FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT

DRAFT PLAN OF SUBDIVISION (NORTH DRAFT PLAN) 21T-M 19003

PART OF LOTS 6, 7, 8 & 9, CONCESSION 9, N.S.
CITY OF MISSISSAUGA
REGIONAL MUNICIPALITY OF PEEL

DERRY-BRITANNIA DEVELOPMENTS LIMITED

PROJECT NO. 13958

Revised MAY 2020

RAND ENGINEERING CORPORATION
5285 SOLAR DRIVE
MISSISSAUGA, ONTARIO
L4W 5B8

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1.0 INTRODUCTION

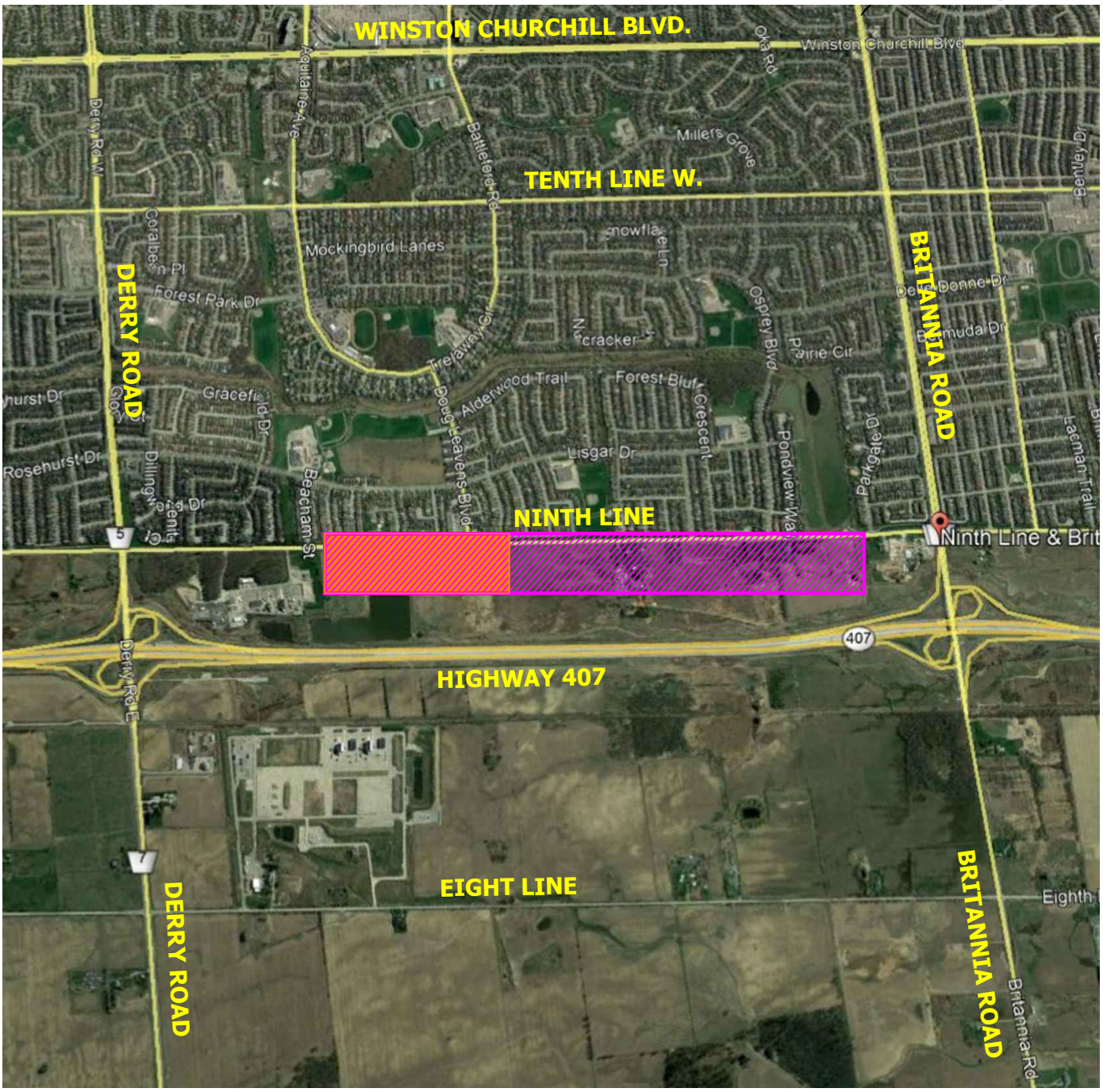
RAND Engineering Corporation has been retained by Derry-Britannia Developments Limited to complete a Functional Servicing and Stormwater Management Report for the proposed Phase 1 of the 45.1 ha (111.4 ac) mixed-use subdivision, located within the Ninth Line Lands, in the City of Mississauga and Region of Peel.

As shown in Figure 1, the Derry-Britannia Developments Limited lands are bounded by Ninth Line to the east, Enbridge Gas property to the north, Highway 407 to the west and the outlet channel from the Osprey Marsh to the south. The property is located on Part of Lots 6, 7, 8 and 9, Concession 9, New Survey (Geographic Township of Trafalgar). The overall development plan for the proposed subdivision, which forms the basis for the servicing plans presented in this report, was prepared by Glen Schnarr & Associates Inc. (GSAI) on April 3, 2020. The lands will be developed in two phases as follows:

- Phase 1 – Draft Plan of Subdivision, which encompasses 8.5 ha (21T-M 19003).
- Phase 2 – Draft Plan of Subdivision, which encompasses 36.6 ha (21T-M 19004).

The general servicing requirements for the subject lands were established in the December 2019 "*Ninth Line Lands: Servicing Strategy Report – City of Mississauga*", prepared by the Region of Peel and April 2020"*Ninth Line Lands Scoped Subwatershed Study"*, prepared by Wood Environmental & Infrastructure Solutions (formerly Amec Foster Wheeler).

The purpose of this report is to outline the preliminary servicing details for the proposed stormwater management, wastewater and water distribution systems required to service the Phase 1 of the Derry-Britannia Developments Limited subdivision. The recommended storm drainage and servicing plans have been prepared in accordance with the design criteria and the requirements of the City of Mississauga, Regional Municipality of Peel, Conservation Halton and Ministry of the Environment, Conservation and Parks (MECP). The information provided in this report is intended to assist the municipality and other regulatory agencies in their review of the draft plan and rezoning applications for the Phase 1 of the Derry-Britannia Developments Limited subdivision (21T-M 19003).



LEGEND

PROPOSED PHASE 1 DEVELOPMENT

DERRY-BRITANNIA DEVELOPMENTS LIMITED LANDS

DERRY-BRITANNIA DEVELOPMENTS LIMITED
21T-M 19003

FIGURE No. 1

NOT TO SCALE

TOWN OF MISSISSAUGA

LOCATION PLAN

PROJECT No. 13958

RAND ENGINEERING CORPORATION

R:\13\13958\Drawings & Figures_2020 April 27 (Latest)\Figure 1_Location Plan.dwg May 08, 2020 – 4:52pm

2.0 BACKGROUND INFORMATION

The following is a list of the background studies and reference documents used in the preparation of this report;

- **Amec Foster Wheeler**, *"Highway 407 Transitway Corridor Assessment within the Ninth Line Lands*", October 12, 2016.
- **Amec Foster Wheeler**, *"Water and Wastewater Assessments for Ninth Line Lands, City of Mississauga, Memorandum to Region of Peel"*, February 8, 2017.
- **Amec Foster Wheeler**, *"Ninth Line Lands Scoped Subwatershed Study, Phase 1 – Background Report and Study Area Characterization (Draft Final)*", April 2020.
- **Amec Foster Wheeler**, *"Ninth Line Lands Scoped Subwatershed Study, Phase 2 – Impact Assessment and Management Study (Draft Final)*", April 2020.
- **City of Mississauga**, *"Development Requirements Manual*", September 2017.
- **City of Mississauga**, *"Ninth Line Lands – Proposed Neighbourhood Character Area Policies and Zoning - Corporate Report"*, November 10, 2017.
- **City of Mississauga**, *"Ninth Line - Plan and Profiles"*, 1990-2003.
- **Crozier Consulting Engineers**, *"Right-of-Way Justification Letter Report, Part of Lots 6,7,8 & 9, Concession 9, Draft Plan of Subdivision, Mississauga, Ontario"*, February 2020.
- **CVC and TRCA**, *"Low Impact Development Stormwater Management Planning and Design Guide"*, 2010.

- **DS Consultants Ltd.**, "*Consolidated Report on Preliminary Geotechnical Investigation Proposed Residential Development Parcels A to J, Ninth Line, Ninth Line, Mississauga, Ontario*", June 5, 2019.

- **DS Consultants Ltd.**, "*Water Balance Analysis – Phase 1 (North Block), Derry & Britannia Developments – Ninth Line, Mississauga, Ontario*", May 2020.

- **Enbridge Gas Distribution Inc.**, "*Third Party Requirements in the Vicinity of Natural Gas Facilities*", September 2018.

- **GGHACA**, "*Erosion & Sediment Control Guideline for Urban Construction*", December 2006.

- **Ministry of the Environment**, "*Stormwater Management Planning and Design Manual*", March 2003.

- **Ministry of Transportation**, "*407 Transitway, Hurontario Street to Brant Street, Environmental Assessment, PIC #1 Information*", December 2018.

- **MMM Group**, "*Ninth Line Corridor Study – Transportation Assessment*", July 2017.

- **Region of Peel**, "*Ninth Line Lands: Servicing Strategy Report – City of Mississauga*", December 2019.

- **Wood Environmental & Infrastructure Solutions**, "*Addendum to the Highway 407 Transitway Corridor Assessment within the Ninth Line Lands Study Area (2016), City of Mississauga*", May 31, 2018.

- **Wood Environmental & Infrastructure Solutions**, "*Ninth Line Lands Scoped Subwatershed Study, Phase 3 – Implementation and Monitoring Plan (Draft Final)*", April 2020.

3.0 PROPOSED DEVELOPMENT

The proposed Phase 1 of the Derry-Britannia Developments Limited subdivision encompasses approximately 8.5 ha. The Draft Plan of Subdivision (21T-M 19003) was prepared by GSAI on April 3, 2020. The proposed servicing and grading design for the Phase 1 lands has been prepared in conjunction with the future development plans for the balance of the property, the 36.6 ha Phase 2 development (Draft Plan of Subdivision 21T-M 19004).

The subject lands lie within the limits of the East Branch Tributary catchment of the Sixteen Mile Creek Subwatershed. The development limits for the subject lands have been established based on the April 2020 *"Ninth Line Lands Scoped Subwatershed Study"* findings and preliminary design information for the 407 Transitway alignment through the Ninth Line lands, obtained from the May 2018 *"Addendum to the Highway 407 Transitway Corridor Assessment within the Ninth Line Lands Study Area (2016), City of Mississauga*".

As shown in Figure 2, the Phase 1 development is located northwest of Doug Leavens Boulevard and Ninth Line and consists of detached units, rear lane and street townhouse units, a condominium block and park blocks. The internal streets within the development will be a 17 m and 20 m right-of-way roads and a 10 m right-of-way laneways.

The Phase 1 development will include a construction of the temporary stormwater management facility with an outlet to the East Branch Tributary of Sixteen Mile Creek and will be completed with a limited grading alteration within a 15 m setback from the existing Regional floodplain.

The temporary SWM facility will provide water quality, quantity and erosion control for the Phase 1 lands. The water and wastewater servicing of the development will be provided via proposed servicing connections to the existing municipal watermain and wastewater infrastructure. The recommended servicing plans for the subject lands have been coordinated with the design information provided by the City of Mississauga and Region of Peel.

LAND USE	LOTS / BLOCKS	AREA (ha)	AREA (ac)	TOTAL UNITS	DENSITY (UPNHA)
REAR LANE DETACHED - 10.7m (35')	1-28	0.56	1.38	28	50.0
REAR LANE TOWNHOUSE - 6.05m (20')	29-41	0.80	1.98	69	86.3
STREET TOWNHOUSE - 6.0m (20')	42-59	1.70	4.20	101	59.4
CONDO APARTMENTS / TOWNS / STACKS	60	0.84	2.08	140-200	166.7-238.1
RESIDENTIAL RESERVE	61	0.50	1.24		
PARK / WALKWAY	62-69	1.13	2.79		
BUFFERS	70-72	0.10	0.25		
ROAD WIDENINGS	73,74	0.17	0.42		
0.3m RESERVES	75,76	0.00	0.00		
10.0m LANEWAY (447m LENGTH)		0.46	1.14		
17.0m LOCAL ROW (634m LENGTH)		1.10	2.72		
20.0m LOCAL ROW (572m LENGTH)		1.17	2.89		
TOTAL	**76**	**8.53**	**21.08**	**338-398**	**86.7-102.1**

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FIGURE No. 2

SCALE: N.T.S.

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DERRY-BRITANNIA DEVELOPMENTS LIMITED
21T-M 19003

DRAFT PLAN OF SUBDIVISION (NORTH DRAFT PLAN)

CITY OF MISSISSAUGA

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Primary access to the Phase 1 development will be provided via Street F at the intersection of Ninth Line and Doug Leavens Boulevard. The Draft Plan of Subdivision was prepared with consideration of the future City of Mississauga plans for the Ninth Line widening from the existing two-lane road to the future four-lane road within a 35 m right-of-way. In February 2020, the City initiated a Schedule C Municipal Class Environmental Assessment study to assess the transportation improvements to Ninth Line between Eglinton Avenue and Derry Road.

As shown in Figure 3, the Draft Plan of Subdivision for Phase 2 encompasses 36.6 ha and consists of townhouse units, condominium duplex blocks, condominium block, school block, park blocks, transitway corridor block, stormwater management block and areas designated for the future Natural Heritage System (NHS).

The future Phase 2 development will include the internal grading and servicing works, construction of the 407 Transitway corridor berm and grading within the existing NHS / floodplain limits. The grading design within the NHS will be completed with the intention to maintain the existing water levels and floodplain storage in the East Branch Tributary of Sixteen Mile Creek. The existing Regional floodplain limits will be redefined to allow the completion of the Phase 2 development.

The Phase 2 works will include and removal of the temporary SWM facility constructed as part of the Phase 1 development. Stormwater quality, erosion and quantity control for the entire development will be provided within the permanent SWM facility with an outlet to the existing Osprey Marsh channel, located at the southern limit of the Phase 2 development.

Primary access to the Phase 2 development will be provided via Street B at the intersection of Ninth Line and Foxwood Avenue and via the intersection of Street C with Ninth Line.

In accordance with the April 2020 "*Ninth Line Lands Scoped Subwatershed Study*" findings, the stormwater management system for the proposed development will be independent from the drainage system for the future 407 Transitway.

LAND USE	BLOCKS	AREA (ha)	AREA (ac)	TOTAL UNITS	DENSITY (UPNHA)
REAR LANE TOWNHOUSE - 6.05m (20')	1-17	1.29	3.19	109	84.5
STREET TOWNHOUSE - 6.0m (20')	18-36	1.72	4.25	94	54.7
CONDOMINIUM DUPLEX	37-62	1.71	4.23	148	86.5
CONDO APARTMENTS / TOWNS / STACKS	63	4.52	11.17	350-1,360	77.4-300.9
RESIDENTIAL RESERVE	64-69	0.49	1.21		
PARK / WALKWAY / TRAIL	70-80	2.09	5.16		
PUBLIC ELEMENTARY SCHOOL	81	0.63	1.56		
SWM POND	82	2.87	7.09		
GREENLANDS	83,84	8.62	21.30		
TRANSITWAY / TRANSITWAY BUFFER	85-89	7.09	17.52		
ROAD WIDENINGS	90-92	0.65	1.61		
0.3m RESERVES	93-99	0.00	0.00		
10.0m LANEWAY (813m LENGTH)		0.83	2.05		
17.0m LOCAL ROW (1,298m LENGTH)		2.25	5.56		
20.0m LOCAL ROW (887m LENGTH)		1.80	4.45		
TOTAL	**99**	**36.56**	**90.34**	**701-1,711**	**75.8-185**

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FIGURE No. 3

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FUTURE PHASE 2 DEVELOPMENT

DERRY-BRITANNIA DEVELOPMENTS LIMITED
21T-M 19003

CITY OF MISSISSAUGA

PROJECT No. 13958

4.0 EXISTING CONDITIONS

4.1 Topography and Drainage

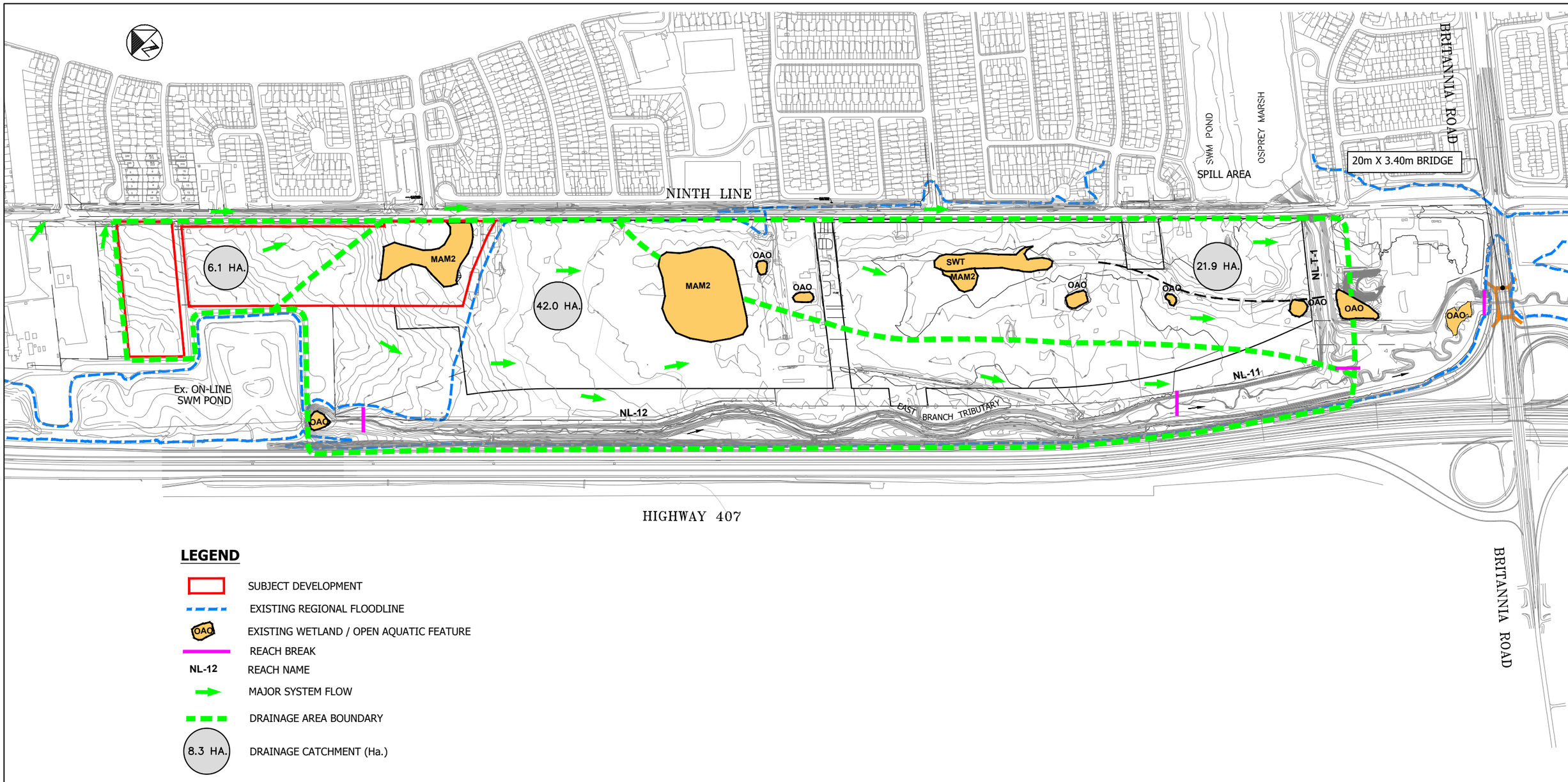
A review of the site conditions has been carried out using topographic mapping and site inspection. Topographic information for the property was obtained from a detailed survey completed by J.D. Barnes on May 13, 2019. The additional information for the adjacent lands was obtained from the City of Mississauga and April 2020 "*Ninth Line Lands Scoped Subwatershed Study*".

The subject lands comprise mainly agricultural lands with scattered pockets of small wetlands. There are a few rural residences located along Ninth Line. The lands are characterized by gently sloping topography with average slopes ranging from 1% to 3 % across the site. There is an established Lisgar residential neighbourhood to the east of Ninth Line.

As shown in Figure 4, the northern portion of the subject lands are drained south-easterly via sheet flow towards the Ninth Line ditch. The southern portion of the property drains southerly via sheet flow towards the East Branch Tributary of the Sixteen Mile Creek (Reach NL-12), located along the east side of the Highway 407 corridor.

Ultimately, the combined drainage is conveyed southerly via the East Branch Tributary (Reach NL-11) towards the 20 m span bridge crossing at Britannia Road.

The April 2020 "*Ninth Line Lands Scoped Subwatershed Study, Phase 1 – Background Report and Study Area Characterization*" identified natural heritage features across the entire Ninth Line Lands study area, including the subject lands. As shown in Figure 4, there is an existing wetland feature MAM2 located at the southern limit of the proposed development.



LEGEND

- SUBJECT DEVELOPMENT
- EXISTING REGIONAL FLOODLINE
- OAO — EXISTING WETLAND / OPEN AQUATIC FEATURE
- REACH BREAK
- NL-12 — REACH NAME
- MAJOR SYSTEM FLOW
- DRAINAGE AREA BOUNDARY
- 8.3 HA. — DRAINAGE CATCHMENT (Ha.)

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EXISTING CONDITIONS

CITY OF MISSISSAUGA

SCALE N.T.S.	JOB No. 13958	FIGURE No. 4

R:\13\13958\Drawings & Figures_2020 April 27 (Latest)\Figure 4-Existing Conditions.dwg May 08, 2020 - 4:54pm

4.2 Soils

A review of the property's subsurface conditions has been carried out using the geotechnical information for the property provided in the June 2019 *"Consolidated Report on Preliminary Geotechnical Investigation Proposed Residential Development Parcels A to J, Ninth Line, Ninth Line, Mississauga, Ontario"*, prepared by DS Consultants Ltd.

The DS Consultants Ltd. report summarizes the geotechnical investigation results with the information previously completed within the subject lands by the other consultants (AMEC Earth & Environmental, Shad & Associates and Sirati and Partners Consultants Limited).

The results of the investigation indicate that the soil stratigraphy of the site consists of 0.10 m to 0.40 m layer of topsoil over a stratum of mainly silty clay and clayey silt till. These soils are exhibiting low rates of infiltration and high rates of runoff.

The groundwater level was observed ranging from approximately 0.9 m below grade in the northern part of the study lands, to approximately 4.2 m in the southern part of the subject lands. The investigation results also showed the water levels observed above the ground (artesian conditions) in several borehole locations in the northern part of the study lands. These lands will be the subject of hydrogeological investigation during the final design stage.

4.3 Existing Floodplain

The existing Regional floodplain and relevant hydraulic modeling information (HEC-RAS computer model) for the East Branch Tributary of Sixteen Mile Creek was obtained from the April 2020 *"Ninth Line Lands Scoped Subwatershed Study"*. The existing floodplain limits are illustrated on Drawing No. 1, included in Appendix J.

As shown in Figure 4, the subject Phase 1 development limits are located outside the Regional floodplain of the East Branch Tributary of Sixteen Mile Creek.

5.0 STORMWATER MANAGEMENT PLAN

The recommended stormwater management plan applicable to the Phase 1 development has been prepared in accordance with the recommendations from the April 2020 "*Ninth Line Lands Scoped Subwatershed Study*" and design requirements of the City of Mississauga, Conservation Halton and MECP. The proposed plan has been prepared with a consideration of the future Phase 2 development.

5.1 Storm Drainage Design Criteria and Requirements

The following storm drainage criteria have been adopted for the stormwater conveyance system within the proposed development:

- The minor drainage system should be designed for the 10-year storm event using the Rational Method and City of Mississauga IDF curves.

- The major system should be designed to accommodate runoff exceeding the capacity of the minor system for flows up to and including the 100-year storm event. The major system should be contained within road allowances and designated easements without over-flowing onto the arterial roads.

- For residential lots, runoff from roof leaders should be discharged to surface pre-cast splash pads and directed towards pervious areas.

- Storm sewers should be installed at adequate depth to enable connection of all basement weeping tiles.

- An on-site retention of the first 5 mm of runoff from the entire impervious surface area by way of infiltration, evapotranspiration or re-use. Various Low Impact Development practices should be considered to provide the on-site runoff retention.

In accordance with the recommended stormwater management plan presented in the April 2020 "*Ninth Line Lands Scoped Subwatershed Study*", stormwater quality, erosion and quantity control for the subject lands should be provided within an end-of-pipe stormwater management facility.

The following summarizes general design criteria for the design of the SWM facility:

- The SWM facility should be designed as an off-line wet pond with permanent storage for water quality control in accordance with the "enhanced" protection level for the receiving watercourse as defined in the March 2003 Ministry of Environment guidelines.

- The SWM facility should incorporate extended detention storage for erosion control to maintain the volume of runoff above the critical flow rate at existing levels, for the 4-hour 25mm storm event and calculated based on 275 m^3 per hectare of contributing impervious area. The extended detention release rate for the ponds should be designed based on 0.002 m^3/s per hectare of contributing area.

- The SWM facility should provide water quantity control for all storm events up to and including the Regional Storm (Hurricane Hazel) event. The storage and discharge requirements are summarized in the following table:

Return Storm	**Cumulative Volume* Required (m^3/impervious Ha)**	**Discharge (m^3/s/Ha)**
2-year	450	0.09
5-year	600	0.38
100-year	875	1.02
Regional	1775	1.53

* - Cumulative unitary volumes are inclusive of extended detention storage requirements for erosion control.

- The SWM facility design should include a bottom draw outlet structure, sediment forebay, outlet plunge pool, emergency overflow spillway and a maintenance access route from a municipal road.

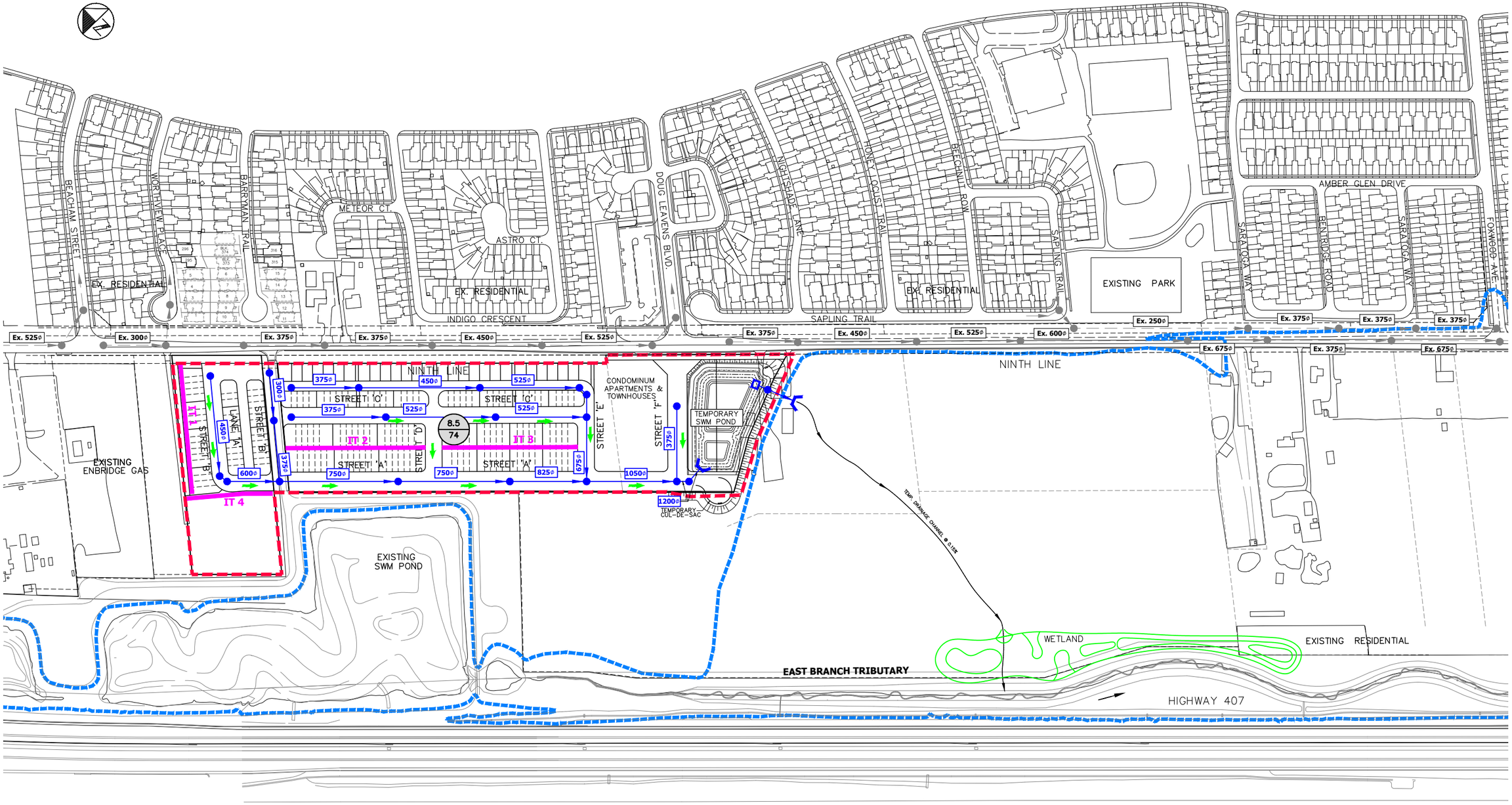
- The SWM facility should be graded with side slopes 5:1 for 3 m horizontally above and below the permanent water level and side slopes of 3:1 to 4:1 elsewhere.

5.2 Proposed Storm Drainage Plan – Phase 1 Development

The general layout of the stormwater conveyance network servicing the Phase 1 development is shown schematically in Figure 5. The preliminary design details of the storm drainage system are shown on Drawing No. 2, included in Appendix J. Post-development storm drainage from the development will be managed using a combination of minor (storm sewers) and major (overland) systems. Stormwater flows collected by the minor system will be conveyed by storm sewers sized to accommodate minimum 10-year peak flows from the development as calculated using the Rational Method and City of Mississauga design criteria. Flows exceeding the capacity of the minor system up to the 100-year storm will be conveyed overland along proposed road allowances, generally following the direction of the minor system.

Due to the grading constraints, all residential units will be equipped with sump pumps connected to storm laterals with gooseneck and backwater prevention valves.

As shown on Drawing No. 2, the combined minor and major systems from the subject development will be conveyed to the temporary SWM Pond. The proposed facility will service the subject lands until the future development plans for the Phase 2 development are approved and implemented. The Phase 2 development will include the construction of the permanent SWM facility to service the Phases 1 and 2 lands. The temporary SWM pond will be removed upon the completion of the permanent facility. The drainage system for the Phase 1 has been designed with a consideration of the ultimate development. The preliminary storm drainage plan and storm sewer design sheets for the entire development are included in Appendix A.



LEGEND

- EXISITNG STORM SEWER
- PROPOSED STORM SEWER
- MAJOR SYSTEM FLOW
- EXISTING REGIONAL FLOODLINE
- DRAINAGE AREA BOUNDARY TO THE TEMPORARY SWM POND
- 8.5 / 74 — DRAINAGE AREA (Ha.) / IMPERVIOUS LEVEL (%)
- WETLAND COMPENSATION AREA
- IT 2 — INFILTRATION TRENCH

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21T-M 19003

PRELIMINARY
STORM DRAINAGE PLAN-PHASE 1

CITY OF MISSISSAUGA

SCALE 1:4,000	JOB No. 13958	FIGURE No. 5

R:\13\13958\Drawings & Figures_2020 April 27 (Latest)\Figure 5- Preliminary Storm Drainage Plan-Phase 1.dwg May 15, 2020 - 10:36am

5.3 Temporary SWM Pond

As shown in Figure 5, the temporary SWM Pond will provide drainage control for approximately 8.4 ha drainage area with an average impervious level of 66%. The facility will be constructed as an off-line wet pond to provide water quality, erosion and quantity control for the contributing drainage area. The temporary pond will be located within the 0.83 ha block at the southern limit of the development. The block will be redeveloped as residential and park areas in conjunction with the future Phase 2 development.

The permanent storage for water quality control in the pond has been sized to achieve an "enhanced" protection level for the receiving watercourse as defined in the 2003 MOE "*Stormwater Management Practices Planning and Design Manual*". The design volume provided within the facility will be approximately 4,160 m^3 at the permanent water level of 190.70 m. The permanent storage depth will be 1.7 m.

In accordance with the April 2020 "*Ninth Line Lands Scoped Subwatershed Study*", erosion control has been determined based on the storage requirement of 275 m^3 per impervious hectare of contributing drainage area and release rate of 0.002 m^3/s per hectare of contributing drainage area.

Based on the preliminary design, the extended detention volume provided within the pond will be 1,525 m^3 controlled to a maximum rate of 0.008 m^3/s (at a depth of 0.6 m). The extended detention storage will be released through an 80 mm diameter orifice installed at the permanent pool elevation of 190.70 m. Based on the proposed development conditions, the drawdown time for the extended detention volume will be approximately 50 hours.

The SWM facility will provide water quantity control of post-development flows to the target rates for the 2-year, 5-year, 100-year and Regional Storm events established in the April 2020 "*Ninth Line Lands Scoped Subwatershed Study*". The maximum storage volume in the SWM facility will be approximately 12,567 m^3, to provide peak flow

attenuation up to and including the Regional Storm event. The storage and outflows requirements for the temporary pond are provided in the following table.

Storage and Outflow Requirements for Temporary SWM Facility		
Storage Volume (m^3)		
	Required	**Provided**
Permanent	1,473	4,160
Extended Detention	1,523	1,525
2 Year	2,492	2,614
5 Year	3,322	3,670
100 Year	6,195	7,777
Regional Storm	12,567	12,680
Outflow Release Rate (m^3/s)		
	Target	**Provided**
Erosion Control	0.017	0.008
2 Year	0.753	0.011
5 Year	3.181	0.013
100 Year	8.537	0.031
Regional Storm	12.806	0.667

The SWMHYMO computer model has been used to evaluate the hydrologic response of the site with the implementation of the temporary SWM facility. Peak flows for post-development conditions have been determined for the 2-yr, 5-yr, 100-yr and Regional storm events.

Design storm hyetographs in the hydrologic simulation are based on 12-hour SCS design storms for the 2-yr, 5-yr and 100-yr storm events. The Regional Storm event simulation is based upon the 12-hour distribution of Hurricane Hazel.

The SWMHYMO modeling results are included in Appendix B.

The pond sizing, outlet performance, stage-storage-discharge curves and pond performance tables for the temporary SWM Pond are provided in Appendix C.

The sediment forebay will have sufficient capacity to accommodate the anticipated 10-year sediment yield. The facility will provide a minimum 0.30 m freeboard above the maximum water level.

As shown on Drawing No. 2, the controlled flows from the facility will be conveyed via an approximately 380 m long temporary outlet swale to the existing East Branch Tributary of Sixteen Mile Creek.

5.4 SWM Pond Components

The outlet structure from the temporary SWM pond will consist of the following components:

Quality and Erosion Control - The water quality control outlet will be a bottom-draw consisting of a 2% reverse-grade PVC outlet pipe with vertical bends connected to a 1500 mm diameter manhole. An orifice will be installed vertically within the manhole at the permanent water elevation, allowing the extended detention volume to drain over a minimum period of 48 hours. The 1500 mm diameter manhole will connect to a manhole downstream of the quantity control outlet structure common to both the quality and quantity control discharge streams. Treated flows will be conveyed from the common manhole via a proposed storm sewer and concrete headwall to the proposed temporary swale connected to the East Branch Tributary.

Quantity Control - The controlled flows will be conveyed via a weir control structure within a concrete chamber. Controlled flows will be conveyed via storm sewer outlet to the proposed temporary swale connected to the East Branch Tributary.

Emergency Spillway - In the event of temporary blockage of the quantity control outlet structure, all flow will be conveyed by an emergency spillway located on the south side of the facility.

To prevent sub-surface migration of water out of the facility, the bottom and side walls of each pond will be lined with clayey fill materials in accordance with recommendations from the geotechnical consultant. The sediment forebay will be separated from the main pond area by a berm, which will be constructed 0.30 m below the normal water level. The forebay will have sufficient capacity to accommodate the anticipated 10-year sediment yield.

Design details for the various components of the proposed temporary and permanent ponds will be provided at the time of the engineering submission for the subject lands.

5.5 Low Impact Development Practices

Based on the City of Mississauga requirements, the proposed storm drainage system for the development will include the on-site detention of the first 5 mm of runoff from the entire impervious area. The on-site runoff retention within the Phase 1 development will be achieved by an implementation of the following Low Impact Development (LID) practices;

- The depth of topsoil on the lots will be increased from the typical 150 mm to 300 mm.
- Runoff from roof leaders will be discharged to surface pre-cast splash pads and directed towards lawns.
- Provision of rear yard infiltration trenches within the townhouse blocks.
- Provision of an infiltration trench within the park area.

The locations of the proposed LID practices are shown schematically in Figure 5. Typical design details and sizing calculations for the proposed infiltration trenches are provided in Appendix D. The impervious coverage of the Phase 1 development is approximately 71% which corresponds to an on-site retention volume of 275 m^3. Based on the preliminary design analysis the storage provided within the proposed LID's will be approximately 279 m^3.

5.6 Water Balance Analysis

The overall water balance analysis for the Phase 1 development has been conducted by DS Consultants Ltd. to evaluate the proposed LID strategy, including the provision of 5 mm of rainfall detention and impact on the groundwater resources.

The water balance analysis results show a pre-development infiltration volume of approximately 16,762 m^3/year. Under post-development conditions, the infiltration volume will be reduced to approximately 5,180 m^3/year without mitigation. With the proposed LID practices, the annual infiltration volume would be approximately 17,702 m^3/year.

The water balance analysis concluded that with the implementation of the LID practices, it is expected an increase in annual infiltration by approximately 8 % in comparison to pre-development conditions.

The results of the DS Consultants Ltd. analysis are provided in Appendix D.

5.7 Feature Based Water Balance Assessment

The proposed Phase 1 development requires the removal of the existing wetland feature MAM2 with the study limits. The wetland compensation analysis has been conducted by GEO Morphix Ltd. and the study findings and recommendations are provided in Appendix E.

As shown on Drawing No. 3, it is proposed that two wetlands will be installed within the future NHS limits. These features will include design elements to enhance the habitat such as overwintering pools extending below the frost line, bedforms, terrestrial mounds and appropriate native vegetation.

Based on the GEO Morphix Ltd. analysis results, the proposed features will function better than the existing wetland recommended for the removal.

5.8 Future Phase 2 Development

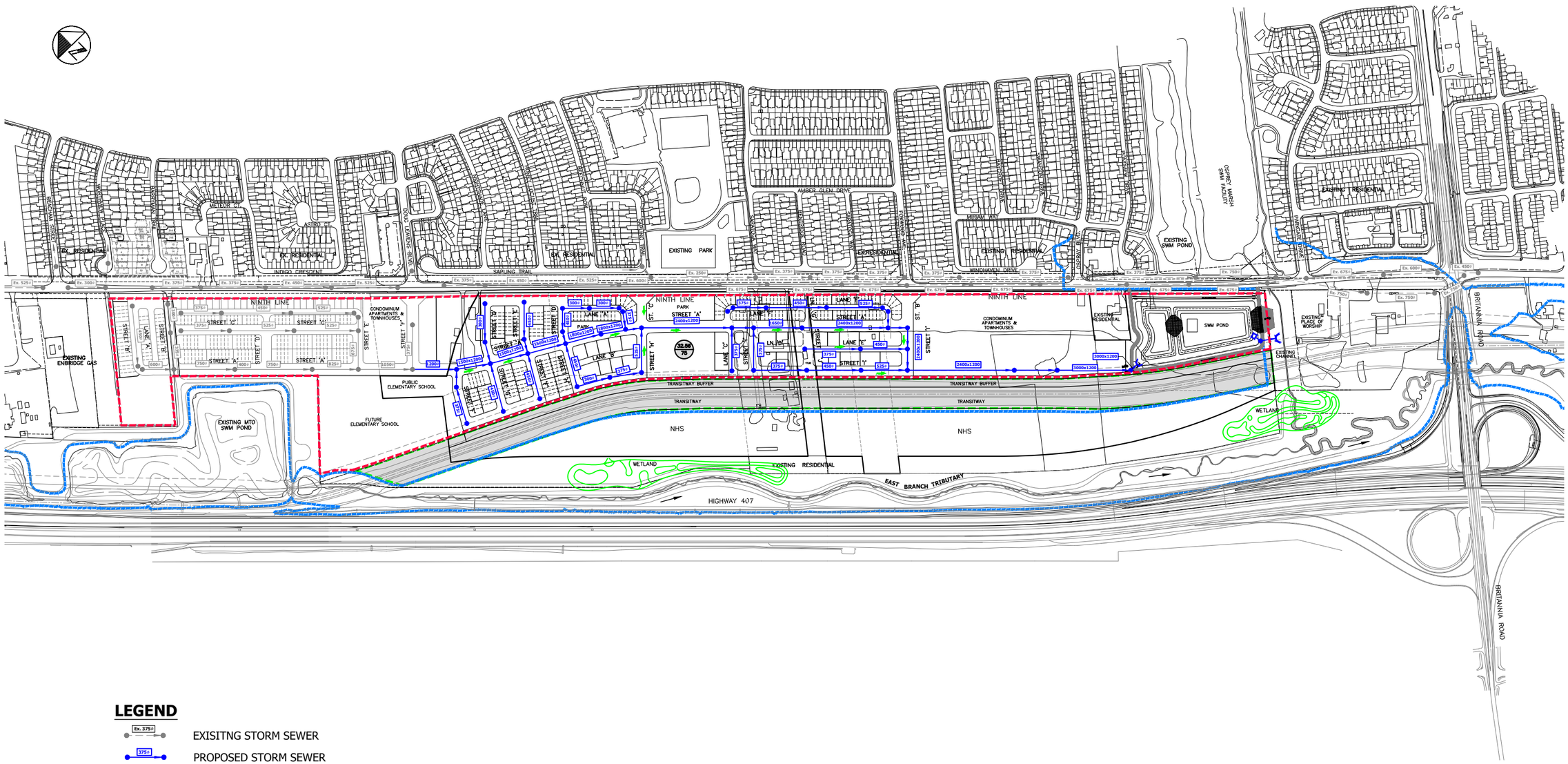
The general layout of the stormwater conveyance network servicing Phase 2 development is shown on Drawing No. 3, included in Appendix J. Post-development storm drainage from the development will be managed using a combination of minor (storm sewers) and major (overland) systems.

Stormwater flows collected by the minor system will be conveyed by storm sewers sized to accommodate minimum 10-year peak flows from the development as calculated using the Rational Method and City of Mississauga design criteria. Flows exceeding the capacity of the minor system up to and 100-year will be conveyed overland along proposed road allowances, generally following the direction of the minor system.

The proposed storm drainage system for the development will include the on-site detention of the first 5 mm of runoff from the entire impervious area. The on-site runoff retention will be achieved by an implementation of the LID practices such as infiltration trenches in the rear yards, enhanced grass swales and bioretention areas within park blocks and buffers. The preliminary storage requirements for the future Phase 2 development are provided in Appendix D. The detailed LID strategy will be provided at the time of the Draft Plan Application for the Phase 2 development.

As shown on Drawing No. 3, the temporary SWM Pond will be removed and the combined minor and major systems from the subject development will be conveyed to the permanent SWM Pond located at the southern limit of the Phase 2 development.

The design of the permanent facility will be conducted in conjunction of the proposed grading and servicing design for the Phase 2 development, Transitway berm design and NHS channelization works along the East Branch Tributary of the Sixteen Mile Creek.



LEGEND

- EXISITNG STORM SEWER
- PROPOSED STORM SEWER
- MAJOR SYSTEM FLOW
- POST DEVELOPMENT REGIONAL FLOODLINE
- DRAINAGE AREA BOUNDARY TO THE ULTIMATE SWM POND
- DRAINAGE AREA (Ha.) / IMPERVIOUS LEVEL (%)
- WETLAND COMPENSATION AREA

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PRELIMINARY
STORM DRAINAGE PLAN-PHASE 2

CITY OF MISSISSAUGA

SCALE 1:7,000	JOB No. 13958	FIGURE No. 6

R:\13\13958\Drawings & Figures_2020 April 27 (Latest)\Figure 6- Preliminary Storm Drainage Plan-Phase 2.dwg May 15, 2020 - 11:53am

5.9 Permanent SWM Pond

As shown on Drawing No. 3, the SWM Pond will provide drainage control for the entire Derry-Britannia Developments Limited subdivision (i.e. Phases 1 and 2). The facility will be constructed as an off-line wet pond and will provide water quality, erosion and quantity control for the contributing 32.1 ha drainage area with an average impervious level of 71%. The pond will be located within the approximately 2.9 ha block located at the southern part of the Phase 2 development.

The permanent storage for water quality control in the pond has been sized to achieve an "enhanced" protection level for the receiving watercourse as defined in the 2003 MOE "*Stormwater Management Practices Planning and Design Manual*". The design volume provided within the facility will be 17,635 m^3 at the permanent water level of 188.00 m. The permanent storage depth will be 2.0 m.

In accordance with the April 2020 "*Ninth Line Lands Scoped Subwatershed Study*", erosion control has been determined based on the storage requirement of 275 m^3 per impervious hectare of contributing drainage area and release rate of 0.002 m^3/s per hectare of contributing drainage area.

Based on the preliminary design, the extended detention volume provided within the pond will be 6,346 m^3 controlled to a maximum rate of 0.032 m^3/s (at a depth of 0.5 m). The extended detention storage will be released through a 150 mm diameter orifice installed at the permanent pool elevation of 188.00 m. Based on the proposed development conditions, the drawdown time for the extended detention volume will be approximately 55 hours.

The SWM facility will provide water quantity control of post-development flows to the target rates for the 2-year, 5-year, 100-year and Regional Storm events established in the April 2020 "*Ninth Line Lands Scoped Subwatershed Study*". The maximum storage volume in the SWM facility will be approximately 49,180 m^3, to provide peak flow attenuation up to and including the Regional Storm event.

The storage and outflows requirements for the Phase 2 pond are provided in the following table.

Storage and Outflow Requirements for Phase 2 SWM Facility		
Storage Volume (m^3)		
	Required	**Provided**
Permanent	6,011	17,635
Extended Detention	6,296	6,346
2 Year	10,302	10,430
5 Year	13,737	14,590
100 Year	24,133	30,360
Regional Storm	48,955	49,180
Outflow Release Rate (m^3/s)		
	Target	**Provided**
Erosion Control	0.064	0.032
2 Year	2.891	0.042
5 Year	12.206	0.049
100 Year	32.762	0.077
Regional Storm	49.144	2.534

The SWMHYMO computer model has been used to evaluate the hydrologic response of the site with the implementation of the proposed SWM facility. Peak flows for post-development conditions have been determined for the 2-yr, 5-yr, 100-yr and Regional storm events.

Design storm hyetographs in the hydrologic simulation are based on 12-hour SCS design storms for the 2-yr, 5-yr and 100-yr storm events. The Regional Storm event simulation is based upon the 12-hour distribution of Hurricane Hazel.

The SWMHYMO modeling results are included in Appendix B. The pond sizing, outlet performance, stage-storage-discharge curves and pond performance tables for the permanent SWM Pond are provided in Appendix F.

The pond will be graded at an average slope of 4:1 down to the upper limit of the safety shelf, then at a 5:1 slope for 3 m horizontally above and below the permanent water level and then at a 3:1 slope to the bottom of the facility. The sediment forebay will have sufficient capacity to accommodate the anticipated 10-year sediment yield. The facility will provide a minimum 0.30 m freeboard above the maximum water level.

As shown on Drawing No. 3, the controlled flows from the facility will be conveyed to the existing Osprey Marsh outlet channel and ultimately to the East Branch Tributary.

5.10 NHS Channelization Works

In accordance with the recommendations presented in the May 2018 *"Addendum to the Highway 407 Transitway Corridor Assessment within the Ninth Line Lands Study Area"* and April 2020 *"Ninth Line Lands Scoped Subwatershed Study*", the modifications to the existing Regional floodplain will be permitted within the study limits.

The proposed works will include filling within the Regional floodplain to allow for construction of the Transitway berm and create developable area between the Transitway and Ninth Line. The loss in floodplain storage will be balanced by the proposed lowering of the floodplain elevations within the NHS corridor, on the west side of the Transitway. The Transitway berm will be erected to a minimum of 0.3 m above the Regional Storm flood depth and will serve as the new watercourse embankment.

It is intended that the proposed grading modifications within the existing floodplain will have no adverse effect upon predicted water levels and floodplain storage for the study lands under post-development conditions under the 2-yr to 100-yr and Regional Storm events.

The proposed grading within the NHS corridor to accommodate the Regional Storm floodplain will be designed to preserve the natural channel functions and enhance hydraulic and geomorphic functionality of the existing system.

5.11 Hydraulic Assessment

The preliminary hydraulic analysis of the post-development conditions was undertaken using the original HEC-RAS hydraulic model for the East Branch Tributary of Sixteen Mile Creek, obtained from the April 2020 *"Ninth Line Lands Scoped Subwatershed Study"*.

The post-development model included the preliminary 407 Transitway grading information obtained from the May 2018 *"Addendum to the Highway 407 Transitway Corridor Assessment within the Ninth Line Lands Study Area*", proposed grading design for the Phase 2 development east of the Transitway and NHS corridor. The following summarizes changes that have been incorporated into the HEC-RAS model for the post-development conditions:

- The HEC-RAS cross sections Nos. 225-234 in the *Existing October 2015* scenario were replaced with the same numbered cross sections from the *Proposed Partial 2KS* scenario to reflect the proposed 407 Transitway berm and NHS works.

- The HEC-RAS cross-sections 225-226 inserted from the *Proposed Partial 2KS* scenario account for the removal of floodplain storage as a result of the proposed grading for the permanent SWM pond grading.

The HEC-RAS modeling results and a comparison of water levels between existing and post-development conditions are provided in Appendix G. The results of the hydraulic analysis for the 2-year to 100-year and Regional Storm events demonstrated insignificant change in water levels in the study reach of the East Branch Tributary of Sixteen Mile Creek, in comparison to the existing conditions.

The results showed a water level decrease of 0.05 m at cross-section No. 232 for the Regional Storm event, which is considered negligible. It was further confirmed that the filling required for the proposed Transitway berm and regrading within the Phase 2 development limits will not interfere with the hydraulic efficiency of the watercourse for the 2-year to 100-year and Regional Storm events.

It should be noted that flood levels for all storm events up to and including the 100-year storm event are confined within the existing East Branch Tributary channel through the study limits and as such would not be affected by the proposed filling works within the existing floodplain.

The post-development Regional Storm floodlines are shown on Drawing No. 4, included in Appendix J.

5.12 Geomorphic Analysis and Natural Channel Design

In accordance with the April 2020 *"Ninth Line Lands Scoped Subwatershed Study"* recommendations, the proposed NHS channel design will improve the overall quality of the stream corridor and enhance aquatic/terrestrial habitats. A comprehensive geomorphic assessment of the NHS will be conducted during the detailed design stage for the Phase 2 development.

Off-line and on-line wetland features will be implemented within the NHS channel to provide sediment and flow retention functions. The final design of the East Branch Tributary channel corridor will be completed at the time of final design of the subject development.

5.13 Erosion and Sediment Control

Erosion and sediment control measures to be implemented during and following construction are outlined below. These measures will comply with the December 2006 *"Erosion and Sediment Control Guideline for Urban Construction"* and current Conservation Halton and City of Mississauga standards.

6.0 WASTEWATER SERVICING PLAN

6.1 Region of Peel Wastewater Servicing Strategy

The preliminary servicing information for the subject lands was obtained from the December 2019, "*Ninth Line Lands: Servicing Strategy Report – City of Mississauga*", prepared by the Region of Peel. This report was prepared in support of the growth-related wastewater and water servicing plans for the Ninth Line lands. The study established the servicing requirements, identified servicing alternatives and recommended the preferred strategy based on the population and land uses forecast determined by the City of Mississauga in September 2016.

In accordance with the Region of Peel servicing strategy, the entire Derry-Britannia Developments Limited subdivision will be serviced by the West Trunk Sewer System draining by gravity to the Clarkson WPCP.

The December 2019 *"Servicing Strategy Report"* confirmed that based on the forecasted population, the existing municipal infrastructure is sufficient to service the subject development.

The Region identified the following existing infrastructure available for wastewater servicing of the Derry-Britannia Developments Limited lands;

- 450 mm diameter trunk sewer on Ninth Line (from north of Saratoga Way to north of Parkgate Drive), and

- 900 mm diameter trunk sewer on Ninth Line (from north of Parkgate Drive to Britannia Road).

The Region's preferred strategy is that any new wastewater sewers to service the Derry-Britannia Developments Limited lands should be designed within the subdivision limits and sized to include the external lands to the north.

Based on the recommendations presented in the December 2019 *"Servicing Strategy Report"*, the design flows should be spilt and conveyed to the existing 450 mm diameter and 900 mm diameter sewers on Ninth Line.

The Region advised that the available capacity in the existing 450 mm sewer on Ninth Line is approximately 55 L/s and indicted that further modelling will be required to confirm this capacity.

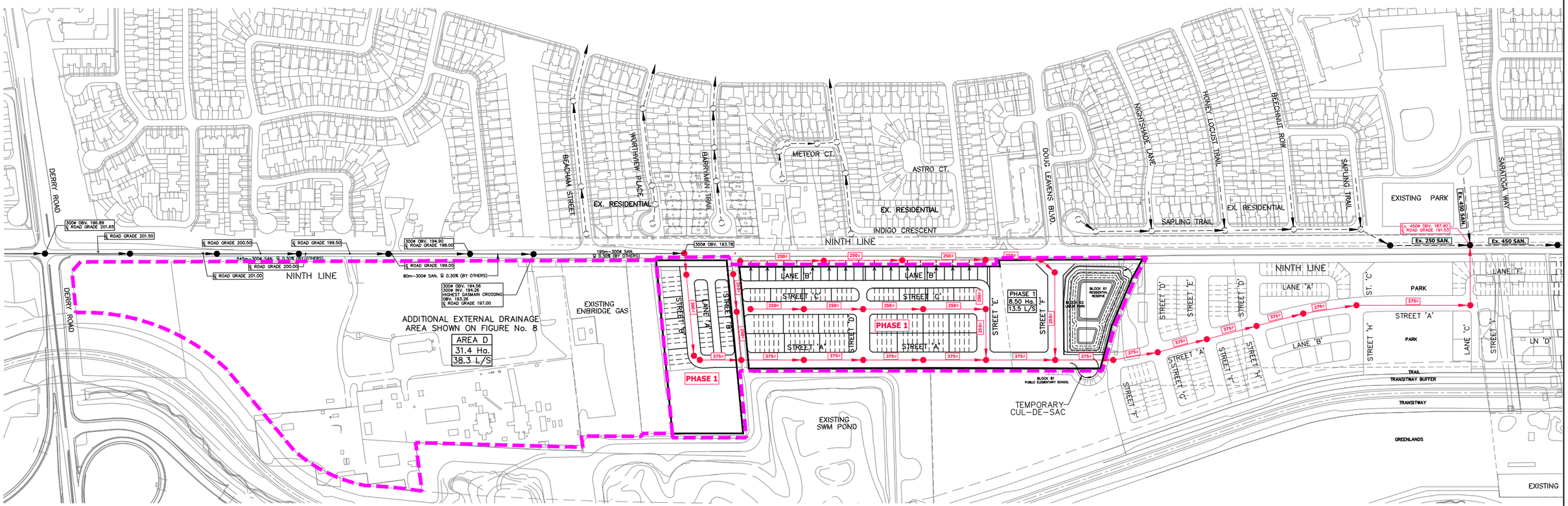
The December 2019 *"Servicing Strategy Report"* recommended that the proposed wastewater servicing system within the Derry-Britannia Developments Limited subdivision should be designed to convey flows from the external drainage Area D, encompassing approximately 31.4 ha, north of the Phase 1 development limits.

The Region's report also recommended that the lands located north of Derry Road (i.e. Areas A, B and C, encompassing approximately 52.1 ha) should be serviced via the existing services within the adjacent residential subdivision located northeast of Derry Road and Ninth Line.

6.2 Phase 1 Development Wastewater Servicing Plan

The review of the design information for the existing municipal infrastructure indicated that there are significant grading and servicing constraints to service the development Areas A, B and C via the existing wastewater system. Therefore, it is recommended that the proposed wastewater servicing system within the Derry-Britannia Developments Limited subdivision should be designed for all external drainage Areas A, B, C and D.

The proposed wastewater sewer network servicing the for the Phase 1 development will be a conventional gravity system. Figure 7 shows schematically the wastewater servicing system and the preliminary design details are shown on Drawing No. 2, included in Appendix J. The preliminary servicing analysis for the subject development is included in Appendix H.



LEGEND

- Ex. 250 SAN. — EXISTING WASTEWATER SEWER
- 375Ø — PROPOSED WASTEWATER SEWER PHASE 1
- 80m–300Ø SAN. @ 0.30% (BY OTHERS) — FUTURE WASTEWATER SEWER (BY OTHERS)
- WASTEWATER SUB-CATCHMENT BOUNDARY

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PRELIMINARY
WASTEWATER SERVICING PLAN-PHASE 1

CITY OF MISSISSAUGA

SCALE 1:5,000	JOB No. 13958	FIGURE No. 7

R:\13\13958\Drawings & Figures_2020 April 27 (Latest)\figure 7– Preliminary Wastewater Servicing Plan–Phase 1.dwg May 15, 2020 – 12:06pm

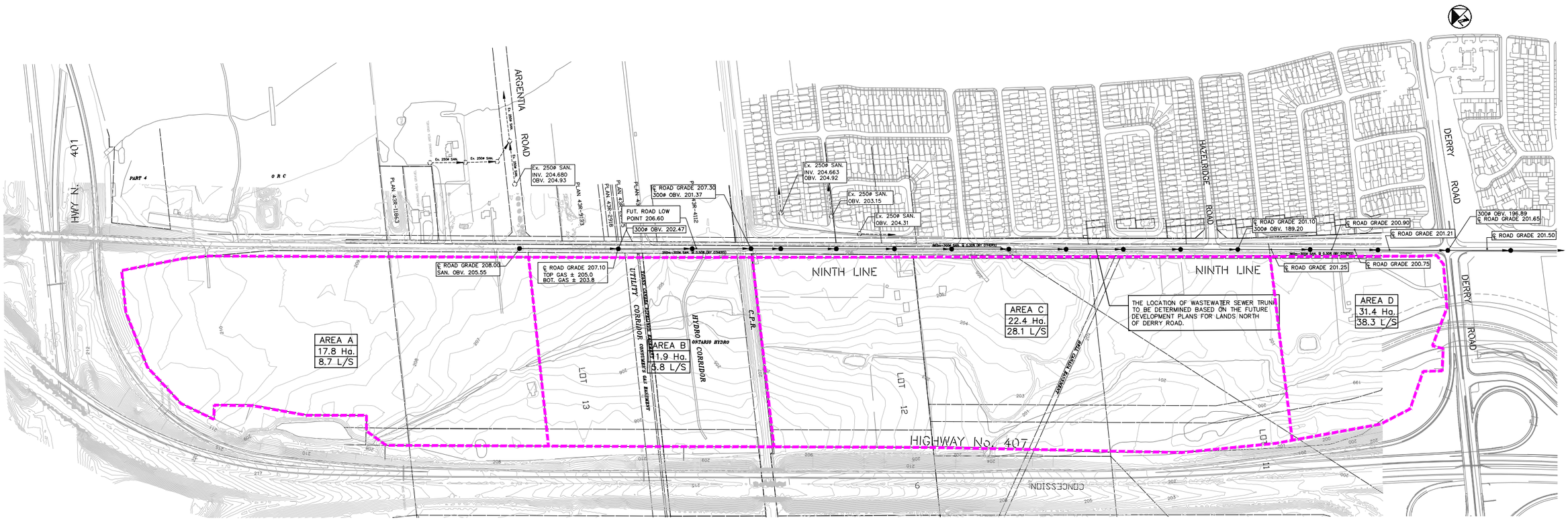
As shown on Drawing No. 2, the proposed wastewater system includes an installation of the internal main wastewater trunk sewer consisting of;

- 200 m of a 300 mm diameter and 405 m of a 375 mm diameter sewers within the Phase 1 development limits,
- 550 m of a 375 mm diameter sewer within the limits of the future Phase 2 development, and
- 80 m of a 300 mm diameter sewer connection to the existing 450 mm diameter sewer on Ninth Line, within the limits of the future Phase 2 development.

As shown on Drawing No. 2, the servicing of the Phase 1 development will require a provision of temporary wastewater easement within the Phase 2 development limits.

The internal wastewater system within the Derry-Britannia Development Limited subdivision has been designed to convey flows from the 83.5 ha external drainage area (i.e. the Region's areas A, B, C and D). The external drainage area limits are shown in Figure 8.

Area D includes the Enbridge Gas property located north of the Phase 1 development. When the Enbridge Gas property is developed, the sewage will be conveyed into the Phase 1 development via an 8 m wide easement to be located within the park block limits.



LEGEND

865m–300ø SAN. @ 0.30% (BY OTHERS) — FUTURE WASTEWATER SEWER (BY OTHERS)

WASTEWATER SUB-CATCHMENT BOUNDARY

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PRELIMINARY EXTERNAL WASTEWATER SERVICING PLAN

CITY OF MISSISSAUGA

SCALE 1:7,000	JOB No. 13958	FIGURE No. 8

R:\13\13958\Drawings & Figures_2020 April 27 (Latest)\Figure 8– Preliminary External Wastewater Servicing Plan.dwg May 15, 2020 – 12:20pm

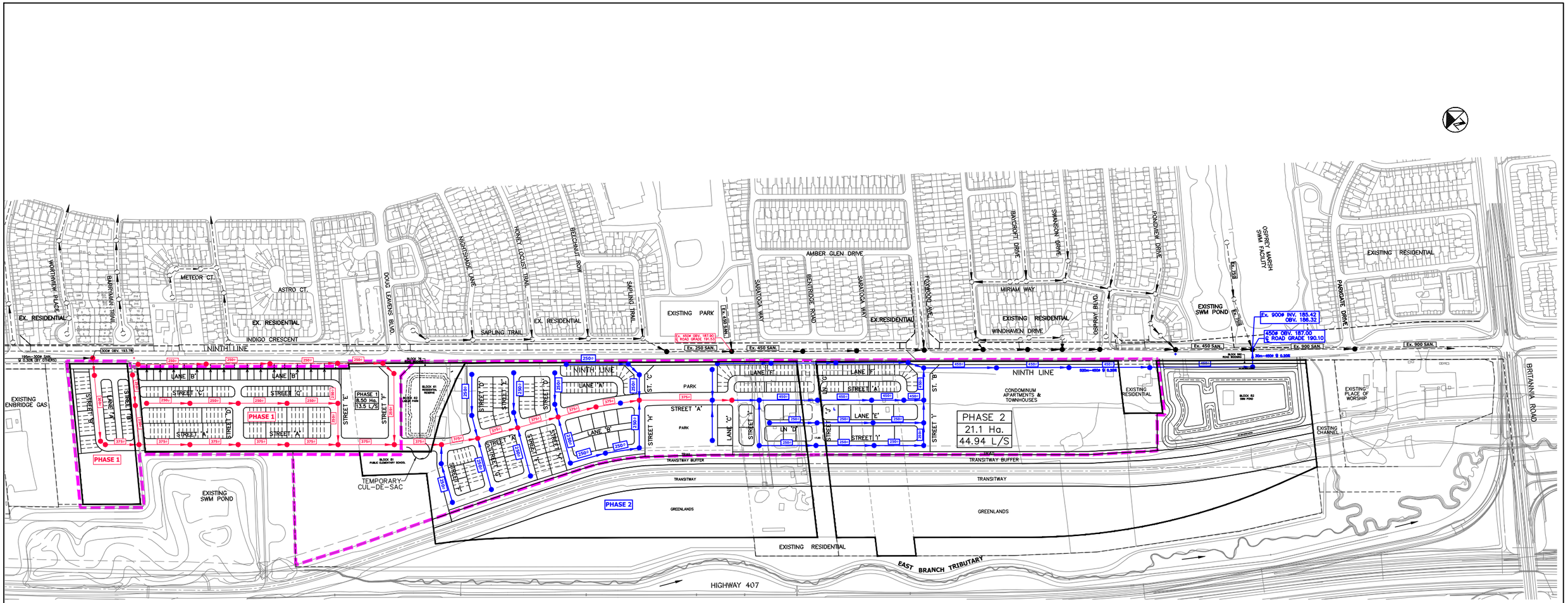
6.3 Future Phase 2 Development Wastewater Servicing Plan

The preliminary water servicing plan for the Phase 2 development is shown schematically in Figure 9. Drawing No. 3, included in Appendix J, shows the preliminary design information for the proposed wastewater trunk sewer alignment within the Phase 2 development limits.

Based on the proposed servicing scheme the main wastewater trunk sewer constructed in the Phase 1 development will be extended to the existing 900 mm diameter sewer on Ninth Line which has sufficient capacity for the entire Derry-Britannia Developments Limited subdivision and external drainage area.

It should be noted that the existing 450 mm diameter sewer on Ninth Line which provides an outlet for the Phase 1 development has a limited capacity. When the servicing of the Phase 2 lands is completed, the temporary 300 mm diameter sewer connection installed to service the Phase 1 development will be removed.

The sizes and locations of proposed sanitary sewers within the development will be verified at the time of detailed engineering design in accordance with the current Region of Peel standards.



LEGEND

- Ex. 250 SAN. — EXISTING WASTEWATER SEWER
- 375ø — PROPOSED WASTEWATER SEWER PHASE 1
- 375ø — PROPOSED WASTEWATER SEWER PHASE 2
- 80m-300ø SAN. @ 0.30% (BY OTHERS) — FUTURE WASTEWATER SEWER (BY OTHERS)
- WASTEWATER SUB-CATCHMENT BOUNDARY

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PRELIMINARY
WASTEWATER SERVICING PLAN-PHASE 2

CITY OF MISSISSAUGA

SCALE 1:6,000	JOB No. 13958	FIGURE No. 9

R:\13\13958\Drawings & Figures_2020 April 27 (Latest)\Figure 9- Preliminary Wastewater Servicing Plan-Phase 2.dwg May 15, 2020 - 12:32pm

7.0 WATER SUPPLY AND DISTRIBUTION PLAN

7.1 Region of Peel Water Servicing Strategy

The preliminary servicing information for the subject lands was obtained from the December 2019, "*Ninth Line Lands: Servicing Strategy Report – City of Mississauga*", prepared by the Region of Peel.

The Region's report concluded that there is sufficient capacity in the Region of Peel water supply and distribution system and recommended that the entire Derry-Britannia Development Limited subdivision should be serviced within the two existing pressure zone systems (PZ-5A and PZ-4A) via proposed water servicing connections to the existing infrastructure within the residential subdivision, located east of Ninth Line.

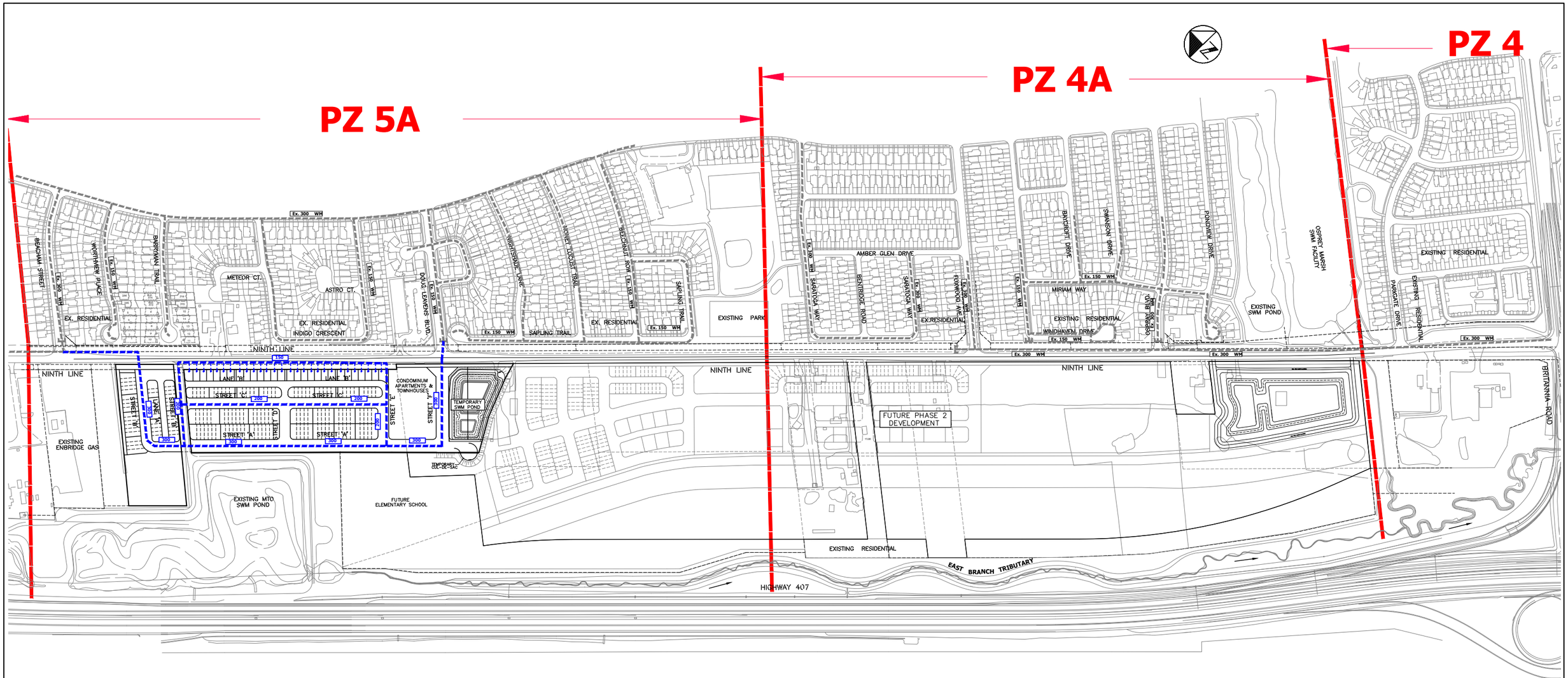
7.2 Phase 1 Development Water Servicing Plan

The preliminary water servicing plan for the Phase 1 development is shown schematically in Figure 10. The design details are shown on Drawing No. 2, included in Appendix J. The preliminary water servicing analysis for the development is included in Appendix I.

In accordance with the Region of Peel servicing strategy, the Phase 1 development will be serviced via the following watermain connections within PZ-5A;

- a 300 mm diameter watermain from Street B to existing 300 mm diameter watermain on Beacham Street, and
- a 300 mm diameter watermain from Street F to existing 150 mm diameter watermain on Doug Leavens Blvd.

The water distribution system for the proposed development will be designed in accordance with the current Region of Peel standards. The sizes and locations of proposed watermains within the subdivision will be verified at the time of detailed engineering design.



LEGEND

Ex. 150 WM	EXISTING WATERMAIN (SIZE mm)
405 WM	PROPOSED WATERMAIN (SIZE mm)
PZ 5A	WATER PRESSURE ZONE

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PRELIMINARY
WATER SERVICING PLAN-PHASE 1

CITY OF MISSISSAUGA

SCALE 1:6,000	JOB No. 13958	FIGURE No. 10

R:\13\13958\Drawings & Figures_2020 April 27 (Latest)\Figure 10- Preliminary Water Servicing Plan-Phase 1.dwg May 08, 2020 - 5:02pm

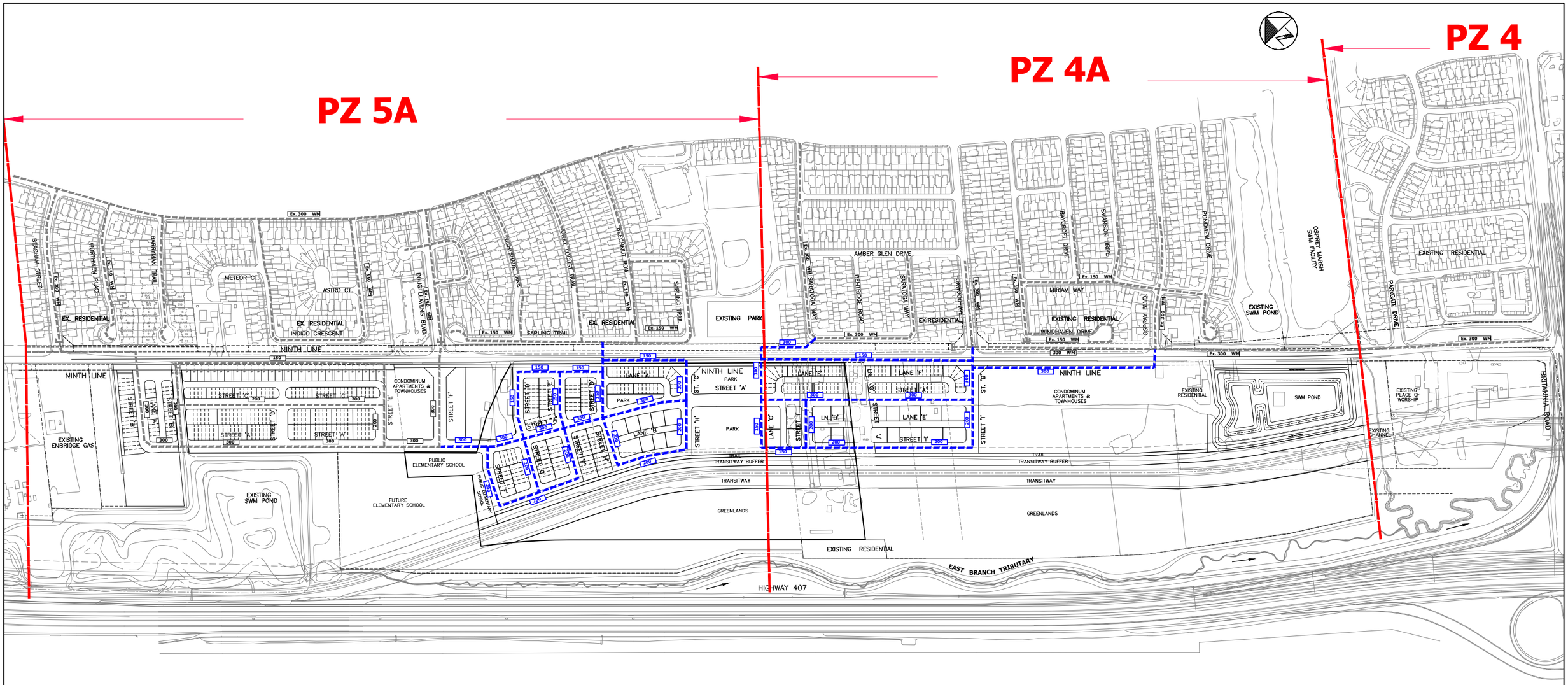
7.3 Future Phase 2 Development Water Servicing Plan

As shown schematically in Figure 11, the future Phase 2 development will be serviced via following watermain connections;

- a 150 mm diameter watermain from Street D to the existing 150 mm diameter watermain on Sapling Trail, within PZ-5A,
- a 300 mm diameter watermain from Street A to the existing 300 m diameter watermain on Saratoga Way, within PZ-4A,
- a 300 mm diameter watermain from Street B to the existing 300 m diameter watermain on Foxwood Avenue, within PZ-4A, and
- a 300 mm diameter watermain from the future Condominium Block to the existing 300 m diameter watermain on Osprey Boulevard, within PZ-4A.

The preliminary water servicing design details for the Phase 2 development are shown on Drawing No. 3, included in Appendix J.

The sizes and locations of proposed watermains within the subdivision will be verified at the time of detailed engineering design.



LEGEND

Ex. 150 WM	EXISTING WATERMAIN (SIZE mm)
400 WM	PROPOSED WATERMAIN (SIZE mm)
PZ 5A	WATER PRESSURE ZONE

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PRELIMINARY
WATER SERVICING PLAN-PHASE 2

CITY OF MISSISSAUGA

SCALE 1:6,000	JOB No. 13958	FIGURE No. 11

R:\13\13958\Drawings & Figures_2020 April 27 (Latest)\Figure 11– Preliminary Water Servicing Plan–Phase 2.dwg May 15, 2020 – 3:23pm

8.0 ROADS

In February 2020, Crozier Consulting Engineers completed the *"Right-of-Way Justification Letter Report"* in support of the proposed configuration and cross-sectional elements of the internal roadways within the Phase 1 development. The primary access to the subdivision will be provided via Street F at the intersection of Ninth Line and Doug Leavens Boulevard. The internal streets within the subdivision will include 17 m and 20 m right-of-way roads and 10 m right-of-way laneways. Figures 12, 13 and 14 illustrate typical road cross section details for the proposed 17 m and 20 m right-of-way roads.

Several servicing options were considered with respect to the servicing of the residential units located along Laneway B and fronting Ninth Line. The servicing design for the development was prepared with consideration of the future Ninth Line widening from the existing two-lane road to the future four-lane road within a 35 m right-of-way.

Servicing Option 1

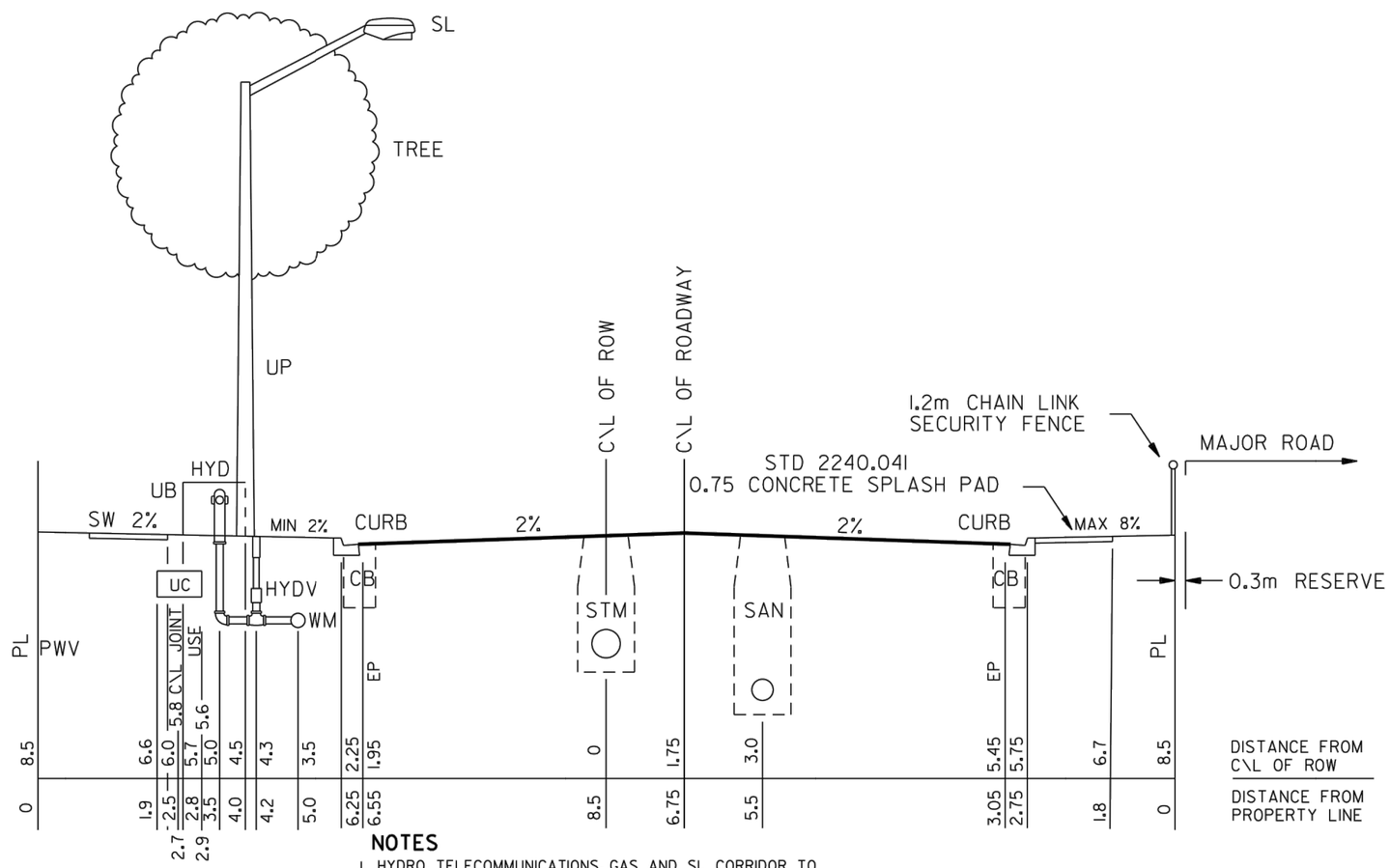
- Storm servicing to be provided via a local storm sewer system installed within the Laneway B right-of-way.

- Wastewater servicing to be provided via service connections from the proposed local 250 mm diameter wastewater sewer installed within the future Ninth Line west boulevard.

- Water servicing to be provided via service connections from the proposed local 150 mm diameter watermain installed under the pavement of the western travel lane, within the future Ninth Line right-of-way.

The proposed Servicing Option 1 scheme is shown on Drawing No. 2. Figure 15 illustrates the preliminary configuration of the 35 m Ninth Line right-of-way and proposed location of a 250 mm diameter wastewater sewer and a 150 mm watermain.

METRIC
ALL DIMENSIONS IN METRES



LEGEND

EP - EDGE OF PAVEMENT
CB - CATCH BASIN
CURB - CURB OR CURB AND GUTTER
C/L - CENTRELINE
GAS - GAS MAIN
HYD - FIRE HYDRANT
HYDV - FIRE HYDRANT VALVE
PWV - PRIVATE WATER VALVE
PL - PROPERTY LINE
SL - STREETLIGHT
SW - SIDEWALK
SAN - SANITARY SEWER
STM - STORM SEWER
UB - UTIITY BOX (HYDRO,TELECOMMUNICATIONS)
UC - UTILITY CORRIDOR(HYDRO,TELECOMM,GAS,SL)
UP - UTILITY POLE
WM - WATERMAIN

NOTES

1. HYDRO, TELECOMMUNICATIONS, GAS AND SL CORRIDOR TO HAVE A MINIMUM COVER OF 0.965m.
2. WATERMAIN TO HAVE A MINIMUM COVER OF 1.7m.
3. IF UTILITIES CANNOT BE INSTALLED ACCORDING TO THIS STANDARD THEY ARE TO BE INSTALLED AS CLOSE AS POSSIBLE TO THE PRESCRIBED LOCATION SUBJECT TO THE APPROVAL OF THE TRANSPORTATION AND WORKS DEPARTMENT OF THE CITY OF MISSISSAUGA
4. A 0.4m - 0.6m CLEARANCE MUST BE MAINTAINED BETWEEN CABLES AND HYDRANTS.
5. A 0.3m CLEARANCE MUST BE MAINTAINED BETWEEN WATERMAINS AND UTILITY POLES.
6. SPLASH PAD TO BE 130 mm THICK, 30 MPa CONCRETE WITH 5 - 7% AIR ENTRAINMENT ON 100 mm THICK GRANULAR 'A' COMPACTED TO 95% PROCTOR.
7. ROAD WIDTH IS MEASURED FROM FACE OF CURB TO FACE OF CURB AS DEFINED ON OPSD STD. 600.040 CURB & GUTTER. PAVEMENT WIDTH IS MEASURED FROM EDGE OF PAVEMENT (EP) TO EDGE OF PAVEMENT (EP).
8. FOR LOCATION OF GAS MAIN WITHIN UTLITY CORRIDOR REFER TO STD. 2211.280

MISSISSAUGA

STANDARD
BUFFER ROAD
8.0m ROAD ON 17m ROW

EFF. DATE		2002-01-01	SCALE	N.T.S.
REV.	11	2015-06-05	STANDARD No.	2211.140

FIGURE No. 12

SCALE: N.T.S.

RAND ENGINEERING CORPORATION

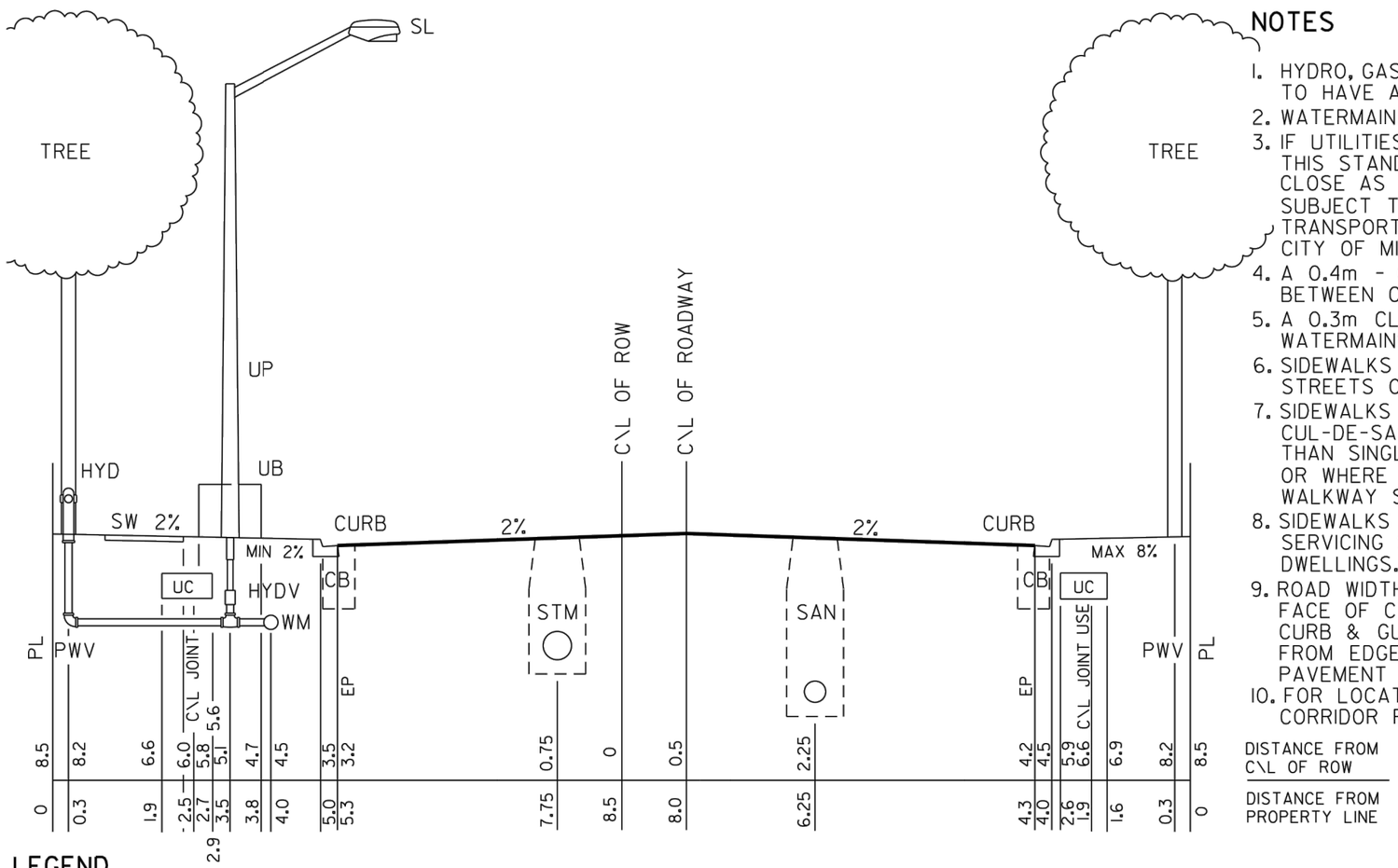
BUFFER ROAD
17.0m R.O.W. CROSS SECTION

DERRY-BRITANNIA DEVELOPMENTS LIMITED
21T-M 19003

CITY OF MISSISSAUGA

PROJECT No. 13958

R:\13\13958\Drawings & Figures_2020 April 27 (Latest)\Figure 12_Buffer Road-17.0m R.O.W.dwg | May 08, 2020 - 5:05pm



METRIC

ALL DIMENSIONS IN METRES

NOTES

1. HYDRO, GAS, TELECOMMUNICATIONS AND SL CORRIDOR TO HAVE A MINIMUM COVER OF 0.965m.
2. WATERMAIN TO HAVE A MINIMUM COVER OF 1.7m.
3. IF UTILITIES CANNOT BE INSTALLED ACCORDING TO THIS STANDARD THEY ARE TO BE INSTALLED AS CLOSE AS POSSIBLE TO THE PRESCRIBED LOCATION SUBJECT TO THE APPROVAL OF THE TRANSPORTATION AND WORKS DEPARTMENT OF THE CITY OF MISSISSAUGA.
4. A 0.4m - 0.6m CLEARANCE MUST BE MAINTAINED BETWEEN CABLES AND HYDRANTS.
5. A 0.3m CLEARANCE MUST BE MAINTAINED BETWEEN WATERMAINS AND UTILITY POLES.
6. SIDEWALKS REQUIRED ON ONE SIDE ONLY ON STREETS OTHER THAN CUL-DE-SACS.
7. SIDEWALKS REQUIRED ON ONE SIDE ONLY ON CUL-DE-SACS SERVICING DEVELOPMENTS OTHER THAN SINGLE FAMILY OR SEMI-DETACHED DWELLINGS OR WHERE SIDEWALKS WILL FORM PART OF A WALKWAY SYSTEM.
8. SIDEWALKS WILL NOT BE REQUIRED ON CUL-DE-SACS SERVICING SINGLE FAMILY OR SEMI-DETACHED DWELLINGS.
9. ROAD WIDTH IS MEASURED FROM FACE OF CURB TO FACE OF CURB AS DEFINED ON OPSD STD. 600.040 CURB & GUTTER. PAVEMENT WIDTH IS MEASURED FROM EDGE OF PAVEMENT (EP) TO EDGE OF PAVEMENT (EP).
10. FOR LOCATION OF GAS MAIN WITHIN UTILITY CORRIDOR REFER TO STD. 2211.280

LEGEND

EP - EDGE OF PAVEMENT
CB - CATCH BASIN
CURB - CURB OR CURB AND GUTTER
C/L - CENTRELINE
GAS - GAS MAIN
HYD - FIRE HYDRANT
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STM - STORM SEWER
UB - UTIITY BOX (HYDRO,TELECOMMUNICATIONS)
UC - UTILITY CORRIDOR (HYDRO,TELECOMMUNICATIONS,SL,GAS)
UP - UTILITY POLE
WM - WATERMAIN

MISSISSAUGA

STANDARD
MINOR LOCAL RESIDENTIAL ROAD
8.0m ROAD ON 17m ROW

EFF. DATE	2002-01-01	SCALE	N.T.S.
REV. 8	2015-06-04	STANDARD No.	2211.060

FIGURE No. 13

SCALE: N.T.S.

RAND ENGINEERING CORPORATION

DERRY-BRITANNIA DEVELOPMENTS LIMITED
21T-M 19003

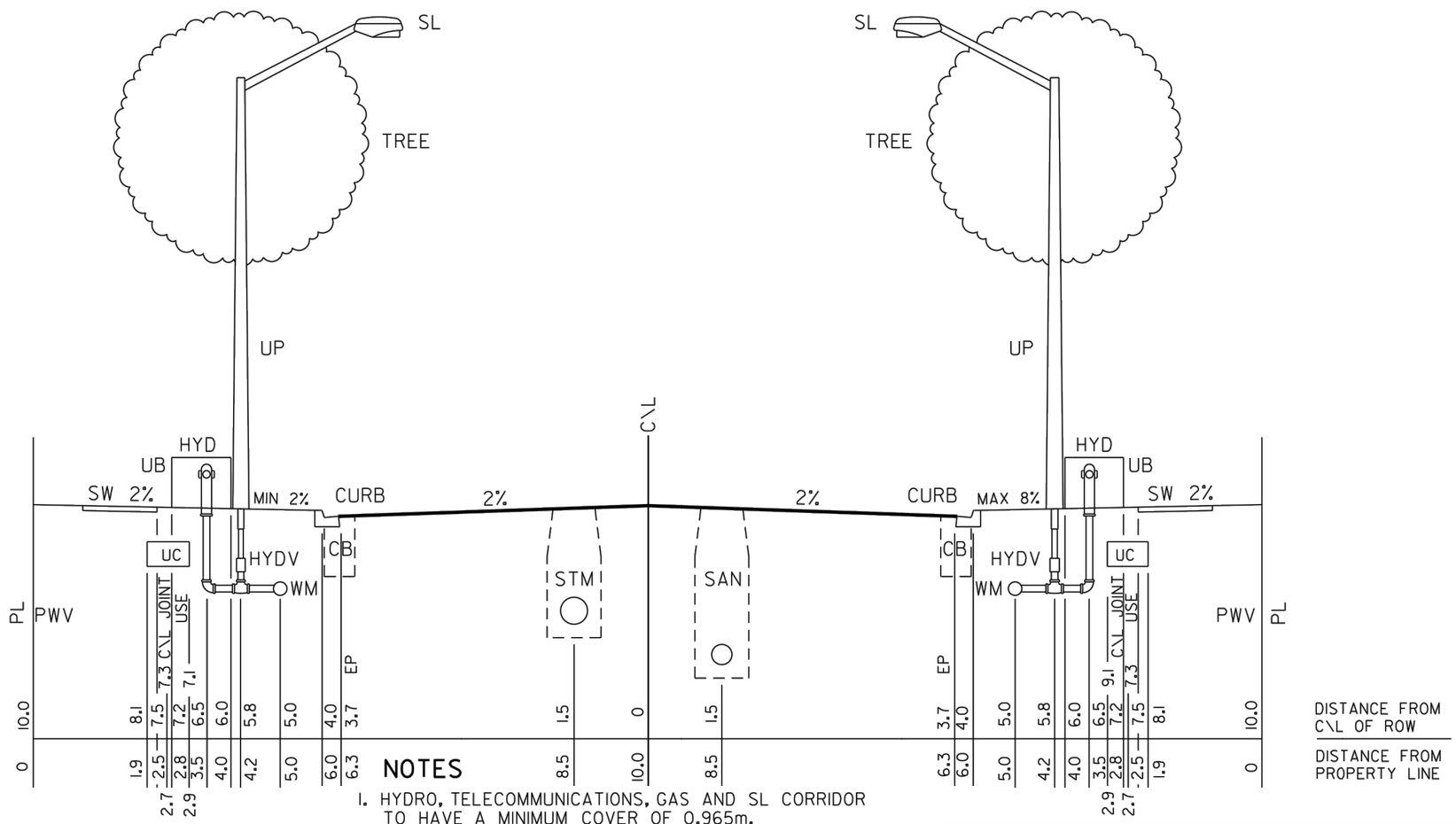
CITY OF MISSISSAUGA

PROJECT No. 13958

LOCAL ROAD
17.0m R.O.W. CROSS SECTION

R:\13\13958\Drawings & Figures_2020 April 27 (Latest)\Figure 13_Local Road-17.0m R.O.W.dwg | May 08, 2020 - 5:05pm

METRIC
ALL DIMENSIONS IN METRES



LEGEND

EP - EDGE OF PAVEMENT
CB - CATCH BASIN
CURB - CURB OR CURB AND GUTTER
C/L - CENTRELINE
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7. FOR LOCATION OF GAS MAIN WITHIN UTILITY CORRIDOR REFER TO STD. 2211.280

MISSISSAUGA

STANDARD
LOCAL RESIDENTIAL ROAD
8.0m ROAD ON 20m ROW

EFF. DATE		2002-01-01	SCALE	N.T.S.
REV.	7	2015-06-05	STANDARD No.	2211.070

FIGURE No. 14

SCALE: N.T.S.

RAND ENGINEERING CORPORATION

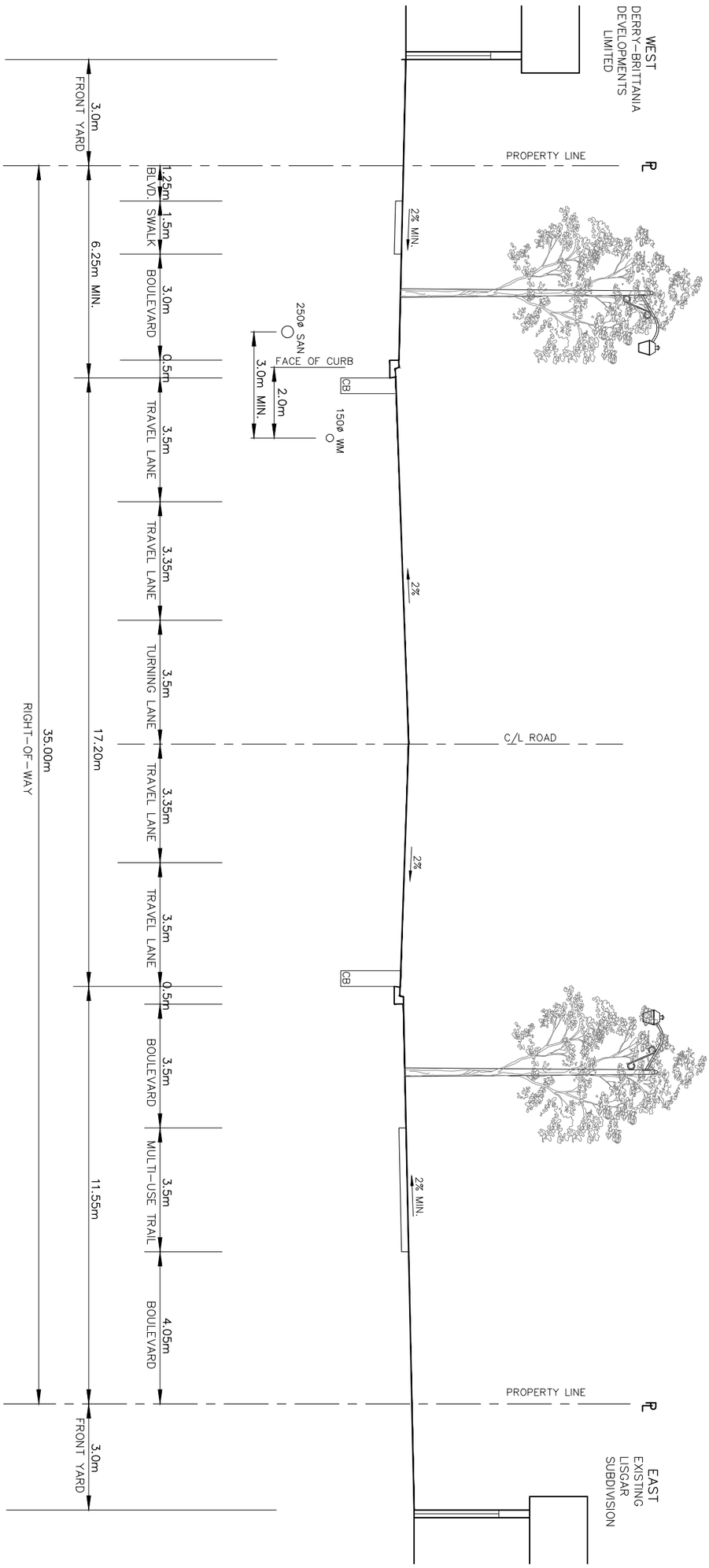
DERRY-BRITANNIA DEVELOPMENTS LIMITED
21T-M 19003

CITY OF MISSISSAUGA

PROJECT No. 13958

LOCAL ROAD
20.0m R.O.W. CROSS SECTION

R:\13\13958\Drawings & Figures_2020 April 27 (Latest)\Figure 14_Local Road-20.0m R.O.W.dwg | May 08, 2020 - 5:05pm



DERRY-BRITANNIA DEVELOPMENTS LIMITED
21T-M 19003

FIGURE No. 15

SCALE: N.T.S.

CITY OF MISSISSAUGA

NINTH LINE

35.0m R.O.W. CROSS SECTION - OPTION 1

PROJECT No. 13958

RAND™ ENGINEERING CORPORATION

Servicing Option 2

- Storm servicing to be provided via a local storm sewer system installed within the Laneway B right-of-way.
- Wastewater servicing to be provided via service connections from the proposed local 250 mm diameter wastewater sewer installed under the pavement of the western travel lane, within the future Ninth Line right-of-way.
- Water servicing to be provided via service connections from the proposed local 150 mm diameter watermain installed within the future Ninth Line west boulevard.

Figure 16 illustrates the preliminary configuration of the 35 m Ninth Line right-of-way and proposed location of a 250 mm diameter wastewater and a 150 mm diameter watermain.

Servicing Option 3

The storm, wastewater and water services to be provided via local services installed within the Laneway B right-of-way. Figure 17 illustrates the proposed cross section for the 10 m right-of-way laneway.

Servicing Recommendation

Based on our review of the servicing options for the residential units located along Laneway B, it is recommended to implement Servicing Option 1, which would provide the following advantages:

- Laneway B will include only storm drainage infrastructure,

- Locating the wastewater and water services within the Ninth Line right-of-way would not cause any crossing conflicts with future storm services,

- Installation of the watermain under the pavement of one travel lane would cause minimal disruption to traffic in the event of a repair,

- Ninth Line is expected to be a five-lane cross-section, which would allow the centre lane to be used to divert traffic if necessary,

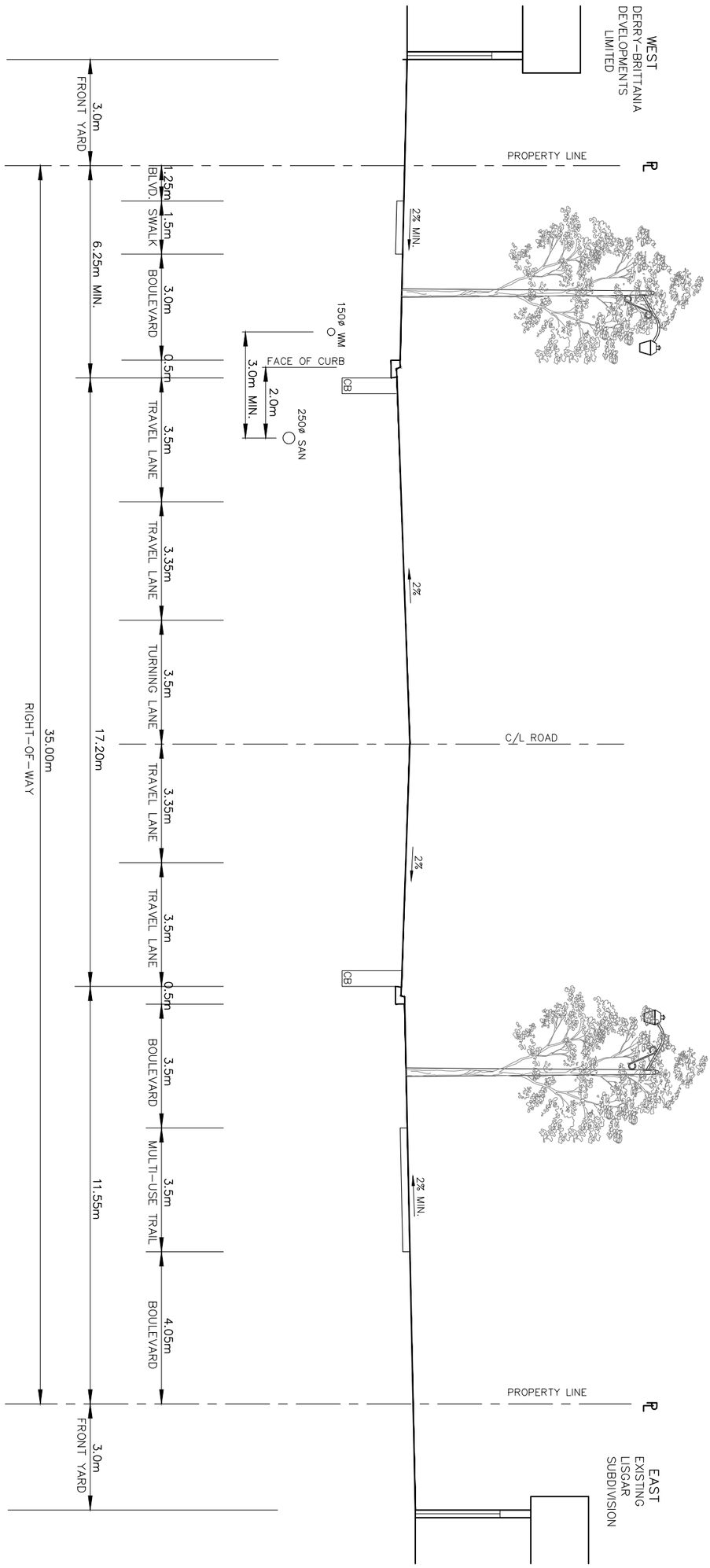
- Locating the wastewater sewer within the boulevard would limit inflow/infiltration into the system, reducing costs for the Region,

- Wastewater manholes could be located within the boulevard, further reducing maintenance costs for the Region,

- Trenchless repairs using liners could be used to limit repair and restoration costs,

- There would be enough room in the right-of-way to keep repair operations away from homeowner front-yards and have minimum impact on landscaping, and

- Due to the available access to the services within the Ninth Line right-of-way, it is expected that maintenance costs will be lower in comparison to Servicing Option 3.



DERRY-BRITANNIA DEVELOPMENTS LIMITED
21T-M 19003

FIGURE No. 16

CITY OF MISSISSAUGA

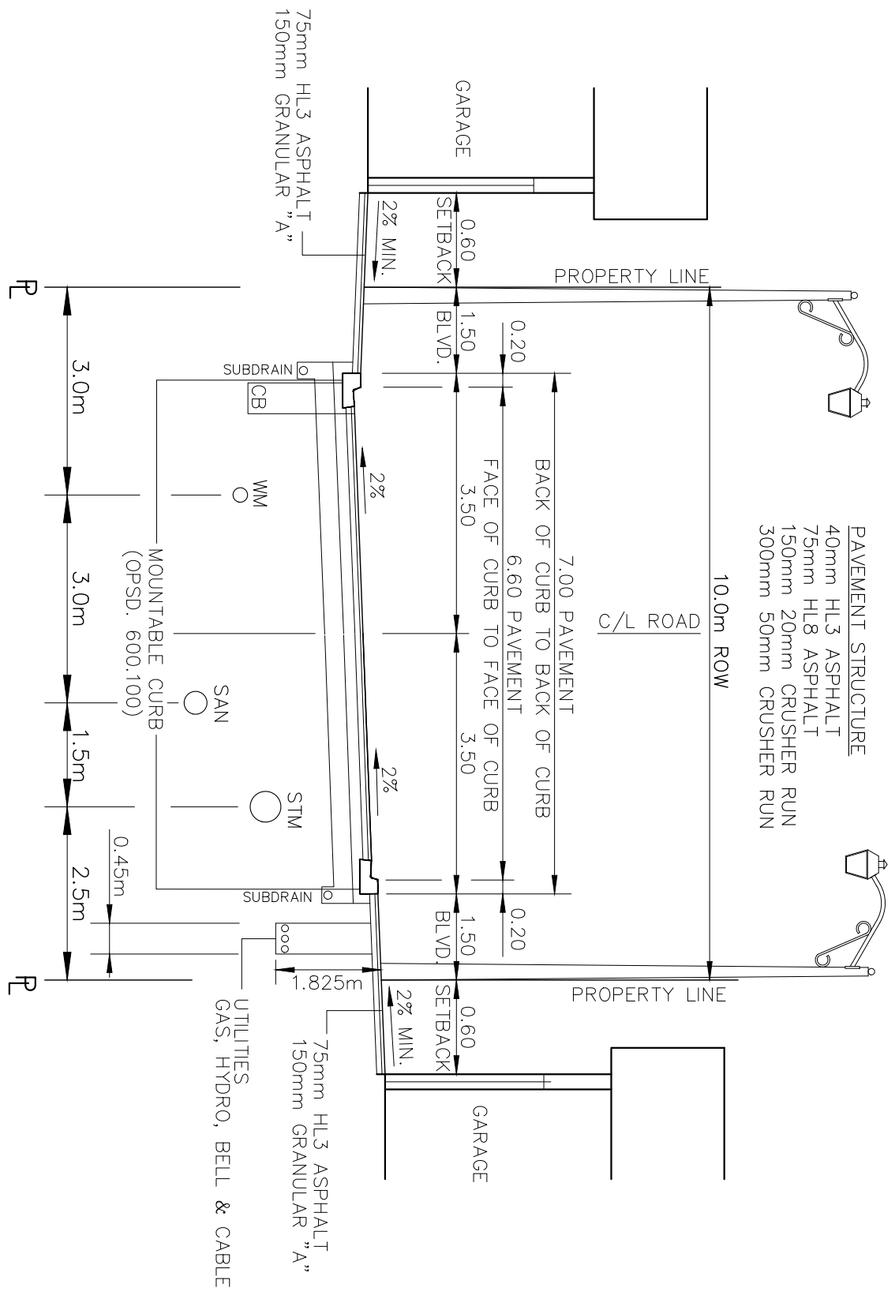
NINTH LINE

35.0m R.O.W. CROSS SECTION - OPTION 2

SCALE: N.T.S.

PROJECT No. 13958

RAND™ ENGINEERING CORPORATION



DERRY-BRITANNIA DEVELOPMENTS LIMITED
21T-M 19003

FIGURE No. 17

SCALE: N.T.S.

CITY OF MISSISSAUGA

LANEWAY

10.0m R.O.W. CROSS SECTION

PROJECT No. 13958

RAND ENGINEERING CORPORATION

9.0 PRELIMINARY GRADING PLAN

A preliminary grading plan for the Phase 1 development has been prepared in conjunction with the conceptual storm and wastewater servicing systems design and based on the existing grading information for Ninth Line, adjacent lands and anticipated ultimate plans for the Derry-Britannia Developments Limited subdivision.

The grading has been designed to provide positive drainage towards the proposed temporary SWM Pond. The preliminary grading information for the Phase 1 development is provided on Drawing No. 5, included in Appendix J.

The design of the Phase 2 development will include the proposed works related to the construction of the 407 Transitway berm and the NHS channelization. The preliminary grading information for the Phase 2 development is shown on Drawing No. 6, included in Appendix J.

Additional grading information for the Derry-Britannia Developments Limited development is provided on Drawings Nos. 7 and 8 – Road Profiles, included in Appendix J. The road profiles and proposed storm and sanitary services for Streets A and B are shown on Drawing No. 7. The design information for Streets C and F is shown on Drawing No. 8.

The road profile for Street A includes the preliminary design information for the Phase 2 development to illustrate the expansion of the development to the ultimate conditions.

10.0 CONSTRUCTION STAGING

Based on the existing environmental constraints, the entire Derry-Britannia Developments Limited subdivision will be implemented in three stages over a 2-3-year period. It is expected that the construction of the Phase 1 development (Stage 1) will be completed in 2021. The following summarizes the intended construction staging plans for the Derry-Britannia Developments Limited lands.

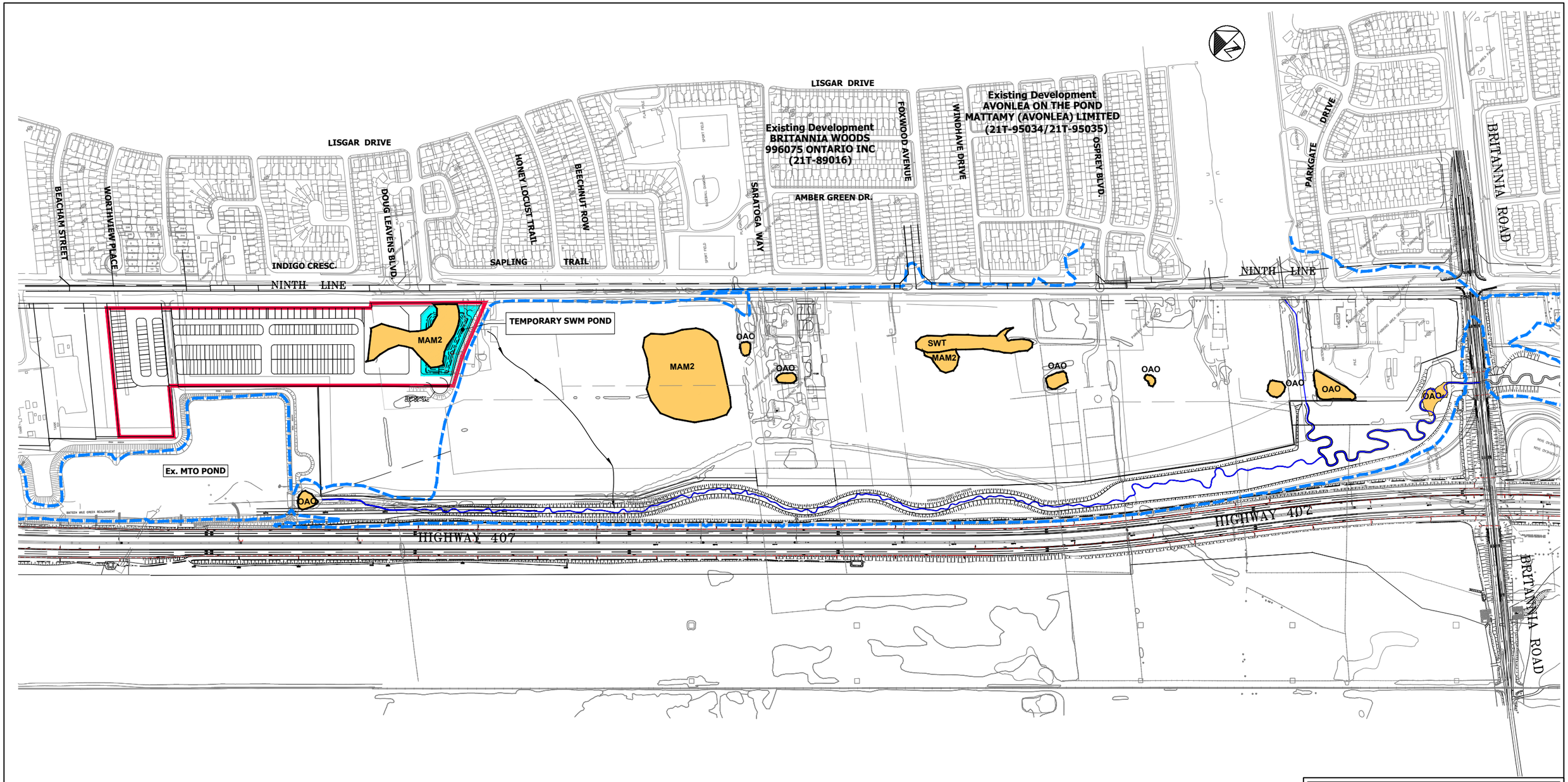
10.1 Stage 1 - Phase 1 Development (Draft Plan of Subdivision 21T-M 19003)

As shown in Figure 18, Stage 1 of the development includes the construction of the northern portion of the subdivision (8.5 ha) located northwest of Doug Leavens Boulevard and Ninth Line. The development will be completed outside the existing Regional floodplain limits. It will include a construction of the temporary SWM facility outlet channel to the existing East Branch Tributary. The wastewater and water servicing of the site will be provided by via proposed connections to the existing municipal infrastructure.

Stage 1 will include the removal of the existing wetland feature (MAM2) located within the property limits. Prior to the Stage 1 construction, a Comprehensive Restoration and Compensation Plan for the study lands will be developed and approved by all government agencies or other satisfactory arrangements will be made. It is expected that MTO will complete the Environmental Assessment process for a preferred transitway corridor alignment and the parkway belt plan designation for the subject lands will be lifted.

10.2 Stage 2 – Phase 2 Development (NHS and Transitway Berm)

A shown in Figure 19, Stage 2 of the development will include grading works within the existing NHS/floodplain limits and construction of the 407 Transitway right-of-way. The grading design will be completed with the intention to maintain existing water levels and floodplain storage within the study limits. The works will be conducted with protection of the existing watercourse and will include the NHS restoration works.



LEGEND

- STAGE 1 LIMIT
- EXISTING REGIONAL FLOODLINE
- OAO — EXISTING WETLAND / OPEN AQUATIC FEATURE

STAGE 1 CONSTRUCTION INCLUDES:

1. RESIDENTIAL DEVELOPMENT, INTERNAL GRADING AND SERVICING.
2. REMOVAL OF EXISTING WETLAND FEATURE.
3. TEMPORARY SWM POND AND OUTLET TO 16 MILE CREEK TRIBUTARY.
4. PHASE 1 WASTEWATER AND WATERMAIN SERVICES.

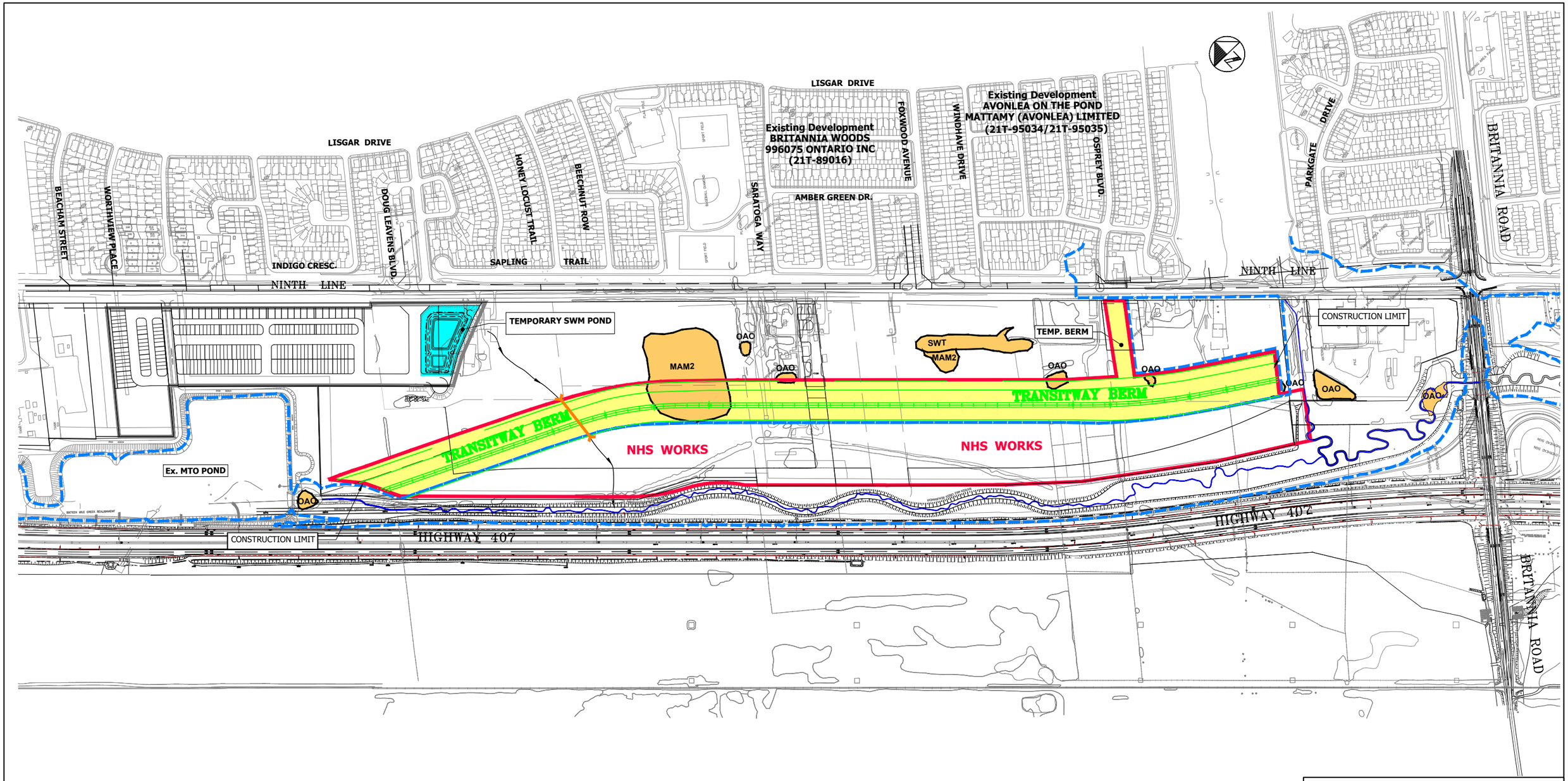
mattamyHOMES
RAND
5285 SOLAR DRIVE
MISSISSAUGA, ONTARIO
L4W 5B8
TEL. (905) 625-9500

DERRY-BRITANNIA DEVELOPMENTS LTD.
21T-M 19003
CONSTRUCTION STAGING
STAGE - 1

CITY OF MISSISSAUGA

SCALE N.T.S.	JOB No. 13958	FIGURE No. 18

R:\13\13958\Drawings & Figures_2020 April 27 (Latest)\Figure 18, 19 & 20-CONSTRUCTION STAGING-Stage 1, 2 & 3.dwg May 11, 2020 - 2:27pm



LEGEND

STAGE 2 LIMIT

POST-DEVELOPMENT REGIONAL FLOODLINE

STAGE 2 CONSTRUCTION INCLUDES:

1. ALL EXISTING WETLANDS/ OPEN AQUATIC FEATURES WITHIN STAGE 2 AND AREA EAST OF TRANSITWAY TO BE REMOVED.
2. NHS/ FLOODPLAIN GRADING AND RESTORATION WORKS.
3. TRANSITWAY CORRIDOR BERM CONSTRUCTION.
4. RECONFIGURATION OF FLOODPLAIN LIMITS.

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DERRY-BRITANNIA DEVELOPMENTS LTD.
21T-M 19003
CONSTRUCTION STAGING
STAGE - 2

CITY OF MISSISSAUGA

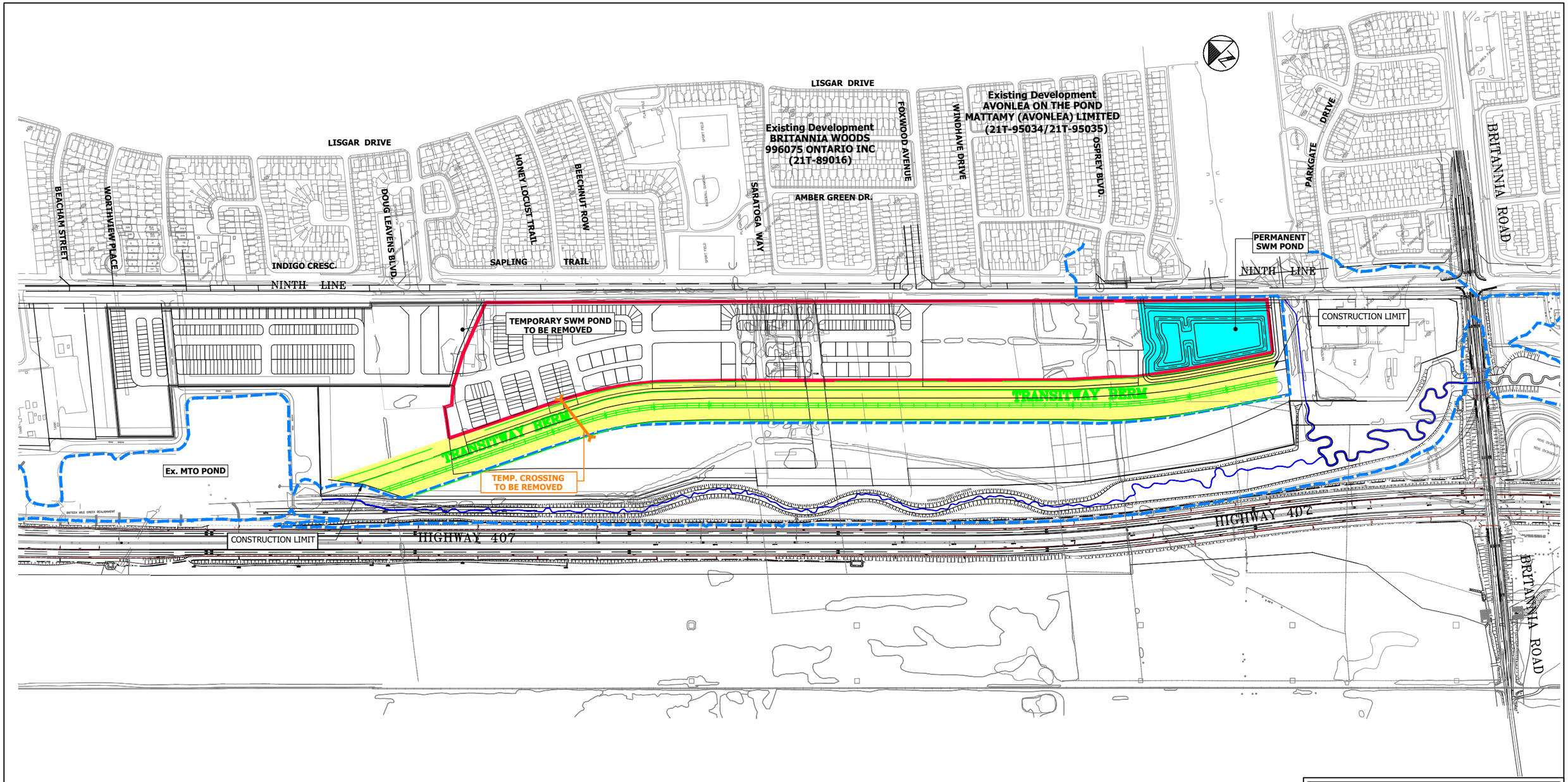
SCALE N.T.S.	JOB No. 13958	Figure No. 19

R:\13\13958\Drawings & Figures_2020 April 27 (Latest)\Figure 18, 19 & 20-CONSTRUCTION STAGING-Stage 1, 2 & 3.dwg May 11, 2020 - 2:32pm

The remaining wetland / open aquatic features located within the ultimate Derry-Britannia Developments Limited limits will be removed in accordance with the Comprehensive Restoration and Compensation Plan. The existing Regional floodplain limits will be redefined which will allow for completion of the grading works east of the Transitway corridor.

10.3 Stage 3 - Phase 2 Development (Draft Plan of Subdivision 21T-M 19004)

As shown in Figure 20, Stage 3 of the development comprises the balance of the residential subdivision including the permanent SWM facility. These works will include internal grading and servicing and removal of the interim SWM facility.



LEGEND

STAGE 3 LIMIT

POST-DEVELOPMENT REGIONAL FLOODLINE

STAGE 3 CONSTRUCTION INCLUDES:

1. CONSTRUCTION OF PERMANENT SWM POND.
2. RESIDENTIAL DEVELOPMENT, INTERNAL GRADING AND SERVICING.
3. REMOVAL OF TEMPORARY SWM POND.

mattamyHOMES

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DERRY-BRITANNIA DEVELOPMENTS LTD.
NINTH LINE LANDS
CONSTRUCTION STAGING
STAGE - 3

CITY OF MISSISSAUGA

21T-M 19003

SCALE N.T.S.	JOB No. 13958	FIGURE No. 20

R:\13\13958\Drawings & Figures_2020 April 27 (Latest)\Figure 18, 19 & 20-CONSTRUCTION STAGING-Stage 1, 2 & 3.dwg May 11, 2020 - 2:38pm

11.0 CONCLUSIONS

This report identifies the storm, wastewater and water supply and distribution systems required to support the proposed Phase 1 of the Derry-Britannia Developments Limited subdivision (Draft Plan of Subdivision - 21T-M 19003). Based on the findings of this study, it is concluded that:

1. A technical assessment of the municipal servicing requirements indicates that the site can be adequately serviced by the proposed storm drainage, wastewater and water distribution systems.

2. Stormwater quality, erosion and quantity control for the proposed Phase 1 of the development will be provided within the temporary SWM Pond. Ultimately, when the Phase 2 lands are developed, the drainage from the Phase 1 lands will be controlled within the permanent SWM Pond.

3. A detailed Stormwater Management Implementation Report will be prepared in conjunction with the final engineering design for the Phase 1 development.

This report is being submitted to the City of Mississauga, Regional Municipality of Peel, Conservation Halton and Ministry of Transportation in support of the draft plan and rezoning application for the proposed Phase 1 of the Derry-Britannia Developments Limited subdivision (21T-M 19003).

Respectfully Submitted,

RAND Engineering Corporation

LICENSED PROFESSIONAL ENGINEER
P. M. SZPONAR
MAY 14/20
PROVINCE OF ONTARIO

P. Jeffrey, P.Eng.

P. Szponar, P.Eng.

APPENDIX A – STORM DRAINAGE PLAN AND STORM SEWER DESIGN SHEETS

Consultant: RAND Engineering Corporation

5285 Solar Drive
Mississauga, Ont. L4W 5B8

CITY OF MISSISSAUGA

STORM SEWER DESIGN SHEET - 10 year Storm
DERRY BRITANNIA DEVELOPMENT LIMITED

Project No.: 13958
Prepared by: P.S.

STREET	FROM MANHOLE	TO MANHOLE	AREA (Ha)	STORM CO-EFFICIENT	SECTION A*C	ACCUMULATED A*C	10 YR INTENSITY (mm/hr)	10 YR FLOW (m^3/s)	LENGTH (m)	SLOPE (%)	DIAMETER (mm)	FULL FLOW CAPACITY (m^3/s)	FULL FLOW VELOCITY (m/s)	FLOW TIME IN PIPE (min)	TIME OF CONCENTRATION (min)	UPSTREAM MANHOLE INVERT (m)	DOWNSTREAM MANHOLE INVERT (m)	UPSTREAM MANHOLE HGL (m)	DOWNSTREAM MANHOLE HGL (m)
Street 1																			
From Street 22 - Pipe: 6 - 4						0.306									16.93				
From Street 23 - Pipe: 3 - 4						0.849									17.28				
	4	7	0.56	0.65	0.364	1.519	91.01	0.384	104.6	0.300	750	0.610	1.38	1.260	18.54	193.464	193.150		
	7	8	0.63	0.65	0.410	1.929	87.12	0.467	110.0	0.300	750	0.610	1.38	1.330	19.87	193.130	192.800		
	8	9	0.51	0.65	0.332	2.261	83.40	0.524	100.0	0.300	825	0.786	1.47	1.130	21.00	192.725	192.425		
From Street 19 - Pipe: 36 - 9						1.593									20.22				
			0.18	0.65															
	9	10	0.84	0.90	0.873	4.727	80.52	1.057	91.0	0.300	1050	1.496	1.73	0.880	21.88	192.200	191.927		
From Street 4 - Pipe: 40 - 10						0.234									16.45				
			0.14	0.65															
	10	11	3.35	0.65	2.269	7.230	78.42	1.575	77.3	0.400	1200	2.466	2.18	0.590	22.47	191.777	191.468		
From Street 17 - Pipe: 42 - 11						0.202									16.56				
	11	12			0.000	7.432	77.09	1.591	10.6	0.400	1500x1200	4.200	2.34	0.080	22.55	191.448	191.406		
	12	13	0.17	0.65	0.111	7.543	76.91	1.611	47.0	0.400	1500x1200	4.200	2.34	0.330	22.88	191.356	191.168		
From Street 18 - Pipe: 45 - 13						0.306									15.98				
From Street 15 - Pipe: 44 - 13						0.970									16.48				
	13	14	0.16	0.65	0.104	8.923	76.19	1.888	64.5	0.300	1500x1200	3.650	2.03	0.530	23.41	191.148	190.955		
From Street 16 - Pipe: 48 - 14						0.364									16.17				
From Street 17 - Pipe: 46 - 14						0.396									16.36				
	14	15	0.17	0.65	0.111	9.794	75.06	2.042	69.0	0.300	1500x1200	3.650	2.03	0.570	23.98	190.935	190.728		
From Street 11 - Pipe: 54 - 15						0.332									16.35				
From Street 15 - Pipe: 50 - 15						0.371									16.55				
	15	16	0.42	0.65	0.273	10.770	73.89	2.211	47.6	0.250	1800x1200	4.200	1.95	0.410	24.39	190.708	190.589		
	16	17			0.000	10.770	73.07	2.186	54.9	0.250	1800x1200	4.200	1.95	0.470	24.86	190.539	190.402		
From Street 14 - Pipe: 53 - 17						0.234									16.21				
	17	18	0.07	0.65	0.046	11.050	72.16	2.215	28.8	0.250	1800x1200	4.200	1.95	0.250	25.11	190.402	190.330		
From Street 11 - Pipe: 57 - 18						0.507									18.35				

Consultant: RAND Engineering Corporation

5285 Solar Drive
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CITY OF MISSISSAUGA

STORM SEWER DESIGN SHEET - 10 year Storm
DERRY BRITANNIA DEVELOPMENT LIMITED

Project No.: 13958
Prepared by: P.S.

STREET	FROM MANHOLE	TO MANHOLE	AREA (Ha)	STORM CO-EFFICIENT	SECTION A*C	ACCUMULATED A*C	10 YR INTENSITY (mm/hr)	10 YR FLOW (m^3/s)	LENGTH (m)	SLOPE (%)	DIAMETER (mm)	FULL FLOW CAPACITY (m^3/s)	FULL FLOW VELOCITY (m/s)	FLOW TIME IN PIPE (min)	TIME OF CONCENTRATION (min)	UPSTREAM MANHOLE INVERT (m)	DOWNSTREAM MANHOLE INVERT (m)	UPSTREAM MANHOLE HGL (m)	DOWNSTREAM MANHOLE HGL (m)
			0.09	0.65															
			0.24	0.90															
			0.49	0.30															
	18	19	0.93	0.30	0.700	12.257	71.69	2.441	153.4	0.250	2400x1200	6.010	2.09	1.220	26.33	190.330	189.946		
From Street 10 - Pipe: 58 - 19						0.208									16.41				
	19	20			0.000	12.465	69.47	2.405	38.5	0.250	2400x1200	6.010	2.09	0.310	26.64	189.946	189.850		
From Street 5 - Pipe: 68 - 20						0.195									16.05				
	20	21	0.32	0.65	0.208	12.868	68.94	2.464	89.4	0.250	2400x1200	6.010	2.09	0.710	27.35	189.850	189.627		
	21	22	0.59	0.65	0.384	13.252	67.74	2.494	138.0	0.250	2400x1200	6.010	2.09	1.100	28.45	189.627	189.282		
From Street 8 - Pipe: 64 - 22						0.734									20.27				
	22	23	0.11	0.65	0.072	14.058	65.97	2.576	22.2	0.250	2400x1200	6.010	2.09	0.180	28.63	189.282	189.226		
To Street 5 - Pipe: 23 - 24						14.058									28.63				
Street 4																			

Consultant: RAND Engineering Corporation

5285 Solar Drive
Mississauga, Ont. L4W 5B8

CITY OF MISSISSAUGA

STORM SEWER DESIGN SHEET - 10 year Storm
DERRY BRITANNIA DEVELOPMENT LIMITED

Project No.: 13958
Prepared by: P.S.

STREET	FROM MANHOLE	TO MANHOLE	AREA (Ha)	STORM CO-EFFICIENT	SECTION A*C	ACCUMULATED A*C	10 YR INTENSITY (mm/hr)	10 YR FLOW (m^3/s)	LENGTH (m)	SLOPE (%)	DIAMETER (mm)	FULL FLOW CAPACITY (m^3/s)	FULL FLOW VELOCITY (m/s)	FLOW TIME IN PIPE (min)	TIME OF CONCENTRATION (min)	UPSTREAM MANHOLE INVERT (m)	DOWNSTREAM MANHOLE INVERT (m)	UPSTREAM MANHOLE HGL (m)	DOWNSTREAM MANHOLE HGL (m)
			0.15	0.90															
	40	10	0.33	0.30	0.234	0.234	99.17	0.064	75.9	0.300	375	0.096	0.87	1.450	16.45	192.830	192.602		
To Street 1 - Pipe: 10 - 11						0.234									16.45				
Street 5																			
	68	69	0.35	0.65	0.227	0.227	99.17	0.063	89.3	0.700	375	0.147	1.33	1.120	16.12	191.000	190.375		
	69	70	0.21	0.65	0.136	0.363	94.96	0.096	66.3	0.300	450	0.156	0.98	1.130	17.25	190.300	190.101		
	70	27	0.36	0.65	0.234	0.597	91.11	0.151	115.0	0.300	525	0.236	1.09	1.760	19.01	190.026	189.681		
To Street 26 - Pipe: 27 - 28						0.597									19.01				
	68	20	0.30	0.65	0.195	0.195	99.17	0.054	77.7	0.600	375	0.136	1.23	1.050	16.05	191.141	190.675		
To Street 1 - Pipe: 20 - 21						0.195									16.05				
From Street 1 - Pipe: 22 - 23						14.058									28.63				
	23	24			0.000	14.058	65.69	2.565	12.3	0.250	2400x1200	6.010	2.09	0.100	28.73	189.226	189.195		
	24	25	0.07	0.65	0.046	14.104	65.54	2.568	31.2	0.250	2400x1200	6.010	2.09	0.250	28.98	189.195	189.117		
From Street 7 - Pipe: 66 - 25						0.475									18.15				
	25	26	0.06	0.65	0.039	14.618	65.16	2.646	28.4	0.250	2400x1200	6.010	2.09	0.230	29.21	189.117	189.046		
	26	27			0.000	14.618	64.81	2.632	15.8	0.250	2400x1200	6.010	2.09	0.130	29.34	189.046	189.006		
To Street 26 - Pipe: 27 - 28						14.618									29.34				
Street 7																			
	65	66	0.42	0.65	0.273	0.273	99.17	0.075	75.8	0.300	375	0.096	0.87	1.450	16.45	190.626	190.399		
	66	25	0.31	0.65	0.202	0.475	93.80	0.124	100.0	0.300	450	0.156	0.98	1.700	18.15	190.146	189.846		
To Street 5 - Pipe: 25 - 26						0.475									18.15				
Street 8																			
	59	60	0.09	0.65	0.058	0.058	99.17	0.016	16.1	0.300	300	0.053	0.75	0.360	15.36	191.174	191.126		
	60	61	0.23	0.65	0.150	0.208	97.77	0.056	63.3	0.300	375	0.096	0.87	1.210	16.57	191.046	190.856		
	61	62	0.35	0.65	0.227	0.435	93.38	0.113	100.0	0.300	450	0.156	0.98	1.700	18.27	190.781	190.481		
	62	63	0.36	0.65	0.234	0.669	87.92	0.163	100.0	0.300	525	0.236	1.09	1.530	19.80	190.406	190.106		
	63	64			0.000	0.669	83.59	0.155	11.4	0.300	525	0.236	1.09	0.170	19.97	190.026	189.992		
	64	22	0.10	0.65	0.065	0.734	83.14	0.170	19.9	0.300	525	0.236	1.09	0.300	20.27	189.942	189.882		
To Street 1 - Pipe: 22 - 23						0.734									20.27				

Consultant: RAND Engineering Corporation

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CITY OF MISSISSAUGA

STORM SEWER DESIGN SHEET - 10 year Storm
DERRY BRITANNIA DEVELOPMENT LIMITED

Project No.: 13958
Prepared by: P.S.

STREET	FROM MANHOLE	TO MANHOLE	AREA (Ha)	STORM CO-EFFICIENT	SECTION A*C	ACCUMULATED A*C	10 YR INTENSITY (mm/hr)	10 YR FLOW (m^3/s)	LENGTH (m)	SLOPE (%)	DIAMETER (mm)	FULL FLOW CAPACITY (m^3/s)	FULL FLOW VELOCITY (m/s)	FLOW TIME IN PIPE (min)	TIME OF CONCENTRATION (min)	UPSTREAM MANHOLE INVERT (m)	DOWNSTREAM MANHOLE INVERT (m)	UPSTREAM MANHOLE HGL (m)	DOWNSTREAM MANHOLE HGL (m)
Street 10																			
	58	19	0.32	0.65	0.208	0.208	99.17	0.057	73.5	0.300	375	0.096	0.87	1.410	16.41	191.276	191.056		
To Street 1 - Pipe: 19 - 20						0.208									16.41				
Street 11																			
	54	55	0.08	0.65	0.052	0.052	99.17	0.014	27.5	0.300	300	0.053	0.75	0.610	15.61	192.044	191.962		
	55	56	0.26	0.65	0.169	0.221	96.82	0.059	74.7	0.300	375	0.096	0.87	1.430	17.04	191.887	191.663		
	56	57			0.000	0.221	91.80	0.056	13.1	0.300	375	0.096	0.87	0.250	17.29	191.583	191.544		
	57	18	0.44	0.65	0.286	0.507	90.98	0.128	69.6	0.300	525	0.236	1.09	1.060	18.35	191.312	191.103		
To Street 1 - Pipe: 18 - 19						0.507									18.35				
	54	15	0.51	0.65	0.332	0.332	99.17	0.091	79.2	0.300	450	0.156	0.98	1.350	16.35	191.739	191.501		
To Street 1 - Pipe: 15 - 16						0.332									16.35				
Street 14																			

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STREET	FROM MANHOLE	TO MANHOLE	AREA (Ha)	STORM CO-EFFICIENT	SECTION A*C	ACCUMULATED A*C	10 YR INTENSITY (mm/hr)	10 YR FLOW (m^3/s)	LENGTH (m)	SLOPE (%)	DIAMETER (mm)	FULL FLOW CAPACITY (m^3/s)	FULL FLOW VELOCITY (m/s)	FLOW TIME IN PIPE (min)	TIME OF CONCENTRATION (min)	UPSTREAM MANHOLE INVERT (m)	DOWNSTREAM MANHOLE INVERT (m)	UPSTREAM MANHOLE HGL (m)	DOWNSTREAM MANHOLE HGL (m)
	51	49	0.15	0.65	0.098	0.098	99.17	0.027	42.7	0.500	300	0.068	0.96	0.740	15.74	192.130	191.916		
To Street 15 - Pipe: 49 - 50						0.098									15.74				
	51	52	0.23	0.65	0.150	0.150	99.17	0.041	50.4	0.900	300	0.092	1.30	0.650	15.65	192.044	191.590		
	52	53			0.000	0.150	96.67	0.040	8.7	1.000	300	0.097	1.37	0.110	15.76	191.540	191.453		
	53	17	0.13	0.65	0.084	0.234	96.27	0.063	30.3	0.500	375	0.124	1.12	0.450	16.21	191.378	191.227		
To Street 1 - Pipe: 17 - 18						0.234									16.21				
Street 15																			
From Street 14 - Pipe: 51 - 49						0.098									15.74				
	49	50	0.42	0.65	0.273	0.371	96.34	0.099	42.5	0.500	450	0.202	1.27	0.560	16.30	191.766	191.553		
	50	15			0.000	0.371	94.32	0.097	14.9	0.300	450	0.156	0.98	0.250	16.55	191.503	191.458		
To Street 1 - Pipe: 15 - 16						0.371									16.55				
	43	44	0.23	0.65	0.150	0.150	99.17	0.041	59.2	0.500	300	0.068	0.96	1.030	16.03	192.441	192.145		
			0.07	0.65															
	44	13	0.86	0.90	0.820	0.970	95.28	0.257	32.2	0.300	600	0.336	1.19	0.450	16.48	191.845	191.748		
To Street 1 - Pipe: 13 - 14						0.970									16.48				
Street 16																			
	47	48	0.49	0.65	0.318	0.318	99.17	0.088	57.9	0.500	450	0.202	1.27	0.760	15.76	192.096	191.807		
	48	14	0.07	0.65	0.046	0.364	96.27	0.097	23.9	0.300	450	0.156	0.98	0.410	16.17	191.757	191.685		
To Street 1 - Pipe: 14 - 15						0.364									16.17				
Street 17																			
	41	42	0.31	0.65	0.202	0.202	99.17	0.056	48.2	0.300	375	0.096	0.87	0.920	15.92	192.569	192.424		
	42	11			0.000	0.202	95.68	0.054	33.5	0.300	375	0.096	0.87	0.640	16.56	192.374	192.273		
To Street 1 - Pipe: 11 - 12						0.202									16.56				
	46	14	0.61	0.65	0.396	0.396	99.17	0.109	80.2	0.300	450	0.156	0.98	1.360	16.36	191.926	191.685		
To Street 1 - Pipe: 14 - 15						0.396									16.36				
Street 18																			
	45	13	0.47	0.65	0.306	0.306	99.17	0.084	74.4	0.500	450	0.202	1.27	0.980	15.98	192.270	191.898		
To Street 1 - Pipe: 13 - 14						0.306									15.98				
Street 19																			

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STREET	FROM MANHOLE	TO MANHOLE	AREA (Ha)	STORM CO-EFFICIENT	SECTION A*C	ACCUMULATED A*C	10 YR INTENSITY (mm/hr)	10 YR FLOW (m^3/s)	LENGTH (m)	SLOPE (%)	DIAMETER (mm)	FULL FLOW CAPACITY (m^3/s)	FULL FLOW VELOCITY (m/s)	FLOW TIME IN PIPE (min)	TIME OF CONCENTRATION (min)	UPSTREAM MANHOLE INVERT (m)	DOWNSTREAM MANHOLE INVERT (m)	UPSTREAM MANHOLE HGL (m)	DOWNSTREAM MANHOLE HGL (m)
	31	32	0.31	0.65	0.202	0.202	99.17	0.056	81.9	0.500	375	0.124	1.12	1.220	16.22	194.846	194.436		
	32	33	0.40	0.65	0.260	0.462	94.60	0.121	110.0	0.500	450	0.202	1.27	1.440	17.66	194.361	193.811		
	33	34	0.42	0.65	0.273	0.735	89.79	0.183	110.0	0.500	525	0.304	1.40	1.310	18.97	193.736	193.186		
	34	35			0.000	0.735	85.88	0.175	8.3	0.500	525	0.304	1.40	0.100	19.07	193.136	193.095		
	35	36	0.05	0.65	0.032	0.767	85.59	0.182	23.6	0.500	525	0.304	1.40	0.280	19.35	193.045	192.927		
From Street 21 - Pipe: 39 - 36						0.748									19.29				
	36	9	0.12	0.65	0.078	1.593	84.81	0.375	67.4	0.300	675	0.460	1.29	0.870	20.22	192.777	192.575		
To Street 1 - Pipe: 9 - 10						1.593									20.22				
Street 21																			
	37	38	0.34	0.65	0.221	0.221	99.17	0.061	87.4	0.500	375	0.124	1.12	1.300	16.30	194.414	193.977		
	38	39	0.42	0.65	0.273	0.494	94.32	0.129	110.0	0.500	525	0.304	1.40	1.310	17.61	193.827	193.277		
	39	36	0.39	0.65	0.254	0.748	89.95	0.187	110.0	0.300	525	0.236	1.09	1.680	19.29	193.257	192.927		

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To Street 19 - Pipe: 36 - 9						0.748									19.29				
Street 22																			
From Street 23 - Pipe: 5 - 6						0.111									15.44				
	6	4	0.30	0.65	0.195	0.306	97.46	0.083	113.6	0.500	450	0.202	1.27	1.490	16.93	194.332	193.764		
To Street 1 - Pipe: 4 - 7						0.306									16.93				
Street 23																			
	1	2	0.65	0.65	0.423	0.423	99.17	0.117	104.6	0.500	450	0.202	1.27	1.370	16.37	194.525	194.002		
	2	3			0.000	0.423	94.08	0.111	11.2	0.300	450	0.156	0.98	0.190	16.56	193.952	193.918		
			0.30	0.65															
	3	4	0.77	0.30	0.426	0.849	93.42	0.220	51.3	0.300	600	0.336	1.19	0.720	17.28	193.768	193.614		
To Street 1 - Pipe: 4 - 7						0.849									17.28				
	5	6	0.17	0.65	0.111	0.111	99.17	0.031	36.2	1.000	300	0.097	1.37	0.440	15.44	194.844	194.482		
To Street 22 - Pipe: 6 - 4						0.111									15.44				
Street 26																			
From Street 5 - Pipe: 70 - 27						0.597									19.01				
From Street 5 - Pipe: 26 - 27						14.618									29.34				
	27	28			0.000	15.215	64.62	2.731	170.0	0.250	2400x1200	6.010	2.09	1.360	30.70	189.006	188.581		
			0.18	0.25															
	28	29	5.00	0.90	4.545	19.760	62.67	3.440	197.3	0.250	3000x1200	7.871	2.19	1.500	32.20	188.581	188.088		
	29	30			0.000	19.760	60.67	3.330	15.0	0.250	3000x1200	7.871	2.19	0.110	32.31	188.038	188.000		

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CITY OF MISSISSAUGA

STORM SEWER DESIGN SHEET - 100 year Storm
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Project No.: 13958
Prepared by: P.S.

STREET	FROM MANHOLE	TO MANHOLE	AREA (Ha)	STORM CO-EFFICIENT	SECTION A*C	ACCUMULATED A*C	100 YR INTENSITY (mm/hr)	100 YR FLOW (m^3/s)	LENGTH (m)	SLOPE (%)	DIAMETER (mm)	FULL FLOW CAPACITY (m^3/s)	FULL FLOW VELOCITY (m/s)	FLOW TIME IN PIPE (min)	TIME OF CONCENTRATION (min)	UPSTREAM MANHOLE INVERT (m)	DOWNSTREAM MANHOLE INVERT (m)	UPSTREAM MANHOLE HGL (m)	DOWNSTREAM MANHOLE HGL (m)
Street 1																			
From Street 22 - Pipe: 6 - 4						0.306									16.93				
From Street 23 - Pipe: 3 - 4						0.849									17.28				
	4	7	0.56	0.65	0.364	1.519	129.28	**0.68**	104.6	0.300	750	0.610	1.38	1.260	18.54	193.464	193.150		
	7	8	0.63	0.65	0.410	1.929			110.0	0.300	750	0.610	1.38	1.330	19.87	193.130	192.800		
	8	9	0.51	0.65	0.332	2.261			100.0	0.300	825	0.786	1.47	1.130	21.00	192.725	192.425		
From Street 19 - Pipe: 36 - 9						1.593									20.22				
			0.18	0.65															
	9	10	0.84	0.90	0.873	4.727			91.0	0.300	1050	1.496	1.73	0.880	21.88	192.200	191.927		
From Street 4 - Pipe: 40 - 10						0.234									16.45				
			0.14	0.65															
	10	11	3.35	0.65	2.269	7.230			77.3	0.400	1200	2.466	2.18	0.590	22.47	191.777	191.468		
From Street 17 - Pipe: 42 - 11						0.202									16.56				
	11	12			0.000	7.432	109.72	**2.83**	10.6	0.400	1500x1200	4.200	2.34	0.080	22.55	191.448	191.406		
	12	13	0.17	0.65	0.111	7.543			47.0	0.400	1500x1200	4.200	2.34	0.330	22.88	191.356	191.168		
From Street 18 - Pipe: 45 - 13						0.306									15.98				
From Street 15 - Pipe: 44 - 13						0.970									16.48				
	13	14	0.16	0.65	0.104	8.923	108.37	**3.36**	64.5	0.300	1500x1200	3.650	2.03	0.530	23.41	191.148	190.955		
From Street 16 - Pipe: 48 - 14						0.364									16.17				
From Street 17 - Pipe: 46 - 14						0.396									16.36				
	14	15	0.17	0.65	0.111	9.794	106.66	**3.63**	69.0	0.300	1500x1200	3.650	2.03	0.570	23.98	190.935	190.728		
From Street 11 - Pipe: 54 - 15						0.332									16.35				
From Street 15 - Pipe: 50 - 15						0.371									16.55				
	15	16	0.42	0.65	0.273	10.770	104.91	**3.92**	47.6	0.250	1800x1200	4.200	1.95	0.410	24.39	190.708	190.589		
	16	17			0.000	10.770	104.91	**3.92**	54.9	0.250	1800x1200	4.200	1.95	0.470	24.86	190.539	190.402		
From Street 14 - Pipe: 53 - 17						0.234									16.21				
	17	18	0.07	0.65	0.046	11.050	102.20	**3.92**	28.8	0.250	1800x1200	4.200	1.95	0.250	25.11	190.402	190.330		
From Street 11 - Pipe: 57 - 18						0.507									18.35				

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			0.09	0.65															
			0.24	0.90															
			0.49	0.30															
	18	19	0.93	0.30	0.700	12.257	101.46	**4.32**	153.4	0.250	2400x1200	6.010	2.09	1.220	26.33	190.330	189.946		
From Street 10 - Pipe: 58 - 19						0.208									16.41				
	19	20			0.000	12.465	97.73	**4.23**	38.5	0.250	2400x1200	6.010	2.09	0.310	26.64	189.946	189.850		
From Street 5 - Pipe: 68 - 20						0.195									16.05				
	20	21	0.32	0.65	0.208	12.868	97.73	**4.37**	89.4	0.250	2400x1200	6.010	2.09	0.710	27.35	189.850	189.627		
	21	22	0.59	0.65	0.384	13.252	96.85	**4.46**	138.0	0.250	2400x1200	6.010	2.09	1.100	28.45	189.627	189.282		
From Street 8 - Pipe: 64 - 22						0.734									20.27				
	22	23	0.11	0.65	0.072	14.058	91.95	**4.49**	22.2	0.250	2400x1200	6.010	2.09	0.180	28.63	189.282	189.226		
To Street 5 - Pipe: 23 - 24						14.058									28.63				
Street 4																			

Consultant: RAND Engineering Corporation

5285 Solar Drive
Mississauga, Ont. L4W 5B8

CITY OF MISSISSAUGA

STORM SEWER DESIGN SHEET - 100 year Storm
DERRY BRITANNIA DEVELOPMENT LIMITED

Project No.: 13958
Prepared by: P.S.

STREET	FROM MANHOLE	TO MANHOLE	AREA (Ha)	STORM CO-EFFICIENT	SECTION A*C	ACCUMULATED A*C	100 YR INTENSITY (mm/hr)	100 YR FLOW (m^3/s)	LENGTH (m)	SLOPE (%)	DIAMETER (mm)	FULL FLOW CAPACITY (m^3/s)	FULL FLOW VELOCITY (m/s)	FLOW TIME IN PIPE (min)	TIME OF CONCENTRATION (min)	UPSTREAM MANHOLE INVERT (m)	DOWNSTREAM MANHOLE INVERT (m)	UPSTREAM MANHOLE HGL (m)	DOWNSTREAM MANHOLE HGL (m)
			0.15	0.90															
	40	10	0.33	0.30	0.234	0.234	99.17	0.064	75.9	0.300	375	0.096	0.87	1.450	16.45	192.830	192.602		
To Street 1 - Pipe: 10 - 11						0.234									16.45				
Street 5																			
	68	69	0.35	0.65	0.227	0.227	99.17	0.063	89.3	0.700	375	0.147	1.33	1.120	16.12	191.000	190.375		
	69	70	0.21	0.65	0.136	0.363	94.96	0.096	66.3	0.300	450	0.156	0.98	1.130	17.25	190.300	190.101		
	70	27	0.36	0.65	0.234	0.597	91.11	0.151	115.0	0.300	525	0.236	1.09	1.760	19.01	190.026	189.681		
To Street 26 - Pipe: 27 - 28						0.597									19.01				
	68	20	0.30	0.65	0.195	0.195	99.17	0.054	77.7	0.600	375	0.136	1.23	1.050	16.05	191.141	190.675		
To Street 1 - Pipe: 20 - 21						0.195									16.05				
From Street 1 - Pipe: 22 - 23						14.058									28.63				
	23	24			0.000	14.058	91.49	**4.47**	12.3	0.250	2400x1200	6.010	2.09	0.100	28.73	189.226	189.195		
	24	25	0.07	0.65	0.046	14.104	91.24	**4.47**	31.2	0.250	2400x1200	6.010	2.09	0.250	28.98	189.195	189.117		
From Street 7 - Pipe: 66 - 25						0.475									18.15				
	25	26	0.06	0.65	0.039	14.618	90.63	**4.60**	28.4	0.250	2400x1200	6.010	2.09	0.230	29.21	189.117	189.046		
	26	27			0.000	14.618	90.07	**4.57**	15.8	0.250	2400x1200	6.010	2.09	0.130	29.34	189.046	189.006		
To Street 26 - Pipe: 27 - 28						14.618									29.34				
Street 7																			
	65	66	0.42	0.65	0.273	0.273	99.17	0.075	75.8	0.300	375	0.096	0.87	1.450	16.45	190.626	190.399		
	66	25	0.31	0.65	0.202	0.475	93.80	0.124	100.0	0.300	450	0.156	0.98	1.700	18.15	190.146	189.846		
To Street 5 - Pipe: 25 - 26						0.475									18.15				
Street 8																			
	59	60	0.09	0.65	0.058	0.058	99.17	0.016	16.1	0.300	300	0.053	0.75	0.360	15.36	191.174	191.126		
	60	61	0.23	0.65	0.150	0.208	97.77	0.056	63.3	0.300	375	0.096	0.87	1.210	16.57	191.046	190.856		
	61	62	0.35	0.65	0.227	0.435	93.38	0.113	100.0	0.300	450	0.156	0.98	1.700	18.27	190.781	190.481		
	62	63	0.36	0.65	0.234	0.669	87.92	0.163	100.0	0.300	525	0.236	1.09	1.530	19.80	190.406	190.106		
	63	64			0.000	0.669	83.59	0.155	11.4	0.300	525	0.236	1.09	0.170	19.97	190.026	189.992		
	64	22	0.10	0.65	0.065	0.734	83.14	0.170	19.9	0.300	525	0.236	1.09	0.300	20.27	189.942	189.882		
To Street 1 - Pipe: 22 - 23						0.734									20.27				

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Project No.: 13958
Prepared by: P.S.

STREET	FROM MANHOLE	TO MANHOLE	AREA (Ha)	STORM CO-EFFICIENT	SECTION A*C	ACCUMULATED A*C	100 YR INTENSITY (mm/hr)	100 YR FLOW (m^3/s)	LENGTH (m)	SLOPE (%)	DIAMETER (mm)	FULL FLOW CAPACITY (m^3/s)	FULL FLOW VELOCITY (m/s)	FLOW TIME IN PIPE (min)	TIME OF CONCENTRATION (min)	UPSTREAM MANHOLE INVERT (m)	DOWNSTREAM MANHOLE INVERT (m)	UPSTREAM MANHOLE HGL (m)	DOWNSTREAM MANHOLE HGL (m)
Street 10																			
	58	19	0.32	0.65	0.208	0.208	99.17	0.057	73.5	0.300	375	0.096	0.87	1.410	16.41	191.276	191.056		
To Street 1 - Pipe: 19 - 20						0.208									16.41				
Street 11																			
	54	55	0.08	0.65	0.052	0.052	99.17	0.014	27.5	0.300	300	0.053	0.75	0.610	15.61	192.044	191.962		
	55	56	0.26	0.65	0.169	0.221	96.82	0.059	74.7	0.300	375	0.096	0.87	1.430	17.04	191.887	191.663		
	56	57			0.000	0.221	91.80	0.056	13.1	0.300	375	0.096	0.87	0.250	17.29	191.583	191.544		
	57	18	0.44	0.65	0.286	0.507	90.98	0.128	69.6	0.300	525	0.236	1.09	1.060	18.35	191.312	191.103		
To Street 1 - Pipe: 18 - 19						0.507									18.35				
	54	15	0.51	0.65	0.332	0.332	99.17	0.091	79.2	0.300	450	0.156	0.98	1.350	16.35	191.739	191.501		
To Street 1 - Pipe: 15 - 16						0.332									16.35				
Street 14																			

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Project No.: 13958
Prepared by: P.S.

STREET	FROM MANHOLE	TO MANHOLE	AREA (Ha)	STORM CO-EFFICIENT	SECTION A*C	ACCUMULATED A*C	100 YR INTENSITY (mm/hr)	100 YR FLOW (m^3/s)	LENGTH (m)	SLOPE (%)	DIAMETER (mm)	FULL FLOW CAPACITY (m^3/s)	FULL FLOW VELOCITY (m/s)	FLOW TIME IN PIPE (min)	TIME OF CONCENTRATION (min)	UPSTREAM MANHOLE INVERT (m)	DOWNSTREAM MANHOLE INVERT (m)	UPSTREAM MANHOLE HGL (m)	DOWNSTREAM MANHOLE HGL (m)
	51	49	0.15	0.65	0.098	0.098	99.17	0.027	42.7	0.500	300	0.068	0.96	0.740	15.74	192.130	191.916		
To Street 15 - Pipe: 49 - 50						0.098									15.74				
	51	52	0.23	0.65	0.150	0.150	99.17	0.041	50.4	0.900	300	0.092	1.30	0.650	15.65	192.044	191.590		
	52	53			0.000	0.150	96.67	0.040	8.7	1.000	300	0.097	1.37	0.110	15.76	191.540	191.453		
	53	17	0.13	0.65	0.084	0.234	96.27	0.063	30.3	0.500	375	0.124	1.12	0.450	16.21	191.378	191.227		
To Street 1 - Pipe: 17 - 18						0.234									16.21				
Street 15																			
From Street 14 - Pipe: 51 - 49						0.098									15.74				
	49	50	0.42	0.65	0.273	0.371	96.34	0.099	42.5	0.500	450	0.202	1.27	0.560	16.30	191.766	191.553		
	50	15			0.000	0.371	94.32	0.097	14.9	0.300	450	0.156	0.98	0.250	16.55	191.503	191.458		
To Street 1 - Pipe: 15 - 16						0.371									16.55				
	43	44	0.23	0.65	0.150	0.150	99.17	0.041	59.2	0.500	300	0.068	0.96	1.030	16.03	192.441	192.145		
			0.07	0.65															
	44	13	0.86	0.90	0.820	0.970	95.28	0.257	32.2	0.300	600	0.336	1.19	0.450	16.48	191.845	191.748		
To Street 1 - Pipe: 13 - 14						0.970									16.48				
Street 16																			
	47	48	0.49	0.65	0.318	0.318	99.17	0.088	57.9	0.500	450	0.202	1.27	0.760	15.76	192.096	191.807		
	48	14	0.07	0.65	0.046	0.364	96.27	0.097	23.9	0.300	450	0.156	0.98	0.410	16.17	191.757	191.685		
To Street 1 - Pipe: 14 - 15						0.364									16.17				
Street 17																			
	41	42	0.31	0.65	0.202	0.202	99.17	0.056	48.2	0.300	375	0.096	0.87	0.920	15.92	192.569	192.424		
	42	11			0.000	0.202	95.68	0.054	33.5	0.300	375	0.096	0.87	0.640	16.56	192.374	192.273		
To Street 1 - Pipe: 11 - 12						0.202									16.56				
	46	14	0.61	0.65	0.396	0.396	99.17	0.109	80.2	0.300	450	0.156	0.98	1.360	16.36	191.926	191.685		
To Street 1 - Pipe: 14 - 15						0.396									16.36				
Street 18																			
	45	13	0.47	0.65	0.306	0.306	99.17	0.084	74.4	0.500	450	0.202	1.27	0.980	15.98	192.270	191.898		
To Street 1 - Pipe: 13 - 14						0.306									15.98				
Street 19																			

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	31	32	0.31	0.65	0.202	0.202	99.17	0.056	81.9	0.500	375	0.124	1.12	1.220	16.22	194.846	194.436		
	32	33	0.40	0.65	0.260	0.462	94.60	0.121	110.0	0.500	450	0.202	1.27	1.440	17.66	194.361	193.811		
	33	34	0.42	0.65	0.273	0.735	89.79	0.183	110.0	0.500	525	0.304	1.40	1.310	18.97	193.736	193.186		
	34	35			0.000	0.735	85.88	0.175	8.3	0.500	525	0.304	1.40	0.100	19.07	193.136	193.095		
	35	36	0.05	0.65	0.032	0.767	85.59	0.182	23.6	0.500	525	0.304	1.40	0.280	19.35	193.045	192.927		
From Street 21 - Pipe: 39 - 36						0.748									19.29				
	36	9	0.12	0.65	0.078	1.593	84.81	0.375	67.4	0.300	675	0.460	1.29	0.870	20.22	192.777	192.575		
To Street 1 - Pipe: 9 - 10						1.593									20.22				
Street 21																			
	37	38	0.34	0.65	0.221	0.221	99.17	0.061	87.4	0.500	375	0.124	1.12	1.300	16.30	194.414	193.977		
	38	39	0.42	0.65	0.273	0.494	94.32	0.129	110.0	0.500	525	0.304	1.40	1.310	17.61	193.827	193.277		
	39	36	0.39	0.65	0.254	0.748	89.95	0.187	110.0	0.300	525	0.236	1.09	1.680	19.29	193.257	192.927		

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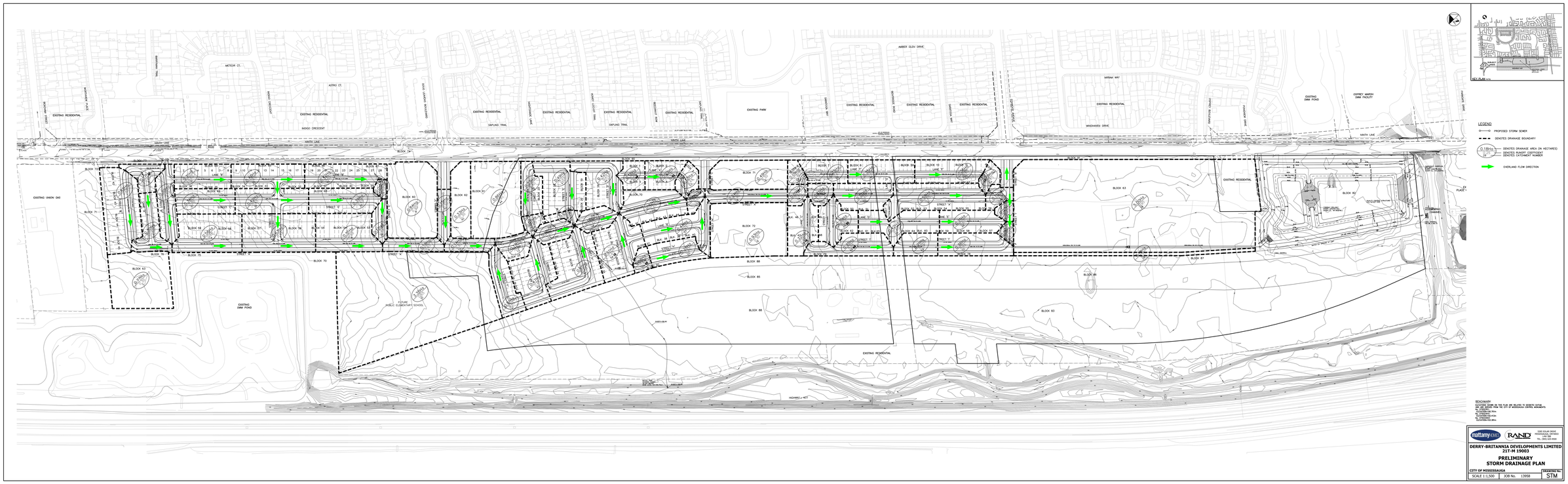
To Street 19 - Pipe: 36 - 9						0.748									19.29				
Street 22																			
From Street 23 - Pipe: 5 - 6						0.111									15.44				
	6	4	0.30	0.65	0.195	0.306	97.46	0.083	113.6	0.500	450	0.202	1.27	1.490	16.93	194.332	193.764		
To Street 1 - Pipe: 4 - 7						0.306									16.93				
Street 23																			
	1	2	0.65	0.65	0.423	0.423	99.17	0.117	104.6	0.500	450	0.202	1.27	1.370	16.37	194.525	194.002		
	2	3			0.000	0.423	94.08	0.111	11.2	0.300	450	0.156	0.98	0.190	16.56	193.952	193.918		
			0.30	0.65															
	3	4	0.77	0.30	0.426	0.849	93.42	0.220	51.3	0.300	600	0.336	1.19	0.720	17.28	193.768	193.614		
To Street 1 - Pipe: 4 - 7						0.849									17.28				
	5	6	0.17	0.65	0.111	0.111	99.17	0.031	36.2	1.000	300	0.097	1.37	0.440	15.44	194.844	194.482		
To Street 22 - Pipe: 6 - 4						0.111									15.44				
Street 26																			
From Street 5 - Pipe: 70 - 27						0.597									19.01				
From Street 5 - Pipe: 26 - 27						14.618									29.34				
	27	28			0.000	15.215	89.77	**4.74**	170.0	0.250	2400x1200	6.010	2.09	1.360	30.70	189.006	188.581		
			0.18	0.25															
	28	29	5.00	0.90	4.545	19.760	86.64	**5.94**	197.3	0.250	3000x1200	7.871	2.19	1.500	32.20	188.581	188.088		
	29	30			0.000	19.760	83.31	**5.72**	15.0	0.250	3000x1200	7.871	2.19	0.110	32.31	188.038	188.000		


EXISTING RESIDENTIAL
EXISTING PARK
EXISTING DRM POND
EXISTING UNION GAS
FUTURE PUBLIC ELEMENTARY SCHOOL
HIGHWAY 407
STREET 'A'
STREET 'B'
STREET 'C'
STREET 'D'
STREET 'E'
STREET 'F'
STREET 'G'
STREET 'H'
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STREET 'Q'
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STREET 'S'
STREET 'T'
STREET 'U'
STREET 'V'
STREET 'W'
STREET 'X'
STREET 'Y'
STREET 'Z'
LEGEND
PROPOSED STORM SEWER
DENOTES DRAINAGE BOUNDARY
DENOTES DRAINAGE AREA (IN HECTARES)
DENOTES RUNOFF COEFFICIENT
DENOTES CATCHMENT NUMBER
OVERLAND FLOW DIRECTION
KEY PLAN N.T.S.
DERRY-BRITANNIA DEVELOPMENTS LIMITED
21T-M 19003
PRELIMINARY
STORM DRAINAGE PLAN
CITY OF MISSISSAUGA
SCALE 1:1,500
JOB No. 13958
DRAWING No. STM

APPENDIX B – HYDROLOGICAL ANALYSIS - SWMHYMO

```
2     Metric units
*#****************************************************************************
*#  Project #    :  13958
*#  Project Name :  DERRY BRITANNIA DEVELOPMENTS LIMITED
*#                  MATTAMY HOMES NINTH LINE PROJECT
*#                  CITY OF MISSISSAUGA
*#  Date         :  MAY 2020
*#  Modeller     :  PJ
*#  Company      :  RAND Engineering Corporation
*#  License #    :  4289424
*#****************************************************************************
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
                    ["SCS12-02.STM"]
*%-----------------|-------------------------------------------------------|
READ STORM          ["STORM.001"]
*%-----------------|-------------------------------------------------------|
*#
*#  PHASE 1 DRAINAGE AREA
*#
CALIB STANDHYD      ID=[1], NHYD=["PH-1"], DT=[1](min), AREA=[8.37](ha),
                    XIMP=[.66], TIMP=[.66], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[79],
                    Pervious   surfaces: IAper=[0.6](mm), SLPP=[2](%),
                                         LGP=[24.5](m), MNP=[0.25], SCP=[0](min)
                    Impervious surfaces: IAimp=[0.2](mm), SLPI=[0.5](%),
                                         LGI=[466](m), MNI=[0.013], SCI=[0](min)
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-------------------------------------------------------|
*#
*#  PHASE 1 SWM POND
*#
ROUTE RESERVOIR     IDout=[2],   NHYD=["SWM-1"],  IDin=[1],
                    RDT=[1](min),
                          TABLE of ( OUTFLOW-STORAGE ) values
                                      (cms) - (ha-m)
                                    [ 0.000 , 0.0000 ]
                                    [ 0.008 , 0.1525 ]
                                    [ 0.010 , 0.2370 ]
                                    [ 0.012 , 0.3263 ]
                                    [ 0.014 , 0.4198 ]
                                    [ 0.015 , 0.5175 ]
                                    [ 0.016 , 0.6195 ]
                                    [ 0.018 , 0.7258 ]
                                    [ 0.045 , 0.8365 ]
                                    [ 0.156 , 0.9516 ]
                                    [ 0.313 , 1.0711 ]
                                    [ 0.506 , 1.1951 ]
                                    [ 0.657 , 1.2590 ]
                                    [ 0.728 , 1.3243 ]
                                    [   -1  ,  -1    ]  (max twenty pts)
                          IDovf=[3], NHYDovf=["OVF-1"]
*%-----------------|-------------------------------------------------------|
*#
*#  PHASE 2 DRAINAGE AREA
*#
CALIB STANDHYD      ID=[1], NHYD=["PH-2"], DT=[1](min), AREA=[32.12](ha),
                    XIMP=[.71], TIMP=[.71], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[79],
                    Pervious   surfaces: IAper=[0.6](mm), SLPP=[2](%),
                                         LGP=[24.5](m), MNP=[0.25], SCP=[0](min)
                    Impervious surfaces: IAimp=[0.2](mm), SLPI=[0.5](%),
                                         LGI=[466](m), MNI=[0.013], SCI=[0](min)
```

```
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-------------------------------------------------------------|
*#
*#  PHASE 2 SWM POND
*#
ROUTE RESERVOIR     IDout=[2],   NHYD=["SWM-2"],  IDin=[1],
                    RDT=[1](min),
                          TABLE of ( OUTFLOW-STORAGE ) values
                                      (cms) - (ha-m)
                                    [ 0.000 , 0.0000 ]
                                    [ 0.032 , 0.6346 ]
                                    [ 0.036 , 0.7729 ]
                                    [ 0.042 , 1.0583 ]
                                    [ 0.047 , 1.3556 ]
                                    [ 0.052 , 1.6649 ]
                                    [ 0.057 , 1.9860 ]
                                    [ 0.061 , 2.3190 ]
                                    [ 0.065 , 2.6640 ]
                                    [ 0.068 , 3.0208 ]
                                    [ 0.278 , 3.3873 ]
                                    [ 0.657 , 3.7610 ]
                                    [ 1.147 , 4.1419 ]
                                    [ 1.727 , 4.5302 ]
                                    [ 2.550 , 4.9257 ]
                                    [   -1  ,  -1    ]  (max twenty pts)
                          IDovf=[3], NHYDovf=["OVF-2"]
*%-----------------|-------------------------------------------------------------|
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
                    ["SCS12-05.STM"]
*%-----------------|-------------------------------------------------------------|
FINISH
```

```
==============================================================================

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9   =========
                                                        9   9  9   9   # 4289424
        StormWater Management HYdrologic Model           999    999    =========

 ******************************************************************************
 ***************************** SWMHYMO Ver/4.05  ******************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                  OTTHYMO-83 and OTTHYMO-89.                 *********
 ******************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
 *********                  Ottawa,  Ontario: (613) 836-3884           *********
 *********                  Gatineau, Quebec: (819) 243-6858           *********
 *********                  E-Mail: swmhymo@jfsa.Com                   *********
 ******************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: RAND Engineering Corporation                 +++++++++
 +++++++++                Mississauga           SERIAL#:4289424       +++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ******************************************************************************
 *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *********
 *********           Maximum value for ID numbers  :     10            *********
 *********           Max. number of rainfall points: 105408            *********
 *********           Max. number of flow points    : 105408            *********
 ******************************************************************************


 **********************   D E T A I L E D   O U T P U T   **********************
 ******************************************************************************
 *         DATE: 2020-05-14     TIME: 13:20:58     RUN COUNTER: 000266         *
 ******************************************************************************
 * Input   filename: S:\13\13958\SWMHYMO\2020-05\958-SCS.DAT                  *
 * Output  filename: S:\13\13958\SWMHYMO\2020-05\958-SCS.out                  *
 * Summary filename: S:\13\13958\SWMHYMO\2020-05\958-SCS.sum                  *
 * User comments:                                                             *
 * 1:_________________________________________________________________________*
 * 2:_________________________________________________________________________*
 * 3:_________________________________________________________________________*
 ******************************************************************************

-------------------------------------------------------------------------------
001:0001----------------------------------------------------------------------
*#****************************************************************************
*#  Project #    :  13958
*#  Project Name :  DERRY BRITANNIA DEVELOPMENTS LIMITED
*#                  MATTAMY HOMES NINTH LINE PROJECT
*#                  CITY OF MISSISSAUGA
*#  Date         :  MAY 2020
*#  Modeller     :  PJ
*#  Company      :  RAND Engineering Corporation
*#  License #    :  4289424
*#****************************************************************************
--------------------
| START            |  Project  dir.: S:\13\13958\SWMHYMO\2020-05\
```

```
--------------------  Rainfall dir.: S:\13\13958\SWMHYMO\2020-05\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   1
           #  1=SCS12-02.STM
-------------------------------------------------------------------------------
001:0002-----------------------------------------------------------------------
--------------------
| READ STORM       |    Filename: * 2 Year 12 hr SCS storm
| Ptotal=  43.53 mm|    Comments: * 2 Year 12 hr SCS storm
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .20    .860 |   3.20   1.720 |   6.20  10.540 |   9.20   1.720
               .40    .860 |   3.40   1.720 |   6.40   6.240 |   9.40   1.720
               .60    .860 |   3.60   1.720 |   6.60   4.520 |   9.60   1.720
               .80    .860 |   3.80   1.720 |   6.80   4.300 |   9.80   1.720
              1.00    .860 |   4.00   1.720 |   7.00   3.010 |  10.00   1.720
              1.20    .860 |   4.20   3.010 |   7.20   2.580 |  10.20    .860
              1.40    .860 |   4.40   3.010 |   7.40   2.580 |  10.40    .860
              1.60    .860 |   4.60   3.010 |   7.60   2.580 |  10.60    .860
              1.80    .860 |   4.80   3.010 |   7.80   2.580 |  10.80    .860
              2.00    .860 |   5.00   3.010 |   8.00   2.580 |  11.00    .860
              2.20   1.720 |   5.20   3.870 |   8.20   1.720 |  11.20    .860
              2.40   1.720 |   5.40   5.590 |   8.40   1.720 |  11.40    .860
              2.60   1.720 |   5.60  12.910 |   8.60   1.720 |  11.60    .860
              2.80   1.720 |   5.80  28.180 |   8.80   1.720 |  11.80    .860
              3.00   1.720 |   6.00  58.940 |   9.00   1.720 |  12.00    .860

-------------------------------------------------------------------------------
001:0003-----------------------------------------------------------------------
*#
*#  PHASE 1 DRAINAGE AREA
*#
----------------------
| CALIB STANDHYD     |   Area    (ha)=    8.37
| 01:PH-1   DT= 1.00 |   Total Imp(%)=   66.00   Dir. Conn.(%)=   66.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       5.52         2.85
     Dep. Storage     (mm)=        .20          .60
     Average Slope     (%)=        .50         2.00
     Length            (m)=     466.00        24.50
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      58.94        19.72
                over (min)      10.00        20.00
     Storage Coeff.  (min)=       9.78 (ii)   19.85 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=        .11          .06
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .67          .10           .742 (iii)
     TIME TO PEAK    (hrs)=       6.07         6.23          6.067
     RUNOFF VOLUME    (mm)=      43.33        16.68         34.271
     TOTAL RAINFALL   (mm)=      43.53        43.53         43.530
     RUNOFF COEFFICIENT   =       1.00          .38           .787

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  79.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
```

```
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0004----------------------------------------------------------------------
*#
*#  PHASE 1 SWM POND
*#
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>01:(PH-1  )   |
| OUT<02:(SWM-1 )   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |     .018  .7258E+00
                            .008  .1525E+00   |     .045  .8365E+00
                            .010  .2370E+00   |     .156  .9516E+00
                            .012  .3263E+00   |     .313  .1071E+01
                            .014  .4198E+00   |     .506  .1195E+01
                            .015  .5175E+00   |     .657  .1259E+01
                            .016  .6195E+00   |     .728  .1324E+01

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (PH-1  )       8.37      .742     6.067     34.271
     OUTFLOW<02: (SWM-1 )       8.37      .011    12.200     34.268
    OVERFLOW<03: (OVF-1 )        .00      .000      .000       .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    1.421
                    TIME SHIFT OF PEAK FLOW         (min)=   368.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.2614E+00

--------------------------------------------------------------------------------
001:0005----------------------------------------------------------------------
*#
*#  PHASE 2 DRAINAGE AREA
*#
----------------------
| CALIB STANDHYD     |   Area    (ha)=   32.12
| 01:PH-2   DT= 1.00 |   Total Imp(%)=   71.00   Dir. Conn.(%)=   71.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      22.81         9.31
     Dep. Storage     (mm)=        .20          .60
     Average Slope     (%)=        .50         2.00
     Length            (m)=     466.00        24.50
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      58.94        19.72
                over (min)      10.00        20.00
     Storage Coeff.  (min)=       9.78 (ii)   19.85 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=        .11          .06
                                                          *TOTALS*
     PEAK FLOW       (cms)=       2.75          .33          2.999 (iii)
     TIME TO PEAK    (hrs)=       6.07         6.23          6.067
     RUNOFF VOLUME    (mm)=      43.32        16.68         35.603
     TOTAL RAINFALL   (mm)=      43.53        43.53         43.530
```

```
     RUNOFF COEFFICIENT   =       1.00          .38           .818

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  79.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0006----------------------------------------------------------------------
*#
*#  PHASE 2 SWM POND
*#
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>01:(PH-2  )   |
| OUT<02:(SWM-2 )   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |     .065  .2664E+01
                            .032  .6346E+00   |     .068  .3021E+01
                            .036  .7729E+00   |     .278  .3387E+01
                            .042  .1058E+01   |     .657  .3761E+01
                            .047  .1356E+01   |    1.147  .4142E+01
                            .052  .1665E+01   |    1.727  .4530E+01
                            .057  .1986E+01   |    2.550  .4926E+01
                            .061  .2319E+01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (PH-2  )      32.12     2.999     6.067     35.603
     OUTFLOW<02: (SWM-2 )      32.12      .042    12.183     35.600
    OVERFLOW<03: (OVF-2 )        .00      .000      .000       .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    1.390
                    TIME SHIFT OF PEAK FLOW         (min)=   367.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.1043E+01

--------------------------------------------------------------------------------
001:0007----------------------------------------------------------------------
  ** END OF RUN :   1

*******************************************************************************




--------------------
| START            |  Project  dir.: S:\13\13958\SWMHYMO\2020-05\
--------------------  Rainfall dir.: S:\13\13958\SWMHYMO\2020-05\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 002
    NSTORM=   1
           #  1=SCS12-05.STM
--------------------------------------------------------------------------------
```

```
002:0002-----------------------------------------------------------------------
*#***********************************************************************
*#  Project #    :  13958
*#  Project Name :  DERRY BRITANNIA DEVELOPMENTS LIMITED
*#                  MATTAMY HOMES NINTH LINE PROJECT
*#                  CITY OF MISSISSAUGA
*#  Date         :  MAY 2020
*#  Modeller     :  PJ
*#  Company      :  RAND Engineering Corporation
*#  License #    :  4289424
*#***********************************************************************
-----------------------------------------------------------------------------
002:0002-----------------------------------------------------------------------
--------------------
| READ STORM       |    Filename: * 5 Year 12 hr SCS storm
| Ptotal=  58.52 mm|    Comments: * 5 Year 12 hr SCS storm
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.20	1.160	3.20	2.310	6.20	14.170	9.20	2.310
.40	1.160	3.40	2.310	6.40	8.380	9.40	2.310
.60	1.160	3.60	2.310	6.60	6.070	9.60	2.310
.80	1.160	3.80	2.310	6.80	5.780	9.80	2.310
1.00	1.160	4.00	2.310	7.00	4.050	10.00	2.310
1.20	1.160	4.20	4.050	7.20	3.470	10.20	1.160
1.40	1.160	4.40	4.050	7.40	3.470	10.40	1.160
1.60	1.160	4.60	4.050	7.60	3.470	10.60	1.160
1.80	1.160	4.80	4.050	7.80	3.470	10.80	1.160
2.00	1.160	5.00	4.050	8.00	3.470	11.00	1.160
2.20	2.310	5.20	5.200	8.20	2.310	11.20	1.160
2.40	2.310	5.40	7.520	8.40	2.310	11.40	1.160
2.60	2.310	5.60	17.350	8.60	2.310	11.60	1.160
2.80	2.310	5.80	37.870	8.80	2.310	11.80	1.160
3.00	2.310	6.00	79.210	9.00	2.310	12.00	1.160

```
-----------------------------------------------------------------------------
002:0003-----------------------------------------------------------------------
*#
*#  PHASE 1 DRAINAGE AREA
*#
----------------------
| CALIB STANDHYD     |   Area    (ha)=    8.37
| 01:PH-1   DT= 1.00 |   Total Imp(%)=   66.00   Dir. Conn.(%)=   66.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       5.52         2.85
     Dep. Storage     (mm)=        .20          .60
     Average Slope     (%)=        .50         2.00
     Length            (m)=     466.00        24.50
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      79.21        34.82
                over (min)        9.00        17.00
     Storage Coeff.  (min)=       8.69 (ii)   16.71 (ii)
     Unit Hyd. Tpeak (min)=       9.00        17.00
     Unit Hyd. peak  (cms)=        .13          .07
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .94          .18          1.083 (iii)
     TIME TO PEAK    (hrs)=       6.05         6.18          6.050
     RUNOFF VOLUME    (mm)=      58.31        26.74         47.585
     TOTAL RAINFALL   (mm)=      58.52        58.52         58.521
     RUNOFF COEFFICIENT   =       1.00          .46           .813
```

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  79.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
002:0004--------------------------------------------------------------------------
*#
*#  PHASE 1 SWM POND
*#
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>01:(PH-1  )   |
| OUT<02:(SWM-1 )   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |     .018  .7258E+00
                            .008  .1525E+00   |     .045  .8365E+00
                            .010  .2370E+00   |     .156  .9516E+00
                            .012  .3263E+00   |     .313  .1071E+01
                            .014  .4198E+00   |     .506  .1195E+01
                            .015  .5175E+00   |     .657  .1259E+01
                            .016  .6195E+00   |     .728  .1324E+01

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (PH-1  )       8.37     1.083     6.050     47.585
     OUTFLOW<02: (SWM-1 )       8.37      .013    12.200     47.579
    OVERFLOW<03: (OVF-1 )        .00      .000      .000       .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    1.189
                    TIME SHIFT OF PEAK FLOW         (min)=   369.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.3670E+00

--------------------------------------------------------------------------------
002:0005--------------------------------------------------------------------------
*#
*#  PHASE 2 DRAINAGE AREA
*#
----------------------
| CALIB STANDHYD     |   Area    (ha)=   32.12
| 01:PH-2   DT= 1.00 |   Total Imp(%)=   71.00   Dir. Conn.(%)=   71.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      22.81         9.31
     Dep. Storage     (mm)=        .20          .60
     Average Slope     (%)=        .50         2.00
     Length            (m)=     466.00        24.50
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      79.21        34.82
                over (min)        9.00        17.00
     Storage Coeff.  (min)=       8.69 (ii)   16.71 (ii)
     Unit Hyd. Tpeak (min)=       9.00        17.00
     Unit Hyd. peak  (cms)=        .13          .07
```

```
                                                          *TOTALS*
     PEAK FLOW       (cms)=       3.88          .59          4.348 (iii)
     TIME TO PEAK    (hrs)=       6.05         6.18          6.050
     RUNOFF VOLUME    (mm)=      58.32        26.74         49.163
     TOTAL RAINFALL   (mm)=      58.52        58.52         58.521
     RUNOFF COEFFICIENT   =       1.00          .46           .840

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  79.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
002:0006----------------------------------------------------------------------
*#
*#  PHASE 2 SWM POND
*#
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>01:(PH-2  )   |
| OUT<02:(SWM-2 )   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |     .065  .2664E+01
                            .032  .6346E+00   |     .068  .3021E+01
                            .036  .7729E+00   |     .278  .3387E+01
                            .042  .1058E+01   |     .657  .3761E+01
                            .047  .1356E+01   |    1.147  .4142E+01
                            .052  .1665E+01   |    1.727  .4530E+01
                            .057  .1986E+01   |    2.550  .4926E+01
                            .061  .2319E+01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (PH-2  )      32.12     4.348     6.050     49.163
     OUTFLOW<02: (SWM-2 )      32.12      .049    12.200     49.158
    OVERFLOW<03: (OVF-2 )        .00      .000      .000       .000

                     TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                     CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                     PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                     PEAK   FLOW   REDUCTION [Qout/Qin](%)=    1.120
                     TIME SHIFT OF PEAK FLOW         (min)=   369.00
                     MAXIMUM  STORAGE   USED       (ha.m.)=.1459E+01

--------------------------------------------------------------------------------
002:0007----------------------------------------------------------------------
--------------------------------------------------------------------------------
002:0002----------------------------------------------------------------------
      FINISH
--------------------------------------------------------------------------------
********************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2020-05-14     at 13:20:58
================================================================================
```

```
2     Metric units
*#*************************************************************************
*#  Project #    :  13958
*#  Project Name :  DERRY BRITANNIA DEVELOPMENTS LIMITED
*#                  MATTAMY HOMES NINTH LINE PROJECT
*#                  CITY OF MISSISSAUGA
*#  Date         :  MAY 2020
*#  Modeller     :  PJ
*#  Company      :  RAND Engineering Corporation
*#  License #    :  4289424
*#*************************************************************************
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
                    ["SCS12100.STM"]
*%-----------------|-------------------------------------------------------|
READ STORM          ["STORM.001"]
*%-----------------|-------------------------------------------------------|
*#
*#  PHASE 1 DRAINAGE AREA
*#
CALIB STANDHYD      ID=[1], NHYD=["PH-1"], DT=[1](min), AREA=[8.37](ha),
                    XIMP=[.85], TIMP=[.85], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[90],
                    Pervious   surfaces: IAper=[0.6](mm), SLPP=[2](%),
                                         LGP=[24.5](m), MNP=[0.25], SCP=[0](min)
                    Impervious surfaces: IAimp=[0.2](mm), SLPI=[0.5](%),
                                         LGI=[466](m), MNI=[0.013], SCI=[0](min)
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-------------------------------------------------------|
*#
*#  PHASE 1 SWM POND
*#
ROUTE RESERVOIR     IDout=[2],   NHYD=["SWM-1"],  IDin=[1],
                    RDT=[1](min),
                          TABLE of ( OUTFLOW-STORAGE ) values
                                      (cms) - (ha-m)
                                    [ 0.000 , 0.0000 ]
                                    [ 0.008 , 0.1525 ]
                                    [ 0.010 , 0.2370 ]
                                    [ 0.012 , 0.3263 ]
                                    [ 0.014 , 0.4198 ]
                                    [ 0.015 , 0.5175 ]
                                    [ 0.016 , 0.6195 ]
                                    [ 0.018 , 0.7258 ]
                                    [ 0.045 , 0.8365 ]
                                    [ 0.156 , 0.9516 ]
                                    [ 0.313 , 1.0711 ]
                                    [ 0.506 , 1.1951 ]
                                    [ 0.657 , 1.2590 ]
                                    [ 0.728 , 1.3243 ]
                                    [   -1  ,  -1    ]  (max twenty pts)
                          IDovf=[3], NHYDovf=["OVF-1"]
*%-----------------|-------------------------------------------------------|
*#
*#  PHASE 2 DRAINAGE AREA
*#
CALIB STANDHYD      ID=[1], NHYD=["PH-2"], DT=[1](min), AREA=[32.12](ha),
                    XIMP=[.86], TIMP=[.86], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[90],
                    Pervious   surfaces: IAper=[0.6](mm), SLPP=[2](%),
                                         LGP=[24.5](m), MNP=[0.25], SCP=[0](min)
                    Impervious surfaces: IAimp=[0.2](mm), SLPI=[0.5](%),
                                         LGI=[466](m), MNI=[0.013], SCI=[0](min)
```

```
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-------------------------------------------------------------|
*#
*#  PHASE 2 SWM POND
*#
ROUTE RESERVOIR     IDout=[2],   NHYD=["SWM-2"],  IDin=[1],
                    RDT=[1](min),
                          TABLE of ( OUTFLOW-STORAGE ) values
                                      (cms) - (ha-m)
                                    [ 0.000 , 0.0000 ]
                                    [ 0.032 , 0.6346 ]
                                    [ 0.036 , 0.7729 ]
                                    [ 0.042 , 1.0583 ]
                                    [ 0.047 , 1.3556 ]
                                    [ 0.052 , 1.6649 ]
                                    [ 0.057 , 1.9860 ]
                                    [ 0.061 , 2.3190 ]
                                    [ 0.065 , 2.6640 ]
                                    [ 0.068 , 3.0208 ]
                                    [ 0.278 , 3.3873 ]
                                    [ 0.657 , 3.7610 ]
                                    [ 1.147 , 4.1419 ]
                                    [ 1.727 , 4.5302 ]
                                    [ 2.550 , 4.9257 ]
                                    [   -1  ,  -1    ]  (max twenty pts)
                          IDovf=[3], NHYDovf=["OVF-2"]
*%-----------------|-------------------------------------------------------------|
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
                    ["S-REG12H"]
*%-----------------|-------------------------------------------------------------|
FINISH
```

```
==============================================================================

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9   =========
                                                        9   9  9   9   # 4289424
        StormWater Management HYdrologic Model           999    999    =========

 ******************************************************************************
 ***************************** SWMHYMO Ver/4.05  ******************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                 OTTHYMO-83 and OTTHYMO-89.                  *********
 ******************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
 *********                  Ottawa,  Ontario: (613) 836-3884           *********
 *********                  Gatineau, Quebec: (819) 243-6858           *********
 *********                  E-Mail: swmhymo@jfsa.Com                   *********
 ******************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: RAND Engineering Corporation                 +++++++++
 +++++++++                Mississauga           SERIAL#:4289424       +++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ******************************************************************************
 *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *********
 *********           Maximum value for ID numbers  :     10            *********
 *********           Max. number of rainfall points: 105408            *********
 *********           Max. number of flow points    : 105408            *********
 ******************************************************************************


 **********************   D E T A I L E D   O U T P U T   **********************
 ******************************************************************************
 *         DATE: 2020-05-14     TIME: 13:16:54     RUN COUNTER: 000265         *
 ******************************************************************************
 * Input   filename: S:\13\13958\SWMHYMO\2020-05\958-REG.DAT                  *
 * Output  filename: S:\13\13958\SWMHYMO\2020-05\958-REG.out                  *
 * Summary filename: S:\13\13958\SWMHYMO\2020-05\958-REG.sum                  *
 * User comments:                                                             *
 * 1:_________________________________________________________________________*
 * 2:_________________________________________________________________________*
 * 3:_________________________________________________________________________*
 ******************************************************************************

-------------------------------------------------------------------------------
001:0001---------------------------------------------------------------------
*#****************************************************************************
*#  Project #    :  13958
*#  Project Name :  DERRY BRITANNIA DEVELOPMENTS LIMITED
*#                  MATTAMY HOMES NINTH LINE PROJECT
*#                  CITY OF MISSISSAUGA
*#  Date         :  MAY 2020
*#  Modeller     :  PJ
*#  Company      :  RAND Engineering Corporation
*#  License #    :  4289424
*#****************************************************************************
--------------------
| START            |  Project  dir.: S:\13\13958\SWMHYMO\2020-05\
```

```
--------------------  Rainfall dir.: S:\13\13958\SWMHYMO\2020-05\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   1
           #  1=SCS12100.STM
-------------------------------------------------------------------------------
001:0002-----------------------------------------------------------------------
--------------------
| READ STORM       |    Filename: * 100 Year 12 hr SCS storm
| Ptotal= 103.43 mm|    Comments: * 100 Year 12 hr SCS storm
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .20   2.040 |   3.20   4.090 |   6.20  25.040 |   9.20   4.090
               .40   2.040 |   3.40   4.090 |   6.40  14.820 |   9.40   4.090
               .60   2.040 |   3.60   4.090 |   6.60  10.730 |   9.60   4.090
               .80   2.040 |   3.80   4.090 |   6.80  10.220 |   9.80   4.090
              1.00   2.040 |   4.00   4.090 |   7.00   7.160 |  10.00   4.090
              1.20   2.040 |   4.20   7.160 |   7.20   6.130 |  10.20   2.040
              1.40   2.040 |   4.40   7.160 |   7.40   6.130 |  10.40   2.040
              1.60   2.040 |   4.60   7.160 |   7.60   6.130 |  10.60   2.040
              1.80   2.040 |   4.80   7.160 |   7.80   6.130 |  10.80   2.040
              2.00   2.040 |   5.00   7.160 |   8.00   6.130 |  11.00   2.040
              2.20   4.090 |   5.20   9.200 |   8.20   4.090 |  11.20   2.040
              2.40   4.090 |   5.40  13.290 |   8.40   4.090 |  11.40   2.040
              2.60   4.090 |   5.60  30.670 |   8.60   4.090 |  11.60   2.040
              2.80   4.090 |   5.80  66.950 |   8.80   4.090 |  11.80   2.040
              3.00   4.090 |   6.00 140.040 |   9.00   4.090 |  12.00   2.040

-------------------------------------------------------------------------------
001:0003-----------------------------------------------------------------------
*#
*#  PHASE 1 DRAINAGE AREA
*#
----------------------
| CALIB STANDHYD     |   Area    (ha)=    8.37
| 01:PH-1   DT= 1.00 |   Total Imp(%)=   85.00   Dir. Conn.(%)=   85.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       7.11         1.26
     Dep. Storage     (mm)=        .20          .60
     Average Slope     (%)=        .50         2.00
     Length            (m)=     466.00        24.50
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=     140.04       124.20
                over (min)        7.00        12.00
     Storage Coeff.  (min)=       6.92 (ii)   11.74 (ii)
     Unit Hyd. Tpeak (min)=       7.00        12.00
     Unit Hyd. peak  (cms)=        .16          .10
                                                          *TOTALS*
     PEAK FLOW       (cms)=       2.33          .29          2.591 (iii)
     TIME TO PEAK    (hrs)=       6.02         6.10          6.033
     RUNOFF VOLUME    (mm)=     103.23        80.67         99.852
     TOTAL RAINFALL   (mm)=     103.43       103.43        103.434
     RUNOFF COEFFICIENT   =       1.00          .78           .965

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  90.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
```

```
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0004----------------------------------------------------------------------
*#
*#  PHASE 1 SWM POND
*#
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>01:(PH-1  )   |
| OUT<02:(SWM-1 )   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |     .018  .7258E+00
                            .008  .1525E+00   |     .045  .8365E+00
                            .010  .2370E+00   |     .156  .9516E+00
                            .012  .3263E+00   |     .313  .1071E+01
                            .014  .4198E+00   |     .506  .1195E+01
                            .015  .5175E+00   |     .657  .1259E+01
                            .016  .6195E+00   |     .728  .1324E+01

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (PH-1  )       8.37     2.591     6.033     99.852
     OUTFLOW<02: (SWM-1 )       8.37      .031    12.117     99.841
    OVERFLOW<03: (OVF-1 )        .00      .000      .000       .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    1.183
                    TIME SHIFT OF PEAK FLOW         (min)=   365.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.7777E+00

--------------------------------------------------------------------------------
001:0005----------------------------------------------------------------------
*#
*#  PHASE 2 DRAINAGE AREA
*#
----------------------
| CALIB STANDHYD     |   Area    (ha)=   32.12
| 01:PH-2   DT= 1.00 |   Total Imp(%)=   86.00   Dir. Conn.(%)=   86.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      27.62         4.50
     Dep. Storage     (mm)=        .20          .60
     Average Slope     (%)=        .50         2.00
     Length            (m)=     466.00        24.50
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     140.04       124.20
                over (min)        7.00        12.00
     Storage Coeff.  (min)=       6.92 (ii)   11.74 (ii)
     Unit Hyd. Tpeak (min)=       7.00        12.00
     Unit Hyd. peak  (cms)=        .16          .10
                                                          *TOTALS*
     PEAK FLOW       (cms)=       9.03         1.03          9.978 (iii)
     TIME TO PEAK    (hrs)=       6.02         6.10          6.033
     RUNOFF VOLUME    (mm)=     103.22        80.68        100.077
     TOTAL RAINFALL   (mm)=     103.43       103.43        103.434
```

```
     RUNOFF COEFFICIENT   =       1.00          .78           .968

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  90.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0006----------------------------------------------------------------------
*#
*#  PHASE 2 SWM POND
*#
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>01:(PH-2  )   |
| OUT<02:(SWM-2 )   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |     .065  .2664E+01
                            .032  .6346E+00   |     .068  .3021E+01
                            .036  .7729E+00   |     .278  .3387E+01
                            .042  .1058E+01   |     .657  .3761E+01
                            .047  .1356E+01   |    1.147  .4142E+01
                            .052  .1665E+01   |    1.727  .4530E+01
                            .057  .1986E+01   |    2.550  .4926E+01
                            .061  .2319E+01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (PH-2  )      32.12     9.978     6.033    100.077
     OUTFLOW<02: (SWM-2 )      32.12      .077    12.167    100.066
    OVERFLOW<03: (OVF-2 )        .00      .000      .000       .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .768
                    TIME SHIFT OF PEAK FLOW         (min)=   368.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.3036E+01

--------------------------------------------------------------------------------
001:0007----------------------------------------------------------------------
  ** END OF RUN :   1

*******************************************************************************




--------------------
| START            |  Project  dir.: S:\13\13958\SWMHYMO\2020-05\
--------------------  Rainfall dir.: S:\13\13958\SWMHYMO\2020-05\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 002
    NSTORM=   1
           #  1=S-REG12H
--------------------------------------------------------------------------------
```

```
002:0002-----------------------------------------------------------------------
*#***************************************************************************
*#  Project #    :  13958
*#  Project Name :  DERRY BRITANNIA DEVELOPMENTS LIMITED
*#                  MATTAMY HOMES NINTH LINE PROJECT
*#                  CITY OF MISSISSAUGA
*#  Date         :  MAY 2020
*#  Modeller     :  PJ
*#  Company      :  RAND Engineering Corporation
*#  License #    :  4289424
*#***************************************************************************
-------------------------------------------------------------------------------
002:0002-----------------------------------------------------------------------
--------------------
| READ STORM       |    Filename: * Regional Storm - 12 Hour
| Ptotal= 211.12 mm|    Comments: * Regional Storm - 12 Hour
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.17	6.350	3.17	12.700	6.17	23.110	9.17	52.880
.33	6.350	3.33	12.700	6.33	23.110	9.33	52.880
.50	6.350	3.50	12.700	6.50	23.110	9.50	52.880
.67	6.350	3.67	12.700	6.67	23.110	9.67	52.880
.83	6.350	3.83	12.700	6.83	23.110	9.83	52.880
1.00	6.350	4.00	12.700	7.00	23.110	10.00	52.880
1.17	4.320	4.17	16.760	7.17	12.700	10.17	37.850
1.33	4.320	4.33	16.760	7.33	12.700	10.33	37.850
1.50	4.320	4.50	16.760	7.50	12.700	10.50	37.850
1.67	4.320	4.67	16.760	7.67	12.700	10.67	37.850
1.83	4.320	4.83	16.760	7.83	12.700	10.83	37.850
2.00	4.320	5.00	16.760	8.00	12.700	11.00	37.850
2.17	6.350	5.17	12.700	8.17	12.700	11.17	12.700
2.33	6.350	5.33	12.700	8.33	12.700	11.33	12.700
2.50	6.350	5.50	12.700	8.50	12.700	11.50	12.700
2.67	6.350	5.67	12.700	8.67	12.700	11.67	12.700
2.83	6.350	5.83	12.700	8.83	12.700	11.83	12.700
3.00	6.350	6.00	12.700	9.00	12.700	12.00	12.700

```
-------------------------------------------------------------------------------
002:0003-----------------------------------------------------------------------
*#
*#  PHASE 1 DRAINAGE AREA
*#
----------------------
| CALIB STANDHYD     |   Area    (ha)=    8.37
| 01:PH-1   DT= 1.00 |   Total Imp(%)=   85.00   Dir. Conn.(%)=   85.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       7.11         1.26
     Dep. Storage     (mm)=        .20          .60
     Average Slope     (%)=        .50         2.00
     Length            (m)=     466.00        24.50
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      52.88        51.59
                over (min)       10.00        17.00
     Storage Coeff.  (min)=      10.22 (ii)   17.07 (ii)
     Unit Hyd. Tpeak (min)=      10.00        17.00
     Unit Hyd. peak  (cms)=        .11          .07
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.04          .17          1.213 (iii)
     TIME TO PEAK    (hrs)=      10.00        10.05         10.000
```

```
     RUNOFF VOLUME    (mm)=     210.90       185.61        207.127
     TOTAL RAINFALL   (mm)=     211.12       211.12        211.120
     RUNOFF COEFFICIENT   =       1.00          .88           .981

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  90.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
002:0004----------------------------------------------------------------------
*#
*#  PHASE 1 SWM POND
*#
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>01:(PH-1  )   |
| OUT<02:(SWM-1 )   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |     .018  .7258E+00
                            .008  .1525E+00   |     .045  .8365E+00
                            .010  .2370E+00   |     .156  .9516E+00
                            .012  .3263E+00   |     .313  .1071E+01
                            .014  .4198E+00   |     .506  .1195E+01
                            .015  .5175E+00   |     .657  .1259E+01
                            .016  .6195E+00   |     .728  .1324E+01

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (PH-1  )       8.37     1.213    10.000    207.127
     OUTFLOW<02: (SWM-1 )       8.37      .667    11.183    207.106
    OVERFLOW<03: (OVF-1 )        .00      .000      .000       .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=   54.942
                    TIME SHIFT OF PEAK FLOW         (min)=    71.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.1268E+01

--------------------------------------------------------------------------------
002:0005----------------------------------------------------------------------
*#
*#  PHASE 2 DRAINAGE AREA
*#
----------------------
| CALIB STANDHYD     |   Area    (ha)=   32.12
| 01:PH-2   DT= 1.00 |   Total Imp(%)=   86.00   Dir. Conn.(%)=   86.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      27.62         4.50
     Dep. Storage     (mm)=        .20          .60
     Average Slope     (%)=        .50         2.00
     Length            (m)=     466.00        24.50
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      52.88        51.59
                over (min)       10.00        17.00
```

```
     Storage Coeff.  (min)=      10.22 (ii)   17.07 (ii)
     Unit Hyd. Tpeak (min)=      10.00        17.00
     Unit Hyd. peak  (cms)=        .11          .07
                                                          *TOTALS*
     PEAK FLOW       (cms)=       4.04          .62          4.659 (iii)
     TIME TO PEAK    (hrs)=      10.00        10.05         10.000
     RUNOFF VOLUME    (mm)=     210.90       185.62        207.380
     TOTAL RAINFALL   (mm)=     211.12       211.12        211.120
     RUNOFF COEFFICIENT   =       1.00          .88           .982

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  90.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
002:0006----------------------------------------------------------------------
*#
*#  PHASE 2 SWM POND
*#
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>01:(PH-2  )   |
| OUT<02:(SWM-2 )   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |     .065  .2664E+01
                            .032  .6346E+00   |     .068  .3021E+01
                            .036  .7729E+00   |     .278  .3387E+01
                            .042  .1058E+01   |     .657  .3761E+01
                            .047  .1356E+01   |    1.147  .4142E+01
                            .052  .1665E+01   |    1.727  .4530E+01
                            .057  .1986E+01   |    2.550  .4926E+01
                            .061  .2319E+01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (PH-2  )      32.12     4.659    10.000    207.380
     OUTFLOW<02: (SWM-2 )      32.12     2.534    11.183    207.356
    OVERFLOW<03: (OVF-2 )        .00      .000      .000       .000

                     TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                     CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                     PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                     PEAK   FLOW   REDUCTION [Qout/Qin](%)=   54.393
                     TIME SHIFT OF PEAK FLOW         (min)=    71.00
                     MAXIMUM  STORAGE   USED       (ha.m.)=.4918E+01

--------------------------------------------------------------------------------
002:0007----------------------------------------------------------------------
--------------------------------------------------------------------------------
002:0002----------------------------------------------------------------------
      FINISH
--------------------------------------------------------------------------------
********************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2020-05-14     at 13:16:54
================================================================================
```

APPENDIX C – TEMPORARY SWM POND SIZING – PHASE 1

TABLE C.1: STORMWATER MANAGEMENT FACILITY STORAGE REQUIREMENTS

DERRY BRITANNIA DEVELOPMENTS LIMITED: PHASE 1 TEMPORARY SWM POND

Table 3.2 Water Quality Storage Requirements based on Receiving Waters *

Protection Level	SWMP Type	Storage Volume (m^3/ha) for Impervious Level 35%	55%	70%	85%
Enhanced	Infiltration	25	30	35	40
80% long-term	Wetlands	80	105	120	140
S.S. removal	Hybrid Wet Pond / Wetland	110	150	175	195
	Wet Pond	140	190	225	250
Normal	Infiltration	20	20	25	30
70% long-term	Wetlands	60	70	80	90
S.S. removal	Hybrid Wet Pond / Wetland	75	90	105	120
	Wet Pond	90	110	130	150
Basic	Infiltration	20	20	20	20
60% long-term	Wetlands	60	60	60	60
S.S. removal	Hybrid Wet Pond / Wetland	60	70	75	80
	Wet Pond	60	75	85	95
	Dry Pond (Continuous Flow)	90	150	200	240

* reproduced from SWM Planning and Design Manual, Ministry of the Environment, March 2003.

The volumetric water quality criteria are presented in Table 3.2. The values are based on a 24-hour drawdown time and a design which conforms to the guidance provided in this manual. Requirements differ with SWMP type to reflect differences in removal efficiencies. Of the specified storage volume for wet facilities, 40 m^3/ha is extended detention, while the remainder represents the permanent pool.

[1] Per Storm Sewer Design Sheets,

Area, A =	8.37
A * C =	5.55
Composite C =	0.66
Imperviousness, I = (C - 0.2) / 0.7 =	66%

Protection Level:	Enhanced
SWMP Type:	Wet Pond
Impervious Level:	66%
Contributing Area:	8.37 ha.

PERMANENT STORAGE

Total storage requirement from Table 3.2	216	m^3/ha
- Active storage requirement	40	m^3/ha
Permanent storage requirement	176	m^3/ha
x Contributing Area	8.37	ha
Permanent Storage Volume	**1,473**	**m^3**

EXTENDED DETENTION STORAGE[2]

25mm storm event runoff	16.54	mm
x Contributing Area	8.37	ha
Extended Detention Storage Volume	**1,384**	**m^3**

[2] Note that this estimate of Extended Detention Storage is exceded by target storage determined from speciific requirements of Phase 3 Implementation and Monitoring Ninth Line Lands Scoped Subwatershed Study (May 2020)

TABLE C.2: POND PERFORMANCE SUMMARY

DERRY BRITANNIA DEVELOPMENTS LIMITED: PHASE 1 TEMPORARY SWM POND

Total Drainage Area (ha):	8.37		
Impervious%:	66%	85%	(for 100-Year & Regional Storm)[2]
Impervious Drainage Area (ha):	5.54	7.08	(for 100-Year & Regional Storm)[2]

	TARGET				DESIGN			
Storm Event	Unit Storage[1] (m^3/Imp ha)	Unit Discharge[1] (m^3/s/ha)	Storage (m^3)	Discharge (m^3/s)	Post-Development Peak Inflow (m^3/s)	Post-Development Peak Outflow (m^3/s)	Model-Predicted Storage (m^3)	Elevation (m)
Erosion / Quality Control								
25 mm storm	275	0.002	1,523	0.017	-	0.008	1,525	191.10
Flood / Quantity Control								
2 Year	450	0.090	2,492	0.753	0.742	0.011	2,614	191.36
5 Year	600	0.380	3,322	3.181	1.083	0.013	3,670	191.59
100 Year	875	1.020	6,195	8.537	2.591	0.031	7,777	192.39
Regional Storm	1,775	1.530	12,567	12.806	1.213	0.667	12,680	193.21

[1] Phase 3 Implementation and Monitoring Plan, Ninth Line Scoped Subwatershed Study, City of Mississauga, May 2020

[2] Per City of Mississauga Development Requirements Manual (2016), in order to account for the increase in runoff due to saturation of the catchment surface that would occur for larger, less frequent storms, an adjustment factor is used. For the 100-year storm, the adjustment factor is 1.25 (applied to all C values <= 0.80).

Per Storm Sewer Design Sheets,

Area, A =	8.37
A * C =	6.63
Composite C =	0.79
Imperviousness, I = (C - 0.2) / 0.7 =	85%

TABLE C.3: STAGE STORAGE DISCHARGE

DERRY BRITANNIA DEVELOPMENTS LIMITED: PHASE 1 TEMPORARY SWM POND

Level	Elevation	Surface Area	Permanent Storage	Active Storage	Quality Control		Quantity Control Outlet			Outlet Structure Conc. Box Open Top		Overflow Spillway		Total Flow	Time to Empty
					Head	Flow	Head	Controlling as	Flow	Head	Flow	Head	Flow		
	(m)	(m^2)	(m^3)	(m^3)	(m)	(m^3/s)	(m)	Weir/Orifice	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m^3/s)	(hrs)
	189.00	1,529													
	189.10	1,648	159												
	189.20	1,767	330												
	189.30	1,885	512												
	189.40	2,004	707												
	189.50	2,123	913												
	189.60	2,199	1,129												
	189.70	2,275	1,353												
	189.80	2,352	1,584												
	189.90	2,428	1,823												
	190.00	2,504	2,070												
	190.10	2,580	2,324												
	190.20	2,740	2,590												
	190.30	2,900	2,872												
	190.40	3,060	3,170												
	190.50	3,220	3,484												
	190.60	3,380	3,814												
PWL	190.70	3,540	4,160												
	190.80	3,677	4,521	361	0.06	0.003									
	190.90	3,813	4,895	735	0.16	0.006									
	191.00	3,950	5,283	1,123	0.26	0.007									
Ext. Det. WL	191.10	4,087	5,685	1,525	0.36	0.008								**0.008**	50
	191.20	4,223	6,101	1,941	0.46	0.010								**0.010**	57
	191.30	4,360	6,530	2,370	0.56	0.010								**0.010**	63
2-Year WL	191.40	4,465	6,971	2,811	0.66	0.011								**0.011**	74
	191.50	4,570	7,423	3,263	0.76	0.012								**0.012**	85
5-Year WL	191.60	4,675	7,885	3,725	0.86	0.013								**0.013**	95
	191.70	4,781	8,358	4,198	0.96	0.014								**0.014**	105
	191.80	4,886	8,841	4,681	1.06	0.014								**0.014**	114
	191.90	4,991	9,335	5,175	1.16	0.015								**0.015**	123
	192.00	5,096	9,839	5,680	1.26	0.016								**0.016**	132
	192.10	5,206	10,355	6,195	1.36	0.016								**0.016**	141
	192.20	5,316	10,881	6,721	1.46	0.017								**0.017**	150
	192.30	5,425	11,418	7,258	1.56	0.018								**0.018**	159
100-Year WL	192.40	5,535	11,966	7,806	1.66	0.018								**0.018**	167
	192.50	5,645	12,525	8,365	1.76	0.019	0.10	WEIR	0.026					**0.045**	172
	192.60	5,755	13,095	8,935	1.86	0.019	0.20	WEIR	0.074					**0.093**	175
	192.70	5,865	13,676	9,516	1.96	0.020	0.30	WEIR	0.136					**0.156**	176
	192.80	5,974	14,268	10,108	2.06	0.020	0.40	WEIR	0.209					**0.230**	177
	192.90	6,084	14,871	10,711	2.16	0.021	0.50	WEIR	0.293					**0.313**	177
	193.00	6,194	15,484	11,325	2.26	0.021	0.60	WEIR	0.385					**0.406**	178
	193.10	6,328	16,111	11,951	2.36	0.022	0.70	WEIR	0.485					**0.506**	178
Regional WL	193.20	6,462	16,750	12,590	2.46	0.022	0.80	WEIR	0.635					**0.657**	179
	193.30	6,595	17,403	13,243	2.56	0.022	0.90	ORIFICE	0.710	0.10	0.542	0.10	0.537	**1.812**	179
	193.40	6,729	18,069	13,909	2.66	0.023	1.00	ORIFICE	0.778	0.20	1.520	0.20	1.653	**3.973**	179
	193.50	6,863	18,749	14,589	2.76	0.023	1.10	ORIFICE	0.840	0.30	2.768	0.30	3.280	**6.912**	179
	193.60	6,997	19,442	15,282	2.86	0.024	1.20	ORIFICE	0.898	0.40	4.226	0.40	5.427	**10.575**	179
	193.70	7,131	20,148	15,988	2.96	0.024	1.30	ORIFICE	0.953	0.50	5.855	0.50	8.111	**14.942**	179
	193.80	7,264	20,868	16,708	3.06	0.025	1.40	ORIFICE	1.004	0.60	7.629	0.60	11.353	**20.012**	179
	193.90	7,398	21,601	17,441	3.16	0.025	1.50	ORIFICE	1.053	0.70	9.530	0.70	15.178	**25.786**	179
	194.00	7,532	22,347	18,188	3.26	0.025	1.60	ORIFICE	1.100	0.80	11.540	0.80	19.609	**32.275**	179

PERMANENT STORAGE: QUALITY CONTROL

Permanent storage requirement:	1,473 m^3
Permanent storage provided:	4,160 m^3
Pond Bottom Elevation:	189.00 m
Permanent Water Level:	190.70 m
Permanent Pool Depth (Main Cell):	1.70 m

EXTENDED DETENTION STORAGE: EROSION & QUALITY CONTROL

Erosion Control Volume:	1,523 m^3
Extended detention provided:	1,525 m^3
Extended detention level:	191.10 m
Extended detention depth:	0.40 m

TABLE C.4: OUTLET STRUCTURE HYDRAULICS

DERRY BRITANNIA DEVELOPMENTS LIMITED: PHASE 1 TEMPORARY SWM POND

Orifice Equation

$Q_o = C_o A_o (2gh_o)^{1/2}$

Weir Equation

$Q_w = C_w L_w h_w^{1.5}$

QUALITY CONTROL OUTLET - ORIFICE

where Q_o = orifice discharge (m^3/s)
C_o = flow coefficient
A = cross-sectional area of orifice (m^2)
[calculated from orifice diameter, d_o (mm)]
g = acceleration due to gravity (m/s^2)
h_o = head above orifice (m)
also, z_o = elevation of orifice (m)

Q_o, h_o =	(see Stage-Storage-Discharge curve)	
C_o =	0.63	
d_o =	80	mm
A_o =	0.005	m^2
g =	9.81	m/s^2
z_o =	190.70	m

QUANTITY CONTROL OUTLET

where Q_w = weir discharge (m^3/s)
C_w = flow coefficient
L_w = weir length (m)
h_w = head above weir (m)
also, z_w = elevation of weir (m)

Q_w, h_w =	(see Stage-Storage-Discharge curve)	
C_w =	1.84	
L_w =	0.45	m
z_w =	192.40	m
z_{TOP} =	193.20	m

OVERFLOW SPILLWAY

where Q_w = weir discharge (m^3/s)
C_w = flow coefficient
L_w = weir length (m)
h_w = head above weir (m)
also, z_w = elevation of weir (m)

Q_w, h_w =	(see Stage-Storage-Discharge curve)	
C_w =	1.55	
L_w =	10.0	m
z_w =	193.20	m
EA Slope (H:1) =	12	
EA Length Factor =	40%	

OVERFLOW TO OUTLET CONTROL STRUCTURE 2400 X 2400 OPEN TOP CONCRETE BOX

where $L_e = L_w - (0.1 * n * h_w)$
$L_w = 2 * (L + W)$
Q_w = weir discharge (m3/s)
C_w = flow coefficient
L = length of opening (m)
W = width of opening (m)

L_w = total weir length (m)
L_e = total effective weir length (m)
n = number of end contractions
h_w = head above weir (m)
z_w = elevation of weir invert (m)

C_w =	1.80	
L =	2.4	m
W =	2.4	m
L_w =	9.6	m
n =	8	
z_w =	193.20	m

APPENDIX D – LID PRACTICES AND WATER BALANCE ANALYSIS

TABLE 1: Phase 1 - Low Impact Development Analysis

DERRY BRITANNIA DEVELOPMENTS LIMITED: PHASE 1

Land Use	Area, A (ha)	Runoff Coeff.[1], C	Imp (%)	A * C
Rear Lane Detached - 10.7m (35')	0.56	0.55	50%	0.31
Rear Lane Townhouse - 6.05m (20')	0.80	0.65	64%	0.52
Street Townhouse - 6.0m (20')	1.70	0.65	64%	1.11
Condo Apartments / Towns / Stacks	0.84	0.65	64%	0.55
Park / Walkway	0.80	0.30	14%	0.24
5m Buffers	0.10	0.65	64%	0.07
Road Widenings, 0.3m Reserves, Laneways, Local ROWs	2.90	0.90	100%	2.61
Total	7.70			5.39
Temp SWMF (DP - Resid. Reserve)	0.50	0.90	100%	
Temp SWMF (DP - Park / Walkway)	0.33	0.90	100%	
Total	8.53			

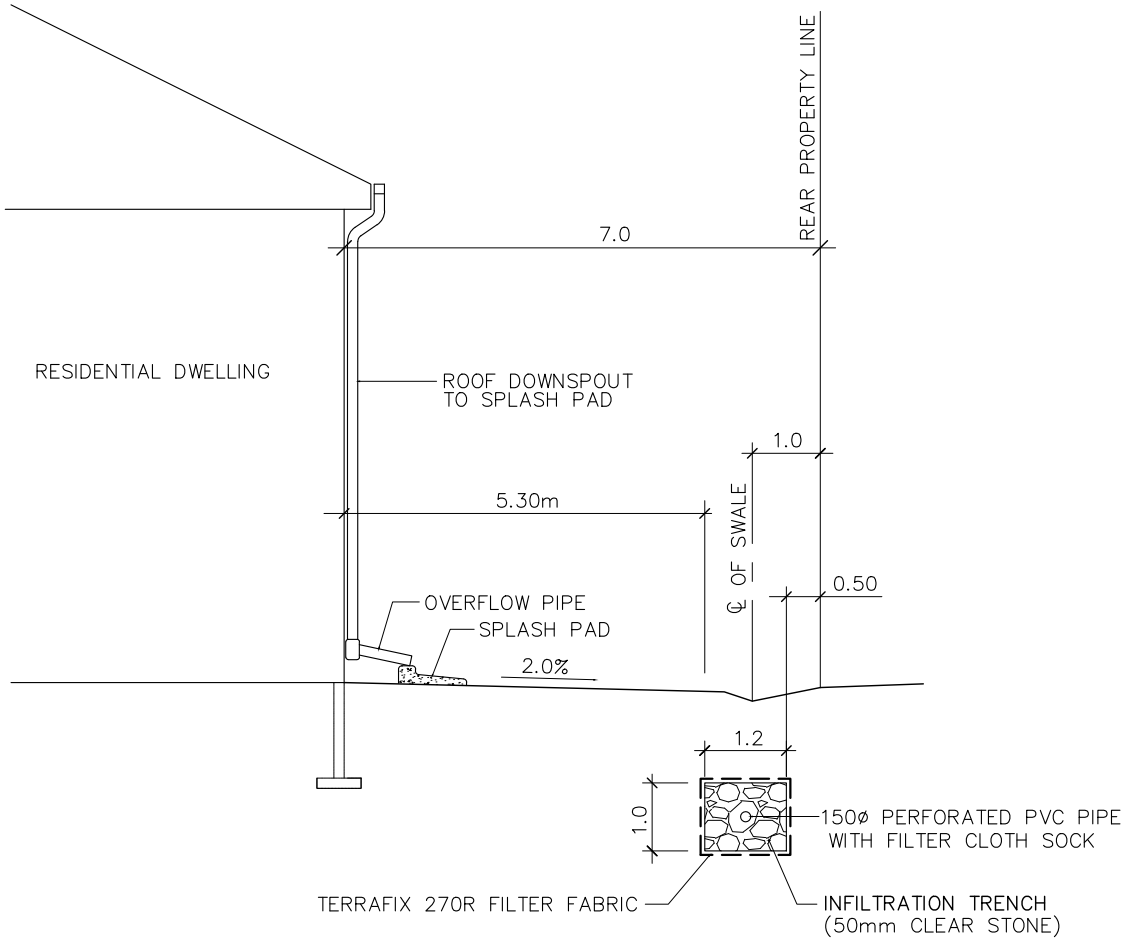
Phase 1 Development Area w/o Temp. Pond	7.70	ha
Total A * C	5.39	
Weighted Runoff Coefficient	0.70	
Imperviousness	0.72	%
Impervious Area	5.51	ha
5mm On-Site Retention Required	**275**	**m^3**

INFILTRATION TRENCH CAPACITY ESTIMATE

The Maximum Allowable Depth d_{Max} = i x ts / n

Average Infiltration Rate (Native Soil)	i =	46.6	mm/hr
Time to drain	ts =	48	hr
Porosity	n =	0.4	
The Maximum Allowable Depth	d_{Max} =	5.6	m
Rear Yard Infiltration Trench Total Length Provided:	L =	360	m
Width:	W =	1.2	m
Depth:	D =	1.0	m
Porosity, n :	n =	0.4	
Trench Bottom Area:	A =	432	m^2
Rear Yard Infiltration Trench Storage Volume Available =		**173**	**m^3**
Park Block Infiltration Trench Total Length Provided:	L =	128	m
Width:	W =	2.6	m
Depth:	D =	0.8	m
Porosity, n :	n =	0.4	
Trench Bottom Area:	A =	333	m^2
Park Block Infiltration Trench Storage Volume Available =		**106**	**m^3**
Total Storage Volume Provided =		**279**	**m^3 > 275 m^3**

[1] From City of Mississauga Development Requirements Manual (2016)



DERRY-BRITANNIA DEVELOPMENTS LIMITED
21T-M 19003

FIGURE No. A

CITY OF MISSISSAUGA

INFILTRATION TRENCH DETAILS

SCALE : NOT TO SCALE

PROJECT No. 13958

RAND ENGINEERING CORPORATION

R:\13\13958\Drawings & Figures_2020 April 27 (Latest)\Figure A_(Infiltration Trench Details).dwg May 11, 2020 - 2:48pm

TABLE 2: Phase 2 - Low Impact Development Analysis

DERRY BRITANNIA DEVELOPMENTS LIMITED: PHASE 2

	Contributing Drainage Area	Area, A (ha)	Runoff Coeff.[1], C	Imp (%)	A * C
Phase 1	Rear Lane Detached - 10.7m (35')	0.56	0.55	50%	0.31
	Rear Lane Townhouse - 6.05m (20')	0.80	0.65	64%	0.52
	Street Townhouse - 6.0m (20')	1.70	0.65	64%	1.11
	Condo Apartments / Towns / Stacks	0.84	0.65	64%	0.55
	Residential Reserve (Future Condo Apartments / Towns / Stacks)	0.50	0.65	64%	0.33
	Park / Walkway	0.33	0.30	14%	0.10
	Park / Walkway	0.76	0.30	14%	0.23
	5m Buffers	0.10	0.65	64%	0.07
	Road Widenings, 0.3m Reserves, Laneways, Local ROWs	2.90	0.90	100%	2.61
Phase 2	Rear Lane Townhouse - 6.05m (20')	1.29	0.65	64%	0.84
	Street Townhouse - 6.0m (20')	1.72	0.65	64%	1.12
	Condominium Duplex	1.71	0.65	64%	1.11
	Condo Apartments / Towns / Stacks	4.52	0.65	64%	2.94
	Residential Reserve (Future Condo Apartments / Towns / Stacks)	0.49	0.65	64%	0.32
	Park / Walkway / Trail	2.09	0.30	14%	0.63
	Road Widenings, 0.3m Reserves, Laneways, Local ROWs	5.53	0.90	100%	4.98
	Total	25.84			17.73
	SWM Pond	2.87	0.90	100%	
	Total	28.71			

Phases 1 and 2 Development Area w/o Pond	25.84	ha
Total A * C	17.73	
Weighted Runoff Coefficient	0.69	
Imperviousness	0.69	%
Impervious Area	17.95	ha
5mm On-Site Retention Required	**898**	**m^3**

[1] From City of Mississauga Development Requirements Manual (2016)

18-692-100 **May 14, 2020**

Derry and Britannia Developments (Mattamy Homes)
Ninth Line, Mississauga, ON

Via email: Craig.Scarlett@mattamycorp.com

Re: Draft Water Balance Analysis- Phase 1 (North Block)
Derry & Britannia Developments-Ninth Line, Mississauga, ON

1.0 INTRODUCTION

DS Consultants Ltd. (DS) completed a water balance study for the proposed Phase 1 (North Block) development located along Ninth Line between Britannia Road and Derry Road in Mississauga, Ontario (Site). The Site is currently vacant and is currently used as agricultural land. The Site is proposed to be developed as a residential subdivision occupying an area of about 85,300 m^2 (8.53 ha). A variety of Low Impact Development (LID) measures are also proposed at the Site to responsibly manage stormwater. To inform the design of LIDs, a Thornthwaite Monthly Water Balance Model was completed and used to evaluate pre-development and post-development hydrological conditions at the Site. The results can be used to design appropriate LID measures to compensate for any anticipated changes or deficits in site hydrology.

2.0 WATER BALANCE ASSESSMENT

2.1 Existing Conditions (Pre-Development)

The Phase 1 Site has a total area of 85,300 m^2 (8.53 ha) and includes approximate pervious areas totalling 35,000 m^2 (agricultural land) and 50,300 m^2 (pasture and shrubs). Pre-development land use is summarised in **Table 2.1**. **Figure 1** shows the pre-development conceptual model considered for establishing current hydrologic conditions.

2.2 Proposed Development (Post-Development)

The proposed area for subdivision is 85,300 m^2 (8.53 ha) with Low Impact Development (LID) measures. For the water balance calculations in this report, it is estimated that the proposed subdivision will include residential dwellings with a combined roof area of about 24,900 m^2 and a paved/road/driveway and undeveloped area of about 38,400 m^2 and the remaining area of 22,000 m^2 will be developed as a pervious area with LID measures. Post-development land use is summarised in **Table 2.1**. **Figure 2** shows the post-development conceptual model considered for establishing post-hydrologic conditions.

Table 2.1: Pre-Development and Post- Development Land Use

Land Use	Pre-Development Area (m^2)	Post-Development Area (m^2)
Impervious Area		
Residential Dwellings (Detached)	-	2,800
Residential Dwellings (Townhomes/condo) & Buffer	-	22,100
Driveways/Roads/Paved surface		29,000
Walkway(park)		1,100
Temp. SWM (Proposed Residential reserved and Park/walkway)		8,300
Pervious Area		
Open Space-Agricultural Land	35,000	-
Open Space-Pasture and Shrubs	50,300	-
Urban Lawn/Landscape-Detached Home	-	2,800
Urban Lawn/Landscape-Town Home/Condo & Buffer	-	12,300
Open Space- Park	-	6,900
Total	**85,300**	**85,300**

2.3 Water Balance Components (Thornthwaite Monthly Water Balance Model)

The Thornthwaite water balance (Thornthwaite, 1948; Mather, 1978; 1979) is an accounting type method used to analyze the allocation of water among various components of the hydrologic cycle. Inputs to the model are monthly temperature, Site latitude, precipitation, and stormwater run-on. Outputs include monthly potential and actual evapotranspiration, evaporation, water surplus, total infiltration, and total runoff. For ease of calculation, a spreadsheet model was used for the computation.

When precipitation (P) occurs, it can either runoff (R) through the surface water system, infiltrate (I) to the water table, or evaporate/evapotranspiration (ET) from the earth's surface and vegetation. The sum of R and I is termed as the water surplus (S). When long-term averages of P, R, I and ET are used, there is no net change in groundwater storage (ST). Annually, however, there is a potential for minor changes in ST. The annual water budget can be stated as **P = ET + R + I + ST** and the components are discussed below.

Precipitation (P)

Based on the 30-year average for Georgetown WWTP Station in Ontario, the average precipitation for the area is about 877.3 mm/year for the period between 1981 and 2010. Also, the average monthly temperature from this station has been used. The monthly distribution of precipitation is presented in **Table A1, Appendix A.**

Storage (ST)

Groundwater storage (ST) of native soils for the existing Site was estimated using values of Water Holding Capacity (mm) of respective land use and soil types identified in Table 3.1 of the Storm Water Management (SWM) Planning & Design Manual (MOE, March 2003). The land uses, soil types and respective water holding capacities shown in **Table 2.2** were chosen to represent existing conditions and applied to March for monthly calculations.

Table 2.2: Water Holding Capacity of Native Soils in Pervious Areas

Land Uses	Soil Types	Water Holding Capacity (mm/year)	
		Pre-Development	Post-Development
Agriculture land- Moderately Rooted Crops	Clayey Loam	200	-
Pasture and Shrubs	Clayey Loam	250	-
Landscape/Urban Lawn	Clay Loam	-	100

Using the procedures outlined in the SWM Planning & Design Manual for the above land use and soil type, the annual change in storage is zero (0).

Evapotranspiration (ET)

Monthly Potential Evapotranspiration (PET) is estimated using monthly temperature data and is defined as a water loss from a homogeneous vegetation-covered area that never lacks water (Thornthwaite,1948; Mather, 1978). In the Thornthwaite water balance model, PET is calculated using the Hamon equation (Hamon, 1061);

PET Hamon = 13.97 * d * D2 * Wt

Where:

d = the number of days in the month

D = the mean monthly hours of daylight in units of 12 hours

Wt = a saturated water vapour density term = 4.95 * e0.627/100

T = the monthly mean temperature in degrees Celsius

The calculated Actual Evapotranspiration (AET) is based on PET and changes in ST (Δ ST). Where there is not enough P to satisfy PET, a reduction in ST occurs. As a result, volumes of AET are less than PET. Also, it is assumed that evaporation will occur and will amount to 15% of the total precipitation for an impervious cover.

Precipitation Surplus (S)

Precipitation surplus is calculated as P–ET. For pervious areas, ET is considered AET and for impervious areas, ET is evaporation.

Infiltration (I) and Runoff (R)

For pervious areas, precipitation surplus has two components in the Thornthwaite model: a runoff component (overland flow that occurs when soil moisture capacity is exceeded) and an infiltration component. The accumulation of infiltration factors for topography, soil types and the cover as prescribed in Table 3.2 of the SWM Planning & Design Manual, MECP(2003) give infiltration factors for existing conditions on the Site as shown below in **Table 2.3**.The runoff component calculated in the pre-development and post-development is the remaining volume of precipitation surplus following AET, ET and infiltration. Runoff coefficients were selected for the post-development using the City of Mississauga Development Requirements Manual (2016).

Table 2.3: Pre-Development and Post-Development Conditions – Infiltration Factors

Land Uses	Topography	Soil	Cover	Infiltration factor	Runoff Coefficient
Pre- Development Conditions					
Agriculture Land	0.3	0.2	0.1	0.6*	0.4*
Pasture and Shrubs	0.2	0.3	0.1	0.6*	0.4*
Post- Development Conditions					
Urban Lawn/Landscape-Detached Home	-	-	-	0.45	0.55**
Urban Lawn/Landscape-Town home/Condo	-	-	-	0.35	0.65**
Open Space- Park	-	-	-	0.70	0.30**
Road/Walkway/Buildings/Temp SWM area				-	0.90**

Note:
*** Table 3.2 of the SWM Planning & Design Manual (March 2003), MECP**
****Runoff coefficient provided to DS based on the City of Mississauga Development Requirements Manual (2016)**

2.4 Water Balance Analysis

To predict outputs of the pre-development and post-development water balance, various inputs were entered into the Thornthwaite model including monthly precipitation and temperature, Site latitude, water holding capacity values for native soils and factors of infiltration as discussed in section 2.3. The analysis is summarised below, and the detailed calculations are presented in **Table A 1-3, Appendix A.**

2.4.1 Water Balance- Pre-Development

The average precipitation for the area is about 877.4 mm/year. For the pervious area, the calculated PET is 585 mm/year or about 67% of the total precipitation. The monthly distribution of ST for the pervious area in clayey loam produced a unit area annual AET of 545 mm/year and 553 mm/year for an agriculture land and shrub and pastures lands. Given a total pervious area of 85,300 m^2, the existing development is expected to produce an evapotranspiration/AET 46,898 m^3/year, an

infiltration 16,762 m^3/year and a runoff 11,174 m^3/year. The analysis is summarised as below in **Table 2.4**. The detailed calculations are presented in **Table A-2, Appendix A.**

Table 2.4: Summary of Water Balance- Pre-Development Land Use

Land Use	Area(m^2)	Evaporation/AET m^3/year	Infiltration m^3/year	Runoff m^3/year
Pervious Area				
Open Space-Agriculture Land	35,000	19,078	6,977	4,651
Open Space- Pasture/Shrubs	50,300	27,820	9,785	6,523
Impervious Area				
Building/Driveway(m^2)	-	-	-	-
Total Post- Development Area- (m^2)	**85,300**	**46,898**	**16,762**	**11,174**

2.4.2 Water Balance- Post-Development (Without mitigation)

A post-development water balance was completed using the draft plan of subdivision, Derry Britannia Development Limited. In the post-construction scenario, changes in land use will result in about 29,400 m^2 of paved surfaces, 31,000 m^2 of buildings and 28,600 m^2 of pervious areas (landscaped and park). The monthly distribution of ST for a landscaped area and open space (parks) produced a unit area annual AET of 509 mm/year. For the impervious areas, it is assumed that evaporation will occur and will amount to 10% of total precipitation (790 mm/year). Given a total pervious area of 22,000 m^2 and an impervious area of 63,300 m^2, the proposed development is expected to produce an evapotranspiration/AET 16,763 m^3/year, an infiltration 5,180 m^3/year and a runoff 52,891 m^3/year. The analysis is summarised as below in **Table 2.5.** The detailed calculations are presented in **Table A-3, Appendix A.**

Table 2.5: Summary of Water Balance- Post-Development

Land Use	Area(m^2)	Evaporation/AET m^3/year	Infiltration m^3/year	Runoff m^3/year
Pervious Area				
Urban Lawn/Landscape-Buildings (Detached home)	28,00	1,427	463	567
Urban Lawn/Landscape-Buildings (Townhome/Condo) & Buffer	12,300	6,267	2,940	1,583
Open Space-Park	6,900	3,516	1,776	761
Impervious Area				
Buildings (Roofs)	24,900	2,185	-	19,660
Roads/ Driveways/Paved Surface/Temp SWM	38,400	3,369	-	30,320
Total Post-Development	**85,300**	**16,763**	**5,180**	**52,891**

2.4.3 Water Balance-Post-Development (With Mitigation- LID Measures)

Based on the results of the pre-development and post-development water balance completed, the proposed development is expected to produce a reduction in annual infiltration about 69 % (-11582 m^3/year) and an increase in annual runoff about 79% (+41717 m^3/year). Low impact development (LID) measures are proposed at the site to manage stormwater and minimize surface runoff and to promote infiltration. Based on LID analysis by RAND Engineering, four infiltration trenches have proposed and designed to retain and infiltrate a 5 mm of runoff from an impervious area of about 5.5 ha(excluded temp SWM area) as per the City of Mississauga's requirement.

The annual rainfall volume for 5 mm on-site retention is 421 mm, about 48% of the total annual average precipitation of 877.3 for the site. This value is estimated based on figure 1a - % of Total Annual Average Rainfall Depth Vs. Daily Rainfall Amounts (Wet Weather Flow Management Guidelines, City of Toronto, 2006). The total provided storage volume of the trenches is 279 m^3 for 5mm run-off retention form impervious area, can accommodate run-off volume of about 20,870 m^3 for infiltration. Considering 60 % runoff reduction efficiency for infiltration trenches, the expected total available runoff for infiltration is 12,522 m^3/year with LID. Also, it is proposed to increase topsoil depth to 300 mm across the site to enhance evaporation and infiltration within the upper shallow zone.

2.4.4 Water Balance Results - Pre-Development to Post- Development Changes (with mitigation)

Based on the results of the pre-development and post-development water balance completed, the proposed development with LID measures is expected to produce an increase in annual infiltration (940 m^3/year) and an increase in annual runoff (29,195 m^3/year). The effects are the result of increased impervious area, replacing pervious areas of the Site. The analysis is summarised as below in Table 2.6.

Table 2.6: Summary of Water Balance- Pre-Development and Post-Development

Development Stage	Unit	Infiltration	Runoff
Pre-Development	m^3/year	16,762	11,174
Post-Development (No mitigation)	m^3/year	5,180	52,891
Change (Pre- to Post-Development)- No Mitigation	**Change- m^3/year**	**-11,582**	**41,717**
	% Change	**-69**	**+79**
Post-Development -With Mitigation-LID Measures	m^3/year	+ 12,522	-12,522
Change (Pre- to Post-Development)- With LID Measures	**Change- m^3/year**	**+940**	**+29,195**
	% Change	**+8**	**+70**

3.0 CONCLUSIONS AND RECOMMENDATIONS

A water balance analysis was completed for the Site to estimate pre-development and post-development evaporation, infiltration and runoff for the proposed development. The following are our conclusions and recommendations based on water balance results.

- The proposed development without LID measures is expected to produce a reduction in annual infiltration (-11582 m^3/year or -69 %) and an increase in annual runoff (+52,891 m^3/year or +79 %). The effects are mainly the result of increased impervious area, replacing pervious areas of the Site.
- Low impact development (LID) measures are proposed at the site to manage stormwater and minimize surface runoff and to promote infiltration. Four infiltration trenches have proposed and designed to retain and infiltrate 5 mm of runoff from an impervious area of about 5.5 ha (excluded temp SWM area) as per the City of Mississauga's requirement.
- The total provided storage volume of the trenches is 279 m^3 for 5mm run-off retention from the impervious area, can accommodate run-off volume of about 20,870 m^3 for infiltration. Considering 60 % runoff reduction efficiency for infiltration trenches, the expected total available runoff for infiltration is 12,522 m^3/year with LID. Also, it is proposed to increase topsoil depth to 300 mm across the site to enhance evaporation and infiltration within the upper shallow zone.
- DS recommends retaining and infiltrating clean water from the roof area and avoiding heavy traffic area such as the road to minimise contamination. Considering the roof area (impervious) of the proposed development (24,900 m^2), the estimated annual runoff produced from the roof area is 19660 m^3/year. There is enough clean water supply available to eliminate the infiltration deficit.
- The proposed development with LID measures is expected to produce an increase in annual infiltration (+940 m^3/year or + 8 %) and an increase in annual runoff (+29,195 m^3/year or +70 %).

We trust this report satisfies your needs. If there are questions or you need more information, please do not hesitate to contact our office.

DS CONSULTANTS LTD

Prepared By:

Reviewed By:

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Hydrogeologist

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Senior Hydrogeologist

Attachments:

Figures:

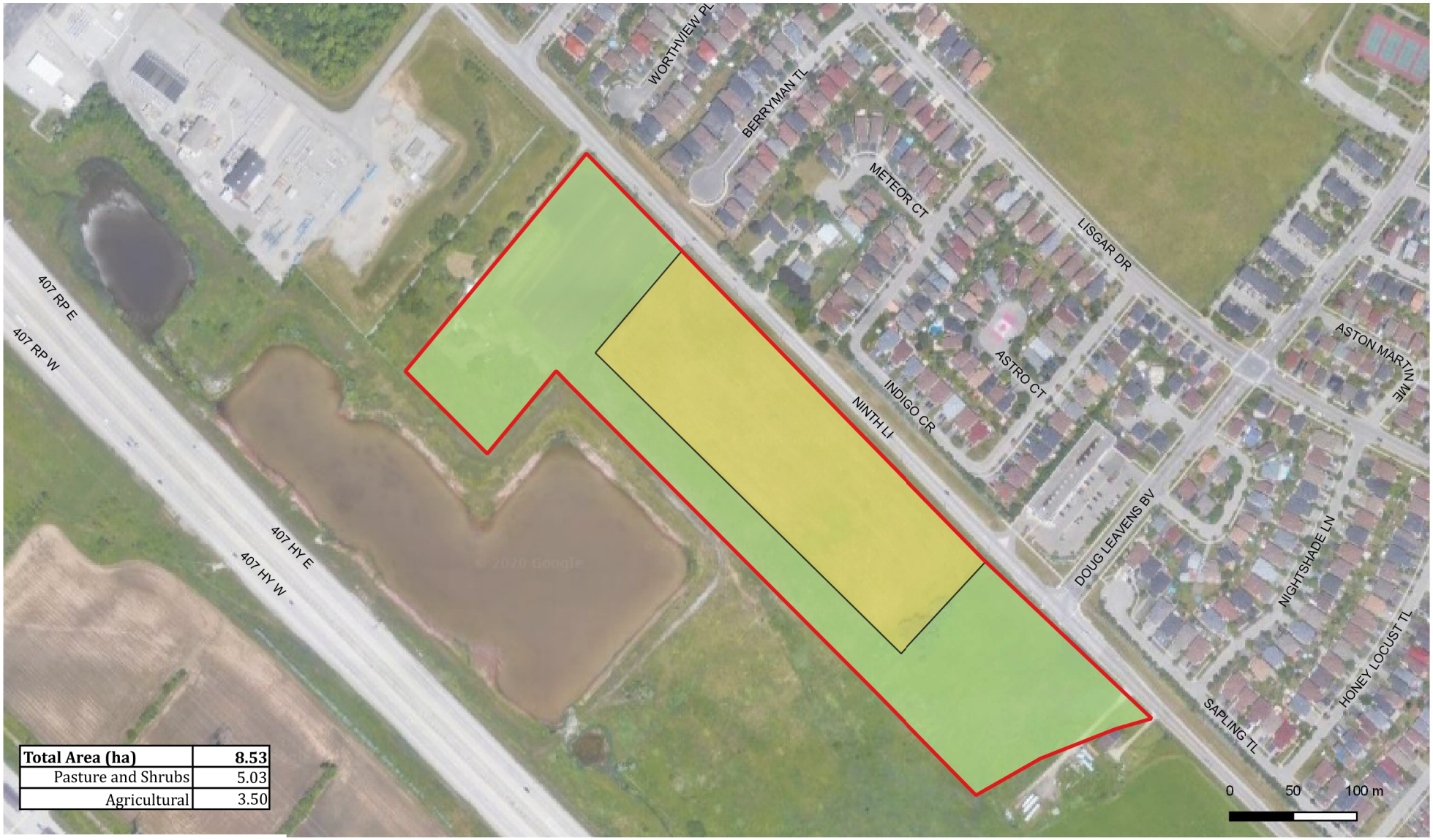
Figure 1: Pre-Development Land Use
Figure 2: Post-Development Land Use

Appendix:

Appendix A: Water Balance Tables A 1 through A3

Figures

C:\0Sharon\18-692-100 Ninth Line_Mattamy Development\1-QGIS\HydroG\Figure 1 - Pre Development - North Block.qgs



Total Area (ha)	8.53
Pasture and Shrubs	5.03
Agricultural	3.50

Legend

- Phase 1 North Block Boundary
- Agricultural
- Pasture and Shrubs

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Client: DERRY BRITANNIA DEVELOPMENTS LTD.

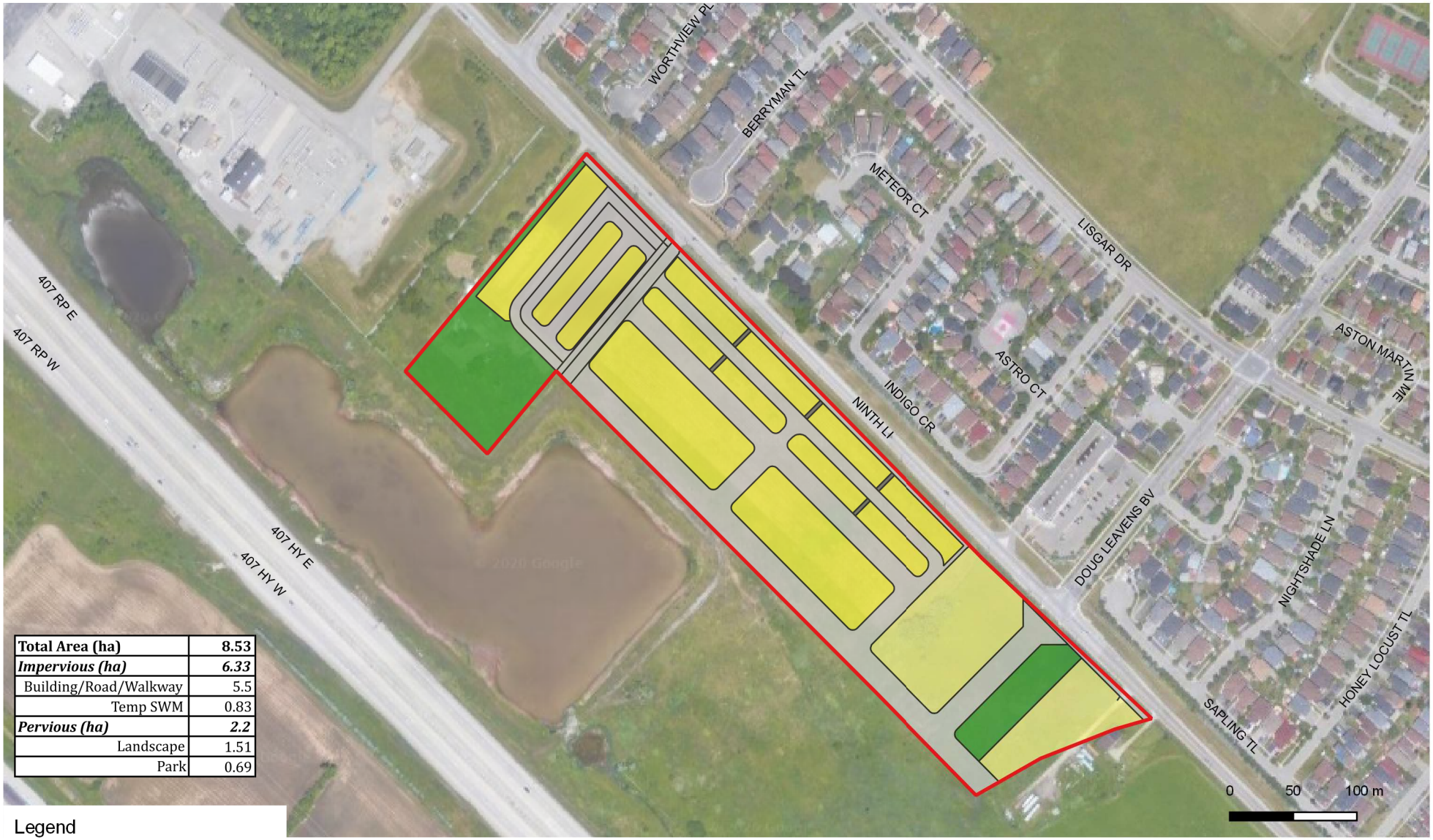
Project: HYDROGEOLOGICAL INVESTIGATION
Ninth Line Properties, Ninth Line, Mississauga, ON

Title: **PRE-DEVELOPMENT LANDUSE (NORTH BLOCK)**

N

Size: 8.5 x 11	Approved By: P.P	Drawn By: S.Y	Date: May 2020
Rev: 0	Scale: As Shown	Project No.: 18-692-100	Figure No.: 1
	Image/Map Source: *Google Satellite Image*		

C:\0Sharon\18-692-100 Ninth Line_Mattamy Development\1-QGIS\HydroG\Figure 2 - Post Development - North Block.qgs



Total Area (ha)	**8.53**
Impervious (ha)	***6.33***
Building/Road/Walkway	5.5
Temp SWM	0.83
Pervious (ha)	***2.2***
Landscape	1.51
Park	0.69

Legend

- Phase 1 North Block Boundary
- Semi/Detached Homes
- Condo/Townhouses
- Park
- Road
- Walkway

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Client: DERRY BRITANNIA DEVELOPMENTS LTD.

Project: HYDROGEOLOGICAL INVESTIGATION
Ninth Line Properties, Ninth Line, Mississauga, ON

Title: **POST-DEVELOPMENT LANDUSE (NORTH BLOCK)**

N

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	P.P	S.Y	May 2020
Rev: 0	Scale: As Shown	Project No.: 18-692-100	Figure No.: **2**

Image/Map Source: *Google Satellite Image*

Appendix A:
Water Balance Tables(A1-A3)

TABLE A-1

CLIMATE NORMALS 1981-2010 (GEORGETOWN WWTP, ONTARIO)

Water Balance -Derry and Britannia Developments, Ninth Line,Mississauga(Phase1-North Side)

	Thornthwaite (1948)					
Month	**Mean Temperature (°C)**	**Heat Index**	**Unadjusted Potential Evapotranspiration (mm)**	**Daylight Correction Value**	**Adjusted Potential Evapotranspiration (mm)**	**Total Precipitation (mm)**
January	-6.3	0.0	0.0	0.81	0.0	67.8
February	-5.2	0.0	0.0	0.82	0.0	60.0
March	-0.9	0.0	0.0	1.02	0.0	57.2
April	6.0	1.3	28.0	1.13	31.6	76.5
May	12.3	3.9	59.7	1.27	75.8	79.3
June	17.4	6.6	86.1	1.29	111.1	74.8
July	20.0	8.2	99.8	1.30	129.7	73.5
August	19.0	7.5	94.5	1.20	113.4	79.3
September	14.8	5.2	72.6	1.04	75.5	86.2
October	8.4	2.2	39.9	0.95	37.9	68.3
November	2.8	0.4	12.5	0.8	10.0	88.5
December	-2.9	0.0	0.0	0.76	0.0	65.9
TOTALS		**35.3**	**493.2**		**585.2**	**877.3**

Notes: Daylight Correction values obtained from Instruction and Tables For Computing Potential Evapotranspiration and The Water Balance (Thornthwaite & Mather, 1957)

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TABLE A-2

Pre-development Water Balance

Water Balance -Derry and Britannia Developments, Ninth Line,Mississauga(Phase1-North Side)

Catchments and Hydrologic Components			Month												Total
			March	April	May	June	July	August	September	October	November	December	January	February	
PET - Adjusted Potential Evapotranspiration (mm)			0.00	31.63	75.85	111.10	129.70	113.41	75.51	37.94	10.02	0.00	0.00	0.00	**585.15**
P - Total Precipitation (mm)			57.20	76.50	79.30	74.80	73.50	79.30	86.20	68.30	88.50	65.90	67.80	60.00	**877.30**
P-PET (mm)			57.20	44.87	3.45	-36.30	-56.20	-34.11	10.69	30.36	78.48	65.90	67.80	60.00	-
Soil Moisture Deficit (mm)			0.00	0.00	0.00	-36.30	-92.50	-126.61	-115.92	-85.55	-7.07	0.00	0.00	0.00	-
Ninth Line	Open Space Pervious Area-Agricultural Land-Moderately Rooted Crops-Clay Loam	**Soil Moisture Storage (mm)**	200.00	200.00	200.00	163.70	107.50	73.39	84.08	114.45	192.93	200.00	200.00	200.00	-
		Actual Potential Evapotranspiration (mm)	0.00	31.63	75.85	107.81	111.60	94.73	75.51	37.94	10.02	0.00	0.00	0.00	**545.08**
		P-AET (mm)	57.20	44.87	3.45	-33.01	-38.10	-15.43	10.69	30.36	78.48	65.90	67.80	60.00	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-33.01	-71.11	-86.53	-75.84	-45.48	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	33.01	38.10	15.43	-10.69	-30.36	-45.48	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	57.20	44.87	3.45	0.00	0.00	0.00	0.00	0.00	33.00	65.90	67.80	60.00	**332.22**
		MOECC Infiltration Factor	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Run-Off Coefficient	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Infiltration (mm)	34.32	26.92	2.07	0.00	0.00	0.00	0.00	0.00	19.80	39.54	40.68	36.00	**199.33**
		Run-Off (mm)	22.88	17.95	1.38	0.00	0.00	0.00	0.00	0.00	13.20	26.36	27.12	24.00	**132.89**
		Catchment Area (m^2) = 35000.00					**Subcatchment Monthly Volumes**								
		Infiltration (m^3)	1201.20	942.17	72.50	0.00	0.00	0.00	0.00	0.00	693.09	1383.90	1423.80	1260.00	**6976.65**
		Run-Off (m^3)	800.80	628.11	48.33	0.00	0.00	0.00	0.00	0.00	462.06	922.60	949.20	840.00	**4651.10**
	Open Space Pervious Area-Pasture and Shrubs-Clay Loam	**Soil Moisture Storage (mm)**	250.00	250.00	250.00	213.70	157.50	123.39	134.08	164.45	242.93	250.00	250.00	250.00	-
		Actual Potential Evapotranspiration (mm)	0.00	31.63	75.85	108.47	115.22	98.46	75.51	37.94	10.02	0.00	0.00	0.00	**553.09**
		P-AET (mm)	57.20	44.87	3.45	-33.67	-41.72	-19.16	10.69	30.36	78.48	65.90	67.80	60.00	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-33.67	-75.39	-94.55	-83.86	-53.49	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	33.67	41.72	19.16	-10.69	-30.36	-53.49	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	57.20	44.87	3.45	0.00	0.00	0.00	0.00	0.00	24.99	65.90	67.80	60.00	**324.21**
		MOECC Infiltration Factor	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Run-Off Coefficient	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Infiltration (mm)	34.32	26.92	2.07	0.00	0.00	0.00	0.00	0.00	14.99	39.54	40.68	36.00	**194.52**
		Run-Off (mm)	22.88	17.95	1.38	0.00	0.00	0.00	0.00	0.00	10.00	26.36	27.12	24.00	**129.68**
		Catchment Area (m^2) = 50300.00					**Subcatchment Monthly Volumes**								
		Infiltration (m^3)	1726.30	1354.04	104.19	0.00	0.00	0.00	0.00	0.00	754.17	1988.86	2046.20	1810.80	**9784.56**
		Run-Off (m^3)	1150.86	902.69	69.46	0.00	0.00	0.00	0.00	0.00	502.78	1325.91	1364.14	1207.20	**6523.04**
							Total Catchment Volumes								
	Total AET (m^3)		0.00	2698.44	6469.82	9229.32	9701.49	8268.02	6440.77	3235.90	854.60	0.00	0.00	0.00	**46898.34**
	Total Infiltration (m^3)		2927.50	2296.21	176.68	0.00	0.00	0.00	0.00	0.00	1447.26	3372.76	3470.00	3070.80	**16761.21**
	Surface Water Contribution -Total Runoff (m^3)		1951.66	1530.80	117.79	0.00	0.00	0.00	0.00	0.00	964.84	2248.51	2313.34	2047.20	11174.14

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TABLE A-3

Post-development Water Balance

Water Balance -Derry and Britannia Developments, Ninth Line,Mississauga(Phase1-North Side)

Catchments and Hydrologic Components			Month												Total
			March	April	May	June	July	August	September	October	November	December	January	February	
PET - Adjusted Potential Evapotranspiration (mm)			0.00	31.63	75.85	111.10	129.70	113.41	75.51	37.94	10.02	0.00	0.00	0.00	**585.15**
P - Total Precipitation (mm)			57.20	76.50	79.30	74.80	73.50	79.30	86.20	68.30	88.50	65.90	67.80	60.00	**877.30**
P-PET (mm)			57.20	44.87	3.45	-36.30	-56.20	-34.11	10.69	30.36	78.48	65.90	67.80	60.00	-
Soil Moisture Deficit (mm)			0.00	0.00	0.00	-36.30	-92.50	-126.61	-115.92	-85.55	-7.07	0.00	0.00	0.00	-
Ninth Line	Pervious Area-Detached home-Landscape	**Soil Moisture Storage (mm)**	100.00	100.00	100.00	63.70	7.50	0.00	10.69	41.06	100.00	100.00	100.00	100.00	-
		Actual Potential Evapotranspiration (mm)	0.00	31.63	75.85	104.51	93.50	80.58	75.51	37.94	10.02	0.00	0.00	0.00	**509.54**
		P-AET (mm)	57.20	44.87	3.45	-29.71	-20.00	-1.28	10.69	30.36	78.48	65.90	67.80	60.00	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-29.71	-49.72	-51.00	-40.31	-9.94	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	29.71	20.00	1.28	-10.69	-30.36	-9.94	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	57.20	44.87	3.45	0.00	0.00	0.00	0.00	0.00	68.54	65.90	67.80	60.00	**367.76**
		MOECC Infiltration Factor	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	
		Run-Off Coefficient	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	-
		Infiltration (mm)	25.74	20.19	1.55	0.00	0.00	0.00	0.00	0.00	30.84	29.66	30.51	27.00	**165.49**
		Run-Off (mm)	31.46	24.68	1.90	0.00	0.00	0.00	0.00	0.00	37.70	36.25	37.29	33.00	**202.27**
		Catchment Area (m^2) = 2800.00					**Subcatchment Monthly Volumes**								
		Infiltration (m^3)	72.07	56.53	4.35	0.00	0.00	0.00	0.00	0.00	86.36	83.03	85.43	75.60	**463.38**
		Run-Off (m^3)	88.09	69.09	5.32	0.00	0.00	0.00	0.00	0.00	105.55	101.49	104.41	92.40	**566.35**
	Pervious Area-Town /condo-Landscape & Buffer	**Soil Moisture Storage (mm)**	100.00	100.00	100.00	63.70	7.50	0.00	10.69	41.06	100.00	100.00	100.00	100.00	-
		Actual Potential Evapotranspiration (mm)	0.00	31.63	75.85	104.51	93.50	80.58	75.51	37.94	10.02	0.00	0.00	0.00	**509.54**
		P-AET (mm)	57.20	44.87	3.45	-29.71	-20.00	-1.28	10.69	30.36	78.48	65.90	67.80	60.00	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-29.71	-49.72	-51.00	-40.31	-9.94	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	29.71	20.00	1.28	-10.69	-30.36	-9.94	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	57.20	44.87	3.45	0.00	0.00	0.00	0.00	0.00	68.54	65.90	67.80	60.00	**367.76**
		MOECC Infiltration Factor	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	
		Run-Off Coefficient	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	-
		Infiltration (mm)	37.18	29.16	2.24	0.00	0.00	0.00	0.00	0.00	44.55	42.84	44.07	39.00	**239.04**
		Run-Off (mm)	20.02	15.70	1.21	0.00	0.00	0.00	0.00	0.00	23.99	23.07	23.73	21.00	**128.72**
		Catchment Area (m^2) = 12300.00					**Subcatchment Monthly Volumes**								
		Infiltration (m^3)	457.31	358.70	27.60	0.00	0.00	0.00	0.00	0.00	547.98	526.87	542.06	479.70	**2940.23**
		Run-Off (m^3)	246.25	193.15	14.86	0.00	0.00	0.00	0.00	0.00	295.07	283.70	291.88	258.30	**1583.20**
	Pervious Area-Park	**Soil Moisture Storage (mm)**	100.00	100.00	100.00	63.70	7.50	0.00	10.69	41.06	100.00	100.00	100.00	100.00	-
		Actual Potential Evapotranspiration (mm)	0.00	31.63	75.85	104.51	93.50	80.58	75.51	37.94	10.02	0.00	0.00	0.00	**509.54**
		P-AET (mm)	57.20	44.87	3.45	-29.71	-20.00	-1.28	10.69	30.36	78.48	65.90	67.80	60.00	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-29.71	-49.72	-51.00	-40.31	-9.94	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	29.71	20.00	1.28	-10.69	-30.36	-9.94	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	57.20	44.87	3.45	0.00	0.00	0.00	0.00	0.00	68.54	65.90	67.80	60.00	**367.76**
		MOECC Infiltration Factor	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	
		Run-Off Coefficient	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-
		Infiltration (mm)	40.04	31.41	2.42	0.00	0.00	0.00	0.00	0.00	47.98	46.13	47.46	42.00	**257.43**
		Run-Off (mm)	17.16	13.46	1.04	0.00	0.00	0.00	0.00	0.00	20.56	19.77	20.34	18.00	**110.33**
		Catchment Area (m^2) = 6900.00					**Subcatchment Monthly Volumes**								
		Infiltration (m^3)	276.28	216.70	16.67	0.00	0.00	0.00	0.00	0.00	331.05	318.30	327.47	289.80	**1776.27**
		Run-Off (m^3)	118.40	92.87	7.15	0.00	0.00	0.00	0.00	0.00	141.88	136.41	140.35	124.20	**761.26**
	Impervious Area-Buildings (Roofs)	**Precipitation Surplus (mm)**	57.20	76.50	79.30	74.80	73.50	79.30	86.20	68.30	88.50	65.90	67.80	60.00	**877.30**
		Evaporation Factor	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	-
		Run-Off Coefficient	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	-
		Evaporation (mm)	5.72	7.65	7.93	7.48	7.35	7.93	8.62	6.83	8.85	6.59	6.78	6.00	**87.73**
		Run-Off (mm)	51.48	68.85	71.37	67.32	66.15	71.37	77.58	61.47	79.65	59.31	61.02	54.00	**789.57**
		Catchment Area (m^2) = 24900.00					**Subcatchment Monthly Volumes**								
		Evaporation (m^3)	142.43	190.49	197.46	186.25	183.02	197.46	214.64	170.07	220.37	164.09	168.82	149.40	**2184.48**
		Run-Off (m^3)	1281.85	1714.37	1777.11	1676.27	1647.14	1777.11	1931.74	1530.60	1983.29	1476.82	1519.40	1344.60	**19660.29**

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TABLE A-3

Post-development Water Balance

Water Balance -Derry and Britannia Developments, Ninth Line,Mississauga(Phase1-North Side)

Catchments and Hydrologic Components			Month												Total
			March	April	May	June	July	August	September	October	November	December	January	February	
PET - Adjusted Potential Evapotranspiration (mm)			0.00	31.63	75.85	111.10	129.70	113.41	75.51	37.94	10.02	0.00	0.00	0.00	**585.15**
P - Total Precipitation (mm)			57.20	76.50	79.30	74.80	73.50	79.30	86.20	68.30	88.50	65.90	67.80	60.00	**877.30**
P-PET (mm)			57.20	44.87	3.45	-36.30	-56.20	-34.11	10.69	30.36	78.48	65.90	67.80	60.00	-
Soil Moisture Deficit (mm)			0.00	0.00	0.00	-36.30	-92.50	-126.61	-115.92	-85.55	-7.07	0.00	0.00	0.00	-
	Impervious Area Driveway/ Road/ Paved Surface/Temp SWM area/Walkway	**Precipitation Surplus (mm)**	57.20	76.50	79.30	74.80	73.50	79.30	86.20	68.30	88.50	65.90	67.80	60.00	**877.30**
		Evaporation Factor	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	-
		Run-Off Coefficient	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	-
		Evaporation (mm)	5.72	7.65	7.93	7.48	7.35	7.93	8.62	6.83	8.85	6.59	6.78	6.00	**87.73**
		Run-Off (mm)	51.48	68.85	71.37	67.32	66.15	71.37	77.58	61.47	79.65	59.31	61.02	54.00	**789.57**
		Catchment Area (m^2) = 38400.00					**Subcatchment Monthly Volumes**								
		Evaporation (m^3)	219.65	293.76	304.51	287.23	282.24	304.51	331.01	262.27	339.84	253.06	260.35	230.40	**3368.83**
		Run-Off (m^3)	1976.83	2643.84	2740.61	2585.09	2540.16	2740.61	2979.07	2360.45	3058.56	2277.50	2343.17	2073.60	**30319.49**
							Total Catchment Volumes								
	Total AET (m^3)		0.00	695.96	1668.65	2299.32	2057.09	1772.74	1661.16	834.58	220.41	0.00	0.00	0.00	**11209.92**
	Total Evaporation (m^3)		362.08	484.25	501.97	473.48	465.26	501.97	545.65	432.34	560.21	417.15	429.17	379.80	**5553.31**
	Total Infiltration (m^3)		805.66	631.93	48.62	0.00	0.00	0.00	0.00	0.00	965.40	928.20	954.96	845.10	**5179.87**
	Total Runoff (m^3)		3711.42	4713.31	4545.05	4261.36	4187.30	4517.72	4910.81	3891.05	5584.34	4275.92	4399.20	3893.10	**52890.59**

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APPENDIX E – FEATURE BASED WATER BALANCE ASSESSMENT

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January 28, 2020

Rand Engineering
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Attention: Piotr Szponar, Project Engineer

Re: Feature Based Water Balance Assessment – Ninth Line Wetland Compensation
City of Mississauga, Ontario
GEO Morphix Project No. PN17098

Two wetlands are proposed to be installed in the Ninth Line lands within Mississauga, Ontario, to address a loss of mineral marsh habitat. It is noted that the existing habitat had limited ecological function and does not meet any of the requirements of significant natural features stipulated within the Provincial Policy Statement as determined by the project ecologics, Savanta. Therefore, the base level requirement for the replicated features should be to provide water attenuation and storage. However, it has been proposed to improve existing habitat within the Ninth Line lands for wetland species, most notably amphibians. To accomplish this the proposed wetlands include design elements to enhance the habitat such as overwintering pools extending below the frost line, bedforms, terrestrial mounds and appropriate native vegetation. These are shown within the design drainigs in **Appendix A**.

To ensure the proposed wetlands meet the hydrological requirements of these vegetation and amphibian communities, an assessment using the Thornthwaite and Mather Soil-Moisture Balance methodology (1957) was completed to estimate the monthly availability of water to the two wetlands, and the approximate mean depth within these features. To complete this assessment, the following tasks were completed:

- Review available background reports, hydrology and hydrogeology information, and mapping (geology, topography)
- Characterization of the hydrological conditions for the Renaissance Property in the vicinity of the wetland using the MOE SWM methodology (2003)
- Completion of pre- and post-development water balance calculations using the Thornthwaite and Mather (1957) monthly soil-moisture balance approach
- Prediction of the average monthly water level within the wetland features based on a simple modeling exercise

Site Location and Description

The Ninth Line property is roughly bounded by Highway 407 to the West, Ninth Line to the East and Britannia Road to the South from which it extends northwards for approximately 1.5 km. The proposed wetlands are to be constructed in the western portion of the property, adjacent to the existing east branch of Joshua's Creek.

Climatic Conditions

Climatic conditions used to inform the water balance assessment were retrieved from the Georgetown Waste Water Treatment Plant (WWTP) Environment Canada weather station (ID: 6152695) for the years between 1981 and 2010. This weather station is geographically the closest to the Ninth Line site and is therefore most applicable.

Geological and Topographic Conditions

The property is located within the physiographic region of the Peel Plain (Chapman and Putnam, 1984), an area characterized as being an undulating tract of clay and till soils gently sloping towards Lake Ontario. Our analysis relied on mapping from the Ontario Geological Survey (20110) regarding surficial geology, which indicated that the dominant material within the site was a silty-clay based fine-textured glaciolacustrine deposit.

From a topographic perspective, the Ninth Line site was characterized as being consistent with conditions within the Peel Plain and is described as having rolling and gently-sloping topography.

Proposed Wetland Characteristics

The proposed wetlands have been designed to encourage habitat complexity to increase the likelihood for adequate conditions for the relevant communities to be maintained throughout the year. To accomplish this, the following design elements were included for the wetland features:

- Variation in depth across and within features
- Variation in wetland area to drainage area ratios to create a range of hydrological conditions
- Features which receive inputs from adjacent perennial watercourses to increase the volume of water available to the features and extend the hydroperiod
- Community specific seed mixes to ensure colonization by the target vegetative species

Table 1: Wetland Characteristics

Wetland ID	Connectivity to Watercourse	Drainage Area (m^2)	Average Wetland Depth (m)	Wetland Area (m^2)
West	Connected	42 000	0.5	11 230
East	Connected	26 000	0.5	10 035

Water Balance Calculations

Water balance calculations were completed using the Monthly Soil-Moisture Balance Approach from Thornthwaite and Mather (1957). This is a relatively straightforward approach to account for the water resources of a given area, specifically the potential and actual amounts of evapotranspiration and the water surplus. This method relies on local climatic conditions and details of the site to estimate the following:

$$P = ET + R + I \qquad \text{[Eq. 1]}$$

Where:
P = Precipitation (m/m^2)
ET = Evapotranspiration (m/m^2)
R = Surface Water Runoff (m/m^2)
I = Infiltration (m/m^2)

Precipitation (P) data are retrieved from Environment Canada weather stations which are within proximity of the subject site. In this instance, data was retrieved form the Georgetown Waste Water Treatment Pland meteorological station, which specifies an annual average volume of 0.877 m of precipitation per year based on a historical record between 1981 and 2001.

Evapotranspiration (ET) rates are governed by climatic and geographic conditions which are held constant and land use characteristics including topography, perviousness, soil moisture retention capacity, soil type and topsoil depth which will vary. Evapotranspiration rates for the different land uses at the subject site were calculated using the Thornthwaite and Mather method (1957).

Surface Water Runoff (R) and Infiltration (I) are largely dependent on soil type, topography and the proportion of impervious surface at the site. The values for these parameters for the various land uses at the subject site were determined using the methodology from the bottom of Table 3.1 of the MOE's Stormwater Planning and Design Manual (MOE, 2003). The MOE infiltration factor methodology from the bottom of Table 3.1 is summarized as follows:

$$I.F = T + S + C \qquad \text{[Eq. 2]}$$

Where,
I.F = Infiltration factor
T = Topography Factor
S = Soil Type
C = Cover Type

This infiltration factor is then multiplied by the water surplus at the subject site to estimate the annual infiltration rate, with the remainder of the water surplus being the surface runoff rate. Notably, infiltration is assumed not to occur during months in which the average temperature is below zero (December – March) due to the water being inaccessible as it is generally in a solid state. The coefficients for *T*, *S* and *C* are provided within **Table 2**, and the values for evapotranspiration, runoff and infiltration are provided within **Table 3**.

Table 2: Infiltration Factor Variables

Soil Moisture Storage	Topography (T)	Soils (S)	Cover (C)	Infiltration Factor
300 mm	Rolling (0.2)	Silty clay (0.15)	Deep Rooted Vegetation (0.15)	0.5

Table 3: Ninth Line Water Balance Calculations

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Evapotranspiration Calculations												
Avg. Temperature (°C)	-6.3	-5.2	-0.9	6	12.3	17.4	20	19	14.8	8.4	2.8	-2.9
Heat Index, *I*	0	0	0	1.32	3.91	6.61	8.16	7.55	5.17	2.19	0.42	0.0
a	0.49	0.49	0.49	0.52	0.56	0.61	0.63	0.62	0.58	0.53	0.5	0.49
Unadjusted Daily Potential Evapotranspiration, *U*	0	0	0	31	75	7	99.88	94.34	72.56	39.80	12.56	0
Actual Factor for *U*	0.81	0.82	1.02	1.12	1.26	1.28	1.29	1.2	1.04	0.95	0.81	0.77
Adjusted Potential Evapotranspiration	0	0	0	31	75	110	129	113	75	38	10	0
Water Balance Calculations												
Precipitation (mm/m^2)	68	60	57.2	76.5	79.3	74.8	73.5	79.3	86.2	68.3	88.5	66
Potential Evapotranspiration (mm/m^2)	0	0	0	31	75	110	129	113	75	38	10	0
P-PET (mm/m^2)	68	60	57.2	45	4.3	-35	-55	-34	11	30	78	66
Water Surplus (mm/m^2)	68	60	57	45	4	0	0	0	0	0	0	61

Wetland specific water balance assessment

Methodology

A simple model which relies on the results from the Thornthwaite and Mather water balance assessment for the Ninth Line Property was created to estimate the monthly average water depth within the proposed wetlands. To do so, the model uses successional simple accounting calculations and reasonable assumptions.

Firstly, the total water surplus from the water balance assessment was multiplied by each wetland's drainage area to determine the potential volume of water accumulated within each wetland per month. These values were then cumulatively summed on a monthly basis to account for carry over from storage within the wetlands. If the total volume of water exceeded the total volume of the wetland, it was assumed that the excess water would still be available in subsequent months if the average monthly temperature was below zero. If not, it was assumed this excess water was lost to infiltration and evapotranspiration.

For each wetland, the infiltration factor of 0.5 established using the MOE methodology (2003) was subsequently applied to the cumulative volumes of water for each month that the average temperature exceeded 0°C (Apr – Nov). It was determined that using the infiltration factor at this stage rather than simply providing cumulative monthly runoff volumes as the inputs into the wetlands would account for infiltration of the stored water within each feature and therefore provide a more conservative estimate of total water within the wetlands. Given that the soil within the wetlands is assumed to be 100% saturated for all months except July and August, the infiltration is not expected to be as significant as the factor suggests.

Evapotranspiration losses were then applied to the stored water within the wetlands for each month in which the water balance assessment indicates that evapotranspiration rates exceed precipitation. The loss factor is considered to be the difference between precipitation and evapotranspiration rates and were applied to the stored water within the wetlands for the months of June, July and August.

The east wetland is 'online' to a significant channel conveying discharge from Osprey Marsh to the East Branch of Joshua's Creek. Although no hydrological modelling is available regarding this channel, the flood modelling from HEC-RAS provided by Rand Engineering indicates that at the lowest recurrence event available, the 2-year storm, the channel discharges approximately 4.08 m^3/s of water into the East Branch of Joshua's Creek. Given this relatively high discharge, it is considered a conservative assumption that the volume of water regularly released from Osprey Marsh will be sufficient to inundate the habitat at a range of depths between 0.05 and 0.45 m for the majority of the year. Thus, a detailed breakdown of depths within this feature based on the water balance method was deemed redundant, as it assumed to consistently hold water.

The west wetland is online with a swale conveying flows from a temporary SWM Pond. Notably, the flows discharged from this swale are expected to be significantly less than those from Osprey Marsh into the East Wetland, with the target release rate of 0.018 m^3/s for the 25 mm event. Assuming a 24 hour release period, this would provide approximately 1500 m^3 of water to the feature in the temporary condition. Although the total volume of water is sufficient to recharge the feaure completely, given the amount of water that will flow through the wetland and into the creek, this is assumed to contribute a

25% recharge to the feature. Our model assumes the frequency of these events to be approximately bi-monthly throughout the summer, beginning in June and ending in August. It is therefore conservatively assumed that the west wetland will be provided with 25% of the water required to fill the feature on a bi-monthly basis from the SWM Pond. Further, because the bottom elevation of the wetland is designed to be 40 cm below the bottow elevation of the adjacent creek, it is expected that there will be a level of communication between the wetland and the creek in which groundwater will be exchanged from the creek to the wetland providing further recharge. However, given the nuances in understanding this complex exchange, this input is treated as a factor of safety and not actually included in the model. These inputs are treated as 'in addition to' the availability of water to the feature from its own catchment by our model.

The final step is dividing the monthly total volume of water available to each wetland by the wetland area to determine the average monthly depth within the features. It should be noted that each wetland feature has different geometries and include separate basins which are at differing depths. Therefore, it is assumed that during periods where water is still available for the wetlands but is scarce, such as during June, the deeper basins which occupy a lower proportion of the surface area will have more substantive depths.

Results

The estimated average depths on a monthly basis within these features is provided within **Table 4**. Results indicate that the west wetland will retain water until year round, but regularly be nearly dry (e.g. – depth below 0.05 m) in the summer. Standing water will again be present within the wetlands beginning in September, which will be sustained until the winter freeze. It should be noted that these estimates are very conservative given that high rates of infiltration are assumed to occur within the wetlands despite saturated conditions.

The average depths within the West wetlands are estimated based on the entire surface area of the wetlands being a common elevation. However, this feature is specifically designed to have a deep overwintering pool which is 0.55 m deeper than the surrounding wetland, and an area at the downstream limit which is graded to be equivalent to the bed elevation of the East Branch of Joshua's Creek. It is therefore assumed that during dry periods these sub-basins will still hold standing water.

With regards to the east wetland, this feature will retain significant quantities of water throughout the summer and should provide annual habitat for amphibians and hydrophilic plant communities given the large volume of water discharging from Osprey Marsh.

Table 4: Average water depth within wetland features

	Average Water Depth (m)											
Wetland ID	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
West Wetland	0.19	0.48	0.5	0.30	0.15	0.14	0.05	0.17	0.26	0.30	0.43	0.5
East Wetland	Assumed to be frequently inundated											

Summary

In total, the proposed Ninth Line wetlands will provide 21 230 m^2 of wetland habitat with contributing drainage from 68 000 m^2 of adjacent lands for plant and amphibian communities to compensate for the loss of previously existing habitat. Our modelling exercise has shown that these features will function better than those wetlands being compensated for in the existing condition by offering an extended hydroperiod through the summer months and increased complexity within the features.

We trust the memo meets your current requirements. Should you have any questions, please contact the undersigned.

Respectfully submitted,

Paul Villard Ph.D., P.Geo., CAN-CISEC
Director, Principal Geomorphologist

Andre-Marcel Baril, M.Sc
River Scientist

References

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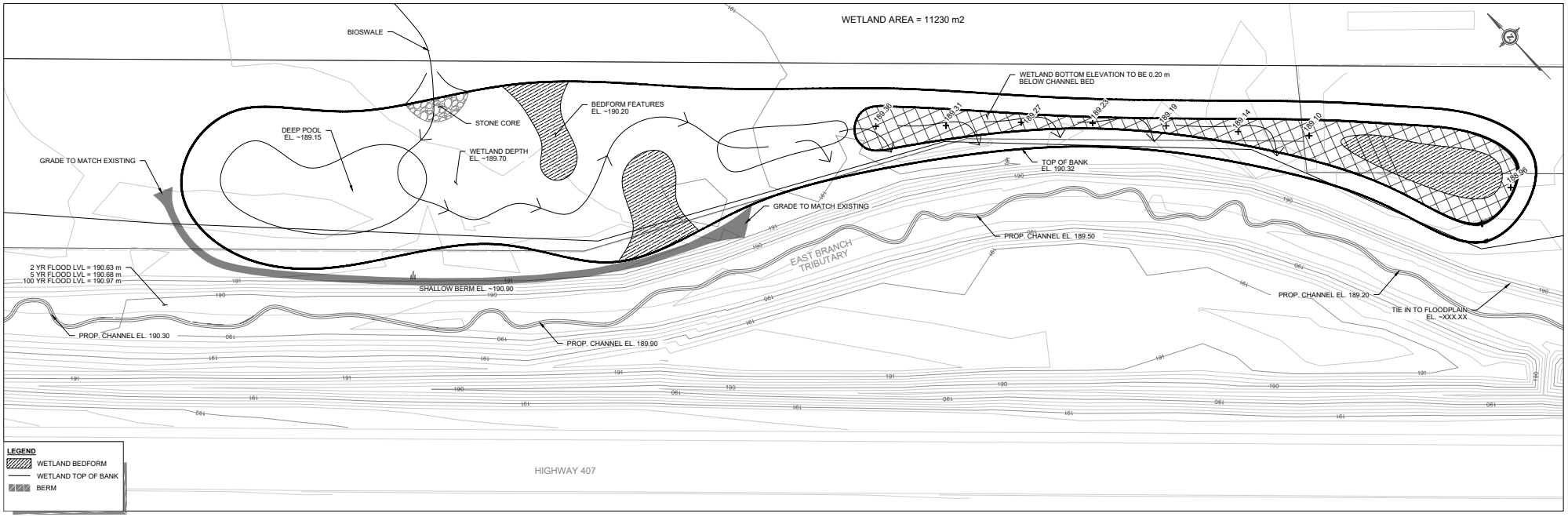
Appendix A
Design Drawings



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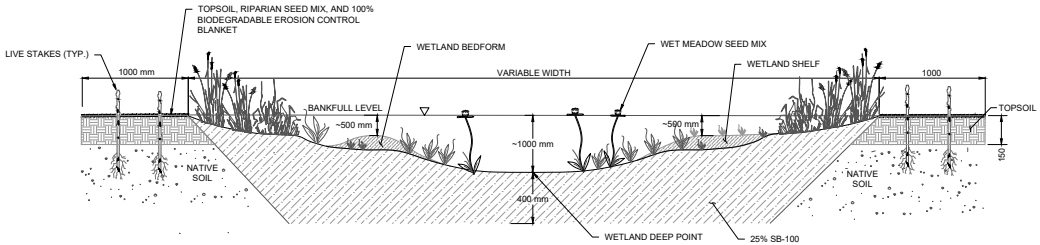

ONLINE WETLAND
N.T.S.

	DATE	BY	REVISIONS

DESIGNED BY: P.V.	CHECKED BY: P.V.
DRAWN BY: B.M.	DATE: JANUARY 2020

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CHANNEL REALIGNMENT AND
WETLAND DESIGN
PLANFORM

PROJECT No.: 17098	DRAWING No.: GEO-1
SCALE: AS NOTED	SHEET 1 OF 2

DRAFT FOR DISCUSSION

APPENDIX F – PERMANENT SWM POND SIZING – PHASE 2

TABLE F.1: STORMWATER MANAGEMENT FACILITY STORAGE REQUIREMENTS

DERRY BRITANNIA DEVELOPMENTS LIMITED: PHASE 2 ULTIMATE SWM POND

Table 3.2 Water Quality Storage Requirements based on Receiving Waters *

Protection Level	SWMP Type	Storage Volume (m^3/ha) for Impervious Level			
		35%	55%	70%	85%
Enhanced	Infiltration	25	30	35	40
80% long-term	Wetlands	80	105	120	140
S.S. removal	Hybrid Wet Pond / Wetland	110	150	175	195
	Wet Pond	140	190	225	250
Normal	Infiltration	20	20	25	30
70% long-term	Wetlands	60	70	80	90
S.S. removal	Hybrid Wet Pond / Wetland	75	90	105	120
	Wet Pond	90	110	130	150
Basic	Infiltration	20	20	20	20
60% long-term	Wetlands	60	60	60	60
S.S. removal	Hybrid Wet Pond / Wetland	60	70	75	80
	Wet Pond	60	75	85	95
	Dry Pond (Continuous Flow)	90	150	200	240

* reproduced from SWM Planning and Design Manual, Ministry of the Environment, March 2003.

The volumetric water quality criteria are presented in Table 3.2. The values are based on a 24-hour drawdown time and a design which conforms to the guidance provided in this manual. Requirements differ with SWMP type to reflect differences in removal efficiencies. Of the specified storage volume for wet facilities, 40 m^3/ha is extended detention, while the remainder represents the permanent pool.

[1] Per Storm Sewer Design Sheets,

Area, A =	32.12
A * C =	22.45
Composite C =	0.70
Imperviousness, I = (C - 0.2) / 0.7 =	71%

Protection Level:	Enhanced	
SWMP Type:	Wet Pond	
Impervious Level:	71%	
Contributing Area:	32.12	ha.

PERMANENT STORAGE

Total storage requirement from Table 3.2	227	m^3/ha
- Active storage requirement	40	m^3/ha
Permanent storage requirement	187	m^3/ha
x Contributing Area	32.12	ha
Permanent Storage Volume	**6,011**	**m^3**

EXTENDED DETENTION STORAGE[2]

25mm storm event runoff	17.82	mm
x Contributing Area	32.12	ha
Extended Detention Storage Volume	**5,724**	**m^3**

[2] Note that this estimate of Extended Detention Storage is exceded by target storage determined from speciific requirements of Phase 3 Implementation and Monitoring Ninth Line Lands Scoped Subwatershed Study (May 2020)

TABLE F.2: POND PERFORMANCE SUMMARY

DERRY BRITANNIA DEVELOPMENTS LIMITED: PHASE 2 ULTIMATE SWM POND

Total Drainage Area (ha):	32.12		
Impervious%:	71%	86%	(for 100-Year & Regional Storm)[2]
Impervious Drainage Area (ha):	22.89	27.58	(for 100-Year & Regional Storm)[2]

	TARGET STORAGE/RELEASE RATES				DESIGN STORAGE / RELEASE RATES			
Storm Event	Unit Storage[1] (m^3/Imp ha)	Unit Discharge[1] (m^3/s/ha)	Storage (m^3)	Discharge (m^3/s)	Post-Development Peak Inflow (m^3/s)	Post-Development Peak Outflow (m^3/s)	Model-Predicted Storage (m^3)	Elevation (m)
Erosion / Quality Control								
25 mm storm	275	0.002	6,296	0.064	-	0.032	6,346	188.50
Flood / Quantity Control								
2 Year	450	0.090	10,302	2.891	2.999	0.042	10,430	188.79
5 Year	600	0.380	13,737	12.206	4.348	0.049	14,590	189.07
100 Year	875	1.020	24,133	32.762	9.978	0.077	30,360	190.01
Regional Storm	1,775	1.530	48,955	49.144	4.659	2.534	49,180	191.00

[1] Per Phase 3 Implementation and Monitoring Plan, Ninth Line Scoped Subwatershed Study, City of Mississauga, May 2020

[2] Per City of Mississauga Development Requirements Manual (2016), in order to account for the increase in runoff due to saturation of the catchment surface that would occur for larger, less frequent storms, an adjustment factor is used. For the 100-year storm, the adjustment factor is 1.25 (applied to all C values <= 0.80).

Per Storm Sewer Design Sheets,

Area, A =	32.12
A * C =	25.73
Composite C =	0.80
Imperviousness, I = (C - 0.2) / 0.7 =	86%

TABLE F.3: STAGE STORAGE DISCHARGE

DERRY BRITANNIA DEVELOPMENTS LIMITED: PHASE 2 ULTIMATE SWM POND

Level	Elevation	Surface Area	Permanent Storage	Active Storage	Quality Control		Quantity Control Outlet			Outlet Structure Conc. Box Open Top		Overflow Spillway		Total Flow	Time to Empty
					Head	Flow	Head	Controlling as	Flow	Head	Flow	Head	Flow		
	(m)	(m^2)	(m^3)	(m^3)	(m)	(m^3/s)	(m)	Weir/Orifice	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m^3/s)	(hrs)
	186.00	6,886													
	186.10	7,069	698												
	186.20	7,251	1,414												
	186.30	7,434	2,148												
	186.40	7,617	2,901												
	186.50	7,799	3,671												
	186.60	7,982	4,460												
	186.70	8,165	5,268												
	186.80	8,348	6,093												
	186.90	8,530	6,937												
	187.00	8,713	7,799												
	187.10	8,896	8,680												
	187.20	9,078	9,579												
	187.30	9,261	10,496												
	187.40	9,444	11,431												
	187.50	9,626	12,384												
	187.60	9,809	13,356												
	187.70	10,253	14,359												
	187.80	10,698	15,407												
	187.90	11,142	16,499												
PWL	188.00	11,587	17,635												
	188.10	12,035	17,635	1,181	0.03	0.008									
	188.20	12,483	17,635	2,407	0.13	0.017									
	188.30	12,931	17,635	3,678	0.22	0.023									
	188.40	13,379	17,635	4,993	0.32	0.028									
Ext. Det. WL	188.50	13,677	17,635	6,346	0.42	0.032								**0.032**	55
	188.60	13,974	17,635	7,729	0.52	0.036								**0.036**	60
	188.70	14,272	17,635	9,141	0.62	0.039								**0.039**	71
2-Year WL	188.80	14,569	17,635	10,583	0.72	0.042								**0.042**	80
	188.90	14,867	17,635	12,055	0.82	0.045								**0.045**	90
	189.00	15,164	17,635	13,556	0.92	0.047								**0.047**	99
5-Year WL	189.10	15,462	17,635	15,088	1.02	0.050								**0.050**	108
	189.20	15,760	17,635	16,649	1.12	0.052								**0.052**	116
	189.30	16,057	17,635	18,239	1.22	0.055								**0.055**	124
	189.40	16,355	17,635	19,860	1.32	0.057								**0.057**	133
	189.50	16,652	17,635	21,510	1.42	0.059								**0.059**	140
	189.60	16,950	17,635	23,190	1.52	0.061								**0.061**	148
	189.70	17,247	17,635	24,900	1.62	0.063								**0.063**	156
	189.80	17,545	17,635	26,640	1.72	0.065								**0.065**	164
	189.90	17,842	17,635	28,409	1.82	0.067								**0.067**	171
100-Year WL	190.00	18,140	17,635	30,208	1.92	0.068								**0.068**	178
	190.10	18,322	17,635	32,031	2.02	0.070	0.10	WEIR	0.073					**0.143**	183
	190.20	18,503	17,635	33,873	2.12	0.072	0.20	WEIR	0.206					**0.278**	186
	190.30	18,685	17,635	35,732	2.22	0.074	0.30	WEIR	0.378					**0.451**	187
	190.40	18,867	17,635	37,610	2.32	0.075	0.40	WEIR	0.582					**0.657**	188
	190.50	19,048	17,635	39,506	2.42	0.077	0.50	WEIR	0.813					**0.890**	189
	190.60	19,230	17,635	41,419	2.52	0.078	0.60	WEIR	1.069					**1.147**	189
	190.70	19,412	17,635	43,352	2.62	0.080	0.70	WEIR	1.347					**1.427**	190
	190.80	19,594	17,635	45,302	2.72	0.081	0.80	WEIR	1.646					**1.727**	190
	190.90	19,775	17,635	47,270	2.82	0.083	0.90	WEIR	1.964					**2.047**	190
Regional WL	191.00	19,957	17,635	49,257	2.92	0.084	1.00	WEIR	2.466					**2.550**	190
	191.10	20,139	17,635	51,262	3.02	0.086	1.10	ORIFICE	2.701	0.10	0.542	0.10	0.537	**3.866**	191
	191.20	20,320	17,635	53,285	3.12	0.087	1.20	ORIFICE	2.918	0.20	1.520	0.20	1.653	**6.177**	191
	191.30	20,502	17,635	55,326	3.22	0.089	1.30	ORIFICE	3.119	0.30	2.768	0.30	3.280	**9.257**	191
	191.40	20,684	17,635	57,385	3.32	0.090	1.40	ORIFICE	3.309	0.40	4.226	0.40	5.427	**13.051**	191
	191.50	20,865	17,635	59,462	3.42	0.091	1.50	ORIFICE	3.487	0.50	5.855	0.50	8.111	**17.544**	191
	191.60	21,047	17,635	61,558	3.52	0.093	1.60	ORIFICE	3.658	0.60	7.629	0.60	11.353	**22.733**	191

PERMANENT STORAGE: QUALITY CONTROL

Permanent storage requirement:	6,011 m^3
Permanent storage provided:	17,635 m^3
Pond Bottom Elevation:	186.00 m
Permanent Water Level:	188.00 m
Permanent Pool Depth (Main Cell):	2.00 m

EXTENDED DETENTION STORAGE: EROSION & QUALITY CONTROL

Erosion Control Volume:	6,296 m^3
Extended detention provided:	6,346 m^3
Extended detention level:	188.50 m
Extended detention depth:	0.50 m

TABLE F.4: OUTLET STRUCTURE HYDRAULICS

DERRY BRITANNIA DEVELOPMENTS LIMITED: PHASE 2 ULTIMATE SWM POND

Orifice Equation

$Q_o = C_o A_o (2gh_o)^{1/2}$

Weir Equation

$Q_w = C_w L_w h_w^{1.5}$

QUALITY CONTROL OUTLET - ORIFICE

where Q_o = orifice discharge (m^3/s)
C_o = flow coefficient
A = cross-sectional area of orifice (m^2)
[calculated from orifice diameter, d_o (mm)]
g = acceleration due to gravity (m/s^2)
h_o = head above orifice (m)
also, z_o = elevation of orifice (m)

Q_o, h_o =	(see Stage-Storage-Discharge curve)	
C_o =	0.63	
d_o =	150	mm
A_o =	0.018	m^2
g =	9.81	m/s^2
z_o =	188.00	m

QUANTITY CONTROL OUTLET

where Q_w = weir discharge (m^3/s)
C_w = flow coefficient
L_w = weir length (m)
h_w = head above weir (m)
also, z_w = elevation of weir (m)

Q_w, h_w =	(see Stage-Storage-Discharge curve)	
C_w =	1.84	
L_w =	1.25	m
z_w =	190.00	m
z_{TOP} =	191.00	m

OVERFLOW SPILLWAY

where Q_w = weir discharge (m^3/s)
C_w = flow coefficient
L_w = weir length (m)
h_w = head above weir (m)
also, z_w = elevation of weir (m)

Q_w, h_w =	(see Stage-Storage-Discharge curve)	
C_w =	1.55	
L_w =	10.0	m
z_w =	191.00	m
EA Slope (H:1) =	12	
EA Length Factor =	40%	

OVERFLOW TO OUTLET CONTROL STRUCTURE 2400 X 2400 OPEN TOP CONCRETE BOX

where $L_e = L_w - (0.1 * n * h_w)$
$L_w = 2 * (L + W)$
Q_w = weir discharge (m3/s)
C_w = flow coefficient
L = length of opening (m)
W = width of opening (m)

L_w = total weir length (m)
L_e = total effective weir length (m)
n = number of end contractions
h_w = head above weir (m)
z_w = elevation of weir invert (m)

C_w =	1.80	
L =	2.4	m
W =	2.4	m
L_w =	9.6	m
n =	8	
z_w =	191.00	m

APPENDIX G – HYDRAULIC ASSESSMENT

Project: Derry Britannia Developments Limited
Proj. No.: 13958
Date: June 7, 2019

COMPARISON OF EXISTING AND PROPOSED FLOODPLAIN WATER SURFACE ELEVATIONS
SIXTEEN MILE CREEK, DERRY ROAD TO BRITANNIA ROAD (PORTION)

Based on HEC-RAS model: 9th Line Transitway Assessment
Existing Scenario: Existing October 2015, as received from City of Mississauga
Proposed Scenario: Existing October 2015 with RS234->RS225 replaced by Proposed Partial 2KS (same RS #'s)

River Station	HEC-RAS Model Scenario	Sixteen Mile Creek Water Surface Elevation (m)						
		2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	Regional
236	Existing	194.52	194.61	194.70	194.75	194.80	194.85	195.16
	Proposed	194.52	194.61	194.70	194.75	194.80	194.85	195.16
	Difference	0	0	0	0	0	0	0
235	Existing	193.72	193.83	193.89	193.93	193.97	194.00	194.65
	Proposed	193.72	193.85	193.96	194.04	194.02	194.09	194.52
	Difference	0	0.02	0.07	0.11	0.05	0.09	-0.13
234	Existing	192.17	192.34	192.54	192.66	192.78	192.89	193.04
	Proposed	192.17	192.29	192.39	192.46	192.59	192.62	192.78
	Difference	0	-0.05	-0.15	-0.20	-0.19	-0.27	-0.26
233	Existing	190.99	191.12	191.18	191.22	191.25	191.26	191.60
	Proposed	190.96	191.07	191.15	191.18	191.22	191.26	191.62
	Difference	-0.03	-0.05	-0.03	-0.04	-0.03	0	0.02
232	Existing	190.63	190.78	190.91	190.95	191.00	191.04	191.38
	Proposed	190.63	190.68	190.77	190.84	190.91	190.97	191.43
	Difference	0	-0.10	-0.14	-0.11	-0.09	-0.07	0.05
231	Existing	190.31	190.52	190.70	190.79	190.86	190.91	191.30
	Proposed	190.31	190.48	190.65	190.72	190.79	190.85	191.32
	Difference	0	-0.04	-0.05	-0.07	-0.07	-0.06	0.02
230	Existing	190.03	190.26	190.44	190.55	190.62	190.67	191.20
	Proposed	190.03	190.31	190.52	190.57	190.67	190.71	191.21
	Difference	0	0.05	0.08	0.02	0.05	0.04	0.01
229	Existing	189.47	189.68	189.86	189.97	190.05	190.13	191.16
	Proposed	189.47	189.57	189.70	189.79	189.78	189.83	191.16
	Difference	0	-0.11	-0.16	-0.18	-0.27	-0.30	0
228	Existing	189.23	189.42	189.61	189.70	189.82	189.93	191.15
	Proposed	189.21	189.35	189.40	189.39	189.56	189.71	191.15
	Difference	-0.02	-0.07	-0.21	-0.31	-0.26	-0.22	0
227	Existing	188.72	188.84	188.94	189.12	189.56	189.72	191.15
	Proposed	188.77	188.69	188.83	188.97	189.53	189.68	191.14
	Difference	0.05	-0.15	-0.11	-0.15	-0.03	-0.04	-0.01
226	Existing	188.20	188.38	188.66	189.01	189.54	189.69	191.14
	Proposed	188.05	188.25	188.58	188.96	189.52	189.68	191.14
	Difference	-0.15	-0.13	-0.08	-0.05	-0.02	-0.01	0
225	Existing	187.91	188.24	188.58	188.97	189.53	189.68	191.14
	Proposed	187.89	188.22	188.56	188.95	189.52	189.68	191.14
	Difference	-0.02	-0.02	-0.02	-0.02	-0.01	0	0
224	Existing	187.82	188.18	188.53	188.94	189.51	189.66	191.13
	Proposed	187.82	188.18	188.53	188.94	189.51	189.66	191.13
	Difference	0	0	0	0	0	0	0

Profile Output Table - Standard Table 1
HEC-RAS Plan: Ex-Oct 2015 River: RIVER-2 Reach: Reach-1

Rivers = 1
Hydraulic Reaches = 1
River Stations = 68
Plans = 1
Profiles = 7

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
Reach-1	261	(Ex) - 2Y	0.34	208.00	208.42	208.22	208.42	0.001266	0.29	1.17	5.22	0.20
Reach-1	261	(Ex) - 5Y	1.12	208.00	208.68	208.35	208.69	0.001167	0.39	2.86	7.56	0.20
Reach-1	261	(Ex) - 10Y	1.97	208.00	208.87	208.44	208.88	0.001014	0.45	4.42	8.61	0.20
Reach-1	261	(Ex) - 25Y	2.63	208.00	208.99	208.49	209.01	0.000926	0.48	5.51	8.98	0.19
Reach-1	261	(Ex) - 50Y	3.27	208.00	209.10	208.54	209.12	0.000873	0.50	6.50	9.31	0.19
Reach-1	261	(Ex) - 100Y	3.99	208.00	209.21	208.59	209.23	0.000830	0.53	7.56	9.64	0.19
Reach-1	261	(Ex) - Regional	7.14	208.00	209.65	208.76	209.67	0.000647	0.59	12.25	30.18	0.18
Reach-1	260.5		Culvert									
Reach-1	260	(Ex) - 2Y	0.68	207.90	208.27	208.27	208.36	0.037687	1.36	0.50	2.73	1.01
Reach-1	260	(Ex) - 5Y	2.02	207.90	208.47	208.47	208.61	0.032469	1.69	1.20	4.22	1.01
Reach-1	260	(Ex) - 10Y	3.35	207.90	208.59	208.59	208.77	0.030304	1.87	1.80	5.17	1.01
Reach-1	260	(Ex) - 25Y	4.39	207.90	208.67	208.67	208.87	0.028932	1.96	2.24	5.78	1.01
Reach-1	260	(Ex) - 50Y	5.40	207.90	208.74	208.74	208.96	0.028143	2.05	2.64	6.27	1.01
Reach-1	260	(Ex) - 100Y	6.51	207.90	208.80	208.80	209.04	0.027811	2.14	3.04	6.73	1.01
Reach-1	260	(Ex) - Regional	11.52	207.90	209.03	209.03	209.34	0.024568	2.50	4.61	12.09	1.01
Reach-1	259	(Ex) - 2Y	0.68	206.90	207.27		207.27	0.000026	0.06	12.11	34.41	0.03
Reach-1	259	(Ex) - 5Y	2.02	206.90	207.47		207.47	0.000053	0.11	19.11	36.14	0.05
Reach-1	259	(Ex) - 10Y	3.35	206.90	207.50		207.50	0.000123	0.17	20.19	36.40	0.07
Reach-1	259	(Ex) - 25Y	4.39	206.90	207.57		207.57	0.000141	0.19	22.96	37.05	0.08
Reach-1	259	(Ex) - 50Y	5.40	206.90	207.64		207.64	0.000157	0.21	25.33	37.61	0.08
Reach-1	259	(Ex) - 100Y	6.51	206.90	207.70		207.70	0.000173	0.24	27.68	38.15	0.09
Reach-1	259	(Ex) - Regional	11.52	206.90	207.92		207.93	0.000233	0.32	36.39	40.08	0.11
Reach-1	258	(Ex) - 2Y	0.68	206.90	207.25	207.11	207.26	0.002386	0.43	1.87	11.09	0.27
Reach-1	258	(Ex) - 5Y	2.02	206.90	207.43	207.23	207.45	0.002673	0.65	4.39	17.20	0.32
Reach-1	258	(Ex) - 10Y	3.35	206.90	207.31	207.31	207.43	0.024931	1.61	2.64	13.25	0.92
Reach-1	258	(Ex) - 25Y	4.39	206.90	207.36	207.36	207.50	0.023414	1.73	3.39	15.07	0.92
Reach-1	258	(Ex) - 50Y	5.40	206.90	207.41	207.41	207.56	0.022361	1.83	4.11	16.63	0.91
Reach-1	258	(Ex) - 100Y	6.51	206.90	207.46	207.46	207.61	0.021302	1.92	4.91	18.21	0.91
Reach-1	258	(Ex) - Regional	11.52	206.90	207.62	207.62	207.81	0.019566	2.25	8.39	25.40	0.91
Reach-1	257	(Ex) - 2Y	0.68	205.60	205.81	205.81	205.86	0.043405	1.05	0.65	6.27	1.02
Reach-1	257	(Ex) - 5Y	2.02	205.60	205.93	205.93	206.02	0.028536	1.40	1.65	10.32	0.94
Reach-1	257	(Ex) - 10Y	3.35	205.60	207.26		207.26	0.000009	0.09	96.62	134.45	0.02
Reach-1	257	(Ex) - 25Y	4.39	205.60	207.30		207.30	0.000013	0.11	102.21	142.76	0.03
Reach-1	257	(Ex) - 50Y	5.40	205.60	207.33		207.33	0.000018	0.13	106.04	145.15	0.03
Reach-1	257	(Ex) - 100Y	6.51	205.60	207.35		207.35	0.000025	0.15	108.21	146.49	0.04
Reach-1	257	(Ex) - Regional	11.52	205.60	207.42		207.42	0.000062	0.25	118.60	153.76	0.06
Reach-1	256	(Ex) - 2Y	0.68	204.50	204.84		204.84	0.001326	0.35	3.42	22.55	0.21
Reach-1	256	(Ex) - 5Y	2.02	204.50	205.15		205.15	0.000409	0.32	13.82	45.52	0.13
Reach-1	256	(Ex) - 10Y	3.35	204.50	207.26		207.26	0.000000	0.03	319.65	252.51	0.01
Reach-1	256	(Ex) - 25Y	4.39	204.50	207.30		207.30	0.000001	0.04	329.90	258.24	0.01
Reach-1	256	(Ex) - 50Y	5.40	204.50	207.33		207.33	0.000001	0.04	336.79	262.01	0.01
Reach-1	256	(Ex) - 100Y	6.51	204.50	207.35		207.35	0.000001	0.05	340.68	264.12	0.01
Reach-1	256	(Ex) - Regional	11.52	204.50	207.41		207.41	0.000004	0.09	359.18	275.76	0.02
Reach-1	255.5	(Ex) - 2Y	0.68	204.10	204.27	204.27	204.31	0.033216	1.00	1.07	14.95	0.91
Reach-1	255.5	(Ex) - 5Y	2.02	204.10	205.15	204.36	205.15	0.000016	0.09	61.70	138.74	0.03
Reach-1	255.5	(Ex) - 10Y	3.35	204.10	207.26	204.41	207.26	0.000000	0.01	559.94	305.01	0.00
Reach-1	255.5	(Ex) - 25Y	4.39	204.10	207.30	204.45	207.30	0.000000	0.02	572.23	306.84	0.00
Reach-1	255.5	(Ex) - 50Y	5.40	204.10	207.33	204.48	207.33	0.000000	0.02	580.36	307.75	0.00
Reach-1	255.5	(Ex) - 100Y	6.51	204.10	207.35	204.50	207.35	0.000000	0.03	584.90	308.26	0.00
Reach-1	255.5	(Ex) - Regional	11.52	204.10	207.41	204.61	207.41	0.000001	0.05	606.13	310.63	0.01
Reach-1	255	(Ex) - 2Y	0.68	202.76	203.49	203.12	203.54	0.002637	0.93	0.73	8.88	0.35
Reach-1	255	(Ex) - 5Y	2.02	202.76	205.10	203.50	205.14	0.000484	0.86	2.34	169.03	0.18

Reach-1	255	(Ex) - 10Y	3.35	202.76	207.25	203.80	207.26	0.001514	0.58	13.36	307.19	0.25
Reach-1	255	(Ex) - 25Y	4.39	202.76	207.29	204.01	207.30	0.001265	0.55	21.60	308.62	0.23
Reach-1	255	(Ex) - 50Y	5.40	202.76	207.32	204.20	207.33	0.001260	0.57	26.70	309.50	0.23
Reach-1	255	(Ex) - 100Y	6.51	202.76	207.33	204.39	207.34	0.001519	0.63	29.12	309.92	0.25
Reach-1	255	(Ex) - Regional	11.52	202.76	207.40	205.14	207.41	0.002351	0.62	43.41	312.21	0.29
Reach-1	254.5		Culvert									
Reach-1	254	(Ex) - 2Y	0.68	202.63	203.27		203.33	0.004081	1.06	0.64	7.04	0.42
Reach-1	254	(Ex) - 5Y	2.02	202.63	203.72	203.37	203.75	0.010698	0.78	3.80	28.39	0.55
Reach-1	254	(Ex) - 10Y	3.35	202.63	203.79	203.71	203.82	0.010019	0.88	5.88	33.18	0.55
Reach-1	254	(Ex) - 25Y	4.39	202.63	203.84	203.75	203.87	0.009414	0.93	7.81	42.31	0.54
Reach-1	254	(Ex) - 50Y	5.40	202.63	203.88	203.77	203.91	0.009200	0.97	9.32	45.31	0.55
Reach-1	254	(Ex) - 100Y	6.51	202.63	203.92	203.79	203.95	0.008841	1.01	11.02	48.56	0.54
Reach-1	254	(Ex) - Regional	11.52	202.63	204.06	203.90	204.09	0.007887	1.14	19.49	76.02	0.53
Reach-1	253	(Ex) - 2Y	0.68	202.40	202.65	202.54	202.66	0.002243	0.37	2.41	18.07	0.26
Reach-1	253	(Ex) - 5Y	2.02	202.40	202.79	202.63	202.81	0.002599	0.56	5.55	27.13	0.30
Reach-1	253	(Ex) - 10Y	3.35	202.40	202.88	202.70	202.90	0.002745	0.67	8.25	33.00	0.32
Reach-1	253	(Ex) - 25Y	4.39	202.40	202.94	202.74	202.96	0.002860	0.74	10.17	36.75	0.34
Reach-1	253	(Ex) - 50Y	5.40	202.40	202.99	202.77	203.01	0.002906	0.79	12.01	40.08	0.34
Reach-1	253	(Ex) - 100Y	6.51	202.40	203.03	202.80	203.05	0.002991	0.85	13.88	43.32	0.35
Reach-1	253	(Ex) - Regional	11.52	202.40	203.19	202.92	203.22	0.003205	1.03	21.61	53.79	0.38
Reach-1	252.5	(Ex) - 2Y	0.68	202.00	202.14	202.14	202.18	0.040363	0.91	0.80	11.10	0.96
Reach-1	252.5	(Ex) - 5Y	2.02	202.00	202.23	202.23	202.30	0.028745	1.22	2.13	17.90	0.91
Reach-1	252.5	(Ex) - 10Y	3.35	202.00	202.29	202.29	202.38	0.026675	1.41	3.33	22.32	0.92
Reach-1	252.5	(Ex) - 25Y	4.39	202.00	202.33	202.33	202.43	0.025064	1.52	4.28	25.27	0.91
Reach-1	252.5	(Ex) - 50Y	5.40	202.00	202.36	202.36	202.47	0.024930	1.62	5.10	27.56	0.92
Reach-1	252.5	(Ex) - 100Y	6.51	202.00	202.40	202.40	202.51	0.024055	1.70	6.05	30.01	0.92
Reach-1	252.5	(Ex) - Regional	11.52	202.00	202.51	202.51	202.65	0.023286	2.01	9.66	35.47	0.95
Reach-1	252	(Ex) - 2Y	1.91	200.60	201.11		201.12	0.000931	0.41	7.63	29.00	0.19
Reach-1	252	(Ex) - 5Y	4.19	200.60	201.30		201.31	0.001021	0.54	13.88	36.92	0.21
Reach-1	252	(Ex) - 10Y	6.84	200.60	201.45		201.46	0.001115	0.64	19.64	41.72	0.23
Reach-1	252	(Ex) - 25Y	9.09	200.60	201.55		201.56	0.001187	0.72	24.13	46.75	0.24
Reach-1	252	(Ex) - 50Y	11.48	200.60	201.64		201.66	0.001246	0.78	28.56	50.75	0.25
Reach-1	252	(Ex) - 100Y	13.95	200.60	201.72		201.74	0.001294	0.84	32.79	53.74	0.26
Reach-1	252	(Ex) - Regional	34.15	200.60	202.17		202.20	0.001584	1.18	62.01	73.96	0.30
Reach-1	251	(Ex) - 2Y	1.91	200.40	200.87	200.66	200.88	0.001603	0.50	6.51	27.51	0.25
Reach-1	251	(Ex) - 5Y	4.19	200.40	201.02	200.77	201.04	0.002009	0.69	11.43	36.63	0.29
Reach-1	251	(Ex) - 10Y	6.84	200.40	201.14	200.86	201.16	0.002272	0.83	15.85	40.18	0.32
Reach-1	251	(Ex) - 25Y	9.09	200.40	201.20	200.91	201.23	0.002759	0.96	18.39	42.95	0.36
Reach-1	251	(Ex) - 50Y	11.48	200.40	201.25	200.98	201.29	0.003219	1.09	20.81	45.43	0.39
Reach-1	251	(Ex) - 100Y	13.95	200.40	201.31	201.04	201.34	0.003624	1.20	23.17	47.72	0.42
Reach-1	251	(Ex) - Regional	34.15	200.40	201.58	201.30	201.66	0.006191	1.89	37.67	58.48	0.57
Reach-1	250	(Ex) - 2Y	1.91	199.70	199.98	199.98	200.06	0.030866	1.25	1.67	13.53	0.94
Reach-1	250	(Ex) - 5Y	4.19	199.70	200.13	200.13	200.21	0.015977	1.34	4.73	41.04	0.75
Reach-1	250	(Ex) - 10Y	6.84	199.70	200.22	200.22	200.30	0.014285	1.48	8.50	58.17	0.73
Reach-1	250	(Ex) - 25Y	9.09	199.70	200.29	200.26	200.36	0.010457	1.41	12.77	64.34	0.64
Reach-1	250	(Ex) - 50Y	11.48	199.70	200.36	200.30	200.42	0.008294	1.38	17.21	71.28	0.59
Reach-1	250	(Ex) - 100Y	13.95	199.70	200.42	200.33	200.48	0.007057	1.36	21.61	77.69	0.55
Reach-1	250	(Ex) - Regional	34.15	199.70	200.78	200.52	200.82	0.003896	1.37	62.83	183.65	0.44
Reach-1	249	(Ex) - 2Y	1.91	198.40	198.88	198.68	198.89	0.001886	0.55	5.83	26.96	0.27
Reach-1	249	(Ex) - 5Y	4.19	198.40	199.05	198.79	199.07	0.002250	0.75	9.97	33.09	0.31
Reach-1	249	(Ex) - 10Y	6.84	198.40	199.19	198.88	199.21	0.002524	0.91	13.93	38.02	0.34
Reach-1	249	(Ex) - 25Y	9.09	198.40	199.28	198.94	199.31	0.002687	1.02	16.96	41.38	0.36
Reach-1	249	(Ex) - 50Y	11.48	198.40	199.37	199.00	199.40	0.002874	1.12	19.85	44.63	0.37
Reach-1	249	(Ex) - 100Y	13.95	198.40	199.44	199.05	199.48	0.003022	1.21	22.70	47.68	0.39
Reach-1	249	(Ex) - Regional	34.15	198.40	199.86	199.38	199.92	0.003811	1.72	41.53	80.40	0.46
Reach-1	248.5	(Ex) - 2Y	1.91	198.10	198.33	198.33	198.40	0.031185	1.20	1.90	19.75	0.93
Reach-1	248.5	(Ex) - 5Y	4.19	198.10	198.43	198.43	198.53	0.025519	1.48	3.90	27.19	0.91
Reach-1	248.5	(Ex) - 10Y	6.84	198.10	198.51	198.51	198.63	0.023729	1.70	5.99	32.62	0.92
Reach-1	248.5	(Ex) - 25Y	9.09	198.10	198.57	198.57	198.70	0.023500	1.86	7.60	36.21	0.93
Reach-1	248.5	(Ex) - 50Y	11.48	198.10	198.62	198.62	198.76	0.022339	1.97	9.39	39.82	0.93
Reach-1	248.5	(Ex) - 100Y	13.95	198.10	198.67	198.67	198.82	0.021964	2.09	11.09	42.97	0.94
Reach-1	248.5	(Ex) - Regional	34.15	198.10	198.94	198.94	199.16	0.020946	2.71	23.20	58.70	0.98

Reach-1	248	(Ex) - 2Y	1.91	196.26	196.84	196.39	196.85	0.000280	0.26	7.36	15.22	0.11
Reach-1	248	(Ex) - 5Y	4.19	196.26	197.10	196.49	197.11	0.000394	0.39	10.63	16.38	0.14
Reach-1	248	(Ex) - 10Y	6.84	196.26	197.34	196.57	197.35	0.000463	0.50	13.59	17.77	0.15
Reach-1	248	(Ex) - 25Y	9.09	196.26	197.49	196.64	197.51	0.000533	0.59	15.46	19.74	0.17
Reach-1	248	(Ex) - 50Y	11.48	196.26	197.63	196.70	197.65	0.000588	0.66	17.27	21.80	0.18
Reach-1	248	(Ex) - 100Y	13.95	196.26	197.76	196.76	197.79	0.000638	0.74	18.94	24.26	0.19
Reach-1	248	(Ex) - Regional	34.15	196.26	198.54	197.17	198.61	0.000952	1.19	28.74	39.43	0.25
Reach-1	247.5		Culvert									
Reach-1	247	(Ex) - 2Y	2.15	195.95	196.84	196.09	196.84	0.000086	0.19	11.24	14.93	0.06
Reach-1	247	(Ex) - 5Y	4.51	195.95	197.10	196.18	197.11	0.000163	0.31	14.49	15.60	0.09
Reach-1	247	(Ex) - 10Y	7.62	195.95	197.33	196.28	197.34	0.000252	0.44	17.41	16.20	0.12
Reach-1	247	(Ex) - 25Y	10.06	195.95	197.48	196.35	197.49	0.000315	0.52	19.24	16.58	0.14
Reach-1	247	(Ex) - 50Y	12.79	195.95	197.62	196.42	197.64	0.000381	0.61	20.99	17.06	0.15
Reach-1	247	(Ex) - 100Y	15.67	195.95	197.74	196.49	197.77	0.000446	0.69	22.61	18.33	0.17
Reach-1	247	(Ex) - Regional	40.02	195.95	198.47	196.96	198.55	0.000934	1.26	31.79	25.29	0.25
Reach-1	246	(Ex) - 2Y	2.15	195.90	196.81	196.46	196.83	0.001895	0.62	4.19	13.01	0.26
Reach-1	246	(Ex) - 5Y	4.51	195.90	197.05	196.65	197.07	0.001985	0.80	7.77	16.51	0.29
Reach-1	246	(Ex) - 10Y	7.62	195.90	197.26	196.83	197.30	0.002098	0.97	11.53	18.38	0.31
Reach-1	246	(Ex) - 25Y	10.06	195.90	197.40	196.93	197.44	0.002174	1.07	14.11	19.55	0.32
Reach-1	246	(Ex) - 50Y	12.79	195.90	197.53	197.02	197.58	0.002255	1.17	16.73	20.69	0.33
Reach-1	246	(Ex) - 100Y	15.67	195.90	197.65	197.10	197.71	0.002337	1.26	19.29	21.76	0.34
Reach-1	246	(Ex) - Regional	40.02	195.90	198.35	197.59	198.46	0.002871	1.83	36.73	28.21	0.40
Reach-1	245.5	(Ex) - 2Y	2.15	195.50	196.41	196.19	196.46	0.004747	0.98	2.92	10.39	0.42
Reach-1	245.5	(Ex) - 5Y	4.51	195.50	196.66	196.43	196.71	0.004259	1.18	6.16	15.53	0.42
Reach-1	245.5	(Ex) - 10Y	7.62	195.50	196.87	196.61	196.93	0.004126	1.36	9.82	18.99	0.43
Reach-1	245.5	(Ex) - 25Y	10.06	195.50	197.00	196.70	197.07	0.004089	1.47	12.45	21.13	0.44
Reach-1	245.5	(Ex) - 50Y	12.79	195.50	197.13	196.79	197.20	0.004056	1.57	15.26	23.19	0.44
Reach-1	245.5	(Ex) - 100Y	15.67	195.50	197.25	196.87	197.33	0.004033	1.66	18.08	25.10	0.45
Reach-1	245.5	(Ex) - Regional	40.02	195.50	197.95	197.36	198.06	0.003579	2.05	39.20	47.09	0.45
Reach-1	245	(Ex) - 2Y	2.15	195.00	196.01	195.69	196.04	0.002902	0.84	3.47	11.56	0.34
Reach-1	245	(Ex) - 5Y	4.51	195.00	196.24	195.95	196.29	0.003201	1.08	6.87	17.35	0.37
Reach-1	245	(Ex) - 10Y	7.62	195.00	196.44	196.14	196.50	0.003383	1.28	10.56	19.97	0.40
Reach-1	245	(Ex) - 25Y	10.06	195.00	196.56	196.26	196.62	0.003505	1.40	13.09	21.58	0.41
Reach-1	245	(Ex) - 50Y	12.79	195.00	196.68	196.33	196.75	0.003587	1.51	15.73	23.03	0.42
Reach-1	245	(Ex) - 100Y	15.67	195.00	196.79	196.42	196.87	0.003659	1.61	18.34	24.33	0.43
Reach-1	245	(Ex) - Regional	40.02	195.00	197.45	196.88	197.57	0.004307	2.25	38.05	37.96	0.50
Reach-1	244	(Ex) - 2Y	2.15	194.40	194.89	194.89	195.01	0.033449	1.57	1.37	5.66	1.01
Reach-1	244	(Ex) - 5Y	4.51	194.40	195.05	195.05	195.22	0.030204	1.83	2.47	7.47	1.02
Reach-1	244	(Ex) - 10Y	7.62	194.40	195.20	195.20	195.42	0.027892	2.05	3.71	8.86	1.01
Reach-1	244	(Ex) - 25Y	10.06	194.40	195.30	195.30	195.54	0.026118	2.16	4.65	9.79	1.00
Reach-1	244	(Ex) - 50Y	12.79	194.40	195.40	195.40	195.66	0.025243	2.28	5.62	10.65	1.00
Reach-1	244	(Ex) - 100Y	15.67	194.40	195.49	195.49	195.77	0.024539	2.38	6.59	11.46	1.00
Reach-1	244	(Ex) - Regional	40.02	194.40	196.00	196.00	196.46	0.018284	3.00	14.21	18.84	0.95
Reach-1	243	(Ex) - 2Y	2.15	194.20	194.73		194.73	0.000024	0.07	31.64	63.96	0.03
Reach-1	243	(Ex) - 5Y	4.51	194.20	194.92		194.92	0.000038	0.10	43.71	67.29	0.04
Reach-1	243	(Ex) - 10Y	7.62	194.20	195.08		195.08	0.000053	0.14	55.25	70.48	0.05
Reach-1	243	(Ex) - 25Y	10.06	194.20	195.19		195.19	0.000063	0.16	62.69	72.46	0.06
Reach-1	243	(Ex) - 50Y	12.79	194.20	195.29		195.29	0.000073	0.18	70.01	74.35	0.06
Reach-1	243	(Ex) - 100Y	15.67	194.20	195.38		195.38	0.000083	0.20	76.90	76.09	0.06
Reach-1	243	(Ex) - Regional	40.02	194.20	195.92		195.92	0.000143	0.33	120.08	85.18	0.09
Reach-1	242	(Ex) - 2Y	2.15	194.20	194.73		194.73	0.000018	0.06	36.14	72.81	0.03
Reach-1	242	(Ex) - 5Y	4.51	194.20	194.91		194.91	0.000029	0.09	49.74	75.95	0.04
Reach-1	242	(Ex) - 10Y	7.62	194.20	195.08		195.08	0.000041	0.12	62.60	78.81	0.04
Reach-1	242	(Ex) - 25Y	10.06	194.20	195.18		195.18	0.000049	0.14	70.84	80.59	0.05
Reach-1	242	(Ex) - 50Y	12.79	194.20	195.28		195.28	0.000056	0.16	78.88	81.91	0.05
Reach-1	242	(Ex) - 100Y	15.67	194.20	195.37		195.37	0.000063	0.18	86.37	83.05	0.06
Reach-1	242	(Ex) - Regional	40.02	194.20	195.90		195.91	0.000111	0.30	132.35	89.96	0.08
Reach-1	241	(Ex) - 2Y	2.15	194.20	194.61	194.61	194.72	0.034916	1.44	1.49	7.24	1.01
Reach-1	241	(Ex) - 5Y	4.51	194.20	194.75	194.75	194.90	0.031595	1.67	2.70	9.74	1.01
Reach-1	241	(Ex) - 10Y	7.62	194.20	194.88	194.88	195.06	0.029340	1.85	4.11	12.03	1.01
Reach-1	241	(Ex) - 25Y	10.06	194.20	194.96	194.96	195.16	0.028328	1.96	5.13	13.44	1.01
Reach-1	241	(Ex) - 50Y	12.79	194.20	195.04	195.04	195.26	0.027478	2.06	6.22	14.79	1.01
Reach-1	241	(Ex) - 100Y	15.67	194.20	195.12	195.12	195.35	0.026034	2.12	7.39	16.12	1.00

Reach-1	241	(Ex) - Regional	40.02	194.20	195.53	195.53	195.87	0.023082	2.56	15.61	23.43	1.00
Reach-1	240	(Ex) - 2Y	2.15	194.00	194.60	194.04	194.60	0.000006	0.04	57.43	99.76	0.02
Reach-1	240	(Ex) - 5Y	4.51	194.00	194.72	194.06	194.72	0.000014	0.06	69.68	101.22	0.02
Reach-1	240	(Ex) - 10Y	7.62	194.00	194.83	194.09	194.83	0.000024	0.09	81.36	102.59	0.03
Reach-1	240	(Ex) - 25Y	10.06	194.00	194.91	194.10	194.91	0.000032	0.11	88.87	103.44	0.04
Reach-1	240	(Ex) - 50Y	12.79	194.00	194.98	194.13	194.98	0.000040	0.13	96.24	104.03	0.04
Reach-1	240	(Ex) - 100Y	15.67	194.00	195.05	194.14	195.05	0.000048	0.15	103.30	104.60	0.05
Reach-1	240	(Ex) - Regional	40.02	194.00	195.48	194.26	195.48	0.000095	0.27	149.50	108.21	0.07
Reach-1	239	(Ex) - 2Y	2.15	194.00	194.60		194.60	0.000005	0.03	64.91	111.91	0.01
Reach-1	239	(Ex) - 5Y	4.51	194.00	194.72		194.72	0.000011	0.06	78.48	113.04	0.02
Reach-1	239	(Ex) - 10Y	7.62	194.00	194.83		194.83	0.000019	0.08	91.32	114.09	0.03
Reach-1	239	(Ex) - 25Y	10.06	194.00	194.90		194.90	0.000025	0.10	99.53	114.76	0.03
Reach-1	239	(Ex) - 50Y	12.79	194.00	194.97		194.97	0.000032	0.12	107.58	115.41	0.04
Reach-1	239	(Ex) - 100Y	15.67	194.00	195.04		195.04	0.000038	0.14	115.27	116.03	0.04
Reach-1	239	(Ex) - Regional	40.02	194.00	195.47		195.47	0.000077	0.24	165.68	119.90	0.07
Reach-1	238	(Ex) - 2Y	2.15	194.00	194.60		194.60	0.000001	0.02	117.51	199.14	0.01
Reach-1	238	(Ex) - 5Y	4.51	194.00	194.72		194.72	0.000003	0.03	141.58	199.90	0.01
Reach-1	238	(Ex) - 10Y	7.62	194.00	194.83		194.83	0.000006	0.05	164.20	200.61	0.02
Reach-1	238	(Ex) - 25Y	10.06	194.00	194.90		194.90	0.000008	0.06	178.61	201.06	0.02
Reach-1	238	(Ex) - 50Y	12.79	194.00	194.97		194.97	0.000009	0.07	192.68	201.50	0.02
Reach-1	238	(Ex) - 100Y	15.67	194.00	195.04		195.04	0.000011	0.08	206.08	201.92	0.02
Reach-1	238	(Ex) - Regional	40.02	194.00	195.47		195.47	0.000023	0.14	292.96	204.61	0.04
Reach-1	237	(Ex) - 2Y	2.15	194.00	194.60	194.02	194.60	0.000001	0.02	116.29	197.82	0.01
Reach-1	237	(Ex) - 5Y	4.51	194.00	194.72	194.04	194.72	0.000003	0.03	140.16	198.92	0.01
Reach-1	237	(Ex) - 10Y	7.62	194.00	194.83	194.05	194.83	0.000006	0.05	162.63	199.94	0.02
Reach-1	237	(Ex) - 25Y	10.06	194.00	194.90	194.06	194.90	0.000008	0.06	176.94	200.59	0.02
Reach-1	237	(Ex) - 50Y	12.79	194.00	194.97	194.08	194.97	0.000010	0.07	190.93	201.23	0.02
Reach-1	237	(Ex) - 100Y	15.67	194.00	195.04	194.09	195.04	0.000012	0.08	204.27	201.90	0.02
Reach-1	237	(Ex) - Regional	40.02	194.00	195.46	194.16	195.46	0.000024	0.14	291.20	206.58	0.04
Reach-1	236	(Ex) - 2Y	2.15	194.30	194.52	194.52	194.59	0.038617	1.14	1.89	14.15	1.00
Reach-1	236	(Ex) - 5Y	4.51	194.30	194.61	194.61	194.71	0.034728	1.35	3.33	17.99	1.00
Reach-1	236	(Ex) - 10Y	7.62	194.30	194.70	194.70	194.82	0.031974	1.51	5.04	22.38	1.00
Reach-1	236	(Ex) - 25Y	10.06	194.30	194.75	194.75	194.89	0.030841	1.62	6.21	24.70	1.00
Reach-1	236	(Ex) - 50Y	12.79	194.30	194.80	194.80	194.95	0.029687	1.71	7.46	26.89	1.00
Reach-1	236	(Ex) - 100Y	15.67	194.30	194.85	194.85	195.02	0.027613	1.80	8.72	28.13	0.98
Reach-1	236	(Ex) - Regional	40.02	194.30	195.16	195.16	195.43	0.022178	2.34	17.59	39.83	0.97
Reach-1	235	(Ex) - 2Y	2.59	193.20	193.72	193.54	193.73	0.003794	0.55	4.68	18.17	0.35
Reach-1	235	(Ex) - 5Y	5.06	193.20	193.83	193.64	193.85	0.004958	0.73	6.91	21.91	0.41
Reach-1	235	(Ex) - 10Y	8.20	193.20	193.89	193.74	193.94	0.007532	0.99	8.31	23.68	0.52
Reach-1	235	(Ex) - 25Y	10.89	193.20	193.93	193.80	194.00	0.009272	1.18	9.34	24.85	0.59
Reach-1	235	(Ex) - 50Y	13.72	193.20	193.97	193.85	194.06	0.010699	1.35	10.38	25.94	0.64
Reach-1	235	(Ex) - 100Y	16.73	193.20	194.00	193.91	194.12	0.012550	1.53	11.24	26.82	0.70
Reach-1	235	(Ex) - Regional	46.48	193.20	194.65	194.29	194.78	0.004786	1.66	35.16	50.11	0.50
Reach-1	234	(Ex) - 2Y	2.59	191.80	192.17	192.17	192.26	0.034915	1.37	1.89	9.88	1.00
Reach-1	234	(Ex) - 5Y	5.06	191.80	192.34	192.29	192.42	0.017078	1.28	3.97	14.41	0.75
Reach-1	234	(Ex) - 10Y	8.20	191.80	192.54	192.39	192.61	0.008111	1.19	7.35	19.30	0.56
Reach-1	234	(Ex) - 25Y	10.89	191.80	192.66	192.46	192.73	0.006119	1.21	9.95	22.12	0.51
Reach-1	234	(Ex) - 50Y	13.72	191.80	192.78	192.52	192.86	0.005019	1.24	12.74	24.79	0.47
Reach-1	234	(Ex) - 100Y	16.73	191.80	192.89	192.59	192.96	0.004215	1.25	17.03	32.93	0.44
Reach-1	234	(Ex) - Regional	46.48	191.80	193.04	193.04	193.38	0.016498	2.77	22.22	35.07	0.90
Reach-1	233	(Ex) - 2Y	2.59	190.30	190.99	190.69	191.01	0.002067	0.56	4.66	11.78	0.28
Reach-1	233	(Ex) - 5Y	5.06	190.30	191.12	190.83	191.15	0.003223	0.83	6.31	14.54	0.36
Reach-1	233	(Ex) - 10Y	8.20	190.30	191.18	190.96	191.26	0.005740	1.20	7.29	15.96	0.49
Reach-1	233	(Ex) - 25Y	10.89	190.30	191.22	191.04	191.33	0.008059	1.48	7.95	16.81	0.59
Reach-1	233	(Ex) - 50Y	13.72	190.30	191.25	191.12	191.41	0.011173	1.79	8.38	17.31	0.70
Reach-1	233	(Ex) - 100Y	16.73	190.30	191.26	191.21	191.49	0.015477	2.13	8.62	17.57	0.82
Reach-1	233	(Ex) - Regional	46.48	190.30	191.60	191.60	191.61	0.001705	0.92	145.08	368.48	0.29
Reach-1	232	(Ex) - 2Y	2.59	189.90	190.63	190.39	190.65	0.003873	0.70	4.52	47.72	0.37
Reach-1	232	(Ex) - 5Y	5.06	189.90	190.78	190.54	190.80	0.002279	0.64	16.55	103.57	0.30
Reach-1	232	(Ex) - 10Y	8.20	189.90	190.91	190.73	190.91	0.001356	0.58	40.87	247.57	0.24
Reach-1	232	(Ex) - 25Y	10.89	189.90	190.95	190.77	190.96	0.001265	0.59	52.96	256.18	0.23
Reach-1	232	(Ex) - 50Y	13.72	189.90	191.00	190.80	191.01	0.001172	0.59	65.87	273.76	0.23
Reach-1	232	(Ex) - 100Y	16.73	189.90	191.04	190.80	191.05	0.001139	0.61	77.19	281.20	0.23

Reach-1	232	(Ex) - Regional	46.48	189.90	191.38	190.99	191.39	0.000777	0.64	184.78	346.99	0.20
Reach-1	231	(Ex) - 2Y	2.59	189.50	190.31	189.98	190.32	0.001977	0.56	4.64	11.35	0.27
Reach-1	231	(Ex) - 5Y	5.06	189.50	190.52	190.13	190.55	0.001882	0.72	7.44	14.29	0.28
Reach-1	231	(Ex) - 10Y	8.20	189.50	190.70	190.26	190.73	0.001722	0.81	20.51	201.82	0.28
Reach-1	231	(Ex) - 25Y	10.89	189.50	190.79	190.35	190.81	0.001321	0.76	38.27	217.07	0.25
Reach-1	231	(Ex) - 50Y	13.72	189.50	190.86	190.44	190.88	0.001102	0.73	56.97	275.23	0.23
Reach-1	231	(Ex) - 100Y	16.73	189.50	190.91	190.51	190.93	0.000995	0.72	71.71	282.35	0.22
Reach-1	231	(Ex) - Regional	46.48	189.50	191.30	190.91	191.31	0.000599	0.69	193.40	347.23	0.18
Reach-1	230	(Ex) - 2Y	2.59	189.20	190.03	189.73	190.05	0.002645	0.61	4.23	10.62	0.31
Reach-1	230	(Ex) - 5Y	5.06	189.20	190.26	189.89	190.29	0.002607	0.72	7.04	13.77	0.32
Reach-1	230	(Ex) - 10Y	8.20	189.20	190.44	190.03	190.48	0.002785	0.83	10.79	27.32	0.34
Reach-1	230	(Ex) - 25Y	10.89	189.20	190.55	190.12	190.59	0.002960	0.91	14.00	36.70	0.36
Reach-1	230	(Ex) - 50Y	13.72	189.20	190.62	190.21	190.66	0.003325	1.01	17.44	82.17	0.38
Reach-1	230	(Ex) - 100Y	16.73	189.20	190.67	190.29	190.72	0.003759	1.10	21.68	89.32	0.41
Reach-1	230	(Ex) - Regional	46.48	189.20	191.20	190.87	191.22	0.000984	0.81	146.76	323.91	0.23
Reach-1	229	(Ex) - 2Y	2.59	188.60	189.47		189.49	0.001933	0.56	4.71	12.48	0.27
Reach-1	229	(Ex) - 5Y	5.06	188.60	189.68		189.70	0.002118	0.69	8.10	20.25	0.29
Reach-1	229	(Ex) - 10Y	8.20	188.60	189.86		189.89	0.002008	0.81	13.45	48.22	0.30
Reach-1	229	(Ex) - 25Y	10.89	188.60	189.97		190.00	0.001910	0.86	22.02	107.11	0.30
Reach-1	229	(Ex) - 50Y	13.72	188.60	190.05		190.08	0.001693	0.86	34.37	172.06	0.29
Reach-1	229	(Ex) - 100Y	16.73	188.60	190.13		190.15	0.001473	0.85	49.02	209.97	0.27
Reach-1	229	(Ex) - Regional	46.48	188.60	191.16		191.16	0.000088	0.33	380.42	421.20	0.07
Reach-1	228	(Ex) - 2Y	2.59	188.50	189.23		189.25	0.002394	0.59	4.46	12.17	0.30
Reach-1	228	(Ex) - 5Y	5.06	188.50	189.42		189.45	0.002390	0.76	7.11	15.39	0.32
Reach-1	228	(Ex) - 10Y	8.20	188.50	189.61		189.65	0.002369	0.91	11.20	37.10	0.33
Reach-1	228	(Ex) - 25Y	10.89	188.50	189.70		189.75	0.002540	1.02	15.55	55.83	0.35
Reach-1	228	(Ex) - 50Y	13.72	188.50	189.82		189.86	0.002255	1.04	22.88	77.63	0.33
Reach-1	228	(Ex) - 100Y	16.73	188.50	189.93		189.97	0.001859	1.02	33.01	100.17	0.31
Reach-1	228	(Ex) - Regional	46.48	188.50	191.15		191.16	0.000059	0.30	412.82	390.12	0.06
Reach-1	227	(Ex) - 2Y	2.59	188.10	188.72	188.55	188.75	0.005803	0.78	3.31	10.62	0.44
Reach-1	227	(Ex) - 5Y	5.06	188.10	188.84	188.69	188.90	0.007470	1.09	4.73	12.54	0.53
Reach-1	227	(Ex) - 10Y	8.20	188.10	188.94		189.04	0.009744	1.43	6.03	14.10	0.63
Reach-1	227	(Ex) - 25Y	10.89	188.10	189.12		189.21	0.006366	1.40	8.74	17.27	0.53
Reach-1	227	(Ex) - 50Y	13.72	188.10	189.56		189.60	0.001538	0.95	21.07	44.03	0.28
Reach-1	227	(Ex) - 100Y	16.73	188.10	189.72		189.75	0.001304	0.95	28.74	56.11	0.27
Reach-1	227	(Ex) - Regional	46.48	188.10	191.15		191.15	0.000047	0.30	449.55	402.81	0.06
Reach-1	226	(Ex) - 2Y	2.59	187.80	188.20		188.22	0.004048	0.67	4.48	19.67	0.37
Reach-1	226	(Ex) - 5Y	5.06	187.80	188.38		188.41	0.002896	0.77	8.48	23.31	0.34
Reach-1	226	(Ex) - 10Y	8.20	187.80	188.66		188.68	0.001471	0.73	15.58	27.53	0.26
Reach-1	226	(Ex) - 25Y	10.89	187.80	189.01		189.02	0.000658	0.62	25.94	38.31	0.19
Reach-1	226	(Ex) - 50Y	13.72	187.80	189.54		189.55	0.000191	0.43	62.85	97.94	0.11
Reach-1	226	(Ex) - 100Y	16.73	187.80	189.69		189.70	0.000182	0.45	79.09	112.61	0.11
Reach-1	226	(Ex) - Regional	46.48	187.80	191.14		191.14	0.000027	0.25	513.67	373.57	0.04
Reach-1	225	(Ex) - 2Y	2.59	187.30	187.91		187.92	0.000767	0.36	8.91	29.47	0.17
Reach-1	225	(Ex) - 5Y	5.06	187.30	188.24		188.25	0.000350	0.35	19.91	37.36	0.13
Reach-1	225	(Ex) - 10Y	8.20	187.30	188.58		188.58	0.000227	0.36	33.92	45.36	0.11
Reach-1	225	(Ex) - 25Y	10.89	187.30	188.97		188.97	0.000123	0.32	53.39	59.74	0.08
Reach-1	225	(Ex) - 50Y	13.72	187.30	189.53		189.53	0.000050	0.25	97.94	105.27	0.06
Reach-1	225	(Ex) - 100Y	16.73	187.30	189.68		189.68	0.000053	0.27	116.62	138.31	0.06
Reach-1	225	(Ex) - Regional	46.48	187.30	191.14		191.14	0.000016	0.21	561.81	334.82	0.04
Reach-1	224	(Ex) - 2Y	6.67	187.03	187.82	187.50	187.83	0.000582	0.45	35.47	89.17	0.16
Reach-1	224	(Ex) - 5Y	16.12	187.03	188.18	187.65	188.19	0.000458	0.51	68.99	97.23	0.15
Reach-1	224	(Ex) - 10Y	26.72	187.03	188.53	187.72	188.54	0.000367	0.55	104.09	105.21	0.14
Reach-1	224	(Ex) - 25Y	35.64	187.03	188.94	187.78	188.94	0.000242	0.52	152.34	127.95	0.12
Reach-1	224	(Ex) - 50Y	44.65	187.03	189.51	187.82	189.51	0.000114	0.43	240.49	178.61	0.09
Reach-1	224	(Ex) - 100Y	54.81	187.03	189.66	187.87	189.67	0.000129	0.48	268.32	192.29	0.09
Reach-1	224	(Ex) - Regional	158.24	187.03	191.13	188.24	191.13	0.000133	0.65	679.91	372.26	0.10
Reach-1	223	(Ex) - 2Y	6.67	186.81	187.62	187.27	187.64	0.001845	0.63	10.65	20.04	0.27
Reach-1	223	(Ex) - 5Y	16.12	186.81	187.98	187.48	188.02	0.002002	0.89	18.04	22.06	0.31
Reach-1	223	(Ex) - 10Y	26.72	186.81	188.34	187.65	188.40	0.001681	1.04	25.74	24.18	0.30
Reach-1	223	(Ex) - 25Y	35.64	186.81	188.79	187.77	188.85	0.001049	1.01	35.24	26.36	0.25
Reach-1	223	(Ex) - 50Y	44.65	186.81	189.42	187.88	189.47	0.000570	0.92	48.45	35.83	0.19
Reach-1	223	(Ex) - 100Y	54.81	186.81	189.55	188.00	189.61	0.000717	1.07	51.15	43.21	0.22

Reach-1	223	(Ex) - Regional	158.24	186.81	190.96	188.91	191.07	0.000885	1.57	193.06	216.00	0.26
Reach-1	222.5		Bridge									
Reach-1	222	(Ex) - 2Y	6.67	186.60	187.52		187.54	0.001231	0.57	11.75	50.75	0.23
Reach-1	222	(Ex) - 5Y	16.12	186.60	187.85		187.89	0.001896	0.88	18.30	57.16	0.30
Reach-1	222	(Ex) - 10Y	26.72	186.60	188.23		188.28	0.001563	1.02	26.26	64.64	0.29
Reach-1	222	(Ex) - 25Y	35.64	186.60	188.72		188.77	0.000919	0.97	36.60	72.55	0.24
Reach-1	222	(Ex) - 50Y	44.65	186.60	189.38		189.42	0.000495	0.89	50.45	83.90	0.18
Reach-1	222	(Ex) - 100Y	54.81	186.60	189.49		189.55	0.000638	1.04	52.87	85.93	0.21
Reach-1	222	(Ex) - Regional	158.24	186.60	190.04	188.77	190.35	0.002755	2.46	64.40	170.61	0.45
Reach-1	221	(Ex) - 2Y	6.67	186.20	187.47		187.48	0.000447	0.51	25.33	42.24	0.15
Reach-1	221	(Ex) - 5Y	16.12	186.20	187.75		187.77	0.000894	0.83	38.07	47.12	0.22
Reach-1	221	(Ex) - 10Y	26.72	186.20	188.15		188.17	0.000761	0.91	57.87	51.30	0.22
Reach-1	221	(Ex) - 25Y	35.64	186.20	188.68		188.70	0.000433	0.81	86.54	56.64	0.17
Reach-1	221	(Ex) - 50Y	44.65	186.20	189.37		189.38	0.000228	0.70	127.88	67.46	0.13
Reach-1	221	(Ex) - 100Y	54.81	186.20	189.48		189.49	0.000292	0.81	136.06	77.62	0.15
Reach-1	221	(Ex) - Regional	158.24	186.20	190.02		190.08	0.001179	1.81	189.17	116.20	0.30
Reach-1	220	(Ex) - 2Y	6.67	186.20	187.44		187.44	0.000505	0.53	28.26	54.78	0.16
Reach-1	220	(Ex) - 5Y	16.12	186.20	187.69		187.71	0.000966	0.84	43.25	62.42	0.23
Reach-1	220	(Ex) - 10Y	26.72	186.20	188.11		188.12	0.000644	0.82	70.61	67.17	0.20
Reach-1	220	(Ex) - 25Y	35.64	186.20	188.66		188.67	0.000316	0.69	109.36	72.90	0.14
Reach-1	220	(Ex) - 50Y	44.65	186.20	189.36		189.36	0.000158	0.58	162.15	81.60	0.11
Reach-1	220	(Ex) - 100Y	54.81	186.20	189.47		189.47	0.000206	0.68	171.37	85.19	0.12
Reach-1	220	(Ex) - Regional	158.24	186.20	189.97		190.01	0.000895	1.56	217.70	108.96	0.26
Reach-1	219	(Ex) - 2Y	6.67	186.20	187.41		187.41	0.000103	0.23	74.03	148.41	0.07
Reach-1	219	(Ex) - 5Y	16.12	186.20	187.65		187.65	0.000185	0.36	109.15	152.24	0.10
Reach-1	219	(Ex) - 10Y	26.72	186.20	188.09		188.09	0.000112	0.34	177.32	157.75	0.08
Reach-1	219	(Ex) - 25Y	35.64	186.20	188.65		188.65	0.000054	0.28	268.71	164.55	0.06
Reach-1	219	(Ex) - 50Y	44.65	186.20	189.35		189.35	0.000027	0.24	398.08	235.41	0.04
Reach-1	219	(Ex) - 100Y	54.81	186.20	189.46		189.46	0.000034	0.28	424.52	247.69	0.05
Reach-1	219	(Ex) - Regional	158.24	186.20	189.94		189.94	0.000196	0.73	560.93	296.68	0.12
Reach-1	218	(Ex) - 2Y	6.67	186.20	187.40		187.40	0.000084	0.21	85.82	179.91	0.07
Reach-1	218	(Ex) - 5Y	16.12	186.20	187.62		187.63	0.000148	0.32	126.42	183.06	0.09
Reach-1	218	(Ex) - 10Y	26.72	186.20	188.07		188.07	0.000082	0.29	210.08	189.39	0.07
Reach-1	218	(Ex) - 25Y	35.64	186.20	188.65		188.65	0.000038	0.24	321.48	206.55	0.05
Reach-1	218	(Ex) - 50Y	44.65	186.20	189.35		189.35	0.000022	0.22	531.26	331.92	0.04
Reach-1	218	(Ex) - 100Y	54.81	186.20	189.46		189.46	0.000027	0.25	567.47	335.73	0.04
Reach-1	218	(Ex) - Regional	158.24	186.20	189.92		189.92	0.000112	0.55	728.10	361.54	0.09
Reach-1	217	(Ex) - 2Y	6.67	186.20	187.40		187.40	0.000047	0.16	105.64	189.70	0.05
Reach-1	217	(Ex) - 5Y	16.12	186.20	187.62		187.62	0.000096	0.25	148.04	193.18	0.07
Reach-1	217	(Ex) - 10Y	26.72	186.20	188.07		188.07	0.000060	0.25	236.77	200.29	0.06
Reach-1	217	(Ex) - 25Y	35.64	186.20	188.65		188.65	0.000031	0.21	366.04	262.74	0.04
Reach-1	217	(Ex) - 50Y	44.65	186.20	189.35		189.35	0.000017	0.19	577.47	340.21	0.03
Reach-1	217	(Ex) - 100Y	54.81	186.20	189.46		189.46	0.000021	0.22	614.87	349.82	0.04
Reach-1	217	(Ex) - Regional	158.24	186.20	189.91		189.92	0.000096	0.50	790.07	404.77	0.09
Reach-1	216	(Ex) - 2Y	6.67	186.10	187.39		187.39	0.000032	0.14	112.77	161.45	0.04
Reach-1	216	(Ex) - 5Y	16.12	186.10	187.61		187.61	0.000080	0.24	148.14	168.09	0.07
Reach-1	216	(Ex) - 10Y	26.72	186.10	188.06		188.06	0.000060	0.25	227.86	182.81	0.06
Reach-1	216	(Ex) - 25Y	35.64	186.10	188.64		188.64	0.000033	0.23	353.04	229.97	0.05
Reach-1	216	(Ex) - 50Y	44.65	186.10	189.35		189.35	0.000017	0.20	575.54	352.67	0.04
Reach-1	216	(Ex) - 100Y	54.81	186.10	189.45		189.45	0.000021	0.22	613.92	358.54	0.04
Reach-1	216	(Ex) - Regional	158.24	186.10	189.90		189.90	0.000094	0.51	782.62	391.03	0.09
Reach-1	215	(Ex) - 2Y	7.53	186.00	187.39		187.39	0.000013	0.09	175.75	200.05	0.03
Reach-1	215	(Ex) - 5Y	17.50	186.00	187.60		187.60	0.000037	0.17	221.13	222.21	0.05
Reach-1	215	(Ex) - 10Y	31.27	186.00	188.06		188.06	0.000036	0.20	327.62	243.20	0.05
Reach-1	215	(Ex) - 25Y	42.17	186.00	188.64		188.64	0.000021	0.19	471.41	249.88	0.04
Reach-1	215	(Ex) - 50Y	53.27	186.00	189.34		189.34	0.000012	0.17	650.66	259.51	0.03
Reach-1	215	(Ex) - 100Y	65.78	186.00	189.45		189.45	0.000016	0.20	678.58	261.46	0.03
Reach-1	215	(Ex) - Regional	200.73	186.00	189.88		189.89	0.000140	0.63	831.72	419.40	0.10
Reach-1	214	(Ex) - 2Y	7.53	186.00	187.39		187.39	0.000009	0.07	214.78	251.79	0.02
Reach-1	214	(Ex) - 5Y	17.50	186.00	187.60		187.60	0.000023	0.13	268.05	257.49	0.04
Reach-1	214	(Ex) - 10Y	31.27	186.00	188.05		188.05	0.000023	0.16	387.38	266.31	0.04
Reach-1	214	(Ex) - 25Y	42.17	186.00	188.64		188.64	0.000015	0.15	548.35	285.94	0.03

Reach-1	214	(Ex) - 50Y	53.27	186.00	189.34		189.34	0.000009	0.14	758.98	314.40	0.03
Reach-1	214	(Ex) - 100Y	65.78	186.00	189.45		189.45	0.000012	0.17	793.23	330.09	0.03
Reach-1	214	(Ex) - Regional	200.73	186.00	189.87		189.88	0.000085	0.48	961.15	420.41	0.08
Reach-1	213	(Ex) - 2Y	7.53	186.00	187.39		187.39	0.000004	0.05	275.57	262.74	0.02
Reach-1	213	(Ex) - 5Y	17.50	186.00	187.60		187.60	0.000013	0.10	330.18	264.69	0.03
Reach-1	213	(Ex) - 10Y	31.27	186.00	188.05		188.05	0.000015	0.13	451.71	268.83	0.03
Reach-1	213	(Ex) - 25Y	42.17	186.00	188.63		188.64	0.000010	0.13	610.09	273.84	0.03
Reach-1	213	(Ex) - 50Y	53.27	186.00	189.34		189.34	0.000009	0.14	822.11	387.54	0.03
Reach-1	213	(Ex) - 100Y	65.78	186.00	189.45		189.45	0.000012	0.17	863.81	395.57	0.03
Reach-1	213	(Ex) - Regional	200.73	186.00	189.86		189.87	0.000074	0.45	1039.68	452.84	0.08
Reach-1	212	(Ex) - 2Y	7.53	186.00	187.39		187.39	0.000006	0.06	242.59	255.49	0.02
Reach-1	212	(Ex) - 5Y	17.50	186.00	187.59		187.59	0.000017	0.12	295.54	257.66	0.03
Reach-1	212	(Ex) - 10Y	31.27	186.00	188.05		188.05	0.000019	0.15	413.61	260.95	0.03
Reach-1	212	(Ex) - 25Y	42.17	186.00	188.63		188.63	0.000012	0.14	567.33	265.33	0.03
Reach-1	212	(Ex) - 50Y	53.27	186.00	189.34		189.34	0.000008	0.13	757.09	271.79	0.02
Reach-1	212	(Ex) - 100Y	65.78	186.00	189.45		189.45	0.000011	0.16	786.08	274.03	0.03
Reach-1	212	(Ex) - Regional	200.73	186.00	189.86		189.86	0.000065	0.43	900.08	282.67	0.07
Reach-1	211	(Ex) - 2Y	7.53	185.99	187.39		187.39	0.000006	0.06	252.96	256.39	0.02
Reach-1	211	(Ex) - 5Y	17.50	185.99	187.59		187.59	0.000016	0.11	305.73	257.76	0.03
Reach-1	211	(Ex) - 10Y	31.27	185.99	188.05		188.05	0.000018	0.14	423.77	260.80	0.03
Reach-1	211	(Ex) - 25Y	42.17	185.99	188.63		188.63	0.000012	0.14	577.42	264.86	0.03
Reach-1	211	(Ex) - 50Y	53.27	185.99	189.34		189.34	0.000008	0.13	767.75	273.52	0.02
Reach-1	211	(Ex) - 100Y	65.78	185.99	189.45		189.45	0.000010	0.16	796.81	275.01	0.03
Reach-1	211	(Ex) - Regional	200.73	185.99	189.85		189.85	0.000063	0.42	909.47	281.88	0.07
Reach-1	210	(Ex) - 2Y	7.53	185.90	187.39		187.39	0.000039	0.16	88.24	85.54	0.05
Reach-1	210	(Ex) - 5Y	17.50	185.90	187.59		187.59	0.000121	0.32	105.60	87.45	0.08
Reach-1	210	(Ex) - 10Y	31.27	185.90	188.04		188.04	0.000141	0.41	146.25	92.07	0.09
Reach-1	210	(Ex) - 25Y	42.17	185.90	188.63		188.63	0.000118	0.44	221.20	161.93	0.09
Reach-1	210	(Ex) - 50Y	53.27	185.90	189.34		189.34	0.000055	0.36	375.47	237.82	0.06
Reach-1	210	(Ex) - 100Y	65.78	185.90	189.44		189.44	0.000070	0.41	400.61	244.30	0.07
Reach-1	210	(Ex) - Regional	200.73	185.90	189.82		189.83	0.000383	1.04	501.77	281.10	0.17
Reach-1	209	(Ex) - 2Y	7.73	185.80	187.38		187.38	0.000040	0.17	89.33	85.75	0.05
Reach-1	209	(Ex) - 5Y	17.80	185.80	187.58		187.58	0.000122	0.32	106.24	87.35	0.08
Reach-1	209	(Ex) - 10Y	31.76	185.80	188.03		188.03	0.000143	0.41	146.64	91.64	0.09
Reach-1	209	(Ex) - 25Y	42.70	185.80	188.62		188.62	0.000137	0.48	207.96	156.10	0.10
Reach-1	209	(Ex) - 50Y	54.07	185.80	189.33		189.33	0.000067	0.40	339.46	214.31	0.07
Reach-1	209	(Ex) - 100Y	66.78	185.80	189.44		189.44	0.000087	0.46	362.04	221.21	0.08
Reach-1	209	(Ex) - Regional	205.61	185.80	189.79		189.81	0.000478	1.16	442.54	232.94	0.19
Reach-1	208	(Ex) - 2Y	7.73	185.71	187.38		187.38	0.000041	0.17	87.36	83.48	0.05
Reach-1	208	(Ex) - 5Y	17.80	185.71	187.57		187.57	0.000128	0.33	103.35	84.88	0.09
Reach-1	208	(Ex) - 10Y	31.76	185.71	188.02		188.02	0.000150	0.43	142.36	88.21	0.10
Reach-1	208	(Ex) - 25Y	42.70	185.71	188.61		188.61	0.000102	0.42	196.88	130.08	0.08
Reach-1	208	(Ex) - 50Y	54.07	185.71	189.33		189.33	0.000076	0.42	357.78	316.14	0.07
Reach-1	208	(Ex) - 100Y	66.78	185.71	189.43		189.43	0.000095	0.48	391.01	332.72	0.08
Reach-1	208	(Ex) - Regional	205.61	185.71	189.76		189.78	0.000479	1.15	506.75	361.71	0.19
Reach-1	207.7	(Ex) - 2Y	7.73	185.42	187.38		187.38	0.000059	0.22	70.99	67.91	0.06
Reach-1	207.7	(Ex) - 5Y	17.80	185.42	187.57		187.57	0.000187	0.42	83.82	69.35	0.10
Reach-1	207.7	(Ex) - 10Y	31.76	185.42	188.02		188.02	0.000222	0.53	115.77	72.81	0.12
Reach-1	207.7	(Ex) - 25Y	42.70	185.42	188.61		188.61	0.000150	0.51	160.12	77.43	0.10
Reach-1	207.7	(Ex) - 50Y	54.07	185.42	189.33		189.33	0.000080	0.44	290.63	252.35	0.08
Reach-1	207.7	(Ex) - 100Y	66.78	185.42	189.43		189.43	0.000104	0.51	317.01	267.19	0.09
Reach-1	207.7	(Ex) - Regional	205.61	185.42	189.73		189.76	0.000783	1.48	406.55	310.92	0.24
Reach-1	207.3	(Ex) - 2Y	7.73	185.14	187.38		187.38	0.000079	0.26	58.72	55.08	0.06
Reach-1	207.3	(Ex) - 5Y	17.80	185.14	187.56		187.56	0.000258	0.50	68.81	56.18	0.12
Reach-1	207.3	(Ex) - 10Y	31.76	185.14	188.01		188.01	0.000315	0.64	94.52	58.87	0.14
Reach-1	207.3	(Ex) - 25Y	42.70	185.14	188.60		188.61	0.000216	0.62	130.50	62.44	0.12
Reach-1	207.3	(Ex) - 50Y	54.07	185.14	189.32		189.33	0.000126	0.55	228.25	285.20	0.09
Reach-1	207.3	(Ex) - 100Y	66.78	185.14	189.42		189.43	0.000162	0.63	257.74	305.26	0.11
Reach-1	207.3	(Ex) - Regional	205.61	185.14	189.70		189.74	0.000925	1.59	355.76	380.42	0.25
Reach-1	207	(Ex) - 2Y	7.73	184.85	187.38	185.38	187.38	0.000009	0.09	84.58	51.36	0.02
Reach-1	207	(Ex) - 5Y	17.80	184.85	187.56	185.59	187.56	0.000033	0.19	93.90	52.25	0.04
Reach-1	207	(Ex) - 10Y	31.76	184.85	188.01	185.79	188.01	0.000053	0.27	117.28	55.12	0.06
Reach-1	207	(Ex) - 25Y	42.70	184.85	188.60	185.91	188.60	0.000045	0.29	149.49	58.89	0.06

Reach-1	207	(Ex) - 50Y	54.07	184.85	189.32	186.06	189.32	0.000034	0.28	190.47	63.92	0.05
Reach-1	207	(Ex) - 100Y	66.78	184.85	189.42	186.16	189.42	0.000048	0.34	196.27	64.76	0.06
Reach-1	207	(Ex) - Regional	205.61	184.85	189.68	186.88	189.72	0.000353	0.97	211.29	66.72	0.16
Reach-1	206.5		Bridge									
Reach-1	206	(Ex) - 2Y	7.73	184.85	187.38		187.38	0.000011	0.10	75.98	45.85	0.03
Reach-1	206	(Ex) - 5Y	17.80	184.85	187.56		187.56	0.000042	0.21	84.32	47.22	0.05
Reach-1	206	(Ex) - 10Y	31.76	184.85	188.00		188.00	0.000070	0.30	106.22	51.30	0.07
Reach-1	206	(Ex) - 25Y	42.70	184.85	188.59		188.60	0.000059	0.31	138.30	56.45	0.06
Reach-1	206	(Ex) - 50Y	54.07	184.85	189.32		189.32	0.000040	0.30	179.69	59.29	0.05
Reach-1	206	(Ex) - 100Y	66.78	184.85	189.41		189.42	0.000056	0.36	185.36	59.58	0.06
Reach-1	206	(Ex) - Regional	205.61	184.85	189.63		189.69	0.000424	1.04	198.19	60.22	0.18
Reach-1	205	(Ex) - 2Y	7.73	184.90	187.38		187.38	0.000011	0.11	74.61	48.45	0.03
Reach-1	205	(Ex) - 5Y	17.80	184.90	187.55		187.56	0.000043	0.23	83.40	50.06	0.05
Reach-1	205	(Ex) - 10Y	31.76	184.90	188.00		188.00	0.000066	0.32	110.10	66.58	0.07
Reach-1	205	(Ex) - 25Y	42.70	184.90	188.59		188.60	0.000053	0.34	152.17	74.97	0.06
Reach-1	205	(Ex) - 50Y	54.07	184.90	189.32		189.32	0.000038	0.33	207.98	79.39	0.05
Reach-1	205	(Ex) - 100Y	66.78	184.90	189.41		189.42	0.000052	0.39	215.75	79.94	0.06
Reach-1	205	(Ex) - Regional	205.61	184.90	189.63		189.68	0.000402	1.12	233.03	81.16	0.18

Profile Output Table - Standard Table 1
HEC-RAS Plan: ExOct2015wPropPart2KS(RS234-225) River: RIVER-2 Reach: Reach-1

Rivers = 1
Hydraulic Reaches = 1
River Stations = 68
Plans = 1
Profiles = 7

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
Reach-1	261	(Ex) - 2Y	0.34	208.00	208.42	208.22	208.42	0.001266	0.29	1.17	5.22	0.20
Reach-1	261	(Ex) - 5Y	1.12	208.00	208.68	208.35	208.69	0.001167	0.39	2.86	7.56	0.20
Reach-1	261	(Ex) - 10Y	1.97	208.00	208.87	208.44	208.88	0.001014	0.45	4.42	8.61	0.20
Reach-1	261	(Ex) - 25Y	2.63	208.00	208.99	208.49	209.01	0.000926	0.48	5.51	8.98	0.19
Reach-1	261	(Ex) - 50Y	3.27	208.00	209.10	208.54	209.12	0.000873	0.50	6.50	9.31	0.19
Reach-1	261	(Ex) - 100Y	3.99	208.00	209.21	208.59	209.23	0.000830	0.53	7.56	9.64	0.19
Reach-1	261	(Ex) - Regional	7.14	208.00	209.65	208.76	209.67	0.000647	0.59	12.25	30.18	0.18
Reach-1	260.5		Culvert									
Reach-1	260	(Ex) - 2Y	0.68	207.90	208.27	208.27	208.36	0.037687	1.36	0.50	2.73	1.01
Reach-1	260	(Ex) - 5Y	2.02	207.90	208.47	208.47	208.61	0.032469	1.69	1.20	4.22	1.01
Reach-1	260	(Ex) - 10Y	3.35	207.90	208.59	208.59	208.77	0.030304	1.87	1.80	5.17	1.01
Reach-1	260	(Ex) - 25Y	4.39	207.90	208.67	208.67	208.87	0.028932	1.96	2.24	5.78	1.01
Reach-1	260	(Ex) - 50Y	5.40	207.90	208.74	208.74	208.96	0.028143	2.05	2.64	6.27	1.01
Reach-1	260	(Ex) - 100Y	6.51	207.90	208.80	208.80	209.04	0.027811	2.14	3.04	6.73	1.01
Reach-1	260	(Ex) - Regional	11.52	207.90	209.03	209.03	209.34	0.024568	2.50	4.61	12.09	1.01
Reach-1	259	(Ex) - 2Y	0.68	206.90	207.27		207.27	0.000026	0.06	12.11	34.41	0.03
Reach-1	259	(Ex) - 5Y	2.02	206.90	207.47		207.47	0.000053	0.11	19.11	36.14	0.05
Reach-1	259	(Ex) - 10Y	3.35	206.90	207.50		207.50	0.000123	0.17	20.19	36.40	0.07
Reach-1	259	(Ex) - 25Y	4.39	206.90	207.57		207.57	0.000141	0.19	22.96	37.05	0.08
Reach-1	259	(Ex) - 50Y	5.40	206.90	207.64		207.64	0.000157	0.21	25.33	37.61	0.08
Reach-1	259	(Ex) - 100Y	6.51	206.90	207.70		207.70	0.000173	0.24	27.68	38.15	0.09
Reach-1	259	(Ex) - Regional	11.52	206.90	207.92		207.93	0.000233	0.32	36.39	40.08	0.11
Reach-1	258	(Ex) - 2Y	0.68	206.90	207.25	207.11	207.26	0.002386	0.43	1.87	11.09	0.27
Reach-1	258	(Ex) - 5Y	2.02	206.90	207.43	207.23	207.45	0.002673	0.65	4.39	17.20	0.32
Reach-1	258	(Ex) - 10Y	3.35	206.90	207.31	207.31	207.43	0.024931	1.61	2.64	13.25	0.92
Reach-1	258	(Ex) - 25Y	4.39	206.90	207.36	207.36	207.50	0.023414	1.73	3.39	15.07	0.92
Reach-1	258	(Ex) - 50Y	5.40	206.90	207.41	207.41	207.56	0.022361	1.83	4.11	16.63	0.91
Reach-1	258	(Ex) - 100Y	6.51	206.90	207.46	207.46	207.61	0.021302	1.92	4.91	18.21	0.91
Reach-1	258	(Ex) - Regional	11.52	206.90	207.62	207.62	207.81	0.019566	2.25	8.39	25.40	0.91
Reach-1	257	(Ex) - 2Y	0.68	205.60	205.81	205.81	205.86	0.043405	1.05	0.65	6.27	1.02
Reach-1	257	(Ex) - 5Y	2.02	205.60	205.93	205.93	206.02	0.028536	1.40	1.65	10.32	0.94
Reach-1	257	(Ex) - 10Y	3.35	205.60	207.26		207.26	0.000009	0.09	96.62	134.45	0.02
Reach-1	257	(Ex) - 25Y	4.39	205.60	207.30		207.30	0.000013	0.11	102.21	142.76	0.03
Reach-1	257	(Ex) - 50Y	5.40	205.60	207.33		207.33	0.000018	0.13	106.04	145.15	0.03
Reach-1	257	(Ex) - 100Y	6.51	205.60	207.35		207.35	0.000025	0.15	108.21	146.49	0.04
Reach-1	257	(Ex) - Regional	11.52	205.60	207.42		207.42	0.000062	0.25	118.60	153.76	0.06
Reach-1	256	(Ex) - 2Y	0.68	204.50	204.84		204.84	0.001326	0.35	3.42	22.55	0.21
Reach-1	256	(Ex) - 5Y	2.02	204.50	205.15		205.15	0.000409	0.32	13.82	45.52	0.13
Reach-1	256	(Ex) - 10Y	3.35	204.50	207.26		207.26	0.000000	0.03	319.65	252.51	0.01
Reach-1	256	(Ex) - 25Y	4.39	204.50	207.30		207.30	0.000001	0.04	329.90	258.24	0.01
Reach-1	256	(Ex) - 50Y	5.40	204.50	207.33		207.33	0.000001	0.04	336.79	262.01	0.01
Reach-1	256	(Ex) - 100Y	6.51	204.50	207.35		207.35	0.000001	0.05	340.68	264.12	0.01
Reach-1	256	(Ex) - Regional	11.52	204.50	207.41		207.41	0.000004	0.09	359.18	275.76	0.02
Reach-1	255.5	(Ex) - 2Y	0.68	204.10	204.27	204.27	204.31	0.033216	1.00	1.07	14.95	0.91
Reach-1	255.5	(Ex) - 5Y	2.02	204.10	205.15	204.36	205.15	0.000016	0.09	61.70	138.74	0.03
Reach-1	255.5	(Ex) - 10Y	3.35	204.10	207.26	204.41	207.26	0.000000	0.01	559.94	305.01	0.00
Reach-1	255.5	(Ex) - 25Y	4.39	204.10	207.30	204.45	207.30	0.000000	0.02	572.23	306.84	0.00
Reach-1	255.5	(Ex) - 50Y	5.40	204.10	207.33	204.48	207.33	0.000000	0.02	580.36	307.75	0.00
Reach-1	255.5	(Ex) - 100Y	6.51	204.10	207.35	204.50	207.35	0.000000	0.03	584.90	308.26	0.00
Reach-1	255.5	(Ex) - Regional	11.52	204.10	207.41	204.61	207.41	0.000001	0.05	606.13	310.63	0.01
Reach-1	255	(Ex) - 2Y	0.68	202.76	203.49	203.12	203.54	0.002637	0.93	0.73	8.88	0.35
Reach-1	255	(Ex) - 5Y	2.02	202.76	205.10	203.50	205.14	0.000484	0.86	2.34	169.03	0.18

Reach-1	255	(Ex) - 10Y	3.35	202.76	207.25	203.80	207.26	0.001514	0.58	13.36	307.19	0.25
Reach-1	255	(Ex) - 25Y	4.39	202.76	207.29	204.01	207.30	0.001265	0.55	21.60	308.62	0.23
Reach-1	255	(Ex) - 50Y	5.40	202.76	207.32	204.20	207.33	0.001260	0.57	26.70	309.50	0.23
Reach-1	255	(Ex) - 100Y	6.51	202.76	207.33	204.39	207.34	0.001519	0.63	29.12	309.92	0.25
Reach-1	255	(Ex) - Regional	11.52	202.76	207.40	205.14	207.41	0.002351	0.62	43.41	312.21	0.29
Reach-1	254.5		Culvert									
Reach-1	254	(Ex) - 2Y	0.68	202.63	203.27		203.33	0.004081	1.06	0.64	7.04	0.42
Reach-1	254	(Ex) - 5Y	2.02	202.63	203.72	203.37	203.75	0.010698	0.78	3.80	28.39	0.55
Reach-1	254	(Ex) - 10Y	3.35	202.63	203.79	203.71	203.82	0.010019	0.88	5.88	33.18	0.55
Reach-1	254	(Ex) - 25Y	4.39	202.63	203.84	203.75	203.87	0.009414	0.93	7.81	42.31	0.54
Reach-1	254	(Ex) - 50Y	5.40	202.63	203.88	203.77	203.91	0.009200	0.97	9.32	45.31	0.55
Reach-1	254	(Ex) - 100Y	6.51	202.63	203.92	203.79	203.95	0.008841	1.01	11.02	48.56	0.54
Reach-1	254	(Ex) - Regional	11.52	202.63	204.06	203.90	204.09	0.007887	1.14	19.49	76.02	0.53
Reach-1	253	(Ex) - 2Y	0.68	202.40	202.65	202.54	202.66	0.002243	0.37	2.41	18.07	0.26
Reach-1	253	(Ex) - 5Y	2.02	202.40	202.79	202.63	202.81	0.002599	0.56	5.55	27.13	0.30
Reach-1	253	(Ex) - 10Y	3.35	202.40	202.88	202.70	202.90	0.002745	0.67	8.25	33.00	0.32
Reach-1	253	(Ex) - 25Y	4.39	202.40	202.94	202.74	202.96	0.002860	0.74	10.17	36.75	0.34
Reach-1	253	(Ex) - 50Y	5.40	202.40	202.99	202.77	203.01	0.002906	0.79	12.01	40.08	0.34
Reach-1	253	(Ex) - 100Y	6.51	202.40	203.03	202.80	203.05	0.002991	0.85	13.88	43.32	0.35
Reach-1	253	(Ex) - Regional	11.52	202.40	203.19	202.92	203.22	0.003205	1.03	21.61	53.79	0.38
Reach-1	252.5	(Ex) - 2Y	0.68	202.00	202.14	202.14	202.18	0.040363	0.91	0.80	11.10	0.96
Reach-1	252.5	(Ex) - 5Y	2.02	202.00	202.23	202.23	202.30	0.028745	1.22	2.13	17.90	0.91
Reach-1	252.5	(Ex) - 10Y	3.35	202.00	202.29	202.29	202.38	0.026675	1.41	3.33	22.32	0.92
Reach-1	252.5	(Ex) - 25Y	4.39	202.00	202.33	202.33	202.43	0.025064	1.52	4.28	25.27	0.91
Reach-1	252.5	(Ex) - 50Y	5.40	202.00	202.36	202.36	202.47	0.024930	1.62	5.10	27.56	0.92
Reach-1	252.5	(Ex) - 100Y	6.51	202.00	202.40	202.40	202.51	0.024055	1.70	6.05	30.01	0.92
Reach-1	252.5	(Ex) - Regional	11.52	202.00	202.51	202.51	202.65	0.023286	2.01	9.66	35.47	0.95
Reach-1	252	(Ex) - 2Y	1.91	200.60	201.11		201.12	0.000931	0.41	7.63	29.00	0.19
Reach-1	252	(Ex) - 5Y	4.19	200.60	201.30		201.31	0.001021	0.54	13.88	36.92	0.21
Reach-1	252	(Ex) - 10Y	6.84	200.60	201.45		201.46	0.001115	0.64	19.64	41.72	0.23
Reach-1	252	(Ex) - 25Y	9.09	200.60	201.55		201.56	0.001187	0.72	24.13	46.75	0.24
Reach-1	252	(Ex) - 50Y	11.48	200.60	201.64		201.66	0.001246	0.78	28.56	50.75	0.25
Reach-1	252	(Ex) - 100Y	13.95	200.60	201.72		201.74	0.001294	0.84	32.79	53.74	0.26
Reach-1	252	(Ex) - Regional	34.15	200.60	202.17		202.20	0.001584	1.18	62.01	73.96	0.30
Reach-1	251	(Ex) - 2Y	1.91	200.40	200.87	200.66	200.88	0.001603	0.50	6.51	27.51	0.25
Reach-1	251	(Ex) - 5Y	4.19	200.40	201.02	200.77	201.04	0.002009	0.69	11.43	36.63	0.29
Reach-1	251	(Ex) - 10Y	6.84	200.40	201.14	200.86	201.16	0.002272	0.83	15.85	40.18	0.32
Reach-1	251	(Ex) - 25Y	9.09	200.40	201.20	200.91	201.23	0.002759	0.96	18.39	42.95	0.36
Reach-1	251	(Ex) - 50Y	11.48	200.40	201.25	200.98	201.29	0.003219	1.09	20.81	45.43	0.39
Reach-1	251	(Ex) - 100Y	13.95	200.40	201.31	201.04	201.34	0.003624	1.20	23.17	47.72	0.42
Reach-1	251	(Ex) - Regional	34.15	200.40	201.58	201.30	201.66	0.006191	1.89	37.67	58.48	0.57
Reach-1	250	(Ex) - 2Y	1.91	199.70	199.98	199.98	200.06	0.030866	1.25	1.67	13.53	0.94
Reach-1	250	(Ex) - 5Y	4.19	199.70	200.13	200.13	200.21	0.015977	1.34	4.73	41.04	0.75
Reach-1	250	(Ex) - 10Y	6.84	199.70	200.22	200.22	200.30	0.014285	1.48	8.50	58.17	0.73
Reach-1	250	(Ex) - 25Y	9.09	199.70	200.29	200.26	200.36	0.010457	1.41	12.77	64.34	0.64
Reach-1	250	(Ex) - 50Y	11.48	199.70	200.36	200.30	200.42	0.008294	1.38	17.21	71.28	0.59
Reach-1	250	(Ex) - 100Y	13.95	199.70	200.42	200.33	200.48	0.007057	1.36	21.61	77.69	0.55
Reach-1	250	(Ex) - Regional	34.15	199.70	200.78	200.52	200.82	0.003896	1.37	62.83	183.65	0.44
Reach-1	249	(Ex) - 2Y	1.91	198.40	198.88	198.68	198.89	0.001886	0.55	5.83	26.96	0.27
Reach-1	249	(Ex) - 5Y	4.19	198.40	199.05	198.79	199.07	0.002250	0.75	9.97	33.09	0.31
Reach-1	249	(Ex) - 10Y	6.84	198.40	199.19	198.88	199.21	0.002524	0.91	13.93	38.02	0.34
Reach-1	249	(Ex) - 25Y	9.09	198.40	199.28	198.94	199.31	0.002687	1.02	16.96	41.38	0.36
Reach-1	249	(Ex) - 50Y	11.48	198.40	199.37	199.00	199.40	0.002874	1.12	19.85	44.63	0.37
Reach-1	249	(Ex) - 100Y	13.95	198.40	199.44	199.05	199.48	0.003022	1.21	22.70	47.68	0.39
Reach-1	249	(Ex) - Regional	34.15	198.40	199.86	199.38	199.92	0.003811	1.72	41.53	80.40	0.46
Reach-1	248.5	(Ex) - 2Y	1.91	198.10	198.33	198.33	198.40	0.031185	1.20	1.90	19.75	0.93
Reach-1	248.5	(Ex) - 5Y	4.19	198.10	198.43	198.43	198.53	0.025519	1.48	3.90	27.19	0.91
Reach-1	248.5	(Ex) - 10Y	6.84	198.10	198.51	198.51	198.63	0.023729	1.70	5.99	32.62	0.92
Reach-1	248.5	(Ex) - 25Y	9.09	198.10	198.57	198.57	198.70	0.023500	1.86	7.60	36.21	0.93
Reach-1	248.5	(Ex) - 50Y	11.48	198.10	198.62	198.62	198.76	0.022339	1.97	9.39	39.82	0.93
Reach-1	248.5	(Ex) - 100Y	13.95	198.10	198.67	198.67	198.82	0.021964	2.09	11.09	42.97	0.94
Reach-1	248.5	(Ex) - Regional	34.15	198.10	198.94	198.94	199.16	0.020946	2.71	23.20	58.70	0.98

Reach-1	248	(Ex) - 2Y	1.91	196.26	196.84	196.39	196.85	0.000280	0.26	7.36	15.22	0.11
Reach-1	248	(Ex) - 5Y	4.19	196.26	197.10	196.49	197.11	0.000394	0.39	10.63	16.38	0.14
Reach-1	248	(Ex) - 10Y	6.84	196.26	197.34	196.57	197.35	0.000463	0.50	13.59	17.77	0.15
Reach-1	248	(Ex) - 25Y	9.09	196.26	197.49	196.64	197.51	0.000533	0.59	15.46	19.74	0.17
Reach-1	248	(Ex) - 50Y	11.48	196.26	197.63	196.70	197.65	0.000588	0.66	17.27	21.80	0.18
Reach-1	248	(Ex) - 100Y	13.95	196.26	197.76	196.76	197.79	0.000638	0.74	18.94	24.26	0.19
Reach-1	248	(Ex) - Regional	34.15	196.26	198.54	197.17	198.61	0.000952	1.19	28.74	39.43	0.25
Reach-1	247.5		Culvert									
Reach-1	247	(Ex) - 2Y	2.15	195.95	196.84	196.09	196.84	0.000086	0.19	11.24	14.93	0.06
Reach-1	247	(Ex) - 5Y	4.51	195.95	197.10	196.18	197.11	0.000163	0.31	14.49	15.60	0.09
Reach-1	247	(Ex) - 10Y	7.62	195.95	197.33	196.28	197.34	0.000252	0.44	17.41	16.20	0.12
Reach-1	247	(Ex) - 25Y	10.06	195.95	197.48	196.35	197.49	0.000315	0.52	19.24	16.58	0.14
Reach-1	247	(Ex) - 50Y	12.79	195.95	197.62	196.42	197.64	0.000381	0.61	20.99	17.06	0.15
Reach-1	247	(Ex) - 100Y	15.67	195.95	197.74	196.49	197.77	0.000446	0.69	22.61	18.33	0.17
Reach-1	247	(Ex) - Regional	40.02	195.95	198.47	196.96	198.55	0.000934	1.26	31.79	25.29	0.25
Reach-1	246	(Ex) - 2Y	2.15	195.90	196.81	196.46	196.83	0.001895	0.62	4.19	13.01	0.26
Reach-1	246	(Ex) - 5Y	4.51	195.90	197.05	196.65	197.07	0.001985	0.80	7.77	16.51	0.29
Reach-1	246	(Ex) - 10Y	7.62	195.90	197.26	196.83	197.30	0.002098	0.97	11.53	18.38	0.31
Reach-1	246	(Ex) - 25Y	10.06	195.90	197.40	196.93	197.44	0.002174	1.07	14.11	19.55	0.32
Reach-1	246	(Ex) - 50Y	12.79	195.90	197.53	197.02	197.58	0.002255	1.17	16.73	20.69	0.33
Reach-1	246	(Ex) - 100Y	15.67	195.90	197.65	197.10	197.71	0.002337	1.26	19.29	21.76	0.34
Reach-1	246	(Ex) - Regional	40.02	195.90	198.35	197.59	198.46	0.002871	1.83	36.73	28.21	0.40
Reach-1	245.5	(Ex) - 2Y	2.15	195.50	196.41	196.19	196.46	0.004747	0.98	2.92	10.39	0.42
Reach-1	245.5	(Ex) - 5Y	4.51	195.50	196.66	196.43	196.71	0.004259	1.18	6.16	15.53	0.42
Reach-1	245.5	(Ex) - 10Y	7.62	195.50	196.87	196.61	196.93	0.004126	1.36	9.82	18.99	0.43
Reach-1	245.5	(Ex) - 25Y	10.06	195.50	197.00	196.70	197.07	0.004089	1.47	12.45	21.13	0.44
Reach-1	245.5	(Ex) - 50Y	12.79	195.50	197.13	196.79	197.20	0.004056	1.57	15.26	23.19	0.44
Reach-1	245.5	(Ex) - 100Y	15.67	195.50	197.25	196.87	197.33	0.004033	1.66	18.08	25.10	0.45
Reach-1	245.5	(Ex) - Regional	40.02	195.50	197.95	197.36	198.06	0.003579	2.05	39.20	47.09	0.45
Reach-1	245	(Ex) - 2Y	2.15	195.00	196.01	195.69	196.04	0.002902	0.84	3.47	11.56	0.34
Reach-1	245	(Ex) - 5Y	4.51	195.00	196.24	195.95	196.29	0.003201	1.08	6.87	17.35	0.37
Reach-1	245	(Ex) - 10Y	7.62	195.00	196.44	196.14	196.50	0.003383	1.28	10.56	19.97	0.40
Reach-1	245	(Ex) - 25Y	10.06	195.00	196.56	196.26	196.62	0.003505	1.40	13.09	21.58	0.41
Reach-1	245	(Ex) - 50Y	12.79	195.00	196.68	196.33	196.75	0.003587	1.51	15.73	23.03	0.42
Reach-1	245	(Ex) - 100Y	15.67	195.00	196.79	196.42	196.87	0.003659	1.61	18.34	24.33	0.43
Reach-1	245	(Ex) - Regional	40.02	195.00	197.45	196.88	197.57	0.004307	2.25	38.05	37.96	0.50
Reach-1	244	(Ex) - 2Y	2.15	194.40	194.89	194.89	195.01	0.033449	1.57	1.37	5.66	1.01
Reach-1	244	(Ex) - 5Y	4.51	194.40	195.05	195.05	195.22	0.030204	1.83	2.47	7.47	1.02
Reach-1	244	(Ex) - 10Y	7.62	194.40	195.20	195.20	195.42	0.027892	2.05	3.71	8.86	1.01
Reach-1	244	(Ex) - 25Y	10.06	194.40	195.30	195.30	195.54	0.026118	2.16	4.65	9.79	1.00
Reach-1	244	(Ex) - 50Y	12.79	194.40	195.40	195.40	195.66	0.025243	2.28	5.62	10.65	1.00
Reach-1	244	(Ex) - 100Y	15.67	194.40	195.49	195.49	195.77	0.024539	2.38	6.59	11.46	1.00
Reach-1	244	(Ex) - Regional	40.02	194.40	196.00	196.00	196.46	0.018284	3.00	14.21	18.84	0.95
Reach-1	243	(Ex) - 2Y	2.15	194.20	194.73		194.73	0.000024	0.07	31.64	63.96	0.03
Reach-1	243	(Ex) - 5Y	4.51	194.20	194.92		194.92	0.000038	0.10	43.71	67.29	0.04
Reach-1	243	(Ex) - 10Y	7.62	194.20	195.08		195.08	0.000053	0.14	55.25	70.48	0.05
Reach-1	243	(Ex) - 25Y	10.06	194.20	195.19		195.19	0.000063	0.16	62.69	72.46	0.06
Reach-1	243	(Ex) - 50Y	12.79	194.20	195.29		195.29	0.000073	0.18	70.01	74.35	0.06
Reach-1	243	(Ex) - 100Y	15.67	194.20	195.38		195.38	0.000083	0.20	76.90	76.09	0.06
Reach-1	243	(Ex) - Regional	40.02	194.20	195.92		195.92	0.000143	0.33	120.08	85.18	0.09
Reach-1	242	(Ex) - 2Y	2.15	194.20	194.73		194.73	0.000018	0.06	36.14	72.81	0.03
Reach-1	242	(Ex) - 5Y	4.51	194.20	194.91		194.91	0.000029	0.09	49.74	75.95	0.04
Reach-1	242	(Ex) - 10Y	7.62	194.20	195.08		195.08	0.000041	0.12	62.60	78.81	0.04
Reach-1	242	(Ex) - 25Y	10.06	194.20	195.18		195.18	0.000049	0.14	70.84	80.59	0.05
Reach-1	242	(Ex) - 50Y	12.79	194.20	195.28		195.28	0.000056	0.16	78.88	81.91	0.05
Reach-1	242	(Ex) - 100Y	15.67	194.20	195.37		195.37	0.000063	0.18	86.37	83.05	0.06
Reach-1	242	(Ex) - Regional	40.02	194.20	195.90		195.91	0.000111	0.30	132.35	89.96	0.08
Reach-1	241	(Ex) - 2Y	2.15	194.20	194.61	194.61	194.72	0.034916	1.44	1.49	7.24	1.01
Reach-1	241	(Ex) - 5Y	4.51	194.20	194.75	194.75	194.90	0.031595	1.67	2.70	9.74	1.01
Reach-1	241	(Ex) - 10Y	7.62	194.20	194.88	194.88	195.06	0.029340	1.85	4.11	12.03	1.01
Reach-1	241	(Ex) - 25Y	10.06	194.20	194.96	194.96	195.16	0.028328	1.96	5.13	13.44	1.01
Reach-1	241	(Ex) - 50Y	12.79	194.20	195.04	195.04	195.26	0.027478	2.06	6.22	14.79	1.01
Reach-1	241	(Ex) - 100Y	15.67	194.20	195.12	195.12	195.35	0.026034	2.12	7.39	16.12	1.00

Reach-1	241	(Ex) - Regional	40.02	194.20	195.53	195.53	195.87	0.023082	2.56	15.61	23.43	1.00
Reach-1	240	(Ex) - 2Y	2.15	194.00	194.60	194.04	194.60	0.000006	0.04	57.43	99.76	0.02
Reach-1	240	(Ex) - 5Y	4.51	194.00	194.72	194.06	194.72	0.000014	0.06	69.68	101.22	0.02
Reach-1	240	(Ex) - 10Y	7.62	194.00	194.83	194.09	194.83	0.000024	0.09	81.36	102.59	0.03
Reach-1	240	(Ex) - 25Y	10.06	194.00	194.91	194.10	194.91	0.000032	0.11	88.87	103.44	0.04
Reach-1	240	(Ex) - 50Y	12.79	194.00	194.98	194.13	194.98	0.000040	0.13	96.24	104.03	0.04
Reach-1	240	(Ex) - 100Y	15.67	194.00	195.05	194.14	195.05	0.000047	0.15	103.33	104.60	0.05
Reach-1	240	(Ex) - Regional	40.02	194.00	195.48	194.26	195.48	0.000095	0.27	149.50	108.21	0.07
Reach-1	239	(Ex) - 2Y	2.15	194.00	194.60		194.60	0.000005	0.03	64.91	111.91	0.01
Reach-1	239	(Ex) - 5Y	4.51	194.00	194.72		194.72	0.000011	0.06	78.48	113.04	0.02
Reach-1	239	(Ex) - 10Y	7.62	194.00	194.83		194.83	0.000019	0.08	91.32	114.09	0.03
Reach-1	239	(Ex) - 25Y	10.06	194.00	194.90		194.90	0.000025	0.10	99.53	114.76	0.03
Reach-1	239	(Ex) - 50Y	12.79	194.00	194.97		194.97	0.000032	0.12	107.58	115.41	0.04
Reach-1	239	(Ex) - 100Y	15.67	194.00	195.04		195.04	0.000038	0.14	115.31	116.04	0.04
Reach-1	239	(Ex) - Regional	40.02	194.00	195.47		195.47	0.000077	0.24	165.68	119.90	0.07
Reach-1	238	(Ex) - 2Y	2.15	194.00	194.60		194.60	0.000001	0.02	117.51	199.14	0.01
Reach-1	238	(Ex) - 5Y	4.51	194.00	194.72		194.72	0.000003	0.03	141.58	199.90	0.01
Reach-1	238	(Ex) - 10Y	7.62	194.00	194.83		194.83	0.000006	0.05	164.20	200.61	0.02
Reach-1	238	(Ex) - 25Y	10.06	194.00	194.90		194.90	0.000008	0.06	178.61	201.06	0.02
Reach-1	238	(Ex) - 50Y	12.79	194.00	194.97		194.97	0.000009	0.07	192.68	201.50	0.02
Reach-1	238	(Ex) - 100Y	15.67	194.00	195.04		195.04	0.000011	0.08	206.14	201.92	0.02
Reach-1	238	(Ex) - Regional	40.02	194.00	195.47		195.47	0.000023	0.14	292.96	204.61	0.04
Reach-1	237	(Ex) - 2Y	2.15	194.00	194.60	194.02	194.60	0.000001	0.02	116.29	197.82	0.01
Reach-1	237	(Ex) - 5Y	4.51	194.00	194.72	194.04	194.72	0.000003	0.03	140.16	198.92	0.01
Reach-1	237	(Ex) - 10Y	7.62	194.00	194.83	194.05	194.83	0.000006	0.05	162.63	199.94	0.02
Reach-1	237	(Ex) - 25Y	10.06	194.00	194.90	194.06	194.90	0.000008	0.06	176.94	200.59	0.02
Reach-1	237	(Ex) - 50Y	12.79	194.00	194.97	194.08	194.97	0.000010	0.07	190.93	201.23	0.02
Reach-1	237	(Ex) - 100Y	15.67	194.00	195.04	194.09	195.04	0.000012	0.08	204.32	201.90	0.02
Reach-1	237	(Ex) - Regional	40.02	194.00	195.46	194.16	195.46	0.000024	0.14	291.20	206.58	0.04
Reach-1	236	(Ex) - 2Y	2.15	194.30	194.52	194.52	194.59	0.038617	1.14	1.89	14.15	1.00
Reach-1	236	(Ex) - 5Y	4.51	194.30	194.61	194.61	194.71	0.034728	1.35	3.33	17.99	1.00
Reach-1	236	(Ex) - 10Y	7.62	194.30	194.70	194.70	194.82	0.031974	1.51	5.04	22.38	1.00
Reach-1	236	(Ex) - 25Y	10.06	194.30	194.75	194.75	194.89	0.030841	1.62	6.21	24.70	1.00
Reach-1	236	(Ex) - 50Y	12.79	194.30	194.80	194.80	194.95	0.029687	1.71	7.46	26.89	1.00
Reach-1	236	(Ex) - 100Y	15.67	194.30	194.85	194.85	195.02	0.028472	1.81	8.63	28.04	1.00
Reach-1	236	(Ex) - Regional	40.02	194.30	195.16	195.16	195.43	0.022178	2.34	17.59	39.83	0.97
Reach-1	235	(Ex) - 2Y	2.59	193.20	193.72	193.54	193.73	0.003794	0.55	4.68	18.17	0.35
Reach-1	235	(Ex) - 5Y	5.06	193.20	193.85	193.64	193.87	0.003929	0.68	7.46	22.63	0.37
Reach-1	235	(Ex) - 10Y	8.20	193.20	193.96	193.74	194.00	0.004033	0.82	10.19	25.75	0.39
Reach-1	235	(Ex) - 25Y	10.89	193.20	194.04	193.80	194.08	0.004097	0.92	12.29	27.85	0.41
Reach-1	235	(Ex) - 50Y	13.72	193.20	194.02	193.85	194.10	0.007394	1.21	11.76	27.33	0.54
Reach-1	235	(Ex) - 100Y	16.73	193.20	194.09	193.91	194.17	0.007346	1.30	13.52	29.01	0.55
Reach-1	235	(Ex) - Regional	46.48	193.20	194.52	194.29	194.70	0.007460	1.92	29.18	44.55	0.61
Reach-1	234	(Ex) - 2Y	2.59	191.80	192.17	192.17	192.26	0.034915	1.37	1.89	9.88	1.00
Reach-1	234	(Ex) - 5Y	5.06	191.80	192.29	192.29	192.41	0.030963	1.56	3.24	12.79	0.99
Reach-1	234	(Ex) - 10Y	8.20	191.80	192.39	192.39	192.55	0.027707	1.77	4.71	15.97	0.98
Reach-1	234	(Ex) - 25Y	10.89	191.80	192.46	192.46	192.64	0.025923	1.91	5.94	17.64	0.97
Reach-1	234	(Ex) - 50Y	13.72	191.80	192.59	192.59	192.67	0.009576	1.39	19.54	138.37	0.62
Reach-1	234	(Ex) - 100Y	16.73	191.80	192.62	192.62	192.70	0.010275	1.49	23.21	138.97	0.65
Reach-1	234	(Ex) - Regional	46.48	191.80	192.78	192.78	192.91	0.015512	2.18	46.10	142.67	0.83
Reach-1	233	(Ex) - 2Y	2.59	190.30	190.96		190.97	0.001617	0.48	11.61	134.24	0.24
Reach-1	233	(Ex) - 5Y	5.06	190.30	191.07		191.08	0.001039	0.44	26.71	136.78	0.20
Reach-1	233	(Ex) - 10Y	8.20	190.30	191.15		191.15	0.001114	0.51	37.09	138.70	0.21
Reach-1	233	(Ex) - 25Y	10.89	190.30	191.18		191.19	0.001338	0.58	42.41	139.68	0.24
Reach-1	233	(Ex) - 50Y	13.72	190.30	191.22		191.23	0.001498	0.64	47.80	140.60	0.25
Reach-1	233	(Ex) - 100Y	16.73	190.30	191.26		191.27	0.001579	0.68	53.68	141.56	0.26
Reach-1	233	(Ex) - Regional	46.48	190.30	191.62		191.64	0.001528	0.89	106.38	152.00	0.28
Reach-1	232	(Ex) - 2Y	2.59	189.90	190.63	190.39	190.65	0.004038	0.71	3.63	10.00	0.38
Reach-1	232	(Ex) - 5Y	5.06	189.90	190.68	190.54	190.76	0.010331	1.20	4.22	10.78	0.61
Reach-1	232	(Ex) - 10Y	8.20	189.90	190.77	190.77	190.83	0.008437	1.21	14.49	138.94	0.57
Reach-1	232	(Ex) - 25Y	10.89	189.90	190.84	190.80	190.88	0.005209	1.05	24.47	140.12	0.46
Reach-1	232	(Ex) - 50Y	13.72	189.90	190.91	190.83	190.94	0.003602	0.95	34.17	141.25	0.39
Reach-1	232	(Ex) - 100Y	16.73	189.90	190.97	190.85	190.99	0.002982	0.92	42.38	142.20	0.36

Reach-1	232	(Ex) - Regional	46.48	189.90	191.43	191.00	191.44	0.001374	0.88	109.17	149.96	0.27
Reach-1	231	(Ex) - 2Y	2.59	189.50	190.31	189.98	190.32	0.001976	0.56	5.13	107.83	0.27
Reach-1	231	(Ex) - 5Y	5.06	189.50	190.48	190.13	190.48	0.000882	0.47	24.00	110.71	0.19
Reach-1	231	(Ex) - 10Y	8.20	189.50	190.65	190.26	190.65	0.000498	0.42	43.23	113.45	0.15
Reach-1	231	(Ex) - 25Y	10.89	189.50	190.72	190.41	190.72	0.000545	0.46	51.12	114.54	0.16
Reach-1	231	(Ex) - 50Y	13.72	189.50	190.79	190.44	190.80	0.000550	0.49	59.71	115.72	0.16
Reach-1	231	(Ex) - 100Y	16.73	189.50	190.85	190.47	190.85	0.000614	0.54	65.79	116.55	0.17
Reach-1	231	(Ex) - Regional	46.48	189.50	191.32	190.64	191.33	0.000727	0.76	123.41	133.94	0.20
Reach-1	230	(Ex) - 2Y	2.59	189.20	190.03	189.73	190.05	0.002639	0.61	4.23	10.63	0.31
Reach-1	230	(Ex) - 5Y	5.06	189.20	190.31	189.89	190.33	0.002073	0.66	7.67	14.39	0.29
Reach-1	230	(Ex) - 10Y	8.20	189.20	190.52	190.03	190.55	0.002015	0.74	13.45	135.59	0.29
Reach-1	230	(Ex) - 25Y	10.89	189.20	190.57	190.12	190.60	0.002502	0.85	20.00	136.48	0.33
Reach-1	230	(Ex) - 50Y	13.72	189.20	190.67	190.21	190.69	0.001848	0.77	33.37	138.29	0.29
Reach-1	230	(Ex) - 100Y	16.73	189.20	190.71	190.29	190.73	0.002046	0.83	38.77	139.03	0.30
Reach-1	230	(Ex) - Regional	46.48	189.20	191.21	190.75	191.23	0.000987	0.81	112.46	150.15	0.23
Reach-1	229	(Ex) - 2Y	2.59	188.60	189.47		189.49	0.001937	0.56	4.64	10.62	0.27
Reach-1	229	(Ex) - 5Y	5.06	188.60	189.57		189.61	0.004243	0.89	5.72	11.79	0.41
Reach-1	229	(Ex) - 10Y	8.20	188.60	189.70		189.76	0.005489	1.13	7.29	13.34	0.48
Reach-1	229	(Ex) - 25Y	10.89	188.60	189.79	189.51	189.84	0.003801	1.04	21.29	149.61	0.41
Reach-1	229	(Ex) - 50Y	13.72	188.60	189.78	189.60	189.86	0.007329	1.42	18.56	149.28	0.56
Reach-1	229	(Ex) - 100Y	16.73	188.60	189.83	189.80	189.90	0.006145	1.37	26.70	150.25	0.52
Reach-1	229	(Ex) - Regional	46.48	188.60	191.16		191.16	0.000119	0.39	245.46	179.09	0.09
Reach-1	228	(Ex) - 2Y	2.59	188.50	189.21	188.96	189.23	0.002951	0.62	4.84	119.95	0.33
Reach-1	228	(Ex) - 5Y	5.06	188.50	189.35	189.09	189.36	0.001324	0.52	22.20	122.30	0.23
Reach-1	228	(Ex) - 10Y	8.20	188.50	189.40	189.28	189.41	0.001864	0.66	28.53	123.14	0.28
Reach-1	228	(Ex) - 25Y	10.89	188.50	189.39		189.41	0.003771	0.92	27.05	122.95	0.39
Reach-1	228	(Ex) - 50Y	13.72	188.50	189.56		189.57	0.001225	0.63	48.10	125.72	0.23
Reach-1	228	(Ex) - 100Y	16.73	188.50	189.71		189.71	0.000686	0.53	66.82	128.14	0.18
Reach-1	228	(Ex) - Regional	46.48	188.50	191.15		191.15	0.000074	0.33	269.91	170.51	0.07
Reach-1	227	(Ex) - 2Y	2.59	188.10	188.77	188.55	188.79	0.003330	0.64	6.22	133.12	0.34
Reach-1	227	(Ex) - 5Y	5.06	188.10	188.69	188.69	188.84	0.030809	1.71	2.95	10.07	1.01
Reach-1	227	(Ex) - 10Y	8.20	188.10	188.83	188.83	188.89	0.010532	1.28	14.65	134.23	0.63
Reach-1	227	(Ex) - 25Y	10.89	188.10	188.97		188.99	0.002544	0.76	33.62	136.71	0.32
Reach-1	227	(Ex) - 50Y	13.72	188.10	189.53		189.53	0.000109	0.25	112.74	148.27	0.07
Reach-1	227	(Ex) - 100Y	16.73	188.10	189.68		189.68	0.000091	0.25	135.80	150.92	0.07
Reach-1	227	(Ex) - Regional	46.48	188.10	191.14		191.15	0.000031	0.24	375.12	185.08	0.05
Reach-1	226	(Ex) - 2Y	2.59	187.80	188.05	188.05	188.07	0.015240	0.87	6.43	109.08	0.66
Reach-1	226	(Ex) - 5Y	5.06	187.80	188.25		188.25	0.000849	0.34	29.60	115.67	0.18
Reach-1	226	(Ex) - 10Y	8.20	187.80	188.58		188.58	0.000162	0.22	68.36	122.73	0.09
Reach-1	226	(Ex) - 25Y	10.89	187.80	188.96		188.96	0.000053	0.17	117.12	131.08	0.05
Reach-1	226	(Ex) - 50Y	13.72	187.80	189.52		189.52	0.000018	0.13	194.32	143.30	0.03
Reach-1	226	(Ex) - 100Y	16.73	187.80	189.68		189.68	0.000019	0.14	216.69	147.29	0.03
Reach-1	226	(Ex) - Regional	46.48	187.80	191.14		191.14	0.000016	0.19	461.89	182.42	0.03
Reach-1	225	(Ex) - 2Y	2.59	187.30	187.89		187.89	0.000206	0.18	25.98	89.15	0.09
Reach-1	225	(Ex) - 5Y	5.06	187.30	188.22		188.22	0.000071	0.15	57.45	98.58	0.06
Reach-1	225	(Ex) - 10Y	8.20	187.30	188.56		188.56	0.000044	0.16	92.92	108.63	0.05
Reach-1	225	(Ex) - 25Y	10.89	187.30	188.95		188.96	0.000024	0.14	137.39	118.06	0.04
Reach-1	225	(Ex) - 50Y	13.72	187.30	189.52		189.52	0.000011	0.12	206.64	126.46	0.03
Reach-1	225	(Ex) - 100Y	16.73	187.30	189.68		189.68	0.000013	0.13	226.26	128.74	0.03
Reach-1	225	(Ex) - Regional	46.48	187.30	191.14		191.14	0.000015	0.20	430.76	150.86	0.03
Reach-1	224	(Ex) - 2Y	6.67	187.03	187.82	187.50	187.83	0.000582	0.45	35.47	89.17	0.16
Reach-1	224	(Ex) - 5Y	16.12	187.03	188.18	187.65	188.19	0.000458	0.51	68.99	97.23	0.15
Reach-1	224	(Ex) - 10Y	26.72	187.03	188.53	187.72	188.54	0.000367	0.55	104.09	105.21	0.14
Reach-1	224	(Ex) - 25Y	35.64	187.03	188.94	187.78	188.94	0.000242	0.52	152.34	127.95	0.12
Reach-1	224	(Ex) - 50Y	44.65	187.03	189.51	187.82	189.51	0.000114	0.43	240.49	178.61	0.09
Reach-1	224	(Ex) - 100Y	54.81	187.03	189.66	187.87	189.67	0.000129	0.48	268.32	192.29	0.09
Reach-1	224	(Ex) - Regional	158.24	187.03	191.13	188.24	191.13	0.000133	0.65	679.91	372.26	0.10
Reach-1	223	(Ex) - 2Y	6.67	186.81	187.62	187.27	187.64	0.001845	0.63	10.65	20.04	0.27
Reach-1	223	(Ex) - 5Y	16.12	186.81	187.98	187.48	188.02	0.002002	0.89	18.04	22.06	0.31
Reach-1	223	(Ex) - 10Y	26.72	186.81	188.34	187.65	188.40	0.001681	1.04	25.74	24.18	0.30
Reach-1	223	(Ex) - 25Y	35.64	186.81	188.79	187.77	188.85	0.001049	1.01	35.24	26.36	0.25
Reach-1	223	(Ex) - 50Y	44.65	186.81	189.42	187.88	189.47	0.000570	0.92	48.45	35.83	0.19
Reach-1	223	(Ex) - 100Y	54.81	186.81	189.55	188.00	189.61	0.000717	1.07	51.15	43.21	0.22

Reach-1	223	(Ex) - Regional	158.24	186.81	190.96	188.91	191.07	0.000885	1.57	193.06	216.00	0.26
Reach-1	222.5		Bridge									
Reach-1	222	(Ex) - 2Y	6.67	186.60	187.52		187.54	0.001231	0.57	11.75	50.75	0.23
Reach-1	222	(Ex) - 5Y	16.12	186.60	187.85		187.89	0.001896	0.88	18.30	57.16	0.30
Reach-1	222	(Ex) - 10Y	26.72	186.60	188.23		188.28	0.001563	1.02	26.26	64.64	0.29
Reach-1	222	(Ex) - 25Y	35.64	186.60	188.72		188.77	0.000919	0.97	36.60	72.55	0.24
Reach-1	222	(Ex) - 50Y	44.65	186.60	189.38		189.42	0.000495	0.89	50.45	83.90	0.18
Reach-1	222	(Ex) - 100Y	54.81	186.60	189.49		189.55	0.000638	1.04	52.87	85.93	0.21
Reach-1	222	(Ex) - Regional	158.24	186.60	190.04	188.77	190.35	0.002755	2.46	64.40	170.61	0.45
Reach-1	221	(Ex) - 2Y	6.67	186.20	187.47		187.48	0.000447	0.51	25.33	42.24	0.15
Reach-1	221	(Ex) - 5Y	16.12	186.20	187.75		187.77	0.000894	0.83	38.07	47.12	0.22
Reach-1	221	(Ex) - 10Y	26.72	186.20	188.15		188.17	0.000761	0.91	57.87	51.30	0.22
Reach-1	221	(Ex) - 25Y	35.64	186.20	188.68		188.70	0.000433	0.81	86.54	56.64	0.17
Reach-1	221	(Ex) - 50Y	44.65	186.20	189.37		189.38	0.000228	0.70	127.88	67.46	0.13
Reach-1	221	(Ex) - 100Y	54.81	186.20	189.48		189.49	0.000292	0.81	136.06	77.62	0.15
Reach-1	221	(Ex) - Regional	158.24	186.20	190.02		190.08	0.001179	1.81	189.17	116.20	0.30
Reach-1	220	(Ex) - 2Y	6.67	186.20	187.44		187.44	0.000505	0.53	28.26	54.78	0.16
Reach-1	220	(Ex) - 5Y	16.12	186.20	187.69		187.71	0.000966	0.84	43.25	62.42	0.23
Reach-1	220	(Ex) - 10Y	26.72	186.20	188.11		188.12	0.000644	0.82	70.61	67.17	0.20
Reach-1	220	(Ex) - 25Y	35.64	186.20	188.66		188.67	0.000316	0.69	109.36	72.90	0.14
Reach-1	220	(Ex) - 50Y	44.65	186.20	189.36		189.36	0.000158	0.58	162.15	81.60	0.11
Reach-1	220	(Ex) - 100Y	54.81	186.20	189.47		189.47	0.000206	0.68	171.37	85.19	0.12
Reach-1	220	(Ex) - Regional	158.24	186.20	189.97		190.01	0.000895	1.56	217.70	108.96	0.26
Reach-1	219	(Ex) - 2Y	6.67	186.20	187.41		187.41	0.000103	0.23	74.03	148.41	0.07
Reach-1	219	(Ex) - 5Y	16.12	186.20	187.65		187.65	0.000185	0.36	109.15	152.24	0.10
Reach-1	219	(Ex) - 10Y	26.72	186.20	188.09		188.09	0.000112	0.34	177.32	157.75	0.08
Reach-1	219	(Ex) - 25Y	35.64	186.20	188.65		188.65	0.000054	0.28	268.71	164.55	0.06
Reach-1	219	(Ex) - 50Y	44.65	186.20	189.35		189.35	0.000027	0.24	398.08	235.41	0.04
Reach-1	219	(Ex) - 100Y	54.81	186.20	189.46		189.46	0.000034	0.28	424.52	247.69	0.05
Reach-1	219	(Ex) - Regional	158.24	186.20	189.94		189.94	0.000196	0.73	560.93	296.68	0.12
Reach-1	218	(Ex) - 2Y	6.67	186.20	187.40		187.40	0.000084	0.21	85.82	179.91	0.07
Reach-1	218	(Ex) - 5Y	16.12	186.20	187.62		187.63	0.000148	0.32	126.42	183.06	0.09
Reach-1	218	(Ex) - 10Y	26.72	186.20	188.07		188.07	0.000082	0.29	210.08	189.39	0.07
Reach-1	218	(Ex) - 25Y	35.64	186.20	188.65		188.65	0.000038	0.24	321.48	206.55	0.05
Reach-1	218	(Ex) - 50Y	44.65	186.20	189.35		189.35	0.000022	0.22	531.26	331.92	0.04
Reach-1	218	(Ex) - 100Y	54.81	186.20	189.46		189.46	0.000027	0.25	567.47	335.73	0.04
Reach-1	218	(Ex) - Regional	158.24	186.20	189.92		189.92	0.000112	0.55	728.10	361.54	0.09
Reach-1	217	(Ex) - 2Y	6.67	186.20	187.40		187.40	0.000047	0.16	105.64	189.70	0.05
Reach-1	217	(Ex) - 5Y	16.12	186.20	187.62		187.62	0.000096	0.25	148.04	193.18	0.07
Reach-1	217	(Ex) - 10Y	26.72	186.20	188.07		188.07	0.000060	0.25	236.77	200.29	0.06
Reach-1	217	(Ex) - 25Y	35.64	186.20	188.65		188.65	0.000031	0.21	366.04	262.74	0.04
Reach-1	217	(Ex) - 50Y	44.65	186.20	189.35		189.35	0.000017	0.19	577.47	340.21	0.03
Reach-1	217	(Ex) - 100Y	54.81	186.20	189.46		189.46	0.000021	0.22	614.87	349.82	0.04
Reach-1	217	(Ex) - Regional	158.24	186.20	189.91		189.92	0.000096	0.50	790.07	404.77	0.09
Reach-1	216	(Ex) - 2Y	6.67	186.10	187.39		187.39	0.000032	0.14	112.77	161.45	0.04
Reach-1	216	(Ex) - 5Y	16.12	186.10	187.61		187.61	0.000080	0.24	148.14	168.09	0.07
Reach-1	216	(Ex) - 10Y	26.72	186.10	188.06		188.06	0.000060	0.25	227.86	182.81	0.06
Reach-1	216	(Ex) - 25Y	35.64	186.10	188.64		188.64	0.000033	0.23	353.04	229.97	0.05
Reach-1	216	(Ex) - 50Y	44.65	186.10	189.35		189.35	0.000017	0.20	575.54	352.67	0.04
Reach-1	216	(Ex) - 100Y	54.81	186.10	189.45		189.45	0.000021	0.22	613.92	358.54	0.04
Reach-1	216	(Ex) - Regional	158.24	186.10	189.90		189.90	0.000094	0.51	782.62	391.03	0.09
Reach-1	215	(Ex) - 2Y	7.53	186.00	187.39		187.39	0.000013	0.09	175.75	200.05	0.03
Reach-1	215	(Ex) - 5Y	17.50	186.00	187.60		187.60	0.000037	0.17	221.13	222.21	0.05
Reach-1	215	(Ex) - 10Y	31.27	186.00	188.06		188.06	0.000036	0.20	327.62	243.20	0.05
Reach-1	215	(Ex) - 25Y	42.17	186.00	188.64		188.64	0.000021	0.19	471.41	249.88	0.04
Reach-1	215	(Ex) - 50Y	53.27	186.00	189.34		189.34	0.000012	0.17	650.66	259.51	0.03
Reach-1	215	(Ex) - 100Y	65.78	186.00	189.45		189.45	0.000016	0.20	678.58	261.46	0.03
Reach-1	215	(Ex) - Regional	200.73	186.00	189.88		189.89	0.000140	0.63	831.72	419.40	0.10
Reach-1	214	(Ex) - 2Y	7.53	186.00	187.39		187.39	0.000009	0.07	214.78	251.79	0.02
Reach-1	214	(Ex) - 5Y	17.50	186.00	187.60		187.60	0.000023	0.13	268.05	257.49	0.04
Reach-1	214	(Ex) - 10Y	31.27	186.00	188.05		188.05	0.000023	0.16	387.38	266.31	0.04
Reach-1	214	(Ex) - 25Y	42.17	186.00	188.64		188.64	0.000015	0.15	548.35	285.94	0.03

Reach-1	214	(Ex) - 50Y	53.27	186.00	189.34		189.34	0.000009	0.14	758.98	314.40	0.03
Reach-1	214	(Ex) - 100Y	65.78	186.00	189.45		189.45	0.000012	0.17	793.23	330.09	0.03
Reach-1	214	(Ex) - Regional	200.73	186.00	189.87		189.88	0.000085	0.48	961.15	420.41	0.08
Reach-1	213	(Ex) - 2Y	7.53	186.00	187.39		187.39	0.000004	0.05	275.57	262.74	0.02
Reach-1	213	(Ex) - 5Y	17.50	186.00	187.60		187.60	0.000013	0.10	330.18	264.69	0.03
Reach-1	213	(Ex) - 10Y	31.27	186.00	188.05		188.05	0.000015	0.13	451.71	268.83	0.03
Reach-1	213	(Ex) - 25Y	42.17	186.00	188.63		188.64	0.000010	0.13	610.09	273.84	0.03
Reach-1	213	(Ex) - 50Y	53.27	186.00	189.34		189.34	0.000009	0.14	822.11	387.54	0.03
Reach-1	213	(Ex) - 100Y	65.78	186.00	189.45		189.45	0.000012	0.17	863.81	395.57	0.03
Reach-1	213	(Ex) - Regional	200.73	186.00	189.86		189.87	0.000074	0.45	1039.68	452.84	0.08
Reach-1	212	(Ex) - 2Y	7.53	186.00	187.39		187.39	0.000006	0.06	242.59	255.49	0.02
Reach-1	212	(Ex) - 5Y	17.50	186.00	187.59		187.59	0.000017	0.12	295.54	257.66	0.03
Reach-1	212	(Ex) - 10Y	31.27	186.00	188.05		188.05	0.000019	0.15	413.61	260.95	0.03
Reach-1	212	(Ex) - 25Y	42.17	186.00	188.63		188.63	0.000012	0.14	567.33	265.33	0.03
Reach-1	212	(Ex) - 50Y	53.27	186.00	189.34		189.34	0.000008	0.13	757.09	271.79	0.02
Reach-1	212	(Ex) - 100Y	65.78	186.00	189.45		189.45	0.000011	0.16	786.08	274.03	0.03
Reach-1	212	(Ex) - Regional	200.73	186.00	189.86		189.86	0.000065	0.43	900.08	282.67	0.07
Reach-1	211	(Ex) - 2Y	7.53	185.99	187.39		187.39	0.000006	0.06	252.96	256.39	0.02
Reach-1	211	(Ex) - 5Y	17.50	185.99	187.59		187.59	0.000016	0.11	305.73	257.76	0.03
Reach-1	211	(Ex) - 10Y	31.27	185.99	188.05		188.05	0.000018	0.14	423.77	260.80	0.03
Reach-1	211	(Ex) - 25Y	42.17	185.99	188.63		188.63	0.000012	0.14	577.42	264.86	0.03
Reach-1	211	(Ex) - 50Y	53.27	185.99	189.34		189.34	0.000008	0.13	767.75	273.52	0.02
Reach-1	211	(Ex) - 100Y	65.78	185.99	189.45		189.45	0.000010	0.16	796.81	275.01	0.03
Reach-1	211	(Ex) - Regional	200.73	185.99	189.85		189.85	0.000063	0.42	909.47	281.88	0.07
Reach-1	210	(Ex) - 2Y	7.53	185.90	187.39		187.39	0.000039	0.16	88.24	85.54	0.05
Reach-1	210	(Ex) - 5Y	17.50	185.90	187.59		187.59	0.000121	0.32	105.60	87.45	0.08
Reach-1	210	(Ex) - 10Y	31.27	185.90	188.04		188.04	0.000141	0.41	146.25	92.07	0.09
Reach-1	210	(Ex) - 25Y	42.17	185.90	188.63		188.63	0.000118	0.44	221.20	161.93	0.09
Reach-1	210	(Ex) - 50Y	53.27	185.90	189.34		189.34	0.000055	0.36	375.47	237.82	0.06
Reach-1	210	(Ex) - 100Y	65.78	185.90	189.44		189.44	0.000070	0.41	400.61	244.30	0.07
Reach-1	210	(Ex) - Regional	200.73	185.90	189.82		189.83	0.000383	1.04	501.77	281.10	0.17
Reach-1	209	(Ex) - 2Y	7.73	185.80	187.38		187.38	0.000040	0.17	89.33	85.75	0.05
Reach-1	209	(Ex) - 5Y	17.80	185.80	187.58		187.58	0.000122	0.32	106.24	87.35	0.08
Reach-1	209	(Ex) - 10Y	31.76	185.80	188.03		188.03	0.000143	0.41	146.64	91.64	0.09
Reach-1	209	(Ex) - 25Y	42.70	185.80	188.62		188.62	0.000137	0.48	207.96	156.10	0.10
Reach-1	209	(Ex) - 50Y	54.07	185.80	189.33		189.33	0.000067	0.40	339.46	214.31	0.07
Reach-1	209	(Ex) - 100Y	66.78	185.80	189.44		189.44	0.000087	0.46	362.04	221.21	0.08
Reach-1	209	(Ex) - Regional	205.61	185.80	189.79		189.81	0.000478	1.16	442.54	232.94	0.19
Reach-1	208	(Ex) - 2Y	7.73	185.71	187.38		187.38	0.000041	0.17	87.36	83.48	0.05
Reach-1	208	(Ex) - 5Y	17.80	185.71	187.57		187.57	0.000128	0.33	103.35	84.88	0.09
Reach-1	208	(Ex) - 10Y	31.76	185.71	188.02		188.02	0.000150	0.43	142.36	88.21	0.10
Reach-1	208	(Ex) - 25Y	42.70	185.71	188.61		188.61	0.000102	0.42	196.88	130.08	0.08
Reach-1	208	(Ex) - 50Y	54.07	185.71	189.33		189.33	0.000076	0.42	357.78	316.14	0.07
Reach-1	208	(Ex) - 100Y	66.78	185.71	189.43		189.43	0.000095	0.48	391.01	332.72	0.08
Reach-1	208	(Ex) - Regional	205.61	185.71	189.76		189.78	0.000479	1.15	506.75	361.71	0.19
Reach-1	207.7	(Ex) - 2Y	7.73	185.42	187.38		187.38	0.000059	0.22	70.99	67.91	0.06
Reach-1	207.7	(Ex) - 5Y	17.80	185.42	187.57		187.57	0.000187	0.42	83.82	69.35	0.10
Reach-1	207.7	(Ex) - 10Y	31.76	185.42	188.02		188.02	0.000222	0.53	115.77	72.81	0.12
Reach-1	207.7	(Ex) - 25Y	42.70	185.42	188.61		188.61	0.000150	0.51	160.12	77.43	0.10
Reach-1	207.7	(Ex) - 50Y	54.07	185.42	189.33		189.33	0.000080	0.44	290.63	252.35	0.08
Reach-1	207.7	(Ex) - 100Y	66.78	185.42	189.43		189.43	0.000104	0.51	317.01	267.19	0.09
Reach-1	207.7	(Ex) - Regional	205.61	185.42	189.73		189.76	0.000783	1.48	406.55	310.92	0.24
Reach-1	207.3	(Ex) - 2Y	7.73	185.14	187.38		187.38	0.000079	0.26	58.72	55.08	0.06
Reach-1	207.3	(Ex) - 5Y	17.80	185.14	187.56		187.56	0.000258	0.50	68.81	56.18	0.12
Reach-1	207.3	(Ex) - 10Y	31.76	185.14	188.01		188.01	0.000315	0.64	94.52	58.87	0.14
Reach-1	207.3	(Ex) - 25Y	42.70	185.14	188.60		188.61	0.000216	0.62	130.50	62.44	0.12
Reach-1	207.3	(Ex) - 50Y	54.07	185.14	189.32		189.33	0.000126	0.55	228.25	285.20	0.09
Reach-1	207.3	(Ex) - 100Y	66.78	185.14	189.42		189.43	0.000162	0.63	257.74	305.26	0.11
Reach-1	207.3	(Ex) - Regional	205.61	185.14	189.70		189.74	0.000925	1.59	355.76	380.42	0.25
Reach-1	207	(Ex) - 2Y	7.73	184.85	187.38	185.38	187.38	0.000009	0.09	84.58	51.36	0.02
Reach-1	207	(Ex) - 5Y	17.80	184.85	187.56	185.59	187.56	0.000033	0.19	93.90	52.25	0.04
Reach-1	207	(Ex) - 10Y	31.76	184.85	188.01	185.79	188.01	0.000053	0.27	117.28	55.12	0.06
Reach-1	207	(Ex) - 25Y	42.70	184.85	188.60	185.91	188.60	0.000045	0.29	149.49	58.89	0.06

Reach-1	207	(Ex) - 50Y	54.07	184.85	189.32	186.06	189.32	0.000034	0.28	190.47	63.92	0.05
Reach-1	207	(Ex) - 100Y	66.78	184.85	189.42	186.16	189.42	0.000048	0.34	196.27	64.76	0.06
Reach-1	207	(Ex) - Regional	205.61	184.85	189.68	186.88	189.72	0.000353	0.97	211.29	66.72	0.16
Reach-1	206.5		Bridge									
Reach-1	206	(Ex) - 2Y	7.73	184.85	187.38		187.38	0.000011	0.10	75.98	45.85	0.03
Reach-1	206	(Ex) - 5Y	17.80	184.85	187.56		187.56	0.000042	0.21	84.32	47.22	0.05
Reach-1	206	(Ex) - 10Y	31.76	184.85	188.00		188.00	0.000070	0.30	106.22	51.30	0.07
Reach-1	206	(Ex) - 25Y	42.70	184.85	188.59		188.60	0.000059	0.31	138.30	56.45	0.06
Reach-1	206	(Ex) - 50Y	54.07	184.85	189.32		189.32	0.000040	0.30	179.69	59.29	0.05
Reach-1	206	(Ex) - 100Y	66.78	184.85	189.41		189.42	0.000056	0.36	185.36	59.58	0.06
Reach-1	206	(Ex) - Regional	205.61	184.85	189.63		189.69	0.000424	1.04	198.19	60.22	0.18
Reach-1	205	(Ex) - 2Y	7.73	184.90	187.38		187.38	0.000011	0.11	74.61	48.45	0.03
Reach-1	205	(Ex) - 5Y	17.80	184.90	187.55		187.56	0.000043	0.23	83.40	50.06	0.05
Reach-1	205	(Ex) - 10Y	31.76	184.90	188.00		188.00	0.000066	0.32	110.10	66.58	0.07
Reach-1	205	(Ex) - 25Y	42.70	184.90	188.59		188.60	0.000053	0.34	152.17	74.97	0.06
Reach-1	205	(Ex) - 50Y	54.07	184.90	189.32		189.32	0.000038	0.33	207.98	79.39	0.05
Reach-1	205	(Ex) - 100Y	66.78	184.90	189.41		189.42	0.000052	0.39	215.75	79.94	0.06
Reach-1	205	(Ex) - Regional	205.61	184.90	189.63		189.68	0.000402	1.12	233.03	81.16	0.18

APPENDIX H – WASTEWATER SERVICING ANALYSIS

PROJECT: DERRY BRITANNIA DEVELOPMENTS LIMITED, NINTH LINE LANDS
PROJECT #: 13958
DATE: May 08, 2020

PRELIMINARY WASTEWATER FLOW DESIGN
PHASE 1

Proposed Development, based on prop. Ph1 DP rev. date April 3, 2020:

Total Area =	8.53	ha (includes future school)
Rear Lane Detached - 10.7m =	0.56	ha
Rear Lane Townhouse - 6.05m =	0.80	ha
Street Townhouse - 6.0m =	1.70	ha
Condo Apartments / Towns / Stacks =	0.84	ha

Draft Plan Unit Type	Region of Peel Description	Pop./Hectare	Pop.
Rear Lane Detached - 10.7m	Single family (greater than 10m frontage)	50	28
Rear Lane Townhouse - 6.05m =	Row Dwelling	175	140
Street Townhouse - 6.0m =	Row Dwelling	175	298
Condo Apartments / Towns / Stacks =	Apartments	475	399
		Total Population:	865

Wastewater Generation Criteria

Population Type	Unit	Avg. Generation Rate [1]	Peaking Factor [2]
Residential	L/cap-d	290	3.84

[1] As specified by Region of Peel in December 2019 Region report, *Ninth Line Lands: Servicing Strategy Report - City of Mississauga* .
[2] Based on Harmon's Peaking Factor Formula, $M = 1 + 14 / (4 + P^{0.5})$, where P = population equivalent in '000's.

Q_{daily} =	250.85	m^3/d	=	2.90	L/s
Q_{peak} =	963.26	m^3/d	=	11.15	L/s

The peak wastewater flow generated from the pop. of the proposed Phase 1 development is	**11.15**	**L/s**
The infiltration flow based on the total prop. Phase 1 development area, at 0.26 L/s/ha is	**2.22**	**L/s**
The total wastewater flow from the proposed Phase 1 development is	**13.37**	**L/s**

PROJECT: DERRY BRITANNIA DEVELOPMENTS LIMITED, NINTH LINE LANDS
PROJECT #: 13958
DATE: April 3, 2020

PRELIMINARY WASTEWATER FLOW DESIGN
PHASE 2, ULTIMATE CONDITIONS, TO 900mm SAN

Proposed Development, based on prop. Ph1 DP rev. date June 28, 2019:

Total Area * =	21.12	ha (includes 3.37 ha school)
Rear Lane Townhouse - 6.05m =	1.29	ha
Street Townhouse - 6.0m =	1.72	ha
Condominium Duplex =	1.71	ha
Condo Apartments / Towns / Stacks =	4.52	ha
Residential Reserve, Assume Built for Ultimate Phase 2 (Condo Apartments / Towns / Stacks) =	0.49	ha
From Phase 1 (was future) Residential Reserve, Assume Built for Ph 2 Ultimate (Condo Apartments / Towns / Stacks) =	0.50	ha
Public Elementary School (Assume Built for Ultimate Phase 2) =	3.37	ha

* Includes ROWs, laneways and reserves within populated portion of development.
Excludes SWM pond, greenlands and transitway corridor.

Draft Plan Unit Type	Region of Peel Description	Pop./Hectare	Pop.
Rear Lane Townhouse - 6.05m	Row Dwelling	175	226
Street Townhouse - 6.0m	Row Dwelling	175	301
Condominium Duplex	Semi-Detached	70	120
Condo Apartments / Towns / Stacks =	Apartments	475	2147
Residential Reserve, Assume Built for Ph 2 Ultimate (Condo Apartments / Towns / Stacks) =	Apartments	475	233
From Phase 1 (was future) Residential Reserve, Assume Built for Ph 2 Ultimate (Condo Apartments / Towns / Stacks) =	Apartments	475	238
Public Elementary School (Future) =	Junior Public School*	-	200
		Residential Population:	3,265
		ICI Population:	200
		Total Population:	3,465

* for Junior Public Schools, Region estimates 1/3 x number of students (600 students minimum)

Wastewater Generation Criteria

Population Type	Unit	Avg. Generation Rate [1]	Peaking Factor [2]
Residential	L/cap-d	290	3.41
ICI		270	4.15

[1] As specified by Region of Peel in December 2019 Region report, *Ninth Line Lands: Servicing Strategy Report - City of Mississauga* .
[2] Based on Harmon's Peaking Factor Formula, $M = 1 + 14 / (4 + P^{0.5})$, where P = population equivalent in '000's.

$Q_{daily,Residential}$ =	946.85	m^3/d	=	10.96	L/s
$Q_{daily,ICI}$ =	54.00	m^3/d	=	0.63	L/s
$Q_{daily,Total}$ =	1,000.85	m^3/d	=	11.58	L/s
$Q_{peak,Residential}$ =	3,228.76	m^3/d	=	37.37	L/s
$Q_{peak,ICI}$ =	224.10	m^3/d	=	2.59	L/s
$Q_{peak,Total}$ =	3,452.86	m^3/d	=	39.96	L/s

The peak wastewater flow generated from the pop. of the ultimate Phase 2 development is	**39.96**	**L/s**
The infiltration flow based on the pop. of this portion of the prop. Ph 2 dev. area, at 0.26 L/s/ha is	**5.49**	**L/s**
The total wastewater flow from the proposed ultimate Phase 2 development is	**45.45**	**L/s**

Project: Derry Britannia Developments Limited, Ninth Line Lands

Proj. No.: 13958

Date: April 3, 2020

ANALYSIS OF WASTEWATER FLOW CONTRIBUTIONS FROM DERRY BRITANNIA DEVELOPMENTS AND EXTERNAL LANDS TO THE NORTH

This analysis has reviewed the report *Ninth Line Lands: Servicing Strategy Report – City of Mississauga* completed by the Region of Peel on December 9, 2019 and the report *Ninth Line Lands, Scoped Subwatershed Study, Phase 2: Impact Assessment and Management Strategy* by AMEC Foster Wheeler, March 2017.

TABLE ADAPTED FROM
"TABLE 5- NINTH LINE LANDS – WASTEWATER FLOW FOR SUB-DRAINAGE AREA",
***NINTH LINE LANDS: SERVICING STRATEGY REPORT – CITY OF MISSISSUAGA*,**
BY REGION OF PEEL

	Drainage Area	Equivalent Population	Net Area (ha)	Wastewater Flow (L/s)					
				ADWF	Peak Factor	PDWF	Infil	PWWF	
EXTERNAL	A	304	17.8	1.0	4.0	4.1	4.6	8.7	
	B	203	11.9	0.7	4.0	2.7	3.1	5.8	
	C	1,832	22.4	6.1	3.6	22.2	5.8	28.1	
	D	2,565	31.4	8.6	3.5	30.1	8.2	38.3	
External Area = 53.8 ha.								**External SAN Q = 80.9 L/s**	
DERRY BRITANNIA DEV LTD	E (incl. Phase 1)	875	8.53	2.90	3.84	11.15	2.22	13.37	**Derry Britannia Dev. Phase 1 to 450mm SAN**
	F (Phase 2)	3,205 Res 200 ICI 3,405 TTL	21.12	10.96 Res 0.63 ICI 11.58 TTL	3.42 Res 4.15 ICI	37.37 Res 2.59 ICI 39.96 TTL	5.49	45.45	**Derry Britannia Dev. Phase 2 to 900mm SAN**

Population, area and wastewater flow rates for Areas E and F based on proposed Draft Plan land uses and Region of Peel wastewater design criteria for population density and peaking factor.

APPENDIX I – WATER SERVICING ANALYSIS

PROJECT: DERRY BRITANNIA DEVELOPMENTS LIMITED, NINTH LINE LANDS
PROJECT #: 13958
DATE: May 14, 2020

PRELIMINARY WATER DEMAND DESIGN
PHASE 1

Proposed Development:

Total Area =	8.53	ha
Rear Lane Detached - 10.7m =	0.56	ha
Rear Lane Townhouse - 6.05m =	0.80	ha
Street Townhouse - 6.0m =	1.70	ha
Townhouse Total =	2.50	ha
Condo Apartments / Towns / Stacks =	0.84	ha

Draft Plan Unit Type	Region of Peel Description	Pop./Hectare	Pop.
Rear Lane Detached - 10.7m	Single family (greater than 10m frontage)	50	28
Rear Lane Townhouse - 6.05m =	Row Dwelling	175	140
Street Townhouse - 6.0m =	Row Dwelling	175	298
Condo Apartments / Towns / Stacks =	Apartments	475	399
		Total Population:	865

Typical Water Demand Criteria

Population Type	Unit	Avg. Consumption Rate *	Max Day Factor *	Peak Hour Factor *
Residential	L/cap-d	265	1.8	3.0

Q_{daily} =	229.23	m^3/d	=	0.0027	m^3/s
$Q_{Max\ Day}$ =	412.61	m^3/d	=	0.0048	m^3/s
Q_{peak} =	687.68	m^3/d	=	0.0080	m^3/s

The typical peak water demand flow rate is **0.0080** **m^3/s**

Potential Short-Term Water Demand Criteria

Population Type	Unit	Avg. Consumption Rate *	Max Day Factor *	Peak Hour Factor *
Residential	L/cap-d	409	2.0	3.0

* As specified in *Region of Peel, Public Works Design, Specifications and Procedures Manual, Linear Infrastructure, Watermain Design Criteria, Revised June 2010.*

Q_{daily} =	353.79	m^3/d	=	0.0041	m^3/s
$Q_{Max\ Day}$ =	707.57	m^3/d	=	0.0082	m^3/s
Q_{peak} =	1,061.36	m^3/d	=	0.0123	m^3/s
The potential short-term water demand flow rate is				**0.0123**	**m^3/s**

Total Demand Including Fire Flow

Fire Protection Demand, Esimated Flow =	250	L/s	=	0.2500	m^3/s
$Q_{Max\ Day}$ =				0.0082	m^3/s
Total Water Demand Including Fire Flow =				**0.2582**	**m^3/s**

APPENDIX J – DRAWINGS

LEGEND

EXISTING REGIONAL FLOODLINE

224 HEC-RAS CROSS SECTION LOCATION

SUBJECT DEVELOPMENT

mattamyHOMES
RAND
5285 SOLAR DRIVE
MISSISSAUGA, ONTARIO
L4W 5B8
TEL. (905) 625-9500

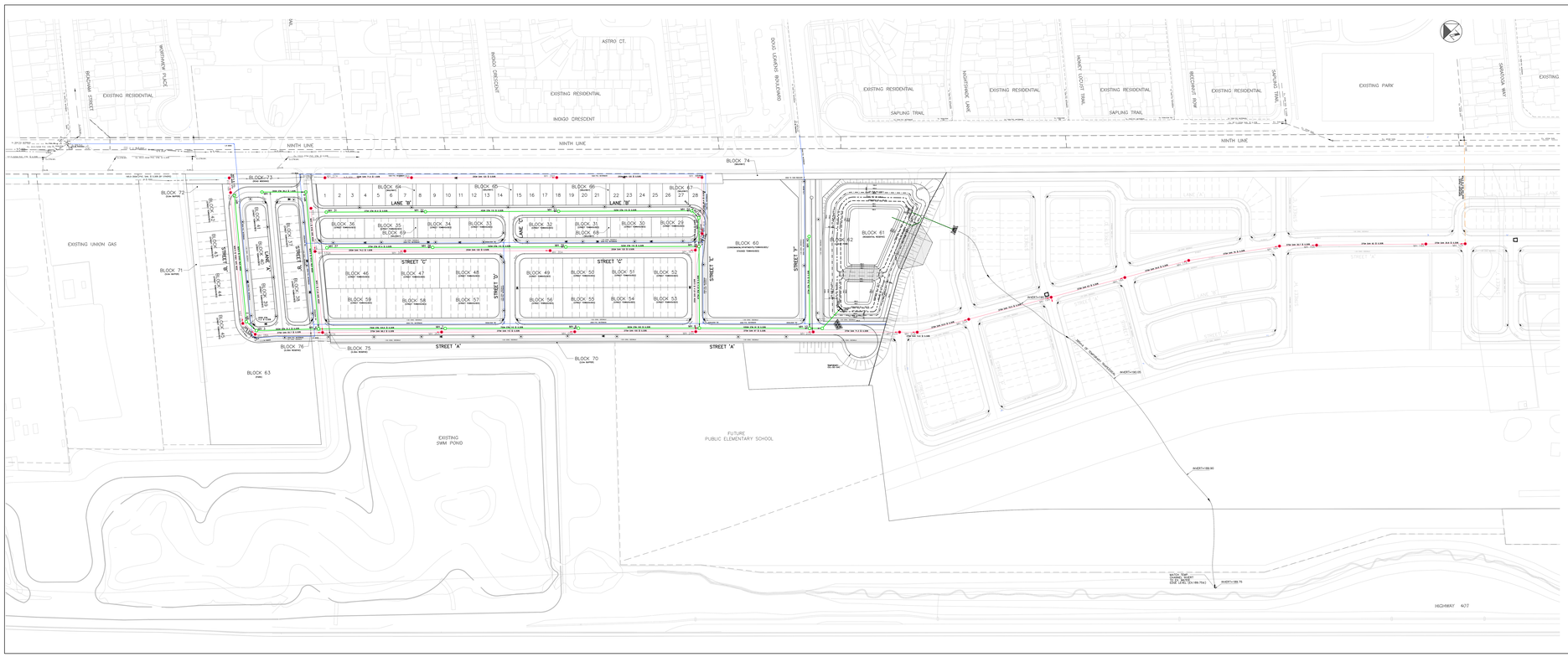
DERRY-BRITANNIA DEVELOPMENTS LIMITED
21T-M 19003

FLOODPLAIN MAPPING
EXISTING CONDITIONS

CITY OF MISSISSAUGA

SCALE 1:3,000	JOB No. 13958	DRAWING No. 1

R:\13\13958\Drawings & Figures_2020 April 27 (Latest)\Drawing 1- Flood Plain Mapping-Existing Conditions.dwg May 15, 2020 - 12:55pm



LEGEND

- DENOTES PROPOSED STORM SEWER
- DENOTES PROPOSED SANITARY SEWER

BENCHMARK
ELEVATIONS SHOWN ON THIS PLAN ARE RELATED TO GEODETIC DATUM.
BENCHMARK USED IS THE BENCHMARK OF THE CITY OF MISSISSAUGA GENERAL BENCHMARKS
No. 12D0504
ELEVATION=174.761m
No. 12D0504R2
ELEVATION=174.761m
No. 12D0504R3
ELEVATION=174.412m
No. 12D0504R4
ELEVATION=172.389m

mattamy HOMES | RAND | 5255 SOLAR DRIVE MISSISSAUGA, ONTARIO L4W 5B8 TEL: (905) 625-9500

DERRY-BRITANNIA DEVELOPMENTS LIMITED
21T-M 19003

PRELIMINARY SERVICING PLAN
PHASE 1

CITY OF MISSISSAUGA		DRAWING No.
SCALE 1:750	JOB No. 13958	2

R:\13\13958\Drawings & Figures_2020 April 27 (Latest)\Drawing 2-Preliminary Servicing Plan-Phase 1.dwg May 15, 2020 - 4:59pm

LEGEND

(DENOTES PROPOSED STORM SEWER

(DENOTES PROPOSED SANITARY SEWER

BENCHMARK
ELEVATIONS SHOWN ON THIS PLAN ARE RELATED TO GEODETIC DATUM AND ARE DERIVED FROM THE CITY OF MISSISSAUGA CONTROL MONUMENTS:
"ELEVATION=99.000m
"ELEVATION=99.900m
"ELEVATION=99.000m
"ELEVATION=99.900m
"ELEVATION=100.000m
"ELEVATION=100.900m

mattamy HOMES | RAND

5355 SOLAR DRIVE
MISSISSAUGA, ONTARIO
L4W 5B8
TEL: (905) 624-2900

DERRY-BRITANNIA DEVELOPMENTS LIMITED
21T-M 19003

PRELIMINARY SERVICING PLAN PHASE 2

CITY OF MISSISSAUGA		DRAWING No.
SCALE 1:1,000	JOB No. 13958	3

R:\13\13958\Drawings ■ Figures_2020 April 27 (Latest)\Drawing 3-Preliminary Servicing Plan-Phase 2.dwg May 15, 2020 - 4:12pm

LEGEND

POST DEVELOPMENT REGIONAL FLOODLINE

224 HEC-RAS CROSS SECTION LOCATION

LIMIT OF THE TRANSITWAY BERM CONSTRUCTION

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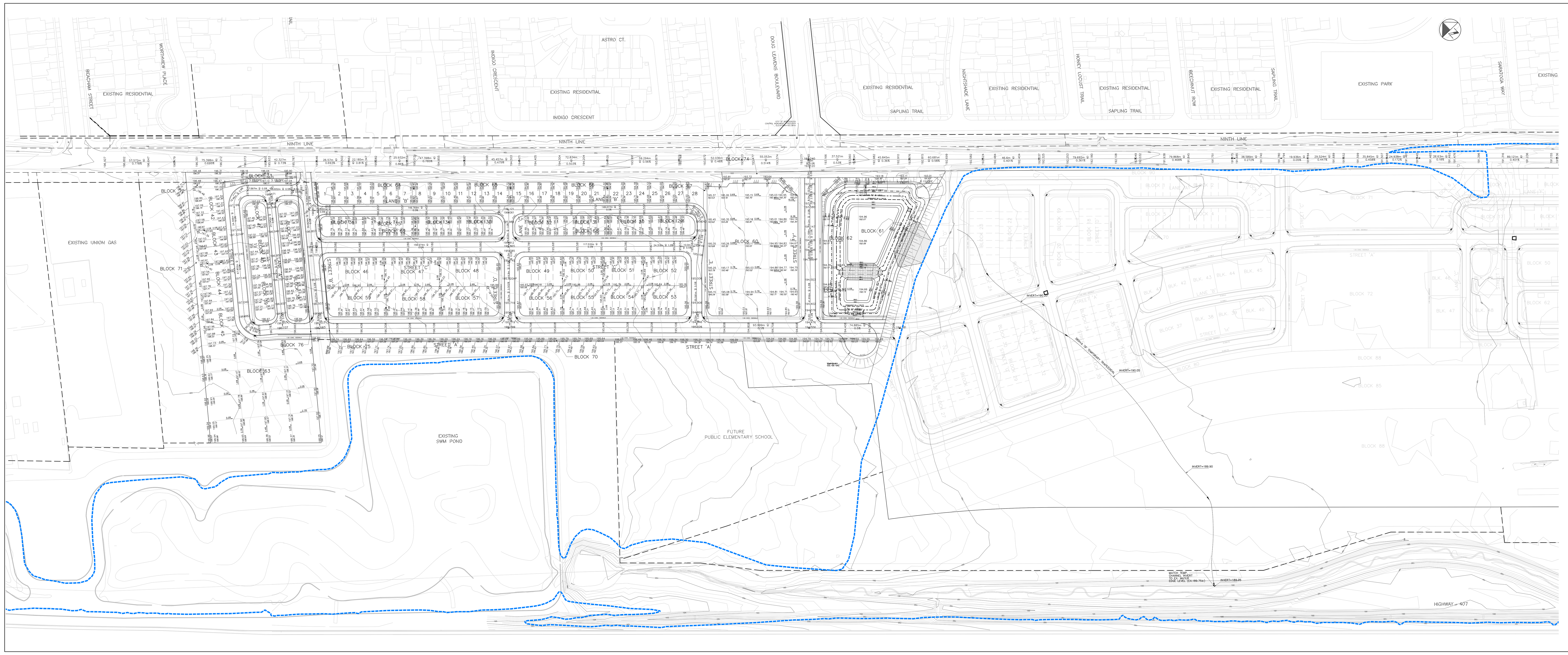
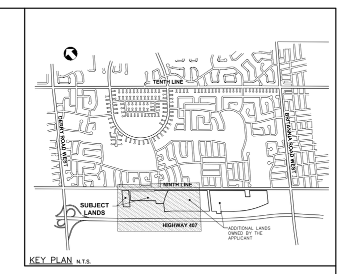
DERRY-BRITANNIA DEVELOPMENTS LIMITED
21T-M 19003
FLOODPLAIN MAPPING
POST DEVELOPMENT CONDITIONS
PHASE 2

CITY OF MISSISSAUGA		DRAWING No.
SCALE 1:3,000	JOB No. 13958	4

R:\13\13958\Drawings & Figures_2020 April 27 (Latest)\Drawing 4- FloodPlain Mapping-Post Development Conditions-Phase 2.dwg May 15, 2020 - 12:57pm





LEGEND

200.00	PROPOSED ELEVATION
200.00	EXISTING ELEVATION
[200.00]	FUTURE ELEVATION (BY OTHERS)
238	EXISTING CONTOUR
192.50	PROPOSED CONTOUR
→	DENOTES DRAINAGE DIRECTION
▬ ▬ ▬	DENOTES POST DEVELOPMENT FLOODLINE

BENCHMARK

ELEVATIONS SHOWN ON THIS PLAN ARE RELATED TO GEODETIC DATUM AND ARE DERIVED FROM THE CITY OF MISSISSAUGA CONTROL MONUMENTS:
No. 075023011
ELEVATION=190.761m
No. 075023010
ELEVATION=192.412m
No. 075033003
ELEVATION=193.381m

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L4W 5B8
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DERRY-BRITANNIA DEVELOPMENTS LIMITED
21T-M 19003

PRELIMINARY GRADING PLAN PHASE 1

CITY OF MISSISSAUGA

SCALE 1:750	JOB No. 13958	DRAWING No. 5

LEGEND

99.99	PROPOSED ELEVATION
99.99	EXISTING ELEVATION
(99.99)	FUTURE ELEVATION (BY OTHERS)
100	EXISTING CONTOUR
100.00	PROPOSED CONTOUR
	DENOTES DRAINAGE DIRECTION
	DENOTES POST DEVELOPMENT FLOODLINE

BENCHMARK

ELEVATIONS SHOWN ON THIS PLAN ARE RELATED TO GEODETIC DATUM AND ARE DERIVED FROM THE CITY OF MISSISSAUGA CONTROL MONUMENTS:

BENCHMARK No. 31-2-0-0
ELEVATION=148.760m
BENCHMARK No. 31-2-0-0
ELEVATION=152.812m
BENCHMARK No. 31-2-0-0
ELEVATION=151.385m

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L4W 5M7
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PRELIMINARY GRADING PLAN-PHASE 2

CITY OF MISSISSAUGA		DRAWING No.
SCALE 1:1,000	JOB No. 13958	6

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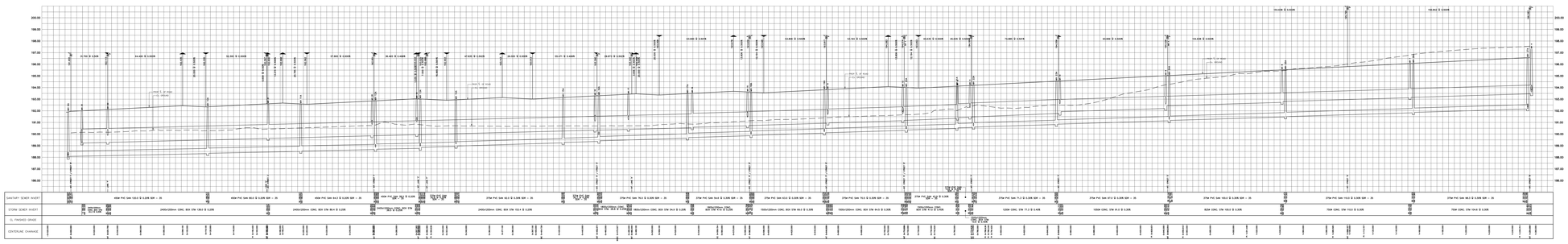
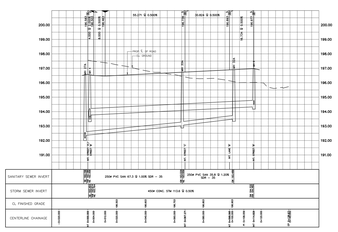
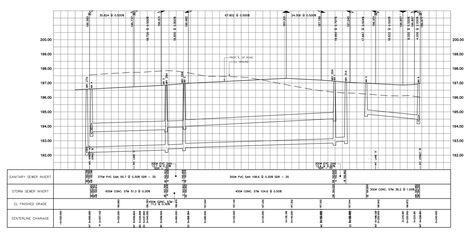


STREET 'C'
SCALE – HORIZ. – 1:750
VERT. – 1:75



STREET 'B'
SCALE – HORIZ. – 1:750
VERT. – 1:75



STREET 'B'
SCALE – HORIZ. – 1:750
VERT. – 1:75

BENCHMARK
DESCRIPTION:
ELEVATIONS SHOWN ON THIS PLAN ARE RELATED TO GEODETIC DATUM.
BASED ON GPS OBSERVATIONS ON THE CITY OF MISSISSAUGA CONTROL BENCHMARK:
"B" CONTROL
ELEVATION: 174.7m
"BL" CONTROL
ELEVATION: 174.8m
"BM" CONTROL
ELEVATION: 173.4m
"BN" CONTROL
ELEVATION: 169.6m

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ROAD PROFILES - STREETS 'A' & 'B'

CITY OF MISSISSAUGA		DRAWING No.
N.T.S.	JOB No. 13958	7

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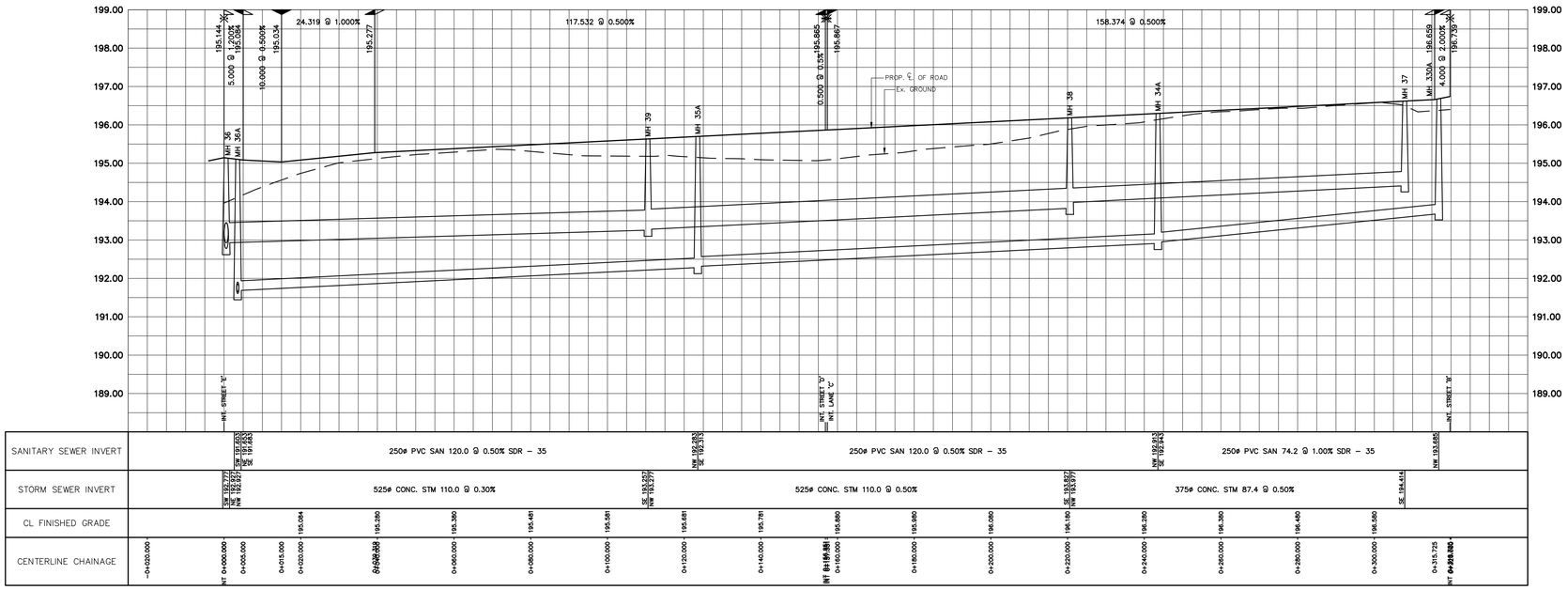
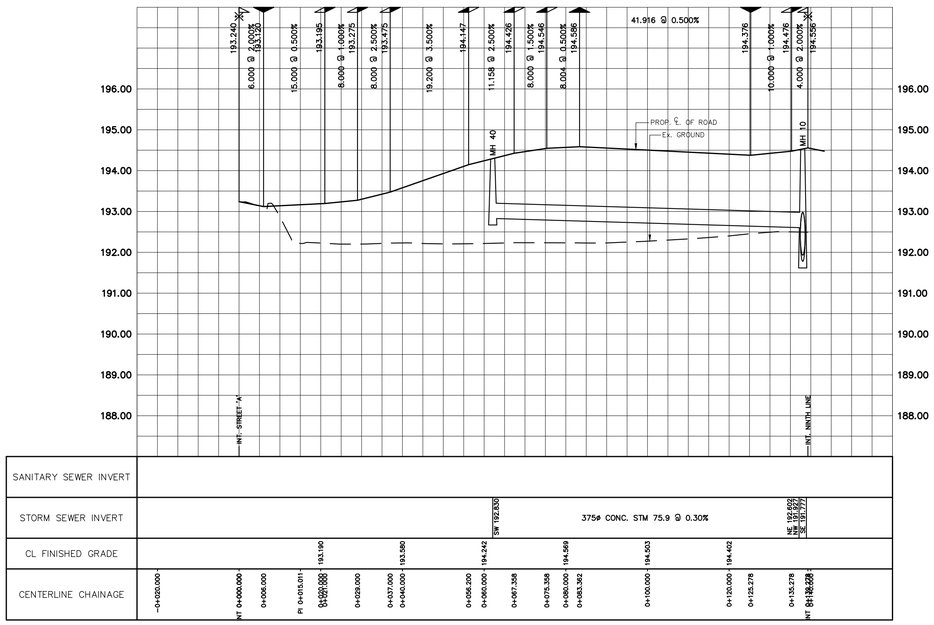


STREET 'C'

SCALE – HORIZ. – 1:750
VERT. – 1:75



STREET 'F'

SCALE – HORIZ. – 1:750
VERT. – 1:75

BENCHMARK

ELEVATIONS SHOWN ON THIS PLAN ARE RELATED TO GEODETIC DATUM AND ARE DERIVED FROM THE CITY OF MISSISSAUGA CONTROL MONUMENTS:
No. 075023011
ELEVATION=190.761m
No. 075023010
ELEVATION=192.412m
No. 075033003
ELEVATION=193.381m

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ROAD PROFILES -STREETS 'C' & 'F'

CITY OF MISSISSAUGA

N.T.S.	JOB No. 13958	DRAWING No. 8

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