First Capital (Park Lawn) Corporation and 2253213 Ontario Limited

2150 Lake Shore

Stormwater Management Report

Issue 2 | February 26, 2021

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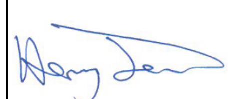
		Signature			
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Executive Summary

This report presents the preliminary stormwater management design strategy and provides technical results for the development of the 27.7 acre/ 11.2 hectare site located on the northeast corner of Park Lawn Road and Lake Shore Boulevard West, municipally known as 2150-2194 Lake Shore Boulevard West and 23 Park Lawn Road ("the site" or "2150 Lake Shore").

Arup has utilized existing infrastructure information, made available by the City of Toronto for the analysis of the existing storm drainage, stormwater management of the site and projected the impact of the proposed development on it. Stormwater management strategy described in this report has been formulated in accordance with City of Toronto's standards and guidelines. The proposed design methodology aims to meet the four general stormwater management criteria set out in the Wet Weather Flow Management guidelines; water balance, water quality, water quantity and erosion control.

The key design features of the Master Plan and findings of this study are as follows:

<u>Storm Servicing</u>

- There are three points of connection of the proposed stormwater network to the municipal network on Lake Shore Boulevard West and two points of connection along Park Lawn Road.
- 250mm and 375mm diameter existing storm sewers, along Lake Shore Bloulevard West are proposed to be upgraded to 450mm diameter and the existing 525mm storm sewer will be upgraded to 600mm diameter as a result of the additional flow being discharged into them from the proposed development.
- 300mm and 375mm diameter existing storm sewers along Park Lawn Road are proposed to be upgraded to 375mm and 450mm diameter respectively, as a result of the additional flow being discharged into them from Plot B and C. Refer to section 4.0 of the Functional Servicing Report for further details on the potential upgrades to the existing storm sewer network.

<u>Stormwater management plan</u>

- Water balance – The aspiration for water balance target for the proposed development is to retain 25mm of rainfall on site, per Tier-3 requirements of Toronto Green Standards. Water balance will be managed through green roofs and rainwater harvesting tanks within private property and soil cells, soakaway pit and geocellular storage structure within public right of way.

- Water Quality – Retaining 25mm on site as part of water balance requirements, ensures enhanced protection by 80% removal of total suspended solids from the runoff. Thus no separate measures are needed to meet water quality target.
- Water Quantity – Water quantity targets are met using underground detention tanks, orifice to control the discharage in to the downstream network. Dual system design also considered for drainage design of the proposed roads. Given the proximity of the proposed development to Lake Ontario, overland flow routes will be analysed for major flows discharging in to the Mimico creek outfall.
- Erosion and Sediment control – Similar to water quality requirements, separate erosion and sediment control measures are not required due to stringent water balance targets resulting in 80% removal of the total suspended solids from the site runoff.

Table of Contents

List of Tables:

List of Figures:

1 Introduction

1.1 Project Description

In October 2019, First Capital (Park Lawn) Corporation and 2253213 Ontario Limited ('the Owners') made an application for an Official Plan Amendment (OPA) in support of a proposed Master Plan for the redevelopment of the 27.7 acre / 11.2 hectare site located on the northeast corner of Park Lawn Road and Lake Shore Boulevard West, municipally known as 2150-2194 Lake Shore Boulevard West and 23 Park Lawn Road site ("the site" or "2150 Lake Shore"), as shown in Figure 1.

Figure 1 - Site Location

A ZBA, DPS submission and OPS resubmission was made in May 2020 for this project. The original Master Plan proposal envisioned a vibrant, mixed-use, transit-oriented redevelopment of the site. The Master Plan included a new Park Lawn GO Station, related TTC transit improvements, a fine-grained network of new streets and connections, a range of new open spaces including a new public park, and a diverse mix of residential, retail, service, entertainment and employment uses. At that time, the Master Plan contemplated a range of built form typologies including low, mid and high-rise buildings, fifteen towers ranging in height from 22 to 71 storeys.

The Master Plan for the site has further evolved, both in response to comments and suggestions from stakeholders, including City staff, and as a result of a more detailed review to support this combined Official Plan Amendament, and Draft Plan of subdivision application resubmission (the Application).

1.2 Existing Site Conditions

The site is historically known as the Mr. Christie Cookie Factory, which was closed in 2013 and demolished in 2017. It is currently empty land except for a Bank of Montreal building in the southwest corner (currently operational).

The existing topography is generally sloping east towards Lake Shore Boulevard West and south towards the Park Lawn Road and Lake Shore Boulevard West intersection.

1.3 Proposed Development

The proposed development contains several mix-use buildings (residential, institutional and retail), two schools, two public parks (1 hectare Community Park and 0.25 hectare Boulevard Square Park), several open spaces, a number of potential community facilities (daycares, library, community recreation centre, human agency), a new train station on the Lake Shore GO line, a Toronto Transit Comission) TTC streetcar loop, and a series of public and private roadways, as shown in Figure 2.

Figure 2 - Proposed Development Layout

1.4 Phasing Overview

The proposed phasing for the site is illustrated in Figure 3. With the completion of phases 1 & 2, public infrastructure such as the internal loop road for TTC street car, station square and Boulevard Square Park will be constructed. Installation of undergound utilities along the TTC right of way and upgrades along Lake Shore Boulevard West are planned in phase 2.

Figure 3 - Proposed Development Phasing

The sequence of construction of different phases will guide the the overall stormwater management design of the project site. The stormwater management strategy for each development plot will be discussed in detail at later stages.

1.5 Scope of Stormwater Management Report

The Stormwater Management Report examines the existing site drainage, proposed drainage conditions, and impacts to the surrounding existing infrastructure and overland flow routes.

This report has been prepared in support of the Zoning By-law Amendment (ZBA) and Draft Plan of Subdivision application, to satisfy the City of Toronto and approval agencies’s requirements by summarizing the stormwater management requirements of the site.

Information forming the basis of this report include:

- Record Drawings from City of Toronto

- Toronto Water Asset Group GIS files from City of Toronto
- Site Survey performed by EllisDon on 24 Feb 2020.

Objectives of the study

For the proposed Master Plan, the key objectives related to the management of stormwater are:

- Achieve an appropriate level of flood risk for the site and maintain or preferably reduce the risk of flooding to adjacent sites
- Meet Toronto Green Standard Tier 3 for Water Balance (25mm onsite retention) and Tier 1 for Water Quality (80% of total suspended solids removed from total average annual rainfalls).
- Adhere to the City of Toronto Green Roof Bylaw and incorporate this into the stormwater retention strategy
- Maximise the use of Green Infrastructure (GI) to reduce amount of stormwater runoff, enhance the quality of stormwater runoff and also maximise infiltration; and
- Conduct preliminary study to determine the capacity of the existing storm sewer, identify required upgrades and integrate with the existing City system

1.6 Proposed Site Condition

The study area will be redeveloped with a mixed use development with public amenities like Go Station, a TTC street car loop road and two public parks for recreation.

The blocks have large shared basements right up to the public right of way which limits the available areas for implementing sustainable urban drainage features, especially structures with underground storage and infiltration. The basement boundaries are shown in drawing LSB-ARP-XX-XX-DR-CD-60000 in Appendix C.

The residential area comprises of several mixed-use buildings with shared podium levels. The buildings will have green roof designed to retain 25mm of rainfall. The landscape area along the public ROW will be provided with soil cells to allow the infiltration of stormwater runoff into the soil.

2 Design Criteria

The stormwater management approach for new development site is driven by the relevant federal, provincial and municipal legislation, by-laws and design guidelines and criteria. The governmentally mandated criteria include the following:

- City of Toronto's Wet Weather Flow Management (WWFM) guidelines (2006)
- City of Toronto's Design Criteria for Sewer and Watermains (DCSW, 2021)
- Toronto Green Standard (TGS, version 3, 2019)
- Toronto and Region Conservation Authority (TRCA) Stormwater Management Criteria (2012)
- The Ministry of Environment (MOE) Stormwater Management Planning and Design Manual (2003)

As mentioned in section 1, the proposed site covers 11.13 ha area, classifying it as a large new development, per WWFM guideline. Table 1 outlines the relevant stormwater management requirements for applicable category.

Table 1 - Stormwater Management Design Criteria for Project Site

Criteria	**Requirements**	**Governing Authority**
Water Quality Management	Enhanced level of protection is required by long-term 80% removal of Total Suspended Solids (TSS) on an annual loading basis from all run-off leaving the proposed development site.	WWFMG – Section 2.2.2.1 (a)
Water Balance Management	In all cases, the minimum on-site runoff retention requires the proponent to retain all runoff from small design rainfall event- typically 5mm m (In Toronto, storms with 24- hour volumes of 5 mm or less contribute about 50% of the total average annual rainfall volume) through infiltration, evapotranspiration & rainwater reuse.	WWFMG – Section 2.2.1.2 (2) Toronto Green Standards – Tier-1
	Retain runoff generated from a minimum of 25 mm depth of rainfall from all site surfaces through infiltration, evapotranspiration and water harvesting and reuse.	Toronto Green Standards – Tier 3

	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 (i.e. presently existing site conditions before the new proposed development) conditions.	WWFMG – Section 2.2.1.1 (b)
	The maximum allowable annual runoff volume from any development site is 50% of the total average annual rainfall depth.	WWFMG – Section 2.2.1.1
Water Quantity – Flood Management	The City of Toronto has adopted the 100-year storm as the level of protection for properties, where feasible, against surface flooding from ponding on streets, particularly, in areas of the City experiencing chronic basement flooding and/or when a proper major overland flow stormwater drainage system does not exist. The required level of peak flow control from a development site contributing flow to a specific watercourse at the point of discharge, shall follow Toronto and Region Conservation Authority (TRCA) Flood Flow Criteria Map Control post-development peak flows to pre-development levels for all storms up to and including the 100-year storm (i.e., 2, 5, 10, 25, 50, and 100-year storms)	WWFMG – Section 2.2.3.1 TRCA – Table 3-1 (Mimico Creek Watershed) WWFMG – Section 2.2.3.2
Water Quantity - Erosion and Sediment Control	Regardless of size for all development sites, temporary erosion and sediment control for construction must be provided on-site.	WWFMG – Section 2.2.3.5 (a)
Water Quantity – Discharge criteria to municipal sewers	The allowable release rate to the municipal storm sewer system (minor system) from the development site during a 2-year design storm event must not exceed the peak runoff rate from the site under pre-development conditions during the same storm event, or existing capacity of the receiving storm sewer, whichever is less.	WWFMG – Section 2.2.3.7
	The City of Toronto has adopted the 100-year storm as the level of protection for properties, where feasible, against surface flooding from ponding on streets, particularly, in areas of the City experiencing chronic basement flooding and/or when a proper major (overland flow) stormwater drainage system does not exist	WWFMG – Section 2.2.3.4

2.1 Water Balance

The primary objective of the Water Balance criteria is to preserve the pre-development hydrology by capturing and managing the annual rainfall on the development site.

2.2 Quality Control

WWFM guidelines in line with MOE SWM Planning and Design Manual, requires long term 80% removal of TSS on an average annual loading basis from all runoff leaving the proposed development site based on the post-development level of imperviousness, to reduce the chronic effect of suspended solids on the aquatic life in the receiving water bodies.

The stormwater management design will meet quality control requirements by utilizing a combination of pervious surfaces; green infrastructure and low impact development facilities such as green roofs, tree pits and soil cells, permeable pavements, rain gardens and grassed swales as well as OGS or filter-based treatment system to promote settlement of suspended solids at the source and conveyance level.

2.3 Erosion and Sedimentation Control

As per WWFM guidelines section 2.2.3.5 (b), temporary erosion and sediment control measures shall be designed. All erosion and sediment control Best Management Practices (BMPs) shall be designed, constructed and maintained in all development sites in accordance with the GTA CA's Erosion & Sediment Control Guidelines for Urban Construction (2006) and/or other City of Toronto requirements on a site-by site basis, where applicable.

The erosion and sediment control requirement as laid out by the WWFMG will be met through onsite retention strategy and providing treatment through a series of GI and LID facilities.

2.4 Water Quantity Control

Water Quantity targets focus primarily on flood flow management and erosion control aimed to minimize the impacts on downstream flooding, stream bank erosion, and overflows of infrastructure. Typically, controls include peak flood control and both peak flow and runoff volume controls to mitigate erosion impacts.

2.4.1 Allowable Release Rates

For discharge into existing sewer according to the WWFM guidelines, the allowable release rate to the municipal storm sewer system during a 2-year design storm event must not exceed the peak runoff rate from the site under pre-development conditions during the same storm event, or existing capacity of the receiving storm sewer (whichever is less). The allowable release rate during a 2-year design storm was calculated for each block within the site, using the modified rational method, as shown in Table 3, section 3.5 of this report.

The rainfall intensity is calculated using the rainfall intensity curves for City of Toronto as illustrated by Figure 5.

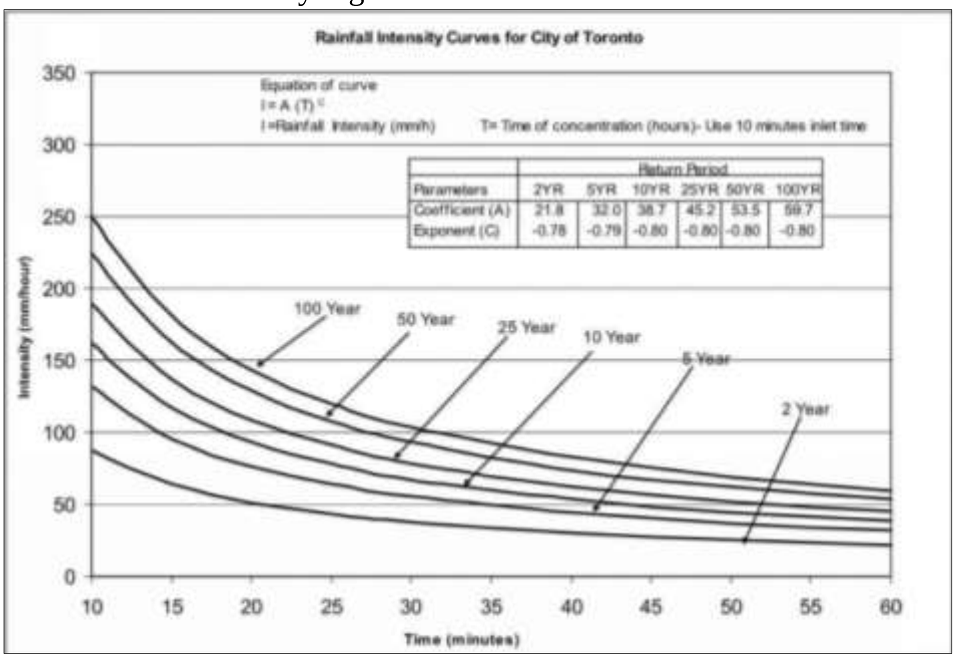

Figure 5 - Rainfall Intensity Curves for City of Toronto, (WWFMG-Section 3.1)

2.5 Key Assumptions

Based on the available information and meeting with Toronto Water, following assumptions have been adopted:

- In absence of final geotechnical investigation results for the site, it is assumed that the infiltration rate and soil type as well as groundwater table will support current SWM design to achieve water balance, water quality and quantity targets. These calculations will be revised, upon receiving the actual infiltration rate values and other relevant geotechnical information.
- Based on preliminary investigations, infiltration rates for the native soil are estimated be in the range of 12 -30 mm/hr. The development lots of the site will be built up from existing levels using granular permeable material

and so greater infiltration rates are anticipated. All the infiltration measures and parameters will be verified at the detailed design stage and all the stormwater management facilities with infiltration components will be reassessed and re-designed based on the final geotechnical information.

- The existing municipal network information is based on the TWAG data made available by the City of Toronto. This information will be confirmed and revised as a result of the SUE investigation.
- The relief road (Street A) is assumed to be an arterial road and other streets within the site, to be collector roads. The drainage design for these roads is done to meet stormwater management requirements for these categories of roads.

3 Proposed Stormwater Management Strategy

3.1 Key Drivers

City developments usually form an impermeable paved layer on top of green space, which affect habitats, can reduce biodiversity and has irreversible effects on the environment. Development can also prevent natural hydrological cycles and increases the volumes of polluted runoff entering stormwater infrastructure and therefore increasing the flood risk. With climate change set to increase the frequency and intensity of storms, the risk of flooding to and around the site could increase with time. Solutions to managing increasing volumes of rain include subsurface infiltration beds, green roofs and permeable paving.

The proposed storm water strategy aims to provide a resilient strategy which achieves an appropriate level of flood protection and maintains (or preferably reduces) the risk of flooding to adjacent sites. The strategy implements sustainable urban drainage principles to best mimic the natural processes which would've happened prior to any development and minimise both operational and capital carbon. Oversized infrastructure/pipe work have significant embodied carbon and so is a last resort within the Master Plan, where green infrastrucute (GI) cannot meet the requirements.

The stormwater management and drainage strategy needs to consider; proposed site levels, infiltration rates, the capacity of existing sewers, the proposed landscape strategy and the level of flood protection to be provided (1:100-year storm).

3.2 Outline Strategy

The stormwater management strategy aims to meet WWFMG criteria for water balance and water quality by retaining 25 mm of rainfall onsite. Water quantity control will be achieved by capturing the run-off from the development blocks and releasing it into the municipal sewer system at 2-year pre-development allowable release rates.

Overland flow from the retention features will be drained to minor system which will eventually join Lake Shore Boulevard West and Park Lawn Road sewer system, before draining into the Mimico Creek through the existing outfall.

The surface runoff exceeding 2-year pre-development allowable release rates where it is practical will flow through an approved existing overland flow route to the outfall. City to confirm availability of the approved overland flow routes downstream of the site.

To address conveyance requirements of the system, the capacity of the existing minor and major systems should be evaluated, and any required upgrades for the existing network and the outfall needs to be considered for this design approach. Considering the size of the site and the discharge point to the Mimico creek, consultation with TRCA is also required in order to address quantity, quality and erosion control requirements for the existing Mimico Creek outfall.

The proposed storm water strategy is shown in drawing LSB-ARP-XX-XX-DR-CD-60000 in Appendix C. On the 2150 Lake Shore site, following measures are recommended for stormwater management:

- Green infrastructure will be used where possible to encourage infiltration.
- Tree pits/ Soil cells will be used to provide retention and allow the rainwater to be used for evapotranspiration within public Right-of-way.
- Large geocellular storage beneath the Community Park and Boulevard Square Park with infiltration provided at the bottom to capture runoff from park area and adjacent development blocks. Stormwater runoff from Block D3 will be captured by the geocellular storage underneath the Communiy Park and the runoff from Block A will be captured by that under the Boulevard Square Park.
- Infiltration trenchs/soakaway pits are proposed within ROW at locations such as parking spots and the section of Street B exclusive of the tracks for TTC street.
- Proposed pipe beneath Street C, connecting to the existing 375mm pipe along Park Lawn Road.
- Proposed pipe beneath The Mews (area between B1 and B2 buildings) connecting to the existing manhole MH3003495 on Park Lawn Road.
- Proposed pipe from the relief road and Block F to the existing manhole MH3159006428 on Lake Shore Boulevard.
- Two pipe runs within the loop road and connects to the existing storm manhole MH3147506388 at Lake Shot eBoulevard West and Silver Moon Drive intersection and the other to MH3138906358 at Lake Shore Boulevard West and Shore Breeze Drive intersection. It is recommended to make these connections at the same time as planned upgrades to these intersections.

3.3 Water Balance

The stormwater management strategy for 2150 Lake Shore, at this stage aims to retain 25mm generated runoff from every storm event. The water balance target for the project site will be re-evaluated at later stage. The detailed design stage will exploit all areas within the Master Plan to achieve as much infiltration as possible considering constraints for subject site. As part of stormwater management plan, 60% of the total available roof area for each plot will be covered by green roofs. These green roofs will be designed to capture 25mm of rainfall for the rest of the available roof area.

Runoff from these roofs and over the podium is considered to be clean and will be diverted to the rainwater storage tank. This collected rainwater could be re-used for irrigation of landscape area and for non-potable uses such as toilet flushing in commercial area. No roof storage has been proposed at this stage, however, roof control for the development plots can be also considered during the detailed design stage.

With basement area being planned extensively under the development plots, it limits the area available for providing underground stormwater management measures. To completely satisfy the water balance requirements, rainwater harvesting tanks will be used to capture the runoff from the private development plots.

Water balance requirements for public and private roads will be met by retaining first 25mm of rainfall from all storm events through strategically placed soil cells and deep soakaway pits with infiltration capacity at the bottom of the structure.

It is understood that the relief road (Street A) is currently analysed in the City's Transportaion Master Plan. Out of the total site area, portion of the relief road parallel to D3 plot and the portion of the site occupied by the ramp to Gardiner Expressway, north-west of plot F are excluded from the stormwater management design and analysis.

The site wide retention volumes have been calculated based on the land use types as explained in Table 2 with the exclusions of these areas from the total site area.

Table 2 - Total Volume of Water Retention Required on Site

Land Use	Area (ha)	Water Depth Retention Through Initial Abstraction and Green Roof (mm)	Volume Retained on Site (m^3)	Volume of Retention Required for 25mm (m^3)
Roof Area – Green	1.3	25.0*	325	325
Roof Area – Hardscape**	0.9	25.0*	217	217
Landscape	2.5	5.0	127	630
Hardscape	6.2	1.2	72	1549
Total	**10.9**		**743[b]**	**2721[a]**
Volume of runoff retained by soil cells within Public ROW (m^3)				**963[c]**
Volume to be Retained by RWH tanks and underground geocellular facilities under Community Park and Boulevard Square Park (m^3) [a-b-c = d]				**1016[d]**

*Green roofs would be designed to capture runoff due to 25mm of rainfall on the total available roof area.
** The hardscape roof area represents 40% of the available roof area. Not all building towers are designed to have green roof. Area for such roofs is accounted within the “Hardscape” area.

From the landscape plans, it is seen that a total of 107 soil cells can be accommodated within private and public street. Each soil cell is designed to retain 9 m^3 of runoff. A detailed calculation of water retention within soil cells can be found in Appendix B of this report.

3.4 Water Quality and Erosion and Sediment Control

The enhanced water quality control requirement calls for long-term removal of 80% of TSS on annual loading from the runoff leaving the proposed development. Retaining 25mm of rainfall on site will satisfy not only water quality target of 80% TSS removal from 90% average annual rainfall but also erosion and sediment control requirements for the site. The design will meet quality control requirements in detail design stage by utilizing a combination of pervious surfaces; green infrastructure and low impact development facilities such as green roofs, tree pits and soil cells, permeable pavements, rain gardens and grassed swales as well as OGS or filter-based treatment system to achieve 80% TSS removal targets.

3.5 Water Quantity

City of Toronto stormwater management criteria requires that the post development storm runoff from the development plots for all events up to and including 1 in 100-year storm be controlled to the existing 1 in 2-year flow rate where proper downstream major overland flow route does not exist, and quantity control requirements strictly apply to the proposed project.

However, 2150 Lake Shore development is located at the end of the sewer system close to the existing Mimico Creek outfall and Lake Ontario. The Mimico creek outfall is regulated by TRCA. Consultation with TRCA will be required if there are any changes in the water quantity, water quality of the runoff to the outfall and changes in the erosion control plan due to the proposed development.

The proposed site is divided into 2 main categories, development plots and public right of way. There are 6 proposed development plots, consisting of buildings, internal walkways, public and private streets, two park areas and a site for future Go Station. The following section explains water quantity requirements for these two categories of area.

3.5.1 Development Plots

The existing site has extensive impervious area which is greater than 50% of the total site area. The run-off coefficient from the existing site is limited to 0.5 per WWMG guidelines for water quantity assessment. Table 3 presents the targeted allowable runoff rate from all the proposed development plots.

Table 3 - Allowable Release Rate for Development Plots

Plots	Area (ha)	Allowable Release rate (l/s)
A	1.95	238.7
B	1.09	134.2
C	0.67	82.3
D1	0.83	101.7
D2 & D3	1.87	229.2
E	0.53	64.9
F	0.41	49.7

The collection of total run-off from the development plots is managed by controlling the flows to the allowable 2-year pre-development rate. The runoff generated by storm events greater than this storm event will be limited via inlet control devices before discharging in to the downstream municipal sewer system also known as the minor system. The volume of runoff beyond the capacity of the minor system, will be conveyed to the outfall following an approved overland flow route. During severe storm events, the street would act as an open channel and will be designed accordingly.

In the proposed condition, site grading is designed such that the runoff from Plot B, Street C and Pedestrian walk between Plot D1 and Plot C, flow towards Park Lawn Road. Lake Shore Boulevard West receives runoff from the proposed development from Street B and relief road (Street A). From Park Lawn Road and Lake Shore Boulevard West, the runoff flows as overland flow towards Mimico Creek via available overland flow route.

The east part of the proposed development along Lake Shore Blvd. West, drains to Lake Ontario. This runoff is conveyed as an overland flow via multiple lanes perpendicular to Lake Shore BoulevardWest, acting as overland flow routes. The surface elevation of Lake Shore Boulevard drops while moving towards the intersection with Silver Moon road creating a ridge point. This low point allows for runoff to flow towards Lake Ontario from Lake Shore Boulevard West through Silver Moon Drive. The surface elevation beyond the ridge point on Lake Shore Boulevard West, slopes down towards the intersection with Park Lawn road.

It is assumed that the available overland flow routes are approved by the city, however, this solution for storm water management strategy for water quantity control will be developed further upon receiving required information. The capacity and conditions of these overlandflow paths needs to be assessed under both existing and proposed conditions. Existing overland flow routes are discussed in section 4.1 in more detail.

In absence of an approved overland flow route for major system flow, the alternative solution would be to design storage areas to detain water and while allowing it to flow through the minor system at a required discharge rate. Any required mitigation for the downstream system including existing Mimico Creek outfall will be proposed to provide adequate conveyance capacity and protection in the system.

Underground detention tank will be used to meet water quantity requirements for the development plots A2, A3, B, C, D1, E and F. The detained runoff will be controlled at 2- year pre-development rate via combination of orifice and a control manhole before discharging into the municipal network. A detailed design of stormwater management for each plot will be developed at a later stage.

The water quantity requirements for development plot covering D2 and D3 buildings will met by utilising the underground stormwater storage facility in the Park. Infiltration will be promoted at the bottom of the tank and any required detention will be achieved using control structure at the outlet of the facility. Similarly, water quantity requirements for development block A will be met by the underground stormwater storage facility within the Boulevard square area.

The stormwater management strategy of the project is to holistically meet the standards site-wide; however, each block might not necessarily fully meet the city requirements, rather would meet the imposed discharge limits based on the integrated site wide stormwater management plan.

3.5.2 Municipal Roads

As part of the project, a future road named relief road to north of the site is proposed. Relief road starts from Park Lawn Road, south of Gardiner Expressway runs along the north edge of the proposed development, turns south within the site and ties to Lake Shore Boulevard West. This road is categorised as an arterial road. According to CoT guidelines, the minor system of the road will be sized based on 10-year storm and any larger storm event will be conveyed using the ROW as an open channel.

This road is currently analysed in the city’s Transportaion Master Plan. Following TMP completion, stages 3 and 4 of the Environmental Assessment process for this road design (including storm drainage) will be evaluated by the FCR team.

The length of the relief road within the project property boundary, passes between block E and F and connects to the Lake Shore Blvd West is considered in the SWM design. The stormwater runoff for 10 year storm along this road will be captured and conveyed to Lake Shore Boulvard system.

Different blocks within the proposed development are connected through a 26m wide internal loop road which is also a proposed route for TTC streetcar loop and two other lateral road, private and public street. These roads are anticipated to be categorised as collector roads.

The drainage and stormwater design of these collector roads will be based on the dual system approach such that the minor system will be sized based on 5-year storm event. Any runoff from the storm exceeding 5-year shall be conveyed as an overland flow via major system. According to the City of Toronto guideline, if the downstream receiving system has capacity limitation, in order to eliminate the adverse impact on the downstream system, the new system must be controlled to the available capacity of the existing sewer system. Required modification to the vertical alignments of the proposed roads as well as changes to the grading design needs to be considered based on the drainage design requirements of the project.

The depth of ponding and the velocity of the overland flow within proposed public ROW, shall meet the criteria as indictated by Table 4. These depth/ velocity parameters are in accordance with Design Criteria for City of Toronto Sewers and Watermains Design and WWFMG, to reduce risk to the public having access to these overland flow routes.

Table 4 - Permissible Velocity and Flood Depth

Water Velocity (m/s)	0.5	1.0	2.0	3.0
Permissible Depth (m)	0.8	0.32	0.21	0.09

A landscape design is proposed along Park Lawn Road and Lake Shore Boulevard to plant more trees in these areas. It is anticipated to introduce soil cells with infiltration at the bottom, under the proposed planting plan, as many as possible subject to site constraints identified at detailed design stage.

It is assumed that existing overland flow route to the outfall are approved by the city. If no approved overland flow route exists, alternative solution for stormwater strategy is to fully capture the 100-year flows and discharge it at the existing Mimico creek outfall using existing municipal storm network. This will be achieved by providing cross-falls and longitudinal grading of the roads towards catch basins located at low points. The existing downstream system will be assessed, and any required mitigation/upgrade will be proposed. TRCA requirements needs to be followed at the existing Mimico Creek outfall.

4 Downstream Capacity Analysis

4.1 Existing Stormwater Network

Existing utility asset information has been ascertained from the Toronto Water Asset Group (TWAG). The asset mapping indicates the presence of storm sewers along roads surrounding the site. These mains are present in the following locations:

Park Lawn Road - a 300mm concrete storm sewer flows north along Park Lawn Road from south of the Metrolinx/GO corridor to an outfall to Mimico Creek. A 300mm concrete storm sewer flows south along Park Lawn Road from approximately 200m north of Lake Shore Boulevard towards the intersection where it is upsized to a 600 Vitrified Clay (VC) pipe and flows into the 900mm concrete pipe outfall to Mimico Creek.

Marine Parade Drive – a 450mm concrete storm sewer collects flow from the bus loop at the intersection of Marine Parade Drive and Lake Shore Boulevard and connects to the 900mm concrete outfall to Mimico Creek. Other flow from Marine Parade Drive and side streets including The Marginal Boulevard, Brookers Lane and Palace Pier Court is directed towards Lake Ontario through outfalls.

Lake Shore Boulevard – from west the intersection of the Marginal Boulevard and Lake Shore Boulevard, a 250mm VC pipe (transitioning to 375mm and 525mm) flows towards Park Lawn Road. It is joined by a 525mm concrete pipe from the 2150 Lake Shore property, where it crosses Lake Shore Boulevard in a 1200mm concrete sewer and turns to flow west on Lake Shore Boulevard as a 750mm concrete pipe (see CUMPA snip below). This pipe joins up with the 900mm outfall to Mimico Creek. The 525mm pipe appears to continue flowing west to meet up with the 600mm VC pipe at the intersection of Park Lawn Road and Lake Shore Boulevard (to be confirmed in the field)

Within the Site – a 300mm concrete pipe with an abandoned connection to the system flowing towards the 900mm outfall to Mimico Creek (this connection will be confirmed to collect flow from no other lands and likely removed to facilitate installation of the development works). A 525mm concrete pipe connects to the system along Lake Shore Boulevard flowing west. There are several storm utilities under the Gardiner Expressway and Metrolinx/GO rail corridors, all of which drain towards Humber River or Mimico Creek through outfalls other than the 900mm outfall mentioned above.

The current hydraulic capacity of these pipes is unknown, the design team will conduct existing network analysis to understand if any mitigation measures are required to support proposed developments.

The known existing stormwater infrastructure near the site is shown in Figure 6 in green. The CUMAP and TWAG asset records do not show a complete extent of any network within much of the site. It is therefore assumed that there may be a series of private/un-adopted sewers servicing the bulk of the industrial area.

As mentioned before, the current municipal network information is based on the TWAG data made available by the City of Toronto. This information will be confirmed and revised as a result of the SUE investigation.

Figure 6 - Known existing storm sewer network (TWAG)

4.2 Existing Overland Flow Conditions

Based on the best available data to date, the high point on Lake Shore Boulevard West, near Brookers Lane, marks the boundary for the overland flow in the major system.

City storm drainage plan MC 2525/3 was received on 27th January 2021, which is attached in Appendix C of this report. The information in this plan was useful in assessing the existing condition composite runoff coefficient of the site and storm sewer connections to the municipal storm network. This plan was referred in conjunction with the functional servicing report for Humber Bay Shores Precinct to assess overland flow routes.

Humber Bay Shores precinct is located to the east of the proposed site. The Functional Servicing Report for this site was prepared by Schaeffers & Associates Ltd. in 2014. This report indicates that the east part of the 2150 Lake Shore along Lake Shore Boulevard West, drains to Lake Ontario. This runoff is conveyed as an overland flow via multiple lanes perpendicular to Lake Shore Boulevard West, acting as overland flow routes. The capacity and conditions of these overland flow paths needs to be assessed under both existing and proposed conditions.

The surface elevation of Lake Shore Boulevard West drops while moving towards the intersection with Silver Moon road creating a ridge point. This ridge point allows for runoff to flow towards Lake Ontario from Lake Shore Boulevard West through Silver Moon Drive. The surface elevation beyond the ridge point on Lake Shore Boulevard West, slopes down towards the intersection with Park Lawn Road. Figure 7, illustrates the existing overland flow routes along Lake Shore Boulevard West and Park Lawn Road.

Figure 7 - Existing Overland Flow Routes (Background source: Google Maps)

Park Lawn Road has a high point south of the under pass, which marks the beginning of the overland flow route on Park Lawn road. From this high point, Park Lawn Road slopes down and intersects with Lake Shore Boulevard West. The overland flow from Park Lawn Road and Lake Shore Boulevard West intersection, flows south up to Mimico Creek. These information needs to be confirmed with field data.

According to the City of Toronto guideline, if the downstream receiving system has capacity limitation, in order to eliminate the adverse impact on the downstream system, the new system must be controlled to the available capacity of the existing sewer system or any required mitigation to the existing system should be considered.

It should be noted that all the information/data required for complete downstream capacity assessment were not available at this time. However, preliminary assessment of the existing downstream minor system discharging to the Mimico Creek existing outfall has been done under post development conditions. The parameters for model set up and drainage area are discussed in the next section. Mitigations and sewer upgrades are expected along both Lake Shore Boulevard West and Park Lawn Road to service proposed development at 2150 Lake Shore while addressing City of Toronto requirements. Overall, the existing percentage imperviousness of the site is estimated to be reduced due to the proposed development plan. With the reduction in the run-off coefficient of the site, the runoff from the proposed development is anticipated to be less than the pre-development condition.

All the analysis will be refined based on the required field data and information. Please refer to Appendix D for preliminary storm sewer profiles.

4.3 Hydraulic Modelling

A stormwater model is set up by simulating the hydrologic and hydraulic parameters of the site based on the available information and proposed site layout. PCSWMM software is selected as the modelling software.

The objective of modelling is to:

- Update the proposed stormwater management design based on the modelling results to achieve water balance, water quantity and water quality criteria for the site.
- Estimate the hydraulic capacity of the existing stormwater network surrounding the proposed development site
- Simulate rainfall- runoff and get the results for different storms events estimate the impact of the proposed development on the downstream stormwater network. These storm events are chosen for analysis based on City of Toronto’s guidelines.

4.3.1 Modelling Parameters

Hydrologic and hydraulic parameters of the site are essential components for setting up the stormwater management model.

The basic steps to create hydrology model include:

- Delineate the proposed drainage area into smaller subcatchments,
- Assigning hydrological runoff parameters to each subcatchments based on available data and characteristics of proposed developments,
- Preliminary design of the internal storm sewer network. Assigning appropriate outlets to the subcatchments using hydraulic elements, and

- Simulate the model using design storm events to generate runoff from all the subcatchments.

4.3.2 Drainage Area

The proposed site was divided in to 29 subcatchments, consisting of 6 plots and each plot further divided based on buildings, internal walkways between the buildings within plot area, the public park, boulevard square and collector roads.

The land use map for the model consists of roof area including green roof and hard roof, landscape and hardscape including roads, walkway and other impervious area. Total imperviousness from the subcatchments is calculated as the weighted average of the different surfaces. Refer to LSB-ARP-XX-XX-DR-CD-60001 for details on drainage catchments, in Appendix-C.

4.3.3 Hydrologic Parameters

The runoff parameters are set based on City of Toronto guidelines for run-off coefficient. The run-off coefficient value considered for pervious as 0.25 and for impervious area as 0.9. A weighted average value for each plot was assigned based on land use. Refer to Appendix D for the hydrologic parameter details.

The design storm analysis is carried out based on the 6-hour Chicago distribution with 10-minute time step and a ratio to peak r=0.38. The design storm rainfall information for the analysis was provided by the City guideline, refer to Appendix-A for 6-hour Chicago design storm details. The design rainfall events considered for modelling purpose are Chicago 6h – 2-year, 5- year, 10- year, 25-year, 50-year and 100-year for water quantity results. Rainfall of Chicago 4h-25mm is considered to get runoff results for water balance requirements. The storm water runoff results for 25mm storm event and 100-year storm are presented in Appendix D.

4.3.4 Stormwater Network

The TWAG data received from the City of Toronto was imported into the PCSWMM model to create existing stormwater network. The data contained sewer alignments, sewer diameter, length and connecting manhole information.

Proposed internal storm sewer network is preliminary and defined in the model to assess the impact of the proposed development on the existing network. Major system is not included in the current model and only preliminary sizing has been done to estimate the conveyance capacity of the minor system.

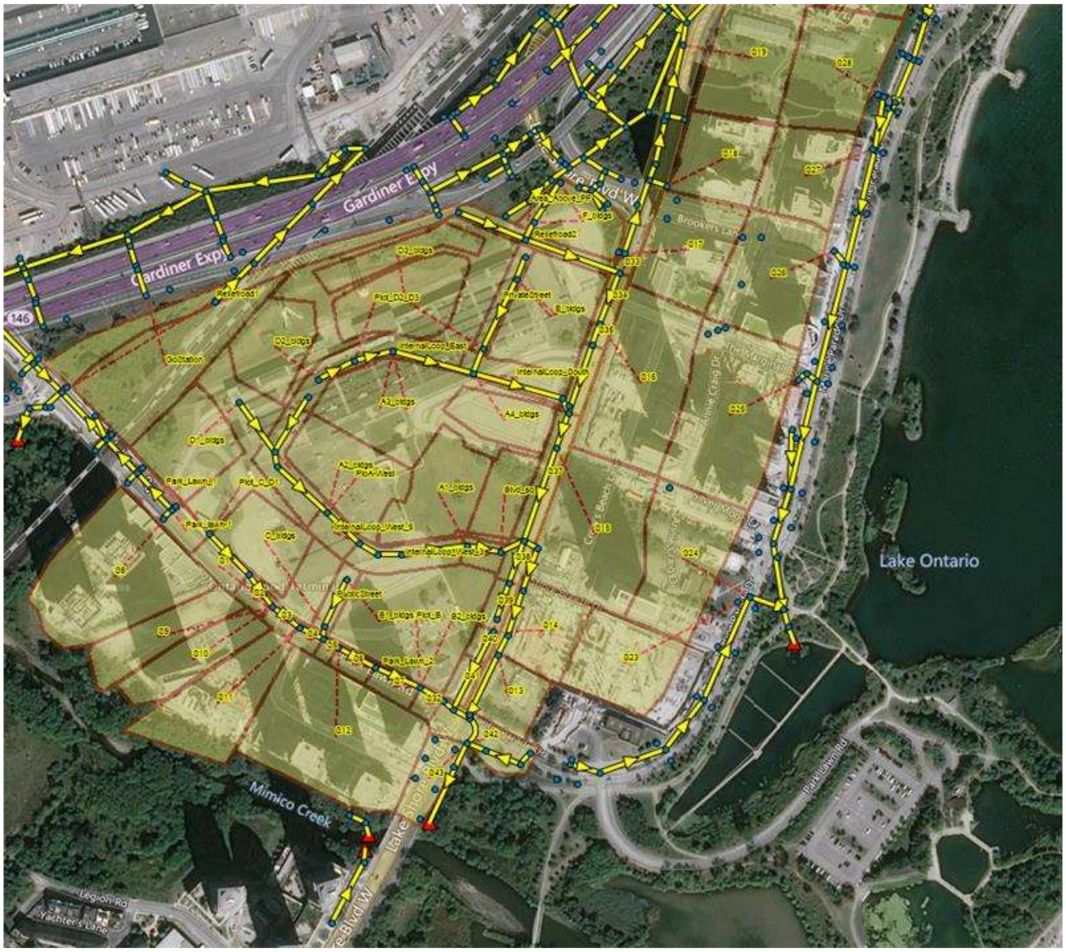

Figure 8 - SWM Site Model

Figure 8 shows the catchment area delineation and stormwater network.

Current hydraulic model is not validated at this stage and needs to be evaluated further in the later stage based on SUE and field data. The final alignment and size of the storm sewers will be designed and confirmed at detailed design stage.

Modelling results and sewer profiles are provided in Appendix D.

5 Conclusions and Summary

This report presents the proposed stormwater management strategy and design of the proposed development at 2150 Lake Shore Boulevard Technical requirements including Quantity, Quality, Water Balance and Erosion Control also have been addressed as outlined in the City of Toronto Sewer and Watermain Design and Wet Weather Flow Management Guidelines.

Proposed public roads will be designed considering dual drainage methodology. The minor system is sized based on 10 and 5-Year storm events, considering the category of the proposed road. Any runoff exceeding minor system design storm capacity shall be carried by proposed ROWs, Lake Shore Boulevard West and Park Lawn Road. It is assumed that approved overland flow route to the outfalls are available.

In the absence of the approved overland routes, a piped drainage network will fully capture the 100-year flows and discharge at the existing Mimico Creek outfalls using existing municipal storm network. The existing downstream storm system will be assessed, and any required upgrades will be considered. TRCA requirements for quantity, quality and erosion control also needs to be followed at the existing Mimico Creek outfall.

The water balance requirements for the municipal roads will be met by retaining first 25mm of rainfall from all storm events through strategically placed soil cells and deep soakaway pits, having infiltration capacity at the bottom of the structure.

For development plots it is assumed that green roofs will occupy 60% of the available roof area and will be designed to capture 25mm of rainfall for the total available roof area. Rainfall retention of 25mm depth for rest of the site is planned to be achieved through rainwater harvesting tanks, soil cells and soakaway pits within the proposed roads.

The collection of surface run-off from the development plots is managed by controlling the flow in the pipes to storm event with 2-year return period. For runoff generated by storm events greater than this, flow will be limited via inlet control devices and allowing the excess runoff to be conveyed to the outfall following an approved overland flow route. In the absence of approved overlandflow route, the overall discharge limits of development needs to be adjusted accordingly.

The enhanced water quality control targets required 80% removal of TSS on annual loading from the annual average runoff. Retaining 25mm of rainfall on site will satisfy not only water quality target of 80% TSS removal from 90% average annual rainfall but also erosion and sediment control requirements for the site.

6 References

CoT. (n.d.). *Design Criteria for Sewers and Watermains.* Retrieved from Standards for Designing and Constructing City Infrastructure: https://www.toronto.ca/wp-content/uploads/2017/11/9753-ecs-specs-dcm-Toronto_Sewer_and_Watermain_Manual_March2014.pdf

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Appendices

Appendix A – Hydrology Information

Appendix B – SWM Calculations

Appendix C – Drawings

Appendix D – Hydraulic Modelling

Appendix A – Hydrology Information

Based on available rainfall data for the City of Toronto, Chicago 6hr rainfall from 2-year to 100-year, IDF curves were developed to measure rainfall intensity.

Table A1: Rainfall Intensity Data

Figure A1: Rainfall Intensity Curve

Table A2: Landuse Runoff Coefficients

Table A3: Manning' 'n' value for different pipe materials

Table A1: Rainfall Intensity Data

Time Step (min)	Intensity (mm/hr)					
	2- Year	5- Year	10-Year	25-Year	50-Year	100-Year
10	88.2	131.8	162.3	189.5	224.3	250.3
11	81.9	122.2	150.4	175.6	207.9	231.9
12	76.5	114.1	140.2	163.8	193.9	216.3
13	71.9	107.1	131.5	153.6	181.9	202.9
14	67.8	101	124	144.8	171.4	191.2
15	64.3	95.7	117.3	137	162.2	181
16	61.1	90.9	111.4	130.1	154	171.9
17	58.3	86.7	106.1	124	146.7	163.7
18	55.8	82.8	101.4	118.4	140.2	156.4
19	53.5	79.4	97.1	113.4	134.2	149.8
20	51.4	76.2	93.2	108.9	128.8	143.8
21	49.4	73.3	89.6	104.7	123.9	138.3
22	47.7	70.7	86.4	100.9	119.4	133.2
23	46.1	68.3	83.3	97.3	115.2	128.6
24	44.6	66	80.5	94.1	111.4	124.3
25	43.2	63.9	78	91.1	107.8	120.3
26	41.9	62	75.6	88.2	104.4	116.6
27	40.6	60.1	73.3	85.6	101.3	113.1
28	39.5	58.4	71.2	83.2	98.4	109.8
29	38.4	56.8	69.2	80.9	95.7	106.8
30	37.4	55.3	67.4	78.7	93.1	103.9
31	36.5	53.9	65.6	76.7	90.7	101.3
32	35.6	52.6	64	74.7	88.5	98.7
33	34.8	51.3	62.4	72.9	86.3	96.3
34	34	50.1	61	71.2	84.3	94
35	33.2	49	59.6	69.6	82.3	91.9
36	32.5	47.9	58.2	68	80.5	89.8
37	31.8	46.9	57	66.5	78.8	87.9
38	31.1	45.9	55.8	65.1	77.1	86
39	30.5	45	54.6	63.8	75.5	84.3
40	29.9	44.1	53.5	62.5	74	82.6
41	29.3	43.2	52.5	61.3	72.6	81
42	28.8	42.4	51.5	60.1	71.2	79.4
43	28.3	41.6	50.5	59	69.8	77.9
44	27.8	40.9	49.6	57.9	68.6	76.5
45	27.3	40.2	48.7	56.9	67.3	75.1
46	26.8	39.5	47.9	55.9	66.2	73.8
47	26.4	38.8	47	55	65	72.6
48	25.9	38.2	46.3	54	64	71.4
49	25.5	37.6	45.5	53.1	62.9	70.2
50	25.1	37	44.8	52.3	61.9	69.1
51	24.7	36.4	44.1	51.5	60.9	68
52	24.4	35.8	43.4	50.7	60	66.9
53	24	35.3	42.7	49.9	59.1	65.9
54	23.7	34.8	42.1	49.2	58.2	65
55	23.3	34.3	41.5	48.5	57.4	64
56	23	33.8	40.9	47.8	56.5	63.1
57	22.7	33.3	40.3	47.1	55.7	62.2
58	22.4	32.9	39.8	46.4	55	61.3
59	22.1	32.4	39.2	45.8	54.2	60.5
60	21.8	32	38.7	45.2	53.5	59.7

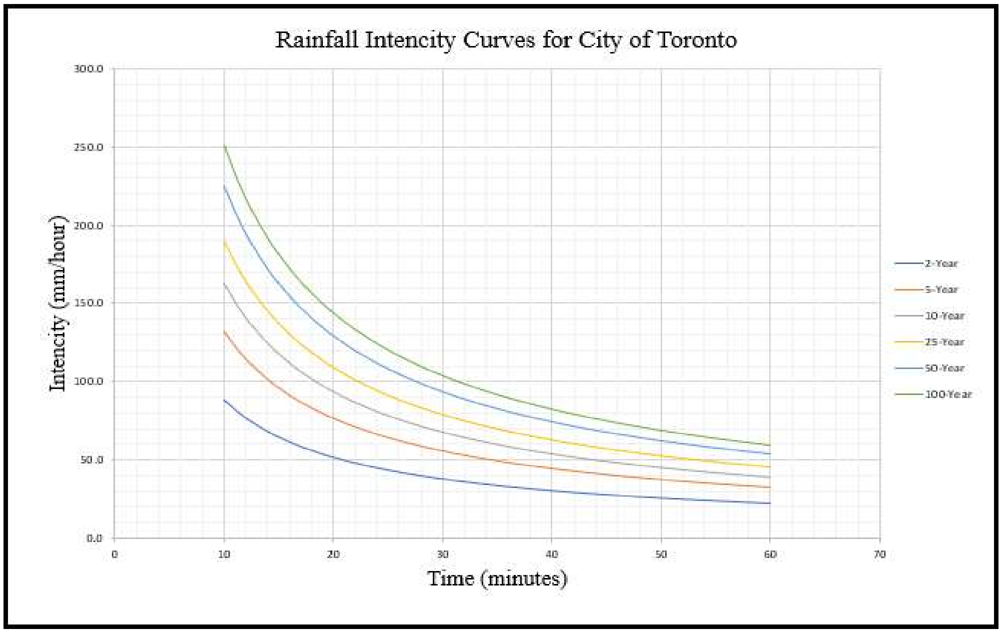


Figure A1 Rainfall Intensity Curves

Table A2 : Land Use Runoff Coefficients
(Design Criteria for Sewers and Watermains)

Land use	Runoff coefficient
forest and dense wooded areas	0.10 - 0.25
parks, open space and palygrounds	0.25
single family residential	0.65
semi-detached residential	0.7
townhouse or rowhousw	0.75
apartments or hi-rise residential	0.75 - 0.85
industrial	0.85
commercial	0.9
institutional	0.75
densely built, paved	0.9
asphalt, concrete, roof areas - without green roofs	0.9

Table A3: Manning' 'n' value for Different Pipe Materials

If pipe material is…	Then value of 'n' is…
concrete (CONC)	0.013
polyvinyl chloride (PVC)	0.013
high density polyethylene (HDPE)	0.013
corrugated steel pipe (CSP)	0.024

Appendix B – SWM Calculations

Table B1 represents plot area as divided based on Landuse.

Table B2 shows soil cell water retention capacity

Table B1: Subcatchement Area Calculation

Plot	Hardscape (ha)	Landscape (ha)	Green Roof Area (ha)	Total
Total area for plot A	1.38	0.13	0.43	1.95
Total area for plot B	0.81	0.13	0.15	1.09
Total area for plot C	0.45	0.10	0.12	0.67
Total area for plot D	1.79	0.47	0.44	2.71
Total area for plot E	0.36	0.06	0.11	0.53
Total area for plot F	0.29	0.08	0.04	0.41
Park Area	0.26	0.78	0.00	1.03
Boulevard Square	0.08	0.23	0.00	0.30
Street C	0.09	0.03	0.00	0.12
Private Street D	0.16	0.05	0.00	0.21
Street B (Internal Loop)	0.98	0.33	0.00	1.30
*Relief Road - Within Property Boundary	0.25	0.08	0.00	0.33
Area above Plot F - Public street	0.025	0.008	0.00	0.03
Area along Park Lawn Road	0.15	0.05	0.00	0.20
[4]Other Area	0.18	0.06	0.00	0.24
Total Area	**7.25**	**2.58**	**1.30**	**11.13**

Assumptions and Considerations:

1. Other Streets and internal loop, assumed to be 75% hardscape
2. Green roofs assumed to be 60% of the available roof area
3. Total hardscape area is calculated as 75 percent of the difference of the total plot area and the
4. "Other Area" includes portion of Relief road parallel to plot D3 and the area above Plot F

Table B2: Soil Cell Water Retention Calculation

Location	No. of Trees (Per Landscape Plan)
Left internal loop	36
central top length	15
Right internal loop	6
Private Street C	12
Private Street D	12
Relief Road within Property Boundary	26
Total no. of Trees with 1.2m soil depth	**107**

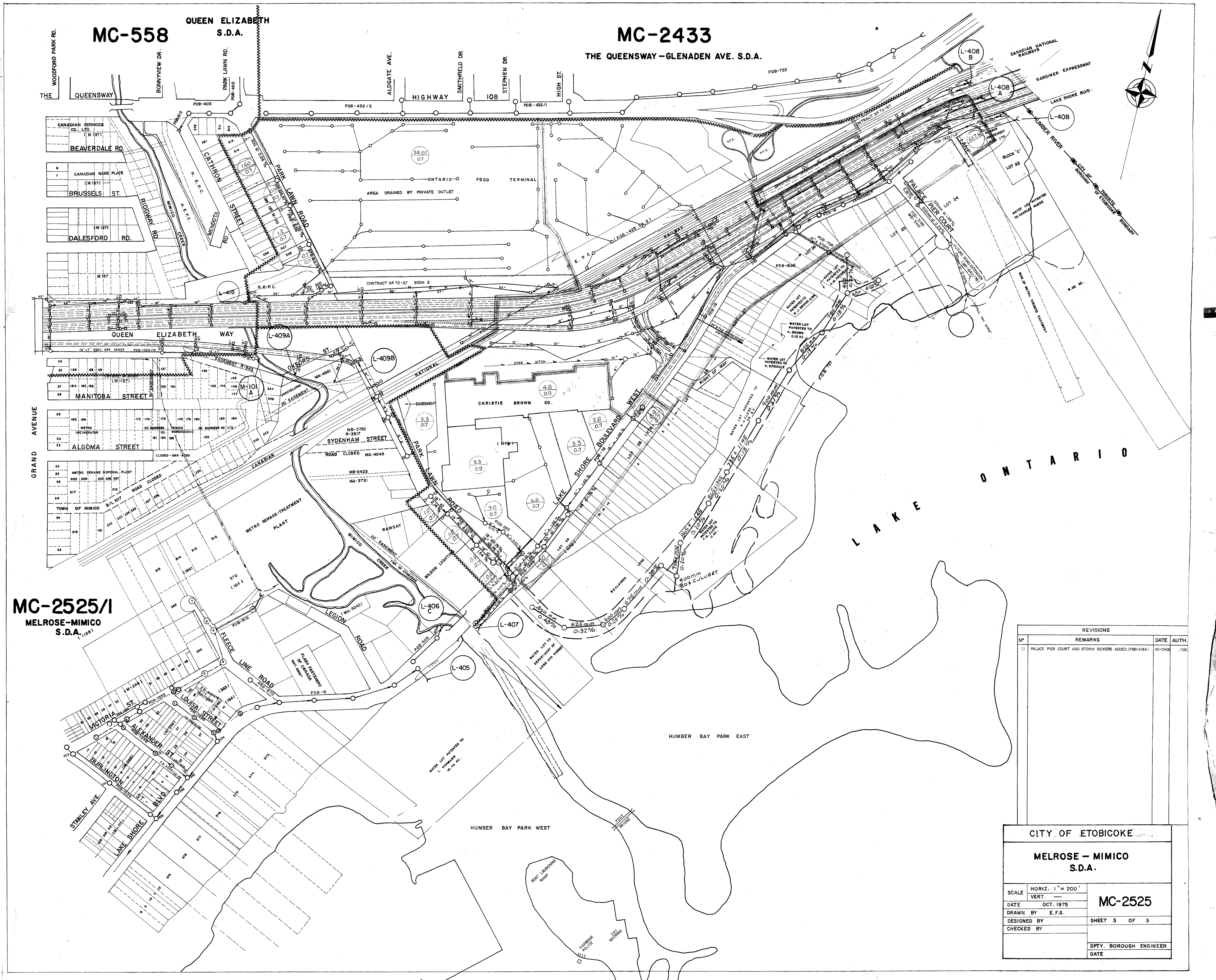
Available Water Retention in soil cells	
No. tree pits	107
Volume of soil per pit (m^3)	30
Assumed porosity of soil	30%
Storage capacity per tree (m^3)	9
Total Retention in soil cells (m3)	**963**

Appendix C – Drawings

Figure C1 Existing Storm Drainage Plan MC-2525/3 (Source: City of Toronto)

Figure C2 Proposed Stormwater Drainage Layout

Figure C3 Drainage Catchment Plan

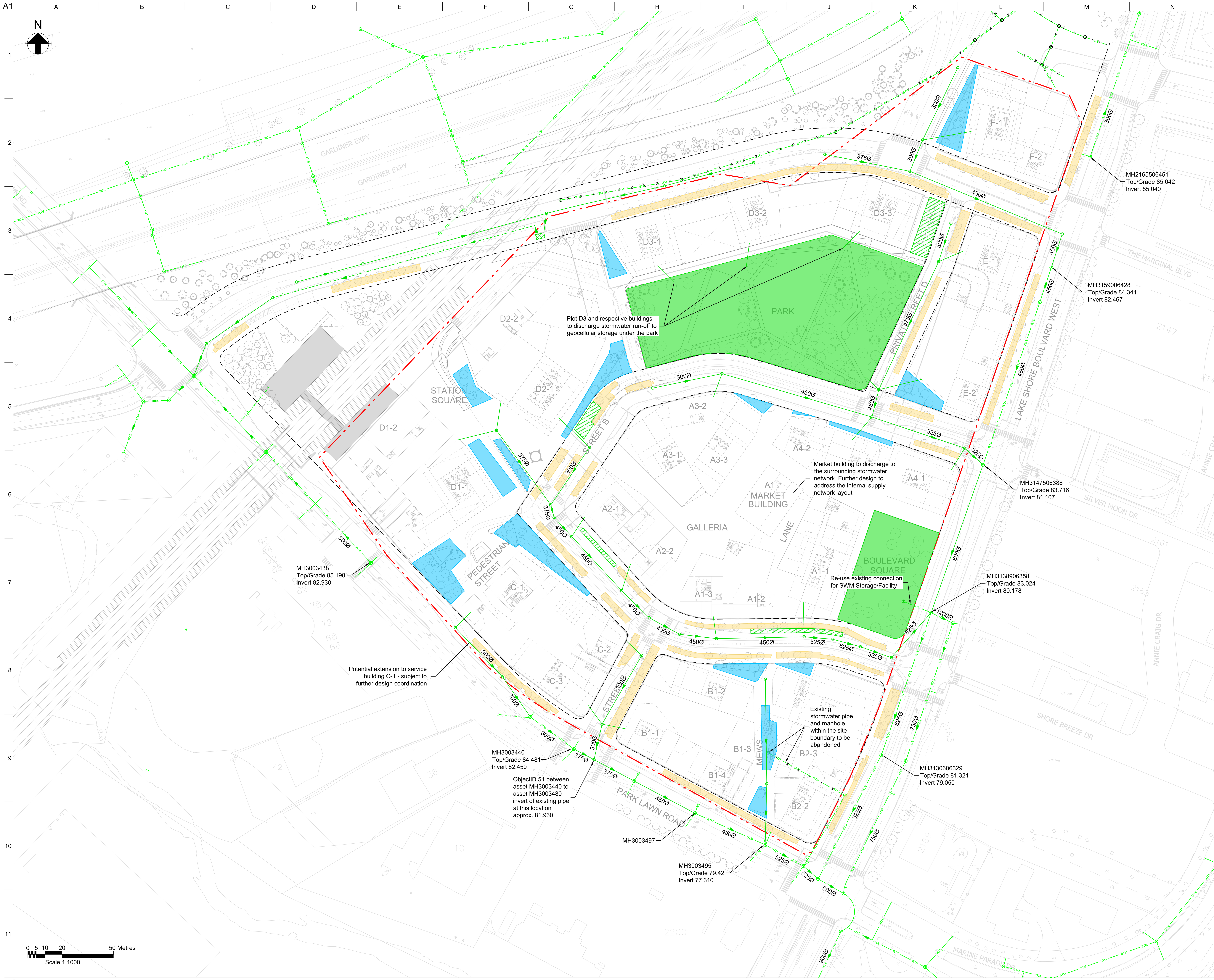


REVISIONS			
Nº	REMARKS	DATE	AUTH.
1)	PALACE PIER COURT AND STORM SEWERS ADDED. (PSB-3186)	90-09-06	/DG

CITY OF ETOBICOKE

MELROSE – MIMICO
S.D.A.

SCALE HORIZ. 1" = 200' VERT. —	MC-2525
DATE OCT. 1975	
DRAWN BY E.F.G.	
DESIGNED BY	SHEET 3 OF 3
CHECKED BY	
	DPTY. BOROUGH ENGINEER
	DATE



Notes

1. All coordinates are in metres and referenced to Zone 10 of the Ontario Coordinate System, NAD (North American Datum) 1927, 1968 adjustment, 3 degree MTM (NAD 27 MTM 3 degrees Zone 10)
2. All dimensions are in metres unless noted otherwise.
3. The design of the stormwater network should comply with Design Criteria for Sewers and Watermains, 2nd edition, January 2021 and Wet Weather Flow Management Guidelines, November 2006.
4. Existing services are based in the topographical survey issued by EllisDon on 24 February 2020 and TWAG information provided by Toronto Water on 04 February 2020.
5. All manholes in the carriageway should be suitable to vehicle loading and finished to same skid resistance as adjacent carriageway.
6. Connection to existing stormwater network is subject to agreement with Toronto Water.
7. Location and extent of existing services is indicative only and is intended to identify approximate location of main service corridors. For full details refer to utility providers record drawings or topographical survey.
8. Off-site reinforcement and temporary construction services are excluded from this drawing.
9. Proposed network design, plot connections and details are indicative only and are subject to approval by existing and proposed network operators as well as building designer.
10. Extent of proposed Soakaway pit, soft landscape and soil cells is indicative only and subject to further detailed modeling.
11. For typical street sections and cover depths refer to drawings LSB-ARP-XX-XX-DR-CU-72001 and LSB-ARP-XX-XX-DR-CU-72002
12. All proposed stormwater mains within the road corridor to be minimum 300mm pipes with a minimum gradient of 1:200, unless otherwise stated.
13. Refer to landscape drawings for Soil Cells details.

Legend

- Site Boundary
- Basement/Tunnel Extent
- Extent of Right-of-way

Existing Utilities

- Stormwater Network

Proposed Utilities

- Stormwater Sewer
- Stormwater Manhole
- Stormwater Force Main
- Pumping Station (Designed by others)
- Existing Stormwater Sewer to be abandoned or diverted
- Park area including SWM facility with infiltration
- Soakaway pit with Infiltration capacity
- Soil Cells with Infiltration Capacity (refer to note 13)
- Soft Landscape (refer to note 13)

Rev	Date	By	Chkd	Appd
02	26/02/21	AF	FF	HJ
Zoning By-Law Application r1				
01	15/05/20	AF	FF	HJ
For planning submission				

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H. R. T. JEENS
100517802
26/02/2021
PROVINCE OF ONTARIO

Client
First Capital (Park Lawn) Corporation and 2253213 Ontario Limited

Project Title
2150 Lake Shore

Drawing Title
Proposed Stormwater Drainage Layout

Scale at Arch D 1:1000

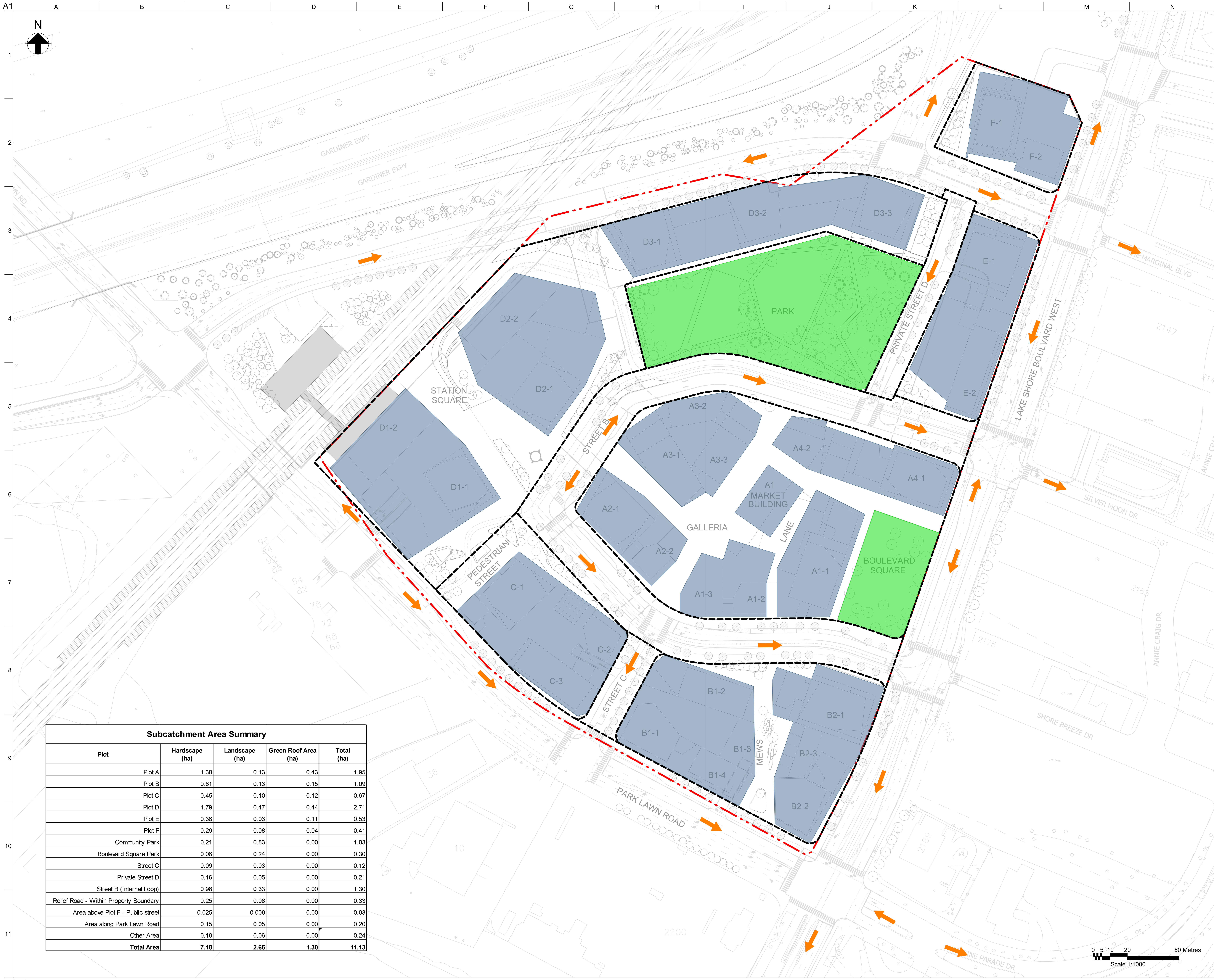
Role Civil

Suitability Detailed Masterplan

Arup Job No 277167

Rev 02

Name
LSB-ARP-XX-XX-DR-CD-60000



Notes

1. All coordinates are in metres and referenced to Zone 10 of the Ontario Coordinate System, NAD (North American Datum) 1927, 1968 adjustment, 3 degree MTM (NAD 27 MTM 3 degrees Zone 10)
2. All dimensions are in metres unless noted otherwise.
3. Refer to Landscape plans for green roof and soil cells details. Green roof occupies 60% of the total available roof area.
4. Refer to general arrangement plans for building and roof plans

Legend

- Site Boundary
- Indicative Plot Boundary
- Indicative Building Area (Refer to Note 3 & 4)
- Park area including SWM facility with infiltration
- Overland flow route

Subcatchment Area Summary

Plot	Hardscape (ha)	Landscape (ha)	Green Roof Area (ha)	Total (ha)
Plot A	1.38	0.13	0.43	1.95
Plot B	0.81	0.13	0.15	1.09
Plot C	0.45	0.10	0.12	0.67
Plot D	1.79	0.47	0.44	2.71
Plot E	0.36	0.06	0.11	0.53
Plot F	0.29	0.08	0.04	0.41
Community Park	0.21	0.83	0.00	1.03
Boulevard Square Park	0.06	0.24	0.00	0.30
Street C	0.09	0.03	0.00	0.12
Private Street D	0.16	0.05	0.00	0.21
Street B (Internal Loop)	0.98	0.33	0.00	1.30
Relief Road - Within Property Boundary	0.25	0.08	0.00	0.33
Area above Plot F - Public street	0.025	0.008	0.00	0.03
Area along Park Lawn Road	0.15	0.05	0.00	0.20
Other Area	0.18	0.06	0.00	0.24
Total Area	**7.18**	**2.65**	**1.30**	**11.13**

Rev	Date	By	Chkd	Appd
02	26/02/21	AF	FF	HJ
Zoning By-Law Application r1				
01	15/05/20	AF	FF	HJ
For planning submission				

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PROVINCE OF ONTARIO

Client
First Capital (Park Lawn) Corporation and 2253213 Ontario Limited

Project Title
2150 Lake Shore

Drawing Title
Drainage Catchment Plan

Scale at Arch D 1:1000

Role Civil

Suitability Detailed Masterplan

Arup Job No **277167**

Rev **02**

Name **LSB-ARP-XX-XX-DR-CD-60001**

Do not scale

Appendix D – Hydraulic Modelling

Figure D1 PCSWMM Existing Scenario

Figure D2 PCSWMM Proposed Scenario

Table D1: Hydrologic Parameters – Existing Condition

Name	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Zero Imperv (%)	Subarea Routing
Ex1	0.013	0.15	1.2	5	0	OUTLET
Ex2	0.013	0.15	1.2	5	0	OUTLET
Ex3	0.013	0.15	1.2	5	0	OUTLET
Ex4	0.013	0.15	1.2	5	0	OUTLET
Ex5	0.013	0.15	1.2	5	0	OUTLET

Notes:
1.N Values = Manning's value
2.Dstore = Initial Abstraction
3.%Zero impervious = % of area with zero depression storage

Table D2: Hydrologic Parameters – Proposed condition

Name	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Zero Imperv (%)	Subarea Routing
A4_bldgs	0.013	0.15	1.2	5	0	OUTLET
InternalLoop_East	0.013	0.15	1.2	5	0	OUTLET
InternalLoop_South	0.013	0.15	1.2	5	0	OUTLET
Plot_D2_D3	0.013	0.15	1.2	5	0	OUTLET
Plot_C_D1	0.013	0.15	1.2	5	0	OUTLET
E_bldgs	0.013	0.15	1.2	5	0	OUTLET
D1_bldgs	0.013	0.15	1.2	5	0	OUTLET
B1_bldgs	0.013	0.15	1.2	5	0	OUTLET
B2_bldgs	0.013	0.15	1.2	5	0	OUTLET
Plot_B	0.013	0.15	1.2	5	0	OUTLET
Plot_E	0.013	0.15	1.2	5	0	OUTLET
C_bldgs	0.013	0.15	1.2	5	0	OUTLET
F_bldgs	0.013	0.15	1.2	5	0	OUTLET
Plot_F	0.013	0.15	1.2	5	0	OUTLET
A3_bldgs	0.013	0.15	1.2	5	0	OUTLET
A2_bldgs	0.013	0.15	1.2	5	0	OUTLET
A1_bldgs	0.013	0.15	1.2	5	0	OUTLET
Blvd_sq	0.013	0.15	1.2	5	0	OUTLET
D2_bldgs	0.013	0.15	1.2	5	0	OUTLET
Park	0.013	0.15	1.2	5	0	OUTLET
D3_bldgs	0.013	0.15	1.2	5	0	OUTLET
PublicStreet	0.013	0.15	1.2	5	0	OUTLET
PrivateStreet	0.013	0.15	1.2	5	0	OUTLET
Reliefroad2	0.013	0.15	1.2	5	0	OUTLET
Reliefroad1	0.013	0.15	1.2	5	0	OUTLET
PloA-West	0.013	0.15	1.2	5	0	OUTLET
PlotA-East	0.013	0.15	1.2	5	0	OUTLET
Park_lawn-1	0.013	0.15	1.2	5	0	OUTLET
InternalLoop_West_1	0.013	0.15	1.2	5	0	OUTLET
InternalLoop_West_3	0.013	0.15	1.2	5	0	OUTLET
InternalLoop_West_2	0.013	0.15	1.2	5	0	OUTLET
InternalLoop_West_5	0.013	0.15	1.2	5	0	OUTLET
Area_Above_PF	0.013	0.15	1.2	5	0	OUTLET
Park_Lawn_1	0.013	0.15	1.2	5	0	OUTLET
Park_Lawn_2	0.013	0.15	1.2	5	0	OUTLET

Notes:
1.N Values = Manning's value
2.Dstore = Initial Abstraction
3.%Zero impervious = % of area with zero depression storage

Table D3: Catchment Parameters – Existing Condition

Name	Outlet	Area (ha)	Slope (%)	Imperv. (%)
Ex1	MH3003496	2.55	0.5	70
Ex2	MH3138906358	3.28	0.5	90
Ex3	MH3138906358	2.75	0.5	70
Ex4	MH3147506388	1.34	0.5	70
Ex5	J31	1.13	0.5	70

Notes:
1.N Values = Manning's value
2.Dstore = Initial Abstraction
3.%Zero impervious = % of area with zero depression storage

Table D4: Catchment Parameters – Proposed Condition

Name	Outlet	Area (ha)	Slope (%)	Imperv. (%)
A4_bldgs	J9	0.36	0.5	63
InternalLoop_East	J1	0.48	2	75
InternalLoop_South	J9	0.17	2	75
Plot_D2_D3	J2	0.46	0.5	65
Plot_C_D1	J6	0.65	0.5	65
E_bldgs	J11	0.46	0.5	69
D1_bldgs	J19	0.52	0.5	57
B1_bldgs	J24	0.46	0.5	74
B2_bldgs	MH3003495	0.46	0.5	63
Plot_B	MH3003495	0.21	0.5	70
Plot_E	J11	0.07	0.5	60
C_bldgs	J23	0.49	0.5	69
F_bldgs	J30	0.29	0.5	60
Plot_F	J29	0.11	0.5	60
A3_bldgs	J3	0.34	0.5	38
A2_bldgs	J16	0.22	0.5	56
A1_bldgs	J7	0.52	0.5	77
Blvd_sq	J25	0.3	0.5	25
D2_bldgs	J1	0.48	0.5	55
Park	J10	1.03	1.2	25
D3_bldgs	Park	0.58	0.5	75
PublicStreet	J23	0.12	1.5	75
PrivateStreet	J12	0.21	2	75
Reliefroad2	J28	0.33	1.3	75
Reliefroad1	MH3003437	0.15	3.5	75
PloA-West	J16	0.29	0.5	90
PlotA-East	J3	0.29	0.5	90
Park_lawn-1	MH3003438	0.1086	1	90
InternalLoop_West_1	J25	0.1035	2	75
InternalLoop_West_3	J7	0.21	2	75
InternalLoop_West_2	J18	0.215	2	75
InternalLoop_West_5	J15	0.1351	2	75
Area_Above_PF	J27	0.0337	0.5	75
Park_Lawn_1	J5	0.13	0.5	60
Park_Lawn_2	MH3003480	0.07	0.5	60

Notes:
1.N Values = Manning's value
2.Dstore = Initial Abstraction
3.%Zero impervious = % of area with zero depression storage

Table D5: Run-off Results for 6hr 100-year Storm – Existing Condition

Name	Area (ha)	Precipitation (mm)	Runoff Volume (ML)	Peak Runoff (m^3/s)
S1	0.13	85.43	0.10	0.08
S2	0.08	85.43	0.06	0.05
S8	1.44	85.43	0.52	0.38
S9	0.50	85.43	0.18	0.13
S10	0.47	85.43	0.17	0.12
S11	0.83	85.43	0.30	0.22
S12	1.63	85.43	0.59	0.43
S13	0.39	85.43	0.14	0.10
S14	0.53	85.43	0.19	0.14
S15	1.27	85.43	0.46	0.33
S16	1.30	85.43	0.47	0.34
S17	0.79	85.43	0.29	0.21
S18	0.62	85.43	0.23	0.16
S19	0.90	85.43	0.33	0.24
S20	0.81	85.43	0.29	0.21
S21	1.11	85.43	0.40	0.29
S22	0.49	85.43	0.18	0.13
S23	0.73	85.43	0.26	0.19
S24	0.99	85.43	0.36	0.26
S25	1.44	85.43	0.52	0.38
S26	0.95	85.43	0.35	0.25
S27	0.64	85.43	0.23	0.17
S28	0.92	85.43	0.33	0.24
S29	1.87	85.43	0.68	0.49
S30	1.14	85.43	0.42	0.30
S31	3.08	85.43	1.12	0.81
S3	0.06	85.43	0.05	0.04
S4	0.06	85.43	0.05	0.04
S5	0.03	85.43	0.03	0.02
S6	0.09	85.43	0.07	0.06
S7	0.12	85.43	0.09	0.08
S32	0.06	85.43	0.05	0.04
S33	0.03	85.43	0.02	0.02
S34	0.10	85.43	0.08	0.06
S35	0.04	85.43	0.03	0.03
S36	0.13	85.43	0.10	0.09
S37	0.28	85.43	0.22	0.18
S38	0.09	85.43	0.07	0.06
S39	0.10	85.43	0.08	0.07
S40	0.07	85.43	0.05	0.04
S41	0.10	85.43	0.08	0.07
S42	0.33	85.43	0.26	0.22
S43	0.27	85.43	0.21	0.17
Ex1	2.55	85.43	1.66	1.15
Ex2	3.28	85.43	2.56	1.74
Ex5	1.13	85.43	0.75	0.61
Ex4	1.34	85.43	0.89	0.72
Ex3	2.75	85.43	1.82	1.48

Table D6: Run-off Results for 6hr 100-year Storm – Proposed Condition

Name	Area (ha)	Precipitation (mm)	Runoff Volume (ML)	Peak Runoff (m^3/s)
GoStation	1.00	85.43	0.74	0.59
A4_bldgs	0.36	85.43	0.25	0.19
InternalLoop_East	0.48	85.43	0.35	0.3
nternalLoop_South	0.17	85.43	0.13	0.11
Plot_D2_D3	0.46	85.43	0.32	0.25
Plot_C_D1	0.65	85.43	0.45	0.35
E_bldgs	0.46	85.43	0.33	0.26
D1_bldgs	0.52	85.43	0.34	0.26
B1_bldgs	0.46	85.43	0.34	0.27
B2_bldgs	0.46	85.43	0.31	0.24
Plot_B	0.21	85.43	0.15	0.12
Plot_E	0.07	85.43	0.05	0.04
C_bldgs	0.49	85.43	0.35	0.27
F_bldgs	0.29	85.43	0.19	0.15
Plot_F	0.11	85.43	0.07	0.06
A3_bldgs	0.34	85.43	0.19	0.13
A2_bldgs	0.22	85.43	0.14	0.11
A1_bldgs	0.52	85.43	0.39	0.31
Blvd_sq	0.30	85.43	0.15	0.09
D2_bldgs	0.48	85.43	0.31	0.23
Park	1.03	85.43	0.93	0.59
D3_bldgs	0.58	85.43	0.43	0.34
PublicStreet	0.12	85.43	0.09	0.07
PrivateStreet	0.21	85.43	0.15	0.13
Reliefroad2	0.33	85.43	0.24	0.2
Reliefroad1	0.15	85.43	0.11	0.1
PloA-West	0.29	85.43	0.23	0.19
PlotA-East	0.29	85.43	0.23	0.19
Park_lawn-1	0.11	85.43	0.09	0.07
S1	0.13	85.43	0.1	0.08
S2	0.08	85.43	0.06	0.05
S8	1.44	85.43	0.52	0.38
S9	0.50	85.43	0.18	0.13
S10	0.47	85.43	0.17	0.12
S11	0.83	85.43	0.3	0.22
S12	1.63	85.43	0.59	0.43
S13	0.39	85.43	0.14	0.1
S14	0.53	85.43	0.19	0.14
S15	1.27	85.43	0.46	0.33
S16	1.30	85.43	0.47	0.34
S17	0.79	85.43	0.29	0.21
S18	0.62	85.43	0.23	0.16
S19	0.90	85.43	0.33	0.24
S20	0.81	85.43	0.29	0.21
S21	1.11	85.43	0.4	0.29
S22	0.49	85.43	0.18	0.13
S23	0.73	85.43	0.26	0.19
S24	0.99	85.43	0.36	0.26

Table D6: Run-off Results for 6hr 100-year Storm – Proposed Condition

Name	Area (ha)	Precipitation (mm)	Runoff Volume (ML)	Peak Runoff (m^3/s)
S25	1.44	85.43	0.52	0.38
S26	0.95	85.43	0.35	0.25
S27	0.64	85.43	0.23	0.17
S28	0.92	85.43	0.33	0.24
S29	1.87	85.43	0.68	0.49
S30	1.14	85.43	0.42	0.3
S31	3.08	85.43	1.12	0.81
S3	0.06	85.43	0.05	0.04
S4	0.06	85.43	0.05	0.04
S5	0.03	85.43	0.03	0.02
S6	0.09	85.43	0.07	0.06
S7	0.12	85.43	0.09	0.08
S32	0.06	85.43	0.05	0.04
S33	0.03	85.43	0.02	0.02
S34	0.10	85.43	0.08	0.06
S35	0.04	85.43	0.03	0.03
S36	0.13	85.43	0.1	0.09
S37	0.28	85.43	0.22	0.18
S38	0.09	85.43	0.07	0.06
S39	0.10	85.43	0.08	0.07
S40	0.07	85.43	0.05	0.04
S41	0.10	85.43	0.08	0.07
S42	0.33	85.43	0.26	0.22
S43	0.27	85.43	0.21	0.17
nternalLoop_West_	0.10	85.43	0.08	0.07
nternalLoop_West_	0.21	85.43	0.15	0.13
nternalLoop_West_	0.22	85.43	0.16	0.14
nternalLoop_West_	0.14	85.43	0.1	0.09
Area_Above_PF	0.03	85.43	0.02	0.02
Park_Lawn_1	0.13	85.43	0.09	0.07
Park_Lawn_2	0.07	85.43	0.05	0.04

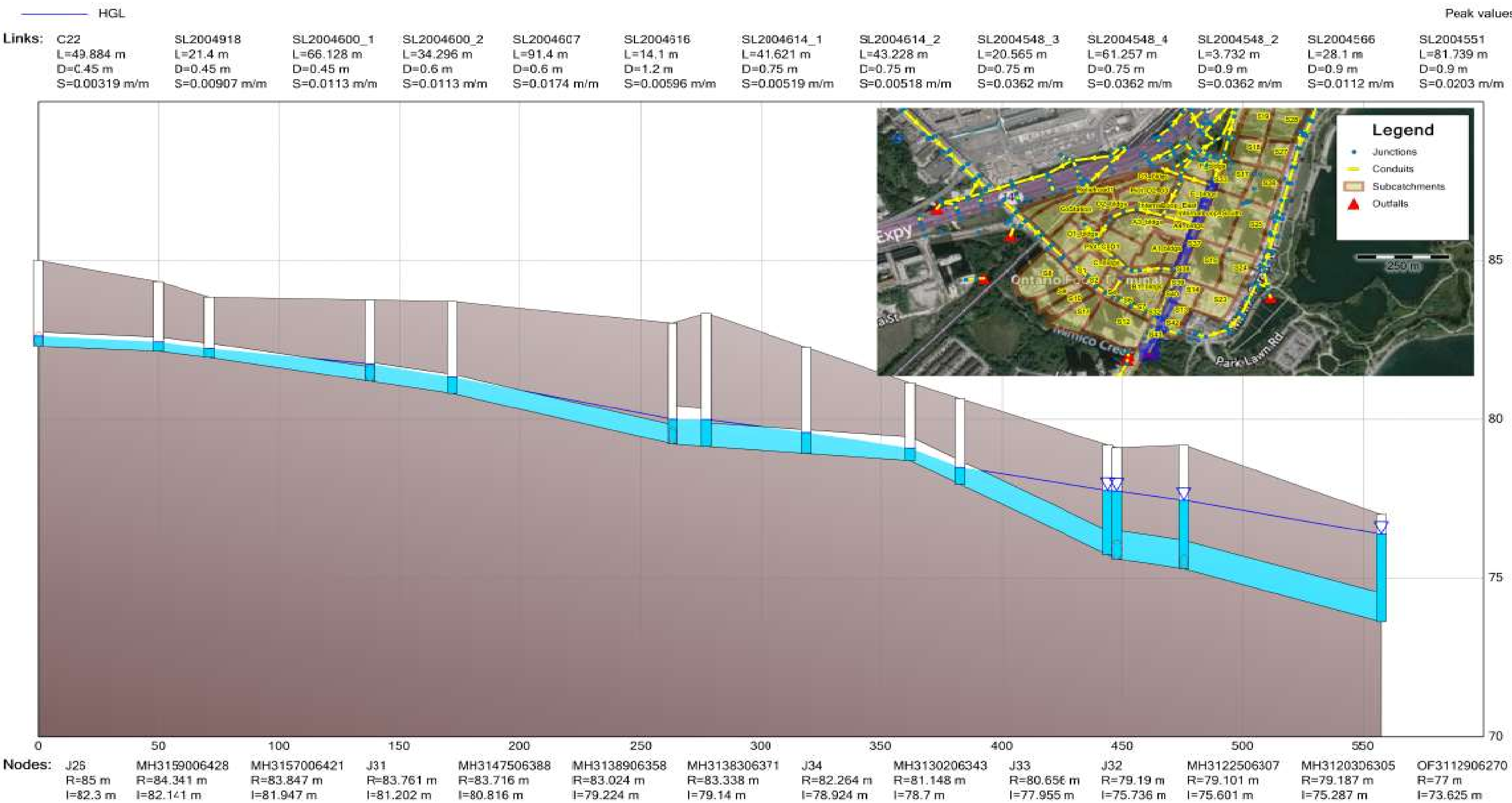

Figure D3 Storm Sewer Profile – along Lake Shore Blvd – Proposed – (100-year)

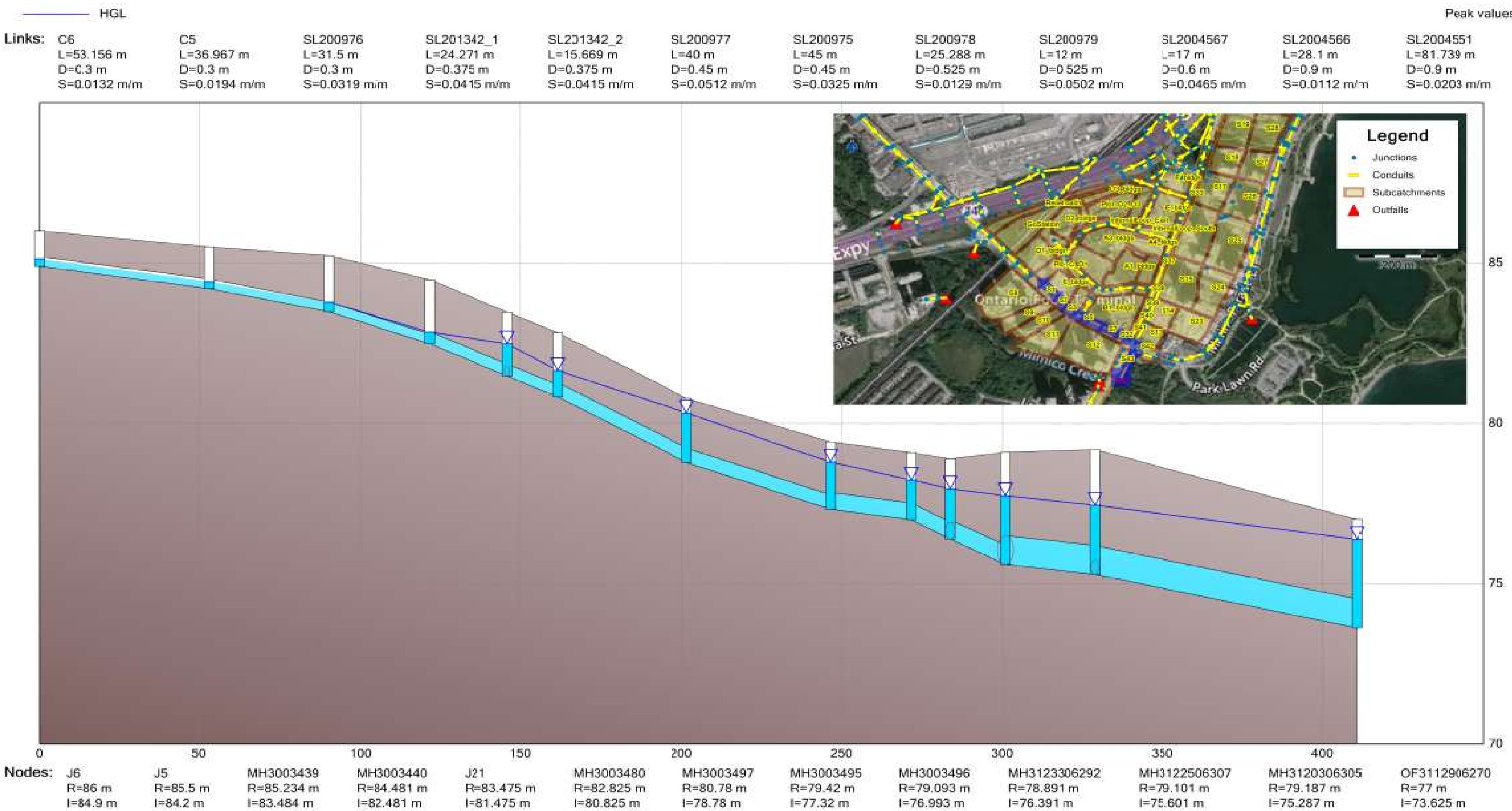

Figure D4 Storm Sewer Profile – along Park Lawn Road – Proposed – (100-year)