APPENDIX O

STORM WATER MANAGEMENT REPORT

SPADINA SUBWAY EXTENSION ENVIRONMENTAL ASSESSMENT

STORMWATER MANAGEMENT REPORT

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APPENDICES

A   TRCA's Flood Flow Criteria Map
B   Rational Method Calculations
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CHAPTER 1.0   INTRODUCTION AND DESIGN STANDARDS

1.1   STUDY PURPOSE

As part of the Spadina Subway Extension Environmental Assessment, the construction of four (4) subway stations and affiliated parking is proposed. **Table 1.1** identifies new impervious areas associated with these facilities. A plan showing the locations of these proposed subway stations is provided in **Exhibit 1.1**.

Table 1.1 – Proposed Subway Station Descriptions

Location	Proposed Facility	New Impervious Area (ha)
Sheppard Avenue West	Station Building	0.2
Finch West	Commuter Parking Lot	2.3
	Passenger Pick-Up/Drop-Off	0.3
	Bus Terminal / Roads / Station Building	1.2
York University Station	Station Building	0.1
Steeles West Station	East Commuter Parking Lot	5.2
	West Commuter Parking Lot	4.9
	Inter-Regional Bus Terminal (north of Steeles) / Station Building	2.1

The proposed subway extension alignment generally follows the divide between the Black Creek subwatershed and the Lower West Don River subwatershed within the Humber Watershed. As a result, surface water is generally conveyed away from each of the proposed station locations to an outlet to one of the two aforementioned watercourses via the existing sewer networks.

With the exception of the Finch West and Steeles West stations where commuter parking lots and bus terminals are proposed, increases in impervious areas resulting from the undertaking consist mainly of small entrance / exit buildings. New roads are proposed at the Steeles West Station but are addressed as part of York Region's Highway 7 Transitway Environmental Assessment. The proposed GO Transit platform at the Sheppard West Station will be addressed under a separate GO Transit Environmental Assessment.

The placement of these permanent facilities with impervious areas may affect the drainage characteristics and quality of runoff from the affected subwatersheds. To offset these potential impacts, lot level conveyance and quality controls will be implemented. To address these potential changes in hydraulic performance, a stormwater management plan for each proposed site has been prepared and is discussed below.

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Exhibit 1.1 – Proposed Subway Station Locations

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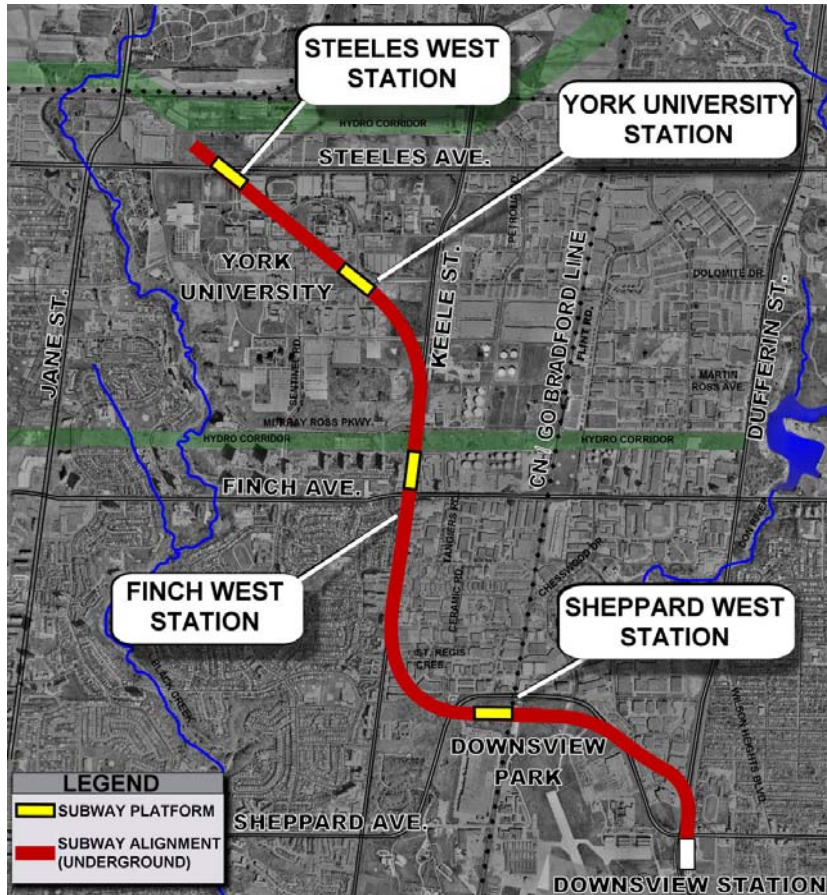
1.2   STUDY SCOPE

This stormwater management (SWM) report includes the following for each proposed station location:

- Identification of the existing drainage condition;
- Proposed Drainage Condition; and
- Stormwater Management Plan (Water Quality and Quantity Control, Water Balance, and Erosion and Sediment Control requirements).

In addition, it is assumed that stormwater management of all underground facilities will be conducted in accordance with standard building code practice with connections to sanitary sewers. For above ground facilities, (stations and transit facilities including bus terminals, commuter parking lots and passenger drop-off / pick-up facilities), downspouts will outlet at ground level. In the case of substations without roofs, it is assumed that their floor drains will also outlet at ground level.

1.3   STORMWATER MANAGEMENT DESIGN CRITERIA – CITY OF TORONTO

In accordance with the City of Toronto's Wet Weather Flow Management Policy (August 2003), the following (interim) must be addressed during design for all proposed subway stations:

- Water Quality;
- Water Quantity including erosion control and; and
- Water Balance.

1.3.1   Water Quality - Total Suspended Solids (TSS)

The wet weather flow (WWF) water quality target is the long-term average removal of 80% of the Total Suspended Solids (TSS) on annual loading basis from all runoff leaving the development site based on the post-development level of imperviousness.

1.3.2   Water Quantity

a) Flood Flow Management Criteria

The required level of peak flow control from the development site shall follow Toronto and Region Conservation Authority (TRCA) Flood Flow Criteria Map, which indicates that quantity control should ensure post to pre-development peak flows for 2 to 100-year return period events. For redevelopment sites < 5 ha, peak flows can be computed using simplified approach such as the Rational Method and IDF curves. Refer to Appendix A for a copy of TRCA's Flood Flow Criteria Map.

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b) Erosion Control

The TTC must contact TRCA staff to determine erosion control/geomorphology requirements for individual development sites in the planning stage (TRCA's response has been noted in each section addressing erosion and sediment control).

1. For Rouge River watershed, follow TRCA (Toronto Region Conservation Authority) erosion control criteria for individual sites, which discharge directly to and/or are in proximity of natural watercourses;

2. For all new large development blocks, which discharge directly to and/or in proximity of natural watercourses within other watersheds, the proponents are required to complete an Erosion Analysis Report to determine the erosion control criteria for the sites. Please consult TRCA for further details.

3. For new development blocks where it is not feasible (i.e. proposed development is negligible with respect to the total drainage area of the receiving watercourse) to complete an Erosion Analysis Report, TRCA typically requires that runoff from a 25 mm storm shall be detained on-site and released over a minimum of 24 hours.

4. For small infill/redevelopment sites < 2 ha, erosion control in the form of stormwater detention is normally not required, provided the on-site minimum runoff retention from a 5 mm daily rainfall event is achieved under the Water Balance Criteria.

c) Erosion and Sediment Control During Construction

The City of Toronto Erosion Control Criteria during construction are as follows:

- Regardless of size for all development sites, temporary erosion and sediment control for construction must be provided on-site.

- All erosion and sediment control 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" as well as City of Toronto Sewer Use By-Law and/or other City of Toronto requirements on a site by site basis, where applicable.

1.3.3 Water Balance

a) Retained on-site, to the maximum 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.

b) If the allowable annual runoff volume from the development site under post-development conditions is less than the pre-development conditions, then the more

stringent runoff volume requirement becomes the governing target for the development site.

c) Regardless of the off-site compensatory/cash-in-lieu option, the minimum on-site runoff retention requires the proponent to capture all runoff from a small design rainfall event (typically 5 mm) and restore it on-site through infiltration, evapo-transpiration and rainwater reuse.

1.4 PERFORMANCE STANDARDS – CITY OF VAUGHAN

The proposed Steeles West station is located on the boundary between the City of Toronto and the Region of York, within the City of Vaughan. City staff has indicated that quality control should be in accordance with TRCA requirements, and that quantity control should ensure post to pre-development peak flows for 2 to 100-year return period events.

Furthermore, any proposed SWM works north of Steeles Avenue between Jane and Keele Streets must proceed in accordance with the stormwater management initiative that will be developed as part of the City of Vaughan's planned development in this area (OPA 620).

1.5 PERFORMANCE STANDARDS – TORONTO TRANSIT COMMISSION (TTC)

This report also considered design criteria recommendations contained in TTC's "Design Standards, Volume 1." Section 2 provides storm drainage design recommendations. The following is a summary:

- The Modified Rational Method may be used to develop hydrographs for the design of detention storage systems (Section 2.2);

- For design purposes the storm frequency shall meet the requirements of the approval authorities (Section 2.4.2.1);

- Roof storage maximum controlled run-off 42 l/s per hectare of roof area, maximum ponding depth 150 mm; surface storage maximum ponding depth of 0mm for 1:2 year storm and 250 mm for 1: 100-Year storm (Section 3.2);

- Overland flow gradients for parking lots shall be a minimum of 2% and a maximum of 4% (Section 5.2.1).

1.6 PERFORMANCE STANDARDS – TORONTO AND REGION CONSERVATION AUTHORITY (TRCA)

In accordance with TRCA's requirements, lot level conveyance controls (parking and roof-top storage) are to be designed to reduce post development peak flows for 2:100 year return periods

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to pre-development flows. Furthermore, the Toronto and Region Conservation Authority (TRCA) encourages the use of innovative lot level stormwater management controls. These practices include maximizing on-site stormwater infiltration, the retention and enhancement of pervious and vegetative area (tree and shrub plantings, infiltration trenches, grassed swales), the use of biologically-based pollutant load reduction features (bio-swales, vegetated filter strips) and the reduction of sediment and nutrient loadings through the development of, for instance, pollution prevention plans, sediment control during construction, oil-grit separators etc.

Examples of innovative of level controls may be viewed on TRCA's website (http://www.trca.on.ca); refer to the Etobicoke / Mimico Creek Strategy document, Chapter 7, page 184. These measures should be considered and incorporated where possible during detailed design. TRCA's Erosion and Sediment Control (ESC) Guidelines - December 2003, will be used as the basis for developing an Erosion and Sedimentation Control Design Brief during detailed design.

1.7 ANALYSIS METHODOLOGY

Quantity Control

For each proposed facility, the Rational Method was used to determine the pre-construction uncontrolled peak flow rate (see **Appendix B**). The following equation was used:

$$Q_{x\ year} = CIA/360$$

Where:

C - permeability coefficient (unitless):   0.3 for open fields was used, 0.9 for new facilities;
I - rainfall intensity (mm/hour):   based on North York IDF curve data,
                                                     Tc = 10 minutes pre, 7 minutes post construction;
A - catchment area (hectares):   area of facility in hectares.

City of Toronto harmonized IDF curves (presently not available) or North York District IDF curves should be used in the detailed designs.

Storage requirements using the Modified Rational Method have been provided in **Appendix C**. For the Finch West Station, release rates for the Humber River Watershed, Sub-Basin 46 have been provided by TRCA (provided below) and should be confirmed during detail design. Roof control (Zurn) release rates were considered for the Sheppard and York University Stations since roof leaders will discharge directly to the ground.

	2-year	5-year	25-year	100-year

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Allowable Release Rate:	Q=7.745-0.762ln(A)	Q=11.468-1.123ln(A)	Q=17.381-1.690ln(A)	Q=22.973-2.256ln(A)

Where for release rates: Q – unit flow (L/s/ha) – litres per second per hectare
                                            A – area in hectares (ha)

For the Steeles West Station, the ultimate SWM plan will be developed during detail design in accordance with OPA 620 requirements, and for the purposes of the interim SWM plan proposed at that Station, storage requirements are based on post to pre peak flow rates for all return periods.

For all proposed stations addressed in this SWM plan, the rational method was used to calculate peak flows. A pre-development drainage coefficient "C" of 0.3 was used, and a post-development drainage coefficient "C" value of 0.9 was used. North York IDF curve coefficients (from the City of Toronto) were used as follows:

Coefficient	2-year	5-year	25-year	100-year
a	652.8	840.7	1082	1334
b	4	3	2	2
c	0.786	0.779	0.771	0.771

Quality Control

Quality control was not considered for the proposed Sheppard West and York University stations due to the absence of pollution sources at these sites (commuter parking is only being provided at the proposed Finch West and Steeles West stations). Proposed quality control for the Finch and Steeles West stations consists of Oil / Grit Separators (OGS) in a "treatment train" approach in accordance with the above noted criteria as applicable.

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Water Balance

Preliminary geotechnical information on the subsurface physical conditions (soil and groundwater) along the proposed subway route was conducted by Golder Associates Ltd. (Golder) and documented in their draft report "Geotechnical Investigation Report – Spadina Subway Extension Environmental Assessment" (December 2005). The following excerpt (page 16) summarizes the typical founding soils for the four proposed subway station base slabs:

Station	Estimated Elevation of Base Slab (m)	Founding Soil	Soil Type
GO/Sheppard Avenue	180	Silt; Clayey silt (Interstadial)	8; 9
Keele/Finch	175	Clayey Silt to Silty Clay Till; Clayey Silt (Interstadial)	11; 9
York University	175	Sandy Silt to Sand and Silt Till	12
Steeles Avenue	180	Clayey Silt to Silty Clay Till	11

Reference is made in this geotechnical report (page 12) to the average hydraulic conductivity of 1.4E-05 to 3.0E-05 cm/s within the cohesive and glacial till deposits. Although these preliminary soils investigations indicate soils not conducive to Water Balance measures, measures will need to be addressed for each station during detail design in accordance with the above noted criteria where feasible.

On-site SWMP's considered in the following plan include rooftop restrictors (at station buildings), exfiltration systems (proposed in a "treatment train" approach with oil / grit separators) and underground storage at the proposed parking lots at Finch and Steeles Stations (super pipe for the 2-year event). Additional SWMP's to be considered during detail design include rainwater harvesting, green roof technologies, absorbent landscaping, pervious pavement in parking lots and tree plantings and bushes. Additionally, the use of curb and gutter with catchbasins and exfiltration / infiltration systems should be considered.

The following summarizes the results of the hydraulic /hydrologic analysis and identifies the proposed stormwater management plan for each proposed station location.

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CHAPTER 2.0   SHEPPARD AVENUE WEST STATION SWM PLAN

The Sheppard West Station, situated entirely within the Downsview Park lands, will be located at the southwest corner of the Bradford GO Line and Sheppard Avenue. New above ground facilities that will reduce the overall permeability within the study area include the new subway station building itself. Impervious areas associated with these new facilities are provided in **Table 2.0**. Refer to **Exhibit 2.1** for a map of this station location including the existing drainage condition as identified from OBM maps and a site visit.

Table 2.0 – Above Ground Facilities at the Sheppard Avenue West Station

Facility	Impervious Area Proposed (ha)
New TTC Station Roof	0.2

The surface at the existing site drains generally to the north. Utility information provided by the City indicates that storm water is conveyed easterly along Sheppard Avenue through a series of storm sewers (900, 1050 mm diameter in the vicinity of the proposed station) eventually draining to the G. Ross Lord Dam and Reservoir to the north/north-east.

2.1   DESIGN REQUIREMENTS

Design of SWM facilities will be based on the criteria provided by the City of Toronto, the TTC, and TRCA as summarized in Sections 1.3 to 1.6 of this Report.

2.2   QUALITY CONTROL

Quality control was not considered for the proposed Sheppard West station due to the absence of pollution sources this site.

2.3   QUANTITY CONTROL

As indicated in Section 1.7, the Rational Method was used to determine the pre-construction uncontrolled 2 to 100-year peak flow rates. To ensure that the subject development will not have a negative impact on downstream conditions, it is necessary to control the post-development flows for each return period from 2 to 100 years to pre-development flows. For the TTC station building, rooftop storage is proposed. A separate GO Transit Environmental Assessment will be conducted for the stormwater management of the proposed new GO Transit platform.

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Exhibit 2.1 – Existing Drainage Conditions at the Proposed Sheppard West Station

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Allowable release rates were provided by TRCA (Section 1.7); however, as downspouts will outlet at ground level, and as the TTC roof storage maximum controlled run-off is 42 l/s per hectare (TTC Standard Volume 1, Section 3.2), a maximum allowable release rate was set to (42 l/s) x (0.2 ha) = 8.4 l/s.

Results are summarized in Table 2.1.

Table 2.1 – Storage Requirements at the Sheppard Avenue West Station

Facility	Area (ha)	Return Period	Allowable Release Rate (l/s)	Q Uncontrolled Pre-Const. (l/s)	Q Uncontrolled Post-Const. (l/s)	Volume Required (m3)
TTC Station Building	0.2	2-year	8.4	13.7	49.6	22
	0.2	5-year	8.4	19.0	70.0	35
	0.2	25-year	8.4	26.6	99.5	53
	0.2	100-year	8.4	32.8	122.7	70

The proposed stormwater management plan for this station entails the use of quantity control through the use of Zurn Roof Control Drains in accordance with previously stated design criteria.

2.4 WATER BALANCE

As indicated in Section 1.7, the preliminary soils investigations in the vicinity of the Sheppard Ave. West station indicate soils may not be conducive to water balance measures. However, City of Toronto water balance requirements in accordance with Section 1.3.3 should be addressed during detail design.

2.5 EROSION AND SEDIMENT CONTROL

Erosion and Sediment Control will be addressed during detail design in accordance with applicable criteria in Section 1.3.2 above. During planning, it was confirmed by TRCA that criteria (c) Section 1.3.2 governs at this location.

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CHAPTER 3.0   FINCH WEST STATION SWM PLAN

The Finch West Station will be located at the intersection of Finch Avenue and Keele Street. New above ground facilities that will reduce the overall permeability of the study area include the new commuter parking lot to the east of Keele Street, the passenger pick –up and drop-off to the west of Keele Street, and the proposed bus terminal including the new roads. Impervious areas associated with these new facilities are provided in **Table 3.0.** Refer to **Exhibit 3.1** for a map of this station location including the existing drainage condition as identified from OBM maps and a site visit.

Table 3.0 – Above ground Facilities at the Finch West Station

Facility	Impervious Area Proposed (ha)
Commuter Parking Lot	2.3
Passenger Pick-Up / Drop-Off	0.3
Bus Terminal / Roads / Station Building	1.2

According to drainage mosaics provided by the City, the surface at the existing site generally drains to the east and west from Keele Street, with the exception of a triangular area at the north-east quadrant of the Finch / Keele intersection which also drains to the west as indicated in **Exhibit 3.1**. The site is drained by storm sewers, with the area west of Keele street draining towards the 5000 x 3000 mm CSP under Finch Avenue, ultimately released to the Black Creek; to the east, storm water is conveyed via storm sewers and creek to the G. Lord Ross Reservoir and Dam.

3.1   DESIGN REQUIREMENTS

Design of SWM facilities will be based on criteria provided by the City of Toronto, the TTC, and TRCA as summarized in Sections 1.3 to 1.6 of this Report.
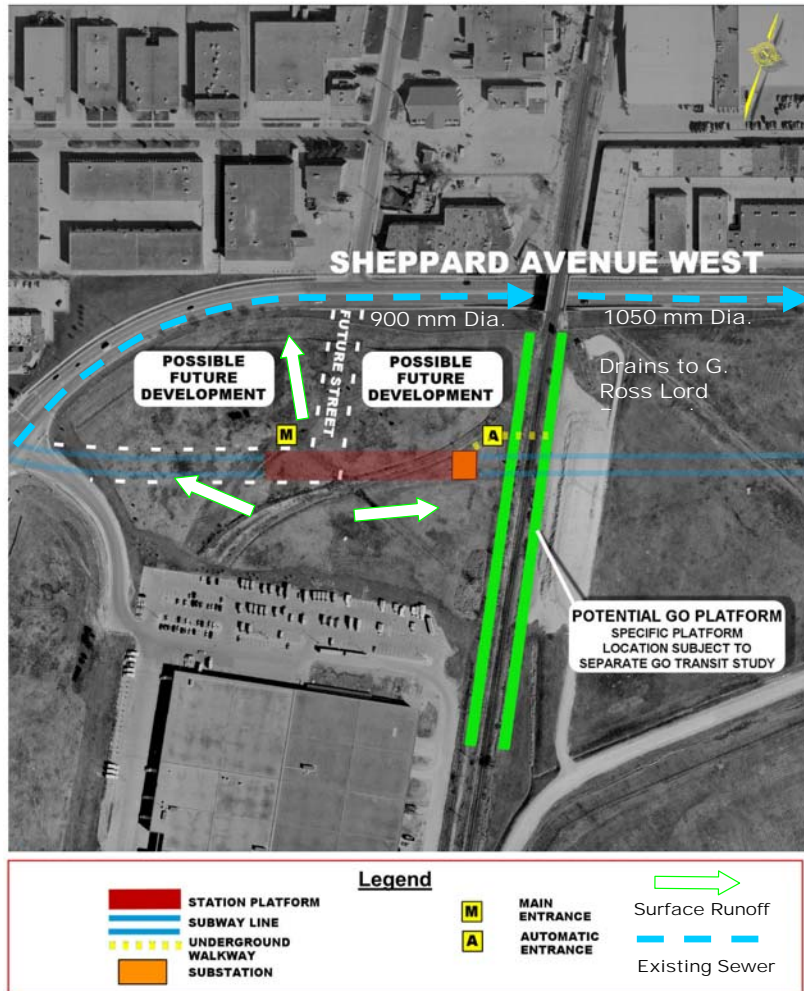
3.2   QUALITY CONTROL

To address the requirements for quality treatment on the site, oil grit separators are proposed in a treatment train approach in coordination to include for instance bio-swales and infiltration systems. Proposed flow patterns are indicated in **Exhibit 3.2.**

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Exhibit 3.1 – Existing Drainage Conditions at the Proposed Finch West Station

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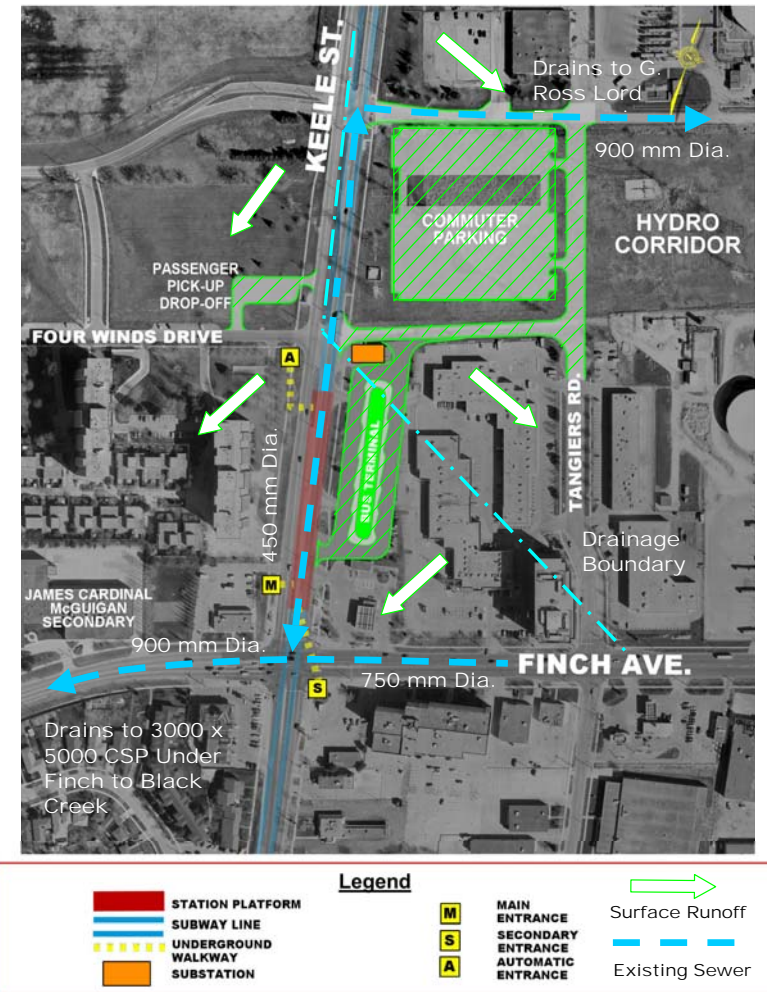
Exhibit 3.2 – Proposed Drainage Conditions at the Proposed Finch West Station

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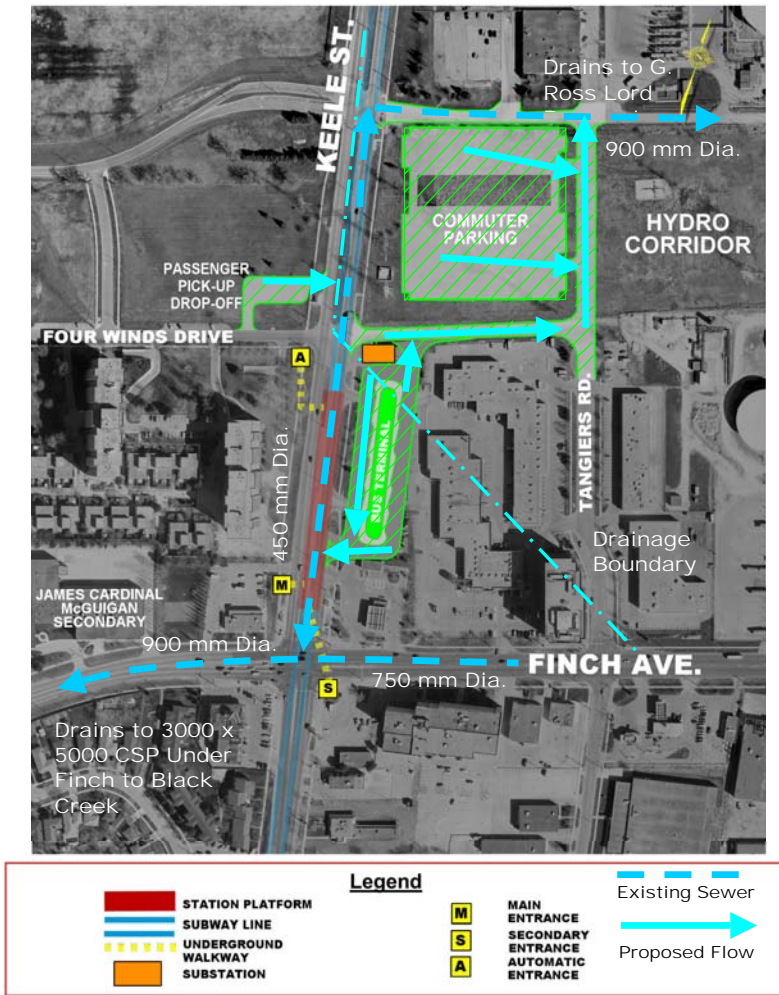
3.3   QUANTITY CONTROL

For the parking lot, passenger pick-up / drop-off and bus terminal, parking lot conveyance control is suggested. Results are summarized in **Tables 3.1, 3.2, and 3.3**.

Table 3.1 – Parking Lot Storage Requirements at the Finch West Station

Facility	Area (ha)	Return Period	Allowable Release Rate (l/s)	Q Uncontrolled Pre-Const. (l/s)	Q Uncontrolled Post-Const. (l/s)	Volume Required (m3)
Comm. Parking Lot	2.3	2-year	16.4	157.3	570.5	498
	2.3	5-year	24.2	218.7	804.7	648
	2.3	25-year	36.7	305.5	1144.3	840
	2.3	100-year	48.5	376.7	1410.7	1013

Table 3.2 – Passenger Pick-up/Drop-off Storage Requirements at the Finch West Station

Facility	Area (ha)	Return Period	Allowable Release Rate (l/s)	Q Uncontrolled Pre-Const. (l/s)	Q Uncontrolled Post-Const. (l/s)	Volume Required (m3)
Pass. Pick-Up Drop-Off	0.3	2-year	2.6	20.5	74.4	61
	0.3	5-year	3.8	28.5	105.0	80
	0.3	25-year	5.8	39.9	149.3	103
	0.3	100-year	7.7	49.1	184.0	124

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Table 3.3 – Bus Terminal Storage Requirements at the Finch West Station

Facility	Area (ha)	Return Period	Allowable Release Rate (l/s)	Q Uncontrolled Pre-Const. (l/s)	Q Uncontrolled Post-Const. (l/s)	Volume Required (m3)
Bus Terminal/ Roads / Station Building	1.2	2-year	9.1	82.1	297.7	255
	1.2	5-year	13.5	114.1	419.9	331
	1.2	25-year	20.5	159.4	597.0	429
	1.2	100-year	27.1	196.5	736.0	517

The proposed stormwater management plan for this station entails the use of quantity control through the use of Zurn Roof Control Drains in accordance with previously stated design criteria. To further satisfy TTC site drainage requirements (see Section 1.5 above) since no ponding will be permitted under the 2-year storm event, it is proposed that the post-construction 2-year storm event be captured in a "super-pipe". Refer to **Exhibit 3.2** for a map of this station location including the proposed drainage condition. It is proposed that Oil / Grit Separators (OGS) be used in a "treatment train" approach, including exfiltration trenches located in grassed boulevard areas adjacent to parking lots prior to entry into City sewer system (as the only available space is in the Hydro Corridor, this will require approval from Ontario Hydro).

3.4   WATER BALANCE

As indicated in Section 1.7, the preliminary soils investigations in the vicinity of the Finch West station indicate soils may not be conducive to water balance measures. However, City of Toronto water balance requirements in accordance with Section 1.3.3 should be addressed during detail design.

3.5   EROSION AND SEDIMENT CONTROL

Erosion and Sediment Control will be addressed during detail design in accordance with applicable criteria in Section 1.3.2 above. During planning, it was confirmed by TRCA that criteria (d) Section 1.3.2 governs at this location, however, TRCA also requested that the runoff from a 25 mm storm be detained on-site and released over a minimum of 48 hours.

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CHAPTER 4.0   YORK UNIVERSITY STATION SWM PLAN

The York University Station will be located at the east end of the "commons" within the University campus. The Subway station will be a below ground facility. New above ground facilities that will reduce the overall permeability of the study area include the substation building, as well as two entrances to the subway. Impervious areas associated with these new facilities are provided in **Table 4.0.** Refer to **Exhibit 4.1** for a map of this station location including the existing drainage condition as identified from OBM maps and a site visit.

Table 4.0 – Above ground Facilities at the York University Station

Facility	Impervious Area Proposed (ha)
Substation Building and Entrances	0.1

Surface water in the vicinity of the proposed facility drains through a series of storm sewers to the pond at Pond Road, then ultimately to the Black Creek. A ditch inlet was noted in the grassed area of the "Common", as well as on the east side of Ian MacDonald Boulevard within the existing grassed swale.

4.1   DESIGN REQUIREMENTS

Design of SWM facilities will be based on criteria provided by the City of Toronto, the TTC, and TRCA as summarized in Sections 1.3 to 1.6 of this Report.

4.2   QUALITY CONTROL

Quality control was not considered for the proposed York University station due to the absence of pollution sources (new facilities include only building roofs) at this site.

4.3   QUANTITY CONTROL

As indicated in Section 1.7, the Rational Method was used to determine the pre-construction uncontrolled 2 to 100-year peak flow rates. To ensure that the subject development will not have a negative impact on downstream conditions, it is necessary to control the post-development flows for each return period from 2 to 100 years to pre-development flows. For the TTC station building, rooftop storage is proposed and summarized in **Table 4.1.** Although peak runoff will be controlled for post to pre for the 2 to 100 year events, York University's Stormwater Management Plan should be consulted for any additional requirements prior to detailed design.

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Exhibit 4.1 – Existing Drainage Conditions at the Proposed York University Station
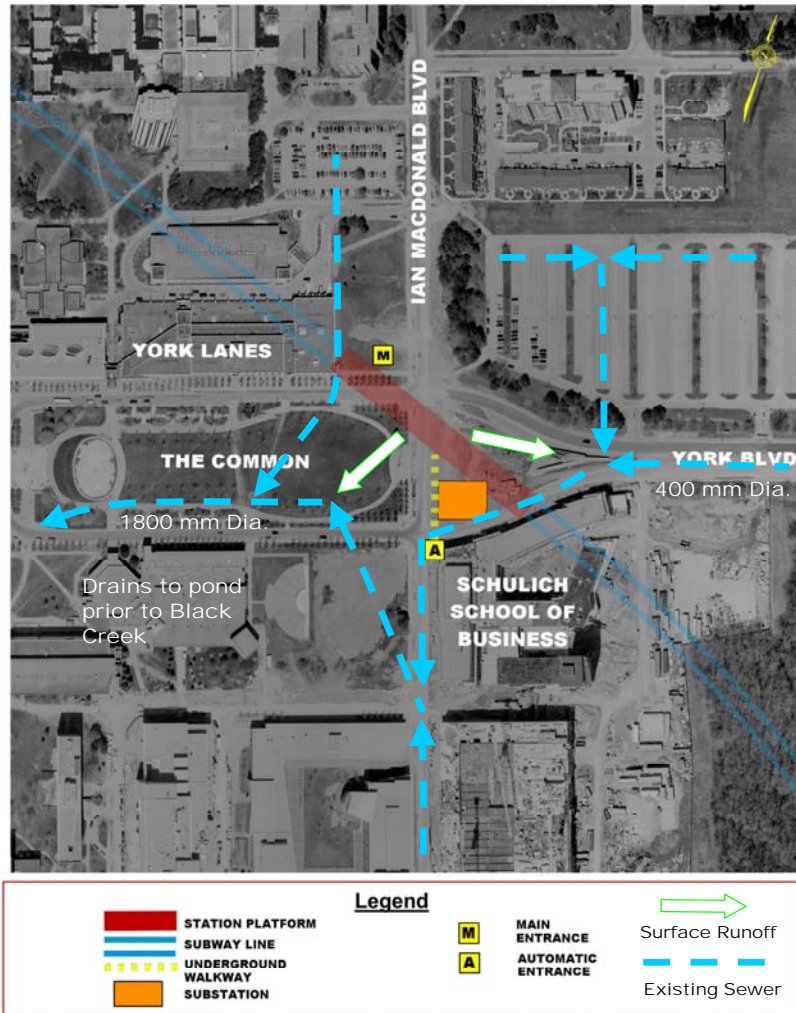
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Allowable release rates were provided by TRCA (Section 1.7); however, as downspouts will outlet at ground level, and as the TTC roof storage maximum controlled run-off is 42 l/s per hectare (TTC Standard Volume 1, Section 3.2), a maximum allowable release rate was set to (42 l/s) x (0.1 ha) = 4.2 l/s.

Table 4.1 –Storage Requirements at the York University Station

Facility	Area (ha)	Return Period	Allowable Release Rate (l/s)	Q Uncontrolled Pre-Const. (l/s)	Q Uncontrolled Post-Const. (l/s)	Volume Required (m3)
TTC Station Building	0.1	2-year	4.2	6.8	24.8	11
	0.1	5-year	4.2	9.5	35.0	17
	0.1	25-year	4.2	13.3	49.8	26
	0.1	100-year	4.2	16.4	61.3	35

The proposed stormwater management plan for this station entails the use of quantity control through the use of Zurn Roof Control Drains in accordance with previously stated design criteria

4.4 WATER BALANCE

As indicated in Section 1.7, the preliminary soils investigations in the vicinity of the York University station indicate soils may not be conducive to water balance measures. However, City of Toronto water balance requirements in accordance with Section 1.3.3 should be addressed during detail design.

4.5 EROSION AND SEDIMENT CONTROL

Erosion and Sediment Control will be addressed during detail design in accordance with applicable criteria in Section 1.3.2 above. During planning, it was confirmed by TRCA that criteria (c) Section 1.3.2 governs at this location.

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CHAPTER 5.0 STEELES WEST STATION SWM PLAN

The Steeles West Station will be located at the intersection of Steeles Avenue and Northwest Gate. New above ground facilities that will reduce the overall permeability of the study area include two new commuter parking lots located within the Hydro corridor north of Steeles Avenue, one bus terminal located north of Steeles Avenue including passenger pick-up and drop-off facilities and entrances. Impervious areas associated with these new facilities are provided in **Table 5.0**. One bus terminal is to be located south of Steeles Avenue utilizing an existing parking lot, and thereby not increasing the ground imperviousness. Refer to **Exhibit 5.1** for a map of this station location including the existing drainage condition as identified from OBM maps and a site visit.

Table 5.0 – Above ground Facilities at the Steeles West Station

Facility	Impervious Area Proposed (ha)
New East Commuter Parking Lot	5.2
New West Commuter Parking Lot including Passenger Pick-Up and Drop-Off	4.9 *
New Inter-Regional Bus Terminals (north of Steeles Avenue) / Station Buildings	2.1
New Inter-Regional Bus Terminal (south of Steeles Avenue) / Station Buildings	Area presently paved

* Includes a portion of facilities included in York Regions Highway 7 Transitway EA.

Presently the subject land, north of Steeles and south of the Hydro corridor, is an open field where Northwest Gate intersects Steeles Avenue at an unsignalized "T" intersection. Surface drainage in the area of the proposed facility is to the south, to two sets of existing storm sewers, one under Steeles Avenue, and one just north of the right-of-way. The storm sewer under Steeles Avenue (600 to 1500 mm diameter) drains to TRCA's pond at Black Creek Pioneer Village; to the north to the right-of-way, the storm sewer (1650 to 1800 mm diameter) drains to a pond north of Steeles Avenue near Jane Street. It is assumed that the building to the east of the proposed facility manages it's own stormwater. Therefore the property boundary of the proposed parking facilities coincides with the drainage boundaries.

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Exhibit 5.1 – Existing Drainage Conditions at the Proposed Steeles West Station

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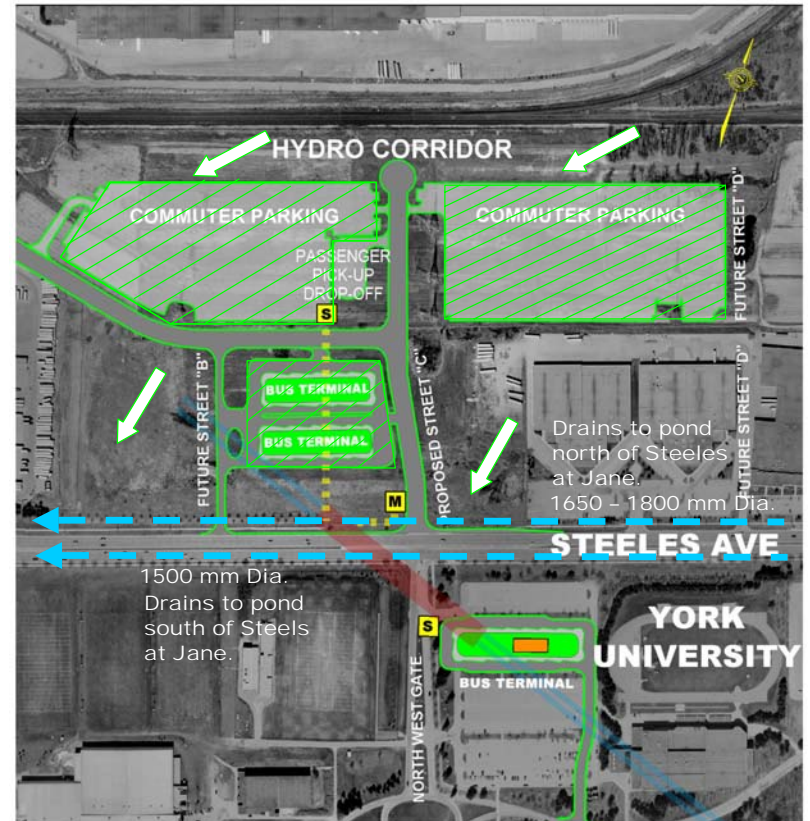
5.1 DESIGN REQUIREMENTS

Design of SWM facilities will be based on the criteria provided by the City of Toronto, the TTC, TRCA and the City of Vaughan, as summarized in Sections 1.3 to 1.6 of this Report.

According to TRCA, the existing stormwater management pond (CFN 8133, TRCA Pond File 42.0) located north of Steeles at Jane Street is inadequate by present day standards, and there is little room available to expand the pond for the redevelopment of the industrial area to the north of Steeles Avenue including the Steeles West Station. The pond is presently a peak flow attenuation facility only. Although it is not presently possible within the scope of this study to provide a definitive SWM plan for the Steeles West Station, a detailed SWM plan for the Steeles West Station will need to be integrated into a comprehensive stormwater Management master plan, once developed, in accordance with development (OPA 620) in the area.

5.2 QUALITY CONTROL

To address the **interim** requirements for quality treatment on the site (prior to a developed Master SWM Plan for the area in accordance with OPA 620), oil grit separators are proposed in a treatment train approach, to include for instance bio-swales and infiltration systems. Proposed flow patterns are indicated in **Exhibit 5.2.**

5.3 QUANTITY CONTROL

For the parking lot, passenger pick-up / drop-off and bus terminal, in-lieu of a definitive SWM Master Plan for the area, interim parking lot conveyance control is suggested. Results are summarized in **Tables 5.1, 5.2, and 5.3.** Although the east and west commuter parking lot areas approach and slightly exceed the criteria for Rational Method calculations (Section 1.3.2 above) the Rational Method was used since some portion of these facilities are actually addressed in York Region's Highway 7 Transitway EA. Furthermore, the impacts from new roads will also be addressed separately through York Region's Hwy 7 Transitway Environmental Assessment.

Table 5.1 – East Commuter Parking Lot Storage Requirements at the Steeles West Station

Facility	Area (ha)	Return Period	Q Uncontrolled Pre-Const. (l/s)	Q Uncontrolled Post-Const. (l/s)	Volume Required (m3)
East Parking Lot	5.2	2-year	355.7	1289.8	450
	5.2	5-year	494.4	1819.4	599
	5.2	25-year	690.8	2587.0	828
	5.2	100-year	851.7	3189.5	1020

Table 5.2 – West Commuter Parking Lot Storage Requirements at the Steeles West Station

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Facility	Area (ha)	Return Period	Q Uncontrolled Pre-Const. (l/s)	Q Uncontrolled Post-Const. (l/s)	Volume Required (m3)
West Parking Lot	4.9	2-year	335.2	1215.4	411
	4.9	5-year	465.8	1714.4	565
	4.9	25-year	650.9	2437.8	780
	4.9	100-year	802.5	3005.5	961

Table 5.3 – Bus Terminal Storage Requirements at the Steeles West Station

Facility	Area (ha)	Return Period	Q Uncontrolled Pre-Const. (l/s)	Q Uncontrolled Post-Const. (l/s)	Volume Required (m3)
Bus Terminal/ Station Building	2.1	2-year	143.7	520.9	176
	2.1	5-year	199.6	734.8	242
	2.1	25-year	279.0	1044.8	334
	2.1	100-year	343.9	1288.1	412

To further satisfy TTC site drainage requirements (see Section 1.5 above) since no ponding will be permitted under the 2-year storm event, it is proposed that the post-construction 2-year storm event be captured in a "super-pipe" or in swales or depressions prior to release. Refer to **Exhibit 5.2** for a map of this station location including the proposed drainage condition. It is proposed that this interim solution (ultimate SWM solution to be part of the SWM Master Plan in accordance with OPA 620), Oil / Grit Separators (OGS) be used in a "treatment train" approach, including exfiltration trenches located in grassed boulevard areas adjacent to parking lots).

5.4 WATER BALANCE

As indicated in Section 1.7, the preliminary soils investigations in the vicinity of the Steeles West station indicate soils may not be conducive to water balance measures. However, City of Toronto water balance requirements according to Section 1.3.3 will be addressed in detail design.

5.5 EROSION AND SEDIMENT CONTROL

Erosion and Sediment Control will be addressed during detail design in accordance with applicable criteria in Section 1.3.2 above. During planning, it was confirmed by TRCA that criteria (d) Section 1.3.2 governs at this location, however, TRCA also requested that the runoff from a 25 mm storm be detained on-site and released over a minimum of 48 hours.

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Exhibit 5.2 – Proposed Drainage Conditions at the Proposed Steeles West Station

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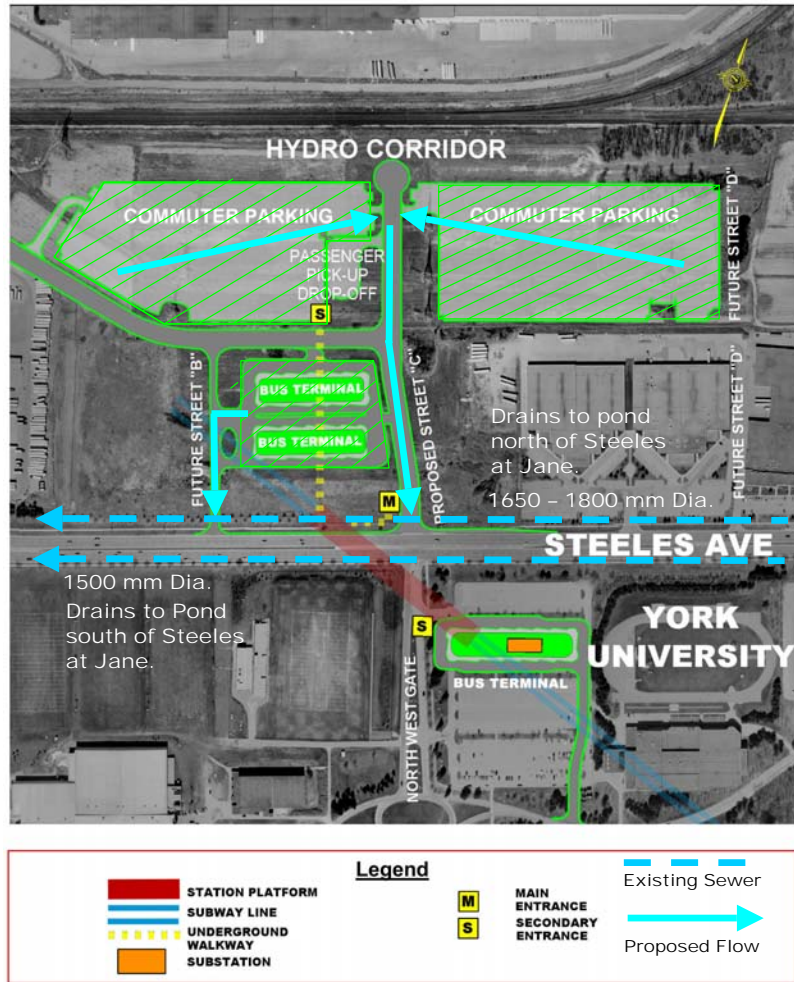
CHAPTER 6.0   CONSTRUCTION IMPACTS AND MITIGATION AND MONITORING

During construction activities including dewatering, erosion and sedimentation potential will be addressed.

Governmental documentation related to erosion control and sedimentation exists in the following three forms: legislation, guidelines and by-laws. Guidelines used within TRCA's jurisdiction include current editions of the following:

- MNR Technical Guideline: Erosion and Sediment Control;

- GTA Conservation Authorities Erosion & Sediment Control Guidelines for Urban Construction;

- City of Toronto Sewer Use B-Law; and,

- MTO Drainage Management Manual.

Mitigation will be addressed in contract documents according to TRCA's Erosion and Sedimentation guidelines with explains the design, function, installation procedure, maintenance procedure, and removal procedure for each of the following ESC measures including, but not limited to sediment traps, interceptor swales/dykes, sediment control fences, straw bales, sodding etc.

Prior to construction, the contractor is required to submit comprehensive environmental controls and methods plan to address, among other elements, effluent (water control) as per TTC's Master Specification 05-06-28 – Section 01575 – subsection 6. The effectiveness of this plan is monitored during a demonstration of the process that is undertaken before the Work can commence on site. A representative of TTC will undertake monitoring of plan compliance.

The construction process will result in exposed soil in areas such as the Hydro corridors during the construction of the commuter parking lots or the Downsview lands during the open cut construction of the running structure. Sediment and erosion control measures will be inspected regularly by TTC to ensure that these measures are maintained in proper working order until all areas are fully stabilized.

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CHAPTER 7.0   CONCLUSIONS

The preliminary analysis as summarized in this report indicates that the proposed stormwater management plan for each of the 3 proposed subway stations, namely Sheppard West, Keele Street, and York University Stations will satisfy design requirements of the TTC, the City of Toronto and TRCA. The SWM plan for the Steeles West Station will require further development during detail design in accordance with a SWM Master Plan to be developed in response to development north of Steeles Avenue.

Further refinements to this plan will be required during the detailed design phase of the subway extension project.

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APPENDICES

APPENDIX A
TRCA's Flood Flow Criteria Map

Toronto and Region Conservation
STORMWATER MANAGEMENT

DUFFERIN

Mono

Adjala-
Tosorontio

SIMCOE

OAK

RIDGES

Aurora

MORAINE

Uxbridge

King

Caledon

Whitchurch-
Stouffville

Richmond
Hill

Rouge River

Duffins Creek

YORK

DURHAM

Humber
River

Markham

Pickering

Vaughan

PEEL

Don River

Petticoat
Creek

Ajax

Brampton

Carruthers
Creek

Mimico
Creek

Etobicoke
Creek

Highland
Creek

TORONTO

Frenchman's
Bay

LAKE

ONTARIO

Mississauga
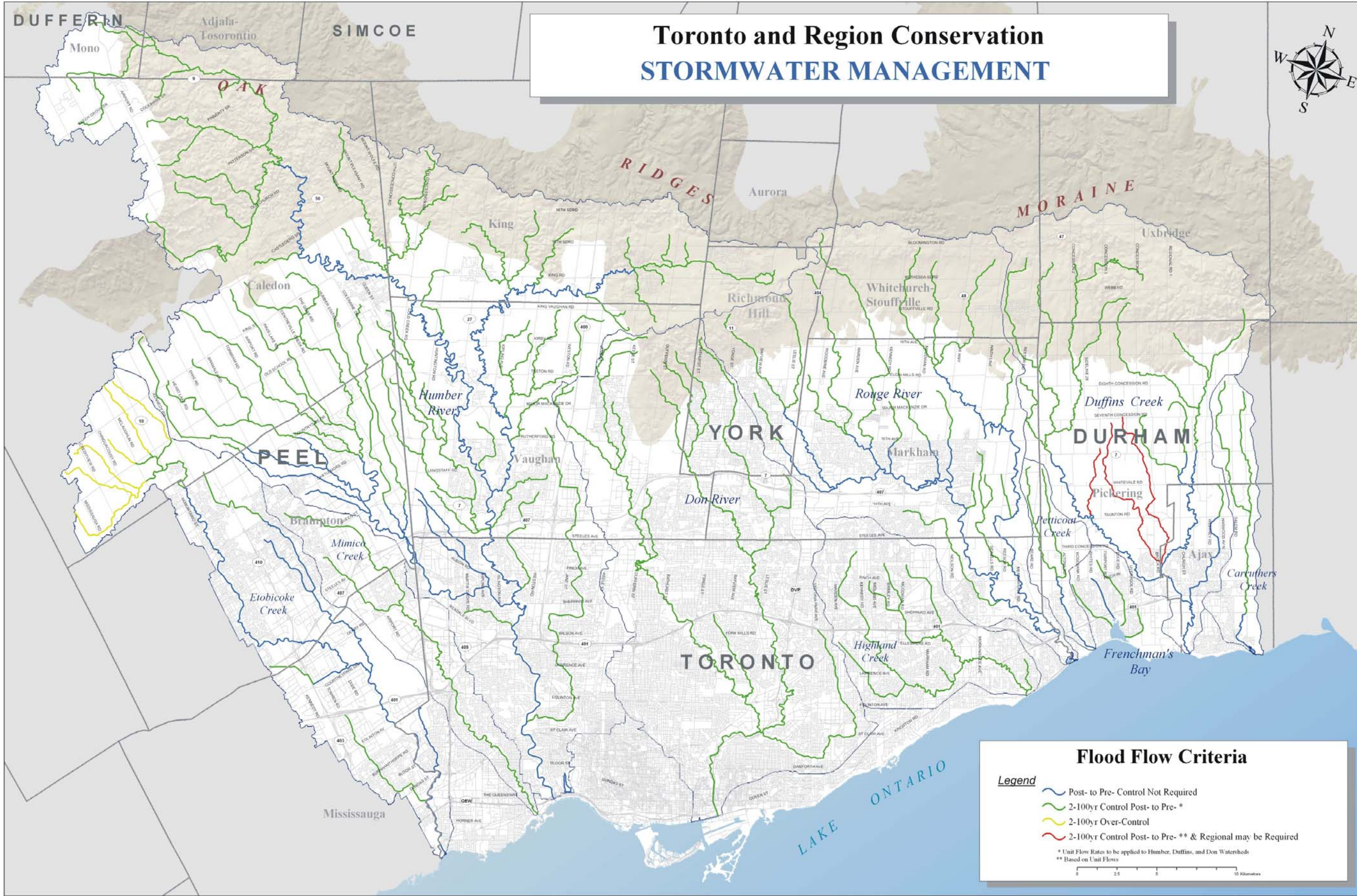
Flood Flow Criteria

Legend

- ⌇ Post- to Pre- Control Not Required
- ⌇ 2-100yr Control Post- to Pre- *
- ⌇ 2-100yr Over-Control
- ⌇ 2-100yr Control Post- to Pre- ** & Regional may be Required

* Unit Flow Rates to be applied to Humber, Duffins, and Don Watersheds
** Based on Unit Flows

0   2.5   5   10 Kilometres

**APPENDIX B
RATIONAL METHOD CALCULATIONS**

Sheppard   Predevelopment

2-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	0.20	ha	York Region
"C" =	0.30		2 Year Storm
Tc =	10.00	min	
AC =	0.060		a = 652.8
2.78*AC =	0.167		b = 4.00
Rainfall Intensity =	82.02	mm/hr	c = 0.786

Runoff = 13.7 l/s

5-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	0.20	ha	York Region
"C" =	0.30		5 Year Storm
Tc =	10.00	min	
AC =	0.060		a = 840.7
2.78*AC =	0.167		b = 3.00
Rainfall Intensity =	113.99	mm/hr	c = 0.779

Runoff = 19.0 l/s

25-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	0.20	ha	York Region
"C" =	0.30		25 Year Storm
Tc =	10.00	min	
AC =	0.060		a = 1082
2.78*AC =	0.167		b = 2.00
Rainfall Intensity =	159.29	mm/hr	c = 0.771

Runoff = 26.6 l/s

100-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	0.20	ha	York Region
"C" =	0.30		100 Year Storm
Tc =	10.00	min	
AC =	0.060		a = 1334
2.78*AC =	0.167		b = 2.00
Rainfall Intensity =	196.38	mm/hr	c = 0.771

Runoff = 32.8 l/s

Finch Parking   Predevelopment

2-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	2.30	ha	York Region
"C" =	0.30		2 Year Storm
Tc =	10.00	min	
AC =	0.690		a = 652.8
2.78*AC =	1.918		b = 4.00
Rainfall Intensity =	82.02	mm/hr	c = 0.786

Runoff = 157.3 l/s

5-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	2.30	ha	York Region
"C" =	0.30		5 Year Storm
Tc =	10.00	min	
AC =	0.690		a = 840.7
2.78*AC =	1.918		b = 3.00
Rainfall Intensity =	113.99	mm/hr	c = 0.779

Runoff = 218.7 l/s

25-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	2.30	ha	York Region
"C" =	0.30		25 Year Storm
Tc =	10.00	min	
AC =	0.690		a = 1082
2.78*AC =	1.918		b = 2.00
Rainfall Intensity =	159.29	mm/hr	c = 0.771

Runoff = 305.5 l/s

100-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	2.30	ha	York Region
"C" =	0.30		100 Year Storm
Tc =	10.00	min	
AC =	0.690		a = 1334
2.78*AC =	1.918		b = 2.00
Rainfall Intensity =	196.38	mm/hr	c = 0.771

Runoff = 376.7 l/s

Finch PPUDO   Predevelopment

2-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	0.30	ha	York Region
"C" =	0.30		2 Year Storm
Tc =	10.00	min	
AC =	0.090		a = 652.8
2.78*AC =	0.250		b = 4.00
Rainfall Intensity =	82.02	mm/hr	c = 0.786

Runoff =   20.5   l/s

5-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	0.30	ha	York Region
"C" =	0.30		5 Year Storm
Tc =	10.00	min	
AC =	0.090		a = 840.7
2.78*AC =	0.250		b = 3.00
Rainfall Intensity =	113.99	mm/hr	c = 0.779

Runoff =   28.5   l/s

25-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	0.30	ha	York Region
"C" =	0.30		25 Year Storm
Tc =	10.00	min	
AC =	0.090		a = 1082
2.78*AC =	0.250		b = 2.00
Rainfall Intensity =	159.29	mm/hr	c = 0.771

Runoff =   39.9   l/s

100-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	0.30	ha	York Region
"C" =	0.30		100 Year Storm
Tc =	10.00	min	
AC =	0.090		a = 1334
2.78*AC =	0.250		b = 2.00
Rainfall Intensity =	196.38	mm/hr	c = 0.771

Runoff =   49.1   l/s

Finch Bus Terminal   Predevelopment

2-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	1.20	ha	York Region
"C" =	0.30		2 Year Storm
Tc =	10.00	min	
AC =	0.360		a = 652.8
2.78*AC =	1.001		b = 4.00
Rainfall Intensity =	82.02	mm/hr	c = 0.786

Runoff =   82.1   l/s

5-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	1.20	ha	York Region
"C" =	0.30		5 Year Storm
Tc =	10.00	min	
AC =	0.360		a = 840.7
2.78*AC =	1.001		b = 3.00
Rainfall Intensity =	113.99	mm/hr	c = 0.779

Runoff =   114.1   l/s

25-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	1.20	ha	York Region
"C" =	0.30		25 Year Storm
Tc =	10.00	min	
AC =	0.360		a = 1082
2.78*AC =	1.001		b = 2.00
Rainfall Intensity =	159.29	mm/hr	c = 0.771

Runoff =   159.4   l/s

100-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	1.20	ha	York Region
"C" =	0.30		100 Year Storm
Tc =	10.00	min	
AC =	0.360		a = 1334
2.78*AC =	1.001		b = 2.00
Rainfall Intensity =	196.38	mm/hr	c = 0.771

Runoff =   196.5   l/s

York University   Predevelopment

2-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	0.10	ha	York Region
"C" =	0.30		2 Year Storm
Tc =	10.00	min	
AC =	0.030		a = 652.8
2.78*AC =	0.083		b = 4.00
Rainfall Intensity =	82.02	mm/hr	c = 0.786

Runoff =   6.8   l/s

5-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	0.10	ha	York Region
"C" =	0.30		5 Year Storm
Tc =	10.00	min	
AC =	0.030		a = 840.7
2.78*AC =	0.083		b = 3.00
Rainfall Intensity =	113.99	mm/hr	c = 0.779

Runoff =   9.5   l/s

25-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	0.10	ha	York Region
"C" =	0.30		25 Year Storm
Tc =	10.00	min	
AC =	0.030		a = 1082
2.78*AC =	0.083		b = 2.00
Rainfall Intensity =	159.29	mm/hr	c = 0.771

Runoff =   13.3   l/s

100-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	0.10	ha	York Region
"C" =	0.30		100 Year Storm
Tc =	10.00	min	
AC =	0.030		a = 1334
2.78*AC =	0.083		b = 2.00
Rainfall Intensity =	196.38	mm/hr	c = 0.771

Runoff =   16.4   l/s

Steeles East Parking   Predevelopment

2-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	5.20	ha	York Region
"C" =	0.30		2 Year Storm
Tc =	10.00	min	
AC =	1.560		a = 652.8
2.78*AC =	4.337		b = 4.00
Rainfall Intensity =	82.02	mm/hr	c = 0.786

Runoff =   355.7   l/s

5-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	5.20	ha	York Region
"C" =	0.30		5 Year Storm
Tc =	10.00	min	
AC =	1.560		a = 840.7
2.78*AC =	4.337		b = 3.00
Rainfall Intensity =	113.99	mm/hr	c = 0.779

Runoff =   494.4   l/s

25-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	5.20	ha	York Region
"C" =	0.30		25 Year Storm
Tc =	10.00	min	
AC =	1.560		a = 1082
2.78*AC =	4.337		b = 2.00
Rainfall Intensity =	159.29	mm/hr	c = 0.771

Runoff =   690.8   l/s

100-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	5.20	ha	York Region
"C" =	0.30		100 Year Storm
Tc =	10.00	min	
AC =	1.560		a = 1334
2.78*AC =	4.337		b = 2.00
Rainfall Intensity =	196.38	mm/hr	c = 0.771

Runoff =   851.7   l/s

Steeles West Parking   Predevelopment

2-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	4.90	ha	York Region
"C" =	0.30		2 Year Storm
Tc =	10.00	min	
AC =	1.470		a = 652.8
2.78*AC =	4.087		b = 4.00
Rainfall Intensity =	82.02	mm/hr	c = 0.786

Runoff =   335.2   l/s

5-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	4.90	ha	York Region
"C" =	0.30		5 Year Storm
Tc =	10.00	min	
AC =	1.470		a = 840.7
2.78*AC =	4.087		b = 3.00
Rainfall Intensity =	113.99	mm/hr	c = 0.779

Runoff =   465.8   l/s

25-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	4.90	ha	York Region
"C" =	0.30		25 Year Storm
Tc =	10.00	min	
AC =	1.470		a = 1082
2.78*AC =	4.087		b = 2.00
Rainfall Intensity =	159.29	mm/hr	c = 0.771

Runoff =   650.9   l/s

100-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	4.90	ha	York Region
"C" =	0.30		100 Year Storm
Tc =	10.00	min	
AC =	1.470		a = 1334
2.78*AC =	4.087		b = 2.00
Rainfall Intensity =	196.38	mm/hr	c = 0.771

Runoff =   802.5   l/s

Steeles Bus Terminal   Predevelopment

2-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	2.10	ha	York Region
"C" =	0.30		2 Year Storm
Tc =	10.00	min	
AC =	0.630		a = 652.8
2.78*AC =	1.751		b = 4.00
Rainfall Intensity =	82.02	mm/hr	c = 0.786

Runoff =   143.7   l/s

5-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	2.10	ha	York Region
"C" =	0.30		5 Year Storm
Tc =	10.00	min	
AC =	0.630		a = 840.7
2.78*AC =	1.751		b = 3.00
Rainfall Intensity =	113.99	mm/hr	c = 0.779

Runoff =   199.6   l/s

25-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	2.10	ha	York Region
"C" =	0.30		25 Year Storm
Tc =	10.00	min	
AC =	0.630		a = 1082
2.78*AC =	1.751		b = 2.00
Rainfall Intensity =	159.29	mm/hr	c = 0.771

Runoff =   279.0   l/s

100-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	2.10	ha	York Region
"C" =	0.30		100 Year Storm
Tc =	10.00	min	
AC =	0.630		a = 1334
2.78*AC =	1.751		b = 2.00
Rainfall Intensity =	196.38	mm/hr	c = 0.771

Runoff =   343.9   l/s

Sheppard   Post Development

2-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	0.20	ha	York Region
"C" =	0.90		2 Year Storm
Tc =	7.00	min	
AC =	0.180		a = 652.8
2.78*AC =	0.500		b = 4.00
Rainfall Intensity =	99.14	mm/hr	c = 0.786

Runoff = 49.6 l/s

5-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	0.20	ha	York Region
"C" =	0.90		5 Year Storm
Tc =	7.00	min	
AC =	0.180		a = 840.7
2.78*AC =	0.500		b = 3.00
Rainfall Intensity =	139.84	mm/hr	c = 0.779

Runoff = 70.0 l/s

25-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	0.20	ha	York Region
"C" =	0.90		25 Year Storm
Tc =	7.00	min	
AC =	0.180		a = 1082
2.78*AC =	0.500		b = 2.00
Rainfall Intensity =	198.84	mm/hr	c = 0.771

Runoff = 99.5 l/s

100-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	0.20	ha	York Region
"C" =	0.90		100 Year Storm
Tc =	7.00	min	
AC =	0.180		a = 1334
2.78*AC =	0.500		b = 2.00
Rainfall Intensity =	245.15	mm/hr	c = 0.771

Runoff = 122.7 l/s

Finch Parking   Post Development

2-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	2.30	ha	York Region
"C" =	0.90		2 Year Storm
Tc =	7.00	min	
AC =	2.070		a = 652.8
2.78*AC =	5.755		b = 4.00
Rainfall Intensity =	99.14	mm/hr	c = 0.786

Runoff = 570.5 l/s

5-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	2.30	ha	York Region
"C" =	0.90		5 Year Storm
Tc =	7.00	min	
AC =	2.070		a = 840.7
2.78*AC =	5.755		b = 3.00
Rainfall Intensity =	139.84	mm/hr	c = 0.779

Runoff = 804.7 l/s

25-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	2.30	ha	York Region
"C" =	0.90		25 Year Storm
Tc =	7.00	min	
AC =	2.070		a = 1082
2.78*AC =	5.755		b = 2.00
Rainfall Intensity =	198.84	mm/hr	c = 0.771

Runoff = 1144.3 l/s

100-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	2.30	ha	York Region
"C" =	0.90		100 Year Storm
Tc =	7.00	min	
AC =	2.070		a = 1334
2.78*AC =	5.755		b = 2.00
Rainfall Intensity =	245.15	mm/hr	c = 0.771

Runoff = 1410.7 l/s

Finch PPUDO   Post Development

2-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	0.30	ha	
"C" =	0.90		York Region
Tc =	7.00	min	2 Year Storm
AC =	0.270		a = 652.8
2.78*AC =	0.751		b = 4.00
Rainfall Intensity =	99.14	mm/hr	c = 0.786

Runoff =   74.4   l/s

5-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	0.30	ha	
"C" =	0.90		York Region
Tc =	7.00	min	5 Year Storm
AC =	0.270		a = 840.7
2.78*AC =	0.751		b = 3.00
Rainfall Intensity =	139.84	mm/hr	c = 0.779

Runoff =   105.0   l/s

25-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	0.30	ha	
"C" =	0.90		York Region
Tc =	7.00	min	25 Year Storm
AC =	0.270		a = 1082
2.78*AC =	0.751		b = 2.00
Rainfall Intensity =	198.84	mm/hr	c = 0.771

Runoff =   149.3   l/s

100-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	0.30	ha	
"C" =	0.90		York Region
Tc =	7.00	min	100 Year Storm
AC =	0.270		a = 1334
2.78*AC =	0.751		b = 2.00
Rainfall Intensity =	245.15	mm/hr	c = 0.771

Runoff =   184.0   l/s

Finch Bus Terminal   Post Development

2-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	1.20	ha	
"C" =	0.90		York Region
Tc =	7.00	min	2 Year Storm
AC =	1.080		a = 652.8
2.78*AC =	3.002		b = 4.00
Rainfall Intensity =	99.14	mm/hr	c = 0.786

Runoff =   297.7   l/s

5-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	1.20	ha	
"C" =	0.90		York Region
Tc =	7.00	min	5 Year Storm
AC =	1.080		a = 840.7
2.78*AC =	3.002		b = 3.00
Rainfall Intensity =	139.84	mm/hr	c = 0.779

Runoff =   419.9   l/s

25-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	1.20	ha	
"C" =	0.90		York Region
Tc =	7.00	min	25 Year Storm
AC =	1.080		a = 1082
2.78*AC =	3.002		b = 2.00
Rainfall Intensity =	198.84	mm/hr	c = 0.771

Runoff =   597.0   l/s

100-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	1.20	ha	
"C" =	0.90		York Region
Tc =	7.00	min	100 Year Storm
AC =	1.080		a = 1334
2.78*AC =	3.002		b = 2.00
Rainfall Intensity =	245.15	mm/hr	c = 0.771

Runoff =   736.0   l/s

York University   Post Development

2-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	0.10	ha	York Region
"C" =	0.90		2 Year Storm
Tc =	7.00	min	
AC =	0.090		a = 652.8
2.78*AC =	0.250		b = 4.00
Rainfall Intensity =	99.14	mm/hr	c = 0.786

Runoff =   24.8   l/s

5-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	0.10	ha	York Region
"C" =	0.90		5 Year Storm
Tc =	7.00	min	
AC =	0.090		a = 840.7
2.78*AC =	0.250		b = 3.00
Rainfall Intensity =	139.84	mm/hr	c = 0.779

Runoff =   35.0   l/s

25-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	0.10	ha	York Region
"C" =	0.90		25 Year Storm
Tc =	7.00	min	
AC =	0.090		a = 1082
2.78*AC =	0.250		b = 2.00
Rainfall Intensity =	198.84	mm/hr	c = 0.771

Runoff =   49.8   l/s

100-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	0.10	ha	York Region
"C" =	0.90		100 Year Storm
Tc =	7.00	min	
AC =	0.090		a = 1334
2.78*AC =	0.250		b = 2.00
Rainfall Intensity =	245.15	mm/hr	c = 0.771

Runoff =   61.3   l/s

Steeles East Parking   Post Development

2-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	5.20	ha	York Region
"C" =	0.90		2 Year Storm
Tc =	7.00	min	
AC =	4.680		a = 652.8
2.78*AC =	13.010		b = 4.00
Rainfall Intensity =	99.14	mm/hr	c = 0.786

Runoff =   1289.8   l/s

5-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	5.20	ha	York Region
"C" =	0.90		5 Year Storm
Tc =	7.00	min	
AC =	4.680		a = 840.7
2.78*AC =	13.010		b = 3.00
Rainfall Intensity =	139.84	mm/hr	c = 0.779

Runoff =   1819.4   l/s

25-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	5.20	ha	York Region
"C" =	0.90		25 Year Storm
Tc =	7.00	min	
AC =	4.680		a = 1082
2.78*AC =	13.010		b = 2.00
Rainfall Intensity =	198.84	mm/hr	c = 0.771

Runoff =   2587.0   l/s

100-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	5.20	ha	York Region
"C" =	0.90		100 Year Storm
Tc =	7.00	min	
AC =	4.680		a = 1334
2.78*AC =	13.010		b = 2.00
Rainfall Intensity =	245.15	mm/hr	c = 0.771

Runoff =   3189.5   l/s

Steeles West Parking   Post Development

2-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	4.90	ha	
"C" =	0.90		York Region
Tc =	7.00	min	2 Year Storm
AC =	4.410		a = 652.8
2.78*AC =	12.260		b = 4.00
Rainfall Intensity =	99.14	mm/hr	c = 0.786

Runoff = 1215.4 l/s

5-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	4.90	ha	
"C" =	0.90		York Region
Tc =	7.00	min	5 Year Storm
AC =	4.410		a = 840.7
2.78*AC =	12.260		b = 3.00
Rainfall Intensity =	139.84	mm/hr	c = 0.779

Runoff = 1714.4 l/s

25-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	4.90	ha	
"C" =	0.90		York Region
Tc =	7.00	min	25 Year Storm
AC =	4.410		a = 1082
2.78*AC =	12.260		b = 2.00
Rainfall Intensity =	198.84	mm/hr	c = 0.771

Runoff = 2437.8 l/s

100-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	4.90	ha	
"C" =	0.90		York Region
Tc =	7.00	min	100 Year Storm
AC =	4.410		a = 1334
2.78*AC =	12.260		b = 2.00
Rainfall Intensity =	245.15	mm/hr	c = 0.771

Runoff = 3005.5 l/s

Steeles Bus Terminal   Post Development

2-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	2.10	ha	
"C" =	0.90		York Region
Tc =	7.00	min	2 Year Storm
AC =	1.890		a = 652.8
2.78*AC =	5.254		b = 4.00
Rainfall Intensity =	99.14	mm/hr	c = 0.786

Runoff = 520.9 l/s

5-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	2.10	ha	
"C" =	0.90		York Region
Tc =	7.00	min	5 Year Storm
AC =	1.890		a = 840.7
2.78*AC =	5.254		b = 3.00
Rainfall Intensity =	139.84	mm/hr	c = 0.779

Runoff = 734.8 l/s

25-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	2.10	ha	
"C" =	0.90		York Region
Tc =	7.00	min	25 Year Storm
AC =	1.890		a = 1082
2.78*AC =	5.254		b = 2.00
Rainfall Intensity =	198.84	mm/hr	c = 0.771

Runoff = 1044.8 l/s

100-Year Pre-Development Peak Flow

Rational Method			Rainfall Intensity Coefficients
Area =	2.10	ha	
"C" =	0.90		York Region
Tc =	7.00	min	100 Year Storm
AC =	1.890		a = 1334
2.78*AC =	5.254		b = 2.00
Rainfall Intensity =	245.15	mm/hr	c = 0.771

Runoff = 1288.1 l/s

**APPENDIX C
MODIFIED RATIONAL METHOD STORAGE
CALCULATIONS**

Modified Rational Method

Project Name : Spadian EA
Sheppard West Station Building
Project No. : 33015347

Area =	**0.2**	ha
"C" =	**0.9**	
AC=	**0.18**	
Tc =	**7.0**	min
Time Increment =	**5.0**	min
Release Rate =	**8.4**	l/s
Max.Storage =	**22**	m3

North York	2yr
a=	652.8
b=	4.00
c=	0.786

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(l/s)	(m3)	(m3)	(m3)	
7.0	99.1	49.61	20.8	3.5	17.3	
12.0	73.8	36.95	26.6	6.0	20.6	
17.0	59.6	29.84	30.4	8.6	21.9	
22.0	50.4	25.23	33.3	11.1	22.2	<<<<
27.0	43.9	21.97	35.6	13.6	22.0	
32.0	39.0	19.54	37.5	16.1	21.4	
37.0	35.2	17.64	39.2	18.6	20.5	
42.0	32.2	16.11	40.6	21.2	19.4	
47.0	29.7	14.86	41.9	23.7	18.2	
52.0	27.6	13.80	43.1	26.2	16.9	
57.0	25.8	12.91	44.1	28.7	15.4	
62.0	24.2	12.13	45.1	31.2	13.9	
67.0	22.9	11.46	46.1	33.8	12.3	
72.0	21.7	10.86	46.9	36.3	10.6	
77.0	20.6	10.33	47.7	38.8	8.9	
82.0	19.7	9.85	48.5	41.3	7.2	
87.0	18.8	9.43	49.2	43.8	5.4	
92.0	18.1	9.04	49.9	46.4	3.5	
97.0	17.4	8.68	50.5	48.9	1.7	
102.0	16.7	8.36	51.2	51.4	-0.2	
107.0	16.1	8.06	51.8	53.9	-2.2	
112.0	15.6	7.79	52.3	56.4	-4.1	
117.0	15.1	7.53	52.9	59.0	-6.1	
122.0	14.6	7.30	53.4	61.5	-8.1	

Modified Rational Method

Project Name : Spadian EA
Sheppard West Station Building
Project No. : 33015347

Area =	**0.2**	ha
"C" =	**0.9**	
AC=	**0.18**	
Tc =	**7.0**	min
Time Increment =	**5.0**	min
Release Rate =	**8.4**	l/s
Max.Storage =	**35**	m3

North York	5yr
a=	840.7
b=	3.00
c=	0.779

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(l/s)	(m3)	(m3)	(m3)	
7.0	139.8	69.98	29.4	3.5	25.9	
12.0	102.0	51.03	36.7	6.0	30.7	
17.0	81.5	40.78	41.6	8.6	33.0	
22.0	68.5	34.27	45.2	11.1	34.2	
27.0	59.4	29.74	48.2	13.6	34.6	<<<<
32.0	52.7	26.37	50.6	16.1	34.5	
37.0	47.5	23.77	52.8	18.6	34.1	
42.0	43.3	21.68	54.6	21.2	33.5	
47.0	39.9	19.97	56.3	23.7	32.6	
52.0	37.1	18.54	57.9	26.2	31.7	
57.0	34.6	17.33	59.3	28.7	30.5	
62.0	32.5	16.28	60.6	31.2	29.3	
67.0	30.7	15.37	61.8	33.8	28.0	
72.0	29.1	14.56	62.9	36.3	26.6	
77.0	27.7	13.85	64.0	38.8	25.2	
82.0	26.4	13.21	65.0	41.3	23.7	
87.0	25.3	12.64	66.0	43.8	22.1	
92.0	24.2	12.11	66.9	46.4	20.5	
97.0	23.3	11.64	67.7	48.9	18.9	
102.0	22.4	11.21	68.6	51.4	17.2	
107.0	21.6	10.81	69.4	53.9	15.5	
112.0	20.9	10.44	70.2	56.4	13.7	
117.0	20.2	10.10	70.9	59.0	11.9	
122.0	19.6	9.78	71.6	61.5	10.1	

Modified Rational Method

Project Name : Spadian EA
Sheppard West Station Building
Project No. : 33015347

Area =	0.2	ha
"C" =	0.9	
AC=	0.18	
Tc =	7.0	min
Time Increment =	5.0	min
Release Rate =	8.4	l/s
Max.Storage =	53	m3

North York	25yr
a=	1082
b=	2.00
c=	0.771

Time (min)	Rainfall Intensity (mm/hr)	Storm Runoff (l/s)	Runoff Volume (m3)	Released Volume (m3)	Storage Volume (m3)	
7.0	198.8	99.50	41.8	3.5	38.3	
12.0	141.4	70.77	51.0	6.0	44.9	
17.0	111.8	55.93	57.0	8.6	48.5	
22.0	93.3	46.71	61.7	11.1	50.6	
27.0	80.7	40.37	65.4	13.6	51.8	
32.0	71.4	35.71	68.6	16.1	52.4	
37.0	64.2	32.12	71.3	18.6	52.7	<<<<
42.0	58.5	29.27	73.8	21.2	52.6	
47.0	53.8	26.94	76.0	23.7	52.3	
52.0	50.0	25.00	78.0	26.2	51.8	
57.0	46.7	23.35	79.8	28.7	51.1	
62.0	43.8	21.93	81.6	31.2	50.3	
67.0	41.3	20.69	83.2	33.8	49.4	
72.0	39.2	19.61	84.7	36.3	48.4	
77.0	37.3	18.64	86.1	38.8	47.3	
82.0	35.5	17.78	87.5	41.3	46.1	
87.0	34.0	17.00	88.8	43.8	44.9	
92.0	32.6	16.30	90.0	46.4	43.6	
97.0	31.3	15.66	91.2	48.9	42.3	
102.0	30.1	15.08	92.3	51.4	40.9	
107.0	29.1	14.54	93.4	53.9	39.4	
112.0	28.1	14.05	94.4	56.4	38.0	
117.0	27.2	13.59	95.4	59.0	36.5	
122.0	26.3	13.17	96.4	61.5	34.9	

Modified Rational Method

Project Name : Spadian EA
Sheppard West Station Building
Project No. : 33015347

Area =	0.2	ha
"C" =	0.9	
AC=	0.18	
Tc =	7.0	min
Time Increment =	5.0	min
Release Rate =	8.4	l/s
Max.Storage =	70	m3

North York	100yr
a=	1334
b=	2.00
c=	0.771

Time (min)	Rainfall Intensity (mm/hr)	Storm Runoff (l/s)	Runoff Volume (m3)	Released Volume (m3)	Storage Volume (m3)	
7.0	245.2	122.67	51.5	3.5	48.0	
12.0	174.4	87.26	62.8	6.0	56.8	
17.0	137.8	68.95	70.3	8.6	61.8	
22.0	115.1	57.59	76.0	11.1	64.9	
27.0	99.5	49.77	80.6	13.6	67.0	
32.0	88.0	44.03	84.5	16.1	68.4	
37.0	79.1	39.61	87.9	18.6	69.3	
42.0	72.1	36.09	90.9	21.2	69.8	
47.0	66.4	33.21	93.7	23.7	70.0	<<<<
52.0	61.6	30.82	96.2	26.2	69.9	
57.0	57.5	28.78	98.4	28.7	69.7	
62.0	54.0	27.03	100.6	31.2	69.3	
67.0	51.0	25.51	102.6	33.8	68.8	
72.0	48.3	24.17	104.4	36.3	68.1	
77.0	45.9	22.98	106.2	38.8	67.4	
82.0	43.8	21.92	107.8	41.3	66.5	
87.0	41.9	20.96	109.4	43.8	65.6	
92.0	40.2	20.10	111.0	46.4	64.6	
97.0	38.6	19.31	112.4	48.9	63.5	
102.0	37.2	18.59	113.8	51.4	62.4	
107.0	35.8	17.93	115.1	53.9	61.2	
112.0	34.6	17.32	116.4	56.4	60.0	
117.0	33.5	16.76	117.6	59.0	58.7	
122.0	32.4	16.23	118.8	61.5	57.4	

Modified Rational Method

Project Name : Spadian EA
Finch West Parking Lot
Project No. : 33015347

Area =	**2.3**	ha
"C" =	**0.9**	
AC=	**2.07**	
Tc =	**7.0**	min
Time Increment =	**10.0**	min
Release Rate =	**16.4**	l/s
Max.Storage =	**498**	m3

North York	2yr
a=	652.8
b=	4.00
c=	0.786

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(l/s)	(m3)	(m3)	(m3)	
7.0	99.1	570.51	239.6	6.9	232.7	
17.0	59.6	343.19	350.1	16.7	333.3	
27.0	43.9	252.69	409.4	26.6	382.8	
37.0	35.2	202.84	450.3	36.4	413.9	
47.0	29.7	170.86	481.8	46.2	435.6	
57.0	25.8	148.43	507.6	56.1	451.5	
67.0	22.9	131.74	529.6	65.9	463.7	
77.0	20.6	118.78	548.7	75.8	473.0	
87.0	18.8	108.39	565.8	85.6	480.2	
97.0	17.4	99.86	581.2	95.4	485.7	
107.0	16.1	92.72	595.3	105.3	490.0	
117.0	15.1	86.64	608.2	115.1	493.1	
127.0	14.1	81.40	620.3	125.0	495.3	
137.0	13.4	76.83	631.5	134.8	496.7	
147.0	12.7	72.80	642.1	144.6	497.4	
157.0	12.0	69.22	652.1	154.5	497.6	<<<<
167.0	11.5	66.02	661.5	164.3	497.2	
177.0	11.0	63.13	670.5	174.2	496.3	
187.0	10.5	60.52	679.0	184.0	495.0	
197.0	10.1	58.14	687.2	193.8	493.4	
207.0	9.7	55.96	695.1	203.7	491.4	
217.0	9.4	53.96	702.6	213.5	489.1	
227.0	9.1	52.12	709.9	223.4	486.5	
237.0	8.8	50.41	716.9	233.2	483.6	

Modified Rational Method

Project Name : Spadian EA
Finch West Parking Lot
Project No. : 33015347

Area =	**2.3**	ha
"C" =	**0.9**	
AC=	**2.07**	
Tc =	**7.0**	min
Time Increment =	**10.0**	min
Release Rate =	**36.7**	l/s
Max.Storage =	**840**	m3

North York	25yr
a=	1082
b=	2.00
c=	0.771

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(l/s)	(m3)	(m3)	(m3)	
7.0	198.8	1144.25	480.6	15.4	465.2	
17.0	111.8	643.17	656.0	37.4	618.6	
27.0	80.7	464.23	752.1	59.5	692.6	
37.0	64.2	369.43	820.1	81.5	738.7	
47.0	53.8	309.81	873.7	103.5	770.2	
57.0	46.7	268.48	918.2	125.5	792.7	
67.0	41.3	237.95	956.6	147.5	809.0	
77.0	37.3	214.37	990.4	169.6	820.9	
87.0	34.0	195.55	1020.8	191.6	829.2	
97.0	31.3	180.14	1048.4	213.6	834.8	
107.0	29.1	167.26	1073.8	235.6	838.2	
117.0	27.2	156.31	1097.3	257.6	839.7	<<<<
127.0	25.5	146.89	1119.3	279.7	839.6	
137.0	24.1	138.67	1139.9	301.7	838.2	
147.0	22.8	131.44	1159.3	323.7	835.6	
157.0	21.7	125.02	1177.6	345.7	831.9	
167.0	20.7	119.27	1195.1	367.7	827.4	
177.0	19.8	114.10	1211.8	389.8	822.0	
187.0	19.0	109.42	1227.7	411.8	815.9	
197.0	18.3	105.15	1242.9	433.8	809.1	
207.0	17.6	101.25	1257.6	455.8	801.8	
217.0	17.0	97.67	1271.7	477.8	793.8	
227.0	16.4	94.36	1285.2	499.9	785.4	
237.0	15.9	91.31	1298.4	521.9	776.5	

Modified Rational Method

Project Name : Spadian EA
Finch West Parking Lot
Project No. : 33015347

Area =	2.3	ha
"C" =	0.9	
AC=	2.07	
Tc =	7.0	min
Time Increment =	10.0	min
Release Rate =	48.5	l/s
Max.Storage =	1013	m3

North York	100yr
a=	1334
b=	2.00
c=	0.771

Time (min)	Rainfall Intensity (mm/hr)	Storm Runoff (l/s)	Runoff Volume (m3)	Released Volume (m3)	Storage Volume (m3)	
7.0	245.2	1410.75	592.5	20.4	572.1	
17.0	137.8	792.96	808.8	49.5	759.4	
27.0	99.5	572.35	927.2	78.6	848.6	
37.0	79.1	455.47	1011.1	107.7	903.5	
47.0	66.4	381.97	1077.2	136.8	940.4	
57.0	57.5	331.01	1132.1	165.9	966.2	
67.0	51.0	293.37	1179.4	195.0	984.4	
77.0	45.9	264.30	1221.1	224.1	997.0	
87.0	41.9	241.10	1258.5	253.2	1005.4	
97.0	38.6	222.09	1292.6	282.3	1010.3	
107.0	35.8	206.21	1323.9	311.4	1012.5	<<<<
117.0	33.5	192.72	1352.9	340.5	1012.4	
127.0	31.5	181.09	1379.9	369.6	1010.4	
137.0	29.7	170.96	1405.3	398.7	1006.7	
147.0	28.2	162.05	1429.3	427.8	1001.5	
157.0	26.8	154.13	1451.9	456.9	995.1	
167.0	25.6	147.05	1473.5	486.0	987.5	
177.0	24.4	140.68	1494.0	515.1	978.9	
187.0	23.4	134.90	1513.6	544.2	969.4	
197.0	22.5	129.64	1532.4	573.3	959.1	
207.0	21.7	124.84	1550.5	602.4	948.1	
217.0	20.9	120.42	1567.8	631.5	936.4	
227.0	20.2	116.34	1584.6	660.6	924.0	
237.0	19.6	112.57	1600.8	689.7	911.1	

Modified Rational Method

Project Name : Spadian EA
Finch West Passenger pick-up drop-off
Project No. : 33015347

Area =	0.3	ha
"C" =	0.9	
AC=	0.27	
Tc =	7.0	min
Time Increment =	10.0	min
Release Rate =	2.6	l/s
Max.Storage =	61	m3

North York	2yr
a=	652.8
b=	4.00
c=	0.786

Time (min)	Rainfall Intensity (mm/hr)	Storm Runoff (l/s)	Runoff Volume (m3)	Released Volume (m3)	Storage Volume (m3)	
7.0	99.1	74.41	31.3	1.1	30.2	
17.0	59.6	44.76	45.7	2.7	43.0	
27.0	43.9	32.96	53.4	4.2	49.2	
37.0	35.2	26.46	58.7	5.8	53.0	
47.0	29.7	22.29	62.8	7.3	55.5	
57.0	25.8	19.36	66.2	8.9	57.3	
67.0	22.9	17.18	69.1	10.5	58.6	
77.0	20.6	15.49	71.6	12.0	59.6	
87.0	18.8	14.14	73.8	13.6	60.2	
97.0	17.4	13.03	75.8	15.1	60.7	
107.0	16.1	12.09	77.6	16.7	61.0	
117.0	15.1	11.30	79.3	18.3	61.1	
127.0	14.1	10.62	80.9	19.8	61.1	<<<<
137.0	13.4	10.02	82.4	21.4	61.0	
147.0	12.7	9.50	83.7	22.9	60.8	
157.0	12.0	9.03	85.1	24.5	60.6	
167.0	11.5	8.61	86.3	26.1	60.2	
177.0	11.0	8.23	87.5	27.6	59.8	
187.0	10.5	7.89	88.6	29.2	59.4	
197.0	10.1	7.58	89.6	30.7	58.9	
207.0	9.7	7.30	90.7	32.3	58.4	
217.0	9.4	7.04	91.6	33.9	57.8	
227.0	9.1	6.80	92.6	35.4	57.2	
237.0	8.8	6.58	93.5	37.0	56.5	

Modified Rational Method

Project Name : Spadian EA

Finch West Passenger pick-up drop-off

Project No. : 33015347

Area =	0.3	ha
"C" =	0.9	
AC=	0.27	
Tc =	7.0	min
Time Increment =	10.0	min
Release Rate =	3.8	l/s
Max.Storage =	80	m3

North York		5yr
	a=	840.7
	b=	3.00
	c=	0.779

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(l/s)	(m3)	(m3)	(m3)	
7.0	139.8	104.97	44.1	1.6	42.5	
17.0	81.5	61.17	62.4	3.9	58.5	
27.0	59.4	44.60	72.3	6.2	66.1	
37.0	47.5	35.65	79.1	8.4	70.7	
47.0	39.9	29.96	84.5	10.7	73.8	
57.0	34.6	25.99	88.9	13.0	75.9	
67.0	30.7	23.05	92.7	15.3	77.4	
77.0	27.7	20.78	96.0	17.6	78.4	
87.0	25.3	18.95	98.9	19.8	79.1	
97.0	23.3	17.46	101.6	22.1	79.5	
107.0	21.6	16.21	104.1	24.4	79.7	<<<<
117.0	20.2	15.15	106.3	26.7	79.7	
127.0	19.0	14.23	108.5	29.0	79.5	
137.0	17.9	13.43	110.4	31.2	79.2	
147.0	17.0	12.73	112.3	33.5	78.8	
157.0	16.1	12.11	114.0	35.8	78.3	
167.0	15.4	11.55	115.7	38.1	77.6	
177.0	14.7	11.05	117.3	40.4	76.9	
187.0	14.1	10.59	118.8	42.6	76.2	
197.0	13.6	10.18	120.3	44.9	75.4	
207.0	13.1	9.80	121.7	47.2	74.5	
217.0	12.6	9.45	123.0	49.5	73.5	
227.0	12.2	9.13	124.3	51.8	72.5	
237.0	11.8	8.83	125.5	54.0	71.5	

Modified Rational Method

Project Name : Spadian EA

Finch West Passenger pick-up drop-off

Project No. : 33015347

Area =	0.3	ha
"C" =	0.9	
AC=	0.27	
Tc =	7.0	min
Time Increment =	10.0	min
Release Rate =	5.8	l/s
Max.Storage =	103	m3

North York		25yr
	a=	1082
	b=	2.00
	c=	0.771

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(l/s)	(m3)	(m3)	(m3)	
7.0	198.8	149.25	62.7	2.4	60.2	
17.0	111.8	83.89	85.6	5.9	79.7	
27.0	80.7	60.55	98.1	9.4	88.7	
37.0	64.2	48.19	107.0	12.9	94.1	
47.0	53.8	40.41	114.0	16.4	97.6	
57.0	46.7	35.02	119.8	19.8	99.9	
67.0	41.3	31.04	124.8	23.3	101.5	
77.0	37.3	27.96	129.2	26.8	102.4	
87.0	34.0	25.51	133.1	30.3	102.9	
97.0	31.3	23.50	136.7	33.8	103.0	<<<<
107.0	29.1	21.82	140.1	37.2	102.8	
117.0	27.2	20.39	143.1	40.7	102.4	
127.0	25.5	19.16	146.0	44.2	101.8	
137.0	24.1	18.09	148.7	47.7	101.0	
147.0	22.8	17.14	151.2	51.2	100.1	
157.0	21.7	16.31	153.6	54.6	99.0	
167.0	20.7	15.56	155.9	58.1	97.8	
177.0	19.8	14.88	158.1	61.6	96.5	
187.0	19.0	14.27	160.1	65.1	95.1	
197.0	18.3	13.72	162.1	68.6	93.6	
207.0	17.6	13.21	164.0	72.0	92.0	
217.0	17.0	12.74	165.9	75.5	90.4	
227.0	16.4	12.31	167.6	79.0	88.6	
237.0	15.9	11.91	169.4	82.5	86.9	

Modified Rational Method

Project Name : Spadian EA
Finch West Passenger pick-up drop-off
Project No. : 33015347

Area =	0.3	ha
"C" =	0.9	
AC=	0.27	
Tc =	7.0	min
Time Increment =	10.0	min
Release Rate =	7.7	l/s
Max.Storage =	124	m3

North York		100yr
	a=	1334
	b=	2.00
	c=	0.771

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(l/s)	(m3)	(m3)	(m3)	
7.0	245.2	184.01	77.3	3.2	74.1	
17.0	137.8	103.43	105.5	7.9	97.6	
27.0	99.5	74.65	120.9	12.5	108.5	
37.0	79.1	59.41	131.9	17.1	114.8	
47.0	66.4	49.82	140.5	21.7	118.8	
57.0	57.5	43.18	147.7	26.3	121.3	
67.0	51.0	38.27	153.8	31.0	122.9	
77.0	45.9	34.47	159.3	35.6	123.7	
87.0	41.9	31.45	164.2	40.2	124.0	<<<<
97.0	38.6	28.97	168.6	44.8	123.8	
107.0	35.8	26.90	172.7	49.4	123.2	
117.0	33.5	25.14	176.5	54.1	122.4	
127.0	31.5	23.62	180.0	58.7	121.3	
137.0	29.7	22.30	183.3	63.3	120.0	
147.0	28.2	21.14	186.4	67.9	118.5	
157.0	26.8	20.10	189.4	72.5	116.8	
167.0	25.6	19.18	192.2	77.2	115.0	
177.0	24.4	18.35	194.9	81.8	113.1	
187.0	23.4	17.60	197.4	86.4	111.0	
197.0	22.5	16.91	199.9	91.0	108.9	
207.0	21.7	16.28	202.2	95.6	106.6	
217.0	20.9	15.71	204.5	100.3	104.2	
227.0	20.2	15.18	206.7	104.9	101.8	
237.0	19.6	14.68	208.8	109.5	99.3	

Modified Rational Method

Project Name : Spadian EA
Finch West Bus Terminal / Roads / Station Building
Project No. : 33015347

Area =	1.2	ha
"C" =	0.9	
AC=	1.08	
Tc =	7.0	min
Time Increment =	10.0	min
Release Rate =	9.1	l/s
Max.Storage =	255	m3

North York		2yr
	a=	652.8
	b=	4.00
	c=	0.786

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(l/s)	(m3)	(m3)	(m3)	
7.0	99.1	297.66	125.0	3.8	121.2	
17.0	59.6	179.05	182.6	9.3	173.4	
27.0	43.9	131.84	213.6	14.7	198.8	
37.0	35.2	105.83	234.9	20.2	214.7	
47.0	29.7	89.15	251.4	25.7	225.7	
57.0	25.8	77.44	264.9	31.1	233.7	
67.0	22.9	68.73	276.3	36.6	239.7	
77.0	20.6	61.97	286.3	42.0	244.3	
87.0	18.8	56.55	295.2	47.5	247.7	
97.0	17.4	52.10	303.2	53.0	250.3	
107.0	16.1	48.38	310.6	58.4	252.1	
117.0	15.1	45.20	317.3	63.9	253.5	
127.0	14.1	42.47	323.6	69.3	254.3	
137.0	13.4	40.08	329.5	74.8	254.7	
147.0	12.7	37.98	335.0	80.3	254.7	<<<<
157.0	12.0	36.11	340.2	85.7	254.5	
167.0	11.5	34.44	345.1	91.2	253.9	
177.0	11.0	32.94	349.8	96.6	253.2	
187.0	10.5	31.58	354.3	102.1	252.2	
197.0	10.1	30.33	358.6	107.6	251.0	
207.0	9.7	29.20	362.6	113.0	249.6	
217.0	9.4	28.16	366.6	118.5	248.1	
227.0	9.1	27.19	370.4	123.9	246.4	
237.0	8.8	26.30	374.0	129.4	244.6	

Modified Rational Method

Project Name : Spadian EA
Finch West Bus Terminal / Roads / Station Building
Project No. : 33015347

Area =	1.2	ha
"C" =	0.9	
AC=	1.08	
Tc =	7.0	min
Time Increment =	10.0	min
Release Rate =	13.5	l/s
Max.Storage =	331	m3

North York	5yr
a=	840.7
b=	3.00
c=	0.779

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(l/s)	(m3)	(m3)	(m3)	
7.0	139.8	419.86	176.3	5.7	170.7	
17.0	81.5	244.68	249.6	13.8	235.8	
27.0	59.4	178.42	289.0	21.9	267.2	
37.0	47.5	142.60	316.6	30.0	286.6	
47.0	39.9	119.84	338.0	38.1	299.9	
57.0	34.6	103.98	355.6	46.2	309.4	
67.0	30.7	92.21	370.7	54.3	316.4	
77.0	27.7	83.10	383.9	62.4	321.6	
87.0	25.3	75.81	395.8	70.5	325.3	
97.0	23.3	69.84	406.5	78.6	327.9	
107.0	21.6	64.84	416.3	86.7	329.6	
117.0	20.2	60.59	425.4	94.8	330.6	
127.0	19.0	56.93	433.8	102.9	330.9	<<<<
137.0	17.9	53.74	441.7	111.0	330.8	
147.0	17.0	50.93	449.2	119.1	330.1	
157.0	16.1	48.43	456.2	127.2	329.0	
167.0	15.4	46.19	462.9	135.3	327.6	
177.0	14.7	44.18	469.2	143.4	325.9	
187.0	14.1	42.36	475.3	151.5	323.8	
197.0	13.6	40.70	481.1	159.6	321.5	
207.0	13.1	39.18	486.7	167.7	319.0	
217.0	12.6	37.79	492.0	175.8	316.2	
227.0	12.2	36.50	497.2	183.9	313.3	
237.0	11.8	35.31	502.1	192.0	310.2	

Modified Rational Method

Project Name : Spadian EA
Finch West Bus Terminal / Roads / Station Building
Project No. : 33015347

Area =	1.2	ha
"C" =	0.9	
AC=	1.08	
Tc =	7.0	min
Time Increment =	10.0	min
Release Rate =	20.5	l/s
Max.Storage =	429	m3

North York	25yr
a=	1082
b=	2.00
c=	0.771

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(l/s)	(m3)	(m3)	(m3)	
7.0	198.8	597.00	250.7	8.6	242.1	
17.0	111.8	335.57	342.3	20.9	321.4	
27.0	80.7	242.21	392.4	33.2	359.2	
37.0	64.2	192.75	427.9	45.5	382.4	
47.0	53.8	161.64	455.8	57.8	398.0	
57.0	46.7	140.08	479.1	70.1	409.0	
67.0	41.3	124.15	499.1	82.4	416.7	
77.0	37.3	111.85	516.7	94.7	422.0	
87.0	34.0	102.03	532.6	107.0	425.6	
97.0	31.3	93.99	547.0	119.3	427.7	
107.0	29.1	87.26	560.2	131.6	428.6	<<<<
117.0	27.2	81.55	572.5	143.9	428.6	
127.0	25.5	76.64	584.0	156.2	427.8	
137.0	24.1	72.35	594.7	168.5	426.2	
147.0	22.8	68.58	604.8	180.8	424.0	
157.0	21.7	65.23	614.4	193.1	421.3	
167.0	20.7	62.23	623.5	205.4	418.1	
177.0	19.8	59.53	632.2	217.7	414.5	
187.0	19.0	57.09	640.5	230.0	410.5	
197.0	18.3	54.86	648.5	242.3	406.2	
207.0	17.6	52.83	656.1	254.6	401.5	
217.0	17.0	50.96	663.5	266.9	396.6	
227.0	16.4	49.23	670.6	279.2	391.4	
237.0	15.9	47.64	677.4	291.5	385.9	

Modified Rational Method

Project Name : Spadian EA
Finch West Bus Terminal / Roads / Station Building
Project No. : 33015347

Area =	1.2	ha
"C" =	0.9	
AC=	1.08	
Tc =	7.0	min
Time Increment =	10.0	min
Release Rate =	27.1	l/s
Max.Storage =	517	m3

North York	100yr
a=	1334
b=	2.00
c=	0.771

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(l/s)	(m3)	(m3)	(m3)	
7.0	245.2	736.04	309.1	11.4	297.8	
17.0	137.8	413.72	422.0	27.6	394.4	
27.0	99.5	298.62	483.8	43.9	439.9	
37.0	79.1	237.64	527.6	60.2	467.4	
47.0	66.4	199.29	562.0	76.4	485.6	
57.0	57.5	172.70	590.6	92.7	498.0	
67.0	51.0	153.06	615.3	108.9	506.4	
77.0	45.9	137.90	637.1	125.2	511.9	
87.0	41.9	125.79	656.6	141.5	515.2	
97.0	38.6	115.87	674.4	157.7	516.7	
107.0	35.8	107.59	690.7	174.0	516.7	<<<<
117.0	33.5	100.55	705.9	190.2	515.6	
127.0	31.5	94.48	720.0	206.5	513.5	
137.0	29.7	89.20	733.2	222.8	510.5	
147.0	28.2	84.55	745.7	239.0	506.7	
157.0	26.8	80.42	757.5	255.3	502.2	
167.0	25.6	76.72	768.8	271.5	497.2	
177.0	24.4	73.40	779.5	287.8	491.7	
187.0	23.4	70.38	789.7	304.1	485.6	
197.0	22.5	67.64	799.5	320.3	479.2	
207.0	21.7	65.13	808.9	336.6	472.4	
217.0	20.9	62.83	818.0	352.8	465.2	
227.0	20.2	60.70	826.7	369.1	457.6	
237.0	19.6	58.73	835.2	385.4	449.8	

Modified Rational Method

Project Name : Spadian EA
York U Station Building
Project No. : 33015347

Area =	0.1	ha
"C" =	0.9	
AC=	0.09	
Tc =	7.0	min
Time Increment =	5.0	min
Release Rate =	4.2	l/s
Max.Storage =	11	m3

North York	2yr
a=	652.8
b=	4.00
c=	0.786

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(l/s)	(m3)	(m3)	(m3)	
7.0	99.1	24.80	10.4	1.8	8.7	
12.0	73.8	18.48	13.3	3.0	10.3	
17.0	59.6	14.92	15.2	4.3	10.9	
22.0	50.4	12.62	16.7	5.5	11.1	<<<<
27.0	43.9	10.99	17.8	6.8	11.0	
32.0	39.0	9.77	18.8	8.1	10.7	
37.0	35.2	8.82	19.6	9.3	10.3	
42.0	32.2	8.06	20.3	10.6	9.7	
47.0	29.7	7.43	20.9	11.8	9.1	
52.0	27.6	6.90	21.5	13.1	8.4	
57.0	25.8	6.45	22.1	14.4	7.7	
62.0	24.2	6.07	22.6	15.6	6.9	
67.0	22.9	5.73	23.0	16.9	6.1	
72.0	21.7	5.43	23.5	18.1	5.3	
77.0	20.6	5.16	23.9	19.4	4.5	
82.0	19.7	4.93	24.2	20.7	3.6	
87.0	18.8	4.71	24.6	21.9	2.7	
92.0	18.1	4.52	24.9	23.2	1.8	
97.0	17.4	4.34	25.3	24.4	0.8	
102.0	16.7	4.18	25.6	25.7	-0.1	
107.0	16.1	4.03	25.9	27.0	-1.1	
112.0	15.6	3.89	26.2	28.2	-2.1	
117.0	15.1	3.77	26.4	29.5	-3.0	
122.0	14.6	3.65	26.7	30.7	-4.0	

Modified Rational Method

Project Name : Spadian EA
York U Station Building
Project No. : 33015347

Area =	**0.1**	ha
"C" =	**0.9**	
AC=	**0.09**	
Tc =	**7.0**	min
Time Increment =	**5.0**	min
Release Rate =	**4.2**	l/s
Max.Storage =	**17**	m3

North York	5yr
a=	840.7
b=	3.00
c=	0.779

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(l/s)	(m3)	(m3)	(m3)	
7.0	139.8	34.99	14.7	1.8	12.9	
12.0	102.0	25.51	18.4	3.0	15.3	
17.0	81.5	20.39	20.8	4.3	16.5	
22.0	68.5	17.14	22.6	5.5	17.1	
27.0	59.4	14.87	24.1	6.8	17.3	<<<<
32.0	52.7	13.19	25.3	8.1	17.3	
37.0	47.5	11.88	26.4	9.3	17.1	
42.0	43.3	10.84	27.3	10.6	16.7	
47.0	39.9	9.99	28.2	11.8	16.3	
52.0	37.1	9.27	28.9	13.1	15.8	
57.0	34.6	8.66	29.6	14.4	15.3	
62.0	32.5	8.14	30.3	15.6	14.7	
67.0	30.7	7.68	30.9	16.9	14.0	
72.0	29.1	7.28	31.5	18.1	13.3	
77.0	27.7	6.93	32.0	19.4	12.6	
82.0	26.4	6.61	32.5	20.7	11.8	
87.0	25.3	6.32	33.0	21.9	11.1	
92.0	24.2	6.06	33.4	23.2	10.3	
97.0	23.3	5.82	33.9	24.4	9.4	
102.0	22.4	5.60	34.3	25.7	8.6	
107.0	21.6	5.40	34.7	27.0	7.7	
112.0	20.9	5.22	35.1	28.2	6.9	
117.0	20.2	5.05	35.4	29.5	6.0	
122.0	19.6	4.89	35.8	30.7	5.1	

Modified Rational Method

Project Name : Spadian EA
York U Station Building
Project No. : 33015347

Area =	**0.1**	ha
"C" =	**0.9**	
AC=	**0.09**	
Tc =	**7.0**	min
Time Increment =	**5.0**	min
Release Rate =	**4.2**	l/s
Max.Storage =	**26**	m3

North York	25yr
a=	1082
b=	2.00
c=	0.771

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(l/s)	(m3)	(m3)	(m3)	
7.0	198.8	49.75	20.9	1.8	19.1	
12.0	141.4	35.39	25.5	3.0	22.5	
17.0	111.8	27.96	28.5	4.3	24.2	
22.0	93.3	23.35	30.8	5.5	25.3	
27.0	80.7	20.18	32.7	6.8	25.9	
32.0	71.4	17.85	34.3	8.1	26.2	
37.0	64.2	16.06	35.7	9.3	26.3	<<<<
42.0	58.5	14.64	36.9	10.6	26.3	
47.0	53.8	13.47	38.0	11.8	26.1	
52.0	50.0	12.50	39.0	13.1	25.9	
57.0	46.7	11.67	39.9	14.4	25.6	
62.0	43.8	10.96	40.8	15.6	25.2	
67.0	41.3	10.35	41.6	16.9	24.7	
72.0	39.2	9.80	42.3	18.1	24.2	
77.0	37.3	9.32	43.1	19.4	23.7	
82.0	35.5	8.89	43.7	20.7	23.1	
87.0	34.0	8.50	44.4	21.9	22.5	
92.0	32.6	8.15	45.0	23.2	21.8	
97.0	31.3	7.83	45.6	24.4	21.1	
102.0	30.1	7.54	46.1	25.7	20.4	
107.0	29.1	7.27	46.7	27.0	19.7	
112.0	28.1	7.02	47.2	28.2	19.0	
117.0	27.2	6.80	47.7	29.5	18.2	
122.0	26.3	6.58	48.2	30.7	17.5	

Modified Rational Method

Project Name : Spadian EA
York U Station Building
Project No. : 33015347

Area =	0.1	ha
"C" =	0.9	
AC=	0.09	
Tc =	7.0	min
Time Increment =	5.0	min
Release Rate =	4.2	l/s
Max.Storage =	35	m3

North York	100yr
a=	1334
b=	2.00
c=	0.771

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(l/s)	(m3)	(m3)	(m3)	
7.0	245.2	61.34	25.8	1.8	24.0	
12.0	174.4	43.63	31.4	3.0	28.4	
17.0	137.8	34.48	35.2	4.3	30.9	
22.0	115.1	28.79	38.0	5.5	32.5	
27.0	99.5	24.88	40.3	6.8	33.5	
32.0	88.0	22.01	42.3	8.1	34.2	
37.0	79.1	19.80	44.0	9.3	34.6	
42.0	72.1	18.04	45.5	10.6	34.9	
47.0	66.4	16.61	46.8	11.8	35.0	<<<<
52.0	61.6	15.41	48.1	13.1	35.0	
57.0	57.5	14.39	49.2	14.4	34.9	
62.0	54.0	13.52	50.3	15.6	34.7	
67.0	51.0	12.76	51.3	16.9	34.4	
72.0	48.3	12.09	52.2	18.1	34.1	
77.0	45.9	11.49	53.1	19.4	33.7	
82.0	43.8	10.96	53.9	20.7	33.3	
87.0	41.9	10.48	54.7	21.9	32.8	
92.0	40.2	10.05	55.5	23.2	32.3	
97.0	38.6	9.66	56.2	24.4	31.8	
102.0	37.2	9.30	56.9	25.7	31.2	
107.0	35.8	8.97	57.6	27.0	30.6	
112.0	34.6	8.66	58.2	28.2	30.0	
117.0	33.5	8.38	58.8	29.5	29.3	
122.0	32.4	8.12	59.4	30.7	28.7	

Modified Rational Method

Project Name : Spadian EA
Steeles East Parking Lot
Project No. : 33015347

Area =	5.2	ha
"C" =	0.9	
AC=	4.68	
Tc =	7.0	min
Time Increment =	5.0	min
Release Rate =	335.7	l/s
Max.Storage =	450	m3

North York	2yr
a=	652.8
b=	4.00
c=	0.786

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(l/s)	(m3)	(m3)	(m3)	
7.0	99.1	1289.84	541.7	141.0	400.7	
12.0	73.8	960.80	691.8	241.7	450.1	<<<<
17.0	59.6	775.90	791.4	342.4	449.0	
22.0	50.4	656.00	865.9	443.1	422.8	
27.0	43.9	571.30	925.5	543.8	381.7	
32.0	39.0	507.95	975.3	644.5	330.7	
37.0	35.2	458.59	1018.1	745.3	272.8	
42.0	32.2	418.93	1055.7	846.0	209.7	
47.0	29.7	386.30	1089.4	946.7	142.7	
52.0	27.6	358.92	1119.8	1047.4	72.4	
57.0	25.8	335.58	1147.7	1148.1	-0.4	
62.0	24.2	315.43	1173.4	1248.8	-75.4	
67.0	22.9	297.84	1197.3	1349.5	-152.2	
72.0	21.7	282.33	1219.6	1450.2	-230.6	
77.0	20.6	268.54	1240.6	1550.9	-310.3	
82.0	19.7	256.19	1260.4	1651.6	-391.2	
87.0	18.8	245.06	1279.2	1752.4	-473.2	
92.0	18.1	234.97	1297.0	1853.1	-556.0	
97.0	17.4	225.77	1314.0	1953.8	-639.8	
102.0	16.7	217.36	1330.2	2054.5	-724.2	
107.0	16.1	209.63	1345.8	2155.2	-809.4	
112.0	15.6	202.49	1360.7	2255.9	-895.2	
117.0	15.1	195.89	1375.1	2356.6	-981.5	
122.0	14.6	189.75	1389.0	2457.3	-1068.4	

Modified Rational Method

Project Name :	Spadian EA
	Steeles East Parking Lot
Project No. :	33015347

Area =	5.2	ha
"C" =	0.9	
AC=	4.68	
Tc =	7.0	min
Time Increment =	5.0	min
Release Rate =	494.4	l/s
Max.Storage =	599	m3

North York	5yr
a=	840.7
b=	3.00
c=	0.779

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(l/s)	(m3)	(m3)	(m3)	
7.0	139.8	1819.41	764.2	207.6	556.5	
12.0	102.0	1326.65	955.2	356.0	599.2	<<<<
17.0	81.5	1060.30	1081.5	504.3	577.2	
22.0	68.5	891.12	1176.3	652.6	523.7	
27.0	59.4	773.13	1252.5	800.9	451.5	
32.0	52.7	685.65	1316.4	949.2	367.2	
37.0	47.5	617.91	1371.8	1097.6	274.2	
42.0	43.3	563.74	1420.6	1245.9	174.7	
47.0	39.9	519.32	1464.5	1394.2	70.3	
52.0	37.1	482.16	1504.3	1542.5	-38.2	
57.0	34.6	450.56	1540.9	1690.8	-149.9	
62.0	32.5	423.32	1574.8	1839.2	-264.4	
67.0	30.7	399.58	1606.3	1987.5	-381.2	
72.0	29.1	378.67	1635.8	2135.8	-500.0	
77.0	27.7	360.10	1663.7	2284.1	-620.5	
82.0	26.4	343.49	1690.0	2432.4	-742.5	
87.0	25.3	328.53	1714.9	2580.8	-865.8	
92.0	24.2	314.98	1738.7	2729.1	-990.4	
97.0	23.3	302.64	1761.4	2877.4	-1116.0	
102.0	22.4	291.36	1783.1	3025.7	-1242.6	
107.0	21.6	280.99	1803.9	3174.0	-1370.1	
112.0	20.9	271.42	1824.0	3322.4	-1498.4	
117.0	20.2	262.57	1843.3	3470.7	-1627.4	
122.0	19.6	254.35	1861.9	3619.0	-1757.1	

Modified Rational Method

Project Name :	Spadian EA
	Steeles East Parking Lot
Project No. :	33015347

Area =	5.2	ha
"C" =	0.9	
AC=	4.68	
Tc =	7.0	min
Time Increment =	5.0	min
Release Rate =	690.8	l/s
Max.Storage =	828	m3

North York	25yr
a=	1082
b=	2.00
c=	0.771

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(l/s)	(m3)	(m3)	(m3)	
7.0	198.8	2587.00	1086.5	290.1	796.4	
12.0	141.4	1840.15	1324.9	497.4	827.5	<<<<
17.0	111.8	1454.12	1483.2	704.6	778.6	
22.0	93.3	1214.44	1603.1	911.9	691.2	
27.0	80.7	1049.56	1700.3	1119.1	581.2	
32.0	71.4	928.43	1782.6	1326.3	456.2	
37.0	64.2	835.23	1854.2	1533.6	320.6	
42.0	58.5	761.05	1917.9	1740.8	177.0	
47.0	53.8	700.45	1975.3	1948.1	27.2	
52.0	50.0	649.89	2027.7	2155.3	-127.6	
57.0	46.7	607.00	2076.0	2362.5	-286.6	
62.0	43.8	570.10	2120.8	2569.8	-449.0	
67.0	41.3	537.98	2162.7	2777.0	-614.3	
72.0	39.2	509.73	2202.0	2984.3	-782.2	
77.0	37.3	484.67	2239.2	3191.5	-952.3	
82.0	35.5	462.27	2274.4	3398.7	-1124.4	
87.0	34.0	442.12	2307.9	3606.0	-1298.1	
92.0	32.6	423.87	2339.8	3813.2	-1473.4	
97.0	31.3	407.27	2370.3	4020.5	-1650.1	
102.0	30.1	392.09	2399.6	4227.7	-1828.1	
107.0	29.1	378.15	2427.7	4434.9	-2007.2	
112.0	28.1	365.30	2454.8	4642.2	-2187.4	
117.0	27.2	353.40	2480.9	4849.4	-2368.5	
122.0	26.3	342.37	2506.1	5056.7	-2550.5	

Modified Rational Method

Project Name :	Spadian EA	
	Steeles East Parking Lot	
Project No. :	33015347	

Area =	**5.2**	ha
"C" =	**0.9**	
AC=	**4.68**	
Tc =	**7.0**	min
Time Increment =	**5.0**	min
Release Rate =	**851.7**	l/s
Max.Storage =	**1020**	m3

North York	100yr
a=	1334
b=	2.00
c=	0.771

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(l/s)	(m3)	(m3)	(m3)	
7.0	245.2	3189.52	1339.6	357.7	981.9	
12.0	174.4	2268.72	1633.5	613.2	1020.3	<<<<
17.0	137.8	1792.78	1828.6	868.7	959.9	
22.0	115.1	1497.28	1976.4	1124.2	852.2	
27.0	99.5	1294.01	2096.3	1379.8	716.5	
32.0	88.0	1144.66	2197.7	1635.3	562.5	
37.0	79.1	1029.76	2286.1	1890.8	395.3	
42.0	72.1	938.31	2364.5	2146.3	218.2	
47.0	66.4	863.59	2435.3	2401.8	33.5	
52.0	61.6	801.26	2499.9	2657.3	-157.4	
57.0	57.5	748.38	2559.4	2912.8	-353.4	
62.0	54.0	702.88	2614.7	3168.3	-553.6	
67.0	51.0	663.28	2666.4	3423.8	-757.5	
72.0	48.3	628.45	2714.9	3679.3	-964.5	
77.0	45.9	597.55	2760.7	3934.9	-1174.2	
82.0	43.8	569.94	2804.1	4190.4	-1386.3	
87.0	41.9	545.09	2845.4	4445.9	-1600.5	
92.0	40.2	522.59	2884.7	4701.4	-1816.7	
97.0	38.6	502.12	2922.4	4956.9	-2034.5	
102.0	37.2	483.41	2958.5	5212.4	-2253.9	
107.0	35.8	466.22	2993.1	5467.9	-2474.8	
112.0	34.6	450.37	3026.5	5723.4	-2696.9	
117.0	33.5	435.71	3058.7	5978.9	-2920.2	
122.0	32.4	422.10	3089.8	6234.4	-3144.7	

Modified Rational Method

Project Name :	Spadian EA	
	Steeles West Parking Lot	
Project No. :	33015347	

Area =	**4.9**	ha
"C" =	**0.9**	
AC=	**4.41**	
Tc =	**7.0**	min
Time Increment =	**5.0**	min
Release Rate =	**335.2**	l/s
Max.Storage =	**411**	m3

North York	2yr
a=	652.8
b=	4.00
c=	0.786

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(l/s)	(m3)	(m3)	(m3)	
7.0	99.1	1215.43	510.5	140.8	369.7	
12.0	73.8	905.37	651.9	241.3	410.5	<<<<
17.0	59.6	731.14	745.8	341.9	403.9	
22.0	50.4	618.15	816.0	442.5	373.5	
27.0	43.9	538.34	872.1	543.0	329.1	
32.0	39.0	478.64	919.0	643.6	275.4	
37.0	35.2	432.13	959.3	744.1	215.2	
42.0	32.2	394.76	994.8	844.7	150.1	
47.0	29.7	364.01	1026.5	945.3	81.2	
52.0	27.6	338.21	1055.2	1045.8	9.4	
57.0	25.8	316.22	1081.5	1146.4	-64.9	
62.0	24.2	297.24	1105.7	1246.9	-141.2	
67.0	22.9	280.66	1128.2	1347.5	-219.3	
72.0	21.7	266.04	1149.3	1448.1	-298.8	
77.0	20.6	253.04	1169.1	1548.6	-379.6	
82.0	19.7	241.41	1187.7	1649.2	-461.5	
87.0	18.8	230.92	1205.4	1749.7	-544.4	
92.0	18.1	221.41	1222.2	1850.3	-628.1	
97.0	17.4	212.75	1238.2	1950.9	-712.7	
102.0	16.7	204.82	1253.5	2051.4	-797.9	
107.0	16.1	197.53	1268.2	2152.0	-883.8	
112.0	15.6	190.81	1282.2	2252.5	-970.3	
117.0	15.1	184.58	1295.8	2353.1	-1057.3	
122.0	14.6	178.80	1308.8	2453.7	-1144.8	

Modified Rational Method

Project Name : Spadian EA
Steeles West Parking Lot
Project No. : 33015347

Area =	4.9	ha	
"C" =	0.9		
AC=	4.41		
Tc =	7.0	min	
Time Increment =	5.0	min	
Release Rate =	465.8	l/s	North York 5yr
Max.Storage =	565	m3	a= 840.7
			b= 3.00
			c= 0.779

Time (min)	Rainfall Intensity (mm/hr)	Storm Runoff (l/s)	Runoff Volume (m3)	Released Volume (m3)	Storage Volume (m3)	
7.0	139.8	1714.45	720.1	195.6	524.4	
12.0	102.0	1250.11	900.1	335.4	564.7	<<<<
17.0	81.5	999.13	1019.1	475.1	544.0	
22.0	68.5	839.71	1108.4	614.9	493.6	
27.0	59.4	728.53	1180.2	754.6	425.6	
32.0	52.7	646.09	1240.5	894.3	346.2	
37.0	47.5	582.26	1292.6	1034.1	258.5	
42.0	43.3	531.22	1338.7	1173.8	164.9	
47.0	39.9	489.36	1380.0	1313.6	66.4	
52.0	37.1	454.34	1417.5	1453.3	-35.8	
57.0	34.6	424.57	1452.0	1593.0	-141.0	
62.0	32.5	398.90	1483.9	1732.8	-248.9	
67.0	30.7	376.52	1513.6	1872.5	-358.9	
72.0	29.1	356.82	1541.5	2012.3	-470.8	
77.0	27.7	339.33	1567.7	2152.0	-584.3	
82.0	26.4	323.67	1592.5	2291.7	-699.3	
87.0	25.3	309.58	1616.0	2431.5	-815.5	
92.0	24.2	296.81	1638.4	2571.2	-932.8	
97.0	23.3	285.18	1659.8	2711.0	-1051.2	
102.0	22.4	274.55	1680.2	2850.7	-1170.5	
107.0	21.6	264.78	1699.9	2990.4	-1290.6	
112.0	20.9	255.76	1718.7	3130.2	-1411.4	
117.0	20.2	247.42	1736.9	3269.9	-1533.0	
122.0	19.6	239.68	1754.5	3409.7	-1655.2	

Modified Rational Method

Project Name : Spadian EA
Steeles West Parking Lot
Project No. : 33015347

Area =	4.9	ha	
"C" =	0.9		
AC=	4.41		
Tc =	7.0	min	
Time Increment =	5.0	min	
Release Rate =	650.9	l/s	North York 25yr
Max.Storage =	780	m3	a= 1082
			b= 2.00
			c= 0.771

Time (min)	Rainfall Intensity (mm/hr)	Storm Runoff (l/s)	Runoff Volume (m3)	Released Volume (m3)	Storage Volume (m3)	
7.0	198.8	2437.75	1023.9	273.4	750.5	
12.0	141.4	1733.99	1248.5	468.6	779.8	<<<<
17.0	111.8	1370.22	1397.6	663.9	733.7	
22.0	93.3	1144.37	1510.6	859.2	651.4	
27.0	80.7	989.01	1602.2	1054.5	547.7	
32.0	71.4	874.86	1679.7	1249.7	430.0	
37.0	64.2	787.05	1747.2	1445.0	302.2	
42.0	58.5	717.15	1807.2	1640.3	166.9	
47.0	53.8	660.04	1861.3	1835.5	25.8	
52.0	50.0	612.40	1910.7	2030.8	-120.1	
57.0	46.7	571.98	1956.2	2226.1	-269.9	
62.0	43.8	537.21	1998.4	2421.3	-422.9	
67.0	41.3	506.94	2037.9	2616.6	-578.7	
72.0	39.2	480.32	2075.0	2811.9	-736.9	
77.0	37.3	456.71	2110.0	3007.2	-897.2	
82.0	35.5	435.60	2143.2	3202.4	-1059.3	
87.0	34.0	416.61	2174.7	3397.7	-1223.0	
92.0	32.6	399.42	2204.8	3593.0	-1388.2	
97.0	31.3	383.77	2233.6	3788.2	-1554.7	
102.0	30.1	369.47	2261.1	3983.5	-1722.4	
107.0	29.1	356.33	2287.7	4178.8	-1891.1	
112.0	28.1	344.22	2313.2	4374.0	-2060.9	
117.0	27.2	333.02	2337.8	4569.3	-2231.6	
122.0	26.3	322.61	2361.5	4764.6	-2403.1	

Modified Rational Method

Project Name : Spadian EA

Steeles West Parking Lot

Project No. : 33015347

Area =	**4.9**	ha
"C" =	**0.9**	
AC=	**4.41**	
Tc =	**7.0**	min
Time Increment =	**5.0**	min
Release Rate =	**802.5**	l/s
Max.Storage =	**961**	m3

North York	100yr
a=	1334
b=	2.00
c=	0.771

Time (min)	Rainfall Intensity (mm/hr)	Storm Runoff (l/s)	Runoff Volume (m3)	Released Volume (m3)	Storage Volume (m3)	
7.0	245.2	3005.51	1262.3	337.1	925.3	
12.0	174.4	2137.84	1539.2	577.8	961.4	<<<<
17.0	137.8	1689.35	1723.1	818.6	904.6	
22.0	115.1	1410.90	1862.4	1059.3	803.1	
27.0	99.5	1219.36	1975.4	1300.1	675.3	
32.0	88.0	1078.62	2071.0	1540.8	530.2	
37.0	79.1	970.35	2154.2	1781.6	372.6	
42.0	72.1	884.17	2228.1	2022.3	205.8	
47.0	66.4	813.76	2294.8	2263.1	31.8	
52.0	61.6	755.03	2355.7	2503.8	-148.1	
57.0	57.5	705.20	2411.8	2744.6	-332.8	
62.0	54.0	662.33	2463.9	2985.3	-521.4	
67.0	51.0	625.01	2512.5	3226.1	-713.5	
72.0	48.3	592.19	2558.3	3466.8	-908.5	
77.0	45.9	563.08	2601.4	3707.6	-1106.1	
82.0	43.8	537.06	2642.3	3948.3	-1306.0	
87.0	41.9	513.64	2681.2	4189.1	-1507.8	
92.0	40.2	492.44	2718.3	4429.8	-1711.5	
97.0	38.6	473.16	2753.8	4670.6	-1916.8	
102.0	37.2	455.52	2787.8	4911.3	-2123.5	
107.0	35.8	439.32	2820.5	5152.1	-2331.6	
112.0	34.6	424.39	2851.9	5392.8	-2540.9	
117.0	33.5	410.58	2882.2	5633.6	-2751.3	
122.0	32.4	397.75	2911.5	5874.3	-2962.8	

Modified Rational Method

Project Name : Spadian EA

Steeles West Bus Terminal / Station build

Project No. : 33015347

Area =	**2.1**	ha
"C" =	**0.9**	
AC=	**1.89**	
Tc =	**7.0**	min
Time Increment =	**5.0**	min
Release Rate =	**143.7**	l/s
Max.Storage =	**176**	m3

North York	2yr
a=	652.8
b=	4.00
c=	0.786

Time (min)	Rainfall Intensity (mm/hr)	Storm Runoff (l/s)	Runoff Volume (m3)	Released Volume (m3)	Storage Volume (m3)	
7.0	99.1	520.90	218.8	60.4	158.4	
12.0	73.8	388.01	279.4	103.5	175.9	<<<<
17.0	59.6	313.34	319.6	146.6	173.0	
22.0	50.4	264.92	349.7	189.7	160.0	
27.0	43.9	230.72	373.8	232.8	141.0	
32.0	39.0	205.13	393.9	275.9	117.9	
37.0	35.2	185.20	411.1	319.0	92.1	
42.0	32.2	169.18	426.3	362.1	64.2	
47.0	29.7	156.00	439.9	405.2	34.7	
52.0	27.6	144.95	452.2	448.3	3.9	
57.0	25.8	135.52	463.5	491.5	-28.0	
62.0	24.2	127.39	473.9	534.6	-60.7	
67.0	22.9	120.28	483.5	577.7	-94.1	
72.0	21.7	114.02	492.6	620.8	-128.2	
77.0	20.6	108.45	501.0	663.9	-162.9	
82.0	19.7	103.46	509.0	707.0	-198.0	
87.0	18.8	98.96	516.6	750.1	-233.5	
92.0	18.1	94.89	523.8	793.2	-269.4	
97.0	17.4	91.18	530.7	836.3	-305.7	
102.0	16.7	87.78	537.2	879.4	-342.2	
107.0	16.1	84.66	543.5	922.6	-379.1	
112.0	15.6	81.78	549.5	965.7	-416.1	
117.0	15.1	79.11	555.3	1008.8	-453.4	
122.0	14.6	76.63	560.9	1051.9	-491.0	

Modified Rational Method

Project Name : Spadian EA
Steeles West Bus Terminal / Station build
Project No. : 33015347

Area =	**2.1**	ha
"C" =	**0.9**	
AC=	**1.89**	
Tc =	**7.0**	min
Time Increment =	**5.0**	min
Release Rate =	**199.6**	l/s
Max.Storage =	**242**	m3

North York	5yr
a=	840.7
b=	3.00
c=	0.779

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(l/s)	(m3)	(m3)	(m3)	
7.0	139.8	734.76	308.6	83.8	224.8	
12.0	102.0	535.76	385.7	143.7	242.0	<<<<
17.0	81.5	428.20	436.8	203.6	233.2	
22.0	68.5	359.88	475.0	263.5	211.6	
27.0	59.4	312.23	505.8	323.4	182.5	
32.0	52.7	276.90	531.6	383.2	148.4	
37.0	47.5	249.54	554.0	443.1	110.9	
42.0	43.3	227.66	573.7	503.0	70.7	
47.0	39.9	209.72	591.4	562.9	28.6	
52.0	37.1	194.72	607.5	622.8	-15.2	
57.0	34.6	181.96	622.3	682.6	-60.3	
62.0	32.5	170.96	636.0	742.5	-106.6	
67.0	30.7	161.37	648.7	802.4	-153.7	
72.0	29.1	152.92	660.6	862.3	-201.6	
77.0	27.7	145.43	671.9	922.2	-250.3	
82.0	26.4	138.72	682.5	982.0	-299.5	
87.0	25.3	132.68	692.6	1041.9	-349.3	
92.0	24.2	127.20	702.2	1101.8	-399.6	
97.0	23.3	122.22	711.3	1161.7	-450.3	
102.0	22.4	117.66	720.1	1221.6	-501.5	
107.0	21.6	113.48	728.5	1281.4	-552.9	
112.0	20.9	109.61	736.6	1341.3	-604.7	
117.0	20.2	106.04	744.4	1401.2	-656.8	
122.0	19.6	102.72	751.9	1461.1	-709.2	

Modified Rational Method

Project Name : Spadian EA
Steeles West Bus Terminal / Station build
Project No. : 33015347

Area =	**2.1**	ha
"C" =	**0.9**	
AC=	**1.89**	
Tc =	**7.0**	min
Time Increment =	**5.0**	min
Release Rate =	**279.0**	l/s
Max.Storage =	**334**	m3

North York	25yr
a=	1082
b=	2.00
c=	0.771

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(l/s)	(m3)	(m3)	(m3)	
7.0	198.8	1044.75	438.8	117.2	321.6	
12.0	141.4	743.14	535.1	200.9	334.2	<<<<
17.0	111.8	587.24	599.0	284.6	314.4	
22.0	93.3	490.45	647.4	368.3	279.1	
27.0	80.7	423.86	686.7	452.0	234.7	
32.0	71.4	374.94	719.9	535.7	184.2	
37.0	64.2	337.31	748.8	619.4	129.4	
42.0	58.5	307.35	774.5	703.1	71.4	
47.0	53.8	282.87	797.7	786.8	10.9	
52.0	50.0	262.46	818.9	870.5	-51.6	
57.0	46.7	245.14	838.4	954.2	-115.8	
62.0	43.8	230.23	856.5	1037.9	-181.4	
67.0	41.3	217.26	873.4	1121.6	-248.2	
72.0	39.2	205.85	889.3	1205.3	-316.0	
77.0	37.3	195.73	904.3	1289.0	-384.7	
82.0	35.5	186.69	918.5	1372.7	-454.2	
87.0	34.0	178.55	932.0	1456.4	-524.4	
92.0	32.6	171.18	944.9	1540.1	-595.2	
97.0	31.3	164.47	957.2	1623.8	-666.5	
102.0	30.1	158.34	969.1	1707.5	-738.4	
107.0	29.1	152.71	980.4	1791.2	-810.8	
112.0	28.1	147.52	991.4	1874.9	-883.5	
117.0	27.2	142.72	1001.9	1958.6	-956.7	
122.0	26.3	138.26	1012.1	2042.3	-1030.2	

Modified Rational Method

Project Name : Spadian EA

Steeles West Bus Terminal / Station build

Project No. : 33015347

Area =	**2.1**	ha
"C" =	**0.9**	
AC=	**1.89**	
Tc =	**7.0**	min
Time Increment =	**5.0**	min
Release Rate =	**343.9**	l/s
Max.Storage =	**412**	m3

North York	100yr
a=	1334
b=	2.00
c=	0.771

Time (min)	Rainfall Intensity (mm/hr)	Storm Runoff (l/s)	Runoff Volume (m3)	Released Volume (m3)	Storage Volume (m3)	
7.0	245.2	1288.08	541.0	144.4	396.6	
12.0	174.4	916.22	659.7	247.6	412.1	<<<<
17.0	137.8	724.01	738.5	350.8	387.7	
22.0	115.1	604.67	798.2	453.9	344.2	
27.0	99.5	522.58	846.6	557.1	289.5	
32.0	88.0	462.27	887.6	660.3	227.3	
37.0	79.1	415.86	923.2	763.5	159.8	
42.0	72.1	378.93	954.9	866.6	88.3	
47.0	66.4	348.76	983.5	969.8	13.7	
52.0	61.6	323.58	1009.6	1073.0	-63.4	
57.0	57.5	302.23	1033.6	1176.1	-142.5	
62.0	54.0	283.86	1055.9	1279.3	-223.4	
67.0	51.0	267.86	1076.8	1382.5	-305.7	
72.0	48.3	253.80	1096.4	1485.6	-389.2	
77.0	45.9	241.32	1114.9	1588.8	-473.9	
82.0	43.8	230.17	1132.4	1692.0	-559.6	
87.0	41.9	220.13	1149.1	1795.2	-646.1	
92.0	40.2	211.05	1165.0	1898.3	-733.3	
97.0	38.6	202.78	1180.2	2001.5	-821.3	
102.0	37.2	195.22	1194.8	2104.7	-909.9	
107.0	35.8	188.28	1208.8	2207.8	-999.1	
112.0	34.6	181.88	1222.2	2311.0	-1088.8	
117.0	33.5	175.96	1235.2	2414.2	-1178.9	
122.0	32.4	170.46	1247.8	2517.3	-1269.5	