Cadillac Fairview

East Harbour Development

Master Stormwater Management Report

April 26, 2021

Confidential

East Harbour Development

Master Stormwater Management Report

Cadillac Fairview

Plan of Subdivision Application

Project No.: 20M-00294-00
Date: April 2021

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Revision History

ISSUE/REVISION	FIRST ISSUE	REVISION 1	REVISION 2	REVISION 3	REVISION 4	REVISION 5
Remarks						
Date	December 2016	October 2017	January 2018	March 2019	December 2020	January 2021
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Issue/revision	**Revision 6**					
Remarks						
Date	April 2021					
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1 INTRODUCTION

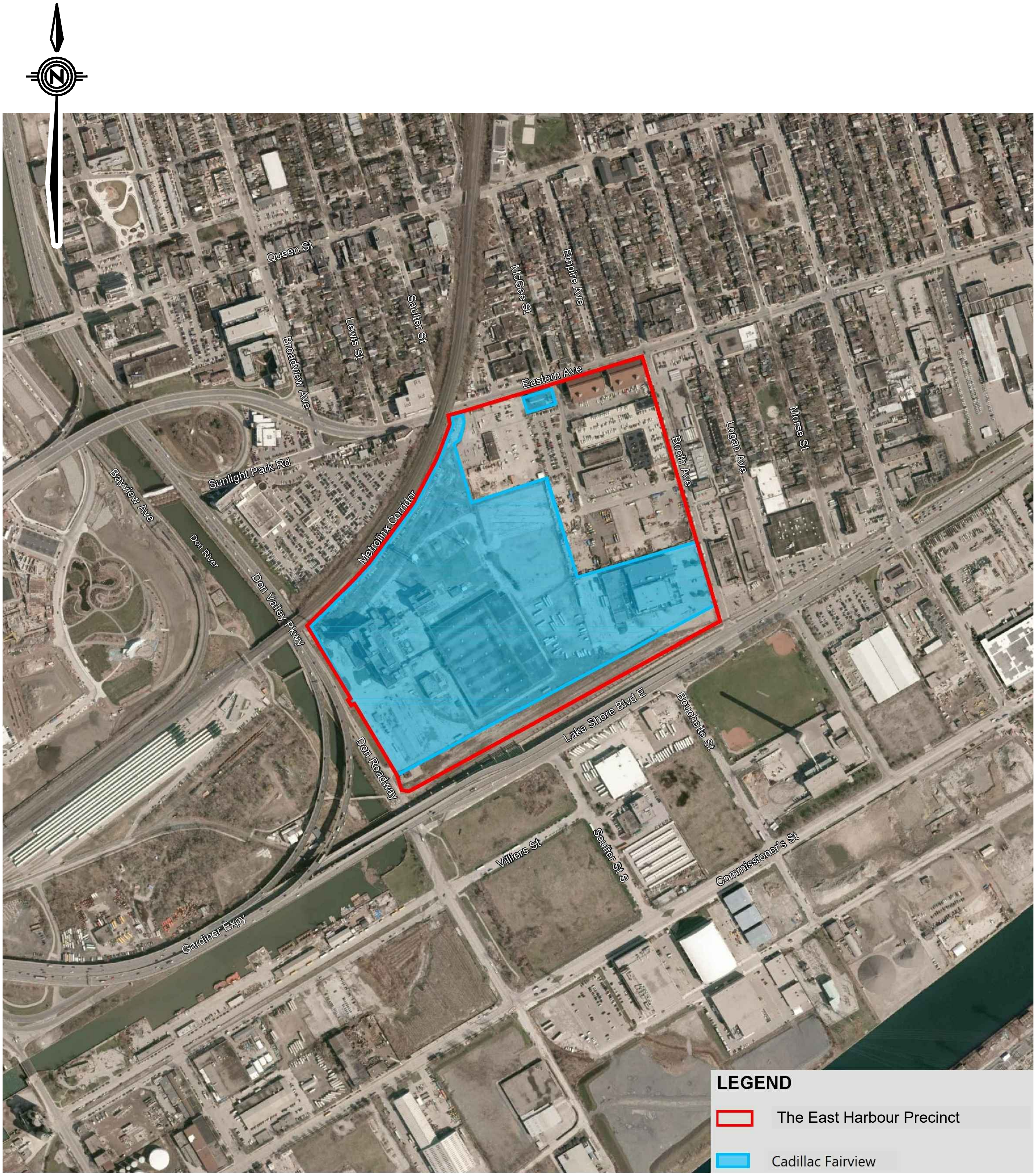
1.1 Scope

This Stormwater Management (SWM) report has been prepared by WSP Canada Inc. on behalf of Cadillac Fairview in support of a Draft Plan of Subdivision resubmission for East Harbour, the approximately 15-hectare site owned by Cadillac Fairview and located at 21 Don Roadway and 30 Booth Avenue in the City of Toronto. A resubmission of the Draft Plan application is being filed to advance the municipal planning and infrastructure approvals processes for the East Harbour lands. The resubmission responds to comments received from City staff and other agencies on the March 2019 Draft Plan submission, and also addresses changes to the master plan which are envisioned, including the integration of residential density into the East Harbour Lands to supplement the non-residential density currently permitted.

In 2016, applications were submitted for rezoning and subdivision approval on the lands within the East Harbour precinct. The applications for Official Plan Amendment and rezoning were approved in June and July 2018, respectively, and the Applicant subsequently submitted for Subdivision Application in 2019. Cadillac Fairview acquired the property subsequently, continuing the advancement of the Subdivision Approval process. Cadillac Fairview's lands are the subject site for this report; **Figure 1** identifies the two properties under ownership.

An updated Functional Servicing Report for the site has been prepared under separate cover. A Flood Study was also prepared by WSP and submitted to the City and the Toronto and Region Conservation Authority (TRCA) under separate cover in December 2017. The TRCA is currently undertaking updates to its flood modelling. The Flood Study is revised accordingly and is resubmitted under separate cover. If the flooding protection line is shifted back from the Don Roadway, there will be an additional area that will run off uncontrolled. However, as all of the storm drainage from the site will be re-directed to the east, there will still be a significant reduction in storm flows to the storm sewer on Don Roadway.

This report examines the potential water quality, quantity, and water balance impacts of the proposed development, and summarizes how each will be addressed in accordance with the City of Toronto’s Wet Weather Flow Management Guidelines (WWFMG).



2019.02.01 FIGURE 1 - Land Ownership Map.dwg - Land Ownership Plan X:\DIV15\2015\15032 - East Harbour\MUNI\SWM\Figures\2019.01 Figures\Figure 1\ Oct 23, 2020 - 3:52pm

CLIENT	Cadillac Fairview
TITLE	EAST HARBOUR LAND OWNERSHIP PLAN

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Date October, 2020	Proj. No. 20M–00294	
Scale N.T.S.	Figure No. 1	Gr.No. 000

1.2 Site Location

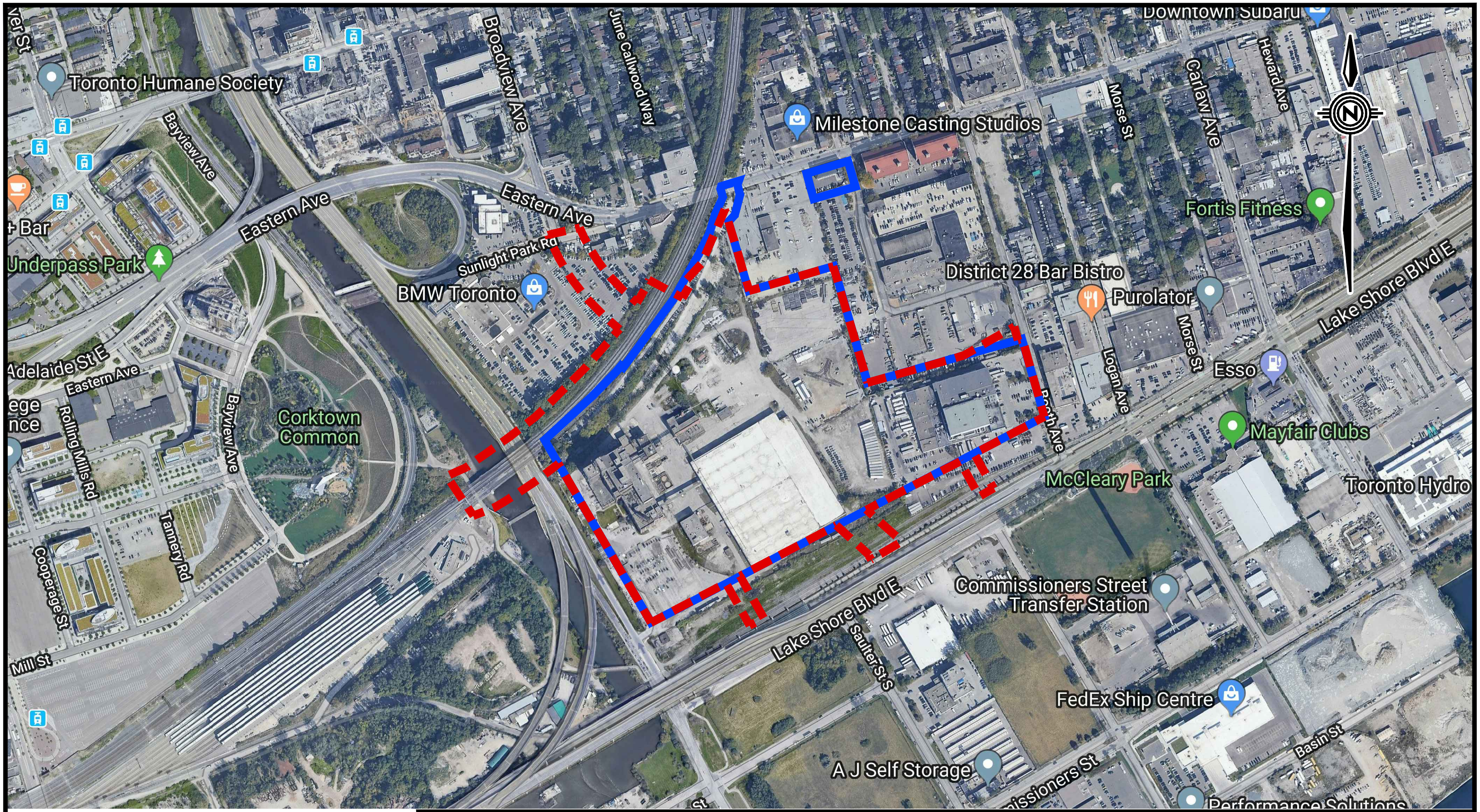
The proposed redevelopment subject site of 15.1 ha is located at the properties of 21 Don Roadway, 30 Booth Avenue, 375 Eastern Avenue and 385 Eastern Avenue in the City of Toronto. The Unilever Precinct is comprised of approximately 24.3 ha of area, bounded to the west by the Don Roadway, to the south by Lake Shore Boulevard East, Booth Avenue to the east, and to the north by Eastern Avenue. The Metrolinx rail corridor forms part of the northern boundary.

As consideration of adjacent lands is important and necessary for servicing and access to the subject site, an extended limit defined as the proposed catchment boundary (18.17 ha) is reflected in the overall stormwater management for the site. The catchment boundary as shown in **Figure 2** includes the following:

- 15.2 ha Subject site, Cadillac Fairview lands (property boundary)
- 2.97 ha Multi-modal transit hub (i.e. GO and Ext. GO) north of the subject site (slight overlap with property boundary)
- 0.42 ha representing external roadways (i.e. 16-U, 17-U and 18-U) connecting the subject site to Lake Shore Boulevard East and Booth Avenue
- 18.17 ha combined catchment boundary for areas relevant for stormwater management

The catchment boundary is assessed as part of this application since it relates to the stormwater management requirements. It should be noted that the catchment boundary is distinct from the ultimate condition of the East Harbour Precinct as shown in **Figure 1**.

2019.10.21 FIGURE 2 - Site Location.dwg Figure 2 - Site Location X:\DIV15\2015\15032 - East Harbour\MUN\SWM\Figures\2019.01 Figures\Figure 2\ Oct 23, 2020 - 3:45pm



@2019 Google Image @2019 First Base Solutions @2019 Tele Atlas

LEGEND

PROPERTY BOUNDARY

CATCHMENT BOUNDARY

0 100 200 300 400m

CLIENT

Cadillac Fairview

TITLE

EAST HARBOUR

SITE LOCATION

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Date October. 2020	Proj. No. 20M-00294
Scale AS SHOWN	Figure No. 2 — Gr.No. 000

1.3 Stormwater Management Plan Objectives

The objectives of the stormwater management plan are as follows:

- Determine site specific stormwater management requirements to ensure that the development project is in conformance with the 'Wet Weather Flow Management Guidelines' (WWFMG) and the Toronto Green Standards (TGS) issued by the City of Toronto
- Evaluate various stormwater management practices that meet the requirements of the City and recommend a preferred strategy
- Prepare a stormwater management report demonstrating a suitable strategy along with the technical information necessary for the preliminary sizing of the proposed stormwater management practices.

1.4 Design Criteria

The City of Toronto has issued the Wet Weather Flow Management Guidelines (WWFMG).

A summary of the stormwater management criteria applicable to this project follows:

- **Water Balance** – The WWFMG requirement is to 'retain stormwater on-site, to the extent practicable, to achieve the same level of annual volume of overland runoff allowable from the development site under pre-development conditions. According to the guidelines, if the allowable annual runoff volume from the development site under post-development conditions is less than the pre-development conditions, the maximum allowable annual runoff is 50% of the total average annual rainfall depth. Typically, the minimum on-site runoff detention will require the site to retain all runoff from a 5 mm storm event through infiltration, evapotranspiration or rainwater reuse. As the proposed development is targeting a high level of sustainability, the feasibility of a 15 mm retention up to a 25 mm retention will be assessed under this application, with the 5 mm retention reserved as the minimum target baseline.
- **Water Quality** – Under the WWFMG, the site is required to provide a long-term removal of 80% of total suspended solids (TSS) on an average annual basis. Water discharged to the municipal storm sewers is in compliance with all city bylaws, including by City of Toronto *Municipal By-Law 681*.
- **Erosion Control** – As indicated in the WWFMG, for large new developments >5.0 ha, within 100 m of a natural watercourse, erosion control criteria would typically be determined by a separate Erosion Analysis Report.

- **Water Quantity Control and Discharge to Municipal Infrastructure** – Runoff from the 2-year to 100-year design storms must not exceed the peak runoff rate from the site under pre-development conditions. The allowable release rate to the municipal storm sewer system from the development site is the 2-year pre-development flow rate based on a maximum runoff coefficient value of 0.50, or the existing capacity of the receiving storm sewer, whichever is less.

1.5 Relevant Background Studies

While the proposed development lies within the Regional floodplain, the *Don Mouth Naturalization and Port Lands Flood Protection Project (DMNP Project) Environmental Assessment (EA)* provides an opportunity for development in this area by contracting the current floodplain limits impacting the site. A new Flood Protection Landform in accordance with *DMNP Project EA* is proposed along the western limits of the site to ensure the protected land be removed from the Regulatory floodplain. Proposed grading will redirect the existing overland flow that is currently directed to the Don River (westward) south-east to an existing 1950 mm x 1225 mm twin culvert trunk sewer (eastward) located at the intersection of Lake Shore Boulevard East and Morse Street.

The proposed site development will require connections to municipal storm sewers at Lake Shore Boulevard East and Booth Avenue via new roadways (Broadview Avenue and East Harbour Boulevard). All stormwater from the site will be directed southeast to the existing trunk storm sewer at the intersection of Lake Shore Boulevard East and Morse Street. Existing drainage conditions at the Metrolinx rail corridor will be altered by the proposed multi modal transit hub in the general location of the proposed extension of Broadview Avenue (Street A), introducing external flows to the property that must be controlled and conveyed. Please refer to Figure 5.1 of the WSP Functional Servicing Report (FSR) for detail.

The TRCA is currently undertaking an EA for an alternate flood protection scenario for Broadview Avenue and Eastern Avenue. This EA is known as the Broadview and Eastern Flood Protection Municipal Class (“Broadview and Eastern”) EA. This EA will include assessing the provision of flood protection along the western limit of the BMW site on the lands generally known as 9 - 20 Sunlight Park Road, similar to what will be implemented on the East Harbour site. This scenario will also remove the 9 - 20 Sunlight Park Road lands from the floodplain for future development potential. Close coordination between the City of Toronto, TRCA, and East Harbour landowners is required to ensure consistency of assumptions between ongoing planning and EA work. Key considerations will include timing, phasing, built form considerations, including the desire to achieve transit-supportive development and implement the City's policy objectives within East Harbour.

2 PRE-DEVELOPMENT CONDITIONS

2.1 General

The 18.17 ha proposed catchment boundary is currently comprised of industrial and commercial buildings with individual parking lots, private driveways, rail tracks and minimal soft landscaped areas. Due to the significant portion of impervious areas under the existing conditions, the maximum runoff coefficient is limited to 0.50 as per the WWMFG. Access to the site is provided by the Don Roadway, Booth Avenue and Eastern Avenue through adjacent lands. Stormwater runoff is directed southerly towards Lake Shore Boulevard East through the adjacent lands, to the west via an outlet to the Don River and easterly, towards an existing trunk sewer via the storm sewers along Booth Avenue and Lake Shore Boulevard East. The existing conditions of the site are shown in **Figure 3**.

2.2 Rainfall Information

The rainfall intensity for the site was calculated using the following equation: $I = AT^C$

Where;

I = rainfall intensity in mm/hour

T = time of concentration in hours

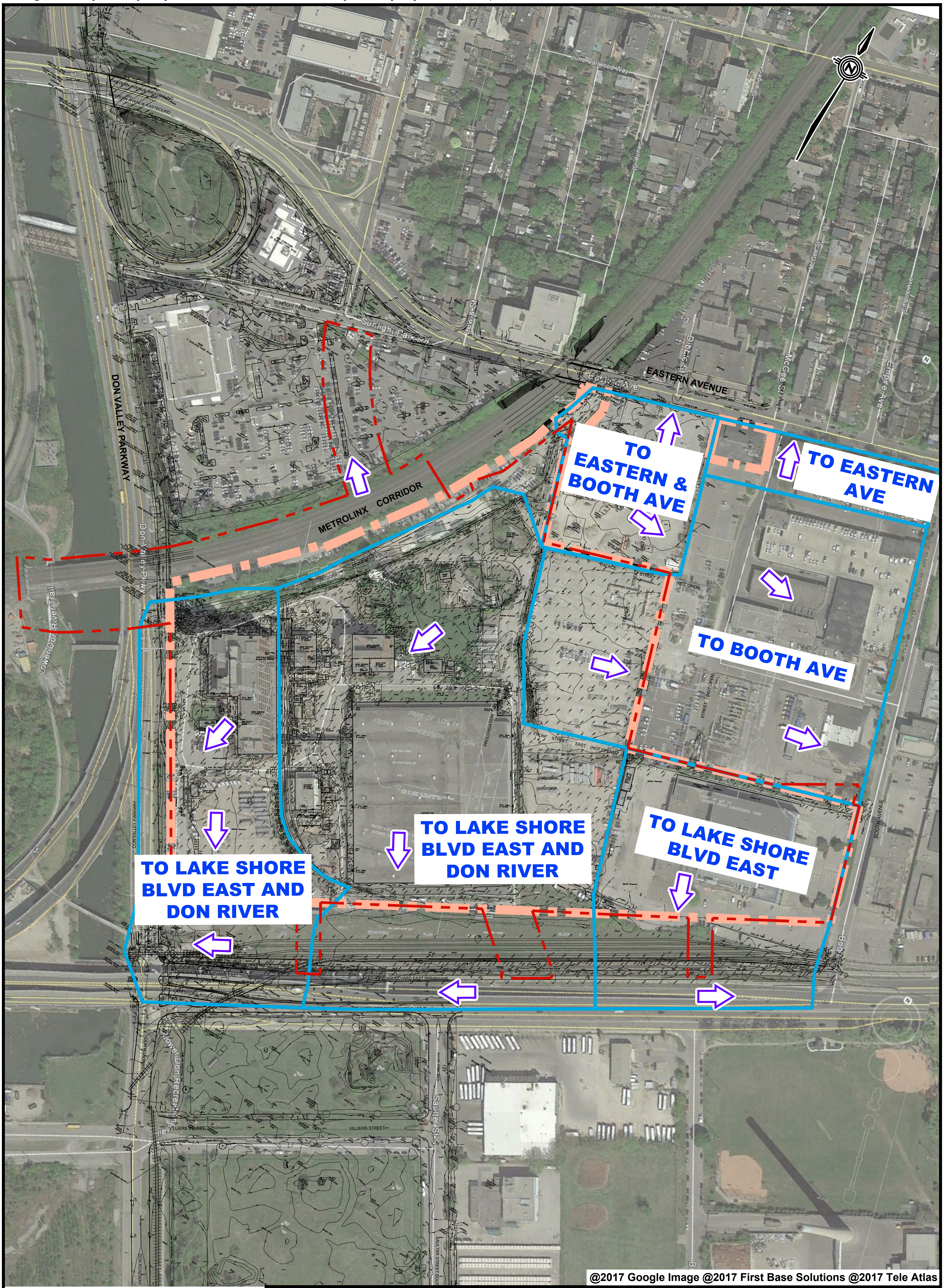
A and C = constant parameters (see below)

The parameters (A, C) recommended for use by the City of Toronto (as per Section 3.1 of the Wet Weather Flow Management Guidelines) are summarized in **Table 1**.

Table 1: Rainfall Parameters

Return Period (Years)	2	5	10	25	50	100
A	21.8	32.0	38.7	45.2	53.5	59.7
C	-0.78	-0.79	-0.80	-0.80	-0.80	-0.80

An initial time of concentration, TC, of 10 minutes (or 0.167 hours) is recommended in the WWFMG document for sites <2.0 ha in size. Areas greater than 2.0 ha are evaluated on a case by case basis to determine the appropriate and most conservative time of concentration.



LEGEND

- PROPERTY BOUNDARY
- PROPOSED CATCHMENT BOUNDARY
- EXISTING DRAINAGE AREA BOUNDARIES
- DRAINAGE DIRECTION

0 50 100 150m

CLIENT	Cadillac Fairview
TITLE	EAST HARBOUR EXISTING CONDITIONS

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Checked: A.M.B.	Drawn: R.J.
Date: October 2020	Proj. No.: 20M–00294
Scale: AS SHOWN	Figure No.: 3
	Gr.No.: 000

2.3 Allowable Flow Rates

2.3.1 Allowable Discharge Rates to Municipal Infrastructure

Due to the large-scale nature of the project and proposed works by both internal and external interest holders, the existing local drainage plan and sewershed of the development limits will greatly differ under proposed conditions.

To adhere to the intent of the WWFMG, post-development flow rates will be controlled to the 2- year pre-development flow rate based on a runoff coefficient of 0.5. Stormwater controls shall be proposed for the development blocks (i.e.1-C, 2, 3, 4, 7, 10, 20, 5-C, 5-U, Go and 1-U) and road blocks (17 and Ext.17-U, 14-U, 14-C1 to C3). Where necessary, the development blocks will be over-controlled to compensate for shortfalls of the quantity control requirements within the private roads and external roads (development blocks connection roads, 16-U and 18-U).

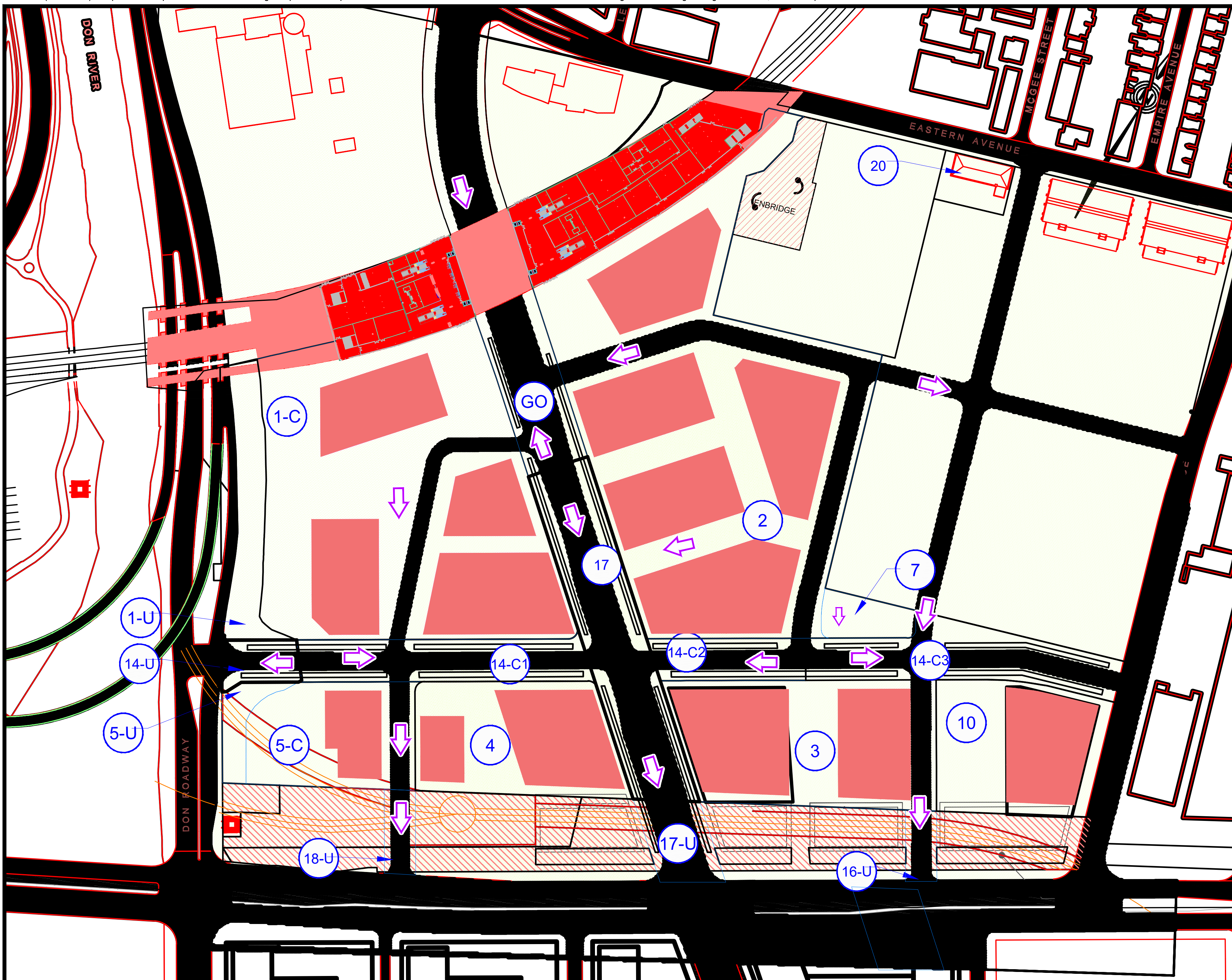
Proposed storm sewers will be sized to convey controlled outflows from the site. A Functional Servicing Report for this development has been prepared under a separate cover. It identifies the existing external storm sewers to be upsized under which the site will operate within the City's Design Criteria for Sewers and Watermains. Allowable release rate calculations are based on the Rational Method. The allowable pre-development peak flow rate for the 2-year storm event for all catchments part of the total catchment boundary are summarized in **Table 2**. Catchments are further discretized into Sub-Catchments (development and municipal ROW) as presented in - **Figure 4**. Detailed calculations are provided in **Appendix A**.

Table 2: Summary of Allowable Release Rates

Catchment	Sub-Catchment	Type	Area (ha)	Release Rate (L/s)
1	1-C	Controlled Development Block 1-C	3.26	332
	Portion of Street D (Connection Road)	Uncontrolled Connection Road	0.13	83
	Total		**3.39**	**415**
1-U	1-U	Controlled Block	**0.49**	**60**
2	2	Controlled Development Block 2	3.41	30
	Portion of Streets A& B (Connection Roads)	Uncontrolled Connection Roads	0.77	480
	Total		**4.18**	**510**
3	3	Controlled Development Block 3	1.16	11
	Ext.16-U and portion of Streets C (connection road)	Uncontrolled Connection Roads and Ext.16-U	0.26	162.9
	Total		**1.42**	**173.9**
4	4	Controlled Development Block 4	0.78	24
	Ext.18-U	Uncontrolled Ext.18-U	0.14	89
	Total		**0.92**	**113**
5	5-C	Controlled Development Block 5-C	0.70	32
	Ext.18-U	Uncontrolled Ext.18-U	0.108	67.7
	Total		**0.81**	**99.7**
5-U	5-U	Controlled Development Block 5-U	**0.13**	**15.5**
7	7	Controlled Development Block 7	**0.15**	**18.3**
10	10	Controlled Development Block 10	0.84	70
	Some portion of Street C and connection roads	Uncontrolled Connection Roads	0.067	41.9
	Total		**0.91**	**111.9**
20	20	Controlled Development Block 20	**0.146**	**17.9**
14-U	14-U	Controlled Road Block 14-U	**0.14**	**17**
14-C1	14-C1	Controlled Road Block 14-C1	**0.5**	**61.5**
17	17	Controlled Road Block 17	0.91	110
	17-U	Controlled Ext. Road Block 17-U	0.22	28
	Total		**1.13**	**138**
14-C2	14-C2	Controlled Road Block 14-C2	**0.26**	**32.3**
14-C3	14-C3	Controlled Road Block 14-C3	**0.63**	**76.7**
GO	GO	Controlled GO Block	0.49	86
	Ext. GO	Controlled Ext. GO Block	2.48	278
	Total		**2.97**	**364**

* allowable release rates based on area, C=0.50 and t_c = 10 minutes

FIGURE 4 (2021.01.08) - Proposed Development - First Gulf Lands.dwg - Proposed Development - First Gulf Lands X:\DIV15\2015\15032 - East Harbour\MUN\SWM\Figures\2019.01 Figures\Figure 4\ Jan 08, 2021 - 3:38pm



Catchment	Sub-Catchment	Type	Area (ha)	Composite Runoff Coefficient, C
1	1-C	Development	3.39	0.84
	1-U	Development	0.49	0.65
2	2	Development	4.18	0.82
3	3	Development	1.42	0.82
4	4	Development	0.92	0.81
5	5-C	Development	0.70	0.86
	5-U	Development	0.13	0.90
7	7	Development	0.15	0.25
10	10	Development	0.91	0.85
20	20	Development	0.146	0.84
14-U	14-U	ROW	0.14	0.72
100	14-C1	ROW	0.50	0.72
	17	ROW	1.13	0.84
200	14-C2	ROW	0.26	0.63
	14-C3	ROW	0.63	0.79
300	16-U	External Laneway	0.09	0.90
	18-U	External ROW	0.11	0.90
400	GO	ROW	0.49	0.74
	GO EXT.	External ROW	2.48	0.83
Total		-	18.17	-

LEGEND

PROPERTY BOUNDARY
CATCHMENT BOUNDARY
SUB-BLOCK BOUNDARIES
DRAINAGE DIRECTION
18-U SUB-CATCHMENT LABEL

0 50 100 150m

CLIENT
Cadillac Fairview

TITLE
EAST HARBOUR

PROPOSED CATCHMENTS

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Checked A.M.	Drawn R.J.
Date January, 2021	Proj. No. 20M-00294
Scale AS SHOWN	Figure No. 4 — Gr.No. 000

3 POST-DEVELOPMENT CONDITIONS

3.1 General

The proposed development will include a number of new buildings with a variety of uses including office, retail, residential, institutional, cultural and entertainment. The Cadillac Fairview lands are intended to be implemented in four phases. As discussed in Section 2.3, the development plan also includes new municipal roadways, with Broadview Avenue extended through the site from Eastern Avenue to Lake Shore Boulevard East, and East Harbour Boulevard will be extended through the site from Don Roadway to Booth Avenue. Note that an additional public roadway to support the broader East Harbour precinct is anticipated on what is primarily City-owned land, west of and parallel to Booth Avenue in the ultimate build out condition of East Harbour Precinct; Please refer to **Figure 4** for details.

The Broadview Avenue extension will extend under the existing Metrolinx rail corridor. A multi-modal transit hub is planned generally in the location of the Broadview Avenue extension and the rail corridor. This hub will support the planned employment density, as well as other uses in and around East Harbour. The density and configuration of the Site is planned to leverage and respond to the transit hub, and to maximize access to transit and active transportation. The multi-modal transit hub is identified as the "*GO*" catchment in **Figure 4**. The proposed underpass of Broadview Avenue Extension under the Metrolinx rail corridor will create a low point that cannot be drained by gravity. As such, storm flows from this localized area (catchment 17) will be collected and pumped to the proposed storm sewer on the Broadview Avenue Extension north of East Harbour Boulevard. Refer to Figure 5.1 for the Storm Servicing Plan in the FSR. The proposed development plan will also include a series of internal private driveways to service the proposed buildings.

The proposed development site condition including the development and municipal ROW catchments are shown in **Figure 4**. A runoff coefficient of 0.90 is used for proposed impervious rooftops, surface driveway and all other at-grade impervious surfaces for the site. Runoff coefficients of 0.25 and 0.45 are specified for soft landscaping and green roofs respectively. **Table 3** summarize the average runoff coefficient of each Sub-Catchment based on land use. Detailed land use breakdown for the Catchments are provided in Appendix A.

Table 3: Rational Method Parameters - Post Development Conditions

Catchment	Sub-Catchment	Type	Area (ha)	Composite Runoff Coefficient, C
1	1-C	Development	3.39	0.84
	1-U	Development	0.49	0.65
2	2	Development	4.18	0.82
3	3	Development	1.42	0.82
4	4	Development	0.92	0.81
5	5-C	Development	0.70	0.86
	5-U	Development	0.13	0.90
7	7	Development	0.15	0.25
10	10	Development	0.91	0.85
20	20	Development	0.146	0.84
14-U	14-U	ROW	0.14	0.72
100	14-C1	ROW	0.50	0.72
	17	ROW	1.13	0.84
200	14-C2	ROW	0.26	0.63
	14-C3	ROW	0.63	0.79
300	16-U	External Laneway	0.09	0.90
	18-U	External ROW	0.11	0.90
400	GO	ROW	0.49	0.74
	GO EXT.	External ROW	2.48	0.83
Total		-	**18.17**	-

3.2 Water Balance

As noted in Section 1.4, the WWFMG states that the proponent should target the detention of 5 mm of stormwater runoff from all surfaces, in order to ensure 50% of the total average annual rainfall volume is retained on site to be drained within 72 hours. It is assumed that all landscaped areas will retain at least 5 mm of rainwater, and all impervious areas will typically accept 1 mm of rainfall prior to runoff generation due to shallow depression storage and wetting, with consequent evaporation. As the East Harbour site is targeting high level sustainability goals, rainwater retention targets ranging between 15 mm to 25 mm will be evaluated for the development blocks as well. The proposed strategies to meet water balance requirements within the development and road blocks are described below.

3.2.1 Development Blocks

The proposed development would increase the site imperviousness by converting pervious surface to impervious surface, resulting in less infiltration, less evaporation, and increased stormwater runoff from the site. To meet water balance requirements, runoff generated from the development blocks will be discharged into the water balance underground storage tanks. Water balance sumps in tank storage for reuse will be primary mechanism to address water balance requirements in the development blocks. Non-potable water can be utilized for applications such as toilet flushing, cleaning, irrigation or rooftop misters.

Transit Hub drainage is being assessed in the proposed stormwater design. Capturing runoff ranging between 5 mm to 25 mm of rainfall on all surfaces is problematic thus, Green infrastructure (GI) and Low Impact Development (LID) elements shall be proposed onsite as well. Although, infiltration is not a feasible mechanism for managing significant water balance volumes within the development blocks due to the large underground parking garages underlying the majority of development blocks, LID units such as permeable pavement, green roof, bioswale and 300 mm layer of absorbent topsoil can be used where there are opportunities to implement. It should be noted that these aspects will be developed in conjunction with the project Landscape Architect.

To meet water balance requirements within the development blocks, the appropriate LID units are described further in the following subsections. Specific design details will be provided at a detailed design stage.

Green roofs:

Green roofs, function very much like trees, with a living landscape system that intercepts rainfall on building rooftops before it can reach the ground. Water that normally runs off the roof and is conveyed directly into a piped stormwater system is absorbed by soil and plants on the roof, evaporates, or is collected below the soil media and drained into downspouts. Any discharged water is greatly reduced in volume and pollutant load.

There are two classifications of green roofs: intensive and extensive. Extensive green roofs are light-weight, allow for 0.10-0.15 meters of soil coverage, and usually support only grass-like plants and sedum species. Intensive green roofs allow for greater soil volumes and wider variety of plant species including shrubs and even some tree species. Green roofs can retain 10mm of the rainfall event which is based on the results of a research paper titled Green Roofs for Stormwater Runoff Control, undertaken on behalf of the United States Environmental Protection Agency (ref. EPA/600/R;09/026 – February 2009). This study concluded that, although detention characteristics of green roofs vary seasonally and are dependent on recent weather conditions, they “effectively retained 10 mm regardless of season”.

According to Toronto Green Roof By-law, 60% of the proposed building rooftop areas must be built as green roof. Building footprints presented in **Figure 4** are preliminary and may be intersected with additional walkways. Therefore, Green roof foot print areas are assumed to be 30% of the total rooftop area in the water balance calculations.

Absorbent topsoil:
All soft landscaping surfaces within the development blocks can be underlain by a 300 mm depth of absorbent topsoil that will abstract a minimum of 25 mm of rainfall depth. Reference to absorbent topsoil can be found in **Appendix C**. The location of the development blocks soft landscaping surfaces will be determined at a detailed design stage.

Permeable pavements:
Permeable pavements may be installed within the walkways and private road's sidewalks of the development blocks with coordination from the City and consistent with Toronto's Green Streets Technical Guide. Permeable paving can be designed to receive runoff from adjacent impervious surfaces as well. However, landscaped areas should drain away from permeable paving to prevent sediment from poor vegetation cover areas from running onto the surface. In general, the impervious area should not exceed 1.2 times the area of the permeable pavement which receives the runoff. Permeable pavements allow rain water to pass through their surface. The permeable pavement surface acts as pre-treatment element to the stone reservoir below. Another pre-treatment element is a pea gravel choking layer above the coarse gravel storage reservoir. The total thickness of the reservoir layer is determined by runoff storage needed for water balance and water quality controls. Where the native soil infiltration rate is less than 15mm/hr, permeable pavements are often designed for partial infiltration. Thus, a perforated pipe should be placed within the granular stone reservoir to convey the stormwater that is not infiltrated. The perforated pipes are connected to the control catchbasins via underdrain pipes. Orifice plates control underdrain pipe release rates prior to discharging into the storm sewers. The location of permeable pavements will be determined at a detailed design stage.

3.2.2 Road Blocks

For the municipal ROW catchments, passive irrigation through permeable pavements and absorbent topsoil (or approved equivalent) within the boulevards can be the proposed water balance strategy. The Permeable pavements allow stormwater to percolate through into a sub-surface stone void reservoir, after which it is infiltrated into the underlying native soil.
Table 4 summarizes the required water balance storage volumes for a 5 mm, 15 mm, and 25 mm detention for development blocks and road blocks, although it is expected the municipal ROWs would not exceed 5mm retention and the development blocks would have a key role in order to make up the runoff control on site. Detailed calculations are provided in **Appendix** A.
Water demands for irrigation and available water balance storage volumes within the LID units will be determined at the detailed design stage.

Table 4: Summary of Water Balance Storage Requirements

Catchment	Sub-Catchment	Type	Water Balance Storage (m^3) 5 mm	15 mm	25 mm
1	1-C	Development	98.6	437	776
	1-U	Development	19.6	68.9	117.6
2	2	Development	143.1	530.8	948.3
3	3	Development	43.9	165	298
4	4	Development	30.7	115.2	207.3
5	5-C	Development	25.8	93.2	163.3
	5-U	Development	5.1	17.7	30.4
7	7	Development	6.0	20.9	35.9
10	10	Development	32	117.7	208.8
20	20	Development	5.0	18.8	33.4
14-U	14-U	ROW	4.0	14.0	24
100	14-C1	ROW	14.6	51.2	87.8
	17	ROW	40	140.2	240.3
200	14-C2	ROW	6.1	21.3	36.5
	14-C3	ROW	20.7	72.4	124.1
300	16-U	External Laneway	4	13	22
	18-U	External ROW	4.3	15.1	25.9
400	GO	External-ROW	93.6	327.6	561
Total		-	**597**	**2,240**	**3,941**

3.3 Water Quality Control

Green and impervious roof areas are considered clean for the purpose of water quality. Internal drainage systems for the development catchments will be designed such that rooftop drainage will connect directly to the cistern for all proposed buildings.

At-grade areas including vehicular surfaces such as the private driveways will be treated to the full 80% TSS removal rate for each development catchment as per the WWFMG criteria. Treatment for uncontrolled external laneways, as shown in **Figure 4,** will be addressed through separate development applications of the East Harbour Precinct. Therefore, no treatment is proposed for the uncontrolled catchments for this application. To meet the water quality requirements for the development catchments, Jellyfish media filtration units in an offline configuration, or an approved equivalent, are proposed to be installed immediately upstream of all individual proposed storage tanks. Water quality unit sizing should be optimized by treating only the contributing at-grade drainage of each catchment while clean rooftop runoff bypasses the individual treatment units and is conveyed directly to their respective cisterns.

This strategy will ensure that water quality measures for the proposed development are met. **Table 5** summarizes the proposed water quality treatment unit for each development catchment and the external multi modal transit hub (GO). OGS units' sizing reports and additional information regarding Jellyfish media filtration units can be found in **Appendix B**.

Table 5: Summary of Water Quality Treatment Units Development Catchments

Catchment	Sub-Catchment	Type	Total At-Grade (ha)	Water Quality Treatment Runoff Coefficient*	% Impervious	Treatment Unit***
1	1-C	Development	1.89	0.90	92%	Jellyfish Unit
	1-U	Development	0.28	0.90	100%	Jellyfish Unit
2	2	Development	1.42	0.90	100%	Jellyfish Unit
3	3	Development	0.39	0.90	100%	Jellyfish Unit
4	4	Development	0.27	0.90	100%	Jellyfish Unit
5	5-C	Development	0.51	0.90	100%	Jellyfish Unit
	5-U	Development	0.10	0.90	100%	Jellyfish Unit
7	7	Development	0.15	-	-	Not Required
10	10	Development	0.48	0.90	100%	Jellyfish Unit
20	20	Development	0.084	-	-	Not Required
14-U	14-U	ROW	0.05	0.90	100%	Permeable Pavements**
100	14-C1	ROW	0.17	0.90	100%	Permeable Pavements**
	17	ROW	1.12	0.90	100%	Permeable Pavements**
200	14-C2	ROW	0.05	0.90	100%	Permeable Pavements**
	14-C3	ROW	0.36	0.90	100%	Permeable Pavements**
300	16-U	External Laneway	0.09	0.90	100%	By Others
	18-U	External ROW	0.11	0.90	100%	By Others
400	GO	ROW	1.42	0.90	100%	Jellyfish Unit
Total		-	-	-	-	-

* Runoff Coefficient includes At-Grade areas only (excluding all rooftops)
** See Table 7 for summary of water quality treatment for the municipal ROW using Permeable Pavements or approved equivalent
***Jellyfish Unit means Jellyfish media filtration units in an offline configuration or an approved equivalent

There is also opportunity to forgo the need for water quality treatment units should a 25 mm water balance detention target be achieved, as capture and detention of the first 25 mm or “first flush” is the generally accepted rainfall depth for when most TSS (> 80%) is discharged from impervious surfaces. If this option is pursued, more rigorous maintenance schedules would be necessary to minimize excessive buildup of sediment in the underground storage units. The proposed water treatment strategy for the municipal ROW catchments is detention of the 25 mm for a minimum duration of 24 hours. This is achieved by utilizing the void space in the absorbent topsoil and permeable pavers to be installed in the sidewalks throughout the ROW for both Streets. ROW widths are taken from preliminary Plan and Sections for Broadview Avenue (Sub-Catchment 17) and East Harbour Boulevard (Sub-Catchment 14-U, 14-C1, 14-C2) as shown in **Figure 5**. Note that these cross sections reflect the January 2017 rezoning/subdivision approval application and that is expected that they will continue to be refined as the application advances. However, if the detention of 25 mm storm event in the ROW is not possible, water quality treatment units will be required. It should be noted that the proposed site will be a tributary to the future port lands SWM treatment system in terms of water quality control treatments.

There are several strategies to convey runoff from the ROW directly to the permeable pavers or approved equivalent for minor storm events that will be explored in detailed design. The preferred option at the master planning level would be to propose passive irrigation pipes connecting the catch basins to the top layer of the Permeable Pavements or approved equivalent, with overflow pipes set to allow for excess water to be redirected to the municipal storm sewer. In the topsoil a minimum depth of 300 mm for lawn is considered to abstract 25 mm of rainfall depth. This controlled storage would be added to the whole controlled storage by permeable pavements along the ROWs (in Green sections, **Figure 5**) with respect to water quality treatment.

Table 6 demonstrates there are adequate permeable pavements and absorbent topsoil proposed for water quality treatment of the municipal ROW catchments. Detailed calculations are provided in **Appendix A**.

Table 6: Summary of Water Quality Treatment for Municipal ROW Catchments

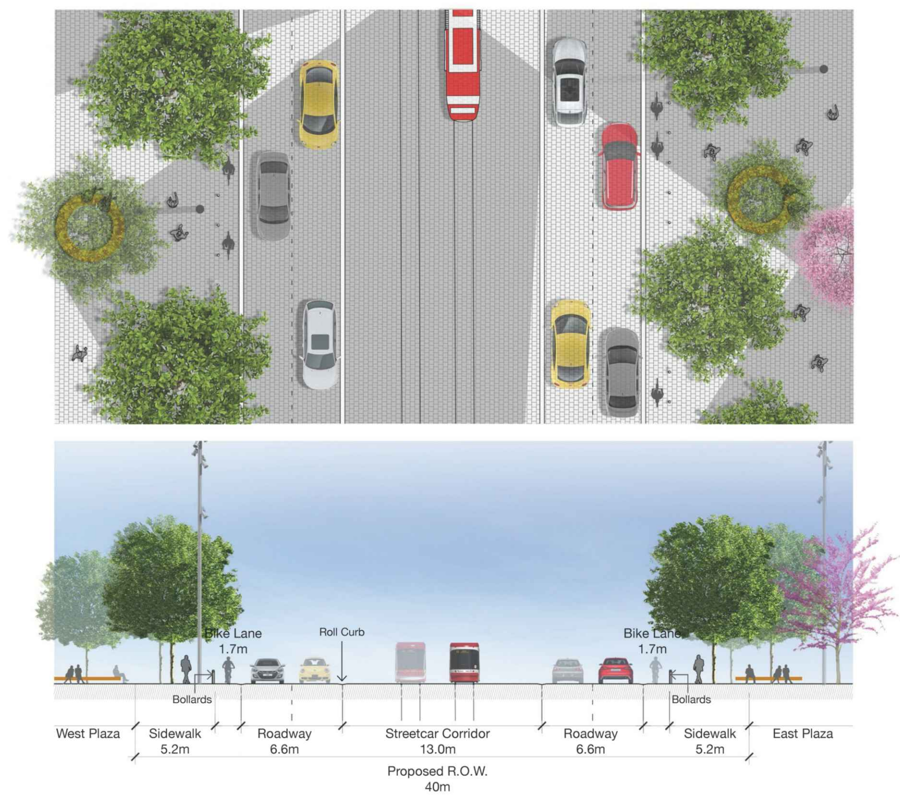
CATCHMENT	SUB-CATCHMENT	AREA (HA)	LID UNIT(S)	25 MM TREATMENT VOLUME (1) (M^3)	AVAILABLE PERMEABLE PAVEMENT VOID STORAGE(2) (M^3)	AVAILABLE VOLUME OF TOPSOIL STORAGE(3) (M^3)	TOTAL PROVIDED STORAGE VOLUME (M^3)	QUALITY CONTROL CRITERIA IS MET?Y/N
14-U	14-U	0.14	Permeable Paver	24	25	N/A	25	**Y**
100	14-C1	0.16	Permeable Paver	87	88	N/A	88	**Y**
	17	1.13	Permeable Paver and Topsoil	240.3	120	132.6	253	**Y**
200	14-C2	0.26	Permeable Paver	36.5	40	N/A	40	**Y**
	14-C3	0.63	Permeable Paver and Topsoil	124.1	90	136.8	227	**Y**
400	GO	2.97	Permeable Paver and Topsoil	561.6	200	370.5	571	**Y**

(1) Storage volume calculated by Sub-Catchment Area x 25 mm

(2) Permeable Pavement volume calculated by using effective length and width (multiples of a standard Permeable Paver dimension) for the sidewalks, depth of maximum 0.5 m

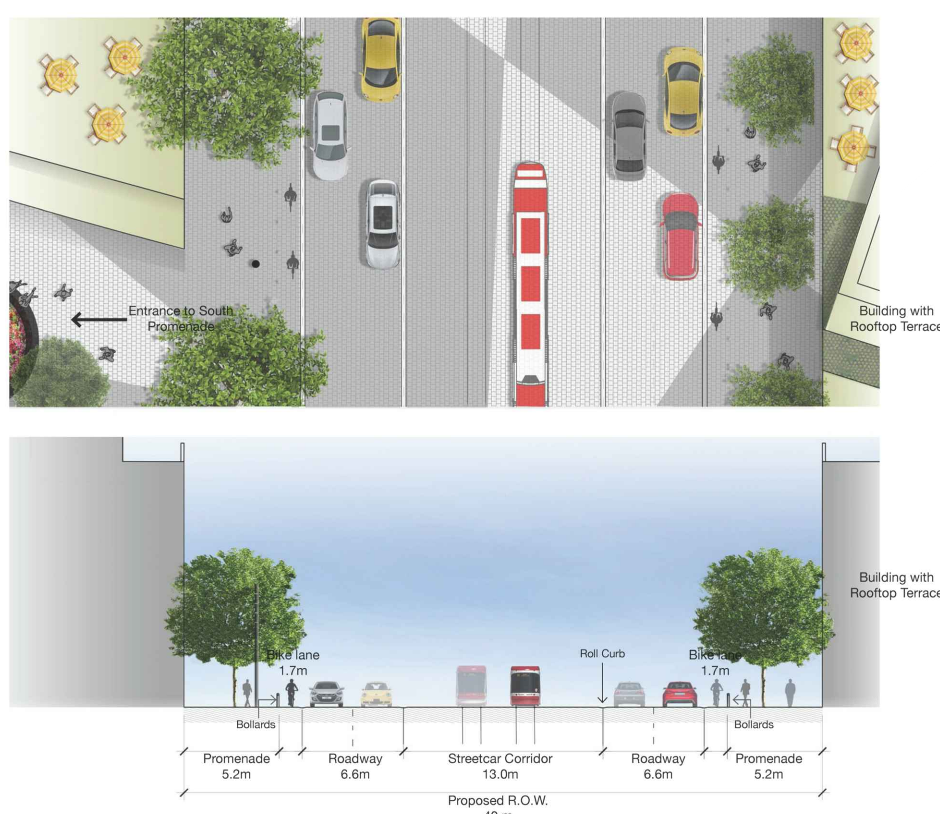
(3) Absorbent Topsoil volume calculated by using available length and width for the vegetated areas, depth of maximum 300 mm

(7) Total Provided storage volume = (2) + (3)



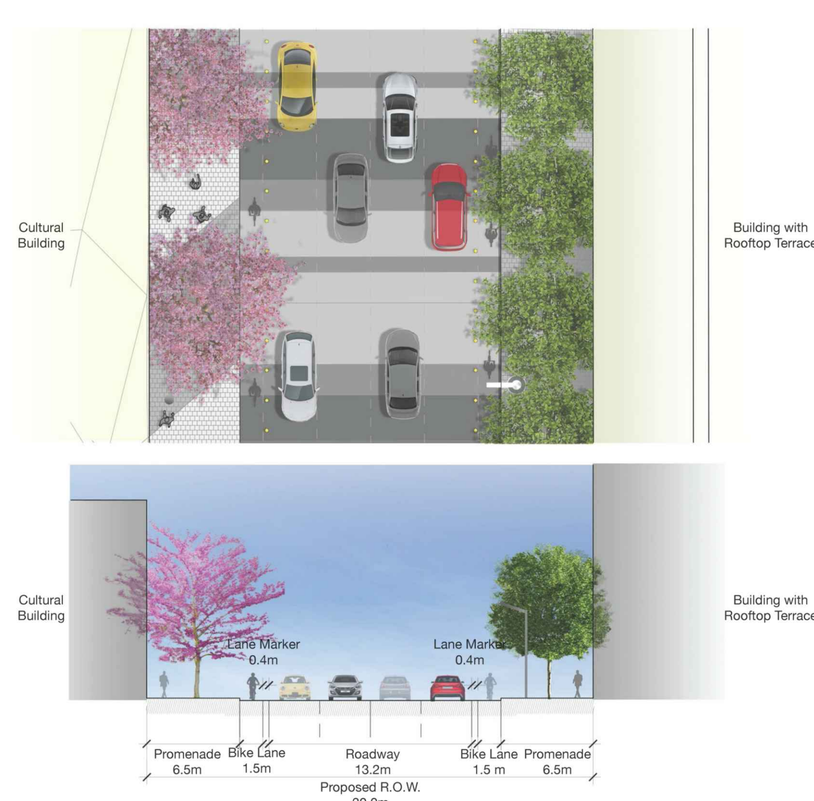
BROADVIEW AVE AT PLAZA

0 2 5 10m



BROADVIEW AVE SOUTH OF EAST HARBOUR

0 2 5 10m



EAST HARBOUR BLVD

0 2 5 10m

CLIENT

Cadillac Fairview

TITLE

EAST HARBOUR

MUNICIPAL RIGHT—OF—WAY
PLAN AND SECTIONS

Checked A.M.B.	Drawn R.J.
Date October, 2020	Proj. No. 20M—00294
Scale AS SHOWN	Figure No. 5
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3.4 Erosion Control

As mentioned in Section 1.4, this development is classified within Table 7 of the WWFMGs as a '*Large new developments > 5.0 ha, within 100 m of a natural watercourse'* or a '*Type 1 Development'*. As such, specific erosion control criteria would typically be determined by a separate Erosion Analysis Report (EAR), which uses existing conditions as a baseline to set targets for stormwater detention.

While the proposed development is adjacent to the Don River, under proposed condition there will be no discharge to the natural watercourse, as all stormwater will be diverted away from the Don River. Additionally, the minimum on-site detention of the 5 mm rainfall event will be achieved as per requirements by TRCA. Therefore, additional measures to address erosion control on a site-wide basis are therefore not recommended.

3.5 Water Quantity Control

As noted in Section 2.3, the allowable discharge rates to the municipal sewer system from the sites are listed in **Table 2**. These flow rates are equivalent to the peak runoff rate under pre-development conditions during a 2-year design storm event with a runoff coefficient of 0.50 based on contributing catchment areas.

The SWM strategies for each catchment include a number of elements which contribute to reduction in peak flow rates leaving the site. These include:

- Stormwater cisterns located in each of the underground parking garages to provide detention and control of runoff from impervious areas. The cistern outlets connection will be fitted with either an orifice tube or a flow control device to restrict discharge to the prescribed flow rates; and
- The use of a green roof and soft landscaping to reduce the volume (and rate) of runoff discharged from at-grade and the new roof building drainage system.

Other water quantity control strategies that would allow for reduced cistern sizes, such as roof top detention (ponding) or low impact development (LID) techniques, will be explored during detailed design.

The modified rational method is used to estimate the required active storage volumes for the proposed catchment boundaries for the 100-year storm event based on a time of concentration of 10 minutes. **Table 7** summarizes the required active storage volume for quantity control in each catchment. It should be noted that during the detailed design, the ultimate storage and potential over control on blocks per either of development units will be reviewed and optimized.

Table 7: Summary of Modified Rational Method Results

Catchment	Sub-Catchment	Type	Area (ha)	Allowable Release Rate (L/s)	Discharge Rate (L/s)	Required Water Quantity Control Storage Volume for 100-Year Event (m^3)
1	1-C	Development	3.39	331.9	331.9	1028
	1-U	Development	0.49	60	60	157
2	2	Development	4.18	510	510	880
3	3	Development	1.42	174	174	639
4	4	Development	0.92	113	113	340
5	5-C	Development	0.70	32	32	201
	5-U	Development	0.13	15.5	15.5	41
7	7	Development	0.15	18.3	18.3	48
10	10	Development	0.91	111.6	111.6	287
20	20	Development	0.146	18	18	43
14-U	14-U	ROW	0.14	17	17	32
100	14-C1	ROW	0.50	61.5	61.5	119
	17	ROW	1.13	138	138	331
200	14-C2	ROW	0.26	32	32	50
	14-C3	ROW	0.63	77	77	167
300	16-U	External Laneway	0.09	11	11	33
	18-U	External ROW	0.11	14	14	39
400	GO	ROW	2.97	364	364	900
Total		-	**18.17**	**1,988**	**1,988**	**6,256**

Broadview Avenue underpass is included in catchment 400 (GO) where runoff is proposed to be collected in a cistern for the 2-year through 100-year storm events. Due to grading constraints, flows will be pumped to the municipal storm sewer at the 2-year target release rate.

Underground storage tanks sized to provide sufficient storage for both water balance and water quantity control (100-year storm) purposes are proposed for all controlled development catchments. A sealed maintenance access and emergency overflow will be provided for each storage tank. **Tables 8, 9** and **10** summarize the required tank size to meet various water balance targets and active storage.

Table 8: Summary of Water Quantity Control Storage Volumes – 5 mm Detention

Catchment	Sub-Catchment	Type	Storage Volume Required (m^3) 5mm Water Balance (m^3)	Active Storage* (m^3)
1	1-C	Development	98.6	1,028
	1-U	Development	19.6	157
2	2	Development	143.1	880
3	3	Development	43.9	636
4	4	Development	30.7	340
5	5-C	Development	25.8	298
	5-U	Development	5.1	41
7	7	Development	6.0	48
10	10	Development	32	287
20	20	Development	5.0	43
14-U	14-U	ROW	4.0	32
100	14-C1	ROW	14.6	119
	17	ROW	40	331
200	14-C2	ROW	6.1	50
	14-C3	ROW	20.7	167
300	16-U	External Laneway	4	33
	18-U	External ROW	4.3	39
400	GO	ROW	93.6	900
Total			**597**	**5,429**

* First 5 mm of Water Balance storage is shared with Active Storage assumed to be reused prior to next major storm event

Table 9: S ummary of Water Quantity Control Storage Volumes – 15 mm Detention

Catchment	Sub-Catchment	Type	Storage Volume Required (m^3) 15 mm Water Balance (m^3)	Active Storage* (m^3)	Total Storage* (m^3)
1	1-C	Development	437	1,028	1,367
	1-U	Development	69	157	206
2	2	Development	531	880	1,267
3	3	Development	165	639	757
4	4	Development	115	340	425
5	5-C	Development	93	298	366
	5-U	Development	18	41	53
7	7	Development	21	48	63
10	10	Development	118	287	372
20	20	Development	19	43	57
14-U	14-U	ROW	14	32	42
100	14-C1	ROW	51	119	155
	17	ROW	211	331	511
200	14-C2	ROW	21	50	65
	14-C3	ROW	72	167	236
300	16-U	External Laneway	14	33	43
	18-U	External ROW	17	39	52
400	GO	ROW	328	900	1,134
Total			2314	5,429	7,172

* First 5 mm of Water Balance storage is shared with Active Storage assumed to be reused prior to next major storm event

Table 10: Summary of Water Quantity Control Storage Volumes – 25 mm Detention

Catchment	Sub-Catchment	Type	Storage Volume Required (m^3) 25 mm Water Balance (m^3)	Active Storage* (m^3)	Total Storage* (m^3)
1	1-C	Development	776	1028	1,705
	1-U	Development	117.6	157	255
2	2	Development	948.3	880	1,685
3	3	Development	298	639	890
4	4	Development	207.3	340	517
5	5-C	Development	163.3	298	436
	5-U	Development	30.4	41	66
7	7	Development	35.9	48	78
10	10	Development	208.8	287	463
20	20	Development	33.4	43	71
14-U	14-U	ROW	24.0	32	52
100	14-C1	ROW	87.8	119	192
	17	ROW	240.3	331	540
200	14-C2	ROW	36.5	50	80
	14-C3	ROW	124.1	167	287
300	16-U	External Laneway	22.0	33	51
	18-U	External ROW	25.9	39	61
400	GO	ROW	561	900	1,368
Total			**3941**	**5,429**	**8,798**

* First 5 mm of Water Balance storage is shared with active storage assumed to be reused prior to next major storm event

3.6 Groundwater Discharge

Hydrogeological Investigation for the Subject Site has been completed by Terraprobe Inc. and an updated report is currently being completed by Golder Associates. The analysis indicates that the groundwater levels onsite are approximately 76.3 m which is relatively shallow compared to surface grades (existing and proposed) and the proposed building structures. As such, there are several different options for addressing groundwater levels for the proposed development:

— The first option is a water tight design of the below grade structure so that groundwater collection and discharge are not required. It is expected that this is the approach that will be pursued;

- The second option is to outlet to the sanitary sewer system with a long-term groundwater discharge permit and associated on-going costs; and
- The third option is to outlet to the storm sewer system if water quality permits. Treatment of the groundwater to meet the municipal storm sewer requirements may be an option. A long-term groundwater discharge permit would also be required for an outlet to the storm sewer system. Under this scenario, it may be possible to over control the storm runoff from the site such that the total discharge to the storm sewer (storm runoff and groundwater) does not exceed the allowable release rate.

The hydrogeological report indicates that water quality exceeds the limits for a number of parameters for discharge to both the storm and sanitary/combined sewer systems. As such, treatment would likely be required in order to discharge groundwater to the City's sewer system. As noted above, it is expected that the buildings will be constructed water-tight below grade, such that permanent discharge to the City's sewer system would not be required.

As groundwater is not proposed to be released through the stormwater system, it will not impact the SWM design.

4 CONCLUSIONS

A Stormwater Management report has been prepared to support the redevelopment of East Harbour Development located at 21 Don Roadway in the City of Toronto based on the Wet Weather Flow Management Guidelines (WWFMG).

- **Water Balance** – Sump storage provided at the base of stormwater cisterns for each development catchment provides a supply of reuse water for application on site and ensures that the WWFMG Water Balance criteria are satisfied. Water balance targets ranging between 5 mm to 25 mm will be evaluated. Permeable Pavement and Absorbent Topsoil, or approved equivalent, are proposed for the municipal ROW catchments to capture rainfall for water detention to be reused as passive irrigation for the trees.

- **Water Quality –** All runoff from controlled at-grade surfaces will be treated by an appropriately sized water quality unit to meet the standards imposed by the Wet Weather Flow Management Guidelines. Runoff from rooftops is considered clean and will bypass the quality units to connect directly with the proposed tanks. Water quality will be achieved in the municipal ROW catchments by stormwater detention of the 25 mm storm. If the detention of the 25 mm storm event in the ROW is not possible, water quality units will be required.

- **Erosion Control –** The proposed development will no longer discharge to the adjacent natural watercourse, the minimum on-site detention of at least 5 mm will be achieved as per requirements by TRCA. Additional measures to address erosion control are therefore not recommended.

- **Water Quantity –** The use of controlled discharge for each catchment will ensure that the peak offsite discharge rate to municipal storm sewers will be below the allowable maximum rate defined in the WWFMG for all storms up to and including the 100-year event.

- **Groundwater Discharge -** A hydrogeological investigation indicated that the groundwater quality exceeds the limits for a number of parameters for discharge to both the storm and sanitary/combined sewer systems. It is expected that the buildings will be constructed water-tight below grade, such that permanent discharge to the City's sewer system would not be required. As groundwater is not proposed to be released through the stormwater system, it will not impact the SWM design.

The report has demonstrated that the proposed SWM strategy will address stormwater management related impacts from this project and meet the intent of the City of Toronto Wet Weather Flow Management Guidelines.