URBANTECH®

STORMWATER MANAGEMENT REPORT

Derry-Britannia Developments Limited
(North and South Draft Plans)

CITY OF MISSISSAUGA
REGIONAL MUNICIPALITY OF PEEL

PREPARED FOR

DERRY-BRITANNIA DEVELOPMENTS LIMITED

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1 INTRODUCTION

Urbantech Consulting has been retained by Derry-Britannia Developments Limited to prepare a Stormwater Management (SWM) report for the proposed mixed-use subdivision, located within the Ninth Line Lands, City of Mississauga, Region of Peel, hereafter referred to as the Subject Lands.

The information in this report applies to the North and South parcels of the proposed development. The subject lands are bounded by Ninth Line to the east, an Enbridge Gas facility to the north, Sixteen Mile Creek and Highway 407 ETR to the west, and the existing Lisgar stormwater pond outlet channel (NLT-1) to the south. The Subject Lands are considered part of Block 2 within the overall Ninth Line Secondary Plan Area.

This study presents the recommended stormwater management plan for the development of the Subject Lands. This report is also applicable for any future revisions to the site plan, assuming the revisions are minor and in general conformance with the concepts outlined herein.

The design information presented in this report considers the following guidelines:

- City of Mississauga T&W Development Requirements
- Region of Peel Public Works Design, Specifications & Procedures Manual
- Conservation Halton Guidelines for Stormwater Management Engineering Submissions
- Draft Ministry of the Environment and Climate Change LID SWM Guidance Manual
- Stormwater Management Planning and Design Manual by the Ministry of Environment and Climate Change

2 BACKGROUND INFORMATION

In addition to all local and municipal SWM criteria, this report is also consistent with the requirements from the following background study reports and supporting documentation for the Derry-Britannia development:

- High Level Concept Plan (HLCP) for the Ninth Line Heritage System Corridor (2024)
- Block 2 Comprehensive Environmental Impact and Integration Study (CEIIS) (2023)
- Ninth Line Lands Scoped Subwatershed Study by Wood (2022)
- Preliminary Geotechnical Investigation by DS Consultants (2019)
- Hydrogeological Analysis by DS Consultants (2021)
- Functional Servicing & Stormwater Management Report by Urbantech Consulting (2023)
- Natural Heritage System Design Brief by Urbantech (2024)

3 PROPOSED DEVELOPMENT

The proposed development features a mixture of townhouses and midrise blocks in both freehold and condominium tenures. Overall, there are between 1,262 and 1,362 units proposed on 115.4 acres including lands designated for City parks, an elementary school, stormwater management facility, 407 Transitway and an integrated Natural Heritage System (NHS). The draft plan reflects the approved Secondary Plan in terms of proposed population and density.

Further, the proposed NHS Corridor also reflects the Secondary Plan and Subwatershed Study vision to contain the Regional Floodplain and create enhancements to the natural heritage features and functions within the Ninth Line Corridor, as compared to existing conditions, and includes:

- the creation of a contiguous and connected NHS corridor west of the 407 transitway consisting of wetlands, woodlands and meadow habitat in place of the existing, isolated natural heritage features; and,

- grading to contain the Regional Storm flood plain such that the proposed development does not result in increases to floodplain elevations east of Ninth Line.

In addition to the improvements as proposed by the Subwatershed Study, the development proposal also provides for the following benefits, not anticipated as part of the Subwatershed Study:

- enhancements to the NLT-1 watercourse corridor (i.e., the watercourse that receives outflows from the Lisgar stormwater management pond) through the removal of the existing concrete lined channel and creation of a low-flow channel with natural channel design within a widened corridor; and,

- improvements to the NLT-1 channel to minimize increases in flood plain elevation along Ninth Line that is anticipated as a result of the City's Ninth Line road widening and the 407 transitway crossing of NLT-1.

Prior to completion of the Ninth Line culvert upgrades, an interim SWM strategy is proposed to advance registration / development of the subject lands. This proposal has been discussed with and reviewed by CH / City staff and the conclusions are described in **Appendix H**. The interim scenario involves constructing the pond up to temporary elevation on the south and east sides that does not obstruct with the existing Regional spill across Ninth Line and therefore does not impact Regional water levels upstream. Only when Ninth Line is raised and the culvert upgrades occur will the spill be mitigated and the pond berm raised to ultimate grades.

4 EXISTING CONDITIONS

4.1. *TOPOGRAPHY AND DRAINAGE*

The Subject Lands have been predominantly cleared for past agricultural use; however, the site also contains several existing environmental features including wetlands and wooded areas (refer to Block 2 CEIIS for detailed information). Several of the smaller properties along Ninth Line which comprise the larger study area are existing rural residences.

The Subject Lands are relatively flat and gently sloped from north to south. All overland drainage is ultimately directed to Sixteen Mile Creek and the confluence of the main branch and the east branch, NLT-1 (Lisgar stormwater outlet channel).

Lands to the east of Ninth Line are predominantly residential. Stormwater management for the lands to the east is primarily provided by the Lisgar SWM facility which is an online pond along the watercourse east of Ninth Line; in addition, two SWM facilities, located within the Ninth Line Lands near Thomas Street, provide the requisite stormwater quantity control for the Churchill Meadows Subdivision east of Ninth Line.

The NHS Corridor is based on the following engineering constraints:

- NHS limits as established in the HLCP;
- Proposed watercourse elevations;
- Elevations along boundary roads (Ninth Line);
- Elevations along Mattamy lands and future MTO corridor; and
- Application of the City of Mississauga and Conservation Halton policies, guidelines and standards.

The NHS Corridor grades (low flow channel inverts) are governed by the existing culverts and channel elevations at Ninth Line and Britannia Road and the upstream watercourse elevations.

Refer to **Drawing 5.2A**, "*Existing Storm Drainage Plan,"* in **Appendix D**.

For detailed information regarding the existing natural features, please refer to the Block 2 Comprehensive Environmental Impact and Integration Study (CEIIS).

4.2. *SOILS*

For detailed geotechnical and hydrogeological information, please refer to the following reports:

- Preliminary Geotechnical Investigation, DS Consultants (2019)
- Hydrogeological Investigation, DS Consultants (2021)

The soils within the Study Area consist of Chinguacousy clay loam and Jeddo clay loam, which are classified as SCS Type 'C' soils, exhibiting relatively low rates of infiltration and comparatively high rates of runoff. Based on the subsurface drilling investigation, the Subject Lands are underlain by surficial / fill material, which in turn is underlain by native soil deposits consisting of clayey silt to silty clay till and sandy silt to silty sand till. Shale bedrock was encountered at the Site underlying the overburden till and was generally found at shallower depths in the northern portion of the Site and declined in elevation towards the south.

A total of seven in-situ infiltration tests (TP1, TP2, TP3, TP4, TP5, TP6 and TP7) were completed in the northern portion of the Subject Lands on April 3, 2020 and a total of six (6) in-situ infiltration tests (TP1, TP2, TP3, TP4, TP5 and TP6) were completed in the southern portion of the Subject Lands and April 6, 2020. The purpose of the in-situ infiltration testing was to estimate the soil percolation rates in the surficial soils. The in-situ infiltration tests were conducted using the double ring infiltrometer method in general accordance with guidelines outlined in the *Low Impact Development (LID) Stormwater Management Planning and Design Guide for Stormwater Infiltration"* by the Toronto and Region Conservation Authority (TRCA), dated 2010. The double ring infiltrometer testing was conducted within the upper 0.3 m to 0.45 m of surficial soil consisting of earth fill (disturbed sandy silt to silty clay with trace amounts of gravel). Based on the results of the testing, the soil percolation rates within the surficial soils generally ranged from 10.8 mm/hour to 43.2 mm/hour, with an average rate of 26.5 mm/hour. The result of an infiltration test at the location of TP5 in the northern portion was estimated to be 158.4 mm/hour, which is considered to be an outlier and not representative of the infiltration rates of the surficial soils across the Subject Lands. During the infiltration testing in the southern portion, infiltration rates in four (4) testing locations (TP3, TP4, TP5 and TP6) were estimated to be approximately zero due to wet ground conditions, likely as a result of the spring snow melt.

4.3. *EXISTING FLOODPLAIN*

A significant portion of the Subject Lands are occupied by the existing Regional floodplain. A detailed analysis of the existing floodplain was undertaken as part of the HLCP (2024); please refer to the HLCP document for detailed information regarding the existing floodplain conditions within the Ninth Line Lands.

5 STORMWATER MANAGEMENT PLAN

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 shall be designed for the 10-year storm event using the Rational Method and City of Mississauga IDF curves;

- The major system shall 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. Where required, 100-year capture into the minor system will be accommodated in the minor system sizing / grate sizing;

- For residential lots, runoff from roof leaders should be directed towards pervious areas where possible;

- Storm sewers should be installed at adequate depth to enable connection of all basement foundation drains where possible, otherwise it is assumed that sump pumps will be required;

On-site retention of the first 5 mm of runoff from the entire impervious surface area by way of infiltration, evapotranspiration or re-use is required. Where soil conditions do not permit infiltration, the first 5 mm of runoff should be filtered instead.
In accordance with the recommended stormwater management plan presented in the Scoped SWS (Wood, 2022), stormwater quality, erosion and quantity control for the subject lands will be provided by an end-of-pipe SWM facility (Pond 294 in the SWS), as follows:

- The SWM facility shall 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 shall 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 pond should be designed based on 0.002 m^3/s per hectare of contributing area; and,

- 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 **Table 5-1.**

Table 5-1: SWM Pond Storage and Discharge Requirements

Return Period	Unit storage volume (m^3/imp ha)	SWS Unit flow rate* (m^3/s/ha)	Corrected unit flow rate* (m^3/s/ha)
2	450	0.09	0.002
5	600	0.38	0.010
100-year	875	1.02	0.027
Regional	1,775	1.53	0.041

Note: Storage volumes are measured from permanent pool and include extended detention volume of 275m^3/imp ha.

*Note that Wood staff has indicated that the unit flow rates reported in Table 2.2.2 of the SWS were incorrectly labelled as "unit flow rates"; these were in fact "total flow rates" for the modelled area to SWS Pond 294 (37.10 ha). Therefore, the actual / "corrected" unit flow rates are the Table 2.2.2 rates divided by 37.10.

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

- The SWM facility shall 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*

The stormwater management strategy for the proposed Derry-Britannia development will include an end-of-pipe SWM facility for quality control, quantity control and erosion control.

Major and minor systems have been designed in accordance with the City of Mississauga's design requirements, as outlined in the following sections.

5.2.1. MINOR SYSTEM STORM DRAINAGE

The storm sewer system was designed to accommodate the 10-year design storm in accordance with the City of Mississauga's design standards. The Rational Method was used to determine the peak flows based on the City of Mississauga's intensity-duration-frequency (IDF) parameters and recommended runoff coefficients. To accurately quantify the runoff that enters the storm sewer system, subcatchments were delineated on a manhole-to-manhole basis based on proposed storm drainage plans (**Drawings 301** to **304**, provided in **Appendix D**).

The proposed layout of the storm sewer network is provided on the storm drainage plans (**Drawings 301** to **304**, provided in **Appendix D**), for which the storm sewer design sheets are provided in **Appendix A**. Due to grading constraints, several major system capture

points are required throughout the development where overland flow cannot be maintained to the downstream pond.

A PCSWMM dual drainage model was used to determine the 100-year hydraulic gradeline (HGL) for the proposed storm system. A summary of HGL results for the minor storm system from the PCSWMM dual drainage model can be found in the **Appendix F**. The 100-year HGL results are also illustrated on the Plan & Profiles, **Drawings 401** to **410**.

Sump pumps are proposed for all lots within the subject development, as the City criteria for minimum freeboard between the 100-year HGL and underside of footing elevations cannot be achieved for the majority of the site, due to grading and servicing constraints.

5.2.2. MAJOR SYSTEM FLOW CAPACITY

The major system uses a combination of proposed rights-of-way and storm sewers to convey overland flows from major storm events (up to and including the 100-year storm event) towards the proposed SWM pond facility.

The major system drainage (up to the 100-year storm event) will generally be conveyed overland via the proposed municipal right-of-ways (ROWs). The PCSWMM dual drainage model was used to provide information on the depth of flow on the proposed ROWs. The ROWs were modelled using the available proposed road cross-sections (refer to **Drawing 701** in **Appendix D**) to reflect the appropriate geometry, cross-section and road roughness parameters. If the flow is restricted into the minor system due to catchbasin inlet capacity, each major system node indicates a representative depth of flow for the major system.

As per the PCSWMM model results, it should be noted that the dual drainage model shows major system flow is contained within the proposed ROWs.

5.3. *LOW IMPACT DEVELOPMENT PRACTICES*

As per the City of Mississauga requirements, the first 5mm of runoff from the entire impervious area of the proposed development will be retained on site. On-site runoff retention will be achieved using the following measures:

- The topsoil depth on the lots will be increased from 150 mm to 300 mm; and,
- Roof leaders will be discharged to pervious areas wherever possible.

The site imperviousness is roughly 73%; total impervious area is 22.83 ha. The 5 mm volume over this area is 1,142 m^3. Conversely, the total pervious area of the proposed lots is 29,222 m^2. In order to store the total 1,142 m^3 runoff volume, the required storage depth is approximately 39 mm. At an assumed porosity of 0.4, 300 mm depth of topsoil within the pervious areas will exceed this requirement.

It is typical to assume that topsoil has a porosity of 0.4, which in this case provides a 7.7 mm total retention depth for the Subject Lands. To conservatively assume the soil is more compact, a porosity of 0.261 can still achieve the 5 mm total retention requirement. Furthermore, precautions during construction to avoid compaction can be taken (similar to LID installation) in which compaction is avoided or the effects of compaction can be mitigated. Refer to LID calculations for increased topsoil in **Appendix C**.

Although the LID approach of increased topsoil is currently proposed for on-site retention mitigation, it is potentially subject to change based on resolution between the Province and the City regarding the CLI-ECA program, where other possible hierarchical approaches will be proposed, where applicable, for retaining the 27 mm runoff event. As per the new (draft) MECP criteria, increased topsoil approach cannot be considered for on-site retention. Therefore, if the 27 mm retention criteria are initiated, potential additional LID measures will be required and could include:

i. ***Rear Yard Infiltration Trenches***

Using resources from the City of Toronto *Wet Weather Flow Management Guidelines (WWFMG, 2006),* rainfall depth infiltrated for each trench can manage up to 96% of the total average annual rainfall (refer to **Appendix C** for details), depending on the associated drainage catchment. A soil percolation rate of 25 mm/hour was also assumed based on minimum soil percolation rate for sandy loam in order to confirm the infiltration trench sizing. Refer to Table 4.4 from the *MOE SWMP Manual (2003)* for soil percolation rate and refer to the Preliminary Geotechnical Investigation by DS Consultants for site soil type. The maximum LID depth is also constrained by high groundwater level which requires further confirmation by the geotechnical consultant, although considering that the site will be filled several metres above the existing ground elevation, groundwater is not anticipated to be a constraint for infiltration depth. The maximum trench width of 1.55 m was applied based on spacing constraints in the proposed rear-yards. The potential preliminary infiltration trench locations are shown on **Figure 5.3** provided in **Appendix D**. Infiltration trench sizing calculations are also provided in **Appendix C** for reference.

ii. ***Front Yard Soakaway Pits (along Ninth Line)***

Due to standard construction and lot grading principles, overland drainage from the front yards of units along Ninth Line will be directed towards the Ninth Line right-of-way. To mitigate impact to the right-of-way, drainage from this catchment could be controlled within the lots by a private LID such as a soakaway pit. The proposed soakaway pits as detailed on **Figure 5.3** in **Appendix D** can manage up to 95% of the total average annual rainfall and capture the equivalent of 27 mm runoff from their respective catchment (refer to **Appendix C**).

The detailed design of the proposed LIDs in this block is to be confirmed at the site plan application stage.

iii. ***Underground Infiltration Systems within Blocks (School and Parks)***

Strong consideration should be given to permitting the use of underground infiltration facilities within the school and public park blocks to retain at least 27 mm of runoff from their respective catchments (or more if sufficient space is available). Systems such as the Greenstorm Geocellular Module have been approved and implemented on other similar projects in the GTA; this or an equivalent system would be a suitable candidate for this site. For the school and public parks combined, a total storage volume of 2,100 m^3 would be required to control up to 100% of the total average annual rainfall which would exceed the 27 mm requirement. These systems typically provide highly efficient storage volumes, up to 96% of the LID volume depending on the configuration. Please refer to **Figure 5.3** for preliminary details or refer to Stormcon.ca for additional product information.

The detailed design of the proposed LIDs in these blocks is to be confirmed at the site plan application stage.

iv. ***Re-Use (High-Density Blocks)***

It is anticipated that the high-density blocks will require underground parking structures to meet the population density requirements for those areas, thus prohibiting many conventional infiltration-based LIDs. Opportunities for on-site re-use such as mechanical or irrigation, should be explored at the future site plan design; however, it would not be practical to retain 27mm of runoff on these blocks.

In the event that the CLI-ECA 27 mm retention requirement is initiated by the City, the total maximum retention volume provided by the above additional LIDs would be approximately 19.3 mm (totaling to 27 mm when fairly accounting for the additional 7.7 mm of retention provided from the increased topsoil depth). Refer to **Appendix C** for details.

The detailed design of the proposed LIDs in these blocks is to be confirmed at the site plan application stage.

5.4. *STORMWATER MANAGEMENT POND*

The minor and major system flows from the Subject Lands will be conveyed to the proposed SWM Pond located at the southern limit of the development. The design of the facility will be conducted in conjunction with the proposed grading and servicing design for the proposed development, interim transitway berm design and NHS channel reconfiguration works along NLT-1. The interim SWM facility is shown in **Drawing 601**, and the ultimate SWM facility is illustrated in **Drawing 601A**. As indicated on the drawings, under interim conditions, the east and south sides of the SWM facility will be constructed to elevation 189.70m to avoid impacts to the existing spill across Ninth Line. All other pond components will be constructed to ultimate conditions and the pond will operate as a 100-year control facility during this condition.

The proposed SWM facility will consist of the following components:

- **Quality Control** - The proposed SWM pond is designed to achieve Enhanced Level water quality control. To achieve Enhanced Level water quality control, 5,882 m^3 of permanent pool volume is required. The proposed pond exceeds the water quality requirement by providing 18,360 m^3 of permanent pool volume. The water quality sizing calculations are provided in **Appendix B**.

- **Erosion Control** - The pond outlet will consist of a bottom draw with a reverse-slope outlet pipe with vertical bends connected to a control manhole. A 190 mm ø orifice will be installed vertically within the control manhole at the permanent water elevation, allowing the extended detention volume (6,540 m^3) to drain over a minimum period of 48 hours. The orifice details are provided on **Drawing 605**

(provided in **Appendix D**) and the drawdown time calculations for the extended detention volume are provided in **Appendix B**.

- **Quantity Control -** The controlled flows will be conveyed via an orifice / weir control structure within a concrete chamber. Controlled flows will be conveyed to the headwall at NLT-1. It should be noted that the storage stacking of the quantity control volume over the extended detention volume in the proposed SWM pond facility is provided, as per Conservation Halton guidelines. The orifice / weir outlet control structure details are provided on **Drawing 605** (provided in **Appendix D**). The detailed outlet control calculations are provided in **Appendix B**.

  Under interim conditions, the ultimate structure will be in place, as it is situated on the west side of the SWM facility (which will be constructed to ultimate grades.

- **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. The emergency spillway is sized to convey the uncontrolled Regional flow (4.397 m^3/s) from the SWM facility. The emergency spillway details are provided on **Drawing 604** (provided in **Appendix D**) and the emergency spillway calculations are provided in **Appendix B**.

  An emergency spillway is proposed for the interim facility as well, at the low point along the temporary pond berm along the south edge of the pond (matching the size and location of the ultimate spillway). This spillway will have a similar treatment to the ultimate emergency spillway.

- **Tailwater Conditions** – The function of the pond outlet was also assessed for tailwater conditions, as per Conservation Halton guidelines. The pond outlet was modelled using PCSWMM. The input flow hydrographs for the SWM pond were obtained from the VO hydrology model output and the input water level hydrographs at the pond outlet were obtained from the 2D HEC-RAS model output. Tailwater conditions were assessed for the 2 to 100-year storm events, as well as the Regional storm event. The results from the PCSWMM model confirmed that the storage volume is still contained within the SWM pond for the 2 to 100-year and Regional storm events. The pond outlet tailwater conditions PCSWMM model and model output are provided in **Appendix B**. Note that the interim pond berm has been set above the existing Regional water level within the NHS corridor to the south. Under interim conditions, the pond is effectively a 100-year pond; therefore, the tailwater conclusions for ultimate conditions apply to the interim facility (up to and including the 100-year storm).

- The pond will be designed with a sediment forebay sized according to the MOE SWM Planning and Design Guidelines.

- As per the Geotechnical Recommendations for Proposed SWM Pond prepared by DS Consultants Ltd. (April 2024), the native soils at the bottom of the pond consist of low permeability silty clay and clayey silt, therefore a pond liner is not required for the proposed SWM pond.

- As per the Geotechnical Recommendations for Proposed SWM Pond prepared by DS Consultants Ltd. (April 2024), all existing material within the footprint of the berm embankment is to be removed prior to construction of the pond berms. The excavation base must be inspected and approved by the geotechnical engineer prior to berm fill placement.

- A maintenance access road (5 m wide) is proposed around the facility within the 15m wide buffer area.

The SWM Pond will provide drainage control for the lands shown on **Drawings 301** to **304** provided in **Appendix D**. The facility will be constructed as an off-line wet pond and will provide water quality, erosion and quantity control for the contributing 31.28 ha drainage area with an average impervious level of 73%. The pond will be located within the approximately 2.81 ha block at the southern part of the Subject Lands.

The permanent pool 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 target volume is approximately 5,882 m^3. The permanent pool level has been established at 187.75 m to facilitate gravity drainage to the lowered NLT-1 watercourse.

Based on the unitary targets, proposed drainage area and proposed imperviousness, **Table 5-2** summarizes the total required and provided storage volumes:

Table 5-2: Required and Provided Storage Volumes

Return Period	Unit storage volume (m^3/imp ha)	Target Storage based on 31.28 ha @ 75 % IMP (m^3)	Provided Storage (Active Storage + Ext Det) (m^3)	Designed Pond Water Level (m)	Target Flow (m^3/s) based on 31.28 ha	Pond Outlet Flow (m^3/s)
Permanent Pool	188 m^3/ha	5,882	18,360	187.75	-	-
Extended Detention	275	6,313	6,540	188.25	0.063	0.048
2-year	450	10,330	10,003	188.50	0.075	0.073
5-year	600	13,774	12,853	188.70	0.319	0.134
100-year	875	20,087	21,059	189.25	0.860	0.645
Regional*	1,775	40,748	43,487	190.60	1.289	1.263

*Provided in ultimate conditions only

The required sediment forebay length for settling is 19 m and for dispersion is 40 m. The forebay has been designed with 70 m forebay length with a minimum length-to-width ratio of 2:1 as per the municipal standards. The extended detention target discharge rate will be maintained with a 190 mm ø orifice. The designed extended detention discharge rate is 48 L/s, which is lower than the target 63 L/s discharge rate. The drawdown time will be 57 hours which is greater than 48 hours as per municipal standards. Refer to SWM calculations in **Appendix B** and **Drawing 605** in **Appendix D** for further pond outlet details.

Under interim conditions, the pond will be constructed up to 189.70m only (on the east and south sides), which is sufficient to contain the 100-year storm flows. The pond will operate as normal in this situation for the extended detention up to and including the 100-year storm. During the Regional storm, some storage is available between the 100-year water level of 189.25m and the interim top of pond elevation of 189.70m; however, this volume may be inundated with the spill from east of Ninth Line during a Regional event. Therefore, the interim facility has been assumed to provide no regional control as a conservative measure. The resulting impacts have been evaluated in **Appendix H**.

5.5. *HYDROLOGICAL MODEL VALIDATION*

As per the City's request, a hydrological model validation is provided to document conformity to the Scoped SWS. The following scenarios were created to obtain the flows under different storm events for the 2D HEC-RAS model:

- 01-B-2D_SWS-Existing_Reg Control-AMC III_Urbantech_Updated July 2022
- 02-B-2D_SWS-Int_Reg Control-AMC III_Urbantech_Updated Aug 2023
- 03-B-2D_SWS-Future-SWM_Reg Control-AMC III_Urbantech_Updated March 2023

- 01-A_2D_SWS-Existing_Reg Control-AMC II_Urbantech_Updated June 2024
- 02-A_2D_SWS-Int_Reg Control-AMC II_Urbantech_Updated June 2024
- 03-A_2D_SWS-Future-Reg Control-AMC II_Urbantech_Updated June 2024

Note that the interim conditions described in this section are not related to the interim SWM pond scenario. Modeling associated with the interim SWM pond is included in **Appendix H**.

All other scenarios listed in Readme.file in **Appendix E** have been updated. Only "Regional No SWM control with AMCIII" and "All SWM Control with AMC II" scenarios are considered for this development application.

The original model from the Ninth Line SWS by Wood (2022) and the Interim/Future scenarios updated by Urbantech are listed below for flow comparison purposes:

- 2-B_ SWS-Interim-SWM_Reg Control-AMC III
- 2-C_ SWS- Interim -SWM_All SWM-AMC II
- 3-B_ SWS-Future-SWM_Reg Control-AMC III
- 3-C_ SWS-Future-SWM_All SWM-AMC II

Table 5-3: Updated Information for VO Model Validation

Original Scenario from Ninth Line SWS (Wood, 2022)	Updated Scenario for updated area and imperviousness (Urbantech, 2023)
• VO ID 211, Catchment area is 37.1 ha with 75% TIMP and 60% XIMP • VO ID 98, Route Channel length is 1350m with 0.25% slope • VO ID 99, Route Channel length is 600m with 0.25% slope	• VO ID 211, Catchment area is 5.82 ha with 75% TIMP and 60% XIMP; • VO ID 600, Catchment area is 31.28 ha with 73% TIMP and 73% XIMP; • SWM pond 294 with detailed rating curve based on pond outlet structure design and provided pond volumes • VO ID 98, route channel length is 450m with 0.69% slope and proposed channel cross-section data points based on the surface "Interim_Block2_Ex_9thLine Wetland" • VO ID 99, Channel length is 1550m with 0.46% slope and proposed channel cross-section data points based on the surface "Interim_Block2_Ex_9thLind Wetland"

The provided pond volume for the Regional storm event is 43,487 m^3, which meets and exceeds the target Regional pond volume of 40,748 m^3. Refer to the VO6 hydrology model provided in **Appendix E**. The flow comparison tables, channel input parameters and VO6 Model Schematic for flow locations are provided in **Appendix E.** The purpose of the flow comparison tables is to confirm the impact downstream of the proposed pond and updated channel.

As a confirmation, the total flows at Britannia Road West (VO ID 237), Sixteen Mille Creek East (VO ID 74), Sixteen Mille Creek (VO ID 101), and Sixteen Mile Creek East and West (VO ID 104) were evaluated for the Regional and 2 to 100-year storm events to ensure targets are not exceeding the original peak flows for the entire study area. The peak flow at the four specified locations are compared between the original and updated model. Under interim condition, the flow at Sixteen Mille Creek (VO ID 101), which is also downstream of the channel, is at most 1.550 m^3/s greater than the original Interim VO model by Wood. The proposed values are at most 0.568 m^3/s lower than the original Future VO model by Wood at Sixteen Mile Creek East and West (VO ID 104). Refer to the flow comparison tables and VO6 Model Schematic for flow locations in **Appendix E**. Based on the preceding results, the SWM pond has sufficient quality, erosion and quantity control volume to accommodate the proposed drainage area and land use.

5.6. *NLT-1 CHANNEL*

The 2D HEC-RAS model was used for hydraulic analysis of the NLT-1 channel, evaluating the following scenarios to ensure flood management and compliance with regulatory requirements:

- Existing conditions (current conditions)
- Interim conditions (Block 2 developed and partial MTO grading / flood plain works; existing Ninth Line plus additional 7m x 2.5m culvert)
- Interim conditions (Block 2 developed and partial MTO grading / flood plain works; proposed Ninth Line widening plus additional 7m x 2.5m culvert)

Note: the interim scenarios described above do not represent the "interim pond" scenario. Refer to **Appendix H** for interim pond modelling.

The modelling results indicate that under interim conditions (i.e., Derry Britannia Developments Ltd. lands / Block 2), the Regional water levels in the NLT-1 channel are less than or equal to the existing Regional floodplain at the north limit of Block 2. Along the Eastern Limit (Ninth Line), the proposed pond and grading activities (berm and Ninth Line grading) obstruct existing spill paths, raising water levels. Flood plain elevation increases are mitigated by additional flood plain storage and modifications to reach NLT-1 west of Ninth Line. Water level increases due to the Ninth Line widening can be mitigated by adding a fourth culvert barrel (coordinated with the City's consultant). In channel modification, lowering NLT-1 will create a flat section prone to frequent wetness, offering a wetland restoration opportunity.
The proposed changes have been deemed acceptable from a fluvial and ecological perspective by GEO Morphix and GEI. Some spills occur along Highway 407 and Ninth Line in all scenarios. However, the Mattamy lands in Block 2 will not impact upstream flooding and will reduce flooding on Ninth Line under interim conditions. The ultimate transitway corridor will narrow the flood plain, affecting flood limits across all three blocks.

The impacts of the change in storage and flows were extracted from the 2D dynamic model at key locations (Derry Road, downstream of Block 1; Britannia Road, downstream of Block 2; and Highway 407, downstream of Block 3).

Table 5-4: Updated Information for VO Model Validation

Block	Location	Regional Peak Flow (m^3/s) extracted from 2D Hydraulic model		
		Existing	Interim with existing Ninth Line	Interim with future Ninth Line
1	d/s Derry Road	38.0	37.87 (-0.3%)	37.87 (-0.3%)
2	d/s Britannia Road	136.5	134.5 (-1.5%)	134.0 (-1.8%)
3	d/s Highway 407	137.75	136.52 (-0.9%)	136.05 (-1.23%)

Overall, the interim model results indicate a slight decrease in flows leaving Block 3 at Highway 407, attributed to the increase in storage volume during interim conditions. It should be noted that the steady flow used for downstream Regional flood mapping (based on the SWS hydrological model) is ~170m^3/s. It is therefore assumed that the downstream flood mapping (i.e., west of Highway 407) has accounted for larger flows than the 2D model, and there will be no impacts further downstream within Sixteen Mile Creek with respect to flood hazards.

The detailed channel report is included in **Appendix G**. The assessment of interim conditions / interim lack of Regional flow control is evaluated in **Appendix H**.

6 EROSION AND SEDIMENT CONTROL

Rigorous erosion and sediment control measures will be designed, implemented and maintained throughout the construction period. Erosion and sediment control will be implemented for all construction activities including topsoil stripping, earthworks, foundation excavation and stockpiling of materials and will remain in place and functional until bare surfaces are stabilized.

The following erosion and sediment control measures should be considered for use during construction:

- Natural features will be staked and temporary fencing provided to keep machinery out of sensitive areas;
- Sediment control fence and snow fence will be placed prior to earthworks;
- Logistics/construction plan will be implemented to limit the size of disturbed areas, minimizing the non-essential clearing and grading areas;
- Temporary sediment ponds fitted with one or more turbidity curtains to increase sediment removal efficiency;
- Rock check-dams and cut-off swales will be provided, where required, in order to control, slow down and direct runoff to sediment basins;
- Sediment traps will be provided;
- Gravel mud mats will be installed at construction vehicle access points to minimize off-site tracking of sediments;
- All temporary erosion and sediment control measures will be routinely inspected monitored and repaired during construction. Temporary controls will not be removed until the areas they serve are restored and stable; and
- Where underground services are located below the water table, the use of trench collars are recommended to provide barriers to flow to prevent groundwater flow along granular bedding material.

General mitigative measures that will be considered are:

- Erosion and sediment control measures will be identified, implemented, monitored and maintained throughout the construction period;
- Construction timing windows for works in streams and for clearing of vegetation will be implemented;
- Fish and wildlife rescues will be carried out if necessary; and,
- Tree protection measures to be installed where required.

Reference will be made to the *Guidelines for Erosion and Sediment Control for Urban Construction Sites* (TRCA, 2019) when preparing Erosion and Sediment Control Plans.

Practical measures for the maintenance of water levels in wetlands and watercourses during construction, as well as monitoring requirements, will be identified and implemented, where feasible. Conceptual staging plans for the NHS construction, demonstrating the extent to which the existing natural features may be retained during construction, are presented in the Block 2 CEIIS. Refer to **CEIIS Drawings 12.1A**, "*Stage 1 – NHS*", and **12.1B**, "*Stage 2 – Subdivision*" for further information on the proposed construction sequence. Additional details will be provided through the future permitting process. To optimize the construction schedule and meet the timing window requirements, it is anticipated that the earthworks program will be separated into several permits.

The stabilization of the interim SWM facility will be coordinated with CH staff and the landscape architect. Temporary stabilization of the interim pond berms shall be to the satisfaction of CH staff.

7 CONCLUSION

This SWM report provides the City of Mississauga and Conservation Halton with a stormwater management design for servicing the Derry-Britannia development lands in the City of Mississauga. This SWM Report has demonstrated that:

- Stormwater quantity, quality and erosion controls for the Subject Lands will be provided by the proposed SWM pond facility in accordance with all applicable guidelines and standards.
- The proposed interim pond can provide quantity control up to and including the 100-year storm, and the temporary lack of Regional control was demonstrated to have no significant impact downstream. This condition will occur prior to the Ninth Line culvert upgrades and further coordination with CH staff will occur to determine when the ultimate conditions for the pond are completed.
- The proposed minor and major storm systems are adequately sized for drainage conveyance through the Subject Lands.
- Water balance mitigation is to be provided by a variety of Low Impact Development measures proposed throughout the Subject Lands in order to promote infiltration and groundwater recharge.

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APPENDIX A

STORM SEWER DESIGN SHEETS

APPENDIX B

SWM POND CALCULATIONS

APPENDIX C

LID CALCULATIONS

APPENDIX D

DRAWINGS & FIGURES

APPENDIX E

HYDROLOGICAL MODEL VALIDATION

APPENDIX F

DUAL DRAINAGE MODEL OUTPUT

APPENDIX G

NATURAL HERITAGE SYSTEM DESIGN BRIEF

APPENDIX H

INTERIM SWM FACILITY ANALYSIS