

640 Liverpool Road

Functional Servicing and Stormwater Management Report

Liverpool Road Limited Partnership

Project #E21030

December 2022, October 2023, November 2025

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Appendices

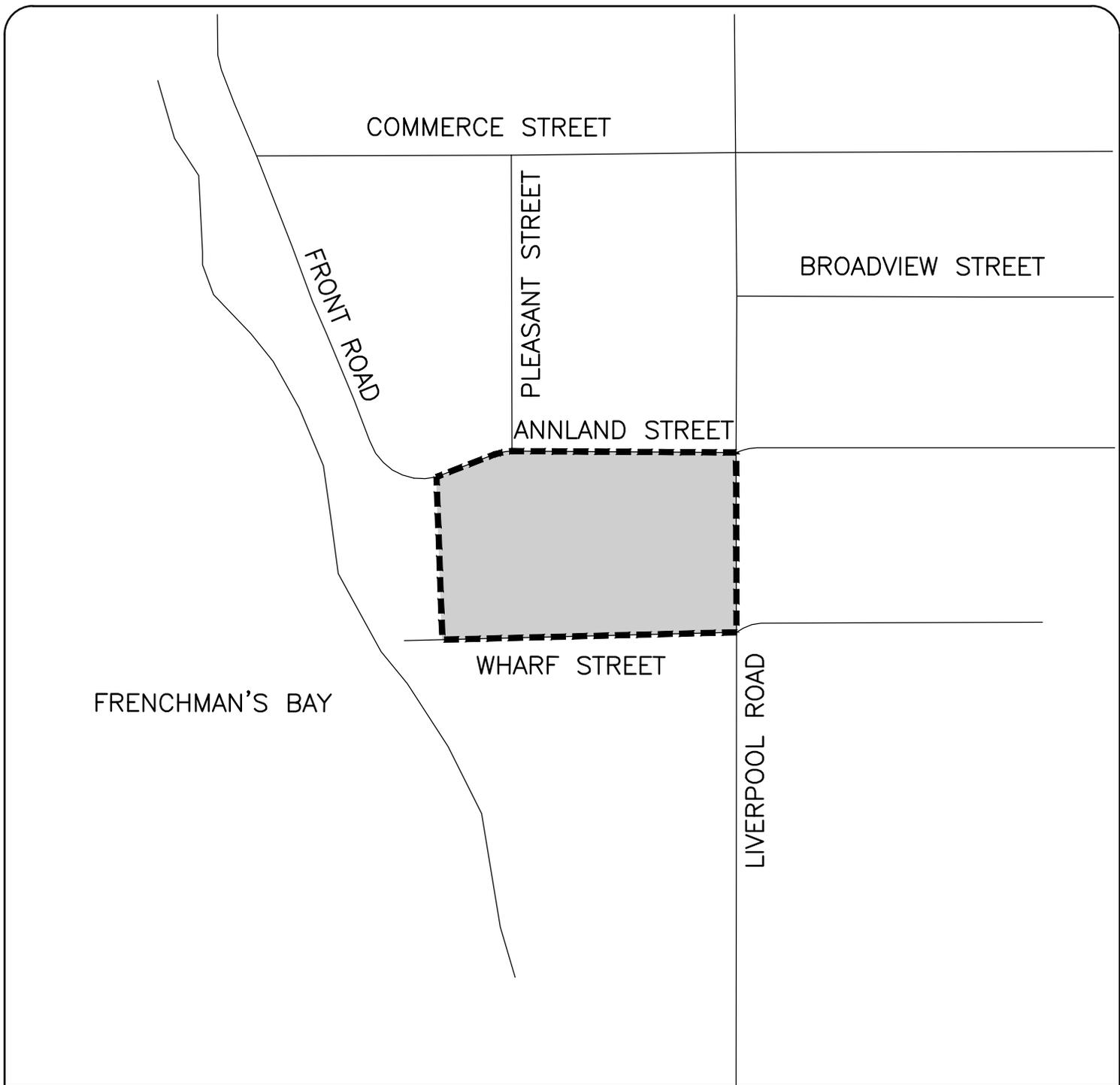
Appendix A	Storm Sewer Design Sheets
Appendix B	Jellyfish Sizing Calculations
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1.0 Introduction and Background

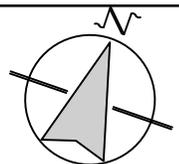
CANDEVCON EAST Limited has been retained by Liverpool Road Limited Partnership to provide a functional servicing and grading design and a stormwater management (SWM) strategy for the proposed residential development in the City of Pickering. The subject site is bound by Annland Street to the north, an existing sanitary sewer easement and residential lots to the west fronting directly on to Frenchman's Bay, Liverpool Road to the east and Wharf Street to the south. The location of the site, which has a total area of 1.14 hectares (ha), is shown on **Figure 1**. The proposed development will consist of residential townhomes, parking spaces and an open space block.

The following documents were reviewed in preparation of this Functional Servicing and Stormwater Management Report (FSSR):

- Draft Hydrogeological Investigation Report, Proposed Residential Development, prepared by Terrapex (April 2022)
- Stormwater Management and Floodplain Management Analysis, Liverpool Road Lands, Sabourin Kimble & Associates Ltd. (March 2002)
- The City of Pickering, Engineering Services Department, Design Guidelines and Standard Drawings (2021)
- The Regional Municipality of Durham Design Specifications for Regional Services (2015)
- Stormwater Management Planning and Design Manual (SWMP Manual) prepared by the Ministry of Environment (March 2003)
- Toronto and Region Conservation Authority, Stormwater Management Criteria (August 2012)



SUBJECT LANDS



640 LIVERPOOL ROAD
THE CORPORATION OF THE CITY OF PICKERING

KEY PLAN

CEC CANDEVCON EAST LIMITED
 CONSULTING ENGINEERS & PLANNERS

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Designed By:	J.R.	Checked By:	K.D.	DWG. No.	FIG.1
Scale:	N.T.S.	Date:	OCTOBER 2023		

2.0 Site Topography and Grading

2.1 Existing Conditions

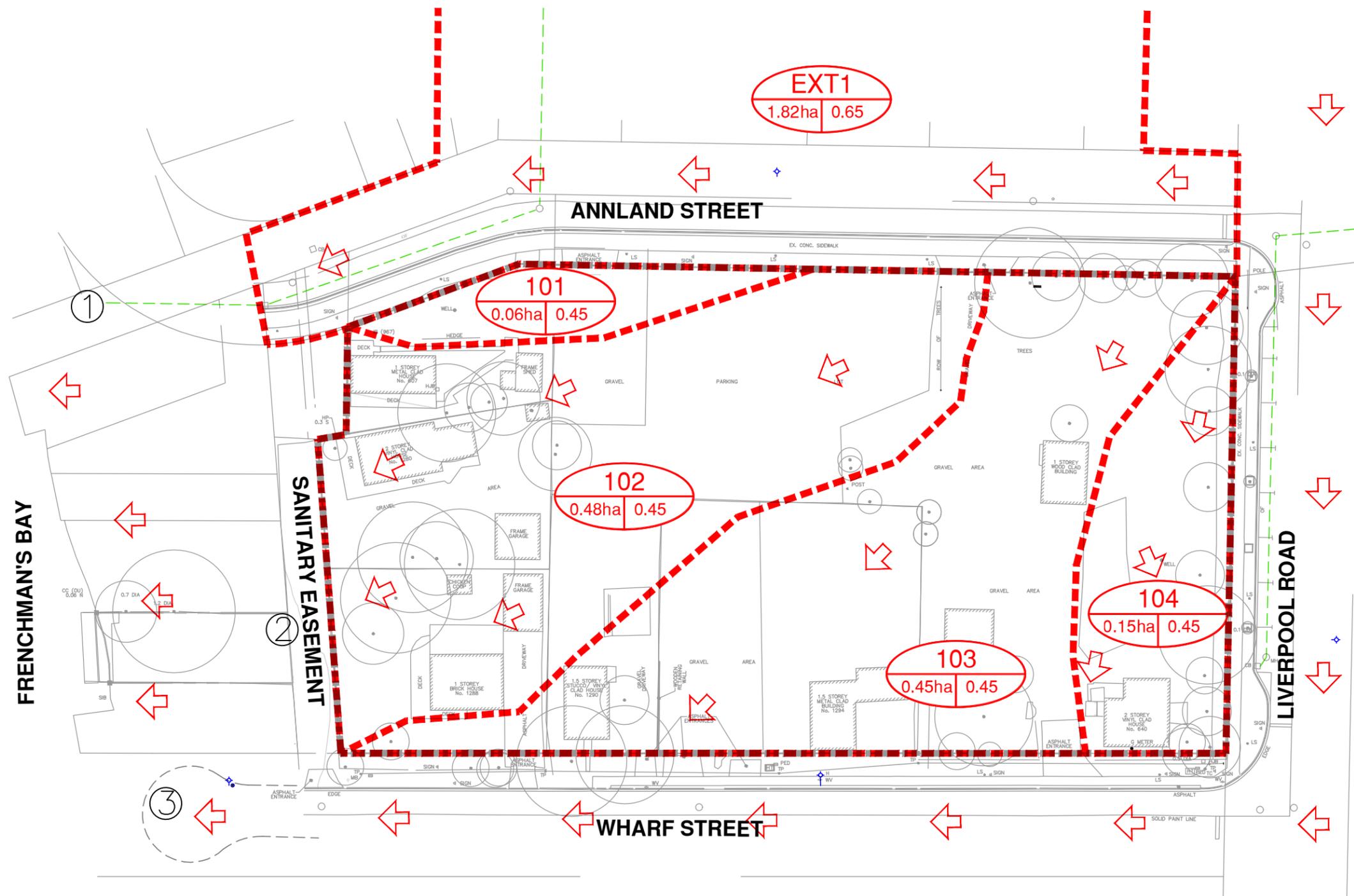
Based on the topographical survey prepared by J.D. Barnes Limited (2022), approximately half of the site generally slopes in a westerly fashion towards Frenchman's Bay. The other half slopes southerly to Wharf Street. There are small areas sloped towards Liverpool Road and Annland Street as further described below in Section 3.1.

The existing topographic conditions are illustrated on **Figure 2**. The existing site consists of residential dwellings and a gravel parking area leased by the City of Pickering.

2.2 Proposed Conditions

Preliminary lot grading and road grades at key points within the proposed development are provided on **Drawing FGP**. These target elevations provide guidance for detailed design to ensure the overall grading and major drainage function.

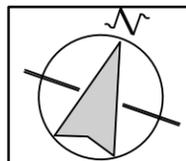
The proposed grading for the development is shown on **Drawing FGP**. Detailed Site Grading Plans will be prepared at the Site Plan Application stage for review by the City of Pickering.



- LEGEND**
- EXISTING CONTOUR
 - SITE BOUNDARY
 - EXISTING DRAINAGE BOUNDARY
 - EXISTING STORM SEWER
 - FLOW DIRECTION

- AREA ID
DRAINAGE AREA IN HECTARES
- RUNOFF COEFFICIENT
- OUTLET ID AND LOCATION

FRENCHMAN'S BAY FLOODLINE
ELEV = 76.20m
SHORELINE FLOODLINE HAZARD +
0.30m VERTICAL FREEBOARD
ELEV = 76.50m



640 LIVERPOOL ROAD

THE CORPORATION OF THE CITY OF PICKERING

EXISTING CONDITIONS DRAINAGE PLAN

CANDEVCON EAST LIMITED
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Scale:	1:750	Date:	OCTOBER 2023		

3.0 Storm Drainage

3.1 Existing Conditions

Under existing conditions, the site consists of multiple single-family dwellings, a gravel lot currently used for outdoor storage and a recently constructed gravel parking lot. There is an existing storm sewer within the Annland Street right of way, which drains westerly towards Frenchman's Bay, but is not sized to accommodate the subject development. The existing sewer on Annland Street currently collects storm drainage from the surrounding area (area EXT-1 on **Figure 2**).

Area 101 drains overland to Annland Street, as shown on **Figure 2**, ultimately draining to Frenchman's Bay at Outlet 1.

As noted above, the site drains into Frenchman's Bay to the west of the site. A portion of the site drains westerly towards the existing sanitary easement, immediately west of the property, identified as Outlet 2 on **Figure 2**, and drains to Frenchman's Bay through the existing lots on the waterfront. Refer to Area 102 on **Figure 2**.

Areas 103 and 104 on **Figure 2** drain southerly and easterly towards Wharf Street and Liverpool Road, respectively. The drainage from both areas is then conveyed via the right of way to a curb cut at the end of the Wharf Street court, where flows are directed through twin 550mm diameter culverts, discharging into Frenchman's Bay, identified as Outlet 3 on **Figure 2**.

3.2 Proposed Conditions

Based on the functional grading presented on **Drawing FGP**, the proposed drainage conditions and outlets are illustrated on **Figure 3**.

Area 201 consists of medium density townhouse units, with associated laneways and parking areas. Flows from this area will be captured and conveyed to the proposed storm sewer within Annland Street, at Outlet 1.

Area 202 consists of front yard and a portion of roof drainage from units fronting onto Annland Street. These flows will be conveyed via the right-of-way, discharging to Frenchman's Bay at Outlet 1.

Area 203 consists of the rear yards and a portion of roof drainage from the units backing onto the sanitary easement. Drainage will flow westerly to Frenchman's Bay through the sanitary easement and existing lots at Outlet 2.

Area 204 consists of boulevard, and a portion of the roof drainage from units fronting onto Wharf Street. These flows will be conveyed via the right-of-way, discharging to Frenchman's Bay at Outlet 3.

Area 205 consists of the boulevard and a portion of the roof fronting onto Liverpool Road. These flows will be conveyed via the right of way, discharging to Frenchman's Bay at Outlet 3

There are no external areas draining through the site. Area EXT-1 will continue to contribute flows to the existing storm sewer on Annland Street.

Based on servicing constraints for the storm sewer, the southern most units on Block D and Blocks I to G, fronting Wharf Street, will require sump pumps for the lower basement units.

3.2.1 Minor System

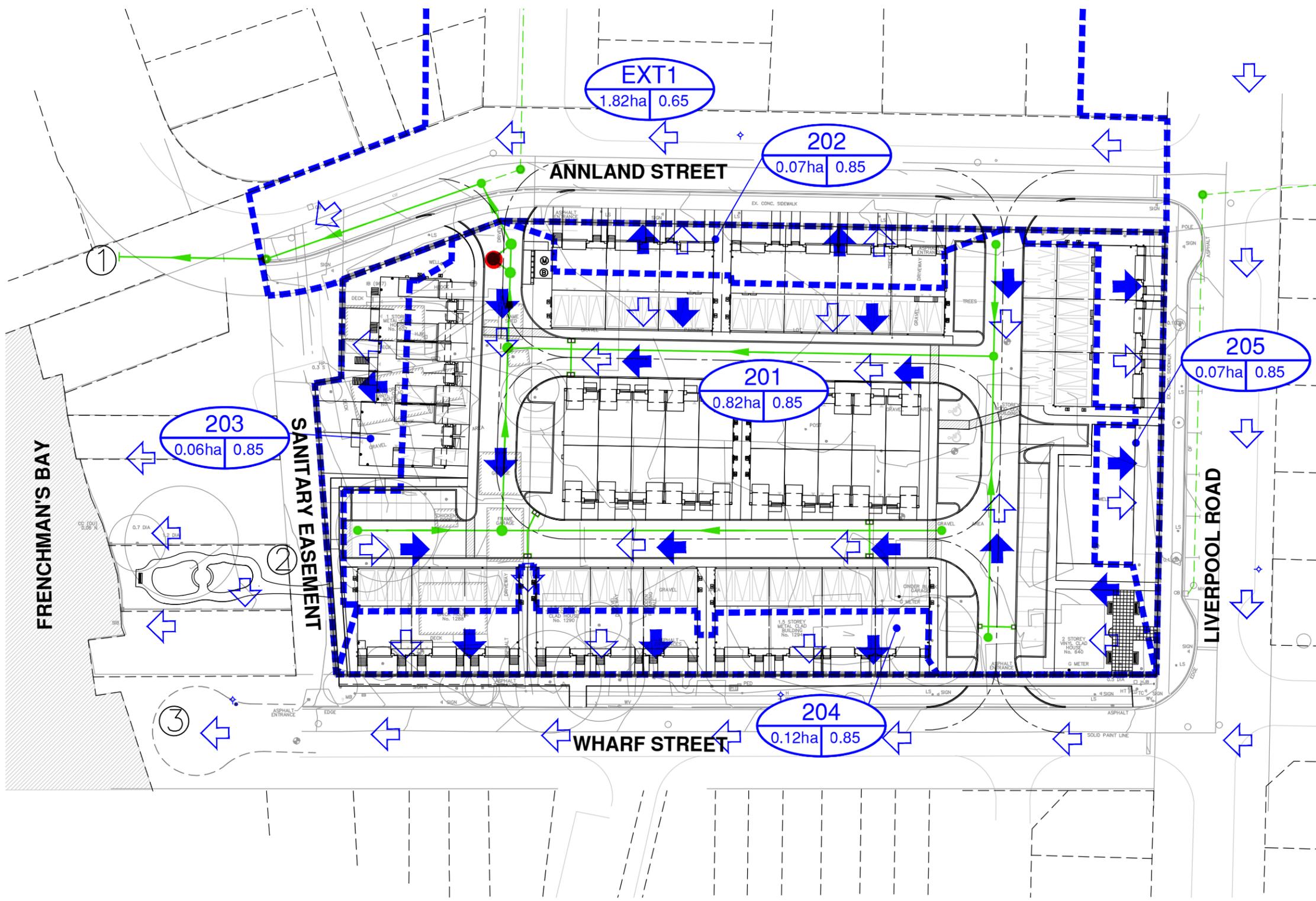
The minor system for the proposed development will be designed to comply with the City of Pickering Engineering Design Guidelines (2021). The storm sewer within Annland Street is proposed to be replaced to convey the 100-year flows from Areas 201 and 202 to Outlet 1 on **Figure 3**.

The storm sewer internal to the site is designed to capture and convey the 100-year flows to the proposed storm sewer on Annland Street, which ultimately discharges to Frenchman's Bay.

The routing and preliminary sizing of the storm sewer to service the development are shown on the Functional Servicing Plan (**Drawing FSP**).

3.2.2 Major System

Major system flows for Area 201 on **Figure 3** will be captured and conveyed to the proposed Annland Street storm sewer. Areas 202, 203, 204 and 205 will continue to drain overland to their respective outlets as outlined above (refer to **Figure 3**).



LEGEND

- EXISTING CONTOUR
- SITE BOUNDARY
- PROPOSED DRAINAGE BOUNDARY
- EXISTING STORM SEWER
- PROPOSED STORM SEWER
- MAJOR SYSTEM FLOW DIRECTION
- MINOR SYSTEM FLOW DIRECTION

AREA ID

DRAINAGE AREA IN HECTARES

① OUTLET ID AND LOCATION

FRENCHMAN'S BAY FLOODLINE
ELEV = 76.20m

SHORELINE FLOODLINE HAZARD +
0.30m VERTICAL FREEBOARD
ELEV = 76.50m

JELLYFISH UNIT

640 LIVERPOOL ROAD

THE CORPORATION OF THE CITY OF PICKERING

PROPOSED CONDITIONS DRAINAGE PLAN

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Scale:	1:750	Date:	Dec. 10, 2025		

4.0 Stormwater Management

4.1 Design Criteria

The criteria for SWM for the subject site is as follows:

- Quantity Control - There are no quantity controls required for sites draining directly to Frenchman's Bay. The original pre-consultation meeting summary required 100-year to 5-year quantity control if the existing sewer on Annland Street was to be utilized.
- Quality Control - An "Enhanced" level of protection for the minor system drainage as per Ministry of Environment guidelines is required (minimum 80% total suspended solids removal) by TRCA guidelines.
- Erosion Control - As per the Pre-consultation Meeting Summary, minimum 5mm retention/infiltration on-site. Low Impact Development (LID) measures shall be designed in accordance with the TRCA & CVC LID SWM Planning & Design Guide and the City's SWM Design Guidelines

4.2 Proposed Conditions

4.2.1 Quantity Control

Areas 201 and 202 on **Figure 3** are proposed to drain towards the Annland Street right-of-way through a proposed storm sewer which has been sized to convey the 100-year storm flows. A storm sewer design sheet has been prepared and is included in **Appendix A**.

Runoff from Area 203 will drain towards Outlet 2 through private property, it is therefore required to ensure there is not an increase in flow to Outlet 2 associated with the development. In existing conditions, a total of 0.48ha with a runoff coefficient of 0.45 (see Area 102 on **Figure 2**) drains to Outlet 2, resulting in an AR value of 0.22. Where in proposed conditions a total of 0.06ha with a runoff coefficient of 0.85 drains to Outlet 2 (see Area 203 on **Figure 3**) resulting in an AR value of 0.05. An overall reduction in peak flows draining towards Outlet 2 is to be expected.

It is noted that Areas 204 and 205, will drain uncontrolled to Wharf Street and Liverpool Road rights-of-way, where these flows will be conveyed to Frenchman's Bay via the existing overland flow routes at Outlet 3. In existing conditions, a total of 0.60ha with a runoff coefficient of 0.45 (see Areas 103 and 104 on **Figure 2**) drains to outlet 3, resulting in an AR value of 0.27. In proposed conditions a total of 0.19ha with a runoff coefficient of 0.85 drains to Outlet 3 (see Areas 204 and 205 on **Figure 3**) resulting in

an AR value of 0.16. An overall reduction in peak flows draining towards Outlet 3 is expected.

Roof leaders are proposed to be directed to pervious surfaces and an infiltration gallery, as discussed in Section 4.2.3. As the post development areas are small and existing drainage patterns are being maintained, quantity control is not proposed for these areas.

4.2.2 Quality Control

As noted above, an “Enhanced” level of protection as presented in Table 3.2 of the MOE Stormwater Management Planning and Design Manual (SWMP Manual, March 2003) is required for the proposed development.

Quality treatment will be provided by Low Impact Development (LID) technologies as part of a treatment train approach along with a Jellyfish unit incorporated into the minor storm sewer system. Based on the site’s drainage area of 1.14ha with an average runoff coefficient of 0.85, a JF8-6-2 provides 89% TSS removal. Refer to **Appendix B** for the Jellyfish sizing report.

4.2.3 Water Balance/Erosion Control

The TRCA requirement is to retain or infiltrate the first 5mm of stormwater. For the 1.14ha site, this corresponds to 57.0m³ of retention or infiltration across the site. Due to high groundwater at the site, subsurface infiltration opportunities are limited. As outlined on **Figure 4**, it is proposed to direct rooftop drainage to near surface infiltration trenches. The infiltration trenches provide approximately 35.8m³ of infiltration volume, representing 3mm of retention/infiltration. Supporting calculations for the infiltration trenches are included in **Appendix C**. Low impact development measures, including additional topsoil depth and permeable pavers are also proposed which will increase the retention and infiltration volumes across the site.

4.2.4 Low Impact Development

Low Impact Development (LID) measures have been considered in order to provide a treatment train approach. These LID measures described below include lot level, as illustrated on **Figure 4**.

Lot Level Controls

Lot level controls present an opportunity to reduce runoff and promote infiltration at the source. Incorporating controls that do not require maintenance can be an effective method in the treatment train approach to stormwater management and will help achieve the required 5mm of stormwater retention.

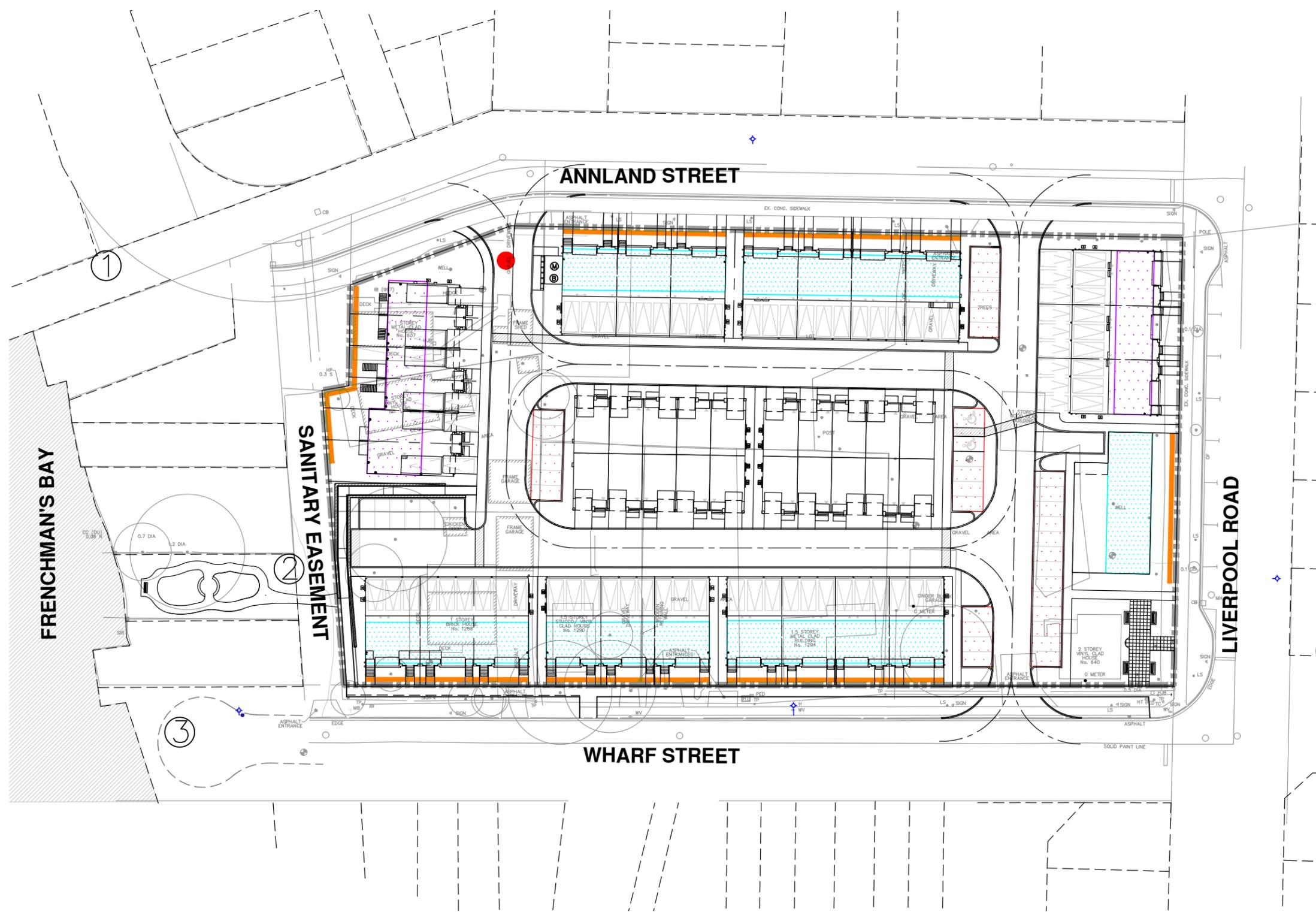
Permeable Pavement - It is proposed that the parking areas be constructed with permeable pavement to encourage infiltration and retention of stormwater at the source. The bedding material of the permeable pavement will be designed to retain the first 5mm of runoff from the impervious surface.

Topsoil Amendments and Increased Depth - Increasing the typical topsoil depth of 0.15m to 0.30m and providing amendments in accordance with TRCA specifications will minimize local runoff while promoting increased infiltration. Soil amendments will be scarified as per Preserving and Restoring Healthy Soils: Best Practices for Urban Construction, June 2012.

<https://sustainabletechnologies.ca/home/urban-runoff-green-infrastructure/healthy-soils/preserving-and-restoring-healthy-soil-best-practices-for-urban-construction/>

Disconnected Roof Leaders - It is proposed that rear yard roof leaders be directed to grassed areas or raingardens where possible to maximize the potential for at source infiltration. This is limited to rear yards as the City of Pickering requires that all front roof leaders be directly connected to the storm sewer.

Passive Landscaping to Promote Infiltration – Planting of gardens and other vegetation designed to minimize local runoff or the use of rainwater as a watering source can be used to reduce rainwater runoff by increasing evaporation, transpiration and infiltration. By promoting infiltration through passive landscaping within the landscape areas, stormwater management is provided for the volume of water infiltrated. Passive landscaping can provide significant stormwater management benefits as part of the overall treatment train approach for the subject development. Wherever possible, through detailed house and landscape design, roof water will be directed to landscaped areas.



- LEGEND**
-  REAR ROOFLEADERS TO GRADE VIA SPLASHPAD
 -  PERMEABLE PAVERS
 -  ROOF LEADERS TO INFILTRATION TRENCHES
 -  INFILTRATION TRENCH
 -  QUALITY CONTROL UNIT JELLYFISH OR APPROVED EQUIVALENT

640 LIVERPOOL ROAD

THE CORPORATION OF THE CITY OF PICKERING

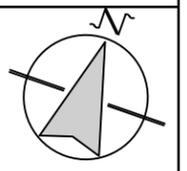
PROPOSED LOW IMPACT DEVELOPMENT PLAN

CEG CANDEVCON EAST LIMITED
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Designed By:	H.L.	Checked By:	S.A.	DWG. No.	FIG.4
Scale:	1:750	Date:	Dec. 10, 2025		



5.0 Sediment and Erosion Control

Sediment and erosion control practices during construction will include, but not be limited to, standard devices such as silt fences, mud mats and catchbasin buffers. Detailed Sediment and Erosion Control Plans will be prepared in conjunction with the site plan application for this development.

6.0 Sanitary Drainage System

6.1 Existing Conditions

The existing sanitary sewer system servicing the site is illustrated on **Drawing FSP**, which shows a 450mm diameter sewer within the Region of Durham Sanitary Easement on the westerly boundary of the site. The existing 450mm diameter sewer within the sanitary easement discharges to the Wharf Street sanitary sewer and is then conveyed easterly to the Liverpool Road Sewage Pumping Station (SPS).

6.2 Proposed Conditions

The proposed sanitary sewer system for the proposed development will be designed to comply with the Region of Durham Design Guidelines. A sanitary sewer system will be constructed within the laneways and rear lot area to service the proposed development. Based on the Region standards for 89 Townhouse Units (3/person/unit) and the commercial floor space, the anticipated flow is 4.63L/s. The flows from the development will be conveyed via gravity south westerly to the existing 450mm diameter sewer within the sanitary easement that discharges to Wharf Street.

The routing and preliminary sizing of the sanitary sewer to service this development is shown in the Functional Servicing Plan (**Drawing FSP**).

7.0 Watermain Distribution System

7.1 Existing Conditions

The existing watermain system located adjacent to the subject site is illustrated on **Drawing FSP** and comprises a 200mm diameter watermain on Annland Street and Liverpool Road, as well as a 150mm diameter on Wharf Street.

7.2 Proposed Conditions

The water distribution network for the development will consist of watermains located within the road and boulevard area. A meter room will be located attached to the northerly end unit of the block on the westerly limit of site providing fire protection and domestic water supply to the development. The domestic watermain and firemain will connect into the existing 200mm diameter watermain connection off of Annland Street.

The routing and preliminary sizing of the watermain to service the development is shown on the Functional Servicing Plan (**Drawing FSP**).

8.0 Conclusions

The servicing and stormwater management for the 640 Liverpool Road development can be accomplished by the following:

- The storm sewer system will be designed to capture and convey the 100-year post-development flows from the site to Annland Street discharging to Frenchman's Bay.
- The existing storm sewer on Annland Street will be upsized to convey the 100-year flows from the site and the existing 5-year flows from the surrounding residential subdivision.
- There are small drainage areas fronting Wharf Street, Liverpool Road and Annland Street that will drain uncontrolled to the rights-of-way, contributing less drainage than in existing conditions. It is proposed to connect the roof leaders to infiltration trenches to minimize the drainage from the site to the municipal rights-of-way.
- A treatment train of Low Impact Development measures, including a Jellyfish, permeable pavement, infiltration trenches are proposed to provide quality and erosion control.
- Sediment and Erosion Control practices will be implemented during construction.
- A sanitary sewer system will be constructed within the laneways and rear lot area to service the proposed development, connecting into the existing 450mm diameter sanitary sewer within the sanitary easement.
- The watermain distribution system for the proposed development will consist of watermains located within the laneways and boulevard area and connecting into the existing 200mm diameter watermain on Annland Street.

Report prepared by:

CANDEVCON EAST LIMITED



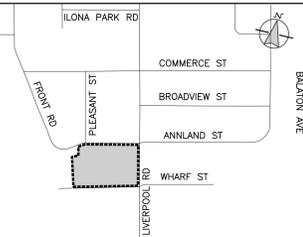
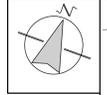
Marco Coscarella, P.Eng.
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Water Resources Engineer

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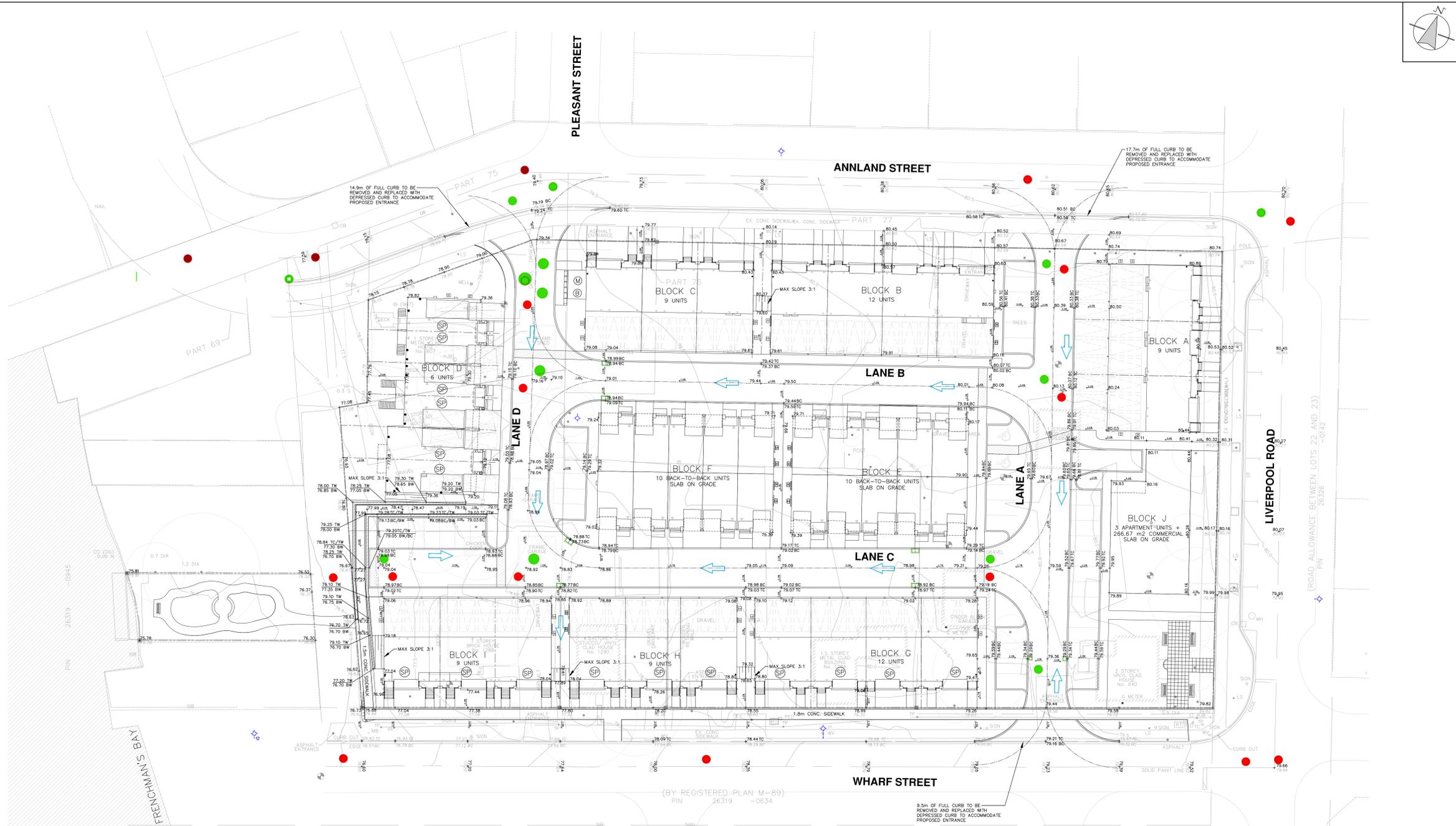
cc: Liverpool Road Limited Partnership, Attn: Mr. Greg Silas
Brian Moss and Associates Ltd., Attn: Mr. Brian Moss



KEY PLAN
N.T.S.

- NOTES:**
1. ALL MEASUREMENTS IN METRES, PIPE SIZES IN MILLIMETRES, UNLESS OTHERWISE SPECIFIED.
 2. ELEVATIONS HEREON ARE GEODETIC AND ARE REFERRED TO CITY OF PICKERING BENCHMARK No. R-39, HAVING A PUBLISHED ELEVATION OF 82.555m (CIVD-1929:1978)

- LEGEND**
- EXISTING GROUND CONTOUR
 - PROPOSED FINISHED GRADE
 - EXISTING GROUND GRADE
 - DIRECTION OF SURFACE DRAINAGE
 - OVERLAND FLOW DIRECTION
 - FRONT DRAINING LOT
 - SPLIT DRAINING LOT
 - BACK SPLIT LOT
 - WALK OUT LOT
 - SUMP PUMPS



REVISIONS				
No.	BY	DATE	DESCRIPTION	APPROVED

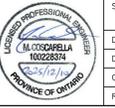
THE CORPORATION OF THE CITY OF PICKERING
ENGINEERING SERVICES DEPARTMENT

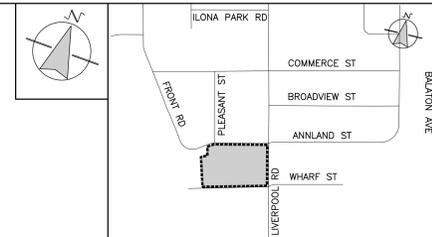
640 LIVERPOOL ROAD

FUNCTIONAL GRADING PLAN

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DESIGNED BY : H.L.	FGP
CHECKED BY : M.C.	REVISION DATE: DEC. 10, 2025

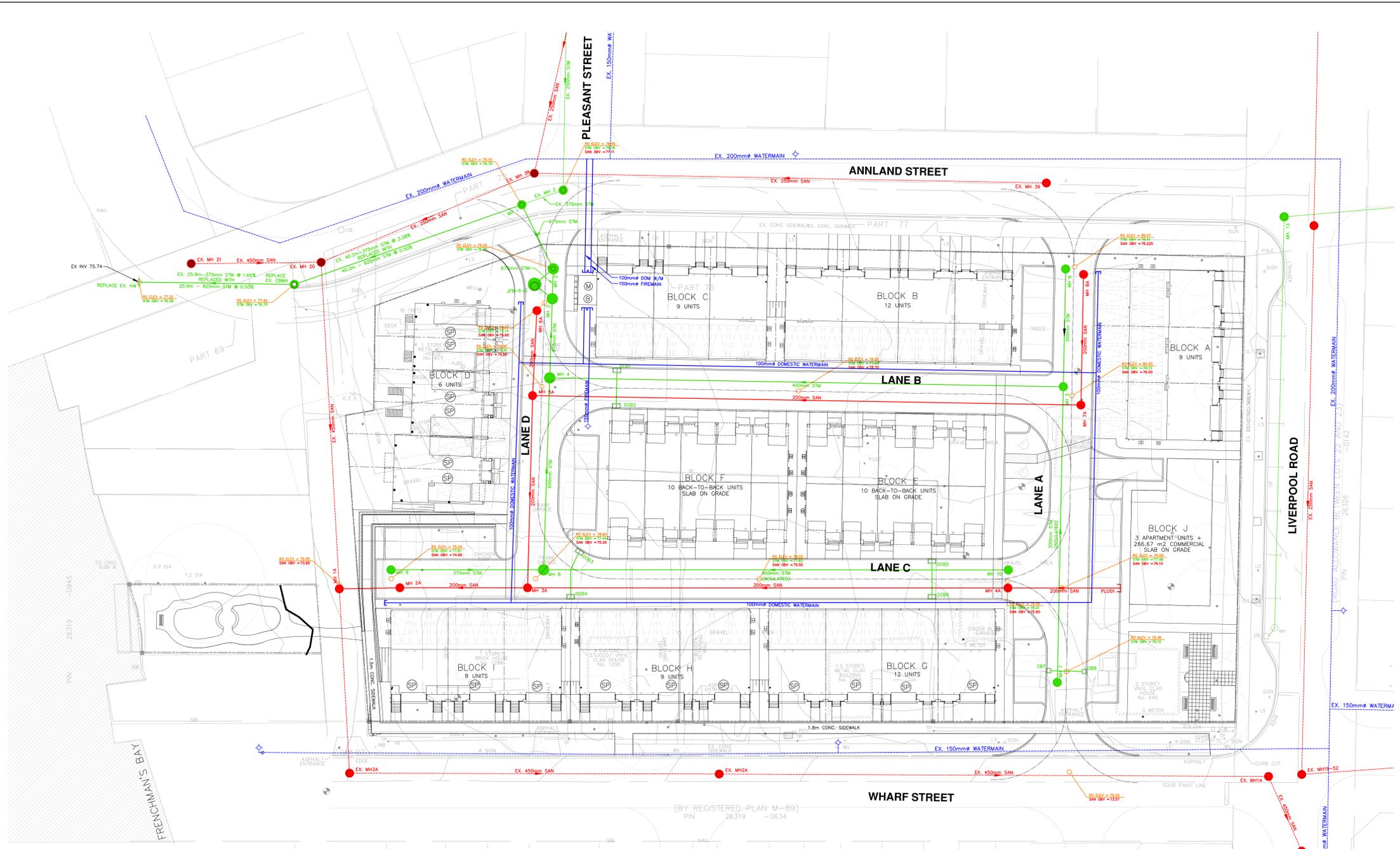




KEY PLAN
N.T.S.

- NOTES:**
1. ALL MEASUREMENTS IN METRES, PIPE SIZES IN MILLIMETRES, UNLESS OTHERWISE SPECIFIED.
 2. ELEVATIONS HERON ARE GEODETIC AND ARE REFERRED TO CITY OF PICKERING BENCHMARK No. R-39, HAVING A PUBLISHED ELEVATION OF 82.555m (CVDG-1929:1978)

- LEGEND**
- EX. STORM SEWER AND FLOW DIRECTION
 - PROP. STORM SEWER AND FLOW DIRECTION
 - EX. SANITARY SEWER AND FLOW DIRECTION
 - PROP. SANITARY SEWER AND FLOW DIRECTION
 - EX. WATERMAIN
 - PROP. WATERMAIN
 - PHASE / DEVELOPMENT LIMIT
 - WATER METER ROOM AND BACKFLOW PREVENTION DEVICE AS PER S-240.041
 - SUMP PUMPS



REVISIONS

No.	BY	DATE	DESCRIPTION	APPROVED

THE CORPORATION OF THE CITY OF PICKERING
ENGINEERING SERVICES DEPARTMENT

640 LIVERPOOL ROAD

FUNCTIONAL SERVICING PLAN

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DESIGNED BY: H.L. DRAWING No.
CHECKED BY: M.C. **FSP**
REVISION DATE: Dec. 10, 2025



Appendix A

Storm Sewer Design Sheets

COMPUTED BY : H.L.
CHECKED BY : M.C.
DATE: Nov. 19, 2025
STATUS: 3rd FSSR Submission

CITY OF PICKERING

STORM SEWER DESIGN SHEET

PROJECT NAME: 640 Liverpool Road
Pickering

CITY OF PICKERING DESIGN CRITERIA:

Q = 2.778 AIR
Q=5 YEAR RETURN STORM
A= AREA IN HECTARES(ha)
R=RUNOFF COEFFICIENT
I=RAINFALL INTENSITY (mm/hr)
Coefficient of Friction in pipe, n = 0.013
Time of Concentration (Tc) min = 10
5 Year Intensity = 1082.901/(t + 6.007)^{0.837}
25 Year Intensity = 1581.718/((Tc+6.007)^{0.848})
100 Year Intensity = 2096.425/(t + 6.485)^{0.863}

PROJECT No. : E21030
100 YEAR DESIGN STORM

LOCATION				FLOWS							SEWER DESIGN							REMARKS
STREET	AREA ID	MANHOLE NO.		"A" AREA (ha)	"R" RUNOFF COEFF.	AR	ACCUM. AR	TIME OF CONC. (min)	RAINFALL INTENSITY (mm/hr)	PEAK FLOW (L/s)	LENGTH (m)	PIPE DIA. (mm)	SLOPE (%)	PIPE CAPACITY (L/s)	FULL VELOCITY (m/s)	TIME IN SECTION (min)	TOTAL TIME (min)	PEAK FLOW / PIPE CAP. (%)
		U/S	D/S															
Lane C	4	MH 10	MH 8	0.21	0.85	0.178	0.178	10.00	186.7	248	77.4	450	1.00	298	1.81	0.71	10.71	83.3
Lane C	5	MH 9	MH 8	0.05	0.85	0.044	0.044	10.00	186.7	125	25.4	375	1.00	183	1.61	0.26	10.26	68.2
Lane D	6	MH 8	MH 4	0.07	0.85	0.063	0.285	10.71	180.0	373	32.1	600	0.50	454	1.55	0.34	11.05	82.2
Lane A	2	MH 7	MH 5	0.18	0.85	0.150	0.150	10.00	186.7	78	49.4	300	1.00	101	1.38	0.59	10.59	76.8
Lane A	1	MH 6	MH 5	0.05	0.85	0.045	0.045	10.00	186.7	23	19.7	300	1.00	101	1.38	0.24	10.24	22.9
Lane B	3	MH 5	MH 4	0.21	0.85	0.179	0.373	10.24	184.4	191	85.5	450	0.50	211	1.28	1.11	11.35	90.8
Lane D	7	MH 4	MH 3	0.04	0.85	0.034	0.692	11.35	174.5	564	13.2	675	0.50	621	1.68	0.13	11.48	90.9
Lane D	0	MH 3	MH 2	0.00	0.00		0.692	11.48	173.4	564	5.0	675	0.50	621	1.68	0.05	11.53	90.9
Lane D	0	MH 2	MH 1	0.00	0.00		0.692	11.53	172.9	564	11.9	675	0.50	621	1.68	0.12	11.65	90.9
ANNLAND STREET	EXT-1	EX. MH 2	MH 1	1.82	0.65	1.183	1.183	10.00	106.3	349								
ANNLAND STREET	8	MH 1	EX. CBMH	0.07	0.85	0.058	1.934	11.65	172.0	914	40.2	825	0.50	1060	1.92	0.35	11.99	86.2
	0	EX. CBMH	EX. HW	0.00	0.00		1.934	11.99	169.2	914	25.9	825	0.50	1060	1.92	0.22	12.22	86.2

Site plan and proposed sewer upsizing, 100-year storm event
Existing Annland Street and Pleaseant Sewer, 5-year storm event

Appendix B

Jellyfish Sizing Calculations



STANDARD OFFLINE Jellyfish Filter Sizing Report

Project Information

Date	Saturday, November 22, 2025
Project Name	640 Liverpool Rd.
Project Number	E21030
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 JF8-6-2 is recommended to meet the water quality objective by treating a flow of 35.3 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 398 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)
JF8-6-2	6	2	2.4	35.3	398

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:

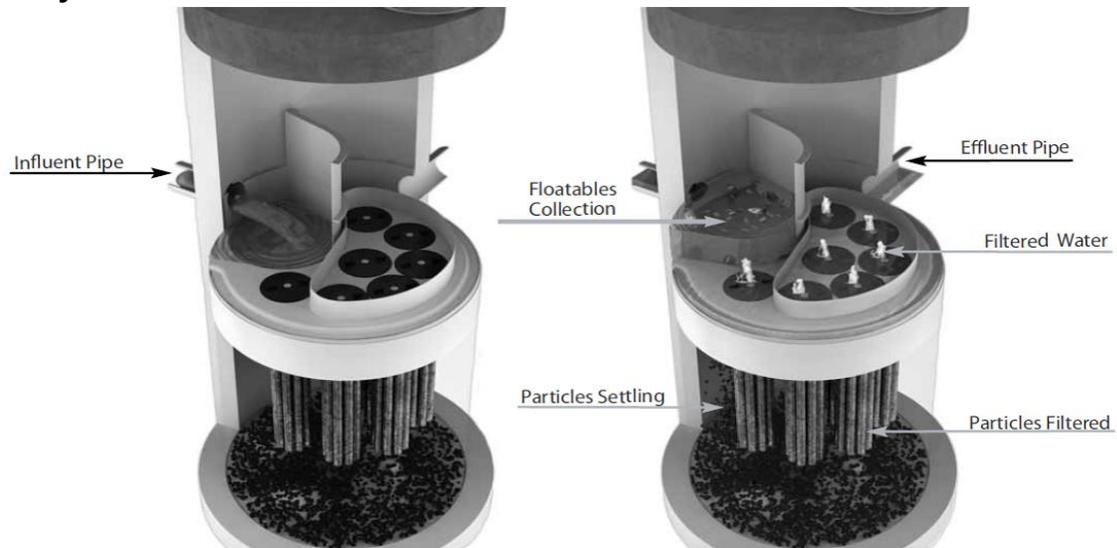
- ☑ 89% of the total suspended solids (TSS) load, including particles less than 5 microns
- ☑ 77% TP removal & 51% TN removal
- ☑ 90% Total Copper, 81% Total Lead, 70% Total Zinc
- ☑ Particulate-bound pollutants such as nutrients, toxic metals, hydrocarbons and bacteria
- ☑ Free oil, Floatable trash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

Field Proven Performance

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

- A median TSS removal efficiency of 90%, 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 monitored 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

Project Information

Date:	Saturday, November 22, 2025
Project Name:	640 Liverpool Rd.
Project Number:	E21030
Location:	Pickering

Designer Information

Company:	Candevcon Ltd.
Contact:	Heikki Loorand
Phone #:	

Notes

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Design System Requirements

Flow Loading	90% of the Average Annual Runoff based on 18 years of TORONTO CENTRAL rainfall data:	27.8 L/s
Sediment Loading	Treating 90% of the average annual runoff volume, 6308 m ³ , with a suspended sediment concentration of 60 mg/L.	378 kg*

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

Recommendation

The Jellyfish Filter model JF8-6-2 is recommended to meet the water quality objective by treating a flow of 35.3 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 398 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 (m ³)	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

Rainfall

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

Drainage Area

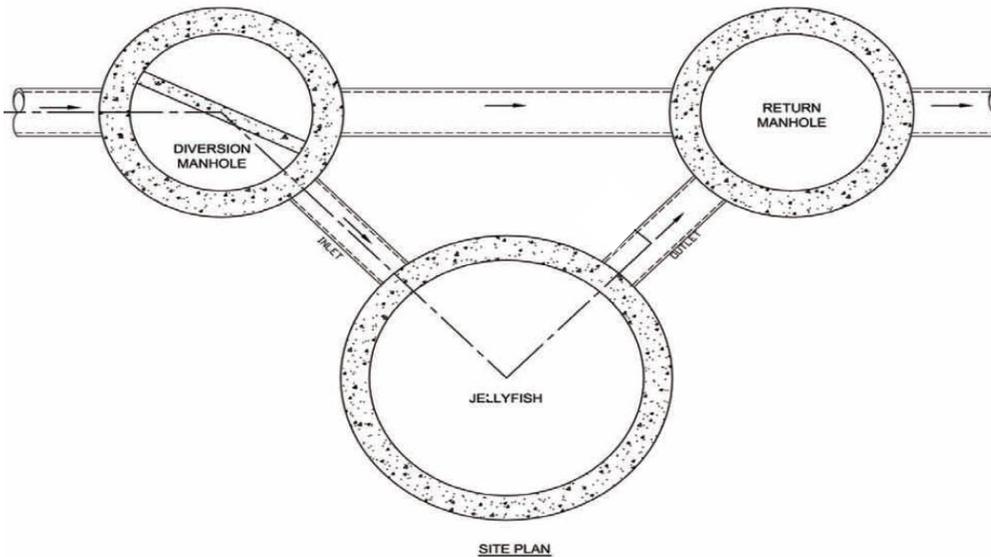
Total Area:	1.14 ha
Runoff Coefficient:	0.85

Upstream Detention

Peak Release Rate:	n/a
Pretreatment Credit:	n/a

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	62°	150	200
1.8	59°	200	250
2.4	52°	250	300
3.0	48°	300	450
3.6	40°	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 calculations account for water elevation during submerged conditions the Jellyfish Filter will function effectively under submerged conditions.
- 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 (ft ² / m ²)	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 Con Seal 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 it 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

DRAWING NOT TO BE USED FOR CONSTRUCTION

GENERAL NOTES:

- ALL DIMENSIONS INDICATED ARE IN MILLIMETERS (INCHES) UNLESS OTHERWISE SPECIFIED.
- JELLYFISH STRUCTURE INLET AND OUTLET PIPE SIZE AND ORIENTATION SHOWN FOR INFORMATIONAL PURPOSES ONLY.
- 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.
- DRAWING FOR INFORMATION PURPOSES ONLY. REFER TO ENGINEER'S SITE/UTILITY PLAN FOR STRUCTURE ORIENTATION.
- NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR PROJECT BID DATE OR AS DIRECTED BY THE ENGINEER OF RECORD.

JELLYFISH STRUCTURE & DESIGN NOTES:

- 762 MM Ø (30") MAINTENANCE ACCESS WALL TO BE USED FOR CLEANOUT AND ACCESS BELOW CARTRIDGE DECK.
- 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.
- 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.
- 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.
- 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.
- 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.
- STEPS TO BE APPROXIMATELY 330 MM (13") APART AND DIMENSIONS MUST MEET LOCAL STANDARDS. STEPS MUST BE INSTALLED AFTER CARTRIDGE DECK IS IN PLACE.
- CONFIGURATION OF INLET AND OUTLET PIPE CAN VARY TO MEET SITE'S NEEDS.
- 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.
- THIS DRAWING MUST BE VIEWED IN CONJUNCTION WITH THE STANDARD JELLYFISH SPECIFICATION, AND STORMWATER QUALITY FILTER TREATMENT JELLYFISH DOCUMENTS.

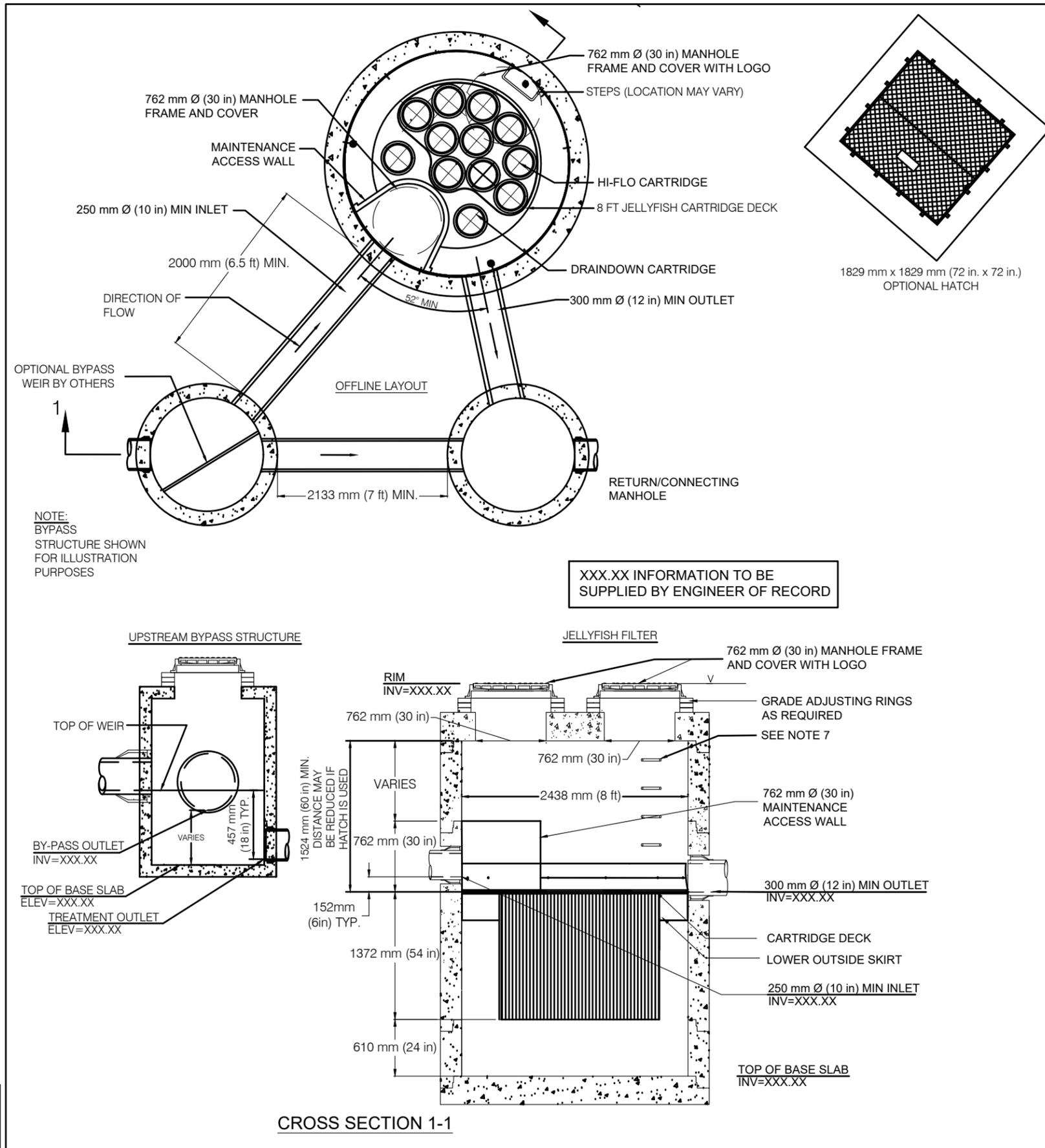
INSTALLATION NOTES

- ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
- CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STRUCTURE (LIFTING CLUTCHES PROVIDED)
- CONTRACTOR WILL INSTALL AND LEVEL THE STRUCTURE, SEALING THE JOINTS, LINE ENTRY AND EXIT POINTS (NON-SHRINK GROUT WITH APPROVED WATERSTOP OR FLEXIBLE BOOT)
- CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.
- 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.



JELLYFISH DESIGN NOTES

JELLYFISH TREATMENT CAPACITY IS A FUNCTION OF THE CARTRIDGE SELECTION AND THE NUMBER OF CARTRIDGES. THE STANDARD MANHOLE STYLE IS SHOWN. Ø2438 mm (96") MANHOLE JELLYFISH PEAK TREATMENT CAPACITY IS 55.5 L/s (1.96 CFS). TREATMENT FLOW RATE IS BASED ON 457 MM (18") OF HEAD PRESSURE.

CARTRIDGE SELECTION	54"	40"	27"	15"
CARTRIDGE DEPTH	90"	76"	63"	51"
OUTLET INVERT TO STRUCTURE BASE SLAB	5.09 / 2.55	3.68 / 1.84	2.55 / 1.27	1.41 / 0.71
FLOW RATE HIGH-FLO / DRAINDOWN (L/s) (per cart)	57 / 28	42 / 21	28 / 14	16 / 8
SEDIMENT CAPACITY HIGH-FLO / DRAINDOWN (kg) (per cart)	626	462	308	176
MAX. CARTS HIGH-FLO/DRAINDOWN	55.5	41.6	27.7	15.3
MAX. SEDIMENT CAPACITY (kg)				
MAX. TREATMENT (L/s)				

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JF8 STANDARD
Scale = 1:50

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 %
INLET #1	*	*	*	*
INLET #2	*	*	*	*
OUTLET	*	*	*	*

* PER ENGINEER OF RECORD

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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 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.
- 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

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JELLYFISH FILTER SPECIFICATIONS



JF8 STANDARD
Scale = 1:50

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Appendix C

Infiltration Trench Calculations

Project Nam 640 Liverpool Road	Prepared By: HL
Project No.: E21030	Checked By: SS
Subject: Infiltration Trench Characteristics - Block B	

Equation 4.2: Maximum Allowable Infiltration Trench Depth (MOE SWMP Manual, 2003)

d = PT / 1000

P = Estimated Percolation Rate*	12	mm/hr
T = Drawdown time	48	hr
d = Maximum allowable depth	0.576	m

Equation 4.3: Infiltration Trench Bottom Area (MOE SWMP Manual, 2003)

A=1000 V / Pn t

A = Area to Infiltration Trench	267	sq.m
d = depth of runoff infiltrated	5	mm
V = Runoff Volume infiltrated	1.3	cu.m
P = Percolation Rate	12	mm/hr
n = Porosity of the Storage Media	0.4	
t = Retention time (24 to 48 hrs)	48	hours
A = Bottom area of trench required	6	sq.m
d = trench depth	0.5	m
L= trench length	37.5	m
W= trench width	0.80	m
A = Bottom area of trench provided	30.0	sq.m
V = trench volume	6.0	cu.m

Project Nam 640 Liverpool Road	Prepared By: HL
Project No.: E21030	Checked By: SS
Subject: Infiltration Trench Characteristics - Block C	

Equation 4.2: Maximum Allowable Infiltration Trench Depth (MOE SWMP Manual, 2003)

d = PT / 1000

P = Estimated Percolation Rate*	12	mm/hr
T = Drawdown time	48	hr
d = Maximum allowable depth	0.576	m

Equation 4.3: Infiltration Trench Bottom Area (MOE SWMP Manual, 2003)

A=1000 V / Pn t

A = Area to Infiltration Trench	200	sq.m
d = depth of runoff infiltrated	5	mm
V = Runoff Volume infiltrated	1.0	cu.m
P = Percolation Rate	12	mm/hr
n = Porosity of the Storage Media	0.4	
t = Retention time (24 to 48 hrs)	48	hours
A = Bottom area of trench required	4	sq.m
d = trench depth	0.5	m
L= trench length	28.0	m
W= trench width	0.75	m
A = Bottom area of trench provided	21.0	sq.m
V = trench volume	4.2	cu.m

Project Nam 640 Liverpool Road	Prepared By: HL
Project No.: E21030	Checked By: SS
Subject: Infiltration Trench Characteristics - Block D	

Equation 4.2: Maximum Allowable Infiltration Trench Depth (MOE SWMP Manual, 2003)

d = PT / 1000

P = Estimated Percolation Rate*	12	mm/hr
T = Drawdown time	48	hr
d = Maximum allowable depth	0.576	m

Equation 4.3: Infiltration Trench Bottom Area (MOE SWMP Manual, 2003)

A=1000 V / Pn t

A = Area to Infiltration Trench	253	sq.m
d = depth of runoff infiltrated	5	mm
V = Runoff Volume infiltrated	1.3	cu.m
P = Percolation Rate	12	mm/hr
n = Porosity of the Storage Media	0.4	
t = Retention time (24 to 48 hrs)	48	hours
A = Bottom area of trench required	5	sq.m
d = trench depth	0.5	m
L= trench length	35.0	m
W= trench width	1.00	m
A = Bottom area of trench provided	35.0	sq.m
V = trench volume	7.0	cu.m

Project Nam 640 Liverpool Road	Prepared By: HL
Project No.: E21030	Checked By: SS
Subject: Infiltration Trench Characteristics - Block G	

Equation 4.2: Maximum Allowable Infiltration Trench Depth (MOE SWMP Manual, 2003)

d = PT / 1000

P = Estimated Percolation Rate*	12	mm/hr
T = Drawdown time	48	hr
d = Maximum allowable depth	0.576	m

Equation 4.3: Infiltration Trench Bottom Area (MOE SWMP Manual, 2003)

A=1000 V / Pn t

A = Area to Infiltration Trench	277	sq.m
d = depth of runoff infiltrated	5	mm
V = Runoff Volume infiltrated	1.4	cu.m
P = Percolation Rate	12	mm/hr
n = Porosity of the Storage Media	0.4	
t = Retention time (24 to 48 hrs)	48	hours
A = Bottom area of trench required	6	sq.m
d = trench depth	0.5	m
L= trench length	35.0	m
W= trench width	0.85	m
A = Bottom area of trench provided	29.8	sq.m
V = trench volume	6.0	cu.m

Project Nam 640 Liverpool Road	Prepared By: HL
Project No.: E21030	Checked By: SS
Subject: Infiltration Trench Characteristics - Block H	

Equation 4.2: Maximum Allowable Infiltration Trench Depth (MOE SWMP Manual, 2003)

d = PT / 1000

P = Estimated Percolation Rate*	12	mm/hr
T = Drawdown time	48	hr
d = Maximum allowable depth	0.576	m

Equation 4.3: Infiltration Trench Bottom Area (MOE SWMP Manual, 2003)

A=1000 V / Pn t

A = Area to Infiltration Trench	200	sq.m
d = depth of runoff infiltrated	5	mm
V = Runoff Volume infiltrated	1.0	cu.m
P = Percolation Rate	12	mm/hr
n = Porosity of the Storage Media	0.4	
t = Retention time (24 to 48 hrs)	48	hours
A = Bottom area of trench required	4	sq.m
d = trench depth	0.5	m
L= trench length	28.0	m
W= trench width	0.75	m
A = Bottom area of trench provided	21.0	sq.m
V = trench volume	4.2	cu.m

Project Nam 640 Liverpool Road	Prepared By: HL
Project No.: E21030	Checked By: SS
Subject: Infiltration Trench Characteristics - Block I	

Equation 4.2: Maximum Allowable Infiltration Trench Depth (MOE SWMP Manual, 2003)

d = PT / 1000

P = Estimated Percolation Rate*	12	mm/hr
T = Drawdown time	48	hr
d = Maximum allowable depth	0.576	m

Equation 4.3: Infiltration Trench Bottom Area (MOE SWMP Manual, 2003)

A=1000 V / Pn t

A = Area to Infiltration Trench	200	sq.m
d = depth of runoff infiltrated	5	mm
V = Runoff Volume infiltrated	1.0	cu.m
P = Percolation Rate	12	mm/hr
n = Porosity of the Storage Media	0.4	
t = Retention time (24 to 48 hrs)	48	hours
A = Bottom area of trench required	4	sq.m
d = trench depth	0.5	m
L= trench length	28.0	m
W= trench width	0.75	m
A = Bottom area of trench provided	21.0	sq.m
V = trench volume	4.2	cu.m

Project Nam 640 Liverpool Road	Prepared By: HL
Project No.: E21030	Checked By: SS
Subject: Infiltration Trench Characteristics - Block J	

Equation 4.2: Maximum Allowable Infiltration Trench Depth (MOE SWMP Manual, 2003)

d = PT / 1000

P = Estimated Percolation Rate*	12	mm/hr
T = Drawdown time	48	hr
d = Maximum allowable depth	0.576	m

Equation 4.3: Infiltration Trench Bottom Area (MOE SWMP Manual, 2003)

A=1000 V / Pn t

A = Area to Infiltration Trench	185	sq.m
d = depth of runoff infiltrated	5	mm
V = Runoff Volume infiltrated	0.9	cu.m
P = Percolation Rate	12	mm/hr
n = Porosity of the Storage Media	0.4	
t = Retention time (24 to 48 hrs)	48	hours
A = Bottom area of trench required	4	sq.m
d = trench depth	0.5	m
L= trench length	26.0	m
W= trench width	0.80	m
A = Bottom area of trench provided	20.8	sq.m
V = trench volume	4.2	cu.m