefficient and the target rate. Through an iterative assessment of various orifice sizes, underground storage configurations and high water levels, a detention system was developed.

Based on the modelling, the post-development mitigated peak flows are summarized in the third row of **Table 4**. A comparison of the flows in the second and third rows of **Table 4** indicates that the mitigated post-development 2 year through 100 year peak flow has been reduced to be less than the target pre-development release rates by using a 150mm orifice tube, within the allowable release rate. Based on the above, storage of 77.4 m^3 is required for the 100 year event, which will be provided in a stormwater detention tank within the underground parking garage level. No ground surface or rooftop detention is proposed.

The location of the orifice and detention system is illustrated in **Figure 6**. The orifice calculation, detention calculation and storage volume summary are presented in **Table E3 to Table E5** which are all contained in **Appendix "E"** together with a storage and discharge summary presented in **Table E**.

5.2 Quality Control

Based on the City of Pickering criteria, storm water quality control for the subject site is to be designed to achieve "Enhanced" protection level (Level 1 treatment) which entails 80% total suspended solids (TSS) removal.

In order to achieve the City's criteria, a treatment unit has been selected from a list of products which provide 80% TSS removal and are supported by field performance data verified under TARP (Technology Acceptance and Reciprocity Partnership) Tier 2 Testing Protocols used in the NJDEP (New Jersey Department of Environmental Protection) assessment and certification program which is recognized by the City of Toronto. In this regard, Jellyfish™ model JF6-3-1 by Imbrium Systems Corporation has been selected and based on the sizing will provide a TSS removal rate of 89%.

The selected Jellyfish™ unit is a filter system contained in a 1,800mm diameter pre-cast concrete maintenance hole. The unit will be located downstream of the orifice such that flows through the unit will be controlled thereby enhancing the efficiency of the unit. The location of the control manhole, orifice and treatment unit are aligned along the front property line such that they are all easily accessible for inspection and maintenance purposes.

The sizing calculation for the sizing of the treatment unit is included in **Appendix "F"** together with the product information. The location of the treatment unit is indicated in **Figure 6**.

5.3 Water Balance

The objective of water balance criteria in the WWFM Policy is to capture and manage annual rainfall on-site to preserve the pre-development hydrology. Water balance consists of runoff, infiltration and evapotranspiration. The target of this policy is to retain the 5mm rainfall depth on site.

The runoff volume is calculated based on the site area with an adjustment for initial abstraction. The initial abstraction has been established based on the various site surface types and was calculated to be 1.54mm. The runoff volume required to be retained on site is calculated as follows:

$$V = A \times (D - Ia)$$

where: V = runoff volume (m^3)
A = area (m^2)
D = rainfall depth (0.005m)
I = Initial Abstraction

V = 5,290 m^2 x (0.005m – 0.00154m)
V = 18.28 m^3

The calculation of the water balance requirement is provided in **Table G1** contained in **Appendix "G"**.

A review of the architect's site plan indicates that the underground parking structure covers almost the entire site, and therefore infiltration methods cannot be utilized. For this project the necessary retention volume will be retained in the stormwater tank on the P1 underground parking level between the bottom of the tank and the tank outlet. The retained water will then be re-used for purposes such as irrigation.

6.0 VEHICULAR & PEDESTRIAN ACCESS

The site plan has been developed with consideration for efficient and safe access and circulation of both vehicular and pedestrian traffic.

6.1 Driveways & Parking

The subject site has frontage on Kingston Road which is an arterial road under the jurisdiction of the Region of Durham. No new municipal roads are required to accommodate the subject development.

Access to the proposed condominium development will be provided by a driveway entrance on Brock Road and a shared driveway access off of Kingston Road.

6.2 Sidewalks & Walkways

Internal pedestrian access will be provided by walkways to safely guide residents through the site to the existing municipal sidewalks on Kingston Road.

7.0 GRADING

Based on a topographic survey of the site completed on July 25, 2022 by IBW Surveyors Ltd., the property slopes from the north at an elevation of approximately 98.16m, down to the southeast of the developable limit, at an elevation of approximately 90.30m resulting in a fall of approximately 7.8m. A copy of the topographic survey prepared by IBW Surveyors Ltd. is included in **Appendix "H"**.

As is typical with condominium buildings, the grading design for the site must accommodate the existing elevations along the neighbouring properties and adjacent road allowances and the ground floor level must be established to provide an accessible route from the driveways and walkways to the lobby of the various buildings and to the retail spaces. In many cases the floor levels can be stepped with internal stairs and ramps to better accommodate the site topography.

The subject site is to be graded in accordance with the municipal grading criteria which dictates that driveways, parking lots and walkway grades are to range from 0.5% to 5.0% and that sodded yard areas are to range from 2.0% to 5.0%. For large grade differentials, a maximum slope 3H : 1V can be used for sodded embankments. In areas where space is limited, retaining walls can be utilized to accommodate grade differentials.

Based on the topography of the site 3:1 slopes and retaining walls will be required along the permitter of the developable area. There will be no grading encroachment within the flood plain. A copy of the preliminary grading plan which, indicates the limits of the flood plain, is appended to the end of the report. A detailed grading plan is to be prepared at the site plan application stage.

Given that the subject site is located in an area that is regulated by the TRCA, a permit will be required from their office prior to the start of earthworks / excavation. A copy of the TRCA's regulation mapping is included in **Appendix "D"**.

8.0 EROSION & SEDIMENT CONTROL DURING CONSTRUCTION

Construction activity, especially operations involving the handling of earthen material, dramatically increases the availability of particulate matter for erosion and transport by surface drainage. In order to mitigate the adverse environmental impacts caused by the release of silt-laden stormwater runoff into receiving watercourses, measures for erosion and sediment control (ESC) are required for construction sites.

The impact of construction on the environment is recognized by the Greater Golden Horseshoe Area Conservation Authorities. In December 2006 they released their document titled "Erosion & Sediment Control Guidelines for Urban Construction". This document provides guidance for the preparation of effective erosion and sediment control plans.

Control measures must be selected that are appropriate for the erosion potential of the site and it is important that they be implemented and modified on a staged basis to reflect the site activities. Furthermore, their effectiveness decreases with sediment loading and therefore inspection and maintenance is required. The selection, implementation, inspection and maintenance of the control features are summarized as follows:

8.1 Control Measures

On moderately sized sites, measures for erosion and sediment control typically include the use of silt fencing, a mud mat and sediment traps. The following is a description of the sediment controls to be implemented on the subject site:

- **Silt Fences** are to be installed adjacent to all property limits subject to drainage from the development area prior to topsoil stripping and in other locations, such as at the bases of topsoil stockpiles.
- **Mud Mat** is to be installed at the construction entrance prior to commencing earthworks to minimize the tracking of mud onto municipal roads.
- **Sediment Traps** are to be installed at all catchbasin and area drain locations once the storm sewer system has been constructed to prevent silt laden runoff from entering the municipal storm sewer system.

8.2 Construction Sequencing

The following is the scheduling of construction activities with respect to sediment controls:

1. Install the silt fences prior to any other activities on the site.
2. Construct temporary mud mat for construction access.
3. Install the sediment traps.
4. Install the shoring, excavate for the underground parking garage and dispose earth material off site.
5. Construct the foundation and underground parking garage.
6. Construct the superstructure of the building and complete the cladding, rough-ins and finishes.
7. Install the service connections.
8. Construct the driveways, surface parking areas and walkways
9. Restore all disturbed areas with final landscape plantings and paving materials.
10. Upon stabilization of all disturbed areas, remove sediment controls.

8.3 ESC Inspection & Maintenance

In order to ensure that the erosion and sediment control measures operate effectively, they are to be regularly monitored and they will require periodic cleaning (e.g., removal of accumulated silt), maintenance and/or re-construction.

Inspections of all of the erosion and sediment controls on the construction site should be undertaken with the following frequency:

- On a weekly basis
- After every rainfall event
- After significant snow melt events

- Prior to forecasted rainfall events

If damaged control measures are found they should be repaired and/or replaced within 48 hours. Site inspection staff and construction managers should refer to the Erosion and Sediment Control Inspection Guide (2008) prepared by the Greater Golden Horseshoe Area Conservation Authorities. This Inspection Guide provides information related to the inspection reporting, problem response and proper installation techniques.

9.0 SUMMARY

Based on the discussions contained herein, the proposed mixed-use development can be adequately serviced with full municipal services (watermain, sanitary and storm) in accordance with the standards of the City of Pickering and the Region of Durham as follows:

Water

- The proposed development will be serviced by a 200mm diameter fire line and a 150mm diameter domestic water service connecting off of the existing 400mm diameter watermain on Kingston Road. These water services will have valves at the street line and will extend into the mechanical room located in the P1 underground parking garage level.
- The existing street fire hydrants do not provide sufficient coverage for the condominium development and therefore site fire hydrants will be provided such that it will be available within 90m of the principle entrance of the buildings and within 45m of the Siamese connections.
- The subject development will require a maximum day plus fire flow of 55.9 L/s at 140 kPa.
- Based on fire hydrant flow test results, the existing watermain system has sufficient capacity to accommodate the subject development.

Wastewater

- The proposed building will be serviced by a 250mm diameter servicing connection. The proposed 250mm diameter service connection will be connected to a sanitary control manhole and discharge to the existing 900mm diameter sanitary trunk sewer located in an easement to the south of the site.
- The subject development will generate a peak wastewater flow of 11.41 L/s.
- The proposed sanitary service connection will be connected to the existing 900mm diameter sanitary trunk sewer in the easement. The Region of Durham is carrying out the sewer capacity analysis of the sewer shed. Based on the confirmation from the Region, there is sufficient capacity in the existing 900mm diameter trunk sewer to receive the wastewater flow from the proposed development.

Storm Drainage

- In accordance with City of Pickering criteria, the subject site will be serviced by a minor system discharging to the existing open ditch that drains to the existing box culvert running southernly under Highway 401.
- The major system will be comprised of an overland flow route which will convey runoff from rainfall events in excess of the capacity of the municipal storm sewer to a safe outlet.

Stormwater Management

- Based on the City of Pickering requirements the following stormwater management measures are to be implemented:
    - The development quantity control will be provided by a detention system. The site runoff will be controlled by a 150 mm diameter orifice tube which will restrict

the discharge from 2 year to 100 year storms under post-development condition to the storm events from 2 year to 100 year under the existing condition. A detention storage of 77.4 m^3 is required for the 100 year event, which will be provided in a stormwater detention tank within the P1 underground parking garage level. No ground surface or rooftop detention is proposed.

- Quality control will be provided the Jellyfish^{TM} model JF6-3-1 by Imbrium Systems Corporation which has been sized to provide "Enhanced" protection (Level 1 treatment) quality control. In this regard, JF6-3-1 model has been selected which will provide a Total Suspended Solids (TSS) removal rate of 89%.
- The site will retain the 5mm rainfall depth by providing at least 18.28m^3 of required retention volume located at the bottom of the tank to achieve the water balance criteria in the WWFM Policy. The retained water will be re-used for irrigation on site.
- Part of the subject site is located within the floodplain of the of the Amberlea Creek that runs along the west side of the site. In order to mitigate flood risk, the proposed development will be located outside the flood plain. Based on the foregoing, no flood mitigation measures are required.

Vehicular & Pedestrian Access

- Vehicular access to the subject site will be provided by one driveways off Kingston Road which is under the jurisdiction of the Region of Durham.
- The existing driveway entrances are to be removed and the curb and boulevard are to be restored.

Grading

- The subject site is to be graded in accordance with the municipal grading criteria which dictates that driveways, parking lots and walkway grades are to range from 0.5% to 5.0% and that sodded yard areas are to range from 2.0% to 5.0%. For large grade differentials, a maximum slope 3H : 1V can be used for sodded embankments. In areas where space is limited, retaining walls can be utilized to accommodate grade differentials.
- Based on the topography of the site 3:1 slopes and retaining walls will be required along the permitter of the developable area. There will be no grading encroachment within the flood plain. A detailed grading plan is to be prepared at the site plan application stage.

Erosion & Sediment Control During Construction

- Erosion and sediment controls are to be implemented during construction to prevent silt laden runoff from leaving the site in accordance with the "Erosion & Sediment Control Guidelines for Urban Construction" (December 2006).

Site Plan Application

- Detailed engineering design for the proposed development is to be prepared at the site plan application stage. This detailed design is to include site servicing and grading plans.

10.0 REFERENCES & BIBLIOGRAPHY

- City of Pickering, **Stormwater Management Guidelines**, July 2019.
- Region of Durham, **Design & Construction Specifications for Regional Services**, April 2013.
- Ministry of Environment, **Stormwater Management Planning & Design Manual**, March 2003.
- Greater Golden Horseshoe Area Conservation Authorities, **Erosion & Sediment Control Guidelines for Urban Construction**, December 2006.
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- Ministry of Municipal Affairs & Housing, **Ontario Building Code**, 2012.

Respectfully Submitted,

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dgiugovaz@valdor-engineering.com

PROPOSED DEVELOPMENT

875 KINGSTON ROAD
CITY OF PICKERING

LOCATION PLAN

VALDOR ENGINEERING INC.
Consulting Engineers - Project Managers
571 CHRISLEA RD, UNIT 4, 2ND FLOOR, WOODBRIDGE, ONTARIO, L4L 8A2
TEL (905)264-0054, FAX (905)264-0069
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www.valdor-engineering.com

SCALE	N.T.S.	CKD. BY	D.G	PROJECT	22115
DATE	MAY 2023	DRAWN BY	H.E.	DWG.	FIGURE 1

KINGSTON ROAD

FAIRPORT ROAD

HIGHWAY 401

DEVELOPABLE AREA

NET DEVELOPABLE AREA LINE

DEVELOPABLE AREA

MTO SETBACK 14M-HIGHWAY BUFFER

NET DEVELOPABLE AREA LINE

DEVELOPABLE AREA

DEVELOPABLE AREA

DRIPLINE SETBACK 10M

TOP OF BANK SETBACK 10M

94.00 FLOODLINE SETBACK 10M

EX. 400mmø CL WATERMAIN

EX. 600mmø CPP WATERMAIN

EX. 350mmø CL WATERMAIN (ABANDONED)

PROP. 150mmø PVC DOMESTIC WATER SERVICE

PROP. 200mmø PVC FIRELINE

EX.HYD

EX HP/LP

PROP. SIAMESE CONNECTION (AT GROUND LEVEL)

PROP. HYDRANT

LIMIT OF UNDERGROUND

APPROXIMATE CENTRELINE OF PAVEMENT

APPROXIMATE CENTRELINE OF PAVEMENT

LEGEND:

- EXISTING WATERMAIN
- PROPOSED WATERMAIN
- WATER METER LOCATION
- BACKFLOW PREVENTER LOCATION
- DCDA — DOUBLE CHECK DETECTOR ASSEMBLY LOCATION
- FIRE HYDRANT
- VALVE CHAMBER

PROJECT

PROPOSED DEVELOPMENT

875 KINGSTON ROAD
CITY OF PICKERING

WATER SERVICING

VALDOR ENGINEERING INC.
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PREPARED BY: S.Y.	CKD. BY: D.G.
SCALE: N.T.S.	DATE: MAY 2023
PROJECT: 22115	DWG.: FIGURE 2

KINGSTON ROAD

FAIRPORT ROAD

DEVELOPABLE AREA

DRIPLINE SETBACK 10M

TOP OF BANK SETBACK 10M

FLOODLINE SETBACK 10M

MTO SETBACK 14M–HIGHWAY BUFFER

NET DEVELOPABLE AREA LINE

LIMIT OF UNDERGROUND

PROP. SAN MH
(1200mmø)
TOP 95.75
N INV 91.58
S INV 91.55

INV 92.63

PROP.
4.8m–250ø
SAN @ 2.0%

PROP. 4.7m–250ø SAN @ 2.0%

EX. SAN MH2
TOP 92.50
EX INV 85.34
N INV 91.46
DROP INV 85.99
(DROP STRUCTURE AS PER
REGION STD S–100.080)

EX. 92m–900mmø CONC. SAN

EX. 121m–900mmø CONC. SAN

EX. SAN MH1A
TOP 89.88
INV 85.48

EX HP/LP

HIGHWAY 401

LEGEND:

- EXISTING SANITARY
- PROPOSED SANITARY

PROJECT

PROPOSED DEVELOPMENT

875 KINGSTON ROAD
CITY OF PICKERING

SANITARY SERVICING

VALDOR ENGINEERING INC.
Consulting Engineers - Project Managers
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PREPARED BY	CKD. BY
S.Y.	D.G.
SCALE: N.T.S.	DATE: MAY 2023
PROJECT: 22115	DWG.: FIGURE 3

KINGSTON ROAD

FAIRPORT ROAD

APPROXIMATE CENTRELINE OF PAVEMENT

DEVELOPABLE AREA

DRIPLINE SETBACK 10M

TOP OF BANK SETBACK 10M

FLOODLINE SETBACK 10M

NET DEVELOPABLE AREA LINE

MTO SETBACK 14M-HIGHWAY BUFFER

LEGEND:

PERVIOUS

GRAVEL

SITE AREA

PRE-DEVELOPMENT AREA SUMMARY

LAND USE	AREA (Ha.)	RC	COMPOSITE RC
PERVIOUS	0.511	0.25	0.27
GRAVEL	0.018	0.70	
TOTAL	0.529		

PROJECT

PROPOSED DEVELOPMENT

875 KINGSTON ROAD
CITY OF PICKERING

PRE-DEVELOPMENT DRAINAGE PLAN

VALDOR ENGINEERING INC.
Consulting Engineers - Project Managers
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PREPARED BY	CKD. BY
S.Y.	D.G.
SCALE: N.T.S.	DATE: MAY 2023
PROJECT: 22115	DWG.: FIGURE 4

KINGSTON ROAD

FAIRPORT ROAD

APPROXIMATE CENTRELINE OF PAVEMENT

DEVELOPABLE AREA

DRIPLINE SETBACK 10M

TOP OF BANK SETBACK 10M

94.00 FLOODLINE SETBACK 10M

NET DEVELOPABLE AREA LINE

MTO SETBACK 14M-HIGHWAY BUFFER

STAKED JUNE 9th '21

EX HP/LP

LEGEND:

- ROOF
- PERVIOUS
- IMPERVIOUS
- SITE AREA

POST-DEVELOPMENT AREA SUMMARY

LAND USE	AREA (Ha.)	RC	COMPOSITE RC
PERVIOUS	0.072	0.25	0.83
ROOF	0.194	0.95	
IMPERVIOUS	0.263	0.90	
TOTAL	0.529		

PROJECT

PROPOSED DEVELOPMENT

875 KINGSTON ROAD
CITY OF PICKERING

POST-DEVELOPMENT DRAINAGE PLAN

VALDOR ENGINEERING INC.
Consulting Engineers - Project Managers
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PREPARED BY	CKD. BY
S.Y.	D.G.
SCALE: N.T.S.	DATE: MAY 2023
PROJECT: 22115	DWG.: FIGURE 5

KINGSTON ROAD

FAIRPORT ROAD

EX. CULVERT

EX. STM DITCH

EX. CULVERT

EX. CBMH
TOP 95.01
E.INV. 91.84
W.INV. 91.62

EX. 35.0m-450mmø CSP STM

EX. STM MH
TOP 95.52
W.INV. 91.42
N.INV 89.98
E.INV. 89.91

EX. 1200mmø CSP STM

EX. CB
TOP 92.15

EX. STM MH
S INV 89.83
NW.INV. 89.72
N.INV 89.78

EX. 18.2m-600mmø
CSP STM @2.3%

1200mm CONC BOX CULVERT

PROP. 150mmø ORIFICE TUBE

PROP. STM MH2
(1200mmø)
TOP 92.50
W.INV 91.13
S.IN.INV 90.86
S.OUT.INV 91.05
E.INV 91.06

PROP. 18.8m-300mmø STM @2.0%

EX. CPP WM. INV. 93.23
PROP. STM INV. 91.13
PROP. STM OBV. 91.43
CLEARANCE = 1.8m

PROP. 3.1m-300mmø
STM @3.7%

AD 3
TOP 95.92

PROP. 3.5m-300mmø STM @2.0%

PROP. STM MH1
(1200mmø)
TOP 91.33
W INV 91.00
E INV 90.95

PROP. 9.52m-300mmø STM @3.7%

PROP. HEADWALL
OPSD 804.00
INV 90.60

150mm DIA RIP
RAP
EROSION
PROTECTION

EX. OPEN DITCH

PROP. 11.2m-300mmø STM
@3.7%

PROP. 1800mmø
JELLYFISH UNIT
MODEL (JF6-3-1)
TOP 95.46
S.IN.INV 91.05
S.OUT.INV 90.90

PROP. 24.0m-250mmø STM @ 2.0%

CB
TOP 94.60

EX. HEADWALL

EX. BOX CULVERT

DEVELOPABLE AREA

AD
TOP 96.85

AD 12
TOP 96.67

EMERGENCY
OVERFLOW GRATE/
MAINTENANCE ACCESS

PROP. P1 LEVEL-
SWM DETENTION TANK
AREA: 39.4m²
TANK OUTLET: 91.60
100YR HWL: 93.78
TANK BOTTOM 91.18
TANK CEILING 94.20
100YR DETENTION VOL. REQUIRED: 77.40m³
DETENTION HEIGHT: 2.18m
RETENTION VOL. REQUIRED: 18.28m³
RETENTION HEIGHT: 0.42m

PROP. STM
MH3
(1200mmø)
TOP 93.70
W INV 91.54
E INV 91.51

AD 4
TOP 96.93

AD 5
TOP 96.72

AD 6
TOP 96.80

AD 7
TOP 95.50

AD 8
TOP 94.63

DRIPLINE SETBACK 10M

TOP OF BANK SETBACK 10M

FLOODLINE SETBACK 10M

NET DEVELOPABLE AREA LINE

MTO SETBACK 14M-HIGHWAY BUFFER

HIGHWAY

401

LEGEND:

- EXISTING STORM
- PROPOSED STORM
- PROPOSED AREA DRAIN

PROJECT
PROPOSED DEVELOPMENT
875 KINGSTON ROAD
CITY OF PICKERING

STORM SERVICING

VALDOR ENGINEERING INC.
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PREPARED BY	CKD. BY
S.Y.	D.G.
SCALE: N.T.S.	DATE: MAY 2023
PROJECT: 22115	DWG.: FIGURE 6

APPENDIX "A"

Preliminary Site Plan & Building Elevations

875 Kingston Road

17 storey development with 5 floors of podium, two towers (a total of 12 storeys above podium

Summary

	m2	ft2	Ha
Site Area	5,291.90	56,962	0.529
Total Units	**400**		
Average Unit Size	**55.93**	602	
UPH	755.87		

	m2	ft2
Total GFA (including comm.)	**43,492.80**	**468,156**
Commercial GFA	629.90	6,780
excludable	16,860.70	181,489
FINAL GFA (including comm.)	**26,632.10**	**286,668**
Total FSI	**5.03**	
Coverage	**1,950.00**	**36.85%**
Building Height (Top of Roof)	**54.05**	

PODIUM

Floors	GFA		Allowable Exclusions of GFA As Per The Definition				FINAL GFA		UNITS			
			Exclusions		Required Amenity				Studio	1B/1B+D	2B/2B+D	Total
	m2	ft2	m2	ft2	m2	ft2	m2	ft2	300-400 sf	450-700sf	750-850 sf	
UG4	3660.30	39,399	3448.10	37115	0.00	0	212.20	2284	0	0	0	0
UG3	3660.30	39,399	3522.10	37,912	0.00	0	138.20	1,488	0	0	0	0
UG2	3660.30	39,399	3522.10	37,912	0.00	0	138.20	1,488	0	0	0	0
UG1	3660.30	39,399	3522.10	37912	0.00	0	138.20	1488	0	0	0	0
1	1,825.40	19,649	287.30	3,092	0.00	0	1538.10	16,556	0	0	0	0
2	2,208.60	23,773	74.00	797	74.00	797	2060.60	22,180	12	19	6	37
3	2,208.60	23,773	74.00	797	74.00	797	2060.60	22,180	12	19	6	37
4	2,208.60	23,773	74.00	797	74.00	797	2060.60	22,180	12	19	6	37
5	2,208.60	23,773	74.00	797	74.00	797	2060.60	22,180	12	19	6	37
Total	**25,301.00**	**272,340**	**14597.70**	**157,130**	**296.00**	**3,186**	**10407.30**	**112,024**	**48**	**76**	**24**	**148**
									32.43%	51.35%	16.22%	100.00%

EAST TOWER

Floors	GFA		Allowable Exclusions of GFA As Per The Definition				FINAL GFA		UNITS			
			Exclusions		Required Amenity				Studio	1B/1B+D	2B/2B+D	Total
	m2	ft2	m2	ft2	m2	ft2	m2	ft2	300-400 sf	450-700sf	750-850 sf	
6	748.70	8,059	37.00	398	14.00	151	697.70	7,510	1	5	1	7
7	748.70	8,059	37.00	398	24.00	258	687.70	7,402	2	8	2	12
8	748.70	8,059	37.00	398	24.00	258	687.70	7,402	2	8	2	12
9	748.70	8,059	37.00	398	24.00	258	687.70	7,402	2	8	2	12
10	748.70	8,059	37.00	398	24.00	258	687.70	7,402	2	8	2	12
11	748.70	8,059	37.00	398	24.00	258	687.70	7,402	2	8	2	12
12	748.70	8,059	37.00	398	24.00	258	687.70	7,402	2	8	2	12
13	799.30	8,604	37.00	398	22.00	237	740.30	7,969	1	7	3	11
14	799.30	8,604	37.00	398	22.00	237	740.30	7,969	1	7	3	11
15	656.30	7,064	37.00	398	16.00	172	603.30	6,494	0	2	6	8
16	656.30	7,064	37.00	398	16.00	172	603.30	6,494	0	2	6	8
17	656.30	7,064	37.00	398	16.00	172	603.30	6,494	0	2	6	8
MPH	287.50	3,095	287.50	3,095	0.00	0	0.00	0	0	0	0	0
Total	**9,095.90**	**97,908**	**731.50**	**7,874**	**250.00**	**2,691**	**8,114**	**87,343**	**15**	**73**	**37**	**125**
									12.00%	58.40%	29.60%	100.00%

WEST TOWER

Floors	GFA		Allowable Exclusions of GFA As Per The Definition				FINAL GFA		UNITS			
			Exclusions		Required Amenity				Studio	1B/1B+D	2B/2B+D	Total
	m2	ft2	m2	ft2	m2	ft2	m2	ft2	300-400 sf	450-700sf	750-850 sf	
6	748.70	8,059	37.00	398	14.00	151	697.70	7,510	1	5	1	7
7	748.70	8,059	37.00	398	24.00	258	687.70	7,402	2	8	2	12
8	748.70	8,059	37.00	398	24.00	258	687.70	7,402	2	8	2	12
9	748.70	8,059	37.00	398	24.00	258	687.70	7,402	2	8	2	12
10	748.70	8,059	37.00	398	24.00	258	687.70	7,402	2	8	2	12
11	748.70	8,059	37.00	398	24.00	258	687.70	7,402	2	8	2	12
12	748.70	8,059	37.00	398	24.00	258	687.70	7,402	2	8	2	12
13	799.30	8,604	37.00	398	24.00	258	738.30	7,947	2	8	2	12
14	799.30	8,604	37.00	398	24.00	258	738.30	7,947	2	8	2	12
15	656.30	7,064	37.00	398	16.00	172	603.30	6,494	0	2	6	8
16	656.30	7,064	37.00	398	16.00	172	603.30	6,494	0	2	6	8
17	656.30	7,064	37.00	398	16.00	172	603.30	6,494	0	2	6	8
MPH	287.50	3,095	287.50	3,095	0.00	0	0.00	0	0	0	0	0
Total	**9,095.90**	**97,908**	**731.50**	**7,874**	**254.00**	**2,734**	**8,110**	**87,300**	**17**	**75**	**35**	**127**
									13.39%	59.06%	27.56%	100.00%

TOTAL

BUILDINGS	FINAL GFA		Allowable Exclusions of GFA As Per The Definition				FINAL GFA		UNITS			
			Exclusions		Required Amenity				Studio	1B/1B+D	2B/2B+D	Total
	m2	ft2	m2	ft2	m2	ft2	m2	ft2	300-400 sf	450-700sf	750-850 sf	
PODIUM	25,301.00	272,339.96	14,597.70	157,129.64	296.00	3,186.14	10,407.30	112,024.18	48	76	24	148
EAST TOWER	9,095.90	97,908.27	731.50	7,873.87	250.00	2,691.00	8,114.40	87,343.40	15	73	37	125
WEST TOWER	9,095.90	97,908.27	731.50	7,873.87	254.00	2,734.06	8,110.40	87,300.35	17	75	35	127
Total	**43,492.80**	**468,156.50**	**16,060.70**	**172,877.37**	**800.00**	**8,611.20**	**26,632.10**	**286,667.92**	**80**	**224**	**96**	**400**
									20.00%	56.00%	24.00%	100.00%

Total Amenity Requied

Total Indoor Amenity	800.00	8,611
Total Outdoor Amenity	800.00	8,611

Total Amenity Provided

Total Indoor Amenity	804.70	8,662
Total Outdoor Amenity	801.70	8,629

Parking Required

Units	Units	Ratio	Spaces
Units	400	0.8	320
Visitors	400	0.15	60
	Area		
Commercial	629.9	0.035	22
Total Parking Required	N/A	N/A	**402**

Parking Provided

Floor	Spaces
GRADE*	19
UG1	85
UG2	99
UG3	99
UG4	100
Total Spaces Provided	**402**

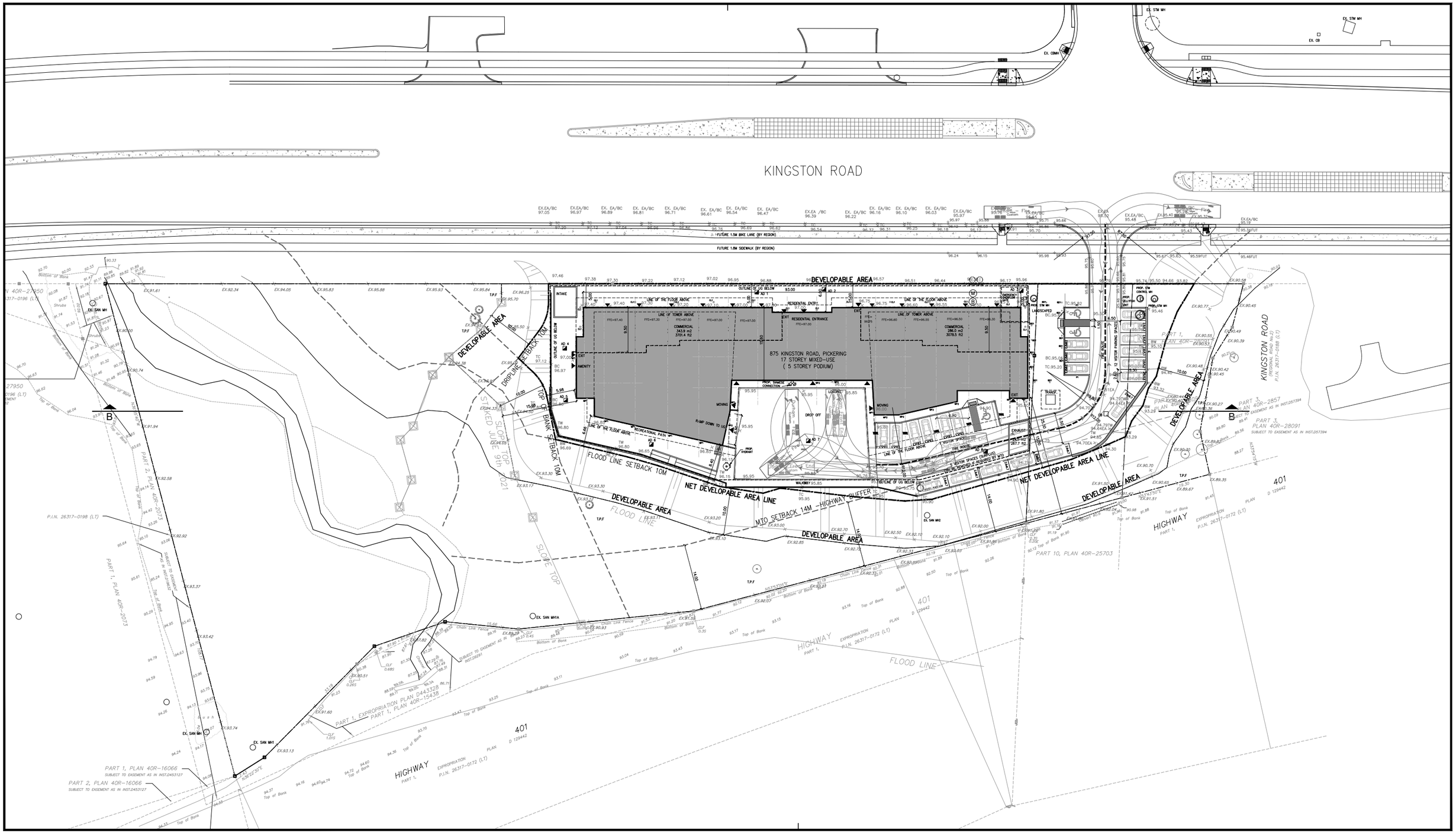
* 5 surplus parking spaces provided as well

Bicycle Parking Required

Land Use	Minimum Bicycle Parking Rate	Unit/Density
Residential	0.5 Spaces per unit	200
Retail	Minimum 2	2
Total		**202**

Bicycle Parking Provided

Floor	Spaces
UG1	26
UG2	65
UG3	65
UG4	56
Total	**212**
Ratio per unit	**0.53**

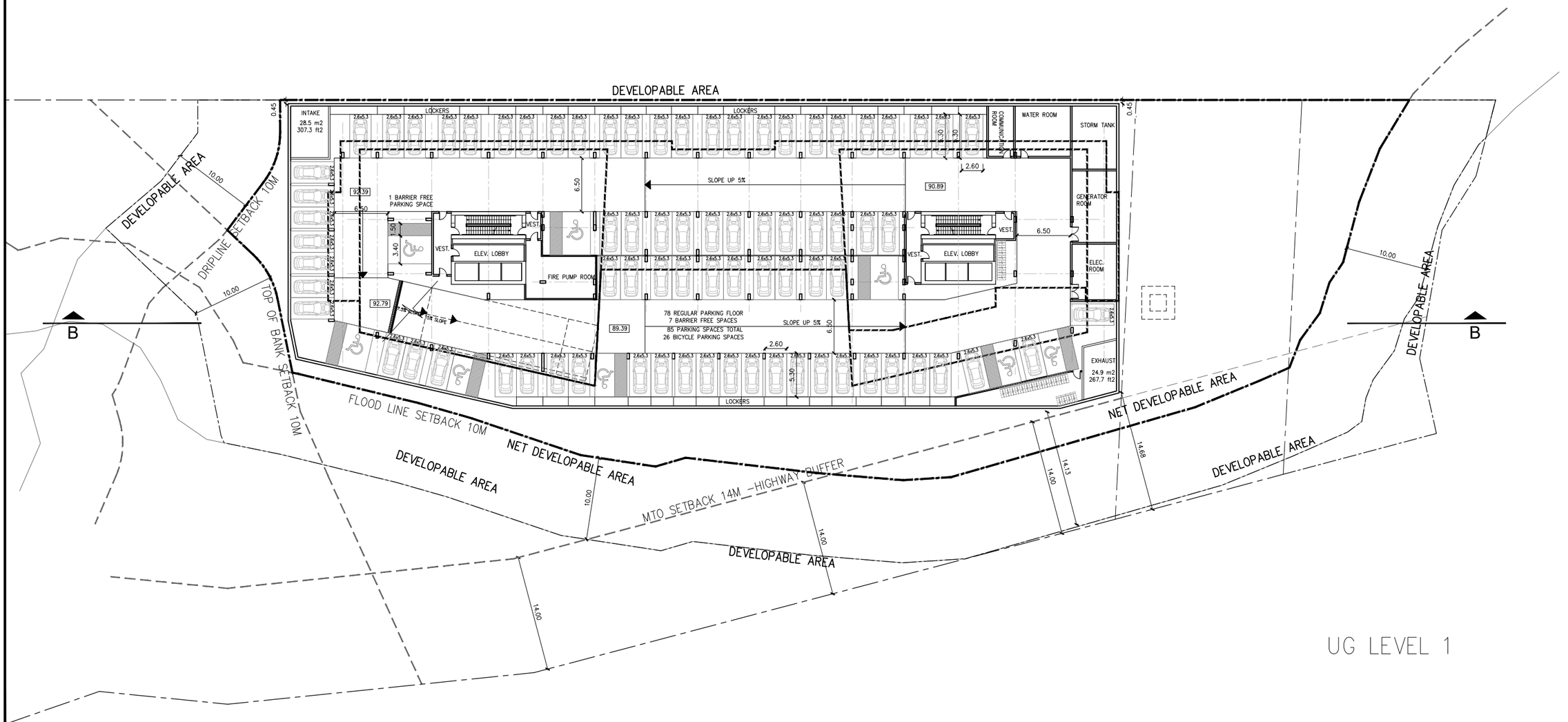


ICON ARCHITECTS
813-4789 YONGE ST., TORONTO
M2N 0G3 ICONARCHITECTS.CA
T:416-224-6606 F:416-224-6064

875 KINGSTON ROAD PICKERING,ONTARIO

SITE PLAN

Scale: 1:750
Date: MAY 5, 2023
Project No. 21124
Drawn by: KA
Checked by: HG
Drawing No. 01



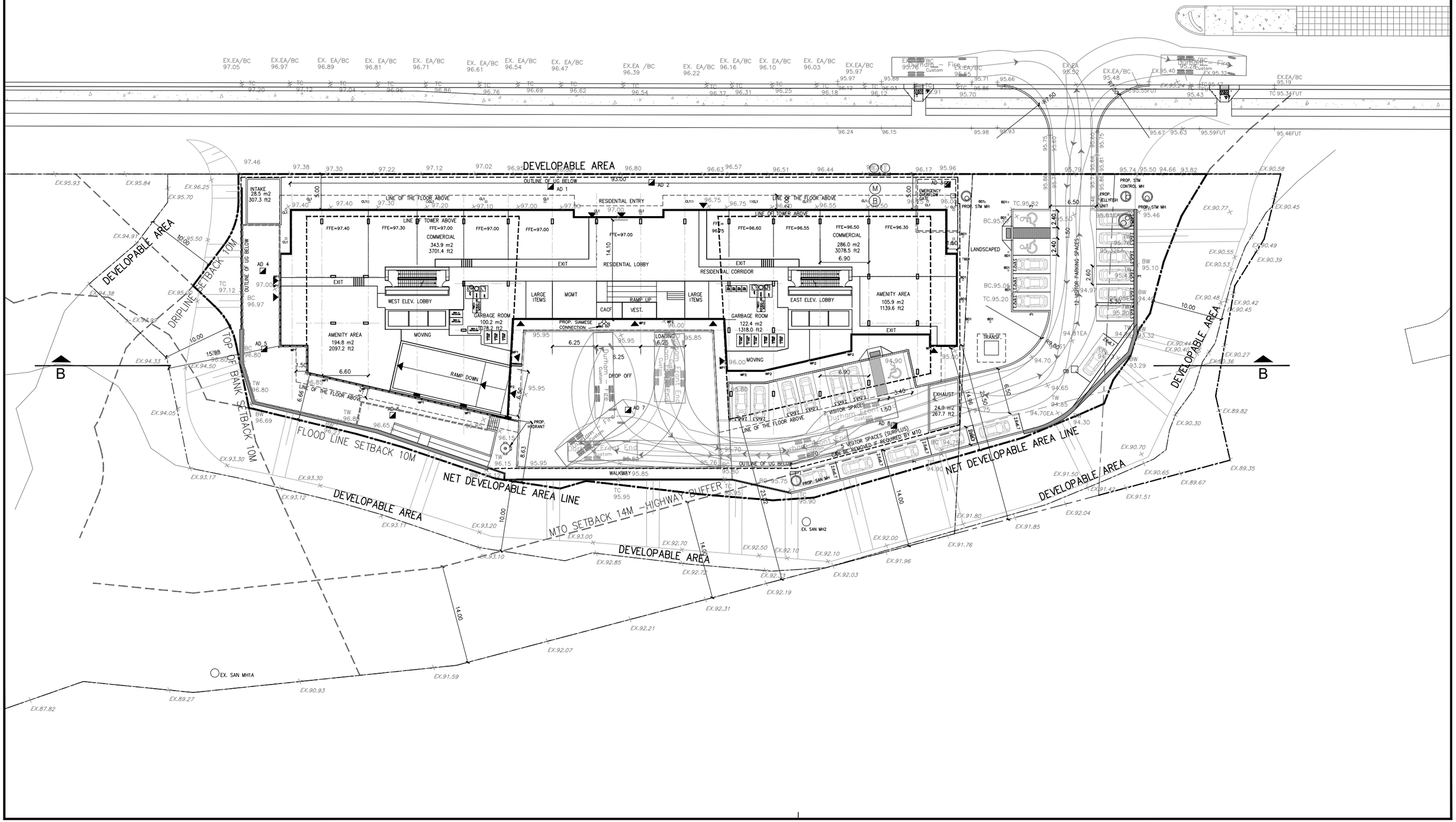
UG LEVEL 1

ICON ARCHITECTS
813-4789 YONGE ST., TORONTO
MAIN 905 ICONARCHITECTS.CA
T/416-524-0505 F/416-524-0504

875 KINGSTON ROAD
PICKERING,ONTARIO

UG1 FLOOR PLAN

Scale: **1:500**	Drawn by: **HT**
Date: **APRIL 28, 2023**	Checked by: **HG**
Project No. **21124**	Drawing No. **05**



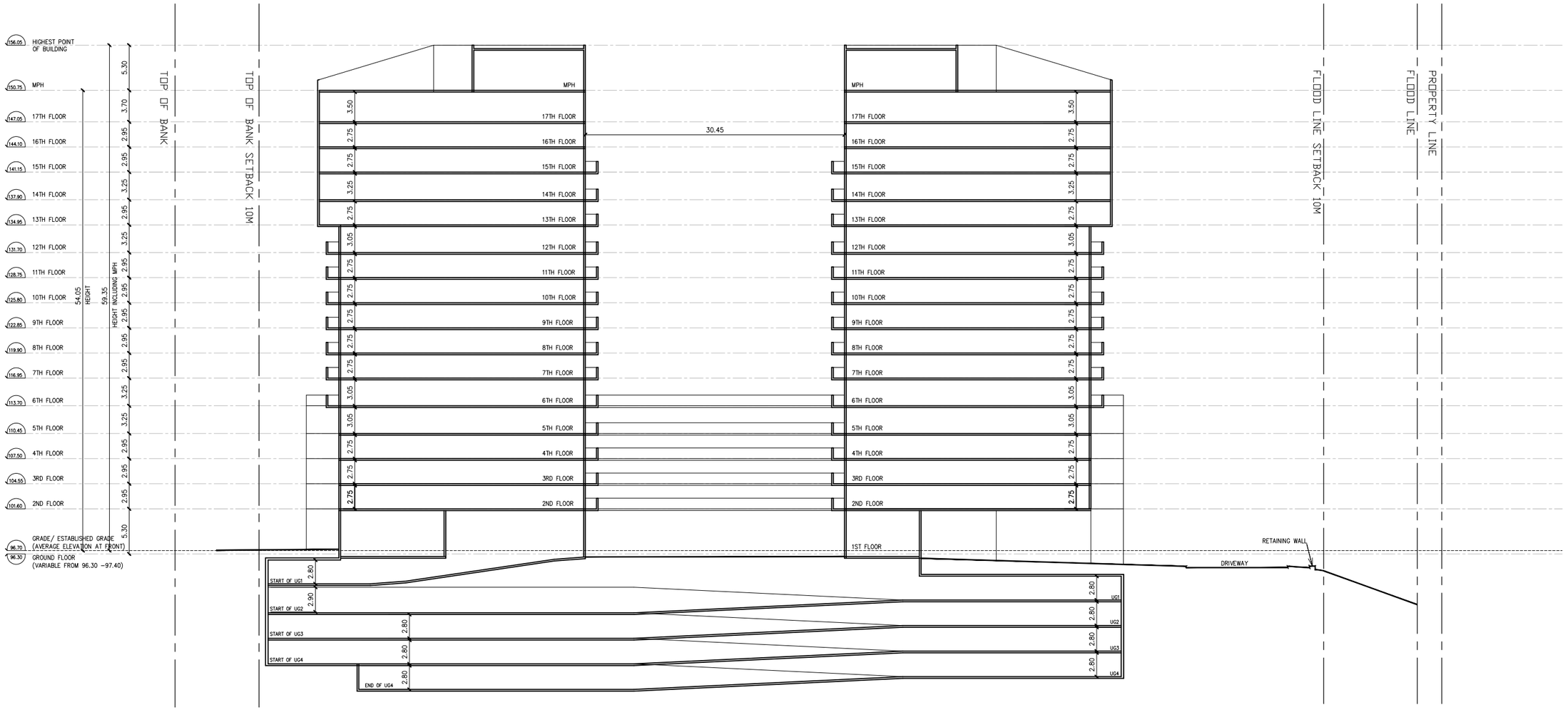
ICON ARCHITECTS

813-4789 YONGE ST., TORONTO
M2N 0G3 ICONARCHITECTS.CA
T/416-224-0005 F/416-224-0004

875 KINGSTON ROAD PICKERING,ONTARIO

GROUND FLOOR PLAN

Scale: 1:500
Date: APRIL 28, 2023
Project No. 21124
Drawn by: HT
Checked by: HG
Drawing No. 06



ICON ARCHITECTS

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M2N 0G8 ICONARCHITECTS.CA
T: 416-224-0005 F: 416-224-0004

875 KINGSTON ROAD PICKERING,ONTARIO

SECTION B-B

Scale: 1:500
Date: APRIL 28, 2023
Project No. 21124
Drawn by: HT
Checked by: HG
Drawing No. 14

VALDOR ENGINEERING INC.
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TABLE: A1

EQUIVALENT POPULATION

Project Name: **875 Kingston Road, Pickering**

File: 22115

Date: April 2023

Unit Type	Population Density	Residential Units	Commercial Floor Area (sq.m)	Equivalent Population
Studio	1.5 persons per unit	80		120
1 Bedroom & 1 Bedroom + Den	1.5 persons per unit	224		336
2 Bedroom & 2 Bedroom + Den	2.5 persons per unit	96		240
Commercial	86 persons/ha		629.9	6
Total:		**400**	**630**	**702**

APPENDIX "B"

Water System Calculations & Details

VALDOR ENGINEERING INC.
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TABLE: B1

WATER DEMAND CALCULATION

Project Name: **875 Kingston Road, Pickering**
File: 22115
Date: April 2023

Critera:

	Eqv. Population	Base Demand		Peaking Factors	
Residential	696	364	L/capita/day	Max Day	2.00
				Peak Hour	3.00
Commercial (Retail)	6	364	L/capita/day	Max Day	1.00
				Peak Hour	1.50

Demand:

	Average Day (L/day)	Average Day (L/min)	Max Day (L/min)	Peak Hour (L/min)	
Residential	253,344	175.9	351.9	527.8	
Commercial	2,184	1.5	1.5	2.3	
Total	**255,528**	**177.5**	**353.4**	**530.1**	

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Table B2

REQUIRED FIRE FLOW CALCULATION

In accordance to Water Supply for Public Fire Protection, Fire Underwriters Survey 2020

Project Name: **875 Kingston Road, Pickering**
File: 22115
Date: April 2023

Notes: **High-Rise Condominium**
(17 Storey Mixed-Use +
5 Storey Podium)

Type of Construction - Fire Resistive

$C =$ 0.6

For building classified with a Construction Coefficient below 1.0, the area shall be the total area of the largest floor plus 25% of each of the two immediately adjoining floors (assuming vertical openings and exterior vertical communications are properly protected):

Floor	Area (sq.m)	%	
Largest Floor Area	2,208.6	100%	(3rd Floor)
Adjacent Upper Adjoining Floor Area	2,208.6	25%	(4th Floor)
Adjacent Lower Adjoining Floor Area	2,208.6	25%	(2nd Floor)
$A =$	3,313	sq.m	

$F = 220\ C\ \sqrt{A}$
$F =$ 7,598 L/min
$F =$ 8,000 (to nearest 1,000 Lmin)

Occupancy Factor

Type:	Residential	Charge -15%
	$f_1 =$	-15%

$F' = F \times (1+f_1)$
$F' =$ 6,800 L/min

Sprinkler Credit

		Charge
NFPA 13 Sprinkler Standard:	YES	-30%
Standard Water Supply:	YES	-10%
Fully Supervised System:	YES	-10%
Total Charge to Fire Flow:	$f_2 =$	-50%

Exposure Factor

		Charge	
North Side - Distance to Building (m):	Over 30 m	0%	
East Side - Distance to Building (m):	Over 30 m	0%	
South Side - Distance to Building (m):	Over 30 m	0%	
West Side - Distance to Building (m):	Over 30 m	0%	
	$f_3 =$	0%	(maximum of 75%)

$F'' = F' + F' \times f_2 + F' \times f_3$
$F'' =$ 3,400 L/min

REQUIRED FIRE FLOW
$F'' =$ **3,000** **L/min** (to nearest 1,000 L/min)

VALDOR ENGINEERING INC.
571 Chrislea Road, Unit 4, 2nd Floor, Vaughan, ON L4L 8A2
Tel: 905-264-0054 Fax: 905-264-0069 info@valdor-engineering.com
www.valdor-engineering.com

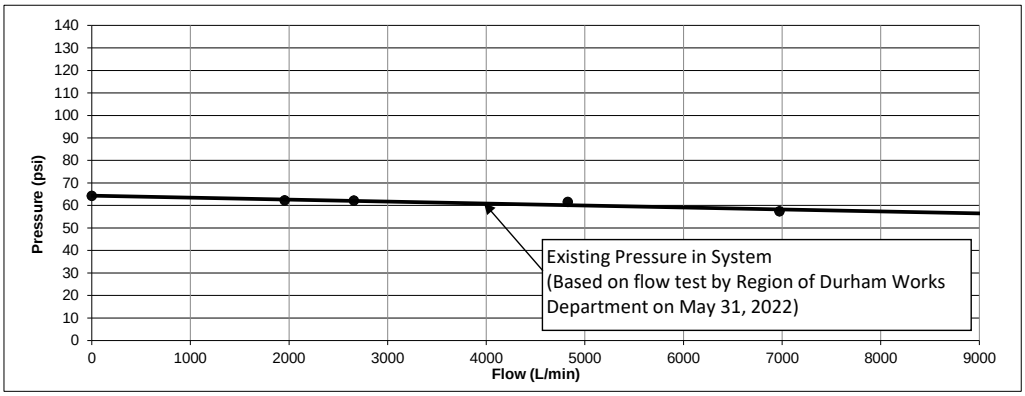
TABLE B3

Water Supply Calculation

Project Name: **875 Kingston Road, Pickering**
File: 22115
Date: April 2023

Hydrant Flow Test Results
Residual Location: 875 Kingston Road, City of Pickering

Number of Outlets & Orifice Size	Flow (IGPM)	Flow (L/min)	Residual Pressure (psi)
0	0	0	64.2
1 x 1 1/2	430.1	1955	62.2
1 x 1 3/4	584.5	2657	62.1
1 x 2 1/2	1061.6	4826	61.5
2 x 2 1/2	1533.6	6972	57.4



$$Q_r = Q_t \times \left(\frac{P_s - Pr}{P_s - Pt}\right)^{0.54}$$

Re-aranged to: $\mathrm{P_r} = \mathrm{P_s} - (Ps - Pt)\sqrt[0.54]{Q_r/Q_t}$

Where,
Q_r= Projected Flow Rate at the Desired Pressure
Q_t= Flow Rate from Flow Test
P_s= Static Pressure
P_r= Desired Residual Pressure
P_t= Residual Pressure inTest

Q_t=	6972	L/min
P_t=	57.4	psi
P_s=	64.2	psi

Maximum Day Domestic Demand =	353.4	L/min	(from Domestic Demand Calculation)
Domestic Peak Hour Flow to Satisfy (Q_{r2})=	530.1	L/min	(from Domestic Demand Calculation)
Fire Flow Requirement =	3,000	L/min	(from Fire Flow Calculation)
Fire Flow + Max Day (Q_{r1})=	3,353	L/min	
Minimum Req. Pressure for Fire-Flow =	140	kPa	
=	20.3		
System Provided Pressure at min. firelow + max. day (P_{r1})=	62.4	psi	
	430.6	kPa	
System Provided Pressure at Peak Hour Flow (P_{r2})=	64.1	psi	
	442.2	kPa	

THE REGIONAL MUNICIPALITY OF DURHAM

WORKS DEPARTMENT

FLOW TEST SUMMARY AND RESULTS

Requested by:	David Giugovaz	Account No.:	
Company:	Sphere Developments (Kingston)		
Address:	571 Chrislea Road, Unit 4	Telephone:	416-518-0431
	Woodbridge, ON	Email:	dgiugovaz@valdor-engineering.com
	L4L 8A2		
Test Location:	875 Kingston Rd		
Municipality:	City of Pickering		
Date:	31-May-22	Time:	1:00PM
Conducted by:	K.J		

Flow Hydrant: PD135

Monitoring Hydrant: PD134

Nozzle Size (in.)	Residual Pressure (p.s.i.)		Pitot Guage	
	Field Reading @ Monitoring Hydrant	Actual @ Flow Hydrant (adjusted)*	Pressure (p.s.i.)	Flow (i.g.p.m.)
STATIC	67.1	64.2		0.0
1-1/2	65.1	62.2	59.9	430.1
1-3/4	65.0	62.1	59.7	584.5
2-1/2	64.4	61.5	57.5	1061.6
2 x 2-1/2	60.3	57.4	30.0	1533.6

* Calculation based on gain/loss in pressure due to elevation difference between flow & monitoring hydrants

Hydrant Elevations (ft.)	
Flow Hydrant:	324.8
Static Hydrant:	318.2
Difference:	6.6
Pressure Diff. (p.s.i.):	2.9

Comments:

Flow for 1-1/2 & 1-3/4 nozzle calculated using Discharge of smooth nozzles

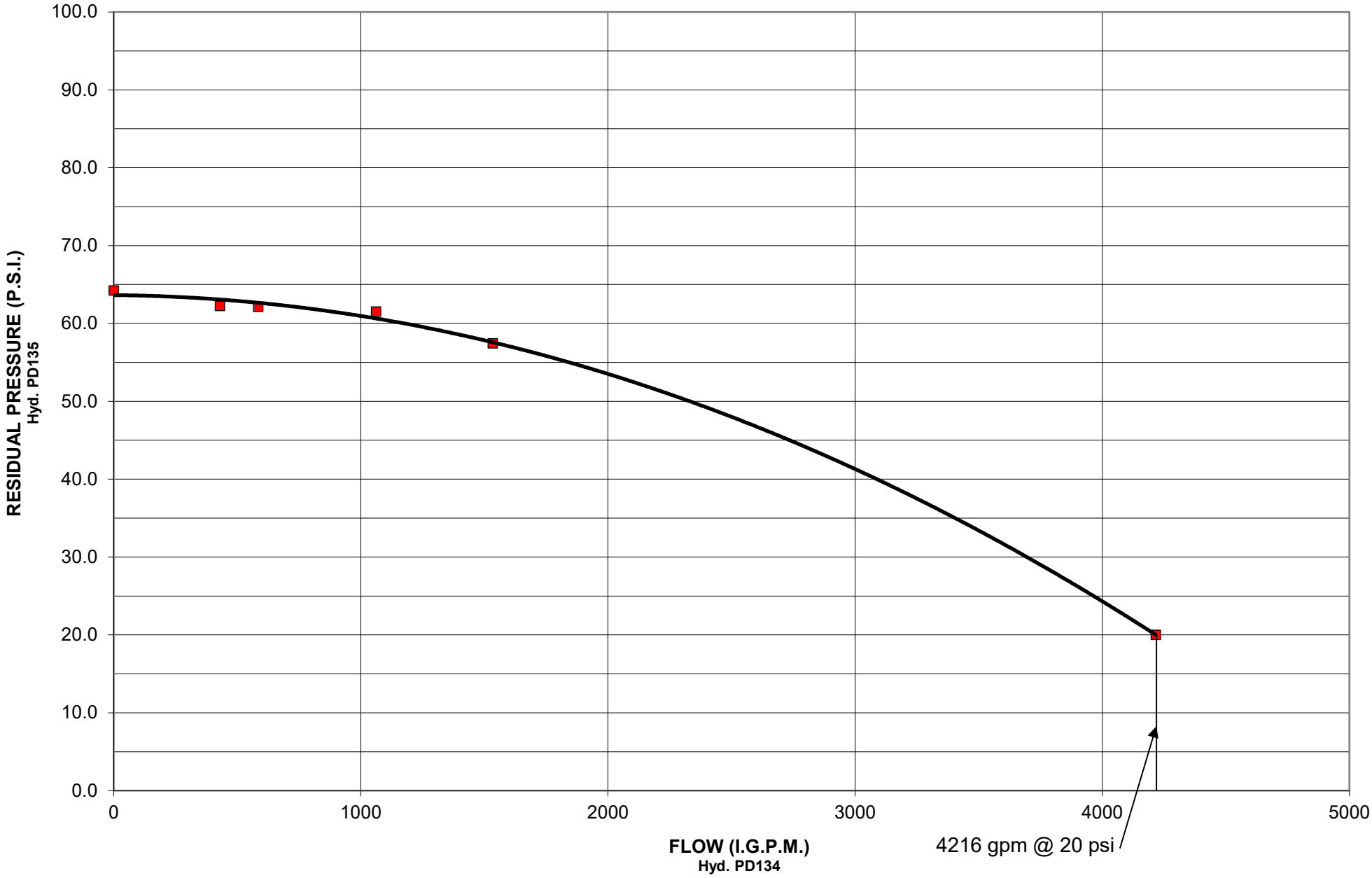
Flow for 2-1/2 nozzle calculated using Discharge for circular outlets

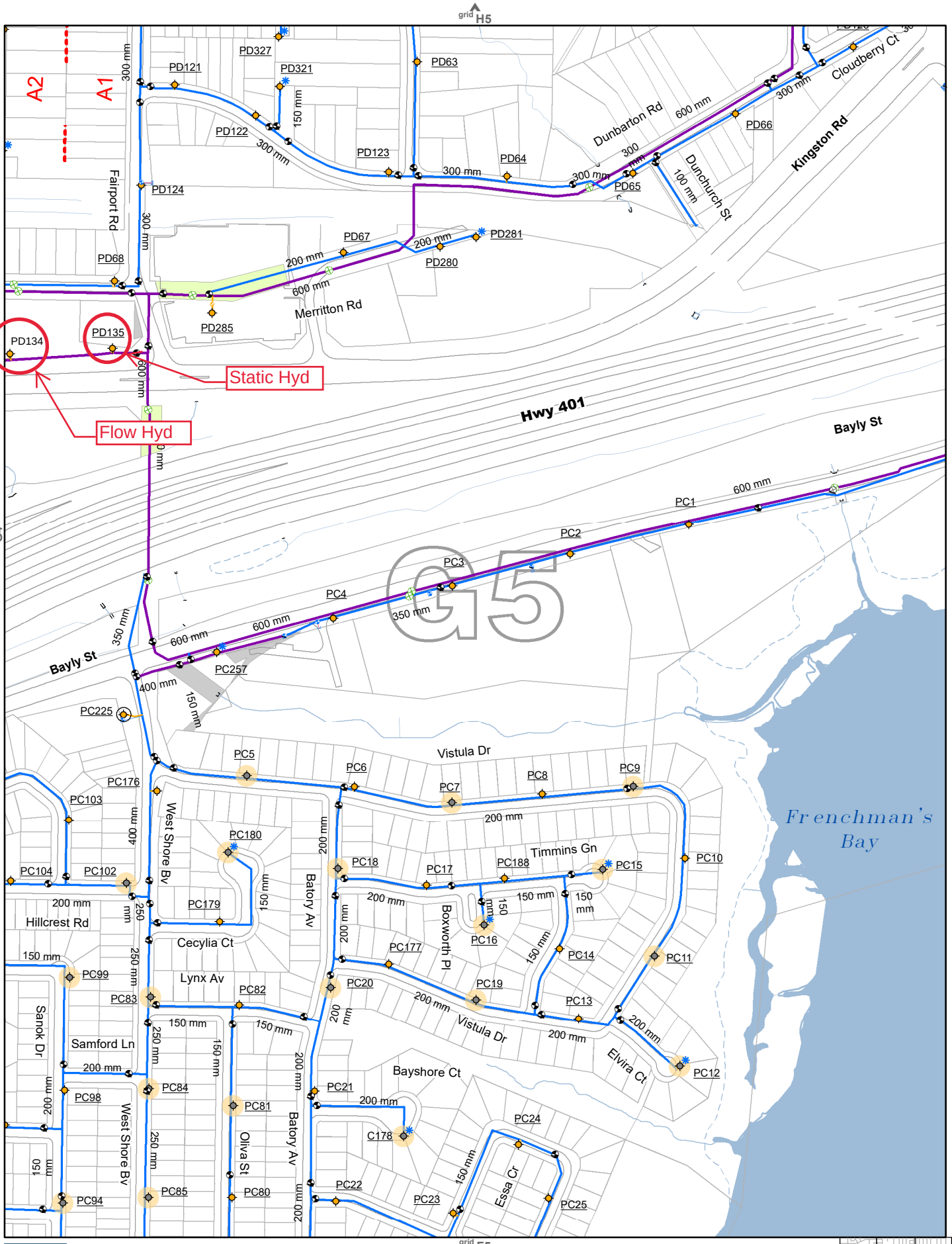
Results	
Static Pressure	64.2
Flow at 20 p.s.i. (I.g.p.m.):	4216 (approx.)
Checked by:	

Location: 875 Kingston Road
Municipality: City of Pickering
Date: May 31, 2022

FIRE FLOW TEST

(Graph of Residual Pressure vs. Hydrant Flow)





The Regional Municipality of Durham
Works Department
Water Supply System

PICKERING (Pickering)

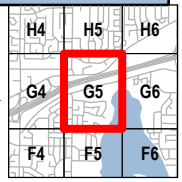
1:5,000

0 25 50 100 150 200 Meters

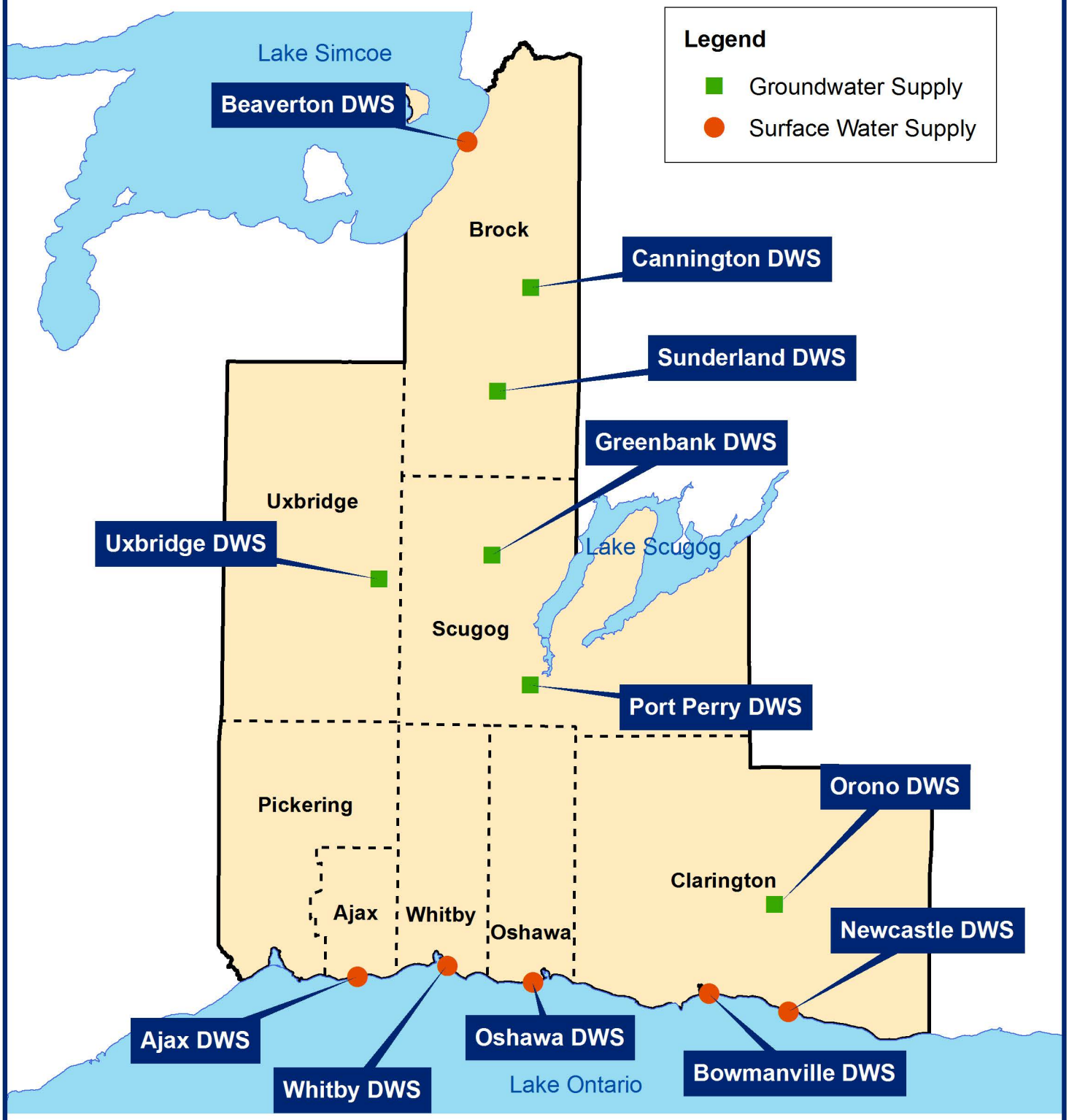
All dimensions are in mm unless otherwise noted.

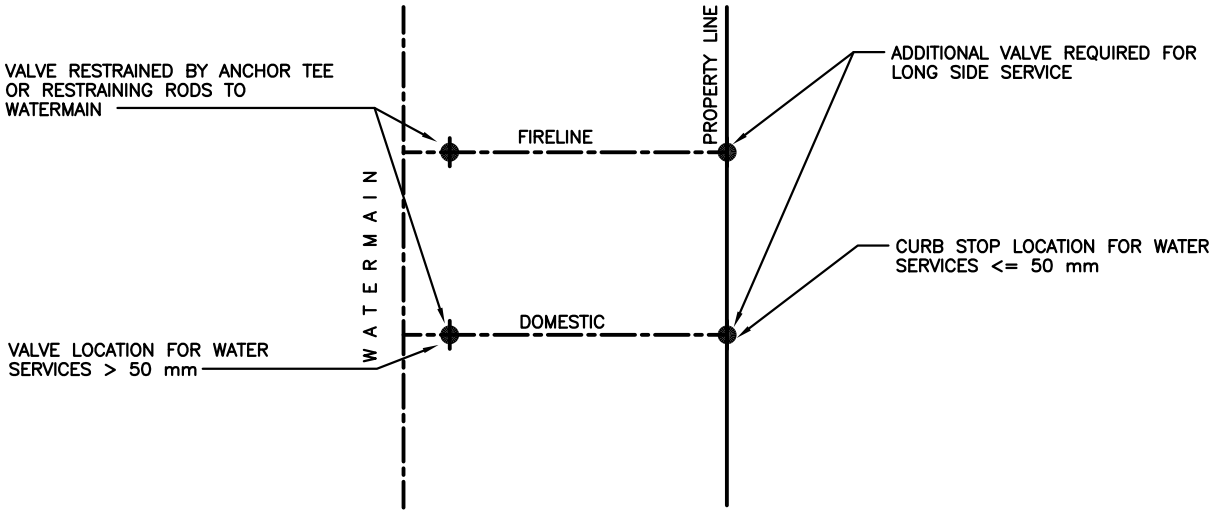
March 25, 2022

Servicing Note:
THIS MAP DEPICTS LOCAL PROXIMITY OF SERVICES ONLY. IT IS NOT TO BE USED TO DETERMINE INDIVIDUAL SITE SERVICING AVAILABILITY OR AVAILABILITY OF CAPACITY WITHIN THE SYSTEM. FOR DETAILED SITE SERVICING INFORMATION PLEASE CONTACT THE DEVELOPMENT APPROVALS SECTION OF THE WORKS DEPARTMENT.



Regional Municipality of Durham
Works Department
Municipal Drinking Water Supply System
(DWS)

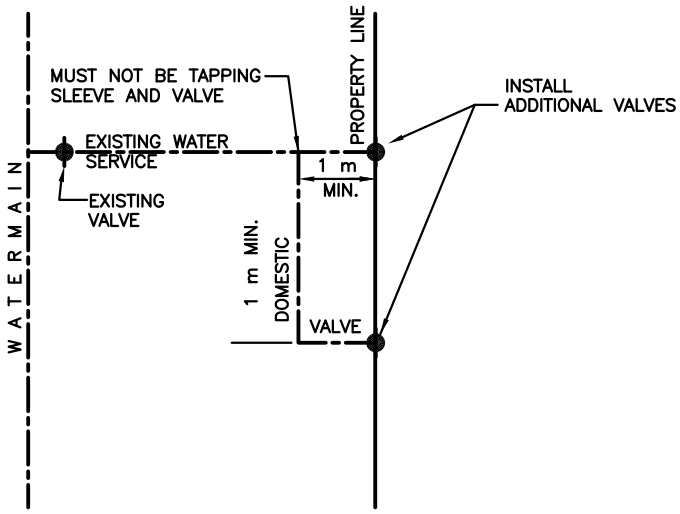




SHORT SIDE OR LONG SIDE CONNECTION

NOTES

1. VALVE LOCATION SHALL BE DETERMINED BY REGION OF DURHAM.
2. CONNECTION LAYOUT SHALL BE DETERMINED BY THE REGION OF DURHAM.
3. BLOWOFFS SHALL BE PROVIDED AS PER S-210.060.
4. 19 mm DIA. TEST POINTS SHALL BE PROVIDED ON CONNECTIONS LARGER THAN 50 mm, AND 6 METRES IN LENGTH OR MORE.
5. LONG SIDE WATER SERVICES REQUIRE AN ADDITIONAL PROPERTY LINE VALVE.



DOMESTIC CONNECTION TO EXISTING WATER SERVICE (LONG SIDE ONLY)

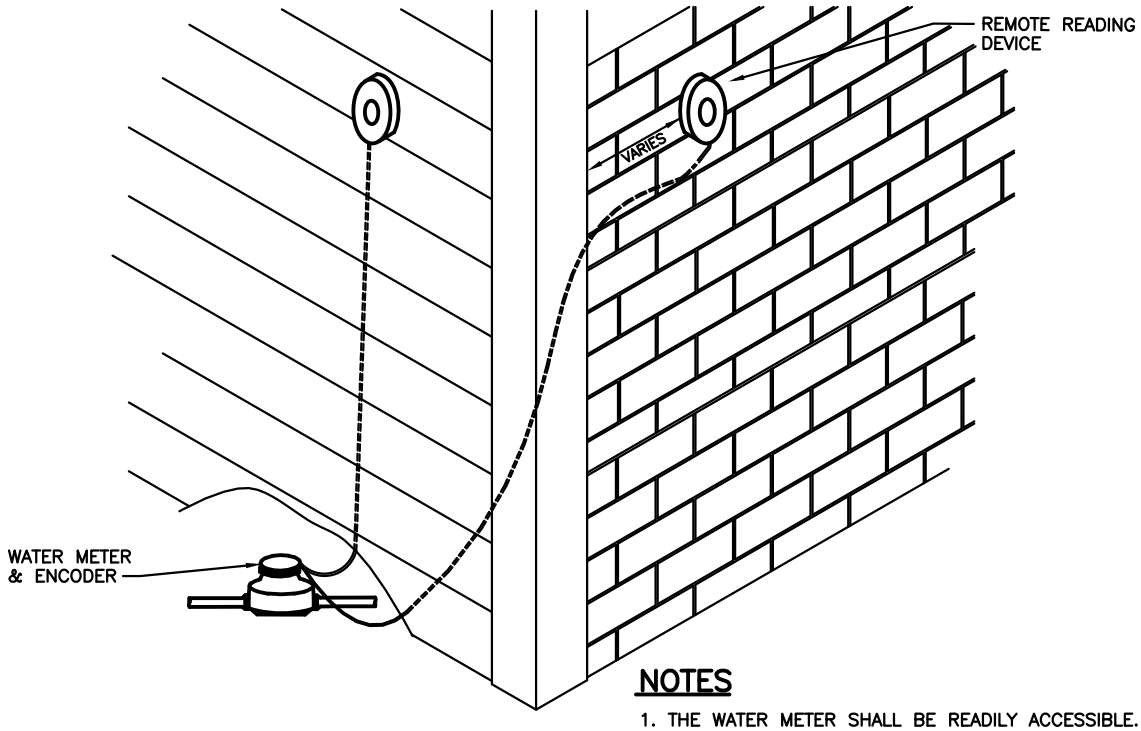
ALL DIMENSIONS IN MILLIMETRES EXCEPT WHERE NOTED.

DURHAM REGION
WORKS DEPARTMENT

PIPING & FITTINGS FOR COMMERCIAL, INDUSTRIAL & MULTI-RESIDENTIAL CONNECTIONS (DOMESTIC & FIRELINE)

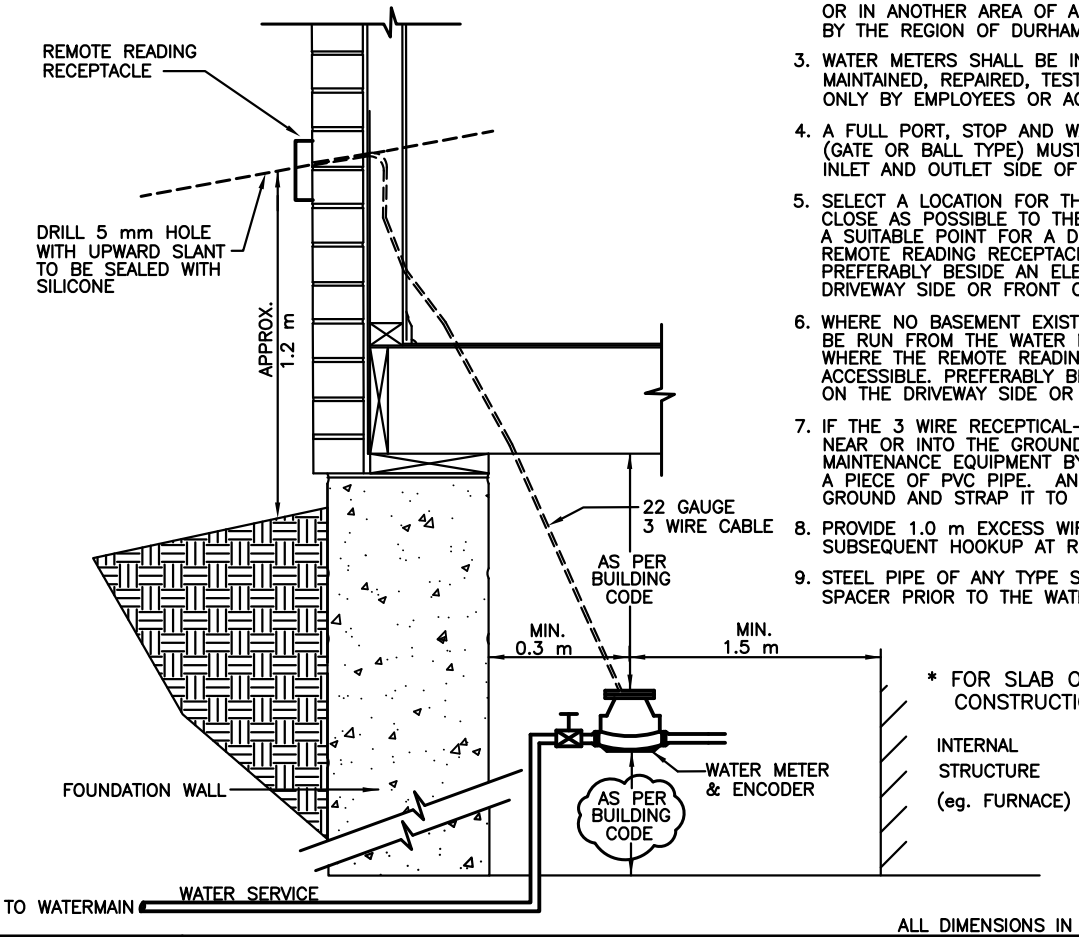
DWG. DATE:	1988 09
REVISION NO.:	9
REV. DATE:	2020 04
SCALE:	N.T.S.

S-230.011



NOTES

1. THE WATER METER SHALL BE READILY ACCESSIBLE.
2. THE WATER METER LOCATION SHALL BE LOCATED WHERE THE SERVICE PIPE ENTERS A BUILDING'S FULL BASEMENT OR IN ANOTHER AREA OF A BUILDING OR LOCATION APPROVED BY THE REGION OF DURHAM.
3. WATER METERS SHALL BE INSTALLED, SEALED, REPLACED MAINTAINED, REPAIRED, TESTED, INSPECTED AND REMOVED ONLY BY EMPLOYEES OR AGENTS OF THE REGION OF DURHAM.
4. A FULL PORT, STOP AND WASTE CORPORATION VALVES (GATE OR BALL TYPE) MUST BE INSTALLED ON BOTH THE INLET AND OUTLET SIDE OF THE METER.
5. SELECT A LOCATION FOR THE RECEPTACLE WHICH IS AS CLOSE AS POSSIBLE TO THE METER AND WHICH PROVIDES A SUITABLE POINT FOR A DRILLED HOLE. LOCATION OF REMOTE READING RECEPTACLE SHOULD BE ACCESSIBLE, PREFERABLY BESIDE AN ELECTRIC OR GAS METER ON THE DRIVEWAY SIDE OR FRONT OF THE BUILDING.
6. WHERE NO BASEMENT EXISTS, A 3 WIRE CABLE MUST BE RUN FROM THE WATER METER TO A LOCATION WHERE THE REMOTE READING DEVICE RECEPTACLE IS ACCESSIBLE. PREFERABLY BESIDE AN ELECTRIC OR GAS METER ON THE DRIVEWAY SIDE OR FRONT OF THE BUILDING.
7. IF THE 3 WIRE RECEPTICAL–TO–ENCODER CABLE RUNS NEAR OR INTO THE GROUND, PROTECT IT FROM LAWN MAINTENANCE EQUIPMENT BY PLACING THE WIRE INSIDE A PIECE OF PVC PIPE. ANCHOR THE PIPE INTO THE GROUND AND STRAP IT TO THE MOUNTING SURFACE.
8. PROVIDE 1.0 m EXCESS WIRE AT EACH END FOR SUBSEQUENT HOOKUP AT READING DEVICE AND AT METER.
9. STEEL PIPE OF ANY TYPE SHALL NOT BE USED AS A SPACER PRIOR TO THE WATER METER BEING INSTALLED.



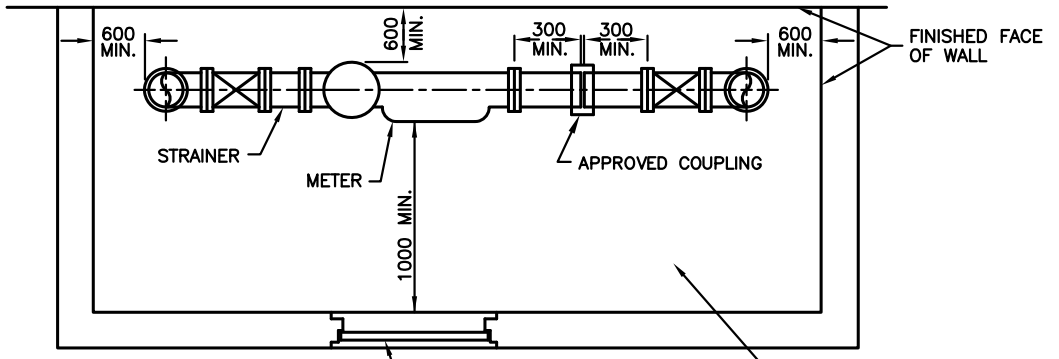
ALL DIMENSIONS IN MILLIMETRES EXCEPT WHERE NOTED.

DURHAM REGION
WORKS DEPARTMENT

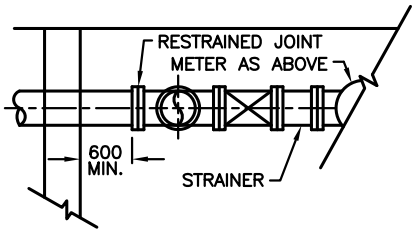
METER, VALVE, REMOTE READING DEVICE AND WIRE INSTALLATION

DWG. DATE:	1995 02
REVISION NO.:	7
REV. DATE:	2019 04
SCALE:	N.T.S.

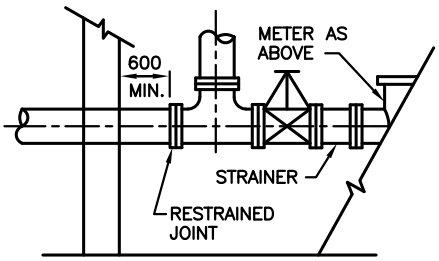
S-240.010



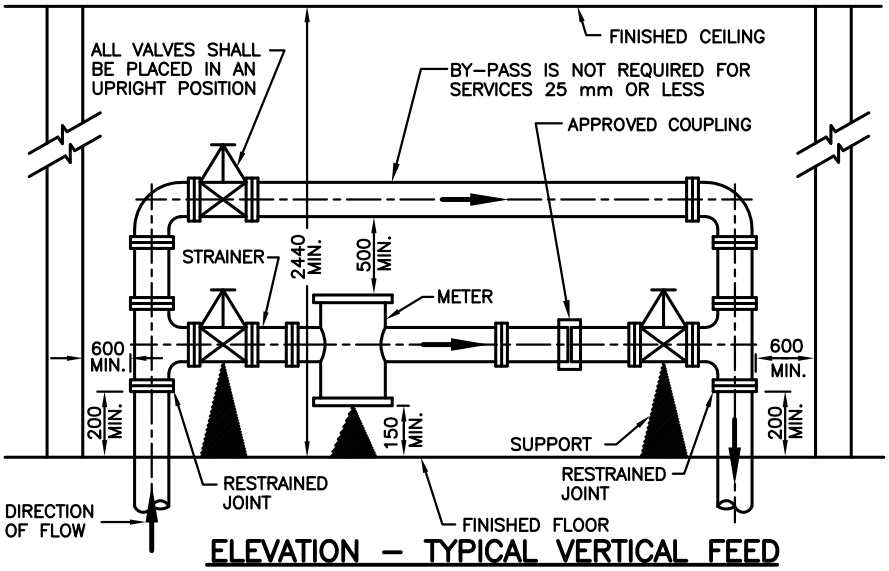
PLAN – TYPICAL VERTICAL FEED



PLAN – TYPICAL HORIZONTAL FEED



ELEVATION – TYPICAL HORIZONTAL FEED



ELEVATION – TYPICAL VERTICAL FEED

NOTES

1. BY-PASS PIPE SHALL BE :
   (A) THE SAME SIZE AS THE INCOMING PIPE.
   (B) REQUIRED ON ALL SERVICES FOR MULTI-RESIDENTIAL, COMMERCIAL, INSTITUTIONAL AND INDUSTRIAL BUILDINGS.
   (C) REQUIRED ON RESIDENTIAL SERVICES LARGER THAN 25 mm.
2. MINIMUM CLEARANCES SHOWN FOR WALL MOUNTED BY-PASS SHALL BE APPLIED TO FLOOR MOUNTED BY-PASS.
3. STRAINERS SHALL BE REQUIRED FOR METERS 75 mm AND LARGER.
4. ALL JOINTS SHALL BE MECHANICALLY RESTRAINED.
5. METER AND VALVES SHALL BE SUPPORTED AS DIRECTED BY THE REGION OF DURHAM.
6. ALL METER ROOMS ARE PRIVATELY OWNED, HOWEVER, ALL METER ROOMS SHALL BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH REGION OF DURHAM WORKS DEPARTMENT DESIGN CRITERIA.
7. WHEN BACKFLOW PREVENTION IS REQUIRED, REFER TO S-240.040, S-240.041, S-240.050 AND S-240.051.
8. WHEN MORE THAN ONE WATER SUPPLY IS GOING THROUGH THE BUILDING, THERE SHALL BE A MINIMUM DISTANCE OF 600 mm BETWEEN PIPES.
9. PROVISION IS TO BE MADE FOR THE DISPOSAL OF WATER USED FOR IN PLACE TESTING EITHER THROUGH FLOOR DRAIN OR THE 125mm FERRULE.
10. IF HOT WATER TANK IS WITHIN 3.0m OF METER, THEN A CHECK VALVE IS REQUIRED BETWEEN THE METER AND HOT WATER TANKS.
11. WHERE METER ROOM IS NOT ADJACENT TO AN OUTSIDE WALL OR IS BELOW EXTERIOR FINISHED GRADE, THE CONTRACTOR/APPLICANT SHALL PROVIDE A CONTINUOUS 12mm E.M.T. CONDUIT COMPLETE WITH NYLON FISH LINE FROM METER ROOM TO 1000mm ABOVE EXTERIOR FINISHED GRADE.
12. METER SHALL BE ACCESSIBLE AT ALL TIMES.
13. RESTRAIN FITTINGS AND PIPE MATERIAL SHALL BE AS PER THE ONTARIO BUILDING CODE.
14. ALL VALVES SHALL BE PLACED IN AN UPRIGHT POSITION.
15. BY-PASS VALVE SHALL BE CHAINED OR SUPERVISED IN THE CLOSED POSITION.
16. REFER TO S-240.030 FOR BUILDING CONTROL VALVE LOCATION.

ALL DIMENSIONS IN MILLIMETRES EXCEPT WHERE NOTED.

DURHAM REGION
WORKS DEPARTMENT

WATER METER ROOM LAYOUT

DWG. DATE:	1988 09
REVISION NO.:	10
REV. DATE:	2017 04
SCALE:	N.T.S.

S-240.020

APPENDIX "C"

Wastewater Calculations & Details

VALDOR ENGINEERING INC.
571 Chrislea Road, Unit 4, 2nd Floor, Vaughan, ON L4L 8A2
Tel: 905-264-0054 Fax: 905-264-0069 info@valdor-engineering.com
www.valdor-engineering.com

TABLE: C1

WASTEWATER LOADING CALCULATION

Project Name: **875 Kingston Road, Pickering**
File: 22115
Date: April 2023

Criteria:

Peak flow design parameters

Avg. Flow Rate (Residential): 364 L/person/day

Design Flow Rate (Commercial): 2.08 L/s/ha

Infiltration Rate: 0.26 L/s/ha

Residential Peaking Factor: 1 + (14 / (4+(P/1000)^0.5)) where P is population in thousands
(Min = 1.5, Max = 3.8)

	Site Area (ha.)	Residential				Infiltration (L/s)	Total Peak Flow (L/s)
		Equivalent Population	Average Flow (L/s)	Peaking Factor	Peak Flow (L/s)		
Condominium	0.529	696.0	2.932	3.8	11.14	0.138	**11.28**
	Floor Area (ha)	**Commercial**					
Commerical	0.063	6.0	0.131	Incl.	Incl.	Incl.	**0.13**
TOTAL	**0.529**	**702.0**					**11.41**

Josh (Shuai) Yuan

From: David Giugovaz
Sent: September 1, 2022 2:27 PM
To: Josh (Shuai) Yuan
Subject: FW: 875 Kingston Road, Pickering

From: Peter Castellan <Peter.Castellan@Durham.ca>
Sent: August 10, 2022 9:58 AM
To: David Giugovaz <DGiugovaz@Valdor-Engineering.com>
Cc: Josh (Shuai) Yuan <SYuan@valdor-engineering.com>
Subject: RE: 875 Kingston Road, Pickering

Hi David,

I don't have access to the flow metering info and until completion of the study, we are unable to release any findings, however, there is capacity available to service 875 Kingston Road.

Regarding the water supply comment, the information provided for this pre-consultation is in error. That comment applies to lands at Liverpool Rd and future extension of Walnut Lane. You are correct, water supply can be provided from the existing 400mm DI watermain.

Pete

Peter Castellan | Supervisor, Development Approvals
Works Department
The Regional Municipality of Durham
Peter.Castellan@durham.ca 905.668.7711 ext 3411 | durham.ca

From: David Giugovaz <DGiugovaz@Valdor-Engineering.com>
Sent: August 4, 2022 1:20 PM
To: Peter Castellan <Peter.Castellan@Durham.ca>
Cc: Josh (Shuai) Yuan <SYuan@valdor-engineering.com>
Subject: RE: 875 Kingston Road, Pickering

File: 22115

Peter:

When you are back next week can you advise on the following:

Based on page 8 of the attached pre-consultation meeting summary, I understand that sanitary can be connected to the existing 900mm diameter sanitary sewer located within an easement on the subject site. What is the status of the Region's sanitary analysis for this sewer shed?

With regards to water servicing I don't understand the requirement for a watermain extension. Can we connect to the existing 400mm diameter watermain on Kingston Road?

Thanks.

David Giugovaz, P.Eng., LEED® AP
Senior Project Manager, Principal

VALDOR ENGINEERING INC.

Head Office: Greater Toronto Area
571 Chrislea Road, Unit 4, 2nd Floor
Woodbridge, Ontario, L4L 8A2
Tel: 905-264-0054 x 224 Fax: 905-264-0069
Cell: 416-518-0431
E-Mail: dgiugovaz@valdor-engineering.com
URL: www.valdor-engineering.com

Branch Office: Peterborough & The Kawarthas
580 The Queensway, Unit 1
Peterborough, Ontario, K9J 7H2

From: Peter Castellan <Peter.Castellan@Durham.ca>
Sent: August 3, 2022 9:41 AM
To: David Giugovaz <DGiugovaz@Valdor-Engineering.com>
Subject: RE: Message from ValdorEng (9052640054)

Hi David,

I'm on vacation this week, however, if you can follow up with an email with the info you are looking for, I may be able to get one of my staff to retrieve and forward it to you, otherwise I'm back next week and I can follow up with you then.

Pete

Peter Castellan | Supervisor, Development Approvals
Works Department
The Regional Municipality of Durham
Peter.Castellan@durham.ca 905.668.7711 ext 3411 | durham.ca

APPENDIX "D"

Watershed Map & IDF Data

City of Pickering IDF Curve Parameters

Parameter	Return Period					
	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
A	715.076	1082.901	1313.979	1581.718	1828.009	2096.425
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

Notes:
Rainfall Intensity, I (mm/hr) = $A/(t+B)^C$, where t is time duration in minutes
IDF Data Source: Toronto City (1940-2007)

City of Pickering Rainfall Intensity

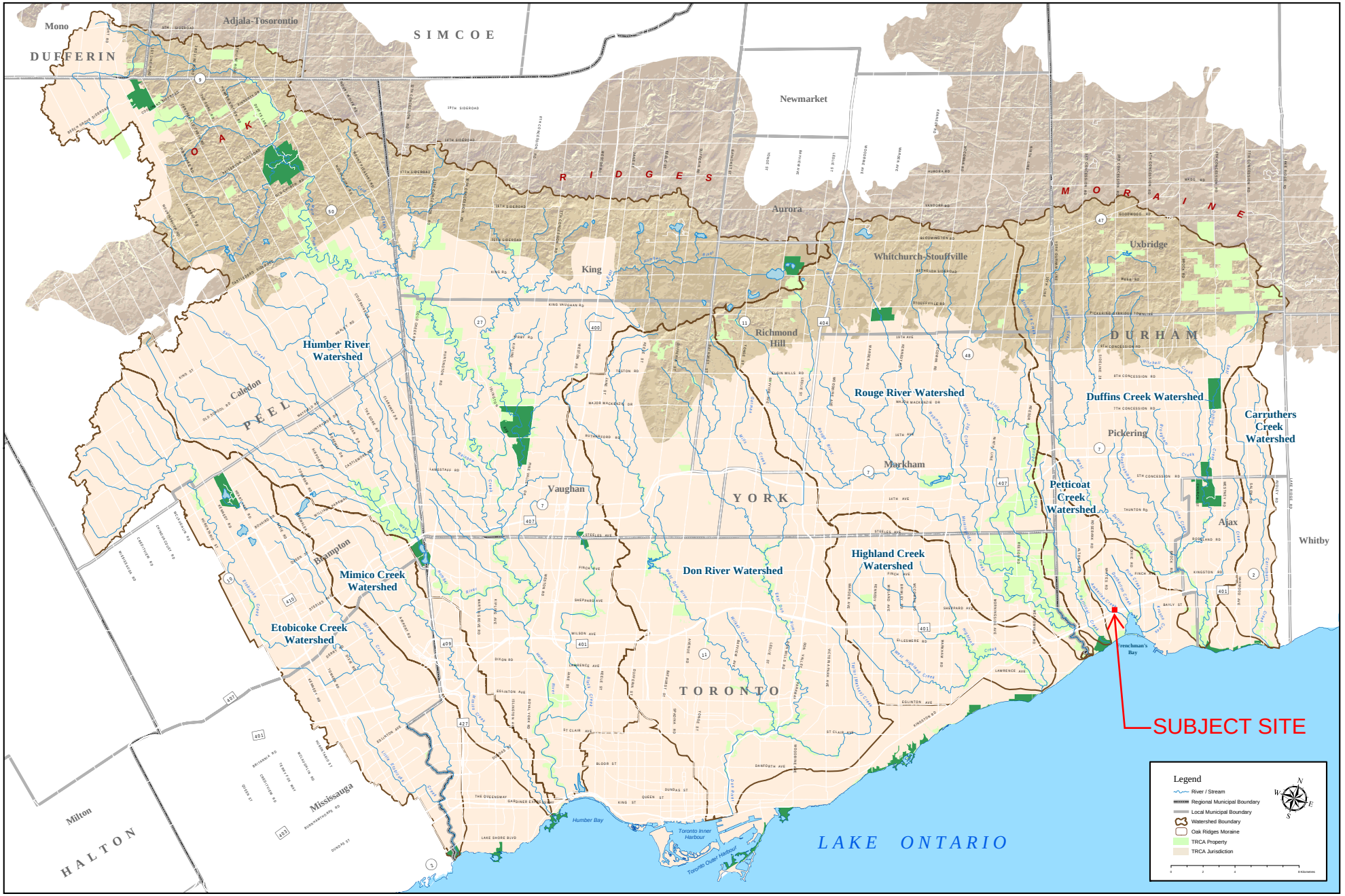
Rainfall Intensity (mm/hr)

Return Period	Duration (min)								
	5	*10*	*15*	*30*	*60*	*120*	*360*	*720*	*1440*
2 Year	109.2	76.1	61.7	39.1	23.8	14.0	5.7	3.4	1.9
5 Year	151.9	101.6	85.0	54.6	32.6	18.7	7.6	4.4	2.5
10 Year	180.1	118.5	100.5	64.9	38.5	21.8	8.9	5.1	2.8
25 Year	215.8	139.8	120.1	77.9	45.9	25.7	10.4	6.0	3.3
50 Year	242.3	155.7	134.6	87.5	51.4	28.7	11.6	6.6	3.6
100 Year	268.5	171.4	148.9	97.0	56.8	31.6	12.8	7.2	3.9

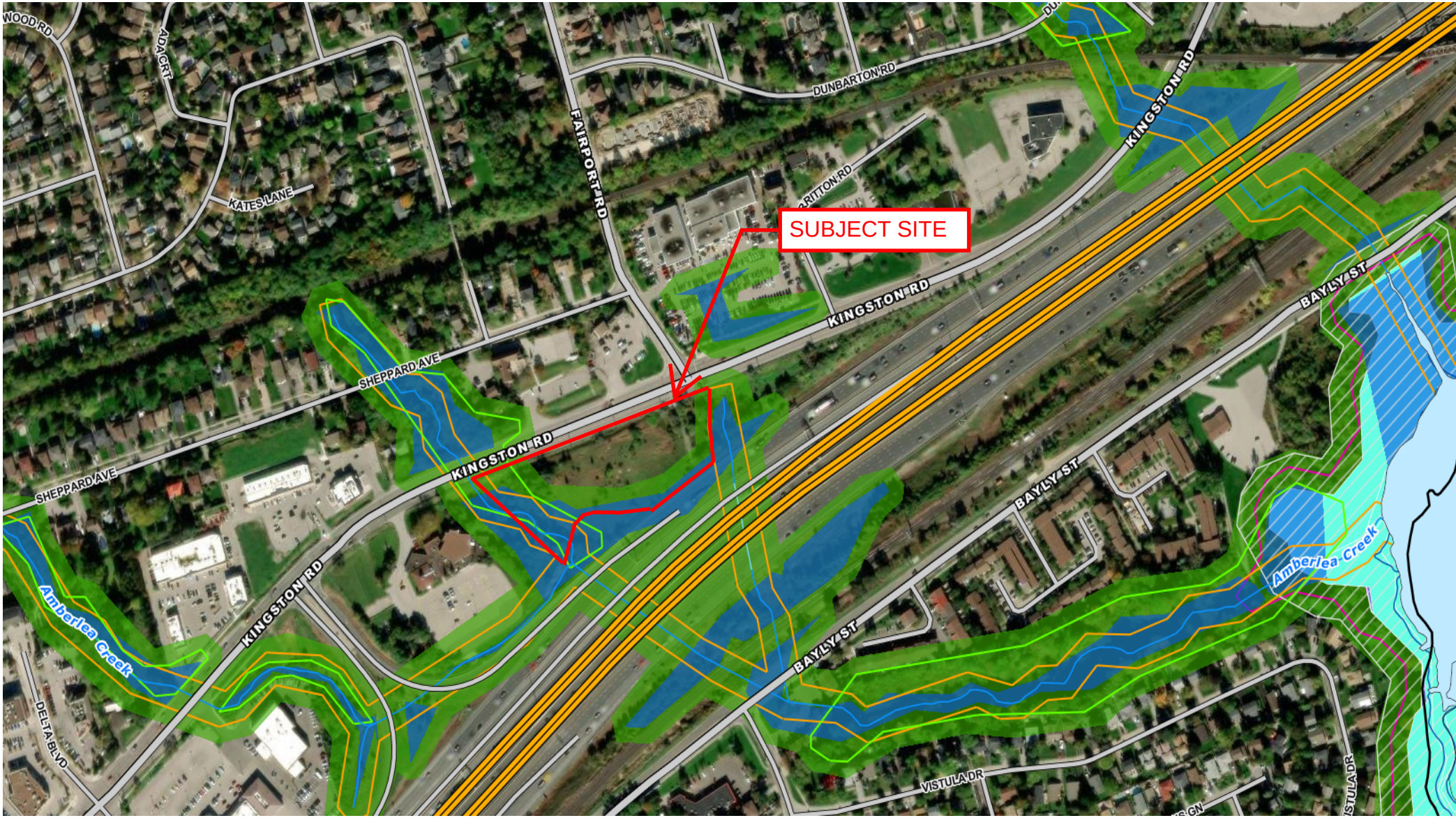
City of Pickering Rainfall Depth

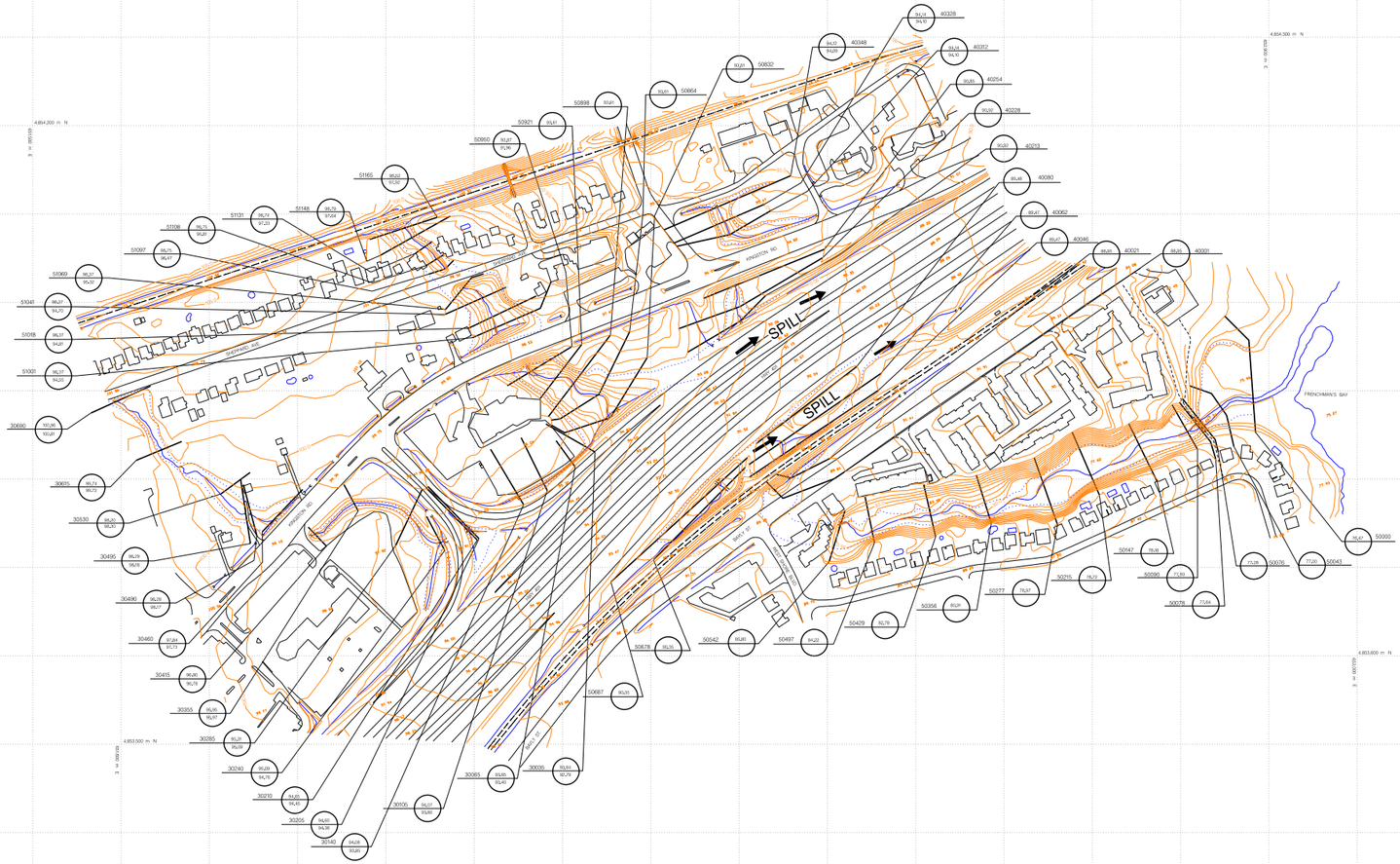
Rainfall Depth (mm)

Return Period	Duration (min)								
	5	*10*	*15*	*30*	*60*	*120*	*360*	*720*	*1440*
2 Year	9.1	12.7	15.4	19.5	23.8	27.9	34.5	41.1	45.9
5 Year	12.7	16.9	21.3	27.3	32.6	37.4	45.8	53.2	59.0
10 Year	15.0	19.7	25.1	32.4	38.5	43.6	53.2	61.3	67.6
25 Year	18.0	23.3	30.0	38.9	45.9	51.5	62.7	71.4	78.5
50 Year	20.2	25.9	33.6	43.7	51.4	57.3	69.7	79.0	86.7
100 Year	22.4	28.6	37.2	48.5	56.8	63.1	76.6	86.5	94.7


Mono
Adjala-Tosorontio
SIMCOE
DUFFERIN
Newmarket
OAK RIDGES MORAINE
Aurora
Whitchurch-Stouffville
Uxbridge
King
Richmond Hill
DURHAM
Humber River Watershed
Caledon
PEEL
Rouge River Watershed
Duffins Creek Watershed
Carruthers Creek Watershed
Pickering
Markham
Vaughan
YORK
Petticoat Creek Watershed
Ajax
Whitby
Brampton
Mimico Creek Watershed
Don River Watershed
Highland Creek Watershed
Etobicoke Creek Watershed
Frenchman's Bay
SUBJECT SITE
TORONTO
Mississauga
Milton
HALTON
Humber Bay
Toronto Inner Harbour
Toronto Outer Harbour
LAKE ONTARIO
Legend
River / Stream
Regional Municipal Boundary
Local Municipal Boundary
Watershed Boundary
Oak Ridges Moraine
TRCA Property
TRCA Jurisdiction

TRCA REGULATION LIMIT





REVISIONS			
NO.	DESCRIPTION	BY	DATE

LEGEND
Cross-Section Label
Cross-Section Leader Line
Regional Flood Elevation (m)
Cross-Section Number — 14.060 — 172.00
100 Year Existing Flood Elevation (m) — 172.00
Cross-Section Centre Line
REGULATORY FLOOD ELEVATION IS THE HIGHER OF THE TWO ELEVATIONS DISPLAYED.

LEGEND

Contour, Index
- Intermediate
- Supplementary
- Approximate
- Depression

Spot Elevation, Water Level
River, Stream, Canal
- Approximate Alignment
- Disappearing
- Spill

Lake
Flooded Land
Marsh, Swamp
Ditch, Drain
Rapids
Reservoir
Falls
Building, Garage, Shed
- Under Construction, Foundation
- Ruins

Roads, Hard Surface, with Median
- Driveway, or Loose Surface
- Farm Lane, Cart Track, Wagon Road
- Footpath, Trail

Bridge, Footbridge
Fence
Cliff, Cut and Fill
Culvert
Dam, Beaver Dam
Pipeline
Airport Runway
Power Transmission Line, with Poles, with Pylons
Railway
Wooded Area
Chimney
Hedge
Well
Regulatory Flood Line

This map was compiled photogrammetrically from 1:10 000 aerial photography exposed in April 2000.

The vertical datum is mean sea level as established by the Geodetic Survey of Canada.

North American Datum 1983, U.T.M. 6° projection
Zone 17, Central Meridian 81° W.

Grid Interval 100 metres.

PLEASE NOTE:
FLOODLINE ELEVATIONS ARE SUBJECT TO CHANGE DUE TO REVISED INFORMATION.

J.D. BARNES LIMITED SURVEYING MAPPING
ONTARIO LAND SURVEYORS
143 NEWPEN CRESCENT SUITE 202
ORANGEVILLE, ONTARIO L9W 3M6
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DATE ISSUED
MAY 15 2002

Aquafor Beech Limited
14 ABACUS ROAD
BRAMPTON, ONTARIO L6T 5B7
905-794-2325

PLEASE NOTE:
THE PROFESSIONAL ENGINEER'S STAMP VERIFIES THE FLOOD LINE AND ASSOCIATED DATA NOT THE MAP DATA UNLESS OTHERWISE NOTED

FLOOD PLAIN MAPPING PROGRAM

FLOODLINE APPROVED DATE: _____

TORONTO AND REGION Conservation
for The Living City
5 Shoreham Drive Downsview Ontario M3N 1S4 (416) 661-6600

Scale 1:2000
100 0 100 200 Metres
200 0 200 400 600 800 1000 Feet
CONTOUR INTERVAL 1.0 METRES

FRENCHMAN'S BAY

SHEET No. 1

APPENDIX "E"

Stormwater Quantity Control Calculations

VALDOR ENGINEERING INC. **TABLE E**

File: 22115
April 2023

Project: 875 Kingston Road, City of Pickering

STORAGE AND DISCHARGE SUMMARY

CONDITION	DRAINAGE AREA (ha)	STORAGE HWL (m)	ORIFICE				PRE-DEVELOPMENT RELEASE RATE (L/S)	STORAGE REQUIRED (cu.m.)	STORAGE PROVIDED (cu.m.)
			LOCATION	INVERT (m)	DIAMETER (mm)	RELEASE RATE (L/s)			
2-Year	0.529	92.30	SWM Tank	91.60	150	50.7	57.0	24.4	27.6
5-Year		92.65				63.4	78.2	37.1	41.4
10-Year		92.90				71.0	92.6	46.4	51.2
25-Year		93.20				79.3	121.8	58.9	63.0
50-Year		93.50				86.7	148.7	67.3	74.9
100-Year		93.78				93.1	171.6	77.4	85.9

VALDOR ENGINEERING INC. **TABLE E1**
File: 22115
April 2023

Project: 875 Kingston Road, City of Pickering

PRE-DEVELOPMENT PEAK FLOW CALCULATION (Unmitigated)

Surface Type	Area (ha.)	Runoff Coefficient
Pervious	0.511	0.25
Gravel	0.018	0.70
TOTAL AREA	0.529	0.27

2 Year Pre-Development Flow

$I = A / (t_c+B)^C$

I = Rainfall Rate (mm/hr)			A =	715.076
Ca =	1		B =	5.262
T =	10	minutes	C =	0.815
I =	77.6	mm/hr		
R =	0.27			
2 yr R =	0.50	(composite)		
N =	2.78			

Q = R x A x I x N

2 year Q =	30.3	L/s
2 year Q (Target) =	57.0	L/s
Total 2-Year Q =	**57.0**	**L/s**

5 Year Pre-Development Flow

$I = A / (t_c+B)^C$

I = Rainfall Rate (mm/hr)			A =	1082.901
Ca =	1		B =	6.007
T =	10	minutes	C =	0.837
I =	106.3	mm/hr		
R =	0.27			
5 yr R =	0.50	(composite)		
N =	2.78			

Q = R x A x I x N x Ca

5 year Q =	41.5	L/s
5 year Q (Target) =	78.2	L/s
Total 5-Year Q =	**78.2**	**L/s**

10 Year Pre-Development Flow

I = Rainfall Rate (mm/hr)			A =	1313.979
Ca =	1		B =	6.026
T =	10	minutes	C =	0.845
I =	126.0	mm/hr		
R =	0.27			
10 yr R =	0.50	(composite)		
N =	2.778			

Q = R x A x I x N x Ca

10 year Q =	49.1	L/s
10 year Q (Target) =	92.6	L/s
Total 10-Year Q =	**92.6**	**L/s**

TABLE E1 (Cont'd)

25 Year Pre-Development Flow

$I = A / (t_c+B)^C$

I = Rainfall Rate (mm/hr)			A =	1581.718
Ca =	1.1		B =	6.007
T =	10	minutes	C =	0.848
I =	150.6	mm/hr		
R =	0.27			
25 yr R =	0.50	(composite)		
N =	2.78			

Q = R x A x I x N

25 year Q =	64.6	L/s
25 year Q (Target)=	121.8	L/s
Total 25-Year Q =	**121.8**	**L/s**

50 Year Pre-Development Flow

$I = A / (t_c+B)^C$

I = Rainfall Rate (mm/hr)			A =	1828.009
Ca =	1.2		B =	6.193
T =	10	minutes	C =	0.856
I =	168.6	mm/hr		
R =	0.27			
50 yr R =	0.50	(composite)		
N =	2.78			

Q = R x A x I x N x Ca

50 year Q =	78.9	L/s
50 year Q (Target)=	148.7	L/s
Total 50-Year Q =	**148.7**	**L/s**

100 Year Pre-Development Flow

I = Rainfall Rate (mm/hr)			A =	2096.425
Ca =	1.25		B =	6.485
T =	10	minutes	C =	0.863
I =	186.7	mm/hr		
R =	0.27			
100 yr R =	0.50			
N =	2.78			

Q = R x A x I x N x Ca

100 year Q =	91.1	L/s
100 year Q (Target)=	171.6	L/s
Total 100-Year Q =	**171.6**	**L/s**

VALDOR ENGINEERING INC. **TABLE E2**
File: 22115
April 2023

Project: 875 Kingston Road, City of Pickering

POST-DEVELOPMENT PEAK FLOW CALCULATION (Unmitigated)

Surface Type	Area (ha.)	Runoff Coefficient
Pervious	0.072	0.25
Roof	0.194	0.95
Impervious	0.263	0.90
TOTAL AREA	0.529	0.83

2 Year Post-Development Flow

$I = A / (t_c+B)^C$

I = Rainfall Rate (mm/hr)			A =	715.076
Ca =	1		B =	5.262
T =	10	minutes	C =	0.815
I =	77.6	mm/hr		
2 yr R =	0.83	(composite)		
N =	2.78			

Q = R x A x I x N x Ca — 2 year Q = 94.7 L/s

Total 2-Year Q = 94.7 L/s

5 Year Post-Development Flow

$I = A / (t_c+B)^C$

I = Rainfall Rate (mm/hr)			A =	1082.901
Ca =	1		B =	6.007
T =	10	minutes	C =	0.837
I =	106.3	mm/hr		
5 yr R =	0.83			
N =	2.78			

Q = R x A x I x N x Ca — 5 year Q = 129.7 L/s

Total 5-Year Q = 129.7 L/s

10 Year Post-Development Flow

$I = A / (t_c+B)^C$

I = Rainfall Rate (mm/hr)			A =	1313.979
Ca =	1		B =	6.026
T =	10	minutes	C =	0.845
I =	126.0	mm/hr		
10 yr R =	0.83			
N =	2.78			

Q = R x A x I x N x Ca — 10 year Q = 153.8 L/s

Total 10-Year Q = 153.8 L/s

TABLE E2 (Cont'd)

25 Year Post-Development Flow

$I = A / (t_c+B)^C$

I = Rainfall Rate (mm/hr)			A =	1581.718
Ca =	1.1		B =	6.007
T =	10	minutes	C =	0.848
I =	150.6	mm/hr		
25 yr R =	0.83			
N =	2.78			

Q = R x A x I x N x Ca — 25 year Q = 202.2 L/s

Total 25-Year Q = 202.2 L/s

50 Year Post-Development Flow

$I = A / (t_c+B)^C$

I = Rainfall Rate (mm/hr)			A =	1828.009
Ca =	1.2		B =	6.193
T =	10	minutes	C =	0.856
I =	168.6	mm/hr		
50 yr R =	0.83			
N =	2.78			

Q = R x A x I x N x Ca — 50 year Q = 246.9 L/s

Total 50-Year Q = 246.9 L/s

100 Year Post-Development Flow

$I = A / (t_c+B)^C$

I = Rainfall Rate (mm/hr)			A =	2096.425
Ca =	1.25		B =	6.485
T =	10	minutes	C =	0.863
I =	186.7	mm/hr		
100 yr R =	0.83			
N =	2.78			

Q = R x A x I x N x Ca — 100 year Q = 284.8 L/s

Total 100-Year Q = 284.8 L/s

VALDOR ENGINEERING INC. **Table E3-A**

File: 22115
April 2023

Project: 875 Kingston Road, City of Pickering

CONTROL ORIFICE DESIGN

2 YEAR STORM

2 Year High Water Level	=	92.30	m
Orifice			
Orifice Coefficient (C)	=	0.82	(Tube)
Acceleration due to gravity (g)	=	9.81	m/s/s
Orifice Invert Elevation	=	91.60	m
Orifice Diameter	=	150	mm
Orifice Springline Elevation		91.675	m
Cross section area of orifice (A)	=	0.0177	sq.m.
Head (H)	=	0.63	m
Actual Discharge (Q) (C x A x (2 x g x H)^0.5)	=	**50.7**	L/s

VALDOR ENGINEERING INC. **Table E3-B**

File: 22115
April 2023

Project: 875 Kingston Road, City of Pickering

CONTROL ORIFICE DESIGN

5 YEAR STORM

5 Year High Water Level	=	92.65	m
Orifice			
Orifice Coefficient (C)	=	0.82	(Tube)
Acceleration due to gravity (g)	=	9.81	m/s/s
Orifice Invert Elevation	=	91.60	m
Orifice Diameter	=	150	mm
Orifice Springline Elevation		91.675	m
Cross section area of orifice (A)	=	0.0177	sq.m.
Head (H)	=	0.98	m
Actual Discharge (Q) (C x A x (2 x g x H)^0.5)	=	**63.4**	L/s

VALDOR ENGINEERING INC. **Table E3-C**

File: 22115
April 2023

Project: 875 Kingston Road, City of Pickering

CONTROL ORIFICE DESIGN

10 YEAR STORM

10 Year High Water Level	=	92.90	m
Orifice			
Orifice Coefficient (C)	=	0.82	(Tube)
Acceleration due to gravity (g)	=	9.81	m/s/s
Orifice Invert Elevation	=	91.60	m
Orifice Diameter	=	150	mm
Orifice Springline Elevation		91.675	m
Cross section area of orifice (A)	=	0.0177	sq.m.
Head (H)	=	1.23	m
Actual Discharge (Q) (C x A x (2 x g x H)^0.5)	=	**71.0**	L/s

VALDOR ENGINEERING INC. **Table E3-D**

File: 22115
April 2023

Project: 875 Kingston Road, City of Pickering

CONTROL ORIFICE DESIGN

25 YEAR STORM

25 Year High Water Level	=	93.20	m
Orifice			
Orifice Coefficient (C)	=	0.82	(Tube)
Acceleration due to gravity (g)	=	9.81	m/s/s
Orifice Invert Elevation	=	91.60	m
Orifice Diameter	=	150	mm
Orifice Springline Elevation		91.675	m
Cross section area of orifice (A)	=	0.0177	sq.m.
Head (H)	=	1.53	m
Actual Discharge (Q) (C x A x (2 x g x H)^0.5)	=	**79.3**	L/s

VALDOR ENGINEERING INC. **Table E3-E**

File: 22115
April 2023

Project: 875 Kingston Road, City of Pickering

CONTROL ORIFICE DESIGN

50 YEAR STORM

50 Year High Water Level	=	93.50	m
Orifice			
Orifice Coefficient (C)	=	0.82	(Tube)
Acceleration due to gravity (g)	=	9.81	m/s/s
Orifice Invert Elevation	=	91.60	m
Orifice Diameter	=	150	mm
Orifice Springline Elevation		91.675	m
Cross section area of orifice (A)	=	0.0177	sq.m.
Head (H)	=	1.83	m
Actual Discharge (Q) (C x A x (2 x g x H)^0.5)	=	**86.7**	L/s

VALDOR ENGINEERING INC. **Table E3-F**

File: 22115
April 2023

Project: 875 Kingston Road, City of Pickering

CONTROL ORIFICE DESIGN

100 YEAR STORM

100 Year High Water Level	=	93.78	m
Orifice			
Orifice Coefficient (C)	=	0.82	(Tube)
Acceleration due to gravity (g)	=	9.81	m/s/s
Orifice Invert Elevation	=	91.60	m
Orifice Diameter	=	150	mm
Orifice Springline Elevation		91.675	m
Cross section area of orifice (A)	=	0.0177	sq.m.
Head (H)	=	2.11	m
Actual Discharge (Q) (C x A x (2 x g x H)^0.5)	=	**93.1**	L/s

VALDOR ENGINEERING INC.
File: 22115
April 2023

TABLE E4-A

Storage Volume Calculations - Rational Method

2-year Storm - City of Pickering

Project: 875 Kingston Road, City of Pickering

Total Area (ha)	0.529
Runoff Coefficient	0.83
Maximum Discharge Through Orifice (L/s)	50.7
Discharged Volume per 5 min Interval (cu.m)	15.2

Time (min)	Intensity (mm/hr)	Runoff Volume (cu.m)	Discharged Volume (cu.m)	Storage Volume (cu.m)
0	0.0	0.000	0.000	0.000
5	2.3	0.848	0.848	0.000
10	2.5	0.926	0.926	0.000
15	2.8	1.022	1.022	0.000
20	3.1	1.143	1.143	0.000
25	3.6	1.299	1.299	0.000
30	4.1	1.511	1.511	0.000
35	5.0	1.814	1.814	0.000
40	6.2	2.284	2.284	0.000
45	8.5	3.112	3.112	0.000
50	13.5	4.941	4.941	0.000
55	32.9	12.021	12.021	0.000
60	107.2	39.218	15.223	23.995
65	42.8	15.652	15.223	0.429
70	22.9	8.390	8.390	0.000
75	15.4	5.644	5.644	0.000
80	11.6	4.238	4.238	0.000
85	9.3	3.392	3.392	0.000
90	7.7	2.831	2.831	0.000
95	6.7	2.433	2.433	0.000
100	5.8	2.136	2.136	0.000
105	5.2	1.906	1.906	0.000
110	4.7	1.723	1.723	0.000
115	4.3	1.573	1.573	0.000
120	4.0	1.449	1.449	0.000
125	3.7	1.344	1.344	0.000
130	3.4	1.254	1.254	0.000
135	3.2	1.177	1.177	0.000
140	3.0	1.109	1.109	0.000
145	2.9	1.049	1.049	0.000
150	2.7	0.995	0.995	0.000
155	2.6	0.947	0.947	0.000
160	2.5	0.904	0.904	0.000
165	2.4	0.865	0.865	0.000
170	2.3	0.830	0.830	0.000
175	2.2	0.797	0.797	0.000
180	2.1	0.768	0.768	0.000

Total Storage Volume Required (cu.m) **24.4**

VALDOR ENGINEERING INC.
File: 22115
April 2023

TABLE E4-B

Storage Volume Calculations - Rational Method

5-year Storm - City of Pickering

Project: 875 Kingston Road, City of Pickering

Total Area (ha)	0.529
Runoff Coefficient	0.83
Maximum Discharge Through Orifice (L/s)	63.4
Discharged Volume per 5 min Interval (cu.m)	19.0

Time (min)	Intensity (mm/hr)	Runoff Volume (cu.m)	Discharged Volume (cu.m)	Storage Volume (cu.m)
0	0.0	0.000	0.000	0.000
5	2.9	1.046	1.046	0.000
10	3.1	1.149	1.149	0.000
15	3.5	1.275	1.275	0.000
20	3.9	1.435	1.435	0.000
25	4.5	1.644	1.644	0.000
30	5.3	1.929	1.929	0.000
35	6.4	2.342	2.342	0.000
40	8.2	2.991	2.991	0.000
45	11.3	4.150	4.150	0.000
50	18.4	6.749	6.749	0.000
55	45.9	16.808	16.808	0.000
60	145.4	53.210	19.013	34.197
65	60.0	21.933	19.013	2.920
70	31.9	11.683	11.683	0.000
75	21.2	7.754	7.754	0.000
80	15.7	5.745	5.745	0.000
85	12.4	4.545	4.545	0.000
90	10.3	3.754	3.754	0.000
95	8.7	3.197	3.197	0.000
100	7.6	2.785	2.785	0.000
105	6.7	2.468	2.468	0.000
110	6.1	2.217	2.217	0.000
115	5.5	2.013	2.013	0.000
120	5.0	1.845	1.845	0.000
125	4.7	1.704	1.704	0.000
130	4.3	1.584	1.584	0.000
135	4.0	1.480	1.480	0.000
140	3.8	1.389	1.389	0.000
145	3.6	1.310	1.310	0.000
150	3.4	1.240	1.240	0.000
155	3.2	1.177	1.177	0.000
160	3.1	1.120	1.120	0.000
165	2.9	1.069	1.069	0.000
170	2.8	1.023	1.023	0.000
175	2.7	0.981	0.981	0.000
180	2.6	0.943	0.943	0.000

Total Storage Volume Required (cu.m) **37.1**

VALDOR ENGINEERING INC.
File: 22115
April 2023

TABLE E4-C

Storage Volume Calculations - Rational Method

10-year Storm - City of Pickering

Project: 875 Kingston Road, City of Pickering

Total Area (ha)	0.529
Runoff Coefficient	0.83
Maximum Discharge Through Orifice (L/s)	71.0
Discharged Volume per 5 min Interval (cu.m)	21.3

Time (min)	Intensity (mm/hr)	Runoff Volume (cu.m)	Discharged Volume (cu.m)	Storage Volume (cu.m)
0	0.0	0.000	0.000	0.000
5	3.2	1.170	1.170	0.000
10	3.5	1.287	1.287	0.000
15	3.9	1.431	1.431	0.000
20	4.4	1.613	1.613	0.000
25	5.1	1.853	1.853	0.000
30	6.0	2.181	2.181	0.000
35	7.3	2.657	2.657	0.000
40	9.3	3.409	3.409	0.000
45	13.0	4.758	4.758	0.000
50	21.3	7.808	7.808	0.000
55	53.9	19.731	19.731	0.000
60	172.9	63.245	21.312	41.933
65	70.6	25.826	21.312	4.514
70	37.3	13.635	13.635	0.000
75	24.6	8.989	8.989	0.000
80	18.1	6.626	6.626	0.000
85	14.3	5.220	5.220	0.000
90	11.7	4.297	4.297	0.000
95	10.0	3.648	3.648	0.000
100	8.7	3.169	3.169	0.000
105	7.7	2.802	2.802	0.000
110	6.9	2.512	2.512	0.000
115	6.2	2.278	2.278	0.000
120	5.7	2.084	2.084	0.000
125	5.3	1.922	1.922	0.000
130	4.9	1.784	1.784	0.000
135	4.6	1.665	1.665	0.000
140	4.3	1.562	1.562	0.000
145	4.0	1.471	1.471	0.000
150	3.8	1.390	1.390	0.000
155	3.6	1.319	1.319	0.000
160	3.4	1.255	1.255	0.000
165	3.3	1.197	1.197	0.000
170	3.1	1.144	1.144	0.000
175	3.0	1.096	1.096	0.000
180	2.9	1.052	1.052	0.000

Total Storage Volume Required (cu.m) **46.4**

VALDOR ENGINEERING INC.
File: 22115
April 2023

TABLE E4-D

Storage Volume Calculations - Rational Method

25-year Storm - City of Pickering

Project: 875 Kingston Road, City of Pickering

Total Area (ha)	0.529
Runoff Coefficient	0.83
Maximum Discharge Through Orifice (L/s)	79.3
Discharged Volume per 5 min Interval (cu.m)	23.8

Time (min)	Intensity (mm/hr)	Runoff Volume (cu.m)	Discharged Volume (cu.m)	Storage Volume (cu.m)
0	0.0	0.000	0.000	0.000
5	3.7	1.365	1.365	0.000
10	4.1	1.502	1.502	0.000
15	4.6	1.671	1.671	0.000
20	5.2	1.885	1.885	0.000
25	5.9	2.167	2.167	0.000
30	7.0	2.554	2.554	0.000
35	8.5	3.116	3.116	0.000
40	10.9	4.003	4.003	0.000
45	15.3	5.600	5.600	0.000
50	25.2	9.220	9.220	0.000
55	64.1	23.448	23.448	0.000
60	206.9	75.697	23.779	51.918
65	84.0	30.736	23.779	6.957
70	44.2	16.160	16.160	0.000
75	29.0	10.625	10.625	0.000
80	21.4	7.816	7.816	0.000
85	16.8	6.147	6.147	0.000
90	13.8	5.053	5.053	0.000
95	11.7	4.286	4.286	0.000
100	10.2	3.720	3.720	0.000
105	9.0	3.287	3.287	0.000
110	8.0	2.944	2.944	0.000
115	7.3	2.668	2.668	0.000
120	6.7	2.440	2.440	0.000
125	6.1	2.249	2.249	0.000
130	5.7	2.086	2.086	0.000
135	5.3	1.946	1.946	0.000
140	5.0	1.825	1.825	0.000
145	4.7	1.718	1.718	0.000
150	4.4	1.623	1.623	0.000
155	4.2	1.539	1.539	0.000
160	4.0	1.464	1.464	0.000
165	3.8	1.396	1.396	0.000
170	3.6	1.334	1.334	0.000
175	3.5	1.278	1.278	0.000
180	3.4	1.227	1.227	0.000

Total Storage Volume Required (cu.m) **58.9**

VALDOR ENGINEERING INC.
File: 22115
April 2023

TABLE E4-E

Storage Volume Calculations - Rational Method

50-year Storm - City of Pickering

Project: 875 Kingston Road, City of Pickering

Total Area (ha)	0.529
Runoff Coefficient	0.83
Maximum Discharge Through Orifice (L/s)	86.7
Discharged Volume per 5 min Interval (cu.m)	26.0

Time (min)	Intensity (mm/hr)	Runoff Volume (cu.m)	Discharged Volume (cu.m)	Storage Volume (cu.m)
0	0.0	0.000	0.000	0.000
5	4.0	1.456	1.456	0.000
10	4.4	1.605	1.605	0.000
15	4.9	1.790	1.790	0.000
20	5.5	2.025	2.025	0.000
25	6.4	2.334	2.334	0.000
30	7.5	2.761	2.761	0.000
35	9.2	3.382	3.382	0.000
40	11.9	4.369	4.369	0.000
45	16.8	6.155	6.155	0.000
50	28.0	10.227	10.227	0.000
55	71.8	26.280	26.013	0.267
60	231.2	84.599	26.013	58.586
65	94.3	34.499	26.013	8.486
70	49.4	18.061	18.061	0.000
75	32.3	11.811	11.811	0.000
80	23.6	8.643	8.643	0.000
85	18.5	6.768	6.768	0.000
90	15.1	5.542	5.542	0.000
95	12.8	4.685	4.685	0.000
100	11.1	4.054	4.054	0.000
105	9.8	3.572	3.572	0.000
110	8.7	3.193	3.193	0.000
115	7.9	2.886	2.886	0.000
120	7.2	2.635	2.635	0.000
125	6.6	2.424	2.424	0.000
130	6.1	2.245	2.245	0.000
135	5.7	2.091	2.091	0.000
140	5.4	1.958	1.958	0.000
145	5.0	1.841	1.841	0.000
150	4.8	1.738	1.738	0.000
155	4.5	1.646	1.646	0.000
160	4.3	1.564	1.564	0.000
165	4.1	1.490	1.490	0.000
170	3.9	1.423	1.423	0.000
175	3.7	1.362	1.362	0.000
180	3.6	1.306	1.306	0.000

Total Storage Volume Required (cu.m) **67.3**

VALDOR ENGINEERING INC.
File: 22115
April 2023

TABLE E4-F

Storage Volume Calculations - Rational Method

100-year Storm - City of Pickering

Project: 875 Kingston Road, City of Pickering

Total Area (ha)	0.529
Runoff Coefficient	0.83
Maximum Discharge Through Orifice (L/s)	93.1
Discharged Volume per 5 min Interval (cu.m)	27.9

Time (min)	Intensity (mm/hr)	Runoff Volume (cu.m)	Discharged Volume (cu.m)	Storage Volume (cu.m)
0	0.0	0.000	0.000	0.000
5	4.3	1.560	1.560	0.000
10	4.7	1.723	1.723	0.000
15	5.3	1.925	1.925	0.000
20	6.0	2.184	2.184	0.000
25	6.9	2.526	2.526	0.000
30	8.2	2.997	2.997	0.000
35	10.1	3.688	3.688	0.000
40	13.1	4.790	4.790	0.000
45	18.6	6.792	6.792	0.000
50	31.1	11.376	11.376	0.000
55	80.3	29.387	27.937	1.449
60	255.0	93.297	27.937	65.360
65	105.4	38.574	27.937	10.637
70	55.2	20.199	20.199	0.000
75	36.0	13.161	13.161	0.000
80	26.2	9.592	9.592	0.000
85	20.4	7.481	7.481	0.000
90	16.7	6.104	6.104	0.000
95	14.1	5.143	5.143	0.000
100	12.1	4.437	4.437	0.000
105	10.7	3.900	3.900	0.000
110	9.5	3.477	3.477	0.000
115	8.6	3.137	3.137	0.000
120	7.8	2.858	2.858	0.000
125	7.2	2.625	2.625	0.000
130	6.6	2.427	2.427	0.000
135	6.2	2.257	2.257	0.000
140	5.8	2.111	2.111	0.000
145	5.4	1.982	1.982	0.000
150	5.1	1.869	1.869	0.000
155	4.8	1.768	1.768	0.000
160	4.6	1.678	1.678	0.000
165	4.4	1.597	1.597	0.000
170	4.2	1.524	1.524	0.000
175	4.0	1.457	1.457	0.000
180	3.8	1.396	1.396	0.000

Total Storage Volume Required (cu.m) **77.4**

VALDOR ENGINEERING INC.
File: 22115
April 2023

TABLE: E5-A

AVAILABLE STORAGE - 2 YEAR

UNDERGROUND STORAGE - BOX

					Area (sq.m)	Height (m)	VOLUME (cu.m)
Underground Detention Tank							
Tank Inv: 91.60		HWL: 92.30			39.40	0.70	27.6
TOTAL							27.6

2 YEAR STORAGE PROVIDED:	**27.6**
2 YEAR STORAGE REQUIRED:	**24.4**

VALDOR ENGINEERING INC.
File: 22115
April 2023

TABLE: E5-B

AVAILABLE STORAGE - 5 YEAR

UNDERGROUND STORAGE - Detention Tank

						Area (sq.m)	Height (m)	VOLUME (cu.m)
Underground Detention Tank								
Tank Inv: 91.60		HWL: 92.65				39.40	1.05	41.4
TOTAL								41.4

5 YEAR STORAGE PROVIDED:	**41.4**
5 YEAR STORAGE REQUIRED:	**37.1**

VALDOR ENGINEERING INC.
File: 22115
April 2023

TABLE: E5-C

AVAILABLE STORAGE - 10 YEAR

UNDERGROUND STORAGE - Detention Tank

						Area (sq.m)	Height (m)	VOLUME (cu.m)
Underground Detention Tank								
Tank Inv: 91.60		HWL: 92.90				39.40	1.30	51.2
TOTAL								51.2

10 YEAR STORAGE PROVIDED:	**51.2**
10 YEAR STORAGE REQUIRED:	**46.4**

VALDOR ENGINEERING INC.
File: 22115
April 2023

TABLE: E5-D

AVAILABLE STORAGE - 25 YEAR

UNDERGROUND STORAGE - Detention Tank

						Area (sq.m)	Height (m)	VOLUME (cu.m)
Underground Detention Tank								
Tank Inv: 91.60		HWL: 93.20				39.40	1.60	63.0
TOTAL								63.0

25 YEAR STORAGE PROVIDED:	**63.0**
25 YEAR STORAGE REQUIRED:	**58.9**

VALDOR ENGINEERING INC.
File: 22115
April 2023

TABLE: E5-E

AVAILABLE STORAGE - 50 YEAR

UNDERGROUND STORAGE - Detention Tank

						Area (sq.m)	Height (m)	VOLUME (cu.m)
Underground Detention Tank								
Tank Inv: 91.60		HWL: 93.50				39.40	1.90	74.9
TOTAL								74.9

50 YEAR STORAGE PROVIDED:	**74.9**
50 YEAR STORAGE REQUIRED:	**67.3**

VALDOR ENGINEERING INC.
File: 22115
April 2023

TABLE: E5-F

AVAILABLE STORAGE - 100 YEAR

UNDERGROUND STORAGE - Detention Tank

		Area (sq.m)	Height (m)	VOLUME (cu.m)
Underground Detention Tank				
Tank Inv: 91.60 HWL: 93.78		39.40	2.18	85.9
TOTAL				85.9

100 YEAR STORAGE PROVIDED:	**85.9**
100 YEAR STORAGE REQUIRED:	**77.4**

APPENDIX "F"

Stormwater Quality Control Calculations

VALDOR ENGINEERING INC.
File: 22115
September 2022

TABLE: F1

JELLYFISH UNIT SIZING

Controlled Site Area = A = 0.529 Ha

Surface Type	**Runoff Coeff**	**Area (Ha)**
Landscape Area	0.25	0.121
Roof Area	0.95	0.194
Impervious Area	0.95	0.214
	0.79	**0.529**

Imperviousness

% Impervious = (Runoff Coefficient - 0.20) / 0.7 x 100

% Impervious = 84.3 %

STANDARD OFFLINE
Jellyfish Filter Sizing Report

Project Information

Date	Thursday, September 01, 2022
Project Name	875 Kingston Rd.
Project Number	22115
Location	Pickering

Jellyfish Filter Design Overview

This report provides information for the sizing and specification of the Jellyfish Filter. When designed properly in accordance to the guidelines detailed in the Jellyfish Filter Technical Manual, the Jellyfish Filter will exceed the performance and longevity of conventional horizontal bed and granular media filters.

Please see ***www.ImbriumSystems.com*** *for more information.*

Jellyfish Filter System Recommendation

The Jellyfish Filter model JF6-3-1 is recommended to meet the water quality objective by treating a flow of 17.7 L/s, which meets or exceeds 90% of the average annual rainfall runoff volume based on 18 years of TORONTO CENTRAL rainfall data for this site. This model has a sediment capacity of 199 kg, which meets or exceeds the estimated average annual sediment load.

Jellyfish Model	Number of High-Flo Cartridges	Number of Draindown Cartridges	Manhole Diameter (m)	Treatment Flow Rate (L/s)	Sediment Capacity (kg)
JF6-3-1	3	1	1.8	17.7	199

The Jellyfish Filter System

The patented Jellyfish Filter is an engineered stormwater quality treatment technology featuring unique membrane filtration in a compact stand-alone treatment system that removes a high level and wide variety of stormwater pollutants. Exceptional pollutant removal is achieved at high treatment flow rates with minimal head loss and low maintenance costs. Each lightweight Jellyfish Filter cartridge contains an extraordinarily large amount of membrane surface area, resulting in superior flow capacity and pollutant removal capacity.

Maintenance

Regular scheduled inspections and maintenance is necessary to assure proper functioning of the Jellyfish Filter. The maintenance interval is designed to be a minimum of 12 months, but this will vary depending on site loading conditions and upstream pretreatment measures. Quarterly inspections and inspections after all storms beyond the 5-year event are recommended until enough historical performance data has been logged to comfortably initiate an alternative inspection interval.

Please see ***www.ImbriumSystems.com*** *for more information.*

Thank you for the opportunity to present this information to you and your client.

Performance

Jellyfish efficiently captures a high level of Stormwater pollutants, including:

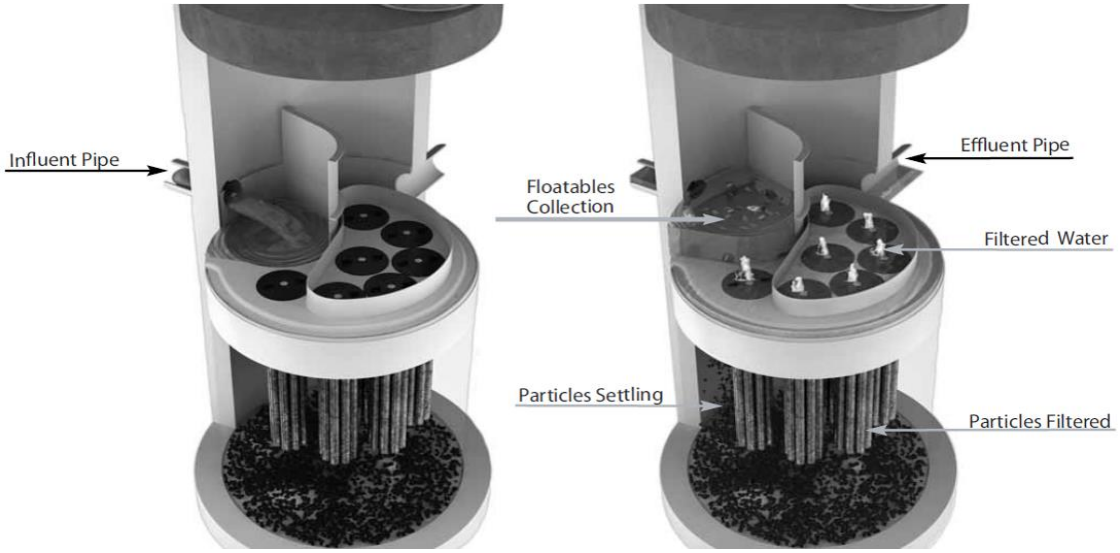
- ☑ 89% of the total suspended solids (TSS) load, including particles less than 5 microns
- ☑ 77% TP removal & 51% TN removal
- ☑ 90% Total Copper, 81% Total Lead, 70% Total Zinc
- ☑ Particulate-bound pollutants such as nutrients, toxic metals, hydrocarbons and bacteria
- ☑ Free oil, Floatable trash and debris

Field Proven Peformance

The Jellyfish filter has been field-tested on an urban site with 25 TARP qualifying rain events and field monitored according to the TARP field test protocol, demonstrating:

- A median TSS removal efficiency of 89%, and a median SSC removal of 99%;
- The ability to capture fine particles as indicated by an effluent d50 median of 3 microns for all monitotred storm events, and a median effluent turbidity of 5 NTUs;
- A median Total Phosphorus removal of 77%, and a median Total Nitrogen removal of 51%.

Jellyfish Filter Treatment Functions



Pre-treatment and Membrane Filtration

Jellyfish® Filter

Project Information

Date:	Thursday, September 01, 2022
Project Name:	875 Kingston Rd.
Project Number:	22115
Location:	Pickering

Designer Information

Company:	Valdor Engineering Inc.
Contact:	Joo Ho Kim
Phone #:	

Notes

Rainfall

Name:	TORONTO CENTRAL
State:	ON
ID:	100
Record:	1982 to 1999
Co-ords:	45°30'N, 90°30'W

Drainage Area

Total Area:	0.529 ha
Imperviousness:	84.3%

Upstream Detention

Peak Release Rate:	67.9 L/s
Pretreatment Credit:	0%

Design System Requirements

Flow Loading	90% of the Average Annual Runoff based on 18 years of TORONTO CENTRAL rainfall data:	**8.7 L/s**
Sediment Loading	Treating 90% of the average annual runoff volume, 2669 m³, with a suspended sediment concentration of 60 mg/L, and 0% removal by upstream detention.	**160 kg***

** Indicates that sediment loading is the limiting parameter in the sizing of this Jellyfish system*

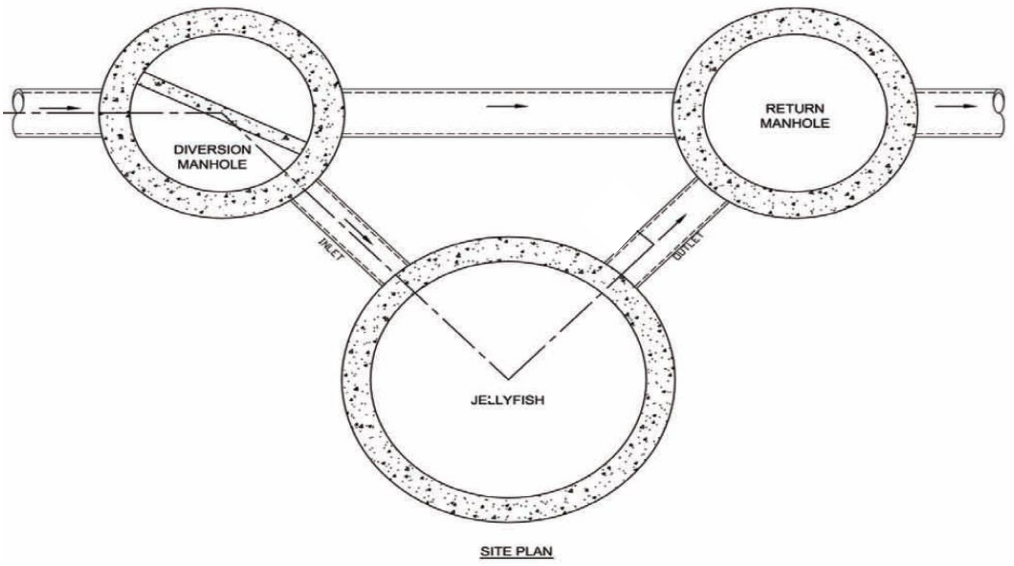
Recommendation

The Jellyfish Filter model JF6-3-1 is recommended to meet the water quality objective by treating a flow of 17.7 L/s, which meets or exceeds 90% of the average annual rainfall runoff volume based on 18 years of TORONTO CENTRAL rainfall data for this site. This model has a sediment capacity of 199 kg, which meets or exceeds the estimated average annual sediment load.

Jellyfish Model	Number of High-Flo Cartridges	Number of Draindown Cartridges	Manhole Diameter (m)	Wet Vol Below Deck (L)	Sump Storage (m³)	Oil Capacity (L)	Treatment Flow Rate (L/s)	Sediment Capacity (kg)
JF4-1-1	1	1	1.2	2313	0.34	379	7.6	85
JF4-2-1	2	1	1.2	2313	0.34	379	12.6	142
JF6-3-1	**3**	**1**	**1.8**	**5205**	**0.79**	**848**	**17.7**	**199**
JF6-4-1	4	1	1.8	5205	0.79	848	22.7	256
JF6-5-1	5	1	1.8	5205	0.79	848	27.8	313
JF6-6-1	6	1	1.8	5205	0.79	848	28.6	370
JF8-6-2	6	2	2.4	9252	1.42	1469	35.3	398
JF8-7-2	7	2	2.4	9252	1.42	1469	40.4	455
JF8-8-2	8	2	2.4	9252	1.42	1469	45.4	512
JF8-9-2	9	2	2.4	9252	1.42	1469	50.5	569
JF8-10-2	10	2	2.4	9252	1.42	1469	50.5	626
JF10-11-3	11	3	3.0	14456	2.21	2302	63.1	711
JF10-12-3	12	3	3.0	14456	2.21	2302	68.2	768
JF10-12-4	12	4	3.0	14456	2.21	2302	70.7	796
JF10-13-4	13	4	3.0	14456	2.21	2302	75.7	853
JF10-14-4	14	4	3.0	14456	2.21	2302	78.9	910
JF10-15-4	15	4	3.0	14456	2.21	2302	78.9	967
JF10-16-4	16	4	3.0	14456	2.21	2302	78.9	1024
JF10-17-4	17	4	3.0	14456	2.21	2302	78.9	1081
JF10-18-4	18	4	3.0	14456	2.21	2302	78.9	1138
JF10-19-4	19	4	3.0	14456	2.21	2302	78.9	1195
JF12-20-5	20	5	3.6	20820	3.2	2771	113.6	1280
JF12-21-5	21	5	3.6	20820	3.2	2771	113.7	1337
JF12-22-5	22	5	3.6	20820	3.2	2771	113.7	1394
JF12-23-5	23	5	3.6	20820	3.2	2771	113.7	1451
JF12-24-5	24	5	3.6	20820	3.2	2771	113.7	1508
JF12-25-5	25	5	3.6	20820	3.2	2771	113.7	1565
JF12-26-5	26	5	3.6	20820	3.2	2771	113.7	1622
JF12-27-5	27	5	3.6	20820	3.2	2771	113.7	1679

Jellyfish Filter Design Notes

- Typically the Jellyfish Filter is designed in an offline configuration, as all stormwater filter systems will perform for a longer duration between required maintenance services when designed and applied in off-line configurations. Depending on the design parameters, an optional internal bypass may be incorporated into the Jellyfish Filter, however note the inspection and maintenance frequency should be expected to increase above that of an off-line system. Speak to your local representative for more information.



Jellyfish Filter Typical Layout

- Typically, 18 inches (457 mm) of driving head is designed into the system, calculated as the difference in elevation between the top of the diversion structure weir and the invert of the Jellyfish Filter outlet pipe. Alternative driving head values can be designed as 12 to 24 inches (305 to 610mm) depending on specific site requirements, requiring additional sizing and design assistance.
- Typically, the Jellyfish Filter is designed with the inlet pipe configured 6 inches (150 mm) above the outlet invert elevation. However, depending on site parameters this can vary to an optional configuration of the inlet pipe entering the unit below the outlet invert elevation.
- The Jellyfish Filter can accommodate multiple inlet pipes within certain restrictions.
- While the optional inlet below deck configuration offers 0 to 360 degree flexibility between the inlet and outlet pipe, typical systems conform to the following:

Model Diameter (m)	Minimum Angle Inlet / Outlet Pipes	Minimum Inlet Pipe Diameter (mm)	Minimum Outlet Pipe Diameter (mm)
1.2	62º	150	200
1.8	**59º**	**200**	**250**
2.4	52º	250	300
3.0	48º	300	450
3.6	40º	300	450

- The Jellyfish Filter can be built at all depths of cover generally associated with conventional stormwater conveyance systems. For sites that require minimal depth of cover for the stormwater infrastructure, the Jellyfish Filter can be applied in a shallow application using a hatch cover. The general minimum depth of cover is 36 inches (915 mm) from top of the underslab to outlet invert.
- If driving head caclulations account for water elevation during submerged conditions the Jellyfish Filter will function effectively under submerged condtions.
- Jellyfish Filter systems may incorporate grated inlets depending on system configuration.
- For sites with water quality treatment flow rates or mass loadings that exceed the design flow rate of the largest standard Jellyfish Filter manhole models, systems can be designed that hydraulically connect multiple Jellyfish Filters in series or alternatively Jellyfish Vault units can be designed.

STANDARD SPECIFICATION
STORMWATER QUALITY – MEMBRANE FILTRATION TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

Specifies requirements for construction and performance of an underground stormwater quality membrane filtration treatment device that removes pollutants from stormwater runoff through the unit operations of sedimentation, floatation, and membrane filtration.

1.2 REFERENCE STANDARDS

ASTM C 891: Specification for Installation of Underground Precast Concrete Utility Structures
ASTM C 478: Specification for Precast Reinforced Concrete Manhole Sections
ASTM C 443: Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM D 4101: Specification for Copolymer steps construction

CAN/CSA-A257.4-M92
Joints for Circular Concrete Sewer and Culvert Pipe, Manhole Sections and Fittings Using Rubber Gaskets

CAN/CSA-A257.4-M92
Precast Reinforced Circular Concrete Manhole Sections, Catch Basins and Fittings

Canadian Highway Bridge Design Code

1.3 SHOP DRAWINGS

Shop drawings for the structure and performance are to be submitted with each order to the contractor. Contractor shall forward shop drawing submittal to the consulting engineer for approval. Shop drawings are to detail the structure's precast concrete and call out or note the fiberglass (FRP) internals/components.

1.4 PRODUCT SUBSTITUTIONS

No product substitutions shall be accepted unless submitted 10 days prior to project bid date, or as directed by the engineer of record. Submissions for substitutions require review and approval by the Engineer of Record, for hydraulic performance, impact to project designs, equivalent treatment performance, and any required project plan and report (hydrology/hydraulic, water quality, stormwater pollution) modifications that would be required by the approving jurisdictions/agencies. Contractor to coordinate with the Engineer of Record any applicable modifications to the project estimates of cost, bonding amount determinations, plan check fees for changes to approved documents, and/or any other regulatory requirements resulting from the product substitution.

1.5 HANDLING AND STORAGE

Prevent damage to materials during storage and handling.

PART 2 – PRODUCTS

2.1 GENERAL

2.1.1 The device shall be a cylindrical or rectangular, all concrete structure (including risers), constructed from precast concrete riser and slab components or monolithic precast structure(s), installed to conform to ASTM C 891 and to any required state highway, municipal or local specifications; whichever is more stringent. The device shall be watertight.

2.1.2 Cartridge Deck The cylindrical concrete device shall include a fiberglass deck. The rectangular concrete device shall include a coated aluminum deck. In either instance, the insert shall be bolted and sealed watertight inside the precast concrete chamber. The deck shall serve as: (a) a horizontal divider between the lower treatment zone and the upper treated effluent zone; (b) a deck for attachment of filter cartridges such that the membrane filter elements of each cartridge extend into the lower treatment zone; (c) a platform for maintenance workers to service the filter cartridges (maximum manned weight = 450 pounds (204 kg)); (d) a conduit for conveyance of treated water to the effluent pipe.

2.1.3 Membrane Filter Cartridges Filter cartridges shall be comprised of reusable cylindrical membrane filter elements connected to a perforated head plate. The number of membrane filter elements per cartridge shall be a minimum of eleven 2.75-inch (70-mm) diameter elements. The length of each filter element shall be a minimum 15 inches (381 mm). Each cartridge shall be fitted into the cartridge deck by insertion into a cartridge receptacle that is permanently mounted into the cartridge deck. Each cartridge shall be secured by a cartridge lid that is threaded onto the receptacle, or similar mechanism to secure the cartridge into the deck. The maximum treatment flow rate of a filter cartridge shall be controlled by an orifice in the cartridge lid, or on the individual cartridge itself, and based on a design flux rate (surface loading rate) determined by the maximum treatment flow rate per unit of filtration membrane surface area. The maximum design flux rate shall be 0.21 gpm/ft² (0.142 lps/m²).

Each membrane filter cartridge shall allow for manual installation and removal. Each filter cartridge shall have filtration membrane surface area and dry installation weight as follows (if length of filter cartridge is between those listed below, the surface area and weight shall be proportionate to the next length shorter and next length longer as shown below):

Filter Cartridge Length (in / mm)	Minimum Filtration Membrane Surface Area (ft2 / m2)	Maximum Filter Cartridge Dry Weight (lbs / kg)
15	106 / 9.8	10.5 / 4.8
27	190 / 17.7	15.0 / 6.8
40	282 / 26.2	20.5 / 9.3
54	381 / 35.4	25.5 / 11.6

2.1.4 Backwashing Cartridges The filter device shall have a weir extending above the cartridge deck, or other mechanism, that encloses the high flow rate filter cartridges when placed in their respective cartridge receptacles within the cartridge deck. The weir, or other mechanism, shall collect a pool of filtered water during inflow events that backwashes the high flow rate cartridges when the inflow

event subsides. All filter cartridges and membranes shall be reusable and allow for the use of filtration membrane rinsing procedures to restore flow capacity and sediment capacity; extending cartridge service life.

2.1.5 Maintenance Access to Captured Pollutants The filter device shall contain an opening(s) that provides maintenance access for removal of accumulated floatable pollutants and sediment, removal of and replacement of filter cartridges, cleaning of the sump, and rinsing of the deck. Access shall have a minimum clear vertical clear space over all of the filter cartridges. Filter cartridges shall be able to be lifted straight vertically out of the receptacles and deck for the entire length of the cartridge.

2.1.6 Bend Structure The device shall be able to be used as a bend structure with minimum angles between inlet and outlet pipes of 90-degrees or less in the stormwater conveyance system.

2.1.7 Double-Wall Containment of Hydrocarbons The cylindrical precast concrete device shall provide double-wall containment for hydrocarbon spill capture by a combined means of an inner wall of fiberglass, to a minimum depth of 12 inches (305 mm) below the cartridge deck, and the precast vessel wall.

2.1.8 Baffle The filter device shall provide a baffle that extends from the underside of the cartridge deck to a minimum length equal to the length of the membrane filter elements. The baffle shall serve to protect the membrane filter elements from contamination by floatables and coarse sediment. The baffle shall be flexible and continuous in cylindrical configurations, and shall be a straight concrete or aluminum wall in rectangular configurations.

2.1.9 Sump The device shall include a minimum 24 inches (610 mm) of sump below the bottom of the cartridges for sediment accumulation, unless otherwise specified by the design engineer. Depths less than 24 inches may have an impact on the total performance and/or longevity between cartridge maintenance/replacement of the device.

2.2 PRECAST CONCRETE SECTIONS

All precast concrete components shall be manufactured to a minimum live load of HS-20 truck loading or greater based on local regulatory specifications, unless otherwise modified or specified by the design engineer, and shall be watertight.

2.3 JOINTS All precast concrete manhole configuration joints shall use nitrile rubber gaskets and shall meet the requirements of ASTM C443, Specification C1619, Class D or engineer approved equal to ensure oil resistance. Mastic sealants or butyl tape are not an acceptable alternative.

2.4 GASKETS Only profile neoprene or nitrile rubber gaskets in accordance to CSA A257.3-M92 will be accepted. Mastic sealants, butyl tape or Conseal CS-101 are not acceptable gasket materials.

2.5 FRAME AND COVER Frame and covers must be manufactured from cast-iron or other composite material tested to withstand H-20 or greater design loads, and as approved by the

local regulatory body. Frames and covers must be embossed with the name of the device manufacturer or the device brand name.

2.6 DOORS AND HATCHES If provided shall meet designated loading requirements or at a minimum for incidental vehicular traffic.

2.7 CONCRETE All concrete components shall be manufactured according to local specifications and shall meet the requirements of ASTM C 478.

2.8 FIBERGLASS The fiberglass portion of the filter device shall be constructed in accordance with the following standard: ASTM D-4097: Contact Molded Glass Fiber Reinforced Chemical Resistant Tanks.

2.9 STEPS Steps shall be constructed according to ASTM D4101 of copolymer polypropylene, and be driven into preformed or pre-drilled holes after the concrete has cured, installed to conform to applicable sections of state, provincial and municipal building codes, highway, municipal or local specifications for the construction of such devices.

2.10 INSPECTION All precast concrete sections shall be inspected to ensure that dimensions, appearance and quality of the product meet local municipal specifications and ASTM C 478.

PART 3 – PERFORMANCE

3.1 GENERAL

3.1.1 Verification – The stormwater quality filter must be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV).

3.1.2 Function - The stormwater quality filter treatment device shall function to remove pollutants by the following unit treatment processes; sedimentation, floatation, and membrane filtration.

3.1.3 Pollutants - The stormwater quality filter treatment device shall remove oil, debris, trash, coarse and fine particulates, particulate-bound pollutants, metals and nutrients from stormwater during runoff events.

3.1.4 Bypass - The stormwater quality filter treatment device shall typically utilize an external bypass to divert excessive flows. Internal bypass systems shall be equipped with a floatables baffle, and must avoid passage through the sump and/or cartridge filtration zone.

3.1.5 Treatment Flux Rate (Surface Loading Rate) – The stormwater quality filter treatment device shall treat 100% of the required water quality treatment flow based on a maximum design treatment flux rate (surface loading rate) across the membrane filter cartridges of 0.21 gpm/ft² (0.142 lps/m²).

3.2 FIELD TEST PERFORMANCE

At a minimum, the stormwater quality filter device shall have been field tested and verified with a minimum 25 TARP qualifying storm events and field monitoring shall have been conducted according to the TARP 2009 NJDEP TARP field test protocol, and have received NJCAT verification.

3.2.1 Suspended Solids Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median TSS removal efficiency of 85% and a minimum median SSC removal efficiency of 95%.

3.2.2 Runoff Volume – The stormwater quality filter treatment device shall be engineered, designed, and sized to treat a minimum of 90 percent of the annual runoff volume determined from use of a minimum 15-year rainfall data set.

3.2.3 Fine Particle Removal - The stormwater quality filter treatment device shall have demonstrated the ability to capture fine particles as indicated by a minimum median removal efficiency of 75% for the particle fraction less than 25 microns, an effluent d_{50} of 15 microns or lower for all monitored storm events.

3.2.4 Turbidity Reduction - The stormwater quality filter treatment device shall have demonstrated the ability to reduce the turbidity from influent from a range of 5 to 171 NTU to an effluent turbidity of 15 NTU or lower.

3.2.5 Nutrient (Total Phosphorus & Total Nitrogen) Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median Total Phosphorus removal of 55%, and a minimum median Total Nitrogen removal of 50%.

3.2.6 Metals (Total Zinc & Total Copper) Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median Total Zinc removal of 55%, and a minimum median Total Copper removal of 85%.

3.3 INSPECTION and MAINTENANCE

The stormwater quality filter device shall have the following features:

3.3.1 Durability of membranes are subject to good handling practices during inspection and maintenance (removal, rinsing, and reinsertion) events, and site specific conditions that may have heavier or lighter loading onto the cartridges, and pollutant variability that may impact the membrane structural integrity. Membrane maintenance and replacement shall be in accordance with manufacturer's recommendations.

3.3.2 Inspection which includes trash and floatables collection, sediment depth determination, and visible determination of backwash pool depth shall be easily conducted from grade (outside the structure).

3.3.3 Manual rinsing of the reusable filter cartridges shall promote restoration of the flow capacity and sediment capacity of the filter cartridges, extending cartridge service life.

3.3.4 The filter device shall have a minimum 12 inches (305 mm) of sediment storage depth, and a minimum of 12 inches between the top of the sediment storage and bottom of the filter cartridge tentacles, unless otherwise specified by the design engineer. Variances may have an impact on the total performance and/or longevity between cartridge maintenance/replacement of the device.

3.3.5 Sediment removal from the filter treatment device shall be able to be conducted using a standard maintenance truck and vacuum apparatus, and a minimum one point of entry to the sump that is unobstructed by filter cartridges.

3.3.6 Maintenance access shall have a minimum clear height that provides suitable vertical clear space over all of the filter cartridges. Filter cartridges shall be able to be lifted straight vertically out of the receptacles and deck for the entire length of the cartridge.

3.3.7 Filter cartridges shall be able to be maintained without the requirement of additional lifting equipment.

PART 4 – EXECUTION

4.1 INSTALLATION

4.1.1 PRECAST DEVICE CONSTRUCTION SEQUENCE

The installation of a watertight precast concrete device should conform to ASTM C 891 and to any state highway, municipal or local specifications for the construction of manholes, whichever is more stringent. Selected sections of a general specification that are applicable are summarized below.

4.1.1.1 The watertight precast concrete device is installed in sections in the following sequence:

- aggregate base
- base slab
- treatment chamber and cartridge deck riser section(s)
- bypass section
- connect inlet and outlet pipes
- concrete riser section(s) and/or transition slab (if required)
- maintenance riser section(s) (if required)
- frame and access cover

4.1.2 The precast base should be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, should be installed in accordance with the precast concrete manufacturer's recommendations.

4.1.3 Adjustment of the stormwater quality treatment device can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections. Damaged sections and gaskets should be repaired or replaced as necessary to restore original condition and watertight seals. Once the stormwater quality treatment device has been constructed, any/all lift holes must be plugged watertight with mortar or non-shrink grout.

4.1.4 Inlet and Outlet Pipes Inlet and outlet pipes should be securely set into the device using approved pipe seals (flexible boot connections, where applicable) so that the structure is watertight, and such that any pipe intrusion into the device does not impact the device functionality.

4.1.5 Frame and Cover Installation Adjustment units (e.g. grade rings) should be installed to set the frame and cover at the required elevation. The adjustment units should be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer. Frames for the cover should be set in a full bed of mortar at the elevation specified.

4.2 MAINTENANCE ACCESS WALL
In some instances the Maintenance Access Wall, if provided, shall require an extension attachment and sealing to the precast wall and cartridge deck at the job site, rather than at the precast facility. In this instance, installation of these components shall be performed according to instructions provided by the manufacturer.

4.3 FILTER CARTRIDGE INSTALLATION Filter cartridges shall be installed in the cartridge deck only after the construction site is fully stabilized and in accordance with the manufacturer's guidelines and recommendations. Contractor to contact the manufacturer to schedule cartridge delivery and review procedures/requirements to be completed to the device prior to installation of the cartridges and activation of the system.

PART 5 – QUALITY ASSURANCE

5.1 FILTER CARTRIDGE INSTALLATION Manufacturer shall coordinate delivery of filter cartridges and other internal components with contractor. Filter cartridges shall be delivered and installed complete after site is stabilized and unit is ready to accept cartridges. Unit is ready to accept cartridges after is has been cleaned out and any standing water, debris, and other materials have been removed. Contractor shall take appropriate action to protect the filter cartridge receptacles and filter cartridges from damage during construction, and in accordance with the manufacturer's recommendations and guidance. For systems with cartridges installed prior to full site stabilization and prior to system activation, the contractor can plug inlet and outlet pipes to prevent stormwater and other influent from entering the device. Plugs must be removed during the activation process.

5.2 INSPECTION AND MAINTENANCE

5.2.1 The manufacturer shall provide an Owner's Manual upon request.

5.2.2 After construction and installation, and during operation, the device shall be inspected and cleaned as necessary based on the manufacturer's recommended inspection and maintenance guidelines and the local regulatory agency/body.

5.3 REPLACEMENT FILTER CARTRIDGES When replacement membrane filter elements and/or other parts are required, only membrane filter elements and parts approved by the manufacturer for use with the stormwater quality filter device shall be installed.

END OF SECTION

STANDARD PERFORMANCE SPECIFICATION
STORMWATER QUALITY – MEMBRANE FILTRATION TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground stormwater quality membrane filtration treatment device that removes pollutants from stormwater runoff through the unit operations of sedimentation, floatation, and membrane filtration.

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental Management – Environmental Technology Verification (ETV)

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: filtration surface area, treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, filtration treatment device product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 GENERAL

2.1.1 Maintenance Access to Captured Pollutants The filter device shall contain an opening(s) that provides maintenance access for removal of accumulated floatable pollutants and sediment, removal of and replacement of filter cartridges, cleaning of the sump, and rinsing of the internal components. Access shall have a minimum clear vertical clear space over all of the filter cartridges. Filter cartridges shall be able to be lifted straight vertically out of their installed placement for the entire length of the cartridge.

2.1.2 Pollutant Storage: The Filter device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants.

PART 3 – PERFORMANCE

3.1 GENERAL

3.1.1 Verification – The stormwater quality filter treatment device shall have been field tested in accordance with either TARP Tier II Protocol (TARP, 2003) and New Jersey Tier II Stormwater Test Requirements – Amendments to TARP Tier II Protocol (NJDEP, 2009) or Washington State Technology Assessment Protocol – Ecology (TAPE), 2011 or later version. The field test shall have been verified in accordance with ISO 14034:2016 Environmental Management – Environmental Technology Verification (ETV). See Section 3.2 of this specification for field test performance requirements.

3.2 FIELD TEST PERFORMANCE

The field test (as specified in section 3.1.1)shall have monitored a minimum of twenty (20) TARP or TAPE qualifying storm events, and report at **minimum** the following results:

3.2.1 Suspended Solids Removal - The stormwater quality filter treatment device shall have ISO 14034 ETV verified load based median TSS removal efficiency of at least 85% and load based median SSC removal efficiency of at least 98%.

3.2.2 Runoff Volume – The stormwater quality filter treatment device shall be engineered, designed, and sized to treat a minimum of 90 percent of the annual runoff volume determined from use of a minimum 15-year rainfall data set.

3.2.3 Fine Particle Removal - The stormwater quality filter treatment device shall have demonstrated the ability to capture fine particles as indicated by a minimum median removal efficiency of 75% for the particle fraction less than 25 microns, and an effluent d_{50} of 15 microns or lower for all monitored storm events.

3.2.4 Turbidity Reduction - The stormwater quality filter treatment device shall have demonstrated the ability to reduce turbidity such that effluent turbidity is 15 NTU or lower.

3.2.5 Nutrients & Metals – The stormwater quality filter treatment device shall have ISO 14034 ETV Verified minimum load based removal efficiencies for the following:

3.2.5.1 Total Phosphorus (TP) Removal - Median TP removal efficiency of at least 49%.

3.2.5.2 Total Nitrogen (TN) Removal - Median TN removal efficiency of at least 39%.

3.2.5.3 Total Zinc (Zn) Removal - Median Zn removal efficiency of at least 69%.

3.2.5.4 Total Copper (Cu) Removal - Median Cu removal efficiency of at least 91%.

END OF SECTION

DRAWING NOT TO BE USED FOR CONSTRUCTION

GENERAL NOTES:

1. ALL DIMENSIONS INDICATED ARE IN MILLIMETERS (INCHES) UNLESS OTHERWISE SPECIFIED.
2. JELLYFISH STRUCTURE INLET AND OUTLET PIPE SIZE AND ORIENTATION SHOWN FOR INFORMATIONAL PURPOSES ONLY.
3. UNLESS OTHERWISE NOTED, BYPASS INFRASTRUCTURE, SUCH AS ALL UPSTREAM DIVERSION STRUCTURES, CONNECTING STRUCTURES, OR PIPE CONDUITS CONNECTING TO COMPLETE THE JELLYFISH SYSTEM SHALL BE PROVIDED AND ADDRESSED SEPARATELY.
4. DRAWING FOR INFORMATION PURPOSES ONLY. REFER TO ENGINEER'S SITE/UTILITY PLAN FOR STRUCTURE ORIENTATION.
5. NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR TO PROJECTS BID DATE, OR AS DIRECTED BY THE ENGINEER OF RECORD.

JELLYFISH STRUCTURE & DESIGN NOTES:

1. 762 MM Ø (30") MAINTENANCE ACCESS WALL TO BE USED FOR CLEANOUT AND ACCESS BELOW CARTRIDGE DECK.
2. CASTINGS OR DOORS OF THE JELLYFISH MANHOLE STRUCTURE TO EXTEND TO DESIGN FINISH GRADE. DEPTHS IN EXCESS OF 3.65 M (12') MAY REQUIRE THE DESIGN AND INSTALLATION OF INTERMEDIATE SAFETY GRATES OR OTHER STRUCTURAL ELEMENTS.
3. CASTINGS AND GRADE RINGS, OR DOORS AND DOOR RISERS, OR BOTH, SHALL BE GROUTED FOR WATERTIGHTNESS.
   STRUCTURE SHALL MEET AASHTO HS-20, ASSUMING EARTH COVER OF 0' - 3', AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 LOAD RATING AND BE CAST WITH THE IMBRIUM LOGO.
4. ALL STRUCTURAL SECTIONS AND PARTS TO MEET OR EXCEED ASTM C-478, ASTM C-443, AND ASTM D-4097 CORRESPONDING TO AASHTO SPECIFICATIONS, AND ANY OTHER SITE OR LOCAL STANDARDS.
5. CONCRETE RISER SECTIONS FROM BOTTOM TO TOP WILL BE ADDED AS REQUIRED INCLUDING TRANSITION PIECES TO SMALLER DIAMETER RISERS FOR SURFACE ACCESSES WHERE WARRANTED BY SERVICING DEPTH.
6. IF MINIMUM DEPTH FROM TOP OF CARTRIDGE DECK TO BOTTOM OF STRUCTURAL TOP SLAB CANNOT BE ACHIEVED DUE TO PIPING INVERT ELEVATIONS OR OTHER SITE CONSTRAINTS. ALTERNATIVE HATCH CONFIGURATIONS MAY BE AVAILABLE. HATCH DOORS SHOULD BE SIZED TO PROVIDE FULL ACCESS ABOVE THE CARTRIDGES TO ACCOMMODATE MAINTENANCE.
7. STEPS TO BE APPROXIMATELY 330 MM (13") APART AND DIMENSIONS MUST MEET LOCAL STANDARDS. STEPS MUST BE INSTALLED AFTER CARTRIDGE DECK IS IN PLACE.
8. CONFIGURATION OF INLET AND OUTLET PIPE CAN VARY TO MEET SITE'S NEEDS.
9. IT IS THE RESPONSIBILITY OF OTHERS TO PROPERLY PROTECT THE TREATMENT DEVICE, AND KEEP THE DEVICE OFFLINE DURING CONSTRUCTION. FILTER CARTRIDGES SHALL NOT BE INSTALLED UNTIL THE PROJECT SITE IS CLEAN AND FREE OF DEBRIS, BY OTHERS. THE PROJECT SITE INCLUDES ANY SURFACE THAT CONTRIBUTES STORM DRAINAGE TO THE TREATMENT DEVICE. CARTRIDGES SHALL BE FURNISHED NEW, AT THE TIME OF FINAL ACCEPTANCE.
10. THIS DRAWING MUST BE VIEWED IN CONJUNCTION WITH THE STANDARD JELLYFISH SPECIFICATION, AND STORMWATER QUALITY FILTER TREATMENT JELLYFISH DOCUMENTS.

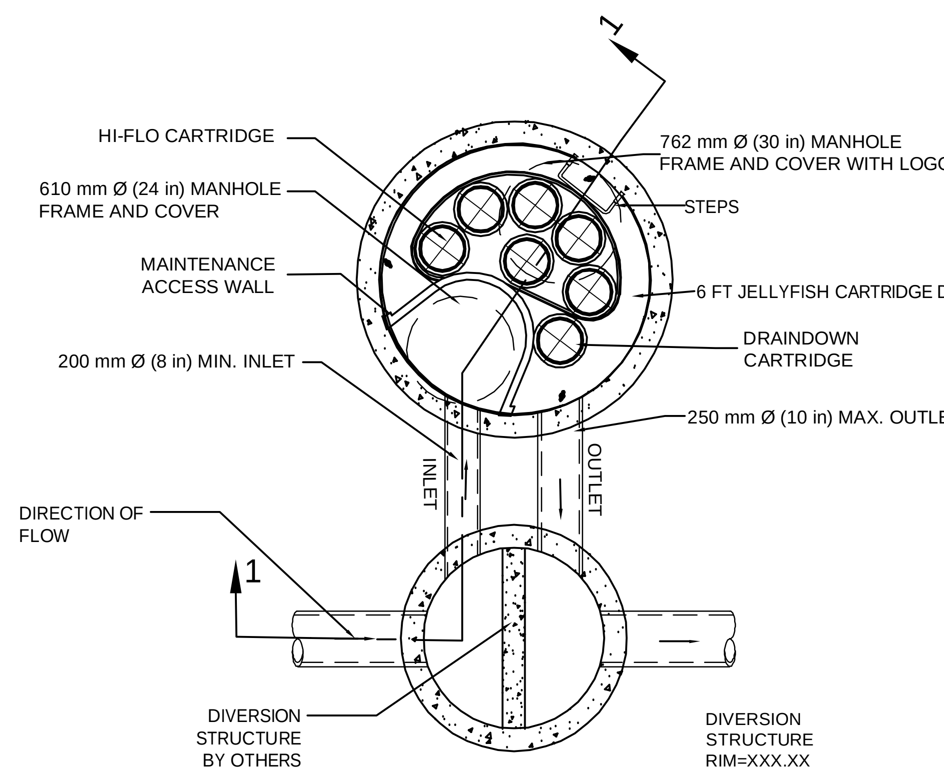
INSTALLATION NOTES

A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STRUCTURE (LIFTING CLUTCHES PROVIDED)
C. CONTRACTOR WILL INSTALL AND LEVEL THE STRUCTURE, SEALING THE JOINTS, LINE ENTRY AND EXIT POINTS (NON-SHRINK GROUT WITH APPROVED WATERSTOP OR FLEXIBLE BOOT)
D. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.
E. CARTRIDGE INSTALLATION, BY IMBRIUM, SHALL OCCUR ONLY AFTER SITE HAS BEEN STABILIZED AND THE JELLYFISH UNIT IS CLEAN AND FREE OF DEBRIS. CONTACT IMBRIUM TO COORDINATE CARTRIDGE INSTALLATION WITH SITE STABILIZATION.

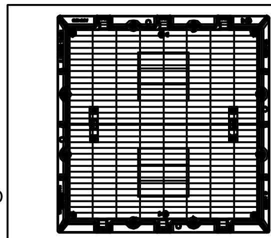
STANDARD OFFLINE JELLYFISH RECOMMENDED PIPE DIAMETERS

MODEL DIAMETER (m)	MINIMUM ANGLE INLET/OUTLET PIPES	MINIMUM INLET PIPE DIAMETER (mm)	MINIMUM OUTLET PIPE DIAMETER (mm)
1.2	62	150	200
1.8	59	200	250
2.4	52	250	300
3.0	48	300	450
3.6	40	300	450
CONTACT IMBRIUM SYSTEMS FOR ALTERNATE PIPE DIAMETERS			

FOR SITE SPECIFIC DRAWINGS PLEASE CONTACT YOUR LOCAL JELLYFISH FILTER REPRESENTATIVE. SITE SPECIFIC DRAWINGS ARE BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME. SOME FIELD REVISIONS TO THE SYSTEM LOCATION OR CONNECTION PIPING MAY BE NECESSARY BASED ON AVAILABLE SPACE OR SITE CONFIGURATION REVISIONS. ELEVATIONS SHOULD BE MAINTAINED EXCEPT WHERE NOTED ON BYPASS STRUCTURE.

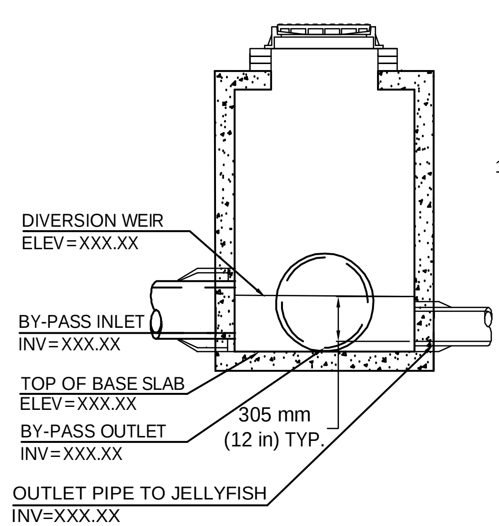


OFFLINE LAYOUT



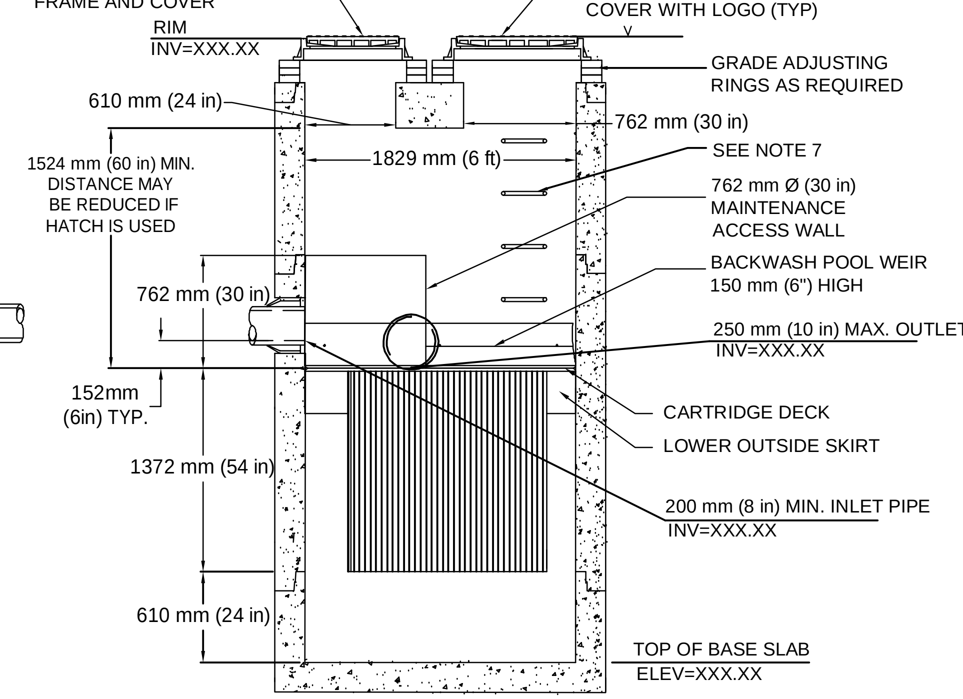
1219 mm x 1219 mm (48 in x 48 i
OPTIONAL HATCH

UPSTREAM DIVERSION STRUCTURE



TOP OF DIVERSION WEIR = JELLYFISH OUTLET INVERT + 18 INCHES (457 MM)

JELLYFISH FILTER



CROSS SECTION 1-1

JELLYFISH DESIGN NOTES

JELLYFISH TREATMENT CAPACITY IS A FUNCTION OF THE CARTRIDGE SELECTION AND THE NUMBER OF CARTRIDGES. THE STANDARD MANHOLE STYLE IS SHOWN. Ø1829 mm (72") MANHOLE JELLYFISH PEAK TREATMENT CAPACITY IS 32.8 L/s (1.16 CFS). TREATMENT FLOW RATE IS BASED ON 457 MM (18") OF HEAD PRESSURE.

CARTRIDGE SELECTION				
CARTRIDGE DEPTH	54"	40"	27"	15"
OUTLET INVERT TO STRUCTURE BASE SLAB	90"	76"	63"	51"
FLOW RATE HIGH-FLO / DRAINDOWN (L/s) (per cart)	5.09 / 2.55	3.68 / 1.84	2.55 / 1.27	1.41 / 0.71
SEDIMENT CAPACITY HIGH-FLO / DRAINDOWN (kg) (per cart)	57 / 28	42 / 21	28 / 14	16 / 8
MAX. CARTS HIGH-FLO/DRAINDOWN	6 / 1			
MAX. SEDIMENT CAPACITY (kg)	370	273	182	104
MAX. TREATMENT (L/s)	32.8	24.6	16.4	9.06

SITE SPECIFIC DATA REQUIREMENTS

JELLYFISH MODEL	*				
STRUCTURE ID	*				
WATER QUALITY FLOW RATE (L/s)	*				
PEAK FLOW RATE (L/s)	*				
RETURN PERIOD OF PEAK FLOW (yrs)	*				
# OF CARTRIDGES REQUIRED (HF / DD)	*				
CARTRIDGE SIZE (inches)	*				
PIPE DATA:	I.E.	MAT'L	DIA	SLOPE %	HGL
INLET #1	*	*	*	*	*
INLET #2	*	*	*	*	*
OUTLET	*	*	*	*	*

* PER ENGINEER OF RECORD

MARK	DATE	REVISION DESCRIPTION	BY
#	#	#	#
#	#	#	#
#	#	#	#
1	08/01/2015	NOTES	BSF
0	10/01/2014	INTIAL RELEASE	BSF

Jellyfish®

JF6 STANDARD
Scale = 1:50

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info@imbriumsystems.com

imbrium®
Jellyfish® Filter

DATE: ########	
DESIGNED:	DRAWN: BSF
CHECKED: BSF	APPROVED: SP
PROJECT #: #####	PROJECT NAME: #####
SHEET: 1 OF 2	

I:\IMBRIUM\PRODUCTS\JELLYFISH FILTER\40 DRAWINGS & DETAILS\STANDARD DETAILS\JELLYFISH FILTER - OFFLINE\JELLYFISH FILTER JF6 - OFFLINE DIVERSION MANHOLE.DWG 4/15/2019 9:20 AM

JELLYFISH® FILTER - SPECIFICATIONS

GENERAL

A. WORK INCLUDED: SPECIFIES REQUIREMENTS FOR CONSTRUCTION AND PERFORMANCE OF AN UNDERGROUND STORMWATER QUALITY, MEMBRANE FILTRATION, AND TREATMENT DEVICE THAT REMOVES POLLUTANTS FROM STORMWATER RUNOFF THROUGH THE UNIT OPERATIONS OF SEDIMENTATION, FLOATATION, AND MEMBRANE FILTRATION.

B. REFERENCE STANDARDS:

ASTM C 891:	SPECIFICATION FOR INSTALLATION OF UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURES
ASTM C 478:	SPECIFICATION FOR PRECAST REINFORCED CONCRETE MANHOLE SECTIONS
ASTM C 990:	SPECIFICATION FOR JOINTS FOR CONCRETE MANHOLES USING PREFORMED FLEXIBLE JOINT SEALANTS
ASTM D 4101:	SPECIFICATION FOR COPOLYMER STEPS CONSTRUCTION

C. SHOP DRAWINGS: SHOP DRAWINGS FOR THE STRUCTURE AND PERFORMANCE ARE TO BE SUBMITTED WITH EACH ORDER TO THE CONTRACTOR. CONTRACTOR SHALL FORWARD SHOP DRAWING SUBMITTAL TO THE CONSULTING ENGINEER FOR APPROVAL. SHOP DRAWINGS ARE TO DETAIL THE STRUCTURE PRECAST CONCRETE AND CALL OUT OR NOTE THE FIBERGLASS (FRP) INTERNALS/COMPONENTS.

D. PRODUCT SUBSTITUTIONS: NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR TO PROJECT BID DATE, OR AS DIRECTED BY THE ENGINEER OF RECORD. SUBMISSIONS FOR SUBSTITUTIONS REQUIRE REVIEW AND APPROVAL BY THE ENGINEER OF RECORD, FOR HYDRAULIC PERFORMANCE, IMPACT TO PROJECT DESIGNS, EQUIVALENT TREATMENT PERFORMANCE, AND ANY REQUIRED PROJECT PLAN AND REPORT (HYDROLOGY/HYDRAULIC, WATER QUALITY, STORMWATER POLLUTION) MODIFICATIONS THAT WOULD BE REQUIRED BY THE APPROVING JURISDICTIONS/AGENCIES. CONTRACTOR TO COORDINATE WITH THE ENGINEER OF RECORD ANY APPLICABLE MODIFICATIONS TO THE PROJECT ESTIMATES OF COST, BONDING AMOUNT DETERMINATIONS, PLAN CHECK FEES FOR CHANGES TO APPROVED DOCUMENTS, AND/OR ANY OTHER REGULATORY REQUIREMENTS RESULTING FROM THE PRODUCT SUBSTITUTION.

E. HANDLING AND STORAGE: PREVENT DAMAGE TO MATERIALS DURING STORAGE AND HANDLING.

PRODUCTS

A. THE DEVICE SHALL BE A CYLINDRICAL OR RECTANGULAR, ALL CONCRETE STRUCTURE (INCLUDING RISERS), CONSTRUCTED FROM PRECAST CONCRETE RISER AND SLAB COMPONENTS OR MONOLITHIC PRECAST STRUCTURE(S), INSTALLED TO CONFORM TO ASTM C 891 AND TO ANY REQUIRED STATE HIGHWAY, MUNICIPAL OR LOCAL SPECIFICATIONS; WHICHEVER IS MORE STRINGENT. THE DEVICE SHALL BE WATERTIGHT.

B. THE CYLINDRICAL CONCRETE DEVICE SHALL INCLUDE A FIBERGLASS CARTRIDGE DECK INSERT. THE RECTANGULAR CONCRETE DEVICE SHALL INCLUDE A COATED ALUMINUM INSERT. IN EITHER INSTANCE, THE INSERT SHALL BE BOLTED AND SEALED WATERTIGHT INSIDE THE PRECAST CONCRETE CHAMBER. THE INSERT SHALL SERVE AS: (A) A HORIZONTAL DIVIDER BETWEEN THE LOWER TREATMENT ZONE AND THE UPPER TREATED EFFLUENT ZONE; (B) A DECK FOR ATTACHMENT OF FILTER CARTRIDGES SUCH THAT THE MEMBRANE FILTER ELEMENTS OF EACH CARTRIDGE EXTEND INTO THE LOWER TREATMENT ZONE; (C) A PLATFORM FOR MAINTENANCE WORKERS TO SERVICE THE FILTER CARTRIDGES (MAXIMUM MANNED WEIGHT = 450 POUNDS); (D) A CONDUIT FOR CONVEYANCE OF TREATED WATER TO THE EFFLUENT PIPE.

C. MEMBRANE FILTER CARTRIDGES SHALL BE COMPRISED OF REUSABLE CYLINDRICAL MEMBRANE FILTER ELEMENTS CONNECTED TO A PERFORATED HEAD PLATE. THE NUMBER OF MEMBRANE FILTER ELEMENTS PER CARTRIDGE SHALL BE A MINIMUM OF ELEVEN 2.75-INCH (70-MM) OR GREATER DIAMETER ELEMENTS. THE LENGTH OF EACH FILTER ELEMENT SHALL BE A MINIMUM 15 INCHES (381 MM). EACH CARTRIDGE SHALL BE FITTED INTO THE CARTRIDGE DECK BY INSERTION INTO A CARTRIDGE RECEPTACLE THAT IS PERMANENTLY MOUNTED INTO THE CARTRIDGE DECK. EACH CARTRIDGE SHALL BE SECURED BY A CARTRIDGE LID THAT IS THREADED ONTO THE RECEPTACLE, OR SIMILAR MECHANISM TO SECURE THE CARTRIDGE INTO THE DECK. THE MAXIMUM TREATMENT FLOW RATE OF A FILTER CARTRIDGE SHALL BE CONTROLLED BY AN ORIFICE IN THE CARTRIDGE LID, OR ON THE INDIVIDUAL CARTRIDGE ITSELF, AND BASED ON A DESIGN FLUX RATE (SURFACE LOADING RATE) DETERMINED BY THE MAXIMUM TREATMENT FLOW RATE PER UNIT OF FILTRATION MEMBRANE SURFACE AREA. THE MAXIMUM FLUX RATE SHALL BE 0.21 GPM/FT2 (0.142 LPS/M2). EACH MEMBRANE FILTER CARTRIDGE SHALL ALLOW FOR MANUAL INSTALLATION AND REMOVAL.

D. ALL FILTER CARTRIDGES AND MEMBRANES SHALL BE REUSABLE AND ALLOW FOR THE USE OF FILTRATION MEMBRANE RINSING PROCEDURES TO RESTORE FLOW CAPACITY AND SEDIMENT CAPACITY; EXTENDING CARTRIDGE SERVICE LIFE.

E. ACCESS SHALL HAVE A MINIMUM CLEAR HEIGHT OF 60" OVER ALL OF THE FILTER CARTRIDGES, OR BE ACCESSIBLE BY A HATCH OR OTHER MECHANISM THAT PROVIDES MINIMUM 60" VERTICAL CLEAR SPACE OVER ALL OF THE FILTER CARTRIDGES. FILTER CARTRIDGES SHALL BE ABLE TO BE LIFTED STRAIGHT VERTICALLY OUT OF THE RECEPTACLES AND DECK FOR THE ENTIRE LENGTH OF THE CARTRIDGE.

F. THE DEVICE SHALL INCLUDE A MINIMUM 24 INCHES (610 MM) OF SUMP BELOW THE BOTTOM OF THE CARTRIDGES FOR SEDIMENT ACCUMULATION, UNLESS OTHERWISE SPECIFIED BY THE DESIGN ENGINEER. DEPTHS LESS THAN 24" MAY HAVE AN IMPACT ON THE TOTAL PERFORMANCE AND/OR LONGEVITY BETWEEN CARTRIDGE MAINTENANCE/REPLACEMENT OF THE DEVICE.

G. ALL PRECAST CONCRETE COMPONENTS SHALL BE MANUFACTURED TO A MINIMUM LIVE LOAD OF HS-20 TRUCK LOADING OR GREATER BASED ON LOCAL REGULATORY SPECIFICATIONS, UNLESS OTHERWISE MODIFIED OR SPECIFIED BY THE DESIGN ENGINEER, AND SHALL BE WATERTIGHT.

H. GASKETS AND/OR SEALANTS TO PROVIDE WATER TIGHT SEAL BETWEEN CONCRETE JOINTS. JOINTS SHALL BE SEALED WITH PREFORMED JOINT SEALING COMPOUND CONFORMING TO ASTM C 990.

I. FRAME AND COVERS MUST BE MANUFACTURED FROM CAST-IRON OR OTHER COMPOSITE MATERIAL TESTED TO WITHSTAND H-20 OR GREATER DESIGN LOADS, AND AS APPROVED BY THE LOCAL REGULATORY BODY. FRAMES AND COVERS MUST BE EMBOSSED WITH THE NAME OF THE DEVICE MANUFACTURER OR THE DEVICE BRAND NAME.

J. DOOR AND HATCHES, IF PROVIDED SHALL MEET DESIGNATED LOADING REQUIREMENTS OR AT A MINIMUM FOR INCIDENTAL VEHICULAR TRAFFIC.

K. ALL CONCRETE COMPONENTS SHALL BE MANUFACTURED ACCORDING TO LOCAL SPECIFICATIONS AND SHALL MEET THE REQUIREMENTS OF ASTM C 478.

L. THE FIBERGLASS PORTION OF THE FILTER DEVICE SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE FOLLOWING STANDARD: ASTM D-4097: CONTACT MOLDED GLASS FIBER REINFORCED CHEMICAL RESISTANT TANKS.

M. STEPS SHALL BE CONSTRUCTED ACCORDING TO ASTM D4101 OF COPOLYMER POLYPROPYLENE, AND BE DRIVEN INTO PREFORMED OR PRE-DRILLED HOLES AFTER THE CONCRETE HAS CURED, INSTALLED TO CONFORM TO APPLICABLE SECTIONS OF STATE, PROVINCIAL AND MUNICIPAL BUILDING CODES, HIGHWAY, MUNICIPAL OR LOCAL SPECIFICATIONS FOR THE CONSTRUCTION OF SUCH DEVICES.

N. ALL PRECAST CONCRETE SECTIONS SHALL BE INSPECTED TO ENSURE THAT DIMENSIONS, APPEARANCE AND QUALITY OF THE PRODUCT MEET LOCAL MUNICIPAL SPECIFICATIONS AND ASTM C 478.

PERFORMANCE

A. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL FUNCTION TO REMOVE POLLUTANTS BY THE FOLLOWING UNIT TREATMENT PROCESSES; SEDIMENTATION, FLOATATION, AND MEMBRANE FILTRATION.

B. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL REMOVE OIL, DEBRIS, TRASH, COARSE AND FINE PARTICULATES, PARTICULATE-BOUND POLLUTANTS, METALS AND NUTRIENTS FROM STORMWATER DURING RUNOFF EVENTS.

C. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL TYPICALLY UTILIZE AN EXTERNAL BYPASS TO DIVERT EXCESSIVE FLOWS. INTERNAL BYPASS SYSTEMS SHALL BE EQUIPPED WITH A FLOATABLES BAFFLE, AND MUST PASS WATER OVER THE CARTRIDGE DECK, AND AVOID PASSAGE THROUGH THE SUMP AND/OR CARTRIDGE FILTRATION ZONE.

D. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL TREAT 100% OF THE REQUIRED WATER QUALITY TREATMENT FLOW BASED ON A MAXIMUM TREATMENT FLUX RATE (SURFACE LOADING RATE) ACROSS THE MEMBRANE FILTER CARTRIDGES NOT TO EXCEED 0.21 GPM/FT2 (0.142 LPS/M2).

E. AT A MINIMUM, THE STORMWATER QUALITY FILTER DEVICE SHALL HAVE BEEN FIELD TESTED AND VERIFIED WITH A MINIMUM 25 QUALIFYING STORM EVENTS AND FIELD MONITORING CONDUCTED ACCORDING TO THE TARP TIER II OR TAPE FIELD TEST PROTOCOL, AND HAVE RECEIVED NJCAT VERIFICATION.

F. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED A MINIMUM MEDIAN TSS REMOVAL EFFICIENCY OF 85% AND A MINIMUM MEDIAN SSC REMOVAL EFFICIENCY OF 95%.

G. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED THE ABILITY TO CAPTURE FINE PARTICLES AS INDICATED BY A MINIMUM MEDIAN REMOVAL EFFICIENCY OF 75% FOR THE PARTICLE FRACTION LESS THAN 25 MICRONS, AN EFFLUENT D50 OF 15 MICRONS OR LOWER FOR ALL MONITORED STORM EVENTS, AND AN EFFLUENT TURBIDITY OF 15 NTUS OR LOWER.

H. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED A MINIMUM MEDIAN TOTAL PHOSPHORUS REMOVAL OF 55%, AND A MINIMUM MEDIAN TOTAL NITROGEN REMOVAL OF 50%.

I. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED A MINIMUM MEDIAN TOTAL ZINC REMOVAL OF 50%, AND A MINIMUM MEDIAN TOTAL COPPER REMOVAL OF 75%.

INSPECTION AND MAINTENANCE

A. DURABILITY OF MEMBRANES ARE SUBJECT TO GOOD HANDLING PRACTICES DURING INSPECTION AND MAINTENANCE (REMOVAL, RINSING, AND REINSERTION) EVENTS, AND SITE SPECIFIC CONDITIONS THAT MAY HAVE HEAVIER OR LIGHTER LOADING ONTO THE CARTRIDGES, AND POLLUTANT VARIABILITY THAT MAY IMPACT THE MEMBRANE STRUCTURAL INTEGRITY. MEMBRANE MAINTENANCE AND REPLACEMENT SHALL BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

B. INSPECTION WHICH INCLUDES TRASH AND FLOATABLES COLLECTION, SEDIMENT DEPTH DETERMINATION, AND VISIBLE DETERMINATION OF BACKWASH POOL DEPTH SHALL BE EASILY CONDUCTED FROM GRADE (OUTSIDE THE STRUCTURE).

C. MANUAL RINSING OF THE REUSABLE FILTER CARTRIDGES SHALL PROMOTE RESTORATION OF THE FLOW CAPACITY AND SEDIMENT CAPACITY OF THE FILTER CARTRIDGES, EXTENDING CARTRIDGE SERVICE LIFE.

D. SEDIMENT REMOVAL FROM THE FILTER TREATMENT DEVICE SHALL BE ABLE TO BE CONDUCTED USING A STANDARD MAINTENANCE TRUCK AND VACUUM APPARATUS, AND A MINIMUM ONE POINT OF ENTRY TO THE SUMP THAT IS UNOBSTRUCTED BY FILTER CARTRIDGES.

E. MAINTENANCE ACCESS SHALL HAVE A MINIMUM CLEAR HEIGHT OF 60" OVER ALL OF THE FILTER CARTRIDGES, OR BE ACCESSIBLE BY A HATCH OR OTHER MECHANISM THAT PROVIDES MINIMUM 60" VERTICAL CLEAR SPACE OVER ALL OF THE FILTER CARTRIDGES. FILTER CARTRIDGES SHALL BE ABLE TO BE LIFTED STRAIGHT VERTICALLY OUT OF THE RECEPTACLES AND DECK FOR THE ENTIRE LENGTH OF THE CARTRIDGE.

F. FILTER CARTRIDGES SHALL BE ABLE TO BE MAINTAINED WITHOUT THE USE OF ADDITIONAL LIFTING EQUIPMENT.

EXECUTION

A. THE INSTALLATION OF A WATERTIGHT PRECAST CONCRETE DEVICE SHOULD CONFORM TO ASTM C 891 AND TO ANY STATE HIGHWAY, MUNICIPAL OR LOCAL SPECIFICATIONS FOR THE CONSTRUCTION OF MANHOLES, WHICHEVER IS MORE STRINGENT. SELECTED SECTIONS OF A GENERAL SPECIFICATION THAT ARE APPLICABLE ARE SUMMARIZED BELOW.

B. THE WATERTIGHT PRECAST CONCRETE DEVICE IS INSTALLED IN SECTIONS IN THE FOLLOWING SEQUENCE:
- AGGREGATE BASE
- BASE SLAB
- TREATMENT CHAMBER AND CARTRIDGE DECK RISER SECTION(S)
- BYPASS SECTION
- CONNECT INLET AND OUTLET PIPES
- CONCRETE RISER SECTION(S) AND/OR TRANSITION SLAB (IF REQUIRED)
- MAINTENANCE RISER SECTION(S) (IF REQUIRED)
- FRAME AND ACCESS COVER

C. INLET AND OUTLET PIPES SHOULD BE SECURELY SET INTO THE DEVICE USING APPROVED PIPE SEALS (FLEXIBLE BOOT CONNECTIONS, WHERE APPLICABLE) SO THAT THE STRUCTURE IS WATERTIGHT, AND SUCH THAT ANY PIPE INTRUSION INTO THE DEVICE DOES NOT IMPACT THE DEVICE FUNCTIONALITY.

D. ADJUSTMENT UNITS (E.G. GRADE RINGS) SHOULD BE INSTALLED TO SET THE FRAME AND COVER AT THE REQUIRED ELEVATION. THE ADJUSTMENT UNITS SHOULD BE LAID IN A FULL BED OF MORTAR WITH SUCCESSIVE UNITS BEING JOINED USING SEALANT RECOMMENDED BY THE MANUFACTURER. FRAMES FOR THE COVER SHOULD BE SET IN A FULL BED OF MORTAR AT THE ELEVATION SPECIFIED.

E. IN SOME INSTANCES THE MAINTENANCE ACCESS WALL, IF PROVIDED, SHALL REQUIRE AN EXTENSION ATTACHMENT AND SEALING TO THE PRECAST WALL AND CARTRIDGE DECK AT THE JOB SITE, RATHER THAN AT THE PRECAST FACILITY. IN THIS INSTANCE, INSTALLATION OF THESE COMPONENTS SHALL BE PERFORMED ACCORDING TO INSTRUCTIONS PROVIDED BY THE MANUFACTURER.

F. FILTER CARTRIDGES SHALL BE INSTALLED IN THE CARTRIDGE DECK AFTER THE CONSTRUCTION SITE IS FULLY STABILIZED AND IN ACCORDANCE WITH THE MANUFACTURERS GUIDELINES AND RECOMMENDATIONS. CONTRACTOR TO CONTACT THE MANUFACTURER TO SCHEDULE CARTRIDGE DELIVERY AND REVIEW PROCEDURES/REQUIREMENTS TO BE COMPLETED TO THE DEVICE PRIOR TO INSTALLATION OF THE CARTRIDGES AND ACTIVATION OF THE SYSTEM.

G. MANUFACTURER SHALL COORDINATE DELIVERY OF FILTER CARTRIDGES AND OTHER INTERNAL COMPONENTS WITH CONTRACTOR. FILTER CARTRIDGES SHALL BE DELIVERED AND INSTALLED COMPLETE AFTER SITE IS STABILIZED AND UNIT IS READY TO ACCEPT CARTRIDGES. UNIT IS READY TO ACCEPT CARTRIDGES AFTER IS HAS BEEN CLEANED OUT AND ANY STANDING WATER, DEBRIS, AND OTHER MATERIALS HAVE BEEN REMOVED. CONTRACTOR SHALL TAKE APPROPRIATE ACTION TO PROTECT THE FILTER CARTRIDGE RECEPTACLES AND FILTER CARTRIDGES FROM DAMAGE DURING CONSTRUCTION, AND IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS AND GUIDANCE. FOR SYSTEMS WITH CARTRIDGES INSTALLED PRIOR TO FULL SITE STABILIZATION AND PRIOR TO SYSTEM ACTIVATION, THE CONTRACTOR CAN PLUG INLET AND OUTLET PIPES TO PREVENT STORMWATER AND OTHER INFLUENT FROM ENTERING THE DEVICE. PLUGS MUST BE REMOVED DURING THE ACTIVATION PROCESS.

H. THE MANUFACTURER SHALL PROVIDE AN OWNER'S MANUAL UPON REQUEST.

I. AFTER CONSTRUCTION AND INSTALLATION, AND DURING OPERATION, THE DEVICE SHALL BE INSPECTED AND CLEANED AS NECESSARY BASED ON THE MANUFACTURER'S RECOMMENDED INSPECTION AND MAINTENANCE GUIDELINES AND THE LOCAL REGULATORY AGENCY/BODY.

J. WHEN REPLACEMENT MEMBRANE FILTER ELEMENTS AND/OR OTHER PARTS ARE REQUIRED, ONLY MEMBRANE FILTER ELEMENTS AND PARTS APPROVED BY THE MANUFACTURER FOR USE WITH THE STORMWATER QUALITY FILTER DEVICE SHALL BE INSTALLED.

END OF SECTION

MARK	DATE	REVISION DESCRIPTION	BY
0	10/01/2014	INTIAL RELEASE	BSF
#	#	#	#
#	#	#	#
#	#	#	#
#	#	#	#

JELLYFISH FILTER SPECIFICATIONS

Jellyfish®

JF6 STANDARD

Scale = 1:50

www.imbriumsystems.com
info@imbriumsystems.com

imbrium®
407 FAIRVIEW DRIVE, WHITBY, ON L1N 3A9
TF 800-565-4801 CA 416-960-9900 INTL +1-416-960-9900

Jellyfish® Filter

DATE: ########	
DESIGNED:	DRAWN: BSF
CHECKED: BSF	APPROVED: SP
PROJECT #: #####	PROJECT NAME: #####
SHEET: 2 OF 2	

I:\IMBRIUM\PRODUCTS\JELLYFISH FILTER\40 DRAWINGS & DETAILS\STANDARD DETAILS\JELLYFISH FILTER - OFFLINE\JELLYFISH FILTER JF6 - OFFLINE DIVERSION MANHOLE.DWG 4/15/2019 9:21 AM

APPENDIX "G"

Water Balance Calculations

VALDOR ENGINEERING INC. **TABLE G1**
File:22115
September 2022

620 Avenue Road, City of Toronto

TABLE G1: WATER BALANCE CALCULATIONS

1. INITIAL ABSTRACTION

Surface Type	Area (Ha)	Runoff Coefficient	Init. Abstract. (mm)
Landscape Area	0.072	0.25	5.0
Roof Area	0.194	0.90	1.0
Green Roof	0.000	0.40	5.0
Impervious Area	0.263	0.90	1.0
Total	**0.529**	**0.81**	**1.5**

2. STORAGE VOLUME REQUIRED

Area of Site (A) = 5290 sq.m.

Target Retention Depth (D) = 0.005 (m)
Overall Initial Abstractions (I) = 0.00154 (m)

Storage Volume Required = V = A x (D - I) = **18.28** (cu.m.)

APPENDIX "H"

Topographic Survey

COMPILED SKETCH PLAN SHOWING TOPOGRAPHY
875 KINGSTON ROAD

CITY OF PICKERING
REGIONAL MUNICIPALITY OF DURHAM

SCALE 1 : 250 METRES

0 10 20 40

STAKED DRIP LINE AND TOP OF SLOPE INFORMATION
FROM IBW SURVEYORS PROJECT A-028852 DATED JUNE 14 2021

TOPOGRAPHIC INFORMATION AND BOUNDARY INFORMATION
FROM ALEX MARTON LIMITED PROJECT 2020-011 DATED FEBRUARY 14 2020

FLOODPLAIN MAPPING INFORMATION
FROM GHD INC. PROJECT 11225953-L101 DATED APRIL 20 2021

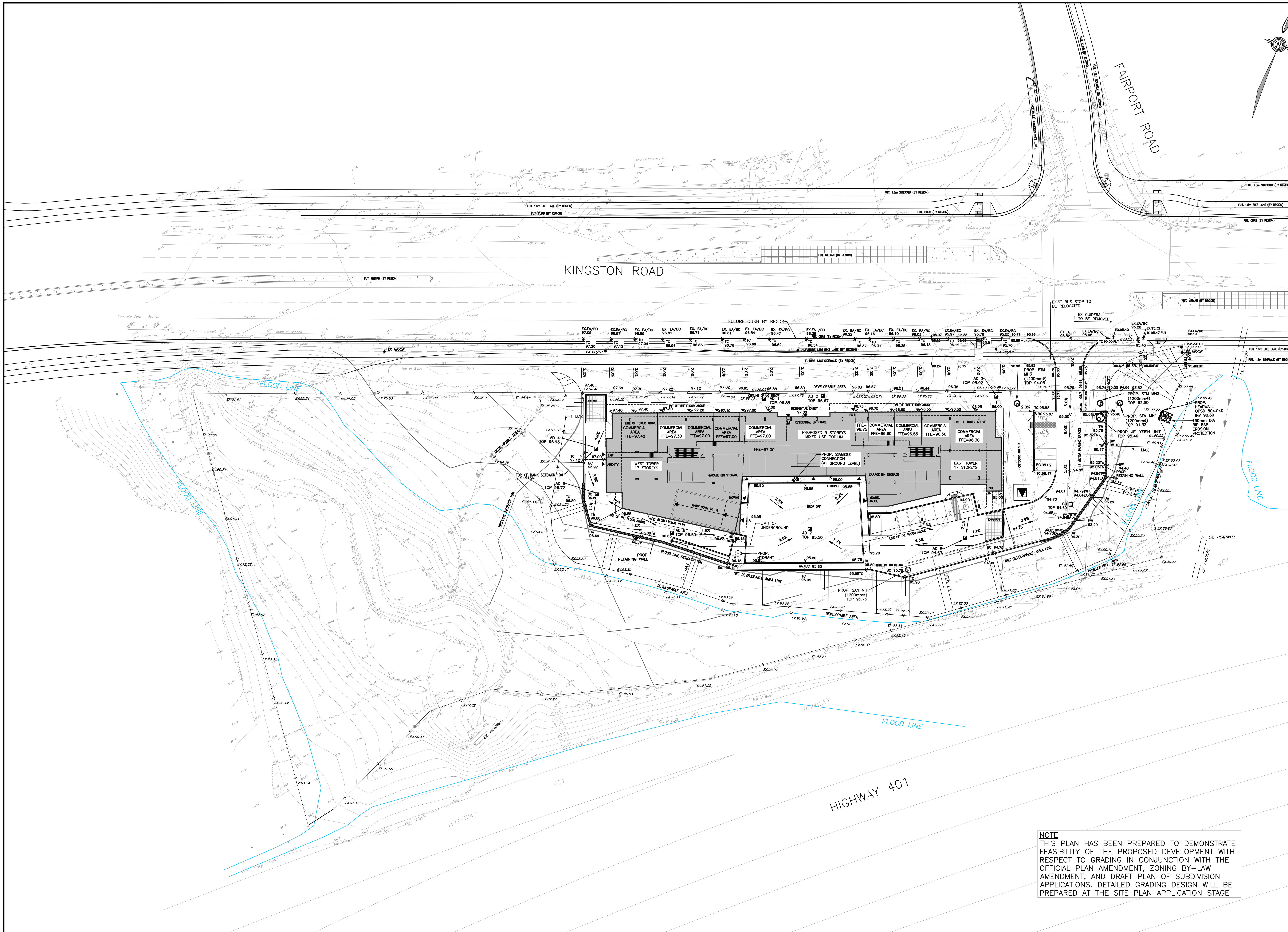
TOPOGRAPHIC INFORMATION ON N/S KINGSTON ROAD FROM FIELDWORK
COMPLETED ON MAY 27, 2022

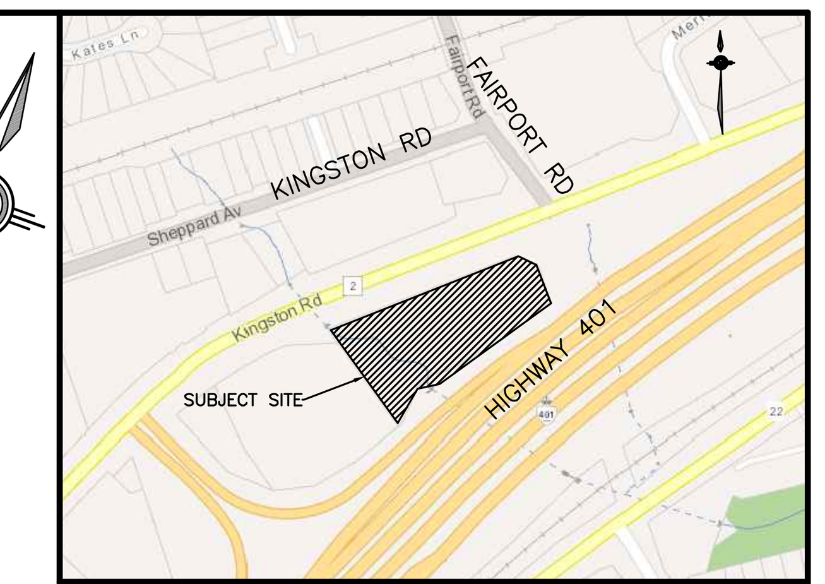
LEGEND

■	DENOTES	SURVEY MONUMENT FOUND
SIB	-	SURVEY MONUMENT PLANTED
MT	-	WITNESS MONUMENT
SIB	-	STANDARD IRON BAR
SSIB	-	SHORT STANDARD IRON BAR
IB	-	IRON BAR
CM	-	CONCRETE MONUMENT
M.E.W.	-	MEASURED EAST, WEST
OLS	-	ONTARIO LAND SURVEYOR
1715	-	ROMAN-STANCIU LTD., O.L.S.
GSF	-	GEOMATICS SOLUTIONS INC., O.L.S.
MTO	-	MINISTRY OF TRANSPORTATION OF ONTARIO
DFP	-	DONEMAN FLEISCHMANN PETRICH LTD., O.L.S.
1583	-	SEXTON MCKAY LTD, O.L.S.
LEP	-	LLOYD & PURCELL LTD., O.L.S.
M.P.C.	-	MARTON PURCELL LTD., O.L.S.
PIN	-	PROPERTY IDENTIFIER NUMBER
MEAS	-	MEASURED
REC	-	RECORD
Prod'n	-	PRODUCTION
P	-	PLAN 40R-25703
P1	-	PLAN 40R-26317
P2	-	PLAN 40R-8743
P3	-	PLAN 40R-27950
P4	-	PLAN 40R-28091
P5	-	PLAN 40R-28091
P6	-	PLAN 40R-30243
INST.	-	INSTRUMENT
W	-	WARD'S ISLAND
SW	-	SANITARY SEWER
WM	-	MONITORING WELL
SIG	-	TRAFFIC OR ELECTRIC SIGNAL
UP	-	UTILITY POLE
O/H	-	OVERHEAD
TC	-	TOP OF CURB
TB	-	TOP OF BANK
BB	-	BOTTOM OF BANK
CLF	-	CHAIN LINK FENCE
CONC	-	CONCRETE
RWS	-	STONE RETAINING WALL
PWF	-	POST & WIRE FENCE
PIN	-	PROPERTY IDENTIFIER NUMBER
Ø	-	DIAMETER
○	-	DECIDUOUS TREE
⁂	-	CONIFEROUS TREE
297.00	-	ELEVATION ON THE GROUND
300.05	-	ELEVATION ON THE TOP OF WALL

IBW SURVEYORS
IBWSURVEYORS.COM | 1.800.667.0696

PARTY CHIEF: N/A | DRAWN BY: DC | CHECKED BY: * | PLOT DATE: JULY 25, 2022
FILE NAME: A-035261-V3





KEY PLAN
N.T.S

LEGEND:

188.50 EX	EXISTING ELEVATION
BW188.50 EX	EXISTING ELEVATION BOTTOM OF WALL
	HYDRANT
	VALVE AND BOX
	STORM MANHOLE
	AREA DRAIN
	CATCHBASIN
	SANITARY MANHOLE
	RETAINING WALL
	FLOOD LINE
	TRANSFORMER

BENCHMARK NOTE:

ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE REFERRED.
BNECHMARK No.0011967U039 HAVING AN ELEVATION OF 95.152 METERS LOCATED IN MANHOLE ON WEST SIDE OF CHURCH STREET, 0.3 KILOMETERS SOUTH OF HIGWAY No.2, 11.6 METERS EAST OF NORTHEAST CORNER OF ST. FRANCIS DE SALES SCHOOL, 10.4 METERS WEST OF CENTRE LINE OF ROAD, 4.0 METERS SOUTH OF WIRE FENCE, 5.5 METERS SOUTHWEST OF POWER POLE NO.53.

BEARING NOTE:

BEARINGS SHOWN ARE GRID BEARINGS AND DERIVED FROM OBSERVED REFERENCE POINTS (ORP'S) 1 AND 2 BY REAL TIME NETWORK OBSERVATIONS, UTM ZONE 17, NAD 83 (CSRS) (1997.0 EPOCH).
DISTANCES SHOWN ON THIS PLAN ARE GROUND DISTANCES AND CAN BE CONVERTED TO GRID DISTANCES BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.99987

METRIC:

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

NO.	DATE	REVISIONS	BY

NOTE
THIS PLAN HAS BEEN PREPARED TO DEMONSTRATE FEASIBILITY OF THE PROPOSED DEVELOPMENT WITH RESPECT TO GRADING IN CONJUNCTION WITH THE OFFICIAL PLAN AMENDMENT, ZONING BY-LAW AMENDMENT, AND DRAFT PLAN OF SUBDIVISION APPLICATIONS. DETAILED GRADING DESIGN WILL BE PREPARED AT THE SITE PLAN APPLICATION STAGE

PRELIMINARY

VALDOR ENGINEERING INC.
Consulting Engineers - Project Managers
571 CHRISLEA ROAD, UNIT 4, 2ND FLOOR, WOODBRIDGE, ONTARIO, L4L 8A2
TEL (905)264-0054, FAX (905)264-0069
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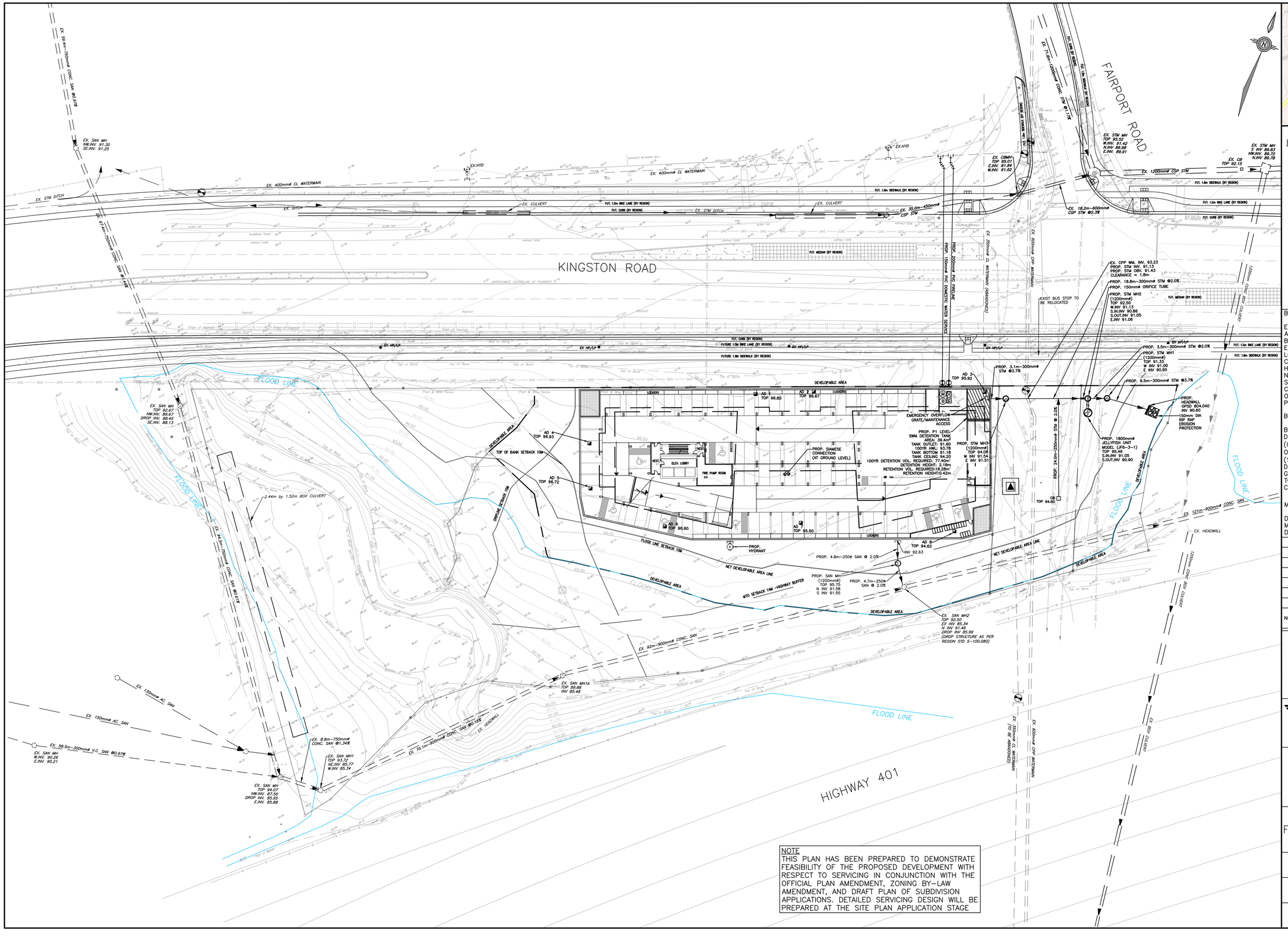
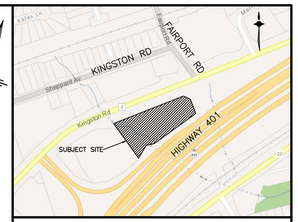
www.valdor-engineering.com

PROPOSED RESIDENTIAL DEVELOPMENT
875 KINGSTON ROAD
CITY OF PICKERING

FUNCTIONAL GRADING PLAN

SCALE	DATE OF DWG.	PROJECT NO.
1:400	MAY 23/2023	22115
DRAWN BY P.M.	DRAWING NO. FSG-1	
CHKD BY D.G.		





KEY PLAN
N.T.S

LEGEND:

- 188.50 EX — EXISTING ELEVATION
- BW188.50 EX — EXISTING ELEVATION BOTTOM OF WALL
- HYDRANT
- VALVE AND BOX
- STORM MANHOLE
- AREA DRAIN
- CATCHBASIN
- SANITARY MANHOLE
- B — BELL LINE
- GAS — GAS LINE
- TL — TRAFFIC LIGHT LINE
- FO — FIBRE OPTIC LINE
- H — HYDRO LINE
- E — ELECTRICAL LINE
- TRANSFORMER

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CITY OF PICKERING

FUNCTIONAL SERVICING PLAN

SCALE	DATE OF DWG.	PROJECT NO.
1:400	MAY 23/2023	22115
DRAWN BY: P.M.	DRAWING NO.	
CHKD BY: D.G.	FSS-1	