ELM DEVELOPMENT CORP.

430 OTTAWA STREET – PHASE 2 SITE PLAN CONTROL APPROVAL AMENDMENT

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT

JULY 27, 2026

COPY

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ELM DEVELOPMENT CORP.

SERVICING REPORT

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1 INTRODUCTION

WSP Canada Inc. (WSP) was retained by Elm Development Corp. to prepare a Functional Servicing and Stormwater Management Report in support of the development of lands municipally known as 430 Ottawa Street in the Town of Mississippi Mills (Almonte), Ontario (the "Development Site"). As part of the Site Plan Control approval process, a Functional Servicing and Stormwater Management Report is required to identify, assess, and demonstrate the adequacy of the proposed municipal servicing and stormwater management infrastructure to support the proposed development.

This submission has been prepared in support of a new Site Plan Control Application for Phase 2 of the approved development. The proposed Phase 2 development consists of a new four-storey residential building, including underground and surface parking facilities, along with associated site servicing, grading, and stormwater management infrastructure.

The purpose of this report is to evaluate the proposed servicing strategy and stormwater management design for Phase 2 of the development and to confirm that the proposed site layout and supporting infrastructure satisfy applicable municipal standards, design guidelines, and regulatory requirements.

1.1 PURPOSE OF THE REPORT

The purpose of this report is to outline and evaluate the proposed servicing strategy for Phase 2 of the development, including water distribution, sanitary servicing, storm sewer systems, stormwater management, and erosion and sediment control measures. This report demonstrates that sufficient municipal infrastructure capacity and appropriate on-site servicing solutions are available to support the proposed Phase 2 residential development, consisting of a new four-storey residential building with underground and surface parking facilities.

Phase 1 of the development consists of a proposed one-storey retail building, for which a separate Site Plan Application has been submitted. The servicing requirements and infrastructure associated with Phase 1 have been considered as part of the overall site servicing strategy and ultimate development conditions.

In addition, ultimate (full build-out) servicing conditions are presented for reference purposes to illustrate how the proposed Phase 2 infrastructure will integrate with the future development of the site. The ultimate build-out condition includes a future Phase 3 development consisting of a retail building and associated surface parking area.

1.2 BACKGROUND INFORMATION

Pertinent background information obtained from previous reports and plans as it relates to this development include:

- Applicant's Study and Plan Identification List from Town of Mississippi Mills (December 2021)
- Applicant's Study and Plan Identification List from Town of Mississippi Mills (November 2022)
- The latest site plan and building elevations (Vandenberg & Wilderboer Architects, March 2023)
- The latest legal plan (Callon & Dietz, February 2023)
- The previous stormwater management report (AECOM, May 2011)
- The previous Grading & Drainage drawing (AECOM, July 2004)

- The previous Grading and Drainage drawing - C01 (AECOM, November 2011)
- The previous technical memo – Almonte Square Official Plan Amendment Existing Site Service (AECOM, January 2015)
- Ottawa Street Reconstruction Drawings (P-3 & P-4) (Jp2g Consultants Inc., July 2008)
- Geotechnical Investigation Report (Toronto Inspection Ltd., November 2022)
- Hydrogeological Study (Franz Environmental Inc., November 2014)
- Landscape Plan (Nak Design Strategies, March 2023)
- Master Plan Update Report – Final Municipal of Mississippi Mills Almonte Ward Water and Wastewater Infrastructure (J.L.Richards & Associate Ltd., February 2018)

The onsite topographic survey has been completed by GeoVera in December 2022 with geodetic system referred to NAD83 CSRS (2010) datum for coordinates and the CGVD-1928:78 vertical datum for elevations (benchmark 0011968U069). The provided topographic plan was used to create the existing ground surface and the based site plan for this study.

1.3 PROJECT AREA

The development site is located within the Almonte Ward in the Town of Mississippi Mills, approximately 45 km west of the City of Ottawa. The development site measures 2.55 ha in area and is sited on the north of Ottawa Street, approximately 250 m west of Ramsay Concession 11 A, and 40 m east of Saddler Drive.

The existing site was a commercial plaza with a L shaped building, including a number of retail stores, with paved driveways, parking lots, and grassed areas. A row of existing townhome buildings is located northwest of the development site and a coffee shop is sited in the southwest corner of the development site and followed by Sadler Street. The location of the development site is presented in Figure 1.1.

Figure 1.1: Location of the Development Site

The latest Draft plan certified by Callon & Dietz, Ontario Land Surveyor, dated on February 2, 2023, is included in **Appendix A**.

The site development is proposed to be completed in three phases. Phase 1 consists of a proposed one-storey commercial building with associated parking and driveway access, located at the southwest corner of the development site. Phase 2 includes a proposed four-storey residential apartment building with underground and surface parking facilities. Phase 3 represents the future development of the site and will include an additional commercial building with associated parking areas.

The following sections of this report provide detailed discussions on the servicing design and stormwater management strategy for the proposed Phase 2 development, including consideration of the interim servicing conditions and the ultimate solution representing the full build-out condition of the site.

The proposed paving, grading, and underground servicing are shown on the engineering drawings included in **Appendix B**.

2 WATER DISTRIBUTION SYSTEM

A looped water distribution system will be proposed for the development site. At the full development stage, the proposed water system will include approximately 315 m of 200 mm diameter PVC DR18 watermain, four (4) fire hydrants, and two (2) connections to the existing 250 mm diameter watermain along south side of Ottawa Street. Note that all watermain and associated structures within the right-of-way will be considered municipal infrastructure post-development.

2.1 WATER SYSTEM DESIGN CRITERIA

As discussed with the Town of Mississippi Mills, the City of Ottawa Design Guidelines was used to analyze and design the water distribution system. And the following design parameters and assumptions were applied for this study:

- Hazen-Williams coefficient: C = 110 (200 mm to 250 mm diameter watermain)
- Residential water consumption rate: 280 litres/capita/day
- Population density (residential): 1.8 persons / average apartment unit
- Commercial water consumption rate: 28,000 L/gross ha/day
- Peak hour factor:
    - Residential: 7.4 (from MECP Design Guideline for Drinking Water System, Table 3-3)
    - Commercial: 2.7
- Maximum day demand factor:
    - Residential: 4.9 (from MECP Design Guideline for Drinking Water System, Table 3-3)
    - Commercial: 1.5
- Maximum system pressure: 552 kPa (80 psi)
- Minimum system pressure under peak hour demand: 276 kPa (40 psi)
- Minimum system pressure under fire flow conditions: 140 kPa (20 psi)

Fire flow requirements for the proposed residential building were evaluated using both the Fire Underwriters Survey (FUS) Water Supply for Public Fire Protection (2020) methodology and the Ontario Building Code (OBC) water supply for firefighting calculation based on the latest architectural building information. The FUS calculation has been completed to assess the available municipal fire protection capacity, while the OBC calculation reflects the required fire flow for the proposed sprinklered building in accordance with the Ontario Building Code. Hydraulic modelling of the proposed water distribution system has been completed to confirm that the available municipal water supply satisfies the governing building code fire flow requirements.

2.2 EXISTING WATER SYSTEM AND BOUNDARY CONDITIONS

The existing site was serviced by a 150 mm diameter watermain which was connected to the existing 250 mm diameter watermain on Ottawa Street. The topographic survey and the existing site plan show that two existing fire hydrants onsite to provide fire protection on the existing building. It is our understanding that the existing water distribution, including 150 mm diameter watermain, water services, and the onsite fire hydrants, will be abandoned or removed for the future development.

The hydraulic boundary conditions at the two proposed connections on the existing 250 mm WM on Ottawa Street were provided by J. L. Richard & Associates Limited (JLR). The correspondence for the water distribution boundary information is included in **Appendix C** and the details are summarized in Table 2.1.

Table 2.1: Existing Water Distribution Boundary Conditions

Connection Location	Flow (L/s)	Pressure (kPa)	HGL (m)
Ottawa Street @ West Connection (ground elevation: 139.78)	1.19 (ADD)	400	180.62
	7.47 (PHD)	386	179.19
	54.87 (MDD+50 FF)	365	177.09
	104.87 (MDD+100 FF)	307	171.13
	116.87 (MDD+112 FF)	288	169.26
	119.87 (MDD+115 FF)	284	168.77
	154.87 (MDD+150 FF)	220	162.26
Ottawa Street @ East Connection (ground elevation: 140.28)	1.19 (ADD)	395	180.62
	7.47 (PHD)	381	179.19
	54.87 (MDD+50 FF)	359	176.95
	104.87 (MDD+100 FF)	297	170.66
	116.87 (MDD+112 FF)	278	168.68
	119.87 (MDD+115 FF)	273	168.20
	154.87 (MDD+150 FF)	206	161.35

2.3 WATER SYSTEM ANALYSIS

A water distribution model was developed using Bentley WaterGEMS CONNECT (version 10.03.01.08) to analyze system behaviour to meet estimated domestic water demands and fire flow requirements.

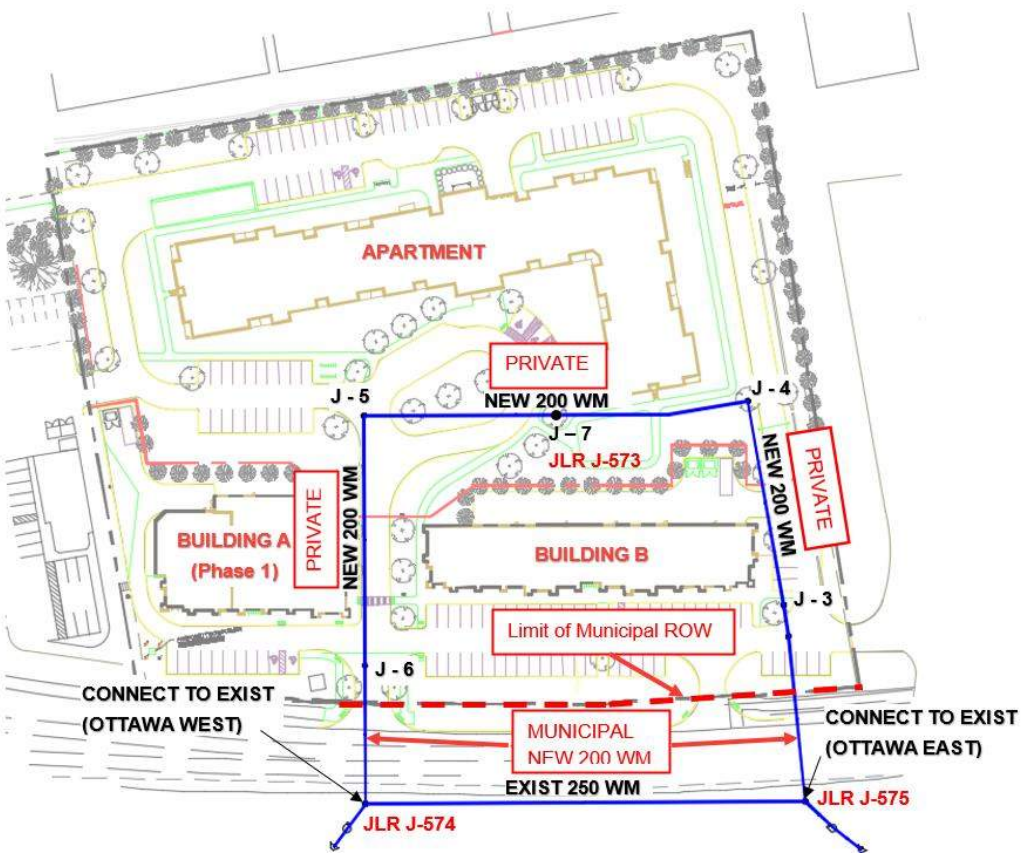


Figure 2.1: Water Distribution Model Schematic

Given the design parameters, the proposed water distribution system can meet the required operating criteria. The modeling results are summarized in Table 2.2.

Table 2.2: Summary of Modeling System Pressure

Scenario	Flow (L/s)	Maximum Pressure (kPa)	Average Pressure (kPa)	Minimum Pressure (kPa)
Average Day Demand (ADD)	1.19	397	397	397
Maximum Day Demand (MDD)	4.87	388	388	388
Peak Hour Demand (PHD)	7.47	383	383	383

The available fire flows at each modeled junction within the development site are shown in Table 2.3.

Table 2.3: Summary of Modeled Available Fire Flows

Junction	Available Fire Flow (L/s)
J-3	165.7
J-4	156.8
J-7	154.87
J-5	150.9
J-6	152.9

The hydraulic model indicates that the available fire flow throughout the proposed water distribution system ranges from 9,060 L/min (151 L/s) to 9,940 L/min (165.7 L/s), as summarized in Table 2.3. The available fire flow values were used to assess the servicing capability of the municipal water distribution system for both the Fire Underwriters Survey (FUS) and Ontario Building Code (OBC) fire flow requirements. Detailed hydraulic modelling results and fire flow calculations are included in **Appendix C.**

2.3.1 Phase 1 Development

The proposed water distribution system for the Phase 1 development consists of approximately 75 m of 200 mm diameter PVC DR18 watermain connecting to the existing 250 mm diameter municipal watermain on Ottawa Street. The proposed watermain will provide domestic water service to Building A and includes one proposed fire hydrant assembly located near modeled Junction J-6 as shown in the Figure 2.1. The Phase 1 watermain will terminate at the northern limit of the development with a valve and cap to facilitate future extension during Phase 2.

Hydraulic modelling indicates that the existing municipal water distribution system has sufficient capacity to supply the proposed domestic demands while maintaining the minimum pressure requirements specified by the City of Ottawa Design Guidelines.

Fire flow analysis indicates that the available fire flow at Junction J-6 is 9,770 L/min (162.9 L/s), which exceeds the required fire protection flow of 8,000 L/min for Building A. (see the previous technical memo in **Appendix C**).

In accordance with Fire Underwriters Survey (FUS) guidelines, a minimum of two fire hydrants is required to provide the required fire protection flow. The proposed onsite hydrant, together with the existing municipal fire hydrant located on the opposite side of Ottawa Street approximately 53 m from the front face of Building A, satisfies this requirement. Accordingly, the Phase 1 development will have adequate domestic water supply and fire protection.

2.3.2 Phase 2 Development

The Phase 2 development represents the completion of the site's ultimate water distribution system. Upon completion of Phase 2, the proposed water distribution network will consist of approximately 240 m of 200 mm diameter PVC DR18 watermain. The system will provide domestic water service and fire protection to Building A and the proposed residential apartment building.

The proposed watermain installed during Phase 1 will be extended to complete a looped distribution system. The first connection to the existing 250 mm diameter municipal watermain on Ottawa Street will have been constructed as part of Phase 1, while the second connection will be completed during Phase 2, resulting in a fully looped water distribution network that improves system reliability and operational redundancy.

Phase 2 will also include the installation of two (2) additional fire hydrant assemblies, providing a total of three onsite hydrants to service the ultimate development.

The estimated domestic water demands associated with the proposed residential building are as follows:

Average Day Demand: 0.81 L/s

Maximum Day Demand: 2.03 L/s

Peak Hour Demand: 4.47 L/s

The estimated average day demand for the proposed residential building is approximately 70 m^3/day, which exceeds the City of Ottawa guideline threshold of 50 m^3/day for a single water service. Accordingly, the residential building will be serviced by two domestic water services to provide operational redundancy during maintenance or emergency conditions.

The proposed water distribution system consists of a looped 200 mm diameter PVC DR18 watermain connected to the existing 250 mm municipal watermain on Ottawa Street. Hydraulic modelling completed using Bentley WaterGEMS indicates that the proposed looped system provides available fire flows ranging from 150.9 L/s to 165.7 L/s throughout the development while maintaining the minimum pressure requirements of the City of Ottawa Design Guidelines.

Fire flow requirements for the proposed residential building were evaluated using both the Fire Underwriters Survey (FUS) Water Supply for Public Fire Protection (2020) methodology and the Ontario Building Code (OBC) water supply for firefighting calculation using the latest architectural building information. The FUS calculation resulted in a required fire flow of 11,000 L/min (183 L/s). The hydraulic model indicates that the available municipal fire flow within the development ranges from 9,060 L/min (151 L/s) to 9,940 L/min (165.7 L/s), which is less than the FUS calculated fire flow requirement.

The proposed residential building is intended to be designed in accordance with the Ontario Building Code and the associated building fire protection provisions identified by the project architect. Based on the OBC Water Supply for Fire Fighting calculation, the required fire flow for the building is 9,000 L/min (150 L/s).

Hydraulic modelling demonstrates that the available municipal fire flow exceeds the OBC fire flow requirement while maintaining the minimum residual pressure criteria specified by the City of Ottawa Design Guidelines. Accordingly, the proposed looped water distribution system provides sufficient domestic water supply and fire protection for the proposed Phase 2 development.

3 SANITARY SEWER SYSTEM

The proposed sanitary sewer system for the development will consist of approximately 115 m of 200 mm diameter sanitary sewer and three maintenance holes at the ultimate build-out condition. The proposed on-site sanitary sewer network will connect to the existing 200 mm diameter sanitary sewer located on Ottawa Street through a proposed maintenance hole. The invert elevation of the proposed 200 mm diameter sanitary sewer connection is 136.30 m. Upon completion of the development, all proposed sanitary sewers and associated structures located within the municipal right-of-way will be considered municipal infrastructure.

3.1 SANITARY SEWER DESIGN CRITERIA

Sanitary flows for the proposed development are based on the following parameters and design criteria as outlined in the City of Ottawa Design Guidelines and the current Ministry of Environment, Conservation and Parks (MECP) Design Guidelines for Sewage Works:

- Hazen-Williams coefficient: C = 110 (200 mm to 250 mm diameter watermain)
- Residential wastewater generation rate: 280 litres/capita/day
- Population density (residential): 1.4 persons / 1-Bed apartment unit
  2.1 persons / 2-Bed apartment unit
  3.1 persons / 3-Bed apartment unit
- Commercial water wastewater generation rate: 28,000 L/gross ha/day
- Extraneous inflow and infiltration allowance: 0.33 L/sec/ha
- Sewer flow peak factor based on Harmon Formula; maximum is 4.0
- Peak design flow = peak domestic sewage flow + extraneous flows
- Sewer pipe selection is based on a minimum full flow velocity of 0.6 m/s. The minimum pipe diameter is 200 mm with a Manning's n value of 0.013.
- The outlet of the sewage flow at the 200 mm diameter sanitary sewer of development site is assumed to be a free flow – normal depth discharge condition.

3.2 SANITARY SEWER SYSTEM DESIGN

A summary of the sanitary flows that are estimated to be generated by the development are presented in Table 3.1. Detailed calculations are included in **Appendix D**.

Table 3.1: Summary of Estimated Sanitary Flows at Full Development Stage

	Value
Average domestic sanitary flow	0.94 L/s
Peak domestic sanitary flow	1.58 L/s
Extraneous inflow and infiltration	0.84 L/s
Peak design flow	2.42 L/s

3.2.1 Phase 1 Development

The proposed sanitary sewer system for the Phase 1 development will include approximately 59 m of 200 mm diameter sanitary sewer and two (2) maintenance holes, including one maintenance hole located south of Building A and one maintenance hole at the connection to the existing 200 mm diameter sanitary sewer

main on Ottawa Street. The proposed on-site sanitary sewer system will connect to the existing municipal sanitary sewer system on Ottawa Street through the proposed connection maintenance hole. The Estimated sanitary flows from Phase 1 development stage are summarized in Table 3.2.

Table 3.2: Summary of Estimated Sanitary Flows at Phase 1 Development Stage

	Value
Average domestic sanitary flow	0.13 L/s
Peak domestic sanitary flow	0.20 L/s
Extraneous inflow and infiltration	0.13 L/s
Peak design flow	0.33 L/s

3.2.2 Phase 2 Development

The proposed sanitary sewer system for the Phase 2 development will extend the Phase 1 sanitary sewer system by approximately 57 m of 200 mm diameter sanitary sewer and include one (1) additional maintenance hole to accommodate the sanitary flows from the proposed residential building service. The proposed Phase 2 sanitary sewer extension will connect to the Phase 1 sanitary sewer infrastructure and convey flows from the proposed building service to the existing municipal sanitary sewer system. The proposed residential building will be serviced through the capped sanitary service installed as part of the Phase 1 works. The Estimated sanitary flows from Phase 1 development stage are summarized in Table 3.3.

Table 3.3: Summary of Estimated Sanitary Flows at Phase 2 Development Stage

	Value
Average domestic sanitary flow	0.81 L/s
Peak domestic sanitary flow	1.39 L/s
Extraneous inflow and infiltration	0.71 L/s
Peak design flow	2.10 L/s

3.3 EXISTING MUNICIPAL SANITARY SEWER CAPACITY REVIEW

JLR has been contacted to review the available capacity of the existing 200mm sanitary sewer on Ottawa Street. The model results indicated that the existing 200mm sanitary sewer on Ottawa Street has sufficient capacity to accommodate the sewage flow generated from the project area for both dry weather flow event and 25-year storm event. A copy of the correspondences between the applicants and JLR, the Municipality's representatives are included in **Appendix D**.

4 STORM SEWER AND STORMWATER MANAGEMENT

4.1 OVERVIEW

Following sections of the report examines the potential water quality and water quantity impacts of the development site and summarizes how each will be addressed in accordance with the City of Ottawa Design Guidelines and MECP Stormwater Management Planning and Design Manual. Note that all proposed storm sewers and associated structures within the right-of-way will be considered municipal infrastructure post-development.

4.1.1 Stormwater Management Plan Objectives

The objectives of the stormwater management plan are as follows:

- **Quantity Control** – the proposed development will increase the imperviousness of the site. The post-development flow will need to be restricted to pre-development flow for both 5-year and 100-year design storm events.
- **Quality Control** – the proposed development is required to meet the MECP's Enhanced Level (80% TSS Removal). This will be addressed with an oil/grit separator using a Stormceptor or approved equivalent.
- **Erosion Control** – appropriate erosion and sediment controls will be implemented during the construction phase. Refer to the Erosion & Sedimentation Control Plan provided in **Appendix B** for details.

4.2 DESIGN CRITERIA

The following sections outline the stormwater management design criteria used in this study.

4.2.1 Rainfall Intensity

Rainfall Intensity-Duration-Frequency (IDF) curves equation were derived from the City of Ottawa Sewer Design Guideline. 2-year design storm, 5-year design storm, and 100-year design storm curve equations and IDF parameters are listed below:

2-year Intensity $= 732.951 / (\text{Time in min} + 6.199)^{0.810}$

5-year Intensity $= 998.071 / (\text{Time in min} + 6.053)^{0.814}$

100-year Intensity $= 1735.688 / (\text{Time in min} + 6.014)^{0.820}$

4.2.2 Storm Sewer Design Parameters

The storm sewer design for the development is based on the following parameters:

- Pipe sizes were determined based on the 5-year design storm, with full pipe capacity and no surcharging permitted.
- Manning's "n" value:
  - 0.013 for the storm sewer pipes regardless of pipe material

- 0.024 for the corrugated metal pipe culvert

- Minimum storm sewer pipe size is 375 mm, and minimum catch basin lead size is 200 mm.
- Pipe diameter and slope are based on providing a minimum full flow velocity of 0.8 m/sec.
- Maximum allowable flow depth permitted within the parking lot and pavement area is 300 mm.

4.2.3 Stormwater Design and Modelling Approach

The pre- and post- development scenarios were designed using Visual OTTHYMO, using the City of Ottawa Sewer Design Guideline design storm curve equations and IDF parameters. The 5-year and 100-years return periods were assessed. Soil group for the subject set was assumed to be SCS Hydrological Soils Group (HSG) "CD" as per the Ontario Soil Survey Complex GeoHub.

4.3 PRE-DEVELOPMENT CONDITIONS

4.3.1 Existing Site Drainage

The existing site is approximately 2.55 ha, located at 430 Ottawa St. Almonte, Ontario. The subject site includes a commercial plaza with an L-shaped building, including a number of retail stores, with paved driveways, parking lots, and grassed areas. The existing site includes two (2) storm outlets, one (1) on the south side of the site and one (1) in the southeast corner of the site.

Runoff from the southwest portion of the site (Catchment PRE-1 and PRE-2) is collected via storm structures and conveyed by storm sewer to the existing storm pond located on the south side of the site. The existing storm pond includes approximately 373 cubic meters of storage and discharges through an existing 300mm corrugated steel pipe culvert to the existing 750mm sewer in Ottawa Street.

The runoff from the north and east side of the site (Catchment PRE-3) is also collected via storm structures and conveyed by storm sewers into an existing swale on the east side of the site. The existing swale includes culverts which convey runoff to the south of the site. The existing swale includes approximately 145 cubic meters of storage and discharges through an existing 400mm corrugated steel pipe culvert also to the existing 750mm sewer in Ottawa Street.

Based on the existing conditions the flow from both catchments were combined to have one (1) singular outlet for all runoff under pre-development conditions. Refer to **Appendix E** for the pre-development catchment map.

4.3.2 APPROVED OUTLET & ALLOWABLE DISCHARGE RATES

A pre-development Visual OTTHYMO model was created to define the existing peak flow rates from the site, based on existing discharge rates and available storage, to define the existing peak flow rates from the site. The 5- and 100-year Ottawa Sewer Design Guideline design storm curve equations and IDF parameters were used to quantify the peak flow rates. The following parameters in Table 4.1 were used to define the Visual Otthymo model.

Table 4.1 : Visual Otthymo Model Parameters

CATCHMENT AREA	TYPE	SCR CURVE NUMBER	TOTAL IMPERVIOUSNESS (%)	INITIAL ABSTRACTION
PRE-1 (VO: 101)	Standard	86	89.6	5.0
PRE-2 (VO: 102)	Standard	87	92.8	5.0
PRE-3 (VO: 103)	Standard	87	66.6	4.9

The modelled allowable discharge rates and storage volumes for the 5- and 100-year storm events are shown in Table 4.2 and Table 4.3 below and are included in the Visual Otthymo model results in **Appendix E**.

Table 4.2: Modelled Allowable Discharge Rates (Pre-Existing)

CATCHMENT AREA	STORM EVENT	PEAK FLOW (L/S)
PRE-1 (VO: 101)	1:5 year	24.3
	1:100 year	74.4
PRE-2 (VO: 102)	1:5 year	282.3
	1:100 year	494.1
PRE-3 (VO: 103)	1:5 year	223.0
	1:100 year	438.9

Table 4.3: Modelled Storage Volumes (Pre-Existing)

STORAGE	STORM EVENT	TIME TO PEAK (HRS)	PEAK STORAGE VOLUME (M^3)	PEAK RELEASE RATE (L/S)
Pond (VO: 201)	1:5 year	1.08	148	130.9
	1:100 year	1.16	328	184.4
Swale (VO: 203)	1:5 year	1.00	6	215.1
	1:100 year	1.00	60	341.8
Total Peak Flow 1:5 year =				331.6
Total Peak Flow 1:100 year =				516.2

Based on the existing modelled conditions the allowable release rate during the 5- and 100-year storm event are 331.6 L/s and 516.2 L/s, respectively.

4.4 POST-DEVELOPMENT CONDITIONS

The proposed development will consist of a Phase 1, Phase 2, and Phase 3 construction staging. The proposed development will collect all stormwater runoff in storm structures and convey runoff to the existing 750mm storm sewer in Ottawa Street. Proposed runoff from the site will be restricted such that the existing peak flows leaving the site do not exceed the existing 5- and 100-year pre-development peak flows. The peak flows will be restricted by inlet control devices and stormwater will be stored via parking lot

surface storage, up to a maximum ponding depth of 0.3m, surface storage within open green space, and by a proposed underground stormwater storage tank.

4.4.1 PROPOSED MINOR STORM SYSTEM

The proposed minor system constitutes a gravity system comprised of storm sewers, maintenance holes, and catch basins. Stormwater that falls on the sites will sheet flow from parking lots, laneways, and the roadway, where it is directed to catch basins. Catch basin leads located within the site areas will direct the flow to the gravity storm sewer system.

The storm sewers (i.e. minor system) were sized using the Rational Method (to establish design flows) and the Mannings's equation (for hydraulics), based on the following criteria:

— Design Storm 1:5 years Return Period

— Initial Inlet Time of Concentration = 10 mins (City of Ottawa Design Standards)

— Pipe Velocities = 1.00 m/s to 6.0 m/s (full flow velocity)(per MOE Stormwater Guidelines)

— Minimum Pipe Size (Diameter) = 250 mm (Sewers), 200 mm (CB Leads), & 250 mm (Double CB Leads)

Refer to **Appendix E** for pre- and post-development catchment maps and storm sewer sizing calculation sheet.

4.4.2 POST-DEVELOPMENT MODELLING PARAMETERS

To determine quantity control and attenuation for the site Visual Otthymo software was utilized to determine peak flows. Excel calculations were completed to determine discharge flow rates, from the underground storage tank, surface ponding, and parking lot ponding, and AutoCAD Civil 3D was used to determine pond stage storage, which were utilized in the Visual Otthymo model. Refer to **Appendix E** for Excel calculations and pond stage storage volumes.

The site includes fifteen (15) sub-catchment areas in the post-development conditions that will outlet to the 750mm storm sewer on Ottawa street. Table 4.4 shows the area breakdown for the post-development conditions of the site. Refer to **Appendix E** for the proposed post-development catchment map and drainage conditions.

Table 4.4: Post-development Catchment Areas

CATCHMENT AREA	TYPE	SCS CURVE NUMBER	INITIAL ABSTRACTION (MM)
PH-1 (VO: 100)	Standard	86	5.0
PH-3 (VO: 300)	Standard	92	4.0
R-1 (VO: 212)	Standard	92	4.0
A-1 (VO: 201)	Standard	92	4.0
A-2 (VO: 202)	Standard	92	4.0
A-3 (VO: 203)	Standard	92	4.0
A-4 (VO: 204)	Standard	86	5.0

A-5 (VO: 205)	Standard	86	5.0
A-6 (VO: 206)	Standard	86	5.0
A-7 (VO: 207)	Standard	86	5.0
A-8 (VO: 208)	Standard	86	5.0
A-9 (VO: 209)	Standard	86	5.0
A-10 (VO: 210)	Standard	86	5.0
A-11 (VO: 211)	Standard	86	5.0
DR-1 (VO: 401)	Standard	86	5.0

To achieve the target release rates for Phase 1 and Phase 2; parking lot ponding, surface ponding, and an underground storage tank were utilized.

Visual Otthymo software was used to model the behaviour of the proposed SWM system. A schematic of the Visual Otthymo model is included in **Appendix E**.

4.4.3 PHASE 1 DEVELOPMENT

Phase 1 will be developed first and therefore the independent area of Phase 1 was designed such that post-development peak flow rates from Catchment PH-1 do not exceed the pre-development peak flow for the Phase 1 catchment area, Pre-1. The proposed drainage boundary of the Phase 1 development site is shown in Drawing C-12 in **Appendix E**. The drainage area of the Phase 1 development is 0.392 ha with an imperviousness of 99%. All flows within the Phase 1 area will be captured in storm structures and routed to the 750mm storm sewer within Ottawa Street.

All grades along the proposed Phase 1 limits are to tie into existing elevations, with on-site grading established such that runoff produced within the Phase 1 development is contained within the site limits. In the Phase 1 conditions, the existing pond and existing swale will be untouched and therefore will still be utilized in the Phase 1 build-out. The Phase 1 development area will utilize surface ponding within parking lot areas and an inlet control device (ICD) to minimize flows from the area. The ICD shall be a 75mm orifice on the inlet pipe from the Phase 1 development to restrict flows.

Table 4.5 shows the peak flow rates from the Phase 1 development.

Table 4.5: Phase 1 development Peak Flow Rates

CATCHMENT AREA	STORM EVENT	MAXIMUM ALLOWABLE RELEASE RATE (L/S)	POST-DEVELOPMENT CONTROLLED PEAK FLOW (L/S)
PH-1 (VO: 100)	1:5 year	24.3	17.4
	1:100 year	74.4	17.6

As shown above, the proposed post-development peak flow from the Phase 1 area will be reduced during the 5- and 100-year storm events.

Downstream of the proposed ICD a proposed Oil/Grit Separator (OGS) will be installed to treat stormwater prior to discharging to Ottawa Street.

4.4.4 PHASE 2 DEVELOPMENT

The storm sewer installed during Phase 1, including the proposed OGS, shall be the primary discharge point for new sewers installed as part of the Phase 2 complete development build-out. The 75 mm orifice plate installed during the Phase 1 development shall be maintained during the full build out of the site.

The Phase 2 development stormwater management was reviewed considering the complete build-out of the entire site, including the Phase 3 development area. All flow from the Phase 2 development (excluding catchment area DR-1) will be captured in structures and routed to an underground storage tank before outletting to the 750mm storm sewer on Ottawa Street. The Phase 3 Development area was considered in the overall peak runoff analysis as the overall development will capture and convey flows from the Phase 2 and Phase 3 development to the underground stormwater storage tank. After the Phase 2 development, prior to the Phase 3 development, the existing pond on the south side of the site will still remain in place. The underground storage tank will be installed as part of the Phase 2 development and will be sized to accommodate the overall site development peak flows. The underground storage tank will include a 450mm outlet pipe which will restrict the post-development peak flows to pre-development peak flow rates for the 5- and 100-year storm events.

The overall development of the site includes fifteen (15) sub-catchment areas which convey flows to the site outlet, the 750mm storm sewer on Ottawa street. The sub-catchment areas were modelled in Visual Otthymo to simulate the overall development peak flows. The Phase 1 development area includes a storage node and a controlled release rate through the previously noted 75mm orifice to the site outlet. The Phase 1 catchment area (PH-1), in the southwest corner of the site, and catchment DR-1, in the southeast corner of the site, will drain directly to the outlet.

For stormwater storage in addition to the proposed stormwater storage tank, surface storage was modelled within CB-04, CB-12, and CB-16 by restricting the flow from the catch basins with 75mm orifices. These orifices will restrict the flow in the catch basins to utilize surface storage within grassed areas upstream of the underground stormwater storage tank.

The overall site critical peak flows for the overall development are shown in Table 4.6.

Table 4.6: Phase 2 Development Peak Flow Rates

CATCHMENT AREA	STORM EVENT	MAXIMUM ALLOWABLE RELEASE RATE (L/S)	POST-DEVELOPMENT CONTROLLED PEAK FLOW (L/S)
Phase 1 Flow (75mm Orifice Control)	1:5 year	N/A	17.4
	1:100 year	N/A	17.6
DR-1 Flow (Uncontrolled)	1:5 year	N/A	19.7
	1:100 year	N/A	39.6
Underground Storage Flow	1:5 year	N/A	259.2
	1:100 year	N/A	458.2
Overall Development Outlet Peak Flow (VO: 55)	1:5 year	331.6	296.3
	1:100 year	516.2	515.4

As shown above, there will be an overall decrease in stormwater flow rates conveyed off-site to the 750mm storm sewer outlet during the minor and major storm events.

The underground storage tank peak flows, as well as the corresponding storage volumes and maximum hydraulic grade line (HGL), are shown in Table 4.7.

Table 4.7: Phase 2 Development Storage Volumes and Maximum HGL

STORAGE	STORM EVENT	TIME TO PEAK (HRS)	POST-DEV CONTROLLED PEAK RELEASE (L/S)	PEAK STORAGE VOLUME (M^3)	PEAK STORAGE HGL (ABOVE BOTTOM OF STORAGE) (M)
Underground Storage Tank (VO: 201)	1:5 year	1.0	259.2	136.0	0.68
	1:100 year	1.083	458.2	297.0	1.49

The proposed underground storage tank has a depth of 1.5m. Based on the peak storage HGL, the stormwater storage tank will have an available free board of 0.82m and 0.01m during the 5-year and 100-year storm events, respectively.

The overall storage volume required for the underground storage tank is 300m^3. The outlet from the underground storage tank will restrict flows and also fill up the upstream pipes and structures up to 1.5m above the bottom of the tank, at an elevation of 138.13m. To minimize the storage volume in the tank and based on the actual conditions, the upstream pipes and structure storage was calculated, as shown in **Appendix E**. The overall storage in the upstream pipes and structures is 53.62 m^3. Therefore, the underground storage tank will require a total volume of 250m^3 for the overall site development.

4.5 QUALITY CONTROL

The quality control for drainage areas within the development site shall be an enhanced level with a long-term removal rate of at least 80% total suspended sediments (TSS) per the application's plan and study identification list (Mississippi Mills, November 14, 2022).

Runoff generated from the development site will be collected by the proposed storm sewer system and discharge to the existing 750 mm diameter storm sewer on Ottawa Street. Total drainage area of these sub-catchments to the treatment unit is 2.55 ha. The estimated runoff coefficient is 0.65.

A Stormceptor EFO8 oil/grit separator is proposed to provide stormwater quality control to remove greater than 80% of the long-term average total suspended solids from runoff collected by the storm sewer system. The proposed Stormceptor EFO8 is sized to meet the quality control objectives for both the interim Phase 1 and ultimate Phase 2 development. The design capacity of Stormceptor EFO8 is outlined below.

- Estimated Water Quality Flow Rate: 52.7 L/s
- Maintenance Sediment Depth: 610 mm
- Maximum Sediment Capacity: 8,780 L
- Maximum Hydrocarbon Storage Capacity: 1,070 L

Stormceptor design details are included in Appendix E.

4.6 EROSION AND SEDIMENT CONTROL

Erosion and sediment controls must be in place during both Phases of site development. Recommendations to the contractor for the Phase 1 development are included on the erosion and sediment control drawing C05 in **Appendix B**. Additional measures shall be established at the time of Phase 2 ultimate development.

Regular monitoring and inspection of the silt mitigation measures and/or devices are critical during site construction until all vegetation is established, and construction activity is complete. This inspection will ensure that any breach of the silt mitigation measures is immediately identified and able to be reinstated and/or remedied in a timely fashion. During the spring freshet and during major storm events, the inspections may have to be more frequent.

A contingency plan should also be in place to ensure the response to any problems can be immediate. This plan shall include:

1. Generic plans for constructing temporary berms, check dams, and new sedimentation control ponds if any emergency measures are required;
2. The necessary equipment (excavator, loader, pumps and hoses) and supplies (silt fencing, clear stone, straw bales and dry sand stock piles) on hand during construction, and check for operational efficiency of the installations daily;
3. A list of contact names and telephone numbers of equipment operators and laborers who can be called upon to make emergency repairs; and
4. A list of emergency contact names and telephone numbers.

If repairs are required for any component of the silt mitigation installations, the work must be performed in a timely manner. The on-site inspector will have the authority to ensure the required works are performed immediately, and to issue a “Stop Work Order” if necessary.

In the event of a spill, or failure of the water quality control measures, the MECP spill reporting procedures shall be used to report any unexpected discharge of silt, sediment, and/or other deleterious substance. The MECP 24-hour spill line is 1-800-268-6060.

5 SUMMARY

5.1 WATER SUPPLY SERVICING

Average day, maximum day, and peak hour water demand under the ultimate development condition are 1.19 L/s, 4.87 L/s, and 7.47 L/s, respectively. Average day, maximum day, and peak hour water demand under the Phase 2 Developments are 0.81 L/s, 2.03 L/s, and 4.47 L/s, respectively. The proposed development will be serviced by a looped 200 mm diameter PVC DR18 watermain connected to the existing 250 mm diameter municipal watermain on Ottawa Street.

Hydraulic modelling indicates that the proposed water distribution system satisfies the domestic water demands while maintaining the minimum pressure requirements specified by the City of Ottawa Design Guidelines. Available fire flows throughout the proposed water distribution system range from 150.9 L/s (9,060 L/min) to 165.7 L/s (9,940 L/min).

For the Phase 1 development, the proposed water distribution system provides sufficient domestic water supply and available fire flow to satisfy the servicing and fire protection requirements for the commercial building.

For the Phase 2 Development, Fire flow requirements for the proposed residential building were evaluated using both the Fire Underwriters Survey (FUS) methodology and the Ontario Building Code (OBC) Water Supply for Fire Fighting calculation based on the latest architectural building information. The FUS methodology resulted in a required fire flow of 11,000 L/min (183 L/s), while the OBC calculation resulted in a required fire flow of 9,000 L/min (150 L/s). Although the available municipal fire flow does not satisfy the FUS-calculated demand, it exceeds the OBC fire flow requirement. Accordingly, the proposed water distribution system provides adequate domestic water servicing and fire protection for the ultimate development.

5.2 SANITARY SEWER SERVICING

The proposed sanitary sewer system will discharge to the existing 200 mm diameter municipal sanitary sewer on Ottawa Street.

For the Phase 1 development, the estimated peak design sanitary flow is 0.33 L/s. Capacity confirmation provided by J.L. Richards & Associates Limited indicates that the existing municipal sanitary sewer has sufficient available capacity to accommodate the proposed Phase 1 sanitary flow.

For the Phase 2 development, the estimated peak design sanitary flow is 2.10 L/s, consisting of 1.39 L/s peak domestic sanitary flow and 0.71 L/s of extraneous inflow and infiltration allowance. Based on the available capacity information provided by J.L. Richards & Associates Limited, the existing municipal sanitary sewer has sufficient capacity to accommodate the ultimate development sanitary flow. Accordingly, the proposed sanitary sewer servicing strategy is considered adequate for both the Phase 1 and Phase 2 development conditions.

5.3 STORMWATER MANAGEMENT

Storm sewer systems are proposed to convey runoff from the development site and discharge to the existing 750 mm diameter storm sewer on Ottawa Street. Runoffs generated from the development site will be restricted to equal or less than the existing peak discharge rates as specified in AECOM's report. The excessive runoffs will be temporarily stored onsite.

Design peak discharge and required onsite storages under 5-year and 100-year design rainfalls are summarized in Table 5-1 and Table 5-2 for the full development stage and the Phase 1 development stage, respectively.

Table 5-1: Stormwater Quantity Control at Full Development Stage

RAINFALL EVENTS	MAX ALLOWABLE DISCHARGE (L/s)	DESIGN PEAK DISCHARGE (L/s)	ESTIMATED STORAGE (m^3)	PONDING ELEVATION (m)	PONDING DEPTH (m)
5-Year	331.6	296.3	136.0	140.43	0.18
100-Year	516.2	515.4	297.0	140.55	0.30

Through the implementation of the Stormwater Plan presented, there will be no increase in peak stormwater flow rates conveyed off-site during minor and major storm events. Additionally, A Stormceptor EFO8 oil/grit separator is proposed to provide stormwater quality control to remove greater than 80% of the long-term average total suspended solids from runoff collected by the storm sewer system.

6 CLOSING

We trust that this Servicing Report is suitable to support the Site Plan Approval process for Phase 2 of the proposed 430 Ottawa Street development. Should you require any additional information, or have any comments or questions, please do not hesitate to contact our office.

APPENDIX

A

DRAFT PLAN BY CALLON & DIETZ (FEB 2023)

PLAN OF SURVEY

OF PART OF

LOT 16, CONCESSION 10

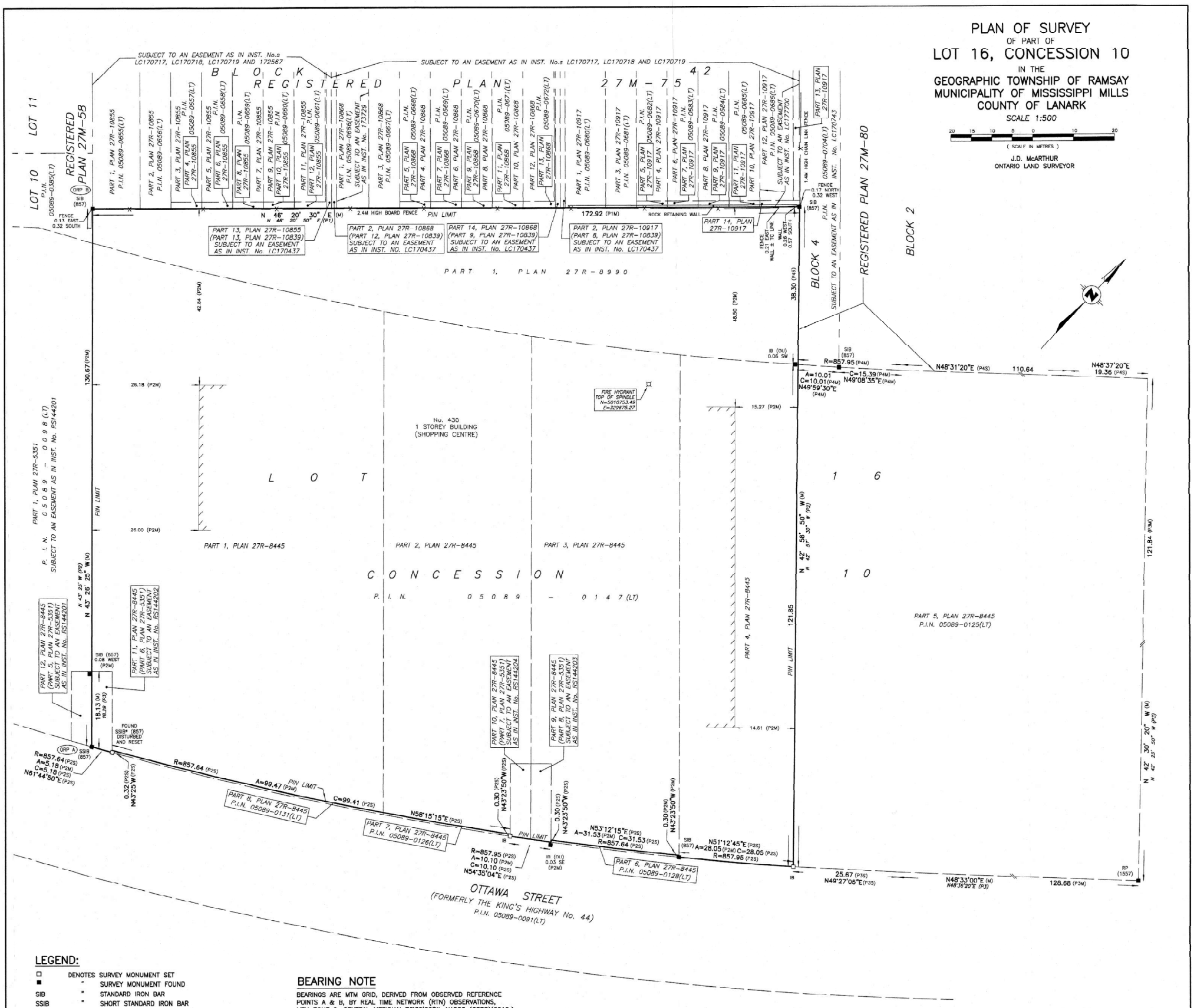
IN THE

GEOGRAPHIC TOWNSHIP OF RAMSAY
MUNICIPALITY OF MISSISSIPPI MILLS
COUNTY OF LANARK

SCALE 1:500

20 15 10 5 0 10 20
(SCALE IN METRES)

J.D. McARTHUR
ONTARIO LAND SURVEYOR



LEGEND:

□	DENOTES	SURVEY MONUMENT SET
■	"	SURVEY MONUMENT FOUND
SIB	"	STANDARD IRON BAR
SSIB	"	SHORT STANDARD IRON BAR
SSIB*	"	0.30m SHORT STANDARD IRON BAR
IB	"	IRON BAR
RIB	"	ROUND IRON BAR
RP	"	ROUND PIPE
CC	"	CUT CROSS
OU	"	ORIGIN UNKNOWN
ORP	"	OBSERVED REFERENCE POINT
WIT	"	WITNESS
M	"	MEASURED
(857)	"	FAIRHALL, MOFFATT & WOODLAND LIMITED
(1557)	"	ADAM KASPRZAK, O.L.S.
P1	"	REGISTERED PLAN 27M-75
P2	"	SURVEYORS REAL PROPERTY REPORT BY (857) DATED JANUARY 7, 2011
P3	"	PLAN 26R-8445
P4	"	REGISTERED PLAN 27M-80
SE	"	SOUTHEAST
SW	"	SOUTHWEST
NW	"	NORTHWEST

BEARING NOTE

BEARINGS ARE MTM GRID, DERIVED FROM OBSERVED REFERENCE POINTS A & B, BY REAL TIME NETWORK (RTN) OBSERVATIONS, MTM ZONE 9, CENTRAL MERIDIAN 76°30'00"W, NAD83 (CSRS)(2010.)

FOR BEARING COMPARISONS, A ROTATION OF 0°09'51 COUNTER CLOCKWISE WAS APPLIED TO THE BEARINGS ON P3

DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.999907

INTEGRATION DATA

OBSERVED REFERENCE POINTS (ORP'S) DERIVED FROM REAL TIME NETWORK OBSERVATIONS (RTN) AND ARE REFERRED TO MTM ZONE 9 NAD83 (CSRS)(2010) COORDINATES COMPLY WITH URBAN ACCURACY PER SEC.14 (2) OF O. REG. 216/10

POINT ID	NORTHING	EASTING
ORP A	5010595.84	329637.14
ORP B	5010690.70	329547.31

COORDINATES CANNOT, IN THEMSELVES, BE USED TO RE-ESTABLISH CORNERS OR BOUNDARIES SHOWN ON THIS PLAN

SURVEYOR'S CERTIFICATE

I CERTIFY THAT:

(1) THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT AND LAND TITLES ACT, AND THE REGULATIONS MADE UNDER THEM.

(2) THE SURVEY WAS COMPLETED ON THE 20th DAY OF JANUARY , 2023

FEBRUARY 2, 2023
DATE

J.D. McARTHUR
ONTARIO LAND SURVEYOR

THIS PLAN OF SURVEY RELATES TO AOLS PLAN SUBMISSION FORM NUMBER 2200615.

METRIC: DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

O:\jobs\1 JOBS CALLON DIETZ\2023\23-1928 ELM Developments - 430 Ottawa St. Almonte\Drawing\23-1928.dwg February 2, 2023

Callon Dietz INCORPORATED
ONTARIO LAND SURVEYORS
CARLETON PLACE LONDON NORTH BAY
info@callondietz.com callondietz.com

ISO 9001 REGISTERED

SURVEY BY: MP	DRAWN BY: NJ	FILE No: 23-1928	PLAN No: X-3331

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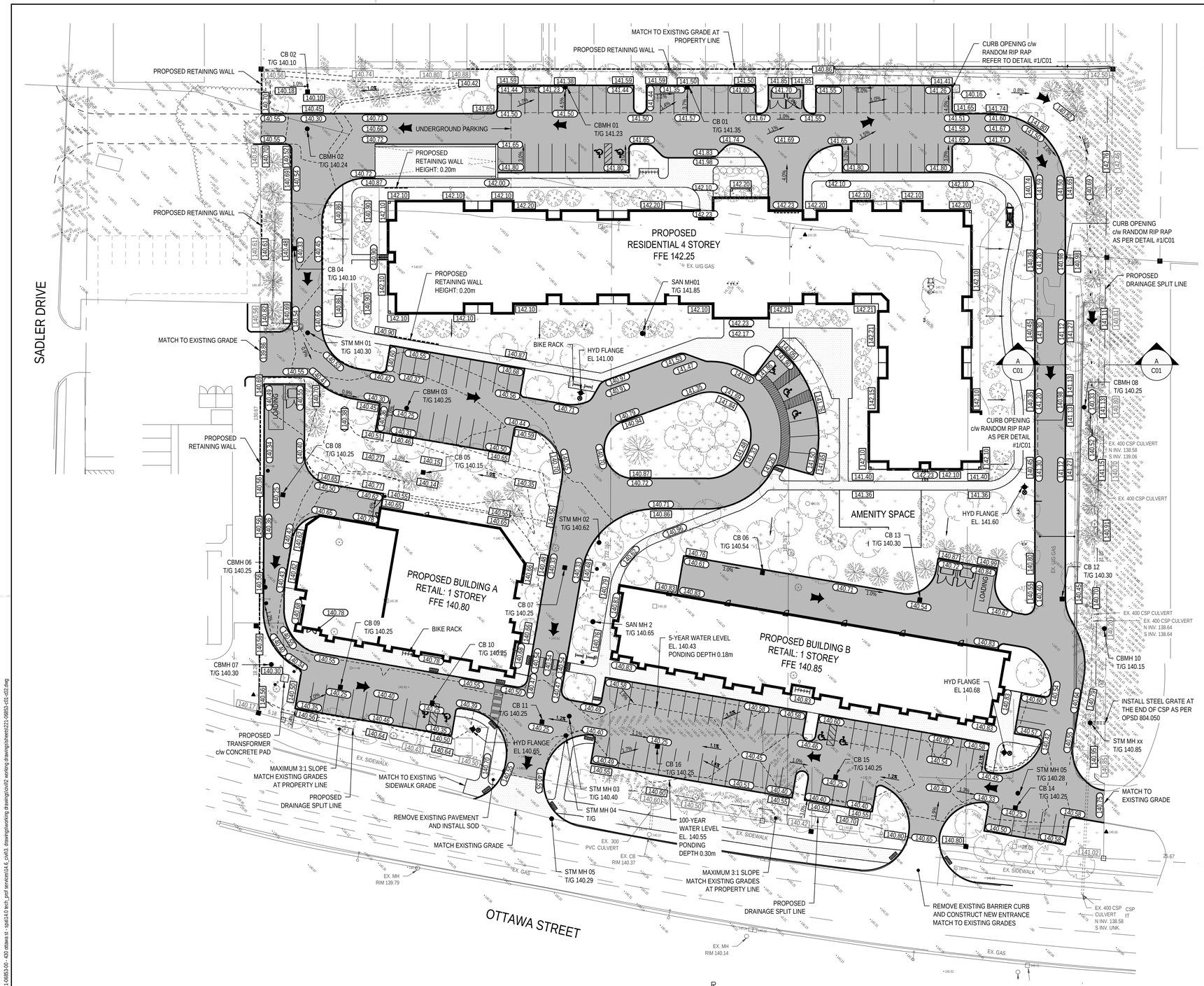
APPENDIX

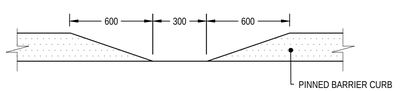
B

CIVIL DESIGN DRAWINGS

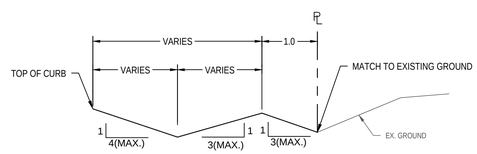
APPENDIX

FULL DEVELOPMENT STAGE CIVIL DESIGN DRAWINGS





1 / C01 CURB OPENING DETAIL
SCALE: NTS



A-A / C01 PROPOSED DITCH SECTION
SCALE: NTS

NOTES:

1. ALL WORK TO BE COORDINATED WITH OTHER PLANS FOR THIS SITE. REFER TO M AND E DRAWINGS FOR GAS, ELECTRICAL, PLUMBING AND COMMUNICATION SERVICES. ARCHITECTURAL SITE PLAN TO BE USED FOR SITE LAYOUT AND PHASING. ARCHITECTURAL DRAWINGS AND SPECIFICATIONS PROVIDE THE PAVEMENT DESIGN.
2. LOCATION OF SERVICES, CHAMBERS, UTILITIES AND ALL UNDERGROUND WORKS ARE APPROXIMATE. CONTRACTOR TO VERIFY LOCATION AND ELEVATION OF ALL SERVICES, UTILITIES, AND UNDERGROUND STRUCTURES PRIOR TO ANY CONSTRUCTION. CONTRACTOR IS RESPONSIBLE FOR PROTECTION AND REINSTATEMENT.
3. THE CONTRACTOR IS RESPONSIBLE FOR ALL REMOVALS NECESSARY TO SATISFY ENGINEERING WORKS.
4. CONTRACTOR RESPONSIBLE FOR OBTAINING ROAD CUT PERMIT, AND PROVIDING ALL ASSOCIATED TRAFFIC CONTROL. CONTRACTOR TO RECORD VERTICAL AND HORIZONTAL LOCATION OF ALL UNDERGROUND WORKS FOR RECORD DRAWINGS.
5. CONTRACTOR TO PROVIDE POST CONSTRUCTION TOPOGRAPHIC SURVEY COMPLETED BY OLS OR PROFESSIONAL ENGINEER RETAINED BY CONTRACTOR CONFIRMING COMPLIANCE WITH GRADING AND SERVICING DESIGN. SURVEY TO INCLUDE SEWER INV.ERTS. SURVEY LEVEL OF DETAIL TO MATCH THAT OF GRADING DESIGN PLANS.
6. REFER TO ARCHITECTURAL PLANS FOR PHASING AND STAGING OF CONSTRUCTION. REFER TO SITE PLAN FOR PAVING LIMITS AND TYPES, INCLUDING SIDEWALK REQUIREMENTS.
7. ROAD ENTRANCES TO BE CONSTRUCTED IN ACCORDANCE WITH SITE PLAN.
8. ASPHALT AND GRANULARS:
   - 8.1. ALL MATERIALS MUST CONFORM TO MUNICIPALITY AND ONTARIO PROVINCIAL STANDARDS AND SPECIFICATIONS. REFER TO TESTING SECTION FOR GEOTECHNICAL REQUIREMENTS AND A LIST OF SUBMITTALS.
   - 8.2. HOT MIX ASPHALT SHALL BE INSTALLED IN ACCORDANCE WITH OPSS 310.
   - 8.3. COMPACTION OF ASPHALT SHALL BE IN ACCORDANCE WITH TABLE 10 OF OPSS 310.
   - 8.4. ALL SAWCUTS SHALL BE STRAIGHT MATCH LINES BETWEEN THE EXISTING PAVEMENT AND NEW PAVEMENT. KEY GRIND A MINIMUM 0.50m WIDE BY 40mm DEEP EDGE WHEN TYING INTO EXISTING ASPHALT AND SEAL JOINTS WITH DENSO ASPHALT REINSTATEMENT TAPE.
   - 8.5. COMPACTION OF BASE AND SUBBASE MATERIALS SHALL BE TO 100% SPMDD.
9. CONCRETE CURBS SHALL BE INSTALLED IN ACCORDANCE WITH OPSD 600.110.
10. CONCRETE SIDEWALKS SHALL BE INSTALLED IN ACCORDANCE WITH OPSD 310.010. ASPHALT SIDEWALKS SHALL BE IN INSTALLED IN ACCORDANCE WITH CITH OF OTTAWA DETAIL SC20.
11. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE INDICATED.
12. DRAWING COORDINATES ARE ZONE 18 UTM NAD83.

RECOMMENDED MINIMUM PAVEMENT STRUCTURE

PAVEMENT STRUCTURE		HEAVY DUTY MATERIALS FIRE ROUTES	LIGHT DUTY PARKING
ASPHALTIC CONCRETE	OPSS HL3 OR EQUIVALENT	40mm	65mm
	OPSS HL8 OR EQUIVALENT	60mm	-
BASE	OPSS GRANULAR A OR 20mm CRUSHER-RUN	150mm	150mm
SUB-BASE	OPSS GRANULAR B OR 50mm CRUSHER-RUN	300mm	200mm

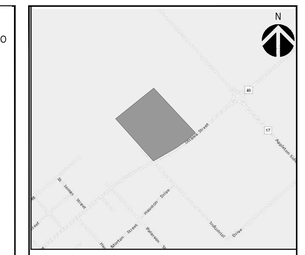
ISSUED FOR REVIEW

EXISTING	LEGEND-PLAN	PROPOSED
150 WM	WATER MAIN	150 WM
300 STM	STORM SEWER	300 STM
250 SAN	SANITARY SEWER	250 SAN
G	GAS	
PO	POWER OVERHEAD HYDRO	
	CURB	
	EDGE OF PAVEMENT	
	CULVERT	
	PROPERTY LINE	
	WOODEN FENCE	
59.367	GROUND ELEVATION	
00.00	ROAD ELEVATION	00.00
00.00	LOT ELEVATION	00.00
00.00	DITCH/SWALE ELEVATION	00.00
	FLOW DIRECTION	
	SWALE FLOW DIRECTION	
	OVERLAND DRAINAGE ARROW	
HP	HYDRO POLE	
	PLUG	
	VALVE	
	HYDRANT	
	MANHOLE	
	CATCHMENT BOUNDARY	
	TOPSOIL AND SOD	
	RIP RAP	
	CONCRETE	
	HEAVY DUTY ASPHALT	
	LIGHT DUTY ASPHALT	

METRIC
WHOLE NUMBERS INDICATE MILLIMETRES
DECIMALIZED NUMBERS INDICATE METRES

BENCHMARK (B.M.)

SOUTHWEST CORNER, SOUTHEAST CORNER AND ON UTILITY BOX NORTH OF BUILDING.



KEY PLAN

REVISION:

REV	DATE	DESCRIPTION	BY
0B	2023-07-14	REVISED AS PER MUNICIPALITY COMMENTS	J.Z.
0A	2023-03-27	ISSUED FOR SPA	J.Z.

SEAL:

LICENSED PROFESSIONAL ENGINEER
J. W. ZHANG
100155766
2023-07-14
PROVINCE OF ONTARIO

DISCLAIMER: COPYRIGHT:
THIS DRAWING AND DESIGN IS COPYRIGHT PROTECTED WHICH SHALL NOT BE USED, REPRODUCED OR REVISED WITHOUT WRITTEN PERMISSION BY WSP. THE CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND UTILITY LOCATIONS AND REPORT ALL ERRORES AND OMISSIONS PRIOR TO COMMENCING WORK.

ORIGINAL SCALE: 1:400
DATE: 2022-12-12
DESIGNED BY: J.Z.
ASSISTED BY: --
DRAWN BY: L.T.
MODIFIED BY: --
APPROVED BY: --
IF THIS BAR IS NOT 25mm LONG, ADJUST YOUR PLOTTING SCALE. 25mm
DISCIPLINE: CIVIL

WSP Canada Inc.
2611 Queensview Drive, Suite 300 Ottawa, Ontario K2B 8K2
T 613-829-28-00| www.wsp.com

PROJECT NUMBER: 221-06853-00

CLIENT:
ELM DEVELOPMENTS

CLIENT REF. #: --

PROJECT:
430 OTTAWA STREET
ALMONTE, ONTARIO

TITLE:
OVERALL SITE
GRADING PLAN

DRAWING NUMBER: C01
REV. 0B

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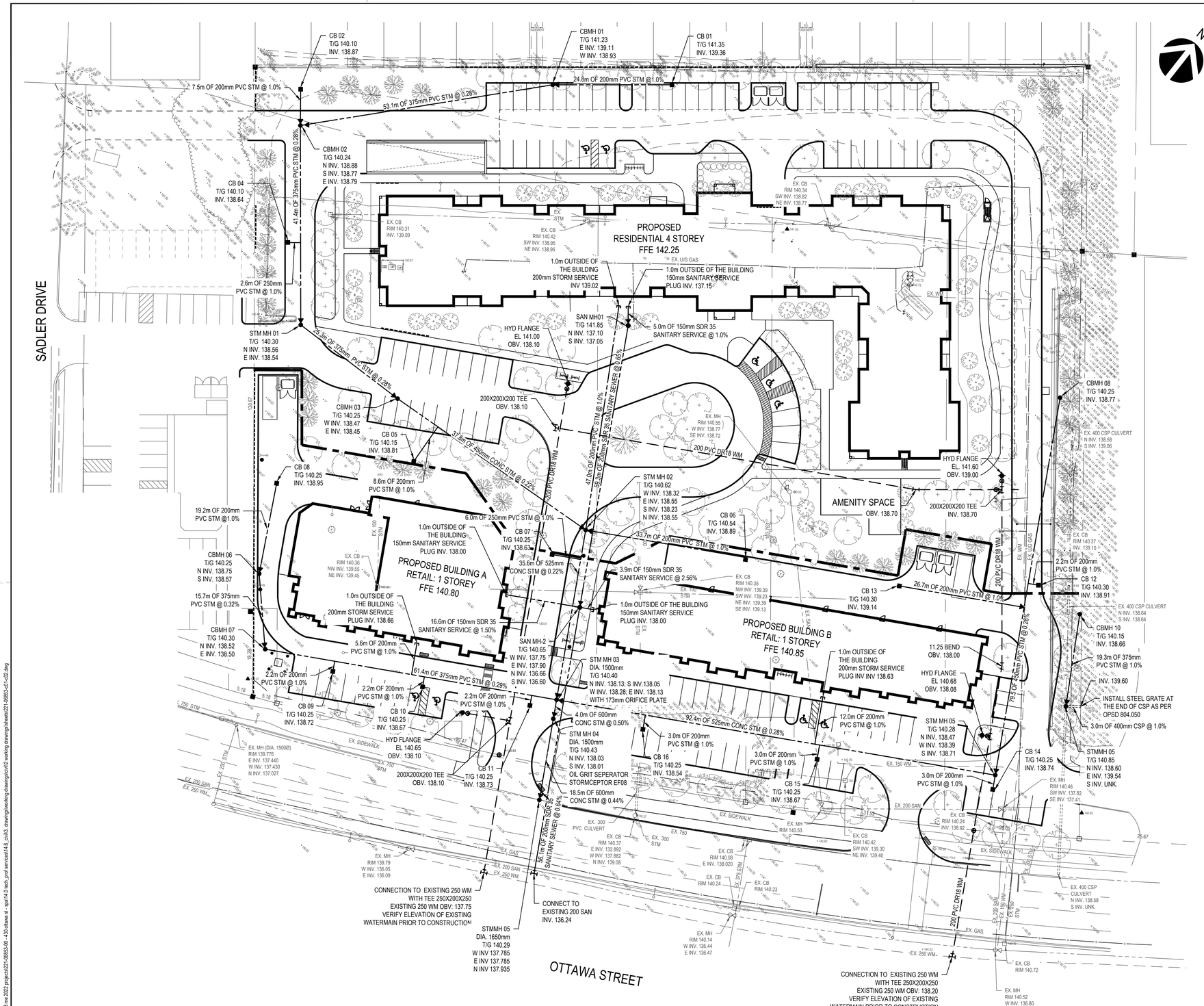
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OTTAWA STREET
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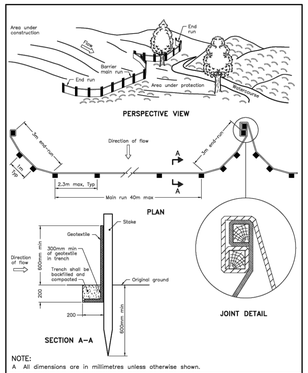
PROPOSED BUILDING A
RETAIL: 1 STOREY
FFE 140.80
PROPOSED BUILDING B
RETAIL: 1 STOREY
FFE 140.85
AMENITY SPACE
OBV. 138.70
CB 02
T/G 140.10
INV. 138.87
CBMH 01
T/G 141.23
E INV. 139.11
W INV. 138.93
CB 01
T/G 141.35
INV. 139.36
7.5m OF 200mm PVC STM @ 1.0%
53.1m OF 375mm PVC STM @ 0.28%
24.8m OF 200mm PVC STM @1.0%
CBMH 02
T/G 140.24
N INV. 138.88
S INV. 138.77
E INV. 138.79
41.4m OF 375mm PVC STM @ 0.28%
CB 04
T/G 140.10
INV. 138.64
2.6m OF 250mm
PVC STM @ 1.0%
STM MH 01
T/G 140.30
N INV. 138.56
E INV. 138.54
25.3m OF 375mm PVC STM @ 0.28%
CBMH 03
T/G 140.25
W INV. 138.47
E INV. 138.45
CB 05
T/G 140.15
INV. 138.81
37.8m OF 450mm CONC STM @ 0.22%
CB 08
T/G 140.25
INV. 138.95
8.6m OF 200mm
PVC STM @ 1.0%
19.2m OF 200mm
PVC STM @1.0%
CBMH 06
T/G 140.25
N INV. 138.75
S INV. 138.57
15.7m OF 375mm
PVC STM @ 0.32%
CBMH 07
T/G 140.30
N INV. 138.52
E INV. 138.50
5.6m OF 200mm
PVC STM @ 1.0%
2.2m OF 200mm
PVC STM @ 1.0%
CB 09
T/G 140.25
INV. 138.72
CB 10
T/G 140.25
INV. 138.67
HYD FLANGE
EL 140.65
OBV.: 138.10
CB 11
T/G 140.25
INV. 138.73
200X200X200 TEE
OBV. 138.10
1.0m OUTSIDE OF
THE BUILDING
150mm SANITARY SERVICE
PLUG INV. 138.00
1.0m OUTSIDE OF
THE BUILDING
200mm STORM SERVICE
PLUG INV. 138.66
16.6m OF 150mm SDR 35
SANITARY SERVICE @ 1.50%
61.4m OF 375mm PVC STM @ 0.29%
6.0m OF 250mm PVC STM @ 1.0%
CB 07
T/G 140.25
INV. 138.63
35.6m OF 525mm
CONC STM @ 0.22%
3.9m OF 150mm SDR 35
SANITARY SERVICE @ 2.56%
1.0m OUTSIDE OF
THE BUILDING
150mm SANITARY SERVICE
PLUG INV. 138.00
SAN MH-2
T/G 140.65
W INV. 137.75
E INV. 137.90
N INV. 136.66
S INV. 136.60
STM MH 03
DIA. 1500mm
T/G 140.40
N INV. 138.13; S INV.138.05
W INV. 138.28; E INV. 138.13
WITH 173mm ORIFICE PLATE
4.0m OF 600mm
CONC STM @ 0.50%
STM MH 04
DIA. 1500mm
T/G 140.43
N INV. 138.03
S INV. 138.01
OIL GRIT SEPERATOR
STORMCEPTOR EF08
18.5m OF 600mm
CONC STM @ 0.44%
92.4m OF 525mm CONC STM @ 0.28%
3.0m OF 200mm
PVC STM @ 1.0%
CB 16
T/G 140.25
INV. 138.54
3.0m OF 200mm
PVC STM @ 1.0%
CB 15
T/G 140.25
INV. 138.67
12.0m OF 200mm
PVC STM @ 1.0%
1.0m OUTSIDE OF
THE BUILDING
200mm STORM SERVICE
PLUG INV INV 138.63
11.25 BEND
OBV. 138.00
HYD FLANGE
EL 140.68
OBV. 138.08
STM MH 05
T/G 140.28
N INV. 138.47
W INV. 138.39
S INV. 138.71
CB 14
T/G 140.25
INV. 138.74
3.0m OF 200mm
PVC STM @ 1.0%
STMMH 05
T/G 140.85
N INV. 138.60
E INV. 139.54
S INV. UNK.
56.1m OF 200mm SDR 35
SANITARY SERVER @ 0.84%
CONNECTION TO EXISTING 250 WM
WITH TEE 250X200X250
EXISTING 250 WM OBV: 137.75
VERIFY ELEVATION OF EXISTING
WATERMAIN PRIOR TO CONSTRUCTION
CONNECT TO
EXISTING 200 SAN
INV. 136.24
STMMH 05
DIA. 1650mm
T/G 140.29
W INV 137.785
E INV 137.785
N INV 137.935
CONNECTION TO EXISTING 250 WM
WITH TEE 250X200X250
EXISTING 250 WM OBV: 138.20
VERIFY ELEVATION OF EXISTING
WATERMAIN PRIOR TO CONSTRUCTION
STM MH 02
T/G 140.62
W INV. 138.32
E INV. 138.55
S INV. 138.23
N INV. 138.55
CB 06
T/G 140.54
INV. 138.89
33.7m OF 200mm PVC STM @ 1.0%
CB 13
T/G 140.30
INV. 139.14
26.7m OF 200mm PVC STM @ 1.0%
2.2m OF 200mm
PVC STM @ 1.0%
CB 12
T/G 140.30
INV. 138.91
CBMH 10
T/G 140.15
INV. 138.66
19.3m OF 375mm
PVC STM @ 1.0%
INV. 139.60
INSTALL STEEL GRATE AT
THE END OF CSP AS PER
OPSD 804.050
3.0m OF 400mm CSP @ 1.0%
CBMH 08
T/G 140.25
INV. 138.77
HYD FLANGE
EL. 141.60
OBV. 139.00
200X200X200 TEE
INV. 138.70
EX. 400 CSP CULVERT
N INV. 138.58
S INV. 139.06
EX. 400 CSP CULVERT
N INV. 138.64
S INV. 138.64
EX. 400 CSP
CULVERT
N INV. 138.58
S INV. UNK.
EX. CB
RIM 140.37
INV. 139.10
EX. CB
RIM 140.31
INV. 139.09
EX. CB
RIM 140.42
SW INV. 138.95
NE INV. 138.95
EX. CB
RIM 140.82
SW INV. 138.82
NE INV. 138.77
EX. CB
RIM 140.36
NW INV. 139.55
NE INV. 139.45
EX. CB
RIM 140.35
NW INV. 139.39
SW INV. 139.23
NE INV. 139.39
SE INV. 139.13
EX. MH
RIM 140.55
W INV. 138.77
SE INV. 138.72
EX. MH (DIA. 1500Ø)
RIM 139.776
E INV. 137.440
W INV. 137.430
N INV. 137.027
EX. MH
RIM 139.79
W INV. 136.05
E INV. 136.09
EX. MH
RIM 140.14
W INV. 136.44
E INV. 136.47
EX. MH
RIM 140.52
W INV. 136.80
E INV. 136.80
EX. MH
RIM 140.46
SW INV. 137.82
SE INV. 137.41
EX. CB
RIM 140.72
EX. CB
RIM 140.24
INV. 138.92
EX. CB
RIM 140.42
SW INV. 139.30
NE INV. 139.40
EX. MH
RIM 140.53
EX. CB
RIM 140.08
E INV. 138.020
EX. CB
RIM 140.24
EX. CB
RIM 140.23
EX. 300
PVC CULVERT
EX. CB
RIM 140.37
E INV. 132.892
W INV. 137.882
N INV. 139.08
EX. 300
STM
EX. 750
EX. 200 SAN
EX. 250 WM
EX. GAS
EX. SIDEWALK
EX. 150 WM
EX. 250 STM
EX. 200 SAN
EX. 250 WM
EX. 200 SAN
EX. 250 WM
EX. 250 STM
EX. 150 WM
EX. 250 STM
EX. 200 SAN
EX. 250 WM
EX. GAS
EX. 250 WM
200 PVC DR18 WM
EX. WM
EX. UIG GAS
EX. STM
EX. UIG GAS
EX. WM
EX. 100 STM
EX. 250 STM
EX. 250 STM
EX. 250

APPENDIX

PHASE 1 DEVELOPMENT
CIVIL DESIGN DRAWINGS

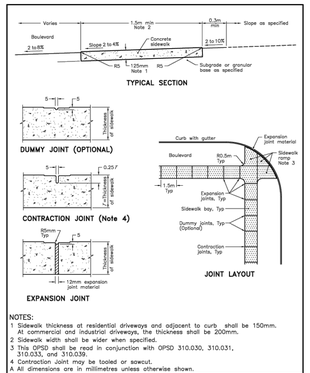


NOTE:
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2021 | Rev 3

LIGHT–DUTY SILT FENCE BARRIER

OPSD 219.110

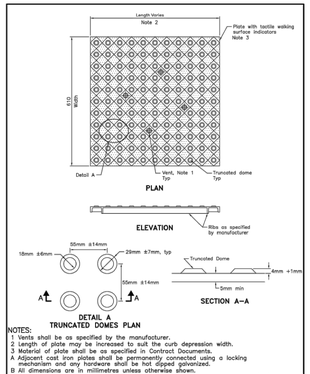


NOTES:
1 Sidewalk thickness at residential driveways and adjacent to curb shall be 150mm. At commercial and industrial driveways, the thickness shall be 200mm.
2 Sidewalk width shall be wider when specified.
3 This OPSD shall be read in conjunction with OPSD 310.030, 310.031, 310.033, and 310.039.
4 Contraction joint may be tooled or sawcut.
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2019 | Rev 3

CONCRETE SIDEWALK

OPSD 310.010

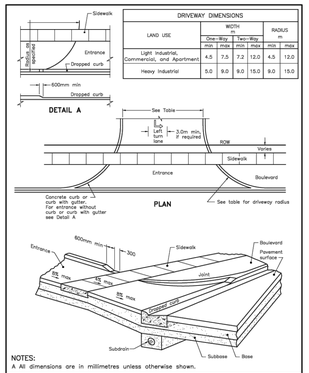


NOTES:
1 Vents shall be as specified by the manufacturer.
2 Length of plate may be increased to suit the curb depression width.
3 Material of plate shall be as specified in Contract Documents.
4 Adjacent cast iron plates shall be permanently connected using a locking mechanism and any hardware shall be hot-dipped galvanized.
B All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2019 | Rev 1

CONCRETE SIDEWALK RAMPS TACTILE WALKING SURFACE INDICATORS COMPONENT

OPSD 310.039



DRIVEWAY DIMENSIONS

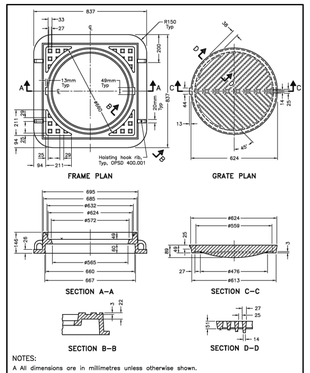
LAND USE	WIDTH One-Way	WIDTH Two-Way		RADIUS m	
	min	max	min	max	min	max
Light Industrial, Commercial, and Apartment	4.5	7.5	7.2	12.0	4.5	12.0
Heavy Industrial	5.0	9.0	9.0	15.0	9.0	15.0

NOTES:
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2018 | Rev 2

URBAN INDUSTRIAL, COMMERCIAL, AND APARTMENT ENTRANCES

OPSD 350.010

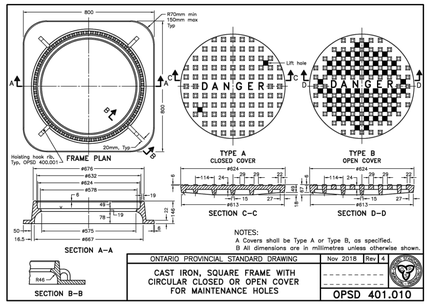


NOTES:
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2018 | Rev 6

CAST IRON, RAISED SQUARE FRAME WITH CIRCULAR FLAT GRATE FOR CATCH BASINS, HERRING BONE OPENINGS

OPSD 400.070

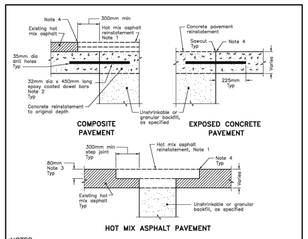


NOTES:
A Covers shall be Type A or Type B, as specified.
B All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2018 | Rev 4

CAST IRON, SQUARE FRAME WITH CIRCULAR CLOSED OR OPEN COVER FOR MAINTENANCE HOLES

OPSD 401.010

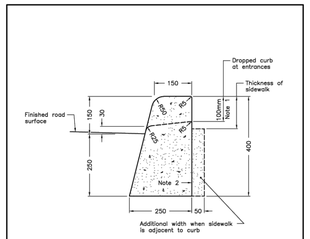


NOTES:
1 Hot mix asphalt type and thickness as specified. The surface course shall not be less than 40mm.
2 Dowels shall be installed at 300mm intervals along all transverse faces. The dowel bars shall be placed mid-depth of the specified slab thickness and parallel to the longitudinal axis and the horizontal plane of the pavement within the following tolerances:
a) Vertical Alignment: ± 15mm along the length of the dowel bar.
b) Horizontal Alignment: ± 15mm along the length of the dowel bar.
c) Slide Shift: The centre of the dowel bar shall lie within ± 40mm from the transverse joint.
The bars shall be installed at 600mm intervals along all longitudinal faces and shall be aligned perpendicular to the longitudinal axis of the pavement. The tie bars shall be installed within a tolerance of ± 15mm from the specified depth.
Where reinforcement is present, dowel and tie bars may be adjusted 25mm horizontally and raised or lowered 10mm to avoid drilling reinforcement.
All dowels and tie bars shall be set with epoxy grout.
3 If the total pavement thickness is less than 80mm, step joint is not required.
4 Joint treatment as specified.
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2020 | Rev 3

PAVEMENT REINSTATEMENT FOR UTILITY CUTS

OPSD 509.010

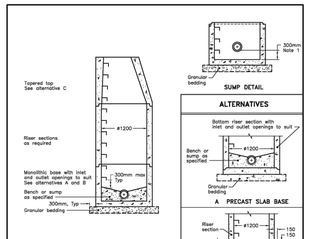


NOTES:
1 When sidewalk is continuously adjacent, the dropped curb at entrances shall be placed as shown.
2 For slipforming procedure a 0/E batter is acceptable.
A Treatment at entrances shall be according to OPSD 351.010.
B Outlet treatment shall be according to the OPSD 610 Series.
C The transition from one curb type to another shall be a minimum length of 3.0m, except in conjunction with guide rail where it shall be according to the OPSD 900 Series.
D All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2012 | Rev 2

CONCRETE BARRIER CURB

OPSD 600.110

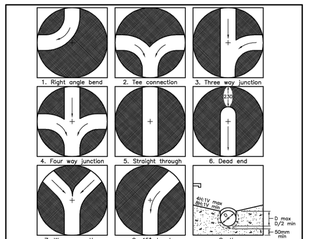


NOTES:
1 The sump is measured from the lowest invert.
A Granular backfill shall be placed to a minimum thickness of 300mm all around the maintenance hole.
B Precast concrete components shall be according to OPSD 701.030, 701.031, or 701.032.
C Structure exceeding 5.0m in depth shall include safety platform according to OPSD 404.020.
D Pipe support according to OPSD 708.020.
E For benching and pipe opening details, see OPSD 701.021.
F For adjustment unit and frame installation, see OPSD 704.010.
G All dimensions are nominal.
H All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2014 | Rev 5

PRECAST CONCRETE MAINTENANCE HOLE
1200mm DIAMETER

OPSD 701.010



MAXIMUM SIZE HOLE IN THE WALL IN PRECAST RISER SECTIONS

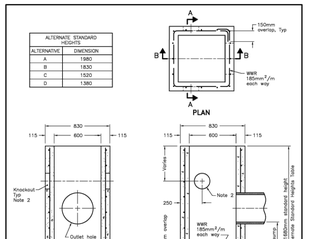
Maintenance Hole Diameter	No. 1–4	No. 5 and 6	No. 8	No. 7 Inlet Hole	No. 7 Outlet Hole
1200	700	860	780	700	860
1500	860	1220	980	860	1170
1800	1220	1485	1220	1220	1485
2400	1485	2020	1760	1485	2020
3000	1930	2450	2300	1930	2450
3600	2470	3085	2730	2470	3085

NOTES:
1 Slopes shall be maintained from the outlet hole opening for top of benching.
A Concrete for benching shall be 30MPa.
B When benching is hand–finished, it shall be given wood float finish, channel shall be given steel trowel finish, and shall be finished to a smooth finish.
C Benching slope and height shall be as specified.
D When specified, maintenance holes that are 1350mm in diameter with a uniform channel for 200 or 250mm pipe may be prebenched at the manufacturer with standardized benching slope and channel orientation.
E All dimensions are nominal.
F All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2014 | Rev 4

MAINTENANCE HOLE BENCHING AND PIPE OPENING ALTERNATIVES

OPSD 701.021



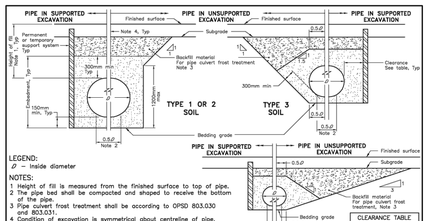
ALTERNATIVE	DIMENSION
A	1980
B	1830
C	1520
D	1380

NOTES:
1 Outlet hole size 525mm diameter maximum, location as required.
2 200mm diameter knockout to accommodate subdrain. Knockout shall be 80mm deep.
A Centre reinforcing in base slab and walls ø200mm.
B Granular backfill shall be placed to a minimum thickness of 300mm all around the catch basin.
C Frame, grate, and adjustment units shall be installed according to OPSD 704.010.
D Pipe support shall be according to OPSD 708.020.
E All dimensions are nominal.
F All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2019 | Rev 4

PRECAST CONCRETE CATCH BASIN 600x600mm

OPSD 705.010



LEGEND:
Ø – Inside diameter

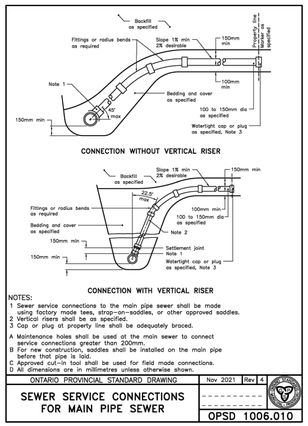
NOTES:
1 Height of fill is measured from the finished surface to top of pipe.
2 The pipe bed shall be compacted and shaped to receive the bottom of the pipe.
3 Pipe culvert frost treatment shall be according to OPSD 803.030 and 803.031.
4 Condition of excavation is symmetrical about centreline of pipe.
A Granular material placed in the haunch area shall be compacted prior to placing and compacting the remainder of the embedment material.
B Soil types as defined in the Occupational Health and Safety Act and Regulations for Construction Projects.
C All dimensions are in metres unless otherwise shown.

CLEARANCE TABLE	
Inside Diameter mm	Clearance mm
900 or less	300
Over 900	500

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2014 | Rev 3

FLEXIBLE PIPE EMBEDMENT AND BACKFILL EARTH EXCAVATION

OPSD 802.010

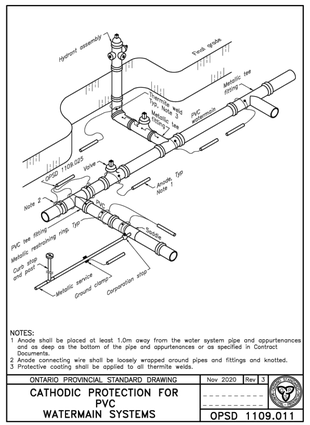


NOTES:
1 Sewer service connections to the main pipe sewer shall be made using factory made tees, strap–on–saddles, or other approved saddles.
2 Vertical risers shall be as specified.
3 Cap or plug at property line shall be adequately braced.
A Maintenance holes shall be used at the main sewer to connect service connections greater than 200mm.
B For new construction, saddles shall be installed on the main pipe before that pipe is laid.
C Approved cut–in tool shall be used for field made connections.
D All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2021 | Rev 4

SEWER SERVICE CONNECTIONS FOR MAIN PIPE SEWER

OPSD 1006.010

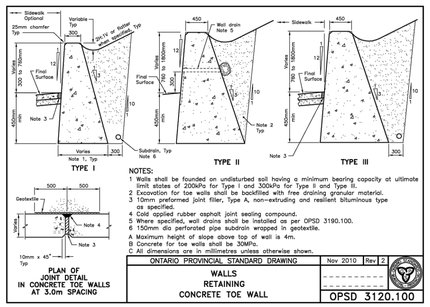


NOTES:
1 Anode shall be placed at least 1.0m away from the water system pipe and appurtenances and as deep as the bottom of the pipe and appurtenances or as specified in Contract Documents.
2 Anode connecting wire shall be loosely wrapped around pipes and fittings and knotted.
3 Protective coating shall be applied to all thermite welds.

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2020 | Rev 3

CATHODIC PROTECTION FOR PVC WATERMAIN SYSTEMS

OPSD 1109.011

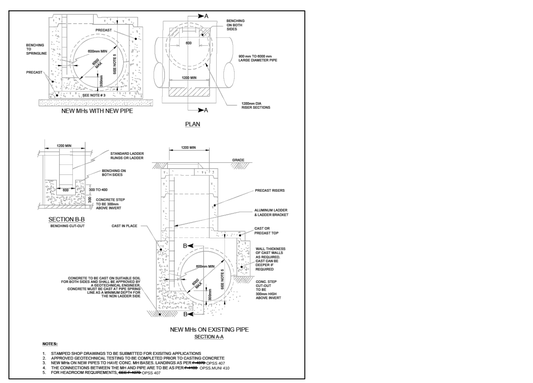


NOTES:
1 Walls shall be founded on undisturbed soil having a minimum bearing capacity at ultimate limit states of 200kPa for Type I and 300kPa for Type II and Type III.
2 Excavation for toe walls shall be backfilled with free draining granular material.
3 10mm preformed joint filler, Type A, non–extruding and resilient bituminous type as specified.
4 Cold applied rubber asphalt joint sealing compound.
5 Where specified, wall drains shall be installed as per OPSD 3190.100.
6 150mm dia perforated pipe subdrain wrapped in geotextile.
A Maximum height of slope above top of wall is 4m.
B Concrete for toe walls shall be 30MPa.
C All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2010 | Rev 2

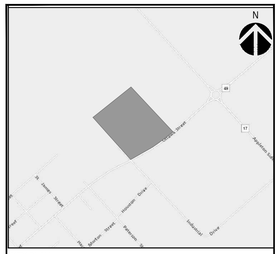
WALLS RETAINING CONCRETE TOE WALL

OPSD 3120.100



NOTES:
1. STAMPED SHOP DRAWINGS TO BE SUBMITTED FOR EXISTING APPLICATIONS
2. APPROVED GEOTECHNICAL TESTING TO BE COMPLETED PRIOR TO EXISTING CONCRETE
3. THE CONNECTIONS BETWEEN THE MH AND PIPE AND TO BE AS PER OPSD 401.010 or 401.011
4. THE CONNECTIONS BETWEEN THE MH AND PIPE AND TO BE AS PER OPSD 401.010
5. FOR HEADROOM REQUIREMENTS, ~~SEE OPSD~~ OPSD 407

1 / C06 MH PLACEMENT FOR NEW & EXISTING PIPE
SCALE / ÉCHELLE = N.T.S



KEY PLAN

ISSUED FOR REVIEW

REVISION:

REV	DATE	DESCRIPTION	BY
0C	2023-09-26	REVISED AS PER MUNICIPALITY COMMENTS	I.J.

SEAL:

REGISTERED PROFESSIONAL ENGINEER
I. M. JAFFERJEE
100164153
2023-09-26
PROVINCE OF ONTARIO

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ORIGINAL SCALE: --
DATE: 2022-12-12
DESIGNED BY: S.M.
ASSISTED BY: --
DRAWN BY: S.M.
MODIFIED BY: --
APPROVED BY: I.J.
DISCIPLINE: CIVIL

IF THIS BAR IS NOT 25mm LONG, ADJUST YOUR PLOTTING SCALE.
25mm

WSP Canada Inc.
2611 Queensview Drive, Suite 300 Ottawa, Ontario K2B 8K2
T 613-829-28-00| www.wsp.com

PROJECT NUMBER: 221-06853-00

CLIENT:
ELM DEVELOPMENTS

CLIENT REF. #: --

PROJECT:
430 OTTAWA STREET
OTTAWA, ONTARIO

TITLE:
STANDARD DETAILS

DRAWING NUMBER: C06
REV. 0C

CTB: wsp-2bhbca-full.ctb
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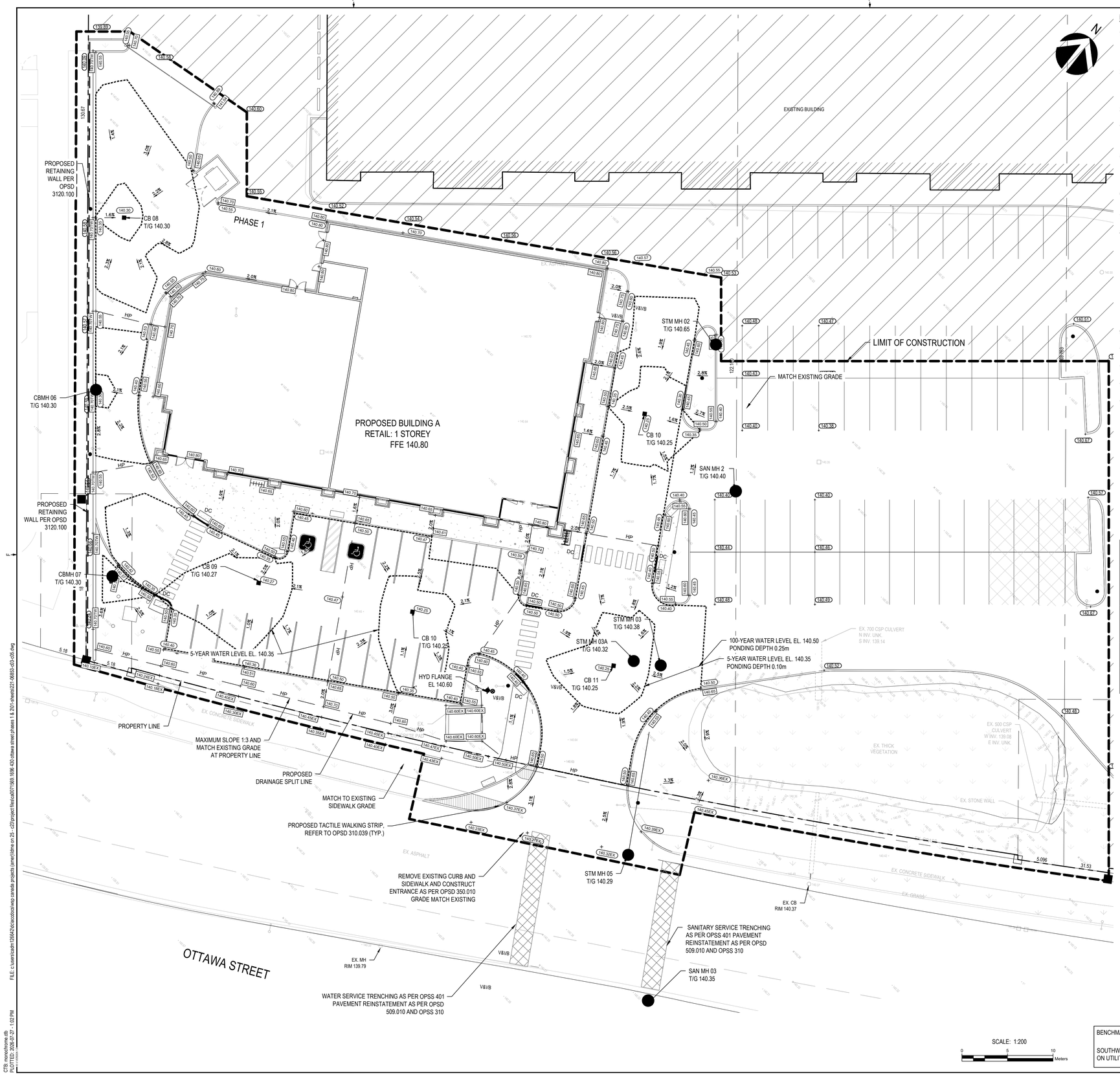


NOTES:

1. ALL WORK TO BE COORDINATED WITH OTHER PLANS FOR THIS SITE. REFER TO M AND E DRAWINGS FOR GAS, ELECTRICAL, PLUMBING AND COMMUNICATION SERVICES. ARCHITECTURAL SITE PLAN TO BE USED FOR SITE LAYOUT AND PHASING. ARCHITECTURAL DRAWINGS AND SPECIFICATIONS PROVIDE THE PAVEMENT DESIGN.
2. LOCATION OF SERVICES, CHAMBERS, UTILITIES AND ALL UNDERGROUND WORKS ARE APPROXIMATE. CONTRACTOR TO VERIFY LOCATION AND ELEVATION OF ALL SERVICES, UTILITIES, AND UNDERGROUND STRUCTURES PRIOR TO ANY CONSTRUCTION. CONTRACTOR IS RESPONSIBLE FOR PROTECTION AND REINSTATEMENT.
3. THE CONTRACTOR IS RESPONSIBLE FOR ALL REMOVALS NECESSARY TO SATISFY ENGINEERING WORKS.
4. CONTRACTOR RESPONSIBLE FOR OBTAINING ROAD CUT PERMIT, AND PROVIDING ALL ASSOCIATED TRAFFIC CONTROL. CONTRACTOR TO RECORD VERTICAL AND HORIZONTAL LOCATION OF ALL UNDERGROUND WORKS FOR RECORD DRAWINGS.
5. CONTRACTOR TO PROVIDE POST CONSTRUCTION TOPOGRAPHIC SURVEY COMPLETED BY OLS OR PROFESSIONAL ENGINEER RETAINED BY CONTRACTOR CONFIRMING COMPLIANCE WITH GRADING AND SERVICING DESIGN. SURVEY TO INCLUDE SEWER INVERTS. SURVEY LEVEL OF DETAIL TO MATCH THAT OF GRADING DESIGN PLANS.
6. REFER TO ARCHITECTURAL PLANS FOR PHASING AND STAGING OF CONSTRUCTION. REFER TO SITE PLAN FOR PAVING LIMITS AND TYPES, INCLUDING SIDEWALK REQUIREMENTS.
7. ROAD ENTRANCES TO BE CONSTRUCTED IN ACCORDANCE WITH SITE PLAN.
8. ASPHALT AND GRANULARS:
   - 8.1. ALL MATERIALS MUST CONFORM TO THE MUNICIPALITY AND ONTARIO PROVINCIAL STANDARDS AND SPECIFICATIONS. REFER TO TESTING SECTION FOR GEOTECHNICAL REQUIREMENTS AND A LIST OF SUBMITTALS.
   - 8.2. HOT MIX ASPHALT SHALL BE INSTALLED IN ACCORDANCE WITH OPSS 310.
   - 8.3. COMPACTION OF ASPHALT SHALL BE IN ACCORDANCE WITH TABLE 10 OF OPSS 310.
   - 8.4. ALL SAWCUTS SHALL BE STRAIGHT MATCH LINES BETWEEN THE EXISTING PAVEMENT AND NEW PAVEMENT. KEY GRIND A MINIMUM 0.50m WIDE BY 40mm DEEP EDGE WHEN TYING INTO EXISTING ASPHALT AND SEAL JOINTS WITH DENSO ASPHALT REINSTATEMENT TAPE.
   - 8.5. COMPACTION OF BASE AND SUBBASE MATERIALS SHALL BE TO 100% SPMDD.
9. CONCRETE CURBS SHALL BE INSTALLED IN ACCORDANCE WITH OPSD 600.110.
10. CONCRETE SIDEWALKS SHALL BE INSTALLED IN ACCORDANCE WITH OPSD 310.010.
11. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE INDICATED.
12. DRAWING COORDINATES ARE ZONE 18 UTM NAD83.
13. DRINKING WATER NOTES:
   - 13.1. THE DESIGN AND CONSTRUCTION OF THE MUNICIPAL WATERMAIN WORKS SHALL CONFORM TO THE REQUIREMENTS OF THE APPLICABLE MUNICIPAL DRINKING WATER LICENCE (MDWL), MUNICIPAL DRINKING WATER WORKS PERMIT (MDWWP), AND THE MECP DESIGN CRITERIA FOR SANITARY SEWERS, STORM SEWERS AND FORCEMAINS FOR ALTERATIONS AUTHORIZED UNDER AN ENVIRONMENTAL COMPLIANCE APPROVAL (CLI DESIGN CRITERIA), AS AMENDED.
   - 13.2. THE CONTRACTOR SHALL RETAIN A PROFESSIONAL ENGINEER LICENSED IN THE PROVINCE OF ONTARIO TO PROVIDE ALL ENGINEERING SERVICES, INSPECTIONS, TESTING, AND CERTIFICATIONS NECESSARY TO SATISFY THE REQUIREMENTS OF THE MUNICIPAL DRINKING WATER LICENCE, MUNICIPAL DRINKING WATER WORKS PERMIT, AND THE CLI DESIGN CRITERIA.
   - 13.3. UPON COMPLETION OF THE WORKS, ALL REQUIRED CERTIFICATIONS, RECORD DOCUMENTATION, AND ENGINEER'S CERTIFICATION SHALL BE SUBMITTED TO THE CONTRACT ADMINISTRATOR/OWNER IN ACCORDANCE WITH THE REQUIREMENTS OF THE MUNICIPAL DRINKING WATER LICENCE, MUNICIPAL DRINKING WATER WORKS PERMIT, AND THE CLI DESIGN CRITERIA.

RECOMMENDED MINIMUM PAVEMENT STRUCTURE

PAVEMENT STRUCTURE		HEAVY DUTY MATERIALS FIRE ROUTES	LIGHT DUTY PARKING
ASPHALTIC CONCRETE	OPSS HL3 OR EQUIVALENT	40mm	65mm
	OPSS HL8 OR EQUIVALENT	60mm	-
BASE	OPSS GRANULAR A OR 20mm CRUSHER-RUN	150mm	150mm
SUB-BASE	OPSS GRANULAR B OR 50mm CRUSHER-RUN	300mm	200mm

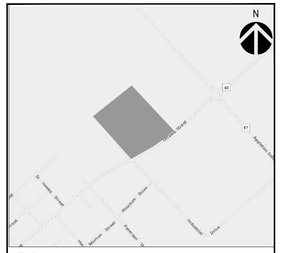
EXISTING	LEGEND-PLAN	PROPOSED
150 WM	WATER MAIN	150 WM
300 STM	LAND DRAINAGE SEWER	300 STM
250 SAN	WASTE WATER SEWER	250 SAN
G	GAS	
PO	POWER OVERHEAD HYDRO	
	CURB	
	EDGE OF PAVEMENT	
	CULVERT	
	PROPERTY LINE	
	HIGH POINT	
	WOODEN FENCE	
	5-YEAR WATER LEVEL	
	10-YEAR WATER LEVEL	
59.367	GROUND ELEVATION	
00.00	ROAD ELEVATION	00.00
00.00	LOT ELEVATION	00.00
00.00	DITCH/SWALE ELEVATION	00.00
	EXISTING ROAD ELEVATION	00.00
	EXISTING LOT ELEVATION	000.00EX
	TOP OF WALL ELEVATION	000.00TW
	FLOW DIRECTION	
	SWALE FLOW DIRECTION	
	DOWNSPOUT	D.S.
HP	HYDRO POLE	
	PLUG	
	VALVE	
	HYDRANT	
	MANHOLE	
	CATCHMENT BOUNDARY	
	TOPSOIL AND SOD	
	CONCRETE	
	HEAVY DUTY ASPHALT	
	LIGHT DUTY ASPHALT	

METRIC

WHOLE NUMBERS INDICATE MILLIMETRES
DECIMALIZED NUMBERS INDICATE METRES

BENCHMARK (B.M.)

SOUTHWEST CORNER, SOUTHEAST CORNER AND ON UTILITY BOX NORTH OF BUILDING.



REVISION:

REV	DATE	DESCRIPTION	BY
0D	2026-06-10	ISSUED FOR SPA AMENDMENT	I.J.
0C	2023-09-26	REVISED AS PER MUNICIPALITY COMMENTS	I.J.
0B	2023-07-14	REVISED AS PER MUNICIPALITY COMMENTS	J.Z.
0A	2023-03-27	ISSUED FOR SPA	J.Z.

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DATE: 2026-06-10
DESIGNED BY: J.Z.
ASSISTED BY: --
DRAWN BY: D.M.
MODIFIED BY: I.J.
APPROVED BY: --
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25mm

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PROJECT NUMBER: 221-06853-00

CLIENT:

ELM DEVELOPMENTS

CLIENT REF. #: --

PROJECT:

430 OTTAWA STREET
ALMONTE, ONTARIO

TITLE:

PHASE 1
LOT GRADING PLAN

DRAWING NUMBER: C03
REV: 0D

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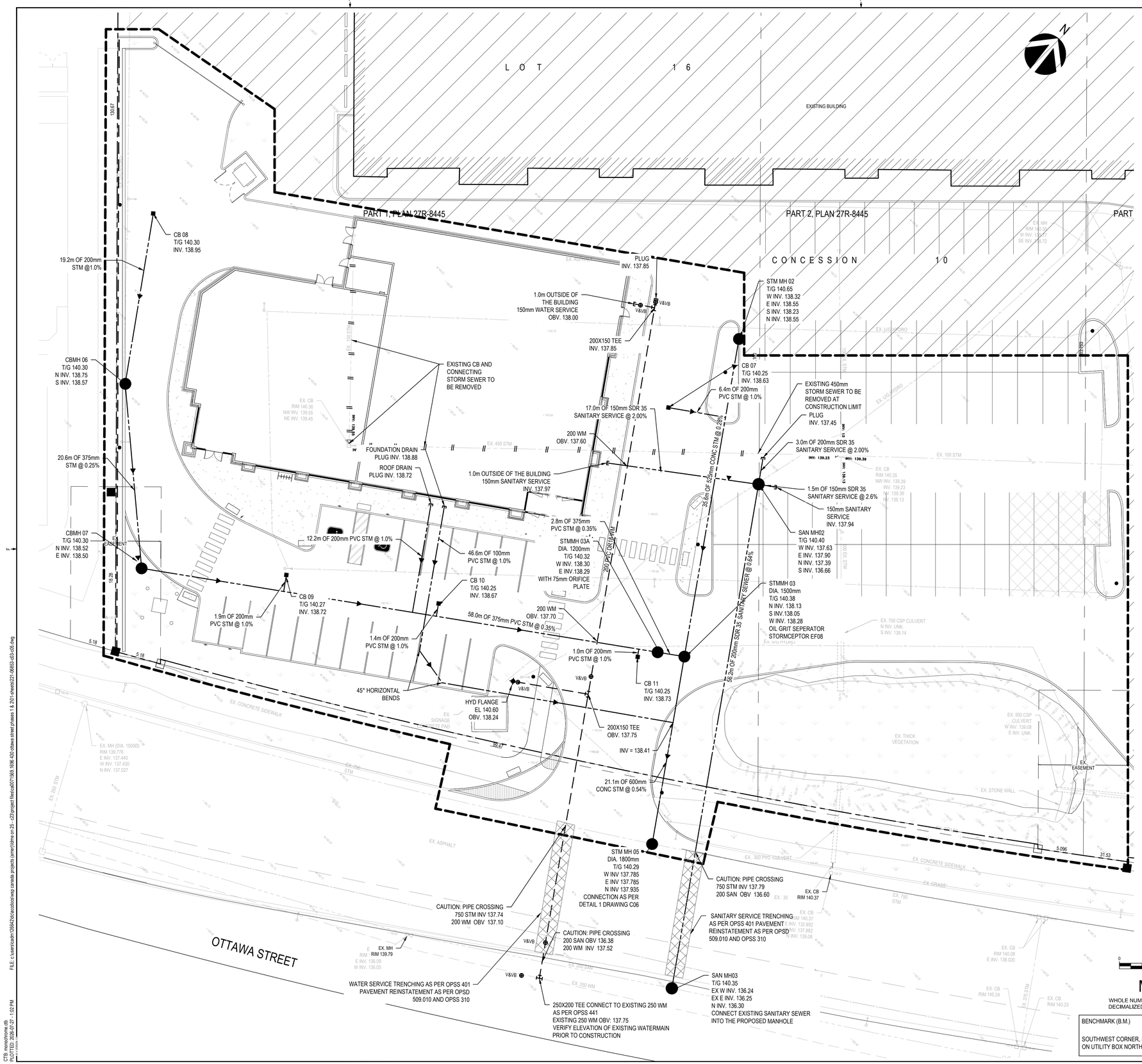

SEWER NOTES

1. CONSTRUCT SEWERS AND APPURTENANCES AS PER MINISTRY OF THE ENVIRONMENT STANDARDS. CONFIRM EXISTING TIE IN ELEVATIONS PRIOR TO CONSTRUCTION. SEWER TRENCH SHALL INCLUDE BEDDING AS PER OPSD 802.010. COMPACTION TO BE A MINIMUM OF 95% SPMDD FOR PIPE AND DRAINAGE STRUCTURE BEDDING AND BACKFILL. GRANULAR BEDDING AND COVER DEPTHS TO BE 300mm AND 300mm RESPECTIVELY. USE VIRGIN GRANULAR A MATERIAL, PLACED IN MAXIMUM 150mm THICK LIFTS.
2. PVC STORM SEWERS AND CATCH BASIN LEADS TO BE PVC DR 35 CERTIFIED TO CAN/CSA-B182.2.
3. PROVIDE FLEXIBLE BOOT CONNECTION FOR ALL PVC SEWER CONNECTIONS AT MANHOLES.
4. STORM CATCHBASINS (CB) TO BE AS PER OPSD 705.010 WITH FRAMES AND ROUND GRATE AS PER OPSD 400.070. SUMP TO BE 600mm.
5. SEWERS AND SERVICES SHALL BE CONSTRUCTED WITH A MINIMUM CLEARANCE OF 2.0m FROM TREES AND UTILITY PLANT.
6. ALL MANHOLES TO BE 1200mm DIA. AS PER OPSD 701.010 EXCEPT AS NOTED BELOW. STORM MANHOLES TO HAVE 300mm MINIMUM SUMP BELOW LOW INVERT. SANITARY MANHOLES TO BE BENCHED AS PER OPSD 701.021.
7. CBMH FRAMES AND ROUND GRATES AS PER OPSD 400.070. SANITARY MANHOLES TO HAVE FRAME AND COVER AS PER TYPE A, OPSD 401.010. STORM MANHOLE TO HAVE TYPE B COVER AND FRAME AS PER OPSD 401.010.
8. PROVIDE CAMERA INSPECTION OF ALL SEWERS FOLLOWING COMPLETION OF CONSTRUCTION AND PROVIDE TO ENGINEER. MAINTAIN SEWERS IN CLEAN CONDITION UNTIL OWNER ACCEPTANCE.
9. COORDINATE WITH MECHANICAL CONTRACTOR AND PROVIDE DYE TEST CERTIFIED BY PROFESSIONAL ENGINEER (RETAINED BY CONTRACTOR) ON BUILDING STORM AND SANITARY SEWER SERVICES TO CONFIRM THAT NO CROSS CONNECTIONS OCCUR ON WORKS BEING CONSTRUCTED IN THIS CONTRACT.
10. ALL PROPOSED SERVICES AND ASSOCIATED STRUCTURES WITHIN THE RIGHT-OF-WAY WILL BE CONSIDERED MUNICIPAL INFRASTRUCTURE POST.

WATERMAIN NOTES:

1. THE CONTRACTOR SHALL CONFIRM THE LOCATION, ELEVATION, SIZE, AND TYPE OF THE EXISTING WATERMAIN WITHIN THE WORK AREA PRIOR TO CONNECTION. THE CONTRACTOR SHALL PREPARE AND SUBMIT A DETAILED PLAN TO THE ENGINEER FOR REVIEW AND APPROVAL PRIOR TO ORDERING FITTINGS. THE PLAN SHALL DETAIL THE TYPE, MAKE AND LOCATION OF ALL PROPOSED FITTINGS, RESTRAINTS AND ASSOCIATED APPURTENANCES. THE PLAN SHALL ALSO DETAIL THE PROPOSED DISINFECTION PROCEDURES, SEQUENCING AND DURATION OF WORK REQUIRED FOR THE REALIGNMENT OF THE WATERMAIN. DISINFECTION PROCEDURE SHALL FOLLOW THE REQUIREMENTS OF OPSS 441 AND THE MUNICIPALITY STANDARDS.
2. CONTRACTOR SHALL COORDINATE TIMING AND DURATION OF SERVICE DISRUPTIONS WITH THE MUNICIPALITY AND AFFECTED LAND OWNERS AND SHALL PROVIDE WRITTEN NOTIFICATION A MINIMUM OF TWO WEEKS PRIOR TO ANY PROPOSED DISRUPTION. NO WORK AFFECTING THE WATER OR OTHER MUNICIPAL SERVICES MAY COMMENCE UNTIL THE CONTRACTOR HAS RECEIVED WRITTEN APPROVAL FROM THE MUNICIPALITY OR ENGINEER.
3. CONTRACTOR TO PROVIDE TEMPORARY POTABLE WATER SERVICES IN ACCORDANCE WITH OPSS MUNI 493.
4. WATERMAIN, VALVES AND HYDRANTS SHALL BE INSTALLED AS PER OPSS 441 AND THE MUNICIPALITY STANDARDS.
5. WATERMAINS AND SERVICES SHALL HAVE MINIMUM 2.40m COVER IN ALL DIRECTIONS AT ALL TIMES.
6. WATERMAIN PIPE SHALL BE CSA CERTIFIED IN ACCORDANCE WITH AWWA C900 DR18.
7. GATE VALVES AS PER AWWA C509.
8. VALVE BOXES SHALL BE A 130mm DIAMETER SLIDE VALVE BOX COMPLETE WITH CASE IRON CAP AS SUPPLIED BY BIBBY-STE-CROIX OR APPROVED EQUAL.
9. CORROSION PROTECTION TO BE PROVIDED ACCORDING TO OPSD 1109.011 AND OPSS 442.
10. TRACER WIRE TO BE INSTALLED ALONG ALL NEW WATERMAINS. TRACER WIRE IS TO BE CONTINUOUS (UNSPLICED) AND SHALL BE SECURED TO THE PIPE USING FIBERGLASS TAPE OR PLASTIC TIE WRAPS, AND FASTENED TO A BOLT ON VALVES IN VALVE BOXES.
11. CONNECTION TO THE EXISTING 150mm WATER SERVICE SHALL BE COORDINATED WITH THE ENGINEER AND THE MUNICIPALITY. THE CONTRACTOR SHALL SUPPLY ALL MATERIALS AND EQUIPMENT REQUIRED TO MAKE THE CONNECTION. AT NO TIME SHALL THE CONTRACTOR OPERATE VALVES WITHIN THE MUNICIPALITY DISTRIBUTION SYSTEM. THIS FUNCTION SHALL BE CARRIED OUT BY THE MUNICIPALITY ONLY. ALL FEES CHARGED BY THE MUNICIPALITY SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
12. CONTRACTOR TO BACKFILL WITH SUITABLE NATIVE MATERIAL SIMILAR TO ADJACENT GROUND UP TO THE SUB-BASE GRANULAR FILL. BACKFILL MATERIAL SHALL BE PLACED IN LAYERS NOT EXCEEDING 200mm AND COMPACTED ACCORDING TO OPSS 501 AND APPROVED BY THE GEOTECHNICAL CONSULTANT.

EXISTING	LEGEND-PLAN	PROPOSED
150 WM	WATER MAIN	150 WM
300 STM	LAND DRAINAGE SEWER	300 STM
250 SAN	WASTE WATER SEWER	250 SAN
G	GAS	
PO	POWER OVERHEAD HYDRO	
	CURB	
	EDGE OF PAVEMENT	
	CULVERT	
	PROPERTY LINE	
	WOODEN FENCE	
59.367	GROUND ELEVATION	
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00.00	LOT ELEVATION	00.00
00.00	DITCH/SWALE ELEVATION	00.00
	FLOW DIRECTION	
	SWALE FLOW DIRECTION	
	DOWNSPOUT	D.S.
HP	HYDRO POLE	
	PLUG	
	VALVE	
	HYDRANT	
	MANHOLE	
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	TOPSOIL AND SOD	
	CONCRETE	
	HEAVY DUTY ASPHALT	
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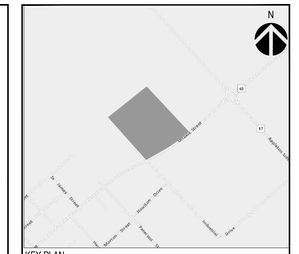

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DATE: 2026-06-10
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ASSISTED BY: --
DRAWN BY: D.M.
MODIFIED BY: I.J.
APPROVED BY: --
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PROJECT NUMBER: 221-06853-00

CLIENT:
ELM DEVELOPMENTS

CLIENT REF. #: --

PROJECT:
430 OTTAWA STREET
ALMONTE, ONTARIO

TITLE:
PHASE 1
LOT SERVICING PLAN

DRAWING NUMBER: C04
REV: 0D

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NOTES: EROSION AND SEDIMENT CONTROL

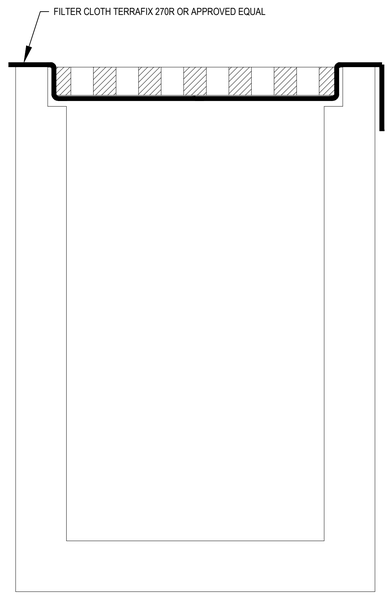
** CONTRACTOR IS RESPONSIBLE FOR ALL INSTALLATION, MONITORING, REPAIR AND REMOVAL OF ALL EROSION AND SEDIMENT CONTROL FEATURES. **

1. PRIOR TO START OF CONSTRUCTION:

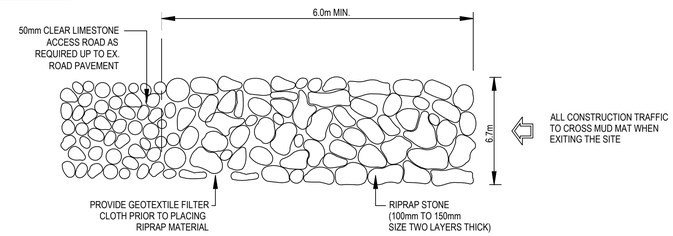
1.1. INSTALL SILT FENCE IN LOCATION SHOWN ON DWG C05.
1.2. INSTALL FILTER FABRIC OR SILT SACK FILTERS IN ALL THE CATCHBASINS AND MANHOLES TO REMAIN DURING CONSTRUCTION WITHIN THE SITE (SEE TYPICAL DETAIL).
1.3. INSPECT MEASURES IMMEDIATELY AFTER INSTALLATION.

2. DURING CONSTRUCTION:

2.1. MINIMIZE THE EXTENT OF DISTURBED AREAS AND THE DURATION OF EXPOSURE AND IMPACTS TO EXISTING GRADING.
2.2. PERIMETER VEGETATION TO REMAIN IN PLACE UNTIL PERMANENT STORM WATER MANAGEMENT IS IN PLACE. OTHERWISE, IMMEDIATELY INSTALL SILT FENCE WHEN THE EXISTING SITE IS DISTURBED AT THE PERIMETER.
2.3. PROTECT DISTURBED AREAS FROM OVERLAND FLOW BY PROVIDING TEMPORARY SWALES TO THE SATISFACTION OF THE FIELD ENGINEER. TIE-IN TEMPORARY SWALE TO EXISTING CB'S AS REQUIRED.
2.4. PROVIDE TEMPORARY COVER SUCH AS SEEDING OR MULCHING IF DISTURBED AREA WILL NOT BE REHABILITATED WITHIN 30 DAYS.
2.5. INSPECT SILT FENCES, FILTER FABRIC FILTERS AND CATCH BASIN SUMPS WEEKLY AND WITHIN 24 HOURS AFTER A STORM EVENT. CLEAN AND REPAIR WHEN NECESSARY.
2.6. DRAWING TO BE REVIEWED AND REVISED AS REQUIRED DURING CONSTRUCTION.
2.7. EROSION CONTROL FENCING TO BE ALSO INSTALLED AROUND THE BASE OF ALL STOCKPILES.
2.8. DO NOT LOCATE TOPSOIL PILES AND EXCAVATION MATERIAL CLOSER THAN 2.5m FROM ANY PAVED SURFACE, OR ONE WHICH IS TO BE PAVED BEFORE THE PILE IS REMOVED. ALL TOPSOIL PILES ARE TO BE SEEDED IF THEY ARE TO REMAIN ON SITE LONG ENOUGH FOR SEEDS TO GROW (LONGER THAN 30 DAYS).
2.9. CONTROL WIND-BLOWN DUST OFF SITE BY SEEDING TOPSOIL PILES AND OTHER AREAS TEMPORARILY (PROVIDE WATERING AS REQUIRED AND TO THE SATISFACTION OF THE ENGINEER).
2.10. NO ALTERNATE METHODS OF EROSION PROTECTION SHALL BE PERMITTED UNLESS APPROVED BY THE FIELD ENGINEER.
2.11. CITY ROADWAY AND SIDEWALK TO BE CLEANED OF ALL SEDIMENT FROM VEHICULAR TRACKING AS REQUIRED.
2.12. DURING WET CONDITIONS, TIRES OF ALL VEHICLES/EQUIPMENT LEAVING THE SITE ARE TO BE SCRAPED.
2.13. ANY MUD/MATERIAL TRACKED ONTO THE ROAD SHALL BE REMOVED IMMEDIATELY BY HAND OR RUBBER TIRE LOADER.
2.14. TAKE ALL NECESSARY STEPS TO PREVENT BUILDING MATERIAL, CONSTRUCTION DEBRIS OR WASTE BEING SPILLED OR TRACKED ONTO ABUTTING PROPERTIES OR PUBLIC STREETS DURING CONSTRUCTION AND PROCEED IMMEDIATELY TO CLEAN UP ANY AREAS SO AFFECTED.
2.15. ALL EROSION CONTROL STRUCTURE TO REMAIN IN PLACE UNTIL ALL DISTURBED GROUND SURFACES HAVE BEEN STABILIZED EITHER BY PAVING OR RESTORATION OF VEGETATIVE GROUND COVER.
2.16. THE CONTRACTOR SHALL IMPLEMENT BEST MANAGEMENT PRACTICES, TO PROVIDE FOR PROTECTION OF THE AREA DRAINAGE SYSTEM AND THE RECEIVING WATERCOURSE, DURING CONSTRUCTION ACTIVITIES. THE CONTRACTOR ACKNOWLEDGES THAT FAILURE TO IMPLEMENT APPROPRIATE EROSION AND SEDIMENT CONTROL MEASURES MAY BE SUBJECT TO PENALTIES IMPOSED BY ANY APPLICABLE REGULATORY AGENCY.



FILTER CLOTH CATCHBASIN OR MANHOLE
SEDIMENT CONTROL DEVICE
(NTS)



MUD MAT DETAIL - PLAN VIEW
(NTS)

METRIC

WHOLE NUMBERS INDICATE MILLIMETRES
DECIMALIZED NUMBERS INDICATE METRES

BENCHMARK (B.M.)

SOUTHWEST CORNER, SOUTHEAST CORNER AND ON UTILITY BOX NORTH OF BUILDING.

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	VALVE	
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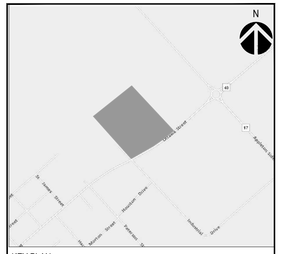
	MANHOLE	
	CATCHMENT BOUNDARY	
	TOPSOIL AND SOD	
	CONCRETE	
	HEAVY DUTY ASPHALT	
	LIGHT DUTY ASPHALT	
	SILT FENCE	SF
	MUD MAT	
	FILTER CLOTH	



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ELM DEVELOPMENTS

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PROJECT:
430 OTTAWA STREET
OTTAWA, ONTARIO

TITLE:
EROSION AND SEDIMENT CONTROL PLAN

DRAWING NUMBER: C05
REV. 0D

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CTB: monochrome.ctb
PLOTTED: 2026-07-27 1:01 PM

APPENDIX

PHASE 2 DEVELOPMENT
CIVIL DESIGN DRAWINGS

NOTES:

1. ALL WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE CONTRACT DOCUMENTS, THE LATEST EDITION OF THE ONTARIO PROVINCIAL STANDARD SPECIFICATIONS (OPSS), ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD), APPLICABLE CSA AND AWWA STANDARDS, THE MUNICIPALITY REQUIREMENTS, AND ALL APPLICABLE CODES, BY-LAWS AND REGULATIONS.
2. ALL WORK SHALL BE COORDINATED WITH THE ARCHITECTURAL, STRUCTURAL, MECHANICAL, ELECTRICAL, LANDSCAPE AND OTHER CONSULTANT DRAWINGS.
3. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, ELEVATIONS, PROPERTY LIMITS, EXISTING CONDITIONS, AND THE LOCATION OF ALL ABOVEGROUND AND UNDERGROUND UTILITIES PRIOR TO COMMENCING CONSTRUCTION.
4. THE LOCATION OF EXISTING UTILITIES SHOWN ON THE DRAWINGS IS APPROXIMATE. THE CONTRACTOR SHALL VERIFY THE LOCATION AND ELEVATION OF ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION, SUPPORT AND REINSTATEMENT OF ALL EXISTING SERVICES DISTURBED BY THE WORK.
5. THE CONTRACTOR SHALL OBTAIN ALL REQUIRED PERMITS, ROAD OCCUPANCY PERMITS, ROAD CUT PERMITS, APPROVALS AND INSPECTIONS REQUIRED TO COMPLETE THE WORK.
6. THE CONTRACTOR SHALL PROVIDE ALL REQUIRED TRAFFIC CONTROL IN ACCORDANCE WITH THE ONTARIO TRAFFIC MANUAL (OTM) AND MUNICIPAL REQUIREMENTS.
7. ALL EXISTING PAVEMENT, CURB, SIDEWALK, BOULEVARD, DRIVEWAY APRONS, UTILITIES AND OTHER FEATURES DISTURBED DURING CONSTRUCTION SHALL BE REINSTATED TO MATCH EXISTING CONDITIONS OR AS DIRECTED BY THE MUNICIPALITY.
8. ALL REMOVALS REQUIRED TO COMPLETE THE WORK SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
9. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
10. ALL ELEVATIONS ARE GEODETIC.
11. THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER OF ANY DISCREPANCIES OR UNFORESEEN SITE CONDITIONS PRIOR TO PROCEEDING WITH THE WORK.
12. UPON COMPLETION OF CONSTRUCTION, THE CONTRACTOR SHALL PROVIDE AN AS-CONSTRUCTED SURVEY PREPARED BY AN ONTARIO LAND SURVEYOR OR A PROFESSIONAL ENGINEER RETAINED BY THE CONTRACTOR SHOWING ALL MUNICIPAL SERVICES, STRUCTURE RIM ELEVATIONS, PIPE INVERTS AND FINISHED SURFACE GRADES.
13. ALL EARTHWORK, EXCAVATION, ENGINEERED FILL, COMPACTION, TRENCH BACKFILL, SUBGRADE PREPARATION AND PAVEMENT CONSTRUCTION SHALL BE COMPLETED IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE GEOTECHNICAL INVESTIGATION REPORT PREPARED BY TORONTO INSPECTION LTD., REPORT NO. 5559-22-GB, DATED NOVEMBER 9, 2022, UNLESS OTHERWISE APPROVED BY THE GEOTECHNICAL ENGINEER.
14. ALL WORK WITHIN THE MUNICIPAL RIGHT-OF-WAY SHALL BE COMPLETED IN ACCORDANCE WITH THE MUNICIPAL APPROVALS, PERMITS, AND THE APPLICABLE MUNICIPAL AND PROVINCIAL STANDARD SPECIFICATIONS.
15. ALL PAVEMENT REMOVALS SHALL BE SAWCUT TO PROVIDE CLEAN, STRAIGHT, FULL-DEPTH EDGES PRIOR TO EXCAVATION. ALL PAVEMENT RESTORATION SHALL BE COMPLETED IN ACCORDANCE WITH THE MUNICIPAL REQUIREMENTS AND TO THE SATISFACTION OF THE MUNICIPALITY.
16. THE CONTRACTOR SHALL RECORD THE HORIZONTAL AND VERTICAL LOCATION OF ALL UNDERGROUND WORKS FOR PREPARATION OF THE RECORD DRAWINGS.

NOTES: EROSION AND SEDIMENT CONTROL

** CONTRACTOR IS RESPONSIBLE FOR ALL INSTALLATION, MONITORING, REPAIR AND REMOVAL OF ALL EROSION AND SEDIMENT CONTROL FEATURES. **

1. PRIOR TO START OF CONSTRUCTION:
   - 1.1. INSTALL EROSION AND SEDIMENT CONTROL MEASURES AT THE LOCATIONS SHOWN ON THE DRAWING (C08) PRIOR TO COMMENCING ANY EARTHWORKS OR VEGETATION REMOVAL.
   - 1.2. INSTALL SEDIMENT CONTROL DEVICES (FILTER FABRIC, SEDIMENT BAGS OR APPROVED EQUIVALENT) WITHIN ALL EXISTING AND PROPOSED CATCH BASINS AND MAINTENANCE HOLES RECEIVING RUNOFF DURING CONSTRUCTION.
   - 1.3. INSPECT ALL EROSION AND SEDIMENT CONTROL MEASURES IMMEDIATELY FOLLOWING INSTALLATION AND REPAIR OR REPLACE ANY DEFICIENT MEASURES PRIOR TO COMMENCING CONSTRUCTION.
   - 1.4. DELINEATE ALL LIMITS OF DISTURBANCE PRIOR TO COMMENCING SITE WORKS.
2. DURING CONSTRUCTION:
   - 2.1. MINIMIZE THE EXTENT AND DURATION OF DISTURBED AREAS AT ALL TIMES.
   - 2.2. PRESERVE EXISTING VEGETATION OUTSIDE THE APPROVED LIMITS OF DISTURBANCE WHEREVER POSSIBLE.
   - 2.3. INSTALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES AS CONSTRUCTION PROGRESSES AND MODIFY THEM AS REQUIRED TO SUIT CHANGING SITE CONDITIONS.
   - 2.4. PROVIDE TEMPORARY STABILIZATION (SEED, MULCH, EROSION CONTROL BLANKET OR OTHER APPROVED MEASURES) ON DISTURBED AREAS THAT WILL REMAIN INACTIVE FOR MORE THAN 30 DAYS.
   - 2.5. INSPECT ALL EROSION AND SEDIMENT CONTROL MEASURES AT LEAST ONCE EVERY SEVEN (7) DAYS AND WITHIN 24 HOURS FOLLOWING EVERY RAINFALL EVENT CAPABLE OF PRODUCING RUNOFF. REPAIR OR REPLACE DAMAGED MEASURES IMMEDIATELY AND REMOVE ACCUMULATED SEDIMENT WHEN REQUIRED.
   - 2.6. MAINTAIN SEDIMENT CONTROL DEVICES WITHIN CATCH BASINS AND MAINTENANCE HOLES THROUGHOUT CONSTRUCTION AND REPLACE AS NECESSARY.
   - 2.7. INSTALL EROSION CONTROL FENCING AROUND ALL SOIL STOCKPILES WHERE SEDIMENT MIGRATION MAY OCCUR.
   - 2.8. LOCATE STOCKPILES AWAY FROM DRAINAGE COURSES, CATCH BASINS, MUNICIPAL ROADS AND SIDEWALKS. STABILIZE STOCKPILES THAT REMAIN IN PLACE FOR MORE THAN 30 DAYS USING TEMPORARY SEEDING, MULCH OR OTHER APPROVED METHODS.
   - 2.9. CONTROL DUST GENERATED BY CONSTRUCTION ACTIVITIES USING WATER OR OTHER APPROVED DUST SUPPRESSION METHODS AS NECESSARY.
   - 2.10. KEEP ALL MUNICIPAL ROADS, SIDEWALKS AND ADJACENT PROPERTIES FREE OF MUD, SEDIMENT AND CONSTRUCTION DEBRIS RESULTING FROM CONSTRUCTION ACTIVITIES.
   - 2.11. REMOVE MUD, SEDIMENT AND OTHER MATERIALS TRACKED ONTO PUBLIC ROADS IMMEDIATELY USING MECHANICAL SWEEPING OR OTHER APPROVED METHODS. SEDIMENT SHALL NOT BE WASHED INTO CATCH BASINS OR STORM SEWERS.
   - 2.12. IMPLEMENT STABILIZED CONSTRUCTION ACCESS OR OTHER SUITABLE MEASURES AS NECESSARY TO MINIMIZE TRACKING OF SEDIMENT ONTO ADJACENT ROADS.
   - 2.13. CONSTRUCTION MATERIALS, WASTE AND DEBRIS SHALL BE STORED AND MANAGED TO PREVENT MIGRATION FROM THE SITE.
   - 2.14. MODIFY EROSION AND SEDIMENT CONTROL MEASURES AS REQUIRED THROUGHOUT CONSTRUCTION TO MAINTAIN THEIR EFFECTIVENESS.
   - 2.15. ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL REMAIN IN PLACE UNTIL ALL DISTURBED AREAS HAVE BEEN PERMANENTLY STABILIZED WITH PAVEMENT, TOPSOIL AND SEED, SOD, LANDSCAPING OR OTHER APPROVED SURFACE TREATMENT.
   - 2.16. THE CONTRACTOR SHALL IMPLEMENT BEST MANAGEMENT PRACTICES THROUGHOUT CONSTRUCTION TO PREVENT SEDIMENT-LADEN RUNOFF FROM ENTERING MUNICIPAL INFRASTRUCTURE, WATERCOURSES OR ADJACENT PROPERTIES AND SHALL COMPLY WITH ALL APPLICABLE ENVIRONMENTAL LEGISLATION AND PERMIT REQUIREMENTS.

SEWER NOTES

1. CONSTRUCT ALL STORM AND SANITARY SEWERS AND APPURTENANCES IN ACCORDANCE WITH THE LATEST APPLICABLE OPSS.MUNI SPECIFICATIONS, OPSD STANDARD DRAWINGS, MUNICIPAL STANDARDS, AND CONTRACT DRAWINGS. CONTRACTOR SHALL VERIFY EXISTING SEWER AND UTILITY LOCATIONS, ELEVATIONS, AND TIE-IN CONDITIONS PRIOR TO CONSTRUCTION. ANY DISCREPANCIES SHALL BE REPORTED TO THE ENGINEER PRIOR TO PROCEEDING WITH THE WORK.
2. SEWER TRENCHES AND PIPE INSTALLATION SHALL CONFORM TO THE REQUIREMENTS OF OPSD 802.010 FOR FLEXIBLE PIPE INSTALLATIONS AND OPSD 802.030 DRAWINGS FOR RIGID PIPE INSTALLATIONS. BEDDING, HAUNCHING, AND BACKFILL SHALL BE COMPLETED IN ACCORDANCE WITH THE APPLICABLE OPSD REQUIREMENTS AND GEOTECHNICAL RECOMMENDATIONS.
3. GRANULAR BEDDING AND COVER MATERIALS SHALL CONFORM TO OPSS.MUNI 1010 GRANULAR A UNLESS OTHERWISE SPECIFIED. BEDDING AND COVER MATERIAL SHALL BE PLACED AND COMPACTED IN ACCORDANCE WITH OPSS REQUIREMENTS. GRANULAR MATERIALS SHALL BE PLACED IN MAXIMUM 300 MM LOOSE LIFTS AND COMPACTED TO A MINIMUM 95% STANDARD PROCTOR MAXIMUM DRY DENSITY (SPMDD) UNLESS OTHERWISE SPECIFIED BY THE GEOTECHNICAL CONSULTANT.
4. PVC STORM SEWER PIPES AND CATCH BASIN LEADS SHALL BE PVC DR 35 CONFORMING TO CSA B182.2 AND OPSS.MUNI 1841.
5. CONCRETE STORM AND SANITARY SEWER PIPES SHALL CONFORM TO THE REQUIREMENTS OF CSA A257.2/A257.3 AND OPSS.MUNI 1350, UNLESS OTHERWISE SPECIFIED ON THE CONTRACT DRAWINGS. CONCRETE PIPE JOINTS SHALL BE WATERTIGHT AND INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS AND APPLICABLE OPSD STANDARDS.
6. PROVIDE WATERTIGHT FLEXIBLE BOOT CONNECTIONS FOR ALL PVC AND CONCRETE SEWER CONNECTIONS TO MAINTENANCE HOLES AND STRUCTURES.
7. STORM CATCH BASINS SHALL BE CONSTRUCTED IN ACCORDANCE WITH OPSD 705.010 WITH FRAMES AND GRATES CONFORMING TO OPSD 400.010, UNLESS OTHERWISE NOTED. CATCH BASINS SHALL HAVE A MINIMUM 600 MM SUMP BELOW OUTLET INVERT.
8. ALL SEWER PIPES AND STRUCTURES SHALL MAINTAIN A MINIMUM HORIZONTAL CLEARANCE OF 2.0 M FROM EXISTING AND PROPOSED TREES, UTILITIES, AND UTILITY STRUCTURES, UNLESS OTHERWISE APPROVED BY THE ENGINEER.
9. ALL MAINTENANCE HOLES SHALL BE 1200 MM DIAMETER IN ACCORDANCE WITH OPSD 701.010, UNLESS OTHERWISE NOTED.
10. STORM MAINTENANCE HOLES SHALL HAVE A MINIMUM 300 MM SUMP BELOW THE LOWEST INVERT UNLESS OTHERWISE SPECIFIED.
11. SANITARY MAINTENANCE HOLES SHALL BE BENCHED IN ACCORDANCE WITH OPSD 701.021.
12. STORM MAINTENANCE HOLE FRAMES AND COVERS SHALL CONFORM TO OPSD 401.010 TYPE A. SANITARY MAINTENANCE HOLE FRAMES AND COVERS SHALL CONFORM TO OPSD 401.010 TYPE A, UNLESS OTHERWISE SPECIFIED.
13. UPON COMPLETION OF SEWER INSTALLATION, THE CONTRACTOR SHALL COMPLETE CCTV INSPECTION OF ALL NEWLY CONSTRUCTED SEWERS AND PROVIDE INSPECTION VIDEOS AND REPORTS TO THE ENGINEER. SEWERS SHALL BE MAINTAINED IN A CLEAN CONDITION UNTIL OWNER ACCEPTANCE.
14. COORDINATE WITH THE MECHANICAL CONTRACTOR TO COMPLETE DYE TESTING OF BUILDING STORM AND SANITARY SERVICE CONNECTIONS. DYE TESTING SHALL BE COMPLETED AND CERTIFIED BY A PROFESSIONAL ENGINEER RETAINED BY THE CONTRACTOR TO CONFIRM THAT NO CROSS-CONNECTIONS EXIST.
15. ALL PROPOSED SERVICES AND ASSOCIATED SEWER STRUCTURES LOCATED WITHIN THE MUNICIPAL RIGHT-OF-WAY SHALL BECOME MUNICIPAL INFRASTRUCTURE UPON COMPLETION AND ACCEPTANCE BY THE MUNICIPALITY.

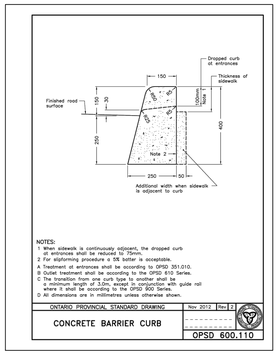
WATERMAIN NOTES:

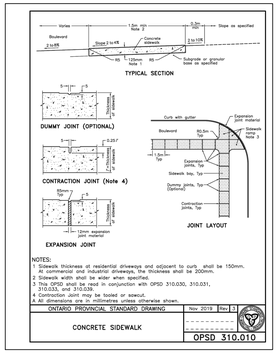
1. PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL VERIFY THE LOCATION, ELEVATION, SIZE, AND MATERIAL OF THE EXISTING WATERMAIN WITHIN OTTAWA STREET. THE CONTRACTOR SHALL SUBMIT A DETAILED WATERMAIN CONNECTION PLAN TO THE ENGINEER AND MUNICIPALITY FOR REVIEW AND APPROVAL PRIOR TO ORDERING FITTINGS. THE SUBMISSION SHALL INCLUDE PROPOSED FITTINGS, RESTRAINTS, SHUTDOWN REQUIREMENTS, SEQUENCING, AND DISINFECTION PROCEDURES.
2. WATERMAIN INSTALLATION, TESTING, COMMISSIONING, AND DISINFECTION SHALL CONFORM TO THE LATEST REQUIREMENTS OF OPSS.MUNI 441, OPSS.MUNI 442, AWWA C651, AWWA C900, AND MUNICIPAL STANDARDS.
3. CONTRACTOR SHALL COORDINATE ALL WATERMAIN SHUTDOWNS AND SERVICE INTERRUPTIONS WITH THE MUNICIPALITY AND AFFECTED PROPERTY OWNERS. WRITTEN NOTIFICATION SHALL BE PROVIDED A MINIMUM OF TWO WEEKS PRIOR TO ANY PLANNED DISRUPTION. NO WORK AFFECTING MUNICIPAL WATER SERVICES SHALL PROCEED WITHOUT WRITTEN APPROVAL FROM THE MUNICIPALITY.
4. TEMPORARY POTABLE WATER SERVICES, WHERE REQUIRED, SHALL BE PROVIDED IN ACCORDANCE WITH OPSS.MUNI 493 AND MUNICIPAL REQUIREMENTS.
   WATERMAIN, VALVES, HYDRANTS, AND APPURTENANCES SHALL BE INSTALLED IN ACCORDANCE WITH OPSS.MUNI 441 AND APPLICABLE MUNICIPAL STANDARDS.
5. WATERMAIN SHALL MAINTAIN A MINIMUM COVER OF 2.40 M UNLESS OTHERWISE APPROVED BY THE MUNICIPALITY OR ENGINEER.
6. PVC WATERMAIN PIPE SHALL BE CSA CERTIFIED AWWA C900 DR18 PVC PRESSURE PIPE UNLESS OTHERWISE SPECIFIED.
7. GATE VALVES SHALL CONFORM TO AWWA C509 AND MUNICIPAL STANDARDS.
8. VALVE BOXES SHALL BE APPROVED MUNICIPAL SLIDE-TYPE VALVE BOXES COMPLETE WITH CAST IRON COVERS.
9. CORROSION PROTECTION SHALL BE PROVIDED IN ACCORDANCE WITH OPSD 1109.011 AND OPSS.MUNI 442 WHERE APPLICABLE.
10. CONTINUOUS TRACER WIRE SHALL BE INSTALLED ALONG ALL NON-METALLIC WATERMAINS. TRACER WIRE SHALL BE CONTINUOUS, SECURELY FASTENED TO THE PIPE, AND TERMINATED AT VALVE BOXES IN ACCORDANCE WITH MUNICIPAL STANDARDS.
11. CONNECTION TO THE EXISTING 250 MM WATERMAIN WITHIN OTTAWA STREET SHALL BE COORDINATED WITH THE ENGINEER AND MUNICIPALITY. CONTRACTOR SHALL SUPPLY ALL REQUIRED FITTINGS, MATERIALS, EQUIPMENT, AND LABOUR REQUIRED TO COMPLETE THE CONNECTION. MUNICIPAL VALVES SHALL ONLY BE OPERATED BY AUTHORIZED MUNICIPAL PERSONNEL.
12. WATERMAIN PRESSURE TESTING, LEAKAGE TESTING, FLUSHING, CHLORINATION, AND BACTERIOLOGICAL TESTING SHALL BE COMPLETED IN ACCORDANCE WITH OPSS.MUNI 441, AWWA C651, AND MUNICIPAL STANDARDS PRIOR TO PLACING THE SYSTEM INTO SERVICE.
13. CONTRACTOR SHALL BACKFILL WATERMAIN TRENCHES USING APPROVED MATERIAL. BACKFILL SHALL BE PLACED IN MAXIMUM 300 MM LIFTS AND COMPACTED IN ACCORDANCE WITH OPSS.MUNI 501 AND GEOTECHNICAL REQUIREMENTS.
14. MAINTAIN MINIMUM VERTICAL CLEARANCES BETWEEN WATERMAIN, SANITARY SEWER, STORM SEWER, AND OTHER UTILITIES IN ACCORDANCE WITH THE LATEST MECP DESIGN GUIDELINES FOR DRINKING-WATER SYSTEMS, MUNICIPAL STANDARDS, AND OPSD REQUIREMENTS.
15. WHERE A WATERMAIN CROSSES OVER OR UNDER A SANITARY OR STORM SEWER, PROVIDE MINIMUM 0.5 M VERTICAL SEPARATION BETWEEN OUTSIDE EDGES OF PIPES UNLESS OTHERWISE APPROVED BY THE ENGINEER AND MUNICIPALITY.
16. WHERE MINIMUM SEPARATION CANNOT BE ACHIEVED, PROVIDE ADDITIONAL PROTECTION MEASURES INCLUDING CONCRETE ENCASEMENT OR APPROVED PIPE MATERIAL UPGRADES AS DIRECTED BY THE ENGINEER AND MUNICIPALITY.

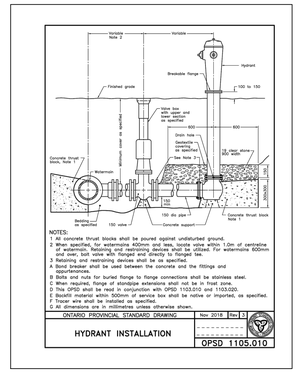
EXISTING	LEGEND-PLAN	PROPOSED
150 WM	WATER MAIN	150 WM
300 STM	STORM SEWER	300 STM
250 SAN	SANITARY SEWER	250 SAN
G	GAS	
PO	POWER OVERHEAD HYDRO	
	CURB	
	EDGE OF PAVEMENT	
	CULVERT	
	PROPERTY LINE	
	WOODEN FENCE	
×59.367	GROUND ELEVATION	
×00.00	PROPOSED ELEVATION	×00.00
×00.00	PROPOSED ELEVATION	×00.00
×00.00	PROPOSED ELEVATION	×00.00
	FLOW DIRECTION	2.0%
	SWALE FLOW DIRECTION	
	OVERLAND DRAINAGE ARROW	
HP	HYDRO POLE	
	PLUG	
	VALVE	
	HYDRANT	
	MANHOLE	
	CATCHMENT BOUNDARY	
	TOPSOIL AND SOD	
	RIP RAP	
	HEAVY DUTY ASPHALT	
	LIGHT DUTY ASPHALT	
	ASPHALT REMOVAL	
	GRAVEL REMOVAL	
	CONCRETE REMOVAL	
	SIDEWALK REMOVAL	
	EX STORM REMOVAL	
	EX SANITARY REMOVAL	
	EX WATER REMOVAL	
	EX GAS REMOVAL	
	BUILDING REMOVAL	
	REMOVAL (GENERAL)	
	DRAINAGE AREA	A-5 0.82 0.83

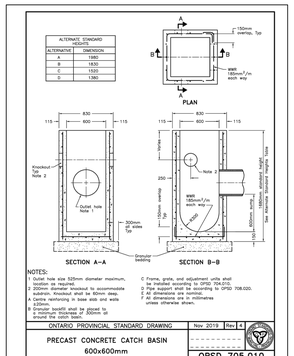
RECOMMENDED MINIMUM PAVEMENT STRUCTURE

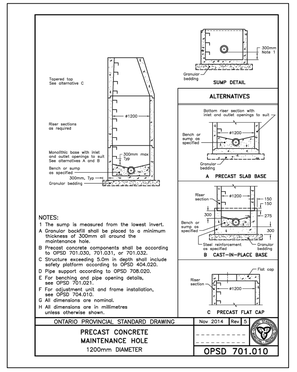
PAVEMENT STRUCTURE		HEAVY DUTY MATERIALS FIRE ROUTES	LIGHT DUTY PARKING
ASPHALTIC CONCRETE	OPSS HL3 OR EQUIVALENT	40mm	65mm
	OPSS HL8 OR EQUIVALENT	60mm	
BASE	OPSS GRANULAR A OR 20mm CRUSHER-RUN	150mm	150mm
SUB-BASE	OPSS GRANULAR B OR 50mm CRUSHER-RUN	300mm	200mm

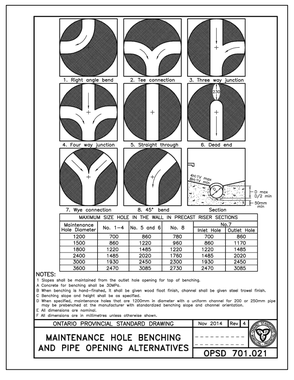


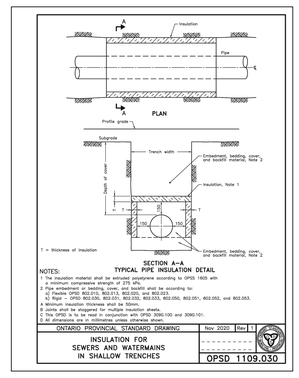


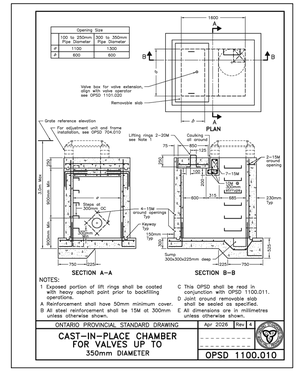


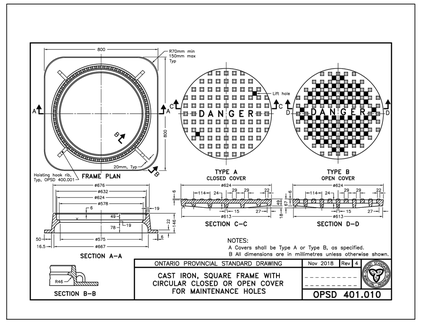


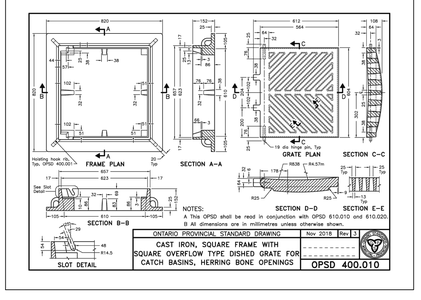


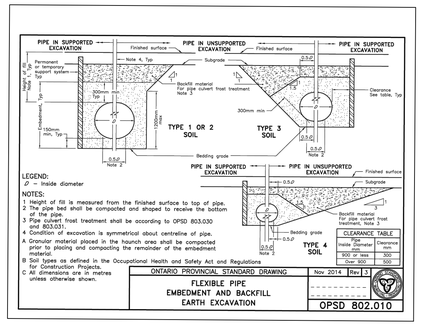


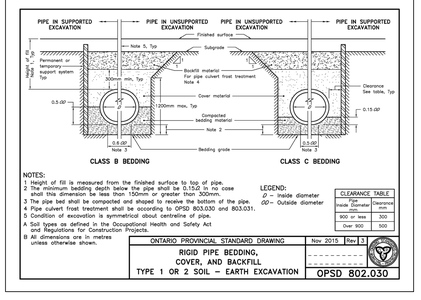












METRIC
WHOLE NUMBERS INDICATE MILLIMETRES
DECIMALIZED NUMBERS INDICATE METRES

N

KEY PLAN

REVISION:

REV	DATE	DESCRIPTION	BY
0	2026/07/27	ISSUED FOR SITE PLAN APPROVAL	I.J.

SEAL:

DISCLAIMER: COPYRIGHT:
THIS DRAWING AND DESIGN IS COPYRIGHT PROTECTED WHICH SHALL NOT BE USED, REPRODUCED OR REVISED WITHOUT WRITTEN PERMISSION BY WSP. THE CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND UTILITY LOCATIONS AND REPORT ALL ERRORS AND OMISSIONS PRIOR TO COMMENCING WORK.

ORIGINAL SCALE: NOT TO SCALE
DATE: 2026-07-27
DESIGNED BY: D.M.
ASSISTED BY: --
DRAWN BY: D.M.
MODIFIED BY: I.J.
APPROVED BY: --
DISCIPLINE: CIVIL

IF THIS BAR IS NOT 25mm LONG, ADJUST YOUR PLOTTING SCALE. 25mm

WSP Canada Inc.
2611 Queensview Drive, Suite 300 Ottawa, Ontario K2B 8K2
T 613-829-28-00| www.wsp.com

PROJECT NUMBER: 221-06853-00

CLIENT:
ELM DEVELOPMENTS

CLIENT REF. #: --

PROJECT:
430 OTTAWA STREET
ALMONTE, ONTARIO

TITLE:
PHASE 2
NOTES & DETAILS

DRAWING NUMBER: C01
REV: 0

CTB: microchrome.ctb
PLOTTED: 2026-07-27 - 12:29 PM
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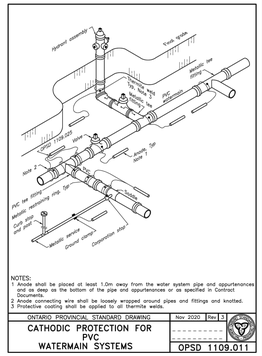
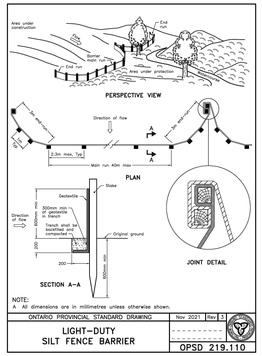


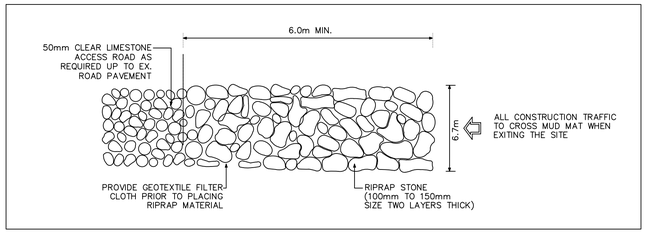
NOTES:
1 Anode shall be placed at least 1.0m away from the water system pipe and appurtenances and as deep as the bottom of the pipe and appurtenances or as specified in Contract Documents.
2 Tee for connecting wire shall be loosely wrapped around pipes and fittings and knotted.
3 Protective coating shall be applied to all thermite welds.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2020	Rev 3
CATHODIC PROTECTION FOR PVC WATERMAIN SYSTEMS		OPSD 1109.011

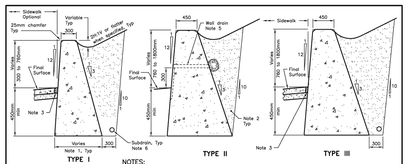


NOTE:
A All dimensions are in millimetres unless otherwise shown.

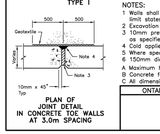
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2021	Rev 3
LIGHT–DUTY SILT FENCE BARRIER		OPSD 219.110



MUD MAT DETAIL - PLAN VIEW
(NTS)



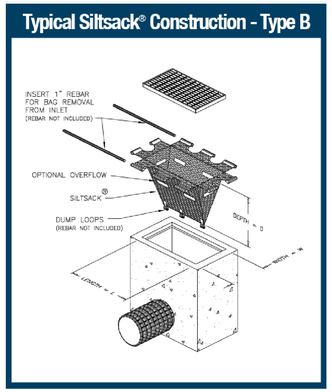
NOTES:
1 Walls shall be founded on undisturbed soil having a minimum bearing capacity at ultimate limit states of 200kPa for Type I and 300kPa for Type II and Type III.
2 Backfill for toe walls shall be backfilled with free draining granular material.
3 Provide preformed joint filler, Type A, non–extruding and resilient bituminous type conforming to
4 Cold applied rubber asphalt joint sealing compound.
5 Where specified, wall drains shall be installed as per OPSD 3190.100.
6 150mm dia perforated pipe subdrain wrapped in geotextile.
A Maximum height of slope above top of wall is 4m.
B Concrete for toe walls shall be 30MPa.
C All dimensions are in millimetres unless otherwise shown.



PLAN OF JOINT DETAIL IN CONCRETE TOE WALLS AT 3.0m SPACING

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2010	Rev 2
WALLS RETAINING CONCRETE TOE WALL		OPSD 3120.100

Typical Siltsack® Construction - Type B



SANITARY MAINTENANCE HOLE DATA

NO.	COVER	STRUCTURE	T/GRATE	INVERTS	NORTHING	EASTING
SANMH 01	OPSD 401.010 A	1200mm Diameter	140.73	137.98 NW 137.96 SE	5009811.70	407115.23

STORM MAINTENANCE HOLE DATA

NO.	COVER	STRUCTURE	T/GRATE	INVERTS	NORTHING	EASTING
CB 01	OPSD 400.010	OPSD 705.010 600X600mm	141.45	140.05 SE	5009894.00	407083.6373
CB 02	OPSD 400.010	OPSD 705.010 600X600mm	141.47	140.07 SE	5009874.01	407062.5135
CB 03	OPSD 400.010	OPSD 705.010 600X600mm	141.43	140.03 SE	5009850.24	407037.3211
CB 04	OPSD 400.010	OPSD 705.010 600X600mm	141.11	139.33 E	5009820.47	407010.8884
CB 05	OPSD 400.010	OPSD 705.010 600X600mm	140.53	139.13 NE	5009783.68	407046.9993
CB 06	OPSD 400.010	OPSD 705.010 600X600mm	140.62	139.22 NW	5009788.52	407081.1578
CB 12	OPSD 400.010	OPSD 705.010 600X600mm	140.15	139.15 SW	5009823.64	407116.0619
CB 13	OPSD 400.010	OPSD 705.010 600X600mm	141.36	139.96 SW	5009861.54	407195.9257
CB 14	OPSD 400.010	OPSD 705.010 600X600mm	141.50	140.10 SW	5009879.99	407178.4503
CB 15	OPSD 400.010	OPSD 705.010 600X600mm	141.50	140.10 SW	5009899.54	407159.9635
CB 16	OPSD 400.010	OPSD 705.010 600X600mm	141.42	139.64 SE	5009930.14	407125.3081
EX STMMH 02	OPSD 401.010 TYPE A	OPSD 701.010 1500mm Dia.	140.65	138.38 NW 138.94 NE 138.30 SE	5009798.18	407118.5044
EX STMMH 03	OPSD 401.010 TYPE A	OPSD 701.010 1500mm Dia.	140.38	138.20 NW 138.28 SW 138.05 SE	5009768.42	407138.3181
FOUNDATION DRAIN				138.81 SE	5009837.55	407097.9680
ROOF DRAIN				139.02 SE	5009835.44	407095.7580
STMMH 01A	OPSD 401.010 TYPE A	OPSD 701.010 1200mm Dia.	141.76	139.84 NW 139.55 SW	5009886.21	407090.9982
STMMH 01B	OPSD 401.010 TYPE A	OPSD 701.010 1200mm Dia.	141.48	139.06 NE 139.24 W 139.06 SE	5009819.48	407020.4383
STMMH 01C	OPSD 401.010 TYPE A	OPSD 701.010 1200mm Dia.	140.77	138.80 NW 138.73 NE	5009782.28	407055.6045
STMMH 01D	OPSD 401.010 TYPE A	OPSD 701.010 1500mm Dia.	141.37	138.55 SW 138.70 NW 138.47 SE	5009821.22	407103.0037
STMMH 05	OPSD 401.010 TYPE A	OPSD 701.010 1200mm Dia.	141.28	139.23 NW	5009823.42	407215.8026

STORM MAINTENANCE HOLE DATA

NO.	COVER	STRUCTURE	T/GRATE	INVERTS	NORTHING	EASTING
STMMH 06	OPSD 401.010 TYPE A	OPSD 701.010 1500mm Dia.	141.58	139.15 NW 139.15 SE 139.80 NE 139.08 SW	5009855.04	407191.4266
STMMH 07	OPSD 401.010 TYPE A	OPSD 701.010 1200mm Dia.	141.66	139.51 NW 139.28 SE	5009918.29	407131.6090
STMMH 08	OPSD 401.010 TYPE A	OPSD 701.010 1200mm Dia.	138.91	138.53 NW 138.52 SE	5009814.54	407115.2841
STMMH 09	OPSD 401.010 TYPE A	OPSD 701.010 1200mm Dia.	140.31	138.32 NW 138.29 SW	5009760.43	407151.6705

WATERMAIN TABLE

CHAINAGE	COVER	DESCRIPTION	FINISHED GRADE	T/WM
0+000.00	2.4m	CONNECTION TO PHASE 1 WM	140.60	138.20
0+005.47	2.4m	TEE CONNECT TO PROPOSED 200Ø WM	140.59	138.19
0+019.02	2.4m	TEE CONNECT TO BUILDING SERVICE	141.02	138.62
0+020.52	2.4m	TEE CONNECT TO BUILDING SERVICE	141.07	138.67
0+022.50	2.4m	VALVE AND VALVE BOX	141.15	138.75

WATERMAIN TABLE

CHAINAGE	COVER	DESCRIPTION	FINISHED GRADE	T/WM
0+005.47	2.4m	CONNECTION TO PROPOSED 200mmØ WM	140.59	138.19
0+007.47	2.4m	VALVE AND VALE BOX	140.58	138.18
0+015.23	3.0m	CROSSING 525mmØ STORM	140.71	137.64
0+020.05	3.0m	CROSSING 200mmØ SAN	140.71	137.64
0+021.68	3.0m	CROSSING 300mmØ STORM	140.71	137.64
0+050.00	2.4m		140.64	138.24
0+094.32	2.4m	45° HORIZONTAL BEND	140.65	138.25
0+105.59	2.4m	TEE CONNECT TO PROPOSED HYD LEAD	141.15	138.75
0+110.69	2.4m	45° HORIZONTAL BEND	141.65	139.25
0+126.29	2.4m	VALVE AND VALVE BOX	141.38	138.98
0+149.71	2.4m	CROSSING EX 200mmØ SAN	140.37	137.97
0+150.00	2.4m		140.37	137.97
0+163.17	2.4m	CROSSING EX 750mmØ STM	140.50	138.10
0+178.49	2.4m	VALVE AND VALVE BOX	140.60	138.20
0+181.5	2.4m	CONNECT TO EXISTING 250mmØ WM	140.60	138.20

METRIC
WHOLE NUMBERS INDICATE MILLIMETRES
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T 613-829-28-00| www.wsp.com

PROJECT NUMBER: 221-06853-00

CLIENT:
ELM DEVELOPMENTS
CLIENT REF. #: --

PROJECT:
430 OTTAWA STREET
ALMONTE, ONTARIO

TITLE:
PHASE 2
NOTES & DETAILS
2/2

DRAWING NUMBER: C02
REV: 0

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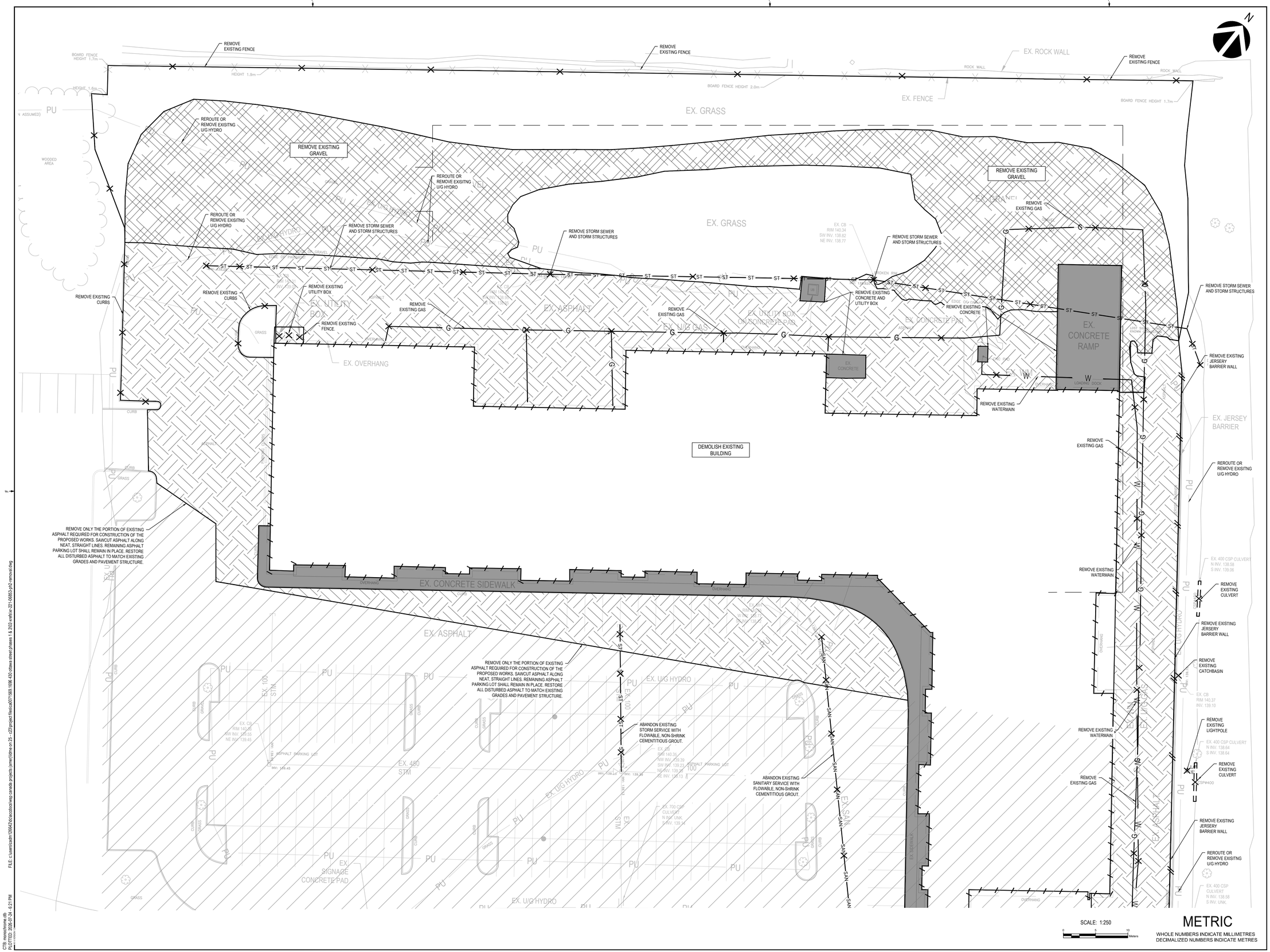

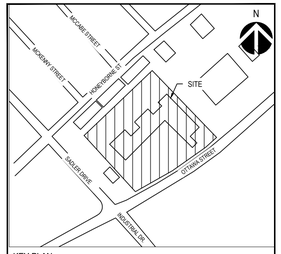

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CLIENT REF. #: --

PROJECT:

430 OTTAWA STREET
ALMONTE, ONTARIO

TITLE:

PHASE 2
REMOVALS PLAN
1/2

DRAWING NUMBER: C03
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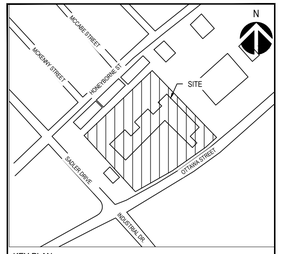

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PROJECT:

430 OTTAWA STREET
ALMONTE, ONTARIO

TITLE:

PHASE 2
REMOVALS PLAN
2/2

DRAWING NUMBER: C04
REV. 0

SCALE: 1:250

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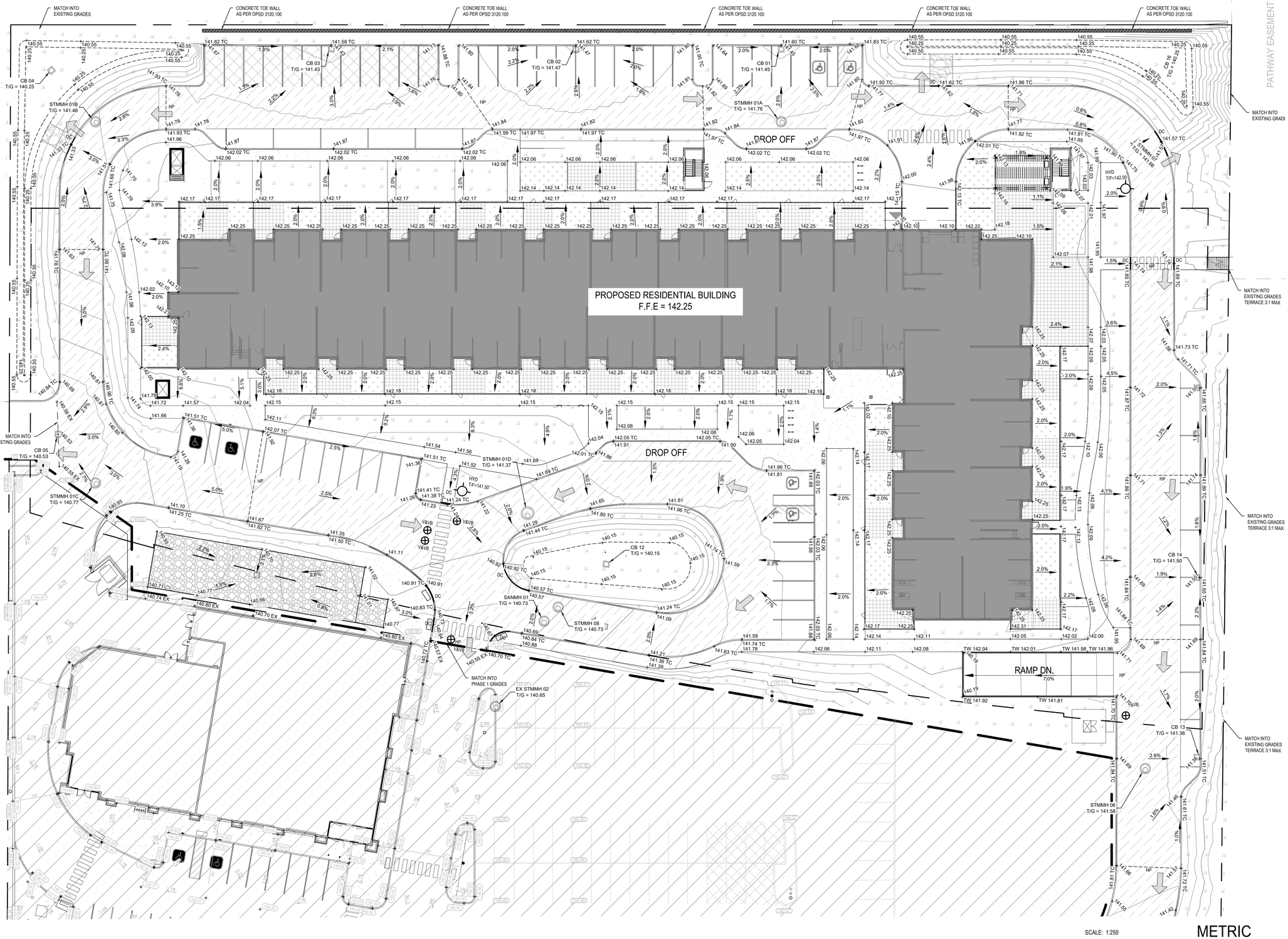

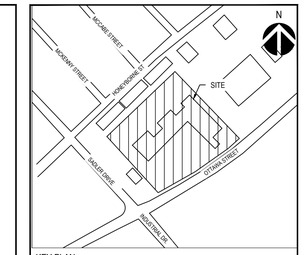

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ALMONTE, ONTARIO

TITLE:

PHASE 2
GRADING PLAN
1/2

DRAWING NUMBER: C05
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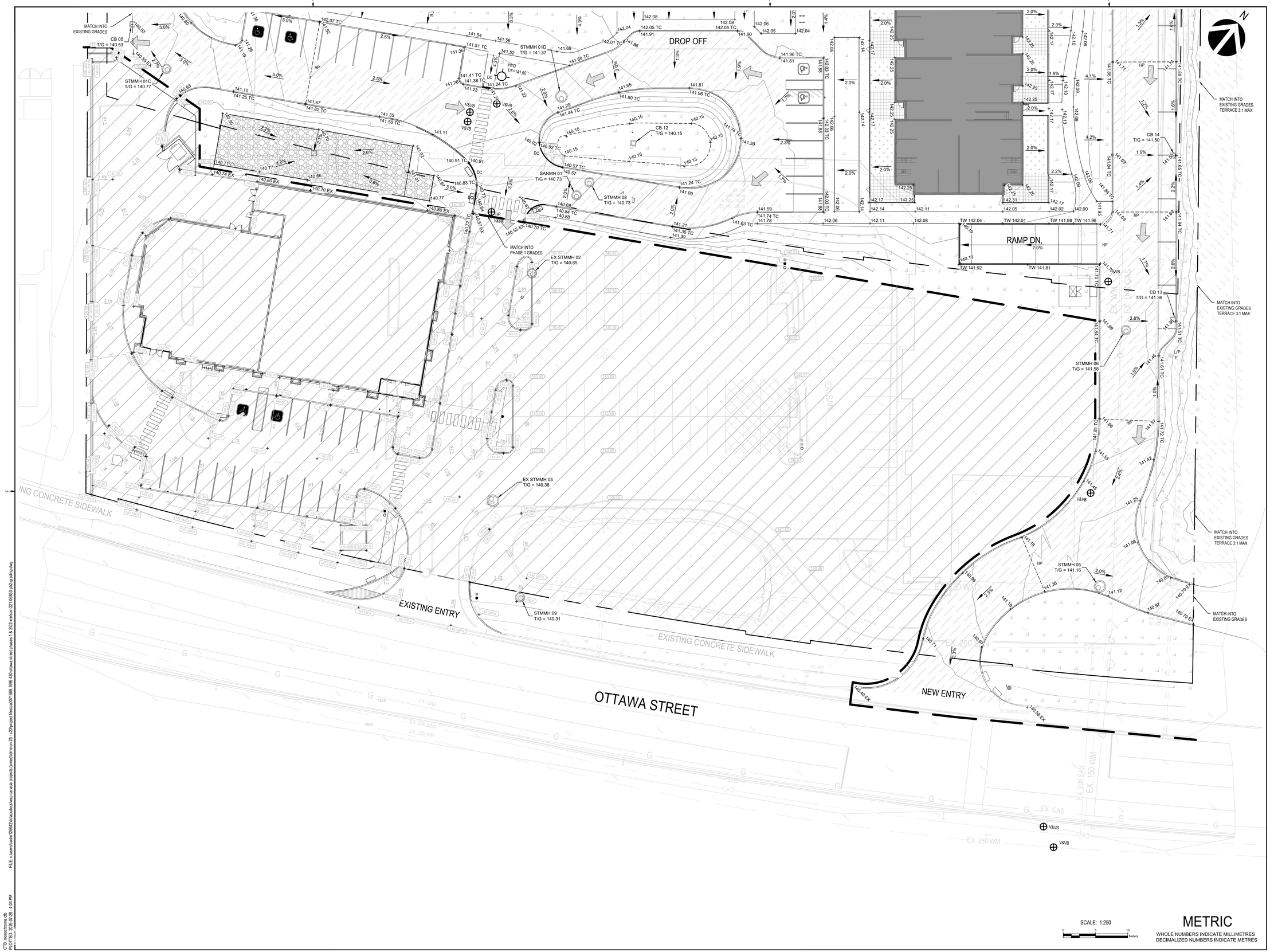

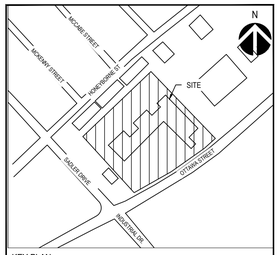

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CLIENT REF. #: --

PROJECT:

430 OTTAWA STREET
ALMONTE, ONTARIO

TITLE:

PHASE 2
GRADING PLAN
2/2

DRAWING NUMBER: C06
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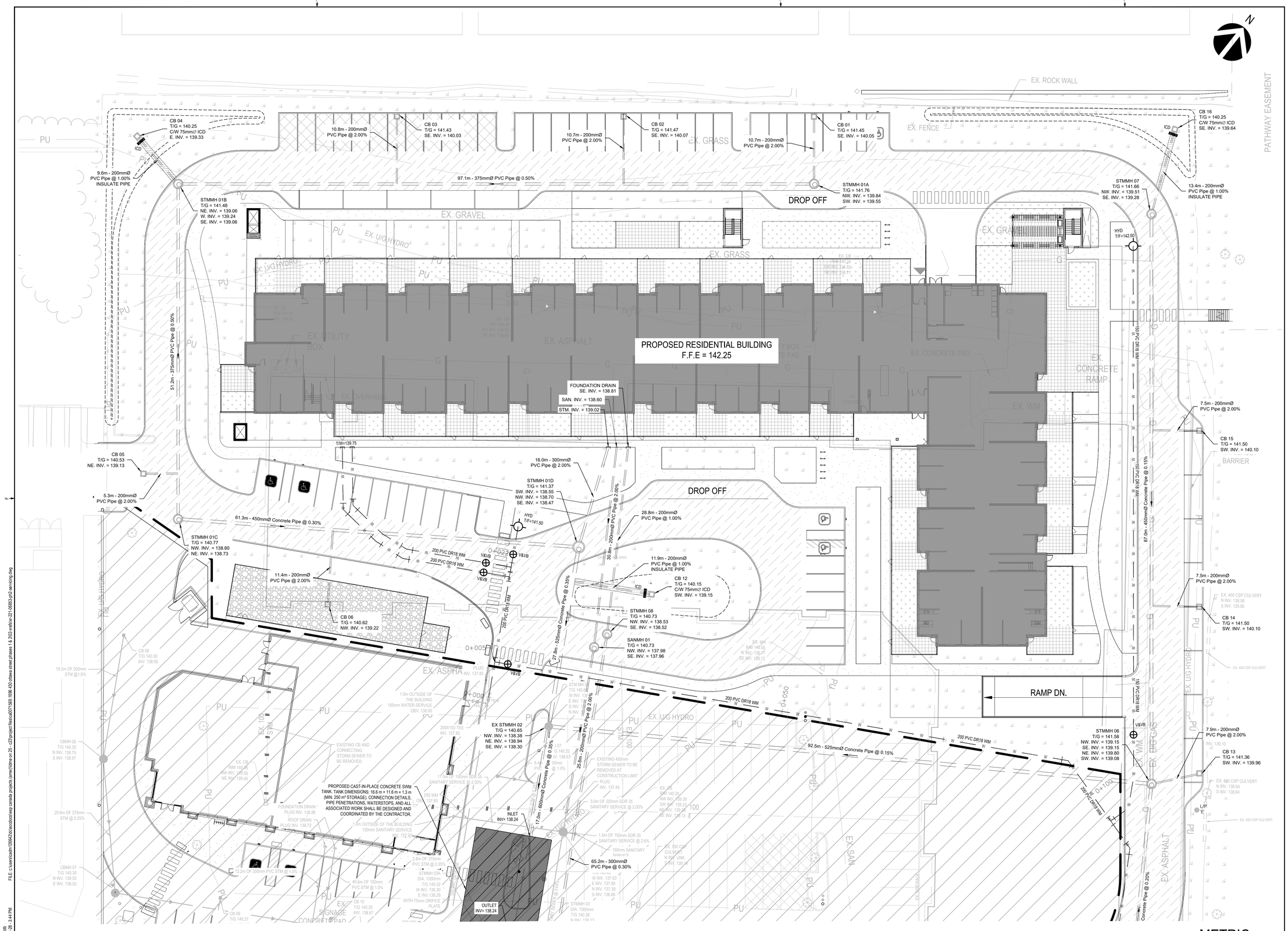

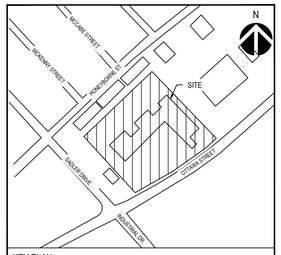

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CLIENT REF. #: --

PROJECT:

430 OTTAWA STREET
ALMONTE, ONTARIO

TITLE:

PHASE 2
SERVICING PLAN
1/2

DRAWING NUMBER: C07
REV: 0

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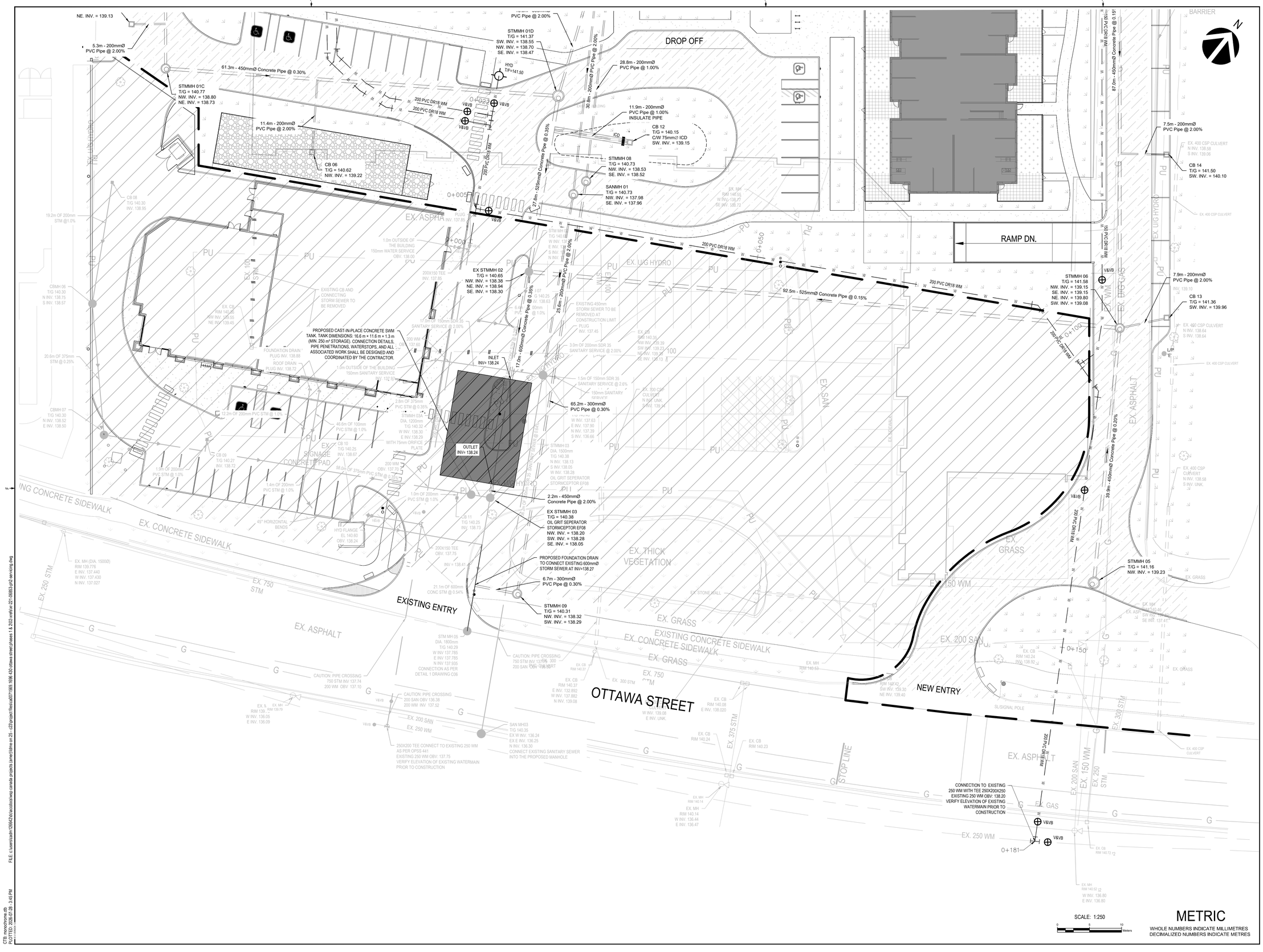

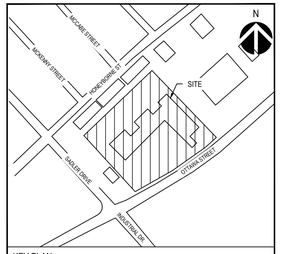

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PROJECT:
430 OTTAWA STREET
ALMONTE, ONTARIO

TITLE:
PHASE 2
SERVICING PLAN
2/2

DRAWING NUMBER: C08
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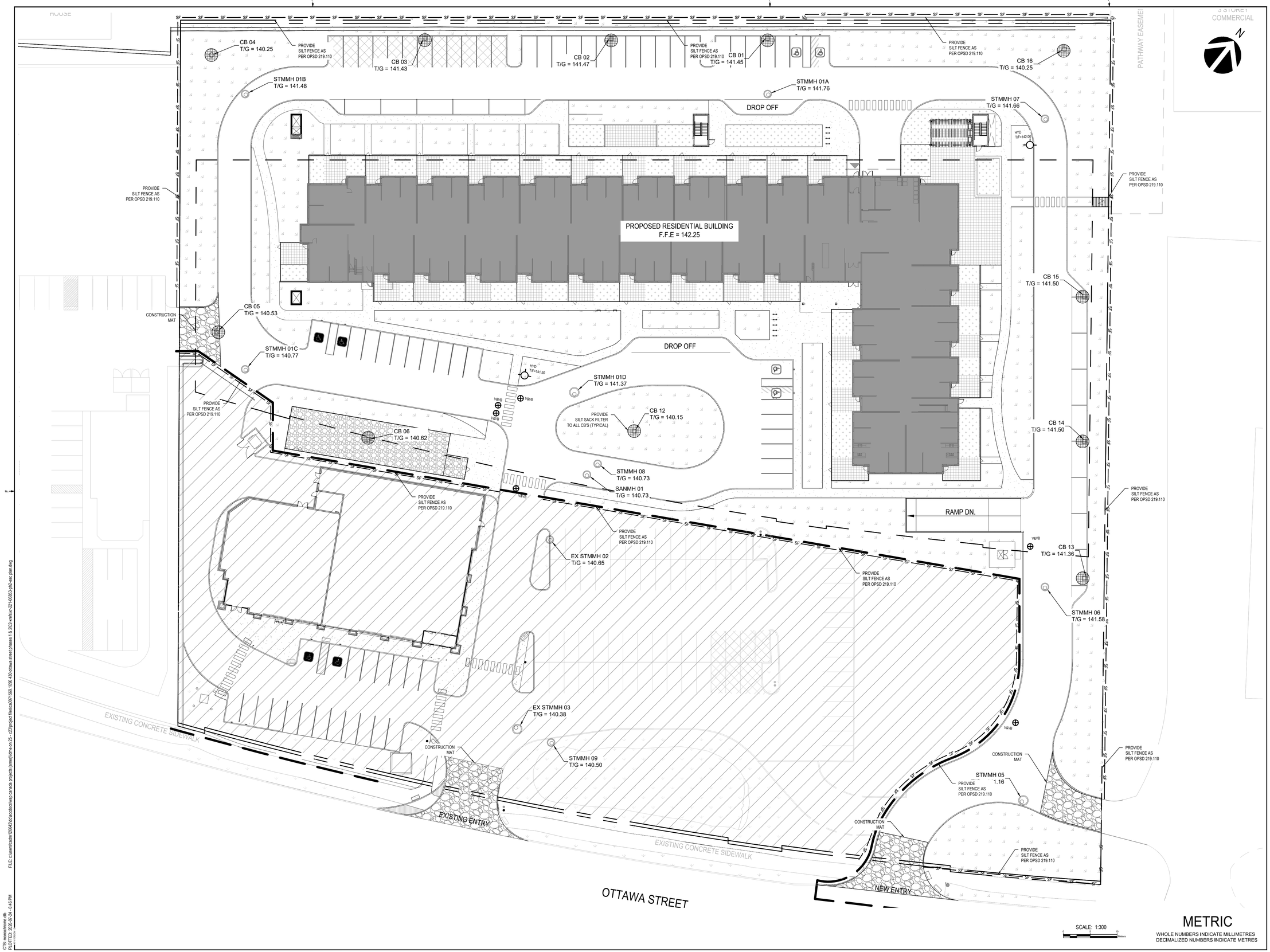

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PROJECT NUMBER: 221-06853-00

CLIENT:

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CLIENT REF. #: --

PROJECT:

430 OTTAWA STREET
ALMONTE, ONTARIO

TITLE:

PHASE 2
ESC PLAN

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APPENDIX

C

WATER DISTRIBUTION SYSTEM

TECHNICAL MEMORANDUM

TO: Shan Goel, Elm Development Corp

FROM: Zhidong Pan, M.Eng., P.Eng.

SUBJECT: **430 Ottawa Street Site Plan Control Approval**

DATE: **March 06, 2023**

WSP Canada Inc. (WSP) was retained by Elm Development Corp to complete an engineering servicing design for a development site at 430 Ottawa Street in the Town of Almonte, Municipality of Mississippi Mills, Ontario.

The purpose of this technical memorandum is to summarize all findings from review of the existing water distribution system boundary conditions, fire protection flow calculation for the proposed buildings on site, and hydraulic modeling results for fire flow analysis.

The development site is located at the northeast corner of the intersection of Ottawa Street and Sadler Drive, Almonte. There is an existing 250 mm diameter watermain along south side of Ottawa Street. The proposed water system includes a looped 200 mm diameter PCV DR18 watermain and two connections to the existing 250 mm watermain on Ottawa Street.

EXISTING WATER DISTRIBUTION SYSTEM CAPACITY

J. L. Richard & Associates Limited (JLR) provided an email on March 1st, 2023, regarding to the hydraulic boundary conditions at the two proposed connections on the existing 250 mm WM on Ottawa Street. The email indicated that the existing water distribution system can provide the maximum 112 L/s (6,720 L/min) fire flow for the assumed 150 mm diameter looped onsite water system and the maximum of 155 L/s (9,300 L/min) fire flow for the assumed 200 mm diameter looped onsite water system. The email also states that the estimated maximum flow flows were simulated using the Municipality's existing hydraulic water model (2017). JLR's email is included in Appendix A.

REQUIRED FIRE PROTECTION FLOW CALCULATION

The required fire protection flows were calculated based on the provided building configurations including floor area, stories, construction type, occupancy types, sprinkler system, etc., and the Water Supply for Public Fire Protection by Fire Underwriters Survey 2020 (FUS).

The required fire flows for proposed building onsite are summarized in Table 1. Detailed fire flow calculation is included in Appendix B.

Table 1: Calculated Fire Flows

Building	Floor Area (m2)	Stories	Construction Type			Occupancy Type	Fully Supervised Spingkler	Estimated Fire Flow (L/Min)
			Wood Combustible	Ordinary	Non combustible	Limited Combustible		
Building A	1149	1	yes			yes		12000
				yes		yes		8000
Building B	1200	1	yes			yes		11000
				yes		yes		8000
Residential Building	1800	4	yes			yes	yes	12000
				yes		yes	yes	8000
					yes	yes	yes	6000

Building A

Building A is a one-story retail store as classified under OBC 3.2.2.61. The construction type of Building A can be either wood frame combustible or ordinary construction (min 1.0 hr fire resistance rate for exterior wall, non fire resistance for interior walls, floors, or roofs). Occupancy type of Build A is assumed to be limited combustible as Group E Mercantile shops / stores. Building A is non sprinklered. The calculated fire flows for Building A are **8,000 L/min** as the assumed Ordinary construction and **12,000 L/min** as the assumed wood frame combustible construction.

Building B

Building B is a one-story retail store as classified under OBC 3.2.2.61. The construction type of Building A can be either wood frame combustible or ordinary construction (min 1.0 hr fire resistance rate for exterior wall, non fire resistance for interior walls, floors, or roofs). Occupancy type of Build B is assumed to be limited combustible as Group E Mercantile shops / stores. Building B is non sprinklered. The calculated fire flows for Building B are **8,000 L/min** as the assumed Ordinary construction and **12,000 L/min** as the assumed wood frame combustible construction.

Residential Building

The proposed residential building (RB) is a four-story building as classified under OBC 3.2.2.45. The construction type of RB can be either wood frame combustible, ordinary construction (min 1.0 hr fire resistance rate for exterior wall, non fire resistance for interior walls, floors, or roofs), or non-combustible (all structural elements, walls, arches, floors, and roofs are constructed with a minimum 1 hr fire resistance rating and are constructed with non-combustible, non-protected vertical openings). Occupancy type of RB is assumed to be limited combustible as Group C Residential. RB is assumed to be protected by the fully supervised sprinkler system. The maximum floor area of 1,800 m^2 is assumed for the fire flow calculation. And it is also assumed that the RB will be subdivided by a vertical firewall with a fire resistance rating of not less than 2 hrs, and meeting OBC requirements. The calculated fire flows for Building B are **8,000 L/min** as the assumed Ordinary construction, **12,000 L/min** as the assumed wood frame combustible construction, and **6,000 L/min** as the assumed non-combustible construction.

HYDRAULIC MODELING ANALYSIS

The hydraulic modeling fire flow analysis was conducted by using Bentley WaterGEMS modeling software to simulate the available fire flows based on the provided water system boundary conditions. The modeling results indicated that the available fire flows for development site range from **9,060 L/min** (151 L/s) to **9,940 L/min** (165.7 L/s) under the maximum day demand scenario and the minimum system residual pressure of 140 kPa (20 psi). The modeling results are included in Appendix C.

RECOMMENDATIONS

The fire flow analysis indicated that the available fire flows for the development site range from **9,060 L/min** (151 L/s) to **9,940 L/min** (165.7 L/s). In order to meet the fire flow requirements as calculated per FUS standards, the proposed buildings should be considered an ordinary construction as minimum and with all other configurations as discussed in this memo.

Sincerely,

WSP Canada Inc.

Prepared by:

Zhidong Pan, M.Eng., P.Eng
Senior Municipal Engineer

Appendices:

Appendix A – Boundary Conditions
Appendix B – Fire flow calculation sheets
Appendix C – Modeling Results

MEMO - APPENDIX

A

BOUNDARY CONDITIONS
WATER DEMAND (PHASE 2)

Water Demand Calculation Sheet

Project:	**430 Ottawa Street - Phase 2 (Residential Building - 4 Storey)**	**Date:**	**2026-07-20**
Location:	**Almonte, Ontario**	**Design:**	**DM**
WSP Project No.	**CA0071569.1696**	**Page:**	**1 of 1**

Proposed Buildings	Residential			Total	Non-Residential			Avg Day			Max Day			Peak Hour			Fire
	Population			Population	Industrial	Institutional	Commercial	Demand (L/s)			Demand (L/s)			Demand (L/s)			Demand
	1-Bed	2-Bed	3-Bed		(ha)	(ha)	(ha)	Res.	Non-Res.	Total	Res.	Non-Res.	Total	Res.	Non-Res.	Total	(L/min)
Residential Building	58	158	35	251				0.81	0.00	0.81	2.03	0.00	2.03	4.47	0.00	4.47	9,000
Total				251						0.81			2.03			4.47	9,000

Population Densities

Single Family	3.4	person/unit
Semi-Detached	2.7	person/unit
Duplex	2.3	person/unit
Townhome (Row)	2.7	person/unit
Bachelor Apartment	1.4	person/unit
1 Bedroom Apartment	1.4	person/unit
2 Bedroom Apartment	2.1	person/unit
3 Bedroom Apartment	3.1	person/unit
4 Bedroom Apartment	4.1	person/unit
Avg. Apartment	1.8	person/unit

Avg Day Demand

Residential	280	L/cap/day
Light Industrial	35000	L/ha/day
Institutional	28000	L/ha/day
Commercial	28000	L/ha/day

Max Day Demand

Residential	2.5	x avg. day
Industrial	1.5	x avg. day
Institutional	1.5	x avg. day
Commercial	1.5	x avg. day

Peak Hour Demand

Residential	2.2	x max. day
Industrial	1.8	x max. day
Institutional	1.8	x max. day
Commercial	1.8	x max. day

Zhang, Jingwei

From: Annie Williams <awilliams@jlrichards.ca>
Sent: Wednesday, March 1, 2023 11:39 AM
To: Zhang, Jingwei
Cc: David Shen; 'Shan Goel'; Jason D'Elia; Mark Buchanan
Subject: RE: 430 Ottawa St SPA - Confirmation of Civil Criteria
Attachments: 29920-014 WaterCAD Schematics.pdf

Good morning Jingwei,

Please find attached the requested hydraulic boundary conditions for two (2) connections to the existing 250 mm watermain at 430 Ottawa Street as requested by the Developer's Engineer.

The proposed development ("430 Ottawa Street") located within the Municipality of Mississippi Mills (Municipality), was simulated using the Municipality's existing hydraulic water model (2017) to determine hydraulic boundary conditions based on theoretical water demands provided by the Developer's Engineer (refer to attached). Table 1 summarizes the theoretical water demands that were included in the model. The elevations at the model junctions were approximated using the information from the model and Google Earth. The development was modelled with both a 150 mm and 200 mm watermain loop through the center of the site. Also included for the Developer's consideration is the expected level of service for three (3) different fire flow scenarios for both the 150 mm and 200 mm watermain loops (refer to Table 2 and 3). **It is noted that the simulated maximum available fire flow is 112 L/s for the 150 mm watermain loop and 155 L/s for the 200 mm watermain loop based on maintaining a minimum pressure of 140 kPa (20 psi) in the system.**

Table 1: Theoretical Water Demands

430 Ottawa St.	Avg Day (L/s)	Max Day (L/s)	Peak Hour (L/s)
Junction Node J-573 (Elev. 141.00 mm)	1.19	4.87	7.47

The hydraulic boundary conditions have been generated at the requested connection locations labelled as node J-574 and node J-575 in the model and are summarized in Table 2 and Table 3 (refer to attached WaterCAD model outputs).

Table 2: 430 Ottawa Street Boundary Conditions – 150 mm Watermain Loop (MAX. AVAILABLE FIRE FLOW 112 L/s)

Demand Scenario	Connection 1		Connection 2	
	Junction Node J-574 (Elev. 139.78 m)		Junction Node J-575 (Elev. 140.28 m)	
	Pressure (kPa)	HGL (m)	Pressure (kPa)	HGL (m)
Average Day	400	180.62	395	180.62
Max Day + Fire Flow (112 L/s)	288	169.26	278	168.68
Max Day + Fire Flow (100 L/s)	307	171.13	297	170.66
Max Day + Fire Flow (50 L/s)	365	177.09	359	176.95
Peak Hour	386	179.19	381	179.19

Table 3: 430 Ottawa Street Boundary Conditions – 200 mm Watermain Loop (MAX. AVAILABLE FIRE FLOW 155 L/s)

Demand Scenario	Connection 1		Connection 2	
	Junction Node J-574 (Elev. 139.78 m)		Junction Node J-575 (Elev. 140.28 m)	
	Pressure (kPa)	HGL (m)	Pressure (kPa)	HGL (m)
Average Day	400	180.62	395	180.62
Max Day + Fire Flow (150 L/s)	220	162.26	206	161.35

Max Day + Fire Flow (115 L/s)	284	168.77	273	168.20
Max Day + Fire Flow (100 L/s)	307	171.13	298	170.69
Peak Hour	386	179.19	381	179.19

Note that the foregoing model results are for current conditions and are based on computer model simulation. We have not reviewed the adequacy of the domestic demand nor the fire flow requirements for the proposed development, which remains the responsibility of the Developer's Engineer.

Disclaimer: The model results are based on current simulated operation of the Municipality's water distribution system and sewer collection system. The computer model simulations are based on the best information available at this time. The operation of the systems can change on a regular basis, resulting in a variation in the boundary conditions. It is further noted that the operational characteristics of the water supply and wastewater collection systems and physical properties of the watermains and sewers can change and/or deteriorate over time. These changes may affect the supply and collection characteristics of the systems and the assumptions made in developing the models, which in turn could lead to variations in the simulation results. This should be considered by any third party undertaking simulation of system upgrades.

Should you have any questions or require anything further, please do not hesitate to contact us.

Regards,
Annie

Annie Williams, P.Eng.
Civil Engineer

J.L. Richards & Associates Limited
1000-343 Preston Street, Ottawa, ON K1S 1N4
Direct: 343-803-4523

J.L. Richards & Associates Limited
ENGINEERS · ARCHITECTS · PLANNERS

BEST MANAGED COMPANIES
Platinum member

From: Zhang, Jingwei <Jingwei.Zhang@wsp.com>
Sent: February 17, 2023 7:28 AM
To: Annie Williams <awilliams@jlrichards.ca>
Cc: David Shen <dshen@mississippimills.ca>; 'Shan Goel' <sgoel@elmdevelopments.com>; Jason D'Elia <j.delia@elmdevelopments.com>; Mark Buchanan <mbuchanan@jlrichards.ca>
Subject: RE: 430 Ottawa St SPA - Confirmation of Civil Criteria

Hi Annie,

Thank you for your reply.

The new development site includes two commercial buildings and a 4-story residential building. Refer to the attached conceptual site plan.

Required steady state water demands for the new development site are listed below.

Scenarios	Estimated Demand (L/s)
Average Day Demand	1.19
Maximum Day Demand	4.87

Peak Hour Demand	7.47

We are currently under the conceptual design stage, and the required fire protection flow for future development is not finalized. And that was the reason we reach out the Town for the existing water distribution system boundary conditions at this moment. We need to know what is the maximum system capacity at the proposed two connections, then we will work with architect, mechanical, and other disciplines to determine the building configurations, such as construction type, occupancy, sprinkler, the maximum fire zone, etc. After that we can finalize the fire flow calculations. The existing boundary condition is critical and a prerequisites for the fire flow calculations. We don't want to just provide a wide range of the fire flows which we will have to revise later when the boundary condition becomes a constraint.

What we want from the Town or J.L. Richards (for fire flow + MDD) is a set of demand vs pressure curve at each connection **under the maximum day scenario**, e.g.

Flow (L/s)	**Pressure (kPa)**
0	-
5	-
10	-
15	-
20	-
25	-
…	140

We are going to build a water distribution model for the development site and use the provided boundary conditions (Demand vs pressure curves) to review the required water main size and if the looped system is necessary or not, etc.

I hope I clarify our requirements for the boundary conditions. If you have further questions please let us know.

The fee has been approved by our client, please send the invoice to the town once the boundary conditions are provided.

We have a strict timeline for this project, please provide the required boundary condition as your earliest convenience.

Thanks,

Jingwei Zhang, M.Eng., P.Eng., PMP
Senior Project Engineer
Municipal Engineering - Ottawa

T+ 1 613-690-1245

WSP Canada Inc.
2611 Queensview Drive, Suite 300
Ottawa, Ontario,
K2B 8K2 Canada

wsp.com

From: Annie Williams <awilliams@jlrichards.ca>
Sent: Tuesday, February 14, 2023 1:45 PM
To: Zhang, Jingwei <Jingwei.Zhang@wsp.com>
Cc: David Shen <dshen@mississippimills.ca>; 'Shan Goel' <sgoel@elmdevelopments.com>; Jason D'Elia

<j.delia@elmdevelopments.com>; Mark Buchanan <mbuchanan@jlrichards.ca>
Subject: RE: 430 Ottawa St SPA - Confirmation of Civil Criteria

Hi Jingwei,

We have reviewed your boundary condition request for 430 Ottawa Street and we would kindly request the following information:

- Please provide the updated water demands (as approved by David Shen) as we have not received this information.
- Please confirm whether a looped watermain is proposed on the site, or if these are 2 separate water services. What diameter watermain is being proposed? Are both connections being used to service one single building?
- What is the development being proposed? If you could send a Site Plan for reference this may be helpful.

We would be happy to provide you with hydraulic boundary conditions from the Municipality's water model at the two (2) requested connection locations. Per our typical boundary condition request procedures, we propose to provide you with the following table (information to be obtained from the model under steady-state scenarios):

Demand Scenario	Connection 1		Connection 2	
	Pressure (kPa)	HGL (m)	Pressure (kPa)	HGL (m)
Average Day				
Maximum Day				
Maximum Day + Fire Flow				
Peak Hour				

We work for the Municipality and we will bill by the hour to an upset limit of **$2,500** (excl. disbursement and tax).

We can provide these boundary conditions within 10 business days upon receiving approval from the Municipality to proceed. Please let us know if you are in agreement with the above.

Thank you,
Annie

Annie Williams, P.Eng.
Civil Engineer

J.L. Richards & Associates Limited
1000-343 Preston Street, Ottawa, ON K1S 1N4
Direct: 343-803-4523

J.L. Richards & Associates Limited
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From: Zhang, Jingwei <Jingwei.Zhang@wsp.com>
Sent: February 9, 2023 3:22 PM
To: Mark Buchanan <mbuchanan@jlrichards.ca>
Cc: David Shen <dshen@mississippimills.ca>; 'Shan Goel' <sgoel@elmdevelopments.com>; Jason D'Elia <j.delia@elmdevelopments.com>
Subject: RE: 430 Ottawa St SPA - Confirmation of Civil Criteria

[CAUTION] This email originated from outside JLR. Do not click links or open attachments unless you recognize the sender and know the content is safe. If in doubt, please forward suspicious emails to Helpdesk.

Hi Mark,

We are working on grading and servicing design for 430 Ottawa Street in Almonte and looking for water boundary conditions at the two main connections as shown in the screenshot below. One main connection (Connection 1) is at the connection of the existing 150mm water service pipe and the other (Connection 2) is approximately 99.6m west of Connection 1. Could you provide the available flow and pressure curve for two connections being flowed concurrently for the following scenarios?

- Average day water demand (ADD)
- Maximum day water demand (MDD)
- Maximum day water demand + Fire (MDD + Fire)
- Peak hour water demand (PHD)

Please provide a quote for this boundary request before the modelling checking.

Thanks,

Jingwei Zhang, M.Eng., P.Eng., PMP
Senior Project Engineer
Municipal Engineering - Ottawa

T+ 1 613-690-1245

WSP Canada Inc.
2611 Queensview Drive, Suite 300

Ottawa, Ontario,
K2B 8K2 Canada

wsp.com

From: David Shen <dshen@mississippimills.ca>
Sent: Thursday, January 5, 2023 11:47 AM
To: Zhang, Jingwei <Jingwei.Zhang@wsp.com>; 'Shan Goel' <sgoel@elmdevelopments.com>; Jason D'Elia <j.delia@elmdevelopments.com>
Cc: Mark Buchanan <mbuchanan@jlrichards.ca>
Subject: RE: 430 Ottawa St SPA - Confirmation of Civil Criteria

Hi Jingwei,

I have reviewed WSP calculation on water/wastewater planning and I am ok with your result.

As mentioned, the next step is I am connecting you and Mark (J.L.Richards). You write an email to Mark summarizing your flowrates (up to you to show your calculation details or not, as I gave the greenlight already), and a figure illustrating your proposed connection points.

Mark, please provide a fee estimate to WSP. Once agreed, you can do the modelling check.

Thanks!

David Shen, P.Eng.
Director, Development Services and Engineering
Municipality of Mississippi Mills
dshen@mississippimills.ca
613-880-5996
Website: www.mississippimills.ca

From: Zhang, Jingwei <Jingwei.Zhang@wsp.com>
Sent: December 29, 2022 9:11 PM
To: David Shen <dshen@mississippimills.ca>
Subject: RE: 430 Ottawa St SPA - Confirmation of Civil Criteria

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Hi David,

Please find attached revised water and wastewater calculations for review. And also please provide the water boundary condition for this site and confirm that the existing sanitary sewer on Ottawa Street has a sufficient capacity to accommodate the peak sewerage flow from this site.

Thanks,

Jingwei Zhang, M.Eng., P.Eng., PMP
Senior Project Engineer
Municipal Engineering - Ottawa

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WSP Canada Inc.
2611 Queensview Drive, Suite 300
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From: McCaughey, Stephen <Stephen.Mccaughey@wsp.com>
Sent: Tuesday, December 6, 2022 2:08 PM
To: David Shen <dshen@mississippimills.ca>; Zhang, Jingwei <Jingwei.Zhang@wsp.com>
Cc: Robert Smith <smithr@mississippimills.ca>; Cory Smith <csmith@mississippimills.ca>
Subject: RE: 430 Ottawa St SPA - Confirmation of Civil Criteria

Hi David,

Thanks for the comments, we'll have the revised demand estimates shortly. Yes as noted we'll have more detailed information once it comes time for the formal submission, in coordination with the architect for specifics of unit count, etc. We wanted to get initial estimates in for coordination.

Also confirming on my other question: will hydrant testing be required for SPA or will the township's water model provide sufficient evidence of capacity?

Thank you,

Stephen McCaughey, P.Eng., PMP
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T +1 613-829-2800 (Office)

From: David Shen <dshen@mississippimills.ca>
Sent: Friday, November 25, 2022 11:02 AM
To: McCaughey, Stephen <Stephen.Mccaughey@wsp.com>
Cc: Robert Smith <smithr@mississippimills.ca>; Cory Smith <csmith@mississippimills.ca>
Subject: RE: 430 Ottawa St SPA - Confirmation of Civil Criteria

Hi Stephen,

I received this email and your follow-up emails.

Your used an average population multiplying unit number to get your residential population. At this stage, it is fine. In the following submission, please update to each type of the unit density multiplying unit number and sum up.

Your water calculation looks good, the content meets the Municipality's requirement. But I would like to ask you go back and check your calculation. The Maximum (or Peak) hour demand calculation uses the ADD as a base to multiple peaking factor. You can confirm within your firm.

Your wastewater calculation looks good, the content meets the Municipality's requirement. Seems you did not include the commercial building B calculation although there is a summary at the bottom.

For wastewater, if you plan to connect the municipal system twice at two locations, you will need, at a later stage when you figure out the building internal plumbing routing, submit calculation result per each connection.

At a later stage, please include a brief description of your proposed water/wastewater connections to the municipal system, including the existing municipal pipe size (w/ww), slope and proposed connection elevation (ww), manhole up/down stream (ww), and hydrant, VB/VC close by (w).

Please resubmit your calculation results to me, and we can arrange J.L.Richards to check the system capacity for you. I don't need all information I mentioned at this stage (if I label "at a later stage", you are fine for now).

David Shen, P.Eng.
Director, Development Services and Engineering
Municipality of Mississippi Mills
dshen@mississippimills.ca
613-880-5996
Website: www.mississippimills.ca

From: McCaughey, Stephen <Stephen.Mccaughey@wsp.com>
Sent: November 21, 2022 9:38 AM
To: David Shen <dshen@mississippimills.ca>
Cc: Robert Smith <smithr@mississippimills.ca>; Cory Smith <csmith@mississippimills.ca>
Subject: RE: 430 Ottawa St SPA - Confirmation of Civil Criteria

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Hello David,

We met at the meeting last week to discussed 430 Ottawa Street. Following that discussion I wanted to provide the sanitary and water demand estimates seeking confirmation of capacity of the existing infrastructure. The existing Master Plan that is publicly available only provides general summaries of capacities that is difficult to state definitively for the purposes of our site plan.

Water:

Avg day: 1.01 L/s
Peak hr: 26.64 L/s
Max day + fire flow: 203.52 L/s

Sanitary:

Peak: 3.81 L/s

Thank you,

Stephen McCaughey, P.Eng., PMP
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T +1 613-829-2800 (Office)

From: McCaughey, Stephen
Sent: Tuesday, October 11, 2022 3:41 PM
To: Cory Smith <csmith@mississippimills.ca>
Cc: Robert Smith <smithr@mississippimills.ca>
Subject: RE: 430 Ottawa St SPA - Confirmation of Civil Criteria

Thank you Cory,

I did find the 2018 Master Plan, which has discussions of both potable water and sanitary capacities but only indicated the summaries. Does the township have the water model or sanitary sewer design sheets from the Master Plan to better define the servicing capacity at our site in question. Also, noting that the Master Plan recommended immediate and short-term work to address capacity issues, can you confirm if any of the work, in the vicinity of our site, has been since completed? Alternatively if we can coordinate with JL Richards for the information, we understand they're acting as the township's third-party engineers.

Also to confirm for the stormwater criteria, we will be designing to "enhanced" quality control (80% TSS removal), correct? What is the quantity control requirements (pre- to post-development up to 100yr; reduction to 5-yr pre-development; etc)?

Much appreciated,

Stephen McCaughey, P.Eng., PMP
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T +1 613-829-2800 (Office)

From: Cory Smith <csmith@mississippimills.ca>
Sent: Wednesday, October 05, 2022 3:13 PM
To: McCaughey, Stephen <Stephen.Mccaughey@wsp.com>; Robert Smith <smithr@mississippimills.ca>
Subject: RE: 430 Ottawa St SPA - Confirmation of Civil Criteria

See below.

Cory Smith, C.Tech.
Director of Roads and Public Works
Municipality of Mississippi Mills
3131 Old Perth Rd.
P.O. Box 400
Almonte, ON
K0A 1A0
csmith@mississippimills.ca
(613)256-2064 x401

From: McCaughey, Stephen <Stephen.Mccaughey@wsp.com>
Sent: October 5, 2022 3:04 PM
To: Robert Smith <smithr@mississippimills.ca>
Cc: Cory Smith <csmith@mississippimills.ca>
Subject: RE: 430 Ottawa St SPA - Confirmation of Civil Criteria
Importance: High

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hi Robert,

Following up on my below questions for clarification of the civil design criteria for 430 Ottawa St

Thank you!

Stephen McCaughey, P.Eng., PMP
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T +1 613-829-2800 (Office)

From: McCaughey, Stephen
Sent: Thursday, September 08, 2022 10:03 AM
To: Robert Smith <smithr@mississippimills.ca>
Cc: Cory Smith <csmith@mississippimills.ca>
Subject: RE: 430 Ottawa St SPA - Confirmation of Civil Criteria

Thank you Robert,

Can you also confirm the below clarifications for design criteria?

- Are there watermain boundary conditions we can work with to verify watermain pressure during domestic and fire demands?
  No
- Does the municipality have existing sanitary capacity information in order to validate the additional sanitary demand?
  There is no recent information available. Please review our water wastewater master plan.
  https://www.mississippimills.ca/en/municipal-hall/plans-studies-and-reports.aspx#?cludoquery=master%20plan&cludopage=2&cludorefurl=https%3A%2F%2Fwww.mississippimills.ca%2Fen%2Fmunicipal-hall%2Fplans-studies-and-reports.aspx&cludorefpt=Plans%2C%20Studies%20and%20Reports%20-%20Mississippi%20Mills&cludoinputtype=standard

- What are the storm quantity and quality control criteria? Since the work will be done in stages (new commercial in before existing commercial demolished, followed by residential construction) does the stormwater management need to be implemented during the interim stage (addressing the stormwater of the new construction) or for the final condition?
  We will be looking for enhanced levels.

Thank you,

Stephen McCaughey, P.Eng., PMP
T +1 613-690-3955 (Direct)
T +1 613-829-2800 (Office)

From: Robert Smith <smithr@mississippimills.ca>
Sent: Wednesday, September 07, 2022 4:33 PM
To: McCaughey, Stephen <Stephen.Mccaughey@wsp.com>
Cc: Cory Smith <csmith@mississippimills.ca>
Subject: RE: 430 Ottawa St SPA - Confirmation of Civil Criteria

Hi Stephen,

Please see attachments to this email consisting of construction drawings for Ottawa Street and the original site plan for 430 Ottawa Street

Robert Smith, C.Tech.
Roads and Public Works Technologist
Municipality of Mississippi Mills
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(613)256-2064 x404

From: Robert Smith
Sent: September 2, 2022 3:49 PM
To: McCaughey, Stephen <Stephen.Mccaughey@wsp.com>
Cc: Cory Smith <csmith@mississippimills.ca>
Subject: RE: 430 Ottawa St SPA - Confirmation of Civil Criteria

Hi Stephen,

Apologies for the delay in getting back to you, it's been one of those weeks.

I've done some digging this afternoon for existing servicing drawings for this area and haven't come across anything yet. I've attached a snip of existing servicing to the lot from our GIS which shows the main as 150mm pvc in blue, 200mm pvc sanitary in red, nothing labeled for the storm outfall.

Sadly this is all I can provide in Cory's absence, which I'm sure he can provide additional information to you next week

Regards,

Robert Smith, C.Tech.
Roads and Public Works Technologist
Municipality of Mississippi Mills
3131 Old Perth Rd.
P.O. Box 400

Almonte, ON
K0A 1A0
smithr@mississippimills.ca
(613)256-2064 x404

From: McCaughey, Stephen <Stephen.Mccaughey@wsp.com>
Sent: August 31, 2022 10:19 AM
To: Robert Smith <smithr@mississippimills.ca>
Cc: Cory Smith <csmith@mississippimills.ca>
Subject: RE: 430 Ottawa St SPA - Confirmation of Civil Criteria

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Also, confirming if the municipality has any existing servicing drawings of the site or immediately in front on Ottawa St.

Thank you,

Stephen McCaughey, P.Eng., PMP
T +1 613-690-3955 (Direct)
T +1 613-829-2800 (Office)

From: McCaughey, Stephen
Sent: Wednesday, August 31, 2022 9:53 AM
To: 'smithr@mississippimills.ca' <smithr@mississippimills.ca>
Subject: FW: 430 Ottawa St SPA - Confirmation of Civil Criteria

Hello Robert, I understand Cory is currently away. I'm working on a site plan application for 430 Ottawa St wondering if you can help answer my below questions about the civil criteria in Cory's absence.

Thank you very much,

Stephen McCaughey, P.Eng., PMP
T +1 613-690-3955 (Direct)
T +1 613-829-2800 (Office)

From: McCaughey, Stephen
Sent: Wednesday, August 31, 2022 9:50 AM
To:
Subject: 430 Ottawa St SPA - Confirmation of Civil Criteria

Hello Cory,

I'm working on the civil scope of the 430 Ottawa St. site plan approval under development, the site had previously undergone zoning amendment. I have the pre-consultation notes and there were some initial questions I wanted to clarify:

- Are there watermain boundary conditions we can work with to verify watermain pressure during domestic and fire demands?

- Does the municipality have existing sanitary capacity information in order to validate the additional sanitary demand?
- What are the storm quantity and quality control criteria? Since the work will be done in stages (new commercial in before existing commercial demolished, followed by residential construction) does the stormwater management need to be implemented during the interim stage (addressing the stormwater of the new construction) or for the final condition?

Thank you very much,

Stephen McCaughey, P.Eng., PMP
Project Engineer
Municipal Infrastructure

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-LAEmHhHzdJzBlTWfa4Hgs7pbKl

MEMO - APPENDIX

B

FIRE FLOW CALCULATION PHASE 2

Fire Flow Design Sheet (FUS)
Russell Elementary School
Township of Russell, Ontario
CA0050674.2866

Date: 2026-07-26
Input By: Devang Maratha
Reviewed By: Winston Yang

Russell Elementary School
Fire Flow Requirements Based on Fire Underwriters Survey (FUS) 2020

To estimate the amount of water required to confine and control a fire, FUS uses the following base formula:

$$F = 220 \times C \times \sqrt{A}$$

F = Required Fire Flow in litres per minute
C = Construction Coefficient related to the type of construction of the building
A = Total Effective Floor Area in square meters of the building

	1. Construction Material		Input	Coefficient	Value Used
C	**Type V**	Wood Frame Construction	Yes	1.5	1.5
	Type IV-A	Mass Timber Construction		0.8	
	Type IV-B	Mass Timber Construction		0.9	
	Type IV-C	Mass Timber Construction		1.0	
	Type IV-D	Mass Timber Construction		1.5	
	Type III	Ordinary Construction		1.0	
	Type II	Non-combustible Construction		0.8	
	Type I	Fire Resistive Construction		0.6	

	2. Floor Area	Input	Value Used
A	Building Footprint (m²)	1,500	6,000
	Number of Floors	4	
	Protected Openings (1-hr)	Yes	
	Total Effective Floor Area (m²) *	6,000	

* 100% of all Floor Areas are considered

3. Base fire flow without adjustments

F = **F = 220 x C x √A =** **26,000 L/min**

	4. Occupancy and Contents Adjustment Factor	FUS Table 3	Adjustment	Value Used
(1)	Non-combustible		-25%	-15%
	Limited combustible	Yes	-15%	
	Combustible		+0%	
	Free Burning		+15%	
	Rapid Burning		+25%	

Adjustment of F due to Occupancy and Contents = **22,100 L/min**

	5. Automatic Sprinkler Protection	FUS Table 4	Adjustment	Value Used
(2)	% of Sprinkler Coverage	100%		-50%
	Adequately Designed System (NFPA 13)	Yes	-30%	
	Standard Water Supply	Yes	-10%	
	Fully Supervised System	Yes	-10%	

Credit for Automatic Spinkler Protection = **-11,050 L/min**

	6. Exposure Surcharge	Separation	FUS Table 5	Value Used
(3)	North Exposure (m)	38	+0%	+0%
	East Exposure (m)	37	+0%	
	South Exposure (m)	35	+0%	
	West Exposure (m)	57	+0%	

Surcharge for Exposure = **+0 L/min**

7. Total Required Fire Flow

F = **F = (1) + (2) + (3) =** **11,000 L/min**
or 183 **L/sec**
or 2,906 **GPM (US)**

Based on method described in:
"Water Supply for Public Fire Protection - A Guide to Recommended Practice", 2020
by Fire Underwriters Survey

OBC Water Supply for Fire Fighting Calculation
Waterdown Fire and Police Station

Building Floor Area		2,900.00	m2 (per architect)
Building Height		12.259	m (per architect)
Building Volume (V)		35551	m3
Water Supply Coefficient (K)		23	Per Architect, fire resistance ratings per 3.2.2 (Building Class C)
Spatial Coefficient (S) (Figure1)			
North Exposure	> 10 m	0	
West Exposure	> 10 m	0	
East Exposure	> 10 m	0	
South Exposure	> 10 m	0	
Total Exposure Coefficient (1<S<2)		1	
Mun. Supply of Water (Coefficients * volume)		817,675	L
Required Fire Flow per Table 2 LPM		9000	L/min
Required Fire Flow per Table 2 LPS		**150**	L/s

OBC References

Table 1

Water Supply Coefficient - K

Type of Construction	Classification by Group or Division in Accordance with Table 3.1.2.1. of the Building Code				
	A-2 B-1 B-2 B-3 C D	A-4 F-3	A-1 A-3	E F-2	F-1
Building is of noncombustible construction with fire separations and fire-resistance ratings provided in accordance with Subsection 3.2.2., including loadbearing walls, columns and arches.	10	12	14	17	23
Building is of noncombustible construction or of heavy timber construction conforming to Article 3.1.4.6. Floor assemblies are fire separations but with no fire-resistance rating. Roof assemblies, mezzanines, loadbearing walls, columns and arches do not have a fire-resistance rating.	16	19	22	27	37
Building is of combustible construction with fire separations and fire-resistance ratings provided in accordance with Subsection 3.2.2., including loadbearing walls, columns and arches. Noncombustible construction may be used in lieu of fire-resistance rating where permitted in Subsection 3.2.2.	18	22	25	31	41
Building is of combustible construction. Floor assemblies are fire separations but with no fire-resistance rating. Roof assemblies, mezzanines, loadbearing walls, columns and arches do not have a fire-resistance rating.	23	28	32	39	53
Column 1	2	3	4	5	6

Table 2

Part 3 Buildings under the Building Code	Required Minimum Water Supply Flow Rate, L/min
One-storey building with building area not exceeding 600 m²	1 800
All other buildings	2 700 (if Q ≤ 108 000 L)(1) 3 600 (if Q > 108 000 L and ≤ 135 000 L)(1) 4 500 (if Q > 135 000 L and ≤ 162 000 L)(1) 5 400 (if Q > 162 000 L and ≤ 190 000 L)(1) 6 300 (if Q > 190 000 L and ≤ 270 000 L)(1) 9 000 (if Q > 270 000 L)(1)

Notes to Table 2:
(1) $Q = KVS_{tot}$ as referenced in Paragraph 3(a)

OBC References

3. **Buildings Requiring On-Site Water Supply**
(a) Except for sprinklered buildings and as required by Items 3(c) and 3(e), buildings should have a supply of water available for firefighting purposes not less than the quantity derived from the following formula:

$$Q = K \cdot V \cdot S_{tot}$$

where

Q = minimum supply of water in litres
K = water supply coefficient from Table 1
V = total building volume in cubic metres
S_{tot} = total of spatial coefficient values from property line exposures on all sides as obtained from the formula:

$$S_{tot} = 1.0 + [S_{side1} + S_{side2} + S_{side3} + \ldots \text{ etc.})]$$

where

S_{side} values are established from Figure 1, as modified by Items 3(d) and 3(f), and
S_{tot} need not exceed 2.0.

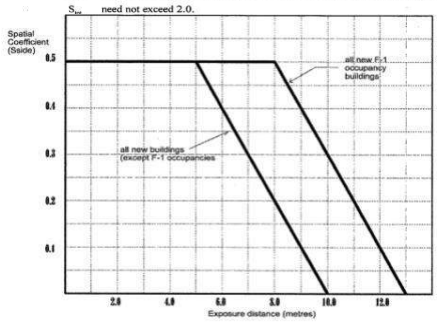

Table 3.1.2.1.
Major Occupancy Classification
Forming Part of Sentences 3.1.2.1.(1), 3.1.2.2.(1) and 3.11.2.1.(3)

Item	Column 1	Column 2	Column 3
	Group	Division	Description of *Major Occupancies*
1.	A	1	*Assembly occupancies* intended for the production and viewing of the performing arts
2.	A	2	*Assembly occupancies* not elsewhere classified in Group A
3.	A	3	*Assembly occupancies* of the arena type
4.	A	4	*Assembly occupancies* in which occupants are gathered in the open air
5.	B	1	*Detention occupancies*
6.	B	2	*Care and treatment occupancies*
7.	B	3	*Care occupancies*
8.	C	—	*Residential occupancies*
9.	D	—	*Business and personal services occupancies*
10.	E	—	*Mercantile occupancies*
11.	F	1	*High hazard industrial occupancies*
12.	F	2	*Medium hazard industrial occupancies*
13.	F	3	*Low hazard industrial occupancies*

MEMO - APPENDIX

C MODELING RESULTS

FlexTable: Junction Table (Current Time: 0.000 hours) (430_OttawaSt_SPA_WaterModel_20230303.wtg)

	Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)	Fire Flow (Available) (L/s)
30: CON-1	CON-1	139.78	0.00	179.71	391	184.33
41: CON-2	CON-2	140.28	0.00	179.71	386	154.95
31: J-2	J-2	140.03	0.00	179.71	388	167.73
33: J-3	J-3	140.03	0.24	179.71	388	165.70
35: J-4	J-4	140.03	0.00	179.71	388	156.76
37: J-5	J-5	140.03	4.43	179.70	388	150.95
39: J-6	J-6	140.03	0.20	179.70	388	152.88

APPENDIX

D

SANITARY SEWER DESIGN CALCULATION SHEET

APPENDIX

FULL DEVELOPMENT STAGE SANITARY SEWER DESIGN CALCULATION SHEET

SANITARY SEWAGE - PROPOSED SANITARY FLOWS

Average Wastewater Flows:		
Residential	280	L/c/d
Commercial	28,000	L/gross ha/d
Institutional	28,000	L/gross ha/d
Light Industrial	35,000	L/gross ha/d
Heavy Industrial	55,000	L/gross ha/d

Peaking Factors:	
Residential	Harmon Equation
Commercial (>20% Area)	1.5
Commercial (<20% Area)	1.0
Institutional (>20% Area)	1.5
Institutional (<20% Area)	1.0
Industrial	Per Figure in Appendix 4-B

$$P.F. = 1 + \left(\frac{14}{4 + \left(\frac{P}{1000}\right)\text{^}0.5}\right) * \mathrm{K}$$

where P = population
K = correction factor = 0.8

Peak Extraneous Flows:	
Infiltration Allowance	0.33
Less than 10 ha:	
Foundation Drain Allowance	5.0
10 ha - 100 ha:	
Foundation Drain Allowance	3.0
Greater than 100 ha:	
Foundation Drain Allowance	2.0

Unit Type	**Person Per Unit**	Unit Count
Single Family	3.4	
Semi-detached	2.7	
Duplex	2.3	
Townhouse (row)	2.7	
Apartments:		
Bachelor	1.4	
1 Bedroom	1.4	
2 Bedroom	2.1	
3 Bedroom	3.1	
Average Apt.	1.8	124
	Total Population:	**223**
	Residential Area (ha):	1.6
	Commercial A Area (ha):	0.4
	Commercial B Area (ha):	0.5
	Total Area (ha)	**2.54**

	Residential Building			**Commercial Building A**			**Commercial Building B**		
Demand Type=	**Residential**			**Commercial**			**Commercial**		
Average Day Demand=	280		L/c/d	28,000		L/gross ha/d	28,000		L/gross ha/d
Population	**223**			**0**			**0**		
Site Area (ha)	**1.648**			**0.404**			**0.491**		
	280	x	223	28,000	x	0	28,000	x	0
	62,496		L/day	11,313		L/day	13,760		L/day
Average Daily Flow=	**0.72**		**L/s**	**0.13**		**L/s**	**0.16**		**L/s**
Peaking Factor Type	Residential			Commercial			Commercial		
Peaking Factor	3.50		*Max=4	1.50		*Max=4	1.50		*Max=4
	3.50	x	average day	1.50	x	average day	1.50	x	average day
	3.50	x	62,496	1.50	x	11,313	1.50	x	13,760
	219,000		L/day	16,970		L/day	20,641		L/day
Peak Daily Flow=	**2.53**		**L/s**	**0.20**		**L/s**	**0.24**		**L/s**
Infiltration Allowance	0.33			0.33			0.33		
	0.33	x	lot area	0.33	x	lot area	0.33	x	lot area
	0.33	x	1.6	0.33	x	0.4	0.33	x	0.5
Peak Extraneous Flow=	**0.54**		**L/s**	**0.13**		**L/s**	**0.16**		**L/s**
	peak daily flow	+	extraneous flow	peak daily flow	+	extraneous flow	peak daily flow	+	extraneous flow
	2.53	+	0.54	0.20	+	0.13	0.24	+	0.16
Total Peak Design Flow=	**3.08**		**L/s**	**0.33**		**L/s**	**0.40**		**L/s**

Residential Peak Design Flow =	**3.08**	**L/s**
Commercial Building A Peak Design Flow =	**0.33**	**L/s**
Commercial Building B Peak Design Flow =	**0.40**	**L/s**
Total Peak Design Flow =	**3.81**	**L/s**

430 Ottawa Street SPA_Sanitary Sewer System Design Sheet

7-Mar-23

Mannings	0.013	
Sewage/dwelling unit	350	lpcd
MH Flow Allowance	0	l/min/manhole
WT Flow Allowance	0	l/min/dwelling

			DOMESTIC WASTEWATER FLOWS																	EXTRANEOUS WASTEWATER FLOWS																			
			POPULATION BASED						AREA BASED									TOTAL DOMESTIC FLOWS		AREA BASED					TOTAL	GRAND TOTALS		Designed Slopes										
Pipe	US Manhole	DS Manhole	Population	U/S Population	Total Population	Average Population Based Domestic Flow (l/s)	Harmon Factor	Peak Population Based Domestic Flow (l/s)	Land Use	Area (ha)	Area Based Wastewater Flow Allowance (L/Ha/day)	Catchment Area Based Average Domestic Flow (l/s)	Upstream Area Based Average Domestic Flow (l/s)	Total Area Based Average Domestic Flow (l/s)	Area Based Flow Peaking Factor	Catchment Area Based Domestic Peak Flow (l/s)	Upstream Area Based Peak Domestic Flow (l/s)	Total Area Based Peak Domestic Flow (l/s)	Total Average Domestic Flow (l/s)	Total Peak Domestic Flow (l/s)	U/S Area (Ha)	Total Area (Ha)	Area Based Extraneous Flow Allowance (L/Ha/s)	Catchment Area Based Extraneous Flow (l/s)	Upstream Area Based Extraneous Flow (l/s)	Total Area Based Extraneous Flow (l/s)	Total Extraneous Flow (l/s)	TOTAL AVERAGE FLOW (l/s)	TOTAL PEAK FLOW (l/s)	Length	Diameter (mm)	Slope	Full Capacity (l/sec)	% Full Flow (Average)	% Full Flow (Peak)	Full flow Velocity (m/s)	U/S Invert (m)	D/S Invert (m)	RIM (m)	Depth (m)
1	WWS-MH1	WWS-MH2	223	0	223	0.90	3.50	3.17	Residential	1.65	0	0.00	0.00	0.00		0.00	0.00	0.00	0.90	3.17	0.00	1.65	0.33	0.54	0.00	0.54	0.54	1.45	3.71	59.3	200	0.65%	26.52	5.5%	14.0%	0.84	137.05	136.66	141.85	4.80
2	WWS-MH2	CONNECTION	0	223	223	0.90	3.50	3.17	Commercial	0.90	28,000	0.29	0.00	0.29	1.50	0.44	0.00	0.44	1.19	3.60	1.65	2.54	0.33	0.30	0.54	0.84	0.84	2.03	4.44	57.5	200	0.62%	25.91	7.8%	17.1%	0.83	136.60	136.24	140.65	4.05

*Full Capacity calculated using Mannings equation: $Q = Cm/n*A*R^{2/3}*S^{1/2}$ Cm = 1.0 (S.I)

Zhang, Jingwei

From: Annie Williams <awilliams@jlrichards.ca>
Sent: Friday, July 7, 2023 5:21 PM
To: Zhang, Jingwei; David Shen
Cc: Mark Buchanan; Shan Goel; Jason D'Elia; Bobby Pettigrew; Mathieu Lacelle
Subject: RE: 430 Ottawa Street SPA - Sanitary flow modelling check

Hi Jingwei, David,

In response to the email from Jingwei Zhang (June 22, 2023), one scenario was assessed based on the future servicing requirements outlined in the email. The scenario used the flow breakdown provided by WSP in the corresponding email.

In previous email correspondences, the approved flow for the Ottawa Street development was 4.44 L./s. This value accounted for peak daily flows and extraneous flows from the proposed residential and commercial buildings and used a peaking factor of 4 for the residential and 1.5 for the commercial flows.

Since the extent of the sanitary sewer infrastructure will not change significantly with the proposed site concept, the portion of the 4.44 L/s attributed to extraneous flows has been removed from the proposed flow and the calibrated extraneous flows for the area, already present in the model, will be used to represent the I&I component.

The master planning level modelling being carried out applies a calibrated daily flow pattern to provide a dynamic input into the model, therefore the average flow based on population and commercial area will be used rather than peak flow rates incorporating the peaking factor. To calculate the average flows from the proposed retrofit project, population and area values were extracted directly from the site servicing report. A population of 223 and an ICI area of 0.9 ha were used with parameters agreed upon with the municipality for in the Mississippi Mills Master Plan. The resulting average flows generated by the proposed development is 1.195 L/s, which represents the sum of average daily flows for the proposed residential and commercial buildings. The following scenario was assessed in the dynamic calibrated trunk sewer sanitary model:

Location:	**SA4MH-109, Northeast of the intersection of Sadler Drive and Ottawa Street**	**Total**
Scenario 1	full buildout population (223 population, 0.9 ha total ICI Area, no extraneous area due to retrofit)	full buildout population (223 population, 0.9 ha total ICI Area, no extraneous area due to retrofit)

In assessing future capacity two constraints were assessed:

- Maintaining free flow capacity in the dry weather flow scenario; and,
- Maintaining 1.8 metre freeboard to the ground elevation in the 1:25 year return period event storm to protect basements. Where the current sewer is already within the basement elevation the HGL is restricted to 0.3m above the sewer.

In summary:

DWF Event Scenarios:

- No capacity concerns under the DWF event have been triggered by the 430 Ottawa Street Development in the dynamic calibrated dry weather flow event for **Scenario 1** above.

25-year Storm Events:

- No capacity concerns under the 25-year storm event have been triggered by the 430 Ottawa Street Development in the dynamic calibrated dry weather flow event for Scenario 1 above. The proposed development flows do not impact areas of concern under the existing condition.

Note that the foregoing model results are for current conditions and are based on computer model simulation. We have not reviewed the adequacy of the wastewater flow calculations for the proposed development, which remains the responsibility of the Developer's Engineer.

The model results are based on current simulated operation of the Municipality's sewer collection system. The computer model simulations are based on the best information available at this time. The operation of the system can change on a regular basis, resulting in a variation in the boundary conditions. It is further noted that the operational characteristics of the wastewater collection system and physical properties of the sewers can change and/or deteriorate over time. These changes may affect the collection characteristics of the system and the assumptions made in developing the model, which in turn could lead to variations in the simulation results. This should be considered by any third party undertaking simulation of system upgrades.

Any questions on the above let us know,
Annie

Annie Williams, P.Eng.
Civil Engineer

J.L. Richards & Associates Limited
1000-343 Preston Street, Ottawa, ON K1S 1N4
Direct: 343-803-4523

From: Mark Buchanan <mbuchanan@jlrichards.ca>
Sent: Thursday, June 22, 2023 3:01 PM
To: Zhang, Jingwei <Jingwei.Zhang@wsp.com>
Cc: Shan Goel <sgoel@elmdevelopments.com>; Jason D'Elia <j.delia@elmdevelopments.com>; Annie Williams <awilliams@jlrichards.ca>; David Shen <dshen@mississippimills.ca>
Subject: RE: 430 Ottawa Street SPA - Sanitary flow modelling check

Understood. Thanks for confirming Jingwei.

Mark

From: Zhang, Jingwei <Jingwei.Zhang@wsp.com>
Sent: Thursday, June 22, 2023 2:47 PM
To: Mark Buchanan <mbuchanan@jlrichards.ca>
Cc: Shan Goel <sgoel@elmdevelopments.com>; Jason D'Elia <j.delia@elmdevelopments.com>; Annie Williams <awilliams@jlrichards.ca>; David Shen <dshen@mississippimills.ca>
Subject: RE: 430 Ottawa Street SPA - Sanitary flow modelling check

Hi Mark,

The peak design flow of 4.44 L/s was confirmed. Please use this number for the modelling check.

Thanks,

Jingwei Zhang, M.Eng., P.Eng., PMP
Senior Project Engineer
Municipal Engineering - Ottawa

T+ 1 613-690-1245

WSP Canada Inc.
2611 Queensview Drive, Suite 300
Ottawa, Ontario,
K2B 8K2 Canada

wsp.com

From: Zhang, Jingwei
Sent: Thursday, June 22, 2023 9:08 AM
To: David Shen <dshen@mississippimills.ca>
Cc: Shan Goel <sgoel@elmdevelopments.com>; Jason D'Elia <j.delia@elmdevelopments.com>; Annie Williams <awilliams@jlrichards.ca>; Mark Buchanan <mbuchanan@jlrichards.ca>
Subject: RE: 430 Ottawa Street SPA - Sanitary flow modelling check

Hi David,

The peak design flow of 4.4 L/s was calculated based on Ottawa Design Guidelines - Sewer October 2012 as requested by the town. It was reviewed and approved by the town. I have attached the detail calculation spreadsheet and the corresponding email to this email.

Please let me know if you have any questions.

Thanks,

Jingwei Zhang, M.Eng., P.Eng., PMP
Senior Project Engineer
Municipal Engineering - Ottawa

T+ 1 613-690-1245

WSP Canada Inc.
2611 Queensview Drive, Suite 300
Ottawa, Ontario,
K2B 8K2 Canada

wsp.com

From: Mark Buchanan <mbuchanan@jlrichards.ca>
Sent: Thursday, June 22, 2023 8:39 AM
To: David Shen <dshen@mississippimills.ca>; Zhang, Jingwei <Jingwei.Zhang@wsp.com>
Cc: Shan Goel <sgoel@elmdevelopments.com>; Jason D'Elia <j.delia@elmdevelopments.com>; Annie Williams <awilliams@jlrichards.ca>
Subject: RE: 430 Ottawa Street SPA - Sanitary flow modelling check

Thanks David,

Agreed, this is a straightforward run, but we'll hang tight until the peak flow is confirmed.

Jingwei: Please confirm the peak flow we are to input in the model.

Regards,
Mark

Mark Buchanan, P.Eng.
Associate
Senior Environmental Engineer

J.L. Richards & Associates Limited
1000-343 Preston Street, Ottawa, ON K1S 1N4
Direct: 343-804-5349

J.L. Richards & Associates Limited
ENGINEERS · ARCHITECTS · PLANNERS

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From: David Shen <dshen@mississippimills.ca>
Sent: Thursday, June 22, 2023 8:30 AM
To: Zhang, Jingwei <Jingwei.Zhang@wsp.com>; Mark Buchanan <mbuchanan@jlrichards.ca>
Cc: Shan Goel <sgoel@elmdevelopments.com>; Jason D'Elia <j.delia@elmdevelopments.com>
Subject: RE: 430 Ottawa Street SPA - Sanitary flow modelling check

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Hi Mark,

The file of 430 Ottawa has been analyzed on water side, but not wastewater side.

Jingwei, can you ensure you are using the correct version of peak flow that was discussed yesterday (since there are more than one version).

The analysis should be very straightforward.

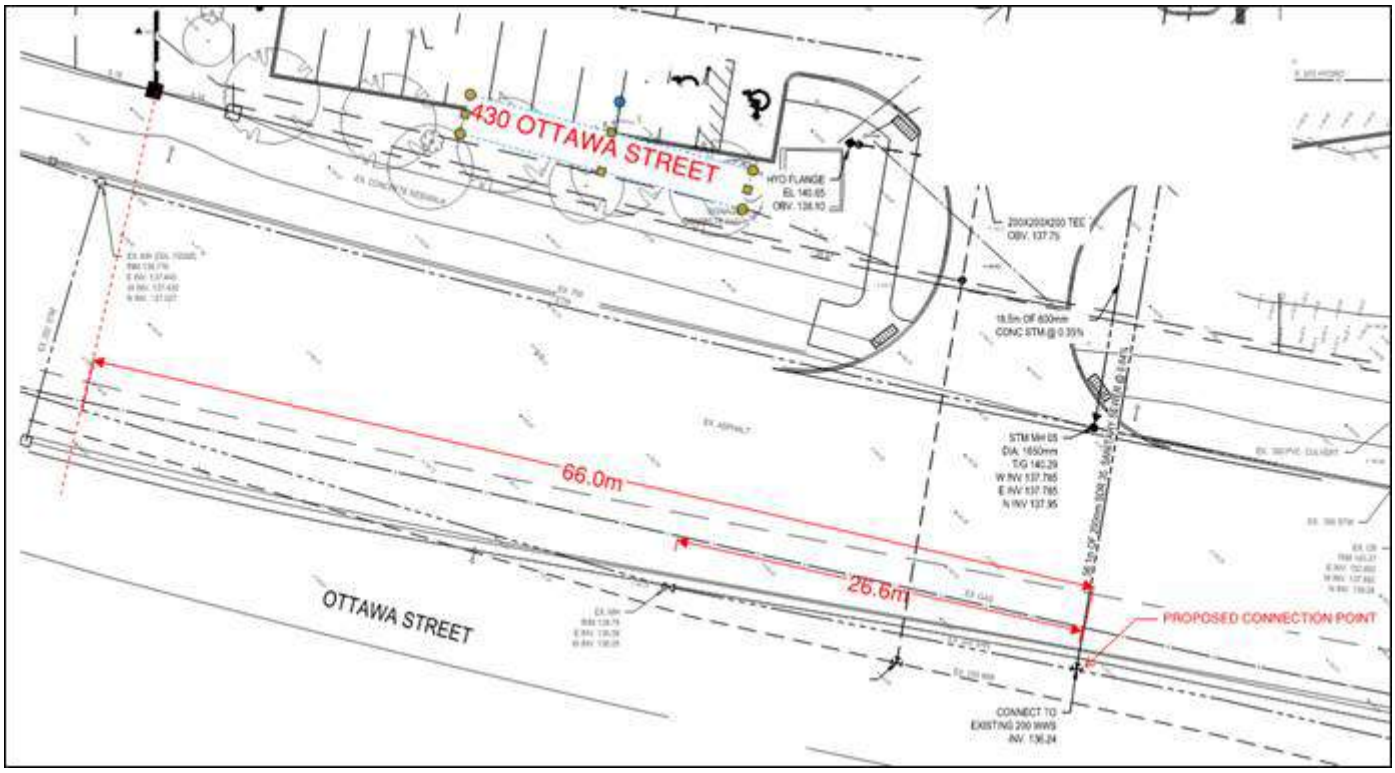
Thanks!
David

From: Zhang, Jingwei <Jingwei.Zhang@wsp.com>
Sent: Thursday, June 22, 2023 7:03 AM
To: Mark Buchanan <mbuchanan@jlrichards.ca>
Cc: David Shen <dshen@mississippimills.ca>; Shan Goel <sgoel@elmdevelopments.com>; Jason D'Elia <j.delia@elmdevelopments.com>
Subject: 430 Ottawa Street SPA - Sanitary flow modelling check

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hi Mark,

Could you do a modeling check to see if the existing 200 sanitary sewer on Ottawa Street has sufficient capacity to accommodate a total peak flow of 4.44 L/s from this site? As shown in the screenshot below, the proposed connection point at the existing 200 sanitary sewer is 26.6m away from the nearest downstream manhole and 66m from the west property line.



If you have any questions, please feel free to contact me

Thanks,

Jingwei Zhang, M.Eng., P.Eng., PMP
Senior Project Engineer
Municipal Engineering - Ottawa

T+ 1 613-690-1245

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APPENDIX

PHASE 2 DEVELOPMENT
SANITARY SEWER DESIGN CALCULATION SHEET

SANITARY SEWER DESIGN SHEET

Project: 430 Ottawa Street - Phase 2 (Residential Building)
Location: Almonte, Ontario
WSP Project No.: CA0071569.1696
Date: 2026-07-26

LOCATION				RESIDENTIAL AREA AND POPULATION												INDUSTRIAL				COMMERCIAL		INSTITUTIONAL		I+C+I	INFILTRATION				PIPE					
LOCATION	FROM M.H.	TO M.H.	SANITARY DRAINAGE AREA ID	INDV AREA (ha)	ACCU AREA (ha)	NUMBER OF UNITS SINGLES	SEMIS	TOWNS	1-BED APT.	2-BED APT.	3-BED APT.	POPULATION INDIV POP.	ACCU POP.	PEAK FACT.	PEAK FLOW (l/s)	GROSS AREA (ha)	DEVEL. AREA (ha)	ACCU. AREA (ha)	PEAK FACTOR	INDIV AREA (ha)	ACCU. AREA (ha)	AREA (ha)	Students*	PEAK FLOW (l/s)	INDIV AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	LENGTH (m)	DIA. (mm)	SLOPE (%)	CAP. (FULL) (l/s)	VEL. (FULL) (m/s)	AVAIL. CAP. (%)
Residential Building	BUILDING	SANMH01		2.16	2.16				41	75	11	251	251	1.71	1.39										2.16	2.16	0.71	**2.10**	*30.80*	*200*	*2.00*	46.38	1.48	**95.47%**
	SANMH01	SANMH02			2.16										1.39										0.00	2.16	0.71	**2.10**	*25.60*	*200*	*0.65*	26.44	0.84	**92.06%**
	SANMH02	SANMH03			2.16										1.39					0.39	0.39			0.19	0.39	2.55	0.84	**2.42**	*56.20*	*200*	*0.64*	26.24	0.84	**90.79%**

DESIGN PARAMETERS

RESIDENTIAL AVG. DAILY FLOW =	280	l/cap/day
COMMERCIAL AVG. DAILY FLOW =	28,000	l/ha/day
	0.324	l/ha/s
INSTITUTIONAL AVG. DAILY FLOW =	28,000	l/ha/day
	0.324	l/ha/s
LIGHT INDUSTRIAL FLOW =	35,000	l/ha/day
	0.405	l/ha/s
HEAVY INDUSTRIAL FLOW =	55,000	l/ha/day
	0.637	l/ha/s

COMMERCIAL PEAK FACTOR =	1.5
INSTITUTIONAL PEAK FACTOR =	1.5
INDUSTRIAL PEAK FACTOR =	* REFER TO MOE GUIDELINES
MANNING N =	0.013
PEAK EXTRANEOUS FLOW, I (l/s/ha) =	0.33

PEAK POPULATION FLOW, (l/s) =	P*q*M/86400
PEAK EXTRANEOUS FLOW, (l/s) =	I*Ac
RESIDENTIAL PEAKING FACTOR, M =	1+(14/(4+P^0.5))
Ac = CUMULATIVE AREA (ha)	
P = POPULATION (THOUSANDS)	
SEWER CAPACITY, Qcap (l/s) =	1/N S^(1/2) R^(2/3) Ac
(MANNING'S EQUATION)	

UNIT TYPE	PERSONS/UNIT
SINGLE APT. UNIT	1.4
2-BED APT. UNIT	2.1
3-BED APT. UNIT	3.1

DESIGNED:	NO.	REVISION	DATE
Devang Maratha, P.Eng.	1.	Site Plan Control	2026-07-27
CHECKED:	2.		
Ishaque Jaffarjee, P.Eng.	3.		
PROJECT:			
430 Ottawa Street - PH 2			
LOCATION:			
Almonte, Ontario			
PAGE NO:	**FILE & DWG. REFERENCE:**		
1 of 1	Phase 2 Servicing Plan (C07 and C08)		

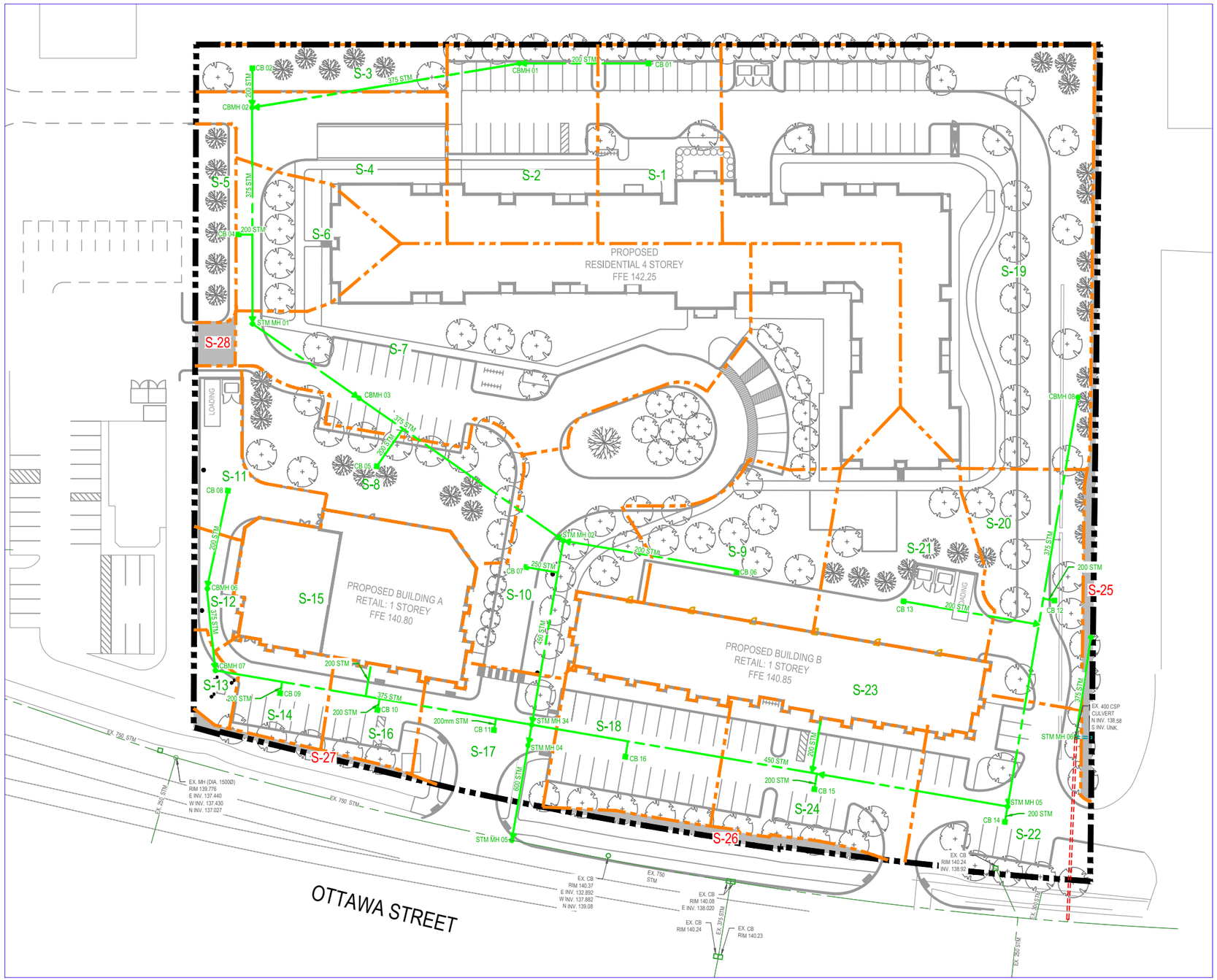
APPENDIX

E

STORMWATER MANAGEMENT

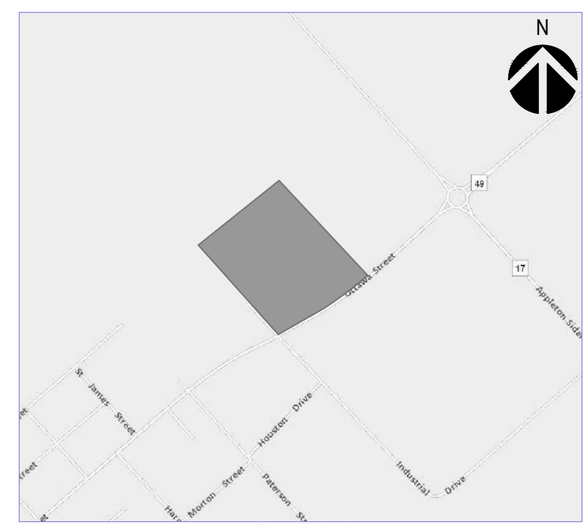
APPENDIX

FULL DEVELOPMENT STAGE STORMWATER MANAGEMENT



LEGEND

- DRAINAGE STUDY BOUNDARY LINE
- POST-DEVELOPMENT SUB-CATCHMENT SPLIT LINE
- PROPOSED STORM SEWER
- PROPOSED CULVERT
- EXISTING CULVERT
- PROPOSED MH / CB
- S-25 UNCONTROLLED SUB-CATCHMENT ID
- S-25 CONTROLLED SUB-CATCHMENT ID



KEY PLAN

wsp
2011 QUEENSVIEW DRIVE
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CANADA K2B 8K2
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430 OTTAWA STREET
POST-DEVELOPMENT DRAINAGE PLAN

SCALE:	DATE:	SKETCH No.
1:400	MARCH 27, 2023	SKETCH 1

STORM SEWER CALCULATION SPREADSHEET

Job Name: 430 Ottawa Street - SPA
430 Ottawa Street, Almonte, ON
Job Number: 221-06853-00
Date: 13-Jul-2023

Design Storm: City of Ottawa 5 year Design Storm
Calculation Method: Rational Method

U/S MH	D/S MH	Catchment ID	Catchment Area (m^2)	Total Time (min)	Rainfall Intensity (mm/hr)	Peak Flow (m^3/s)	Pipe Diameter (mm)	Pipe Length (m)	Pipe Slope (%)	Manning's "n"	Capacity (m^3/s)	Velocity (m/s)	Travel Time (min)	Invert U/S MH (m)	Invert D/S MH (m)	Manhole Drop (m)	Ground U/S MH (m)	Cover U/S MH (m)	Q/Q full Ratio %
CB01	CBMH01	S-1	902	10.00	104.19	0.0188	200	24.8	1.00%	0.013	0.0328	1.04	0.40	139.360	139.112	0.18	141.35	1.99	57.4%
CBMH01	CBMH02	S-2	1098	10.40	102.15	0.0411	375	53.1	0.28%	0.013	0.0934	0.85	1.05	138.932	138.781	0.10	141.23	2.30	44.0%
CB2	CBMH02	S-3	435	10.00	104.19	0.0025	200	7.5	1.00%	0.013	0.0328	1.04	0.12	138.865	138.790	0.18	141.10	2.23	7.7%
CBMH02	Main 1	S-4	895	11.44	97.15	0.0617	375	24.3	0.29%	0.013	0.0944	0.85	0.47	138.681	138.610	0.00	140.24	1.56	65.3%
CB 03	CB 04	S-5	292	10.00	104.19	0.0017	200	4.0	1.00%	0.013	0.0328	1.04	0.06	138.700	138.660	0.02	140.10	1.40	5.2%
CB 04	Main 1	S-6	631	10.06	103.86	0.0099	200	3.0	1.00%	0.013	0.0328	1.04	0.05	138.640	138.610	0.00	140.33	1.69	30.2%
Main 1	STM MH01			11.92	95.06	0.0694	375	17.1	0.29%	0.013	0.0944	0.85	0.33	138.610	138.561	0.02	140.39	1.78	73.5%
STM MH01	CBMH03			12.25	93.64	0.0684	375	25.3	0.28%	0.013	0.0928	0.84	0.50	138.541	138.470	0.02	140.30	1.76	73.7%
CBMH03	Main 2	S-7	2833	12.75	91.60	0.1192	450	10.2	0.27%	0.013	0.1484	0.93	0.18	138.450	138.422	0.00	140.25	1.80	80.3%
CB 05	Main 2	S-8	927	10.00	104.19	0.0054	200	8.6	1.00%	0.013	0.0328	1.04	0.14	138.808	138.722	0.30	140.15	1.34	16.4%
Main 2	STM MH02			12.93	90.89	0.1229	450	37.6	0.27%	0.013	0.1484	0.93	0.67	138.422	138.320	0.10	140.00	1.58	82.8%
CB 06	STM MH02	S-9	871	10.00	104.19	0.0127	200	33.7	1.00%	0.013	0.0328	1.04	0.54	138.887	138.550	0.33	140.54	1.65	38.8%
STM MH02	Main 3			13.60	88.35	0.1303	525	6.2	0.28%	0.013	0.2276	1.05	0.10	138.225	138.208	0.00	140.62	2.39	57.3%
CB07	Main 3	S-10	2751	10.00	104.19	0.0485	250	6.0	1.00%	0.013	0.0595	1.21	0.08	138.628	138.568	0.36	140.25	1.62	81.5%
Main 3	STM MH03			13.70	88.00	0.1707	525	29.6	0.28%	0.013	0.2276	1.05	0.47	138.208	138.125	0.08	140.40	2.19	75.0%
CB08	CBMH06	S-11	453	10.00	104.19	0.0100	200	19.2	1.00%	0.013	0.0328	1.04	0.31	138.942	138.750	0.18	140.25	1.31	30.5%
CBMH06	CBMH07	S-12	198	10.31	102.60	0.0136	375	15.7	0.32%	0.013	0.0992	0.90	0.29	138.570	138.520	0.02	140.25	1.68	13.7%
CBMH07	Main 4	S-13	108	10.60	101.14	0.0140	375	13.0	0.29%	0.013	0.0936	0.85	0.26	138.500	138.463	0.00	140.25	1.75	14.9%

CB 09	Main 4	S-14	463	10.00	104.19	0.0110	200	2.2	1.00%	0.013	0.0328	1.04	0.04	138.715	138.693	0.23	140.25	1.54	33.5%
Main 4	Main 5			10.60	101.14	0.0246	375	16.2	0.29%	0.013	0.0936	0.85	0.32	138.463	138.417	0.00	140.30	1.84	26.3%
Building A	Main 5	S-15	1164	10.00	104.19	0.0303	200	5.6	1.00%	0.013	0.0328	1.04	0.09	138.658	138.602	0.19	140.45	1.79	92.4%
Main 5	Main 6			10.92	99.59	0.0532	375	2.7	0.29%	0.013	0.0936	0.85	0.05	138.417	138.409	0.00	140.30	1.88	56.9%
CB 10	Main 6	S-16	350	10.00	104.19	0.0073	200	2.2	1.00%	0.013	0.0328	1.04	0.04	138.661	138.639	0.23	140.25	1.59	22.4%
Main 6	Main 7			10.97	99.34	0.0601	375	22.6	0.29%	0.013	0.0936	0.85	0.44	138.409	138.345	0.00	140.30	1.89	64.2%
CB 11	Main 7	S-17	606	10.00	104.19	0.0126	200	2.2	1.00%	0.013	0.0328	1.04	0.04	138.597	138.575	0.23	140.25	1.65	38.6%
Main 7	STM MH03			11.41	97.27	0.0707	375	22.6	0.29%	0.013	0.0936	0.85	0.44	138.345	138.280	0.23	140.30	1.96	75.5%
CBMH08	Main 8	S-19	4157	10.00	104.19	0.0689	450	39.1	0.28%	0.013	0.1506	0.95	0.69	138.696	138.587	0.00	140.25	1.55	45.7%
CB 12	Main 8	S-20	874	10.00	104.19	0.0142	200	2.2	1.00%	0.013	0.0328	1.04	0.04	138.909	138.887	0.30	140.30	1.39	43.4%
Main 8	Main 9			10.69	100.69	0.0803	450	5.0	0.28%	0.013	0.1506	0.95	0.09	138.587	138.573	0.00	140.40	1.81	53.3%
CB 13	Main 9	S-21	1091	10.00	104.19	0.0186	200	26.7	1.00%	0.013	0.0328	1.04	0.43	139.140	138.873	0.30	140.30	1.16	56.7%
Main 9	STM MH05			10.78	100.26	0.0979	450	38.3	0.28%	0.013	0.1506	0.95	0.67	138.573	138.466	0.08	140.40	1.83	65.0%
CB 14	STM MH05	S-22	997	10.00	104.19	0.0213	200	3.0	1.00%	0.013	0.0328	1.04	0.05	138.741	138.711	0.33	140.25	1.51	65.0%
STM MH05	Main 10			11.45	97.11	0.1147	525	37.0	0.28%	0.013	0.2284	1.05	0.58	138.386	138.281	0.00	140.40	2.01	50.2%
CB 15	Main 10	S-24	997	10.00	104.19	0.0218	200	3.0	1.00%	0.013	0.0328	1.04	0.05	138.671	138.641	0.36	140.30	1.63	66.5%
Building B	Main 10	S-23	1200	10.00	104.19	0.0313	200	10.0	1.00%	0.013	0.0328	1.04	0.16	138.631	138.531	0.25	140.60	1.97	95.3%
Main 10	Main 11			12.03	94.55	0.1598	525	36.7	0.28%	0.013	0.2284	1.05	0.58	138.281	138.178	0.00	140.40	2.12	70.0%
CB 16	Main 11	S-18	841	10.00	104.19	0.0186	200	3.0	1.00%	0.013	0.0328	1.04	0.05	138.538	138.508	0.33	140.30	1.76	56.8%
Main 11	STM MH03			12.61	92.15	0.1722	525	18.7	0.28%	0.013	0.2284	1.05	0.30	138.178	138.125	0.08	140.40	2.22	75.4%
STM MH03	STM MH04			14.17	86.33	0.3915	600	4.0	0.50%	0.013	0.4342	1.54	0.04	138.050	138.030	0.02	140.25	2.20	90.2%
STM MH04	EX STM MH			14.22	86.18	0.3908	600	17.1	0.44%	0.013	0.4073	1.44	0.20	138.010	137.935	0.08	140.55	2.54	96.0%
														ex 750 conc	137.785				

APPENDIX

PHASE 1 DEVELOPMENT STORMWATER MANAGEMENT

STORM SEWER DESIGN SHEET

430 Ottawa Street - Phase 1
430 Ottawa Street, Almonte, ON
Project: CA0071569.1696
Date: June 2026

LOCATION				AREA (Ha)						RATIONAL DESIGN FLOW												PROPSOED SEWER DATA								
STREET	AREA ID	FROM	TO	C= 0.20	C= 0.35	C= 0.40	C= 0.70	C= 0.80	C= 0.90	IND 2.78AC	CUM 2.78 AC	INLET (min)	TOTAL (min)	i (2) (mm/hr)	i (5) (mm/hr)	i (100) (mm/hr)	2yr PEAK FLOW (L/s)	5yr PEAK FLOW (L/s)	100yr PEAK FLOW (L/s)	CONTROLLED FLOW (L/s)	DESIGN FLOW (L/s)	MATERIAL PIPE	SIZE (mm)	SLOPE (%)	LENGTH (m)	CAPACITY (l/s)	VELOCITY (m/s)	TIME IN PIPE	AVAIL CAP (5yr) (L/s)	(%)
POST-DEVELOPMENT																														
	S11	CB08	CBMH 06	0.009					0.036	0.096	0.096	10.00	10.31	76.81	104.19	178.56		10.00			10.00	PVC DR-35	200	1.00	19.20	32.83	1.04	0.31	22.83	69.53%
	S12	CBMH 06	CBMH 07	0.007					0.013	0.036	0.132	10.31	10.74	75.65	102.60	175.80		13.58			13.58	PVC DR-35	375	0.25	20.60	87.75	0.79	0.43	74.18	84.53%
	S13 - S17	CBMH 07	STM MH 03A	0.040					0.229	0.595	0.727	10.74	11.77	74.08	100.44	172.07		73.02			73.02	PVC DR-35	375	0.35	58.00	103.83	0.94	1.03	30.81	29.67%
		STM MH 03A	STM MH 03							0.000	0.727	11.77	11.82	70.62	95.70	163.86		69.57			69.57	PVC DR-35	375	0.35	2.80	103.83	0.94	0.05	34.26	33.00%
	S10	STM MH 02	STM MH 03	0.115					0.161	0.465	0.465	10.00	10.56	76.81	104.19	178.56		48.50			48.50	CONC. STM	525	0.28	35.60	227.80	1.05	0.56	179.30	78.71%
		STM MH 03	STM MH 05	0.000					0.000	0.000	1.192	11.82	12.04	70.46	95.48	163.49		113.86			113.86	CONC. STM	600	0.54	21.10	451.66	1.60	0.22	337.80	74.79%

Definition:
Q=2.78CiA, where:
Q = Peak Flow in Litres per Second (L/s)
A = Area in Hectares (Ha)
i = Rainfall Intensity in millimeters per hour (mm/hr)
i = 732.951/(TC+6.199)^0.810 — 2 Year
i = 1174.184/(TC+6.014)^0.816 — 5 Year
i = 1735.688/(TC+6.014)^0.820 — 100 Year

Notes:
1. Mannings coefficient (n) = 0.013

Time-of-Concentration in the Swale
FAA Equation: t (min) = 3.258 [(1.1 - C) L^0.5 / S^.33]
Where: Longest Watercourse Length, L (m). S (%)

No.	L (m)	S %	C	Tc (min)
1				#DIV/0!
2				#DIV/0!
3				#DIV/0!
4				#DIV/0!

Designed: D.M.
Checked: I.J.
Dwg. Reference: C04

No.	Revision	Date
1.	Issued for SPA	2026-06-10

File Reference:	Date:	Sheet No:
	2026-06-09	1 of 1

430 Ottawa Street - Phase 1
430 Ottawa Street, Almonte, ON
Project: CA0071569.1696
Date: June 2026

TABLE 2 - Controlled Flows (Phase 1)

Post Dev run-off Coefficient "C"

			2 & 5 Year Event		100 Year Event	
Area	Surface	Ha	"C"	C_{avg}	"C" x 1.25	$C_{100\ avg}$
Total	Roof	0.120	0.90		1.00	
0.343	Asphalt	0.182	0.90	**0.82**	1.00	**0.91**
	Grass	0.041	0.20		0.25	

*Areas are approximate based on Architectural site plan and Storm Drainage Area Plan

Runoff Coefficient Equation
$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{tot}$
$*C = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{tot}$

*Runoff coefficients increased by 25% up to a maximum value of 1.0 for the 100-Year event

QUANTITY STORAGE REQUIREMENTS - 5 Year

0.343 = Area(ha)
0.82 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Controlled Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3	Storage Avail m^3
	20	70.25	54.93	13.37	41.56	49.87	153.20
	25	60.90	47.61	13.37	34.25	51.37	153.20
	30	**53.93**	**42.17**	**13.37**	**28.80**	**51.84**	**153.20**
5 YEAR	35	48.52	37.94	13.37	24.57	51.59	153.20
	40	44.18	34.55	13.37	21.18	50.83	153.20
	45	40.63	31.77	13.37	18.40	49.68	153.20

QUANTITY STORAGE REQUIREMENTS - 100 Year

0.343 = Area(ha)
0.91 = *C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Controlled Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3	Storage Avail m^3
	50	63.95	55.49	13.71	41.78	125.35	153.20
	55	**59.62**	**51.74**	**13.71**	**38.02**	**125.48**	**153.20**
100 YEAR	60	55.89	48.50	13.71	34.79	125.24	153.20
	65	52.65	45.68	13.71	31.97	124.68	153.20
	70	49.79	43.20	13.71	29.49	123.86	153.20
	75	47.26	41.00	13.71	27.29	122.82	153.20
	80	44.99	39.04	13.71	25.33	121.57	153.20

Orifice #1 Sizing

CB01

Event	Flow (L/s)	Head (m)	ORIFICE AREA(m^2)	SQUARE (1-side mm)	CIRC (mmØ)
5 Year	13.37	2.30	0.003	58	65
100 Year	13.71	2.42	0.003	58	65

Orifice Control Sizing
Q = 0.6 x A x (2gh)1/2
Where:
Q is the release rate in m^3/s
A is the orifice area in m^2
g is the acceleration due to gravity, $9.81 m/s^2$
h is the head of water above the orifice centre in m
d is the diameter of the orifice in m

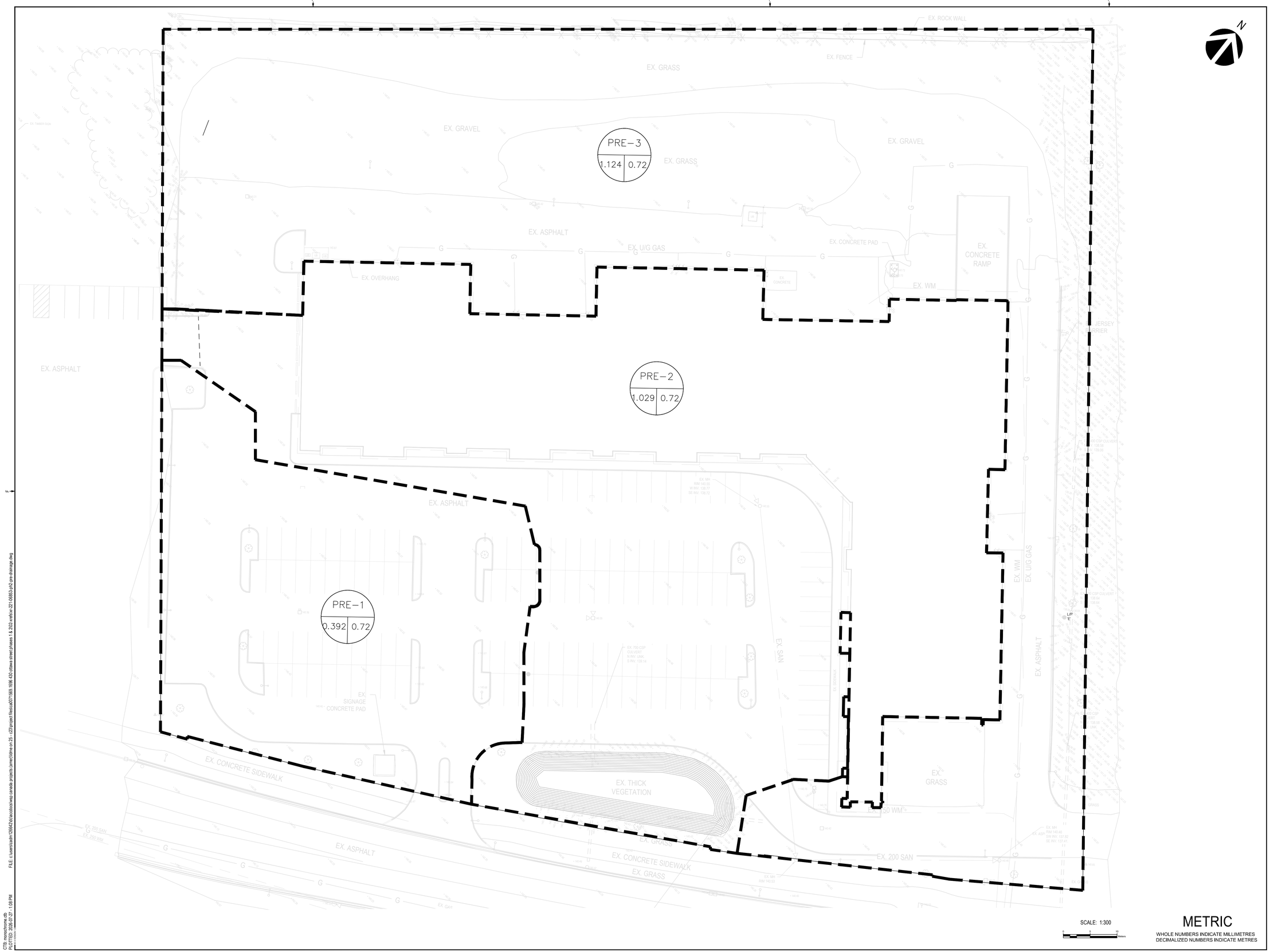
Orifice Invert =	138.050	m
Ponding Elevation =	140.500	m
Top of CB Elevation =	140.380	m

Equations:

Flow Equation
Q = 2.78 x C x I x A
Where:
C is the runoff coefficient
I is the intensity of rainfall, City of Ottawa IDF
A is the total drainage area

APPENDIX

PHASE 2 DEVELOPMENT STORMWATER MANAGEMENT



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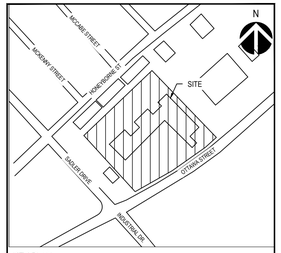
METRIC

WHOLE NUMBERS INDICATE MILLIMETRES
DECIMALIZED NUMBERS INDICATE METRES



KEY PLAN

REVISION:

REV	DATE	DESCRIPTION	BY
0	2026-07-27	ISSUED FOR SITE PLAN APPROVAL	I.J.

SEAL:

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DATE: 2026-07-27
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ASSISTED BY: --
DRAWN BY: D.M.
MODIFIED BY: I.J.
APPROVED BY: --

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2611 Queensview Drive, Suite 300 Ottawa, Ontario K2B 8K2
T 613-829-28-00| www.wsp.com

PROJECT NUMBER: 221-06853-00

CLIENT:

ELM DEVELOPMENTS

CLIENT REF. #: --

PROJECT:

430 OTTAWA STREET
ALMONTE, ONTARIO

TITLE:

PHASE 2
PRE-EXISTING
DRAINAGE AREA
PLAN

DRAWING NUMBER: C10
REV. 0

FILE: c:\users\cadm1264420\acccloud\wsp canada projects (amer)\drive on 25 - c25\project files\cad\071569 1696 430 ottawa street phases 1 & 2\02-workflow 221-06853-p02-pre-drainage.dwg
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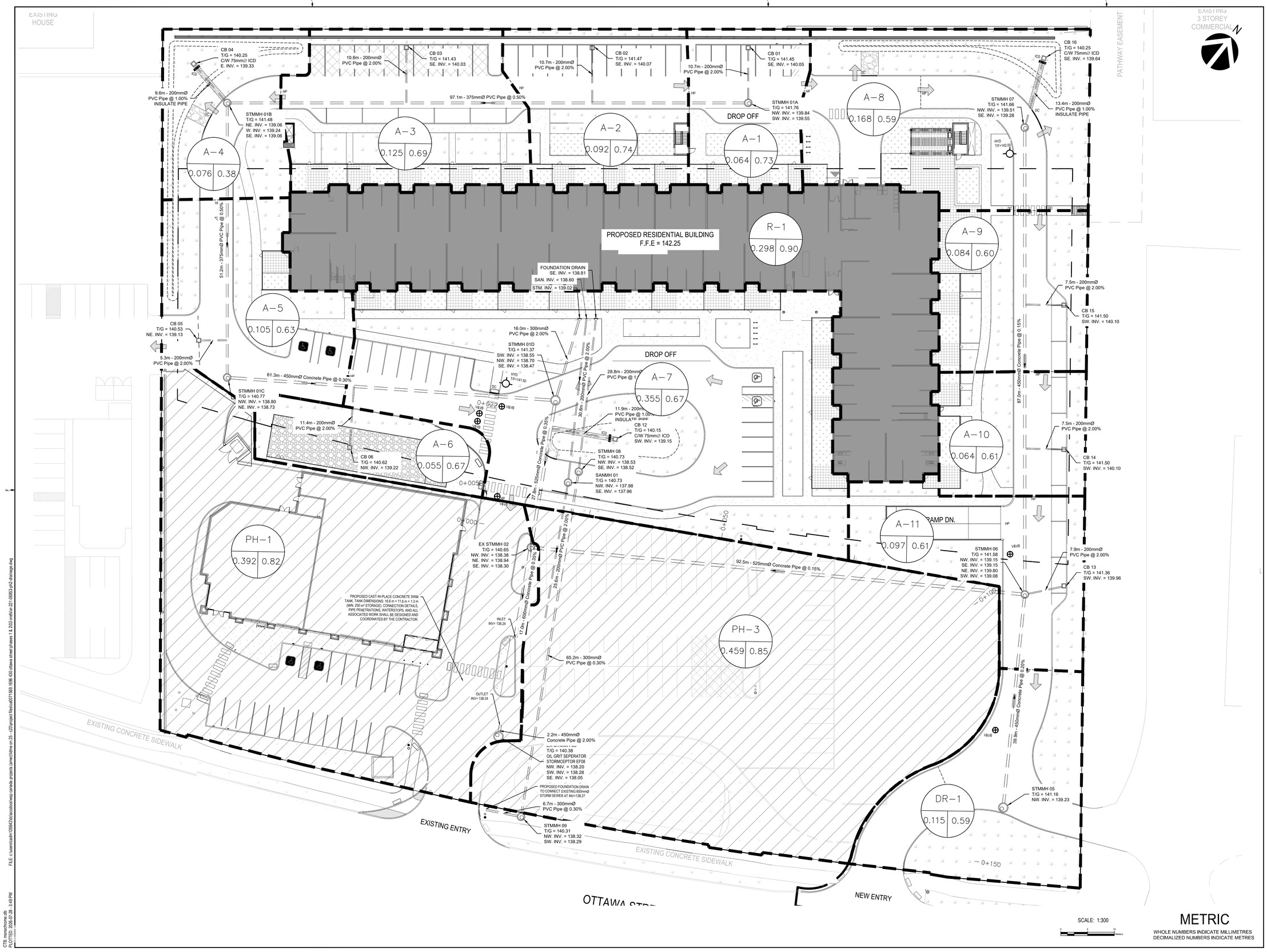

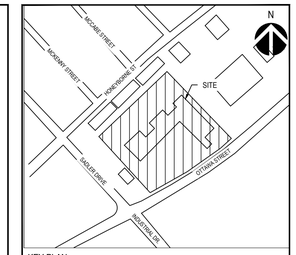

KEY PLAN

REVISION:

REV	DATE	DESCRIPTION	BY
0	2026-07-27	ISSUED FOR SITE PLAN APPROVAL	I.J.

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PROJECT NUMBER: 221-06853-00

CLIENT:
ELM DEVELOPMENTS

CLIENT REF. #: --

PROJECT:
430 OTTAWA STREET
ALMONTE, ONTARIO

TITLE:
PHASE 2
DRAINAGE AREA
PLAN

DRAWING NUMBER: C11
REV: 0

CTB: mpostnone.ctb
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STORM SEWER DESIGN SHEET

430 Ottawa Street - Phase 2
430 Ottawa Street, Almonte, ON
Project: CA0071569.1696
Date: July 2026

LOCATION				AREA (Ha)						RATIONAL DESIGN FLOW												PROPSOED SEWER DATA								
STREET	AREA ID	FROM	TO	C= 0.20	C= 0.35	C= 0.40	C= 0.70	C= 0.80	C= 0.90	IND 2.78AC	CUM 2.78 AC	INLET (min)	TOTAL (min)	i (2) (mm/hr)	i (5) (mm/hr)	i (100) (mm/hr)	2yr PEAK FLOW (L/s)	5yr PEAK FLOW (L/s)	100yr PEAK FLOW (L/s)	CONTROLLED FLOW (L/s)	DESIGN FLOW (L/s)	MATERIAL PIPE	SIZE (mm)	SLOPE (%)	LENGTH (m)	CAPACITY (l/s)	VELOCITY (m/s)	TIME IN PIPE	AVAIL CAP (5yr) (L/s)	AVAIL CAP (5yr) (%)
POST-DEVELOPMENT																														
	A-1 to A-3	STMMH 01A	STMMH 01B	0.075					0.207	0.559	0.559	10.00	11.44	76.81	104.19	178.56		58.25			58.25	PVC DR-35	375	0.50	97.10	124.10	1.12	1.44	65.85	53.06%
	A-4 to A-5	STMMH 01B	STMMH 01C	0.097					0.085	0.265	0.824	11.44	12.20	71.68	97.15	166.37		80.07			80.07	PVC DR-35	375	0.50	51.20	124.10	1.12	0.76	44.04	35.48%
	A-6	STMMH 01C	STMMH 01D	0.018					0.037	0.103	0.927	12.20	13.24	69.27	93.84	160.66		86.97			86.97	CONC. STM	450	0.30	61.30	156.32	0.98	1.04	69.35	44.36%
	R-1	Building	STMMH 01D	0.000					0.298	0.746	0.746	10.00	10.14	76.81	104.19	178.56		77.69			77.69	PVC DR-35	300	2.00	16.00	136.89	1.93	0.14	59.21	43.25%
	A-7	STMMH 01D	EX STMMH 02	0.115					0.241	0.665	2.338	10.14	13.24	76.28	103.47	177.31		241.89			241.89	CONC. STM	525	0.35	27.80	254.69	1.18	0.39	12.80	5.03%
	A-8 to A-10	STMMH 07	STMMH 06	0.138					0.178	0.523	0.523	12.09	14.18	69.62	94.32	161.48		49.32			49.32	CONC. STM	450	0.15	87.00	110.53	0.69	2.09	61.22	55.38%
	PH-3	STMMH 05	STMMH 06	0.033					0.426	1.085	1.085	14.18	15.01	63.78	86.31	147.65		93.62			93.62	CONC. STM	450	0.20	39.90	127.63	0.80	0.83	34.02	26.65%
	A-11	STMMH 06	EX STMMH 02	0.041					0.056	0.163	1.771	15.01	17.01	61.75	83.54	142.86		147.92			147.92	CONC. STM	525	0.15	92.50	166.73	0.77	2.00	18.81	11.28%
		EX STMMH 02	SWM TANK	0.115					0.161	0.467	4.575	17.01	17.23	57.40	77.58	132.58		354.94			354.94	CONC. STM	600	0.35	17.00	363.62	1.28	0.22	8.68	2.39%
		SWM TANK	EX STMMH 03							0.000	4.575	17.23	17.25	56.96	76.98	131.55		352.21			352.21	CONC. STM	450	2.00	2.20	403.61	2.54	0.01	51.40	12.74%
		Foundation Drain	STMMH 08																		7.00	PVC DR-35	200	1.00	28.80	32.83	1.04	0.46	25.83	78.68%
		STMMH 08	STMMH 09																		7.00	PVC DR-35	300	0.30	65.20	53.02	0.75	1.45	46.02	86.80%
		STMMH 09	EX STMMH 04																		7.00	PVC DR-35	300	0.30	6.70	53.02	0.75	0.15	46.02	86.80%

Definition:
Q=2.78CiA, where:
Q = Peak Flow in Litres per Second (L/s)
A = Area in Hectares (Ha)
i = Rainfall Intensity in millimeters per hour (mm/hr)
i = 732.951/(TC+6.199)^0.810 — 2 Year
i = 1174.184/(TC+6.014)^0.816 — 5 Year
i = 1735.688/(TC+6.014)^0.820 — 100 Year

Notes:
1. Mannings coefficient (n) = 0.013

Time-of-Concentration in the Swale
FAA Equation: t (min) = 3.258 [(1.1 - C) L^0.5 / S^.33]
Where: Longest Watercourse Length, L (m). S (%)

No.	L (m)	S %	C	Tc (min)
1				#DIV/0!
2				#DIV/0!
3				#DIV/0!
4				#DIV/0!

Designed: D.M.
Checked: I.J.
Dwg. Reference: C04

No.	Revision	Date
1.	Issued for SPA (Phase 2)	2026-07-27

File Reference:	Date:	Sheet No:
Phase 2 (Drawing C07 and C08)	2026-07-27	1 of 1

PRE-DEVELOPMENT STAGE STORAGE

wsp	Project: 430 Ottawa Street	No: CA0071569.1696
	By: Devang Maratha	Date: July 27th, 2026
	Checked: Jared Delpellaro	

Subject: Stormwater Management - Pre-Development Stage Storage Calculations

Existing Pond - Stage Stoage		
ELEVATION	AREA (SQ M)	CUMULATIVE STORAGE (CU M)
139.2	165.65	0
139.3	187.97	17.68
139.4	210.86	37.62
139.5	234.32	59.88
139.6	258.33	84.51
139.7	282.92	111.58
139.8	308.07	141.13
139.9	333.78	173.22
140	360.05	207.91
140.1	386.89	245.26
140.2	414.3	285.32
140.3	442.28	328.15
140.4	470.96	373.81

CB10 - Stage Stoage		
ELEVATION	AREA (SQ M)	CUMULATIVE STORAGE (CU M)
138.58	0	0
138.7	0.84	0.05
138.75	5.77	0.17
138.8	10.05	0.56
138.85	14.27	1.17
138.9	18.48	1.54
138.95	27.41	1.58
139	37.82	1.68
139.05	48.82	1.87
139.1	60.28	2.45
139.15	72.51	3.15
139.2	85.68	4
139.25	100.59	5.12
139.3	116.29	7.47
139.35	134.35	8.71
139.4	148.11	11.59
139.45	163.44	14.74
139.5	178.5	18.15
139.55	193.33	21.82
139.6	207.97	25.75
139.65	222.44	29.92
139.7	236.62	34.33
139.75	250.67	38.98
139.8	264.99	43.87
139.85	279.69	48.99
139.9	294.83	54.37
139.95	310.42	59.99
140	326.81	62.89
140.05	343.69	65.95
140.1	362.85	74.98
140.15	378	84.46

140.2	402.14	94.52
140.25	434.8	105.41
140.3	460.29	116.92
140.35	492.98	145.52

POST-DEVELOPMENT STAGE STORAGE

wsp	Project: 430 Ottawa Street	No: CA0071569.1696
	By: Devang Maratha	Date: July 27th, 2026
	Checked: Jared Delpellaro	

Subject: Stormwater Management - Phase I Post-Development Stage Storage Calculations

CB09 - Stage Stoage		
ELEVATION	AREA (SQ M)	CUMULATIVE STORAGE (CU M)
140.25	0	0
140.3	14.14	0
140.35	100.6	2.54
140.4	225.5	10.49
140.45	305.45	23.71
140.5	349.21	40.06

CB10 - Stage Stoage		
ELEVATION	AREA (SQ M)	CUMULATIVE STORAGE (CU M)
140.25	0.8	0
140.3	19.99	0.42
140.35	80.02	2.92
140.4	156.94	8.84
140.45	226.9	18.44
140.5	278.44	31.07

CB11 - Stage Stoage		
ELEVATION	AREA (SQ M)	CUMULATIVE STORAGE (CU M)
140.25	0.74	0
140.3	18.61	0.39
140.35	74.48	2.71
140.4	167.6	8.77
140.45	275.34	19.84
140.5	363.11	35.8

CB12 - Stage Stoage		
ELEVATION	AREA (SQ M)	CUMULATIVE STORAGE (CU M)
140.25	0.83	0
140.3	20.73	0.43
140.35	74.3	2.81
140.4	137.03	8.09
140.45	193.83	16.36
140.5	262.87	27.78

CB08 - Stage Stoage		
ELEVATION	AREA (SQ M)	CUMULATIVE STORAGE (CU M)
140.3	0.78	0
140.35	19.5	0.41
140.4	65.9	2.54
140.45	128.4	7.4
140.5	200.01	15.61

	CBMH06 - Stage Stoage		
	ELEVATION	AREA (SQ M)	CUMULATIVE STORAGE (CU M)
	140.3	0.28	0
	140.35	7.19	0.15
	140.4	28.8	1.05
	140.45	56.11	3.17
	140.5	8320	6.66
	Total Phase I Parking Lot Pnding		
	ELEVATION	AREA (SQ M)	CUMULATIVE STORAGE (CU M)
	140.25	2.37	0
	140.3	74.53	1.24
	140.35	356.09	11.54
	140.4	781.77	39.78
	140.45	1186.03	88.92
	140.5	9773.64	156.98

wsp	Project: 430 Ottawa Street	No: CA0071569.1696
	By: Devang Maratha	Date: July 27th, 2026
	Checked: Jared Delpellaro	

Subject: Stormwater Management - Phase II Post-Development Stage Storage Calculations

CB12 (A-7) - Stage Stoage		
ELEVATION	AREA (SQ M)	CUMULATIVE STORAGE (CU M)
140.15	96.76	0
140.2	132.87	5.74
140.25	141.23	12.59
140.3	149.73	19.87
140.35	158.37	27.57
140.4	167.16	35.71
140.45	176.09	44.29
140.5	185.15	53.32
140.55	194.37	62.81

CB04 (A-4) - Stage Stoage		
ELEVATION	AREA (SQ M)	CUMULATIVE STORAGE (CU M)
140.25	99.96	0
140.3	119.8	5.49
140.35	139.47	11.98
140.4	159.22	19.44
140.45	179.1	27.9
140.5	199.08	37.36
140.55	235.96	48.23

CB16 (A-8) - Stage Stoage		
ELEVATION	AREA (SQ M)	CUMULATIVE STORAGE (CU M)
140.25	49.7	0
140.3	63.4	2.82
140.35	77.06	6.34
140.4	90.83	10.54
140.45	104.73	15.43
140.5	118.73	21.01
140.55	132.83	27.3

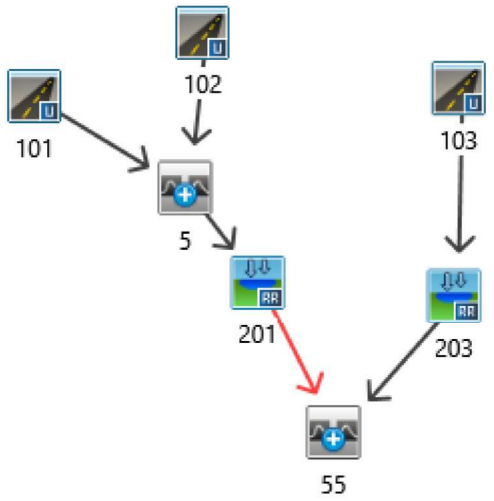
VISUAL OTTHYMO PARAMETERS AND RESULTS

WSP PROJECT: CA0071569.1696
DATE: 2026-07-27

Summary of Existing Conditions Hydrologic Modelling Parameters

230 Ottawa Street - Almonte

Sub-Catchment ID	IUH Class	Drainage Area (ha)	Imperviousness (%)					SCS Curve Number	Initial Abstraction (mm)		Manning's 'n'		Time to Peak (hours)	Number of Linear Reservoirs	Flow Length (m)		Slope (%)		CN AMC II
			Direct	+	Indirect	=	Total		Pervious	Impervious	Pervious	Impervious			Pervious	Impervious	Pervious	Impervious	
		Area	XIMP				TIMP	CN	IA	DPSI	MNP	MNI	TP	N	LGP	LGI	SLPP	SLPI	
PH-1	Standard	0.392	93	+	0	=	92.7	86	5.0	2.0	0.25	0.013	n/a	n/a	40	51.12	2.0	1.0	86.0
PH-3	Standard	0.459	80	+	0	=	80.0	92	4.0	2.0	0.25	0.013	n/a	n/a	40	55.32	2.0	1.0	92.0
R-1	Standard	0.298	100	+	0	=	99.8	92	4.0	2.0	0.25	0.013	n/a	n/a	40	44.57	2.0	1.0	92.0
A-1	Standard	0.064	100	+	0	=	99.8	92	4.0	2.0	0.25	0.013	n/a	n/a	40	20.66	2.0	1.0	92.0
A-2	Standard	0.092	100	+	0	=	99.8	92	4.0	2.0	0.25	0.013	n/a	n/a	40	24.77	2.0	1.0	92.0
A-3	Standard	0.125	100	+	0	=	99.8	92	4.0	2.0	0.25	0.013	n/a	n/a	40	28.87	2.0	1.0	92.0
A-4	Standard	0.076	42	+	0	=	41.8	86	5.0	2.0	0.25	0.013	n/a	n/a	40	22.51	2.0	1.0	86.0
A-5	Standard	0.105	65	+	0	=	65.2	86	5.0	2.0	0.25	0.013	n/a	n/a	40	26.46	2.0	1.0	86.0
A-6	Standard	0.055	68	+	0	=	68.3	86	5.0	2.0	0.25	0.013	n/a	n/a	40	19.15	2.0	1.0	86.0
A-7	Standard	0.355	80	+	0	=	80.4	86	5.0	2.0	0.25	0.013	n/a	n/a	40	48.65	2.0	1.0	86.0
A-8	Standard	0.168	56	+	0	=	56.3	86	5.0	2.0	0.25	0.013	n/a	n/a	40	33.47	2.0	1.0	86.0
A-9	Standard	0.084	60	+	0	=	60.3	86	5.0	2.0	0.25	0.013	n/a	n/a	40	23.66	2.0	1.0	86.0
A-10	Standard	0.064	62	+	0	=	62.0	86	5.0	2.0	0.25	0.013	n/a	n/a	40	20.66	2.0	1.0	86.0
A-11	Standard	0.097	80	+	0	=	80.3	86	5.0	2.0	0.25	0.013	n/a	n/a	40	25.43	2.0	1.0	86.0
DR-1	Standard	0.115	55	+	0	=	54.9	86	5.0	2.0	0.25	0.013	n/a	n/a	40	27.69	2.0	1.0	86.0
PRE-2	Standard	1.029	93	+	0	=	92.8	86	5.0	2.0	0.25	0.013	n/a	n/a	40	82.83	2.0	1.0	86.0
PRE-3	Standard	1.124	67	+	0	=	66.6	87	4.9	2.0	0.25	0.013	n/a	n/a	40	86.58	2.0	1.0	87.0
PRE-1	Standard	0.39	90	+	0	=	89.6	86	5.0	2.0	0.25	0.013	n/a	n/a	40	51.12	2.0	1.0	86.0
Total/Ave		**5.09**	**0**	**+**	**0**	**=**	**81**	**86**	**5.00**										



PRE-DEVELOPMENT VISUAL OTTHYMO RESULTS

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        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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5-YEAR PREDEVELOPMENT

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DATE: 07-24-2026                          TIME: 08:54:04

USER:



COMMENTS: ____________________________________________________________


------------------------------------------------------------------------------------------------------------
  ************************************************
  ** SIMULATION : 3-hour Chicago Design Storm 5 **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 998.071
| Ptotal= 42.51 mm |                          B=   6.053
--------------------                          C=   0.814
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  3.00 hrs
                       Storm time step    = 10.00 min
                       Time to peak ratio =  0.33

                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    3.68 |  0.83  104.19 |  1.67    6.69 |  2.50    3.51
                 0.17    4.58 |  1.00   32.04 |  1.83    5.63 |  2.67    3.22
                 0.33    6.15 |  1.17   16.34 |  2.00    4.87 |  2.83    2.98
                 0.50    9.61 |  1.33   10.96 |  2.17    4.30 |
                 0.67   24.17 |  1.50    8.29 |  2.33    3.86 |


-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0102)|   Area    (ha)=   1.03
|ID= 1 DT= 5.0 min |   Total Imp(%)=  93.00   Dir. Conn.(%)=  93.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.96         0.07
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      82.83        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    3.68 | 0.833   24.17 | 1.583    8.29 |  2.33    4.30
                0.167    3.68 | 0.917  104.19 | 1.667    8.29 |  2.42    3.86
                0.250    4.58 | 1.000  104.19 | 1.750    6.69 |  2.50    3.86
                0.333    4.58 | 1.083   32.04 | 1.833    6.69 |  2.58    3.51
                0.417    6.15 | 1.167   32.04 | 1.917    5.63 |  2.67    3.51
                0.500    6.15 | 1.250   16.34 | 2.000    5.63 |  2.75    3.22
                0.583    9.61 | 1.333   16.34 | 2.083    4.87 |  2.83    3.22
```

```
                0.667    9.61 | 1.417   10.96 | 2.167    4.87 |  2.92    2.98
                0.750   24.17 | 1.500   10.96 | 2.250    4.30 |  3.00    2.98

     Max.Eff.Inten.(mm/hr)=     104.19        39.19
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       2.24 (ii)    4.71 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.30         0.22
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.27         0.01          0.282 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.00           1.00
     RUNOFF VOLUME    (mm)=      40.51        17.84          38.93
     TOTAL RAINFALL   (mm)=      42.51        42.51          42.51
     RUNOFF COEFFICIENT   =       0.95         0.42           0.92

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  86.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0101)|   Area    (ha)=   0.39
|ID= 1 DT= 5.0 min |   Total Imp(%)=   7.00   Dir. Conn.(%)=   7.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.03         0.36
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      50.99        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    3.68 | 0.833   24.17 | 1.583    8.29 |  2.33    4.30
                0.167    3.68 | 0.917  104.19 | 1.667    8.29 |  2.42    3.86
                0.250    4.58 | 1.000  104.19 | 1.750    6.69 |  2.50    3.86
                0.333    4.58 | 1.083   32.04 | 1.833    6.69 |  2.58    3.51
                0.417    6.15 | 1.167   32.04 | 1.917    5.63 |  2.67    3.51
                0.500    6.15 | 1.250   16.34 | 2.000    5.63 |  2.75    3.22
                0.583    9.61 | 1.333   16.34 | 2.083    4.87 |  2.83    3.22
                0.667    9.61 | 1.417   10.96 | 2.167    4.87 |  2.92    2.98
                0.750   24.17 | 1.500   10.96 | 2.250    4.30 |  3.00    2.98

     Max.Eff.Inten.(mm/hr)=     104.19        32.22
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       1.68 (ii)   12.78 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.32         0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.02          0.024 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.17           1.17
     RUNOFF VOLUME    (mm)=      40.51        17.85          19.41
     TOTAL RAINFALL   (mm)=      42.51        42.51          42.51
     RUNOFF COEFFICIENT   =       0.95         0.42           0.46

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  86.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0005)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0101):     0.39   0.024     1.17    19.41
      + ID2= 2 (  0102):     1.03   0.282     1.00    38.93
        ==================================================
        ID = 3 (  0005):     1.42   0.300     1.00    33.56
```

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     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0201)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1540      0.0208
                          0.0427     0.0038   |   0.1761      0.0285
                          0.0955     0.0084   |   0.1957      0.0374
                          0.1281     0.0141   |   0.0000      0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0005)      1.419      0.300      1.00      33.56
   OUTFLOW: ID= 1 (  0201)      1.419      0.131      1.08      33.55

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 43.68
                   TIME SHIFT OF PEAK FLOW         (min)=  5.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0148

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0103)|   Area    (ha)=   1.12
|ID= 1 DT= 5.0 min |   Total Imp(%)=  66.00   Dir. Conn.(%)=  66.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.74         0.38
     Dep. Storage     (mm)=       2.00         4.90
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      86.56        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                                ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    3.68 | 0.833   24.17 | 1.583    8.29 |  2.33    4.30
                0.167    3.68 | 0.917  104.19 | 1.667    8.29 |  2.42    3.86
                0.250    4.58 | 1.000  104.19 | 1.750    6.69 |  2.50    3.86
                0.333    4.58 | 1.083   32.04 | 1.833    6.69 |  2.58    3.51
                0.417    6.15 | 1.167   32.04 | 1.917    5.63 |  2.67    3.51
                0.500    6.15 | 1.250   16.34 | 2.000    5.63 |  2.75    3.22
                0.583    9.61 | 1.333   16.34 | 2.083    4.87 |  2.83    3.22
                0.667    9.61 | 1.417   10.96 | 2.167    4.87 |  2.92    2.98
                0.750   24.17 | 1.500   10.96 | 2.250    4.30 |  3.00    2.98

     Max.Eff.Inten.(mm/hr)=     104.19        34.17
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       2.30 (ii)   13.15 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.30         0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.21         0.02        0.223 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.17         1.00
     RUNOFF VOLUME    (mm)=      40.51        18.72        33.10
     TOTAL RAINFALL   (mm)=      42.51        42.51        42.51
     RUNOFF COEFFICIENT   =       0.95         0.44         0.78

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  87.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0203)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.3037      0.0026
                          0.0759     0.0001   |   0.3479      0.0049
                          0.1860     0.0002   |   0.3871      0.0075
                          0.2518     0.0009   |   0.4234      0.0146

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
```

```
   INFLOW : ID= 2 (  0103)      1.124      0.223      1.00      33.10
   OUTFLOW: ID= 1 (  0203)      1.124      0.215      1.00      33.10

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 96.49
                    TIME SHIFT OF PEAK FLOW         (min)=  0.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0006

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0055)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):     1.42   0.131     1.08    33.55
      + ID2= 2 (  0203):     1.12   0.215     1.00    33.10
        ===================================================
        ID = 3 (  0055):     2.54   0.332     1.00    33.35

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
```

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==========================================================================================================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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```

100-YEAR PRE-DEVELOPMENT

```
                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\CAJD070997\AppData\Local\Civica\VH5\da7fca0c-17d2-4ed8-9508-57013b4c55d5\e9ac1cc9
  Summary filename: C:\Users\CAJD070997\AppData\Local\Civica\VH5\da7fca0c-17d2-4ed8-9508-57013b4c55d5\e9ac1cc9


DATE: 07-24-2026                          TIME: 08:54:04

USER:



COMMENTS: ____________________________________________________________


----------------------------------------------------------------------------------------------------------
  ************************************************
  ** SIMULATION : 3-hour Chicago Design Storm 1 **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1735.688
| Ptotal= 71.66 mm |                          B=   6.014
--------------------                          C=   0.820
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  3.00 hrs
                        Storm time step    = 10.00 min
                        Time to peak ratio =  0.33

                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    6.05 |  0.83  178.56 |  1.67   11.06 |  2.50    5.76
                 0.17    7.54 |  1.00   54.05 |  1.83    9.29 |  2.67    5.28
                 0.33   10.16 |  1.17   27.32 |  2.00    8.02 |  2.83    4.88
                 0.50   15.97 |  1.33   18.24 |  2.17    7.08 |
                 0.67   40.65 |  1.50   13.74 |  2.33    6.35 |


-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0102)|   Area    (ha)=   1.03
|ID= 1 DT= 5.0 min |   Total Imp(%)=  93.00   Dir. Conn.(%)=  93.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.96         0.07
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      82.83        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                            ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    6.05 | 0.833   40.65 | 1.583   13.74 |  2.33    7.08
                0.167    6.05 | 0.917  178.56 | 1.667   13.74 |  2.42    6.35
                0.250    7.54 | 1.000  178.56 | 1.750   11.06 |  2.50    6.35
                0.333    7.54 | 1.083   54.05 | 1.833   11.06 |  2.58    5.76
                0.417   10.16 | 1.167   54.05 | 1.917    9.29 |  2.67    5.76
                0.500   10.16 | 1.250   27.32 | 2.000    9.29 |  2.75    5.28
                0.583   15.97 | 1.333   27.32 | 2.083    8.02 |  2.83    5.28
```

```
                0.667   15.97 | 1.417   18.24 | 2.167    8.02 |  2.92    4.88
                0.750   40.65 | 1.500   18.24 | 2.250    7.08 |  3.00    4.88

     Max.Eff.Inten.(mm/hr)=     178.56       101.37
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       1.81 (ii)    3.80 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.32         0.25
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.47         0.02         0.494 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.00          1.00
     RUNOFF VOLUME    (mm)=      69.66        41.14         67.67
     TOTAL RAINFALL   (mm)=      71.66        71.66         71.66
     RUNOFF COEFFICIENT   =       0.97         0.57          0.94

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  86.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0101)|   Area    (ha)=   0.39
|ID= 1 DT= 5.0 min |   Total Imp(%)=   7.00   Dir. Conn.(%)=   7.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.03         0.36
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      50.99        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    6.05 | 0.833   40.65 | 1.583   13.74 |  2.33    7.08
                0.167    6.05 | 0.917  178.56 | 1.667   13.74 |  2.42    6.35
                0.250    7.54 | 1.000  178.56 | 1.750   11.06 |  2.50    6.35
                0.333    7.54 | 1.083   54.05 | 1.833   11.06 |  2.58    5.76
                0.417   10.16 | 1.167   54.05 | 1.917    9.29 |  2.67    5.76
                0.500   10.16 | 1.250   27.32 | 2.000    9.29 |  2.75    5.28
                0.583   15.97 | 1.333   27.32 | 2.083    8.02 |  2.83    5.28
                0.667   15.97 | 1.417   18.24 | 2.167    8.02 |  2.92    4.88
                0.750   40.65 | 1.500   18.24 | 2.250    7.08 |  3.00    4.88

     Max.Eff.Inten.(mm/hr)=     178.56       101.37
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.35 (ii)    8.37 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.33         0.12
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.07         0.074 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08          1.08
     RUNOFF VOLUME    (mm)=      69.66        41.14         43.12
     TOTAL RAINFALL   (mm)=      71.66        71.66         71.66
     RUNOFF COEFFICIENT   =       0.97         0.57          0.60

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  86.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0005)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0101):     0.39   0.074     1.08    43.12
      + ID2= 2 (  0102):     1.03   0.494     1.00    67.67
        ==================================================
        ID = 3 (  0005):     1.42   0.563     1.00    60.92
```

```
     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0201)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1540      0.0208
                          0.0427     0.0038   |   0.1761      0.0285
                          0.0955     0.0084   |   0.1957      0.0374
                          0.1281     0.0141   |   0.0000      0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0005)      1.419      0.563      1.00      60.92
   OUTFLOW: ID= 1 (  0201)      1.419      0.184      1.17      60.91

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 32.74
                   TIME SHIFT OF PEAK FLOW         (min)= 10.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0328

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0103)|   Area    (ha)=   1.12
|ID= 1 DT= 5.0 min |   Total Imp(%)=  66.00   Dir. Conn.(%)=  66.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.74         0.38
     Dep. Storage     (mm)=       2.00         4.90
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      86.56        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                                ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    6.05 | 0.833   40.65 | 1.583   13.74 |  2.33    7.08
                0.167    6.05 | 0.917  178.56 | 1.667   13.74 |  2.42    6.35
                0.250    7.54 | 1.000  178.56 | 1.750   11.06 |  2.50    6.35
                0.333    7.54 | 1.083   54.05 | 1.833   11.06 |  2.58    5.76
                0.417   10.16 | 1.167   54.05 | 1.917    9.29 |  2.67    5.76
                0.500   10.16 | 1.250   27.32 | 2.000    9.29 |  2.75    5.28
                0.583   15.97 | 1.333   27.32 | 2.083    8.02 |  2.83    5.28
                0.667   15.97 | 1.417   18.24 | 2.167    8.02 |  2.92    4.88
                0.750   40.65 | 1.500   18.24 | 2.250    7.08 |  3.00    4.88

     Max.Eff.Inten.(mm/hr)=     178.56       105.90
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.86 (ii)    6.15 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.32         0.15
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.37         0.09         0.439 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08          1.00
     RUNOFF VOLUME    (mm)=      69.66        42.57         60.45
     TOTAL RAINFALL   (mm)=      71.66        71.66         71.66
     RUNOFF COEFFICIENT   =       0.97         0.59          0.84

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  87.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0203)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.3037      0.0026
                          0.0759     0.0001   |   0.3479      0.0049
                          0.1860     0.0002   |   0.3871      0.0075
                          0.2518     0.0009   |   0.4234      0.0146

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
```

```
   INFLOW : ID= 2 (  0103)      1.124      0.439      1.00      60.45
   OUTFLOW: ID= 1 (  0203)      1.124      0.342      1.00      60.45

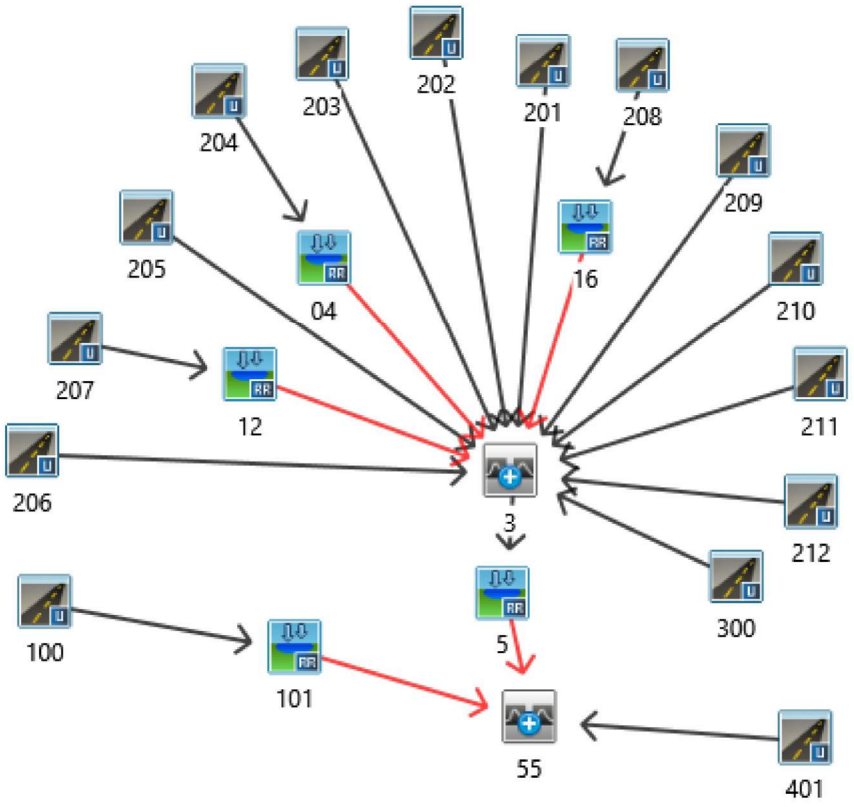
                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 77.87
                    TIME SHIFT OF PEAK FLOW         (min)=  0.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0060

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0055)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):     1.42   0.184     1.17    60.91
      + ID2= 2 (  0203):     1.12   0.342     1.00    60.45
        ====================================================
        ID = 3 (  0055):     2.54   0.516     1.08    60.71

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

 FINISH
==================================================================================================================
```



POST-DEVELOPMENT VISUAL OTTHYMO RESULTS

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

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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```

5-YEAR POST-DEVELOPMENT

```
                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\CAJD070997\AppData\Local\Civica\VH5\da7fca0c-17d2-4ed8-9508-57013b4c55d5\26b6e034
  Summary filename: C:\Users\CAJD070997\AppData\Local\Civica\VH5\da7fca0c-17d2-4ed8-9508-57013b4c55d5\26b6e034


DATE: 07-27-2026                          TIME: 11:17:29

USER:



COMMENTS: ____________________________________________________________


------------------------------------------------------------------------------------------------------------
  ************************************************
  ** SIMULATION : Run 01                        **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 998.071
| Ptotal= 42.51 mm |                          B=   6.053
--------------------                          C=   0.814
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  3.00 hrs
                       Storm time step    = 10.00 min
                       Time to peak ratio =  0.33

                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    3.68 |  0.83  104.19 |  1.67    6.69 |  2.50    3.51
                 0.17    4.58 |  1.00   32.04 |  1.83    5.63 |  2.67    3.22
                 0.33    6.15 |  1.17   16.34 |  2.00    4.87 |  2.83    2.98
                 0.50    9.61 |  1.33   10.96 |  2.17    4.30 |
                 0.67   24.17 |  1.50    8.29 |  2.33    3.86 |


------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0100)|   Area    (ha)=   0.39
|ID= 1 DT= 5.0 min |   Total Imp(%)=  93.00   Dir. Conn.(%)=  93.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.36         0.03
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      51.12        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    3.68 | 0.833   24.17 | 1.583    8.29 |  2.33    4.30
                0.167    3.68 | 0.917  104.19 | 1.667    8.29 |  2.42    3.86
                0.250    4.58 | 1.000  104.19 | 1.750    6.69 |  2.50    3.86
                0.333    4.58 | 1.083   32.04 | 1.833    6.69 |  2.58    3.51
                0.417    6.15 | 1.167   32.04 | 1.917    5.63 |  2.67    3.51
                0.500    6.15 | 1.250   16.34 | 2.000    5.63 |  2.75    3.22
                0.583    9.61 | 1.333   16.34 | 2.083    4.87 |  2.83    3.22
```

```
                0.667    9.61 | 1.417   10.96 | 2.167    4.87 |  2.92    2.98
                0.750   24.17 | 1.500   10.96 | 2.250    4.30 |  3.00    2.98

     Max.Eff.Inten.(mm/hr)=     104.19        39.19
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       1.68 (ii)    4.15 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.32         0.24
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.11         0.00          0.108 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.00           1.00
     RUNOFF VOLUME    (mm)=      40.51        17.85          38.93
     TOTAL RAINFALL   (mm)=      42.51        42.51          42.51
     RUNOFF COEFFICIENT   =       0.95         0.42           0.92

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  86.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0101)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0172      0.0040
                          0.0168     0.0001   |   0.0174      0.0089
                          0.0170     0.0012   |   0.0176      0.0157

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0100)      0.392      0.108      1.00      38.93
   OUTFLOW: ID= 1 (  0101)      0.392      0.017      1.33      39.07
   OVERFLOW:ID= 3 (  0003)      0.000      0.000      0.00       0.00

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                   PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 16.00
                   TIME SHIFT OF PEAK FLOW         (min)= 20.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0070

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   0.06
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.06         0.00
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      20.66        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    3.68 | 0.833   24.17 | 1.583    8.29 |  2.33    4.30
                0.167    3.68 | 0.917  104.19 | 1.667    8.29 |  2.42    3.86
                0.250    4.58 | 1.000  104.19 | 1.750    6.69 |  2.50    3.86
                0.333    4.58 | 1.083   32.04 | 1.833    6.69 |  2.58    3.51
                0.417    6.15 | 1.167   32.04 | 1.917    5.63 |  2.67    3.51
                0.500    6.15 | 1.250   16.34 | 2.000    5.63 |  2.75    3.22
                0.583    9.61 | 1.333   16.34 | 2.083    4.87 |  2.83    3.22
                0.667    9.61 | 1.417   10.96 | 2.167    4.87 |  2.92    2.98
                0.750   24.17 | 1.500   10.96 | 2.250    4.30 |  3.00    2.98

     Max.Eff.Inten.(mm/hr)=     104.19        59.44
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.98 (ii)    2.08 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.31
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.02         0.00          0.018 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.00           1.00
```

```
     RUNOFF VOLUME    (mm)=      40.51        24.48          40.35
     TOTAL RAINFALL   (mm)=      42.51        42.51          42.51
     RUNOFF COEFFICIENT   =       0.95         0.58           0.95

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  92.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.09         0.00
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      24.77        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    3.68 | 0.833   24.17 | 1.583    8.29 |  2.33    4.30
                0.167    3.68 | 0.917  104.19 | 1.667    8.29 |  2.42    3.86
                0.250    4.58 | 1.000  104.19 | 1.750    6.69 |  2.50    3.86
                0.333    4.58 | 1.083   32.04 | 1.833    6.69 |  2.58    3.51
                0.417    6.15 | 1.167   32.04 | 1.917    5.63 |  2.67    3.51
                0.500    6.15 | 1.250   16.34 | 2.000    5.63 |  2.75    3.22
                0.583    9.61 | 1.333   16.34 | 2.083    4.87 |  2.83    3.22
                0.667    9.61 | 1.417   10.96 | 2.167    4.87 |  2.92    2.98
                0.750   24.17 | 1.500   10.96 | 2.250    4.30 |  3.00    2.98

     Max.Eff.Inten.(mm/hr)=     104.19        59.44
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       1.09 (ii)    2.19 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.31
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.03         0.00          0.027 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.00           1.00
     RUNOFF VOLUME    (mm)=      40.51        24.48          40.35
     TOTAL RAINFALL   (mm)=      42.51        42.51          42.51
     RUNOFF COEFFICIENT   =       0.95         0.58           0.95

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  92.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0203)|   Area    (ha)=   0.12
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.12         0.00
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      28.87        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    3.68 | 0.833   24.17 | 1.583    8.29 |  2.33    4.30
                0.167    3.68 | 0.917  104.19 | 1.667    8.29 |  2.42    3.86
                0.250    4.58 | 1.000  104.19 | 1.750    6.69 |  2.50    3.86
                0.333    4.58 | 1.083   32.04 | 1.833    6.69 |  2.58    3.51
```

```
                0.417    6.15 | 1.167   32.04 | 1.917    5.63 |  2.67    3.51
                0.500    6.15 | 1.250   16.34 | 2.000    5.63 |  2.75    3.22
                0.583    9.61 | 1.333   16.34 | 2.083    4.87 |  2.83    3.22
                0.667    9.61 | 1.417   10.96 | 2.167    4.87 |  2.92    2.98
                0.750   24.17 | 1.500   10.96 | 2.250    4.30 |  3.00    2.98

     Max.Eff.Inten.(mm/hr)=     104.19        59.44
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       1.19 (ii)    2.30 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.33         0.30
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.04         0.00          0.036 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.00           1.00
     RUNOFF VOLUME    (mm)=      40.51        24.48          40.35
     TOTAL RAINFALL   (mm)=      42.51        42.51          42.51
     RUNOFF COEFFICIENT   =       0.95         0.58           0.95

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  92.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0204)|   Area    (ha)=   0.08
|ID= 1 DT= 5.0 min |   Total Imp(%)=  42.00   Dir. Conn.(%)=  42.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.03         0.04
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      22.51        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    3.68 | 0.833   24.17 | 1.583    8.29 |  2.33    4.30
                0.167    3.68 | 0.917  104.19 | 1.667    8.29 |  2.42    3.86
                0.250    4.58 | 1.000  104.19 | 1.750    6.69 |  2.50    3.86
                0.333    4.58 | 1.083   32.04 | 1.833    6.69 |  2.58    3.51
                0.417    6.15 | 1.167   32.04 | 1.917    5.63 |  2.67    3.51
                0.500    6.15 | 1.250   16.34 | 2.000    5.63 |  2.75    3.22
                0.583    9.61 | 1.333   16.34 | 2.083    4.87 |  2.83    3.22
                0.667    9.61 | 1.417   10.96 | 2.167    4.87 |  2.92    2.98
                0.750   24.17 | 1.500   10.96 | 2.250    4.30 |  3.00    2.98

     Max.Eff.Inten.(mm/hr)=     104.19        32.22
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       1.03 (ii)   12.13 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.34         0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.010 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.17           1.00
     RUNOFF VOLUME    (mm)=      40.51        17.84          27.26
     TOTAL RAINFALL   (mm)=      42.51        42.51          42.51
     RUNOFF COEFFICIENT   =       0.95         0.42           0.64

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  86.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0121     0.0028
                          0.0111     0.0005   |   0.0124     0.0037
                          0.0115     0.0012   |   0.0126     0.0048
```

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                        0.0118     0.0019   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0204)      0.076      0.010      1.00      27.26
   OUTFLOW: ID= 1 (  0004)      0.076      0.007      1.08      27.17
   OVERFLOW:ID= 3 (  0003)      0.000      0.000      0.00       0.00

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                   PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 68.14
                   TIME SHIFT OF PEAK FLOW         (min)=  5.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0004

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0205)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  65.00   Dir. Conn.(%)=  65.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.07         0.04
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      26.46        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    3.68 | 0.833   24.17 | 1.583    8.29 |  2.33    4.30
                0.167    3.68 | 0.917  104.19 | 1.667    8.29 |  2.42    3.86
                0.250    4.58 | 1.000  104.19 | 1.750    6.69 |  2.50    3.86
                0.333    4.58 | 1.083   32.04 | 1.833    6.69 |  2.58    3.51
                0.417    6.15 | 1.167   32.04 | 1.917    5.63 |  2.67    3.51
                0.500    6.15 | 1.250   16.34 | 2.000    5.63 |  2.75    3.22
                0.583    9.61 | 1.333   16.34 | 2.083    4.87 |  2.83    3.22
                0.667    9.61 | 1.417   10.96 | 2.167    4.87 |  2.92    2.98
                0.750   24.17 | 1.500   10.96 | 2.250    4.30 |  3.00    2.98

     Max.Eff.Inten.(mm/hr)=     104.19        32.22
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       1.13 (ii)   12.23 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.34         0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.02         0.00        0.021 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.17         1.00
     RUNOFF VOLUME    (mm)=      40.51        17.85        32.51
     TOTAL RAINFALL   (mm)=      42.51        42.51        42.51
     RUNOFF COEFFICIENT   =       0.95         0.42         0.76

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  86.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD (  0206)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  68.00   Dir. Conn.(%)=  68.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.04         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      19.15        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
```

```
                0.083    3.68 | 0.833   24.17 | 1.583    8.29 |  2.33    4.30
                0.167    3.68 | 0.917  104.19 | 1.667    8.29 |  2.42    3.86
                0.250    4.58 | 1.000  104.19 | 1.750    6.69 |  2.50    3.86
                0.333    4.58 | 1.083   32.04 | 1.833    6.69 |  2.58    3.51
                0.417    6.15 | 1.167   32.04 | 1.917    5.63 |  2.67    3.51
                0.500    6.15 | 1.250   16.34 | 2.000    5.63 |  2.75    3.22
                0.583    9.61 | 1.333   16.34 | 2.083    4.87 |  2.83    3.22
                0.667    9.61 | 1.417   10.96 | 2.167    4.87 |  2.92    2.98
                0.750   24.17 | 1.500   10.96 | 2.250    4.30 |  3.00    2.98

     Max.Eff.Inten.(mm/hr)=     104.19        32.22
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       0.93 (ii)   12.04 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.34         0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00         0.011 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.17          1.00
     RUNOFF VOLUME    (mm)=      40.51        17.85         33.13
     TOTAL RAINFALL   (mm)=      42.51        42.51         42.51
     RUNOFF COEFFICIENT   =       0.95         0.42          0.78

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  86.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD (  0207)|   Area    (ha)=   0.35
|ID= 1 DT= 5.0 min |   Total Imp(%)=  80.00   Dir. Conn.(%)=  80.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.28         0.07
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      48.65        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    3.68 | 0.833   24.17 | 1.583    8.29 |  2.33    4.30
                0.167    3.68 | 0.917  104.19 | 1.667    8.29 |  2.42    3.86
                0.250    4.58 | 1.000  104.19 | 1.750    6.69 |  2.50    3.86
                0.333    4.58 | 1.083   32.04 | 1.833    6.69 |  2.58    3.51
                0.417    6.15 | 1.167   32.04 | 1.917    5.63 |  2.67    3.51
                0.500    6.15 | 1.250   16.34 | 2.000    5.63 |  2.75    3.22
                0.583    9.61 | 1.333   16.34 | 2.083    4.87 |  2.83    3.22
                0.667    9.61 | 1.417   10.96 | 2.167    4.87 |  2.92    2.98
                0.750   24.17 | 1.500   10.96 | 2.250    4.30 |  3.00    2.98

     Max.Eff.Inten.(mm/hr)=     104.19        39.19
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.63 (ii)    5.62 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.32         0.15
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.08         0.01         0.087 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08          1.00
     RUNOFF VOLUME    (mm)=      40.51        17.85         35.97
     TOTAL RAINFALL   (mm)=      42.51        42.51         42.51
     RUNOFF COEFFICIENT   =       0.95         0.42          0.85

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  86.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| RESERVOIR(  0012)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
```

```
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0123      0.0036
                          0.0111     0.0006   |   0.0126      0.0044
                          0.0114     0.0013   |   0.0129      0.0053
                          0.0117     0.0020   |   0.0131      0.0063
                          0.0120     0.0028   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0207)      0.355      0.087      1.00      35.97
   OUTFLOW: ID= 1 (  0012)      0.349      0.013      1.25      35.83
   OVERFLOW:ID= 3 (  0003)      0.006      0.004      1.25      35.83

                    TOTAL NUMBER OF SIMULATION OVERFLOW  =     1
                    CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.08
                    PERCENTAGE OF TIME OVERFLOWING   (%) =  2.08

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 15.11
                    TIME SHIFT OF PEAK FLOW         (min)= 15.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0063

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--------------------
| CALIB            |
| STANDHYD (  0208)|   Area    (ha)=   0.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  56.00   Dir. Conn.(%)=  56.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.09         0.07
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      33.47        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    3.68 | 0.833   24.17 | 1.583    8.29 |  2.33    4.30
               0.167    3.68 | 0.917  104.19 | 1.667    8.29 |  2.42    3.86
               0.250    4.58 | 1.000  104.19 | 1.750    6.69 |  2.50    3.86
               0.333    4.58 | 1.083   32.04 | 1.833    6.69 |  2.58    3.51
               0.417    6.15 | 1.167   32.04 | 1.917    5.63 |  2.67    3.51
               0.500    6.15 | 1.250   16.34 | 2.000    5.63 |  2.75    3.22
               0.583    9.61 | 1.333   16.34 | 2.083    4.87 |  2.83    3.22
               0.667    9.61 | 1.417   10.96 | 2.167    4.87 |  2.92    2.98
               0.750   24.17 | 1.500   10.96 | 2.250    4.30 |  3.00    2.98

     Max.Eff.Inten.(mm/hr)=     104.19        32.22
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       1.30 (ii)   12.41 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.33         0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.03         0.00         0.029 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.17          1.00
     RUNOFF VOLUME    (mm)=      40.51        17.85         30.50
     TOTAL RAINFALL   (mm)=      42.51        42.51         42.51
     RUNOFF COEFFICIENT   =       0.95         0.42          0.72

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  86.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| RESERVOIR(  0016)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0114      0.0015
                          0.0104     0.0003   |   0.0117      0.0021
                          0.0108     0.0006   |   0.0120      0.0027
                          0.0111     0.0010   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0208)      0.168      0.029      1.00      30.50
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   OUTFLOW: ID= 1 (  0016)      0.168      0.011      1.17      30.50
   OVERFLOW:ID= 3 (  0003)      0.000      0.000      0.00       0.00

                    TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                    CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                    PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 38.50
                    TIME SHIFT OF PEAK FLOW         (min)= 10.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0013

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--------------------
| CALIB            |
| STANDHYD (  0209)|   Area    (ha)=   0.08
|ID= 1 DT= 5.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  60.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.05         0.03
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      23.66        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    3.68 | 0.833   24.17 | 1.583    8.29 |  2.33    4.30
                0.167    3.68 | 0.917  104.19 | 1.667    8.29 |  2.42    3.86
                0.250    4.58 | 1.000  104.19 | 1.750    6.69 |  2.50    3.86
                0.333    4.58 | 1.083   32.04 | 1.833    6.69 |  2.58    3.51
                0.417    6.15 | 1.167   32.04 | 1.917    5.63 |  2.67    3.51
                0.500    6.15 | 1.250   16.34 | 2.000    5.63 |  2.75    3.22
                0.583    9.61 | 1.333   16.34 | 2.083    4.87 |  2.83    3.22
                0.667    9.61 | 1.417   10.96 | 2.167    4.87 |  2.92    2.98
                0.750   24.17 | 1.500   10.96 | 2.250    4.30 |  3.00    2.98

     Max.Eff.Inten.(mm/hr)=     104.19        32.22
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       1.06 (ii)   12.16 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.34         0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.015 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.17           1.00
     RUNOFF VOLUME    (mm)=      40.51        17.85          31.37
     TOTAL RAINFALL   (mm)=      42.51        42.51          42.51
     RUNOFF COEFFICIENT   =       0.95         0.42           0.74

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  86.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD (  0210)|   Area    (ha)=   0.06
|ID= 1 DT= 5.0 min |   Total Imp(%)=  62.00   Dir. Conn.(%)=  62.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.04         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      20.66        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    3.68 | 0.833   24.17 | 1.583    8.29 |  2.33    4.30
                0.167    3.68 | 0.917  104.19 | 1.667    8.29 |  2.42    3.86
                0.250    4.58 | 1.000  104.19 | 1.750    6.69 |  2.50    3.86
                0.333    4.58 | 1.083   32.04 | 1.833    6.69 |  2.58    3.51
                0.417    6.15 | 1.167   32.04 | 1.917    5.63 |  2.67    3.51
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                0.500    6.15 | 1.250   16.34 | 2.000    5.63 |  2.75    3.22
                0.583    9.61 | 1.333   16.34 | 2.083    4.87 |  2.83    3.22
                0.667    9.61 | 1.417   10.96 | 2.167    4.87 |  2.92    2.98
                0.750   24.17 | 1.500   10.96 | 2.250    4.30 |  3.00    2.98

     Max.Eff.Inten.(mm/hr)=     104.19        32.22
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       0.98 (ii)   12.08 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.34         0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.012 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.17           1.00
     RUNOFF VOLUME    (mm)=      40.51        17.85          31.79
     TOTAL RAINFALL   (mm)=      42.51        42.51          42.51
     RUNOFF COEFFICIENT   =       0.95         0.42           0.75

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  86.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD (  0211)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  80.00   Dir. Conn.(%)=  80.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      25.43        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    3.68 | 0.833   24.17 | 1.583    8.29 |  2.33    4.30
                0.167    3.68 | 0.917  104.19 | 1.667    8.29 |  2.42    3.86
                0.250    4.58 | 1.000  104.19 | 1.750    6.69 |  2.50    3.86
                0.333    4.58 | 1.083   32.04 | 1.833    6.69 |  2.58    3.51
                0.417    6.15 | 1.167   32.04 | 1.917    5.63 |  2.67    3.51
                0.500    6.15 | 1.250   16.34 | 2.000    5.63 |  2.75    3.22
                0.583    9.61 | 1.333   16.34 | 2.083    4.87 |  2.83    3.22
                0.667    9.61 | 1.417   10.96 | 2.167    4.87 |  2.92    2.98
                0.750   24.17 | 1.500   10.96 | 2.250    4.30 |  3.00    2.98

     Max.Eff.Inten.(mm/hr)=     104.19        39.19
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.11 (ii)    5.09 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.16
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.02         0.00          0.024 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08           1.00
     RUNOFF VOLUME    (mm)=      40.51        17.85          35.93
     TOTAL RAINFALL   (mm)=      42.51        42.51          42.51
     RUNOFF COEFFICIENT   =       0.95         0.42           0.85

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  86.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD (  0300)|   Area    (ha)=   0.46
|ID= 1 DT= 5.0 min |   Total Imp(%)=  80.00   Dir. Conn.(%)=  80.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.37         0.09
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         2.00
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     Length            (m)=      55.32        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    3.68 | 0.833   24.17 | 1.583    8.29 |  2.33    4.30
               0.167    3.68 | 0.917  104.19 | 1.667    8.29 |  2.42    3.86
               0.250    4.58 | 1.000  104.19 | 1.750    6.69 |  2.50    3.86
               0.333    4.58 | 1.083   32.04 | 1.833    6.69 |  2.58    3.51
               0.417    6.15 | 1.167   32.04 | 1.917    5.63 |  2.67    3.51
               0.500    6.15 | 1.250   16.34 | 2.000    5.63 |  2.75    3.22
               0.583    9.61 | 1.333   16.34 | 2.083    4.87 |  2.83    3.22
               0.667    9.61 | 1.417   10.96 | 2.167    4.87 |  2.92    2.98
               0.750   24.17 | 1.500   10.96 | 2.250    4.30 |  3.00    2.98

     Max.Eff.Inten.(mm/hr)=     104.19        59.44
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.76 (ii)    5.75 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.32         0.15
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.11         0.01          0.116 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08           1.00
     RUNOFF VOLUME    (mm)=      40.51        24.48          37.30
     TOTAL RAINFALL   (mm)=      42.51        42.51          42.51
     RUNOFF COEFFICIENT   =       0.95         0.58           0.88

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  92.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0212)|   Area    (ha)=   0.30
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.30         0.00
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      44.57        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    3.68 | 0.833   24.17 | 1.583    8.29 |  2.33    4.30
               0.167    3.68 | 0.917  104.19 | 1.667    8.29 |  2.42    3.86
               0.250    4.58 | 1.000  104.19 | 1.750    6.69 |  2.50    3.86
               0.333    4.58 | 1.083   32.04 | 1.833    6.69 |  2.58    3.51
               0.417    6.15 | 1.167   32.04 | 1.917    5.63 |  2.67    3.51
               0.500    6.15 | 1.250   16.34 | 2.000    5.63 |  2.75    3.22
               0.583    9.61 | 1.333   16.34 | 2.083    4.87 |  2.83    3.22
               0.667    9.61 | 1.417   10.96 | 2.167    4.87 |  2.92    2.98
               0.750   24.17 | 1.500   10.96 | 2.250    4.30 |  3.00    2.98

     Max.Eff.Inten.(mm/hr)=     104.19        59.44
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       1.55 (ii)    2.65 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.33         0.29
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.09         0.00          0.086 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.00           1.00
     RUNOFF VOLUME    (mm)=      40.51        24.48          40.34
     TOTAL RAINFALL   (mm)=      42.51        42.51          42.51
     RUNOFF COEFFICIENT   =       0.95         0.58           0.95

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  92.0    Ia = Dep. Storage  (Above)
```

```
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH   0004 <ID= 1> IS DRY.
*** W A R N I N G :  HYDROGRAPH   0003 = HYDROGRAPH 0012
        ID1= 1 (  0004):     0.00   0.000     0.00     0.00
      + ID2= 2 (  0012):     0.01   0.004     1.25    35.83
        ====================================================
        ID = 3 (  0003):     0.01   0.004     1.25    35.83

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH   0016 <ID= 2> IS DRY.
*** W A R N I N G :  HYDROGRAPH   0001 = HYDROGRAPH 0003
        ID1= 3 (  0003):     0.01   0.004     1.25    35.83
      + ID2= 2 (  0016):     0.00   0.000     0.00     0.00
        ====================================================
        ID = 1 (  0003):     0.01   0.004     1.25    35.83

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0003):     0.01   0.004     1.25    35.83
      + ID2= 2 (  0201):     0.06   0.018     1.00    40.35
        ====================================================
        ID = 3 (  0003):     0.07   0.018     1.00    39.96

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0003):     0.07   0.018     1.00    39.96
      + ID2= 2 (  0202):     0.09   0.027     1.00    40.35
        ====================================================
        ID = 1 (  0003):     0.16   0.045     1.00    40.18

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0003):     0.16   0.045     1.00    40.18
      + ID2= 2 (  0203):     0.12   0.036     1.00    40.35
        ====================================================
        ID = 3 (  0003):     0.29   0.081     1.00    40.26

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0003):     0.29   0.081     1.00    40.26
      + ID2= 2 (  0205):     0.10   0.021     1.00    32.51
        ====================================================
        ID = 1 (  0003):     0.39   0.102     1.00    38.18

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
```

```
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0003):     0.39   0.102     1.00    38.18
      + ID2= 2 (  0206):     0.05   0.011     1.00    33.13
        ====================================================
        ID = 3 (  0003):     0.45   0.113     1.00    37.56

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0003):     0.45   0.113     1.00    37.56
      + ID2= 2 (  0209):     0.08   0.015     1.00    31.37
        ====================================================
        ID = 1 (  0003):     0.53   0.129     1.00    36.58

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0003):     0.53   0.129     1.00    36.58
      + ID2= 2 (  0210):     0.06   0.012     1.00    31.79
        ====================================================
        ID = 3 (  0003):     0.60   0.141     1.00    36.07

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0003):     0.60   0.141     1.00    36.07
      + ID2= 2 (  0211):     0.10   0.024     1.00    35.93
        ====================================================
        ID = 1 (  0003):     0.69   0.165     1.00    36.05

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0003):     0.69   0.165     1.00    36.05
      + ID2= 2 (  0212):     0.30   0.086     1.00    40.34
        ====================================================
        ID = 3 (  0003):     0.99   0.250     1.00    37.34

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0003):     0.99   0.250     1.00    37.34
      + ID2= 2 (  0300):     0.46   0.116     1.00    37.30
        ====================================================
        ID = 1 (  0003):     1.45   0.366     1.00    37.33

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0005)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.3783      0.0200
                          0.0680     0.0050   |   0.4351      0.0250
                          0.2254     0.0100   |   0.4852      0.0300
                          0.3114     0.0150   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)      1.449      0.366      1.00      37.33
   OUTFLOW: ID= 1 (  0005)      1.449      0.259      1.00      37.32
```

```
                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 70.76
                    TIME SHIFT OF PEAK FLOW         (min)=  0.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0136

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0401)|   Area    (ha)=   0.12
|ID= 1 DT= 5.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  55.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.06         0.05
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      27.69        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    3.68 | 0.833   24.17 | 1.583    8.29 |  2.33    4.30
                0.167    3.68 | 0.917  104.19 | 1.667    8.29 |  2.42    3.86
                0.250    4.58 | 1.000  104.19 | 1.750    6.69 |  2.50    3.86
                0.333    4.58 | 1.083   32.04 | 1.833    6.69 |  2.58    3.51
                0.417    6.15 | 1.167   32.04 | 1.917    5.63 |  2.67    3.51
                0.500    6.15 | 1.250   16.34 | 2.000    5.63 |  2.75    3.22
                0.583    9.61 | 1.333   16.34 | 2.083    4.87 |  2.83    3.22
                0.667    9.61 | 1.417   10.96 | 2.167    4.87 |  2.92    2.98
                0.750   24.17 | 1.500   10.96 | 2.250    4.30 |  3.00    2.98

     Max.Eff.Inten.(mm/hr)=     104.19        32.22
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       1.16 (ii)   12.27 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.34         0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.02         0.00          0.020 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.17           1.00
     RUNOFF VOLUME    (mm)=      40.51        17.85          30.26
     TOTAL RAINFALL   (mm)=      42.51        42.51          42.51
     RUNOFF COEFFICIENT   =       0.95         0.42           0.71

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  86.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0055)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH   0101 <ID= 1> IS DRY.
*** W A R N I N G :  HYDROGRAPH   0055 = HYDROGRAPH 0401
        ID1= 1 (  0101):     0.00   0.000     0.00     0.00
      + ID2= 2 (  0401):     0.12   0.020     1.00    30.26
        ==================================================
        ID = 3 (  0055):     0.12   0.020     1.00    30.26

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0055)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0055):     0.12   0.020     1.00    30.26
      + ID2= 2 (  0005):     1.45   0.259     1.00    37.32
        ==================================================
        ID = 1 (  0055):     1.56   0.279     1.00    36.80

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
```

```
==========================================================================================================
       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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```

100-YEAR POST-DEVELOPMENT

```
                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\CAJD070997\AppData\Local\Civica\VH5\da7fca0c-17d2-4ed8-9508-57013b4c55d5\97875a13
  Summary filename: C:\Users\CAJD070997\AppData\Local\Civica\VH5\da7fca0c-17d2-4ed8-9508-57013b4c55d5\97875a13


DATE: 07-27-2026                          TIME: 11:17:29

USER:



COMMENTS: ____________________________________________________________


----------------------------------------------------------------------------------------------------------
  ************************************************
  ** SIMULATION : Run 03                        **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1735.688
| Ptotal= 71.66 mm |                          B=   6.014
--------------------                          C=   0.820
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  3.00 hrs
                       Storm time step    = 10.00 min
                       Time to peak ratio =  0.33

                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    6.05 |  0.83  178.56 |  1.67   11.06 |  2.50    5.76
                 0.17    7.54 |  1.00   54.05 |  1.83    9.29 |  2.67    5.28
                 0.33   10.16 |  1.17   27.32 |  2.00    8.02 |  2.83    4.88
                 0.50   15.97 |  1.33   18.24 |  2.17    7.08 |
                 0.67   40.65 |  1.50   13.74 |  2.33    6.35 |


-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0100)|   Area    (ha)=   0.39
|ID= 1 DT= 5.0 min |   Total Imp(%)=  93.00   Dir. Conn.(%)=  93.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.36         0.03
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      51.12        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    6.05 | 0.833   40.65 | 1.583   13.74 |  2.33    7.08
                0.167    6.05 | 0.917  178.56 | 1.667   13.74 |  2.42    6.35
                0.250    7.54 | 1.000  178.56 | 1.750   11.06 |  2.50    6.35
                0.333    7.54 | 1.083   54.05 | 1.833   11.06 |  2.58    5.76
                0.417   10.16 | 1.167   54.05 | 1.917    9.29 |  2.67    5.76
                0.500   10.16 | 1.250   27.32 | 2.000    9.29 |  2.75    5.28
                0.583   15.97 | 1.333   27.32 | 2.083    8.02 |  2.83    5.28
```

```
                0.667   15.97 | 1.417   18.24 | 2.167    8.02 |  2.92    4.88
                0.750   40.65 | 1.500   18.24 | 2.250    7.08 |  3.00    4.88

     Max.Eff.Inten.(mm/hr)=     178.56       101.37
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       1.35 (ii)    3.34 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.33         0.26
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.18         0.01          0.189 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.00           1.00
     RUNOFF VOLUME    (mm)=      69.66        41.14          67.67
     TOTAL RAINFALL   (mm)=      71.66        71.66          71.66
     RUNOFF COEFFICIENT   =       0.97         0.57           0.94

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  86.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0101)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0172      0.0040
                          0.0168     0.0001   |   0.0174      0.0089
                          0.0170     0.0012   |   0.0176      0.0157

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0100)      0.392      0.189      1.00      67.67
   OUTFLOW: ID= 1 (  0101)      0.392      0.018      1.50      67.87
   OVERFLOW:ID= 3 (  0003)      0.000      0.000      0.00       0.00

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                   PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  9.32
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0151

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   0.06
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.06         0.00
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      20.66        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    6.05 | 0.833   40.65 | 1.583   13.74 |  2.33    7.08
                0.167    6.05 | 0.917  178.56 | 1.667   13.74 |  2.42    6.35
                0.250    7.54 | 1.000  178.56 | 1.750   11.06 |  2.50    6.35
                0.333    7.54 | 1.083   54.05 | 1.833   11.06 |  2.58    5.76
                0.417   10.16 | 1.167   54.05 | 1.917    9.29 |  2.67    5.76
                0.500   10.16 | 1.250   27.32 | 2.000    9.29 |  2.75    5.28
                0.583   15.97 | 1.333   27.32 | 2.083    8.02 |  2.83    5.28
                0.667   15.97 | 1.417   18.24 | 2.167    8.02 |  2.92    4.88
                0.750   40.65 | 1.500   18.24 | 2.250    7.08 |  3.00    4.88

     Max.Eff.Inten.(mm/hr)=     178.56       133.38
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.79 (ii)    1.68 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.32
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.03         0.00          0.032 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.00           1.00
```

```
     RUNOFF VOLUME    (mm)=      69.66        51.01          69.48
     TOTAL RAINFALL   (mm)=      71.66        71.66          71.66
     RUNOFF COEFFICIENT   =       0.97         0.71           0.97

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  92.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.09         0.00
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      24.77        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    6.05 | 0.833   40.65 | 1.583   13.74 |  2.33    7.08
                0.167    6.05 | 0.917  178.56 | 1.667   13.74 |  2.42    6.35
                0.250    7.54 | 1.000  178.56 | 1.750   11.06 |  2.50    6.35
                0.333    7.54 | 1.083   54.05 | 1.833   11.06 |  2.58    5.76
                0.417   10.16 | 1.167   54.05 | 1.917    9.29 |  2.67    5.76
                0.500   10.16 | 1.250   27.32 | 2.000    9.29 |  2.75    5.28
                0.583   15.97 | 1.333   27.32 | 2.083    8.02 |  2.83    5.28
                0.667   15.97 | 1.417   18.24 | 2.167    8.02 |  2.92    4.88
                0.750   40.65 | 1.500   18.24 | 2.250    7.08 |  3.00    4.88

     Max.Eff.Inten.(mm/hr)=     178.56       133.38
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.88 (ii)    1.77 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.32
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.05         0.00          0.046 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.00           1.00
     RUNOFF VOLUME    (mm)=      69.66        51.01          69.48
     TOTAL RAINFALL   (mm)=      71.66        71.66          71.66
     RUNOFF COEFFICIENT   =       0.97         0.71           0.97

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  92.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD (  0203)|   Area    (ha)=   0.12
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.12         0.00
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      28.87        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    6.05 | 0.833   40.65 | 1.583   13.74 |  2.33    7.08
                0.167    6.05 | 0.917  178.56 | 1.667   13.74 |  2.42    6.35
                0.250    7.54 | 1.000  178.56 | 1.750   11.06 |  2.50    6.35
                0.333    7.54 | 1.083   54.05 | 1.833   11.06 |  2.58    5.76
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                0.417   10.16 | 1.167   54.05 | 1.917    9.29 |  2.67    5.76
                0.500   10.16 | 1.250   27.32 | 2.000    9.29 |  2.75    5.28
                0.583   15.97 | 1.333   27.32 | 2.083    8.02 |  2.83    5.28
                0.667   15.97 | 1.417   18.24 | 2.167    8.02 |  2.92    4.88
                0.750   40.65 | 1.500   18.24 | 2.250    7.08 |  3.00    4.88

     Max.Eff.Inten.(mm/hr)=     178.56       133.38
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.96 (ii)    1.85 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.32
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.06         0.00          0.062 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.00           1.00
     RUNOFF VOLUME    (mm)=      69.66        51.01          69.48
     TOTAL RAINFALL   (mm)=      71.66        71.66          71.66
     RUNOFF COEFFICIENT   =       0.97         0.71           0.97

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  92.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD (  0204)|   Area    (ha)=   0.08
|ID= 1 DT= 5.0 min |   Total Imp(%)=  42.00   Dir. Conn.(%)=  42.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.03         0.04
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      22.51        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    6.05 | 0.833   40.65 | 1.583   13.74 |  2.33    7.08
                0.167    6.05 | 0.917  178.56 | 1.667   13.74 |  2.42    6.35
                0.250    7.54 | 1.000  178.56 | 1.750   11.06 |  2.50    6.35
                0.333    7.54 | 1.083   54.05 | 1.833   11.06 |  2.58    5.76
                0.417   10.16 | 1.167   54.05 | 1.917    9.29 |  2.67    5.76
                0.500   10.16 | 1.250   27.32 | 2.000    9.29 |  2.75    5.28
                0.583   15.97 | 1.333   27.32 | 2.083    8.02 |  2.83    5.28
                0.667   15.97 | 1.417   18.24 | 2.167    8.02 |  2.92    4.88
                0.750   40.65 | 1.500   18.24 | 2.250    7.08 |  3.00    4.88

     Max.Eff.Inten.(mm/hr)=     178.56       101.37
                over (min)        5.00         10.00
     Storage Coeff.  (min)=       0.83 (ii)    7.85 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.13
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.02         0.01          0.023 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08           1.00
     RUNOFF VOLUME    (mm)=      69.66        41.14          53.07
     TOTAL RAINFALL   (mm)=      71.66        71.66          71.66
     RUNOFF COEFFICIENT   =       0.97         0.57           0.74

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  86.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| RESERVOIR(  0004)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0121     0.0028
                          0.0111     0.0005   |   0.0124     0.0037
                          0.0115     0.0012   |   0.0126     0.0048
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                        0.0118     0.0019   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0204)      0.076      0.023      1.00      53.07
   OUTFLOW: ID= 1 (  0004)      0.076      0.011      1.17      52.96
   OVERFLOW:ID= 3 (  0003)      0.000      0.000      0.00       0.00

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                   PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 49.60
                   TIME SHIFT OF PEAK FLOW         (min)= 10.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0009

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--------------------
| CALIB            |
| STANDHYD (  0205)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  65.00   Dir. Conn.(%)=  65.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.07         0.04
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      26.46        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    6.05 | 0.833   40.65 | 1.583   13.74 |  2.33    7.08
                0.167    6.05 | 0.917  178.56 | 1.667   13.74 |  2.42    6.35
                0.250    7.54 | 1.000  178.56 | 1.750   11.06 |  2.50    6.35
                0.333    7.54 | 1.083   54.05 | 1.833   11.06 |  2.58    5.76
                0.417   10.16 | 1.167   54.05 | 1.917    9.29 |  2.67    5.76
                0.500   10.16 | 1.250   27.32 | 2.000    9.29 |  2.75    5.28
                0.583   15.97 | 1.333   27.32 | 2.083    8.02 |  2.83    5.28
                0.667   15.97 | 1.417   18.24 | 2.167    8.02 |  2.92    4.88
                0.750   40.65 | 1.500   18.24 | 2.250    7.08 |  3.00    4.88

     Max.Eff.Inten.(mm/hr)=     178.56       101.37
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       0.91 (ii)    5.28 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.16
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.03         0.01        0.041 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08         1.00
     RUNOFF VOLUME    (mm)=      69.66        41.14        59.66
     TOTAL RAINFALL   (mm)=      71.66        71.66        71.66
     RUNOFF COEFFICIENT   =       0.97         0.57         0.83

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  86.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD (  0206)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  68.00   Dir. Conn.(%)=  68.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.04         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      19.15        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
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                0.083    6.05 | 0.833   40.65 | 1.583   13.74 |  2.33    7.08
                0.167    6.05 | 0.917  178.56 | 1.667   13.74 |  2.42    6.35
                0.250    7.54 | 1.000  178.56 | 1.750   11.06 |  2.50    6.35
                0.333    7.54 | 1.083   54.05 | 1.833   11.06 |  2.58    5.76
                0.417   10.16 | 1.167   54.05 | 1.917    9.29 |  2.67    5.76
                0.500   10.16 | 1.250   27.32 | 2.000    9.29 |  2.75    5.28
                0.583   15.97 | 1.333   27.32 | 2.083    8.02 |  2.83    5.28
                0.667   15.97 | 1.417   18.24 | 2.167    8.02 |  2.92    4.88
                0.750   40.65 | 1.500   18.24 | 2.250    7.08 |  3.00    4.88

     Max.Eff.Inten.(mm/hr)=     178.56       101.37
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.75 (ii)    4.89 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.22
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.02         0.00          0.023 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.00           1.00
     RUNOFF VOLUME    (mm)=      69.66        41.14          60.47
     TOTAL RAINFALL   (mm)=      71.66        71.66          71.66
     RUNOFF COEFFICIENT   =       0.97         0.57           0.84

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  86.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD (  0207)|   Area    (ha)=   0.35
|ID= 1 DT= 5.0 min |   Total Imp(%)=  80.00   Dir. Conn.(%)=  80.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.28         0.07
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      48.65        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    6.05 | 0.833   40.65 | 1.583   13.74 |  2.33    7.08
                0.167    6.05 | 0.917  178.56 | 1.667   13.74 |  2.42    6.35
                0.250    7.54 | 1.000  178.56 | 1.750   11.06 |  2.50    6.35
                0.333    7.54 | 1.083   54.05 | 1.833   11.06 |  2.58    5.76
                0.417   10.16 | 1.167   54.05 | 1.917    9.29 |  2.67    5.76
                0.500   10.16 | 1.250   27.32 | 2.000    9.29 |  2.75    5.28
                0.583   15.97 | 1.333   27.32 | 2.083    8.02 |  2.83    5.28
                0.667   15.97 | 1.417   18.24 | 2.167    8.02 |  2.92    4.88
                0.750   40.65 | 1.500   18.24 | 2.250    7.08 |  3.00    4.88

     Max.Eff.Inten.(mm/hr)=     178.56       101.37
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       1.31 (ii)    4.53 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.33         0.23
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.14         0.02          0.160 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.00           1.00
     RUNOFF VOLUME    (mm)=      69.66        41.14          63.95
     TOTAL RAINFALL   (mm)=      71.66        71.66          71.66
     RUNOFF COEFFICIENT   =       0.97         0.57           0.89

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  86.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| RESERVOIR(  0012)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
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--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0123      0.0036
                          0.0111     0.0006   |   0.0126      0.0044
                          0.0114     0.0013   |   0.0129      0.0053
                          0.0117     0.0020   |   0.0131      0.0063
                          0.0120     0.0028   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0207)      0.355      0.160      1.00      63.95
   OUTFLOW: ID= 1 (  0012)      0.229      0.013      1.00      64.67
   OVERFLOW:ID= 3 (  0003)      0.126      0.152      1.00      64.67

                    TOTAL NUMBER OF SIMULATION OVERFLOW  =     9
                    CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.75
                    PERCENTAGE OF TIME OVERFLOWING   (%) = 17.31

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  8.19
                    TIME SHIFT OF PEAK FLOW         (min)=  0.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0063

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--------------------
| CALIB            |
| STANDHYD (  0208)|   Area    (ha)=   0.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  56.00   Dir. Conn.(%)=  56.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.09         0.07
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      33.47        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    6.05 | 0.833   40.65 | 1.583   13.74 |  2.33    7.08
                0.167    6.05 | 0.917  178.56 | 1.667   13.74 |  2.42    6.35
                0.250    7.54 | 1.000  178.56 | 1.750   11.06 |  2.50    6.35
                0.333    7.54 | 1.083   54.05 | 1.833   11.06 |  2.58    5.76
                0.417   10.16 | 1.167   54.05 | 1.917    9.29 |  2.67    5.76
                0.500   10.16 | 1.250   27.32 | 2.000    9.29 |  2.75    5.28
                0.583   15.97 | 1.333   27.32 | 2.083    8.02 |  2.83    5.28
                0.667   15.97 | 1.417   18.24 | 2.167    8.02 |  2.92    4.88
                0.750   40.65 | 1.500   18.24 | 2.250    7.08 |  3.00    4.88

     Max.Eff.Inten.(mm/hr)=     178.56       101.37
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.05 (ii)    8.07 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.13
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.05         0.01         0.058 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08          1.00
     RUNOFF VOLUME    (mm)=      69.66        41.14         57.09
     TOTAL RAINFALL   (mm)=      71.66        71.66         71.66
     RUNOFF COEFFICIENT   =       0.97         0.57          0.80

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  86.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| RESERVOIR(  0016)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0114      0.0015
                          0.0104     0.0003   |   0.0117      0.0021
                          0.0108     0.0006   |   0.0120      0.0027
                          0.0111     0.0010   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0208)      0.168      0.058      1.00      57.09
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   OUTFLOW: ID= 1 (  0016)      0.146      0.012      1.08      57.02
   OVERFLOW:ID= 3 (  0003)      0.022      0.017      1.08      57.02

                    TOTAL NUMBER OF SIMULATION OVERFLOW  =     4
                    CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.33
                    PERCENTAGE OF TIME OVERFLOWING   (%) =  9.52

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 20.61
                    TIME SHIFT OF PEAK FLOW         (min)=  5.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0027

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--------------------
| CALIB            |
| STANDHYD (  0209)|   Area    (ha)=   0.08
|ID= 1 DT= 5.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  60.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.05         0.03
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      23.66        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    6.05 | 0.833   40.65 | 1.583   13.74 |  2.33    7.08
                0.167    6.05 | 0.917  178.56 | 1.667   13.74 |  2.42    6.35
                0.250    7.54 | 1.000  178.56 | 1.750   11.06 |  2.50    6.35
                0.333    7.54 | 1.083   54.05 | 1.833   11.06 |  2.58    5.76
                0.417   10.16 | 1.167   54.05 | 1.917    9.29 |  2.67    5.76
                0.500   10.16 | 1.250   27.32 | 2.000    9.29 |  2.75    5.28
                0.583   15.97 | 1.333   27.32 | 2.083    8.02 |  2.83    5.28
                0.667   15.97 | 1.417   18.24 | 2.167    8.02 |  2.92    4.88
                0.750   40.65 | 1.500   18.24 | 2.250    7.08 |  3.00    4.88

     Max.Eff.Inten.(mm/hr)=     178.56       101.37
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       0.85 (ii)    5.61 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.15
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.02         0.01         0.031 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08          1.00
     RUNOFF VOLUME    (mm)=      69.66        41.14         58.23
     TOTAL RAINFALL   (mm)=      71.66        71.66         71.66
     RUNOFF COEFFICIENT   =       0.97         0.57          0.81

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  86.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0210)|   Area    (ha)=   0.06
|ID= 1 DT= 5.0 min |   Total Imp(%)=  62.00   Dir. Conn.(%)=  62.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.04         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      20.66        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    6.05 | 0.833   40.65 | 1.583   13.74 |  2.33    7.08
                0.167    6.05 | 0.917  178.56 | 1.667   13.74 |  2.42    6.35
                0.250    7.54 | 1.000  178.56 | 1.750   11.06 |  2.50    6.35
                0.333    7.54 | 1.083   54.05 | 1.833   11.06 |  2.58    5.76
                0.417   10.16 | 1.167   54.05 | 1.917    9.29 |  2.67    5.76
```

```
                0.500   10.16 | 1.250   27.32 | 2.000    9.29 |  2.75    5.28
                0.583   15.97 | 1.333   27.32 | 2.083    8.02 |  2.83    5.28
                0.667   15.97 | 1.417   18.24 | 2.167    8.02 |  2.92    4.88
                0.750   40.65 | 1.500   18.24 | 2.250    7.08 |  3.00    4.88

     Max.Eff.Inten.(mm/hr)=     178.56       101.37
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       0.79 (ii)    5.39 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.16
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.02         0.01         0.024 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08          1.00
     RUNOFF VOLUME    (mm)=      69.66        41.14         58.76
     TOTAL RAINFALL   (mm)=      71.66        71.66         71.66
     RUNOFF COEFFICIENT   =       0.97         0.57          0.82

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  86.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0211)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  80.00   Dir. Conn.(%)=  80.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      25.43        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    6.05 | 0.833   40.65 | 1.583   13.74 |  2.33    7.08
                0.167    6.05 | 0.917  178.56 | 1.667   13.74 |  2.42    6.35
                0.250    7.54 | 1.000  178.56 | 1.750   11.06 |  2.50    6.35
                0.333    7.54 | 1.083   54.05 | 1.833   11.06 |  2.58    5.76
                0.417   10.16 | 1.167   54.05 | 1.917    9.29 |  2.67    5.76
                0.500   10.16 | 1.250   27.32 | 2.000    9.29 |  2.75    5.28
                0.583   15.97 | 1.333   27.32 | 2.083    8.02 |  2.83    5.28
                0.667   15.97 | 1.417   18.24 | 2.167    8.02 |  2.92    4.88
                0.750   40.65 | 1.500   18.24 | 2.250    7.08 |  3.00    4.88

     Max.Eff.Inten.(mm/hr)=     178.56       101.37
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.89 (ii)    4.11 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.24
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.04         0.01         0.044 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.00          1.00
     RUNOFF VOLUME    (mm)=      69.66        41.14         63.93
     TOTAL RAINFALL   (mm)=      71.66        71.66         71.66
     RUNOFF COEFFICIENT   =       0.97         0.57          0.89

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  86.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0300)|   Area    (ha)=   0.46
|ID= 1 DT= 5.0 min |   Total Imp(%)=  80.00   Dir. Conn.(%)=  80.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.37         0.09
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         2.00
```

```
     Length            (m)=      55.32        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    6.05 | 0.833   40.65 | 1.583   13.74 |  2.33    7.08
                0.167    6.05 | 0.917  178.56 | 1.667   13.74 |  2.42    6.35
                0.250    7.54 | 1.000  178.56 | 1.750   11.06 |  2.50    6.35
                0.333    7.54 | 1.083   54.05 | 1.833   11.06 |  2.58    5.76
                0.417   10.16 | 1.167   54.05 | 1.917    9.29 |  2.67    5.76
                0.500   10.16 | 1.250   27.32 | 2.000    9.29 |  2.75    5.28
                0.583   15.97 | 1.333   27.32 | 2.083    8.02 |  2.83    5.28
                0.667   15.97 | 1.417   18.24 | 2.167    8.02 |  2.92    4.88
                0.750   40.65 | 1.500   18.24 | 2.250    7.08 |  3.00    4.88

     Max.Eff.Inten.(mm/hr)=     178.56       133.38
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       1.42 (ii)    4.63 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.33         0.22
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.18         0.03         0.214 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.00          1.00
     RUNOFF VOLUME    (mm)=      69.66        51.01         65.93
     TOTAL RAINFALL   (mm)=      71.66        71.66         71.66
     RUNOFF COEFFICIENT   =       0.97         0.71          0.92

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  92.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0212)|   Area    (ha)=   0.30
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.30         0.00
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      44.57        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    6.05 | 0.833   40.65 | 1.583   13.74 |  2.33    7.08
                0.167    6.05 | 0.917  178.56 | 1.667   13.74 |  2.42    6.35
                0.250    7.54 | 1.000  178.56 | 1.750   11.06 |  2.50    6.35
                0.333    7.54 | 1.083   54.05 | 1.833   11.06 |  2.58    5.76
                0.417   10.16 | 1.167   54.05 | 1.917    9.29 |  2.67    5.76
                0.500   10.16 | 1.250   27.32 | 2.000    9.29 |  2.75    5.28
                0.583   15.97 | 1.333   27.32 | 2.083    8.02 |  2.83    5.28
                0.667   15.97 | 1.417   18.24 | 2.167    8.02 |  2.92    4.88
                0.750   40.65 | 1.500   18.24 | 2.250    7.08 |  3.00    4.88

     Max.Eff.Inten.(mm/hr)=     178.56       133.38
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       1.25 (ii)    2.14 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.33         0.31
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.15         0.00         0.147 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.00          1.00
     RUNOFF VOLUME    (mm)=      69.66        51.01         69.47
     TOTAL RAINFALL   (mm)=      71.66        71.66         71.66
     RUNOFF COEFFICIENT   =       0.97         0.71          0.97

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  92.0    Ia = Dep. Storage  (Above)
```

```
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH   0004 <ID= 1> IS DRY.
*** W A R N I N G :  HYDROGRAPH   0003 = HYDROGRAPH 0012
        ID1= 1 (  0004):     0.00   0.000     0.00     0.00
      + ID2= 2 (  0012):     0.13   0.152     1.00    64.67
        ====================================================
        ID = 3 (  0003):     0.13   0.152     1.00    64.67

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0003):     0.13   0.152     1.00    64.67
      + ID2= 2 (  0016):     0.02   0.017     1.08    57.02
        ====================================================
        ID = 1 (  0003):     0.15   0.157     1.00    63.52

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0003):     0.15   0.157     1.00    63.52
      + ID2= 2 (  0201):     0.06   0.032     1.00    69.48
        ====================================================
        ID = 3 (  0003):     0.21   0.189     1.00    65.31

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0003):     0.21   0.189     1.00    65.31
      + ID2= 2 (  0202):     0.09   0.046     1.00    69.48
        ====================================================
        ID = 1 (  0003):     0.30   0.234     1.00    66.57

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0003):     0.30   0.234     1.00    66.57
      + ID2= 2 (  0203):     0.12   0.062     1.00    69.48
        ====================================================
        ID = 3 (  0003):     0.43   0.296     1.00    67.41

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0003):     0.43   0.296     1.00    67.41
      + ID2= 2 (  0205):     0.10   0.041     1.00    59.66
        ====================================================
        ID = 1 (  0003):     0.53   0.337     1.00    65.89

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
```

```
        ID1= 1 (  0003):     0.53   0.337     1.00    65.89
      + ID2= 2 (  0206):     0.05   0.023     1.00    60.47
        ====================================================
        ID = 3 (  0003):     0.59   0.360     1.00    65.39

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0003):     0.59   0.360     1.00    65.39
      + ID2= 2 (  0209):     0.08   0.031     1.00    58.23
        ====================================================
        ID = 1 (  0003):     0.67   0.392     1.00    64.49

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0003):     0.67   0.392     1.00    64.49
      + ID2= 2 (  0210):     0.06   0.024     1.00    58.76
        ====================================================
        ID = 3 (  0003):     0.74   0.416     1.00    64.00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0003):     0.74   0.416     1.00    64.00
      + ID2= 2 (  0211):     0.10   0.044     1.00    63.93
        ====================================================
        ID = 1 (  0003):     0.83   0.460     1.00    63.99

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0003):     0.83   0.460     1.00    63.99
      + ID2= 2 (  0212):     0.30   0.147     1.00    69.47
        ====================================================
        ID = 3 (  0003):     1.13   0.608     1.00    65.43

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0003)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0003):     1.13   0.608     1.00    65.43
      + ID2= 2 (  0300):     0.46   0.214     1.00    65.93
        ====================================================
        ID = 1 (  0003):     1.59   0.822     1.00    65.57

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0005)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.3783      0.0200
                          0.0680     0.0050   |   0.4351      0.0250
                          0.2254     0.0100   |   0.4852      0.0300
                          0.3114     0.0150   |   0.0000      0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)      1.592      0.822      1.00      65.57
   OUTFLOW: ID= 1 (  0005)      1.592      0.458      1.08      65.57

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 55.77
                   TIME SHIFT OF PEAK FLOW         (min)=  5.00
```

```
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0297

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0401)|   Area    (ha)=   0.12
|ID= 1 DT= 5.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  55.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.06         0.05
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      27.69        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    6.05 | 0.833   40.65 | 1.583   13.74 |  2.33    7.08
               0.167    6.05 | 0.917  178.56 | 1.667   13.74 |  2.42    6.35
               0.250    7.54 | 1.000  178.56 | 1.750   11.06 |  2.50    6.35
               0.333    7.54 | 1.083   54.05 | 1.833   11.06 |  2.58    5.76
               0.417   10.16 | 1.167   54.05 | 1.917    9.29 |  2.67    5.76
               0.500   10.16 | 1.250   27.32 | 2.000    9.29 |  2.75    5.28
               0.583   15.97 | 1.333   27.32 | 2.083    8.02 |  2.83    5.28
               0.667   15.97 | 1.417   18.24 | 2.167    8.02 |  2.92    4.88
               0.750   40.65 | 1.500   18.24 | 2.250    7.08 |  3.00    4.88

     Max.Eff.Inten.(mm/hr)=     178.56       101.37
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       0.94 (ii)    7.96 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.13
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.03         0.01         0.040 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08          1.00
     RUNOFF VOLUME    (mm)=      69.66        41.14         56.79
     TOTAL RAINFALL   (mm)=      71.66        71.66         71.66
     RUNOFF COEFFICIENT   =       0.97         0.57          0.79

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  86.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0055)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH   0101 <ID= 1> IS DRY.
*** W A R N I N G :  HYDROGRAPH   0055 = HYDROGRAPH 0401
        ID1= 1 (  0101):     0.00   0.000     0.00     0.00
      + ID2= 2 (  0401):     0.12   0.040     1.00    56.79
        ===================================================
        ID = 3 (  0055):     0.12   0.040     1.00    56.79

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0055)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0055):     0.12   0.040     1.00    56.79
      + ID2= 2 (  0005):     1.59   0.458     1.08    65.57
        ===================================================
        ID = 1 (  0055):     1.71   0.478     1.08    64.98

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
```

Stormceptor

FORTERRA

Stormceptor® EF Sizing Report

STORMCEPTOR®
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

03/27/2023

Province:	Ontario
City:	Ottawa
Nearest Rainfall Station:	OTTAWA CDA RCS
Climate Station Id:	6105978
Years of Rainfall Data:	20
Site Name:	430 Ottawa Street
Drainage Area (ha):	2.513
Runoff Coefficient 'c':	0.65
Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0
Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	52.72
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	Yes
Upstream Orifice Control Flow Rate to Stormceptor (L/s):	88.60
Peak Conveyance (maximum) Flow Rate (L/s):	
Site Sediment Transport Rate (kg/ha/yr):	

Project Name:	430 Ottawa Street
Project Number:	211-06853-00
Designer Name:	Kathryn Kerker
Designer Company:	WSP
Designer Email:	kathryn.kerker@wsp.com
Designer Phone:	613-690-1206
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	63
EFO6	77
EFO8	86
EFO10	90
EFO12	95

Recommended Stormceptor EFO Model: EFO8

Estimated Net Annual Sediment (TSS) Load Reduction (%): 86

Water Quality Runoff Volume Capture (%): > 90

imbrium

THIRD-PARTY TESTING AND VERIFICATION

►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

►**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterwavs.

PARTICLE SIZE DISTRIBUTION (PSD)

►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

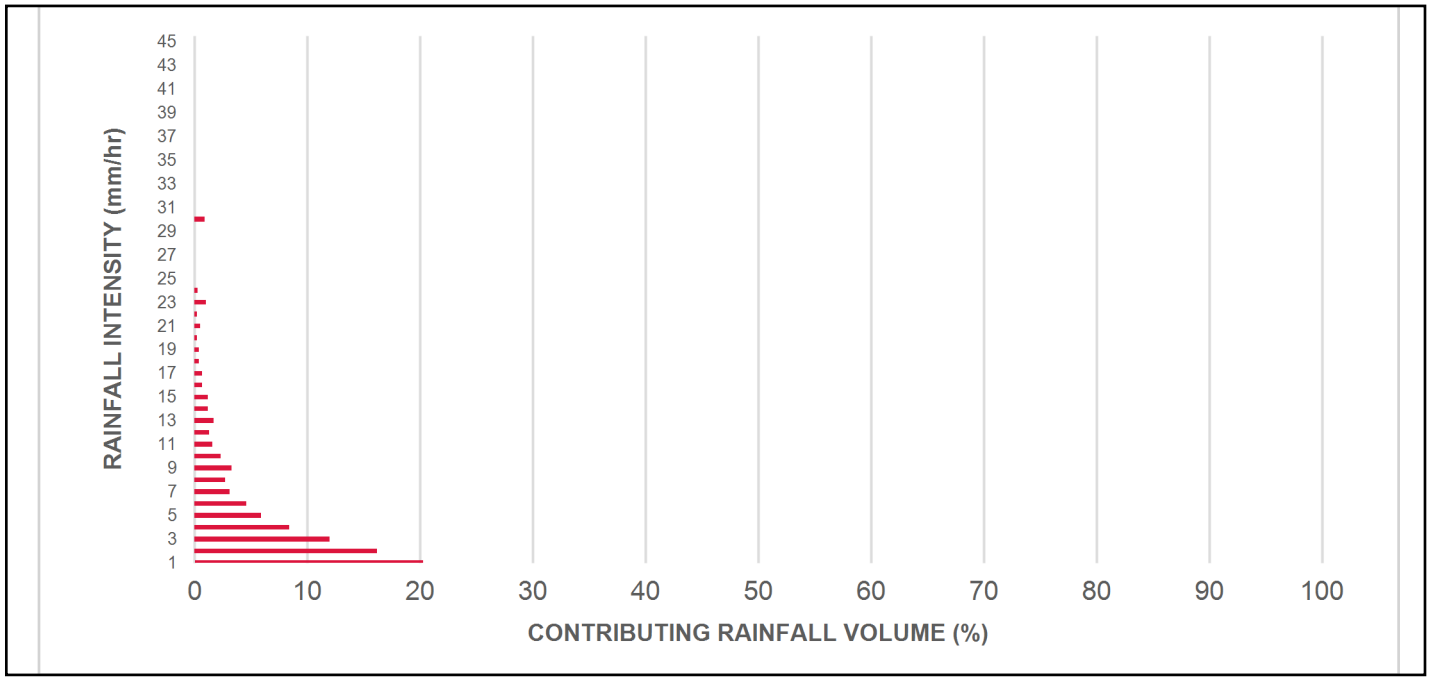
Particle Size (μm)	Percent Less Than	Particle Size Fraction (μm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Upstream Flow Controlled Results

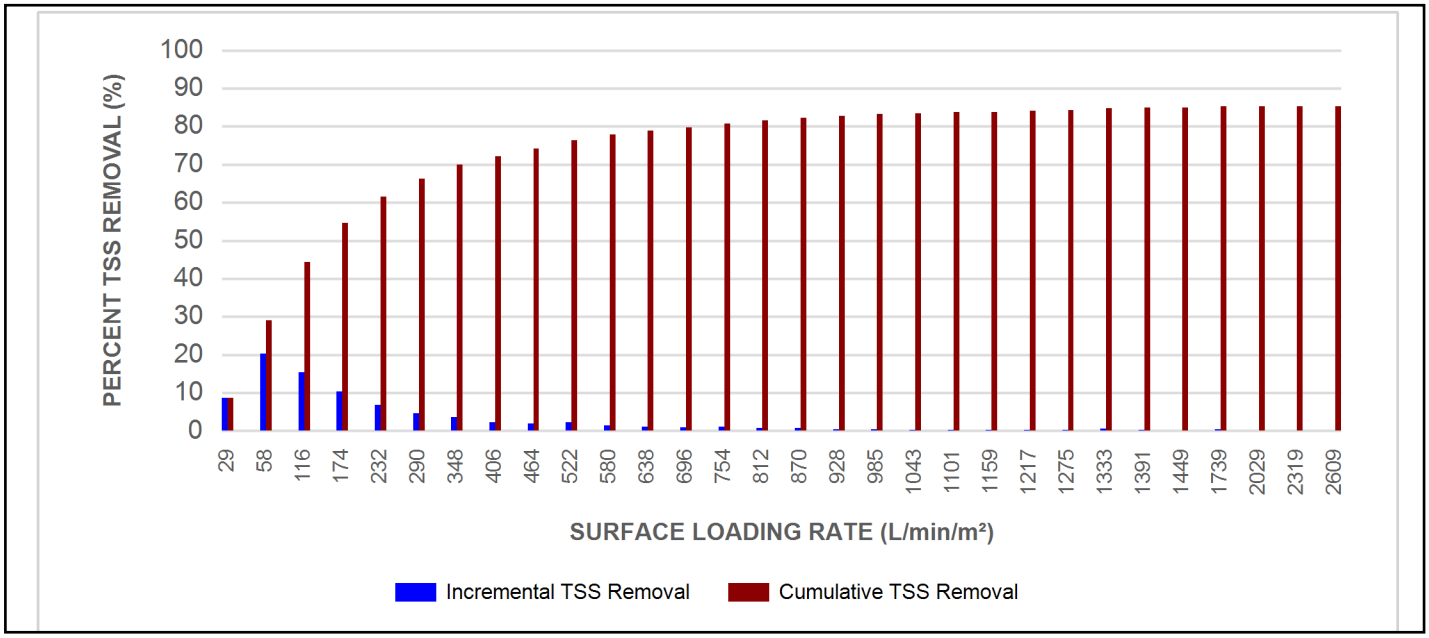
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.5	8.6	8.6	2.27	136.0	29.0	100	8.6	8.6
1	20.3	29.0	4.54	272.0	58.0	100	20.3	29.0
2	16.2	45.2	9.08	545.0	116.0	95	15.3	44.3
3	12.0	57.2	13.62	817.0	174.0	87	10.4	54.7
4	8.4	65.6	18.16	1090.0	232.0	82	6.9	61.6
5	5.9	71.6	22.70	1362.0	290.0	79	4.7	66.3
6	4.6	76.2	27.25	1635.0	348.0	77	3.5	69.9
7	3.1	79.3	31.79	1907.0	406.0	74	2.3	72.1
8	2.7	82.0	36.33	2180.0	464.0	71	1.9	74.1
9	3.3	85.3	40.87	2452.0	522.0	68	2.3	76.4
10	2.3	87.6	45.41	2725.0	580.0	66	1.5	77.9
11	1.6	89.2	49.95	2997.0	638.0	64	1.0	78.9
12	1.3	90.5	54.49	3270.0	696.0	64	0.8	79.7
13	1.7	92.2	59.03	3542.0	754.0	63	1.1	80.8
14	1.2	93.5	63.57	3814.0	812.0	63	0.8	81.6
15	1.2	94.6	68.11	4087.0	870.0	63	0.7	82.3
16	0.7	95.3	72.66	4359.0	928.0	62	0.4	82.7
17	0.7	96.1	77.20	4632.0	985.0	62	0.5	83.2
18	0.4	96.5	81.74	4904.0	1043.0	61	0.2	83.4
19	3.5	100.0	86.28	5177.0	1101.0	59	2.1	85.5
20	0.0	100.0	89.00	5340.0	1136.0	59	0.0	85.5
21	0.0	100.0	89.00	5340.0	1136.0	59	0.0	85.5
22	0.0	100.0	89.00	5340.0	1136.0	59	0.0	85.5
23	0.0	100.0	89.00	5340.0	1136.0	59	0.0	85.5
24	0.0	100.0	89.00	5340.0	1136.0	59	0.0	85.5
25	0.0	100.0	89.00	5340.0	1136.0	59	0.0	85.5
30	0.0	100.0	89.00	5340.0	1136.0	59	0.0	85.5
35	0.0	100.0	89.00	5340.0	1136.0	59	0.0	85.5
40	0.0	100.0	89.00	5340.0	1136.0	59	0.0	85.5
45	0.0	100.0	89.00	5340.0	1136.0	59	0.0	85.5
Estimated Net Annual Sediment (TSS) Load Reduction =								**86 %**

Climate Station ID: 6105978 *Years of Rainfall Data*: 20

RAINFALL DATA FROM OTTAWA CDA RCS RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

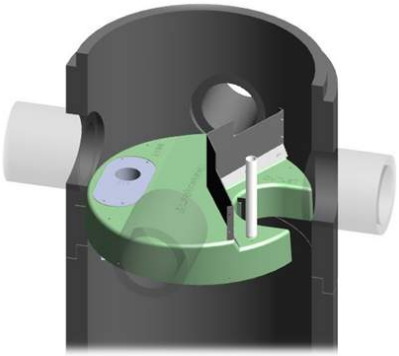
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

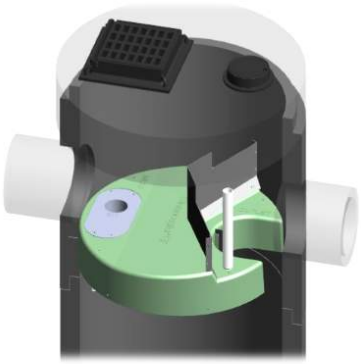
DESIGN FLEXIBILITY

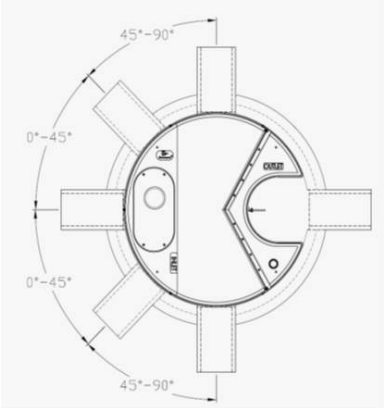
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.

45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft³)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity

** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft³)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD PERFORMANCE SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The minimum sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall

remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m^2 to 1400 L/min/m^2, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m^2 and 1400 L/min/m^2 shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m^2 shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m^2. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m^2.

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m^2.

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

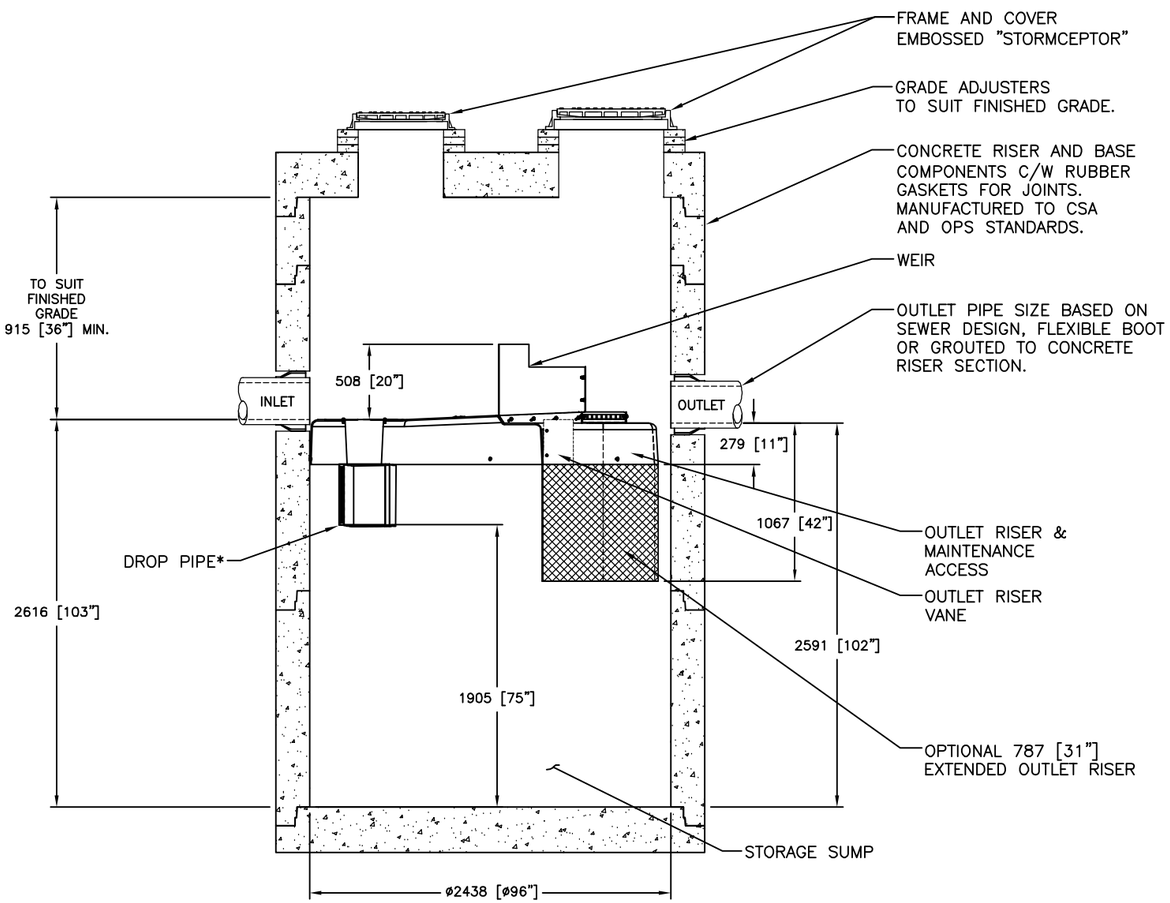
3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators,** with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to

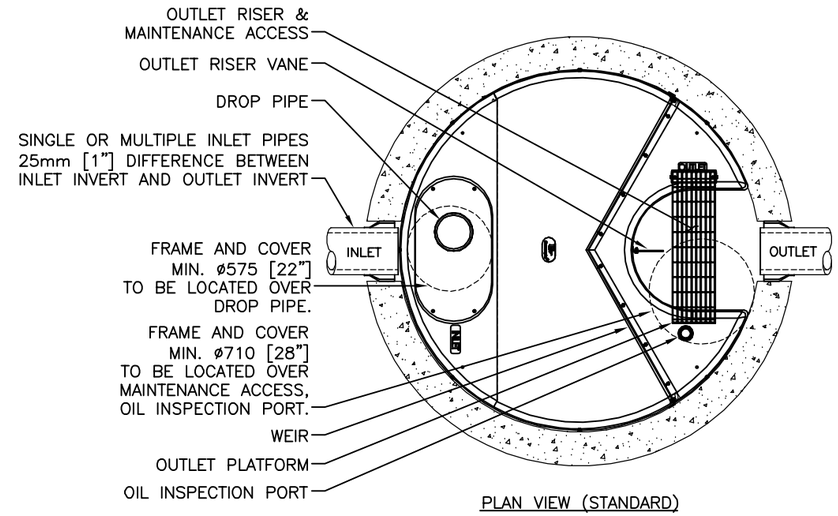
assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m^2 to 2600 L/min/m^2) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.

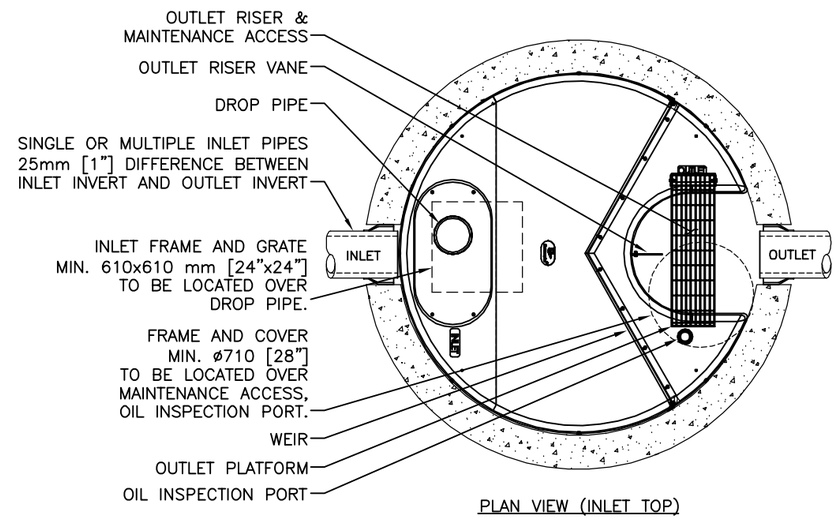
DRAWING NOT TO BE USED FOR CONSTRUCTION



SECTION VIEW



PLAN VIEW (STANDARD)



PLAN VIEW (INLET TOP)

GENERAL NOTES:

* MAXIMUM SURFACE LOADING RATE (SLR) INTO LOWER CHAMBER THROUGH DROP PIPE IS 1135 L/min/m^2 (27.9 gpm/ft^2) FOR STORMCEPTOR EF8 AND 535 L/min/m^2 (13.1 gpm/ft^2) FOR STORMCEPTOR EFO8 (OIL CAPTURE CONFIGURATION).

1. ALL DIMENSIONS INDICATED ARE IN MILLIMETERS (INCHES) UNLESS OTHERWISE SPECIFIED.
2. STORMCEPTOR STRUCTURE INLET AND OUTLET PIPE SIZE AND ORIENTATION SHOWN FOR INFORMATIONAL PURPOSES ONLY.
3. UNLESS OTHERWISE NOTED, BYPASS INFRASTRUCTURE, SUCH AS ALL UPSTREAM DIVERSION STRUCTURES, CONNECTING STRUCTURES, OR PIPE CONDUITS CONNECTING TO COMPLETE THE STORMCEPTOR SYSTEM SHALL BE PROVIDED AND ADDRESSED SEPARATELY.
4. DRAWING FOR INFORMATION PURPOSES ONLY. REFER TO ENGINEER'S SITE/UTILITY PLAN FOR STRUCTURE ORIENTATION.
5. NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR TO PROJECT BID DATE, OR AS DIRECTED BY THE ENGINEER OF RECORD.

INSTALLATION NOTES

A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STRUCTURE (LIFTING CLUTCHES PROVIDED)
C. CONTRACTOR WILL INSTALL AND LEVEL THE STRUCTURE, SEALING THE JOINTS, LINE ENTRY AND EXIT POINTS (NON-SHRINK GROUT WITH APPROVED WATERSTOP OR FLEXIBLE BOOT)
D. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT THE DEVICE FROM CONSTRUCTION-RELATED EROSION RUNOFF.
E. DEVICE ACTIVATION, BY CONTRACTOR, SHALL OCCUR ONLY AFTER SITE HAS BEEN STABILIZED AND THE STORMCEPTOR UNIT IS CLEAN AND FREE OF DEBRIS.

FOR SITE SPECIFIC DRAWINGS PLEASE CONTACT YOUR LOCAL STORMCEPTOR REPRESENTATIVE. SITE SPECIFIC DRAWINGS ARE BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME. SOME FIELD REVISIONS TO THE SYSTEM LOCATION OR CONNECTION PIPING MAY BE NECESSARY BASED ON AVAILABLE SPACE OR SITE CONFIGURATION REVISIONS. ELEVATIONS SHOULD BE MAINTAINED EXCEPT WHERE NOTED ON BYPASS STRUCTURE (IF REQUIRED).

STANDARD DETAIL
NOT FOR CONSTRUCTION

SITE SPECIFIC DATA REQUIREMENTS

STORMCEPTOR MODEL	EFO8				
STRUCTURE ID					*
HYDROCARBON STORAGE REQ'D (L)					*
WATER QUALITY FLOW RATE (L/s)					*
PEAK FLOW RATE (L/s)					*
RETURN PERIOD OF PEAK FLOW (yrs)					*
DRAINAGE AREA (HA)					*
DRAINAGE AREA IMPERVIOUSNESS (%)					*
PIPE DATA:	I.E.	MAT'L	DIA	SLOPE %	HGL
INLET #1	*	*	*	*	*
INLET #2	*	*	*	*	*
OUTLET	*	*	*	*	*

* PER ENGINEER OF RECORD

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MARK	DATE	REVISION DESCRIPTION	BY
####	####	####	####
####	####	####	####
####	####	####	####
1	6/8/18	OUTLET PLATFORM	JSK
0	5/26/17	INITIAL RELEASE	JSK

Stormceptor® EF

SCALE = NTS

imbrium®
407 FAIRVIEW DRIVE, WHITBY, ON L1N 3A9
TF 800-565-4801 CA 416-960-9900 INTL +1-416-960-9900

DATE: 10/13/2017	
DESIGNED: JSK	DRAWN: JSK
CHECKED: BSF	APPROVED: *
PROJECT No.: EFO8	SEQUENCE No.: *
SHEET: 1 OF 1	

I:\IMBRIUM\PRODUCTS\STORMCEPTOR EF\40 DRAWINGS & DETAILS\STANDARD DETAILS\EFO STANDARD DETAILS\EFO8-DETAIL.DWG 4/12/2019 11:07 AM