
FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT

SCHLEGEL URBAN DEVELOPMENT CORP.

52 HAWKESVILLE ROAD, ST. JACOBS

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WALTERFEDY

SCHLEGEL URBAN DEVELOPMENTS CORP.

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1.0 INTRODUCTION

WalterFedy has been retained by Schlegel Urban Developments to provide civil engineering services in support of an Official Plan Amendment, Zoning By-Law Amendment, and Draft Plan of Subdivision for the lands located at 52 Hawkesville Road in St. Jacobs, Ontario, hereafter referred to as the Site. Refer to Figure I for the location plan.

The purpose of this Functional Servicing and Stormwater Management Report is to provide a preliminary overview of how the development will be serviced, including water, sanitary, and storm connections to existing municipal infrastructure. The report will discuss the boundary servicing conditions and the capacity of the municipal system to accommodate the development. Storm sewer design, sanitary sewer design, and watermain sizing have been presented, demonstrating compliance with the Township of Woolwich, Region of Waterloo, and Grand River Conservation Authority guidelines and criteria.

1.1 Background

The 28.98 ha site is located in St. Jacobs, Ontario, and is bordered by an existing environmental feature (woodlot/wetland) to the north, the waterloo central railway corridor to the west, Hawkesville Road to the South, and existing residential and institutional properties to the east.

The site is currently zoned as Agricultural (A) in the Township Zoning By-Law. An Official Plan and Zoning By-Law Amendment will be required to permit the proposed development. The Draft Plan of Subdivision proposes a mixed-use development incorporating a combination of low-density residential, street townhouses, multi-residential blocks, as well as open space uses and two stormwater management facilities.



Figure I: Site Location

This report demonstrates that the Draft Plan for the Site can be developed with full municipal servicing and utilities in accordance with the standards of the applicable municipalities and related requirements of the various approval agencies/authorities.

The servicing strategies presented in this report are conceptual in nature; detailed engineering drawings will be submitted as part of the detailed engineering design process once the proposed Draft Plan has been approved.

1.2 Reference Reports and Drawings

The following were referenced in the preparation of this Functional Servicing and Stormwater Management Report.

1. Design Guidelines and Supplemental Specifications for Municipal Services (DGSSMS), Region of Waterloo and Area Municipalities, February 2023
2. Township of Woolwich Engineering Development and Infrastructure Manual, Township of Woolwich, March 2022
3. Stormwater Management Planning and Design Manual, Ministry of the Environment, Conservation and Parks (MECP), 2003
4. Design Guidelines for Drinking-Water Systems, Ministry of the Environment, Conservation and Parks, 2008
5. Design Guidelines for Sewage Works, Ministry of the Environment, Conservation and Parks, 2008
6. Development Concept, St. Jacobs Subdivision, GSP, April 2025
7. Hydrogeological Assessment, St. Jacobs, GHD, April 2025
8. Northside Drive Municipal Drain 2011, Dietrich Engineering Limited, June 2011
9. Municipal Drain No. 11 Report, Headway Engineering, April 2023
10. Regional Official Plan Amendment No. 6, Region of Waterloo, June 6, 2023
11. Source Protection Guidance Document Salt Impact Assessment, Region of Waterloo
12. Beneficial Practices Worksheet 2017, Region of Waterloo Water and Wastewater Services
13. Salt Application Best Practices for Winter Maintenance Contracts, Sustainable Technologies Evaluation Program
14. Water Supply for Public Fire Protection, Fire Underwriters Survey (FUS), 2020
15. St. Jacobs-Elmira Wastewater Treatment Master Plan, XCG, February 2013
16. Feature-Based Water Balance Assessment, GHD, April 2025
17. Geotechnical Investigation, 52 Hawkesville Road, St. Jacobs, Ontario, MTE, January 2025
18. Environmental Impact Study, Natural Resource Solutions Inc., April 2025

2.0 EXISTING INFORMATION

2.1 Land Use

The Site is utilized for agricultural purposes and has a drainage pattern conveying storm flows to the woodlot/wetland to the north and ultimately draining to the Municipal Drain No. 11. Additionally, storm flows from the southernmost portion of the site drain toward Hawkesville Road and ultimately flows south along the adjacent railway corridor. Topographically, grades range from 367.0 MASL (metres above sea level) in the northwest to 344.5 MASL in the southeast.

2.2 Topography and Drainage

The Site has a drainage pattern that conveys runoff from south-to-north to the existing woodlot/wetland, and ultimately draining to the Municipal Drain no. 11, before ultimately outletting to the Grand River. The eastern side of the property drains northeast at a slope of approximately 0.7%. The western side of the property drains in a southwesterly direction with slopes ranging from 1.0% to 2.5%. During larger storm events, the runoff will pond until it spills downstream.

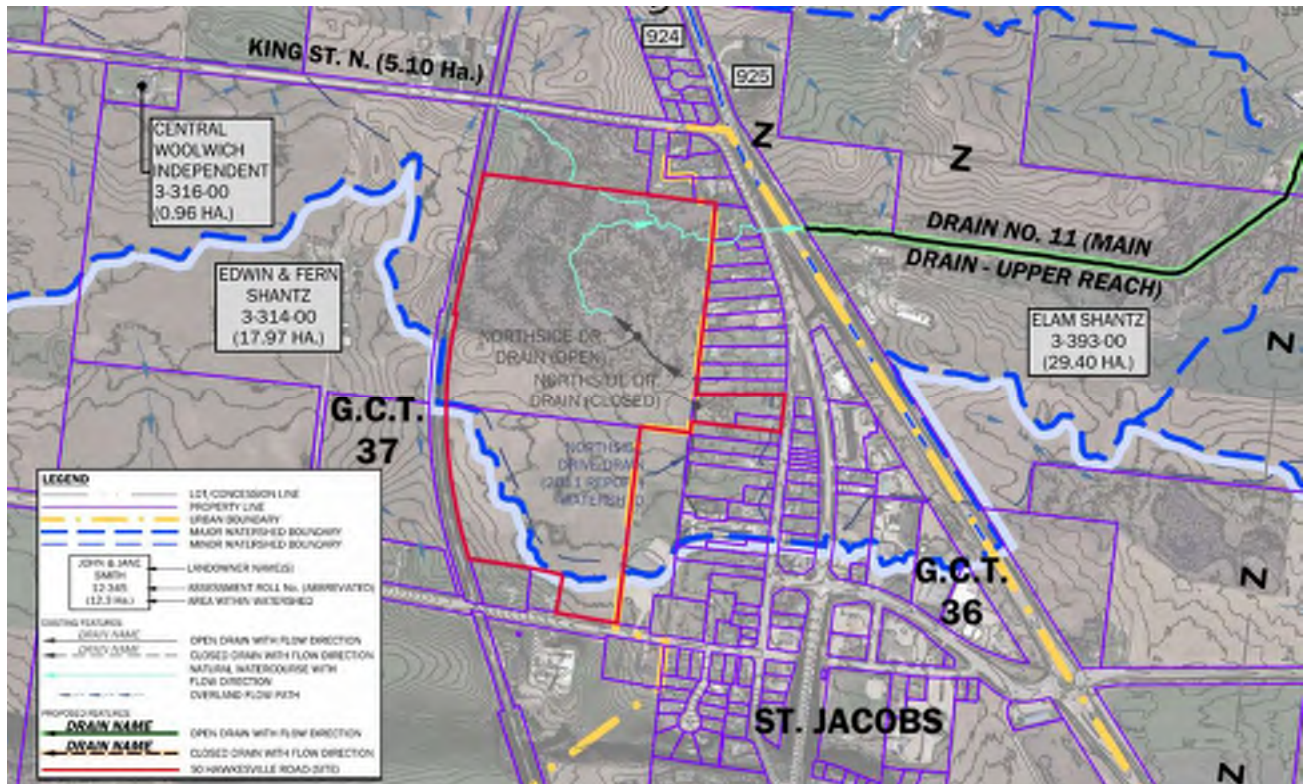


Figure II: Watershed Plan by Headway Engineering, April 2023

Existing topographic information was obtained from a survey completed by WalterFedy in May 2024. Additional survey work was completed along the northern boundary of the site, including legal surveys carried out by Van Harten Surveying Inc. in October 2023 and February 2024. The proposed development site currently consists of agricultural fields, with a few residential units located along Northside Drive and a woodlot/wetland located at the northern portion of the Site

2.3 Geotechnical and Hydrogeological Information

Site boreholes and monitoring wells were installed by CVD on December 2021. The results of these investigations are summarized below:

- A topsoil layer ranging from 0.15 m to 0.76 m in thickness was found in all borehole locations, characterized as sandy brown to black soil, with trace gravel and organics.
- Sandy silt, sand, clayey silt, and glacial till materials were encountered at depths ranging from 0.285 m to 3.96 m.
- Glaciofluvial deposits consisting of coarse-to fine-grained sand were encountered at depths up to 6.96m varying from poorly to well graded.
- Glaciolacustrine deposits consisting of fine grained layers (clay, silty sand, sandy silt) were generally found below sand.
- Dense silt and clay with trace of sand/gravel was encountered beneath coarse-and fine-grained materials and extended the depth of completion of the boreholes at approximately 6.5 m.

Additionally, a preliminary geotechnical investigation was conducted by MTE on November 9, 2023. A total of six boreholes were advanced on Site; the findings of the geotechnical investigation are summarized below:

- A topsoil layer ranging from 0.175 m to 0.610 m in thickness was found in all borehole locations, averaging 0.285 m.
- Sandy silt, sand, clayey silt, and glacial till materials were encountered at depths ranging from 0.285 m to 3.0 m.
- Shallow groundwater was observed during drilling at a depth pf 2.2 m (elevation 345.7 MASL) and some wet conditions in the sand deposits were encountered at a depth of 1.2 m (elevation 346.7 MASL).

Furthermore, a hydrogeological assessment was completed by GHD on April 2025. The summarized conclusions of this report include:

- The groundwater elevation data collected to date show that, during seasonally wet periods in winter and spring, the depth to groundwater is generally shallow across the site, ranging from approximately 0.2 to 1.8 meters.
- There is a northwest to southeast oriented groundwater flow divide in the southern portion of the Site. This divide coincides with a topographic ridge in the area. To the north of this divide, groundwater flows towards the north and northeast, eventually reaching the wetland. To the south, groundwater flows southwest along the railway and ultimately to the Conestogo River, approximately 0.5 km south of the site.
- The groundwater elevation monitoring shows that groundwater discharge to the wetland from the shallow groundwater zone does not occur and that the wetland is sustained by surface water runoff.

For a more detailed review and discussion of specific grading, servicing, and road construction recommendations, reference can be made to the previously-noted geotechnical and hydrogeological reports.

2.4 Environmental Impact Study

An Environmental Impact Study has been completed for the Site by Natural Resource Solutions Inc. The proposed stormwater management design and grading plan include provisions to provide a water balance for the environmental feature within the woodlot/wetland. As part of the conceptual planning process, opportunities to provide "complimentary" habitat features have been implemented through strategic placement of stormwater management facilities, municipal roadways, future community trail corridors, and open space. It is anticipated that this strategy will provide enhanced opportunities to support existing natural areas and habitat. For further natural environment information, reference can be made to the respective report.

2.5 Source Protection

The Site is located within the Grand River Source Protection Area. Based on the most recent information obtained from the MECP's Source Protection Information Atlas, the Site is classified as an Intake Protection Zone (IPZ) 3 with a score of 2.

For context, an IPZ is an area of water and land that provides water for a municipal surface water intake and is vulnerable to land-use activities that could contaminate or deplete the river, stream, or lake that is the source for municipal drinking water. A vulnerability score is given to IPZs by assigning significance to identified or potential activities that have been deemed threats to the drinking water sources, scoring is between 2 (lowest vulnerability) and 10 (highest vulnerability).

Additionally, the Site is classified as a Significant Groundwater Recharge Area (SGRA); however, it is not located within a highly vulnerable aquifer (HVA) or Issue Contributing Area (ICA). Table 1 provides a summary of the source protection parameters that apply to the Site.

Table 1: Source Protection Details

Source Protection Area	Grand River
Water Quality	
Wellhead Protection Area	No
Wellhead Protection Area (WHPA-E):	No
Intake Protection Zone:	3, Score = 2
Issue Contributing Area:	No
Significant Groundwater Recharge Area:	Yes (Score = N/A)
Highly Vulnerable Aquifer:	No
Event Based Area:	No
Water Quantity	
Wellhead Protection Area Q1:	No
Wellhead Protection Area Q2:	No
Intake Protection Zone Q:	No

The Northside Municipal Drain No. 11 crosses through the northern portion of the Site and captures runoff from the Site and adjacent lands to the northeast. Water balance measures have been implemented to ensure that the total post-development infiltration closely meets the pre-development infiltration levels, effectively managing stormwater and maintaining the water balance to the woodlot/wetland environmental feature.

To ensure that the infrastructure proposed as part of this development does not become a significant threat in the future, the infrastructure is designed in accordance with MECP's sewage guidelines to help ensure that the maximum expected service life is realized and to reduce the potential for incidences of failure.



The municipal infrastructure and utilities in the vicinity of the Site are summarized below and are shown on the conceptual servicing plan.

There is a 150-mm-diameter watermain on Hawkesville Road located south of the Site which will need to be extended to reach the Site's southern limit. Additionally, there are 150-mm- and 300-mm-watermains on Northside Drive located east of the Site. Ultimately, the watermain will be connected to the 300-mm-diameter Regional watermain on Northside Drive.

There is a 200-mm diameter sanitary sewer on Northside Drive, located east of the subject site. A second 200-mm-diameter sanitary sewer is located on Hawkesville Road, extending west from the intersection with Northside Drive to service the Calvary United Church property, approximately 75 m east of the Site. For the proposed development, only a single sanitary connection is proposed. The existing sanitary sewer on Northside Drive is sufficient to fully service the lands via gravity, and no additional connections are necessary.

Per the St. Jacobs-Elmira Wastewater Treatment Master Plan completed by XCG (February 2013), several modelling options were investigated to determine growth accommodation to 2041. The preferred option includes decommissioning the St. Jacobs Wastewater Treatment Plant (WWTP) and transferring flows to the Waterloo WWTP. Per the Region's monitoring report, the St. Jacobs WWTP expansion will not be required until 2031; the Township should continue to address infiltration and inflow impacts at the plant.

The Regional Municipality of Waterloo in collaboration with Ainley Group has started the Schedule C Class Environmental Assessment (EA) for expansion of St. Jacobs Wastewater Treatment Plant (WWTP). The objective of this EA is to review alternatives for the St. Jacobs WWTP to meet the future 2051 capacity needs for treatment of sanitary sewage generated in the community of St. Jacobs.

2.6.3 Storm Servicing

There is an existing 375-mm-diameter storm sewer located along Hawkesville Road servicing an area of 0.75ha at the south end of the site. Additionally, the Site has a storm drainage pattern that conveys runoff from south-to-north to the existing woodland, and ultimately draining to the Municipal Drain no. 11, before ultimately outletting to the Grand River. The eastern side of the property drains north to the woodlot/wetland at a slope of approximately 0.7%. The western side of the property drains in a southeasterly direction with slopes ranging from 1.0 % and 2.5%.

3.0 REVIEW AGENCIES

3.1 Township of Woolwich

The Township of Woolwich will be responsible for the review and approval of the Draft Plan of Subdivision, as well as preliminary servicing, grading, and SWM designs for the overall development.

3.2 Region of Waterloo

The Region of Waterloo will be responsible for the review and approval of the Draft Plan of Subdivision as it relates to preliminary servicing and Regional infrastructure for the overall development.

3.3 Grand River Conservation Authority (GRCA)

The GRCA will be responsible for the review and approval of the Draft Plan of Subdivision, as well as preliminary grading, drainage, and SWM designs for the overall development.

3.4 Other Utilities

The development will require review by utility providers for the supply and installation of services including, but not limited to, hydro, gas, and telecommunications (cable and fiber). As such, drawings will be circulated to relevant agencies for their comment during detailed design.

4.0 GRADING AND DRAINAGE

4.1 Proposed Development

Utilizing the Draft Plan prepared by GSP, WalterFedy has prepared preliminary grading and servicing plans. The proponent proposes to develop the property into a mixed-use subdivision. The residential development includes low-density residential (46-78 units), low density/semi/towns (101-236 units), street townhouse/multi-residential (40-95 units), park land, and two stormwater management facilities (SWMFs).

4.2 Design Constraints and Procedures

Constraints in designing the road profiles and lot grading are:

- Match existing road and boundary elevations (i.e., property limits, etc.)
- Where possible, satisfy the Township of Woolwich's minimum separations from the underside of footings to seasonally-high groundwater levels

- Maintain existing grades, where possible, to minimize grading and cut/fill quantities
- Minimize changes to the surface hydrology and hydrogeology of the area
- Satisfy the Township of Woolwich's road design requirements for minimum and maximum road grades
- Provide major overland flow route(s) to the stormwater management facilities for flows in excess of the storm sewer capacity
- Where possible, maintain adequate cover over storm and sanitary sewers and watermain
- Where possible maintain existing limits of subwatersheds.
- Promote infiltration of rainwater runoff
- Protect existing environmental features (woodlot areas/natural areas, etc.) by adhering to "no-touch" zone buffer limits

4.3 Preliminary Overall Grading

Earth cuts of 1.0 m to 3.5 m and fills of 1.0 m to 5.5 m depth are proposed throughout the Site in order to provide minimum groundwater separation, positive drainage for local services, and to address topographic/environmental constraints. The overall cut/fill operation is anticipated to require detailed planning/coordination to enhance infiltration opportunities (i.e., placement/exposure of permeable soils) throughout the Site, with the intent of the area grading operation replicating existing drainage conditions using suitable engineering practices and procedures. The proposed grading design includes retaining walls along the railway corridor to facilitate the transition between existing and proposed grades.

The proposed lot grading consists of grades ranging from 2.5% to a maximum of 5%, including 3:1 transitional slopes, in order to accommodate various grade changes within the Site (i.e., adjacent to SWMFs and surrounding protected environmental features) and the internal road profiles. The grading is proposed to satisfy minimum separations from the underside of footings to seasonally-high groundwater levels, which will be further revised as the detailed designs progress.

Various lot types are required throughout the Site to accommodate the required grade changes. The proposed grading is illustrated on drawings C200 to C203.

4.4 Preliminary Earthworks

During detailed design, the road profile and grading concept will be refined to reduce overall grading impacts for the proposed subdivision while maintaining minimum clearance for high-groundwater levels. Topsoil fill areas will be identified in order to minimize offsite removal of excess topsoil material. It is anticipated that earth cuts with up to 3.5 m will be required, as well as up to 5.5 m of earth fill in order to service the Site.

4.5 Preliminary Road Profiles

Preliminary road profiles were established for the Site based on the street configuration from the proposed Concept Plan dated April 2025 (GSP). To satisfy the noted constraints, road profiles were designed in accordance with the Township of Woolwich's road design criteria while matching the existing elevations of the perimeter roads, Northside Drive and Hawkesville Road. In an effort to maintain minimum separations from the underside of footings to seasonally-high groundwater levels (0.6 m for residential and non-residential buildings and 0.8m for walk-outs residential and non-residential buildings), roads have grades ranging from 0.7% to a maximum of 5%, which will also help maintain overland flow drainage routes to and from the two SWMFs, while matching the existing topography where possible. The proposed centerline road elevations are illustrated on drawings C400 to C402.

5.0 SANITARY SERVICING

In accordance with the Township's 2024 Development Charges Background Study and the Region of Waterloo DGSSMS, the sanitary flows from the subject development were calculated based on the various categories of residential units proposed for the development. In order to determine the conservative scenario for this development, the maximum population per proposed zoning was used to determine sanitary demand.

Table 2 provides a summary of the total domestic flow expected to be generated from the overall development.

Table 2: Proposed Sanitary Flow

Developable Area	15.24 ha
Low Residential	
Number of Low Density Residential	78 units
Average Residential Daily Flow	305 L/c/d
Design Population density	143 p/ha
Area of Development	2.46 ha
Design Population	352 persons
Average Daily Flow	1.24 L/s
Harmon's Peaking Factor	4.05
Extraneous Flows (Infiltration/Inflow)	0.25 L/s/ha
Total Peak Flow	5.64 L/s
Low Density/Semi/Towns	
Number of Street Townhouses	236 units
Average Residential Daily Flow	305 L/c/d
Design Population density	143 p/ha
Area of Development	5.07 ha
Design Population	725 persons
Average Daily Flow	2.56 L/s
Harmon's Peaking Factor	3.89
Extraneous Flows (Infiltration/Inflow)	0.25 L/s/ha
Total Peak Flow	10.01 L/s
Street Townhomes	
Number of Multi-residential units	38 units
Average Residential Daily Flow	305 L/c/d
Design Population density	196 p/ha
Area of Development	0.54 ha
Design Population	106 persons
Average Daily Flow	0.37 L/s
Harmon's Peaking Factor	4.24
Extraneous Flows (Infiltration/Inflow)	0.25 L/s/ha
Total Peak Flow	1.72 L/s
Multi-Residential	
Number of Multi-residential units	57 units
Average Residential Daily Flow	305 L/c/d
Design Population density	196 p/ha
Area of Development	0.60 ha

Design Population	118 persons
Average Daily Flow	0.42 L/s
Harmon's Peaking Factor	4.22
Extraneous Flows (Infiltration/Inflow)	0.25 L/s/ha
Total Peak Flow	1.90 L/s
Total Residential Sanitary Peak Flow	19.27 L/s
EXTERNAL LANDS	
Institutional Site Area (PeopleCare)	1.07 ha
Number of Beds	224 beds
Institutional Design Criteria	2.5 L/s/ha
Peaking Factor	1.5
Institutional Sanitary Flow	4.01 L/s
Total Sanitary Flow	23.29 L/s

The design population was calculated through a multiplication of the number of units proposed of each dwelling type by the prescribed population densities as per the Region's 2009 Land Budget.

It is proposed that the development be serviced by the existing 200-mm-diameter sanitary service located on Northside Drive, at the northeastern corner of the site, as shown on Drawing C300, which is sufficient to fully service the lands, and no additional connections are necessary.

5.1 Local Servicing

As previously noted, local 200-mm-diameter sanitary sewers will be extended throughout the Site and will be constructed at typical depths of 2.8 m to 5.0 m within the proposed rights-of-way, where possible, as shown on the Servicing Concept Plans. At the south limit of Street A, approaching Hawkesville Road, approximately 100m of road will have sewer depths less than 2.8 m. Frost protection for the sanitary sewers and grinder pumps for the units are proposed in accordance with the current Township of Woolwich guidelines.

All sewers within the project limits have been designed to provide a minimum full-flow velocity of 0.8 m/s to provide self-cleansing within the pipes. The sewers are also designed with a maximum full-flow velocity of 3.0 m/s to mitigate concerns for pipe displacement as a result of impact and erosion. These velocities have been calculated using the Chézy-Manning formula with a roughness coefficient of 0.013 in accordance with Township of Woolwich, Region of Waterloo DGSSMS, and MECP design criteria.

6.0 WATER SERVICING

The proposed subdivision will have two watermain connections from the existing infrastructure surrounding the Site. A connection to the existing 150-mm-diameter watermain on Hawkesville Road will be installed at the southern entrance of the Site. This connection will require a short extension of the main to reach the development boundary. Additionally, a connection to the existing 300-mm-diameter watermain on Northside Drive will be installed at the north-eastern entrance of the Site.

6.1 Model Development and Design Criteria

The Region of Waterloo requires that watermain distribution systems be able to convey the larger of the maximum daily demand and fire flow or the peak hourly demand. Additionally, the Region of Waterloo DGSSMS recommends that the average daily flow from any development be conveyed with a resulting pressure within the range of 350 kPa (50 psi) to 550 kPa (80 psi).

The Region also stipulates that the minimum resultant pressure under any non-fire demand scenario shall not be less than 275 kPa (40 psi). With the inclusion of fire flows, the minimum residual pressure in the distribution system shall not be less than 140 kPa (20 psi) and shall not cause velocities in the system to be greater than 5 m/s.

Should static pressures in the system exceed 550 kPa (80 psi), the Region requires the use of individual pressure-reducing valves for new developments. The distribution system must also be designed to ensure that pressures do not exceed 700 kPa (100 psi) at any point in the system.

The water distribution system was modelled in EPANET to understand pressures and velocities in the system. Refer to Appendix C for detailed modelling results.

6.1.1 Region of Waterloo Modelling Information

Based on information obtained from the Region of Waterloo, the Site is adjacent to the St. Jacobs pressure zone. Two nodes from the Region's model were used as the boundary conditions for the EPANET model prepared for the proposed development. The hydraulic grade lines for the average day and maximum day demand patterns were obtained for node JCT_05153, located south of the Site on Hawkesville Road, and node JCT_05473, located east of the Site at the intersection of Northside Drive and King Street. Correspondence received from the Region regarding the water modelling results are provided in Appendix C.

6.2 Domestic Water Demand

In accordance with the DGSSMS, the average residential demand for the proposed development was estimated using a demand of 225 L/cap/day. An assumed domestic demand of 450 L/bed/day was assigned to the adjacent institutional site (PeopleCare) located on the northeastern edge of the Site, in order to align with previously-submitted servicing materials for the Site. Population densities in the order of 3.416 (single/semi-detached), 2.579 (townhome units), and 1.887 (multi-residential units) persons per unit (ppu) were assigned as per the Township of Woolwich's 2024 Development Charges study.

A peaking factor of 2.75 was used to convert the average daily demand into a maximum day demand. This peaking factor is in accordance with the water distribution masterplan. A peaking factor of 4.13 was used to convert the average daily demand into the peak hourly demand in accordance with Table 3-1 of the MECP guidelines, for a design population between 500 and 1,000 persons.

Table 3: Anticipated Domestic Water Demand

Gross Site Area	28.98 ha
Residential Site Area	8.67 ha
Number of Single/Semi-detached residential units	78 units
Design Population density	3.416 ppu
Design Population	266 persons
Number of Townhouse/condo units	236 units
Design Population density	2.579 ppu
Design Population	609 persons
Number of Multi-residential units	95 units
Design Population density	1.887 ppu
Design Population	179 persons
Total Design Population	1054 persons

Average Daily Residential Design Flow	225 L/person/day
Average Daily Residential Flow	2.75 L/s
Peak Hour Peaking Factor (MECP Table 3-1)	4.13
Peak Hourly Residential Flow	11.34 L/s
Maximum Day Peaking Factor (MECP Table 3-1)	2.75
Maximum Daily Residential Flow	7.55 L/s
EXTERNAL LANDS	
Institutional Lands (PeopleCare)	0.89 ha
Institutional Allowance	450 L/bed/day
Number of Beds Allocated	224 beds
Peak Hour Peaking Factor (MECP Table 3-1)	4.30
Peak Hourly Residential Flow	5.02 L/s
Maximum Day Peaking Factor (MECP Table 3-1)	2.90
Maximum Daily Residential Flow	3.38 L/s

6.3 Fire Flow Demand

In addition to the daily domestic water demand for the proposed development, fire flow demands were calculated to assess the adequacy of the proposed watermain system. The Region of Waterloo specifies that all fire flow requirements shall be determined in accordance with the current issue of Water Supply for Public Fire Protection published by the Fire Underwriters Survey (FUS), and the Ontario Building Code.

The fire flow targets utilized within the EPANET modeling of the Site are detailed in Table 4. In order to reflect the scenario in which the greatest available flow was provided to the proposed development, a looped system connecting to existing nodes on both Hawkesville Road and Northside Drive was modelled using information provided by the Region of Waterloo. It is noted that the maximum available flow noted within both node results from the Region of Waterloo was set at a value of 129.9 L/s. Due to this restriction in available flow within the proposed development area, the prescribed fire flow targets were not capable of being achieved. Best efforts were utilized in order to maximize the available fire flow at all nodes in the development.

Table 4: Prescribed Fire Flow Targets

Land Use	Recommended Fire Flow Target (L/s)
Institutional	200
Residential – Single	150
Residential – Multi	150

6.4 Distribution System Criteria and Layout

As per the MECP drinking water guidelines, the water distribution system shall be designed to convey the greater of the combination of the maximum day demand and the fire demand or the peak hour demand based on the following criteria:

- The distribution system shall maintain a minimum pressure of 140 kPa (20 psi) under maximum day demands plus fire flow conditions.
- The normal operating pressure shall be between 350 to 481 kPa (50 to 70 psi), and not less than 275 kPa (40 psi).
- The maximum pressure in the distribution system shall not exceed 700 kPa (100 psi).

Watermain sizes will be selected to ensure that velocities in the maximum day plus fire scenario do not exceed 5 m/s and maintain a 0.8 m/s flushing velocity for cleaning and disinfection procedures. The watermain shall

be designed to be installed within the road allowance per the Municipality's Typical Cross Section with a minimum cover of 1.8 m.

It is proposed to connect the watermain system to the existing watermain on Hawkesville Road and Northside Drive. Connection details will be confirmed and finalized during detailed design. Individual service connections are to comply with the requirements of the *Safe Drinking Water Act, 2002, S.O. 2002, c. 32 (SDWA)*.

6.5 Modelling and Results

The model was run to optimize pipe sizes in the proposed subdivision according to the aforementioned design criteria. The subdivision pipe sizes were modelled as 200-mm- and 300-mm-diameter feeders connecting to the 150-mm-diameter and 300-mm-diameter mains on Hawkesville Road and Northside Drive, respectively. In order to determine the maximum available flow that can be supported by the proposed system, a fire flow analysis was conducted within the system on PCSWMM.

In order to create the Maximum Day demand plus fire flow model, the demands noted in Table 3 were divided by the number of system nodes within each respective portion of the proposed development – the resulting products were then assigned to the system nodes within the model.

For this system in particular, there were 48 nodes corresponding to residential areas and one node reserved for servicing the adjacent institutional site (PeopleCare). For nodes located within the residential lands, the maximum day demands for each node was set to a value of approximately 0.119 (the product of the overall residential maximum day demand divided by the 48 nodes within the residential lands). This process was repeated in order to create the peak hourly demand model.

Additionally, a minimum constraint of 14.1 m (20 psi) was assigned to all nodes within the system. A specified target pressure analysis was then performed on the system. Under this analysis, the program computes the maximum available fire flow such that no nodes within the system drop below the minimum pressure constraint assigned to them.

It is noted that the fire flow analysis conducted considers the previously-assigned Maximum Day demand values that were assigned to the non-hydrant nodes in the model when determining the available fire flow at the hydrant nodes. The fire flow analysis tool utilized within the fire flow scenarios simulates a situation in which a hydrant within the system is required to provide the prescribed fire flow for a duration of 3 hours, under the prescribed system pressure constraints, within the modelled system. The fire flow analysis tool does not override the previously-prescribed demands assigned to the nodes within the system, instead it takes them into account when determining the maximum available fire flow at each hydrant node.

The results for a few select nodes, noted to be in key positions within the development (nodes with larger base demand values and nodes that are the furthest away from the subdivision's connections to the existing watermain), are presented in Table 5. Detailed results for all fire flow scenarios modelled are provided in Appendix C.

Table 5: MDD + Fire Flow Results for Key Nodes

Junction	Required Fire Flow (L/s)	Min. Residual Pressure (m)	Fire Flow Period (hours)	Available Fire Flow at Min. Residual Pressure (L/s)
J17	150	14.1	3.00	120.1
J7	150	14.1	3.00	120.09
Institutional	200	14.1	3.00	121.25

As illustrated on the modelling results shown above and provided within Appendix C, the proposed network configuration will be constrained to a maximum available flow of approximately 121 L/s throughout the Site.

6.6 Water Quality

The site is serviced by a looped watermain to ensure that water quality is maintained through the elimination of stagnation and loss of chlorine residual within the system.

7.0 STORM SERVICING AND STORMWATER MANAGEMENT

Under post-development conditions, stormwater quantity, quality, and erosion control for the development will be provided by two SWMFs located to the north of the Site. The facilities will be designed in accordance with MECP guidelines. The proposed development will include the construction of a municipal storm sewer system to convey minor system flows to the proposed SWMFs. The proposed storm sewer network will be sized to convey the Township of Woolwich's 5-year storm event. Major flows will be conveyed overland through the internal street network to the SWMFs.

7.1 Stormwater Management Criteria

The proposed SWM features incorporated into the development will be subject to the following criteria:

- Quality Control – Provide an Enhanced (80% total suspended solids (TSS) removal) level of water quality protection per MECP guidelines.
- Erosion Control – Provide extended detention drawdown over a 24- to 48-hour period for the 25 mm (4-hour duration) Chicago Storm event outletting from the wet pond cell.
- Quantity Control – Control post-development peak flow discharge to the receiving outlet to less than pre-development conditions for the 2-year to 100-year storm events and provide safe conveyance of the Regional storm event through the SWMF. The Regional storm event was the Hurricane Hazel 48-hour event with a total depth of 285 mm.
- Water Balance – ensure that the proposed lands provide a sufficient annual outflow to the existing woodlot/wetland located north of the Site. This will be accomplished through the designed outlet structures of the proposed SWMFs.

7.2 Pre-Development Conditions

Under pre-development conditions the subject lands are utilized for agricultural purposes. The northern areas of the Site drain via overland flow to the woodlot/wetland area north of the Site – ultimately draining to Municipal Drain No. 11 before outletting to the Grand River. The southern portion of the Site drains uncontrolled towards Hawkesville Road. The pre-development conditions were discretized into three catchment areas as indicated in Table 6 and depicted in Figure 1. A flow schematic of pre-development conditions has been provided in Figure 2. The pre-development conditions were analyzed with PCSWMM.

As per the Township of Woolwich's Engineering Development and Infrastructure Manual, the City of Kitchener's IDF parameters were utilized in order to analyze the pre- and post-development conditions of the Site. The City of Kitchener's 3- and 4-hour storm distributions, alongside their relevant IDF parameters, were used within the preliminary PCSWMM modelling.

Infiltration was modelled using the Green-Ampt Infiltration model. The Ministry of Agriculture, Food, and Agribusiness' online GIS mapping system, AgMaps, was consulted in order to determine the subsurface soil conditions within the subject lands. As illustrated in Figure 3, it was determined that the soils within the subject lands are comprised mostly of sandy loam soils. Table 4-7 of the Storm Water Management Model Reference

Manual, Volume I – Hydrology prepared by the US EPA was consulted in order to determine the appropriate parameter values utilized within the hydrologic model completed for the Site.

Hydrologic modeling parameters are included in Appendix D. The pre-development peak flows for each of the outlet locations as well as the total for the subject site are shown in Table 7. These flows will be used to compare with the post-development results. It is noted that the areas listed within Table 6 does not include the approximately 13.79 ha of existing woodlot area located north of the Site. Under post-development conditions this area will remain unchanged and was therefore not included within the hydrological modelling.

Table 6: Pre-Development Catchment Areas

Catchment ID	Description	Outlet	Area (ha)
100	Southwestern portion of the Site	Hawkesville Road	4.09
101	Northeastern portion of the Site	Municipal Drain no. 11	11.2
102	Northwestern portion of the Site	Municipal Drain no. 11	0.29
103	External areas east of the Site	Municipal Drain no. 11	5.16
Total			20.74

Table 7: Pre-Development Peak Flows (m³/s) From Subject Lands to Outlet Locations

Storm Event	Outlet O-1 Hawkesville Road	Outlet O-2 Municipal Drain No. 11	Total Site
25 mm	0.291	0.597	0.888
2-Year	0.430	0.967	1.397
5-Year	0.593	1.337	1.930
10-Year	0.784	1.707	2.491
25-Year	0.971	2.025	2.996
50-Year	1.172	2.361	3.533
100-Year	1.378	2.697	4.075

7.3 Post-Development Conditions

Under post-development conditions, the subject lands will be developed into a residential subdivision. The post-development analysis will include the proposed Institutional site (PeopleCare) located on the northeastern portion of the property as well as the northern portion of the existing development located at 48 Hawkesville Road, St. Jacobs; both properties will be serviced through the Site.

The post-development conditions were discretized into thirteen catchment areas as indicated in Table 8 and depicted in Figure 4 for the purposes of the PCSWMM hydrologic modeling. A flow schematic of post-development conditions has also been provided in Figure 5. Hydrologic modeling parameters are provided in Appendix D. The following sections of the report will describe proposed stormwater management measures and peak flow summaries for the overall development.

Table 8: Post-Development Catchment Areas

Catchment ID	Description	Outlet	Area (ha)
201	Main portion of proposed subdivision	Municipal Drain no. 11	8.59
202	Proposed Institutional Site (PeopleCare)	Municipal Drain no. 11	0.89
203	Proposed dry pond area	Municipal Drain no. 11	0.47
204	Northeastern entrance to Site	Municipal Drain no. 11	1.53
205	Southern multi-residential area	Hawkesville Road	1.39
208	Northwest rear yard area, drains directly to woodlot/wetland	Municipal Drain no. 11	0.80
209	Proposed SWM pond area	Municipal Drain no. 11	1.18
210	Existing residential area east of Site	Municipal Drain no. 11	2.89
211	Northern rear lot areas, draining to proposed SWM pond	Municipal Drain no. 11	0.44
212	Residential areas west of the proposed People Care Site	Municipal Drain no. 11	0.57
213	Residential areas north of the proposed People Care Site	Municipal Drain no. 11	0.28
220	Northern portion of the existing Calvary United Church Site	Municipal Drain no. 11	1.70
Total			20.74

7.3.1 Northwestern Stormwater Management Facility

The northwestern SWMF has a footprint of approximately 1.18 ha. The proposed facility will outlet to the northern woodlot area. As per the hydrological studies conducted by GHD, it is understood that the woodlot/wetland ultimately outlets to Municipal Drain no. 11. Table 9 summarizes the basic operating levels, volumes, and outlet controls within the proposed facility. Detailed stage-storage-discharge information is provided in Appendix D. The low-flow quality control orifice will be serviced by a reversed-slope pipe extending into the permanent pool of the pond. The remaining quantity control will be achieved by a 5-m-wide rectangular weir with a sill elevations of 346.70 m.

Table 9: Northwestern SWM Facility Operating Levels

Stage	Elevation (m)	Active Volume (m ³)	Cumulative Volume (m ³)
Bottom of Forebay	344.05	0	0
Bottom of Wet Cell	344.50	0	225
Permanent Pool	345.50	0	3885
Extended Detention (25mm)	345.82	1604	5490
Overflow Weir Sill	346.55	6031	9916
Top of Pond	347.00	9113	12998
Outlet Controls:	One – 150-mm-diameter low-flow orifice (quality) at elev. 345.50 m One – 75-mm diameter low-flow orifice (water balance) at elev. 345.87 m Two – 450-mm-diameter orifices (quantity) at elev. 345.90 m 5-m-long weir at elev. 346.55 m		

(1) Quality Control – Northwestern SWMF

The SWMF on the northwestern portion of the property will be constructed as a wet pond facility that will provide an Enhanced (80% TSS removal) level of water quality protection per MECP guidelines for the catchment areas that it receives flow from. The SWMF will include a permanent pool with forebay and extended detention drawdown for the 25 mm storm event. Table 10 summarizes the water quality control design features of the northwestern SWMF. Detailed calculations and design sheets are included in Appendix D.

Table 10: Northwestern SWMF – Summary of Water Quality Control

Component	Required	Provided
Protection Level	Enhanced (80% long-term TSS removal)	
Drainage Area for Quality Control	13.41 ha	
Percent Impervious	63.2%	
Req'd MECP Water Quality Unit Volume	209 m ³ /ha	
Permanent Pool Volume		
Permanent Pool (Required unit volume = 210 m ³ /ha) ^A	2302 m ³	3885 m ³
Permanent Pool Depth	1.0 – 2.0 m	1.0 m
Extended Detention Volume/Control		
Extended Detention Volume (Based on 25mm storm) ^B	536 m ³	1604 m ³ (elev. 345.82 m)
Drawdown time for Erosion Control	24 – 48 hours	30.5 hours
Orifice Diameter (Water Quality)	---	150 mm dia. (invert 345.50 m)
Forebay Length	23 m	25 m

^A Permanent Pool Volume = Total required volume, less 40 m³/s/ha

^B MECP minimum requirement is 40 m³/ha, but 25 mm storm volume governs

(2) Quantity Control – Northwestern SWMF

The results of the PCSWMM modeling are presented in Table 11. The analysis shows a significant attenuation of the uncontrolled peak flows entering the SWMF, with all storm events being contained within the SWMF.

Table 11: Northwestern SWMF – Peak Flows and Storage Volume Summary

Storm Event	Inflow (m ³ /s)	Controlled Outflow to all Outlets (m ³ /s)	Req'd Active Storage Volume (m ³)	Ponding Elevation (m)
25 mm	0.95	0.02	1568	345.82
2-year	1.57	0.04	2278	345.95
5-year	2.23	0.10	3136	346.10
10-year	2.88	0.17	3762	346.21
25-year	3.46	0.32	4558	346.34
50-year	4.04	0.46	5111	346.43
100-year	4.63	0.55	5765	346.53

7.3.2 Northeastern Dry Pond

The northeastern dry pond has a footprint of approximately 0.52 ha and is located east of the proposed SWMF wetpond cell. This proposed dry pond will outlet directly to the woodlot/wetland area located north of the Site. Table 12 summarizes the basic operating levels, volumes, and outlet controls within the proposed facility. Detailed stage-storage-discharge information is provided in Appendix D. The dry pond will be serviced by a 75-mm-diameter orifice located at the base of the pond. A 5-m-wide emergency overflow weir will also be provided in order to safely route runoff from high-intensity storm events through the dry pond. Detailed information with respect to the quality and quantity control function of the proposed dry pond is provided in Table 12.

Table 12: Northeastern Dry Pond Operating Levels

Stage	Elevation (m)	Storage Volume (m ³)
Bottom of Pond	344.55	0
Overflow Weir Sill	346.85	1153
Top of Pond	346.15	1597
Outlet Controls:	One – 75 mm diameter low-flow orifice (quality) at elev. 344.55 m 5 m long weir at elev. 346.85	

(1) Quality Control – Northeastern Dry Pond

The proposed dry pond will provide a Basic (60% TSS removal) level of water quality protection per MECP guidelines. In order to achieve the Enhanced (80% TSS removal) level of water quality protection required, it is proposed that an oil-grit separator (OGS) unit be provided in line with the proposed dry pond to provide a treatment train. Table 13 summarizes the water quality control features of the proposed dry pond and OGS unit. Detailed calculations and design sheets for the dry pond are provided in Appendix D.

Table 13: Northeastern Dry Pond – Summary of Water Quality Control

Component	Required	Provided
Protection Level	'Basic' (60% long-term TSS removal)	
Drainage Area for Quality Control		5.20
Percent Impervious		64.7%
Required MECP Water Quality Unit Volume		179 m ³ /ha
Storage Requirements		
Required Storage Volume (Required unit volume = 179 m ³ /ha)	931 m ³	1597 m ³
Drawdown time for Erosion Control	24 – 48 hours	26.6 hours
Orifice Diameter (Water Quality)	---	75 mm dia. (invert 344.55 m)
OGS Unit (HydroStorm HS-8)	59% TSS Removal for ETV Particle Size Distribution	
Net TSS Removal (Treatment Train)		83%

(2) Quantity Control – Northeastern Dry Pond

The results of the PCSWMM modeling are presented in Table 14. The analysis shows a significant attenuation of the uncontrolled peak flows entering the SWMF with all storm events.

Table 14: Northeastern Dry Pond – Peak Flows and Storage Volumes Summary

Storm Event	Inflow (m ³ /s)	Controlled Outflow (m ³ /s)	Req'd Storage Volume (m ³)	Ponding Elevation (m)
25 mm	0.27	0.01	250	344.96
2-year	0.41	0.01	323	345.06
5-year	0.56	0.01	395	345.15
10-year	0.71	0.02	436	345.21
25-year	0.84	0.02	680	345.37
50-year	0.98	0.02	728	345.51
100-year	1.12	0.02	900	345.69

7.3.3 Overall Peak Flow Summary for Subject Lands

The sections above summarized the peak flow and storage volume requirements for the individual SWMFs. Table 15 provides a comparison of the total pre- and post-development peak flow rates from the subject lands. The results show that, under post-development conditions, there will be a reduction in total peak flows compared to pre-development conditions.

Table 15: Comparison of Total Peak Flows from Subject Lands – All Outlets (m³/s)

Storm Event	Pre-Development Conditions ^A	Post-Development Conditions
25 mm	0.888	0.619
2-year	1.397	0.933
5-year	1.930	1.311
10-year	2.491	1.732
25-year	2.996	2.190
50-year	3.533	2.660
100-year	4.075	3.074

^A Table 7

Table 16 and Table 17 compare the pre- and post-development peak flows to each outlet location. These tables show that the post-development peak flow rates will be less than those recorded under pre-development conditions for all modelled storm events.

Table 16: Comparison of Total Peak Flows from Subject Lands – Hawkesville Road Outlet (m³/s)

Storm Event	Pre-Development Conditions	Post-Development Conditions
25 mm	0.291	0.215
2-year	0.430	0.321
5-year	0.593	0.430
10-year	0.784	0.547
25-year	0.971	0.644
50-year	1.172	0.745
100-year	1.378	0.843

Table 17: Comparison of Total Peak Flows from Subject Lands – Municipal Drain no. 11 (m³/s)

Storm Event	Pre-Development Conditions	Post-Development Conditions
25 mm	0.597	0.404
2-year	0.967	0.612
5-year	1.337	0.881
10-year	1.707	1.185
25-year	2.025	1.546
50-year	2.361	1.915
100-year	2.697	2.231

7.4 Storm Sewer Servicing

It is proposed that the Northwestern SWM facility will outlet to both the northern woodlot/wetland area and to a proposed storm sewer system located along Northside Drive. The Northeastern Dry Pond facility will also outlet to the northern woodlot area in order to assist water balance efforts. As per the findings of the GHD report, it is understood that runoff generated from the subject lands that are directed to the northern woodlot feature enter into an existing drain (the Northside Drive Municipal Drain), which flows through the sensitive environmental feature towards a natural watercourse that discharges through Arthur Street to Municipal Drain No. 11.

The southernmost portion of the site will ultimately discharge to the existing 375 mm diameter storm sewer located on Hawkesville Road. Under existing conditions, a contributing storm catchment area of approximately 0.75 hectares, located at the south end of the site, already drains to the existing storm infrastructure on Hawkesville Road. To mitigate potential increase in post-development peak flows and reduce the burden on the downstream system, an oversized-stormwater pipe is proposed to attenuate flows. This underground storage pipe will temporarily retain stormwater and release it at a controlled rate, ensuring that post-development flows are attenuated to existing conditions.

The proposed development will include the construction of a municipal storm sewer system to convey minor system flows to the proposed SWMFs. The proposed storm sewer network will be sized to convey the Township of Woolwich's 5-year storm event. Major flows will be conveyed overland through the internal street network to the SWMFs.

7.5 Water Balance

7.5.1 Wetland Runoff Balance

A feature-based water balance analysis has been conducted by GHD in order to ensure that the hydrological functions of the sensitive woodlot feature located along the northern edge of the Site will be maintained under post-development conditions. In order to ensure that the surface runoff contributions to the woodlot feature are maintained within the post-development conditions, the proposed stormwater management facilities were outfitted with outlet structures to direct a portion of the flow they receive directly to the woodlot feature. This is accomplished through the use of a 75-mm-diameter, low-flow orifice located at the permanent pool elevation of the proposed wet pond, and a 75-mm-diameter orifice located at the base of the proposed dry pond.

In order to ensure that sufficient flow was being provided to the northern woodlot feature, a continuous model was constructed for the post-development conditions of the Site. The continuous model used climate data retrieved from the Environment Canada weather station Elora RCS from the years 2005-2024 in order to replicate daily precipitation, infiltration, and evapotranspiration values. The monthly average outflows to the

woodlot from both the proposed dry pond and northwestern SWMF were recorded and utilized by GHD in order to analyze the impact that the proposed development will have on the hydrological function of the woodlot. A summary of the pre- and post-development runoff volumes directed to the northern woodlot are provided in Table 18 below.

Table 18: Summary of Average Monthly Runoff Volumes to Woodlot

Scenario	Pre-Development		Post-Development		Change from Pre-Development	
	m ³ /ha	mm/yr	m ³ /ha	mm/yr	m ³ /ha	mm/yr
January	3590	19	3550	41	-40	-0.2
February	3670	20	3490	40	-180	-1
March	7905	42	7385	86	-520	-3
April	4825	26	4445	52	-380	-2
May	1205	6	1035	12	-170	-1
June	700	4	595	7	-105	-1
July	270	1	200	2	-70	-0.4
August	290	2	310	4	20	0.1
September	730	4	1030	12	300	2
October	1150	6	2075	24	925	5
November	2705	15	3710	43	1005	5
December	3130	17	3390	39	260	1
Total	30170	162	31215	362	1045	6

Notes:

^[1] Table 18 taken from *Preliminary feature-based water balance assessment technical memorandum* by GHD, dated April 28th, 2025

Further information regarding the water balance analysis conducted can be found within the *Preliminary Feature-Based Water Balance Assessment Technical Memorandum* conducted by GHD.

7.5.2 Infiltration Water Balance

The geotechnical information indicates high groundwater elevations throughout the proposed development. As such, the implementation of lot-level infiltration measures is not feasible and has not been proposed. However, a preliminary water balance was prepared for the pre- and post-development conditions (see Appendix E) that shows a 15,735 m³ (25%) infiltration deficit under post-development conditions with no supplemental infiltration measures. Potential opportunities for at source infiltration will be reviewed in further detail with the Township during the detailed design stage.

8.0 SALT IMPACT ASSESSMENT

8.1 Reasonable Use Concept (RUC)

The MECP's Reasonable Use Criteria (RUC) has been implemented as a means of assessing allowable levels of contaminants in groundwater. These criteria factor in both the background concentrations of a contaminant as well as the reasonable use of groundwater on an adjacent property, setting limits that prevent significant, adverse effects on the usage of groundwater on the neighbouring property.

The RUC Criterion is established to be the concentration leaving the site boundary that does not exceed the background plus a percentage increase of the difference between the drinking water standard and the background concentration. The Ontario Drinking Water Standard (ODWS) for chloride of 250 mg/L, generally defines the upper limit of acceptability.

The RUC concentration is calculated using the following equation:

$$C_m = C_b + x (C_r - C_b)$$

Where:

C_m = Maximum allowable concentration at the property boundary (mg/L)

C_b = Existing background groundwater concentration (mg/L)

x = A constant that reduces contamination to a level that the MECP considers negligible.
 $x = 0.5$ for non- health-related parameters

C_r = Ontario Drinking Water Standard (ODWS) for chloride = 250 mg/L

According to the Region of Waterloo's Salt Impact Assessment from the Source Protection Guidance Documents, in cases where there is no background information on the groundwater chloride concentration, a 15 mg/L concentration shall be used. Based on the above, the calculated maximum reasonable use for chlorides (C_m) is **132.5 mg/L**.

8.2 Salt Loading Assessment

To quantify the potential impacts on the existing groundwater quality as a result of winter salting operations, a mass balance analysis was completed that included salting of the proposed municipal roads and the private parking/driveway areas on the Site Plan block. A total Site area of 28.93 ha was used for the subsequent analysis which includes the area proposed for active development comprised of the proposed municipal rights-of-way and future residential lots and Site Plan block, and the existing Open Space block at the north that will remain in an existing condition and will not be subject to winter salting or the introduction of additional chlorides into the groundwater.

8.2.1 Municipal Roads

The proposed Draft Plan includes the construction of approximately 2150 m of municipal rights-of-way. The proposed roads are considered local roads.

Winter maintenance for the proposed roads will be the responsibility of the Township of Woolwich. Salt application data for municipal roads is provided in the 2003 Region of Waterloo Study entitled: Road Salt Management and Chloride Reduction Study Phase 2: Evaluation of Chloride Reduction Options (Stantec Consulting Ltd., 2003). Salt application rates per kilometre of two-lane municipal road are as follows:

- Primary Roads: 44 tonnes / two-lane km
- Secondary Roads: 22 tonnes / two-lane km
- Local Roads: 2.2 tonne / two-lane km

For roadways, it was assumed that 30% of the applied salt load will infiltrate through adjacent boulevard areas due to splash-over from the road or overspray from the salt trucks.

8.2.2 Private Site Parking/Driveways

Salt application rates for private parking lots can be highly variable. Information from the Upper Cedar Creek Scoped Subwatershed Study (Matrix, 2019) indicated a range of salt applications for commercial properties ranging from 15 to 22 tonnes/salted ha/year. An assumed loading rate of 50 g/m²/event at 37 events occurring annually will be used to calculate salt application across the site.

Similar to the rights-of-way, it was assumed that 30% of applied salt load could potentially infiltrate through adjacent landscaped areas due to overspray and splash-over.

8.2.3 Infiltration Volume

A post-development infiltration rate of 162.3 mm/year was calculated for the property under post-development conditions. This is comprised of 15.14 ha (at 63% impervious) of active development area and 13.79 ha of the existing open space lands, resulting in a total area of 28.93 ha with a weighted % imperviousness of 33% impervious. See Appendix E for water balance calculations. Table 18 summarizes the annual infiltration volume that will be used to calculate the subsequent chloride concentrations under post-development conditions.

Table 19: Post-Development Site Infiltration Summary

Surface	Total Area	Annual Infiltration Depth (mm)	Annual Infiltration Volume (m ³)
Post-Development Property (33% imp)	28.93	162.3	46957

8.2.4 Mass Balance Analysis

Based on the salt loading rates and assumptions provided above, the salt loading and estimated chloride concentration resulting from development was determined to be 32.93 mg/L, which is less than the allowable chloride concentration of 132.5 mg/L. Detailed Mass Balance calculations are provided in Appendix E.

8.2.5 Salt Management Plans

For the proposed Site Plan block, snow removal and ice control will likely be undertaken by private winter maintenance contractors. The purpose of the Salt Management Plan will be to reduce the impact of all winter maintenance activities involving salting practices on the surface water and groundwater resources. The Salt Management Plan should outline operational practices and strategies for three main areas of concern: general salt use, salt storage, and snow storage/disposal. Appendix E contains a copy of the Region of Waterloo's *Winter Maintenance for Multi-Residential and Commercial Properties* worksheet. Appendix E also contains the Sustainable Technologies Evaluation Program's *Salt Application Best Practices for Winter Maintenance Contracts*, along with the Region of Waterloo's *Salt Impact Assessment Guidance Document* which provides additional information and guidance.

9.0 EROSION AND SEDIMENT CONTROL

In order to control erosion and transportation of sediment offsite, an erosion and sediment control strategy will be developed during the final design and implemented during the construction process. This plan will focus on the protection of downstream receivers, namely the woodlot/wetland in the north, and other neighbouring properties.

9.1 Preliminary Erosion and Sediment Control Plan

The details of the Erosion and Sediment Control Plan will be provided with the submission of the pre-grading application and/or final design submission for development applications and will be based on the preliminary erosion and sediment control measures recommended herein. It is recommended that the Erosion and Sediment Control Plan incorporate the following measures:

- Erect heavy-duty silt fences prior to grading or construction adjacent to the woodlot areas, and existing road rights-of-way that are down-gradient along the perimeter of the property to protect adjacent and downstream areas from the migration of sediment in any overland flow (in consultation with the environmental Consultant).
- Erect additional (tiered) silt fence along minor down-gradient slope areas.
- Provide sediment control basins sized to accommodate 250 m³/ha of sediment storage at key locations during grading or construction operations in addition to the proposed SWM facility locations. These facilities shall be relocated as operations proceed to always mitigate sediment transfer.
- Provide erosion control berms/swales in appropriate/critical areas to divert flows to temporary storage locations (sedimentation basins).
- Provide a construction entrance feature ('mud mat') to minimize the offsite transport of sediment from construction vehicles. A road sweeping regimen will also be developed.
- Install temporary rock check dams in swales, where appropriate, to help attenuate flows and encourage sediment deposition.
- Install erosion control matting on all steep (greater than 3:1) slopes.
- Stabilize all disturbed areas according to OPSS 572.
- During construction, all catchbasins are to be sealed until roads are paved to prevent sediment deposition in the catchbasin sumps and conveyance of silt to the SWM facilities.
- An Erosion Control Implementation Schedule will be included with the Detailed Erosion and Sedimentation Control Plan prepared in conjunction with the pre-grading application and/or final engineering design.

To ensure the effectiveness of the various erosion and sediment control measures, an appropriate inspection and maintenance program is necessary. The inspection activities during construction will include:

- Inspections of the erosion and sediment controls bi-weekly and after each significant rainfall event (greater than 25 mm).
- Inspections should include all silt fence installations, sediment traps and basins, outlets, and vegetation.
- Submission of bi-weekly monitoring reports to the Township of Woolwich and the GRCA during active construction periods.

All erosion and sediment control measures will be removed at the end of construction.

10.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the analysis presented in this report, it is concluded that:

- The proposed Site can be adequately serviced through both existing and planned municipal infrastructure (sanitary, storm, and watermain) and utilities.
- Municipal servicing and roadworks can be constructed in accordance with the Township of Woolwich and MECP standards.
- Stormwater management measures can be provided in accordance with various agency guidelines.
- Streets within the Block Plan will be constructed to the Township of Woolwich Design Standards.
- It is proposed that the development be serviced by the existing 200-mm-diameter sanitary service located on Northside Drive, at the northeastern corner of the site, which is sufficient to fully service the lands, and no additional connections are necessary.
- The proposed subdivision will have two watermain connections from the existing infrastructure surrounding the Site. A connection to the existing 150-mm-diameter watermain on Hawkesville Road will be installed at the southern entrance of the Site. This connection will require a short extension of the main to reach the development boundary. Additionally, a connection to the existing 300-mm-diameter watermain on Northside Drive will be installed at the north-eastern entrance of the Site. The final water distribution network will consist of 200-mm- to 300-mm-diameter pipes.
- Pipe sizes are such that velocities in all watermains are generally less than 5 m/s under fire flow conditions.
- The construction of two SWMFs (one wet pond, one dry pond that is in line with a proposed OGS unit) can effectively provide an Enhanced (80% TSS removal) level of water quality protection for the proposed development areas. Moreover, runoff from the 25 mm storm event can be detained and released over a 24-to-48-hour period to mitigate stream erosion.
- Sufficient storage volume is available in the proposed SWMFs to reduce overall post-development peak flows from the subject lands to less than pre-development levels. Post-development peak flows will be reduced to less than pre-development conditions and the Regional storm event can be safely conveyed through the SWMFs.
- A municipal storm sewer system can be sized to convey the 5-year minor system flows to the proposed SWMFs with major flows routed via the internal road network to overland flow inlets into the SWMFs.
- Efforts to maintain minimum separations from the underside of footings to seasonally-high groundwater levels (0.6m for residential and non-residential buildings and 0.8m for walk-outs residential and non-residential buildings) roads have grades ranging from 0.7% to a maximum of 5%, which will also help maintain overland flow drainage routes to and from the two SWMFs, while matching the existing topography where possible.
- Erosion control measures will be required and will be reviewed and designed during the detailed design stage.
- The Engineer/Designer hereby certifies that the proposed lot drainage and/or grading plan(s) have been designed in accordance with drainage common law in Ontario, sound engineering principles and the Ontario Building Code Articles, such as but not limited to 9.14.6.1 and 9.15.4.6. The Engineer/Designer ensures artificially collected and/or surface drainage will not adversely affect adjacent properties.

All of which is respectfully submitted,

WALTERFEDY



Matt Ninomiya, MBA, P.Eng.
Land Development Manager, Civil
Partner

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519.576.2150, Ext. 399



Erika Woods, P.Eng.
Project Engineer, Civil

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519.576.2150, Ext.387



John Oreskovic, P.Eng.
Senior Water Resources Engineer, Civil

joreskovic@walterfedy.com
519.576.2150, Ext.364

A handwritten signature in black ink, reading 'C Mahoney'.

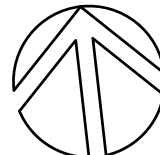
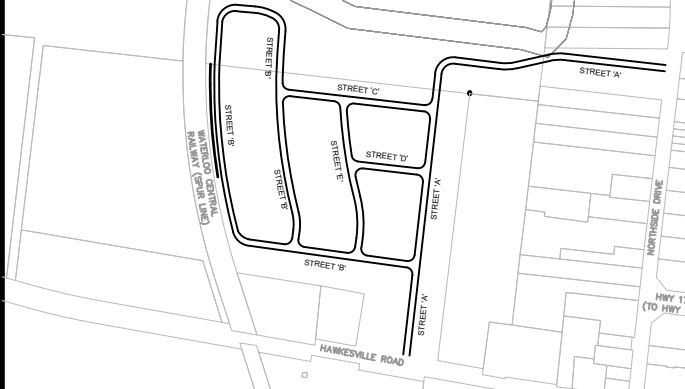
Circe Mahoney, C.E.T.
Water Resources EIT, Civil

cmahoney@walterfedy.com
519.576.2150, Ext.414

FIGURES

- **Figure 1** **Existing Conditions Drainage Plan**
- **Figure 2** **Existing Conditions Flow Schematic**
- **Figure 3** **Soil Information from AgMaps**
- **Figure 4** **Proposed Conditions Drainage Plan**
- **Figure 5** **Proposed Conditions Flow Schematic**

KEY PLAN



North

DATE	ISSUANCE	NO.
2025.04.30	ISSUED FOR DRAFT PLAN APPROVAL	

LEGEND

- CB PROPOSED CATCHBASIN
- DCB PROPOSED DOUBLE CATCHBASIN
- CBMH PROPOSED CATCHBASIN MANHOLE
- DCBMH PROPOSED DOUBLE CATCHBASIN MANHOLE
- MH PROPOSED STORM MANHOLE
- EX CB EXISTING CATCHBASIN
- EX DCB EXISTING DOUBLE CATCHBASIN
- EX MH EXISTING STORM MANHOLE
- EX CBMH EXISTING CATCHBASIN MANHOLE
- EX DCBMH EXISTING DOUBLE CATCHBASIN MANHOLE
- PROPOSED STORM SEWER/SERVICE
- EXISTING STORM SERVICE
- PROPOSED SWALE
- PROPOSED SWALE WITH SUBDRAIN
- PROPOSED OVERLAND FLOW ROUTE
- EXISTING/PROPOSED STORM DRAINAGE AREA
- REACH #
- AREA IN HECTARES

1:1000 0 10.0 20.0 50.0

CLIENT

SCHLEGEL URBAN DEVELOPMENT CORP.

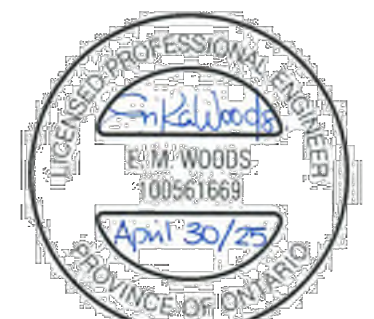
PROJECT

ST. JACOBS LANDS
52 HAWKESVILLE ROAD
St. Jacobs, Ontario

TITLE

DRAINAGE AREA PLAN
PRE DEVELOPMENT

WALTERFEDY
KITCHENER | HAMILTON | TORONTO | CALGARY
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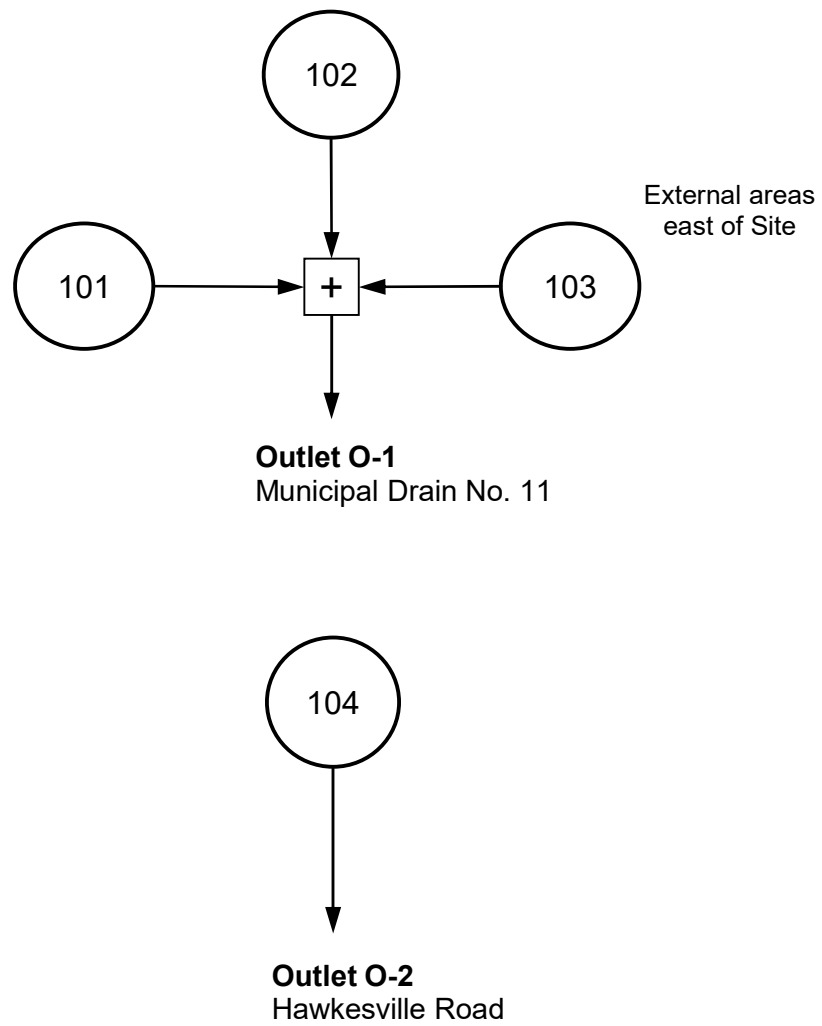
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SCALE	DATE	SHEET NO.
1:1000	2025-04-29	C310
	PROJECT NO.: 2023-0849-10	
	DRAWN BY: JBM	
	CHECKED BY: MN	

NOTES:
1. SURVEYS WERE COMPLETED BY VAN HARTEN, 2023 AND WALTER FEDY, 2024.
2. LEGAL FABRIC PROVIDED BY VAN HARTEN, DATED FEBRUARY 20, 2025.
3. BENCHMARK: TOP OF FIRE HYDRANT ALONG NORTHSIDE OR ELEVATION: 347.28
4. CONCEPT PLAN PROVIDED BY GSP, DATED APRIL 2025.
5. ENVIRONMENTAL DISPLINES AND TREE SURVEY PROVIDED BY NRSI, 2024.

PRE-DEVELOPMENT CONDITIONS
PCSWMM HYDROLOGIC MODELING SCHEMATIC



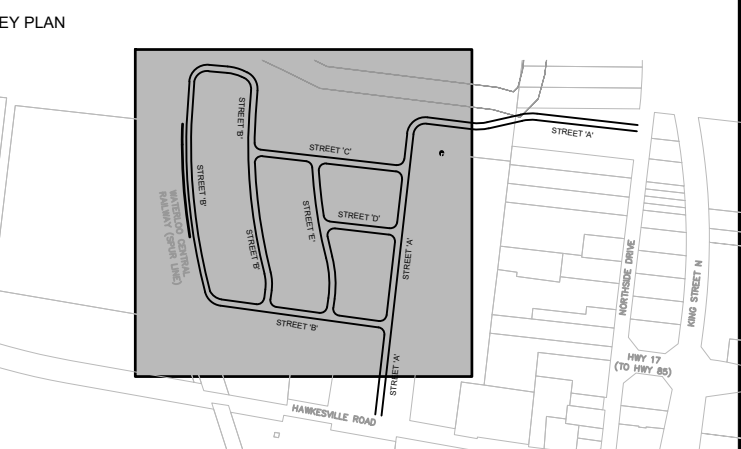
AgMaps Results



Legend

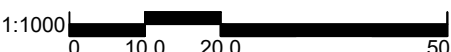
☐ Soil Name Label

This map should not be relied on as a precise indicator of routes or locations, nor as a guide to navigation. The Ontario Ministry of Agriculture, Food and Agribusiness (OMAFRA) shall not be liable in any way for the use or any information on this map, of, or reliance upon, this map.



DATE	ISSUANCE	NO.
2025.04.30	ISSUED FOR DRAFT PLAN APPROVAL	

LEGEND	
	PROPOSED CATCHBASIN
	PROPOSED DOUBLE CATCHBASIN
	PROPOSED CATCHBASIN MANHOLE
	PROPOSED DOUBLE CATCHBASIN MANHOLE
	PROPOSED STORM MANHOLE
	EXISTING CATCHBASIN
	EXISTING DOUBLE CATCHBASIN
	EXISTING STORM MANHOLE
	EXISTING CATCHBASIN MANHOLE
	EXISTING DOUBLE CATCHBASIN MANHOLE
	PROPOSED STORM SEWER/SERVICE
	EXISTING STORM SERVICE
	PROPOSED SWALE
	PROPOSED SWALE WITH SUBDRAIN
	PROPOSED OVERLAND FLOW ROUTE
	EXISTING/PROPOSED STORM DRAINAGE AREA
	REACH #
	AREA IN HECTARES



CLIENT
SCHLEGEL URBAN
DEVELOPMENT CORP.

PROJECT
ST. JACOBS LANDS
52 HAWKESVILLE ROAD
St. Jacobs, Ontario

TITLE
DRAINAGE AREA PLAN
PROPOSED DEVELOPMENT

WALTERFEDY
KITCHENER | HAMILTON | TORONTO | CALGARY
A PART OF WF GROUP
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SCALE	DATE	PROJECT NO.	SHEET NO.
1:1000	2025-04-29	2023-0849-10	C311
DRAWN BY	JBM	CHECKED BY	MIN

NOTES:
1. SURVEYS WERE COMPLETED BY VAN HARTEN, 2023 AND WALTER FEDY, 2024.
2. LEGAL FABRIC PROVIDED BY VAN HARTEN, DATED FEBRUARY 20, 2025.
3. BENCHMARK: TOP OF FIRE HYDRANT ALONG NORTHSIDE DR. ELEVATION: 347.28
4. CONCEPT PLAN PROVIDED BY GSP, DATED APRIL 2025.
5. ENVIRONMENTAL DRIPLINES AND TREE SURVEY PROVIDED BY NRSL, 2024.

Outlet (O-2) - To Municipal
Drain No. 11

Dry Pond
Facility

Northwestern
SWM Facility

STORM WATER
MANAGEMENT FACILITY

203
0.47

209
1.18

213
0.28

204
1.53

212
0.57

202
0.89

210
2.89

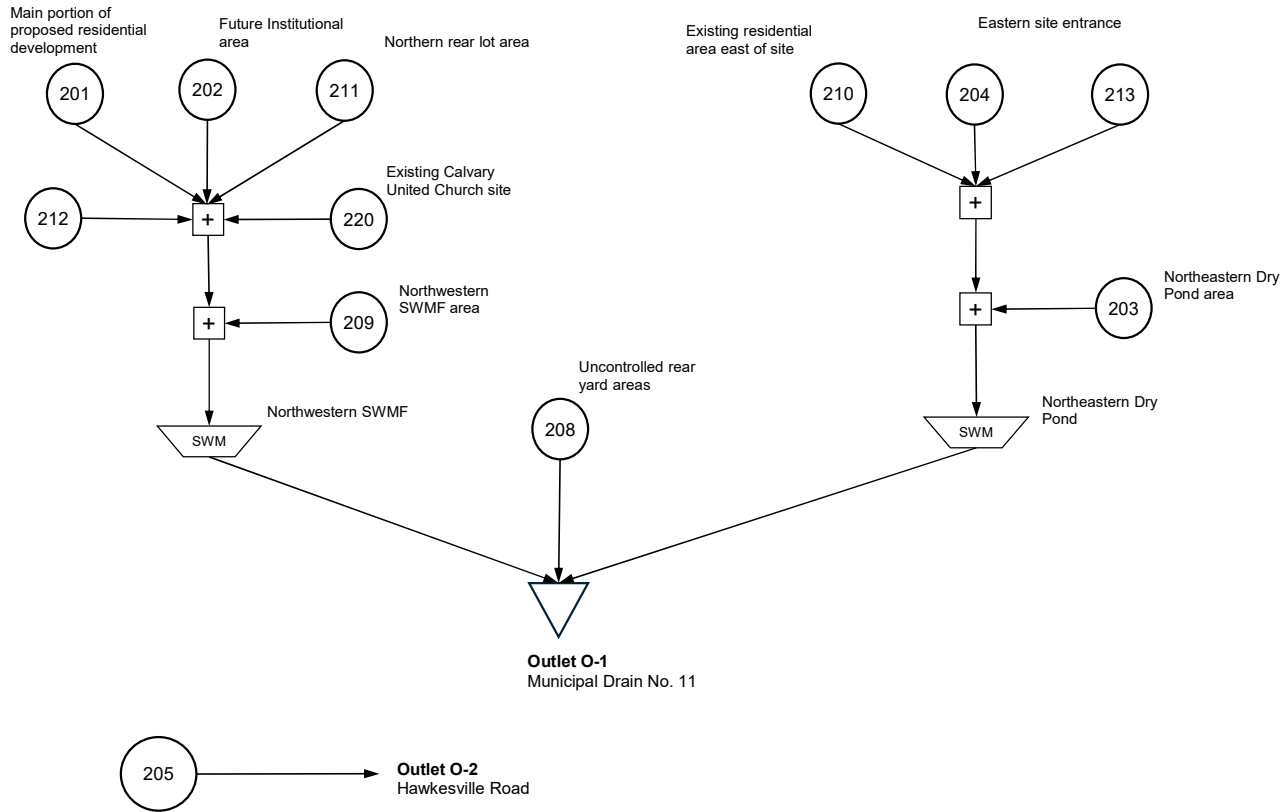
220
1.70

201
8.59

205
1.39

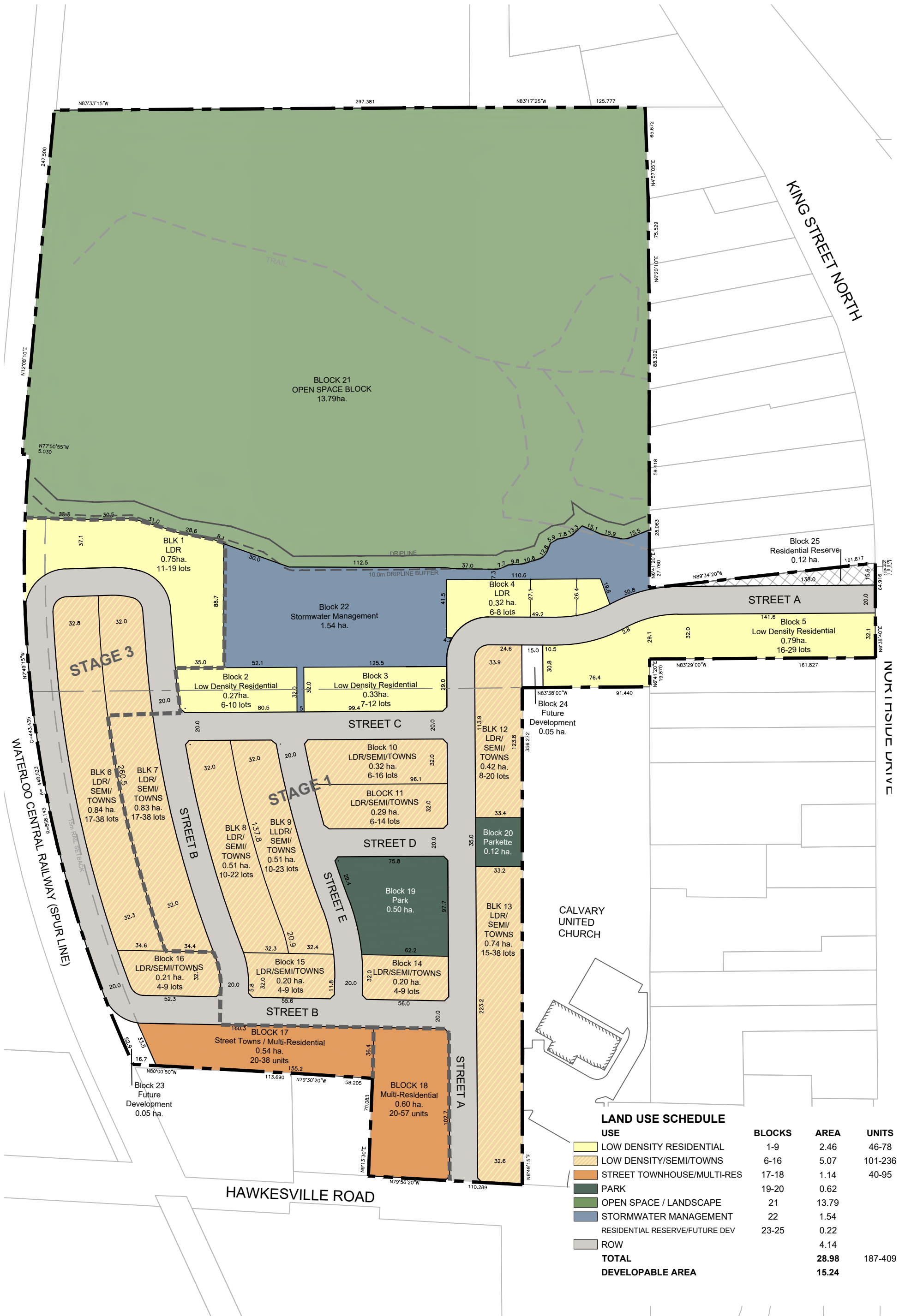
Outlet (O-1) - Hawkesville Road

POST-DEVELOPMENT CONDITIONS
PCSWMM HYDROLOGIC MODELING SCHEMATIC



APPENDIX A

Development Concept - GSP



DEVELOPMENT CONCEPT

Schlegel - St. Jacobs Subddivision

NOTE: This concept should be considered as a preliminary demonstration model that illustrates an 'order of magnitude' development scenario for the site. The number of units, floor area and parking supply are approximate and subject to more detailed design as well as municipal planning approvals.

Scale 1:400 | April 28, 2025 | Project No. 24032 | Drawn By: MN



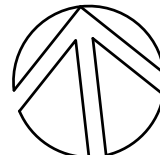
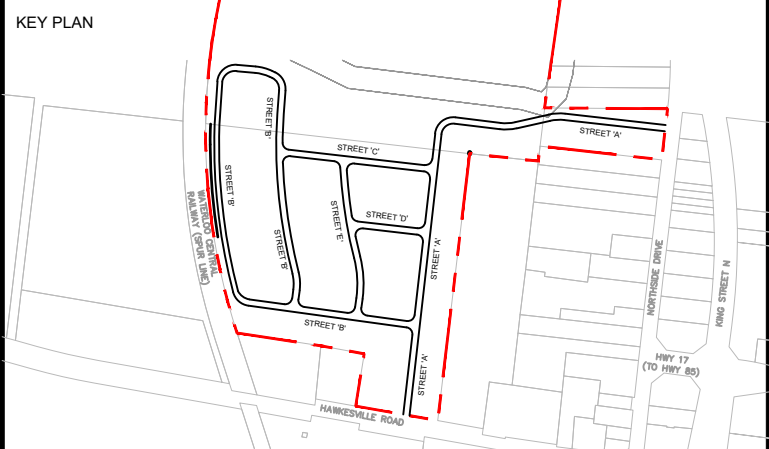
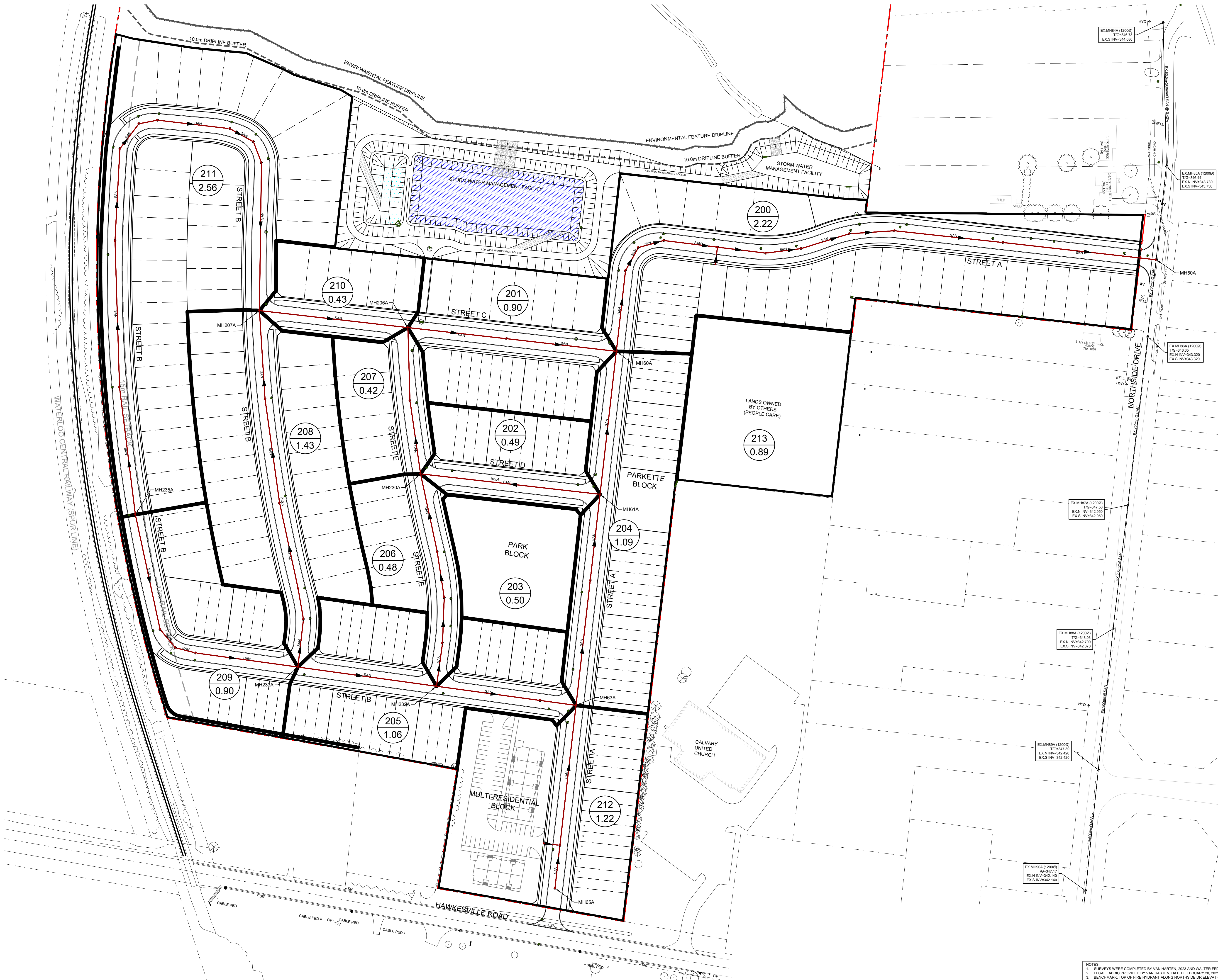
APPENDIX B

Sewer Design Sheets

Project: 52 Hawkesville Road, St. Jacobs						Design Data			Persons Per Unit (PPU)			SANITARY SEWER DESIGN CALCULATIONS																				
Project No: 2023-0849-10						Min. Velocity			Houses			Residential				Commercial				Industrial				Institutional				Total C+H-I Flow (L/s)				
Date: 4/30/2025						Max. Velocity			Unspecified			Peaking Factor				Peaking Factor				Peaking Factor				Peaking Factor								
Designed By: EW						Manning's 'n'			Townhouses			Avg. Daily Flow				Avg. Daily Flow				Avg. Daily Flow				Avg. Daily Flow								
Checked By: MN						Infiltration			Multi-Res			0.0035 L/s/p				2.5				2.5				1.5								
						L/s/ha			2.11							0.95 L/s/ha				0.4 L/s/ha				2.5 L/s/ha								
Pipe Data						Residential										Cumulative				Commercial				Industrial				Institutional				Total C+H-I Flow (L/s)
From		To		Length (m)	Area ID	Area (ha)	Single	Street Townhouse	Multi-Residential	Density p/ha	Population (people)	Area (ha)	Population (people)	Peak Factor	Peak Flow (L/s)	Area ID	Area (ha)	Total Area (ha)	Area ID	Area (ha)	Total Area (ha)	Area ID	Area (ha)	Total Area (ha)								
52 Hawkesville Road	Low Density Residential					2.46	78			143	352			4.05	1.24										5.64							
	Low Density/Semi/Towns					5.07		236		143	725			3.89	2.56										10.01							
	Street Townhomes					0.54			38	196	106			4.24	0.37										1.72							
	Multi-Residential					0.60			57	196	118			4.22	0.42										1.90							
	Overall Site										1183														19.27							
External Lands		PeopleCare [1]				1.07					224												1.07		4.01							
TOTAL FOR ALL LANDS						9.14					1407				4.17								1.07		23.29							

[1] Population taken from the landowner's estimated number of beds for facility
[2] Persons Per Unit were taken from The Region of Waterloo's Water and Wastewater Monitoring Report 2024

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DATE	ISSUANCE	NO.
2025.04.30	ISSUED FOR DRAFT PLAN APPROVAL	

LEGEND

- MH PROPOSED SANITARY MANHOLE
- EX SAN MH EXISTING SANITARY MANHOLE
- PROPOSED SANITARY SEWER/SERVICE
- EXISTING SANITARY SERVICE
- PROPOSED SANITARY DRAINAGE AREA
- CATCHMENT AREA #
- AREA IN HECTARES

1:1000
0 10.0 20.0 50.0

CLIENT
SCHLEGEL URBAN
DEVELOPMENT CORP.

PROJECT
ST. JACOBS LANDS
52 HAWKESVILLE ROAD
St. Jacobs, Ontario

TITLE
SANITARY DRAINAGE AREA PLAN

WALTERFEDY
KITCHENER | HAMILTON | TORONTO | CALGARY
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SCALE	DATE	SHEET NO.
1:1000	2025-04-29	C312
PROJECT NO.: 2023-0849-10		
DRAWN BY: JBM		
CHECKED BY: MN		

- NOTES
- SURVEYS WERE COMPLETED BY VAN HARTEN, 2023 AND WALTER FEDY, 2024.
 - LEGAL FABRIC PROVIDED BY VAN HARTEN, DATED FEBRUARY 20, 2025.
 - BENCHMARK: TOP OF FIRE HYDRANT ALONG NORTHSIDE DR. ELEVATION: 347.28
 - CONCEPT PLAN PROVIDED BY GSP, DATED APRIL 2025.
 - ENVIRONMENTAL DRIPLINES AND TREE SURVEY PROVIDED BY NRSI, 2024.

WALTER F E D Y

Project:	52 Hawkesville Road, St Jacobs, - Schlegel Urban Developments				Storm Parameters		STORM SEWER DESIGN CALCULATIONS					
Project No:	2023-0849-10											
Date:	30-Apr-25						A	1593	Design Frequency	5	Maximum Permitted Full Flow Velocity (m/s)	6.00
Designed By:	KB	Checked By:	EW				B	11		Manning's 'n'	0.013	Minimum Permitted Full Flow Velocity (m/s)
					C	0.8789						

	Pipe Data			Drainage Area					Time		Design Flow		Pipe Flow								Remarks
	From	To	Length (m)	Area ID	Area (ha)	C	AC	ΣAC	Inlet (min)	System (min)	I (mm/hr)	Q (cu.m/s)	Diameter (mm)	Slope (%)	Q _{FULL} (cu.m/s)	Q/Q _{FULL}	V _{FULL} (m/s)	V (m/s)	Flow Time (min)		
People Care	87	86	47.5		1.70	0.50	0.85	0.85	10.00	10.00	109.7	0.259	675	0.20	0.376	68.9%	1.05	1.13	0.70	No Surcharge	
	86	141	77.2		0.00	0.60	0.00	0.85		10.70	106.6	0.252	675	0.20	0.376	66.9%	1.05	1.13	1.14	No Surcharge	
										11.84											
Street A	100 (2	163	14.5		0.28	0.90	0.25	0.25	10.00	10.00	109.7	0.076	300	2.23	0.144	52.8%	2.04	2.07	0.12	No Surcharge	
	163	162	29.7		0.00	0.50	0.00	0.25		10.12	109.1	0.076	375	0.50	0.124	61.1%	1.12	1.18	0.42	No Surcharge	
	162	161	17.9		0.00	0.60	0.00	0.25		10.54	107.3	0.074	375	0.50	0.124	60.1%	1.12	1.17	0.25	No Surcharge	
	161	160	18.7		0.00	0.60	0.00	0.25		10.79	106.2	0.074	375	0.50	0.124	59.5%	1.12	1.17	0.27	No Surcharge	
	160	141	42.6		0.00	0.60	0.00	0.25		11.06	105.0	0.073	375	0.50	0.124	58.8%	1.12	1.17	0.61	No Surcharge	
										11.66											
Street A	141	140	19.9		0.57	0.45	0.26	1.36	11.84	11.84	101.9	0.385	750	0.20	0.498	77.3%	1.13	1.24	0.27	No Surcharge	
	140	130	90.8		0.00	0.60	0.00	1.36		12.11	100.8	0.381	825	0.20	0.642	59.3%	1.20	1.25	1.21	No Surcharge	
										13.32											
Street D	66	131	15.0		1.61	0.45	0.72	0.72	10.00	10.00	109.7	0.219	525	0.35	0.255	86.1%	1.18	1.32	0.19	No Surcharge	
										10.19											
Street E	71	131	50.2		1.42	0.45	0.64	0.64	10.00	10.00	109.7	0.195	525	0.50	0.304	64.2%	1.40	1.49	0.56	No Surcharge	
										10.56											
Street E	131	85	38.4		0.47	0.45	0.21	1.57	10.56	10.56	107.2	0.467	675	0.50	0.596	78.5%	1.66	1.84	0.35	No Surcharge	
	85	70	30.6		0.00	0.60	0.00	1.57		10.91	105.7	0.461	675	0.50	0.597	77.2%	1.67	1.84	0.28	No Surcharge	
	70	130	17.4		0.00	0.60	0.00	1.57		11.19	104.5	0.456	750	0.28	0.594	76.7%	1.35	1.48	0.20	No Surcharge	
										11.38											
Street C	103	130	91.1		4.50	0.45	2.03	2.03	10.00	10.00	109.7	0.618	825	0.50	1.015	60.9%	1.90	1.99	0.76	No Surcharge	
										10.76											
SWMF	130	101	42.9		0.00	0.60	0.00	4.96	13.32	13.32	96.4	1.328	1350	0.20	2.412	55.1%	1.68	1.73	0.41	No Surcharge	
	101	100	22.1		0.00	0.60	0.00	4.96		13.73	95.0	1.309	1350	0.20	2.387	54.8%	1.67	1.71	0.22	No Surcharge	
										13.95											
Note: This storm sewer design sheet is intended to demonstrate and confirm that all storm runs with slopes less than 0.5% meet the minimum velocity requirements under the 5-year design storm conditions, ensuring adequate flow and system performance. All storm runs with slopes equal to or greater than 0.5% will inherently meet or exceed the minimum velocity criteria performance.																					

[illegible]

APPENDIX C

Domestic Water Demand Calculations & EPANET Modelling



ENGINEERING AND ENVIRONMENTAL SERVICES

Water and Wastewater Services

150 Frederick Street 7th Floor

Kitchener Ontario N2G 4J3 Canada

Telephone: 519-575-4400; TTY: 519-575-4608

Email: waterservices@regionofwaterloo.ca

www.regionofwaterloo.ca/water

Erika Valecillos, EIT
Walterfedy
T. 519.576.2150 x387
C. 519.465.7767
E. evalecillos@walterfedy.com

Date: February 4, 2025

Dear Erika Valecillos,

Re: 50 Hawkesville Road in St. Jacobs - Regional Water Modelling Request

Please find the results of the revised modeling simulations for boundary conditions requested on January 14th, 2024 that include a new looped configuration. The results include a figure showing the location of the node from the Region's model. Attached are a series of spreadsheets containing results for Average Day, Maximum Day demands and available fire flows for node **JCT_05153** and **JCT_05473** located south of the subject site on Hawkesville Road and south of intersection of Northside Drive and King St N. The diurnal 24-hour demand distribution accounts for the minimum hour and peak hour peaking factors. The maximum pressure on the average day represents the minimum hour, and the minimum pressure on the maximum day represents the peak hour.

Table 1 – Modeling Results

Node	Elevation (mASL)	Demand		Fire Flow Results	
		Ave Day (L/s)	Max Day (L/s)	Design Flow (L/s)	Design Pressure (m)
JCT_05153	348.0	2.5	6.9	129.9	14.1
JCT_05473	346.0	2.5	6.9	107.9	18.1

A fire flow analysis shows the maximum flow available at a node with an associated design pressure during the maximum day scenario while maintaining the minimum design pressure of 14 m (140 kPa) at all nodes within the pressure zone.

If you have any questions, please contact me

A handwritten signature in black ink, appearing to read "KD", followed by a horizontal line.

Kevin Dolishny P.Eng.
Senior Engineer, Water Services
c. 226.751.4551
e. kdolishny@regionofwaterloo.ca

St Jacobs

Hawkesville Road

JCT_05153 Average Day 24 Hour Simulation

Time	Demand (L/s)	Head (m)	Pressure (m)
00:00 hrs	1.12	380.00	32.00
01:00 hrs	1.29	380.00	32.00
02:00 hrs	1.40	379.99	31.99
03:00 hrs	1.24	380.00	32.00
04:00 hrs	1.02	380.00	32.00
05:00 hrs	1.57	379.99	31.99
06:00 hrs	3.40	379.97	31.97
07:00 hrs	3.68	379.97	31.97
08:00 hrs	3.40	379.97	31.97
09:00 hrs	3.30	379.97	31.97
10:00 hrs	3.15	379.98	31.98
11:00 hrs	2.97	379.98	31.98
12:00 hrs	2.84	379.98	31.98
13:00 hrs	2.64	379.98	31.98
14:00 hrs	2.44	379.98	31.98
15:00 hrs	2.59	379.98	31.98
16:00 hrs	2.76	379.98	31.98
17:00 hrs	3.19	379.98	31.98
18:00 hrs	3.47	379.97	31.97
19:00 hrs	3.50	379.97	31.97
20:00 hrs	3.24	379.98	31.98
21:00 hrs	2.89	379.98	31.98
22:00 hrs	2.31	379.99	31.99
23:00 hrs	1.50	379.99	31.99

Average Day HGL:

379.98

Minimum Hour:

380.00

JCT_05153 Maximum Day 24 Hour Simulation

Time	Demand (L/s)	Head (m)	Pressure (m)
00:00 hrs	6.40	379.92	31.92
01:00 hrs	4.52	379.96	31.96
02:00 hrs	4.38	379.96	31.96
03:00 hrs	4.87	379.95	31.95
04:00 hrs	5.22	379.95	31.95
05:00 hrs	8.21	379.88	31.88
06:00 hrs	8.42	379.87	31.87
07:00 hrs	8.35	379.87	31.87
08:00 hrs	12.17	379.74	31.74
09:00 hrs	12.59	379.73	31.73
10:00 hrs	12.73	379.72	31.72
11:00 hrs	13.50	379.69	31.69
12:00 hrs	10.09	379.81	31.81
13:00 hrs	4.88	379.95	31.95
14:00 hrs	7.37	379.90	31.90
15:00 hrs	4.17	379.96	31.96
16:00 hrs	3.20	379.98	31.98
17:00 hrs	2.78	379.98	31.98
18:00 hrs	3.41	379.98	31.98
19:00 hrs	4.11	379.97	31.97
20:00 hrs	4.59	379.96	31.96
21:00 hrs	6.88	379.91	31.91
22:00 hrs	7.44	379.90	31.90
23:00 hrs	6.67	379.92	31.92

Maximum Day HGL:

379.89

Peak Hour:

379.69

[illegible]

Fire Flow Analysis

Fire Flow Node:

JCT_05153

Design Flow (L/s):

129.9

Design Pressure (m):

14.1

Design Flow:

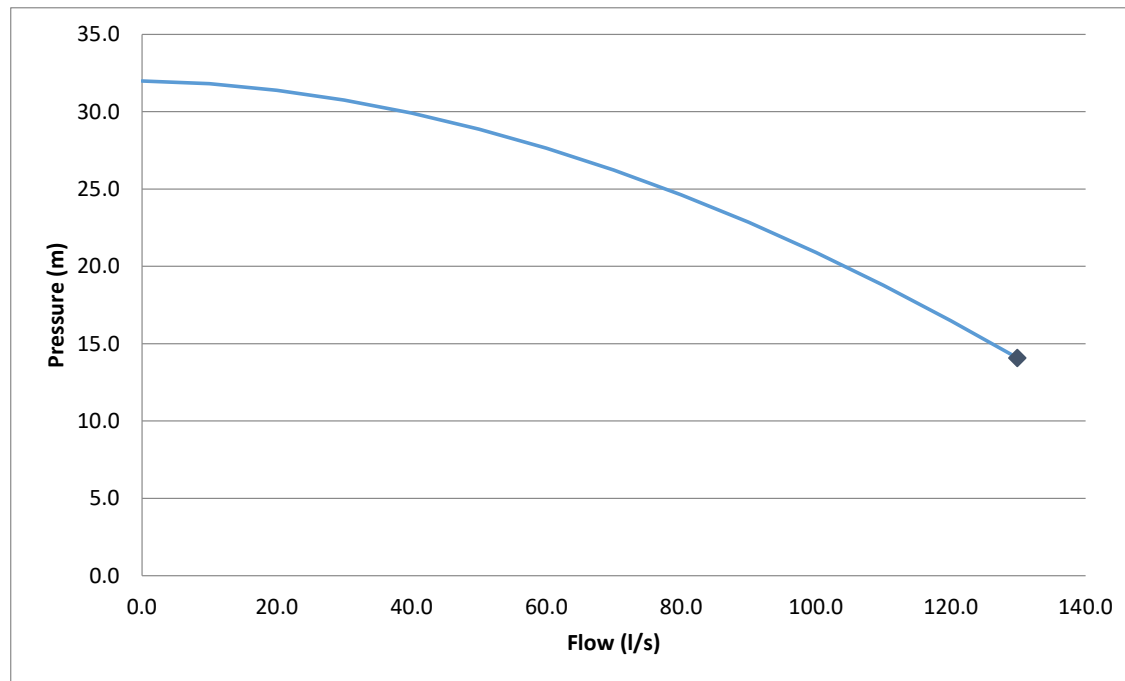
The final adjusted flow at the node to maintain the minimum design pressure (14m (140 kPa)) at ALL locations within the pressure zone.

Design Pressure:

The lowest allowable pressure at the node to maintain the minimum design pressure (14m (140 kPa)) at ALL locations within the pressure zone.

Critical Node ID:

The constraining node within the pressure zone that drops to the minimum design pressure of (14m (140 kPa)) during the design flow.



St Jacobs

Northside Drive

JCT_05473 Average Day 24 Hour Simulation

Time	Demand (L/s)	Head (m)	Pressure (m)
00:00 hrs	0.02	380.00	34.00
01:00 hrs	0.02	380.00	34.00
02:00 hrs	0.02	380.00	34.00
03:00 hrs	0.02	380.00	34.00
04:00 hrs	0.02	380.00	34.00
05:00 hrs	0.03	380.00	34.00
06:00 hrs	0.05	379.98	33.98
07:00 hrs	0.06	379.98	33.98
08:00 hrs	0.05	379.98	33.98
09:00 hrs	0.05	379.98	33.98
10:00 hrs	0.05	379.98	33.98
11:00 hrs	0.05	379.99	33.99
12:00 hrs	0.05	379.99	33.99
13:00 hrs	0.04	379.99	33.99
14:00 hrs	0.04	379.99	33.99
15:00 hrs	0.04	379.99	33.99
16:00 hrs	0.04	379.99	33.99
17:00 hrs	0.05	379.98	33.98
18:00 hrs	0.06	379.98	33.98
19:00 hrs	0.06	379.98	33.98
20:00 hrs	0.05	379.98	33.98
21:00 hrs	0.05	379.99	33.99
22:00 hrs	0.04	379.99	33.99
23:00 hrs	0.02	380.00	34.00

Average Day HGL:

379.99

Minimum Hour:

380.00

JCT_05473 Maximum Day 24 Hour Simulation

Time	Demand (L/s)	Head (m)	Pressure (m)
00:00 hrs	0.06	379.95	33.95
01:00 hrs	0.04	379.98	33.98
02:00 hrs	0.04	379.98	33.98
03:00 hrs	0.05	379.97	33.97
04:00 hrs	0.05	379.97	33.97
05:00 hrs	0.08	379.93	33.93
06:00 hrs	0.08	379.92	33.92
07:00 hrs	0.08	379.92	33.92
08:00 hrs	0.12	379.84	33.84
09:00 hrs	0.12	379.83	33.83
10:00 hrs	0.12	379.83	33.83
11:00 hrs	0.13	379.81	33.81
12:00 hrs	0.10	379.89	33.89
13:00 hrs	0.05	379.97	33.97
14:00 hrs	0.07	379.94	33.94
15:00 hrs	0.04	379.98	33.98
16:00 hrs	0.03	379.99	33.99
17:00 hrs	0.03	379.99	33.99
18:00 hrs	0.03	379.98	33.98
19:00 hrs	0.04	379.98	33.98
20:00 hrs	0.04	379.97	33.97
21:00 hrs	0.07	379.95	33.95
22:00 hrs	0.07	379.94	33.94
23:00 hrs	0.06	379.95	33.95

Maximum Day HGL:

379.94

Peak Hour:

379.81

[illegible]

Fire Flow Analysis

Fire Flow Node:

JCT_05473

Design Flow (L/s):

107.9

Design Pressure (m):

	18.1
--	------

Design Flow:

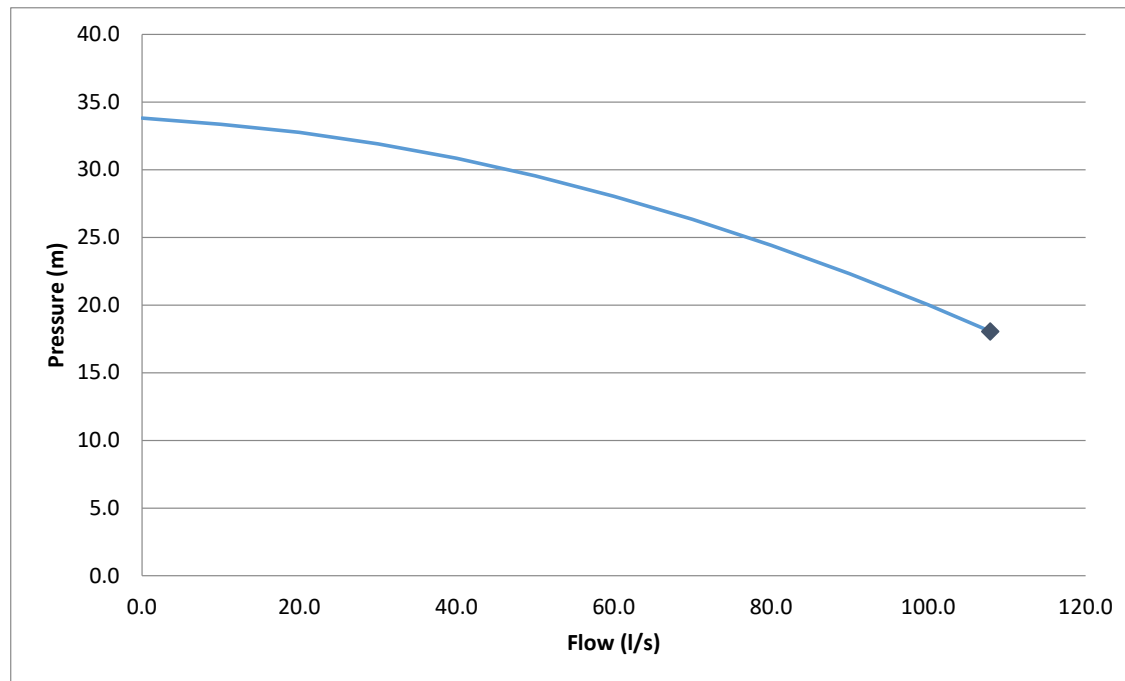
The final adjusted flow at the node to maintain the minimum design pressure (14m (140 kPa)) at ALL locations within the pressure zone.

Design Pressure:

The lowest allowable pressure at the node to maintain the minimum design pressure (14m (140 kPa)) at ALL locations within the pressure zone.

Critical Node ID:

The constraining node within the pressure zone that drops to the minimum design pressure of (14m (140 kPa)) during the design flow.



```
(1*,1((5,1* $1'  
(19,5210(17$/ 6(59,&(6  
:DWHU DQG :DVWHZDWHU 6  
      )UHGHLFN 6WUHHW  
.LWFKHQHU 21 &DQDGD 1 *  
7HOHSKRQH  
)D[  
ZZZ UHJLRQRIZDWHUORR F
```

- X Q F W L R Q

- \$FWLYH

7 D Q N

? \$FWLYH

3 X P S

\$FWLYH

9 D O Y H

= \$FWLYH

3 L S H

— \$FWLYH

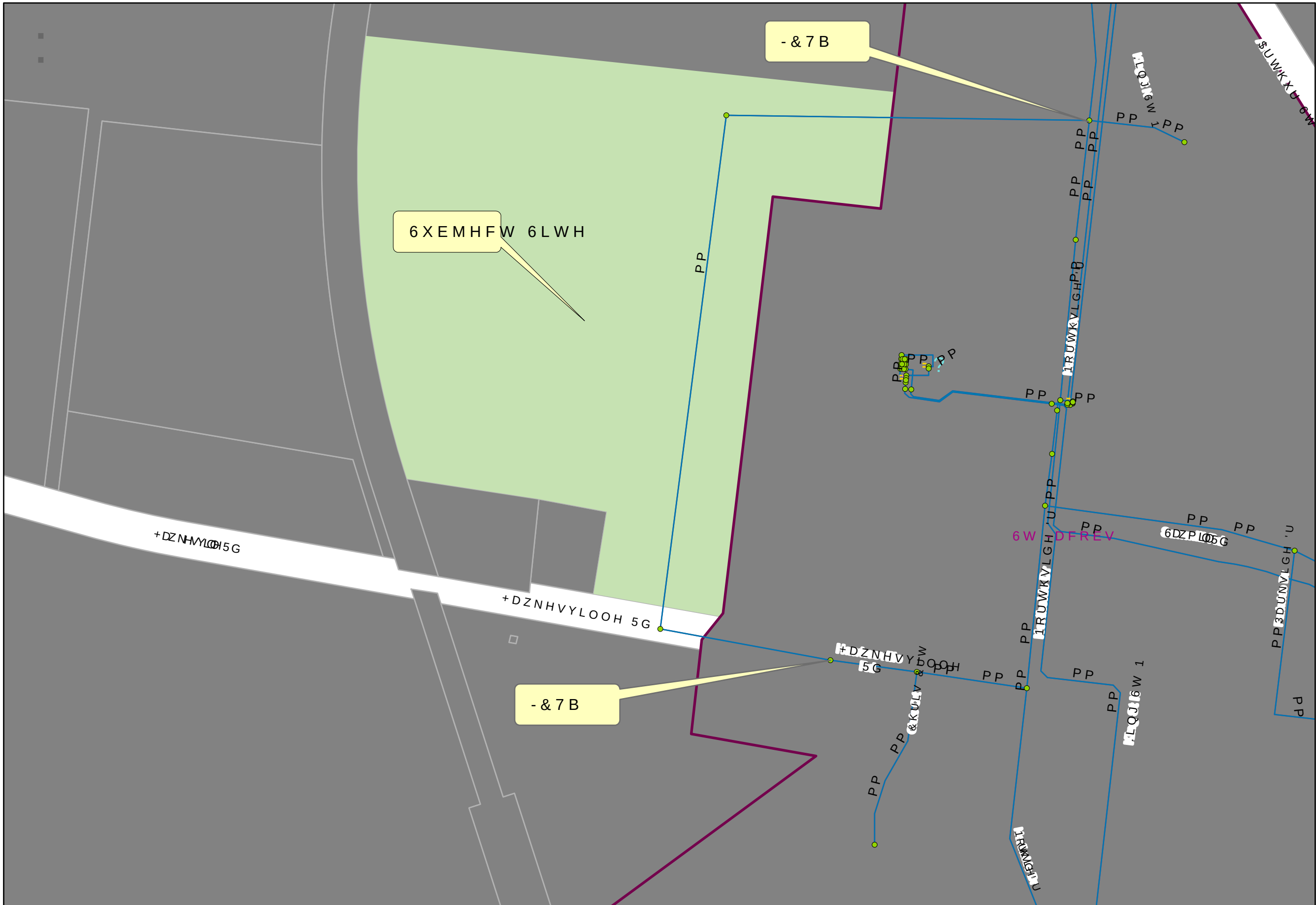
3,3(B', \$0(7(5

1 R Q 0 R G H O O L Q J '

 : D W H U 3 U H V V X U H = R Q H

6XEMHFW 6LWH

■ \$VVHVVP HQW 3DUFH OV



+DZNHVYLOOH
6W -DFREV

REQUIRED DOMESTIC FLOW
ONTARIO BUILDING CODE

WALTERFEDY

Project	50 Hawkesville Road, St. Jacobs
Project #	2023-0849-10
Designer	CM
Description	Residential Domestic Flow

Building Description	Units	Persons/ Unit	Population	Operating Hours	Demand	Max Daily Peak Factor	Max Hourly Peak Factor	Max Daily Demand (L/s)	Max Hourly Demand (L/s)
Low Density Residential	78	3.416	266	24					
Townhomes/Medium Density Residential	236	2.579	609	24					
Multi-Residential/ High Density Residential	95	1.887	179	24					
Proposed Subdivision	409		1054	24	225 L/cap/day	2.75	4.13	7.55	11.34
Total								7.55	11.34

- Notes:**
- [1] Unit counts as per the Development Concept Plan produced by GSP group, dated March 17, 2025
 - [2] Persons per unit as per the Township of Woolwich 2024 D.C. Background Study.
 - [3] Peaking Factors were taken from Table 3-1: Peaking Factors from MECP's Design Guidelines for Drinking-Water Systems.

REQUIRED DOMESTIC FLOW
ONTARIO BUILDING CODE

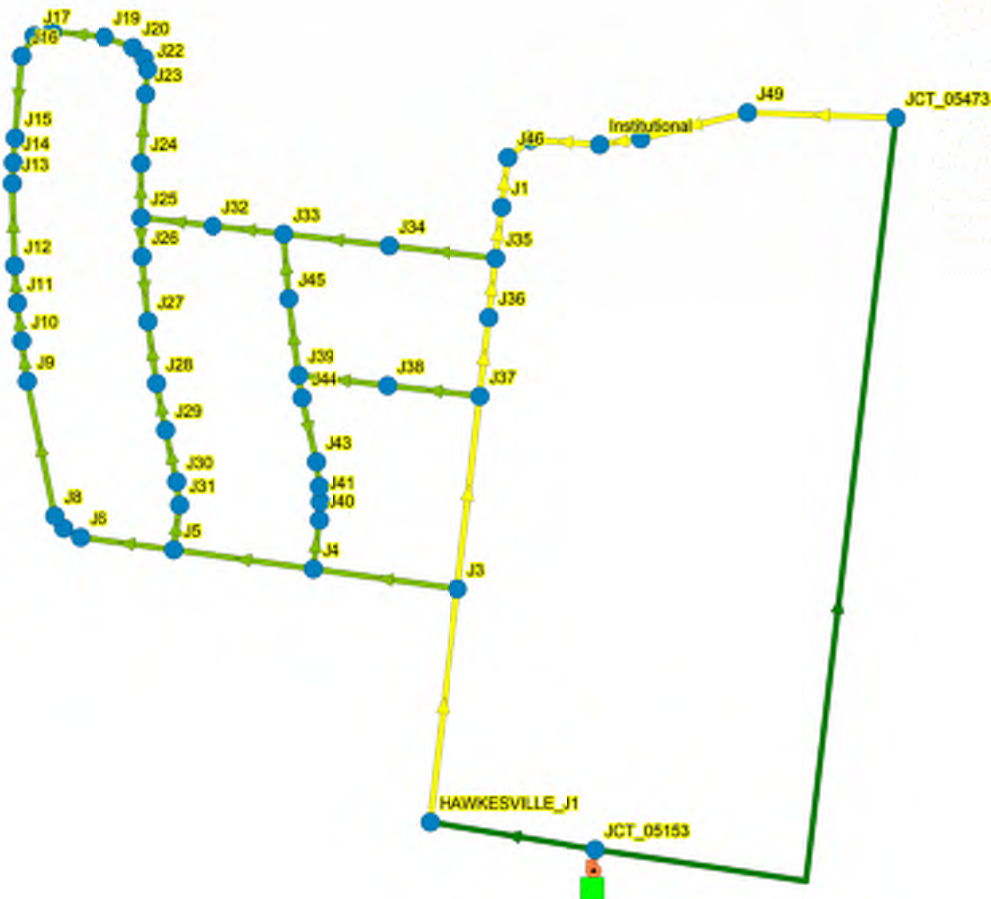
WALTERFEDY

Project	50 Hawkesville Road, St. Jacobs							
Project #	2023-0849-10							
Designer								
Description	Projected Institutional Flow Rate							
Building Description	Beds	Population	Operating Hours	Demand	Max Daily Peak Factor	Max Hourly Peak Factor	Max Daily Demand (L/s)	Max Hourly Demand (L/s)
Projected Institutional Block	224	224	24					
Projected Institutional Block	224	224	24	450 L/bed/day	2.90	4.30	3.38	5.02
Total							3.38	5.02

Notes:

- [1] Domestic Demand taken from previous People Care LTC home Site calculations
[2] Peaking Factors were taken from Table 3-3: Peaking Factors from MECP's Design Guidelines for Drinking-Water Systems.

2023-0849-10: SYSTEM LAYOUT MAP



Legend

- Junctions
- Reservoirs

Pipes

- Diameter = 150 (mm)
- Diameter = 200 (mm)
- Diameter = 300 (mm)
- Diameter = 400 (mm)
- Diameter > 400 (mm)
- Pumps

Junctions

- Pressure < 14.1 m
- Pressure: 14.1 - 35.7 m
- Pressure: 35.7 - 56.1 m
- Pressure: 56.1 - 71.4 m
- Pressure >= 71.4 m

■ Reservoirs

- Pipes**
- Velocity < 0.01 m/s
 - Velocity: 0.01 - 1 m/s
 - Velocity: 1 - 2 m/s
 - Velocity: 2 - 5 m/s
 - Velocity >= 5 m/s
- Pumps**

```

*****
*               E P A N E T               *
*           Hydraulic and Water Quality    *
*       Analysis for Pipe Networks         *
*           Version 2.2                   *
*****

```

Input File: 2023-0849-10 - PHD Scenario.inp

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
C56	JCT_05153	JCT_05473	623.19	150
C1	JCT_05153	HAWKESVILLE_J1	158.09	150
C55	J49	JCT_05473	153.77	300
C54	J48	J49	56.39	300
C53	Institutional	J48	20.28	300
C52	J47	Institutional	62.97	300
C51	J46	J47	17.018	300
C50	J1	J46	30.042	300
C48	J45	J33	38.809	200
C47	J39	J45	46.267	200
C46	J44	J39	13.761	200
C45	J43	J44	39.165	200
C44	J42	J43	14.954	200
C43	J41	J42	9.09	200
C42	J40	J41	10.902	200
C41	J4	J40	29.547	200
C40	J38	J39	53.966	200
C39	J37	J38	55.771	200
C38	J37	J3	116.192	300
C37	J36	J37	47.335	300
C36	J35	J36	35.789	300
C35	J34	J35	64.355	200
C34	J33	J34	63.764	200
C33	J32	J33	42.637	200
C32	J25	J32	43.088	200
C31	J31	J5	27.038	200
C30	J30	J31	13.946	200
C29	J29	J30	31.555	200
C28	J28	J29	28.585	200
C27	J27	J28	37.416	200
C26	J26	J27	38.934	200
C25	J25	J26	23.34	200
C24	J24	J25	32.601	200
C23	J23	J24	41.515	200
C22	J22	J23	14.74	200
C21	J21	J22	7.139	200
C20	J20	J21	9.145	200



Link - Node Table: (continued)

Link ID	Start Node	End Node	Length m	Diameter mm
C19	J19	J20	18.368	200
C18	J18	J19	31.437	200
C17	J17	J18	11.098	200
C16	J16	J17	14.002	200
C15	J15	J16	49.298	200
C14	J14	J15	14.726	200

2023-0849-10: PHD Report

C13	J13	J14	12.495	200
C12	J12	J13	49.203	200
C11	J11	J12	22.615	200
C10	J10	J11	22.706	200
C9	J9	J10	24.31	200
C8	J8	J9	82.292	200
C7	J7	J8	9.164	200
C6	J6	J7	11.304	200
C5	J5	J6	56.44	200
C4	J4	J5	84.295	200
C3	J3	J4	87.695	200
C2	HAWKESVILLE_J1	J3	140.64	300
C49	J35	J1	30.671	300
P1	JCT_05153_Res	JCT_05153	#N/A	#N/A Pump

Energy Usage:

Pump	Usage Factor	Avg. Effic.	Kw-hr /m3	Avg. Kw	Peak Kw	Cost /day
P1	100.00	75.00	0.11	6.66	6.66	0.00
Demand Charge:						0.00
Total Cost:						0.00

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality
J1	0.23	411.10	61.01	0.00
HAWKESVILLE_J1	0.00	411.11	63.98	0.00
J3	0.23	411.10	60.70	0.00
J4	0.23	411.09	60.69	0.00
J5	0.23	411.09	60.09	0.00
J6	0.23	411.09	59.75	0.00
J7	0.23	411.09	59.61	0.00
J8	0.23	411.09	59.47	0.00
J9	0.23	411.08	59.15	0.00
J10	0.23	411.08	59.29	0.00
J11	0.23	411.08	59.43	0.00



Page 3

Node Results: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality
J12	0.23	411.08	59.57	0.00
J13	0.23	411.08	59.71	0.00
J14	0.23	411.08	59.85	0.00
J15	0.23	411.08	59.99	0.00
J16	0.23	411.08	60.39	0.00
J17	0.23	411.08	60.52	0.00
J18	0.23	411.08	60.60	0.00
J19	0.23	411.08	60.90	0.00
J20	0.23	411.08	61.01	0.00
J21	0.23	411.08	61.08	0.00
J22	0.23	411.09	61.12	0.00
J23	0.23	411.09	61.21	0.00
J24	0.23	411.09	61.43	0.00
J25	0.23	411.09	61.40	0.00
J26	0.23	411.09	61.16	0.00
J27	0.23	411.09	61.02	0.00
J28	0.23	411.09	60.76	0.00
J29	0.23	411.09	60.71	0.00
J30	0.23	411.09	60.43	0.00

J31	0.23	411.09	60.29	0.00
J32	0.23	411.09	61.73	0.00
J33	0.23	411.09	62.14	0.00
J34	0.23	411.09	61.79	0.00
J35	0.23	411.10	61.23	0.00
J36	0.23	411.10	60.96	0.00
J37	0.23	411.10	61.12	0.00
J38	0.23	411.10	61.49	0.00
J39	0.23	411.09	61.60	0.00
J40	0.23	411.09	60.97	0.00
J41	0.23	411.09	61.03	0.00
J42	0.23	411.09	61.11	0.00
J43	0.23	411.09	61.25	0.00
J44	0.23	411.09	61.53	0.00
J45	0.23	411.09	62.00	0.00
J46	0.23	411.10	60.87	0.00
J47	0.23	411.10	60.73	0.00
Institutional	5.02	411.10	60.86	0.00
J48	0.23	411.10	61.50	0.00
J49	0.23	411.10	62.33	0.00
JCT_05473	0.00	411.10	65.10	0.00
JCT_05153	0.00	411.49	63.49	0.00
JCT_05153_Res	-16.12	379.89	0.00	0.00 Reservoir



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Link Results:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
C56	5.26	0.30	0.62	Open
C1	10.86	0.61	2.36	Open
C55	-5.26	0.07	0.02	Open
C54	-5.03	0.07	0.02	Open
C53	-4.80	0.07	0.02	Open
C52	0.22	0.00	0.00	Open
C51	0.45	0.01	0.00	Open
C50	0.68	0.01	0.00	Open
C48	1.20	0.04	0.01	Open
C47	1.44	0.05	0.01	Open
C46	-0.70	0.02	0.00	Open
C45	-0.47	0.01	0.00	Open
C44	-0.24	0.01	0.00	Open
C43	-0.01	0.00	0.00	Open
C42	0.23	0.01	0.00	Open
C41	0.46	0.01	0.00	Open
C40	2.37	0.08	0.03	Open
C39	2.60	0.08	0.04	Open
C38	-6.63	0.09	0.03	Open
C37	-3.81	0.05	0.01	Open
C36	-3.57	0.05	0.01	Open
C35	-2.43	0.08	0.04	Open
C34	-2.20	0.07	0.03	Open
C33	-3.17	0.10	0.06	Open
C32	-2.94	0.09	0.05	Open
C31	-0.99	0.03	0.01	Open
C30	-0.76	0.02	0.01	Open
C29	-0.53	0.02	0.00	Open
C28	-0.30	0.01	0.00	Open
C27	-0.07	0.00	0.00	Open
C26	0.16	0.01	0.00	Open
C25	0.39	0.01	0.00	Open
C24	-2.31	0.07	0.03	Open
C23	-2.08	0.07	0.03	Open
C22	-1.85	0.06	0.02	Open
C21	-1.62	0.05	0.02	Open

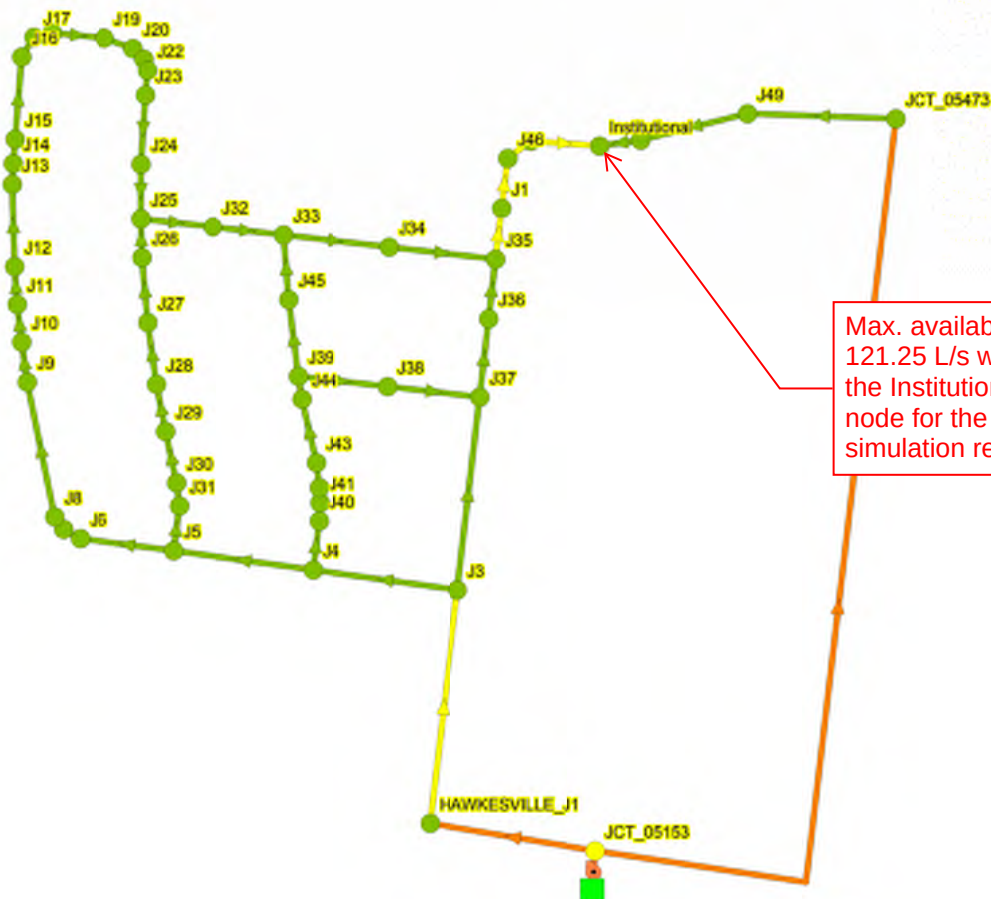
C20	-1.39	0.04	0.01	Open
C19	-1.16	0.04	0.01	Open
C18	-0.93	0.03	0.01	Open
C17	-0.70	0.02	0.00	Open
C16	-0.46	0.01	0.00	Open
C15	-0.23	0.01	0.00	Open
C14	0.00	0.00	0.00	Open
C13	0.23	0.01	0.00	Open
C12	0.46	0.01	0.00	Open
C11	0.69	0.02	0.00	Open
C10	0.92	0.03	0.00	Open

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Link Results: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
C9	1.15	0.04	0.01	Open
C8	1.39	0.04	0.01	Open
C7	1.62	0.05	0.02	Open
C6	1.85	0.06	0.02	Open
C5	2.08	0.07	0.03	Open
C4	3.30	0.11	0.06	Open
C3	3.99	0.13	0.09	Open
C2	10.86	0.15	0.08	Open
C49	0.92	0.01	0.00	Open
P1	16.12	0.00	-31.60	Open Pump

2023-0849-10: MAX. DAILY DEMAND + FIRE FLOW RESULTS



Max. available fire flow of 121.25 L/s was applied to the Institutional servicing node for the observed simulation results

Legend

Junctions

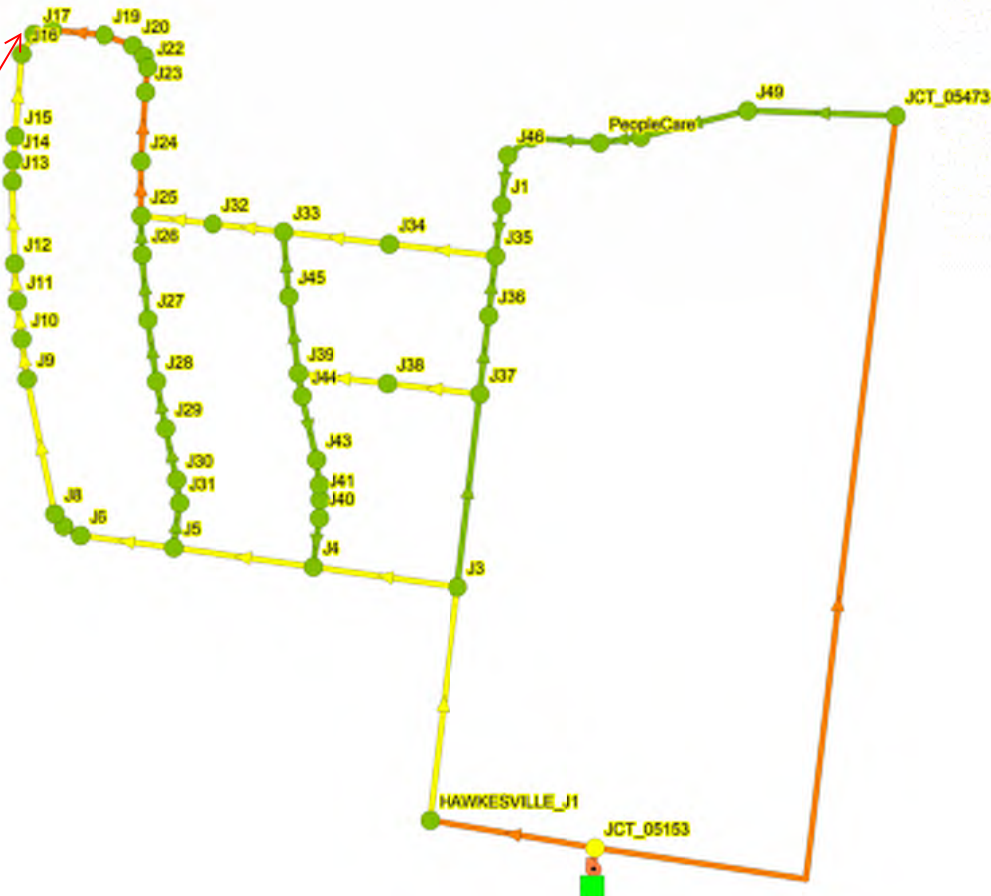
- Pressure < 14.1 m
- Pressure: 14.1 - 35.7 m
- Pressure: 35.7 - 56.1 m
- Pressure: 56.1 - 71.4 m
- Pressure >= 71.4 m

Reservoirs

Pipes

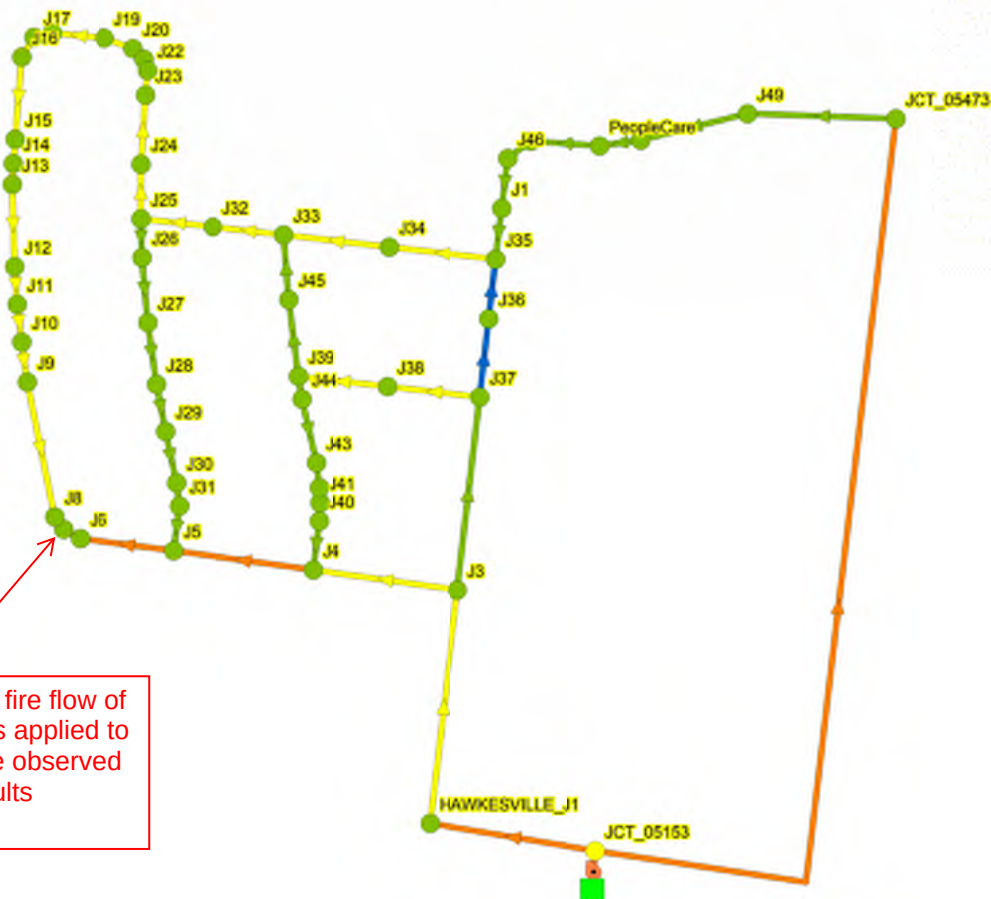
- Velocity < 0.01 m/s
- Velocity: 0.01 - 1 m/s
- Velocity: 1 - 2 m/s
- Velocity: 2 - 5 m/s
- Velocity >= 5 m/s
- Pumps

2023-0849-10: MAX. DAILY DEMAND + FIRE FLOW RESULTS



Max. available fire flow of 120.1 L/s was applied to node J17 for the observed simulation results

2023-0849-10: MAX. DAILY DEMAND + FIRE FLOW RESULTS



Legend

Junctions

- Pressure < 14.1 m
- Pressure: 14.1 - 35.7 m
- Pressure: 35.7 - 56.1 m
- Pressure: 56.1 - 71.4 m
- Pressure >= 71.4 m

Reservoirs

Pipes

- Velocity < 0.01 m/s
- Velocity: 0.01 - 1 m/s
- Velocity: 1 - 2 m/s
- Velocity: 2 - 5 m/s
- Velocity >= 5 m/s
- Pumps

```

*****
*               E P A N E T               *
*           Hydraulic and Water Quality    *
*       Analysis for Pipe Networks         *
*               Version 2.2               *
*****

```

Input File: 2023-0849-10 - MDD+Fire Scenario_FFA.inp

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
C56	JCT_05153	JCT_05473	623.19	150
C1	JCT_05153	HAWKESVILLE_J1	158.09	150
C55	J49	JCT_05473	153.77	300
C54	J48	J49	56.39	300
C53	PeopleCare	J48	20.28	300
C52	J47	PeopleCare	62.97	300
C51	J46	J47	17.018	300
C50	J1	J46	30.042	300
C48	J45	J33	38.809	200
C47	J39	J45	46.267	200
C46	J44	J39	13.761	200
C45	J43	J44	39.165	200
C44	J42	J43	14.954	200
C43	J41	J42	9.09	200
C42	J40	J41	10.902	200
C41	J4	J40	29.547	200
C40	J38	J39	53.966	200
C39	J37	J38	55.771	200
C38	J37	J3	116.192	300
C37	J36	J37	47.335	300
C36	J35	J36	35.789	300
C35	J34	J35	64.355	200
C34	J33	J34	63.764	200
C33	J32	J33	42.637	200
C32	J25	J32	43.088	200
C31	J31	J5	27.038	200
C30	J30	J31	13.946	200
C29	J29	J30	31.555	200
C28	J28	J29	28.585	200
C27	J27	J28	37.416	200
C26	J26	J27	38.934	200
C25	J25	J26	23.34	200
C24	J24	J25	32.601	200
C23	J23	J24	41.515	200
C22	J22	J23	14.74	200
C21	J21	J22	7.139	200
C20	J20	J21	9.145	200



Link - Node Table: (continued)

Link ID	Start Node	End Node	Length m	Diameter mm
C19	J19	J20	18.368	200
C18	J18	J19	31.437	200
C17	J17	J18	11.098	200
C16	J16	J17	14.002	200
C15	J15	J16	49.298	200
C14	J14	J15	14.726	200

2023-0849-10: MDD + Fire Results

C13	J13	J14	12.495	200
C12	J12	J13	49.203	200
C11	J11	J12	22.615	200
C10	J10	J11	22.706	200
C9	J9	J10	24.31	200
C8	J8	J9	82.292	200
C7	J7	J8	9.164	200
C6	J6	J7	11.304	200
C5	J5	J6	56.44	200
C4	J4	J5	84.295	200
C3	J3	J4	87.695	200
C2	HAWKESVILLE_J1	J3	140.64	300
C49	J35	J1	30.671	300
P1	JCT_05153_Res	JCT_05153	#N/A	#N/A Pump

Energy Usage:

Pump	Usage Factor	Avg. Effic.	Kw-hr /m3	Avg. Kw	Peak Kw	Cost /day
P1	100.00	75.00	0.05	23.41	23.41	0.00
Demand Charge:						0.00
Total Cost:						0.00

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality
J1	0.15	374.21	24.12	0.00
HAWKESVILLE_J1	0.00	375.32	28.19	0.00
J3	0.15	374.77	24.37	0.00
J4	0.15	374.57	24.17	0.00
J5	0.15	374.52	23.52	0.00
J6	0.15	374.52	23.18	0.00
J7	0.15	374.52	23.04	0.00
J8	0.15	374.51	22.89	0.00
J9	0.15	374.51	22.58	0.00
J10	0.15	374.50	22.71	0.00
J11	0.15	374.50	22.85	0.00



Page 3

Node Results: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality
J12	0.15	374.50	22.99	0.00
J13	0.15	374.50	23.13	0.00
J14	0.15	374.50	23.27	0.00
J15	0.15	374.49	23.40	0.00
J16	0.15	374.49	23.80	0.00
J17	0.15	374.49	23.93	0.00
J18	0.15	374.49	24.01	0.00
J19	0.15	374.49	24.31	0.00
J20	0.15	374.49	24.42	0.00
J21	0.15	374.49	24.49	0.00
J22	0.15	374.49	24.52	0.00
J23	0.15	374.49	24.61	0.00
J24	0.15	374.49	24.83	0.00
J25	0.15	374.49	24.80	0.00
J26	0.15	374.49	24.56	0.00
J27	0.15	374.50	24.43	0.00
J28	0.15	374.50	24.17	0.00
J29	0.15	374.51	24.13	0.00
J30	0.15	374.51	23.85	0.00

2023-0849-10: MDD + Fire Results

J31	0.15	374.52	23.72	0.00
J32	0.15	374.48	25.12	0.00
J33	0.15	374.47	25.52	0.00
J34	0.15	374.39	25.09	0.00
J35	0.15	374.31	24.44	0.00
J36	0.15	374.40	24.26	0.00
J37	0.15	374.50	24.52	0.00
J38	0.15	374.50	24.89	0.00
J39	0.15	374.51	25.01	0.00
J40	0.15	374.55	24.43	0.00
J41	0.15	374.55	24.49	0.00
J42	0.15	374.54	24.56	0.00
J43	0.15	374.53	24.69	0.00
J44	0.15	374.51	24.95	0.00
J45	0.15	374.48	25.39	0.00
J46	0.15	374.11	23.88	0.00
J47	0.15	374.05	23.68	0.00
PeopleCare	124.63	373.84	23.60	0.00
J48	0.15	373.86	24.26	0.00
J49	0.15	373.92	25.15	0.00
JCT_05473	0.00	374.08	28.08	0.00
JCT_05153	0.00	393.46	45.46	0.00
JCT_05153_Res	-132.02	379.89	0.00	0.00 Reservoir



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Link Results:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
C56	43.66	2.47	31.09	Open
C1	88.36	5.00	114.72	Open
C55	-43.66	0.62	1.06	Open
C54	-43.50	0.62	1.06	Open
C53	-43.35	0.61	1.05	Open
C52	81.28	1.15	3.36	Open
C51	81.43	1.15	3.37	Open
C50	81.59	1.15	3.38	Open
C48	9.47	0.30	0.45	Open
C47	9.63	0.31	0.47	Open
C46	10.48	0.33	0.54	Open
C45	10.63	0.34	0.56	Open
C44	10.79	0.34	0.57	Open
C43	10.94	0.35	0.59	Open
C42	11.09	0.35	0.61	Open
C41	11.25	0.36	0.62	Open
C40	-0.70	0.02	0.00	Open
C39	-0.54	0.02	0.00	Open
C38	-65.80	0.93	2.27	Open
C37	-66.19	0.94	2.30	Open
C36	-66.03	0.93	2.29	Open
C35	15.86	0.50	1.17	Open
C34	16.01	0.51	1.20	Open
C33	6.70	0.21	0.24	Open
C32	6.85	0.22	0.25	Open
C31	-6.26	0.20	0.21	Open
C30	-6.11	0.19	0.20	Open
C29	-5.95	0.19	0.19	Open
C28	-5.80	0.18	0.18	Open
C27	-5.65	0.18	0.17	Open
C26	-5.49	0.17	0.17	Open
C25	-5.34	0.17	0.16	Open
C24	1.67	0.05	0.02	Open
C23	1.82	0.06	0.02	Open
C22	1.97	0.06	0.03	Open
C21	2.13	0.07	0.03	Open

2023-0849-10: MDD + Fire Results

C20	2.28	0.07	0.03	Open
C19	2.44	0.08	0.04	Open
C18	2.59	0.08	0.04	Open
C17	2.74	0.09	0.05	Open
C16	2.90	0.09	0.05	Open
C15	3.05	0.10	0.06	Open
C14	3.21	0.10	0.06	Open
C13	3.36	0.11	0.07	Open
C12	3.51	0.11	0.07	Open
C11	3.67	0.12	0.08	Open
C10	3.82	0.12	0.08	Open

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Link Results: (continued)

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
C9	3.98	0.13	0.09	Open
C8	4.13	0.13	0.10	Open
C7	4.28	0.14	0.11	Open
C6	4.44	0.14	0.11	Open
C5	4.59	0.15	0.12	Open
C4	11.01	0.35	0.60	Open
C3	22.41	0.71	2.23	Open
C2	88.36	1.25	3.92	Open
C49	81.74	1.16	3.39	Open
P1	132.02	0.00	-13.57	Open Pump

* E P A N E T *

* Hydraulic and Water Quality *

* Analysis for Pipe Networks *

* Version 2.2 *

Node Results

Node ID	Elevation (m)	Peak Hourly Demand			Max. Daily Demand + Fire		
		Demand (LPS)	Head (m)	Pressure (m)	Demand (LPS)	Head (m)	Pressure (m)
Modelled Junctions							
HAWKESVILLE_J1	347.13	0	411.113	63.983	0	375.32	28.19
Institutional	350.24	5.02	411.097	60.857	124.63	373.84	23.6
J1	350.09	0.231	411.097	61.007	0.154	374.21	24.12
J10	351.79	0.231	411.085	59.295	0.154	374.504	22.714
J11	351.65	0.231	411.085	59.435	0.154	374.502	22.852
J12	351.51	0.231	411.084	59.574	0.154	374.5	22.99
J13	351.37	0.231	411.084	59.714	0.154	374.497	23.127
J14	351.23	0.231	411.084	59.854	0.154	374.496	23.266
J15	351.09	0.231	411.084	59.994	0.154	374.495	23.405
J16	350.69	0.231	411.084	60.394	0.154	374.492	23.802
J17	350.56	0.231	411.084	60.524	0.154	374.492	23.932
J18	350.48	0.231	411.084	60.604	0.154	374.491	24.011
J19	350.18	0.231	411.085	60.905	0.154	374.49	24.31
J20	350.07	0.231	411.085	61.015	0.154	374.489	24.419
J21	350	0.231	411.085	61.085	0.154	374.489	24.489
J22	349.97	0.231	411.085	61.115	0.154	374.489	24.519
J23	349.88	0.231	411.085	61.205	0.154	374.488	24.608
J24	349.66	0.231	411.087	61.427	0.154	374.487	24.827
J25	349.69	0.231	411.088	61.398	0.154	374.487	24.797
J26	349.93	0.231	411.088	61.158	0.154	374.49	24.56
J27	350.07	0.231	411.088	61.018	0.154	374.497	24.427
J28	350.33	0.231	411.088	60.758	0.154	374.503	24.173
J29	350.38	0.231	411.088	60.708	0.154	374.508	24.128
J3	350.4	0.231	411.101	60.701	0.154	374.769	24.369
J30	350.66	0.231	411.088	60.428	0.154	374.515	23.855
J31	350.8	0.231	411.088	60.288	0.154	374.517	23.717
J32	349.36	0.231	411.09	61.73	0.154	374.476	25.116
J33	348.95	0.231	411.092	62.142	0.154	374.466	25.516
J34	349.3	0.231	411.094	61.794	0.154	374.39	25.09
J35	349.87	0.231	411.097	61.227	0.154	374.314	24.444
J36	350.14	0.231	411.097	60.957	0.154	374.396	24.256
J37	349.98	0.231	411.098	61.118	0.154	374.505	24.525
J38	349.61	0.231	411.095	61.485	0.154	374.505	24.895
J39	349.49	0.231	411.093	61.603	0.154	374.505	25.015

* E P A N E T *

* Hydraulic and Water Quality *

* Analysis for Pipe Networks *

* Version 2.2 *

Node Results

J4	350.4	0.231	411.093	60.693	0.154	374.573	24.173
J40	350.12	0.231	411.093	60.973	0.154	374.555	24.435
J41	350.06	0.231	411.093	61.033	0.154	374.548	24.488
J42	349.98	0.231	411.093	61.113	0.154	374.543	24.563
J43	349.84	0.231	411.093	61.253	0.154	374.534	24.694
J44	349.56	0.231	411.093	61.533	0.154	374.512	24.952
J45	349.09	0.231	411.093	62.003	0.154	374.483	25.393
J46	350.23	0.231	411.097	60.867	0.154	374.108	23.878
J47	350.37	0.231	411.097	60.727	0.154	374.051	23.681
J48	349.6	0.231	411.097	61.497	0.154	373.861	24.261
J49	348.77	0.231	411.098	62.328	0.154	373.92	25.15
J5	351	0.231	411.088	60.088	0.154	374.523	23.523
J6	351.34	0.231	411.086	59.746	0.154	374.516	23.176
J7	351.48	0.231	411.086	59.606	0.154	374.515	23.035
J8	351.62	0.231	411.086	59.466	0.154	374.514	22.894
J9	351.93	0.231	411.085	59.155	0.154	374.506	22.576
JCT_05153	348	0	411.486	63.486	0	393.456	45.456
JCT_05473	346	0	411.101	65.101	0	374.084	28.084

Name	Inlet Node	Outlet Node	Length (m)	Diameter (mm)	Roughness	Initial Status
C1	JCT_05153	HAWKESVILLE_J1	158.09	150	150	Open
C10	J10	J11	22.706	200	150	Open
C11	J11	J12	22.615	200	150	Open
C12	J12	J13	49.203	200	150	Open
C13	J13	J14	12.495	200	150	Open
C14	J14	J15	14.726	200	150	Open
C15	J15	J16	49.298	200	150	Open
C16	J16	J17	14.002	200	150	Open
C17	J17	J18	11.098	200	150	Open
C18	J18	J19	31.437	200	150	Open
C19	J19	J20	18.368	200	150	Open
C2	HAWKESVILLE_J1	J3	140.64	300	150	Open
C20	J20	J21	9.145	200	150	Open
C21	J21	J22	7.139	200	150	Open
C22	J22	J23	14.74	200	150	Open
C23	J23	J24	41.515	200	150	Open
C24	J24	J25	32.601	200	150	Open
C25	J25	J26	23.34	200	150	Open
C26	J26	J27	38.934	200	150	Open
C27	J27	J28	37.416	200	150	Open
C28	J28	J29	28.585	200	150	Open
C29	J29	J30	31.555	200	150	Open
C3	J3	J4	87.695	200	150	Open
C30	J30	J31	13.946	200	150	Open
C31	J31	J5	27.038	200	150	Open
C32	J25	J32	43.088	200	150	Open
C33	J32	J33	42.637	200	150	Open
C34	J33	J34	63.764	200	150	Open
C35	J34	J35	64.355	200	150	Open
C36	J35	J36	35.789	300	150	Open
C37	J36	J37	47.335	300	150	Open
C38	J37	J3	116.192	300	150	Open
C39	J37	J38	55.771	200	150	Open
C4	J4	J5	84.295	200	150	Open
C40	J38	J39	53.966	200	150	Open
C41	J4	J40	29.547	200	150	Open
C42	J40	J41	10.902	200	150	Open
C43	J41	J42	9.09	200	150	Open
C44	J42	J43	14.954	200	150	Open
C45	J43	J44	39.165	200	150	Open
C46	J44	J39	13.761	200	150	Open
C47	J39	J45	46.267	200	150	Open

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*****
      *               E P A N E T               *
    *               Hydraulic and Water Quality   *
    *               Analysis for Pipe Networks     *
      *               Version 2.2                 *
*****
C48      J45      J33      38.809      200      150      Open
C49      J35      J1       30.671      300      150      Open
C5       J5       J6       56.44      200      150      Open
C50      J1       J46      30.042      300      150      Open
C51      J46      J47      17.018      300      150      Open
C52      J47      Institutional 62.97      300      150      Open
C53      Institutional J48      20.28      300      150      Open
C54      J48      J49      56.39      300      150      Open
C55      J49      JCT_05473 153.77      300      150      Open
C56      JCT_05153 JCT_05473 623.19      150      150      Open
C6       J6       J7       11.304      200      150      Open
C7       J7       J8       9.164      200      150      Open
C8       J8       J9      82.292      200      150      Open
C9       J9       J10      24.31      200      150      Open

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2023-0849-10
FIRE FLOW ANALYSIS RESULTS

Note: The fire flow analysis was conducted on the maximum day demand models for each scenario, the fire flow analysis takes into account the previously prescribed maximum day demand values at each node when determining the available fire flow at each hydrant

Junction	Required Fire Flow (L/s)	Min. Residual Pressure (m)	Fire Flow Period (hours)	Available Fire Flow at Min. Residual Pressure (L/s)
Fire Flow Analysis				
J10	150	14.1	3.00	120.09
J14	150	14.1	3.00	120.09
J17	150	14.1	3.00	120.1
J21	150	14.1	3.00	120.1
J29	150	14.1	3.00	120.09
J3	150	14.1	3.00	119.86
J32	150	14.1	3.00	120.12
J34	150	14.1	3.00	120.27
J36	150	14.1	3.00	120.39
J37	150	14.1	3.00	120.23
J38	150	14.1	3.00	120.19
J4	150	14.1	3.00	120.03
J43	150	14.1	3.00	120.09
J45	150	14.1	3.00	120.13
J47	150	14.1	3.00	120.92
J49	150	14.1	3.00	121.63
J5	150	14.1	3.00	120.08
J7	150	14.1	3.00	120.09
Institutional	200	14.1	3.00	121.25

APPENDIX D

Stormwater Management Information

TABLE 1
DESIGN STORM PARAMETERS

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT
52 HAWKESVILLE ROAD
ST JACOBS, ONTARIO

Design Storm	IDF Storm Parameters			Time of Peak Ratio r	Storm Duration D (h)	Total Rainfall (mm)	Max. Rainfall Intensity (mm/h)
	a	b	c				
12.5 mm	254.1	6	0.7989	0.35	4	12.5	37.4
25 mm	509	6	0.7989	0.35	4	25.0	74.9
2-year	743	6	0.7989	0.35	3	34.3	109.4
5-year	1593	11	0.8789	0.35	3	47.3	139.3
10-year	2221	12	0.9080	0.35	3	56.3	169.6
25-year	3158	15	0.9355	0.35	3	68.3	191.6
50-year	3886	16	0.9495	0.35	3	77.6	215.8
100-year	4688	17	0.9624	0.35	3	87.1	239.4

Notes:

^[1] IDF Parameters taken from the City of Kitchener's Development Manual (Dated Summer 2021)

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT
52 HAWKESVILLE ROAD
ST JACOBS, ONTARIO

Subcatchment	Area (ha)	Percent Impervious (%)	Flow Length (m)	Slope (%)	Mannings Roughness		Green-Ampt Parameters			Depression Storage	
					Impervious	Pervious	Suction Head (mm)	Conductivity (mm/hr)	Initial Deficit	Impervious (mm)	Pervious (mm)
<u>To Proposed Wet Pond</u>											
201	8.59	70	350	2	0.013	0.250	115	11	0.25	2	4
202	0.89	90	97	2	0.013	0.250	115	11	0.25	2	4
209	1.18	35	50	2	0.013	0.250	115	11	0.25	2	4
211	0.44	70	20	2	0.013	0.250	115	11	0.25	2	4
212	0.57	70	20	2	0.013	0.250	115	11	0.25	2	4
220	1.70	43	80	2	0.013	0.250	115	11	0.25	2	4
<u>To Proposed Dry Pond</u>											
203	0.47	35	50	2	0.013	0.250	115	11	0.25	2	4
204	1.53	70	60	2	0.013	0.250	115	11	0.25	2	4
210	2.89	35	200	2	0.013	0.250	115	11	0.25	2	4
213	0.28	70	20	2	0.013	0.250	115	11	0.25	2	4
<u>To North Woodlot</u>											
208	0.80	35	40	2	0.013	0.250	115	11	0.25	2	4
<u>To Hawkesville Road</u>											
205	1.39	76	40	2	0.013	0.250	115	11	0.25	2	4
Total Area		20.74	60								

**TABLE 4
RUNOFF VOLUME SUMMARY**

**FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT
52 HAWKESVILLE ROAD
ST JACOBS, ONTARIO**

Subcatchment	Design Storms						
	25-mm (m ³)	2-year (m ³)	5-year (m ³)	10-year (m ³)	25-year (m ³)	50-year (m ³)	100-year (m ³)
Existing Conditions							
100	339.1	479.8	814.7	1114.9	1524.3	1857.7	2201.6
101	931.8	1301.4	1946.6	2545.8	3460.8	4252.6	5105.0
102	24.0	34.3	60.0	82.1	111.6	135.3	159.8
103	429.8	602.2	950.0	1280.2	1760.6	2162.6	2584.6
Proposed Conditions							
201	1353	1899	2730	3374	4268	4994	5743
202	187	262	373	453	557	639	722
203	38	54	93	128	175	214	253
204	239	338	502	626	789	919	1051
205	246	346	510	630	787	911	1037
208	65	93	162	222	303	368	435
209	96	137	234	321	440	536	636
210	236	332	516	691	951	1171	1403
211	71	101	153	190	239	278	317
212	119	167	240	290	357	408	461
213	55	78	118	147	185	215	245
220	170	240	384	509	682	822	967

TABLE 5
PEAK FLOW RATE SUMMARY

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT
52 HAWKESVILLE ROAD
ST JACOBS, ONTARIO

Subcatchment	Design Storms						
	25-mm (m ³ /s)	2-year (m ³ /s)	5-year (m ³ /s)	10-year (m ³ /s)	25-year (m ³ /s)	50-year (m ³ /s)	100-year (m ³ /s)
Existing Conditions							
100	0.300	0.440	0.600	0.790	0.980	1.190	1.400
101	0.580	0.950	1.310	1.670	1.970	2.290	2.610
102	0.020	0.030	0.040	0.060	0.080	0.100	0.110
103	0.340	0.510	0.690	0.880	1.050	1.230	1.410
Proposed Conditions							
201	0.530	0.900	1.330	1.730	2.110	2.480	2.850
202	0.130	0.210	0.290	0.360	0.420	0.480	0.540
203	0.040	0.060	0.080	0.100	0.130	0.150	0.180
204	0.200	0.300	0.400	0.510	0.600	0.690	0.790
205	0.220	0.320	0.430	0.550	0.640	0.740	0.840
208	0.050	0.080	0.110	0.150	0.180	0.220	0.270
209	0.090	0.130	0.170	0.230	0.290	0.350	0.410
210	0.180	0.280	0.380	0.480	0.560	0.660	0.750
211	0.060	0.090	0.120	0.150	0.180	0.210	0.240
212	0.130	0.190	0.260	0.320	0.360	0.410	0.460
213	0.050	0.070	0.100	0.130	0.160	0.180	0.210
220	0.150	0.220	0.290	0.380	0.450	0.530	0.610

TABLE 6
STORAGE PERFORMANCE SUMMARY

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT
52 HAWKESVILLE ROAD
ST JACOBS, ONTARIO

PCSWMM Model Element	Design Storm	Peak Inflow (L/s)	Peak Outflow to Storm Sewer Network (L/s)	Max. Active Storage Volume (m ³)	Max. Ponding Elevation (m)
SWM_Pond					
	25-mm	0.95	0.02	1568	345.82
	2-year	1.57	0.04	2278	345.95
	5-year	2.23	0.10	3136	346.10
	10-year	2.88	0.17	3762	346.21
	25-year	3.46	0.32	4558	346.34
	50-year	4.04	0.46	5111	346.43
	100-year	4.63	0.55	5765	346.53
Dry_Pond					
	25-mm	0.28	0.01	250	344.96
	2-year	0.43	0.01	323	345.06
	5-year	0.58	0.01	395	345.15
	10-year	0.74	0.02	436	345.21
	25-year	0.88	0.02	680	345.37
	50-year	1.03	0.02	728	345.51
	100-year	1.18	0.02	900	345.69

TABLE 7
OUTLET COMPARISONS

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT
52 HAWKESVILLE ROAD
ST JACOBS, ONTARIO

Design Storm Event	To Hawkesville Road	
	Existing (m ³ /s)	Proposed (m ³ /s)
25-mm	0.291	0.215
2-year	0.430	0.321
5-year	0.593	0.430
10-year	0.784	0.547
25-year	0.971	0.644
50-year	1.172	0.745
100-year	1.378	0.843

Design Storm Event	To Municipal Drain no. 11	
	Existing (m ³ /s)	Proposed (m ³ /s)
25-mm	0.597	0.404
2-year	0.967	0.612
5-year	1.337	0.881
10-year	1.707	1.185
25-year	2.025	1.546
50-year	2.361	1.915
100-year	2.697	2.231

MECP CALCULATIONS FOR NORTHWESTERN SWM POND

Stormwater Management Pond

Areas Contributing to SWM Pond for MECP Water Quality

Sub-Catchment ID	Area (ha)	Percent Impervious (%)
201	8.59	70
202	0.89	90
209	1.18	35
211	0.44	70
212	0.57	70
220	1.70	43
TOTAL	13.37	64.8

SWM Pond

Required protection level:	Enhanced
Contributing drainage area:	13.37 ha
Impervious level:	64.8 %
Total required water quality storage volume per hectare:	213 m ³ /ha
Required permanent pool volume per hectare:	173 m ³ /ha
Required extended detention storage volume per hectare:	40 m ³ /ha
Required permanent pool volume:	2,312 m ³
Provided permanent pool volume:	3,885 m ³
MECP Required extended detention storage volume:	535 m ³
Required extended detention storage volume (based on 25mm event):	1,604 m ³

MECP SWM Design Manual Table 3.2

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

STAGE-STORAGE-DISCHARGE CURVE FOR NORTHWESTERN SWM POND

PRELIMINARY OUTLET DESIGN FOR SWM FACILITY

Outlet Device No. 1 (Quality Control - to Northside)

Outlet Device No. 2 (Quantity - to Northside)

Outlet Device No. 3 (Quantity - to Woodlot)

Outlet No. 4 (Emergency - to Woodlot)

Type: Circular Orifice
Diameter (mm) 150
Area (m²) 0.01767
Invert Height (m) 345.50
C/L Height (m) 345.58
Disch. Coeff. (C_d) 0.62
Discharge (Q) = C_d A (2 g H)^{0.5}
Number of Orifices: 1

Type: Circular Orifice
Diameter (mm) 450
Area (m²) 0.15904
Invert Height (m) 345.90
C/L Height (m) 346.13
Disch. Coeff. (C_d) 0.62
Discharge (Q) = C_d A (2 g H)^{0.5}
Number of Orifices: 2

Type: Circular Orifice
Diameter (mm) 75
Area (m²) 0.00442
Invert Elev. (m) 345.87
C/L Elev. (m) 345.91
Disch. Coeff. (C_d) 0.62
Discharge (Q) = C_d A (2 g H)^{0.5}
Number of Orifices: 1

Type: Broad crested
overflow weir
Sill Height (m) 346.55
Length (m) 5.0
Discharge (Q) = 1.67 L H^{1.5}

	Height m	Volume Summary			Outlet No. 1		Outlet No. 2		Outlet No. 3		Outlet No. 4		Total Discharge m ³ /s
		Area m ²	Total Volume m ³	Active Storage m ³	H m	Discharge m ³ /s	H m	Discharge m ³ /s	H m	Discharge m ³ /s	H m	Discharge m ³ /s	
Bottom of Forebay	344.05	145.08	0										
	344.10	160.97	8										
	344.20	193.89	25										
	344.30	228.34	47										
	344.40	264.32	71										
Bottom Wet Cell	344.50	2822.46	225										
	344.60	2980.10	516										
	344.70	3141.00	822										
	344.80	3305.17	1144										
	344.90	3472.60	1483										
Limits of Sediment Storage	345.00	3643.30	1839										
	345.10	3817.26	2212										
	345.20	3994.49	2602										
	345.30	4174.99	3011										
	345.40	4358.75	3437										
Top Perm. Pool	345.50	4599.02	3885	0									0.0000
25mm event (345.82 m)	345.60	4798.82	4355	470	0.03	0.008							0.0077
	345.70	4998.72	4845	960	0.13	0.017							0.0172
	345.80	5261.36	5358	1473	0.23	0.023							0.0230
	345.90	5428.38	5893	2007	0.32	0.028	0.00	0.000	0.03	0.00			0.0277
	346.00	5596.86	6444	2559	0.43	0.032	0.10	0.015	0.13	0.00			0.0500
	346.10	5766.78	7012	3127	0.53	0.035	0.20	0.059	0.23	0.01			0.0994
	346.20	5938.14	7597	3712	0.63	0.038	0.30	0.121	0.33	0.01			0.1656
	346.30	6110.96	8200	4314	0.73	0.041	0.40	0.197	0.43	0.01			0.2457
	346.40	6285.22	8820	4934	0.82	0.044	0.50	0.391	0.53	0.01			0.4431
	346.50	6491.19	9458	5573	0.93	0.047	0.60	0.478	0.63	0.01			0.5344
	346.60	6710.17	10118	6233	1.03	0.049	0.70	0.552	0.73	0.01	0.050	0.093	0.7050
	346.70	6949.65	10801	6916	1.13	0.051	0.80	0.618	0.83	0.01	0.150	0.485	1.1650
	346.80	7196.32	11509	7623	1.23	0.054	0.90	0.677	0.93	0.01	0.250	1.044	1.7855
	346.90	7445.50	12241	8355	1.33	0.056	1.00	0.731	1.03	0.01	0.350	1.729	2.5277
Top of Pond	347.00	7698.77	12998	9113	1.43	0.058	1.10	0.781	1.13	0.01	0.450	2.521	3.3725

SWM Facility - Sediment Forebay Sizing

Based on MOEE SWMP Planning & Design Manual

Length Based on Settling Velocity

$$L = \sqrt{\frac{r Q_p}{v_s}}$$

$$L = 20.49 \text{ m}$$

r : 1 = length to width ratio

Q_p = peak SWM outflow during quality storm (25mm storm)

v_s = settling velocity for 0.15 mm particles (m/s)

$$r = 3$$

$$Q_p = 0.0420$$

$$v_s = 0.0003$$

Dispersion Length

$$L_D = \frac{8 Q}{d v_f}$$

$$L_D = 22.78 \text{ m}$$

Q = Inlet pipe to SWMF - 1200mm @ 0.30% (m³/s)

d = depth of perm pool in forebay (m)

v_f = desired vel in forebay (m/s)

$$Q = 2.13542$$

$$d = 1.5$$

$$v_f = 0.5$$

Check Scour Velocity

$$v = Q/A$$

$$v = 0.100 \text{ m/s}$$

b = bottom width (avg) of forebay (m)

Q = inlet flow (m³/s)

A = cross-sectional area (m²)

Target velocity = 0.15 m/s

$$b = 10$$

$$Q = 2.13542$$

$$A = 21.25$$

$$V_{\text{targ}} = 0.15$$

Therefore, **Velocity Target Satisfied**

Required Forebay Length = 22.78 m

Proposed SWM Facility - Drawdown Calculations

Pond drawdown time can be estimated using Equation 4.10
(MOEE SWMP Planning & Design Manual)

$$t = \frac{2A_p}{CA_o(2g)^{0.5}} (h_1^{0.5} - h_2^{0.5})$$

t = drawdown time in seconds	=	to be calculated
Ap = surface area of the pond (m ²)	=	5386 (Avg. Surface Area between h ₁ & h ₂)
C = discharge coefficient	=	0.62
D = diameter of controlling orifice (m)	=	0.150
Ao = cross-sectional area of orifice (m ²)	=	0.01767
g = acceleration due to gravity (m/s ²)	=	9.81
Orifice invert elevation (m)	=	345.500 (Permanent Pool Elev.)
Orifice centreline elevation (m)	=	345.575
Extended detention elevation (m)	=	345.820 (modelled max. depth at 25 mm event)
h ₁ = starting water level above orifice (m)	=	0.2450
h ₂ = ending water level above orifice (m)	=	0.00

t = 109866.5 seconds =

30.5 hours

Dry Pond MECP Calculations

Areas Contributing to SWM Pond for MECP Water Quality		
Sub-Catchment ID	Area (ha)	Percent Impervious (%)
203	0.47	35
204	1.42	70
210	2.89	35
213	0.28	70
TOTAL	5.17	47.3

SWM Pond		
	Required protection level:	Basic
	Contributing drainage area:	5.17 ha
	Impervious level:	47.3 %
Total required water quality storage volume per hectare:		124 m³/ha
	Required Storage Volume:	642 m³
	Provided Storage Volume:	1,597 m³

MECP SWM Design Manual Table 3.2					
Protection Level	SWMP Type	Storage Volume (m³/ha) for Impervious Level			
		35%	55%	70%	85%
<i>Enhanced</i> (80% long-term S.S. removal)	Infiltration	25	30	35	40
	Wetlands	80	105	120	140
	Hybrid Wet Pond/Wetland	110	150	175	195
	Wet Pond	140	190	225	250
<i>Normal</i> (70% long-term S.S. removal)	Infiltration	20	20	25	30
	Wetlands	60	70	80	90
	Hybrid Wet Pond/Wetland	75	90	105	120
	Wet Pond	90	110	130	150
<i>Basic</i> (60% long-term S.S. removal)	Infiltration	20	20	20	20
	Wetlands	60	60	60	60
	Hybrid Wet Pond/Wetland	60	70	75	80
	Wet Pond	60	75	85	95
	Dry Pond (Continuous Flow)	90	150	200	240

STAGE-STORAGE-DISCHARGE CALCULATIONS FOR PROPOSED DRY POND FACILITY

Outlet Device No. 1 (Quality & Erosion)

Type: Circular Orifice
Diameter (mm) 75
Area (m²) 0.00442
Invert Elev. (m) 344.55
C/L Elev. (m) 344.59
Disch. Coeff. (C_d) 0.8
Discharge (Q) = C_d A (2 g H)^{0.5}
Number of Orifices: 1

Outlet Device No. 2 (Quantity)

Type: Circular Orifice
Diameter (mm) 0
Area (m²) 0.00000
Invert Elev. (m) 0.00
C/L Elev. (m) 0.00
Disch. Coeff. (C_d) 1
Discharge (Q) = C_d A (2 g H)^{0.5}
Number of Orifices: 1
Spill into pipe elev. (m) 0.00

Outlet Device No. 3

Type:
Diameter (mm) 0
Area (m²) 0.00000
Invert Elev. (m) 0.00
C/L Elev. (m) 0.00
Disch. Coeff. (C_d) 0
Discharge (Q) = C_d A (2 g H)^{0.5}
Number of Orifices: 0

Outlet No. 4 (Quantity)

Type: Broad crested overflow weir
Sill Elevation (m) 346.85
Length (m) 5.0
Discharge (Q) = 1.67 L H^{1.5}

	SWM Pond Volumes				Outlet No. 1		Outlet No. 2		Outlet No. 3		Outlet No. 4		Total Discharge m ³ /s
	Elevation m	Area m ²	Incremental Volume m ³	Cumulative Volume m ³	H m	Discharge m ³ /s	H m	Discharge m ³ /s	H m	Discharge m ³ /s	H m	Discharge m ³ /s	
Bottom of Pond	344.55	487	0	0									0.0000
	344.65	547	52	52	0.06	0.004							0.0039
	344.75	604	58	109	0.16	0.006							0.0063
	344.85	661	63	172	0.26	0.008							0.0080
	344.95	720	69	242	0.36	0.009							0.0094
	345.05	780	75	317	0.46	0.011							0.0106
	345.15	842	81	398	0.56	0.012							0.0117
	345.25	905	87	485	0.66	0.013							0.0127
	345.35	970	94	579	0.76	0.014							0.0137
	345.45	1036	100	679	0.86	0.015							0.0145
	345.55	1106	107	786	0.96	0.015							0.0154
	345.65	1182	114	901	1.06	0.016							0.0161
	345.75	1262	122	1023	1.16	0.017							0.0169
	345.85	1347	130	1153	1.26	0.018							0.0176
	345.95	1434	139	1292	1.36	0.018							0.0183
	346.05	1525	148	1440	1.46	0.019							0.0189
Top of Pond	346.15	1620	157	1597	1.56	0.020							0.0196

Proposed Dry Pond- Drawdown Calculations

Pond drawdown time can be estimated using Equation 4.10
(MOEE SWMP Planning & Design Manual)

$$t = \frac{2 A_p}{C A_o (2g)^{0.5}} (h_1^{0.5} - h_2^{0.5})$$

t = drawdown time in seconds	=	to be calculated
Ap = surface area of the pond (m ²)	=	612 (Avg. Surface Area between h ₁ & h ₂)
C = discharge coefficient	=	0.62
D = diameter of controlling orifice (m)	=	0.075
Ao = cross-sectional area of orifice (m ²)	=	0.00442
g = acceleration due to gravity (m/s ²)	=	9.81
Orifice invert elevation (m)	=	344.550 (Permanent Pool Elev.)
Orifice centreline elevation (m)	=	344.588
Extended detention elevation (m)	=	344.970 (modelled max. depth at 25 mm event)
h ₁ = starting water level above orifice (m)	=	0.3825
h ₂ = ending water level above orifice (m)	=	0.00

t = 95770.97 seconds =

26.6 hours

Northeast Dry Pond and OGS Unit Treatment Train

The drainage area serviced by the proposed northeast dry pond is too small for the implementation of a wet pond facility for quality control. Water quality will be achieved through a treatment train process utilizing an inline oil/grit unit that will outlet to the dry pond that will provide extended detention and release of the MOE water quality volume. A continuous flow dry pond is capable of achieving 60% annual TSS removal. The implementation of a Hydrostorm HS-8 unit (see below) will achieve 59% annual TSS removal based on City of Kitchener rainfall and the ETV particle size distribution. The overall TSS removal for the oil/grit unit and dry pond SWM facility in series can be determined using the equation below:

$$R = A + B - [(A \times B) / 100]$$

Where:

R = Total TSS Removal Rate

A = TSS Removal Rate of the First or Upstream BMP (**Oil/grit unit = 59%**)

B = TSS Removal Rate of the Second or Downstream BMP (**Dry Pond = 60%**)

Source: New Jersey Stormwater Best Management Practices Manual (February 2004)

Total TSS Removal = 83%

Therefore, the use of the oil/grit unit and dry pond in series will results in an annual TSS removal that exceeds the minimum 80% required for Enhanced water quality protection.

Hydroworks Hydrodynamic Separator Sizing Program - HydroStorm

File Product Units CAD Video Help

General Dimensions Rainfall Site TSS PSD TSS Loading Quantity Storage By-Pass Custom CAD Video Other

Site Parameters
Area (ha) 5.17
Imperviousness (%) 48

Units
☐ U.S.
☒ Metric

Rainfall Station
Kitchener / Waterloo Ontario
1998 To 2018 Rainfall Timestep = 15 min.

Project Title (2 lines)
OGS unit upstream of Northeast Dry Pond SWMF
Treatment Train

ETV Lab Testing Results ☐ Post Treatment Recharge

Outlet Pipe
Diam. (mm) 525 Peak Design Flow (m3/s)
Slope (%) .5

HydroStorm Annual Sizing Results

Model #	Qlow (m3/s)	Qtot (m3/s)	Flow Capture (%)	TSS Removal (%)
Unavailable	.029	.304	86 %	23 %
HS 4	.051	.304	92 %	32 %
HS 5	.064	.304	94 %	43 %
HS 6	.077	.304	95 %	50 %
Unavailable	.108	.304	97 %	55 %
HS 8	.143	.304	98 %	59 %
HS 10	.201	.304	99 %	67 %
HS 12	.261	.304	100 %	73 %

Particle Size Distribution

Size (um)	%	SG
1	5	2.65
4	5	2.65
6	5	2.65
7	5	2.65
18	15	2.65
45	10	2.65
70	5	2.65
90	10	2.65
125	15	2.65
200	15	2.65

Note: Results vary significantly based on particle size distribution

Simulate

PCSWMM OUTPUT FILES
PRE- and POST-DEVELOPMENT

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

Element Count

Number of rain gages 8
 Number of subcatchments ... 4
 Number of nodes 2
 Number of links 0
 Number of pollutants 0
 Number of land uses 0

Raingage Summary

Name	Data Source	Data Type	Recording Interval
Chicago_3h_100-Year	Chicago_3h_100-Year	INTENSITY	5 min.
Chicago_3h_10-Year	Chicago_3h_10-Year	INTENSITY	5 min.
Chicago_3h_25-Year	Chicago_3h_25-Year	INTENSITY	5 min.
Chicago_3h_2-Year	Chicago_3h_2-Year	INTENSITY	5 min.
Chicago_3h_50-Year	Chicago_3h_50-Year	INTENSITY	5 min.
Chicago_3h_5-Year	Chicago_3h_5-Year	INTENSITY	5 min.
Chicago_4h_12.5-mm	Chicago_4h_12.5-mm	INTENSITY	5 min.
Chicago_4h_25-mm	Chicago_4h_25-mm	INTENSITY	5 min.

Subcatchment Summary

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
100	4.09	681.67	35.00	2.5000	Chicago_4h_25-mm	Hawksville
101	11.20	373.33	35.00	1.4000	Chicago_4h_25-mm	Woodlot
102	0.29	58.00	35.00	4.8000	Chicago_4h_25-mm	Woodlot
103	5.16	344.00	35.00	2.0000	Chicago_4h_25-mm	Woodlot

Node Summary

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
Hawksville	OUTFALL	0.00	0.00	0.0	
Woodlot	OUTFALL	0.00	0.00	0.0	

Analysis Options

Flow Units CMS
 Process Models:
 Rainfall/Runoff YES
 RDII NO
 Snowmelt NO
 Groundwater NO
 Flow Routing NO
 Water Quality NO
 Infiltration Method GREEN_AMPT
 Surcharge Method EXTRAN
 Starting Date 04/14/2025 00:00:00
 Ending Date 04/14/2025 16:00:00

2023-0849-10: Pre-Dev 25mm

Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00

*****	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
*****	-----	-----
Total Precipitation	0.519	25.042
Evaporation Loss	0.000	0.000
Infiltration Loss	0.338	16.277
Surface Runoff	0.172	8.313
Final Storage	0.011	0.527
Continuity Error (%)	-0.300	

*****	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
*****	-----	-----
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.172	1.724
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.172	1.724
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

Subcatchment Runoff Summary

-----	Total	Total	Total	Total	Imperv	Perv	Total	Total	Peak	Runoff
Subcatchment	Precip	Runon	Evap	Infil	Runoff	Runoff	Runoff	Runoff	Runoff	Coeff
-----	mm	mm	mm	mm	mm	mm	mm	10^6 ltr	CMS	
100	25.04	0.00	0.00	16.28	8.29	0.00	8.29	0.34	0.30	0.331
101	25.04	0.00	0.00	16.28	8.32	0.00	8.32	0.93	0.58	0.332
102	25.04	0.00	0.00	16.28	8.27	0.00	8.27	0.02	0.02	0.330
103	25.04	0.00	0.00	16.28	8.33	0.00	8.33	0.43	0.34	0.332

Analysis begun on: Fri Apr 25 09:28:00 2025
Analysis ended on: Fri Apr 25 09:28:00 2025
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

Element Count

Number of rain gages 8
 Number of subcatchments ... 4
 Number of nodes 2
 Number of links 0
 Number of pollutants 0
 Number of land uses 0

Raingage Summary

Name	Data Source	Data Type	Recording Interval
Chicago_3h_100-Year	Chicago_3h_100-Year	INTENSITY	5 min.
Chicago_3h_10-Year	Chicago_3h_10-Year	INTENSITY	5 min.
Chicago_3h_25-Year	Chicago_3h_25-Year	INTENSITY	5 min.
Chicago_3h_2-Year	Chicago_3h_2-Year	INTENSITY	5 min.
Chicago_3h_50-Year	Chicago_3h_50-Year	INTENSITY	5 min.
Chicago_3h_5-Year	Chicago_3h_5-Year	INTENSITY	5 min.
Chicago_4h_12.5-mm	Chicago_4h_12.5-mm	INTENSITY	5 min.
Chicago_4h_25-mm	Chicago_4h_25-mm	INTENSITY	5 min.

Subcatchment Summary

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
100	4.09	681.67	35.00	2.5000	Chicago_3h_2-Year	Hawksville
101	11.20	373.33	35.00	1.4000	Chicago_3h_2-Year	Woodlot
102	0.29	58.00	35.00	4.8000	Chicago_3h_2-Year	Woodlot
103	5.16	344.00	35.00	2.0000	Chicago_3h_2-Year	Woodlot

Node Summary

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
Hawksville	OUTFALL	0.00	0.00	0.0	
Woodlot	OUTFALL	0.00	0.00	0.0	

Analysis Options

Flow Units CMS
 Process Models:
 Rainfall/Runoff YES
 RDII NO
 Snowmelt NO
 Groundwater NO
 Flow Routing NO
 Water Quality NO
 Infiltration Method GREEN_AMPT
 Surcharge Method EXTRAN
 Starting Date 04/14/2025 00:00:00
 Ending Date 04/14/2025 15:00:00

2023-0849-10: Pre-Dev 2-Year

Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00

*****	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
*****	-----	-----
Total Precipitation	0.711	34.277
Evaporation Loss	0.000	0.000
Infiltration Loss	0.460	22.202
Surface Runoff	0.242	11.658
Final Storage	0.011	0.527
Continuity Error (%)	-0.321	

*****	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
*****	-----	-----
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.242	2.418
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.242	2.418
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

Subcatchment Runoff Summary

-----	Total	Total	Total	Total	Imperv	Perv	Total	Total	Peak	Runoff
Subcatchment	Precip	Runon	Evap	Infil	Runoff	Runoff	Runoff	Runoff	Runoff	Coeff
-----	mm	mm	mm	mm	mm	mm	mm	10^6 ltr	CMS	
100	34.28	0.00	0.00	22.10	11.52	0.21	11.73	0.48	0.44	0.342
101	34.28	0.00	0.00	22.25	11.59	0.04	11.62	1.30	0.95	0.339
102	34.28	0.00	0.00	22.00	11.50	0.32	11.82	0.03	0.03	0.345
103	34.28	0.00	0.00	22.20	11.58	0.08	11.67	0.60	0.51	0.340

Analysis begun on: Fri Apr 25 09:27:59 2025
Analysis ended on: Fri Apr 25 09:28:00 2025
Total elapsed time: 00:00:01

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

Element Count

Number of rain gages 8
 Number of subcatchments ... 4
 Number of nodes 2
 Number of links 0
 Number of pollutants 0
 Number of land uses 0

Raingage Summary

Name	Data Source	Data Type	Recording Interval
Chicago_3h_100-Year	Chicago_3h_100-Year	INTENSITY	5 min.
Chicago_3h_10-Year	Chicago_3h_10-Year	INTENSITY	5 min.
Chicago_3h_25-Year	Chicago_3h_25-Year	INTENSITY	5 min.
Chicago_3h_2-Year	Chicago_3h_2-Year	INTENSITY	5 min.
Chicago_3h_50-Year	Chicago_3h_50-Year	INTENSITY	5 min.
Chicago_3h_5-Year	Chicago_3h_5-Year	INTENSITY	5 min.
Chicago_4h_12.5-mm	Chicago_4h_12.5-mm	INTENSITY	5 min.
Chicago_4h_25-mm	Chicago_4h_25-mm	INTENSITY	5 min.

Subcatchment Summary

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
100	4.09	681.67	35.00	2.5000	Chicago_3h_5-Year	Hawksville
101	11.20	373.33	35.00	1.4000	Chicago_3h_5-Year	Woodlot
102	0.29	58.00	35.00	4.8000	Chicago_3h_5-Year	Woodlot
103	5.16	344.00	35.00	2.0000	Chicago_3h_5-Year	Woodlot

Node Summary

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
Hawksville	OUTFALL	0.00	0.00	0.0	
Woodlot	OUTFALL	0.00	0.00	0.0	

Analysis Options

Flow Units CMS
 Process Models:
 Rainfall/Runoff YES
 RDII NO
 Snowmelt NO
 Groundwater NO
 Flow Routing NO
 Water Quality NO
 Infiltration Method GREEN_AMPT
 Surcharge Method EXTRAN
 Starting Date 04/14/2025 00:00:00
 Ending Date 04/14/2025 15:00:00

2023-0849-10: Pre-Dev 5-Year

Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00

*****	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
*****	-----	-----
Total Precipitation	0.980	47.265
Evaporation Loss	0.000	0.000
Infiltration Loss	0.596	28.723
Surface Runoff	0.377	18.185
Final Storage	0.011	0.527
Continuity Error (%)	-0.361	

*****	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
*****	-----	-----
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.377	3.772
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.377	3.772
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

Subcatchment Runoff Summary

-----	Total	Total	Total	Total	Imperv	Perv	Total	Total	Peak	Runoff
Subcatchment	Precip	Runon	Evap	Infil	Runoff	Runoff	Runoff	Runoff	Runoff	Coeff
-----	mm	mm	mm	mm	mm	mm	mm	10^6 ltr	CMS	
100	47.26	0.00	0.00	27.02	16.07	3.85	19.92	0.81	0.60	0.422
101	47.26	0.00	0.00	29.51	16.15	1.23	17.38	1.95	1.31	0.368
102	47.26	0.00	0.00	26.32	16.05	4.64	20.69	0.06	0.04	0.438
103	47.26	0.00	0.00	28.50	16.13	2.28	18.41	0.95	0.69	0.389

Analysis begun on: Fri Apr 25 09:28:00 2025
Analysis ended on: Fri Apr 25 09:28:00 2025
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

Element Count

Number of rain gages 8
 Number of subcatchments ... 4
 Number of nodes 2
 Number of links 0
 Number of pollutants 0
 Number of land uses 0

Raingage Summary

Name	Data Source	Data Type	Recording Interval
Chicago_3h_100-Year	Chicago_3h_100-Year	INTENSITY	5 min.
Chicago_3h_10-Year	Chicago_3h_10-Year	INTENSITY	5 min.
Chicago_3h_25-Year	Chicago_3h_25-Year	INTENSITY	5 min.
Chicago_3h_2-Year	Chicago_3h_2-Year	INTENSITY	5 min.
Chicago_3h_50-Year	Chicago_3h_50-Year	INTENSITY	5 min.
Chicago_3h_5-Year	Chicago_3h_5-Year	INTENSITY	5 min.
Chicago_4h_12.5-mm	Chicago_4h_12.5-mm	INTENSITY	5 min.
Chicago_4h_25-mm	Chicago_4h_25-mm	INTENSITY	5 min.

Subcatchment Summary

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
100	4.09	681.67	35.00	2.5000	Chicago_3h_10-Year	Hawksville
101	11.20	373.33	35.00	1.4000	Chicago_3h_10-Year	Woodlot
102	0.29	58.00	35.00	4.8000	Chicago_3h_10-Year	Woodlot
103	5.16	344.00	35.00	2.0000	Chicago_3h_10-Year	Woodlot

Node Summary

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
Hawksville	OUTFALL	0.00	0.00	0.0	
Woodlot	OUTFALL	0.00	0.00	0.0	

Analysis Options

Flow Units CMS
 Process Models:
 Rainfall/Runoff YES
 RDII NO
 Snowmelt NO
 Groundwater NO
 Flow Routing NO
 Water Quality NO
 Infiltration Method GREEN_AMPT
 Surcharge Method EXTRAN
 Starting Date 04/14/2025 00:00:00
 Ending Date 04/14/2025 15:00:00

2023-0849-10: Pre-Dev 10-Year

Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00

*****	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
*****	-----	-----
Total Precipitation	1.167	56.290
Evaporation Loss	0.000	0.000
Infiltration Loss	0.659	31.778
Surface Runoff	0.502	24.221
Final Storage	0.011	0.527
Continuity Error (%)	-0.419	

*****	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
*****	-----	-----
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.502	5.024
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.502	5.024
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

Subcatchment Runoff Summary

-----	Total	Total	Total	Total	Imperv	Perv	Total	Total	Peak	Runoff
Subcatchment	Precip	Runon	Evap	Infil	Runoff	Runoff	Runoff	Runoff	Runoff	Coeff
-----	mm	mm	mm	mm	mm	mm	mm	10^6 ltr	CMS	
100	56.29	0.00	0.00	28.81	19.22	8.04	27.26	1.12	0.79	0.484
101	56.29	0.00	0.00	33.24	19.33	3.40	22.73	2.55	1.67	0.404
102	56.29	0.00	0.00	27.88	19.20	9.12	28.32	0.08	0.06	0.503
103	56.29	0.00	0.00	31.18	19.30	5.51	24.81	1.28	0.88	0.441

Analysis begun on: Fri Apr 25 09:27:59 2025
Analysis ended on: Fri Apr 25 09:27:59 2025
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

Element Count

Number of rain gages 8
 Number of subcatchments ... 4
 Number of nodes 2
 Number of links 0
 Number of pollutants 0
 Number of land uses 0

Raingage Summary

Name	Data Source	Data Type	Recording Interval
Chicago_3h_100-Year	Chicago_3h_100-Year	INTENSITY	5 min.
Chicago_3h_10-Year	Chicago_3h_10-Year	INTENSITY	5 min.
Chicago_3h_25-Year	Chicago_3h_25-Year	INTENSITY	5 min.
Chicago_3h_2-Year	Chicago_3h_2-Year	INTENSITY	5 min.
Chicago_3h_50-Year	Chicago_3h_50-Year	INTENSITY	5 min.
Chicago_3h_5-Year	Chicago_3h_5-Year	INTENSITY	5 min.
Chicago_4h_12.5-mm	Chicago_4h_12.5-mm	INTENSITY	5 min.
Chicago_4h_25-mm	Chicago_4h_25-mm	INTENSITY	5 min.

Subcatchment Summary

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
100	4.09	681.67	35.00	2.5000	Chicago_3h_25-Year	Hawksville
101	11.20	373.33	35.00	1.4000	Chicago_3h_25-Year	Woodlot
102	0.29	58.00	35.00	4.8000	Chicago_3h_25-Year	Woodlot
103	5.16	344.00	35.00	2.0000	Chicago_3h_25-Year	Woodlot

Node Summary

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
Hawksville	OUTFALL	0.00	0.00	0.0	
Woodlot	OUTFALL	0.00	0.00	0.0	

Analysis Options

Flow Units CMS
 Process Models:
 Rainfall/Runoff YES
 RDII NO
 Snowmelt NO
 Groundwater NO
 Flow Routing NO
 Water Quality NO
 Infiltration Method GREEN_AMPT
 Surcharge Method EXTRAN
 Starting Date 04/14/2025 00:00:00
 Ending Date 04/14/2025 15:00:00

2023-0849-10: Pre-Dev 25-Year

Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00

*****	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
*****	-----	-----
Total Precipitation	1.416	68.266
Evaporation Loss	0.000	0.000
Infiltration Loss	0.725	34.953
Surface Runoff	0.686	33.064
Final Storage	0.011	0.527
Continuity Error (%)	-0.406	

*****	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
*****	-----	-----
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.686	6.858
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.686	6.858
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

Subcatchment Runoff Summary

-----	Total	Total	Total	Total	Imperv	Perv	Total	Total	Peak	Runoff
Subcatchment	Precip	Runon	Evap	Infil	Runoff	Runoff	Runoff	Runoff	Runoff	Coeff
-----	mm	mm	mm	mm	mm	mm	mm	10^6 ltr	CMS	
100	68.27	0.00	0.00	30.87	23.42	13.85	37.27	1.52	0.98	0.546
101	68.27	0.00	0.00	37.06	23.53	7.37	30.90	3.46	1.97	0.453
102	68.27	0.00	0.00	29.85	23.43	15.05	38.48	0.11	0.08	0.564
103	68.27	0.00	0.00	33.89	23.49	10.63	34.12	1.76	1.05	0.500

Analysis begun on: Fri Apr 25 09:27:59 2025
Analysis ended on: Fri Apr 25 09:27:59 2025
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

Element Count

Number of rain gages 8
 Number of subcatchments ... 4
 Number of nodes 2
 Number of links 0
 Number of pollutants 0
 Number of land uses 0

Raingage Summary

Name	Data Source	Data Type	Recording Interval
Chicago_3h_100-Year	Chicago_3h_100-Year	INTENSITY	5 min.
Chicago_3h_10-Year	Chicago_3h_10-Year	INTENSITY	5 min.
Chicago_3h_25-Year	Chicago_3h_25-Year	INTENSITY	5 min.
Chicago_3h_2-Year	Chicago_3h_2-Year	INTENSITY	5 min.
Chicago_3h_50-Year	Chicago_3h_50-Year	INTENSITY	5 min.
Chicago_3h_5-Year	Chicago_3h_5-Year	INTENSITY	5 min.
Chicago_4h_12.5-mm	Chicago_4h_12.5-mm	INTENSITY	5 min.
Chicago_4h_25-mm	Chicago_4h_25-mm	INTENSITY	5 min.

Subcatchment Summary

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
100	4.09	681.67	35.00	2.5000	Chicago_3h_50-Year	Hawksville
101	11.20	373.33	35.00	1.4000	Chicago_3h_50-Year	Woodlot
102	0.29	58.00	35.00	4.8000	Chicago_3h_50-Year	Woodlot
103	5.16	344.00	35.00	2.0000	Chicago_3h_50-Year	Woodlot

Node Summary

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
Hawksville	OUTFALL	0.00	0.00	0.0	
Woodlot	OUTFALL	0.00	0.00	0.0	

Analysis Options

Flow Units CMS
 Process Models:
 Rainfall/Runoff YES
 RDII NO
 Snowmelt NO
 Groundwater NO
 Flow Routing NO
 Water Quality NO
 Infiltration Method GREEN_AMPT
 Surcharge Method EXTRAN
 Starting Date 04/14/2025 00:00:00
 Ending Date 04/14/2025 15:00:00

2023-0849-10: Pre-Dev 50-Year

Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00

*****	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
*****	-----	-----
Total Precipitation	1.610	77.648
Evaporation Loss	0.000	0.000
Infiltration Loss	0.765	36.886
Surface Runoff	0.841	40.542
Final Storage	0.011	0.527
Continuity Error (%)	-0.396	

*****	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
*****	-----	-----
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.841	8.409
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.841	8.409
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

Subcatchment Runoff Summary

-----	Total	Total	Total	Total	Imperv	Perv	Total	Total	Peak	Runoff
Subcatchment	Precip	Runon	Evap	Infil	Runoff	Runoff	Runoff	Runoff	Runoff	Coeff
-----	mm	mm	mm	mm	mm	mm	mm	10^6 ltr	CMS	
100	77.65	0.00	0.00	32.14	26.70	18.72	45.42	1.86	1.19	0.585
101	77.65	0.00	0.00	39.40	26.83	11.14	37.97	4.25	2.29	0.489
102	77.65	0.00	0.00	31.06	26.69	19.98	46.67	0.14	0.10	0.601
103	77.65	0.00	0.00	35.51	26.78	15.13	41.91	2.16	1.23	0.540

Analysis begun on: Fri Apr 25 09:28:00 2025
Analysis ended on: Fri Apr 25 09:28:00 2025
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

Element Count

Number of rain gages 8
 Number of subcatchments ... 4
 Number of nodes 2
 Number of links 0
 Number of pollutants 0
 Number of land uses 0

Raingage Summary

Name	Data Source	Data Type	Recording Interval
Chicago_3h_100-Year	Chicago_3h_100-Year	INTENSITY	5 min.
Chicago_3h_10-Year	Chicago_3h_10-Year	INTENSITY	5 min.
Chicago_3h_25-Year	Chicago_3h_25-Year	INTENSITY	5 min.
Chicago_3h_2-Year	Chicago_3h_2-Year	INTENSITY	5 min.
Chicago_3h_50-Year	Chicago_3h_50-Year	INTENSITY	5 min.
Chicago_3h_5-Year	Chicago_3h_5-Year	INTENSITY	5 min.
Chicago_4h_12.5-mm	Chicago_4h_12.5-mm	INTENSITY	5 min.
Chicago_4h_25-mm	Chicago_4h_25-mm	INTENSITY	5 min.

Subcatchment Summary

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
100	4.09	681.67	35.00	2.5000	Chicago_3h_100-Year	Hawksville
101	11.20	373.33	35.00	1.4000	Chicago_3h_100-Year	Woodlot
102	0.29	58.00	35.00	4.8000	Chicago_3h_100-Year	Woodlot
103	5.16	344.00	35.00	2.0000	Chicago_3h_100-Year	Woodlot

Node Summary

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
Hawksville	OUTFALL	0.00	0.00	0.0	
Woodlot	OUTFALL	0.00	0.00	0.0	

Analysis Options

Flow Units CMS
 Process Models:
 Rainfall/Runoff YES
 RDII NO
 Snowmelt NO
 Groundwater NO
 Flow Routing NO
 Water Quality NO
 Infiltration Method GREEN_AMPT
 Surcharge Method EXTRAN
 Starting Date 04/14/2025 00:00:00
 Ending Date 04/14/2025 15:00:00

2023-0849-10: Pre-Dev 100-Year

Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00

*****	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
*****	-----	-----
Total Precipitation	1.806	87.079
Evaporation Loss	0.000	0.000
Infiltration Loss	0.797	38.427
Surface Runoff	1.005	48.462
Final Storage	0.011	0.527
Continuity Error (%)	-0.386	

*****	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
*****	-----	-----
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	1.005	10.051
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	1.005	10.051
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

Subcatchment Runoff Summary

-----	Total	Total	Total	Total	Imperv	Perv	Total	Total	Peak	Runoff
Subcatchment	Precip	Runon	Evap	Infil	Runoff	Runoff	Runoff	Runoff	Runoff	Coeff
-----	mm	mm	mm	mm	mm	mm	mm	10^6 ltr	CMS	
100	87.08	0.00	0.00	33.20	30.00	23.84	53.83	2.20	1.40	0.618
101	87.08	0.00	0.00	41.26	30.14	15.43	45.58	5.10	2.61	0.523
102	87.08	0.00	0.00	32.11	29.98	25.11	55.09	0.16	0.11	0.633
103	87.08	0.00	0.00	36.79	30.08	20.01	50.09	2.58	1.41	0.575

Analysis begun on: Fri Apr 25 09:27:59 2025
Analysis ended on: Fri Apr 25 09:27:59 2025
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

WARNING 10: crest elevation raised to downstream invert for regulator Link Emerg_Over

Element Count

Number of rain gages 8
 Number of subcatchments ... 13
 Number of nodes 6
 Number of links 3
 Number of pollutants 0
 Number of land uses 0

Raingage Summary

Name	Data Source	Data Type	Recording Interval
Chicago_3h_100-Year	Chicago_3h_100-Year	INTENSITY	5 min.
Chicago_3h_10-Year	Chicago_3h_10-Year	INTENSITY	5 min.
Chicago_3h_25-Year	Chicago_3h_25-Year	INTENSITY	5 min.
Chicago_3h_2-Year	Chicago_3h_2-Year	INTENSITY	5 min.
Chicago_3h_50-Year	Chicago_3h_50-Year	INTENSITY	5 min.
Chicago_3h_5-Year	Chicago_3h_5-Year	INTENSITY	5 min.
Chicago_4h_12.5-mm	Chicago_4h_12.5-mm	INTENSITY	5 min.
Chicago_4h_25-mm	Chicago_4h_25-mm	INTENSITY	5 min.

Subcatchment Summary

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	8.59	350.00	70.00	2.0000	Chicago_4h_25-mm	SWM_POND
202	0.89	97.00	90.00	2.0000	Chicago_4h_25-mm	SWM_POND
203	0.47	50.00	35.00	2.0000	Chicago_4h_25-mm	Dry_Pond
204	1.53	60.00	70.00	2.0000	Chicago_4h_25-mm	Dry_Pond
205	1.39	40.00	76.00	2.0000	Chicago_4h_25-mm	HAWKESVILLE_RD
208	0.80	40.00	35.00	2.0000	Chicago_4h_25-mm	WOODLOT
209	1.18	50.00	35.00	2.0000	Chicago_4h_25-mm	SWM_POND
210	2.89	200.00	35.00	2.0000	Chicago_4h_25-mm	Dry_Pond
211	0.44	20.00	70.00	2.0000	Chicago_4h_25-mm	SWM_POND
212	0.57	20.00	70.00	2.0000	Chicago_4h_25-mm	SWM_POND
213	0.28	20.00	70.00	2.0000	Chicago_4h_25-mm	Dry_Pond
220	1.70	80.00	43.00	2.0000	Chicago_4h_25-mm	SWM_POND

Node Summary

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
HAWKESVILLE_RD	OUTFALL	0.00	0.00	0.0	
NORTHSIDE_DRIVE	OUTFALL	343.18	0.00	0.0	
WOODLOT	OUTFALL	347.00	0.00	0.0	
Dry_Pond	STORAGE	344.55	1.60	0.0	
SWM_POND	STORAGE	345.50	1.50	0.0	

Link Summary

2023-0849-10: Post-Dev 25mm

Name	From Node	To Node	Type	Length	%Slope Roughness
Emerg_Over	SWM_POND	WET_1	OUTLET		
OL1	Dry_Pond	WET_2	OUTLET		
OUT_Pond	SWM_POND	NORTHSIDE_DRIVE	OUTLET		

Cross Section Summary

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
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Street Summary

Street Street

Area:

0.0008	0.0030	0.0068	0.0120	0.0188
0.0270	0.0368	0.0480	0.0608	0.0750
0.0908	0.1081	0.1268	0.1471	0.1688
0.1921	0.2158	0.2396	0.2634	0.2871
0.3109	0.3347	0.3584	0.3822	0.4059
0.4297	0.4535	0.4772	0.5010	0.5248
0.5485	0.5723	0.5960	0.6198	0.6436
0.6673	0.6911	0.7149	0.7386	0.7624
0.7861	0.8099	0.8337	0.8574	0.8812
0.9050	0.9287	0.9525	0.9762	1.0000

Hrad:

0.0124	0.0248	0.0372	0.0495	0.0619
0.0743	0.0867	0.0991	0.1115	0.1238
0.1362	0.1486	0.1610	0.1734	0.1858
0.2002	0.2246	0.2491	0.2734	0.2977
0.3220	0.3462	0.3703	0.3944	0.4184
0.4423	0.4662	0.4900	0.5138	0.5375
0.5612	0.5848	0.6083	0.6318	0.6552
0.6786	0.7019	0.7252	0.7484	0.7715
0.7946	0.8177	0.8407	0.8636	0.8865
0.9093	0.9320	0.9547	0.9774	1.0000

Width:

0.0632	0.1263	0.1895	0.2526	0.3158
0.3789	0.4421	0.5053	0.5684	0.6316
0.6947	0.7579	0.8211	0.8842	0.9474
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Analysis Options

Flow Units CMS

Process Models:

Rainfall/Runoff YES
RDII NO
Snowmelt NO
Groundwater NO
Flow Routing YES
Ponding Allowed NO
Water Quality NO

Infiltration Method CURVE_NUMBER

2023-0849-10: Post-Dev 25mm

Flow Routing Method DYNWAVE
Surcharge Method EXTRAN
Starting Date 04/14/2025 00:00:00
Ending Date 04/14/2025 16:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00
Routing Time Step 5.00 sec
Variable Time Step YES
Maximum Trials 8
Number of Threads 1
Head Tolerance 0.001500 m

	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
*****	-----	-----
Total Precipitation	0.519	25.042
Evaporation Loss	0.000	0.000
Infiltration Loss	0.209	10.082
Surface Runoff	0.287	13.862
Final Storage	0.025	1.204
Continuity Error (%)	-0.421	

	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
*****	-----	-----
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.287	2.875
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.206	2.059
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.082	0.816
Continuity Error (%)	0.003	

Time-Step Critical Elements

None

Highest Flow Instability Indexes

All links are stable.

Most Frequent Nonconverging Nodes

Convergence obtained at all time steps.

Routing Time Step Summary

Minimum Time Step : 3.50 sec
Average Time Step : 5.00 sec
Maximum Time Step : 5.00 sec
% of Time in Steady State : 0.00

2023-0849-10: Post-Dev 25mm

Average Iterations per Step : 2.00
 % of Steps Not Converging : 0.00
 Time Step Frequencies :
 5.000 - 3.155 sec : 100.00 %
 3.155 - 1.991 sec : 0.00 %
 1.991 - 1.256 sec : 0.00 %
 1.256 - 0.792 sec : 0.00 %
 0.792 - 0.500 sec : 0.00 %

 Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201	25.04	0.00	0.00	8.01	15.75	0.00	15.75	1.30	0.53	0.629
202	25.04	0.00	0.00	2.50	20.96	0.00	20.96	0.19	0.13	0.837
203	25.04	0.00	0.00	16.28	8.11	0.00	8.11	0.04	0.04	0.324
204	25.04	0.00	0.00	7.51	16.29	0.00	16.29	0.24	0.20	0.651
205	25.04	0.00	0.00	6.01	17.67	0.00	17.67	0.25	0.22	0.706
207	25.04	0.00	0.00	11.77	12.26	0.00	12.26	0.03	0.03	0.489
208	25.04	0.00	0.00	16.28	8.10	0.00	8.10	0.06	0.05	0.324
209	25.04	0.00	0.00	16.28	8.11	0.00	8.11	0.10	0.09	0.324
210	25.04	0.00	0.00	16.28	8.15	0.00	8.15	0.24	0.18	0.326
211	25.04	0.00	0.00	7.51	16.21	0.00	16.21	0.06	0.06	0.647
212	25.04	0.00	0.00	2.50	20.86	0.00	20.86	0.15	0.13	0.833
213	25.04	0.00	0.00	7.51	16.21	0.00	16.21	0.06	0.05	0.647
220	25.04	0.00	0.00	14.27	10.00	0.00	10.00	0.17	0.15	0.399

 Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
HAWKESVILLE_RD	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
NORTHSIDE_DRIVE	OUTFALL	0.00	0.00	343.18	0 00:00	0.00
WOODLOT	OUTFALL	0.00	0.00	347.00	0 00:00	0.00
Dry_Pond	STORAGE	0.20	0.41	344.96	0 02:54	0.41
SWM_POND	STORAGE	0.23	0.32	345.82	0 04:08	0.32

 Node Inflow Summary

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
HAWKESVILLE_RD	OUTFALL	0.215	0.215	0 01:25	0.249	0.249	0.000
NORTHSIDE_DRIVE	OUTFALL	0.000	0.024	0 04:08	0	1.04	0.000
WET_1	OUTFALL	0.143	0.143	0 01:25	0.161	0.161	0.000
WET_2	OUTFALL	0.232	0.237	0 01:25	0.294	0.611	0.000
Dry_Pond	STORAGE	0.284	0.284	0 01:25	0.334	0.334	0.000
SWM_POND	STORAGE	0.945	0.945	0 01:25	1.84	1.84	0.004

Node Surcharge Summary

No nodes were surcharged.

Node Flooding Summary

No nodes were flooded.

Storage Volume Summary

Storage Unit	Average Volume 1000 m ³	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m ³	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
Dry_Pond	0.113	7.1	0.0	0.0	0.250	15.7	0 02:54	0.010
SWM_POND	1.097	12.0	0.0	0.0	1.568	17.2	0 04:08	0.024

Outfall Loading Summary

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10 ⁶ ltr
HAWKESVILLE_RD	30.53	0.014	0.215	0.249
NORTHSIDE_DRIVE	93.68	0.019	0.024	1.038
WOODLOT	94.25	0.011	0.380	0.772
System	61.00	0.056	0.600	2.059

Link Flow Summary

Link	Type	Maximum Flow CMS	Time of Max Occurrence days hr:min	Maximum Veloc m/sec	Max/ Full Flow	Max/ Full Depth
Emerg_Over	DUMMY	0.000	0 00:00			
OL1	DUMMY	0.010	0 02:54			
OUT_Pond	DUMMY	0.024	0 04:08			

Flow Classification Summary

Conduit	Adjusted /Actual Length	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
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2023-0849-10: Post-Dev 25mm

Conduit Surcharge Summary

No conduits were surcharged.

Analysis begun on: Thu Apr 24 21:28:26 2025
Analysis ended on: Thu Apr 24 21:28:27 2025
Total elapsed time: 00:00:01

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

WARNING 10: crest elevation raised to downstream invert for regulator Link Emerg_Over

Element Count

Number of rain gages 8
 Number of subcatchments ... 13
 Number of nodes 6
 Number of links 3
 Number of pollutants 0
 Number of land uses 0

Raingage Summary

Name	Data Source	Data Type	Recording Interval
Chicago_3h_100-Year	Chicago_3h_100-Year	INTENSITY	5 min.
Chicago_3h_10-Year	Chicago_3h_10-Year	INTENSITY	5 min.
Chicago_3h_25-Year	Chicago_3h_25-Year	INTENSITY	5 min.
Chicago_3h_2-Year	Chicago_3h_2-Year	INTENSITY	5 min.
Chicago_3h_50-Year	Chicago_3h_50-Year	INTENSITY	5 min.
Chicago_3h_5-Year	Chicago_3h_5-Year	INTENSITY	5 min.
Chicago_4h_12.5-mm	Chicago_4h_12.5-mm	INTENSITY	5 min.
Chicago_4h_25-mm	Chicago_4h_25-mm	INTENSITY	5 min.

Subcatchment Summary

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	8.59	350.00	70.00	2.0000	Chicago_3h_2-Year	SWM_POND
202	0.89	97.00	90.00	2.0000	Chicago_3h_2-Year	SWM_POND
203	0.47	50.00	35.00	2.0000	Chicago_3h_2-Year	Dry_Pond
204	1.53	60.00	70.00	2.0000	Chicago_3h_2-Year	Dry_Pond
205	1.39	40.00	76.00	2.0000	Chicago_3h_2-Year	HAWKESVILLE_RD
208	0.80	40.00	35.00	2.0000	Chicago_3h_2-Year	WOODLOT
209	1.18	50.00	35.00	2.0000	Chicago_3h_2-Year	SWM_POND
210	2.89	200.00	35.00	2.0000	Chicago_3h_2-Year	Dry_Pond
211	0.44	20.00	70.00	2.0000	Chicago_3h_2-Year	SWM_POND
212	0.57	20.00	70.00	2.0000	Chicago_3h_2-Year	SWM_POND
213	0.28	20.00	70.00	2.0000	Chicago_3h_2-Year	Dry_Pond
220	1.70	80.00	43.00	2.0000	Chicago_3h_2-Year	SWM_POND

Node Summary

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
HAWKESVILLE_RD	OUTFALL	0.00	0.00	0.0	
NORTHSIDE_DRIVE	OUTFALL	343.18	0.00	0.0	
WET_1	OUTFALL	347.00	0.00	0.0	
WET_2	OUTFALL	0.00	0.00	0.0	
Dry_Pond	STORAGE	344.55	1.60	0.0	
SWM_POND	STORAGE	345.50	1.50	0.0	

Link Summary

2023-0849-10: Post-Dev 2-Year

Name	From Node	To Node	Type	Length	%Slope Roughness
Emerg_Over	SWM_POND	WET_1	OUTLET		
OL1	Dry_Pond	WET_2	OUTLET		
OUT_Pond	SWM_POND	NORTHSIDE_DRIVE	OUTLET		

Cross Section Summary

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
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Street Summary

Street Street

Area:

0.0008	0.0030	0.0068	0.0120	0.0188
0.0270	0.0368	0.0480	0.0608	0.0750
0.0908	0.1081	0.1268	0.1471	0.1688
0.1921	0.2158	0.2396	0.2634	0.2871
0.3109	0.3347	0.3584	0.3822	0.4059
0.4297	0.4535	0.4772	0.5010	0.5248
0.5485	0.5723	0.5960	0.6198	0.6436
0.6673	0.6911	0.7149	0.7386	0.7624
0.7861	0.8099	0.8337	0.8574	0.8812
0.9050	0.9287	0.9525	0.9762	1.0000

Hrad:

0.0124	0.0248	0.0372	0.0495	0.0619
0.0743	0.0867	0.0991	0.1115	0.1238
0.1362	0.1486	0.1610	0.1734	0.1858
0.2002	0.2246	0.2491	0.2734	0.2977
0.3220	0.3462	0.3703	0.3944	0.4184
0.4423	0.4662	0.4900	0.5138	0.5375
0.5612	0.5848	0.6083	0.6318	0.6552
0.6786	0.7019	0.7252	0.7484	0.7715
0.7946	0.8177	0.8407	0.8636	0.8865
0.9093	0.9320	0.9547	0.9774	1.0000

Width:

0.0632	0.1263	0.1895	0.2526	0.3158
0.3789	0.4421	0.5053	0.5684	0.6316
0.6947	0.7579	0.8211	0.8842	0.9474
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Analysis Options

Flow Units CMS

Process Models:

Rainfall/Runoff YES
RDII NO
Snowmelt NO
Groundwater NO
Flow Routing YES
Ponding Allowed NO
Water Quality NO

Infiltration Method CURVE_NUMBER
 Flow Routing Method DYNWAVE
 Surcharge Method EXTRAN
 Starting Date 04/14/2025 00:00:00
 Ending Date 04/14/2025 15:00:00
 Antecedent Dry Days 0.0
 Report Time Step 00:01:00
 Wet Time Step 00:05:00
 Dry Time Step 00:05:00
 Routing Time Step 5.00 sec
 Variable Time Step YES
 Maximum Trials 8
 Number of Threads 1
 Head Tolerance 0.001500 m

	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
Total Precipitation	0.711	34.277
Evaporation Loss	0.000	0.000
Infiltration Loss	0.284	13.700
Surface Runoff	0.405	19.528
Final Storage	0.025	1.204
Continuity Error (%)	-0.454	

	Volume	Volume
Flow Routing Continuity	hectare-m	10 ⁶ ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.405	4.050
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.276	2.757
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.129	1.293
Continuity Error (%)	0.003	

 Time-Step Critical Elements

 None

 Highest Flow Instability Indexes

 All links are stable.

 Most Frequent Nonconverging Nodes

 Convergence obtained at all time steps.

 Routing Time Step Summary

 Minimum Time Step : 4.50 sec
 Average Time Step : 5.00 sec
 Maximum Time Step : 5.00 sec

2023-0849-10: Post-Dev 2-Year

% of Time in Steady State : 0.00
 Average Iterations per Step : 2.00
 % of Steps Not Converging : 0.00
 Time Step Frequencies :
 5.000 - 3.155 sec : 100.00 %
 3.155 - 1.991 sec : 0.00 %
 1.991 - 1.256 sec : 0.00 %
 1.256 - 0.792 sec : 0.00 %
 0.792 - 0.500 sec : 0.00 %

 Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201	34.28	0.00	0.00	10.94	22.09	0.03	22.11	1.83	0.90	0.645
202	34.28	0.00	0.00	3.35	29.36	0.08	29.44	0.26	0.21	0.859
203	34.28	0.00	0.00	22.08	11.35	0.22	11.57	0.06	0.06	0.338
204	34.28	0.00	0.00	10.14	22.79	0.17	22.96	0.33	0.30	0.670
205	34.28	0.00	0.00	8.05	24.70	0.20	24.91	0.35	0.32	0.727
208	34.28	0.00	0.00	22.04	11.34	0.27	11.61	0.08	0.08	0.339
209	34.28	0.00	0.00	22.08	11.35	0.22	11.57	0.14	0.13	0.338
210	34.28	0.00	0.00	22.22	11.41	0.06	11.48	0.33	0.28	0.335
211	34.28	0.00	0.00	9.99	22.67	0.33	23.01	0.09	0.09	0.671
212	34.28	0.00	0.00	3.29	29.18	0.18	29.36	0.21	0.19	0.857
213	34.28	0.00	0.00	9.99	22.67	0.33	23.01	0.08	0.07	0.671
220	34.28	0.00	0.00	19.41	13.99	0.15	14.13	0.24	0.22	0.412

 Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
HAWKESVILLE_RD	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
NORTHSIDE_DRIVE	OUTFALL	0.00	0.00	343.18	0 00:00	0.00
WET_1	OUTFALL	0.00	0.00	347.00	0 00:00	0.00
WET_2	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
Dry_Pond	STORAGE	0.33	0.51	345.06	0 02:52	0.51
SWM_POND	STORAGE	0.33	0.45	345.95	0 03:10	0.45

 Node Inflow Summary

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
HAWKESVILLE_RD	OUTFALL	0.321	0.321	0 01:05	0.351	0.351	0.000
NORTHSIDE_DRIVE	OUTFALL	0.000	0.037	0 03:10	0	1.34	0.000
WET_1	OUTFALL	0.212	0.212	0 01:05	0.229	0.229	0.000
WET_2	OUTFALL	0.356	0.363	0 01:05	0.415	0.837	0.000
Dry_Pond	STORAGE	0.426	0.426	0 01:05	0.471	0.471	0.001
SWM_POND	STORAGE	1.566	1.566	0 01:05	2.58	2.58	0.005

Node Surcharge Summary

No nodes were surcharged.

Node Flooding Summary

No nodes were flooded.

Storage Volume Summary

Storage Unit	Average Volume 1000 m ³	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m ³	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
Dry_Pond	0.199	12.5	0.0	0.0	0.323	24.1	0 02:52	0.012
SWM_POND	1.645	18.1	0.0	0.0	2.278	25.0	0 03:10	0.037

Outfall Loading Summary

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10 ⁶ ltr
HAWKESVILLE_RD	29.08	0.022	0.321	0.351
NORTHSIDE_DRIVE	95.83	0.026	0.037	1.340
WET_1	23.63	0.018	0.212	0.229
WET_2	96.64	0.016	0.363	0.837
System	61.30	0.082	0.903	2.757

Link Flow Summary

Link	Type	Maximum Flow CMS	Time of Max Occurrence days hr:min	Maximum Veloc m/sec	Max/ Full Flow	Max/ Full Depth
Emerg_Over	DUMMY	0.000	0 00:00			
OL1	DUMMY	0.012	0 02:52			
OUT_Pond	DUMMY	0.037	0 03:10			

Flow Classification Summary

Conduit	Adjusted /Actual Length	----- Up Dry	Down Dry	Fraction of Sub Crit	Time in Flow Class Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
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Conduit Surcharge Summary

No conduits were surcharged.

Analysis begun on: Thu Apr 24 21:28:25 2025
Analysis ended on: Thu Apr 24 21:28:25 2025
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

WARNING 10: crest elevation raised to downstream invert for regulator Link Emerg_Over

Element Count

Number of rain gages 8
 Number of subcatchments ... 13
 Number of nodes 6
 Number of links 3
 Number of pollutants 0
 Number of land uses 0

Raingage Summary

Name	Data Source	Data Type	Recording Interval
Chicago_3h_100-Year	Chicago_3h_100-Year	INTENSITY	5 min.
Chicago_3h_10-Year	Chicago_3h_10-Year	INTENSITY	5 min.
Chicago_3h_25-Year	Chicago_3h_25-Year	INTENSITY	5 min.
Chicago_3h_2-Year	Chicago_3h_2-Year	INTENSITY	5 min.
Chicago_3h_50-Year	Chicago_3h_50-Year	INTENSITY	5 min.
Chicago_3h_5-Year	Chicago_3h_5-Year	INTENSITY	5 min.
Chicago_4h_12.5-mm	Chicago_4h_12.5-mm	INTENSITY	5 min.
Chicago_4h_25-mm	Chicago_4h_25-mm	INTENSITY	5 min.

Subcatchment Summary

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	8.59	350.00	70.00	2.0000	Chicago_3h_5-Year	SWM_POND
202	0.89	97.00	90.00	2.0000	Chicago_3h_5-Year	SWM_POND
203	0.47	50.00	35.00	2.0000	Chicago_3h_5-Year	Dry_Pond
204	1.53	60.00	70.00	2.0000	Chicago_3h_5-Year	Dry_Pond
205	1.39	40.00	76.00	2.0000	Chicago_3h_5-Year	HAWKESVILLE_RD
208	0.80	40.00	35.00	2.0000	Chicago_3h_5-Year	WOODLOT
209	1.18	50.00	35.00	2.0000	Chicago_3h_5-Year	SWM_POND
210	2.89	200.00	35.00	2.0000	Chicago_3h_5-Year	Dry_Pond
211	0.44	20.00	70.00	2.0000	Chicago_3h_5-Year	SWM_POND
212	0.57	20.00	70.00	2.0000	Chicago_3h_5-Year	SWM_POND
213	0.28	20.00	70.00	2.0000	Chicago_3h_5-Year	Dry_Pond
220	1.70	80.00	43.00	2.0000	Chicago_3h_5-Year	SWM_POND

Node Summary

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
HAWKESVILLE_RD	OUTFALL	0.00	0.00	0.0	
NORTHSIDE_DRIVE	OUTFALL	343.18	0.00	0.0	
WET_1	OUTFALL	347.00	0.00	0.0	
WET_2	OUTFALL	0.00	0.00	0.0	
Dry_Pond	STORAGE	344.55	1.60	0.0	
SWM_POND	STORAGE	345.50	1.50	0.0	

Link Summary

2023-0849-10: Post-Dev 5-Year

Name	From Node	To Node	Type	Length	%Slope Roughness
Emerg_Over	SWM_POND	WET_1	OUTLET		
OL1	Dry_Pond	WET_2	OUTLET		
OUT_Pond	SWM_POND	NORTHSIDE_DRIVE	OUTLET		

Cross Section Summary

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
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Street Summary

Street Street

Area:

0.0008	0.0030	0.0068	0.0120	0.0188
0.0270	0.0368	0.0480	0.0608	0.0750
0.0908	0.1081	0.1268	0.1471	0.1688
0.1921	0.2158	0.2396	0.2634	0.2871
0.3109	0.3347	0.3584	0.3822	0.4059
0.4297	0.4535	0.4772	0.5010	0.5248
0.5485	0.5723	0.5960	0.6198	0.6436
0.6673	0.6911	0.7149	0.7386	0.7624
0.7861	0.8099	0.8337	0.8574	0.8812
0.9050	0.9287	0.9525	0.9762	1.0000

Hrad:

0.0124	0.0248	0.0372	0.0495	0.0619
0.0743	0.0867	0.0991	0.1115	0.1238
0.1362	0.1486	0.1610	0.1734	0.1858
0.2002	0.2246	0.2491	0.2734	0.2977
0.3220	0.3462	0.3703	0.3944	0.4184
0.4423	0.4662	0.4900	0.5138	0.5375
0.5612	0.5848	0.6083	0.6318	0.6552
0.6786	0.7019	0.7252	0.7484	0.7715
0.7946	0.8177	0.8407	0.8636	0.8865
0.9093	0.9320	0.9547	0.9774	1.0000

Width:

0.0632	0.1263	0.1895	0.2526	0.3158
0.3789	0.4421	0.5053	0.5684	0.6316
0.6947	0.7579	0.8211	0.8842	0.9474
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Analysis Options

Flow Units CMS

Process Models:

Rainfall/Runoff YES
RDII NO
Snowmelt NO
Groundwater NO
Flow Routing YES
Ponding Allowed NO
Water Quality NO

Infiltration Method CURVE_NUMBER
 Flow Routing Method DYNWAVE
 Surcharge Method EXTRAN
 Starting Date 04/14/2025 00:00:00
 Ending Date 04/14/2025 15:00:00
 Antecedent Dry Days 0.0
 Report Time Step 00:01:00
 Wet Time Step 00:05:00
 Dry Time Step 00:05:00
 Routing Time Step 5.00 sec
 Variable Time Step YES
 Maximum Trials 8
 Number of Threads 1
 Head Tolerance 0.001500 m

	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
Total Precipitation	0.980	47.265
Evaporation Loss	0.000	0.000
Infiltration Loss	0.358	17.266
Surface Runoff	0.602	29.047
Final Storage	0.025	1.204
Continuity Error (%)	-0.533	

	Volume	Volume
Flow Routing Continuity	hectare-m	10 ⁶ ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.602	6.024
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.433	4.332
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.169	1.692
Continuity Error (%)	0.003	

 Time-Step Critical Elements

 None

 Highest Flow Instability Indexes

 All links are stable.

 Most Frequent Nonconverging Nodes

 Convergence obtained at all time steps.

 Routing Time Step Summary

 Minimum Time Step : 4.50 sec
 Average Time Step : 5.00 sec
 Maximum Time Step : 5.00 sec

2023-0849-10: Post-Dev 5-Year

% of Time in Steady State : 0.00
 Average Iterations per Step : 2.00
 % of Steps Not Converging : 0.00
 Time Step Frequencies :
 5.000 - 3.155 sec : 100.00 %
 3.155 - 1.991 sec : 0.00 %
 1.991 - 1.256 sec : 0.00 %
 1.256 - 0.792 sec : 0.00 %
 0.792 - 0.500 sec : 0.00 %

 Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201	47.26	0.00	0.00	14.33	30.97	0.81	31.78	2.63	1.33	0.672
202	47.26	0.00	0.00	3.92	41.07	0.88	41.95	0.37	0.29	0.888
203	47.26	0.00	0.00	26.91	15.89	3.97	19.86	0.10	0.08	0.420
204	47.26	0.00	0.00	12.06	31.88	2.24	34.13	0.49	0.40	0.722
205	47.26	0.00	0.00	9.40	34.57	2.11	36.68	0.52	0.43	0.776
208	47.26	0.00	0.00	26.60	15.89	4.31	20.20	0.15	0.11	0.427
209	47.26	0.00	0.00	26.91	15.89	3.97	19.86	0.23	0.17	0.420
210	47.26	0.00	0.00	28.87	15.97	1.89	17.86	0.52	0.38	0.378
211	47.26	0.00	0.00	11.58	31.78	2.91	34.69	0.14	0.12	0.734
212	47.26	0.00	0.00	3.78	40.87	1.18	42.06	0.29	0.26	0.890
213	47.26	0.00	0.00	11.58	31.78	2.91	34.69	0.12	0.10	0.734
220	47.26	0.00	0.00	24.03	19.57	3.01	22.58	0.38	0.29	0.478

 Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
HAWKESVILLE_RD	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
NORTHSIDE_DRIVE	OUTFALL	0.00	0.00	343.18	0 00:00	0.00
WET_1	OUTFALL	0.00	0.00	347.00	0 00:00	0.00
WET_2	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
Dry_Pond	STORAGE	0.54	0.60	345.15	0 02:41	0.60
SWM_POND	STORAGE	0.41	0.60	346.10	0 02:38	0.60

 Node Inflow Summary

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
HAWKESVILLE_RD	OUTFALL	0.430	0.430	0 01:05	0.517	0.517	0.000
NORTHSIDE_DRIVE	OUTFALL	0.000	0.095	0 02:38	0	2.21	0.000
WET_1	OUTFALL	0.293	0.293	0 01:05	0.373	0.373	0.000
WET_2	OUTFALL	0.485	0.493	0 01:05	0.662	1.23	0.000
Dry_Pond	STORAGE	0.576	0.576	0 01:05	0.716	0.716	0.002
SWM_POND	STORAGE	2.231	2.231	0 01:05	3.76	3.76	0.004

Node Surcharge Summary

No nodes were surcharged.

Node Flooding Summary

No nodes were flooded.

Storage Volume Summary

Storage Unit	Average Volume 1000 m ³	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m ³	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
Dry_Pond	0.360	22.5	0.0	0.0	0.395	38.4	0 02:41	0.014
SWM_POND	2.106	23.1	0.0	0.0	3.136	34.4	0 02:38	0.095

Outfall Loading Summary

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10 ⁶ ltr
HAWKESVILLE_RD	29.12	0.033	0.430	0.517
NORTHSIDE_DRIVE	96.22	0.043	0.095	2.211
WET_1	23.66	0.029	0.293	0.373
WET_2	96.65	0.024	0.493	1.231
System	61.41	0.128	1.228	4.332

Link Flow Summary

Link	Type	Maximum Flow CMS	Time of Max Occurrence days hr:min	Maximum Veloc m/sec	Max/ Full Flow	Max/ Full Depth
Emerg_Over	DUMMY	0.000	0 00:00			
OL1	DUMMY	0.014	0 02:41			
OUT_Pond	DUMMY	0.095	0 02:38			

Flow Classification Summary

Conduit	Adjusted /Actual Length	----- Up Dry	Down Dry	Fraction of Sub Crit	Time in Flow Class Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
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Conduit Surcharge Summary

No conduits were surcharged.

Analysis begun on: Thu Apr 24 21:28:26 2025
Analysis ended on: Thu Apr 24 21:28:26 2025
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

WARNING 10: crest elevation raised to downstream invert for regulator Link Emerg_Over

Element Count

Number of rain gages 8
 Number of subcatchments ... 13
 Number of nodes 6
 Number of links 3
 Number of pollutants 0
 Number of land uses 0

Raingage Summary

Name	Data Source	Data Type	Recording Interval
Chicago_3h_100-Year	Chicago_3h_100-Year	INTENSITY	5 min.
Chicago_3h_10-Year	Chicago_3h_10-Year	INTENSITY	5 min.
Chicago_3h_25-Year	Chicago_3h_25-Year	INTENSITY	5 min.
Chicago_3h_2-Year	Chicago_3h_2-Year	INTENSITY	5 min.
Chicago_3h_50-Year	Chicago_3h_50-Year	INTENSITY	5 min.
Chicago_3h_5-Year	Chicago_3h_5-Year	INTENSITY	5 min.
Chicago_4h_12.5-mm	Chicago_4h_12.5-mm	INTENSITY	5 min.
Chicago_4h_25-mm	Chicago_4h_25-mm	INTENSITY	5 min.

Subcatchment Summary

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	8.59	350.00	70.00	2.0000	Chicago_3h_10-Year	SWM_POND
202	0.89	97.00	90.00	2.0000	Chicago_3h_10-Year	SWM_POND
203	0.47	50.00	35.00	2.0000	Chicago_3h_10-Year	Dry_Pond
204	1.53	60.00	70.00	2.0000	Chicago_3h_10-Year	Dry_Pond
205	1.39	40.00	76.00	2.0000	Chicago_3h_10-Year	HAWKESVILLE_RD
208	0.80	40.00	35.00	2.0000	Chicago_3h_10-Year	WOODLOT
209	1.18	50.00	35.00	2.0000	Chicago_3h_10-Year	SWM_POND
210	2.89	200.00	35.00	2.0000	Chicago_3h_10-Year	Dry_Pond
211	0.44	20.00	70.00	2.0000	Chicago_3h_10-Year	SWM_POND
212	0.57	20.00	70.00	2.0000	Chicago_3h_10-Year	SWM_POND
213	0.28	20.00	70.00	2.0000	Chicago_3h_10-Year	Dry_Pond
220	1.70	80.00	43.00	2.0000	Chicago_3h_10-Year	SWM_POND

Node Summary

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
HAWKESVILLE_RD	OUTFALL	0.00	0.00	0.0	
NORTHSIDE_DRIVE	OUTFALL	343.18	0.00	0.0	
WET_1	OUTFALL	347.00	0.00	0.0	
WET_2	OUTFALL	0.00	0.00	0.0	
Dry_Pond	STORAGE	344.55	1.60	0.0	
SWM_POND	STORAGE	345.50	1.50	0.0	

Link Summary

2023-0849-10: Post-Dev 10-Year

Name	From Node	To Node	Type	Length	%Slope Roughness
Emerg_Over	SWM_POND	WET_1	OUTLET		
OL1	Dry_Pond	WET_2	OUTLET		
OUT_Pond	SWM_POND	NORTHSIDE_DRIVE	OUTLET		

Cross Section Summary

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
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Street Summary

Street Street

Area:

0.0008	0.0030	0.0068	0.0120	0.0188
0.0270	0.0368	0.0480	0.0608	0.0750
0.0908	0.1081	0.1268	0.1471	0.1688
0.1921	0.2158	0.2396	0.2634	0.2871
0.3109	0.3347	0.3584	0.3822	0.4059
0.4297	0.4535	0.4772	0.5010	0.5248
0.5485	0.5723	0.5960	0.6198	0.6436
0.6673	0.6911	0.7149	0.7386	0.7624
0.7861	0.8099	0.8337	0.8574	0.8812
0.9050	0.9287	0.9525	0.9762	1.0000

Hrad:

0.0124	0.0248	0.0372	0.0495	0.0619
0.0743	0.0867	0.0991	0.1115	0.1238
0.1362	0.1486	0.1610	0.1734	0.1858
0.2002	0.2246	0.2491	0.2734	0.2977
0.3220	0.3462	0.3703	0.3944	0.4184
0.4423	0.4662	0.4900	0.5138	0.5375
0.5612	0.5848	0.6083	0.6318	0.6552
0.6786	0.7019	0.7252	0.7484	0.7715
0.7946	0.8177	0.8407	0.8636	0.8865
0.9093	0.9320	0.9547	0.9774	1.0000

Width:

0.0632	0.1263	0.1895	0.2526	0.3158
0.3789	0.4421	0.5053	0.5684	0.6316
0.6947	0.7579	0.8211	0.8842	0.9474
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Analysis Options

Flow Units CMS

Process Models:

Rainfall/Runoff YES
RDII NO
Snowmelt NO
Groundwater NO
Flow Routing YES
Ponding Allowed NO
Water Quality NO

2023-0849-10: Post-Dev 10-Year

Infiltration Method CURVE_NUMBER
Flow Routing Method DYNWAVE
Surcharge Method EXTRAN
Starting Date 04/14/2025 00:00:00
Ending Date 04/14/2025 15:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00
Routing Time Step 5.00 sec
Variable Time Step YES
Maximum Trials 8
Number of Threads 1
Head Tolerance 0.001500 m

	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
*****	-----	-----
Total Precipitation	1.167	56.290
Evaporation Loss	0.000	0.000
Infiltration Loss	0.390	18.805
Surface Runoff	0.760	36.625
Final Storage	0.025	1.204
Continuity Error (%)	-0.611	

	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
*****	-----	-----
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.760	7.596
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.571	5.711
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.189	1.885
Continuity Error (%)	0.002	

Time-Step Critical Elements

None

Highest Flow Instability Indexes

All links are stable.

Most Frequent Nonconverging Nodes

Convergence obtained at all time steps.

Routing Time Step Summary

Minimum Time Step : 4.50 sec
Average Time Step : 5.00 sec
Maximum Time Step : 5.00 sec

2023-0849-10: Post-Dev 10-Year

% of Time in Steady State : 0.00
 Average Iterations per Step : 2.00
 % of Steps Not Converging : 0.00
 Time Step Frequencies :
 5.000 - 3.155 sec : 100.00 %
 3.155 - 1.991 sec : 0.00 %
 1.991 - 1.256 sec : 0.00 %
 1.256 - 0.792 sec : 0.00 %
 0.792 - 0.500 sec : 0.00 %

 Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201	56.29	0.00	0.00	15.93	37.16	2.11	39.28	3.24	1.73	0.698
202	56.29	0.00	0.00	4.13	49.25	1.62	50.87	0.45	0.36	0.904
203	56.29	0.00	0.00	28.67	19.05	8.20	27.24	0.14	0.10	0.484
204	56.29	0.00	0.00	12.76	38.21	4.35	42.56	0.62	0.51	0.756
205	56.29	0.00	0.00	9.92	41.43	3.88	45.31	0.64	0.55	0.805
208	56.29	0.00	0.00	28.25	19.04	8.68	27.72	0.20	0.15	0.492
209	56.29	0.00	0.00	28.67	19.05	8.20	27.24	0.32	0.23	0.484
210	56.29	0.00	0.00	31.89	19.14	4.78	23.92	0.69	0.48	0.425
211	56.29	0.00	0.00	12.22	38.07	5.20	43.27	0.17	0.15	0.769
212	56.29	0.00	0.00	3.99	48.98	1.95	50.93	0.36	0.32	0.905
213	56.29	0.00	0.00	12.22	38.07	5.20	43.27	0.15	0.13	0.769
220	56.29	0.00	0.00	25.76	23.45	6.50	29.96	0.51	0.38	0.532

 Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
HAWKESVILLE_RD	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
NORTHSIDE_DRIVE	OUTFALL	0.00	0.00	343.18	0 00:00	0.00
WET_1	OUTFALL	0.00	0.00	347.00	0 00:00	0.00
WET_2	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
Dry_Pond	STORAGE	0.63	0.66	345.21	0 02:38	0.66
SWM_POND	STORAGE	0.45	0.71	346.21	0 02:11	0.71

 Node Inflow Summary

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
HAWKESVILLE_RD	OUTFALL	0.547	0.547	0 01:05	0.639	0.639	0.000
NORTHSIDE_DRIVE	OUTFALL	0.000	0.166	0 02:11	0	3.03	0.000
WET_1	OUTFALL	0.386	0.386	0 01:05	0.495	0.495	0.000
WET_2	OUTFALL	0.624	0.633	0 01:05	0.891	1.55	0.000
Dry_Pond	STORAGE	0.739	0.739	0 01:05	0.906	0.906	0.002
SWM_POND	STORAGE	2.878	2.878	0 01:05	4.67	4.67	0.004

2023-0849-10: Post-Dev 10-Year

Node Surge Summary

No nodes were surcharged.

Node Flooding Summary

No nodes were flooded.

Storage Volume Summary

Storage Unit	Average Volume 1000 m³	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m³	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
Dry_Pond	0.400	31.1	0.0	0.0	0.436	49.7	0 02:38	0.015
SWM_POND	2.318	25.4	0.0	0.0	3.762	41.3	0 02:11	0.166

Outfall Loading Summary

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
HAWKESVILLE_RD	29.63	0.040	0.547	0.639
NORTHSIDE_DRIVE	96.32	0.058	0.166	3.030
WET_1	24.18	0.038	0.386	0.495
WET_2	97.13	0.029	0.633	1.547
System	61.82	0.166	1.582	5.711

Link Flow Summary

Link	Type	Maximum Flow CMS	Time of Max Occurrence days hr:min	Maximum Veloc m/sec	Max/ Full Flow	Max/ Full Depth
Emerg_Over	DUMMY	0.000	0 00:00			
OL1	DUMMY	0.015	0 02:38			
OUT_Pond	DUMMY	0.166	0 02:11			

Flow Classification Summary

Conduit	Adjusted /Actual Length	----- Up Dry	Down Dry	Fraction of Sub Crit	Time in Flow Class Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
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Conduit Surcharge Summary

No conduits were surcharged.

Analysis begun on: Thu Apr 24 21:28:25 2025
Analysis ended on: Thu Apr 24 21:28:25 2025
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

WARNING 10: crest elevation raised to downstream invert for regulator Link Emerg_Over

Element Count

Number of rain gages 8
 Number of subcatchments ... 13
 Number of nodes 6
 Number of links 3
 Number of pollutants 0
 Number of land uses 0

Raingage Summary

Name	Data Source	Data Type	Recording Interval
Chicago_3h_100-Year	Chicago_3h_100-Year	INTENSITY	5 min.
Chicago_3h_10-Year	Chicago_3h_10-Year	INTENSITY	5 min.
Chicago_3h_25-Year	Chicago_3h_25-Year	INTENSITY	5 min.
Chicago_3h_2-Year	Chicago_3h_2-Year	INTENSITY	5 min.
Chicago_3h_50-Year	Chicago_3h_50-Year	INTENSITY	5 min.
Chicago_3h_5-Year	Chicago_3h_5-Year	INTENSITY	5 min.
Chicago_4h_12.5-mm	Chicago_4h_12.5-mm	INTENSITY	5 min.
Chicago_4h_25-mm	Chicago_4h_25-mm	INTENSITY	5 min.

Subcatchment Summary

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	8.59	350.00	70.00	2.0000	Chicago_3h_25-Year	SWM_POND
202	0.89	97.00	90.00	2.0000	Chicago_3h_25-Year	SWM_POND
203	0.47	50.00	35.00	2.0000	Chicago_3h_25-Year	Dry_Pond
204	1.53	60.00	70.00	2.0000	Chicago_3h_25-Year	Dry_Pond
205	1.39	40.00	76.00	2.0000	Chicago_3h_25-Year	HAWKESVILLE_RD
208	0.80	40.00	35.00	2.0000	Chicago_3h_25-Year	WOODLOT
209	1.18	50.00	35.00	2.0000	Chicago_3h_25-Year	SWM_POND
210	2.89	200.00	35.00	2.0000	Chicago_3h_25-Year	Dry_Pond
211	0.44	20.00	70.00	2.0000	Chicago_3h_25-Year	SWM_POND
212	0.57	20.00	70.00	2.0000	Chicago_3h_25-Year	SWM_POND
213	0.28	20.00	70.00	2.0000	Chicago_3h_25-Year	Dry_Pond
220	1.70	80.00	43.00	2.0000	Chicago_3h_25-Year	SWM_POND

Node Summary

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
HAWKESVILLE_RD	OUTFALL	0.00	0.00	0.0	
NORTHSIDE_DRIVE	OUTFALL	343.18	0.00	0.0	
WET_1	OUTFALL	347.00	0.00	0.0	
WET_2	OUTFALL	0.00	0.00	0.0	
Dry_Pond	STORAGE	344.55	1.60	0.0	
SWM_POND	STORAGE	345.50	1.50	0.0	

Link Summary

2023-0849-10: Post-Dev 25-Year

Name	From Node	To Node	Type	Length	%Slope Roughness
Emerg_Over	SWM_POND	WET_1	OUTLET		
OL1	Dry_Pond	WET_2	OUTLET		
OUT_Pond	SWM_POND	NORTHSIDE_DRIVE	OUTLET		

Cross Section Summary

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
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Street Summary

Street Street

Area:

0.0008	0.0030	0.0068	0.0120	0.0188
0.0270	0.0368	0.0480	0.0608	0.0750
0.0908	0.1081	0.1268	0.1471	0.1688
0.1921	0.2158	0.2396	0.2634	0.2871
0.3109	0.3347	0.3584	0.3822	0.4059
0.4297	0.4535	0.4772	0.5010	0.5248
0.5485	0.5723	0.5960	0.6198	0.6436
0.6673	0.6911	0.7149	0.7386	0.7624
0.7861	0.8099	0.8337	0.8574	0.8812
0.9050	0.9287	0.9525	0.9762	1.0000

Hrad:

0.0124	0.0248	0.0372	0.0495	0.0619
0.0743	0.0867	0.0991	0.1115	0.1238
0.1362	0.1486	0.1610	0.1734	0.1858
0.2002	0.2246	0.2491	0.2734	0.2977
0.3220	0.3462	0.3703	0.3944	0.4184
0.4423	0.4662	0.4900	0.5138	0.5375
0.5612	0.5848	0.6083	0.6318	0.6552
0.6786	0.7019	0.7252	0.7484	0.7715
0.7946	0.8177	0.8407	0.8636	0.8865
0.9093	0.9320	0.9547	0.9774	1.0000

Width:

0.0632	0.1263	0.1895	0.2526	0.3158
0.3789	0.4421	0.5053	0.5684	0.6316
0.6947	0.7579	0.8211	0.8842	0.9474
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Analysis Options

Flow Units CMS

Process Models:

Rainfall/Runoff	YES
RDII	NO
Snowmelt	NO
Groundwater	NO
Flow Routing	YES
Ponding Allowed	NO
Water Quality	NO

2023-0849-10: Post-Dev 25-Year

Infiltration Method CURVE_NUMBER
Flow Routing Method DYNWAVE
Surcharge Method EXTRAN
Starting Date 04/14/2025 00:00:00
Ending Date 04/14/2025 15:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00
Routing Time Step 5.00 sec
Variable Time Step YES
Maximum Trials 8
Number of Threads 1
Head Tolerance 0.001500 m

*****	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
*****	-----	-----
Total Precipitation	1.416	68.266
Evaporation Loss	0.000	0.000
Infiltration Loss	0.424	20.445
Surface Runoff	0.975	47.008
Final Storage	0.025	1.204
Continuity Error (%)	-0.573	

*****	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
*****	-----	-----
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.975	9.750
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.764	7.638
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.211	2.112
Continuity Error (%)	0.002	

Time-Step Critical Elements

None

Highest Flow Instability Indexes

All links are stable.

Most Frequent Nonconverging Nodes

Convergence obtained at all time steps.

Routing Time Step Summary

Minimum Time Step : 4.50 sec
Average Time Step : 5.00 sec
Maximum Time Step : 5.00 sec

2023-0849-10: Post-Dev 25-Year

% of Time in Steady State : 0.00
 Average Iterations per Step : 2.00
 % of Steps Not Converging : 0.00
 Time Step Frequencies :
 5.000 - 3.155 sec : 100.00 %
 3.155 - 1.991 sec : 0.00 %
 1.991 - 1.256 sec : 0.00 %
 1.256 - 0.792 sec : 0.00 %
 0.792 - 0.500 sec : 0.00 %

 Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201	68.27	0.00	0.00	17.54	45.33	4.35	49.68	4.10	2.11	0.728
202	68.27	0.00	0.00	4.44	60.04	2.53	62.57	0.56	0.42	0.917
203	68.27	0.00	0.00	30.71	23.25	14.03	37.28	0.19	0.13	0.546
204	68.27	0.00	0.00	13.66	46.60	7.09	53.69	0.78	0.60	0.786
205	68.27	0.00	0.00	10.64	50.54	6.09	56.63	0.80	0.64	0.829
207	68.27	0.00	0.00	20.64	35.20	12.25	47.45	0.13	0.11	0.695
208	68.27	0.00	0.00	30.24	23.25	14.57	37.82	0.27	0.18	0.554
209	68.27	0.00	0.00	30.71	23.25	14.03	37.28	0.44	0.29	0.546
210	68.27	0.00	0.00	34.91	23.33	9.57	32.91	0.95	0.56	0.482
211	68.27	0.00	0.00	13.12	46.49	7.91	54.40	0.22	0.18	0.797
212	68.27	0.00	0.00	4.30	59.79	2.77	62.55	0.44	0.36	0.916
213	68.27	0.00	0.00	13.12	46.49	7.91	54.40	0.18	0.16	0.797
220	68.27	0.00	0.00	27.66	28.61	11.49	40.10	0.68	0.45	0.587

 Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
HAWKESVILLE_RD	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
NORTHSIDE_DRIVE	OUTFALL	0.00	0.00	343.18	0 00:00	0.00
WET_1	OUTFALL	0.00	0.00	347.00	0 00:00	0.00
WET_2	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
Dry_Pond	STORAGE	0.80	0.82	345.37	0 02:41	0.82
SWM_POND	STORAGE	0.49	0.84	346.34	0 01:58	0.84

 Node Inflow Summary

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
HAWKESVILLE_RD	OUTFALL	0.644	0.644	0 01:05	0.798	0.798	0.000
NORTHSIDE_DRIVE	OUTFALL	0.000	0.316	0 01:58	0	4.21	0.000
WET_1	OUTFALL	0.472	0.472	0 01:05	0.657	0.657	0.000
WET_2	OUTFALL	0.748	0.758	0 01:05	1.22	1.97	0.000
Dry_Pond	STORAGE	0.880	0.880	0 01:05	1.16	1.16	0.003
SWM_POND	STORAGE	3.456	3.456	0 01:05	5.91	5.91	0.003

Node Surcharge Summary

No nodes were surcharged.

Node Flooding Summary

No nodes were flooded.

Storage Volume Summary

Storage Unit	Average Volume 1000 m ³	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m ³	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
Dry_Pond	0.679	43.0	0.0	0.0	0.680	64.6	0 02:41	0.017
SWM_POND	2.532	27.8	0.0	0.0	4.558	50.0	0 01:58	0.316

Outfall Loading Summary

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10 ⁶ ltr
HAWKESVILLE_RD	29.76	0.050	0.644	0.798
NORTHSIDE_DRIVE	96.75	0.081	0.316	4.209
WET_1	24.27	0.050	0.472	0.657
WET_2	97.20	0.038	0.758	1.973
System	61.99	0.218	1.893	7.638

Link Flow Summary

Link	Type	Maximum Flow CMS	Time of Max Occurrence days hr:min	Maximum Veloc m/sec	Max/ Full Flow	Max/ Full Depth
Emerg_Over	DUMMY	0.000	0 00:00			
OL1	DUMMY	0.017	0 02:41			
OUT_Pond	DUMMY	0.316	0 01:58			

Flow Classification Summary

Adjusted /Actual	----- Up	Fraction of Time in Flow Class	----- Down	Sub	Sup	Up	Down	Norm	Inlet
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2023-0849-10: Post-Dev 25-Year

Conduit	Length	Dry	Dry	Dry	Crit	Crit	Crit	Crit	Ltd	Ctrl

Conduit Surcharge Summary

No conduits were surcharged.

Analysis begun on: Thu Apr 24 21:28:25 2025
Analysis ended on: Thu Apr 24 21:28:25 2025
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

WARNING 10: crest elevation raised to downstream invert for regulator Link Emerg_Over

Element Count

Number of rain gages 8
 Number of subcatchments ... 13
 Number of nodes 6
 Number of links 3
 Number of pollutants 0
 Number of land uses 0

Raingage Summary

Name	Data Source	Data Type	Recording Interval
Chicago_3h_100-Year	Chicago_3h_100-Year	INTENSITY	5 min.
Chicago_3h_10-Year	Chicago_3h_10-Year	INTENSITY	5 min.
Chicago_3h_25-Year	Chicago_3h_25-Year	INTENSITY	5 min.
Chicago_3h_2-Year	Chicago_3h_2-Year	INTENSITY	5 min.
Chicago_3h_50-Year	Chicago_3h_50-Year	INTENSITY	5 min.
Chicago_3h_5-Year	Chicago_3h_5-Year	INTENSITY	5 min.
Chicago_4h_12.5-mm	Chicago_4h_12.5-mm	INTENSITY	5 min.
Chicago_4h_25-mm	Chicago_4h_25-mm	INTENSITY	5 min.

Subcatchment Summary

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	8.59	350.00	70.00	2.0000	Chicago_3h_50-Year	SWM_POND
202	0.89	97.00	90.00	2.0000	Chicago_3h_50-Year	SWM_POND
203	0.47	50.00	35.00	2.0000	Chicago_3h_50-Year	Dry_Pond
204	1.53	60.00	70.00	2.0000	Chicago_3h_50-Year	Dry_Pond
205	1.39	40.00	76.00	2.0000	Chicago_3h_50-Year	HAWKESVILLE_RD
208	0.80	40.00	35.00	2.0000	Chicago_3h_50-Year	WOODLOT
209	1.18	50.00	35.00	2.0000	Chicago_3h_50-Year	SWM_POND
210	2.89	200.00	35.00	2.0000	Chicago_3h_50-Year	Dry_Pond
211	0.44	20.00	70.00	2.0000	Chicago_3h_50-Year	SWM_POND
212	0.57	20.00	70.00	2.0000	Chicago_3h_50-Year	SWM_POND
213	0.28	20.00	70.00	2.0000	Chicago_3h_50-Year	Dry_Pond
220	1.70	80.00	43.00	2.0000	Chicago_3h_50-Year	SWM_POND

Node Summary

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
HAWKESVILLE_RD	OUTFALL	0.00	0.00	0.0	
NORTHSIDE_DRIVE	OUTFALL	343.18	0.00	0.0	
WET_1	OUTFALL	347.00	0.00	0.0	
WET_2	OUTFALL	0.00	0.00	0.0	
Dry_Pond	STORAGE	344.55	1.60	0.0	
SWM_POND	STORAGE	345.50	1.50	0.0	

Link Summary

2023-0849-10: Post-Dev 50-Year

Name	From Node	To Node	Type	Length	%Slope Roughness
Emerg_Over	SWM_POND	WET_1	OUTLET		
OL1	Dry_Pond	WET_2	OUTLET		
OUT_Pond	SWM_POND	NORTHSIDE_DRIVE	OUTLET		

Cross Section Summary

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
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Street Summary

Street Street

Area:

0.0008	0.0030	0.0068	0.0120	0.0188
0.0270	0.0368	0.0480	0.0608	0.0750
0.0908	0.1081	0.1268	0.1471	0.1688
0.1921	0.2158	0.2396	0.2634	0.2871
0.3109	0.3347	0.3584	0.3822	0.4059
0.4297	0.4535	0.4772	0.5010	0.5248
0.5485	0.5723	0.5960	0.6198	0.6436
0.6673	0.6911	0.7149	0.7386	0.7624
0.7861	0.8099	0.8337	0.8574	0.8812
0.9050	0.9287	0.9525	0.9762	1.0000

Hrad:

0.0124	0.0248	0.0372	0.0495	0.0619
0.0743	0.0867	0.0991	0.1115	0.1238
0.1362	0.1486	0.1610	0.1734	0.1858
0.2002	0.2246	0.2491	0.2734	0.2977
0.3220	0.3462	0.3703	0.3944	0.4184
0.4423	0.4662	0.4900	0.5138	0.5375
0.5612	0.5848	0.6083	0.6318	0.6552
0.6786	0.7019	0.7252	0.7484	0.7715
0.7946	0.8177	0.8407	0.8636	0.8865
0.9093	0.9320	0.9547	0.9774	1.0000

Width:

0.0632	0.1263	0.1895	0.2526	0.3158
0.3789	0.4421	0.5053	0.5684	0.6316
0.6947	0.7579	0.8211	0.8842	0.9474
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Analysis Options

Flow Units CMS

Process Models:

Rainfall/Runoff YES
RDII NO
Snowmelt NO
Groundwater NO
Flow Routing YES
Ponding Allowed NO
Water Quality NO

2023-0849-10: Post-Dev 50-Year

Infiltration Method CURVE_NUMBER
Flow Routing Method DYNWAVE
Surcharge Method EXTRAN
Starting Date 04/14/2025 00:00:00
Ending Date 04/14/2025 15:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00
Routing Time Step 5.00 sec
Variable Time Step YES
Maximum Trials 8
Number of Threads 1
Head Tolerance 0.001500 m

	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
*****	-----	-----
Total Precipitation	1.610	77.648
Evaporation Loss	0.000	0.000
Infiltration Loss	0.445	21.440
Surface Runoff	1.149	55.421
Final Storage	0.025	1.204
Continuity Error (%)	-0.538	

	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
*****	-----	-----
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	1.149	11.494
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.922	9.221
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.227	2.273
Continuity Error (%)	0.002	

Time-Step Critical Elements

None

Highest Flow Instability Indexes

All links are stable.

Most Frequent Nonconverging Nodes

Convergence obtained at all time steps.

Routing Time Step Summary

Minimum Time Step : 4.50 sec
Average Time Step : 5.00 sec
Maximum Time Step : 5.00 sec

2023-0849-10: Post-Dev 50-Year

% of Time in Steady State : 0.00
 Average Iterations per Step : 2.00
 % of Steps Not Converging : 0.00
 Time Step Frequencies :
 5.000 - 3.155 sec : 100.00 %
 3.155 - 1.991 sec : 0.00 %
 1.991 - 1.256 sec : 0.00 %
 1.256 - 0.792 sec : 0.00 %
 0.792 - 0.500 sec : 0.00 %

 Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201	77.65	0.00	0.00	18.51	51.75	6.39	58.14	4.80	2.48	0.749
202	77.65	0.00	0.00	4.62	68.50	3.29	71.79	0.64	0.48	0.925
203	77.65	0.00	0.00	31.97	26.53	18.92	45.44	0.24	0.15	0.585
204	77.65	0.00	0.00	14.22	53.16	9.37	62.53	0.91	0.69	0.805
205	77.65	0.00	0.00	11.08	57.66	7.89	65.56	0.92	0.74	0.844
208	77.65	0.00	0.00	31.47	26.52	19.49	46.01	0.33	0.22	0.593
209	77.65	0.00	0.00	31.97	26.53	18.92	45.44	0.54	0.35	0.585
210	77.65	0.00	0.00	36.72	26.62	13.88	40.51	1.17	0.66	0.522
211	77.65	0.00	0.00	13.69	53.04	10.12	63.16	0.25	0.21	0.813
212	77.65	0.00	0.00	4.49	68.21	3.43	71.64	0.50	0.41	0.923
213	77.65	0.00	0.00	13.69	53.04	10.12	63.16	0.21	0.18	0.813
220	77.65	0.00	0.00	28.82	32.64	15.72	48.36	0.82	0.53	0.623

 Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
HAWKESVILLE_RD	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
NORTHSIDE_DRIVE	OUTFALL	0.00	0.00	343.18	0 00:00	0.00
WET_1	OUTFALL	0.00	0.00	347.00	0 00:00	0.00
WET_2	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
Dry_Pond	STORAGE	0.88	0.96	345.51	0 02:42	0.96
SWM_POND	STORAGE	0.51	0.93	346.43	0 01:52	0.93

 Node Inflow Summary

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
HAWKESVILLE_RD	OUTFALL	0.745	0.745	0 01:05	0.924	0.924	0.000
NORTHSIDE_DRIVE	OUTFALL	0.000	0.460	0 01:52	0	5.19	0.000
WET_1	OUTFALL	0.562	0.562	0 01:05	0.789	0.789	0.000
WET_2	OUTFALL	0.882	0.893	0 01:05	1.5	2.31	0.000
Dry_Pond	STORAGE	1.029	1.029	0 01:05	1.36	1.36	0.004
SWM_POND	STORAGE	4.042	4.042	0 01:05	6.92	6.92	0.003

Node Surge Summary

No nodes were surcharged.

Node Flooding Summary

No nodes were flooded.

Storage Volume Summary

Storage Unit	Average Volume 1000 m ³	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m ³	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
Dry_Pond	0.580	52.8	0.0	0.0	0.728	76.7	0 02:42	0.018
SWM_POND	2.637	28.9	0.0	0.0	5.111	56.1	0 01:52	0.460

Outfall Loading Summary

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10 ⁶ ltr
HAWKESVILLE_RD	29.79	0.057	0.745	0.924
NORTHSIDE_DRIVE	96.86	0.099	0.460	5.195
WET_1	24.29	0.060	0.562	0.789
WET_2	97.20	0.044	0.893	2.313
System	62.04	0.261	2.222	9.221

Link Flow Summary

Link	Type	Maximum Flow CMS	Time of Max Occurrence days hr:min	Maximum Veloc m/sec	Max/ Full Flow	Max/ Full Depth
Emerg_Over	DUMMY	0.000	0 00:00			
OL1	DUMMY	0.018	0 02:42			
OUT_Pond	DUMMY	0.460	0 01:52			

Flow Classification Summary

Conduit	Adjusted /Actual Length	----- Up Dry	Down Dry	Fraction of Sub Crit	Time in Flow Class Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
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Conduit Surcharge Summary

No conduits were surcharged.

Analysis begun on: Thu Apr 24 21:28:26 2025

Analysis ended on: Thu Apr 24 21:28:26 2025

Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

WARNING 10: crest elevation raised to downstream invert for regulator Link Emerg_Over

Element Count

Number of rain gages 8
 Number of subcatchments ... 13
 Number of nodes 6
 Number of links 3
 Number of pollutants 0
 Number of land uses 0

Raingage Summary

Name	Data Source	Data Type	Recording Interval
Chicago_3h_100-Year	Chicago_3h_100-Year	INTENSITY	5 min.
Chicago_3h_10-Year	Chicago_3h_10-Year	INTENSITY	5 min.
Chicago_3h_25-Year	Chicago_3h_25-Year	INTENSITY	5 min.
Chicago_3h_2-Year	Chicago_3h_2-Year	INTENSITY	5 min.
Chicago_3h_50-Year	Chicago_3h_50-Year	INTENSITY	5 min.
Chicago_3h_5-Year	Chicago_3h_5-Year	INTENSITY	5 min.
Chicago_4h_12.5-mm	Chicago_4h_12.5-mm	INTENSITY	5 min.
Chicago_4h_25-mm	Chicago_4h_25-mm	INTENSITY	5 min.

Subcatchment Summary

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	8.59	350.00	70.00	2.0000	Chicago_3h_100-Year	SWM_POND
202	0.89	97.00	90.00	2.0000	Chicago_3h_100-Year	SWM_POND
203	0.47	50.00	35.00	2.0000	Chicago_3h_100-Year	Dry_Pond
204	1.53	60.00	70.00	2.0000	Chicago_3h_100-Year	Dry_Pond
205	1.39	40.00	76.00	2.0000	Chicago_3h_100-Year	HAWKESVILLE_RD
208	0.80	40.00	35.00	2.0000	Chicago_3h_100-Year	WOODLOT
209	1.18	50.00	35.00	2.0000	Chicago_3h_100-Year	SWM_POND
210	2.89	200.00	35.00	2.0000	Chicago_3h_100-Year	Dry_Pond
211	0.44	20.00	70.00	2.0000	Chicago_3h_100-Year	SWM_POND
212	0.57	20.00	70.00	2.0000	Chicago_3h_100-Year	SWM_POND
213	0.28	20.00	70.00	2.0000	Chicago_3h_100-Year	Dry_Pond
220	1.70	80.00	43.00	2.0000	Chicago_3h_100-Year	SWM_POND

Node Summary

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
HAWKESVILLE_RD	OUTFALL	0.00	0.00	0.0	
NORTHSIDE_DRIVE	OUTFALL	343.18	0.00	0.0	
WET_1	OUTFALL	347.00	0.00	0.0	
WET_2	OUTFALL	0.00	0.00	0.0	
Dry_Pond	STORAGE	344.55	1.60	0.0	
SWM_POND	STORAGE	345.50	1.50	0.0	

Link Summary

2023-0849-10: Post-Dev 100-Year

Name	From Node	To Node	Type	Length	%Slope Roughness
Emerg_Over	SWM_POND	WET_1	OUTLET		
OL1	Dry_Pond	WET_2	OUTLET		
OUT_Pond	SWM_POND	NORTHSIDE_DRIVE	OUTLET		

Cross Section Summary

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
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Street Summary

Street Street

Area:

0.0008	0.0030	0.0068	0.0120	0.0188
0.0270	0.0368	0.0480	0.0608	0.0750
0.0908	0.1081	0.1268	0.1471	0.1688
0.1921	0.2158	0.2396	0.2634	0.2871
0.3109	0.3347	0.3584	0.3822	0.4059
0.4297	0.4535	0.4772	0.5010	0.5248
0.5485	0.5723	0.5960	0.6198	0.6436
0.6673	0.6911	0.7149	0.7386	0.7624
0.7861	0.8099	0.8337	0.8574	0.8812
0.9050	0.9287	0.9525	0.9762	1.0000

Hrad:

0.0124	0.0248	0.0372	0.0495	0.0619
0.0743	0.0867	0.0991	0.1115	0.1238
0.1362	0.1486	0.1610	0.1734	0.1858
0.2002	0.2246	0.2491	0.2734	0.2977
0.3220	0.3462	0.3703	0.3944	0.4184
0.4423	0.4662	0.4900	0.5138	0.5375
0.5612	0.5848	0.6083	0.6318	0.6552
0.6786	0.7019	0.7252	0.7484	0.7715
0.7946	0.8177	0.8407	0.8636	0.8865
0.9093	0.9320	0.9547	0.9774	1.0000

Width:

0.0632	0.1263	0.1895	0.2526	0.3158
0.3789	0.4421	0.5053	0.5684	0.6316
0.6947	0.7579	0.8211	0.8842	0.9474
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Analysis Options

Flow Units CMS

Process Models:

Rainfall/Runoff YES
RDII NO
Snowmelt NO
Groundwater NO
Flow Routing YES
Ponding Allowed NO
Water Quality NO

2023-0849-10: Post-Dev 100-Year

Infiltration Method CURVE_NUMBER
Flow Routing Method DYNWAVE
Surcharge Method EXTRAN
Starting Date 04/14/2025 00:00:00
Ending Date 04/14/2025 15:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00
Routing Time Step 5.00 sec
Variable Time Step YES
Maximum Trials 8
Number of Threads 1
Head Tolerance 0.001500 m

*****	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
*****	-----	-----
Total Precipitation	1.806	87.079
Evaporation Loss	0.000	0.000
Infiltration Loss	0.461	22.240
Surface Runoff	1.329	64.077
Final Storage	0.025	1.204
Continuity Error (%)	-0.507	

*****	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
*****	-----	-----
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	1.329	13.290
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	1.084	10.841
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.245	2.448
Continuity Error (%)	0.002	

Time-Step Critical Elements

None

Highest Flow Instability Indexes

All links are stable.

Most Frequent Nonconverging Nodes

Convergence obtained at all time steps.

Routing Time Step Summary

Minimum Time Step : 4.50 sec
Average Time Step : 5.00 sec
Maximum Time Step : 5.00 sec

2023-0849-10: Post-Dev 100-Year

% of Time in Steady State : 0.00
 Average Iterations per Step : 2.00
 % of Steps Not Converging : 0.00
 Time Step Frequencies :
 5.000 - 3.155 sec : 100.00 %
 3.155 - 1.991 sec : 0.00 %
 1.991 - 1.256 sec : 0.00 %
 1.256 - 0.792 sec : 0.00 %
 0.792 - 0.500 sec : 0.00 %

 Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201	87.08	0.00	0.00	19.27	58.20	8.66	66.86	5.52	2.85	0.768
202	87.08	0.00	0.00	4.78	77.01	4.06	81.08	0.72	0.54	0.931
203	87.08	0.00	0.00	33.02	29.82	24.03	53.86	0.28	0.18	0.618
204	87.08	0.00	0.00	14.70	59.76	11.73	71.50	1.04	0.79	0.821
205	87.08	0.00	0.00	11.47	64.83	9.76	74.58	1.05	0.84	0.857
208	87.08	0.00	0.00	32.52	29.82	24.61	54.43	0.39	0.27	0.625
209	87.08	0.00	0.00	33.02	29.82	24.03	53.86	0.64	0.41	0.618
210	87.08	0.00	0.00	38.14	29.93	18.62	48.55	1.40	0.75	0.557
211	87.08	0.00	0.00	14.17	59.63	12.41	72.04	0.29	0.24	0.827
212	87.08	0.00	0.00	4.65	76.69	4.16	80.85	0.57	0.46	0.928
213	87.08	0.00	0.00	14.17	59.63	12.41	72.04	0.24	0.21	0.827
220	87.08	0.00	0.00	29.77	36.69	20.18	56.87	0.97	0.61	0.653

 Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
HAWKESVILLE_RD	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
NORTHSIDE_DRIVE	OUTFALL	0.00	0.00	343.18	0 00:00	0.00
WET_1	OUTFALL	0.00	0.00	347.00	0 00:00	0.00
WET_2	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
Dry_Pond	STORAGE	1.05	1.14	345.69	0 02:44	1.14
SWM_POND	STORAGE	0.53	1.03	346.53	0 01:51	1.03

 Node Inflow Summary

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
HAWKESVILLE_RD	OUTFALL	0.843	0.843	0 01:05	1.05	1.05	0.000
NORTHSIDE_DRIVE	OUTFALL	0.000	0.548	0 01:51	0	6.21	0.000
WET_1	OUTFALL	0.653	0.653	0 01:05	0.924	0.924	0.000
WET_2	OUTFALL	1.018	1.030	0 01:05	1.79	2.66	0.000
Dry_Pond	STORAGE	1.175	1.175	0 01:05	1.56	1.56	0.004
SWM_POND	STORAGE	4.627	4.627	0 01:05	7.96	7.96	0.002

Node Surcharge Summary

No nodes were surcharged.

Node Flooding Summary

No nodes were flooded.

Storage Volume Summary

Storage Unit	Average Volume 1000 m ³	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m ³	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
Dry_Pond	0.798	63.0	0.0	0.0	0.900	89.0	0 02:44	0.019
SWM_POND	2.765	30.3	0.0	0.0	5.765	63.3	0 01:51	0.548

Outfall Loading Summary

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10 ⁶ ltr
HAWKESVILLE_RD	30.37	0.064	0.843	1.052
NORTHSIDE_DRIVE	96.99	0.118	0.548	6.206
WET_1	24.86	0.069	0.653	0.924
WET_2	97.75	0.050	1.030	2.660
System	62.49	0.302	2.549	10.841

Link Flow Summary

Link	Type	Maximum Flow CMS	Time of Max Occurrence days hr:min	Maximum Veloc m/sec	Max/ Full Flow	Max/ Full Depth
Emerg_Over	DUMMY	0.000	0 00:00			
OL1	DUMMY	0.019	0 02:44			
OUT_Pond	DUMMY	0.548	0 01:51			

Flow Classification Summary

Conduit	Adjusted /Actual Length	----- Up Dry	Down Dry	Fraction of Sub Crit	Time in Flow Class Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
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Conduit Surcharge Summary

No conduits were surcharged.

Analysis begun on: Thu Apr 24 21:28:25 2025

Analysis ended on: Thu Apr 24 21:28:25 2025

Total elapsed time: < 1 sec

APPENDIX E

Chloride Assessment

Project	Schlegel Urban Development Corp. - St. Jacobs							Location	ELORA 1991-2020						
Project #:	2023-0849-10							ID	6142286						
Address	52 Hawkesville Road, St. Jacobs							Latitude	43.65	degrees	0.762	radians			
														Soil Moisture Capacity (mm)	200
(MOE Table 3.1 - Moderately Rooted Crops (Corn) - Clay Loam)															
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	
Number of Days	$n \text{ (days)}$	31	28	31	30	31	30	31	31	30	31	30	31	365	
Daily Average Temperature	$T_m \text{ (}^{\circ}\text{C)}$	-6.9	-6.7	-1.5	5.6	12.3	17.3	19.5	18.6	15.0	8.5	2.4	-3.3	6.7	
Potential Evapotranspiration Analysis for Site															
$I \text{ (Annual Heat Index)} = \sum_{n=1}^{12} i_n; \quad i \text{ (Monthly Heat Index)} = \left(\frac{T_m}{5}\right)^{1.514}; \quad PET = 16 \times k \times \left(\frac{10 \times T_m}{I}\right)^{\alpha}$ $\alpha = (675 \times 10^{-9} \times I^3) - (771 \times 10^{-7} \times I^2) + (1792 \times 10^{-5} \times I) + 0.49239$															
Monthly Heat Index	i	0.000	0.000	0.000	1.187	3.907	6.549	7.850	7.308	5.277	2.233	0.329	0.000	34.640	
Alpha	α	1.049													
$N = \frac{24}{\pi} \omega_s; \quad \omega_s = \frac{\pi}{2} - \arctan\left[\frac{-\tan(\varphi) \cdot \tan(\delta)}{X^{0.5}}\right]; \quad X = 1 - [\tan(\varphi)]^2 \cdot [\tan(\delta)]^2; \quad \delta = 0.409 \cdot \sin\left(2\pi \cdot \frac{d_j}{365} - 1.39\right); \quad k = \left(\frac{N}{12}\right) \times \left(\frac{n}{30}\right)$															
Julian Day	d_j	15	45	75	105	136	166	197	228	258	289	319	350		
	δ	-0.370	-0.236	-0.040	0.166	0.333	0.407	0.372	0.233	0.037	-0.175	-0.335	-0.408		
	X	0.863	0.947	0.999	0.975	0.891	0.831	0.862	0.949	0.999	0.971	0.890	0.830		
	ω_s	1.192	1.339	1.532	1.731	1.907	1.993	1.951	1.799	1.606	1.401	1.233	1.147		
Mean Daylight Hours	N	9.107	10.231	11.705	13.225	14.566	15.228	14.906	13.746	12.269	10.702	9.416	8.763		
Correction Factor	k	0.810	0.810	1.020	1.120	1.270	1.290	1.300	1.200	1.040	0.950	0.800	0.740		
Unadjusted PET	(mm)	0.00	0.00	0.00	26.48	60.43	86.42	97.97	93.24	74.41	41.01	10.89	0.00	490.84	
Potential ET	$PET \text{ (mm)}$	0.00	0.00	0.00	29.66	76.74	111.48	127.37	111.88	77.38	38.96	8.71	0.00	582.18	
Evapotranspiration Analysis															
Average Precipitation	(mm)	81.60	52.90	58.30	79.10	78.10	84.40	89.90	77.00	75.10	77.50	76.60	65.50	896.00	
P-PET (Surplus for Infil & Runoff)	$\Delta P \text{ (mm)}$	81.60	52.90	58.30	49.44	1.36	-27.08	-37.47	-34.88	-2.28	38.54	67.89	65.50	313.82	
Potential Water Loss	$APWL \text{ (mm)}$	0.00	0.00	0.00	0.00	0.00	-27.08	-64.54	-99.43	-101.71	-63.17	0.00	0.00		
Storage	(mm)	347.10	400.00	458.30	200.00	200.00	174.68	144.84	121.66	120.27	145.83	200.00	265.50		
Change in Storage	$\Delta S \text{ (mm)}$	0.00	0.00	0.00	0.00	0.00	-25.32	-29.84	-23.18	-1.38	25.56	54.17	0.00	0.00	
Actual Evapotranspiration	$AET \text{ (mm)}$	0.00	0.00	0.00	29.66	76.74	109.72	119.74	100.18	76.48	38.96	8.71	0.00	560.20	

EXISTING CONDITIONS		101	102							TOTAL
Imperviousness	(%)	0.0%	0.0%							0.00%
Topography		0.150	0.250	101 - Future development area under existing conditions						
Soils		0.300	0.300	102 - Existing Woodlot						
Cover		0.100	0.200							
Infiltration Factor		0.550	0.750							
Catchment Area	ha	15.14	13.79							28.93
Pervious Area	m ²	151400	137900							289300
Precipitation	m ³ /year	135654	123558							259213
Evapotranspiration	m ³ /year	84814	77252							162066
Surplus	m ³ /year	50840	46307							97147
Infiltration	m ³ /year	27962	34730							62692
Runoff	m ³ /year	22878	11577							34455
Impervious Area	m ²	0								0
Precipitation	m ³ /year	0								0
Evaporation (10% of PET)	m ³ /year	0								0
Runoff	m ³ /year	0								0
Diverted Runoff (to Infiltration)	m ³ /year	0								0
Totals										
Precipitation	m ³ /year	135654	123558							259213
Evapotranspiration & Evaporation	m ³ /year	84814	77252							162066
Runoff	m ³ /year	22878	11577							34455
Infiltration	m ³ /year	27962	34730							62692
PROPOSED CONDITIONS		201	202							TOTAL
Imperviousness	(%)	63.0%	0.0%							32.97%
Topography		0.250	0.250	201 - Future Development						0.250
Soils		0.300	0.300	202 - Existing Woodlot						0.300
Cover		0.100	0.200							0.200
Infiltration Factor		0.650	0.750							
Catchment Area	ha	15.14	13.79							28.93
Pervious Area	m ²	56018	137900							193918
Precipitation	m ³ /year	50192	123558							173751
Evapotranspiration	m ³ /year	31381	77252							108633
Surplus	m ³ /year	18811	46307							65118
Infiltration	m ³ /year	12227	34730							46957
Runoff	m ³ /year	6584	11577							18161
Infiltration	m ³ /year	12227	34730							46957
Impervious Area	m ²	95382	0							95382
Precipitation	m ³ /year	85462	0							85462
Evaporation	m ³ /year	5553	0							5553
Runoff	m ³ /year	79909	0							79909
Diverted Runoff (to Infiltration)	m ³ /year	0	0							0
Totals										
Precipitation	m ³ /year	135654	123558							259213
Evapotranspiration & Evaporation	m ³ /year	36934	77252							114186
Runoff	m ³ /year	86493	11577							98070
Infiltration	m ³ /year	12227	34730							46957
Comparison		EX	PR	PR - EX						Change
Precipitation	mm/year	896.00	896.00		m ³ /year	0				0%
Evapotranspiration & Evaporation	mm/year	560.20	394.70		m ³ /year	-47880				-30%
Runoff	mm/year	119.10	338.99		m ³ /year	63615				285%
Infiltration	mm/year	216.70	162.31		m ³ /year	-15735				-25%

Salt/Chloride Loading - Reasonable Use Concept (RUC)
With No Adjustments to Application Rate

$C_m = C_b + x(C_r - C_b)$

Where:

C_b = Background Chloride Concentration (mg/L) =	15
C_r = Ontario Drinking Water Standard (ODWS) (mg/L) =	250
x = Factor for non-health related parameter =	0.5
C_m = Maximum allowable concentration (mg/L) =	132.5

Location / Area	Length of Road (km)	Parking Areas (ha)	Annual Salt Application (tonnes/2-lane km) or (g/m ² /event @ 37 events/year) ¹	Total Annual Salt Load (tonnes)	Total Annual Chloride Load ² (tonnes)
Primary Roads		0		44	0
Secondary Roads		0		22	0.00
Local Roads		2.15		2.2	4.73
Total					4.73
Salt Infiltration into Subsurface (30%)					1.42
Site Parking		0.2		50	3.64
Salt Infiltration into Subsurface (30%)					1.09
Total Annual Salt Load				8.37	
Total Annual Salt Infiltrated				2.51	1.52
				Total Annual Infiltration Volume (m ³)	46957
				Chloride Concentration from Proposed Development based on Infiltration Rate (mg/L)	32.93

Notes:

- 1. Source Protection Guidance - Salt Impact Assessment (*Region of Waterloo*)
- 2. Chloride accounts for 60.6% of Sodium-Chloride

Beneficial Practices Worksheet



Winter Maintenance

Version 1 2017

Reference number: 4424429



Region of Waterloo, Water and Wastewater Services

Supply · Protection · Conservation · Wastewater

regionofwaterloo.ca/water

Section 1: instructions

This worksheet includes beneficial practices for property owners and staff to consider when developing a winter maintenance plan. Following these practices may help improve winter safety and reduce the use of salt that can be harmful to our drinking water sources.

Before you start

The Region of Waterloo recommends you first confirm the property is not in a wellhead protection area. Properties in wellhead protection areas may be subject to the Grand River Source Protection Plan and may require the negotiation of a Risk Management Plan with the Region of Waterloo. Financial support may also be available to implement the Risk Management Plan.

To find out if the property requires a Risk Management Plan:

1. Go to <http://taps.regionofwaterloo.ca>
2. Click on “Does the Source Protection Plan apply to my property?”
3. Enter the property location
4. Answer questions as prompted
5. Follow instructions on how to proceed

To learn more go to www.regionofwaterloo.ca/SourceProtection.

Create your winter maintenance plan

- ☐ Complete a property site assessment
 - Complete a visual inspection of the property
 - Use a property site map to include applicable identifiers. Refer to the end of this worksheet for a sample map with possible identifiers.
 - Complete Sections 2 and 3 of this worksheet
- ☐ Develop and implement your winter maintenance plan
- ☐ Review the plan annually with your winter maintenance team
 - Are there changes to the property requiring updates to your plan?
 - Does your team require training?
 - How effective was the plan last year? Can you identify areas for improvement?
- ☐ Additional resources available at www.regionofwaterloo.ca/WinterPlan

Section 2: property and contact information

Company name: _____

Property address: _____

Property owner: _____

Property tenant (if applicable): _____

Property contractor (if applicable): _____

Person(s) engaged in activity or activities:

☐ Owner

☐ Tenant

☐ Contractor

☐ Other (e.g. property / site manager): _____

Section 3: beneficial management practices

The following section contains the beneficial management practices that will protect our water and form the basis of your Winter Maintenance Plan. Under each practice indicate the most accurate status and provide additional information in the notes section as follows:

- In place: describe what you are doing or have done and indicate the location on the site map
- Planned: describe how and when you will have the practice in place, and indicate the new location (where applicable) on the site map
- Not practical: describe the reason and provide an alternative practice that can achieve a similar result

Certifications, training and tracking

1. Property is Smart About Salt™ Certified

- ☐ Completed. Certification date: _____
- ☐ Planned or in progress
- ☐ Not planned

Notes: _____

2. Individuals (employees and /or contractors) performing or supervising winter maintenance activities are Smart About Salt trained

- ☐ Completed
 - Winter maintenance staff have successfully completed Smart About Salt Operator Training
 - Winter maintenance is completed by a Smart About Salt Certified Contractor
- ☐ Planned

Notes: _____

3. Maintain annual documentation of winter maintenance activities and employee and/or contractor training

Documentation may include:

- Weather and site condition logs
- Application records
- Training records
- Spreader calibration logs
- Salt and snow management protocols: application rates, snow plowing and storage, salt storage inspections

☐ In place

☐ Planned

Notes: _____

Salt contract

☐ Not applicable. Do not contract out winter maintenance.

1. Contract salt by unit price per event or lump sum per season

Many contracts are “salt extra” where the client pays based on how much salt is applied. To encourage contractors to use less salt, the basis of payment for new contracts should be unit price per event or lump sum per season.

☐ In place

☐ Planned

Notes: _____

2. Contract specifies that all winter maintenance activities are performed by persons who have successfully completed Smart About Salt Operator Training

☐ In place

☐ Planned

Notes: _____

Ice formation prevention and parking lot design

1. Direct roof drainage away from paved areas, including walkways and entrances

☐ In place

☐ Planned

☐ Not practical

Notes: _____

2. Maintain pavement to ensure impermeability, to allow for complete snow removal, and to prevent ponding

Examples where ponding may occur include around catch basins and low areas.

☐ In place

☐ Planned

☐ Not practical

Notes: _____

3. Close off areas not requiring maintenance during winter months

Close off unneeded areas that do not block emergency exits, accessibility ramps or entrances.

Benefits may include:

- Allows winter maintenance team to focus efforts on high traffic areas
- Reduce winter maintenance costs and repairs from salt damage
- Manage risk from potential slip and fall hazards
- Reduce winter maintenance costs from plowing and salting
- Provides location to store plowed snow

☐ In place

☐ Planned

☐ Not practical

Notes: _____

Winter maintenance practices

1. Clean up excess applied salt

- If using contractor, notify them to assess the application rate and clean up excess applied salt
- Train staff to recognize excess salt and clean up when contractor not involved

☐ In place

☐ Planned

Notes: _____

2. Prepare and implement a maintenance strategy for temperatures below -10°C, when salt is less effective

- ☐ In place. Include strategy with completed worksheet
- ☐ Planned

Notes: _____

3. Remove areas of drifting snow

Consider wind direction, elevation changes and location of snow fences.

- ☐ In place
- ☐ Planned
- ☐ Not practical

Notes: _____

4. Store snow on a sufficiently sized impermeable surface adjacent to a catch basin

- Consult with contractor about snow storage location and size to ensure feasibility
- Direct snow melt from piles towards a catch basin to prevent an ice hazard requiring more salt
- Snow melt must not infiltrate directly to grassed areas

- ☐ In place
- ☐ Planned
- ☐ Snow is stored on an impermeable surface, but cannot be feasibly located adjacent to a catch basin. Use chloride-free chemical (ex. Calcium magnesium acetate) to de-ice snow storage melt between snow events.

Notes: _____

Salt storage

☐ Not applicable. Salt not stored on property.

1. Store smaller quantity of salt on property as needed and only during winter months

☐ In place

☐ Planned

☐ Not practical

Notes: _____

2. Store salt in a secure, closed container or enclosure on an impermeable pad

☐ In place

☐ Planned

Notes: _____

3. Clean up spilled salt

☐ In place

☐ Planned

Notes: _____

Salt storage – liquid de-icers only

☐ Not applicable. Liquid de-icers not stored on property.

1. Store and handle liquid de-icers in an area that does not drain into the environment, including storm sewer, sanitary sewer or watercourse

- Includes direct and indirect drainage such as floor cracks, drains or ditches
- Prevention includes sealing cracked floors, moving liquid de-icer storage away from drainage areas, completing drain assessments, covering or decommissioning drainage points
- If moving de-icers to new location, label proposed storage area on the site plan

☐ In place

☐ Planned

Notes: _____

2. Protect liquid de-icer storage areas from all vehicular traffic

☐ In place

☐ Planned

Notes: _____

3. Prepare and implement your Spills Plan, including prevention and response measures

- Complete and review your written Spills Plan at least once a year
- Document the completion of each review in your Spills Plan

☐ In place. Include Spills Plan with completed worksheet.

☐ Planned

Notes: _____

4. Train staff on Spills Plan, including prevention and response measures

- All staff to complete training initially with annual review
- New staff to complete training upon hire
- Document training and retain records

☐ In place

☐ Planned

Notes: _____

5. Continuously supervise delivery and transfer of liquid de-icers by personnel trained on the Spills Plan

☐ In place

☐ Planned

Notes: _____

6. Place spill kits in accessible locations

- Spill kit contents must be appropriate for liquid salt, inventoried annually with Spills Plan review, and restocked as necessary
- Document spill kit contents and locations

☐ In place

☐ Planned

Notes: _____

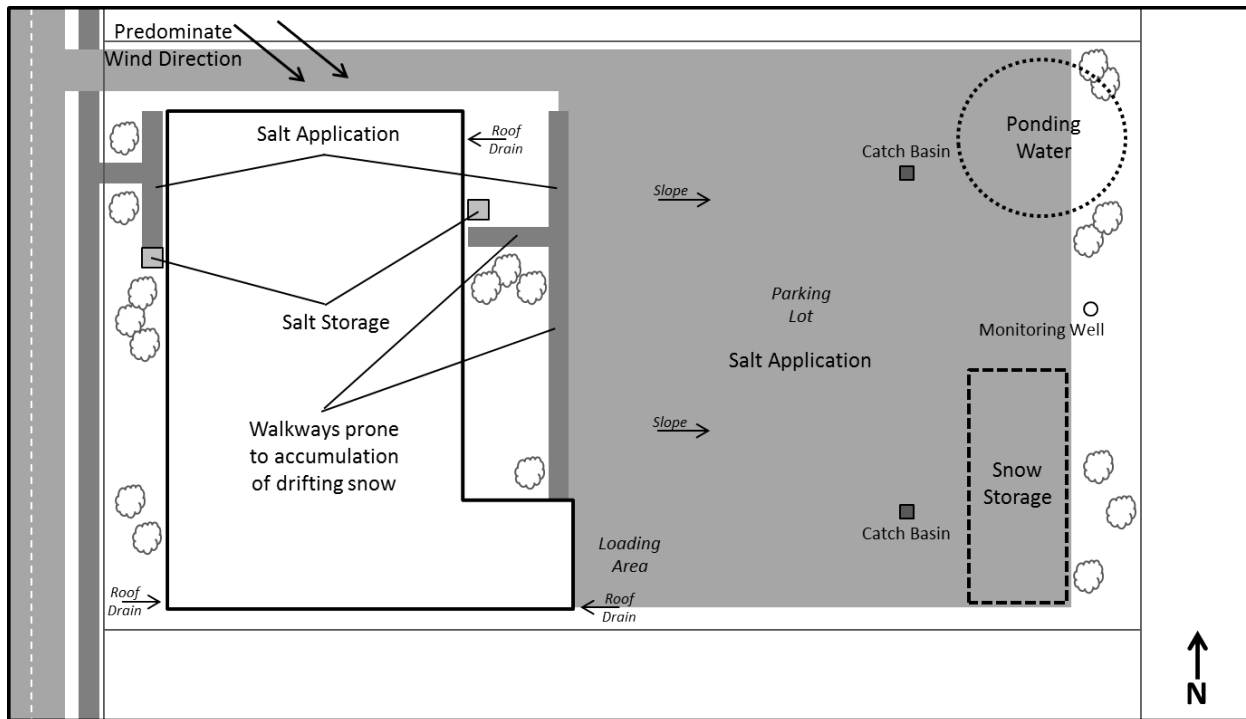
7. Store de-icing liquids in a tank or tote on an impermeable pad with 110% secondary containment and collision protection

☐ In place

☐ Planned

Notes: _____

Winter maintenance sample map



The map should include the following identifiers (where applicable).

- salt application areas
- building drainage outlets i.e. roof drains
- loading areas
- parking locations
- septic systems
- wells
- areas of ponding water
- areas prone to accumulation of drifting snow
- snow fence locations
- direction of surface drainage flow
- predominant wind direction
- areas to close not requiring winter maintenance i.e. seasonal walkway or overflow parking
- site drainage features, including catch basins (specify discharge point)
- stormwater management ponds and discharge locations
- areas of land leased
- salt storage areas, including salt boxes and salt pails by entrances
- snow storage locations

Salt Application Best Practices for Winter Maintenance Contracts



Help reduce damage to your property and protect the environment by ensuring your winter snow and ice maintenance contractor is not applying too much salt. Salt is a critical component of any good winter maintenance plan. But applying too much salt shortens the life of pavements and hastens the corrosion of building materials. Salt applied to parking lots and roads also finds its way into streams and rivers, where it harms fish and other aquatic life, many of which are very sensitive to even low amounts of salt.

Businesses can help reduce over-salting by ensuring that salt is applied responsibly on parking lots and walkways. An easy way to do this is by ensuring that your snow and ice maintenance contract includes provisions requesting that industry best practices be employed and operators are adequately trained. These will not only help ensure the 'right' amount of salt is applied to manage risk, but can also save money and prevent damage to building infrastructure.

PROCUREMENT BEST PRACTICES INCLUDE:

Effective pricing of services - Often payment for services is based on the amount of work or the quantity of salt applied which can encourage using more salt than is necessary. Contract pricing structures based on a lump sum by season, a fixed sum per event with extra paid for standby costs, or some combination of these payment options creates a financial incentive to apply less salt.

Accurate salt delivery - Calibration of salt spreaders helps ensure that the equipment is functioning properly and the amount of salt applied matches the rate of application set by the driver. Automated salt delivery systems that control application rates by vehicle ground speed can significantly reduce the amount of salt applied compared to conventional spreaders. These delivery systems ensure a more even spread of salt and allow contractors to precisely track the amount of salt applied.

Reducing liability risk - Slip and falls may occur, even when contractors and owners have tried their best to maintain a safe environment. In the event of lawsuits, it helps to have good records as evidence of the care that has been taken. Knowing and presenting accurate records of where, when, and how plowing and salting has occurred is the best form of defense against lawsuits.



Efficient application - The amount of road salt needed to keep parking lots clear of snow and ice can be significantly reduced by using anti-icing application techniques and pre-wetted salt. Anti-icing involves applying a liquid (such as salt brine) to paved surfaces before the storm arrives. This prevents snow and ice from bonding to the pavement, reducing the amount of salt needed after plowing. Pre-wetting involves coating the surface with a liquid to accelerate melting by providing initial moisture, while helping salt adhere better to the road surface.

Low chloride alternatives - A number of low chloride alternatives to road salt are currently available, such as acetates, formates, and organic products made from sugar beets, and other plant materials. Road salt alternatives provide effective snow and ice control at a wide range of temperatures. Many can be used as anti-icing or pre-wetting agents, delivering the same benefits as conventional salts and brines, while using considerably less salt.

Well informed decision making - Making good decisions about application methods and timing requires the use of supporting tools. Skillful use of local weather forecasts, road weather information systems, internet



based radar systems, and infrared thermometers to determine pavement temperature trends can help make decisions that save on salt, time and money.

Trained professionals - Applying the right material in the right amount at the right time and place can only be achieved by knowledgeable contractor and property management staff. Developing this knowledge requires training and experience. Requesting evidence of this experience and requiring training and certification through the **Ontario Smart about Salt Program** will help to ensure that the contractor and property operation staff have the skills necessary to implement best practices for road salt use.

KEY FACTS:

1. In a comprehensive study in the US, the use of closed loop electronic controllers resulted in salt savings of up to 47% when compared with manually controlled systems (Blackburn et al, 2008).
2. In the City of Toronto, the implementation of a road salt management training program for winter maintenance supervisors and operators reduced salt use by almost 37,000 tonnes over two winter seasons and saved nearly \$1.9 million dollars. (Environment Canada 2003).
3. In the Niagara Region, municipal application of a beet juice compound as an anti-icing and pre-wetting agent to roads has reduced the amount of road salt on the roads by as much as 30% while also lowering winter road maintenance costs. (Regional Municipality of Niagara).
4. In a study of Ontario roadways, prewetted salt was more effective than dry salts in 5 of 7 cases, reducing snow cover by between 18% and 40% compared to dry salt (Fu et al., 2006).

This communication has been prepared by the Sustainable Technologies Evaluation Program. Funding support for this project is provided by the Toronto and Region Remedial Action Plan (MOECC and Environment Canada), Region of Peel, York Region and the City of Toronto. The contents of this document do not necessarily represent the policies of the supporting agencies and the funding does not indicate an endorsement of the contents.

Published 2019. Visit us at www.sustainabletechnologies.ca to access our guidance document on how salt best practices can be incorporated into your winter maintenance contracts.

Please contact us at:

STEP@trca.on.ca | twitter.com/STEPLivingCity

The water component of STEP is a collaborative of:



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		Revision Date	
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		Section	
Salt Impact Assessment			

1.0 Purpose

To assess if salt loading due to winter de-icing activities from a proposed development will cause adverse source water quality concerns in the context of the Ministry of the Environment, Conservation and Parks (MECP) *Reasonable Use Concept (RUC)* water quality guidelines.

2.0 Background

Policy RW-MC-36

The Regional Municipality of Waterloo and Area Municipalities shall amend their Official Plans to state that *Planning Act* and *Condominium Act* applications proposing new roads as part of a subdivision and condominium applications where salt could be applied may be permitted subject to study in accordance with the Regional Implementation Guideline for Source Water Protection Studies and a Regional Salt Impact Assessment to the satisfaction of the Regional Municipality of Waterloo:

- i. In Wellhead Protection Area B where the vulnerability is equal to ten (10);
- ii. Where a Chloride and/or Sodium Issue has been identified, in all Wellhead Protection Areas except Wellhead Protection Area A.

3.0 Qualifications

This assessment shall be prepared by a Qualified Person (QP). A QP is a licensed Professional Geoscientist in the Province of Ontario or an exempted Professional Engineer as set out in the *Professional Geoscientists Act of Ontario*. The assessment should follow generally accepted methods outlined in the *Professional Practice Guidelines for Groundwater Resources Evaluation, Development, Management and Protection Programs in Ontario* (APGO, 2004).

4.0 Methodology

A *Salt Impact Assessment* is required to the satisfaction of the Region prior to draft plan approval proposing new roads as part of a subdivision or condominium application where salt will be applied. Based on the total length of roads and parking lot areas, and the amount of salt applied, the hydraulic loading to groundwater must be assessed relative to the MECP's *Reasonable Use Concept (RUC)* water quality guideline for chloride. In determining the hydraulic loading, a pre- and post-construction water balance (water budget) is required whereby consideration is given to the hydraulic

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Salt Impact Assessment			

properties of the underlying soil materials, the area of imperviousness, and the overall stormwater management strategy for the site.

Predicted chloride concentrations need to be determined prior to development to evaluate if the proposed land use is reasonable and if preventative measures should be implemented through the development approval process. The MECP's *Reasonable Use Concept (RUC)* was not strictly developed for this purpose; however, it is one approach to assessing stormwater-related impacts to groundwater recommended in the *Stormwater Management Planning and Design Manual* (MOE, 2003).

Two assessments may be required as part of an overall *Salt Impact Assessment* for a particular area:

- an assessment of the impact of the individual development on groundwater quality; and,
- an area-wide assessment of the cumulative impact on municipal water supply well(s).

The first assessment noted above is to ensure that the proposed development does not have an adverse impact on local groundwater quality. The second assessment is necessary in the case of secondary plans, new major roads (i.e. roads requiring a Municipal Class Environmental Assessment), etc. where the cumulative impact of roads and parking lots in a specific area could result in increased chloride loadings to a particular municipal water supply well(s) as a result of winter de-icing activities.

This guideline is provided for the first type of assessment – i.e. an assessment related to salt loading associated with individual developments. In the case of an area-wide assessment, the proponent should contact Region Hydrogeology and Source Water staff for additional guidance.

All information requested below must be included in the *Salt Impact Assessment*.

4.1 Hydrogeological Assessment

A hydrogeologic characterization should be completed according to generally accepted professional practice guidelines before initiating the *Salt Impact Assessment*. The hydrogeological characterization should include the following information:

- location and condition of boreholes and monitoring wells;
- location and condition of domestic and municipal water supply wells;

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- local and regional-scale hydrostratigraphy in cross-section (conceptual hydrogeologic model), including depth to municipal water supply aquifers and aquitards and hydraulic properties;
- Source Water Protection areas; including vulnerability scores
- intrinsic susceptibility of water supply aquifers;
- seasonal groundwater contours and flow direction;
- seasonal horizontal and vertical hydraulic gradients;
- identification of recharge and discharge areas; and,
- background groundwater quality, including sodium and chloride.

4.2 Salt Impact Assessment

In addition to the information in the *Hydrogeological Assessment* above, the *Salt Impact Assessment* will require soils investigations to determine soil profiles and the hydraulic properties of the native geologic materials to estimate infiltration rates across the subject property. Representative infiltration rates are required for all soil types on the property.

The *Salt Impact Assessment* should also include an evaluation of the proposed *Stormwater Management Plan* for the subject property and its ability to minimize the infiltration of salt-laden winter runoff and to mitigate impacts to source water quality.

It is necessary for the proponent to determine existing background chloride concentrations, and include a discussion of the concentrations relative to potential sources. If the Region has already completed an area-wide assessment for a well under consideration for a given development application, then the applicant will be expected to use this background assessment in their chloride loading calculations. If the proposed development is located in an area where an estimate has not been completed by the Region, the site-specific *Salt Impact Assessment* should determine the background levels.

Background chloride concentrations in the groundwater prior to anthropogenic impacts in the Region are typically between 2.5 and 15 mg/L. Where background concentrations cannot be determined the maximum concentration (15 mg/L) should be used to assess the impact from a development.

The following additional site-specific information is also required:

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Salt Impact Assessment			

- the total length of roads in the development (in 2-lane-kms) and type of roads (e.g. primary, secondary or local);
- the area of parking lots;
- anticipated winter maintenance service level and salt application rates (based upon the type of roads proposed or other available information); and,
- anticipated proportion of salt that will infiltrate to the ground water.

Based on the proposed road network, parking lot area, and the anticipated salt loading the hydraulic loading to the groundwater must be assessed. In determining the hydraulic loading, an existing and proposed conditions water balance will be required which must be consistent with the water balance determined as part of the *Stormwater Management Plan* for the subject property.

4.2.1 Assumptions

4.2.1.1 Salt Application Rates

For roads, the proponent should assume the following:

- 44 tonnes/two-lane-km (primary roads);
- 22 tonnes/two-lane-km (secondary roads); and,
- 2.2 tonnes/two-lane-km (local roads).

Instead of the rates above, loading rates reported by the Area Municipalities may also be used based on a minimum 3-year rolling average. Justification will be required if lower salt loading rates than those recommended above are used.

For parking lots, data provided by the Smart About Salt (SAS) program indicates that there is a wide range reported in terms of salt application rates and the number of times salt is applied per year by winter maintenance contractors. The proponent should assume an average loading rate of 50 g/m²/event to parking lots with salt applied on average 37 events per year (WESA, 2013).

4.2.1.2 Salt Infiltration Rate

The proponent should assume 28% of the salt that is applied to the roads infiltrates to the subsurface in catchments where there is a surface water outlet and up to 100% of the salt that is applied to the roads infiltrates to the subsurface in catchments with no outlet (e.g. in the case of dry ponds or end-of-pipe

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Salt Impact Assessment			

infiltration facilities). If road salt is applied to roads with impervious boulevards (i.e. kill strips) the amount of salt infiltrating may be reduced to 25%.

Any other assumptions used in the assessment should be clearly stated and justified to the satisfaction of the Region.

4.2.2 Reasonable Use Concept

The assessment must demonstrate that chloride levels in groundwater found at the site boundary under proposed conditions meet the provincially accepted RUC water quality criteria as set out in the 1994 MOEE document *Guidelines B-7 – Incorporation of the Reasonable Use concept into MOE Groundwater Management Activities*. RUC criteria for chloride evaluate whether groundwater concentrations at the site boundary exceed the following:

$$\text{RUC} = \text{background chloride concentration (in groundwater on the subject land)} + 50\% \text{ of } 250 \text{ mg/L (ODWS aesthetic objective for chloride)}$$

4.3 Reporting and Recommendations

The *Salt Impact Assessment* should discuss the final anticipated chloride concentrations in the groundwater as a result of the proposed development relative to the calculated RUC water quality guideline.

Recommendations should be made for mitigating the impacts of winter de-icing in terms of the overall layout of roads, parking areas, snow storage, etc. in the proposed Development Concept Plan.

Recommendations should also be provided to guide the *Stormwater Management Plan* to prevent or mitigate the impacts of winter de-icing on the municipal drinking water supply and to enable opportunities for environmental restoration or enhancement with respect to water resources.

As well, recommendations should be made in terms of the overall winter de-icing activities for the proposed development, including *Salt Management Plans*, snow storage, and other winter de-icing best practices. The *Salt Impact Assessment* should also include discussions of the existing and proposed conditions water balance, as well as the overall effect of development on the regional water budget, if applicable.

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		Section	
Salt Impact Assessment			

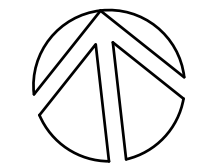
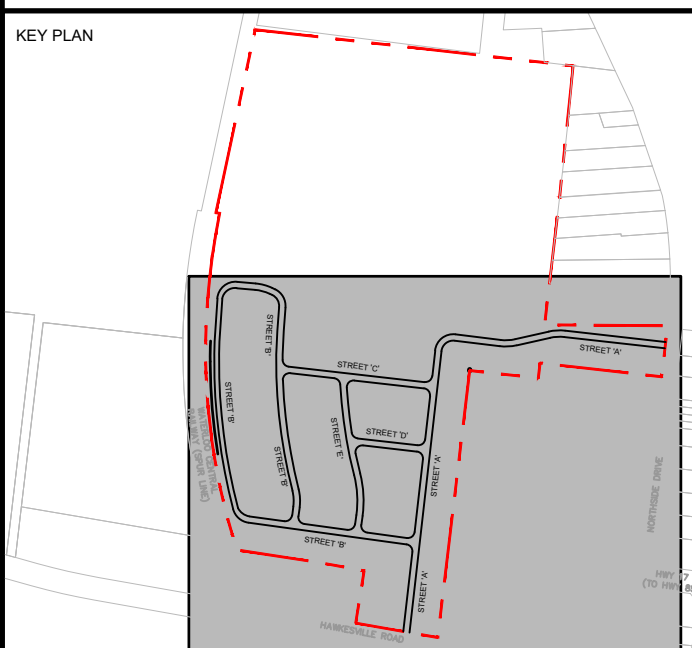
5.0 Relevant Documents

Relevant Documents	Document Location, Source or URL
• C.T. Johnson et al, 2004, Evaluation of Road Salt Impacts and Management Strategies for Groundwater Supplies Using GIS and Mass Balance Modeling Techniques • MOEE, 1994, GUIDELINE B-7 Incorporation of the Reasonable Use Concept into MOEE Groundwater Management Activities. • MOE, 2003, Stormwater Management Planning and Design Manual. • RMOW, 2016, Risk Management Plan, Winter Maintenance, New Activities • Stantec, 2003, Road Salt Management and Chloride Reduction Study Phase 2: Evaluation of Chloride Reduction Options. • WESA, 2013, Winter De-Icing Salt Assessment For Higher Priority Well Fields.	https://www.ontario.ca/document/guideline-b-7-incorporation-reasonable-use-concept-moe-groundwater-management-activities https://www.ontario.ca/document/stormwater-management-planning-and-design-manual

APPENDIX F

Drawings

ALL PROPOSED WORKS TO REMAIN OUTSIDE
DESIGNATED ENVIRONMENTAL FEATURE AREA



DATE	ISSUANCE	NO.
2025.04.30	ISSUED FOR DRAFT PLAN APPROVAL	

LEGEND	
	PROPERTY LINE
	EXISTING DECIDUOUS TREE
	EXISTING CONIFEROUS TREE
	EXISTING TREE DRIPLINE AND/OR VEGETATION LINE
	EXISTING SURVEYED CONTOUR
	EXISTING LIDAR CONTOUR (SWOOP 2018)
	EXISTING GASLINE
	EXISTING FENCE
	EXISTING OVERHEAD HYDRO
	EXISTING MONITORING WELL LOCATION
	REMOVAL AREA
	REMOVALS
	HYDRO POLE GUY WIRE



CLIENT
SCHLEGEL URBAN DEVELOPMENT CORP.

PROJECT
**ST. JACOBS LANDS
52 HAWKESVILLE ROAD
St. Jacobs, Ontario**

TITLE
**EXISTING CONDITIONS PLAN
SHEET 1 OF 2**

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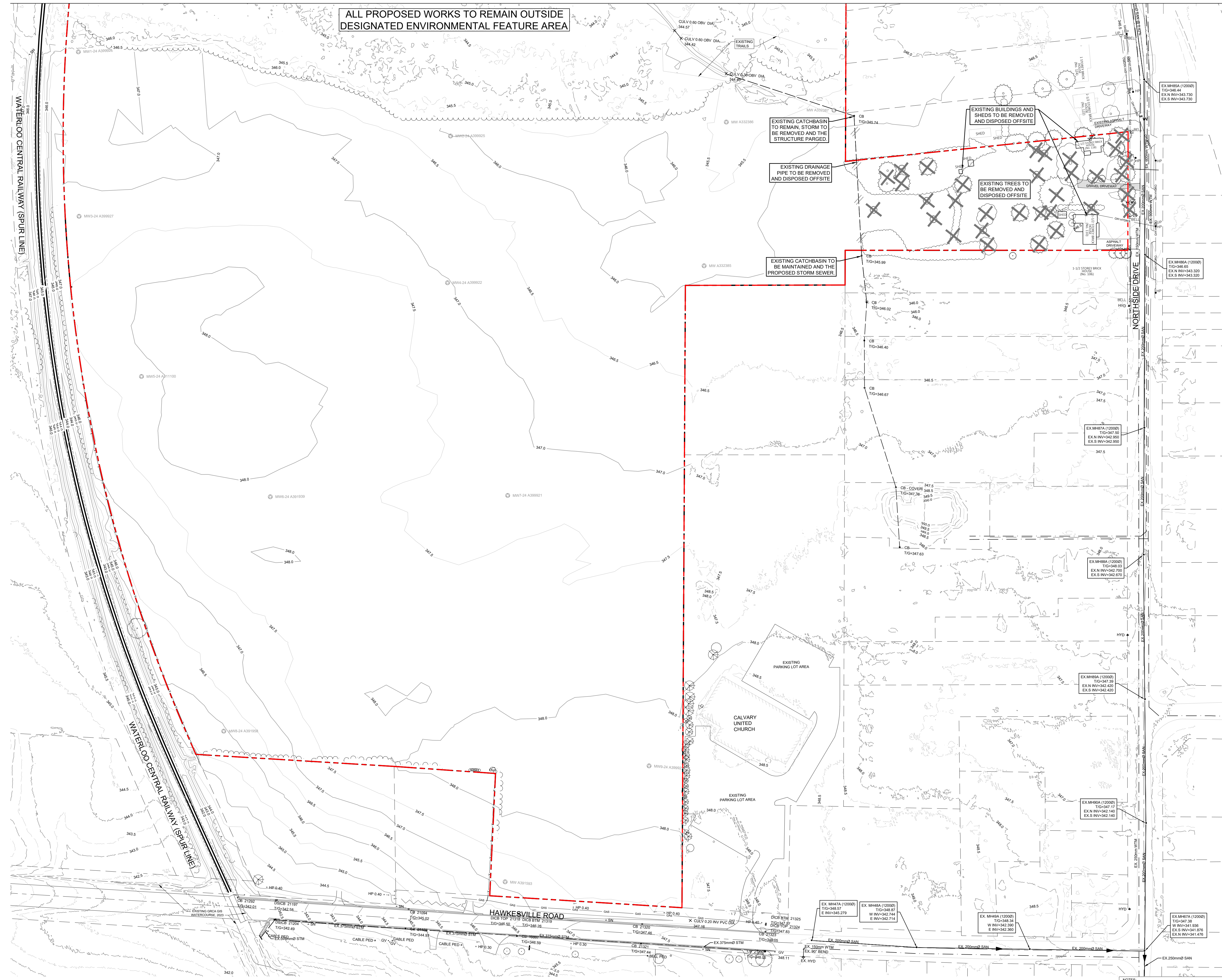


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 3. BENCHMARK: TOP OF FIRE HYDRANT ALONG NORTHSIDE DR ELEVATION: 347.28
 4. CONCEPT PLAN PROVIDED BY GSP, DATED APRIL 2025.
 5. ENVIRONMENTAL DISPLINES AND TREE SURVEY PROVIDED BY NRSI, 2024.

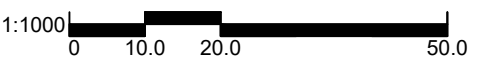




DATE	ISSUANCE	NO.
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LEGEND

- PROPERTY LINE**
EXISTING DECIDUOUS TREE
- EXISTING CONIFEROUS TREE**
- EXISTING TREE DRUPLINE**
ANJOR VEGETATION LINE
- EXISTING SURVEYED CONTOUR**
- EXISTING LIDAR CONTOUR**
(SWOOP 2018)
- EXISTING GASLINE**
- EXISTING FENCE**
- EXISTING OVERHEAD HYDRO**
- EXISTING MONITORING WELL LOCATION**
- REMOVAL AREA**
- REMOVALS**
- HYDRO POLE GUY WIRE**



CLIENT

SCHLEGEL URBAN
DEVELOPMENT CORP.

PROJECT

ST. JACOBS LANDS
52 HAWKESVILLE ROAD
St. Jacobs, Ontario

TITLE

EXISTING CONDITIONS PLAN
SHEET 2 OF 2

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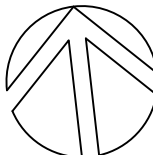
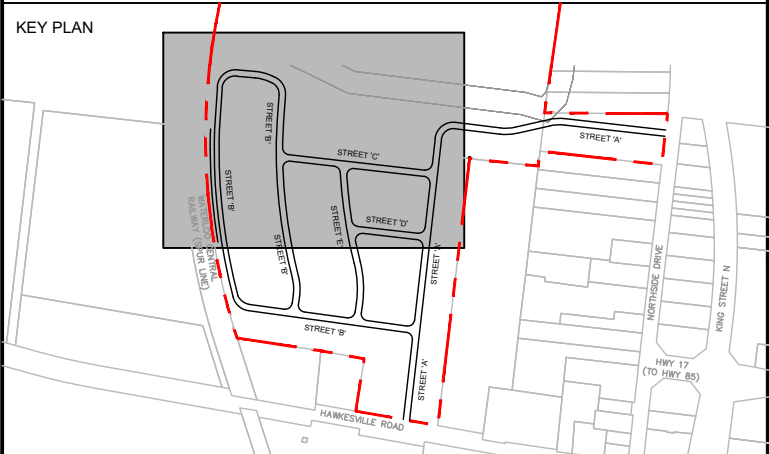
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C101

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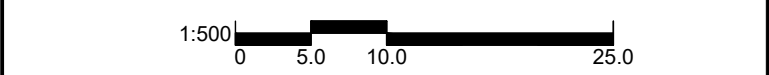
SEE DWG C100



DATE	ISSUANCE	NO.
2025.04.30	ISSUED FOR DRAFT PLAN APPROVAL	

LEGEND	
—	PROPERTY LINE
+ [123.45]	PROPOSED GRADE
+ [123.45]X	EXISTING GRADE
2.0%	PROPOSED DRAINAGE ARROW/SLOPE
~	PROPOSED SWALE
→	PROPOSED OVERLAND FLOW ROUTE
3.1	PROPOSED EMBANKMENT (3.1 MAX UNLESS OTHERWISE NOTED)
325.0	EXISTING SURVEYED CONTOUR
325.0	EXISTING LIDAR CONTOUR
[123.45]	GRADE BREAK
LOW PT	LOW POINT
HIGH PT	HIGH POINT
[123.45]	DROP LINE
—	TURFSTONE SURFACE
—	GRAVEL SURFACE
—	PROPOSED PERMANENT POOL

SEE DWG C201



CLIENT
SCHLEGEL URBAN
DEVELOPMENT CORP.

PROJECT
ST. JACOBS LANDS
52 HAWKESVILLE ROAD
St. Jacobs, Ontario

TITLE
CONCEPTUAL GRADING PLAN

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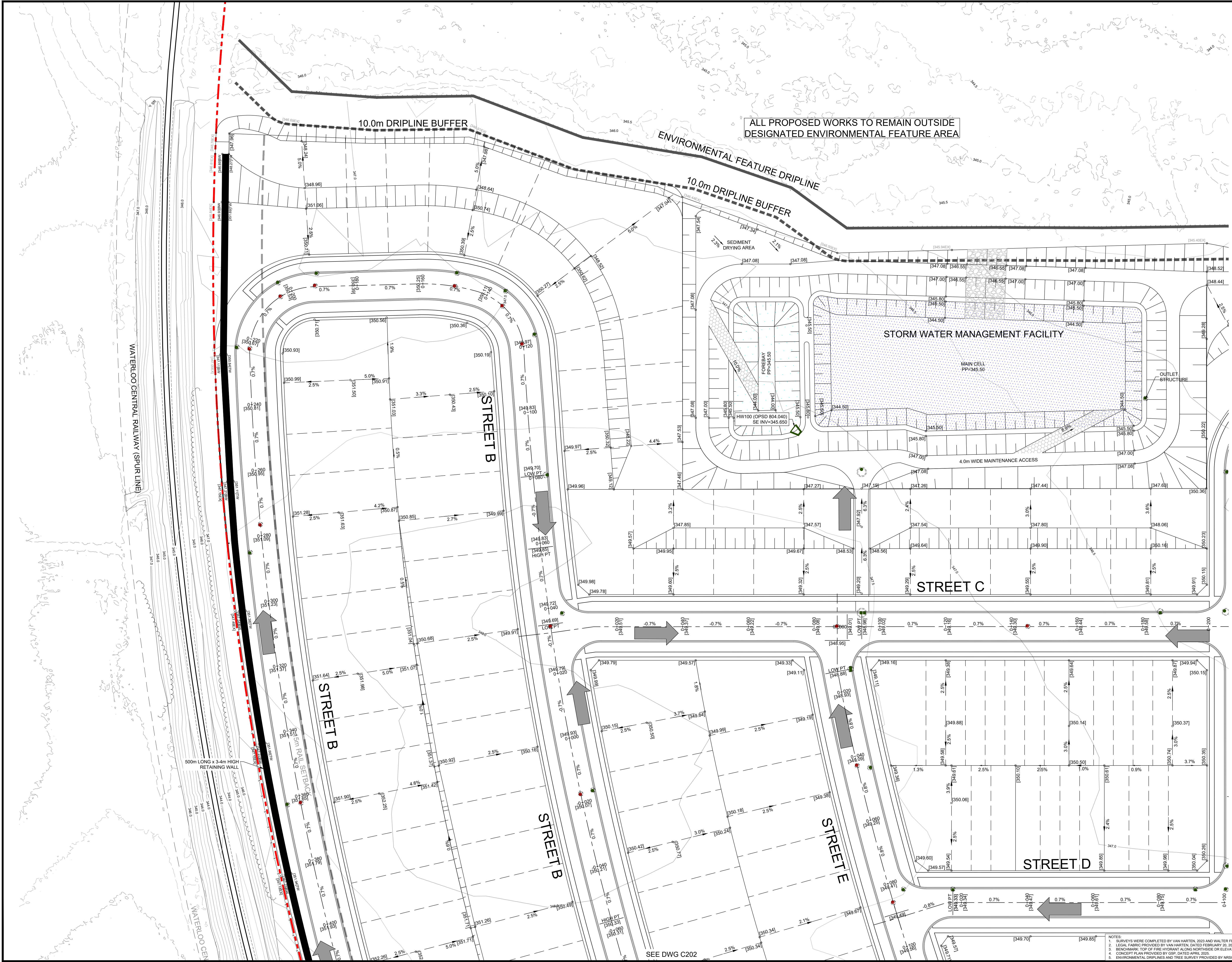


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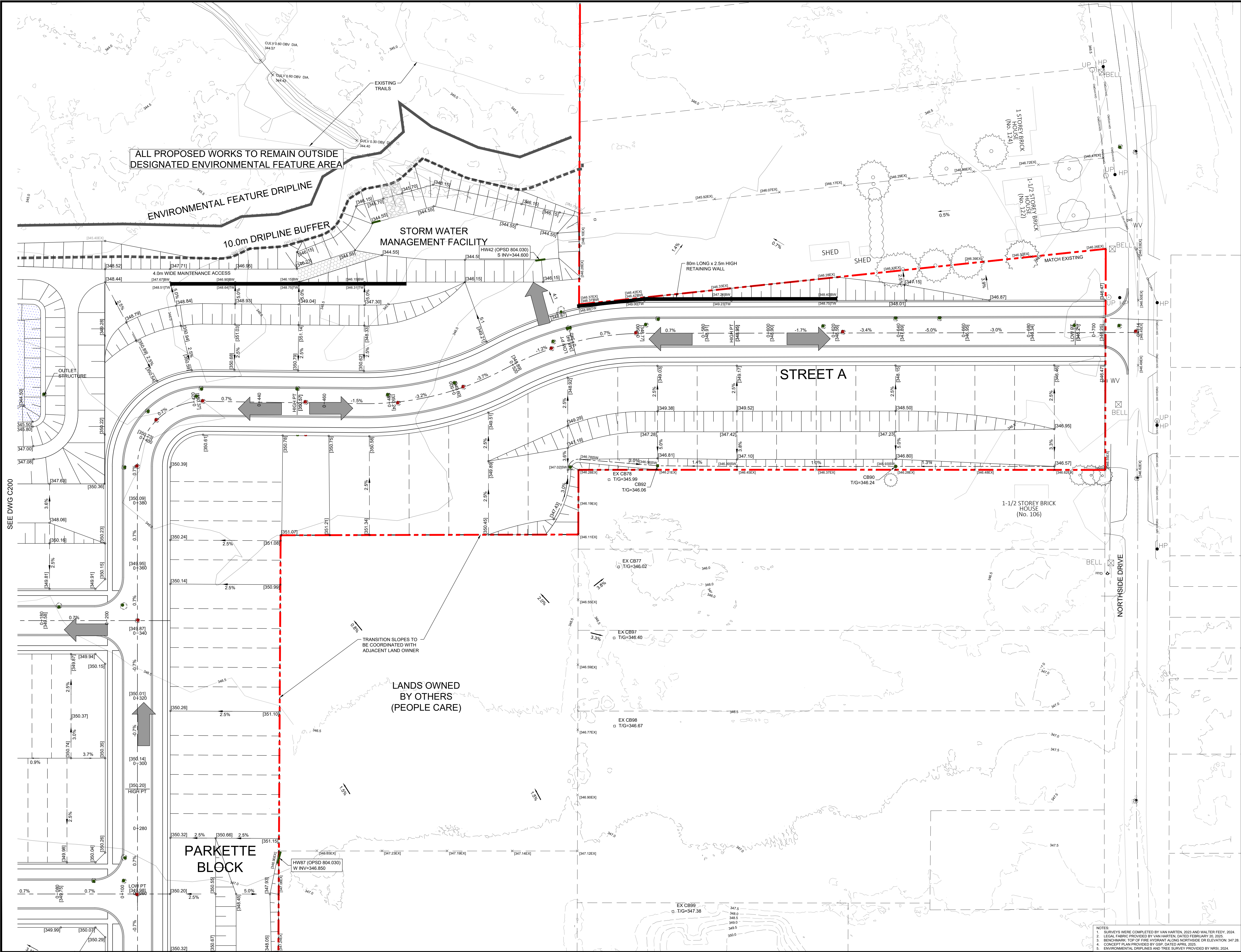
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SEE DWG C202



KEY PLAN

North

DATE	ISSUANCE	NO.
2025.04.30	ISSUED FOR DRAFT PLAN APPROVAL	

LEGEND

- PROPERTY LINE
- PROPOSED GRADE
- EXISTING GRADE
- PROPOSED DRAINAGE ARROW/SLOPE
- PROPOSED SWALE
- PROPOSED OVERLAND FLOW ROUTE
- PROPOSED EMBANKMENT (3:1 MAX UNLESS OTHERWISE NOTED)
- EXISTING SURVEYED CONTOUR
- EXISTING LIDAR CONTOUR
- GRADE BREAK
- LOW POINT
- HIGH POINT
- DRIPLINE
- TURFSTONE SURFACE
- GRAVEL SURFACE
- PROPOSED PERMANENT POOL

1:500
0 5.0 10.0 25.0

CLIENT

SCHLEGEL URBAN DEVELOPMENT CORP.

PROJECT

ST. JACOBS LANDS
52 HAWKESVILLE ROAD
St. Jacobs, Ontario

TITLE

CONCEPTUAL GRADING PLAN

WALTERFEDY
KITCHENER | HAMILTON | TORONTO | CALGARY
A PART OF WF GROUP
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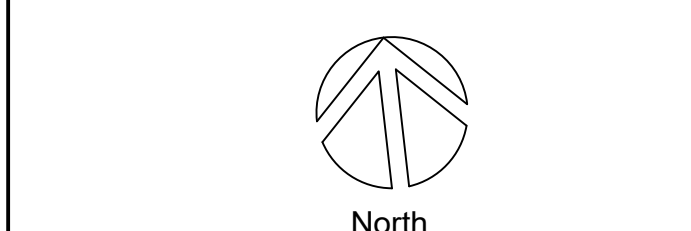
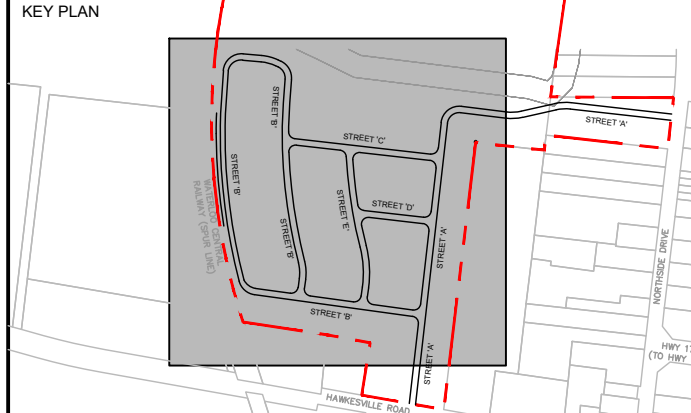
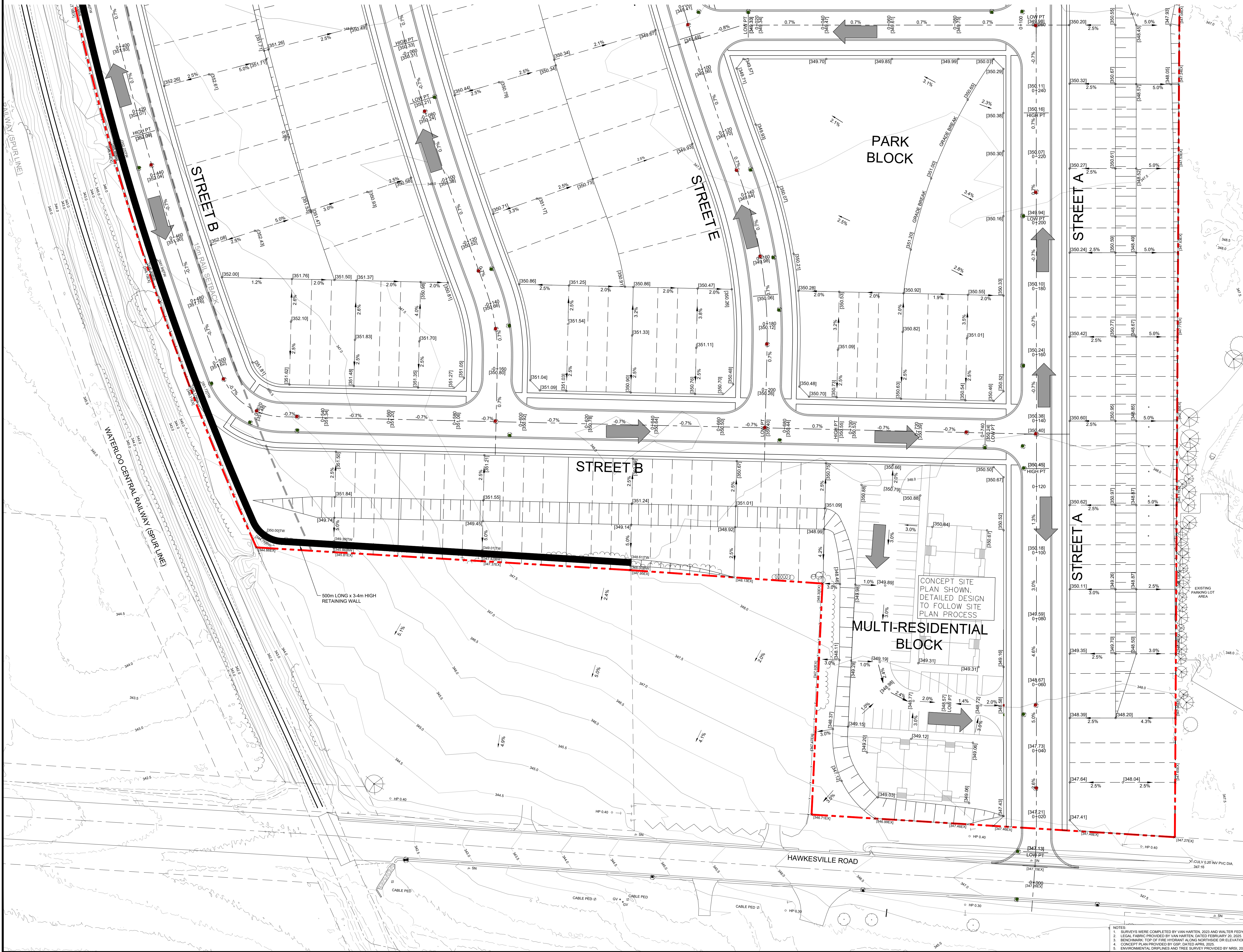
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SCALE	DATE	SHEET NO.
1:500	2025-04-29	C201
PROJECT NO.: 2023-0849-10		
DRAWN BY: JBM		
CHECKED BY: MN		

NOTES

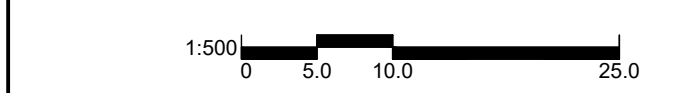
1. SURVEYS WERE COMPLETED BY VAN HARTEN, 2023 AND WALTER FEDY, 2024.
2. LEGAL FABRIC PROVIDED BY VAN HARTEN, DATED FEBRUARY 20, 2025.
3. BENCHMARK: TOP OF FIRE HYDRANT ALONG NORTHSIDE DR. ELEVATION: 347.28.
4. CONCEPT PLAN PROVIDED BY GSP, DATED APRIL 2025.
5. ENVIRONMENTAL DRIPLINES AND TREE SURVEY PROVIDED BY NRSI, 2024.

SEE DWG C200



DATE	ISSUANCE	NO.
2025.04.30	ISSUED FOR DRAFT PLAN APPROVAL	

LEGEND	
	PROPERTY LINE
	PROPOSED GRADE
	EXISTING GRADE
	PROPOSED DRAINAGE ARROW/SLOPE
	PROPOSED SWALE
	PROPOSED OVERLAND FLOW ROUTE
	PROPOSED EMBANKMENT (3.1 MAX UNLESS OTHERWISE NOTED)
	EXISTING SURVEYED CONTOUR
	EXISTING LIDAR CONTOUR
	GRADE BREAK
	LOW POINT
	HIGH POINT
	D RIP LINE
	TURFSTONE SURFACE
	GRAVEL SURFACE
	PROPOSED PERMANENT POOL



CLIENT
SCHLEGEL URBAN
DEVELOPMENT CORP.

PROJECT
ST. JACOBS LANDS
52 HAWKESVILLE ROAD
St. Jacobs, Ontario

TITLE
CONCEPTUAL GRADING PLAN

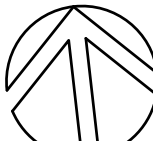
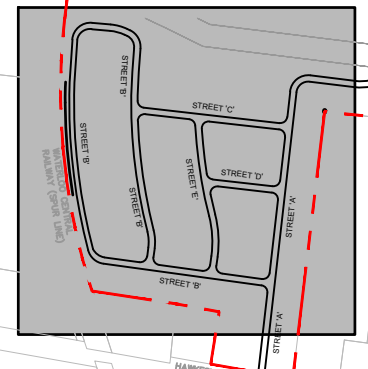
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SCALE	DATE	SHEET NO.
1:500	2025-04-29	C202
PROJECT NO.	2023-0849-10	
DRAWN BY	JBM	
CHECKED BY	MIN	

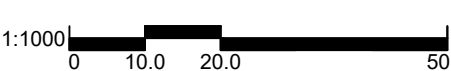
NOTES
1. SURVEYS WERE COMPLETED BY VAN HARTEN, 2023 AND WALTER FEDY, 2024.
2. LEGAL FABRIC PROVIDED BY VAN HARTEN, DATED FEBRUARY 20, 2025.
3. BENCHMARK, TOP OF FIRE HYDRANT ALONG NORTHSIDE OR ELEVATION: 347.28
4. CONCEPT PLAN PROVIDED BY GSP, DATED APRIL 2025.
5. ENVIRONMENTAL DISPLINES AND TREE SURVEY PROVIDED BY NRSI, 2024.



North

DATE	ISSUED FOR DRAFT PLAN APPROVAL	ISSUANCE	NO.
2025.04.30			

- LEGEND**
- PROPERTY LINE
 - PROPOSED SANITARY SEWER/SERVICE
 - PROPOSED STORM SEWER/SERVICE
 - PROPOSED WATERMAIN SEWER/SERVICE
 - PROPOSED STORM MANHOLE
 - PROPOSED SANITARY MANHOLE
 - PROPOSED EMBANKMENT (3:1 MAX UNLESS OTHERWISE NOTED)
 - PROPOSED CHAINLINK FENCE
 - EXISTING CHAINLINK FENCE
 - EXISTING TREE DRIPLINE
 - PROPOSED RETAINING WALL
 - PROPOSED BUFFER LINE
 - PROPOSED GRINDER PUMP REQUIRED



CLIENT
SCHLEGEL URBAN DEVELOPMENT CORP.

PROJECT
ST. JACOBS LANDS
52 HAWKESVILLE ROAD
St. Jacobs, Ontario

TITLE
CONCEPTUAL SERVICING PLAN

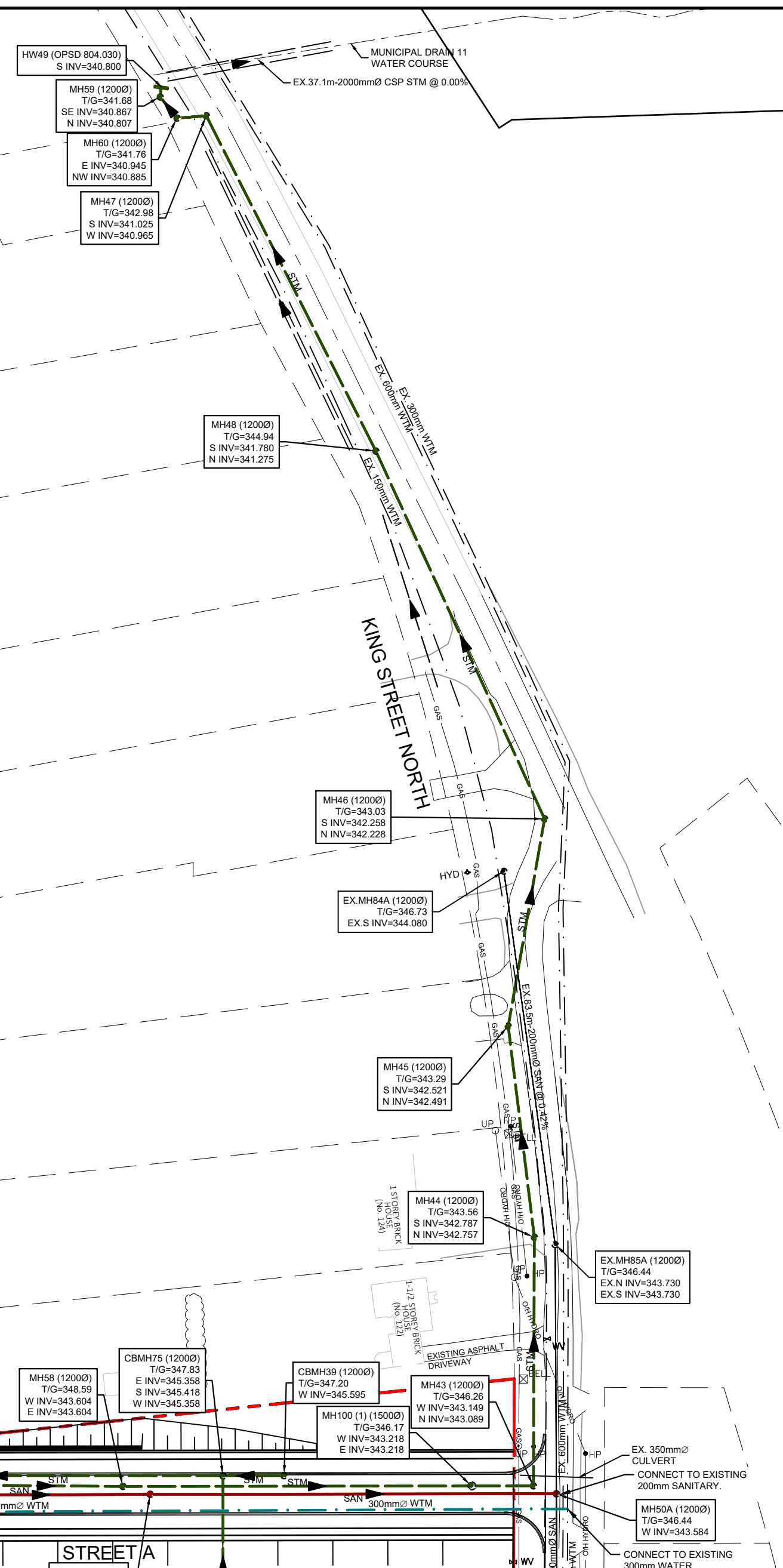
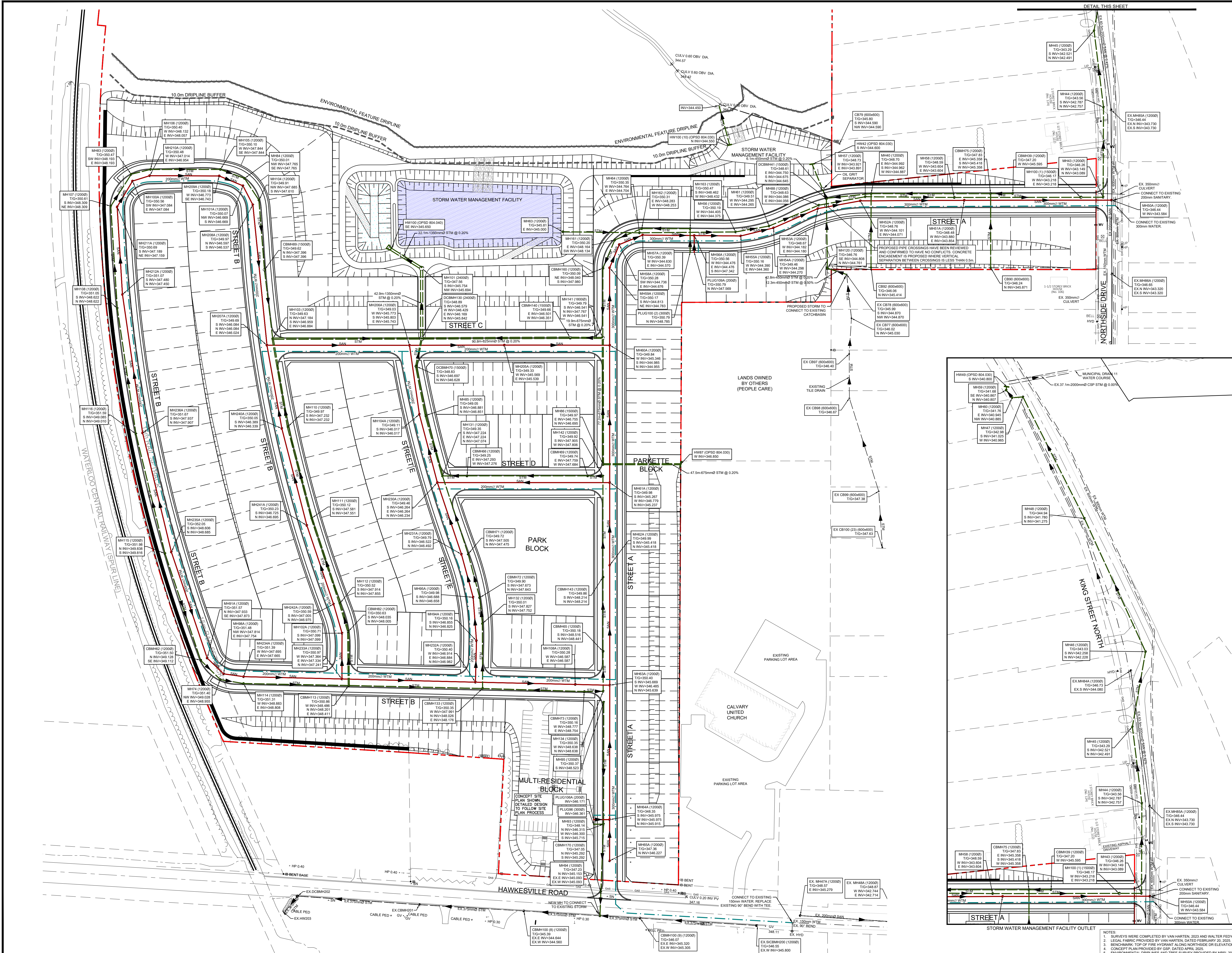
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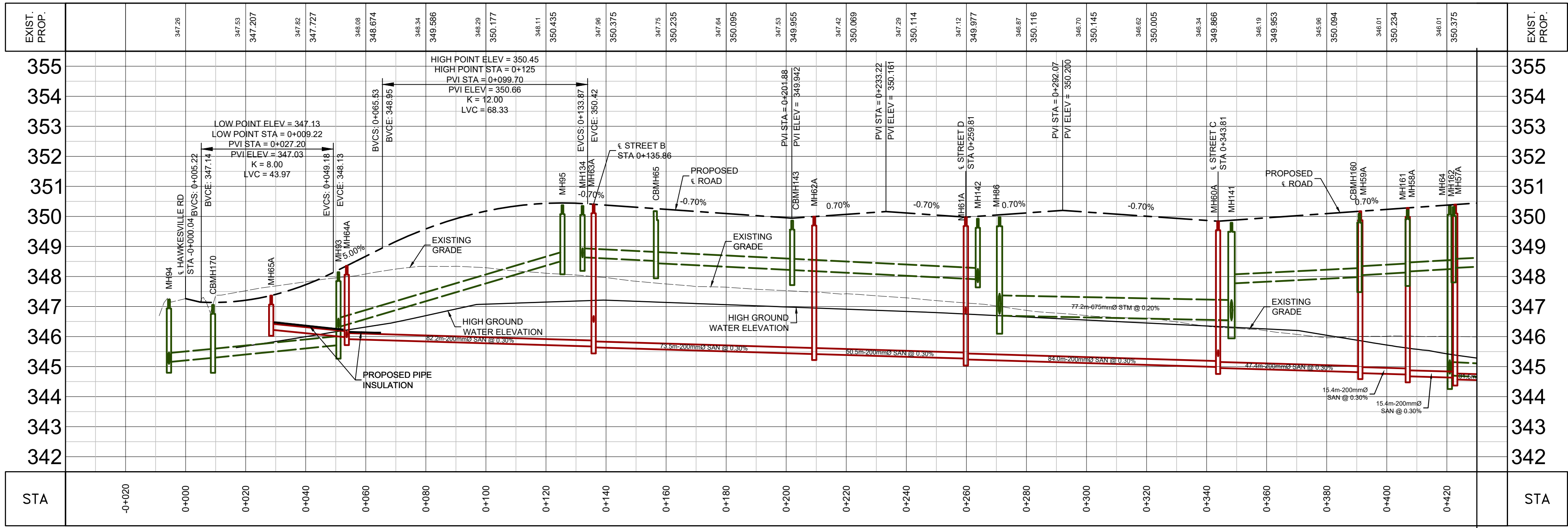
SCALE: 1:1000	SHEET NO.:
DATE: 2025-04-29	PROJECT NO.: 2023-0849-10
DRAWN BY: JBM	CHECKED BY: MN

C300

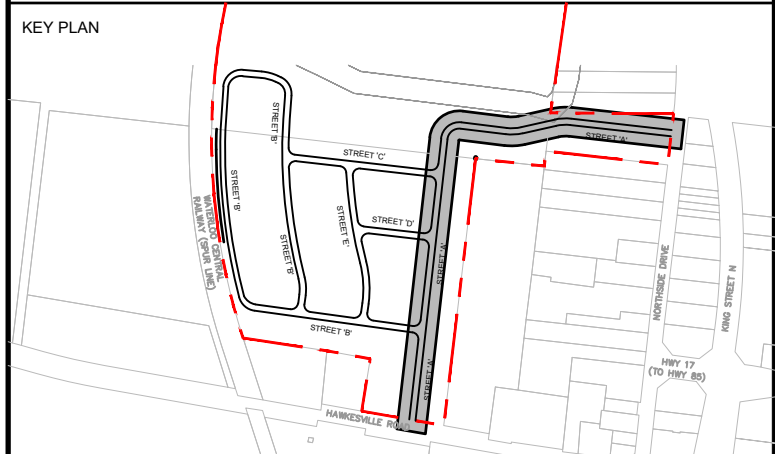
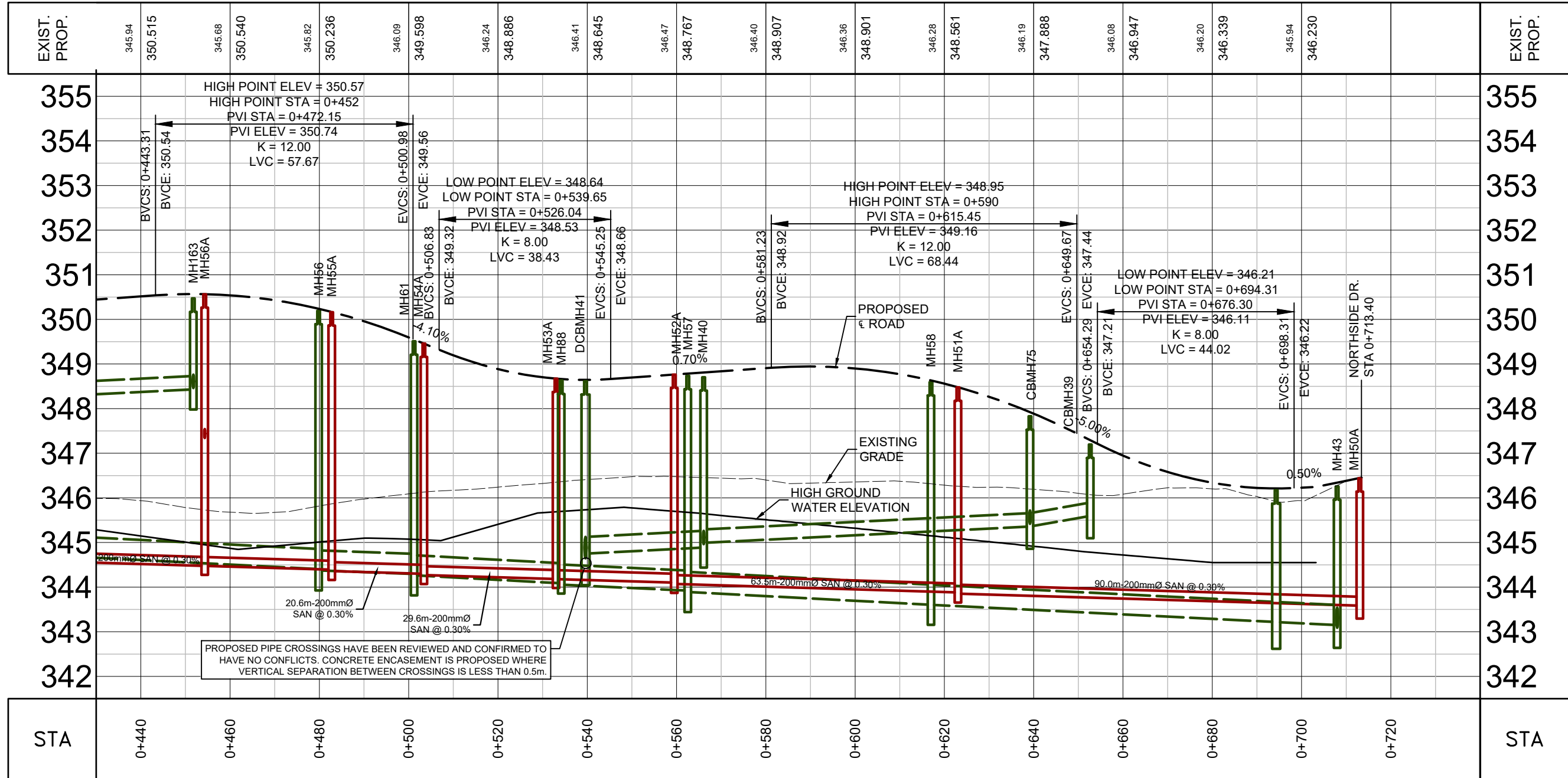


- NOTES
- SURVEYS WERE COMPLETED BY VAN HARTEN, 2023 AND WALTER FEDY, 2024.
 - LEGAL FABRIC PROVIDED BY VAN HARTEN, DATED FEBRUARY 20, 2025.
 - BENCHMARK: TOP OF FIRE HYDRANT ALONG NORTHEAST DR. ELEVATION: 347.28
 - CONCEPT PLAN PROVIDED BY GSP, DATED APRIL 2025.
 - ENVIRONMENTAL DRIPLINES AND TREE SURVEY PROVIDED BY NRSL 2024.

STREET A



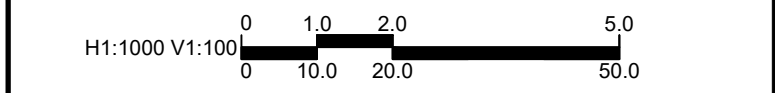
STREET A



DATE	ISSUANCE	NO.
2025.04.30	ISSUED FOR DRAFT PLAN APPROVAL	

LEGEND	
—	PROPOSED SANITARY SEWER
---	PROPOSED STORM SEWER

NOTE:
1. DROP STRUCTURES AND SAFETY GRATES REQUIREMENTS TO BE REVIEWED DURING DETAILED DESIGN.
2. PIPE & STRUCTURE SIZES TO BE REVIEWED DURING DETAILED DESIGN.



CLIENT
SCHLEGEL URBAN DEVELOPMENT CORP.

PROJECT
**ST. JACOBS LANDS
52 HAWKESVILLE ROAD
St. Jacobs, Ontario**

TITLE
**CONCEPTUAL PROFILES
STREET A**

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SCALE	H1:1000 V1:100	SHEET NO.:
DATE	2025-04-29	C400
PROJECT NO.:	2023-0849-10	
DRAWN BY:	JBH	
CHECKED BY:	MN	

NOTES:
1. SURVEYS WERE COMPLETED BY VAN HARTEN, 2023 AND WALTER FEDY, 2024.
2. LEGAL FABRIC PROVIDED BY VAN HARTEN, DATED FEBRUARY 20, 2025.
3. BENCHMARK: TOP OF FIRE HYDRANT ALONG NORTHSIDE DR. ELEVATION: 347.28.
4. CONCEPT PLAN PROVIDED BY GSP, DATED APRIL 2025.
5. ENVIRONMENTAL DISPLINES AND TREE SURVEY PROVIDED BY NRSI, 2024.

STA	EXIST. PROP.
-0+200	
-0+180	347.81 350.888
-0+160	347.73 350.801
-0+140	347.70 350.661
-0+120	347.78 350.521
-0+100	348.01 350.381
-0+080	347.92 350.241
-0+060	347.91 350.311
-0+040	348.12 350.212
-0+020	348.21 350.072
0+000	348.16 349.832
0+020	348.03 349.792
0+040	347.99 349.721
0+060	348.17 349.840
0+080	347.99 349.700
0+100	347.37 349.833
0+120	347.12 349.973
0+140	348.06 350.113
0+160	348.87 350.253
0+180	348.90 350.393
0+200	348.81 350.533
0+220	348.69 350.673
0+240	347.28 350.813
0+260	347.21 350.953
0+280	347.64 351.093
0+300	347.71 351.233
0+320	347.62 351.373
0+340	347.46 351.513
0+360	347.42 351.653
0+380	347.39 351.793
0+400	347.16 351.933
0+420	348.96 352.073
0+440	348.79 352.035

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LEGEND

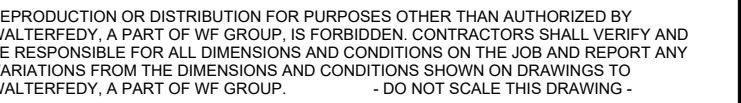
— PROPOSED SANITARY SEWER

- - - PROPOSED STORM SEWER

PROJECT

ST. JACOBS LANDS
52 HAWKESVILLE ROAD
St. Jacobs, Ontario

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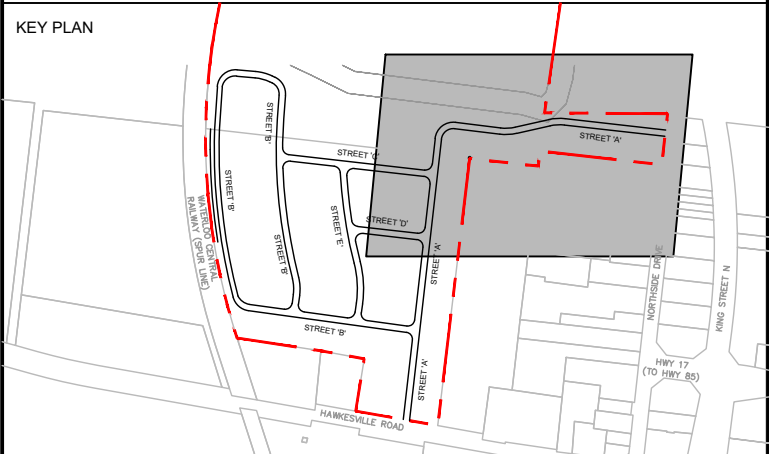
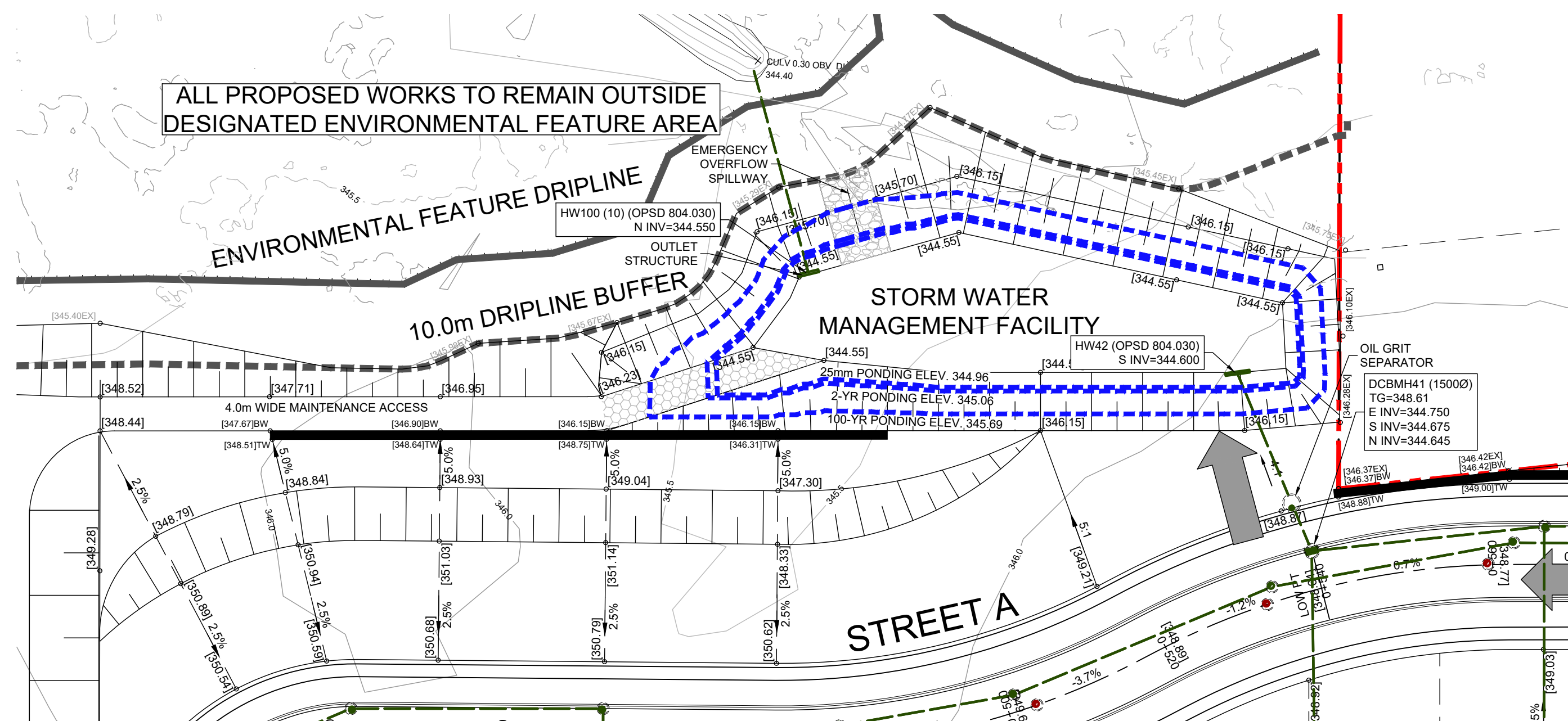
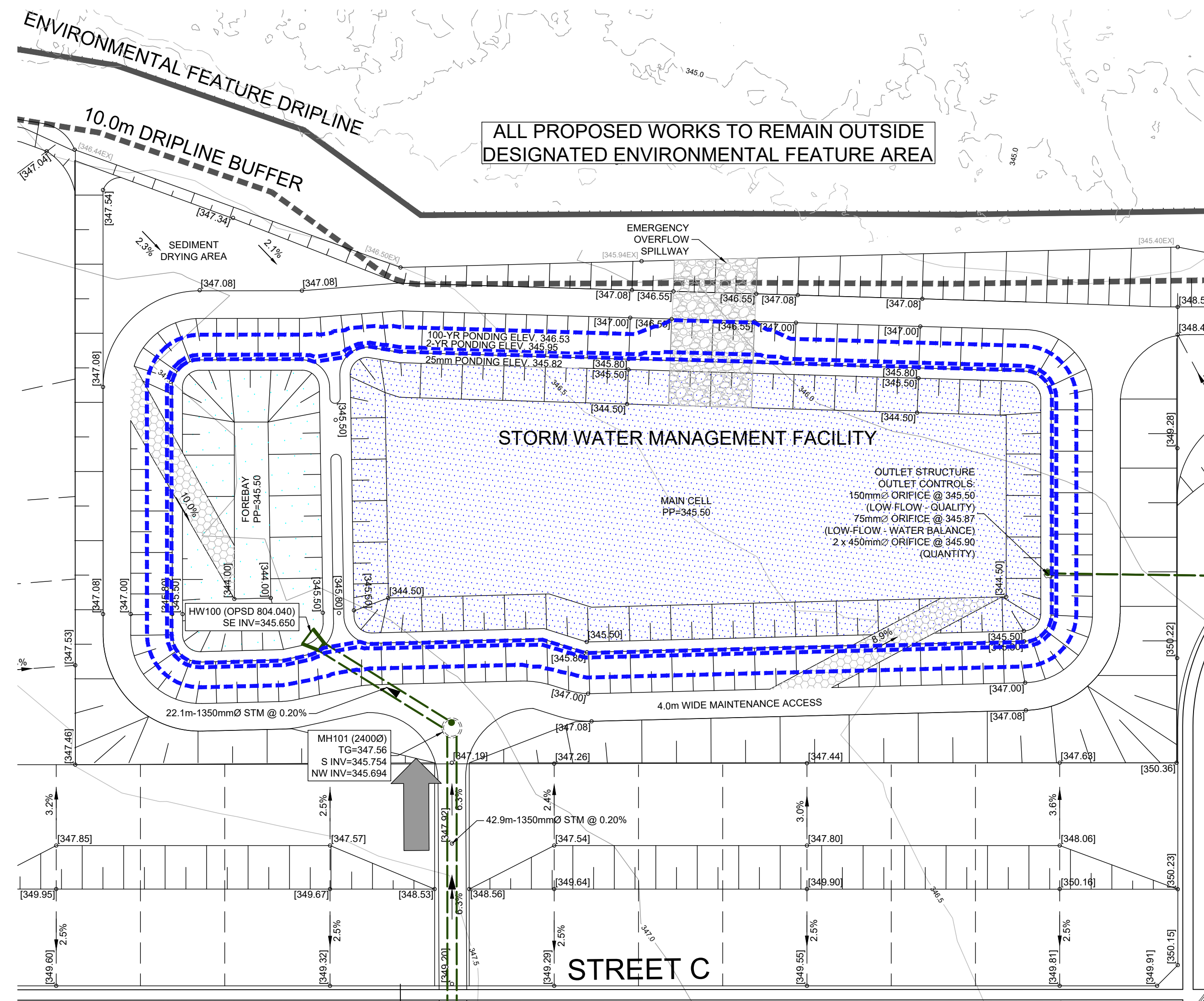
C402

EXIST. PROP.															EXIST. PROP.
354															354
353															353
352															352
351															351
350															350
349															349
348															348
347															347
346															346
345															345
STA	-0+020	0+000	0+020	0+040	0+060	0+080	0+100	0+120	0+140	0+160	0+180	0+200	0+220	STA	

EXIST. PROP.																	EXIST. PROP.	
355																		355
354																		354
353																		353
352																		352
351																		351
350																		350
349																		349
348																		348
347																		347
346																		346
345																		345
344																		344
STA	-0+020	0+000	0+020	0+040	0+060	0+080	0+100	0+120	0+140	0+160	0+180	0+200	0+220	0+240			STA	

EXIST. PROP.											EXIST. PROP.
354											354
353											353
352											352
351											351
350											350
349											349
348											348
347											347
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STA	-0+20	0+00	0+20	0+40	0+60	0+80	0+100	0+120		STA	

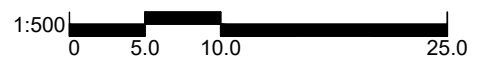
SCALE:	H1:1000 V1:100	SHEET NO.: C402
DATE:	2025-04-29	
PROJECT NO.:	2023-0849-10	
DRAWN BY:	JBM	
CHECKED BY:	MN	



DATE	ISSUANCE	NO.
2025.04.30	ISSUED FOR DRAFT PLAN APPROVAL	

LEGEND

	PROPOSED GRADE
	EXISTING GRADE
	PROPOSED DRAINAGE ARROWSLOPE
	PROPOSED SWALE
	PROPOSED OVERLAND FLOW ROUTE
	PROPOSED EMBANKMENT (3:1 MAX UNLESS OTHERWISE NOTED)
	EXISTING SURVEYED CONTOUR
	EXISTING LIDAR CONTOUR
	EXISTING TREE DRILINE
	PROPOSED BUFFER LINE
	PONDING ELEVATION



CLIENT

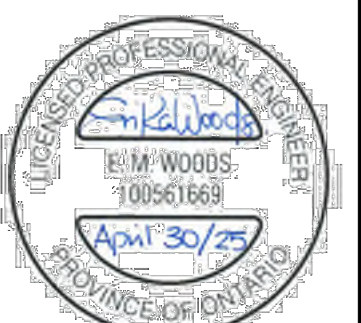
SCHLEGEL URBAN
DEVELOPMENT CORP.

PROJECT

ST. JACOBS LANDS
52 HAWKESVILLE ROAD
St. Jacobs, Ontario

TITLE	CONCEPTUAL STORM WATER MANAGEMENT FACILITIES
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SCALE: 1:500	SHEET NO.: C600
DATE: 2025-04-29	
PROJECT NO.: 2023-0849-10	
DRAWN BY: JBM	
CHECKED BY: MN	

- NOTES:
1. SURVEYS WERE COMPLETED BY VAN HARTEN, 2023 AND WALTER FEDY, 2024.
 2. LEGAL FABRIC PROVIDED BY VAN HARTEN, DATED FEBRUARY 20, 2025.
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 4. CONCEPT PLAN PROVIDED BY GSP, DATED APRIL 2025.
 5. ENVIRONMENTAL DIAPHRANES AND TREE SURVEY PROVIDED BY NRSI, 2024.